

POPULAR MECHANICS

AUG. 1968
50 CENTS

What
Owners
Think of
Torino
and Dart

Bombardier's New *SEA-DOO*

The Jet That
*Almost
Flies*

BUILD PM's
**GAS-POWERED
MINI-TRUCK**

Page 140



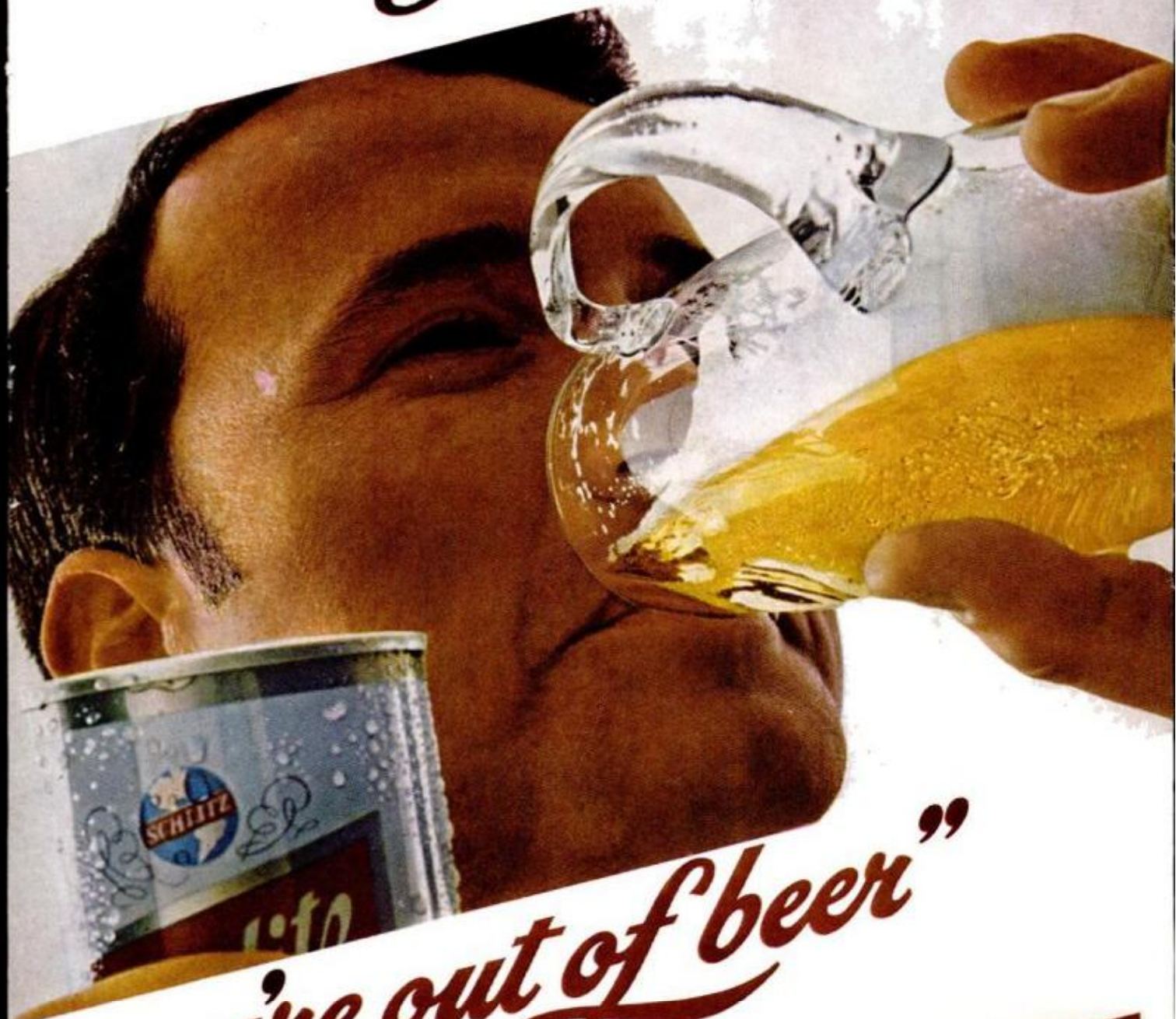
*Please, Mr. Automaker:
Can't You Cure These Headaches?*
(An Open Letter to Detroit)

The New All-Out War on Forest Fires

Chicago's Next Airport: In the Middle of Lake Michigan?

Weekend Projects to Modernize Your Home Now! *Water-Based Epoxy Paint* Buying a Van? How Ford, Chevy, Dodge, VW Compare

*"When you're out
of Schlitz,*



you're out of beer"

Quality never comes easy. Schlitz is most carefully brewed for smoothness, gusto, and aroma, without "beer bite." This is pure beer. This is Schlitz. The beer that made Milwaukee famous.



© 1969 J. & J. Schlitz Brewing Co., Milwaukee and other great cities.
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You can burn up your intake and exhaust valves before you'll burn up the road.

There are awful things happening in your engine, drivers.

You've seen 'em. Carbonaceous, lead-salt ash deposits.

They lodge on valve seats; they flake off and bridge spark plug electrodes; they fall all over your pistons and cylinder heads.

And if you're driving a '67 or '68, and driving it hard, your car's valves are building up these messy deposits faster than ever.

All this is building up your cost of driving faster than ever, too.

Texaco has made a new Sky Chief gasoline that can drive down the cost of driving by minimizing deposit formation on new valves and by arresting further deposit

build-up on old valves. Better than any other leading gasoline you can buy.

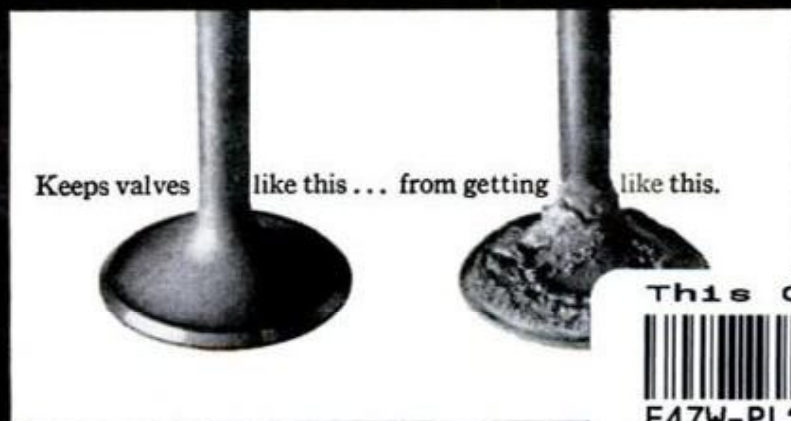
We don't have to tell you what this can mean in terms of compression pressure, idling, acceleration, mileage—and repairs.

We will tell you this: Over the long haul, new Sky Chief can save you a pile.

Driving down the cost of driving is one reason Texaco sells more gasoline than anybody else.

We're first . . . and we think that's a big responsibility.

Especially to guys like you.



This One



E47W-PL2-EB84

Texaco's new Sky Chief Gasoline.
It can drive down the cost of high-performance driving.

For the clean guys.

Hair shows up clear and clean even through a whole bottle of Vaseline® Hair Tonic (label removed). No surprise, then, that Vaseline Hair Tonic looks clear and clean after you put it on... so pure, so refined that there's no need for us to cream it, gel it or color it. Just a little clear clean Vaseline Hair Tonic keeps your hair doing just what you want it to (no matter what length you choose to wear your hair). Ask any girl who she'd prefer to snuggle up to. And she'll tell you. One of the clean guys.





The DieHard thinks 100° is no sweat

Hot or cold, it's America's most powerful car battery of its size—by 35%.

One of the worst things you can do to an ordinary battery after a tough winter is put it through a long, hot summer. Heat makes a battery's blood boil, saps its strength.

Then you ask it to get you out of a "hot stall". And, believe it or not, an overheated engine can take more power to turn over than a frigid one in the middle of winter. No wonder so many batteries give up the ghost in July.

The DieHard is made of sterner stuff. It's the most powerful car battery of its size in America. Thanks to its thin-walled white polypropylene case. The thin walls leave more room inside for more lead and acid, the source

of battery power. We'll stack the DieHard against the next best battery in the country—and deliver a good 35% more usable starting power any day in the week.

Something else. Polypropylene resists heat. After baking at 200°, it ends up 40 times stronger than an old style rubber battery case.

And one more thing. You can see through this white, thin-wall case. Which means you can check your own water level and keep your DieHard from dying of thirst.

You might sweat a few more months out of your old battery. But why bother, when a new DieHard will probably outlive your car? Remember, we back the DieHard with a 5-year guarantee—and when Sears guarantees, Sears guarantees.

The Sears 5-year guarantee:

"Free replacement within 90 days of purchase if battery proves defective. After 90 days we replace the battery, if defective, and charge you only for the period of ownership, based on the regular price less trade-in at the time of return, prorated over number of months of guarantee."

You can buy the DieHard in over 2500 Sears, Roebuck and Co. stores, and Charge It on your Sears Revolving Charge.

The DieHard. Sold only at Sears. \$29.95 with trade-in.

Sears

ALLSTATE

You can't do better than Sears.

The DieHard is so new it's available in Groups 24, 29NF, and 22F only. These sizes fit all Chevrolets from '57 on, all Buick Specials and Skylarks, all Ramblers and Willys, most Chryslers, Dodges, Plymouths, Fords, 1956-64 Mercurys, Studebakers, many Mercury Comets, Oldsmobiles and Pontiacs. Soon it will be available in all popular sizes. Sears carries a complete line of other fine batteries as well, in a wide range of prices.

POPULAR MECHANICS®

INTERNATIONAL EDITIONS: AUSTRALIA, BRAZIL, CARIBBEAN, DENMARK, FRANCE, MEXICO, SOUTHERN HEMISPHERE, SWEDEN

AUTOMOBILES AND DRIVING

- 30 Drivin' With Dan
- 24 Detroit Listening Post
- 53 Automobile Clinic
- 61 Straighten Up and Drive Right!
- 64 PM Owners Report: Ford Torino
- 76 Dear Mr. Automaker
- 100 Comparing the Versatile Vans
- 112 PM Owners Report: Dodge Dart
- 119 Car Hints
- 120 Saturday Mechanic: How to Do Your Own Preventive Maintenance

HOME AND YARD

- 58 Homeowners' Clinic
- 106 Tired of the View? Just Turn the House
- 130 Solving Home Problems
- 132 Build a Bookshelf for Your New PM Do-It-Yourself Encyclopedia
- 136 Build These Handsome Wall-Hung Shaving Bars
- 140 Build PM's Turn-on-a-Dime Mini-Mover
- 148 Weekend Remodeling Ideas
- 150 Exciting New Products
- 154 A Decorative Well House You Can Use
- 156 Now: Water-Base Epoxy Paint
- 164 Build This Mobile Scaffold

AEROSPACE, AVIATION, MILITARY

- 56 Aviation Jetstream
- 70 How Can We Stop Those Vietcong Rockets?
- 82 Future Airports
- 95 New Battle Plan for Forest Fires

ELECTRONICS, RADIO AND TV

- 37E New in Electronics
- 166 Single-Tube Aircraft Band Converter
- 170 Electronic Kinks

SHOP AND CRAFTS

- 126 This Block Puzzle Is a Real Puzzler
- 128 Antique Gilt Goes On Like Wax
- 129 Shine Your Shoes With a Paint Roller
- 132 Build a Bookshelf for Your New PM Do-It-Yourself Encyclopedia
- 135 Hints From Readers
- 136 Handsome Wall-Hung Shaving Bars
- 140 Build PM's Turn-on-a-Dime Mini-Mover
- 147 Hints From Readers
- 148 Weekend Remodeling Ideas
- 153 New Tools You Should Know About
- 154 A Decorative Well House You Can Use
- 156 Now: Water-Base Epoxy Paint
- 158 How to Make and Use Lathe Boring Tools
- 163 Hints From Readers
- 164 Build This Mobile Scaffold
- 172 Hints From Readers

BOATING, OUTDOOR RECREATION

- 22 What's New Outdoors
- 88 It Isn't Fishing: It's Murder
- 91 Sea-Doo: a Jet Speedster
- 124 Troubleshooting an Outboard That Won't Start

SCIENCE AND INVENTIONS

- 20 Science Worldwide
- 12 "Turtle Car" Totes Its Garage on Back
- 68 Just Patented: PM Picks the New Inventions
- 95 New Battle Plan for Forest Fires

PHOTOGRAPHY

- 34 Picture This
- 116 5 Easy Steps to Expert Exposure
- 152 Photo Hints

REGULAR FEATURES

- 6 Letters

Cover Photography by Burton McNeely

NEXT MONTH IN POPULAR MECHANICS

How to Handle the Deadly Hazards of Night Driving. Be ready for them.
What Owners Think of the VW: PM Owners Report: Does the love affair linger?
Sealab III: Home, Sweet Home at 600 Feet. Features full-color cutaway painting.
Preview of Top Ideas From the World's Greatest Inventors Show. See the best of the gimmicks, gadgets and bright ideas that'll be shown in New York in September.

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AUGUST 1968

86 Proof Early Times Distillery Co., Louisville, Ky. ©1968



let's make it

Make yourself the greatest home bartender in town. Just send \$3.50 to Early Times Glass Offer*— P. O. Box 1080, Louisville, Kentucky 40201. We'll send you a set of 6 Giant 15 oz. Early Times Jiggers. Or send \$3.00, for a set of 8 Early Times 10½ oz. Highball Glasses. They're beautiful, so get both sets while they last. Do it now.

*offer valid only where legal

THE TRUE OLD-STYLE KENTUCKY BOURBON

The Lazy Pipe Tobacco



Bond Street is the pipe tobacco that burns slow and lazy-like. Doesn't rush you through your pleasure. The rich taste stays around awhile. All because we use a combination of plugs and flakes, for smooth and steady burning.

Contented Bond Street smokers tell us that on a single pipeful you can sail from Lake Forest, Ill. to Racine, Wis. (provided there's a stiff breeze behind you). And, if you pass other sailors along the way, one will surely say something complimentary about the aroma.

Lights easy—
takes its own good time
about burning.



LETTERS TO THE EDITOR

Footnote to motorcycles

You are to be commended on your excellent article, *Buying Your First Motorcycle* (page 97, June *PM*). This was a most informative piece and apparently well researched.

As a point of information, your article and table listed several 350-cc motorcycles in the middleweight classification. Conspicuous by its absence was the Yamaha 350, which in racing competition at Daytona Beach this March defeated every other brand with machines twice as large; they took second and third with only one 750-cc machine coming in ahead of them.

Also, when describing "dirt" motorcycles which can be used on the road, you should be aware that the Yamaha 250 Enduro has become a best seller in its first six months in this market.

YAMAHA INTERNATIONAL CORP. DON GATELY
MONTEBELLO, CALIF. ADV. MGR.

Glad to have these additional bits of information, though we'll have to repeat what we said in the chart: "Not all makes or complete model lines are represented in this guide." We'd have been printing a catalog if we hadn't narrowed the listings down to representative models and makes.

Pass the salt, please

In *Build This Plywood Kayak* (page 146, May *PM*) there's a drawing of the sail plan on page 202. Just because the mainsail is cut from a bed sheet (main or secondary) does not entitle you to call it a mainsheet! Ugh!

VENTURA, CALIF.

ROBERT N. CORDY

Our old salts looked seasick when they spotted that one. It just couldn't happen, they keep telling us.

Happy aquarium builder

Thanks for the great idea in *Build *PM*'s Coffee-Table Aquarium* (page 150, April *PM*). I started on it within an hour after I received the April issue.

As you can see, it turned out beautifully. And, as you said, if you're careful on the initial sealing, no leaks.

I altered the design a slight bit and made it one complete aquarium, without dividers. I also made the bottom of plywood covered with three coats of epoxy paint;

(Please turn to page 8)

This free booklet will tell you how you can become a Computer Programmer

50,000 more programmers needed now! 500,000 more will be needed in a few years!

...and how you can train at home for big earnings in the world's newest, most exciting profession.

IF YOU'RE dissatisfied with your present job, why don't you become a programmer? So great is the demand for programmers, you'll have your choice of openings, with a growing future ahead.

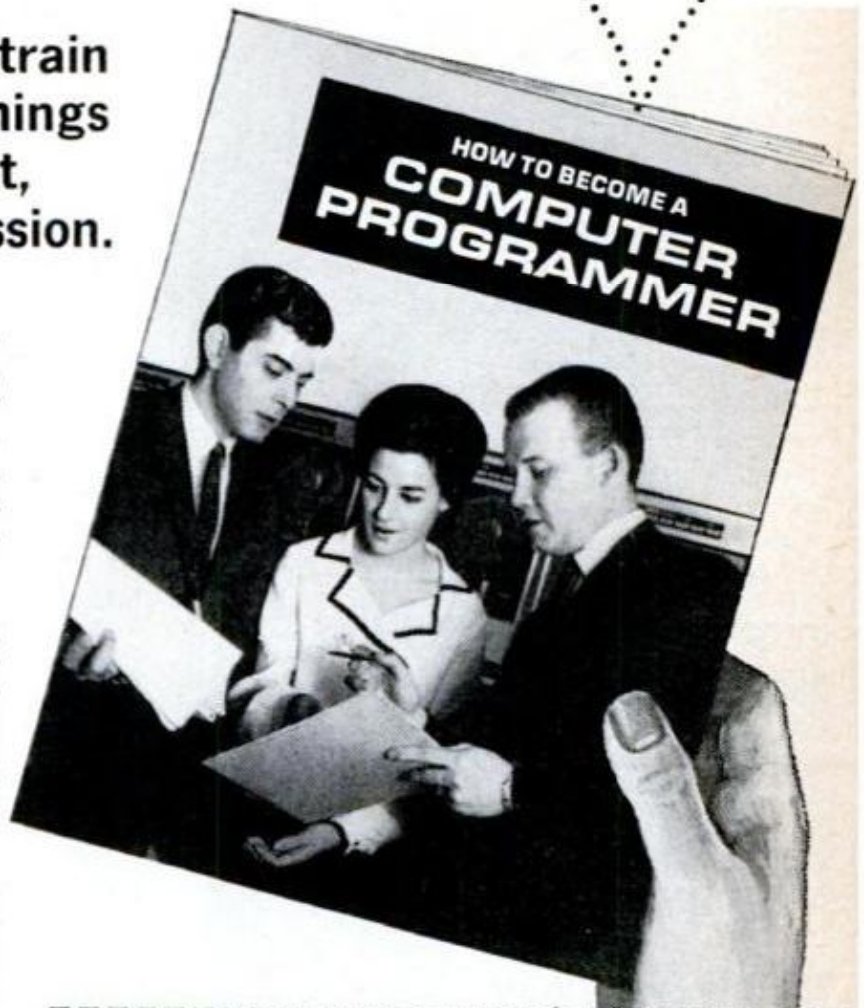
For the vast majority of good positions, a high school education, a logical mind and the right preparation are all that are required. LaSalle, world leader in home education, will train you as a programmer in your spare time.

Why not plan for bigger success in the field where employers are looking for you? *Authorities agree that for many years to come there will be more openings in computer programming than people to fill them!* Even beginners are paid well; and with experience, programmers can fill major supervisory positions at salaries of \$12,000 to \$15,000 a year — often as much as \$20,000.

Without leaving your present position, you can start your training now — at very low cost. You can study at home, in hours of your own choosing. Experienced LaSalle instructors will guide you by mail every step of the way. Industry experts say this is the most thorough course of its kind that they have seen. The ease and rapidity with which you learn will surprise you.

LaSalle has just published a fascinating booklet "How To Become a Computer Programmer." In simple, non-technical language this booklet tells you what computer programming is; what the programmer does; how you can train by mail through the school that has enrolled more than 1,500,000 people in its many success courses. Mail the coupon for your free copy or write to LaSalle, 417 S. Dearborn, Chicago, Illinois 60605.

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 417 S. Dearborn Street, Dept. 80-117, Chicago, Illinois 60605

Please mail to me the free illustrated booklet "How To Become a Computer Programmer."

Name..... Age.....
 Address..... County.....
 City & State..... Zip No.....
 Occupation..... Working Hours..... A.M..... P.M.

Get with the COOL ONE!



NEW AQUA VELVA

**FROST
LIME**

AFTER SHAVE LOTION

There's Something
About An
AQUA VELVA
Man!



New Refreshing FROST LIME in your shave, too!
AQUA VELVA Silicone Lather FROST LIME SHAVE
for a silicone-smooth shave.

LETTERS

(Continued from page 6)



it was much easier than using glass—and cheaper.

One caution for other builders: Underwater filters produce bubbles which burst at the surface and keep the underside of the glass top wet, which ruins the beauty. I solved the problem by using underwater filters and extending the bubble tube to the surface, then added a slotted bubble cap over the top of the tube cut from some small two-oz. plastic cups.

CLEVELAND, OHIO

ANTHONY F. ORSINI

Our kind of reader

Popular Mechanics is the greatest, and I think the June issue is the best. My mother hates comics, but she goes for *Popular Mechanics*; she thinks it's educational. I'm your favorite fan. Please let me come in contact with your kind.

DETROIT, MICH.

MARK GLENN

We frequently send one of our kind into your galaxy. Watch for him. He's faster than a speeding bullet and he wears bib overalls.

2000-ton detail

Many thanks for an interesting article on large-tanker construction (*The Biggest Thing That Ever Moved*, page 70, May PM). May I point out an error.

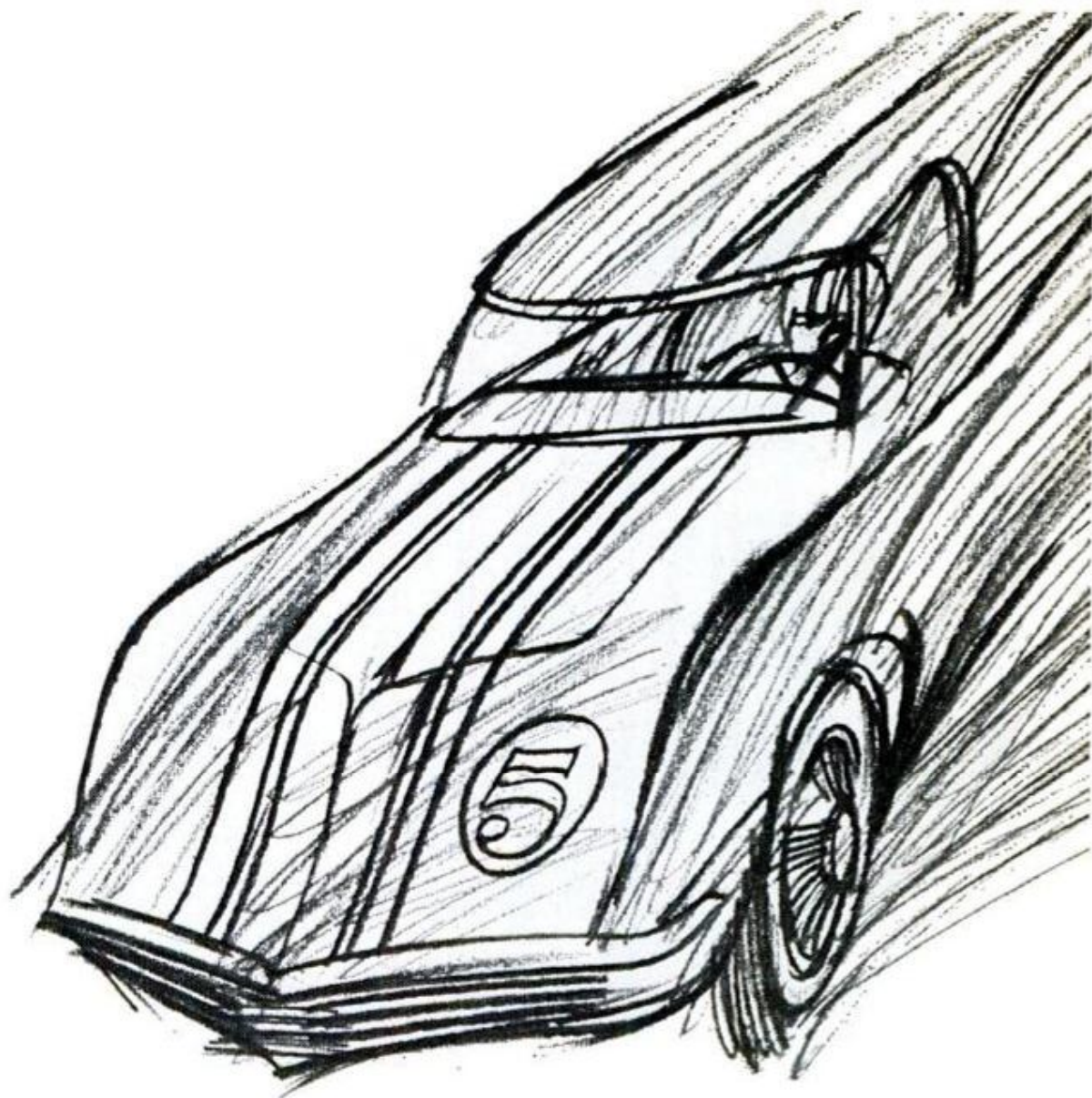
You stated that one foot increase in the length of a tanker in the 300,000-ton class would cause an increase of 2000 tons in its capacity. This is impossible.

Being a naval architect, I pay great attention to detail in articles about ships.

NEW YORK

W. A. G. HOGG

It should have read: "Add one foot to the width of a 300,000-tonner and you increase its capacity by 2000 tons." ★★★

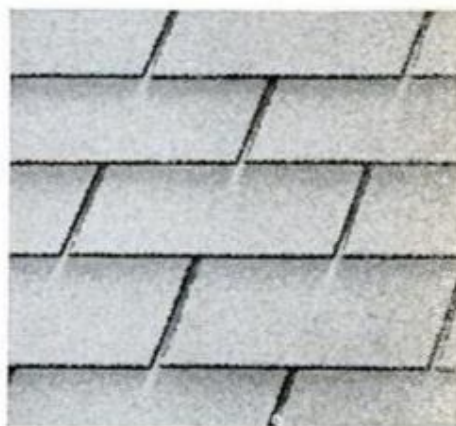


**We put fiber glass in FGA* shingles
for one of the reasons it's in some car bodies:
*lasting good looks.***

J-M's FGA* shingles team fiber glass with asbestos . . . because fiber glass in shingles (as in car bodies) resists change. It stands up to rotting, cracking, curling and warping. So year after year, FGA shingles look great and give extra protection from the weather.

FGA shingles have actually withstood hurricanes—our Seal-O-Matic® feature makes them exceptionally wind resistant. And they've been awarded the Underwriters' Laboratories Class A fire rating, the highest given.

When you replace your roof, do it with FGA shingles. They come in 14 wife-pleasing color blends. See them at your J-M dealer's.



*Johns-Manville trademark

Johns-Manville

AUGUST 1968

9

Материал, защищенный авторскими правами

"A good screwdriver is like gold"



Otto Neubrand, master gunsmith of Clarence, N. Y. spends dozens of hours a year with a screwdriver in his hand. He owns 27 of them. We thought he'd be a good man to ask about screwdrivers.



Why 27 Otto? "You need a near perfect fit to do a good job. The screwdriver must fit the full length and depth of the slot, and be close to fitting the width."

Why is the fit so important? "To get full force without slipping. A

slip can ruin a gun, or a stock . . . or a finger. And a misfit damages the screw."



"Puts a burr on the edges of the slot. Burrs are the sign of a kitchen mechanic. And if the screwdriver doesn't fit you can hardly avoid burring the screw."

What do you look for in screwdrivers? "Tough steel. If they're too soft, they bend and lose their edge. If they're too hard, they

break and are hard to regrind. Either kind, I throw away. A good one is like gold."

The steel in *Crescent Bridgeport Cushion Grip* screwdrivers is so good it's tough on the machinery in our plant. But it makes a great screwdriver. You won't find *Cushion-grips* at the grocery



for a quarter. But then, who'd expect to get a "gold" screwdriver for two bits?

CRESCENT®  **BRIDGEPORT**

CRESCENT TOOL COMPANY / DIVISION OF CRESCENT NIAGARA CORPORATION / BUFFALO, NEW YORK 14202

TORO's automatic sprinkler system* will turn your neighbors green.



To say nothing about your lawn.



Think of it . . . lush green turf that stays that way when the rest of the neighborhood is turning parched-brown.

Think of having an underground system (installed so fast your neighbors won't know what you're up to) that works so automatically you can set it and forget it. From then on in, you relax—it does the

sprinkling thinking for you!

Think you can't afford it? Why not invest a quarter to find out that you can. Send for our booklet that tells you *everything* you have to know about an underground system, including the approximate cost for a lawn *your* size.

Think of it . . . green neighbors!

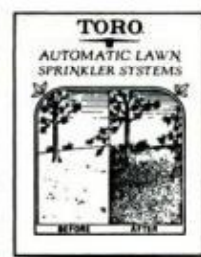
TORO

AUTOMATIC LAWN
SPRINKLER SYSTEMS

*TORO calls it Moist O'MATIC®

To: TORO MANUFACTURING CORPORATION
8111 Lyndale Avenue South PM1
Minneapolis, Minnesota 55420
Send me the Moist O'MATIC story.
I'm enclosing 25¢ to cover handling
and mailing.

NAME _____
STREET _____
CITY _____
STATE _____ ZIP _____

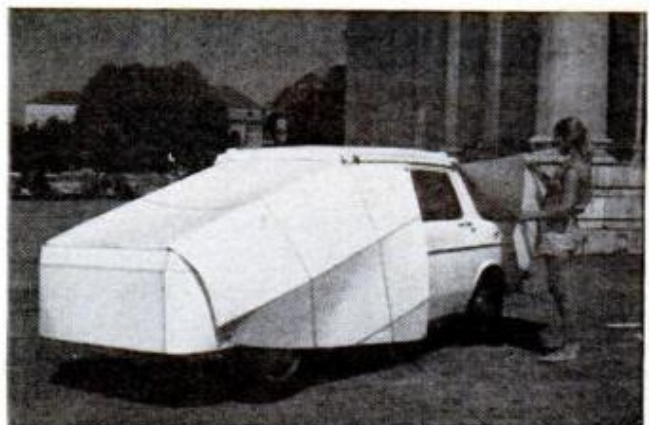


From Next Month's Inventors Show:

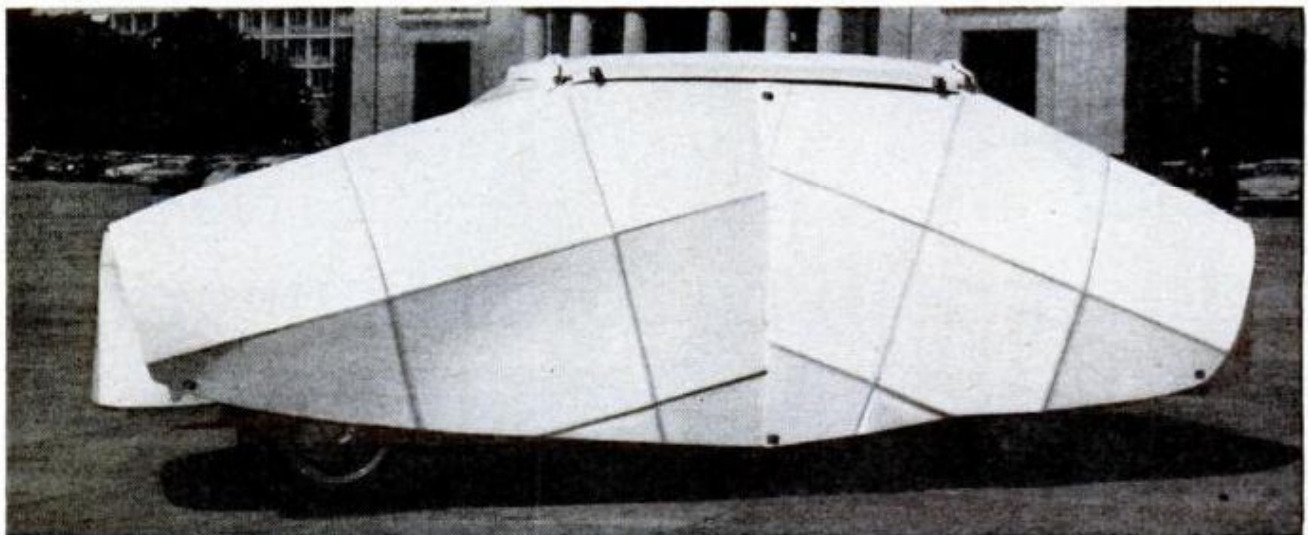
'Turtle Car' Totes Its Garage on Back



PARKED OUTSIDE, it starts to sprout from the roof



PLASTIC PANELS take only seconds to snap together



HOW ABOUT THAT! All buttoned up snug and dry from hood to taillights. Now bring on your rain and snow

THIS UNUSUAL CAR not only carries its house on its back like a turtle—it even *looks* like a turtle. In bad weather or at night, it huddles under a plastic shell whose checkered panels give it the appearance of a reptile's armor. It's one of thousands of new inventions, gadgets and novel ideas to be unveiled next month at the giant International Inventors and New Products Exposition in New York.

The idea behind the instant garage is to protect your car when you're away from home on a trip or have to leave it parked all day at your place of work. You just slide the plastic panels out from under a roof-mounted rack, pull them down around the car and snap them together. The cartop shelter is being introduced by the German firm of IWV-Industrie-Werbe- und Vertriebs-GmbH in Munich.

Don't Miss the Big Inventors Show

Next month's idea-packed International Inventors Show is open to the public and readers are welcome. Those wishing to obtain tickets can purchase them in advance from Patent Exhibits, Inc., 554 Fifth Ave., New York, N. Y. 10036. Prices are: adults, \$2; children under 12, \$1. The show will run from Sept. 12 through

15 at the New York Coliseum, 59th St. at Columbus Circle. Hours are 11:00 a.m. to 9:00 p.m. weekdays and 1:00 p.m. to 8:00 p.m. on Sunday. A directory of exhibitors is available for \$1 from Patent Exhibits. If you can't make the show in person, read all about the exciting highlights in a special feature in PM for September.



**Some people have to drive in the rain
whether they like it or not.**

There are more than 6 million people who drive small trucks for a living.

Like butchers, bakers, TV repairmen. People who drive all day, every day, rain or shine.

And, for some time now, these people have been asking Uniroyal for a truck tire that's as surefooted on wet roads as The Rain Tire™ is for cars. After all, they argued, they couldn't stay home every time it rained.

Well, each time they asked, we had to say not yet.

You see, to make a tire that has all the features of The Rain Tire and that's strong enough for trucks takes time.

But we finally did it: we made The Rain Tire for Small Trucks.

Of course, driving in the rain will never be a pleasure. But now, at least it will be less of a nightmare.

The rain tire® for small trucks



UNION CARBIDE CORPORATION

HE'S AVERAGING \$20,000 WORKING 6 MONTHS A YEAR

**NO COLLEGE... NO EXPERIENCE
NO SELLING—Yet Joe Miller
Made The Move To Top Money
Fast. Read How He Did It.**

When Joe Miller walked to a mailbox that day in Duncan, Oklahoma, the things he wanted in life seemed far beyond his reach.

He wanted a lot more money. He wanted to break free of his deadend job. He wanted independence, security. He wanted a new future—one that wouldn't just dribble away in disappointment.

Chances looked dim. Joe had no college. His only experience was in his old job. He couldn't just quit and hope.

But when Joe Miller dropped his envelope in that mailbox, everything he wanted suddenly became possible. *It was the single most profitable act of his life.* It changed everything. Yet, all he had done was mail a coupon like the one you have at the bottom of this page.

FREE BOOK PUT JOE MILLER ON THE ROAD TO BIG INCOME

That coupon brought Joe a fascinating, free book from Universal Schools—the same book you can have in just a few days. It's an eye-opener! It tells the little-known story of a world of opportunity all around you in the booming Accident Investigation field.

It was all new to Joe. Like most men, he'd hardly ever heard of Accident Investigation. He didn't know the first thing about it. Yet, Joe Miller felt he had found the perfect opportunity.

And he had! Soon Joe was moving ahead in the most exciting, new career imaginable. His first full year he made \$14,768.72! *Since then he's averaged \$20,000 working about six months a year.* The rest of the time he just relaxes and takes it easy.

JOE MILLER LEARNED THE SECRETS OF SUCCESS IN JUST 30 MINUTES!

Joe skimmed through Universal's free book in 30 minutes and changed his life. He learned many money-making facts. But the three points that showed Joe the way to real success are these:

FREE PLACEMENT SERVICE

Universal Schools provides prompt, effective job placement help in any part of the United States and Canada. More than 1,000 companies have requested and receive our monthly list of graduates. Universal trains and places more men in the Accident Investigation field than any other school. Or, if you would prefer to start your own full or part time business, we will show you exactly how to do it.



● That Accident Investigation is one of the biggest service businesses today—a \$19 billion industry booming to new growth every year. It's safe from layoffs, recession and automation because accidents keep right on happening no matter what the economic conditions.

● That more and more men are urgently needed to investigate and settle some 22 million accidents and losses every year for insurance and other companies—and the accident rate goes up steadily.

● That for nearly 20 years Universal Schools' training-by-mail plan has been the path to success for hundreds of men in this profitable, fast-growing field—most of them men with no college and no experience.

So there it was. The opportunity of a lifetime and the way to grab it. Joe did—fast. He enrolled for Universal's correspondence training at the mere cost of cigarette money.

HE TRAINED WITHOUT RISK, IN HIS SPARE TIME AT HOME

It was suprisingly easy. Joe simply studied his lessons-by-mail. He did it in his spare time, at home, at his own pace. He didn't risk a single paycheck because he kept right on with his old job while he trained.

In brief, clear, interesting lessons, Joe learned exactly how to step in and start making money quickly in Accident Investigation. And, obviously, that's what he did. But even today, successful as he is, Joe says: "If at any time I'm in doubt, I refer to my Universal books."

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Science Worldwide

BY JOHN F. PEARSON

An electron beam capable of cutting rocks is produced by an experimental instrument under development by scientists at Westinghouse. The gun shoots out a narrow beam that is rated at 9000 watts at 150,000 volts. The beam reportedly can penetrate as deep as four inches into rock when the instrument is within half an inch of the surface. "It melts through many kinds of rock like a hot knife through wax," says Westinghouse's Dr. B. W. Schumacher. "When fully developed, the device could be used for tunnels, trenches for pipes, quarries and mines, where it should prove to be faster than other methods. It works just as well under water as above."

Earthquake-spawned tsunamis, powerful sea waves that travel at speeds approaching 500 mph, will have their force blunted by a computer-designed breakwater at Kochi, a Japanese coastal city that has been battered by a number of the giant, land-smashing waves. By translating hydraulic-engineering concepts into mathematical models and taking economic factors into consideration, Japanese engineers are developing a computer program that will help them determine the breakwater's optimum height and strength.

What is the hydrologic cycle? Where can you take courses in oceanography? Who hires oceanographers? You'll find answers to these questions about oceanography (as well as 97 others) in a new 120-page paperback, *Questions About the Ocean*, published by the National Oceanographic Data Center, Suitland, Md. To get a copy, send 55 cents to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

How long has man inhabited the New World? Some scientists, including Dr. Louis S. B. Leakey, say that evidence in the form of chipped stone tools found near Barstow, Calif., indicates a history of over 40,000 years. This more than doubles previous estimates. Other scientists are skeptical, saying the stones probably became chipped through natural processes. Dr. Leakey, famous for his discoveries of early manlike creatures in East Africa, has called for a scientific symposium to resolve the differences of opinion.

Long-distance diagnosis was recently achieved when a Marine in a camp near Tokyo had his breathing action and heart and brain waves monitored and analyzed by computers in Houston, Tex., and Washington, D.C., some 7000 miles away. Electronic devices at bedside detected electrical impulses from the Marine's body. The impulses were sent by telephone to a transmitting center in another part of Japan. From there they were beamed to communications satellite Intelsat II, which relayed them to Brewster Flat in Washington State. From there the signals went by phone lines to a University of Texas computer in Houston and to computers at the U.S. Public Health Service in Washington, D.C. While an audience of scientists looked on—it was a special demonstration—the Houston computer processed the medical data taken from the Marine and came up with a diagnosis.

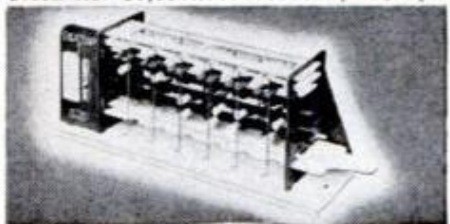
Lightweight protective vests for ground troops capable of stopping a .30-cal. armor-piercing bullet at a distance of 100 yards have been announced by a New England company. Boron carbide, a man-made material so hard it has to be shaped with diamond-cutting tools, is the key to the vest's effectiveness. Standard vests used by Army personnel provide protection against grenade and mortar fragments but not high-velocity slugs. The new vests should prove useful to police in flushing snipers, say company spokesmen.

It's tough to give up that weed. Smoking withdrawal clinics at Roswell Park Memorial Institute, Buffalo, N.Y., achieved only a 17 percent cure among 1800 volunteers from 1964 to 1966, reports Dr. Charles A. Ross, chief of thoracic surgery. In the program, which employed a combination of education and drugs, men were more successful in breaking the habit than women. Men over 40 were more successful than younger ones. ★ ★ ★



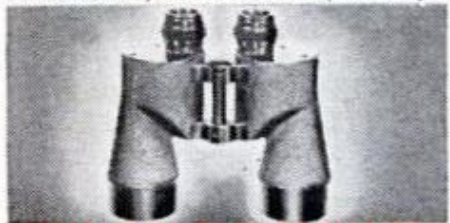
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WHAT'S NEW OUTDOORS

BY DAN FALES

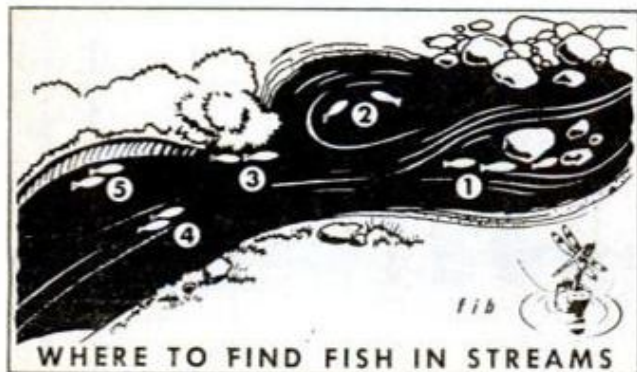
IT'S A FIB FACT that more than half of you fresh-water fishermen prefer to wet a line in rivers and streams than to tackle lakes or ponds. And by more than two-to-one you favor natural to man-made facilities.

These bits of statistics have been passed along to me by the Fisherman's Information Bureau. Knowing this, FIB drew up a diagram showing the best places to fish on rivers and streams.

According to F. I. Sherman, FIB consultant, there is a piscatorial propensity for propinquity. Translated: "Fish like to be near something."

In other words, experienced fishermen look for their action in locations likely to provide fish with food, shelter and protection.

As a handy guide, FIB has put out a sketch showing the likely spots to hit: (1) a rock pile; (2) a pool or eddy; (3) under overhanging brush; (4) a mainstream pool; (5) an undercut of a bank. The experts



also suggest you fish right near toppled trees, weed beds, brush piles—everything and anything that offers a clue to concealment. And that's no fib.

CONGRATULATIONS! You sportsmen went out and bought hunting and fishing licenses in record numbers during fiscal 1967. Figures just in from the U.S. Department of the Interior's Bureau of Sport Fisheries and Wildlife show that state fishing license sales are over 27 million—up a million from last year. This means that about \$73 million has gone to the state fish conservation programs all across the country.

State hunting licenses totaled over 20 million for the same period—up about a half million. And that means that about \$80 million went to state game conservation agencies.

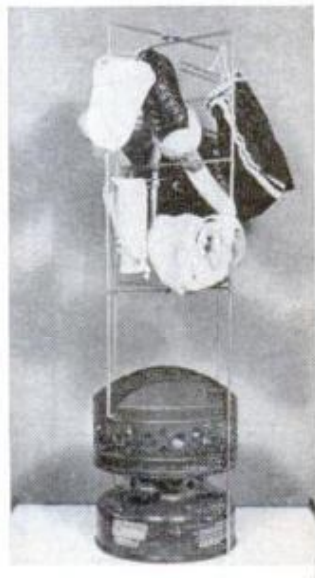
A CAMPER CADDY is a natural for hard-to-carry items such as fishing rods, tent poles, tent stakes. This dustproof,



waterproof storage tube is 4 inches in diameter and 6 feet long. It's white to harmonize with any trailer color, and has snap-on caps at both ends.

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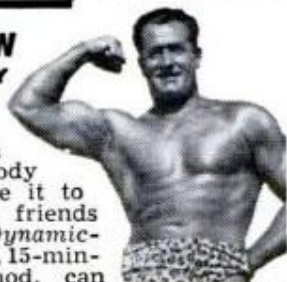
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LISTENING POST

BY BOB IRVIN

THE 1969 MODELS are due next month. You'll find Pontiac has gone to a 122-in. wheelbase on the Catalina while Plymouth is up to 120 in. on the Fury. Reason? Ford's 121-in. wheelbase on its big car. . . . Some new convertibles will gain more rear-seat room by redesigning the folding top mechanism. . . . Pontiac's Bonneville will have a front nose guard made of rubber, also a rear bumper protector made of the same material. . . . Has Lincoln styling found converts elsewhere? The new Cadillac has flared and pointed front fenders like the Lincoln-Continental. The new Imperial also appears to borrow from the Continental's front end styling theme. . . . On its standard-size car, for 1969, Chevrolet's base V8 may be the 327-in. engine. For '68 it had been the 307-incher on the big as well as the intermediate cars. This would put Chevy one up on Ford, whose 302 engine will continue to be the base V8 for its big car.

THE 1969 SHELBY MUSTANG—or Cobra—will sport a distinctive plastic grille which many observers think looks sharper than its new Ford-produced offspring, the high-performance, racy-looking Mustang Mach 1. This should keep Shelby in the specialty-car sales race.

SNAKE ON WHEELS. That's to be the emblem of a new Ford Torino model designed to compete with the Plymouth Road Runner and the Dodge Super Bee. Maybe these ought to be called the "Zoo Cars."

A BLARING BUGLE should scare off any would-be Corvette thieves. The miniature six-inch-long horn sounds off if anyone tries to break into the 'Vette through the hood or doors. The control mechanism is well hidden to prevent anyone from ripping it out. Speaking of antitheft devices, a new one to keep parked trucks and trailers from being moved by thieves will soon be marketed. Details aren't as yet available.

GAMESMANSHIP BY OLDSMOBILE left Pontiac and Ford holding the bag. Late in the 1968 model run, Olds offered an electrically-heated rear window as an option on the Toronado. Pontiac wanted to be first with the device on the '69 Grand Prix. Then Ford got wind of it and decided to put it on the '69 Thunderbird.

METAL SUPPLIERS are being queried by General Motors on material prices for turbine engine components. Word is that GM would like to start production in 1970 of 300 turbine engines. They'd be for big commercial vehicles. In line with this, GM's reported to be building a second experimental turbine bus. Meanwhile, Ford engineers believe they're at least 18 months ahead of the pack in development of the turbines. They cite their development work on a new, less-costly ceramic regenerator as an indication of their lead.

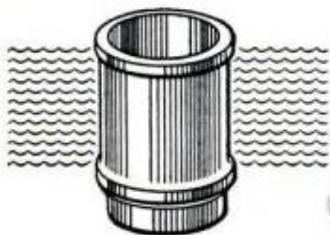
THAT LONG-RUMORED SMALL CAR in the works at Ford—designed to compete with the VW-sized imports—features sensational styling. It has a distinctly European flavor—about as far away as you can get from the run-of-the-mill styling on some current compacts and imports. The car has a sharply sloping hood, a semi-fastback roof and a squared-off rear end with just a hint of a spoiler. It looks like trouble for competitors, since Ford will be out with the car next spring. American Motors will be ready in the fall of 1969 with a slightly smaller version of its Rambler compact. The design will be based on the Cavalier, a show car AMC displayed some time ago. General Motors is reportedly a couple of years behind in this field because it's starting from scratch to build a car in the small-import price range. Ford will use the Falcon

(Please turn to page 28)

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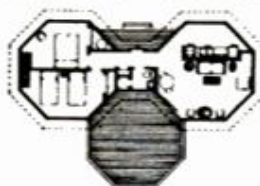


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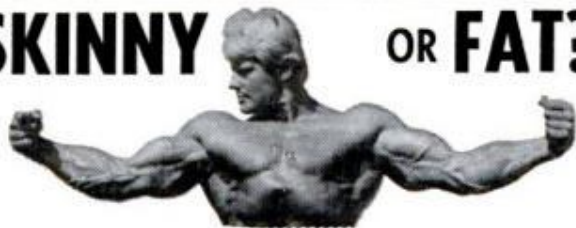
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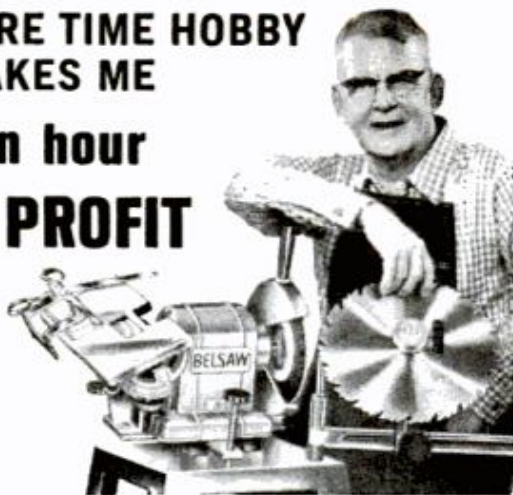
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DETROIT LISTENING POST

(Continued from page 24)

driveline and claims it isn't aiming at the Beetle market. Chrysler's not talking, yet.

THE 1969 GM CARS will have a new energy-absorbing steering column. Designed to collapse at a more uniform, controlled rate, it is said to be a decided improvement over existing columns. Main feature of the new design is that the column itself absorbs the energy rather than the meshlike metal jacket now in use. Collapsible steering columns work, too; a recent University of Michigan study showed that only two of 51 accident fatalities could be attributed to steering-column impact. A previous Michigan study showed that striking the steering column was at one time second only to ejection as the leading cause of auto accident deaths. Also in the safety race, Ford's new frame on its full-size 1969 cars will have S-shaped front rails to absorb energy in a crash. Replacing the straight rails used previously, the new curved rails fold like an accordion when the car is struck head-on. Ford's goal is to reduce the impact forces on a driver by 25 percent. The new energy-absorbing front end is an improvement over the one Ford pioneered on the 1968 models. This is a far cry from the horsepower race of a few years ago.

AN ANTISKID BRAKING SYSTEM will also be on the Continental Mark III as well as the Thunderbird for 1969. As an option, the price will be about \$150. Since it's attached to the rear wheels, it will help only in a straight stop, not in a power skid where steering is needed to recover. A four-wheel system is necessary for that. But Ford says the rear-axle system is the only practical one at the moment. It's bound to be improved, but Ford gets the credit for a first on the American market.

LOOKING AHEAD: Chevrolet's expected to have a new personal car in 1970. It's believed to be based on the Chevelle two-door body. This means it will probably follow the same long-hood, short-deck approach of Pontiac with its new Grand Prix. The GP is mainly a stretched version of the Pontiac's intermediates.

CONVERTIBLES may be on the way out. Car buyers are reported opting for air-conditioning in lieu of the added sticker price on convertibles. American Motors is said to be dropping all soft-tops from its 1969 line. Other makers may follow. Cost of special tooling and added labor puts cars of this type in a profit squeeze. ★★

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Drivin' with Dan

How about roll bars and racing harnesses for a family car? On cars under test, what's the bicycle wheel for? Has anyone tested a car to its maximum limits? Dan Gurney answers these and other provocative questions



GURNEY AND PM EDITOR BOB CROSSLEY discuss Dan's stock-block Eagle prior to the '68 Indianapolis 500. Dan was second to Bob Unser, also in an Eagle

Q. Please settle a disagreement between friends. What is more hazardous, a front or rear blow-out?—Aubrey Hudson, Atlanta.

A. I'd say it's six of one, a half dozen of the other. If you're in a hard turn and lose either front or rear tire on the outside—or loaded side of the car—you're in a very dangerous situation.

Q. Has anyone ever tested a car to see just how long it can last?—Glenn Ross, Reseda, Calif.

A. I don't believe so. There are so many variables—environment, a driver's habits, other drivers, traffic patterns, and so on—it's just about impossible to arrive at a positive conclusion regarding the ultimate life of a car.

However, not many will go 100,000 miles without giving some sort of trouble.

Q. Because Chrysler Hemi engines are sold to the public in only one way—that is, with two 4-bbl. carburetors—why are they allowed only one on the stock car tracks? Doesn't this give the competition an unfair advantage? Is there any chance the rule will be changed?—Tom Ritter, Mattoon, Ill.

A. My understanding is that recently Mopar cars have been allowed to run with two carbs, but that so far this hasn't spelled instant success. There's a lot more to racing than slapping on another carb, but, on the surface, I suppose the rule does seem to give Chrysler's competition an unfair advantage. Any advantage is unfair unless it happens to be yours. It's all part of racing and everyone concerned works very hard to gain an edge, no matter how large or small. As for your final question, the rule has just been reversed again. Mopars will have to run with one 4-bbl. carb during the next two seasons.

Q. I ordered a Cougar XR7-G with a 230-hp engine, disc brakes, 3.25 equallock rear end, and manual steering. Would it be a good idea to add traction masters and/or a rear antisway bar?—Ed Waleck, Closter, N.J.

A. Ed, I can promise you a rear antisway bar works just great in conjunction with a larger, front antisway bar.

Q. Would there be any purpose in equipping the family car with racing harnesses and a roll bar?—David McLain, LaGrange, Ga.

A. I'd say it would be safer in the event of most types of accidents. But, quite frankly, these things are also rather inconvenient as

(Please turn to page 32)



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DRIVIN' WITH DAN

(Continued from page 30)

to comfort, entry and exit, and so on. The best solution, I think, is equip the family car with a safe, alert driver.

Q. I have a '68 Chevy II Nova, column three-speed with a 307-cu.-in. engine. Should I put a Hurst three-speed conversion kit on it while the car is still under warranty, or wait until the warranty ends? I was also thinking of installing a lift kit, but the front end is covered by a warranty, too. Do you think I ought to risk putting the kit on now?—Tim Mitcham, El Dorado, Ark.

A. I assume you're thinking in terms of getting maximum performance. If so, you can forget your warranty coverage—warranties don't apply to competition parts, and obviously you would void any protection covering affected parts. That's the price we car buffs must pay. But if it's performance you want, go ahead and take the risk. Drive carefully, and have fun.

Q. Why do cars under test often have a bicycle wheel hooked up behind them?—Michael Fillion, Agincourt, Ont.

A. It's a device to measure more accurately such things as speed and distance covered.

Q. You've said karting is good experience for someone who wants to learn to drive a race car. What about mini-bikes? From an experience point of view, are they as good as karts?—R. Grumen, Los Angeles.

A. I doubt it, but mini-bikes can be great fun and exercise. On the other hand, anything you race gives you some of the elements of race car driving.

Q. What's the difference between Formula 1 and Indy cars?—Bill Roy, Franklin, Ind.

A. Formula 1 limits engine displacement to 183 cu. in. unsupercharged, or 91 cu. in. supercharged. Also F1 rules specify pump gas only for fuel, and require a self-starter be carried aboard. Minimum weight with water and oil—but not fuel—is 1102 pounds. The maximum engine displacements at Indy are 255 cu. in. unsupercharged, 168 cu. in. supercharged and 305 cu. in. for stock blocks. Type of fuel is optional, but capacity is limited to

75 gallons. Dry-weight minimum at Indy is 1350 pounds. Also, there are other differences in rules pertaining to such things as construction materials, skin thickness, roll bars, bumpers, fuel bags, breathers, oil, tires and so on.

Q. I've seen "diagnostic centers" for cars mentioned in your column, but have been unable to find one. Are they listed anywhere?—Elwood Femrite, Dover, Del.

A. Out-and-out diagnostic centers seem to be a bit rare, I admit. However, most tune-up shops offer much of the same type of electronic equipment. It seems obvious, but try the Yellow Pages.

Q. Are there any racing schools near me? And what is the best way to start racing if you don't have much money and want to get into Grand-Prix cars?—Robert Hankins, Osbornville, N. J.

A. Check the various magazines for location of drivers schools. Curtis Turner, the living NASCAR legend, recently opened a high-performance driving school at the Charlotte (N.C.) Motor Speedway (*The Fastest School in the World*, page 94, Jan. PM), although it is focused on stock cars mostly. You must get experience in racing—any kind is good in the beginning. Then you don't give up; you keep trying, and it gradually unfolds.

Q. I'll be 16 soon and I want a 50-cc scooter. But my parents think anything with two wheels and a motor is dangerous. Do you agree?—Joe Martelli, Canton, Ohio.

A. Yes, Joe, I do. But also dangerous is anything that has four wheels and a motor. So are bathtubs, banana peels, bicycles and so on. The point is it's up to you to prove to your parents that you'll handle the scooter with good and careful judgment, and with a full awareness of all the dangers that are involved. In other words, you'll have to show them that you're mature enough to use good sense. In the meantime, however, watch out for those bathtubs! ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 53).

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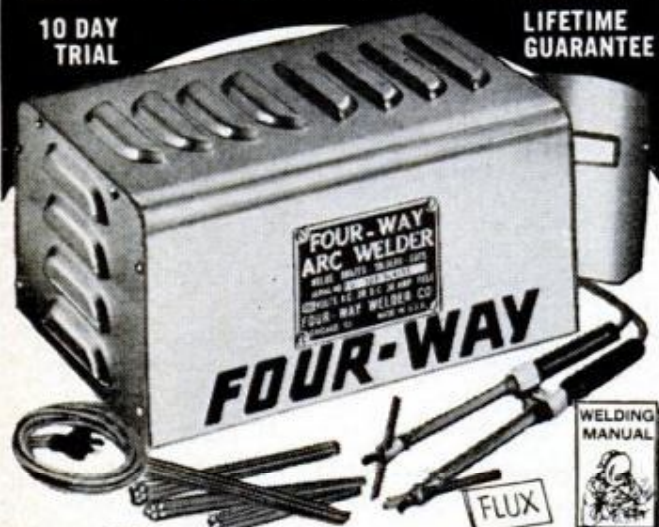
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PICTURE THIS

By SHELDON M. GALLAGER



NO BIGGER THAN A PACK OF CIGARETS, this self-contained electronic flash operates on built-in batteries or on house current at the flick of a switch. A small plug-in charger (inset photo above) provides overnight recharging and doubles as an a.c. power source. In tests, the handy pocket-size unit was found to deliver almost as much light (within about one stop) as the so-called "big" guns. Recycle time is 8 to 10 seconds on batteries and 6 seconds on a.c. Each charge is good for 45 flashes. The Bauer E-160 Ultrablitz is distributed by Allied Impex Corp., 300 Park Ave. S., New York. Price is \$59.95



YOU GET A CHOICE of two types of flash with this new Konica EEmatic 35-mm rangefinder camera. A rotating socket on top takes the popular four-sided flash cube. If you prefer to use individual bulbs, there's also a miniature pop-up reflector for the AG size. The camera has a built-in light meter, a 42-mm f/2.8 lens and speeds from 1/30th to 1/250th of a second. Price: \$79.95 from Konica Camera Corp.

(Please turn to page 37A)

POPULAR MECHANICS

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An important message for every man who doesn't want to be...

"Ashamed to go to his class reunion!"

REMEMBER, DEAR, OUR HIGH SCHOOL REUNION IS THIS WEEKEND.

DO WE HAVE TO GO, HONEY? SUPPOSE SOMEONE ASKS ME ABOUT THAT CRUMMY JOB OF MINE...?



PLEASE, HARRY, I'M DYING TO SEE OUR OLD GANG AGAIN.

HARRY! WHERE HAVE YOU BEEN KEEPING YOURSELF?

OH, YOU KNOW— AROUND. LOOKS LIKE YOU'VE DONE ALL RIGHT, THOUGH.



ONLY SINCE I GOT SMART AND GOT INTO ELECTRONICS! IT'S TODAY'S BIG "GROWTH" FIELD!

SOUNDS GREAT. BUT HOW'D YOU BREAK IN?



EASIER THAN YOU MIGHT THINK. I LEARNED EVERYTHING I NEEDED TO KNOW IN MY SPARE TIME, AT HOME... WITH CIE!

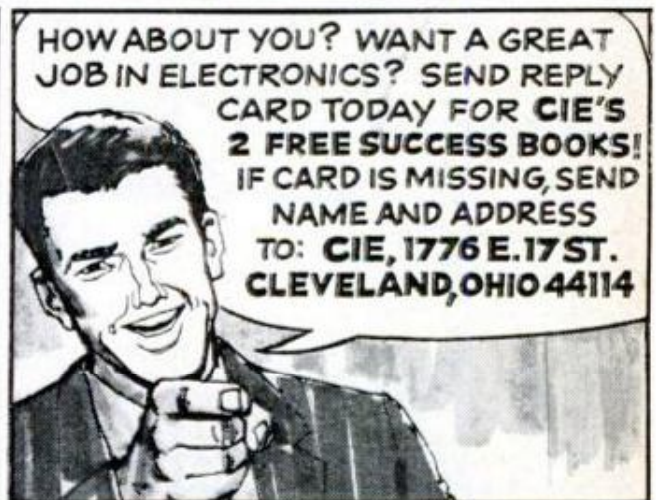


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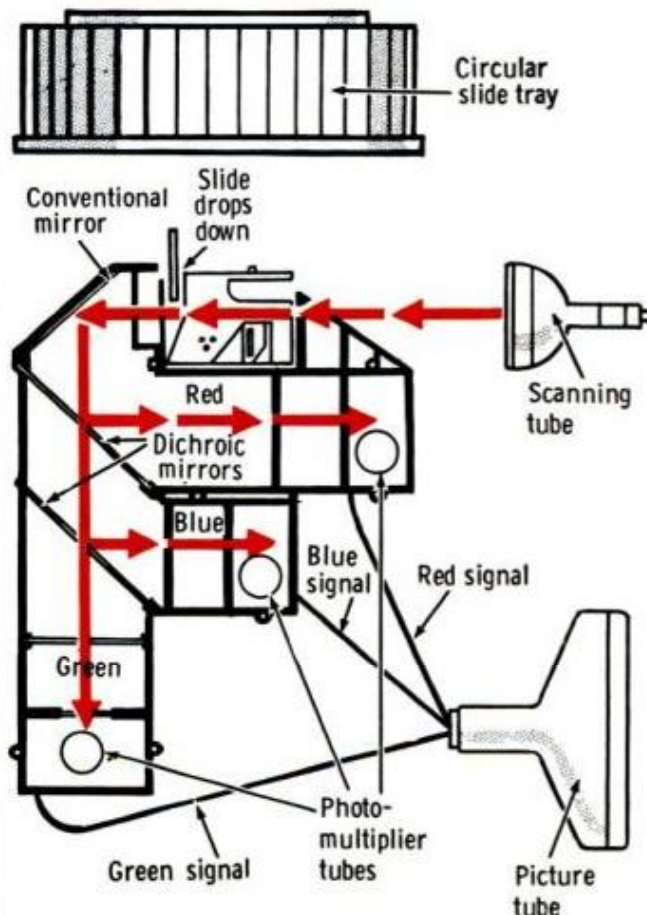
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PICTURE THIS

(Continued from page 34)



SHOW COLOR SLIDES ON A TV SET? You can with the new Sylvania home entertainment center shown above. The console contains a conventional color TV combined with a Kodak Carousel slide-changing mechanism. To switch from TV to your own slides, you just turn a knob. One by one, the slides drop down and are scanned like a TV trace by a rapidly moving beam of light from a cathode-ray tube, as shown in the drawing below. Special dichroic mirrors capable of dividing white light into different wavelengths split the beam into the three primary colors—red, blue and green. These are converted into electronic signals by photomultiplier tubes and fed to the color TV tube. Each slide image is then recreated on the TV screen just as if it were a TV picture. The console, called the Color Slide Theater, can be used to view regular TV programs in both color and black-and-white. There's also a built-in cassette-type tape recorder that can be synchronized with the slide mechanism for making your own taped slide shows. Price is about \$995



Would you like to earn up to \$8.00 an hour for pleasant spare-time work?

Switch to full time if you like. **NO SELLING!**

If you're an average man, with some high school education, the door is wide open to get into a fast-growing professional field. No previous experience is necessary. You can operate privately part-time, then switch to full-time later and you can often earn while you learn.

Gain Prestige and Security

What has caused this tremendous opportunity? The ever-increasing number of claims being filed by people because of accidents, fires, storms. Insurance companies, transportation firms and governmental agencies must hire trained people to investigate the damage and pay out the millions of dollars to settle these claims. **The law requires it.** And the demand for good trained accident investigators far exceeds the supply!

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road to success. You can progress as fast or as slow as you wish.

Some men have received their diplomas in five or six weeks. (And the cost is less than you'd imagine, with payments as little as \$10 a month.)

Earnings Like These in Our Files!

Anthony Allen of Baltimore writes that he is now making \$1080 a month. John Parzynski, a former plant guard, writes he has made \$38 a day, working only part time. Bill Peck averaged \$188 a day investigating hurricane claims. Oscar Silcox earns as much as \$100 a day working as an independent investigator.

Free Employment Help

We give you FREE employment help through our NATION-WIDE PLACEMENT SERVICE—or show you how to start an investigating business of your own at home.

The coupon at right or postcard addressed to Jim Edwards, Dept. 58, Liberty School, 162 E. Cook, Libertyville, Illinois 60048, brings you complete information. No salesman will call. (The Liberty School is fully approved under the new G.I. Bill for Veterans and Servicemen's Educational Benefits.)



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Liberty School of Claim Investigating
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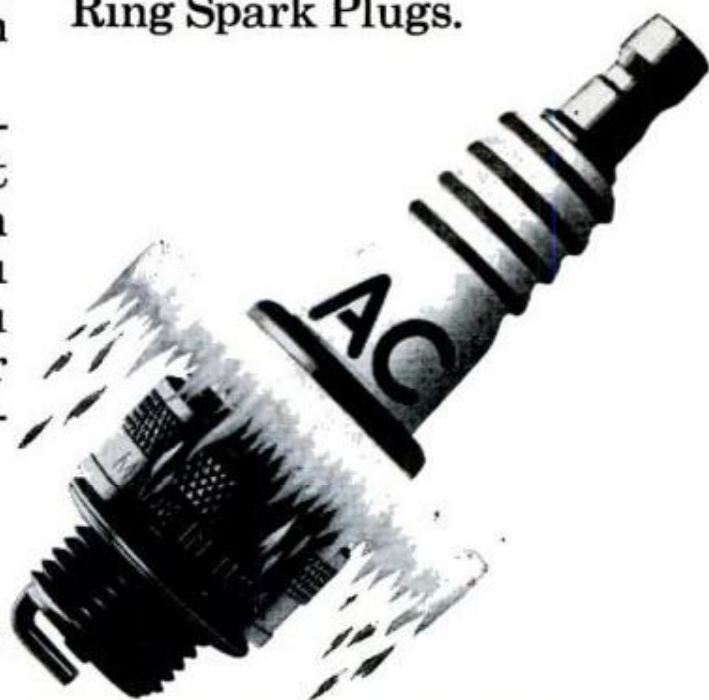
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Doesn't that sound like the kind of performance you want from your car?

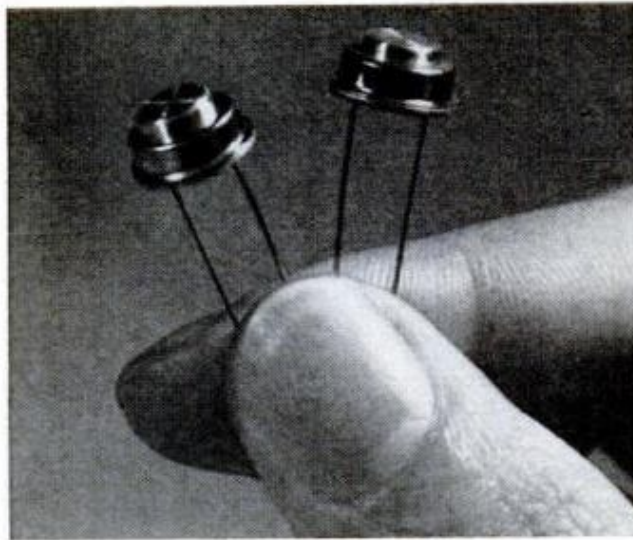
Next time you tune up, get what you want. Get AC Fire-Ring Spark Plugs.



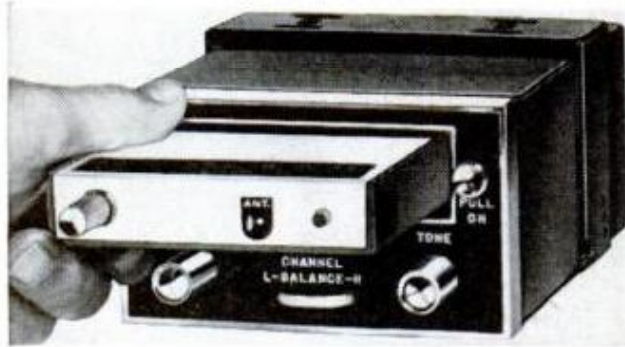
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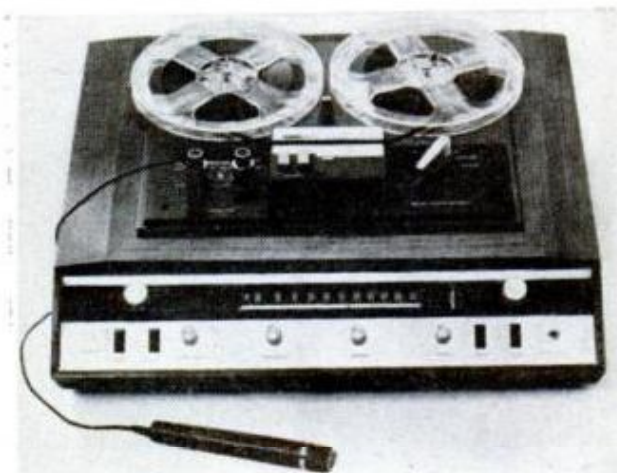
NEW IN ELECTRONICS . . .



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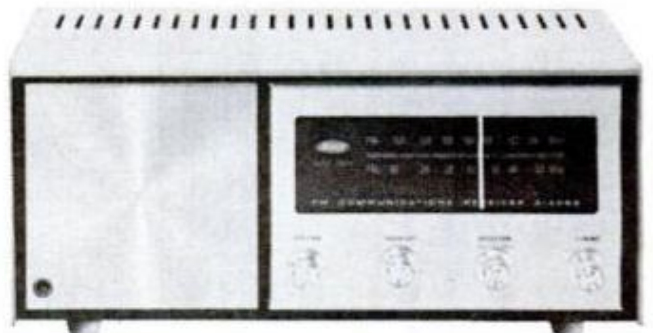
CAR-RADIO REVERBERATOR gives sound a three-dimensional quality by electronically delaying signal to rear speaker by milliseconds. The 12-volt, solid-state adapter has a balance control for mixing dash and rear speaker outputs. It's \$16.50 from J. C. Whitney Co.



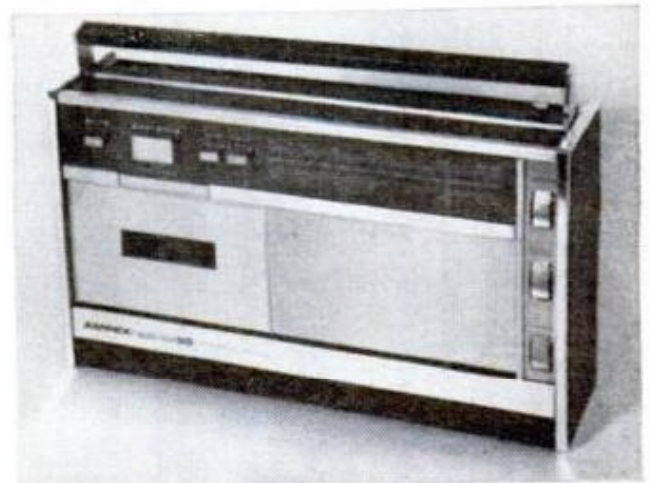
TAPE DECK AND HI-FI RECEIVER are combined in one home-entertainment package. Harman-Kardon's TDC33 has a 60-watt FM stereo receiver with three-head tape deck. Solid-state unit, enclosed in walnut, is \$490.



HIGH-VOLTAGE RECTIFIER at right is a solid-state device that replaces rectifier tube at left, making picture tube the only tube in Motorola's solid-state color TVs. Solid-state rectifier lasts longer than a tube, provides higher voltage and has instant warmup.

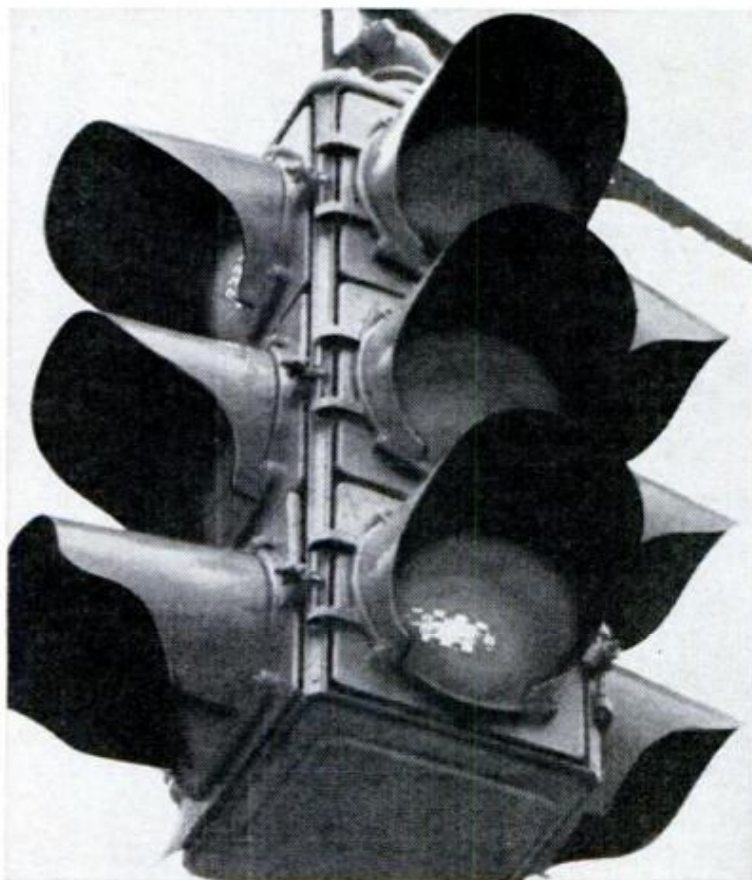


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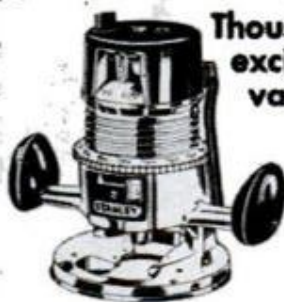
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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Freeze up

I hope you can help me avoid a problem this coming fall that I had all of last year with my 1966 Volks. It stalls in cool, damp weather. The car won't idle without stalling until the engine's been run for about 15 minutes and is warmed up.—Alfred E. Urban, Garden City, N.Y.

If idle and fast-idle speed adjustments are set to specification, then your problem is probably being caused by carburetor jet icing. It's been a bother to many VW owners and occurs when the carburetor preheater flap locks in a fixed position. Make sure yours is swinging freely. If not, clean out the gunk around it and give it a shot of a carburetor cleaner, such as Gumout.

Pulsing pump

I get a moaning sound from the engine compartment of my 1963 Cadillac, which gets louder and louder and finally peaks at about 25 mph. This happens also with the transmission in neutral as I press down slowly on the gas pedal. Have you heard of it and, if so, can it be stopped?—Bryon Sobel, Cleveland.

There was a power-steering pump problem with this car which acted just as you describe. A pressure hose was issued that has a chambered orifice to dampen pulsations produced by the pump. If you have a car with engine No. 137944 or lower, I'd have this hose installed. It's part No. 5692602.

Pedal problem

I just bought a used 1966 Coronet Six with manual transmission. I've noticed that the clutch pedal doesn't return all the way. How much trouble am I in?—H. F. Kutler, Montreal.

Not too much. Early in the production year of this car it was found that by positioning the torque shaft return spring differently, there would be full pedal return. Suggest you see a Dodge shop.

Oil mystery

My problem's a 1966 Ford Galaxie 500

that started using a quart of oil every 200 miles at 10,000 miles. New valve seals were installed three times, new rings twice, and new manifold gaskets. I now have 34,000 miles and still the problem persists despite all the work by reputed mechanics. Why?—D. A. Calliham, Thomaston, Tex.

One feasible explanation involves what can happen with chrome piston rings, which are installed in your car. Unless the new or newly ringed engine is operated at a fairly good highway speed frequently, rings will not seat and a glaze will build up on cylinder walls. You'll start to use oil. A mechanic who simply installs new rings without honing cylinder walls to break the glaze is not curing anything. Perhaps this is what happened in your case. If so, your argument is with the mechanic who did the work.

How to stop a leak

Water is leaking through the back windshield of my 1963 Pontiac. How can I stop it?—Bob Masters, Los Angeles.

The method of stopping a water leak in the back window of a 1963 Pontiac depends on the body series. The Tempest used adhesive caulked glass which, by the way, is the method now employed on current Pontiac production. The 1963 larger Pontiacs (such as Catalina and Bonneville) used a rubber channel installation. Follow these instructions for fixing both:

1. Remove the interior garnish moldings from around the back window and water-test to determine the leak point.

2. If installation is the rubber channel type and the leak is between the glass and rubber channel, seal the leak with black weatherstrip adhesive.

3. If installation is the rubber channel type and the leak is between the body and rubber channel, remove the moldings from around the leak and flow in a generous amount of 3M Seam Sealer.

4. If installation is the adhesive caulk type, remove the moldings from around the leak point and seal with adhesive caulking compound supplied in General Motors parts kit No. 4226000. Before you

(Please turn to page 54)

AUTOMOBILE CLINIC

(Continued from page 53)

apply this, trim off excess material from the leak point and prime the surface with the adhesive caulking primer supplied in the kit.

All materials can be purchased from an auto supply dealer or a Pontiac dealer.

Silence the scrape

When I turn the steering wheel of my 1964 Oldsmobile F-85, I get an annoying scraping noise. Can this be eliminated?—Frank St. John, Raleigh, N.C.

Probably, but it's a job. The steering wheel has to come off, and the spring and turn-signal-canceling cam has to be removed. The brass ring and horn contact are polished with No. 44 wet-or-dry sandpaper until smooth. If the ring cannot be sanded smooth, the entire canceling cam assembly has to be replaced. Finally, the brass ring and contact are cleaned thoroughly and a calcium-based lubricant such as Lubriplate 105 is applied to both.

What's up front

My 1966 Ford Fairlane has hard steering and transmits much road shock to the steering wheel. The dealer has tried all sorts of things with the front-end geometry but nothing works. He's given up. Can you help?—Raymond Nigro, Utica, N.Y.

Hard steering and road shock are frequent complaints. Here's the order in which I'd tackle troubleshooting. Test the car after each step:

1. Make sure tires are properly inflated and in good shape.
2. If the car's equipped with power steering, test fluid pressure to make sure it's to spec. Check for leaks, assure that the reservoir is filled to the proper level, and make sure the drive belt is to specified tension. If the pressure test indicates that pressure's okay, check the control-valve spool-centering spring for proper adjustment and the control-valve ball stud for free movement.
3. Make sure front-end alignment is to spec.
4. Finally, start looking for loose or worn suspension and steering components

in this order—shock absorbers, ball joints, idler arm, strut bearings and steering linkage.

Jeep speed

I have a 1962 Willys Jeep utility wagon with the Six-226 engine. Some mechanics have told me to keep my speed to about 45 mph on parkways, because prolonged high speeds could ruin the engine. Is this good advice?—Walter Nichols, East Hampton, Conn.

Not according to Kaiser Jeep Corp., which makes the vehicle. They say, "A speed limitation need not be placed on the L6-226 engine. This engine is originally equipped with heavy-duty bearings, hard-faced valves, valve rotators and valve seat inserts, and normal parkway speeds would not be considered abusive."

Service Tips

- **Chevrolet** tells us that windshields and back windows of new cars are being replaced without need, because they look stained or etched. In many cases, Chevy says, the only problem is a clear or amber substance, such as primer used in production for good adhesion between glass and adhesive caulking compound. People mistake this for a flaw. The company suggests that before replacing glass you scrape the spot with a razor blade to see if it can be removed.
- **Oldsmobile** warns us of the consequences of installing cooling system thermostats in the wrong manner. If a thermostat is installed backwards, the thermostat valve will act as a baffle, causing coolant to change direction to pass around the valve. This interrupts the smooth flow of coolant and could result in an overheating condition. When installing a thermostat, make sure that the word "FRONT," which is stamped on the top of every thermostat, is positioned up and toward the radiator.
- **The American Automobile Assn.** has a warning. If you own a foreign-made car, take good care of the keys. It might even pay to have some spares made. Foreign automakers don't release key codes to U.S. locksmiths as do domestic manufacturers. So, if you lose a key, the lock will probably have to be bored out and replaced with a new one. That's an expensive deal.

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Letters cannot be answered individually, but problems of general interest will be published in the column.



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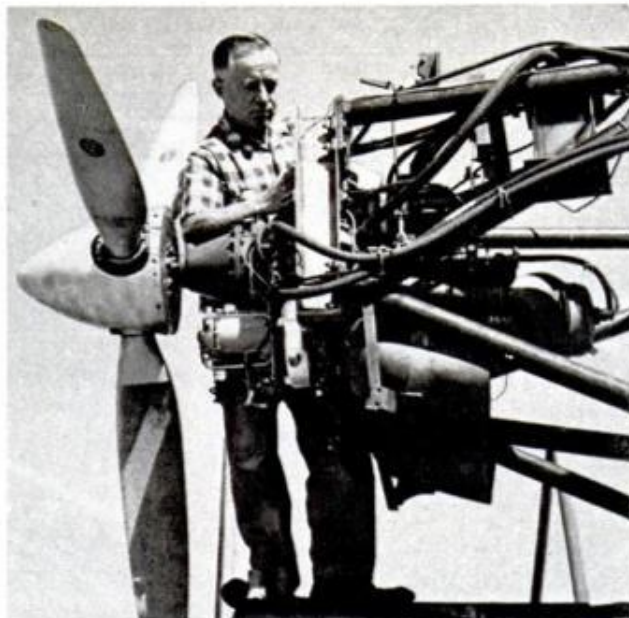
BY KEVIN V. BROWN
AVIATION
JETSTREAM

TURBOPROP ENGINES for small planes? Yes, they're coming. Some multi-engine business aircraft already have propjets, but one maker (Allison Div. of General Motors) recently announced it is going into production with a lightweight turboprop engine for small, fixed-wing aircraft, specifically single-engine airplanes.

Not every aircraft owner can afford one, of course, because the engine will produce the equivalent of better than 300 hp, which will put it in the top price bracket of single-engine aircraft, say \$30,000 or better.

But the trend is on. Military and commercial aviation have switched almost exclusively to turbine engines, and general aviation has started the switch. So there's not much chance of turning back.

In fact, at least one breakthrough in ultralight turboprops has been made in the homebuilt field. An open cockpit biplane, first designed in 1937, has been flown in England with a modified industrial turbine engine. Early problems, in-



PROPJET ENGINE for small planes from GM's Allison

cluding compressor-blade stalling and designing a special, variable-pitch propeller, took some doing to overcome.

Even so, the rewards seem to be worth it in performance. Even though they consume more fuel, turboprops produce more speed with a smoother ride.

When will the first homebuilt with a turbine be produced in America? ★★★

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ALL-NEW FORD CLUB WAGON

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Finishing plywood edges

I'm making a built-in of plywood that is to be painted. I'm using fir plywood 1/2 and 3/4 in. thick and want the exposed edges finished smooth—really smooth. How can I do this?—A.D., Vt.

There are several ways of finishing exposed edges of plywood. Where they are to be painted or enameled the problem is easy to solve.

The first step is to fill any voids along the exposed edges. Wood putty serves this purpose nicely, but be sure it is pressed firmly into each opening. Then strike off the excess slightly above the surface so you can sand the putty flush after it hardens. As a rule, the rest of that coarse, grainy edge that usually shows even after a couple of coats of paint or enamel can also be filled and sanded flush.

First lay on an even coating of the wood putty with the knife and press it into the grain. Allow it to harden fully and then sand, first with a coarse or medium grade of sandpaper and then with a finer grade. Use a sanding block without a felt padding so that you get a square edge.

You can also use glue to "level" a plywood edge. First fill any voids with the putty, then spread on a coating of glue (any of the white glues will do) with your finger. After this hardens and cures, lay on a second coating. Allow this to harden and then sand smooth. Edges treated in either fashion will take paint or enamel without any grain showing.

Squaring steel posts

In my basement there are two steel posts supporting an I-beam. I know how to box in the beam but how do I provide the nailers necessary to enclose the round posts?—L.G., Mont.

You don't give the diameter of the posts but I assume it is 4 in., a common size. One way is to make semicircular, 2-in.-radius cuts at the centers of two short lengths of 2x6 stock. Then drill the two pieces edgewise so clamping bolts can be used (holes for the bolts should just clear the semicircular cuts). Counterbore these holes in both pieces so that the heads and nuts of the bolts will seat below the sur-

face. Then clamp the nailers in place on the post and measure the overall width. Cut the 2x6s to length equal to the width. This will give you a nailer for a square wood box, or post.

Although two nailers per post might do, three would be better with one each near the top, the bottom and the center. After fitting the nailers it's a good idea to secure them with epoxy.

Mix a batch as directed and spread it on the semicircular surfaces and immediately clamp the nailers permanently in place. If the posts are painted, scrape away the paint before applying the epoxy. Be sure, of course, that the nailers are in line.

Renewing laundry tubs

I have some old and discolored laundry tubs in my basement. They have no cracks or chips. I wish to preserve them, yet make them easier on the eyes. Will paint or enamel do it? What kind?—N.D., Ky.

It's going to take some elbow-grease, because the cleanup job must be very thorough. Dirt and soap residues all must be removed before any coating can be applied. Perhaps the best way to do this is by vigorous use of a stiff-bristle scrubbing brush and a medium-to-strong detergent solution, such as trisodium phosphate. Use a fair handful of the trisodium to a gallon of water. Clean every inch of the tubs, inside and out, scrubbing with the brush and rinsing as you go. You may have to steel-wool areas where there are heavy soap residues.

Then rinse thoroughly and allow all surfaces to dry before applying one or two coats of epoxy enamel in whatever color desired, using either brush or spray (epoxy enamels are now supplied in pressurized containers). Open the basement windows and use an electric fan to circulate the air. Give the coating plenty of time to dry before using.

Lightning rods—a hoax?

I live in "country" suburbia—in the open—and I'm interested in lightning rods for my home and two venerable shade trees. But a neighbor tells me that lightning rods are a waste of time and money. Is he right, or is there something to this lightning-rod deal?—L.C., Mo.

There most definitely is "something to this lightning-rod deal," as you put it. In fact, proper rodding of both buildings and trees offers almost 100 percent protection from damage by lightning. ★★

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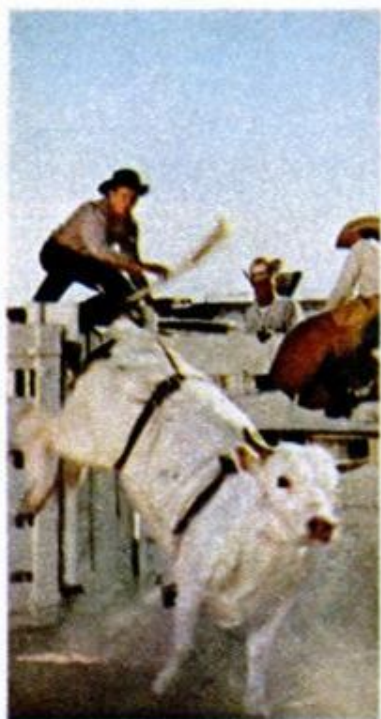
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The Air Force has a tough, new course for "turnpike pilots." Test yourself: Would you get your wings or wash out?

Today, every U.S. airman under 26 must take an 18-hour course in traffic safety. Teaching driving skills isn't the idea; rather it's to instill an awareness of mistakes, perhaps deadly ones, you're likely to make—and see made—while operating a car. The Air Force wants its drivers to see and think and steer. Below are a few of the "lessons." The course is one of the best I've encountered.

Bill Repentin

Auto Editor

SITUATION: On a three-lane highway, you pull out in the middle lane to pass the car in front of you. Another driver, coming from the opposite direction, does the same thing. You're boxed in; there are cars left, right, ahead. What do you do?

BEST BET: Move right. Head for even a tiny gap between cars. Blast your horn as you do so. If there's no gap, sideswipe a car if you have to; a sideswipe is far less dangerous than a head-on crash.

SITUATION: Suddenly, a young bull darts into the road. If you swerved left, you'd hit the horse and rider. So you swerve right and hit the tree. Or do you?

BEST BET: Cute little fella, and all that, but given a choice between him or a tree . . . well, he's a lot softer. Swerving suddenly to avoid livestock, deer, or dogs has killed many a driver. The thing to remember is to not panic. Brake and head for the softest target—him.





SITUATION: But now what? You're doing at least 30 mph, enough to kill that child if you hit him. Your choice is the child or the tree; which one do you hit?

BEST BET: You've had it here. In order to protect the child, you have to swerve right, and that puts you into the tree. Try to hit it a glancing blow.



SITUATION: You're heading down a two-lane access ramp to a superhighway. The name of the game is acceleration, plus extreme caution. What's the principal danger to watch for in this type of situation?

ANSWER: The main thing to watch for are cars overtaking you as you try to work your way into the flow of traffic. Often this type of two-lane freeway entrance narrows down to just one lane, leaving you with no place to go but up.



SITUATION: You're zooming along a freeway at a good clip. Everything's roses. But there's a potential hazard area in here somewhere. Do you see it? If you do, what do you do about it?

ANSWER AND BEST BET: Ahead, to the right, there's another freeway blending in with yours. It could spell big trouble. Your best bet is to change lanes to the left, thus giving other drivers every advantage. But watch that center divider; there's no fence or barrier to stop an oncoming car from crossing over into your lane.



SITUATION: Things look perfect here, don't they? But are they? No, you're not too close to the guy in front of you, and let's assume you have plenty of room all around. A clue?

ANSWER: It's that center divider again. Sure, it's wide enough, but it still lacks a fence or barrier to stop or slow down an out-of-control car coming at you from the opposite direction.



SITUATION: You want to pass that big truck ahead and to your right. What should you try to do?

BEST BET: Try to make eye contact with the truck driver to be certain he sees you as you start to pass him. Check his big side-view mirror; you'll see him, and chances are he'll look and see you, thus alerting him to your presence.

SITUATION: You and the fellow on your right are both doing about 60 mph. But, by not altering your position relative to the other car, you're causing a potentially unsafe situation. What is it?

ANSWER: You're in his blind spot, meaning he might not be aware of your presence. If, not knowing you were there, he suddenly changed lanes, you might find yourself in an accident. So, change lanes, or slow down and drop back, or accelerate and pass him—anything to get yourself out of his blind spot.



SITUATION: The driver of that car ahead wants to turn to his left. Let's assume he gave the proper hand signal, that his direction signals are flashing a left turn. Still, he's making a serious error. What is it?

ANSWER: His front end is over in the oncoming lane and wheels are turned left. If he gets smacked from behind, he'll be pushed directly into oncoming traffic. Stay in lane, and keep your wheels *straight*, when waiting to make a turn out of traffic.



SITUATION: If you're on the ball, you should be able to spot a potential traffic hazard here. The clue is almost hidden, but it's there. What's the possible problem?

ANSWER: That guy on your right better turn right at the intersection. There are cars parked in the curb lane ahead, and if he doesn't turn right, he's going to have to move to his left into *your* lane. By being aware of this possibility, you might avoid an accident.



SITUATION: If Bonehead up ahead there doesn't get back in his own lane in another split second, you'll have to make a move. What should it be?

BEST BET: That's a good, firm shoulder off to the right and there's no reason why you shouldn't use it as an escape road. In fact, it's a good idea always to drive with an escape route in mind.



SITUATION: Essentially the same as above. But this time that "shoulder" to your right is a ditch lined with loose stones and gravel. Should you pull off into it?

BEST BET: Sure. Even a ditch is better than a head-on crash. Try to angle into it gradually, then straighten out and drive along the ditch until you can bring the car to a stop.

(Please turn to page 174)





Ford Torino



Comfort of Buckets Is Tops, But Workmanship Bottoms Out

By **BILL HARTFORD**, Associate Auto Editor

Photos by Irving Dolin

FOR THE REAL LOWDOWN on a Torino, just ask an owner. Better yet, ask a thousand. They're the guys who've given Ford's new intermediate the real shakedown, and anyone who's plopped a pile of pesos on a car really puts his mouth where his money is.

Forget all that Pace Car stuff and the seductive Ford brochures; forget the Millinocket to La Mesa Mileage Runs;

and forget that Tom McPushrod zero-to-sixtied the 427 Fastback in so-many seconds and took it across the Morton Salt Flats winding so-many miles an hour.

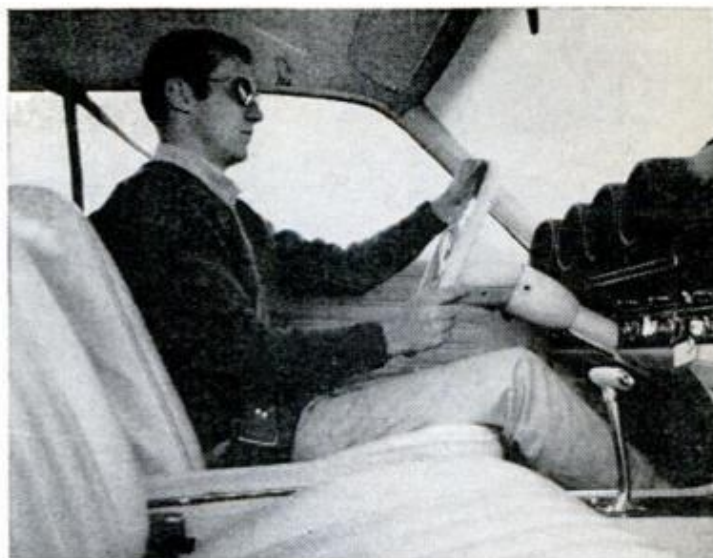
What should perk up your ears is that an owner in Wisconsin almost lost his V8 because "an engine-mount bolt was defective or not installed when the car was new"; that an electrical

A Nationwide Survey Based on 1,331,800 Owner-Driven Miles



worker in Illinois brags about the 22 mpg around town and 28 mpg on trips from his 302-cu.-in. V8; that an Illinois state policeman had to have the axle replaced on his station wagon: "Passenger car axle inadvertently installed at factory"; that a Vermont store owner likes "everything about it"; that an auditor in the state of Washington had his "rear transmission seal fail due to vibration caused by defective drive shaft"; that a Texas serviceman finds the seating comfort of his Torino absolutely "outstanding"; that a truck-driver in Virginia has a 390 V8 in his GT and the "timing won't stay set"; not only that but "the transmission locks up. Second one in the car is about to come out. Over \$4000 is too

AUGUST 1968



SEAT-OF-THE-PANTS handling, feel and medium size of car rate high. Some owners want more headroom

much to pay for a car that you can't get to work in"; that . . . well, stay tuned, folks, there's more to come.

A glance at the age distribution of owners in the accompanying summary chart reveals that the Torino seems to be one of those few cars for all seasons. Equal numbers of young, middle-aged and over-the-hill-but-still-behind-the-wheel folks own Torinos. They say the first reason for buying one is its style. Second most mentioned motive was a predisposition for Ford cars. A 70-year-old Texas "farmerette," as she calls herself, hasn't a single complaint about her Torino: "If I live to wear this one out, it'll be another Ford." Another 70-year-old, a weighmaster in

FRONT BUCKET SEATS are outstandingly comfortable, say Torino owners. "Nice and thick," comments one





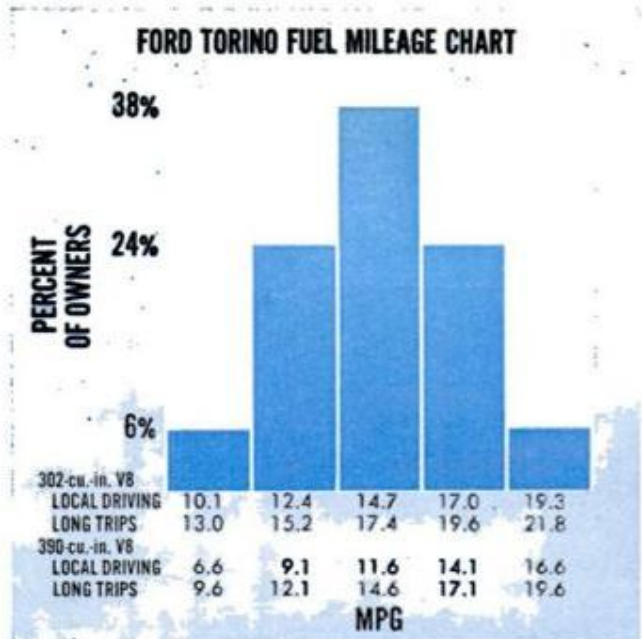
REAR SEAT of formal hardtop is quite comfortable, but it's hard to enter and exit; knee room is tight

New York, likes "its good styling and the way it attracts attention." And simply, "Ford is unbeatable," says a laconic Texas foreman.

But being hung up on Fords doesn't blind owners to their faults. A North Carolina housewife says, "I've owned 15 new Fords in the last 15 years and this is the worst." Totally disgruntled with workmanship, she answered when asked about her praises of the car, "Are you kidding?"

Not counted among the relatively

VENTLESS SIDE WINDOW on Torino, unlike that of most cars, has cap of chrome molding for snug fit



high 24.2 percent of owners who say they wouldn't buy another Torino is this Ohio hospital attendant: He already got rid of his. "You never knew when it would just shoot right out from under you. Dealer couldn't find the trouble. After having it in for repair eight times, I just gave up. I've about had it with Fords."

Owners who are sticking with their Torinos give style and handling top ratings. Two-thirds of all owners, incidentally, run Torinos, the other third pilot Torino GTs. Comments on handling for both are very matter-of-fact. After all, they seem to say, if a car's given a name like "Torino" it's supposed to look great and supposed to handle like a James Bond special. What seemed to catch owners unawares, however, was comfort.

Many of the owners, amazed at the

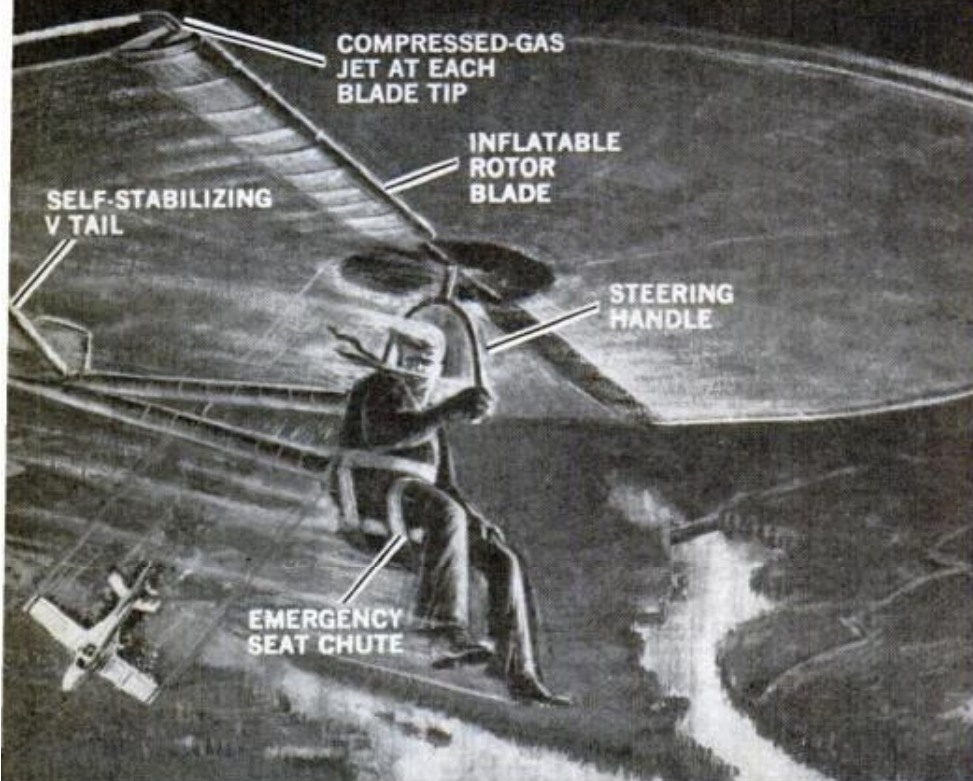
TORINO TRUNK provides sufficient luggage space. A few owners wish the lid opening was larger, however



Just patented

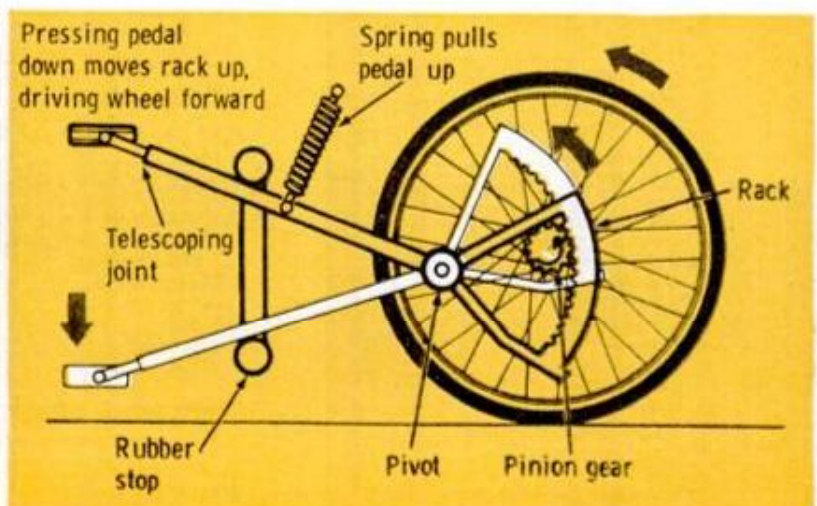
PM'S PICK OF THE NEW INVENTIONS

Prepared in cooperation with Roger S. Shashoua, Director, International Inventors Association, Inc.

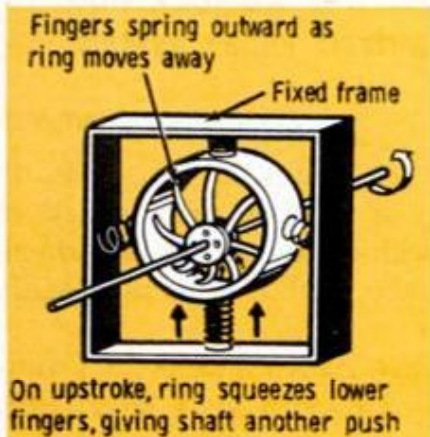
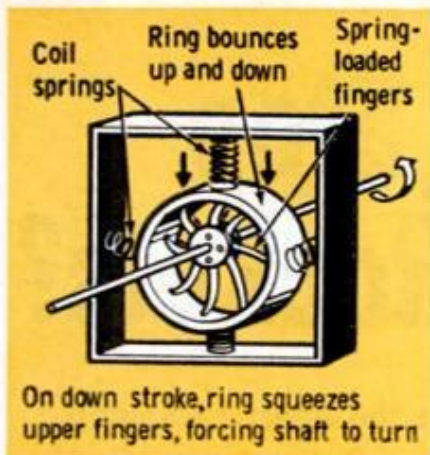


1. THIS INFLATABLE "ROTORCHUTE" is designed to carry the pilot of a disabled airplane to a safe, gentle landing. The spinning blade provides enough lift to glide for several miles and can be steered to a desirable landing point. Made of fabric, the blade and tail boom store collapsed in a backpack and are inflated by compressed gas. Pulling the rip cord releases a small drogue chute that opens the pack and starts the inflation. Blade-tip jets spin the rotor for a second or two to get it going, after which it turns on its own like an autogyro. Twisting the handle below the rotor hub tilts the blade to steer it

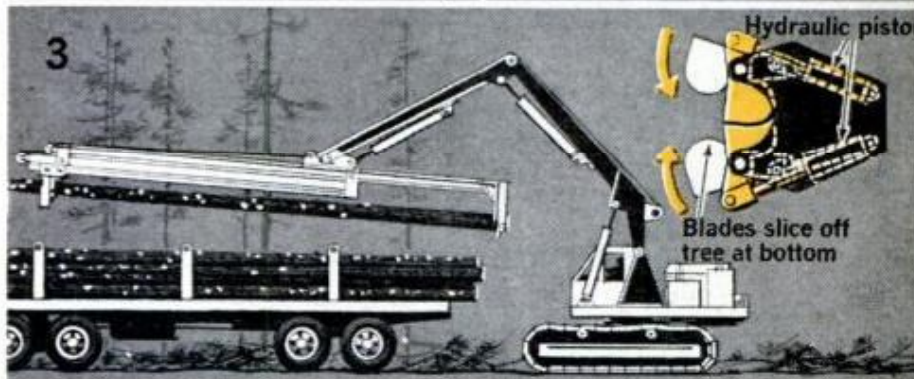
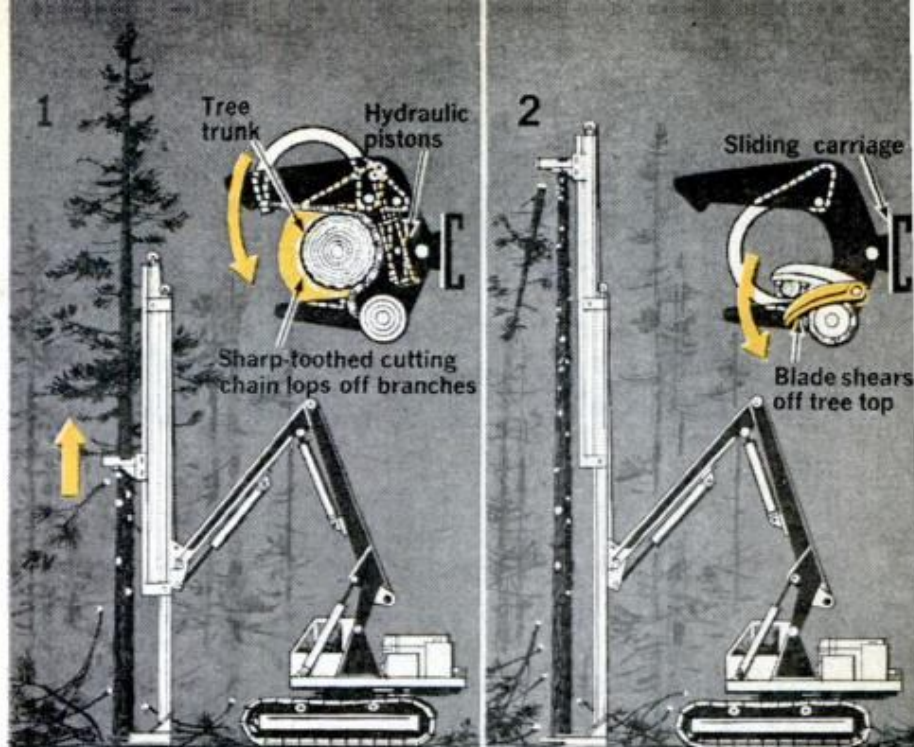
2. EASIER PEDALING is the object of the clever bike drive below. Instead of going around in a circle, the pedals move up and down. This eliminates the dead spot at the bottom of the stroke and lets you exert more push on the pedals. Pressing down on a pedal forces a toothed rack against a pinion gear on the rear wheel, driving the bike forward. The pedals are on telescoping arms that can be lengthened to increase leverage. This has the effect of changing the gear ratio without actually switching the gears



Inventors of the items shown on these pages are as follows: 1. Agnew E. Larsen, New Britain, and Robert F. Le Vino, Huntingdon Valley, Pa. (No. 3,362,665); 2. Kenneth W. Frye, Alhambra, Calif.; 3. Nicholas A. Plati,



3. "JIGGLE POWER" drives the unusual motor above. As the ring bounces up and down, it presses against spring-loaded fingers on the shaft. The fingers give the shaft a push forward each time they're squeezed. The ring's constant jiggling keeps the shaft turning at a high speed. The motor will work anywhere there's natural motion, such as on a train, bus or ship. It could drive small devices or generate electric power



4. THE LOGGER'S CRY OF "TIMBER!" may become a thing of the past. Trees felled by this modern mechanized method never hit the ground at all. A crane with a long telescoping boom moves up to a tree and clamps a cutting chain around it. The chain rides up the boom in a track, automatically lopping off all branches. Near the top, another cutter snips off the tip. Then the smoothly trimmed trunk is cut off at the ground by powerful hydraulic shears and loaded onto a truck for a sawmill—all without a lumberman's ax ever coming near

5. LATEST SHAPE IN LOUNGE CHAIRS is this novel design that looks like half a big hollow ball. You can sit in it, lie in it, tumble in it or use it upright as a playpen. While it can tip, it can't fall over and merely rolls harmlessly to a new position. It's a fiberglass shell covered with foam rubber



Yonkers, N. Y.; 4. Robert W. Larson, Ashland, Wis., Ole E. Olson, Caramat, Ontario, and Wilfrid D. Harkness and William E. Mair, Marathon, Ontario (No. 3,353,575); 5. Keith Albarn and Partners, London.

How Can We Stop Those Vietcong Rockets?

Those deadly attacks on Da Nang and the heart of Saigon proved as hard to stop as sniper fire. But we may find a defense in a new low-level computerized radar system

By MORT SCHULTZ

Illustration by Herb Mott

ON A QUIET NIGHT in February 1967 at Da Nang Air Base, South Vietnam, the stillness was shattered by a whoosh that ended in an earthshaking explosion. One hour of whoosh-cracks later 12 Americans and 35 South Vietnamese lay dead amid the rubble of a supposedly impregnable fortress.

For the first time, the Vietcong had given the Allies a peek at a new page in the Vietnam War—barrage rocketry. Almost a year later, they threw the whole book at us.

Tet, 1968, was the week-long terror of last February when almost every city and village in South Vietnam, including Saigon, came under Vietcong attack. As was the case at Da Nang, long-range rockets that gave the Cong a virtually undetectable artillery capability were his most powerful weapon. They still are.

GIs had no effective way of challenging the weapons then—they have no way now. They will not have an effective means of neutralizing enemy long-range rockets for at least another year. That's when a new

RPG-7 LAUNCHER

OPTICAL SIGHT TRIGGER STABILIZING ASSEMBLY

BURSTING CHARGE

FUSE

BOOSTER

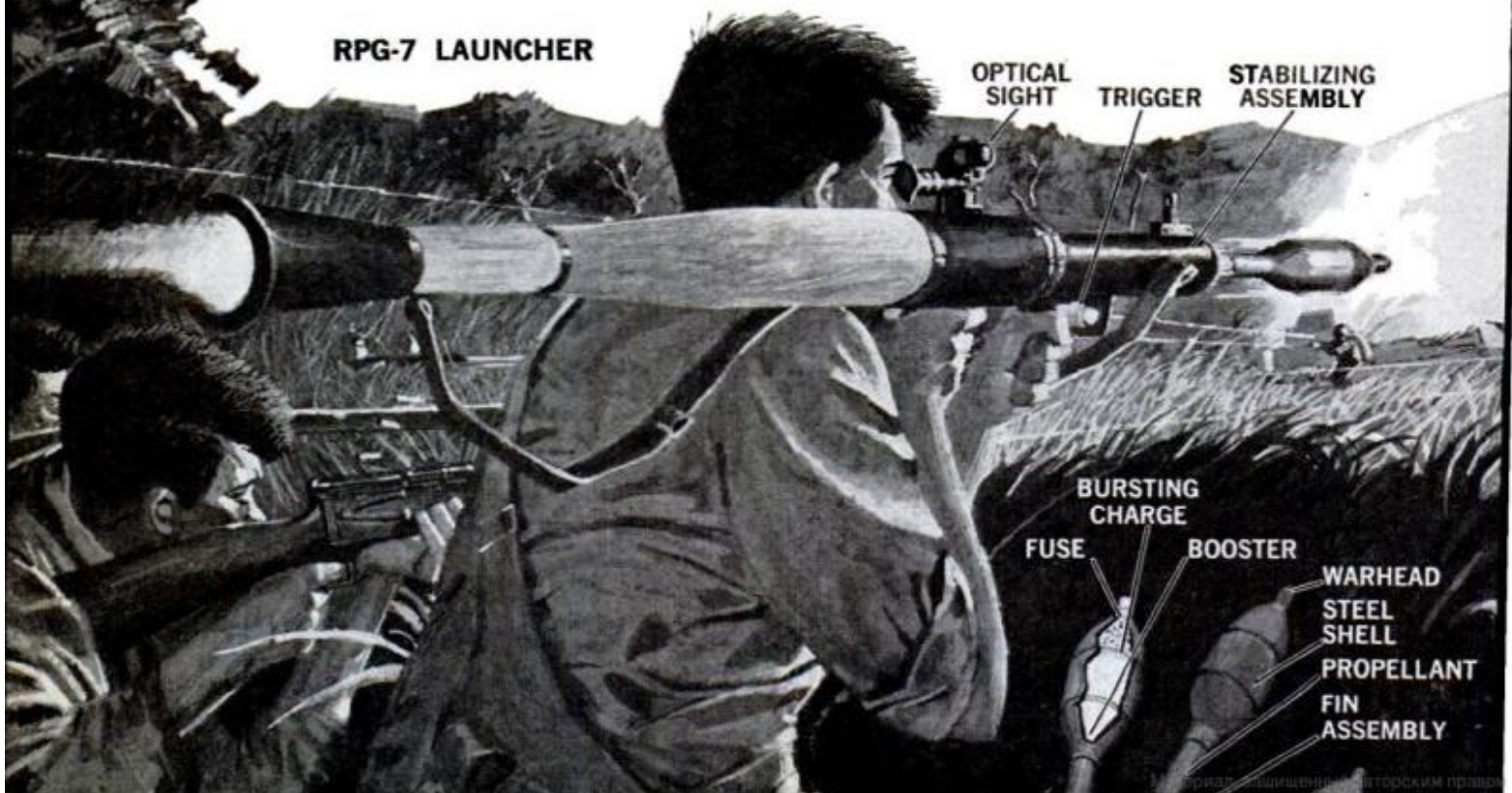
WARHEAD

STEEL SHELL

PROPELLANT

FIN

ASSEMBLY



radar system that traces incoming projectiles back to their source will hopefully be ready.

Until then, the Vietcong will be able to plaster, practically at will and within the limits of his ammunition supply, any U.S. base or South Vietnamese hamlet he takes a mind to.

That, essentially, is where we stand today against the most formidable weapon the VC has thrown against us in four years of war. Barrage rockets being supplied to the Cong in ever-increasing numbers by the Communists give him a versatility he did not possess in the early years of combat.

Even his short-range, one-man, fired-from-the-shoulder rockets are getting better. These provide ferocious close-in support for small units. The newest one, the Russian RPG-7, is probably the best in the world.

Designed primarily for use against armor, the RPG-7 is murder against landing craft, trucks in convoy, bunkers and troop concentrations. Its projectile, unlike any used by a bazooka-type weapon, is rocket-assisted.

A small rocket motor in the projectile's shaft cuts in after the 80-mm round leaves the tube to give it great range, a flatter trajectory and increased

accuracy. The setup makes the U.S. 3.5-inch bazooka look like a popgun.

For example, the effective range of the RPG-7 is 550 yards—that of the 3.5 is about 200 yards. The RPG-7's projectile penetrates 12½ inches of armor—that of the 3.5-inch penetrates 10½ inches.

None of the GIs I spoke with had come up against the RPG-7. They had left Vietnam before the weapon made an appearance. But they had nothing except damnation for the earlier, and much milder, RPG-2.

Sgt. Frank Gibson of Fayetteville, N. C., now stationed at Fort Dix, N. J., was a member of the 2nd Battalion, 7th Cavalry, when his company was ambushed outside of Tuy Hoa.

"They had 30 or 40 rounds in on us before we knew what happened," he says. "We took 27 casualties before we could figure out where the rockets were coming from. By the time we could lay effective fire into the jungle, the VC had hightailed it."

Short-range, close-in rockets, how-



140-mm LAUNCHER

140-mm
ROCKET



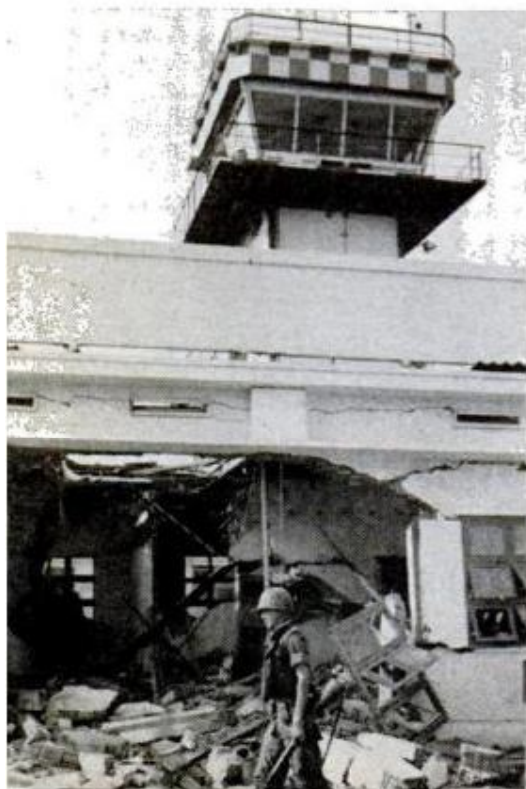
SOVIET-MADE RPG-7 (inset) and other Vietcong rockets are captured along with several VC terrorists

ever, don't worry military planners as much as long-range barrage rockets which can be used against base camps and cities. They give the Vietcong a highly mobile weapon that's practically impossible to find.

For example, a Cong unit can set up a rocket emplacement, fire several rounds, tear the weapon down, shift position, set up and fire again—all within the time it takes for us to get one of our 105-mm howitzers ready for firing.

Barrage rockets in the VC arsenal are a 140-mm, 107-mm and the dreaded

GREATEST DAMAGE was done to Allied airfields. This is Tan Son Nhut control tower after an attack



GRAPHIC EVIDENCE of carnage caused by VC rockets. Personnel carrier was destroyed during Tet offensive

122-mm, which destroyed U. S. planes on practically every airstrip from Da Nang to Saigon's Tan Son Nhut.

The 140-mm ushered in barrage rocket warfare at Da Nang, but is in a phasing-out stage. It's giving way to the more deadly 122-mm which has a range of close to 10 miles. By comparison, the standard U. S. artillery piece, the 105-mm howitzer also has a range of about 10 miles. But the tube and fin-stabilized projectile of the tripod-mounted 122-mm weighs a total of 214 pounds. The 105-mm weighs 3000 pounds.

WRECKAGE LITTERS Da Nang Air Base flight line after early morning attack by Vietcong rocket barrage





ROCKET LAUNCHERS were discovered by Forward Air Controller pilots less than 10 miles north of Da Nang

The 107-mm, supplied by the Chinese, is deadly accurate at ranges of up to five miles and packs almost twice the power of a 75-mm howitzer. Its self-propelled, spin-stabilized projectile is electrically fired. Total weight of weapon, tripod and round is only 200 pounds.

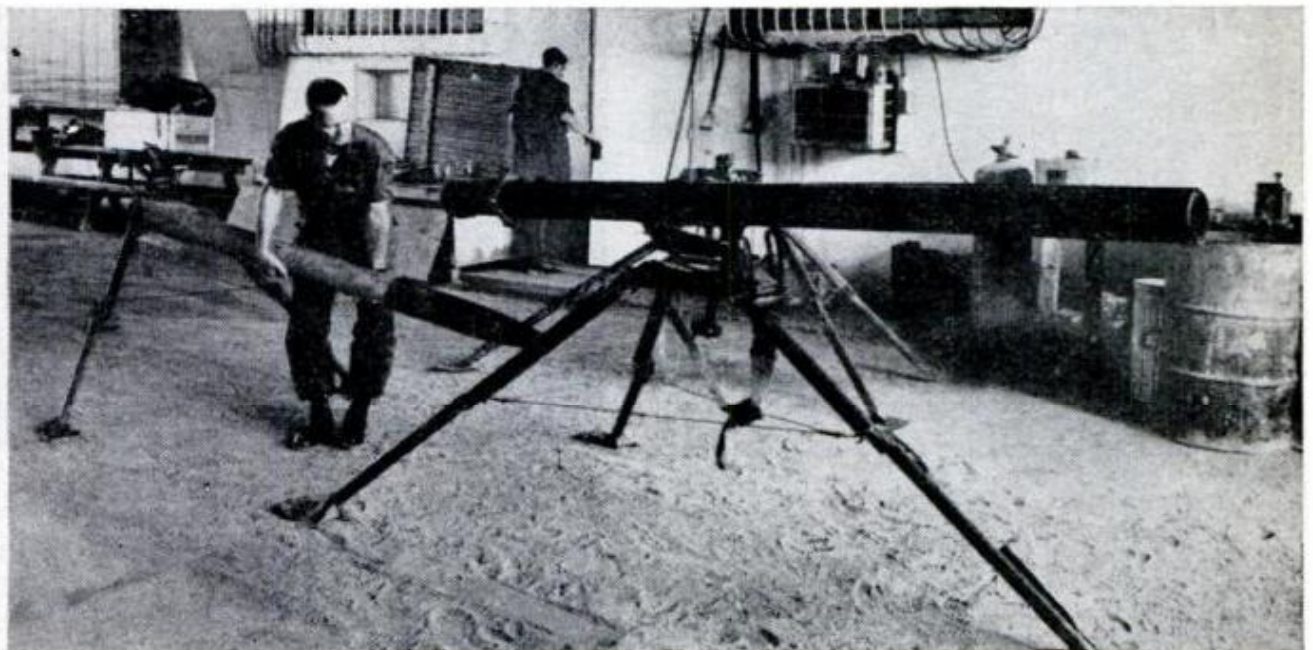
U. S. forces do not have rockets in Vietnam comparable to the 140-mm and 122-mm, a fact that points up the difference in tactics. The VC rely on hit-and-run operations for effectiveness. Their positions are not fixed; they need portable artillery. Lightweight rockets provide this. Whatever artillery support U. S. troops need can usually be supplied by fixed artillery with

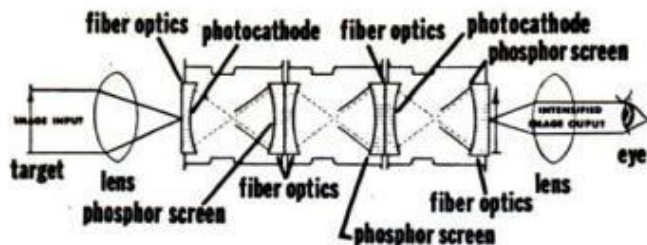
ranges of up to 20 miles. In close-in operations where artillery isn't available, U. S. forces call upon other heavy weapons, such as recoilless rifles and mortars, planes and the guns of destroyers. Spec. 5 Elliott Hoskins of Mullica Hill, N. J., knows what it's like to be under barrage rocket attack. He had six straight nights of it during the Tet offensive at Cu Chi, headquarters of the 25th Division.

"We got hit with mortars and 122-mm rockets," he relates. "Our Q-4 pinpointed the mortar emplacements, and our counter-mortar batteries took care of them pretty well. But there wasn't a thing that we could do about the

(Please turn to page 176)

122-MM ROCKET LAUNCHER on tripod mount has replaced 140-mm in VC arsenal. It equals our 105-mm howitzer





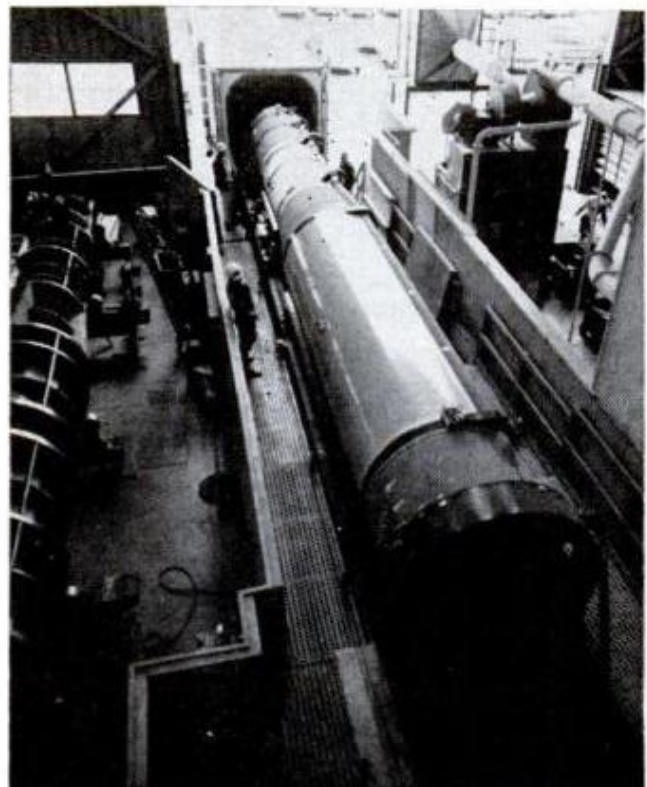
Army reveals starlight scope

Night-vision devices that amplify the faint glow of starlight—or even the dim light of skyglow—are being used extensively in Vietnam, the Army revealed recently. The devices range from a hand-held starlight scope (above, left) to larger night-vision sights for crew-served weapons and more distant viewing. The tank and soldier at left, indistinguishable at night to the naked eye, are shown as seen through the starlight scope. The drawing (above) shows the internal system of the image-intensification tube used in the devices, which were developed by the Night Vision Laboratory of the Army Electronics Command. Since the soldier using the new device does not generate a light source (as he did with the old infrared equipment), he doesn't risk giving away his position to an enemy using an infrared viewer.



Big job for hand tools

Even though it's the tallest hedge in England (36 feet), this yew hedge in Cirencester is trimmed by hand. The job keeps three trimmers busy for 10 days every year.



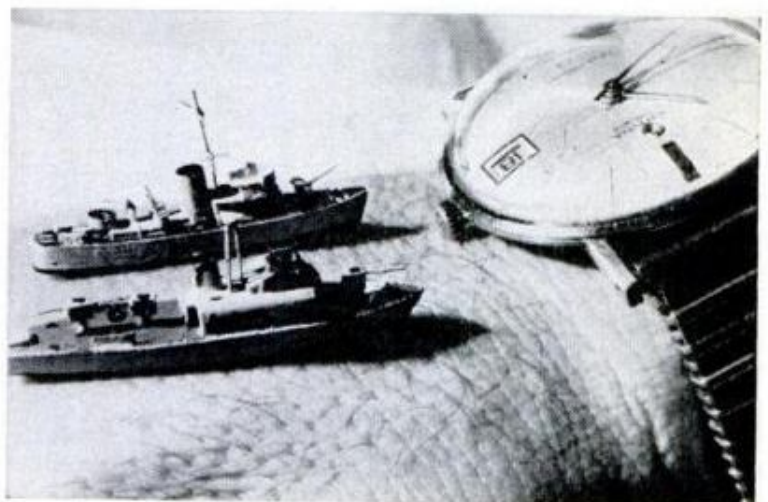
Tests start on Minuteman III

The first "ground-test model" of the new Minuteman III intercontinental ballistic missile is loaded into a transporter-erector at the Boeing Co.'s developmental center.



Hotel on wheels carries 26 on international tours

Europe's first "rotel," a bus with sleeping and eating accommodations aboard, is now in service carrying 26 passengers on extensive international trips from Stuttgart, Germany.



Britain's 'biggest' shipbuilder has fleet of 970

Entire navies and shipping fleets are included in the 970 miniature vessels built of cardboard and paper by Duncan Haws of Henley-on-Thames, England. For the past 35 years, Haws has been spending anywhere from a few hours to "weeks and weeks" to build each model. At upper left is the German *Preussen*; at upper right are his smallest models, an Italian and Dutch ship; the *Queen Elizabeth* is at lower left; and a "drydock" is at lower right.

Dear Mr. Automaker:

You build great cars, but can't you do something about these headaches?



Little things count with car owners. Your sales appeal is to the emotions, yet you automakers seem surprised when buyers react emotionally (angrily, that is) to such goofs as those at left and below. Owners feel there's no excuse for them.

NEXT MONTH you'll be introducing your 1969 models, and I hope you've eliminated or corrected some of the things that bug many owners of your '68s.

Each year, as it has for more than ten years, *PM* selects a dozen or so models of cars and asks thousands of people who've bought them what they think of their purchases. We print what they say in our *Owners Reports*, and too many owners say they're disappointed in—even burned up about—what they've bought for their three, four, or five thousand dollars. Before these people lay it on the line for a new car, they're going to ask a few questions.

For example, has workmanship been upgraded? Is gasoline mileage going to be any better? Have ventilation systems been debugged? Are controls, instruments and gauges handy and readable? Can ashtrays be used with safety? Are glove compartments any roomier? These are just some of the things your customers want improved.

Almost one-fifth of the thousands of new-car owners who answered *PM's* questionnaires this year said their



biggest gripe was poor workmanship. No manufacturer escaped the charge—it was cited by 20.9 percent of Chevelle owners, 18 percent of Javelin owners, 17 percent of Monterey owners, and a whopping 37.8 percent of Imperial owners. They complained about rattles, water leaks, ill-fitting body panels, loose or sloppy trim, doors and windows that don't fit properly, spotty, thin, and in some cases mismatched paint, and so on.

Project the average of these percentages to cover your entire output of '68s, Mr. Automaker, and you've got a lot of unhappy people on your hands.

Next on the list is poor economy. Those complaining to *PM* about the low mpg they are getting on their new cars include 30.3 percent of Catalina owners, 30.2 of Olds F-85 owners, 17.9 percent of Chevelle owners, 17.8 percent of Monterey owners and on down the line in diminishing percentages. Buyers know the new antismog gadgets tend to cut down on mpg, but they feel you should have anticipated the government's requirement and done some advance homework. An owner getting a



Design lapses, indicating what many owners feel is either thoughtlessness or unconcern, "bug" them to outrage. Inside of seat back release (above) is rough. Lower door trim option (left) is sure-bet knuckle-knocker. Rakish windshield (below) combines with canted dash panel to form virtually inaccessible area.

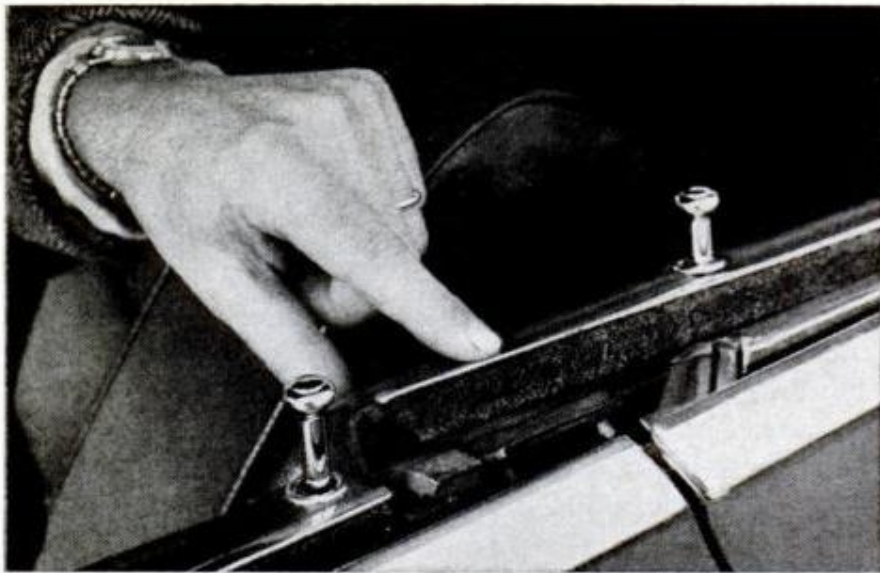
snappy eight mpg, despite repeated and often futile trips to his dealer for "adjustment" won't buy your alibis: all he knows is that his '68 costs him too much to operate.

Here are some other beefs:

On Firebirds, 14.7 percent think so-called "flow-through" ventilation is for the birds, 18 percent of Javelin owners say their cars create too much wind noise, 22.7 percent of Belvedere owners think the ashtray is poorly designed, 14.2 percent of Monterey owners don't like the ignition switch location, 11.1 percent of F-85 owners and 10.6 percent of Catalina owners say it's too hard to see to the rear, 17.9 percent of Mustang owners find the back "seat" terribly cramped, 14.4 percent of Buick Special owners are unhappy with dealer service. So it goes. Granted, these aren't complaints from a majority of owners, but they are headaches to a lot of your customers.

Beefs mentioned so far come straight from our *Owners*





The inspector must have been out to lunch when this beauty came down the line. Owners can understand slipups in production, can't understand why they're not caught.

Reports. But as you know, I get to drive a lot of cars during the course of a year and to the owners' gripes I'd like to add a few of my own about clammy airconditioning, poor visibility, those now-you-see-'em-now-you-don't retractable headlights, sharp edges, window cranks that jab your left knee, the seat belt "jungle," windows that take too long to defog, marshmallow suspensions, erratic brakes, puny sidelights, and steering wheels that feel greasy.

Now don't get mad. I'm the first to point out that when you consider the use and abuse to which the average U.S. motorist subjects his car, you make a remarkable product. That it operates in just about all extremes of weather, that by-and-large it gets its job done with a minimum of fuss and bother is a tribute to your design and manufacturing skills. But even so, were I you I'd go a bit softer on that self-praise pedal.

Doesn't it embarrass you to claim "distinctive" styling when so many of your cars look like they came from the same cookie cutter? Don't you feel a little sheepish when an owner has to go after his dealer with an ax to get proper service? Aren't you a little uncomfortable about



Lack of headroom is universal complaint pertaining to most cars. Both men, women squawk about headgear being knocked askew when they get in and out of the cars.



"Concours" means competition in French, but when a still-new car starts shedding parts, it's handicapped right from the start. Credibility gap between what you automakers claim and what owners actually experience is getting too wide.



Long thumb is needed to reach horn ring. This may not seem important, but can spell difference between owner satisfaction and dissatisfaction.



your "mark of excellence" (or whatever you choose to call it) when workmanship complaints are piling up to here?

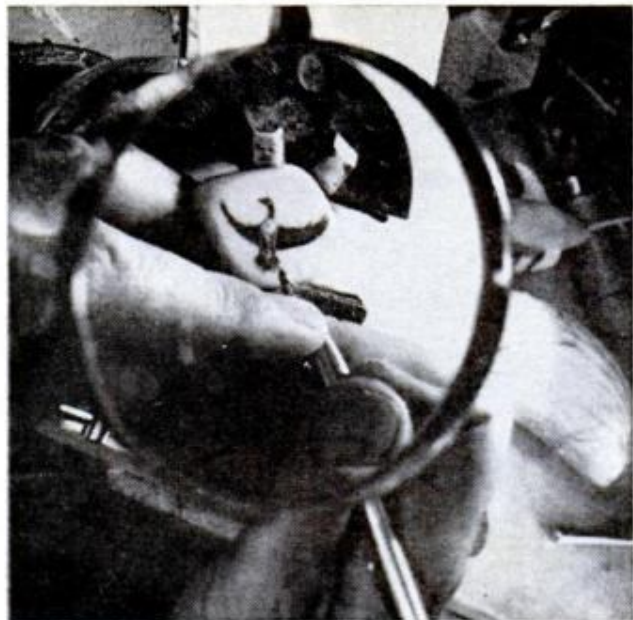
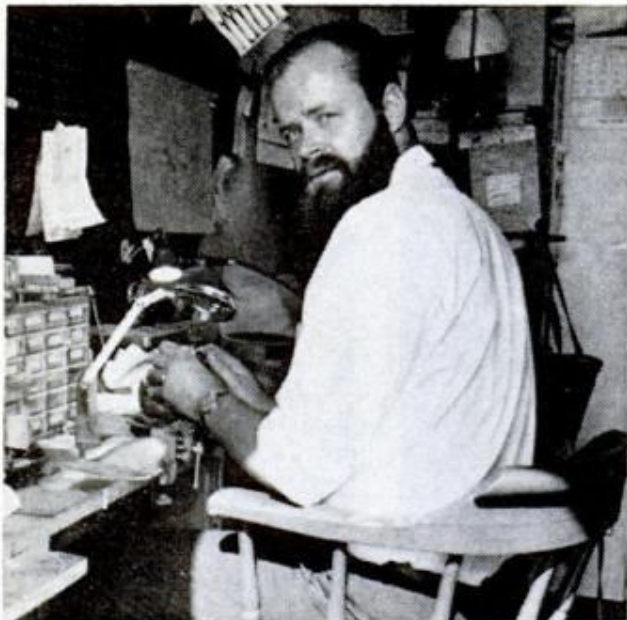
What are owners *supposed* to think when "the ultimate in a 50-year tradition of building fine cars" needs debugging before the license plates get dirty? What are they supposed to think when getting work done under a warranty may drag out like peace negotiations? What are they supposed to think when a "minor adjustment" costs \$47.83 plus tax?

It may be good promotion to tell the world what a good job you're doing, but you run the danger of falling in love with your own press notices. Outside of Detroit, I'm afraid

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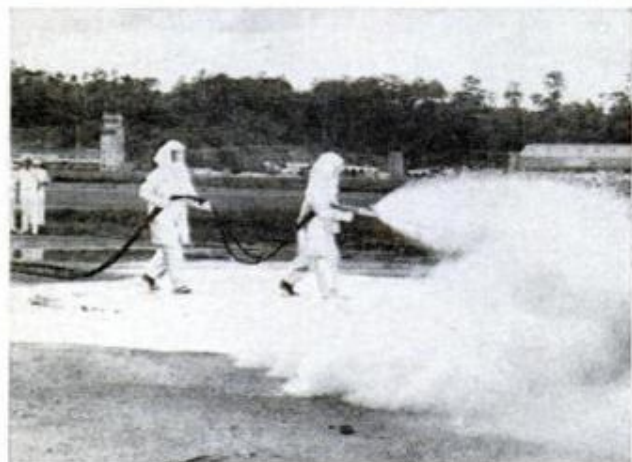
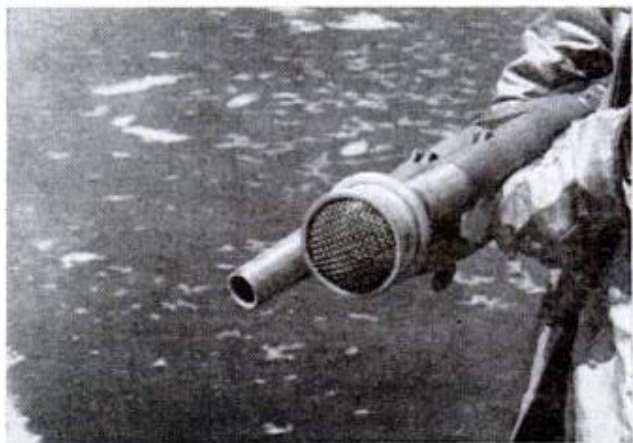
Indignation sums up owner reaction to such vagaries as sloppy body fit, particularly when car is high priced. Ventless windows get poor rating from owners who miss fresh air.





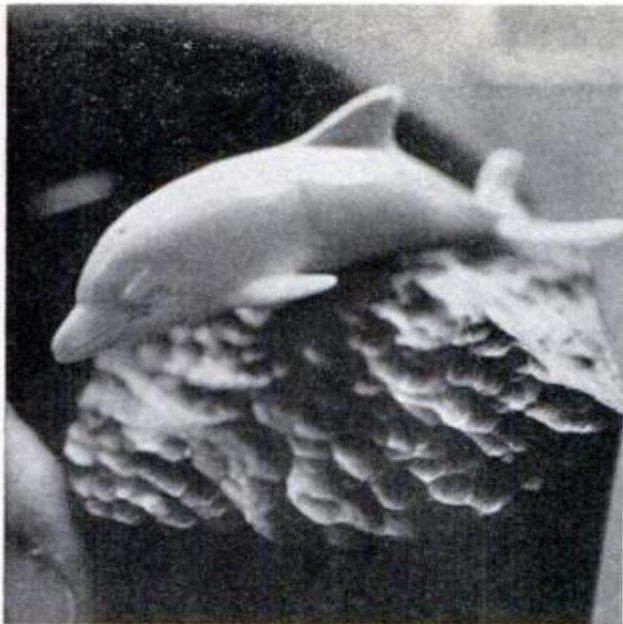
New Englanders still carry on an art of the old-time

Scrimshaw, once the pastime of sailors on American whaling ships, still continues as an art form, particularly around New Bedford, Mass., a former whaling port. Outstanding artists there are Herbert Hadfield (far left) and T. M. Richards, who carve and scribe ivory



Navy develops 'light-water' system for fighting carrier fires

Within 24 hours after the fire on the USS *Forrestal*, Naval research scientists began experiments with new fire-fighting techniques—and came up with a twin-ball unit mounted on a service truck (upper left). One ball contains "light water"—a foamy liquid light enough to float on fuels; the other ball contains Purple K, a flame-quenching powder. Delivered from a dual nozzle (upper right) the material effectively quenches fires (lower left.) The foam can also be delivered by helicopter (lower right).



whaling-ship sailors

(sperm-whale teeth) and whalebone. The second photo shows Hadfield working under a glass with a diamond-tipped scribing tool. (India ink rubbed into the engraving makes it visible.) The porpoise is by Hadfield and the jewelry (right) is by Richards.



Home-made trihull

Briton Laurie Osborne recently launched a home-built, 31-foot trimaran in which he plans to compete in ocean racing.



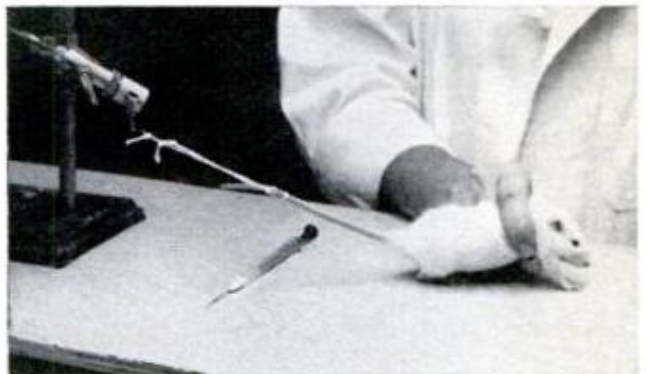
A-frame goes to France

The A-frame vacation house, popular in America, is being made in France. This one's on stilts and has cement-slab roofing.



He has things under control

One man, at a 40-foot desk, observes (by TV) and controls 72 elevators carrying 18,000 persons daily into New York's Pan Am Bldg.

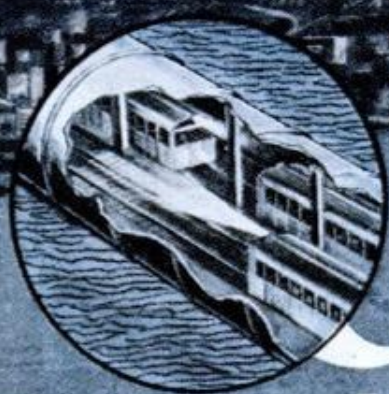


Rodent-power rater

Very light forces—such as one mouse-pull—can be measured on the microscale of Statham Instruments' transducer.

Future Airports: How are we

Rapid-transit subway



Hydrofoil shuttle buses

Connecting causeway

Jumbo jet transport

Rapid turnoff taxiways

Maintenance area

Marinas

Dam

Approach lighting system

Landing runway

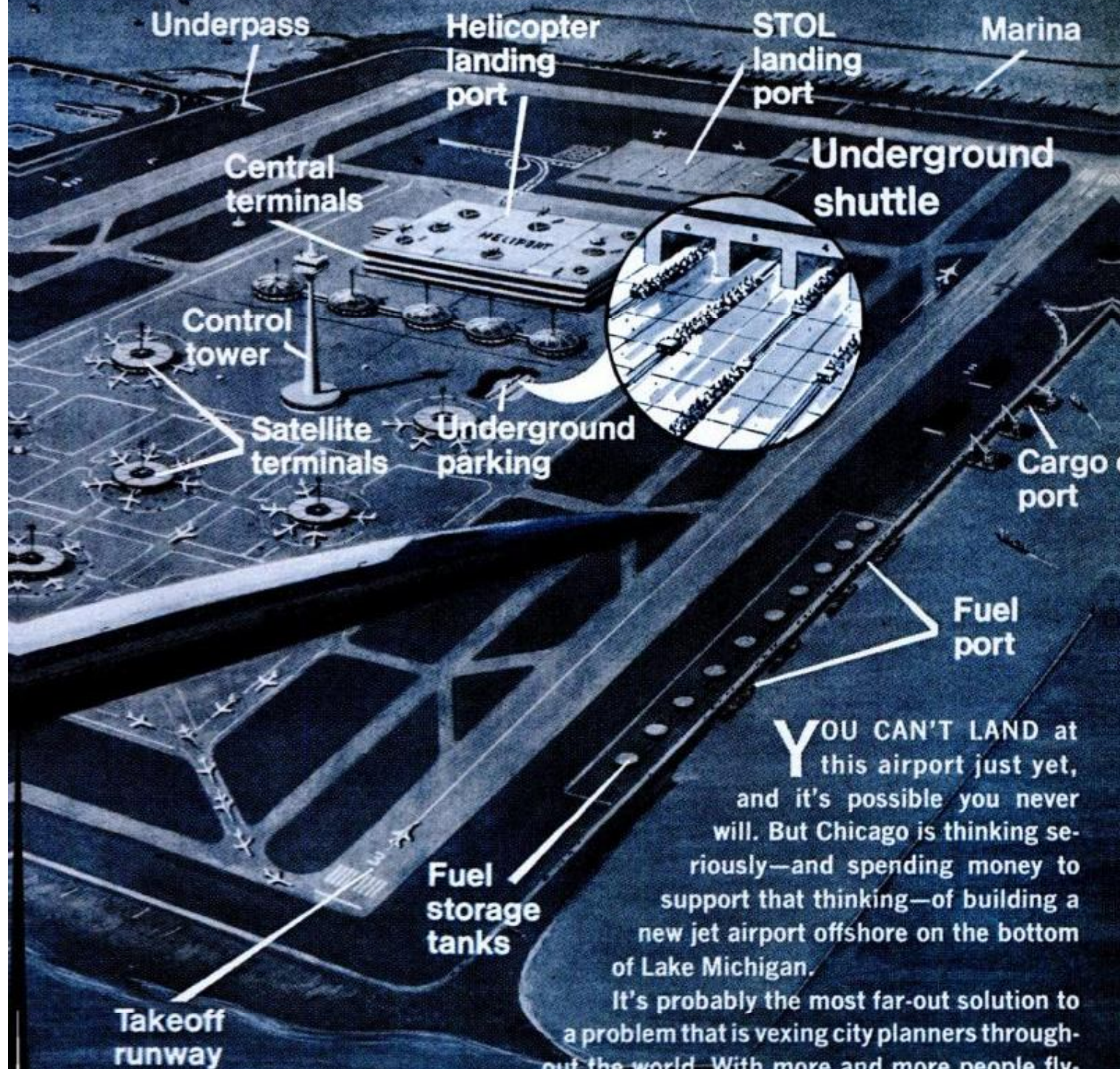
Supersonic transport

Illustration by Monroe Eisenberg

going to get 'em out to the field?

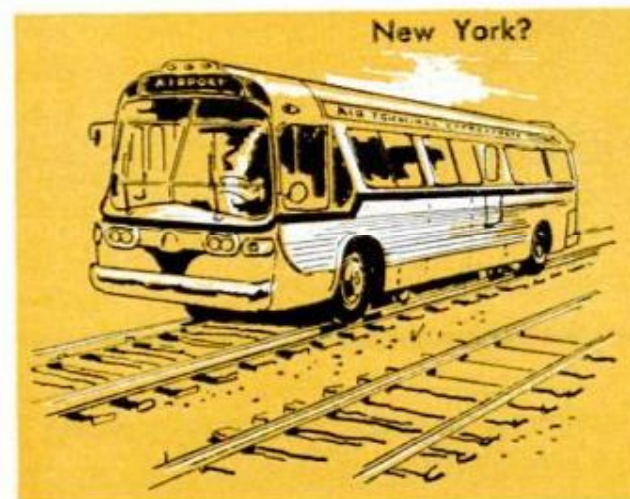
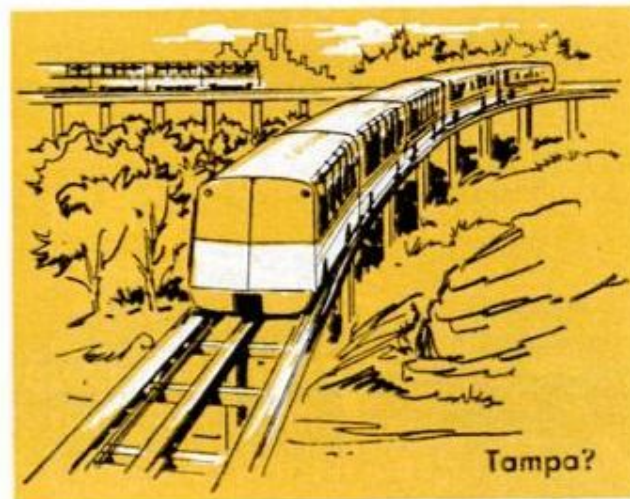
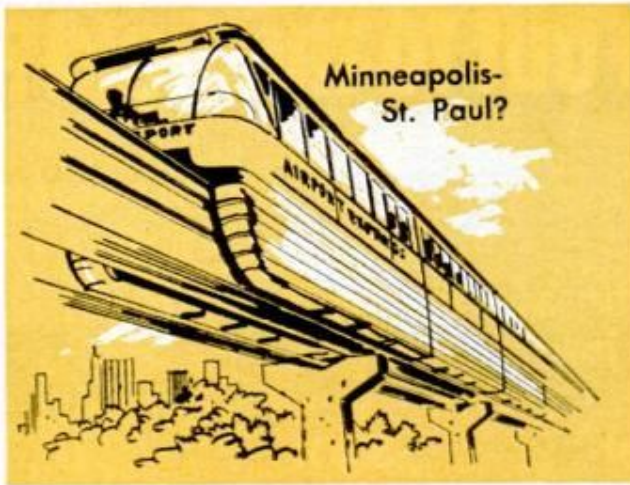
By KEVIN V. BROWN

Handling the big new jets will be easier than handling their passengers. Here's how you may be traveling to and from the terminals



YOU CAN'T LAND at this airport just yet, and it's possible you never will. But Chicago is thinking seriously—and spending money to support that thinking—of building a new jet airport offshore on the bottom of Lake Michigan.

It's probably the most far-out solution to a problem that is vexing city planners throughout the world. With more and more people flying, and bigger and faster airplanes being built to carry them, shuttling these crowds between the cities and the loading gates has become a major bottleneck. Chicago's plan is to break the



bottleneck by bringing the airport downtown, but other communities are studying new and novel ways to carry the passengers out to the airport.

Dallas and Fort Worth will share the new Dallas-Fort Worth Regional Airport and may build a special spur from the expressway that joins them.

Tokyo already has a monorail to the airport, and other cities are considering such a system.

Tampa, Fla., is seriously thinking about a rubber-tired, completely automatic, overhead train.

New York City, where air passengers have nearly doubled in five years, has tested a bus that also rides on rails, picking up passengers on city streets, then lowering its metal wheels and making most of the trip on rails.

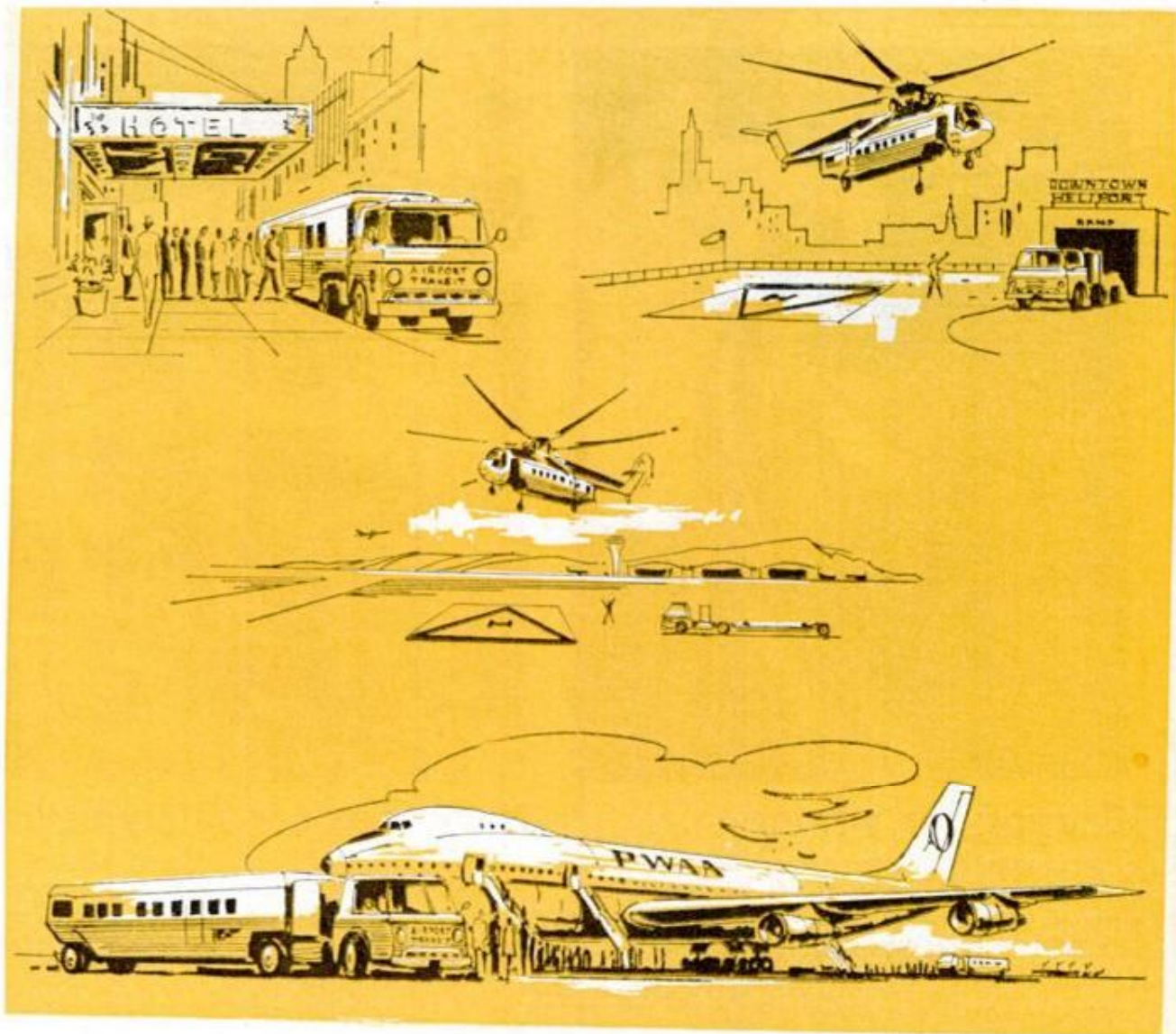
Still others, notably Los Angeles, are well down the road—or up in the air—on new vertical-rising aircraft that can take off from downtown locations, rise straight up, then scoot above traffic to the airport.

The Chicago plan, however, is by far the "farthest-out." A lake-bottom airport would be built a few miles offshore, where the water depth is about 30 feet. The water would be dammed off and the entire complex would rise from the lake bottom. An underground rapid-transit system or an overwater causeway would connect the airport to the downtown area, a distance of just a few miles. Special features of a lake airport would be docking facilities for oil tankers or other cargo vessels, a marina for local sailors, even a beach. With the runways running north-south, planes would avoid flying over congested areas, and, if necessary later, the runways could be extended indefinitely.

Other areas have been thinking similar thoughts. Los Angeles has studied a plan to build an offshore "sea-drome"

NEW SYSTEMS for getting to and from outlying airports, and avoiding bottlenecked street traffic, include (from top) monorail trains, which would carry large numbers on direct trips; STOL and VTOL aircraft, which fly above traffic; rubber-tired trains that operate automatically without motormen, and combination bus-trains that ride either on tires or rails

POPULAR MECHANICS



SOPHISTICATED LOS ANGELES system would use bus "pod" to pick up passengers at hotels, then drive to heliport, where flying crane would pick it up then fly it to airport, where bus would drive out to plane

which would float on *top* of the water, and England has studied another one which would include an intercontinental airport on one of the sandbanks in the English Channel.

Such solutions, however, are available only to those areas that have open water nearby and can bring the airport closer to the passengers. Others have to fall back on new ways to shuttle passengers to the airport.

Expressways, in spite of exotic new rapid-transit systems, will predominate. Aviation experts point out that most people prefer to drive on at least one end of a flight, because of the convenience of getting to or from their homes, and many then rent cars at the other end of the trip.

Multiple-deck expressways may evolve. Some terminals already have

two levels, one for departing passengers and the other for arriving passengers, but at least one expert is urging "vertical terminals" of six or more levels, either above or below ground. Four levels would be used for parking, ending the added delay of getting into or out of an open-air lot. Expressways, starting far from the field, would then become multilevel to match terminal levels, again speeding traffic and eliminating bumper-to-bumper approaches.

Even so, some airports hope to reduce, if not eliminate, auto traffic by building more attractive rapid-transit systems. Mass transport of hundreds of passengers in just one vehicle, instead of in scores of automobiles or taxis, is an appealing proposition.

Paris, which is now building its new
(Please turn to page 178)



Bearing for yawing

This giant bearing—almost 14 feet in diameter—will be used to impart yawing motion to a space-motion simulator being built for NASA's Ames Research Center.



Navy uses car-safety device

The outer jacket of General Motors' energy-absorbing steering column now serves as a shockproof support for seats on Navy troop carriers, cushioning troops from mine blasts.



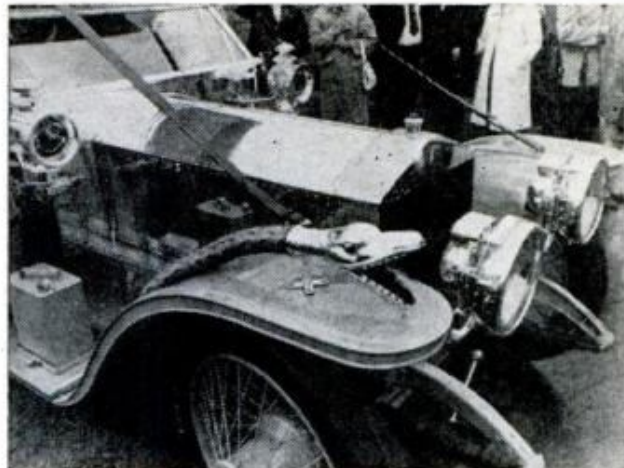
Railroad talk

A rigger finishes adjusting a Union Pacific microwave tower. The reflectors send and receive a narrow beam of radio waves as part of the railroad's communications network.



Astronaut rescue boat

A loading ramp on a new twin-hull boat lets para-rescue men climb aboard after they've placed flotation gear on a floating space capsule. Builder is Steel Cruiser, Inc.



Rolls reunion

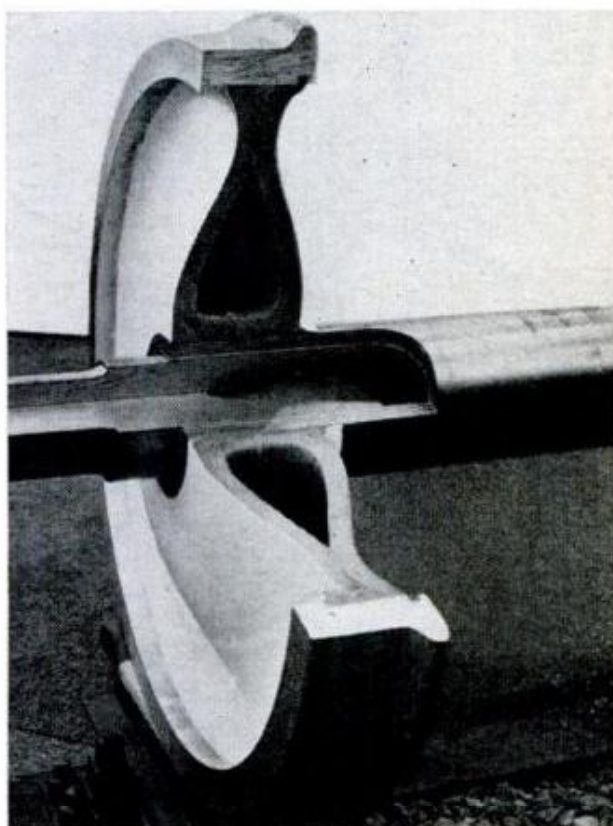
More than 1000 Rolls-Royce and Bentley cars—representing every model built since the founding of the firm in 1904—turned up at a pageant in Sussex, England. At upper left are just some of the cars that owners drove in for display and judging. At left is a Rolls that was found in a scrap pile and restored. Above is a Roides Belges Rolls; the snake is a horn.



Mail order, American plan

A large store in France has installed a computer system for fulfilling its catalog orders. Girls seated at 72 typewriters—each with a TV screen—tap out the orders as an IBM computer compares original orders with typing and points out errors on the screen.

AUGUST 1968



Plastic rail wheels

German Federal Railway engineers are experimenting with fiberglass train wheels in an effort to overcome two disadvantages of steel: the weight and the noise. The new wheels are 60 percent lighter, but have not yet been fully tested for resistance to stress.

It Isn't

By J. A.
MAXTONE GRAHAM



Many of the zany fishing techniques explained here are downright illegal, but each one has been used somewhere in the world

ANYONE WHO'S MANAGED to catch, in a lifetime of fishing, the whole range of species, from tench to tuna, through tope and the three-bearded rockling, may reasonably claim to have learned most of the ways in which the sport can be done. Yet there exist, in odd corners of the world, strange local techniques involving equipment that is not normally found in the average American creel: worsted thread, swans, herds of cattle and sledgehammers, for example.

Not all are used at once, of course,

and it must be admitted that some of these methods do not meet with the approval of game wardens. For example, the sledgehammer is considered ideal for trouting in the sort of Scottish mountain stream where a good many rocks protrude through the water. Men accustomed to wielding large hammers—blacksmiths, fencing contractors and the like—watch gleefully as the fish run under a rock; a smart hammer blow thereon sets up enough vibration to stun them. In some places—like the Beaverkill—this would un-

Fishing: It's Murder

doubtedly cause a raised eyebrow or two; all the same, you could pick up your breakfast without so much as taking your split-cane rod from its case. Should you have left your hammer at home, you can tickle the fish from under a cutaway bank; this hand method is brought to a peak of perfection by Scottish schoolboys, who call it "guddlin."

Through the ages, original thinkers of the fishing world have carefully examined the problems of making good catches without the appalling exertions of using a rod and reel. Sir Walter Scott was nearly drowned in Scotland's River Tweed when he went out for a jolly night's salmon-killing with a lantern and a wicked-looking barbed spear called a "leister."

Wherever there are lakes and men are lazy, much thought is given to the problem of catching plenty without the expense of hiring a boat or the indignity of wading. One unethical but highly practical method is to use an "otter." It's a flat slab of lumber, weighted on one edge so that it just floats, with the unweighted edge just breaking the surface. Attachment of a long line to the broad side of the slab, slightly behind the center, could make fishing a real pleasure, for instance on some remote Canadian lake away from prying eyes. Just walk along the bank pulling the line, and the otter seeks farther and farther out from the bank. A dozen or so flies, lures or baits attached at intervals to the line will soon attract their quota of fish. In China the same effect is achieved with a kite.

A whisky bottle, filled to the point that it floats cork upward, can be released in a lake with a yard of line, a hook and a worm, and it is rare indeed not to find it bobbing vigorously upside down within the hour. For the fly-fishing purist, however, the better

method is to sail a model yacht with a leader of three wet-flies tied to the stern.

The greatest saving of piscatorial energy is achieved by getting someone else to do the work for you. Japanese fishermen have their trained cormorants, and a neat brass ring round the bird's neck ensures that the haul is not immediately eaten. A great sport in Britain was using a swan to catch pike. Here's how pike-fishing can be done, medieval style:

1. Catch a small fish for bait, up to half a pound.
2. Catch a swan. (A large landing net, preferably with a long handle, will do fine for this tricky job.)
3. Tie three feet of line to the swan's leg; on the other end hook the live bait.
4. Set the swan adrift.
5. Wait for a pike to take the live bait.
6. Sit and watch the angry battle that ensues between fish and bird. Although it may suffer many an undignified submersion in the early stages, the swan invariably wins in the end.



Animals again are sometimes used by salmon fishermen: A river pool may fish better if the salmon are first stirred up by a dog swimming down the water. A more extreme treatment is to drive in a herd of cattle, should you have such a thing handy.

But sometimes animals go too far. Back in the 18th century, the Earl of Home had a Newfoundland dog that became expert in extracting salmon, unaided, from the River Tweed. So many fish were thus taken out to fill the Home larders that the Earl who



"A great sport in Britain was using a swan to catch pike."

owned the opposite bank brought a lawsuit: "The Earl of Tankerville *versus* a Dog, the property of the Earl of Home." Judgment was given in favor of the Dog.

Rod, line and *no* hook are the basic equipment for the ancient English art of "babbing." Fishers of the Hudson and other eel-rich waters who have experienced the horrifying tangles that an eel can induce in regular terminal tackle should try babbing. Take 12 inches of worsted thread, and run it with a needle the entire length of two or three big worms. Then coil the whole into a little ring, and fix into shape with more thread. This worm-worsted syndrome is tied with more line to any stout pole. When an eel takes the

mass of worms, you lift gently until it is out of the water, still hanging hopefully onto its meal. Swing it over the boat or bank, shake the eel into a sack or barrel and go on fishing without interruption: no loss of worms, no tangles, no hook to extract, no need even to handle the slimy thing. (They say that if you *do* have to handle one, put it on a newspaper and it won't wriggle.)

Crayfish make the greatest of bass baits, but are such a chore to catch that most people don't bother. A method from Austria, somewhat similar to babbing, may be the answer. Wrap some meat in a net, lower it to the bottom of the water, and haul up again after a ten-minute wait. The secret lies in the quality of the meat. "Das Fleisch muss gut stinken," says the fisher lovingly as he hauls up a load of delicate crustaceans clinging eagerly to the putrescent bait.

Who knows what wild gadgets may have been devised, perfected and lost in the past? There was an English patent taken out in 1632 by a Mr. Thomas Grant: The official specification describes it as a "fish call or looking glass, to lure fishes to nets, spears or hooks." Sixty years later, someone else registered a sort of lamp which could be lowered into the water and would (infallibly) attract all the fish for acres around. In 1854 someone produced a hollow rod through which the line passed on gentle rollers: It is hard to see the special advantage of what must have been an exceedingly expensive form of manufacture.

England, Scotland and Ireland each have a unique form of fishing. In England, all through the midlands, the most popular sport is the catching of inedible roach, bream and tench: It is the total weight of the haul that

(Please turn to page 180)



Sea- Doo: A JET SPEEDSTER THAT BRINGS NEW ZOOM AND A NEW BOOM TO BOATING FUN

By **DAN FALES**, *Boating Editor*

Photos by Burton McNeely

HERE'S THE FIRST report on the newest and hottest "boat" you'll see this summer. Called Sea-Doo, it's to water what snowmobiles are to snow. In fact, this jet-powered water scooter is produced by Bombardier, Ltd., maker of the popular Ski-Doo snowmobiles.

During a special trip to Florida, I rode a new Sea-Doo. I raced it, jumped it, played tag with it, spun it out. I tried to tip it, to drown it, to foul it on a beach. Verdict: a fun machine that's bound to catch on.

But Sea-Doo's success will not be based on fun alone. There are two other important reasons. First, no propeller. Second, it won't tip over (unless you really **work** at flipping it). Until now, water scooters have been sexy little boats usually powered by outboard motors;

they're fast, but most have propellers extending below the hull. Generally, the props are shielded, but they still can present problems. Some people claim they are unsafe, others feel they draw too much water.

But Sea-Doo doesn't have a prop—it uses a water jet. And only three inches of water is needed when the machine's at rest—less when up on plane.

Bombardier, this summer, is testing its new scooter in several areas of North America. The company expects to swing into normal production next season.

The power behind each Sea-Doo is a 320-cc, 2-cycle Rotax motor that develops 18.5 hp. Through a system of four belts, this motor has direct drive to a Berkeley jet pump. Once on plane, the jet will push Sea-Doo at about 25 mph—depending on load.

Bombardier says its new scooter will handle a load of 250 pounds. But in fact, you don't want to put much more than 200 pounds aboard.

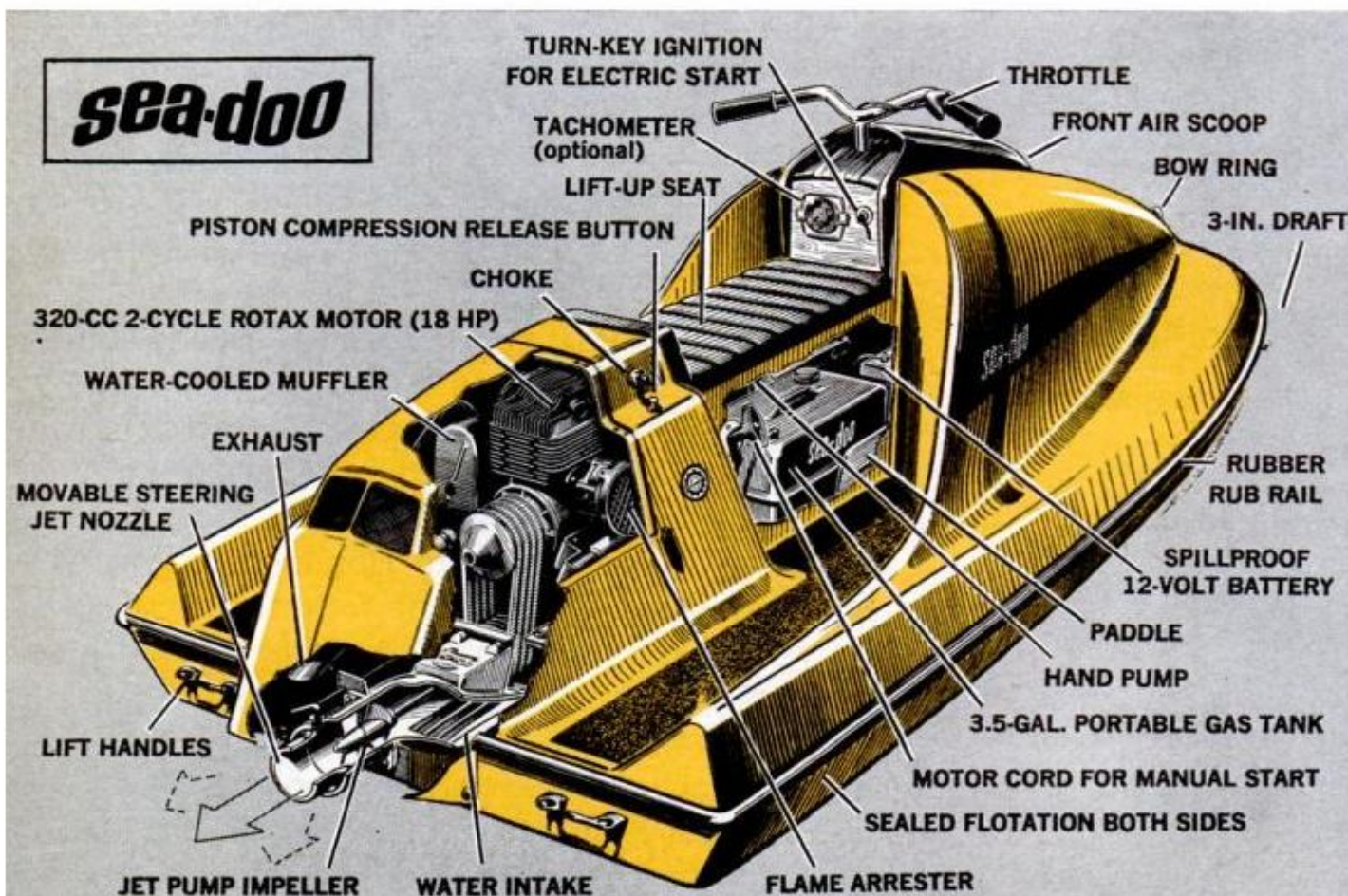
The lighter the weight, the quicker you'll get her up on plane. With my

weight pushing the 200-pound limit, I found I really had to lean forward to get Sea-Doo up on the step. Actually, I had to try to push the bow down with my left hand as I kept the motor wide open with my right grabbing the handlebar throttle.

But once on plane, I flew. I found myself riding Sea-Doo like a snowmobile. I stood up and jockeyed back and forth—hiking my weight out on every turn. I was surprised though at the stability of this machine. Sea-Doo is almost elliptical in shape. It's 7½ feet long and 5 feet wide. No matter what I did under way, I always felt I had complete control, and never did I feel that she would break away and spill me.

I even tried standing with both feet on one side while going 25 mph. Even in a turn Sea-Doo was stable.

Next came the spin-out test. Again doing 25 mph, I raced down a long straightaway. When I thought she was at top speed, I spun the handlebar. The jet swung her stern around. I hung on while doing a 360° spin. After the spin, I was almost dead in the water. The





JUMPING OFF a ramp built at the end of a dock can be loads of fun. Note that use of a water-jet pump eliminates any need for a propeller that hangs below the hull. Except for several stabilizing skegs, the bottom is smooth. Fiberglass hull easily takes pounding when you land

ZIPPING ALONG on relatively calm water makes for easy maneuvering, as you can see from look-ma-no-hands operation. Bombardier says the machine functions well in anything up to a two-foot chop. For saltwater operations, all motor surfaces are treated to resist corrosion

STABILITY is an asset in this machine. Though you might think it's about to tip over—it never did, even with the driver hiked way out to one side. He could have flipped it at this point if he wanted by giving an extra yank on the handlebar. But this would take a deliberate effort





IT'S EASY just to run up on a beach. With no prop below, there is nothing to foul when landing. Two children can ride a machine with no trouble

wake caught up with me and washed into the cockpit. A quick pump of the throttle and I was off again. Though a little water got into the engine compartment, it was quickly pumped out by a small siphon designed for just this job. If too much water gets into the compartment, the drive belts will get wet and slip on the pump shaft. Sometimes, but not too often, you must stop and give the siphon an assist with a little hand pump. If the belts are slipping, you can't get enough speed to make the siphon work.

But once the compartment is clear, you're off again.

It's true that if you submerge the motor for any length of time, you'll have the same problems as you have with a regular outboard. But I saw one Sea-Doo tipped over several times. Each time the driver righted her, climbed aboard, and took off without a motor miss. The operator actually tried to tip his machine over. He yanked on the handlebar while in a steep turn. Just going into a steep turn doesn't upset this machine.

Next came jumping. With no prop underneath, it was easy to fly off a wooden jump erected at the end of a dock six inches out of water.

Wave-jumping is the next best thing. Following a speedboat, you can push

off its wake like a water skier—climbing high and smacking down on the water a few seconds later.

This rough treatment shouldn't harm the machine. It's made entirely of fiberglass with the hull built up to three layers of mat and two layers of roving. The top is three layers of mat and one of roving. With the fiberglass hull and motor, total weight is 280 pounds.

In the final test, I ran Sea-Doo right up on a beach. At top speed, I cut the motor (turn key off) just before slipping up the sand. The momentum carried the scooter out of the water. I just stepped off. Nothing was damaged on the hull or in the propulsion system.

This isn't all you can do with Sea-Doo. You can fish, skin dive, go on a picnic, set up a slalom course, race.

As the popularity of these machines increases, I can see the horsepower going up. I would imagine that racing these scooters will become a common sport. But if racing isn't your bit, you can always play tag, or bump, or just explore.

The 3.5-gallon gas tank lets you run for about three hours. As with snowmobiles, you mix oil and gas.

Bombardier has tested Sea-Doo for hundreds of hours in fresh water. The only major question, which should be resolved this summer, is saltwater operation. The company says "all (motor) surfaces treated for saltwater resistance." Nevertheless, it's a good idea to flush Sea-Doo with fresh water after saltwater operations.

Though Sea-Doo is at her best in relatively calm water, she will function well in anything up to a two-foot chop.

If, for some reason, the electric start feature of the Sea-Doo should fail, there is a manual start arrangement. The pull cord is out in the open on the right side of the machine. There is also a piston compression release button. Just pulling this button means that a child or woman can easily start the motor, manually.

Bombardier has established a suggested retail price, including electric start, at \$995. That's competitive. ★★★

New Battle Plan For Forest Fires



Recruited from widespread logging camps, Indian reservations and college campuses, a volunteer army of firefighters is airlifted to the "combat zone" where their moves are mapped by master strategy

By FRANK A. TINKER

Illustration by Ed Valigursky

LAST SUMMER, on a few hours' notice, an army was assembled and moved across the western part of the country—parts of it speeding from one border to the other.

This army boasts its own air corps, heavy equipment, logistic support and sophisticated electronic scouts. Literally thousands of men and hundreds of aircraft were involved; that it completed its move almost without notice or any dislocation of other travel is characteristic of its casual efficiency. Yet this army and its remarkable service deserve notice, for its enemy is

common to every citizen, no matter who or where he may be.

The Northwest's year began in generous style, with a moist spring generating a lush growth in forest and plain. But with early summer the rains ceased. For more than two months parts of forested Oregon received no measurable precipitation, breaking all records of drought. In the mountain areas of Idaho and Montana weeks passed without a drop of moisture. The woods dried.

Travel in many forest areas was banned, due to the fire danger reported

FROM DENVER

C-124 TROOP TRANSPORT

TBF TANKER

C-119 CARGO CARRIER

C-47 CARGO CARRIER

FORD TRIMOTOR

SMOKEJUMPERS

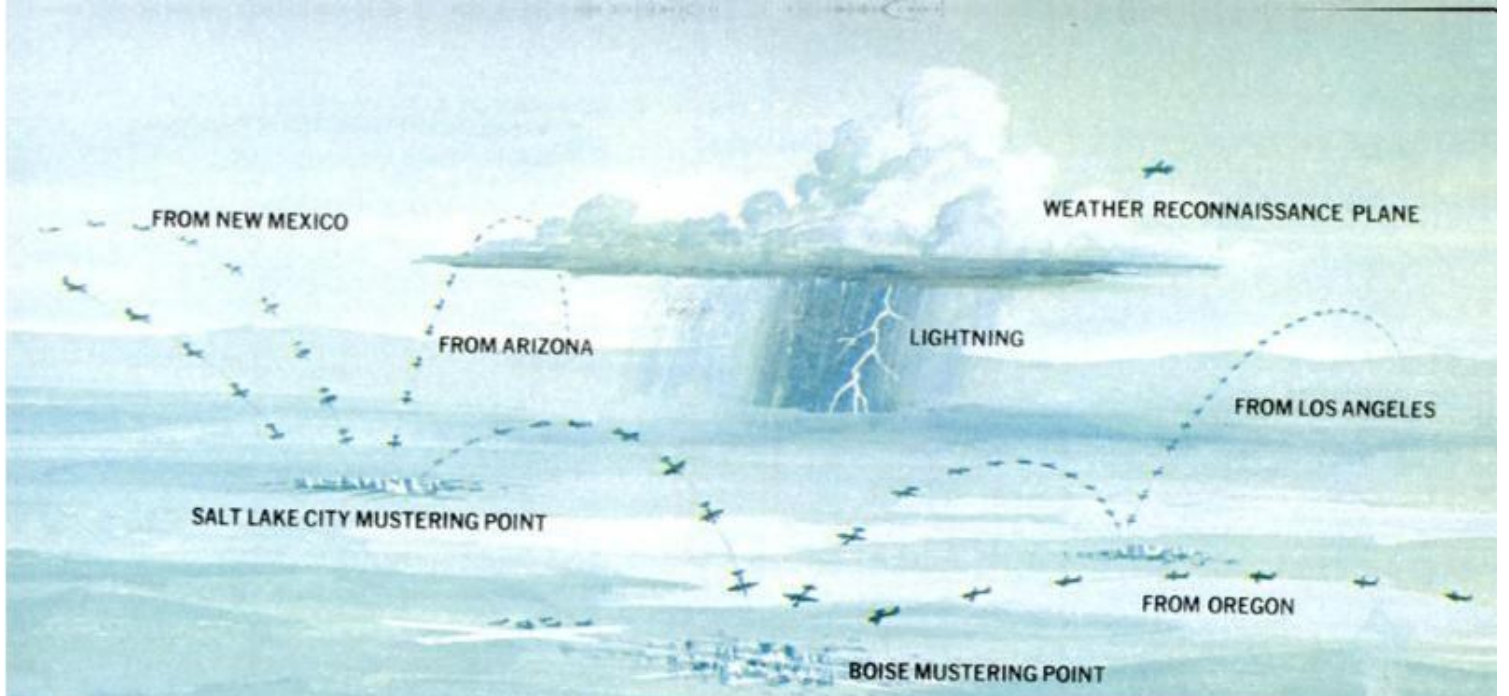
PILATUS PORTER JUMP SHIP

HELICOPTER FERRY

FIRE CAMP

25-MAN CREW





How World's Hottest Army Moves into Combat
Flown by its "instant airline" from far-flung Indian reservations, college campuses or other forest areas, to central mustering areas, fire-fighting forces then move by land and air to assigned sectors where fire boss coordinates their activities into overall battle strategy





DEPLOYING TROOPS and equipment was job of dispatchers in Boise fire center during last year's major holocaust. With thousands of crewmen coming in, and hundreds of fires going on, it was important to place right men in right positions. Venerable TBF (below) drops fire retardant during early stages



from mobile weather stations cruising the region. The first scouting units of this modern fire counter-force were already on duty: fire lookouts in isolated mountain towers, aerial patrols, and a unique airborne infrared detection unit called Fire-Scan. In weather like this, old forestry hands know where the greatest danger would come from. As each frustrated nimbus bank formed and marched across the mountains, spitting lightning, spot fires were left smoldering in unseen remote groves.

"Some of those snags will just smoke for days," a forester explained, "then touch off a real fire when the wind hits."

To spot these potential infernos, a high-flying Convair followed close behind the dry storms, its sensitive infrared instruments and film noting the exact location of hidden hot spots. Each night an 8000-square-mile block was patrolled and, even though this program is still in an experimental stage, 500 targets were discovered. All of these targets proved valid—and all were within one-eighth of a mile from their reported positions.

By the middle of August the woods fairly crackled. Then one more great cloud rolled in from the west. No rain fell, but lightning bursts crashed in dazzling display. Both infrared and human eyes immediately reported the inevitable: countless small fires spouting up from the woods, at first overwhelming by their very number the quick-strike forces available. From Missoula, headquarters of the Forest Service's Northern Region, forward units of the alerted mobile army launched quick and effective suppression missions. Aerial tankers, from single-engined torpedo bombers to B-17 Fortresses, dropped tons of chemical retardant on the worst of the blazes, slowing them down until smokejumpers or ground units could follow and shovel them under. More than 100 fires a day were reported in this area after one such lightning burst had passed.

Although most of these were

squelched by initial attack squads and aerial support, two were not. One, near Trapper Peak in the Idaho Panhandle, was in isolated private timber where the Forest Service ordinarily has no authority. Another, on state land east of Priest Lake near Sundance Mountain, also had time to establish itself. They smoldered for a week; then winds arrived. Both became "project" fires almost immediately as they leaped scanty lines and entered the surrounding Kaniksu National Forest.

Dispatchers in regional headquarters at Missoula had not waited. Even as these fires burst their lines word was going out to the other five western regions: Mobilize! Indian pickups began bouncing over New Mexico deserts, supplemental airlines along the West Coast rolled out transport planes, the large interagency fire center at Boise, manned by the Bureau of Land Management, spurred itself to handle the feeding, housing, and processing of transient thousands.

Above all, the army thus summoned and airlifted is professional. The old practice of emptying jails and dole offices or handing a shovel to an astonished tourist has been all but abandoned. Although here the emergency was so vast that some untrained crews, mostly unemployed miners, had to be rounded up, such sources have been largely replaced by skilled woodsmen. The only general public usually recruited for fire lines now are crews from lumber companies, each of which in cutting in a national forest must agree to provide men when fire clouds sweep over the woods.

Aside from these skilled lumberjacks and machine operators, fire crews are true specialists. Forest Service employees, whatever their regular jobs, have a fire-duty assignment. This is indicated on a red card which each must carry, stating his experience and qualifications, so a fire boss can assign him a job at a glance. The calls going out from Missoula were not just for

(Please turn to page 182)



FOREST FIRES are "contained," not extinguished, so work of bulldozers (also brought in by instant airline) in clearing "breaks" in timber is important



STOLS, HELICOPTERS are vital in combating fires, dropping firefighters near or evacuating them from forward fire lines. This short-field takeoff capability is especially important in mountainous country. No less important is logistics problem of feeding and equipping forest forces (below)



Comparing the Versatile Vans



QUIETEST and smoothest riding, the Ford also has plainest interior. Though only two inches longer than last year's model, van has 37 percent more usable cargo space, thanks to relocated engine. Ford is 169 inches long overall. Side-door opening is 47½ by 49 inches, rear opening is 47¾ by 49½. Our test van had a few options: V8, automatic transmission, radio, two-tone paint, passenger seat, and rear windows. Price as equipped: \$2888



BRAWNIEST test van was the Chevy; it hauled 2400 pounds of sand plus bulky driver. In spite of its heavy-duty springs, it rode quite well for vehicle of this type. Overall length is 189 inches. Side doors measure 48¼ by 49¾, and rear door is 48¼ by 49¾. Test truck came with V8 and Powerglide, extra-cost rear-door windows, well-padded jump seat, stabilizer, brake booster, big tires, radio, two-tone paint, 3.73 axle, and other options, all adding up to \$3242

SPLIT WINDSHIELD on Dodge truck may not look too glamorous, but it's cheaper to replace. Like the Chevy, the Dodge van is 189 inches long. Same-size doors (47½ by 51¾) are used on side and rear. With V8, automatic, heavy-duty wheels and tires, stiff rear springs, extra seat, and other options, 108-inch test van costs \$3099



They're half truck, half station wagon and all business

By ALEX MARKOVICH

SO MAYBE they are great for do-it-yourselfers, people who move often and guys who knock over Brinks trucks. But driving these panel vans is likely to be mistaken for a plush job only by an ex-infantryman.

The trucks I road-tested are the 108-inch-wheelbase Chevy G20 (base list \$2618) and Dodge A108 (\$2491), the 105½-inch-wheelbase Ford E100 (\$2408), and the Volkswagen panel truck of 94½ inches (\$2299). The American trucks had up to \$750 worth of optional equipment, including automatic transmissions and V8s ranging from 302 to 318 cu. in. and from 200 to 210 hp. The VW comes only with a 96-cu.-in., 57-hp flat four and manual four-speed floor shift. Though devoid of options, the VW didn't give an impression of a stripped, poor-man's model.

All four vans share what I think are some pretty horrible drawbacks—but I'm used to testing cars, not trucks. To get into any of the driver's seats, you have to learn how to mount. It takes a while to get the hang of it.

Behind the wheel, you realize that you can't see out the sides and back. You can order side windows as an op-

tion, but they may get broken when you haul bulky cargo. So I found myself learning to depend on mirrors and worrying every time I backed up or merged right.

In the three American vans the engine is up front, practically in your lap. This, along with that nice, flat, upholstered body paneling, effectively discourages conversation. Though the VW engine is in the rear under a stepped cargo bed, it's as noisy as the others.

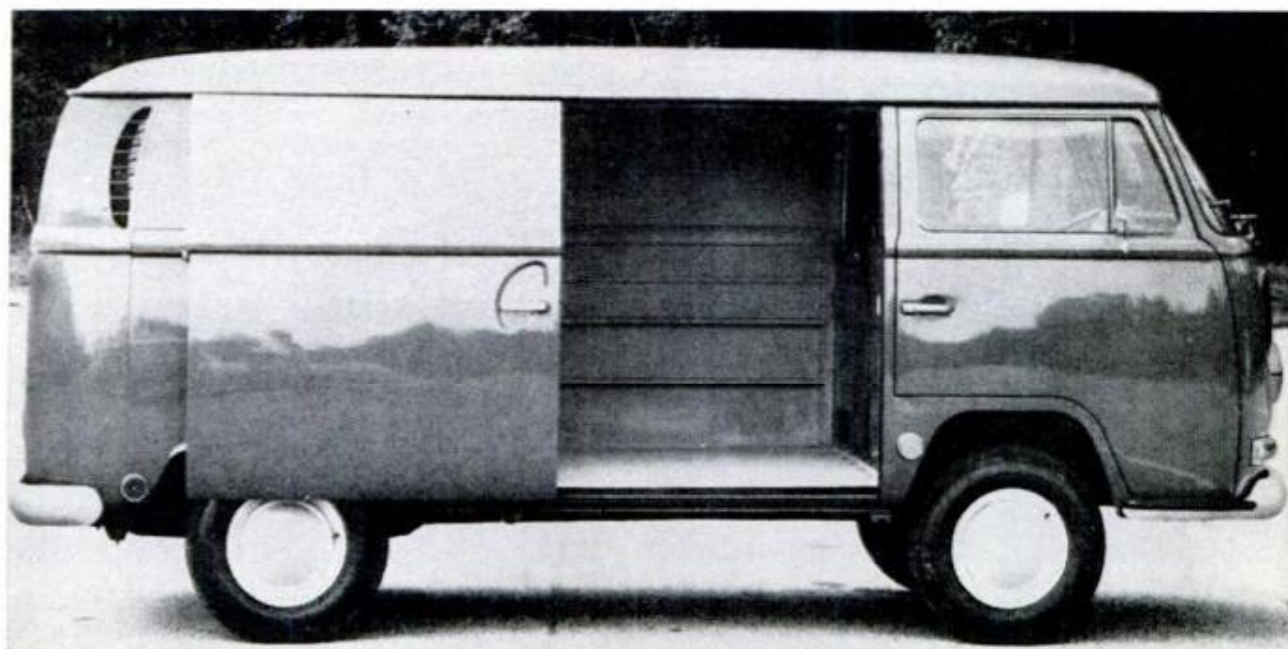
Ride? These vans have a tendency to pitch—partly because the seats are so far forward, partly because of hefty suspensions. All lean hard in corners and are sensitive to crosswinds. Their maneuverability is poor, except for the VW. But, of course, they're trucks, not sports cars.

Also, I couldn't clear the low entrances in many public garages. Better measure your own garage before buying a van.

Finally, there's styling. All four vans follow the functional, bread-loaf school of design. But you're not trying to impress the country-club set.

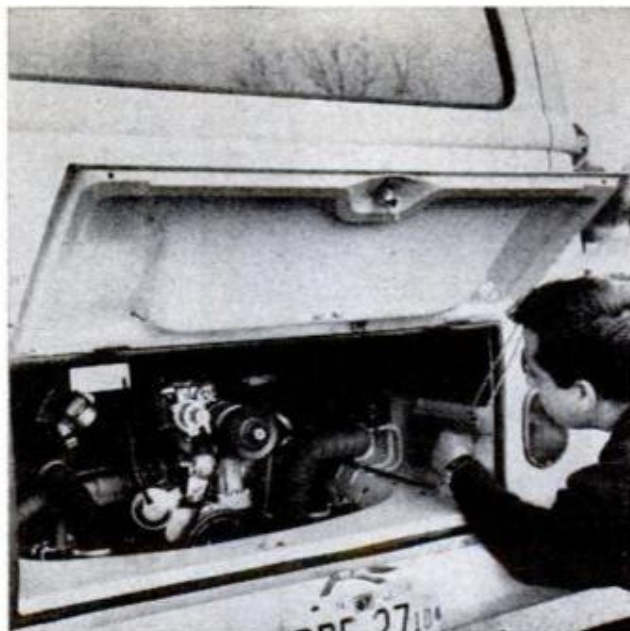
The Ford has the most spartan in-

CHOOSE ONE OR TWO SIDE DOORS on your VW van. We wonder whether tracks could freeze up in winter





TOP OF ENGINE COVER lifts for quick inspection of Chevy V8. Passenger seat is small but comfortable



BATTERY LURKS IN CORNER of VW compartment, can't be easily checked. Engine accessibility is fair



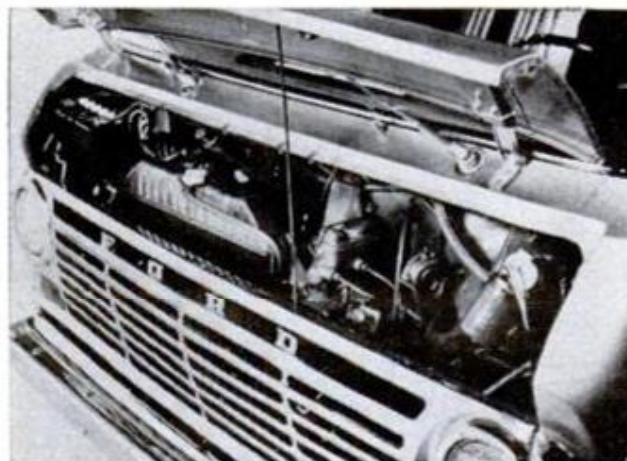
PROP HOLDS UP ENGINE COVER in Dodge. Good insulation keeps engine heat from escaping to cockpit



COVER UNBOLTS EASILY to expose entire Ford engine. When you need to check oil, radiator, wipers...

terior. There aren't any sharp edges or misaligned panels, but the cab is pretty stark. Ford's no-nonsense instrument panel rates a gold star for its full array of instruments, including ammeter and water-temperature and oil-pressure gauges. (The Chevy and VW offer only warning lights.) A cardboard headliner that ends right in front of the driver's head reminds you it's a truck, and make no mistake about it! The VW and Chevy interiors look a bit neater, but they're by no means luxurious.

The Dodge instrument panel most resembles a passenger car—in spite of a stylized *thing* (actually some sort of safety padding) jutting out of the right side that looks like an upholstered meat cleaver. An ammeter and a water-temperature gauge are mounted, but a



... just raise the lid under the windshield. Ford van provides the best overall engine accessibility

warning light monitors oil pressure. A neat headliner stretches the full length of the van.

None of the driver's seats offers much lateral support. I thought the Dodge seat the best-shaped, but VW's earns an honorable mention for its rake adjustment and its excellent fore-and-aft travel. The American vans allot ample legroom—that is, if you're built like a piano stool. I must say, though, there's plenty of cargo space in all four trucks, and that's what you're buying.

A passenger seat is optional in the American vans, standard in the VW. That in the Chevy is skimpy but well padded.

The brake handle on the Chevy is strategically placed in front of the driver's seat where it can keep gouging your right leg. None of the vans has a handbrake that's useful in an emergency—there's too much spring tension for gradual or partial applications. I found it hard to understand why the Dodge ignition switch should be on the left of the steering column. Squeezing your gloved hand through that little space between the door and the steering wheel is an unnecessary nuisance.

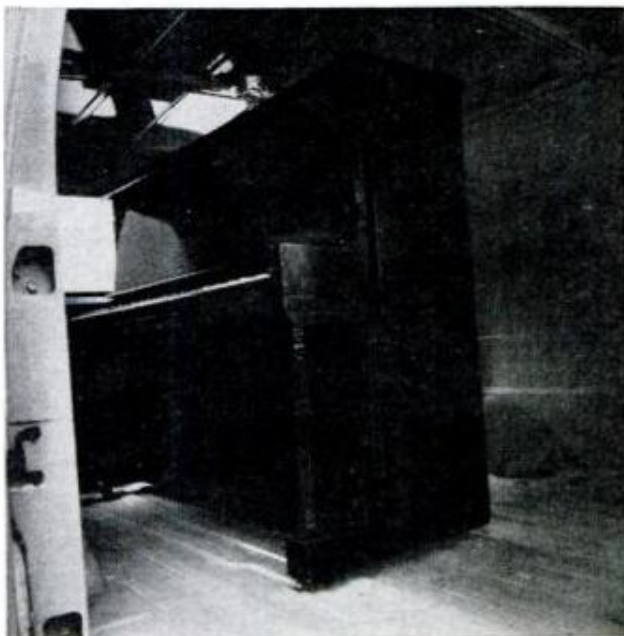
In the Dodge and Chevy vans, the engine (concealed under a big plastic cover bolted to the floorboards) sits smack up against the seat. This means



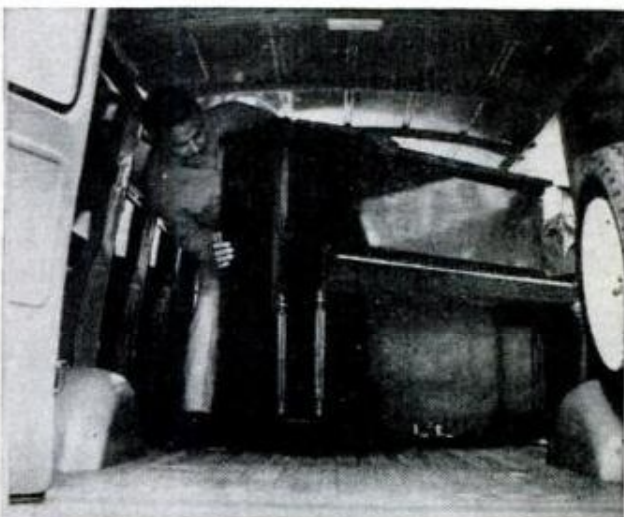
EIGHTY-POUND SANDBAGS made it easy to vary load from truck to truck. VW managed to hold 25
AUGUST 1968



A 600-POUND SPINET PIANO rolls into Dodge van with greatest of ease through the wide rear doors



HERE'S THE SAME PIANO sitting pretty in Ford van. Rear suspension developed squeak from heavy loads



SIDE-DOOR LOADING took some maneuvering, but piano fitted nicely in Chevy. Ride barely changed

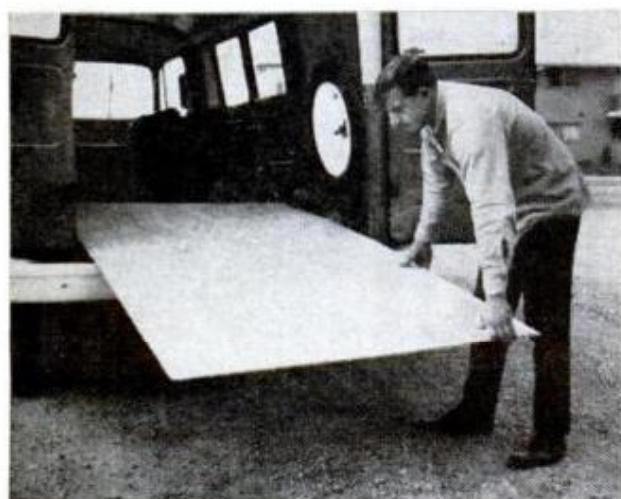
you have to step outside and walk around the van to get from the cockpit to the cargo area. The Chevy cover could be better insulated; engine heat is transmitted to your right leg.

Ford tried something new in this year's van: They pushed the engine forward 22 inches, right over the front axle, and moved the driver back slightly. The results are both good and bad. On the plus side, this leaves room between the engine cover and the seats for easy passage and provides a cargo area 37 percent larger than last year's. It helps reduce the pitching effect, too, because the driver now sits behind the front axle, not right over it. And, it gives the Ford the best overall engine accessibility. With the motor right up against the grille, you can check engine oil, radiator, battery, and wiper motor through a hinged panel under the windshield. For more extensive engine servicing, you undo two fasteners and four bolts and the entire engine cover lifts off.

On the minus side, with that big engine so far forward, the Ford suffers from understeer. And standing-start acceleration is limited because rear-wheel spin is hard to control.

In the Chevy and Dodge, routine engine inspections can be made by undoing one or two snaps and raising a lid in the top of the engine cover. Complete removal of the cover, however,

(Please turn to page 186)



CHEVY VAN ACCEPTS 4x8 PANEL with equal ease. Maximum width of all three American vans is similar



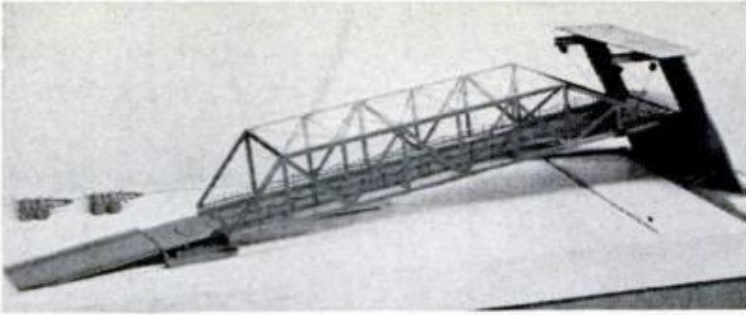
IT'S A TIGHT SQUEEZE between those wheel wells, but 4x8 panel lies flat in cargo area of Dodge van



DISTANCE BETWEEN WHEEL WELLS is greater than rear-door width in the Ford. A 4x8 panel fits easily

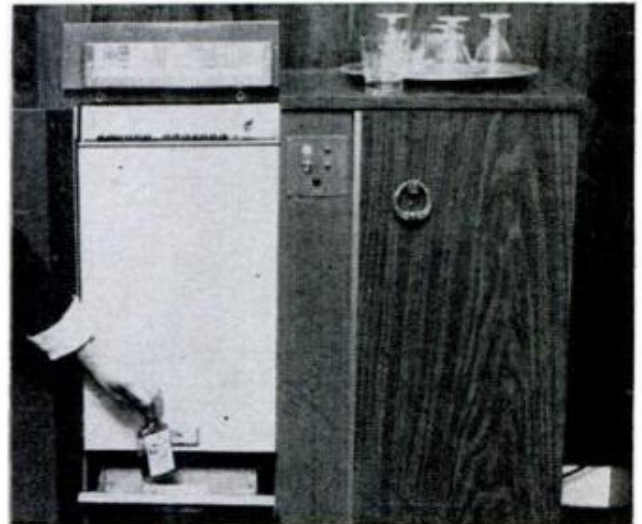
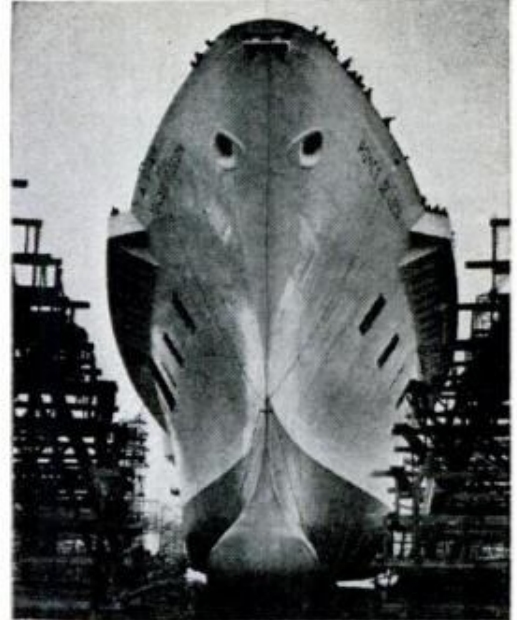


WOOD PANEL IS TILTED to clear spare wheel in VW. Spare could be remounted behind one of the seats



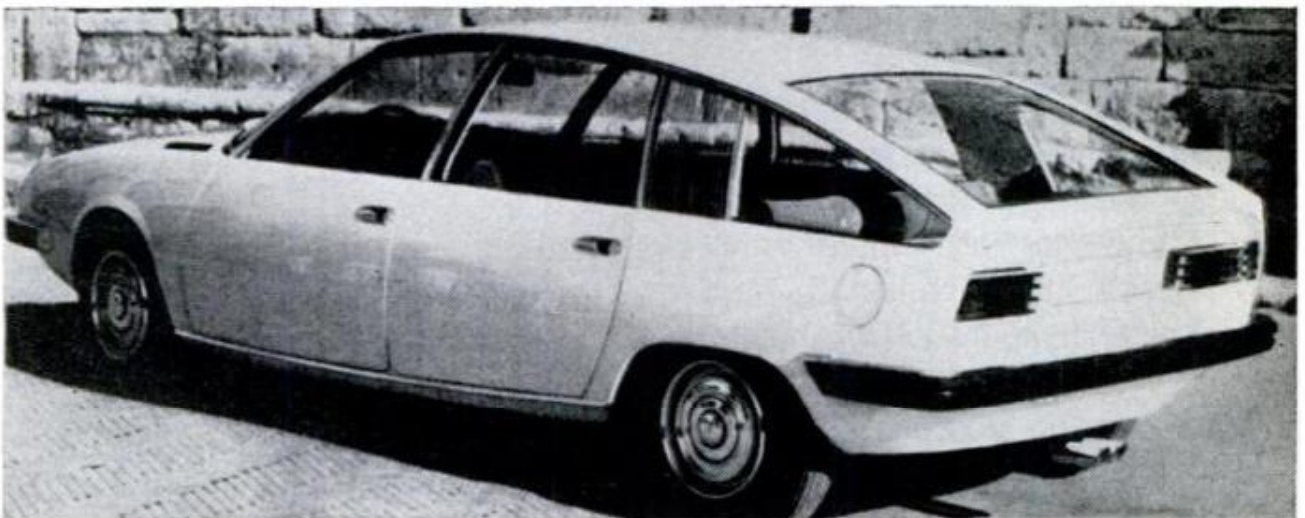
'Truss-bridges' speed loading

Largest and fastest roll-on/roll-off trailership is the newly launched SS *Ponce de Leon*, which can carry 260 40-foot trailers plus 300 autos at a speed of 25 knots. Fast loading is accomplished by three side loading "truss-bridge" ramps (model, above). The ship was built by Sun Shipbuilding for Transamerican Trailer Transport service between Puerto Rico and the U.S.



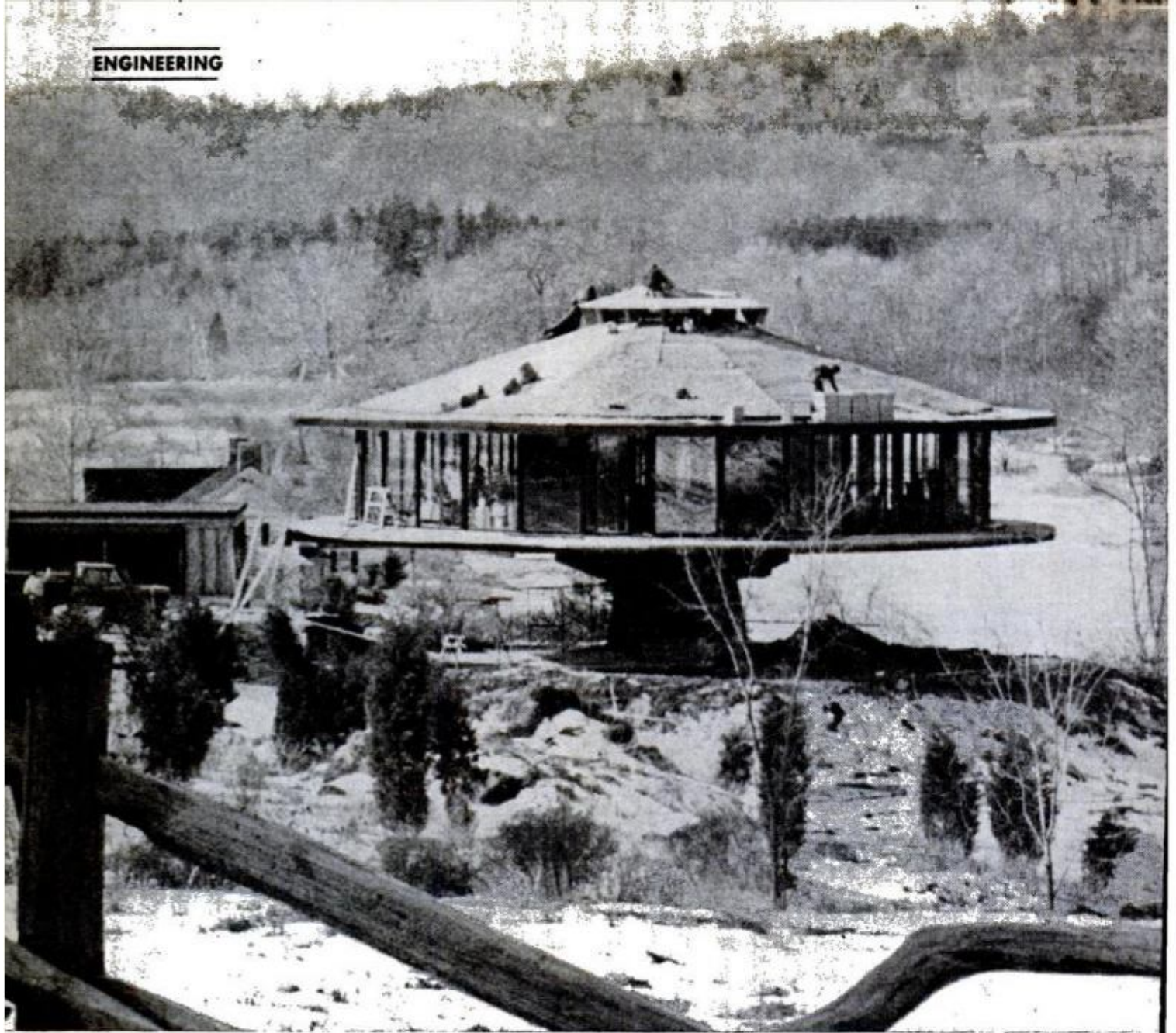
Room service at the push of a button

By pushing a button on the electronic "bell captain," a hotel guest can order a variety of items—from drinks to paperback books—right in his room. It's a Canadian invention.



Italian outside, British inside

Shown recently in Europe was this Pininfarina-designed car, built on a British Motor Corp. chassis. Among its features are automatic airconditioning and front-wheel drive.



Tired of the View? Just

The idea sounds great, but how do you keep from twisting all the utility connections into a spaghetti tangle? Here's how architect Richard Foster licked such problems.

By **ARTHUR MIKESELL**

PERCHED HIGH on a New England hillside near Wilton, Conn., is one of the world's most unusual houses.

Appearance alone would be enough to set it apart from the traditional salt

boxes and colonials favored by most residents of that area. It's a giant glass-walled disc elevated one story above the ground on a stubby, shingled pedestal. However, the feature that makes this house different from all other houses is something that doesn't show—the whole nine-room disc can be made to rotate at the push of a button.

Designer and owner of this unconventional residence is Richard Foster, a New York architect. The story behind it is a classic of engineering ingenuity.

The rotating feature was Foster's solution to a difficult architectural prob-



tating around a stationary core containing most (or all) of the utility connections. So far as Foster knows, his is the first such rotating structure to link all utilities to the rotating section.

The huge ball bearing on which the half-million-pound rotating section rests came from Rotek, Inc., a manufacturer of multiloop bearings for large cranes and excavators. The balls ride on raceways of hardened steel wire, and the design provides for simultaneous transmittal of axial, radial and tilting moment loads. The mechanism itself is strong enough to take vertical loads of up to five million pounds and withstand sideways forces created by 125-mph winds. Rotation power is supplied by a 1½-hp motor mounted in the stationary portion of the pedestal.

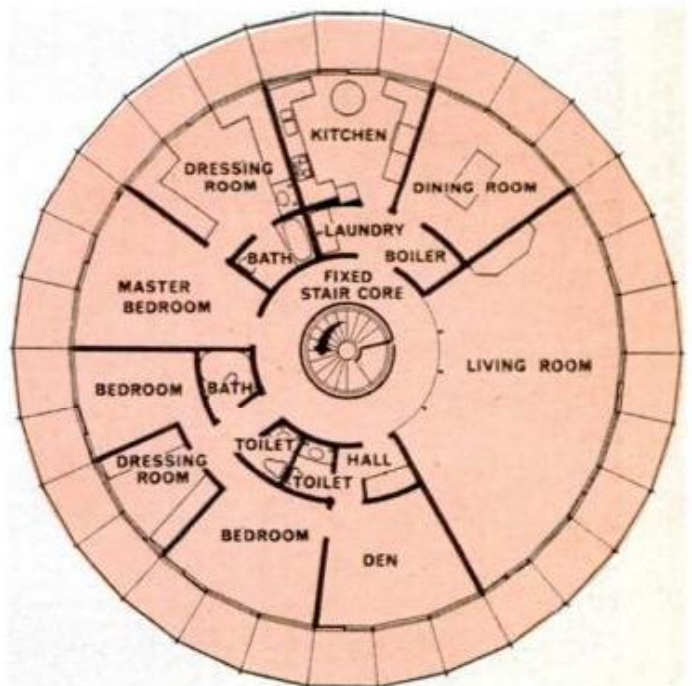
The speed of rotation ranges from 5 to 40 revolutions in 24 hours. Measured at the outside wall of the house, this means from nine inches to five feet per minute. Design speed is just over one revolution per hour, a rate so slow that there is no sensation of motion unless you concentrate on some fixed point outside. The direction of rotation can be reversed by flicking a switch.

In case the bearing ever has to be replaced, four jacking points have been

Turn the House

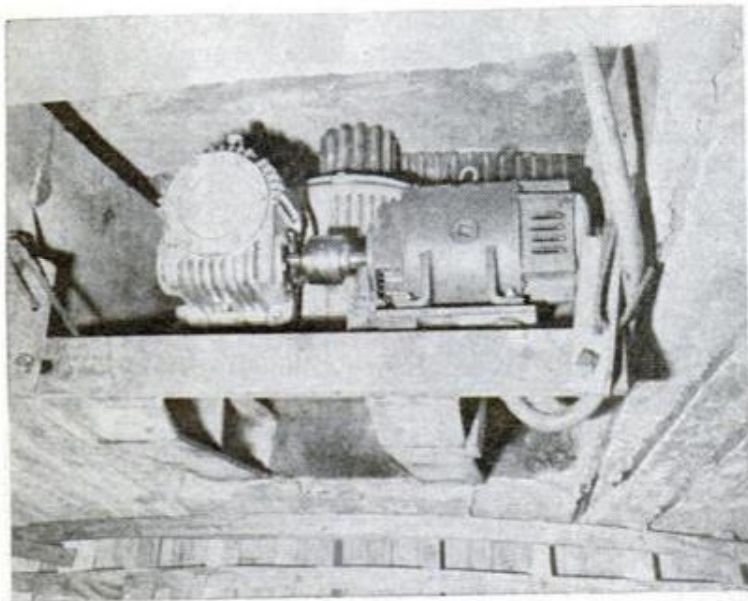
lem. His choice six-acre building site offered almost 360° of beautiful vistas. Orienting a normal house toward any one view would automatically downgrade equally beautiful views at the sides and rear. Mulling over this problem, he decided to design a house which wouldn't have to be permanently oriented in any one direction.

Of course, the idea of rotating structures isn't entirely new. The Dutch began using rotating windmills centuries ago, and there are many modern restaurants described as "rotating." The latter, however, are simply rings ro-



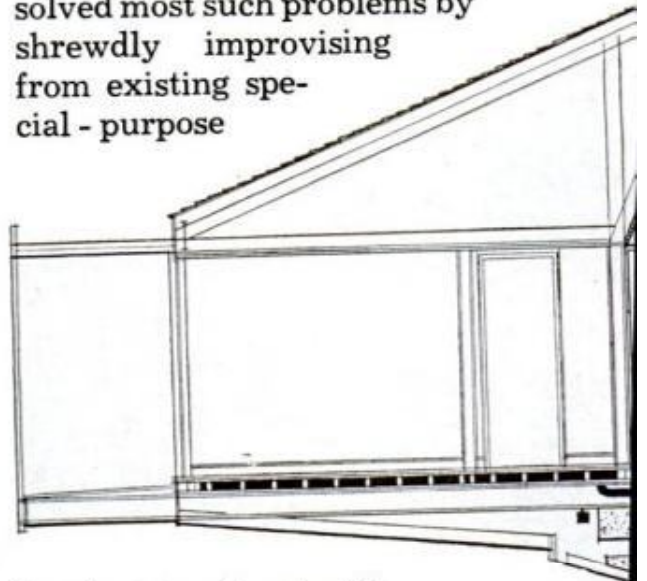
provided which will make it relatively simple to elevate the rotating section above the pedestal and slip in a new bearing.

The entire weight of the house is "hung" from a center ring at the top and, in turn, transmitted straight down, uniformly on all sides, to the giant bearing. This method of equalizing load distribution eliminates any balance problems which might occur if 60 people were crowded into the living room during a party with no counterbalancing load on the opposite side of the house. It also eliminates wind sway.



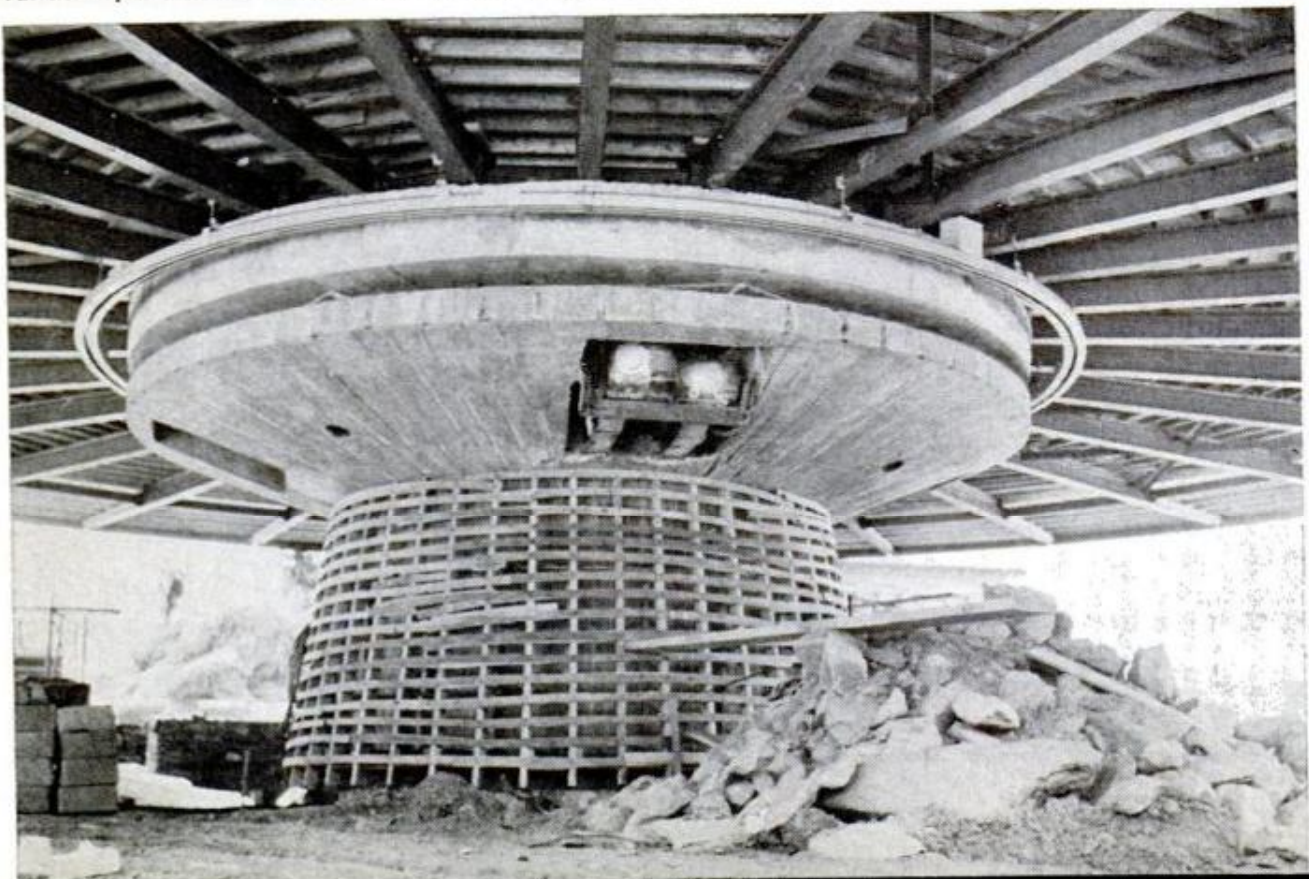
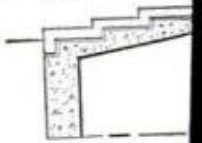
POWER TO TURN HOUSE comes from 1 1/2-hp electric motor with variable-speed drive, above. It's mounted in pedestal, below

Providing for rotation proved to be only the first of many problems. Linking each utility to the rotating section of the house was a separate challenge, but Foster didn't run into any insurmountable difficulties. He solved most such problems by shrewdly improvising from existing special-purpose

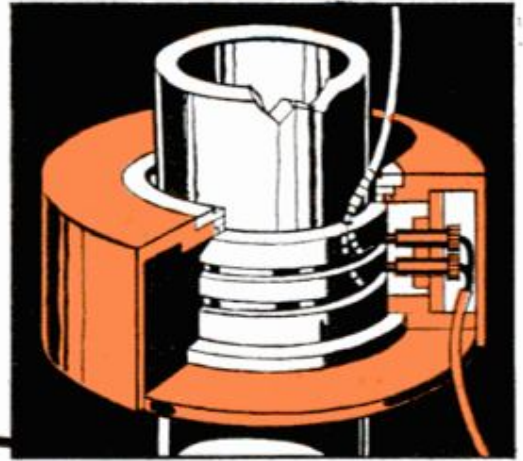


hardware and materials.

Water, for instance, enters the house through a stationary intake pipe running up the inside of a service core in the center of the circular stairway. A special swivel joint on top of this pipe carries water to the plumbing lines



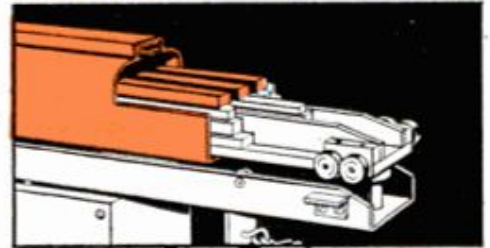
PLUMBING



TELEPHONE

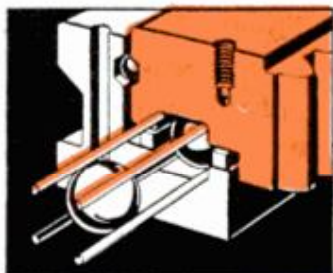
SPECIAL COMPONENTS making it possible for the house to rotate came mainly from industrial sources. However, the water-gasketed sewage system was fabricated on site. With exception of motor, color portion of each detail indicates rotating section of that special system

ELECTRICAL DETAIL



TURNTABLE

SEWAGE



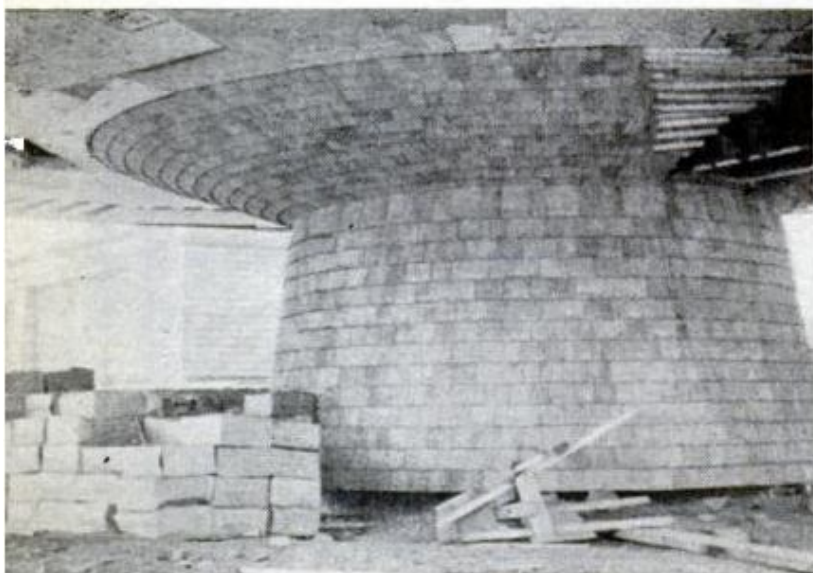
BEARING DETAIL

MOTOR

ELECTRICAL



EXCLUSIVE CONSTRUCTION PHOTOS were taken last spring. House will be completed this summer, too late to include photos here. Note that porch guard rails were still to be installed, above. Underbody had been insulated and sheathed with plywood, below, but lacked the shingles



placed in the attic which lead down between the partitions to the kitchen, laundry and baths. Foster bought the swivel joint from Chiksan, a company which makes equipment used in drilling for oil and loading tankers, fields where this special swiveling requirement is commonplace.

No such easy solution was available for the problem of sewage disposal, so Foster had to design a system which would transfer sewage from the rotating section to the stationary base while sealing in all odors. His ingenious design works something like this:

A circular collection trough located on top of the stationary pedestal just

inside the rim of the rotating section has a narrow "gasket trough" on each side which is filled with water. The inner wall of each of these smaller troughs is lower than the outer wall, so any overflow will spill into the collecting trough. The collection trough is pitched to four drains located 90° apart which lead down through the walls of the pedestal to a septic field. All of the above is stationary.

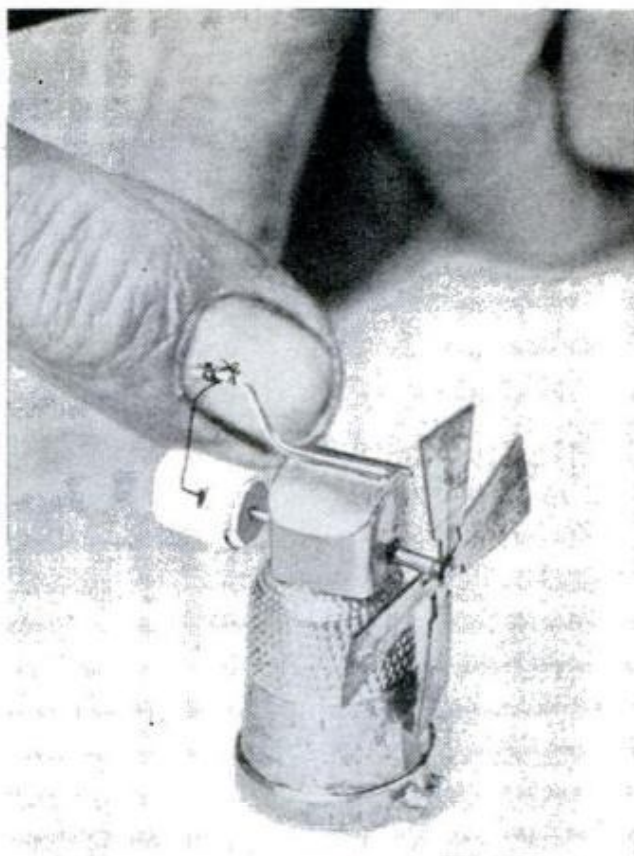
In the rotating section, feeder drains under the floor lead back toward the core where they empty into the collection trough through elbows in an upside-down circular channel. This cap ring covers the collection trough all the way around, but is mounted on the rotating section. The sides of the cap ring fit into the gasket troughs and extend below the waterline but not far enough to rub against the bottom. Four standpipes, again 90° apart, extend from the cap ring up through the roof.

It's a simple, foolproof system which still allows for free rotation. Foster plans to install a lawn-sprinkler timer on the filler valve for the gasket troughs so the operation will be fully automatic.

To connect the electricity, Foster again went to industrial sources for the necessary equipment. Electric Feedrail manufactures trolley systems for distributing electrical power to moving equipment, such as the tools used in assembly-line work. They're designed so that power can be taken off anywhere along the length of the track.

Foster purchased a circular track just slightly larger than the diameter of the pedestal, but instead of bringing power in through the track and taking it off through the trolley, he reversed the mounting. The track is hung from the rotating section, while the trolley

(Please turn to page 188)



More fun (scratch) than a (itch) three-ring circus

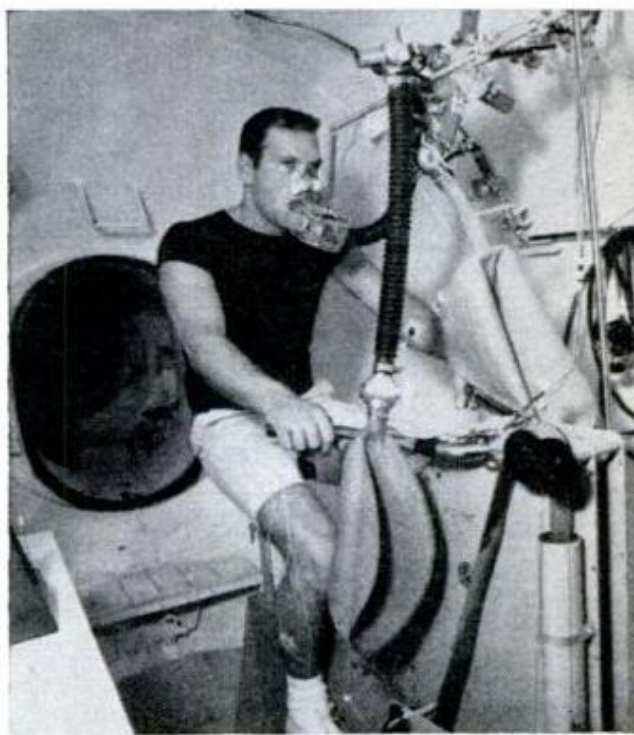
Even flea circuses have their troubles, says Len Tomlin, Manchester, England, who claims flea-training is a dying art because too few people "have a steady enough hand" and, worse, there just aren't many fleas anymore. He's shown with his daughter, and, of course, his fleas.



Saturday night in orbit

Astronauts in orbit can take showers, reported Martin Marietta Corp. after tests in a KC-135 performing zero-gravity parabolas.

AUGUST 1968



Deep-diving pedaler

The bike used in Aircor's deep-diving tests was an ergometer that helped measure oxygen use down to simulated 1000-ft. depth.

111



Dodge Dart

A Nationwide Survey Based on
1,380,200 Owner-Driven Miles



Low-Horse Sixes Provide Real Economy, but Road and Wind Noise Make It a Roaring Ride

By **BILL HARTFORD**, Associate Auto Editor

Photos by *Irving Dolin*

"IT RUNS!" exclaims an Ohio civil servant sounding like the first-time owner of a horseless carriage. This—the only praise he expressed for Dodge Dart transportation—conveys the fact that now, just as seventy years ago, the first requirement for a car be that it start, stop and run when you want it to.

Most Dart owners know that this is what a car is all about—despite unme-

chanical, miniskirted mamas doing their thing on billboards and TV to lure them—sensible car buyers—into the intoxicating atmosphere of the showroom.

It's the old story. In 1899, as the romantic slogans went, you could buy a horseless carriage and look ahead at that long, long trial a'winding instead of watching a horse's laboring differential—even if the clippety-clop of that independent rear

POPULAR MECHANICS



SLIPSHOD HANDIWORK inside Dart includes such things as careless headliner trimming, shown here



REAR SEAT COMFORT, headroom and spaciousness is good for a compact, according to most Dart owners

suspension was a more dependable sound than *putt-putt-putt*. Today the car-selling slogans still stress romance, revolution and rebellion, and still, dependability and economy are what really count in everyday getting-where-you're-going.

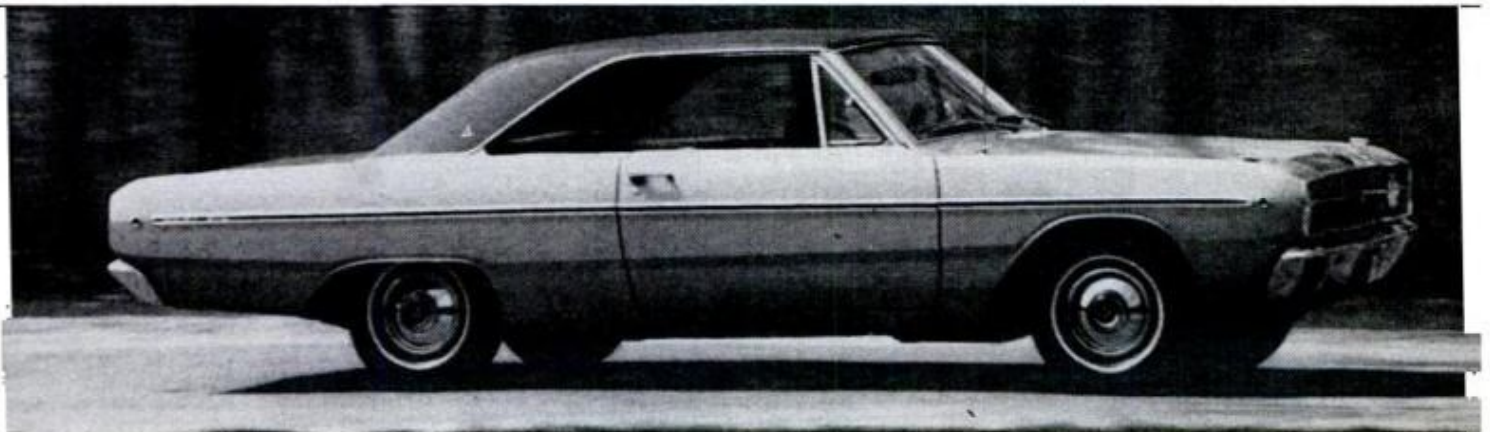
Getting where they're going is very important to Dart owners. Dodge fever cools fast at 6:00 a.m. on a day in January if the slogan isn't backed up with working hardware. Most Dart owners tell us that, happily, they're getting the hardware:

"On cold mornings my Dart always

comes through," says an Illinois serviceman. "Very dependable," says a Florida owner who has had no mechanical trouble on this one and none on his last Dart until it was two years old and had 58,000 miles. "Engine and transmission in my opinion are perfect. Warranty doesn't seem to be needed," says an Ohio maintenance foreman. "No mechanical trouble; and it's got get up an' went," drawls a Wisconsin farm hand.

Satisfied owners, to be sure. Their car is all they want it to be. But some of their

HANDLING, ECONOMY AND STYLE are almost tied in survey results as the best single thing about Dodge Dart





POSITION OF REAR-VIEW MIRROR blocks vision in right-hand turns, but where else can it be located?

brothers in the Dart fraternity got bad initiations. A Georgia salesman got a real hazing with his new Dart: "The following happened to my Dart the *first* day I had it! Power steering leaked around a loose fitting on the pump body. Lost all fluid. Gasket not seated on oil filter assembly—lost two quarts of engine oil at break-in time. Could have been very serious. Shortly after this the entire lower pulley assembly and balancer wheel had to be removed to grease bearing behind it. It howled because it was not lubed when installed." And a New Jersey housewife was initiated by having her power steering fluid line break after five days; furthermore, "After I had it about six weeks, I had to be towed. It wouldn't turn over—something with the wiring."

A Massachusetts manager likes the smooth ride of the small Dart and the power and economy of his 225 Six, but his car "came with a defective brake drum and the engine is always stalling—whether it's been running for hours or minutes, in any type of weather, at any speed, day or night. That's dangerous."

If these owners were beguiled into the showroom, they won't be again. A Pennsylvania brooder-house employee certainly won't be. He brought his Dart back to the dealer with some complaints and got no satisfaction. And, to end any further discussion, he was told: "We don't build them, we just sell them."

A Pennsylvania chemical engineer sums up the problem of factory bugs and adds a new term to the automotive vocabulary—one it could do without. It's italicized in this praise of his dealer. Happily, he's got

a good one: "*Initial defects* taken care of promptly by dealer."

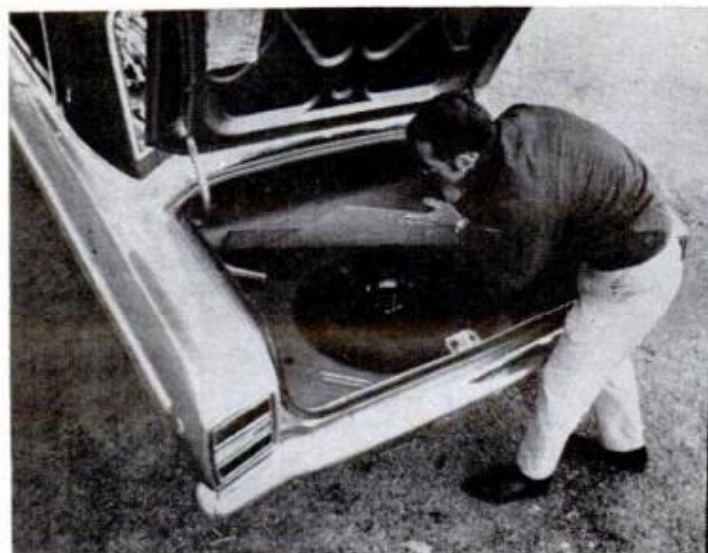
It's an unusual man who can matter-of-factly accept faulty workmanship in a brand new automobile and institutionalize it under the term, initial defects. I guess it's that or an ulcer, take your choice.

His complaints are about what he feels to be minor design faults, like the location of the front seat-back safety catches, but in his praise of handling and economy he speaks for most Dart owners: "Easily handled in tight places—traffic and parking. Good economy."

A Pennsylvania rural development specialist says he "must live with a 7-cent-a-mile reimbursement, and my Dart is the least expensive car to run." "Cheap on gas," says an Illinois farmer. A Virginia veteran had various complaints about the Dart, but praises its economy of operation. He gets an above-average 18 mpg in town and 24 mpg on trips with his 225.

Not enough owners have optional high-performance engines in their Darts to provide *PM* with meaningful mileage figures on them. Two owners in Ohio, however, have 340-cu.-in. V8s and indicate 12 and 15, and 14 and 16 mpg in what they refer to as "hard driving." The draftsman asks, "What's the best performance the 340 will put out in the quarter? I've turned 100 by my speedometer but I don't know if it's true or not." The farmer from Ohio isn't relying on his Dart's speedometer. He answers with the fact that with a precise timing rig he's clocked 101.76 mph. It seems that at least a few owners do want their Darts to do more than just run!

LOCATION OF SPARE TIRE results in usable trunk space that is somewhat shallow for certain packages

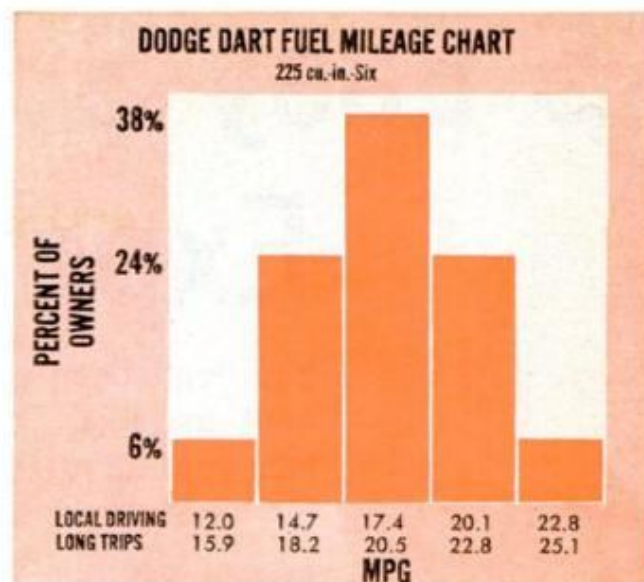




COAT HOOK is mounted too high in this single instance, making it horizontal and totally useless

Many owners don't have to be doing a hundred at the end of a quarter to find wind and road noise objectionable. In fact, half that speed is sufficient, and the noise is enough to make it the biggest single beef owners have about Darts.

"Wind noises rather bad," says a New Jersey teacher. "One complaint: the noise caused by ill-fitting side windows," says a Wisconsin teacher. "Not insulated from road noise."—Georgia student. "Fresh-air intakes leak cold winds on your feet," says a New Jersey plumber. "Whistle



around windows," says a New Jersey public relations man who also had road noise from the rear since the separator between trunk and rear seat was missing on his new Dart.

A Kentucky printer had something missing on his new Dart, too—the engine. The one he wanted, that is. He says he just found out after 9500 miles that his dealer didn't have the 225 engine he wanted so he disguised a 170 engine with a 225 air cleaner! How's that for horse trading? ★★★

Summary of 1968 Dodge Dart Owners Reports*

Total miles driven 1,360,200

Average miles per gallon:

170-cu.-in.-Six, local driving 19.1
long trips . . . n.a.
225-cu.-in.-Six, local driving 17.4
long trips . . . 20.5
273-cu.-in.-V8, local driving 15.0
long trips . . . 18.6
340-cu.-in.-V8, 318-cu.-in.-V8, 383-
cu.-in.-V8: not available.

Specific likes:

Handling 47.2%
Economy 45.1
Style 44.4
Power 21.5
Comfort 20.1
Performance 16.0
Ride 11.8
Roadability 8.3

Specific dislikes:

Wind noise 16.4%
Carburetor 14.8
Workmanship 10.7
Gas mileage 9.0
Road noise 9.0
Dealer service 8.2
Ride 7.4
More room in rear 7.4
Seat comfort 6.6
Rattles 5.7
Finish 4.9

What changes would you like?

Reduce road noise 7.3%
Workmanship 6.4
Quieter 6.4
Rear-view mirror position 6.4

Ignition switch location... 5.5
Ride 5.5

Model:

Dart Six 26.7%
270 Six 25.5
GTS V8 16.8
GT Six 9.9
270 V8 9.3
GT V8 9.3
Dart V8 2.5

Transmission:

Automatic 83.4%
3-speed manual 9.8
4-speed manual 6.7

Had any mechanical trouble?

No 53.0%
Yes 47.0

What kind of trouble?

Carburetor (includes routine
adjustment and recall of
high-performance V8s for
idle cam) 36.4%
Brakes 13.0
Windshield wipers 9.1
Transmission 9.1
Oil leak 6.5
Heater 6.5

Dealer repair satisfactory?

Yes 62.7%
No 32.8

Why the Dart?

Past experience 33.1%

Style 32.5
Reputation 14.6
Price 11.9
Economy 11.9
Size 11.9

Is the Dart your only car?

Yes 52.1%
No 47.9

Other cars owned:

Dodge 27.5%
Chevrolet 18.8
Ford 16.2
Plymouth 8.8
Rambler 7.5
Valiant 5.0
Chrysler 5.0

What options/accessories?

Radio 53.5%
Power steering 49.4
Power top (convertible) 20.0
Whitewall tires 14.8
Airconditioning 13.5
Tinted glass 10.3
Tinted windshield 10.3
Console 9.7
Bucket seats 9.7
Vinyl top 9.7
Power brakes 6.2

Age distribution of owners:

15-29 31.3%
30-49 35.0
50 plus 33.7

*Where applicable percentages may not equal 100 percent due to rounding and/or insufficient sample.

5 Easy Steps to Expert Exposure

You don't need a light meter to tell how much light there is. This simple-to-remember guide lets you estimate the proper camera settings for most picture-taking situations in daylight

By PHIL GERACI




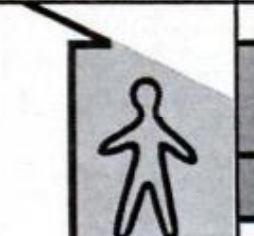

PHOTO PROCESSING LABS report that more film is spoiled through incorrect exposure than from any other picture-taking error. The pros solve the exposure problem with a light meter. But you may not have a meter handy or care to get involved in using one. One drawback of relying on a meter is that it quickly becomes a crutch. You get to depend on it so much that you're taking a new reading on every shot even though the light may not have changed for hours.

There's a very simple method for determining correct exposure that anyone can use, and it doesn't require a meter. It's called the "step" system. The amount of light required to take a picture varies over a relatively narrow range. By dividing this range into steps and learning how to apply them, you can handle 90 percent of all picture-taking situations outdoors in daylight. All you have to do is remember which step to use for each degree of light intensity. Five steps cover the majority of light conditions you'll encounter.




















You can use the system with any adjustable camera and with some automatic models that have provision for manual exposure control. In some cases, the step system will enable you to take pictures where a meter or automatic control would tell you not to. It works so well that photography students to whom I've introduced the system continue to use it even after they've purchased expensive meters.

To understand how the system works, it's necessary only to keep in mind that shutter-speed settings and f-stop diaphragm settings all control light in even steps. Each step up doubles the amount of light reaching the film, and each step

PHOTOGRAPHIC CHART at right shows how step system works under actual conditions. Note that basic exposure is correct for bright sun, but produces progressively darker pictures as light gets weaker. Compensating for this weaker light is simply a matter of increasing basic exposure one, two or three steps

HOW TO TELL HOW MANY STEPS TO USE				
SUBTRACT 1 STEP	USE BASIC EXPOSURE	ADD 1 STEP	ADD 2 STEPS	ADD 3 STEPS
				
Water, beach or snow scenes in bright sun	Bright sun, clear sky, strong shadows	Light overcast or shade, faint shadows	Moderate shade or heavy overcast; no shadows show	Deep shade, rain or fog; also scenes shot at dusk, such as sunsets

HOW THE STEP SYSTEM WORKS UNDER DIFFERENT LIGHT CONDITIONS

LIGHT CONDITION	BASIC EXPOSURE	1 STEP INCREASE	2 STEPS INCREASE	3 STEPS INCREASE
BRIGHT SUN	 <p style="text-align: center;">Correct exposure</p>	 <p style="text-align: center;">Too light</p>	 <p style="text-align: center;">Washed out</p>	<p>NOTE: All examples shown in this chart made on Tri-X film using basic exposure of 1/250 sec. at f/22</p>
HAZY, OVERCAST	 <p style="text-align: center;">Too dark</p>	 <p style="text-align: center;">Correct exposure</p>	 <p style="text-align: center;">Too light</p>	 <p style="text-align: center;">Washed out</p>
MODERATE SHADE	 <p style="text-align: center;">Way too dark</p>	 <p style="text-align: center;">Slightly dark</p>	 <p style="text-align: center;">Correct exposure</p>	 <p style="text-align: center;">Too light</p>
DEEP SHADE	 <p style="text-align: center;">Way too dark</p>	 <p style="text-align: center;">Slightly dark</p>	 <p style="text-align: center;">Correct exposure</p>	 <p style="text-align: center;">Too light</p>
BACK-LIGHTED SUBJECT	 <p style="text-align: center;">Way too dark</p>	 <p style="text-align: center;">Slightly dark</p>	 <p style="text-align: center;">Correct exposure</p>	 <p style="text-align: center;">Too light</p>

down cuts it in half. The f-stop settings determine the size of the lens opening through which the light passes, and the shutter-speed settings determine the length of time the shutter is open. In either case, the bigger the number, the smaller the amount of light. Twice as much light reaches the film at f/8 as at f/11. In the same way, a shutter speed of 1/30th of a second lets in twice as much light as 1/60th of a second.

You can vary either the diaphragm opening or the shutter speed and the effect is the same. An exposure of 1/60th of a second at f/8 is exactly the same as 1/30th of a second at f/11. In the first case, you're letting in a large chunk of light but only for a short time. In the second, you're letting in half as much light but for twice as long. The total amount of light reaching the film is the same in both.

Film speeds are related to each other in the same way. A film rated at ASA 400 requires only half as much light under



BRIGHT SCENES like this beach view need one step less exposure to compensate for added glare. Normal sunny-day settings would give overexposure

any given condition as a film rated at ASA 200. The whole business of exposure is thus a matter of knowing which step to use for the particular film you have in the camera and the particular light condition at the moment. If you know the right step for one basic situation, you can figure out how many steps to go up or down from this on other situations.

The starting point is bright sun on a

(Please turn to page 190)



WHICH SETTINGS YOU VARY

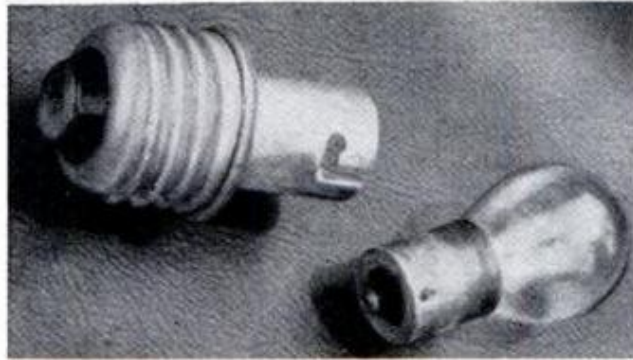
—shutter speed or diaphragm opening—depend on the type of scene you're shooting and the effect you want. The exuberantly athletic shot at far left was made at 1/500th of a second to freeze the dramatic motion. Scene at the near left was shot at a slow speed and small opening. Background is sharp and has good depth, but passerby is blurred. Such blurring is sometimes used deliberately to create a sense of motion, such as of a speeding car that would merely look stopped if shot at a fast shutter speed

HOW TO FIND THE RIGHT EXPOSURE FOR ANY STEP ON ANY FILM

FILM SPEED (ASA RATING)	1600	800	400	200	100-125	50-80	25-40	12-20
BASIC EXPOSURE	1/500-f/32	1/250-f/32	1/250-f/22	1/250-f/16	1/250-f/11	1/250-f/8	1/125-f/8	1/125-f/5.6
1 STEP INCREASE	1/500-f/22 or 1/250-f/32	1/250-f/22 or 1/125-f/32	1/250-f/16 or 1/125-f/22	1/250-f/11 or 1/125-f/16	1/250-f/8 or 1/125-f/11	1/250-f/5.6 or 1/125-f/8	1/125-f/5.6 or 1/60-f/8	1/125-f/4 or 1/60-f/5.6
2 STEPS INCREASE	1/500-f/16 or 1/250-f/22	1/250-f/16 or 1/125-f/22	1/250-f/11 or 1/125-f/16	1/250-f/8 or 1/125-f/11	1/250-f/5.6 or 1/125-f/8	1/250-f/4 or 1/125-f/5.6	1/125-f/4 or 1/60-f/5.6	1/125-f/2.8 or 1/60-f/4
3 STEPS INCREASE	1/500-f/11 or 1/250-f/16	1/250-f/11 or 1/125-f/16	1/250-f/8 or 1/125-f/11	1/250-f/5.6 or 1/125-f/8	1/250-f/4 or 1/125-f/5.6	1/250-f/2.8 or 1/125-f/4	1/125-f/2.8 or 1/60-f/4	1/125-f/2 or 1/60-f/2.8
4 STEPS INCREASE	1/500-f/8 or 1/250-f/11	1/250-f/8 or 1/125-f/11	1/250-f/5.6 or 1/125-f/8	1/250-f/4 or 1/125-f/5.6	1/125-f/4 or 1/60-f/5.6	1/125-f/2.8 or 1/60-f/4	1/60-f/2.8 or 1/30-f/4	1/60-f/2 or 1/30-f/2.8

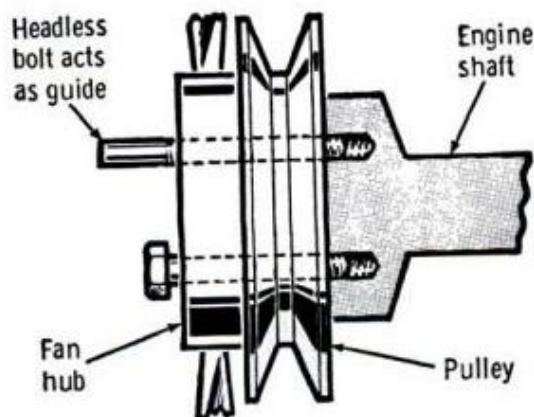
CAR HINTS

For the Saturday Mechanic



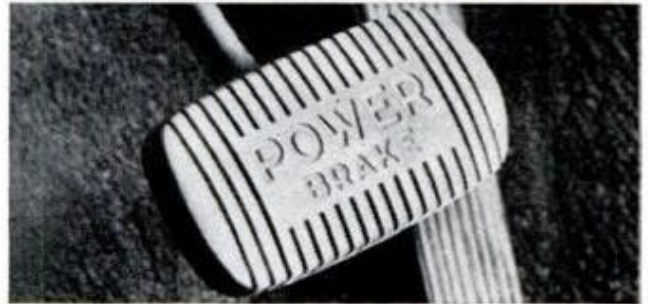
SWITCHING TO BATTERY POWER in a house trailer is always a nuisance. While there are low-voltage bulbs that fit 115-volt sockets, they're expensive and look so much like regular bulbs that you often forget to change them. I found the perfect answer in the little screw-base adapters for small-base flashbulbs. These make it easy to fit bayonet-base taillight bulbs into household-type screw sockets. I just wire a spare battery to a two-prong plug and insert it in one of the trailer's outlets. To switch back to 115-volt power, it takes only a few minutes to unplug the battery and exchange the adapters for regular light bulbs.—Jerome V. McGinn

WHEN OVERHAULING AN ENGINE, always reinstall tappets in the same tappet bores from which they were removed. This tip, passed on by the service department of International Harvester Co., is recommended because each tappet tends to form its own particular wear pattern in relation to the cam lobe and the tappet bore. If tappets are replaced in different bores, new wear patterns will form over the old ones. This can result in accelerated wear and possible damage to the cam lobe and tappet

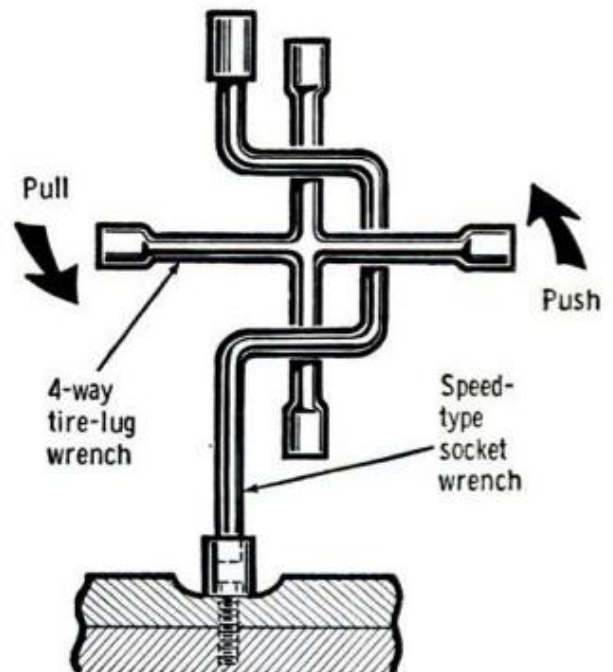


REPLACING A FAN BLADE is often a pesky job because it's hard to line up the bolt holes down where you can't see what you're doing. You'll have less trouble if you try this trick. Find a spare bolt of the right thread size and cut off its head with a hacksaw. Run the bolt into one of the holes before you put on the blade. The protruding stud will help guide the blade hub into place, as shown above. When all the other bolts are secured, replace the headless stud with a regular bolt.—Ed Mayover

AUGUST 1968

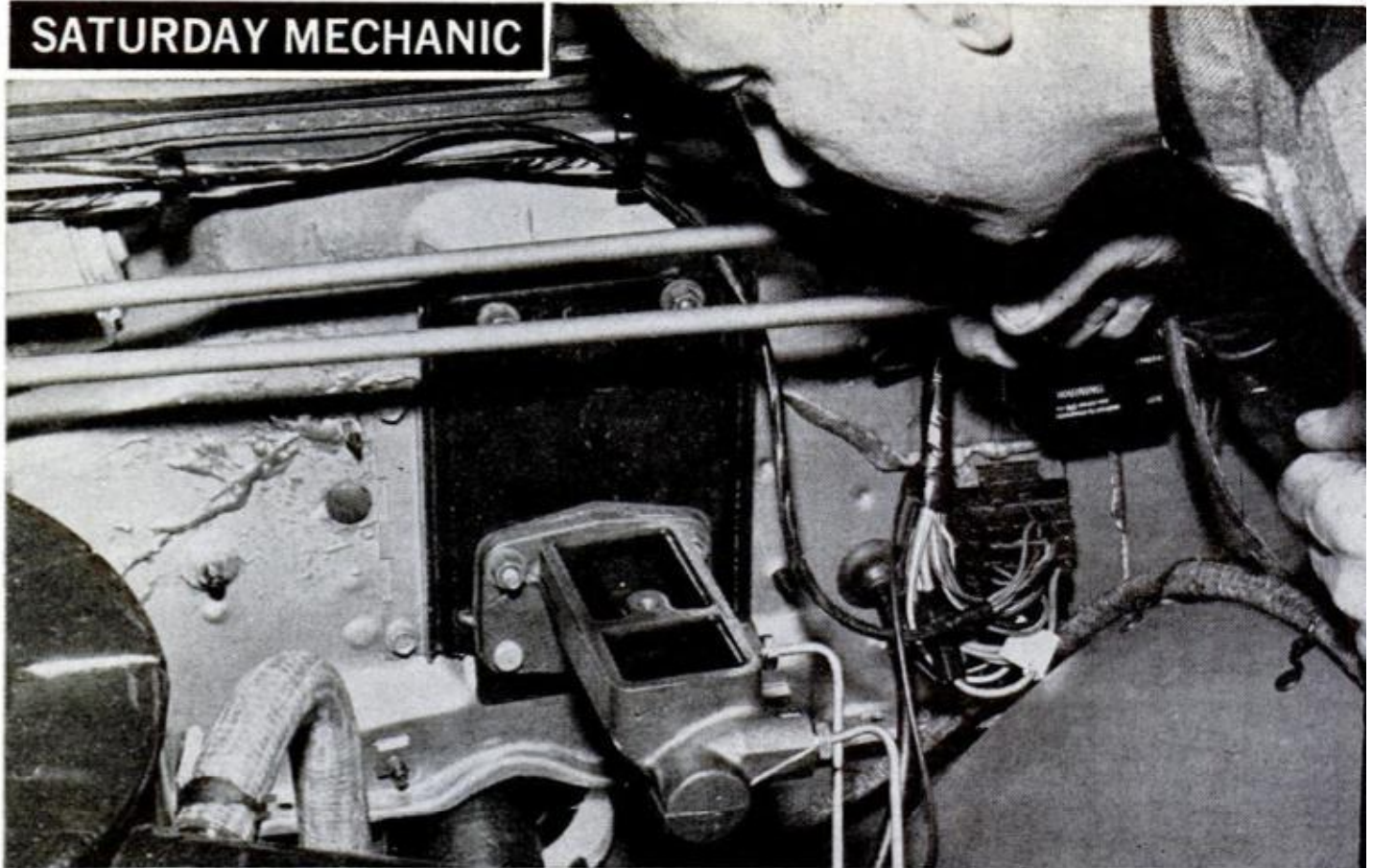


ADDING A WIDER BRAKE PEDAL will make your brake safer and more comfortable to use. This is easy to do on cars that have automatic transmissions but are equipped with the older narrow-type pedal. Purchase a rubber power-brake replacement pad from an auto parts store. Shape a piece of $\frac{1}{8}$ -in. steel plate to fit the pocket in the back of the pad and bolt this to the existing brake pedal. Attach the plate with two $\frac{1}{4}$ -in. flathead bolts, countersunk so that their heads lie flush (top photo above). Use lock washers on the back side so that the plate can't loosen. Slip the new pad over the plate and you have a modern wide-type pedal.—F. L. Greenwald



STUBBORN ENGINE BOLTS can often be removed with this combination of two common tools. Slip a speed-type socket wrench on the bolt head, then run a four-way lug wrench through the handle as shown above. The lug wrench will give you enough extra leverage to break loose most frozen bolts. Do not, however, use this method to tighten bolts, especially where a torque wrench is called for. You may run the risk of overtightening a bolt, causing it to shear off or crack a casting.—C. L. Sample

119



CHECKING FLUID LEVELS should be a matter of habit. Once a month is not too often to check brake fluid

How to Do Your Own Preventive Maintenance

Going over your car an hour or two every few weeks is a lot quicker, cheaper and less aggravating than a weekend spent on unexpected repairs

By **MORT SCHULTZ**



AUTOMATIC TRANSMISSION FLUID is drained from two locations. At left, plug is removed to drain the converter. Below, pan is removed to drain the transmission body. Replace gasket and filter screen



MAINTEINING YOUR CAR on a regular basis is the best way to reduce the likelihood of breakdowns and costly repairs. It works like a charm. Preventive maintenance, as it's called, saves lots of work, money and aggravation.

There are arguments people offer in dismissing the need for a regular preventive maintenance program: It's not needed; it costs too much; it's inconvenient to tie up the car; you can't find a decent mechanic. Many drivers claim they don't know what services to perform or when to do them, so they do nothing.

Every Saturday Mechanic knows that preventive maintenance is most certainly required for best performance, quick starts, maximum gas mileage and—the life of the car.

But cost is the big factor for most of us. An engine tune-up alone costs an average of \$26.16 for parts and labor, and this doesn't include other services which are necessary for a good preventive maintenance program.

According to George M. Galster, manager of services for Champion, "To keep a car in mechanically-mint condition at all times, an average expenditure of \$19 a month is required." His estimate is based on maintaining a full-sized sedan with V8 engine and automatic transmission.

That's a lot of loot. But Saturday Mechanics can do most of the services themselves. In fact, as you can see by the accompanying chart, there is only one service which you probably can't do yourself: checking wheel alignment and balance. This costs from \$12 to \$15 every six months.

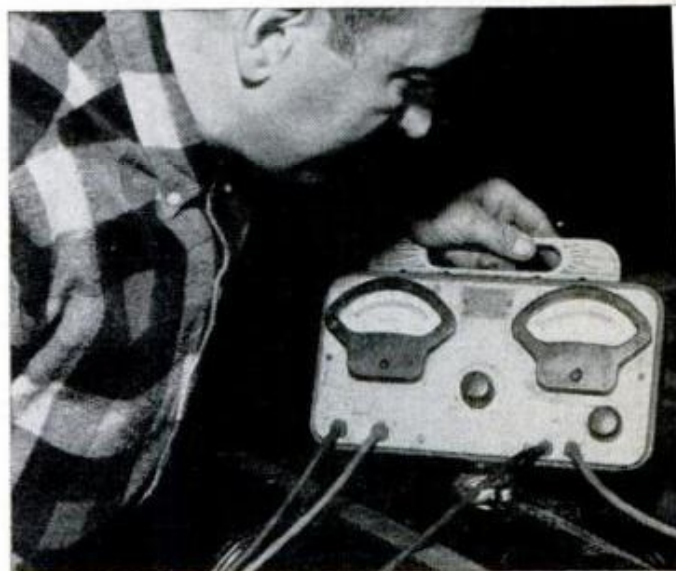
In other words, taking Galster's figure that an average of \$228 a year is needed to keep a car properly maintained, do-it-yourself maintenance can cost you as little as \$24 to \$30 a year.

There are a few things to keep in mind as you undertake a realistic preventive maintenance program. For one, the program does not imply repair. But you will eventually find things that need repair or replacement. For example, you may find a muffler and tailpipe that need changing, a brake system that needs overhaul, a steering part that's in critical shape, or shock absorbers that should be discarded. There is no sure way to determine when repair or replacement will be needed.

Once you go past 12 months' service,



BRAKE LININGS should be checked over their entire surface so uneven wear does not go undetected



MAJOR TUNE-UP should include check of cranking voltage and alternator charge rate with volt/ammeter



BEST DRAIN RECEPTACLES are empty oil or antifreeze cans with their tops cut out, so don't discard them

other services may have to be done that are outside the realm of the average Saturday Mechanic. I speak particularly of automatic transmission maintenance (adjusting bands and linkage). This is often recommended once every 24 or 30 months and should be left to a trained transmission man.

However, there is no reason why you can't drain and change fluid yourself. All that's usually involved is removing the transmission oil pan and converter plug to allow fluid to drain.

In many cars, the converter plug (located at the front of the converter) is covered by a plate. Remove the plate. You may have to rev the engine until the plug drops to the opening. Draining the converter, though, does not remove fluid from the transmission body.

In most cases, you have to drop the transmission pan to do this. Remove bolts slowly and allow fluid to drain until the pan is removed entirely. Inside you will find a filter screen that must be replaced.

Dropping the transmission pan usually destroys the gasket, so get a new one. Gasket and filter can be purchased from a local auto parts house or dealer.

Transmission fluid service is usually recommended once every 24 months, although some manufacturers recommend that it be done every 12 months and others state that it doesn't have to be done at all. Check the service guide in your owner's manual to be sure.

If your car is still under warranty, services that are required to keep that warranty in force must be done and authenti-

cated by an authorized service shop. However, you can do the other services which are only recommended.

When you undertake a preventive maintenance program, an initial outlay has to be made for some tools and instruments. I'm referring to things other than common wrenches, screwdrivers, files, feeler gauges, and so on.

Three suppliers of tools and instruments are retail auto supply stores, large retail department stores and mail order houses. Cost of equipment usually decreases in that order. In judging cost, keep in mind that quality of tools differs. Those listed for the auto supply store, for instance, are mostly sturdy, highly accurate instruments which the professional mechanic would normally have and you might not need, so do some comparison shopping.

You should also have the service manual for your car for tune-up specifications and other data, such as location of the PCV valve and chassis lube points. Cost is about \$5 from the technical publications department of the manufacturer who makes your car. If he doesn't have it, try the Helm Publishing Co., Box 7750, Detroit, Mich. Or get a copy of *Motor's*, *Chilton's* or similar auto-repair manual. They're in most libraries.

Most maintenance services are self-explanatory, but some need a little explanation or are easier with some short-cut tips.

In testing the PCV, for example, remove the valve and shake it near your ear. If you do not hear a clicking, it means the valve is plugged. Replace it.

OIL FILTER WRENCH is used for removing filter, but new one is put on hand tight only. Right, hand grease gun isn't as fast and easy as professional pressure gun, but it does the job just as surely



A PRACTICAL PREVENTIVE MAINTENANCE PROGRAM

FREQUENCY	SERVICE	SPECIAL TOOLS
Every month regardless of mileage	<ul style="list-style-type: none"> ● Check and replenish all fluid levels (coolant, engine oil, brake fluid, power steering, rear axle, windshield washer, battery electrolyte, transmission) ● Check drive belts for tension to specifications ● Check condition of tires and air pressure ● Check lights for burned-out bulbs 	None
Every 2 months or 2000 miles	<ul style="list-style-type: none"> ● Change engine oil ● Test positive crankcase ventilation (PCV) system 	None
Every 4 months or 4000 miles	<ul style="list-style-type: none"> ● Change oil filter ● Clean carburetor air filter ● Rotate tires 	Oil filter wrench
Every 6 months or 6000 miles	<ul style="list-style-type: none"> ● Perform minor engine tune-up (see text) ● Lube chassis ● Check for vacuum leaks ● Test battery ● Check condition of windshield wiper blades ● Check wheel alignment and balance (at professional shop) 	Timing light, dwell/tachometer, vacuum gauge, hand grease gun, battery hydrometer
Every 12 months or 12,000 miles	<ul style="list-style-type: none"> ● Flush cooling system, check for weak hoses, check thermostat function, check radiator pressure cap, install new antifreeze ● Replace PCV valve ● Perform major engine tune-up (see text) 	Cooling system pressure tester, volt/ammeter, dwell/tachometer, timing light

To test the rest of the system, start and idle the engine, holding your finger over the open end of the vent hose. You should feel strong suction, and engine idle speed should vary as you cover and uncover the end of the hose with your finger. Weak suction or lack of engine idle change suggests a plugged hose or carburetor port. Clean out the port, test again and replace the hose if necessary.

To clean a carburetor air filter every

four months, knock surface dirt from it by tapping it against a hard surface. This filter and the in-line fuel filter should be replaced every 12 or 24 months, depending on the number of dust storms you've driven through.

In checking brake linings, be careful. The lining may look thick at the front where you can see it, but be worn in the rear where your vision is blocked. Sight

(Please turn to page 188)

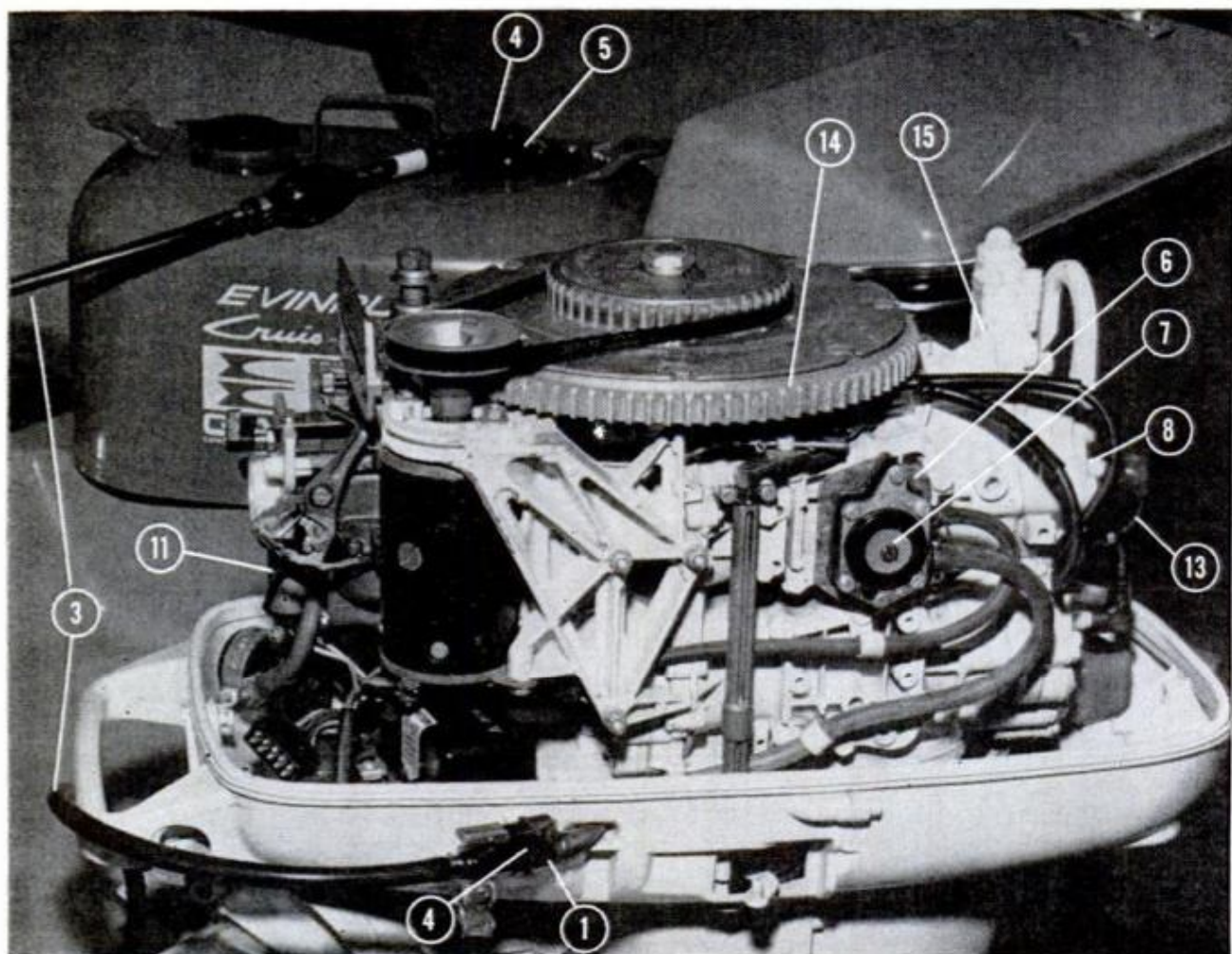


BATTERY CHECK for electrolyte level should be accompanied by specific gravity reading with hydrometer, left. Cooling system pressure tester (below) can help detect leaks and check out radiator cap



By HENRY B. NOTROM

Troubleshooting an



NUMBERS refer to the various parts in this outboard noted in the text. This is an electric-start outboard motor

NOTHING DEFEATS a boatman quicker than an outboard that refuses to start. Before you yank your arm off pulling the starter cord, or kill the battery on an electric start, take a few minutes to troubleshoot the problem.

Touch four bases right off the bat.

First, make sure you've got fuel in the tank.

Second, make sure the fuel line is pushed *all the way* into the fuel tank at one end and to the fuel pump line connection at the other (1). (See photographs above and at right.)

Third, squeeze fuel-line pressure bulb. It should be hard.

Fourth, determine whether fuel is contaminated. Let some drip into the palm of your hand then blow on it. If fuel is loaded with water or dirt, you'll see it as the gas evaporates. Dump that bad fuel.

If this doesn't get you started, find out if the problem is a clogged fuel system

forward of the carburetor. Unscrew the high-speed needle or drain plug at the head of the carburetor (2). If fuel doesn't pour from the hole, you immediately know a stoppage exists somewhere between the gas tank and the carburetor inlet. Here's how to track it down.

Look for a kinked or ruptured fuel line, and make sure the fuel tank isn't lying on top of the fuel line (3). Check for chipped O-rings inside the fuel-line connectors at both ends of the line (4). These are used to seal the line. If one's bugged, air can be diluting fuel, preventing easy starts. Replace it.

Check for a clogged fuel tank vent. Remove the gas cap. If air rushes in, put the cap back on and try to start the engine. If it starts, you can figure the vent's clogged.

Some tanks have the vent in the upper housing and fuel line assembly (5). Replace the entire assembly. Other tanks are vented by means of a vent hole in the

Outboard That Won't Start

gas cap. Replace the cap with a new one.

A clogged filter screen inside the gas tank can keep fuel from getting to the fuel pump. Unscrew the upper housing and fuel line assembly. Pull it out. Clean off the filter screen. You'll find it at the base of the long pipe.

Check the fuel pump (6). You could have a clogged fuel filter inside the fuel pump housing (7). Some model outboards, like the one shown here, have the filter in a housing over the pump. Other models have this filter cut into the fuel pump-to-carburetor inlet. In any event, when a fuel stoppage shows up, always remove and clean the in-line fuel filter.

Tighten fuel-pump housing bolts. If this doesn't get the engine started, remove the fuel-pump cover and replace the pump diaphragm.

Okay, suppose when you removed the high-speed needle or drain plug, gas did pour forth. You have to see if fuel is getting from the carburetor to the combustion chamber, so prime the engine and remove a sparkplug (8).

A wet plug means the engine's getting gas, but maybe it's getting too much or not enough. Check the choke plate to make sure it's not stuck in the closed or open position (9). Follow with a check of the low-speed idle adjustment (10). Turn the adjustment screw a little at a time to one side, and then the other. Try to start the engine at each setting.

If fuel is not getting to the combustion chamber but is getting to the carburetor, the trouble lies inside the carburetor or with a reed valve that isn't working right.

To fix it, you'll have to remove the carburetor (11); take it down; clean it, and install new parts if needed.

You remove the reed valve assembly by taking off the manifold (12). (You can forget about fishing for the day.) Reed valves that are gummed up (seldom happens) can be cleaned with gasoline. If the reed valve is damaged, replace it.

The cause of your engine problem could lie inside the ignition system. So, while you have the sparkplug out checking for fuel in the combustion chamber, hold the plug one-half inch from a clean ground on the powerhead and crank the engine. Absence of a strong, blue spark signifies ignition troubles. But where?

Probably with the sparkplug since 90 percent of ignition problems involve this part. Replace a cracked or damaged plug. Make sure the electrode gap is set to specifications.

Check lead wires for breaks in insulation (13). Replace defective wires.

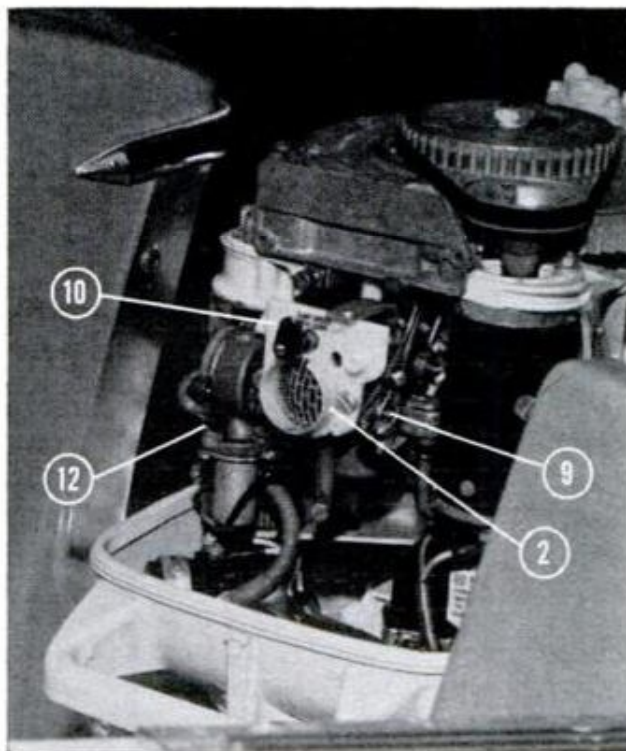
If nothing to this point helps, the flywheel has to come off for a check of magneto components (14) or, if your engine is so equipped, you'll have to remove the cap for a check inside the distributor.

Inspect ignition points first for proper gap and a burned or dirty condition. If okay, then the cause of your ignition failure is probably a weak coil or condenser.

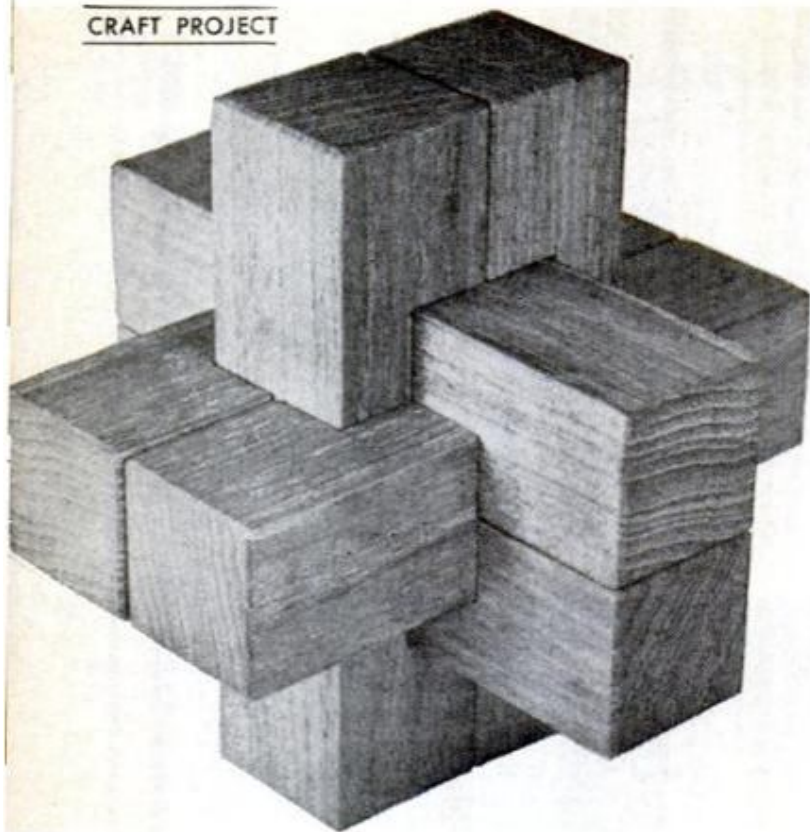
With an engine that has a distributor, check the distributor cap for cracks and burned contacts, and check the condition of the rotor before replacing the coil.

There's one other major cause of an

(Please turn to page 192)



AN ANGLE SHOT of the front of the same motor. Again the numbers are those referred to in the text



THIS BLOCK PUZZLE IS A REAL PUZZLER

It's not only a tough brain-teaser but also a challenging project for the wood craftsman

By KENNETH WELLS

WHEN ASSEMBLED, the six blocks detailed on the opposite page look enough like a piece of wood sculpture to be placed on your coffee table or mantel as an ornament. It's the way in which they are assembled that makes this a puzzle.

These interlocking blocks form a very intricate piece of joinery which can be put together in only one way. The solution shown in the photos below may seem quite simple, but that's common to all good puzzles. Actually, this is a much advanced version of the square-peg/round-hole puzzle used in testing IQ.

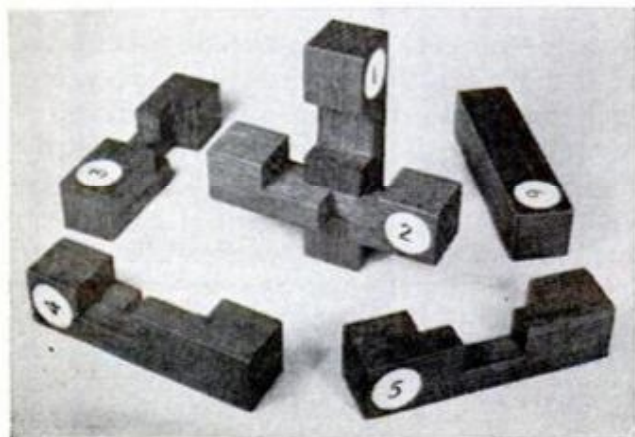
All dimensions shown in the drawing are based on the use of 1-in.-square blocks. By adjusting the sizes of the slots, however, you could easily substitute $\frac{3}{4}$ -

in. or $\frac{7}{8}$ -in. material. Walnut, mahogany, teak or other hardwood is recommended, since this will not only give the best appearance but make possible more accurate fitting. The use of a dado head is almost a necessity for cutting the slots to exact measurement, and even with this you'll have to do a little chisel work (see block 4). Of course, the whole thing could be made with hand tools, but the difficulties involved in obtaining an exact fit would be increased tremendously.

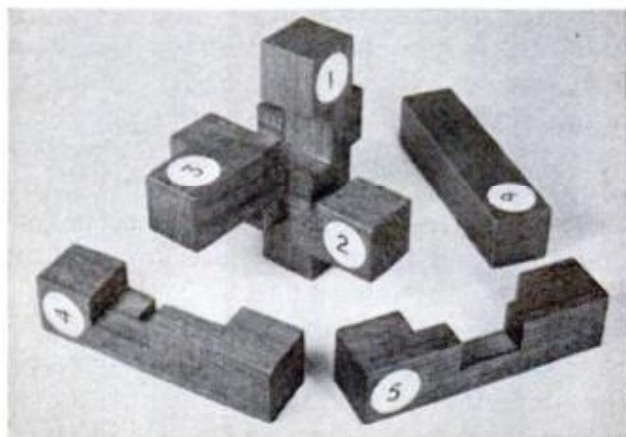
All edges should be beveled slightly and all sanding completed before you cut the slots. Finish with clear varnish, followed by a coat of furniture polish.

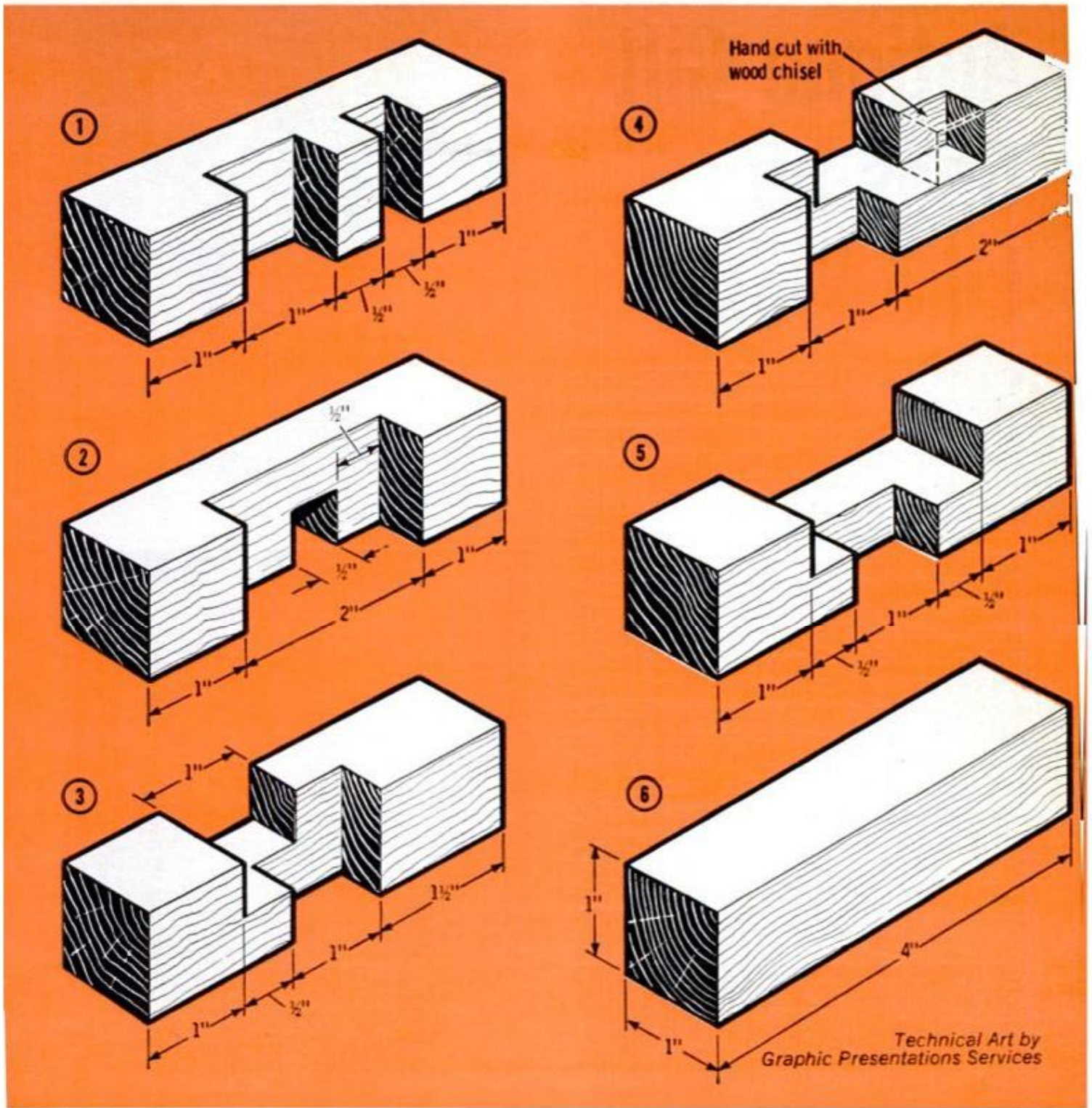
While you're at it, you might turn out two or three. They make good gifts. ★★★

STEP 1

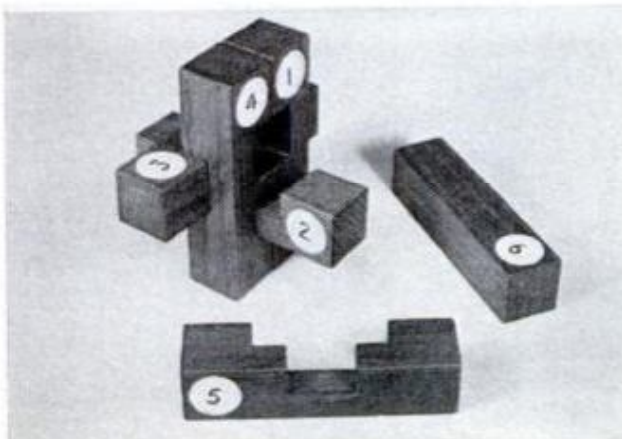


STEP 2

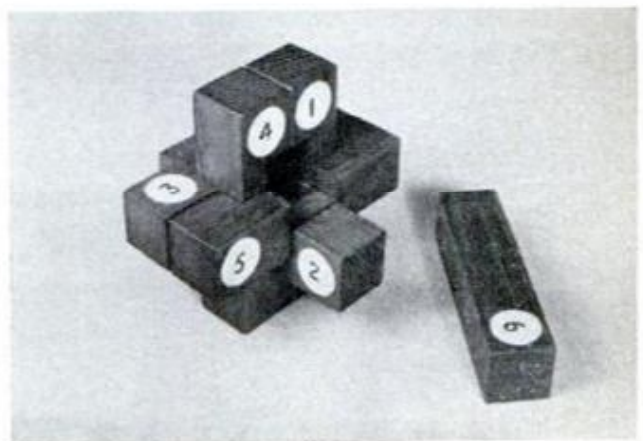




STEP 3



STEP 4



Antique Gilt Goes on Like Wax

PUTTING AN ANTIQUE FINISH on a piece of accent furniture no longer has to take hours, for a new antiquing product called Treasure Gold goes on as easily as wax—and just as quickly.

As shown in the photos, the gilt has the consistency of a fine polishing paste, so it readily covers all curved and irregular surfaces without heavy rubbing or application. To use, just wipe it on lightly with a finger or cloth then immediately buff it with a soft cloth. For pieces subjected to some wear, a light coat of varnish or acrylic plastic spray is recommended. The gilt, however, is *not* recommended for heavily used items such as doorknobs, bathroom fixtures or switch plates.

This nontarnishing, finishing material is available in four gold colors, plus copper, silver, brass and pewter from Connoisseur Studio, Box 7187, Louisville, Ky. A 1-oz. jar sells for \$2. ★★★



Shine Your Shoes With a Paint Roller

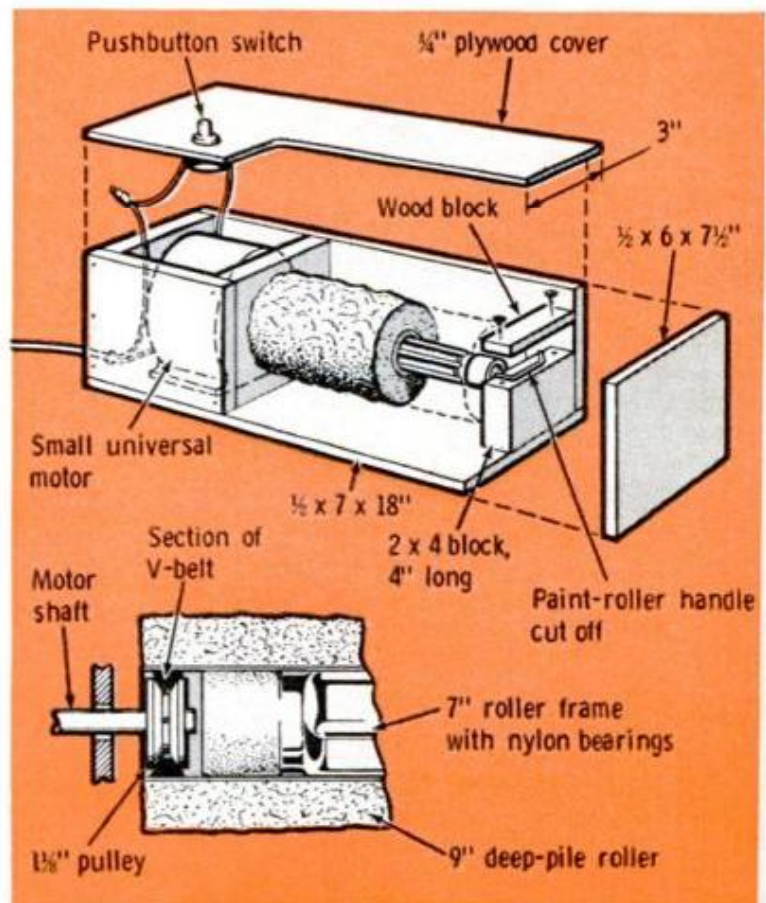
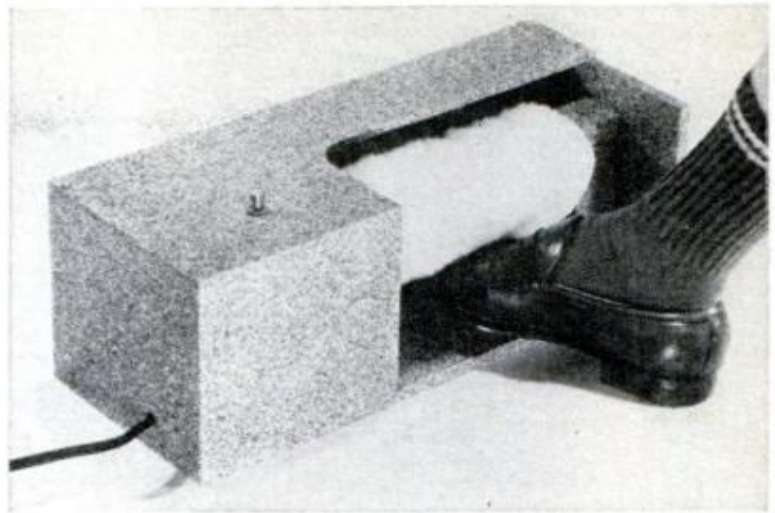
YOU STILL HAVE to apply the polish and rub it down, but this motor-driven shoe buffer takes all the rest of the work out of producing a high-luster shine.

All you need to build it is a small 110-v. motor, a 7-in. paint-roller frame with nylon bushings, a 9-in. deep-pile roller of the type used on stucco or concrete, plus a few other miscellaneous parts and the plywood to construct the box.

To link the motor to the paint roller, install a $1\frac{1}{8}$ -in. pulley on the motor shaft. This pulley will be slightly smaller than the inside diameter of the roller, so you'll have to cut a length of drive belt to wrap around the outside of the pulley and produce a snug press fit. The pulley can then provide direct friction drive to the roller from the motor.

To construct the bearing for the opposite end, cut the handle off the 7-in. paint-roller frame, leaving the small section perpendicular to the roller axis to use in mounting. This section is placed on the end block and clamped securely in place by means of a small wood cap strip which is attached to the block with a pair of screws.

Make up the box and install the mechanical components inside. Use screws to attach the top, so that it can be removed easily if you should have to adjust or replace the roller or lubricate the shaft.—*David Lorton*



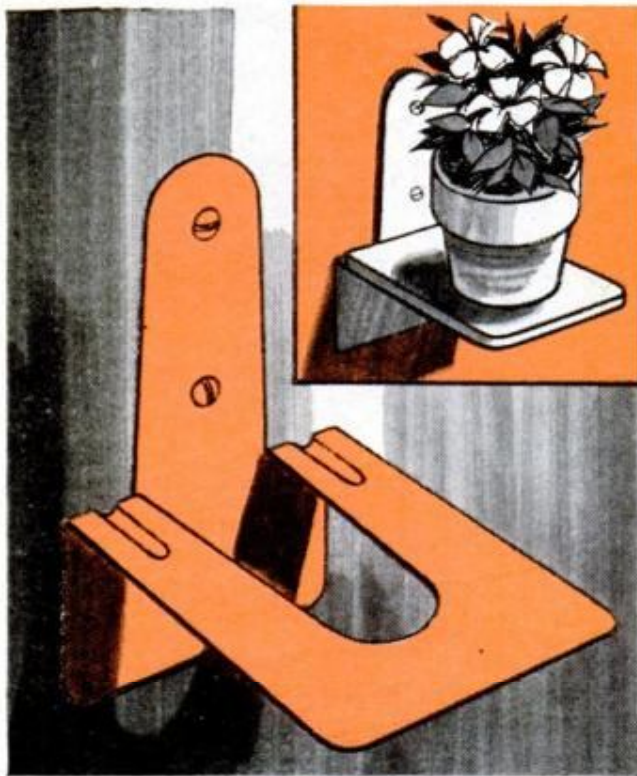
Ridding your lawn of moles

A simple way of combating moles requires only a handful of mothballs. When you see a fresh mound of dirt, open up a hole into the tunnel with your fingers and throw in the mothballs, then quickly pour in a quart of hot water and cover up the hole. The fumes will penetrate into all the connecting runways and either drive the moles out or smother them. It's simple, but it works.—*P. Casperson*

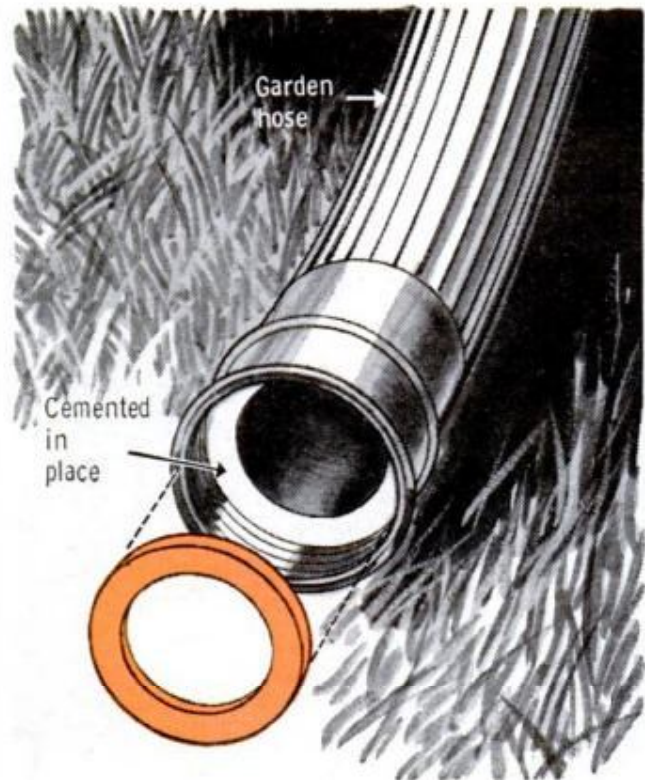
Cleaning an electric shaver head

If your shaver seems to be losing its efficiency, no matter how carefully you brush out the head after each shave, try this method of bringing it back to tip-top operating condition. Pour a little lacquer thinner into a small dish and soak the cutter head in it overnight. This solvent will remove any deposits that have built up on the head so you can get a quick, close shave again.—*Stephen N. Stresnic*

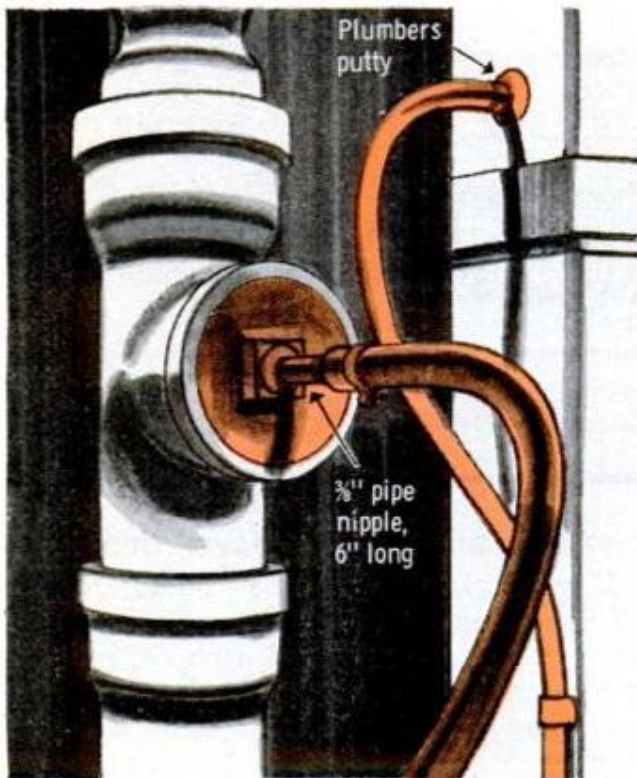
Solving Home Problems



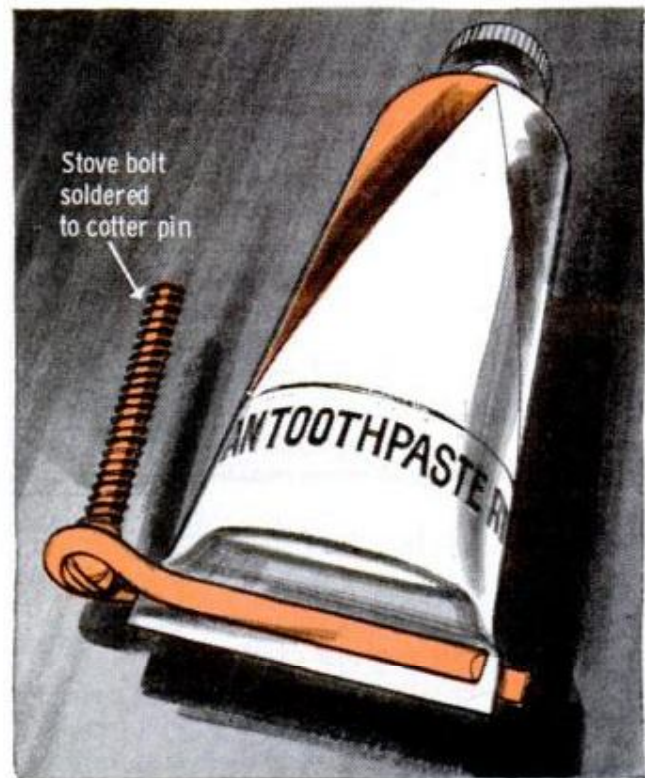
UTILITY SHELF made from a steel bookend will support a small plant or figurine. Drill mounting holes in solid arm and cement $\frac{1}{4}$ -in. plywood shelf on the open arm. A coat of enamel and it's ready to hang



ONE GOOD WAY to prevent a hose washer from being lost is to smear a little contact cement on it before you push it into the female hose fitting. When the washer becomes worn, you can easily pry it out



IF FLOOR DRAIN is too far away from your central airconditioning unit to take care of extracted water, run a hose to the standpipe. Connect it at a level below the outlet on the unit. Loop acts as a trap



IMPROVED KEY for rolling toothpaste tubes neatly is just a 2-in. cotten pin with a $1\frac{1}{2}$ -in. bolt soldered in the eye to serve as a handle. It not only conserves toothpaste but avoids breaking the tubes



LETTER HOLDER for a rural mailbox prevents outgoing mail from blowing away when the box is opened. A spring paper clamp bolted to inside of door not only holds mail but eliminates the long reach into the box

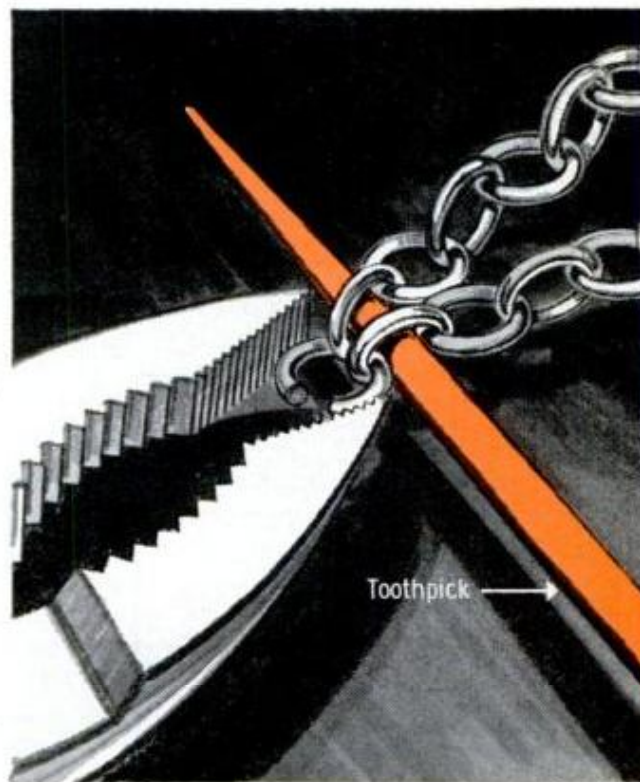


HIDDEN SHELF in your kneehole desk holds seldom used books or files neatly out of sight. Make it about 10 in. deep, notching corners to fit around the desk framing. It rests on well molding without nailing



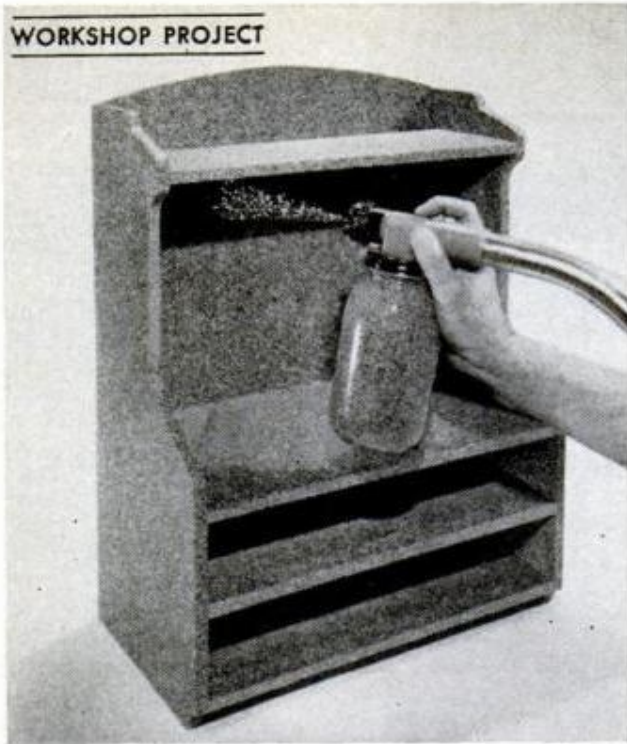
3" U-bolt

HANDY HOLD-DOWN on your garbage can lets you steady can with your foot when pulling off a tight lid. Make it by attaching 3-in. U-bolt to bottom edge with four nuts, two on the inside and two on outside



Toothpick

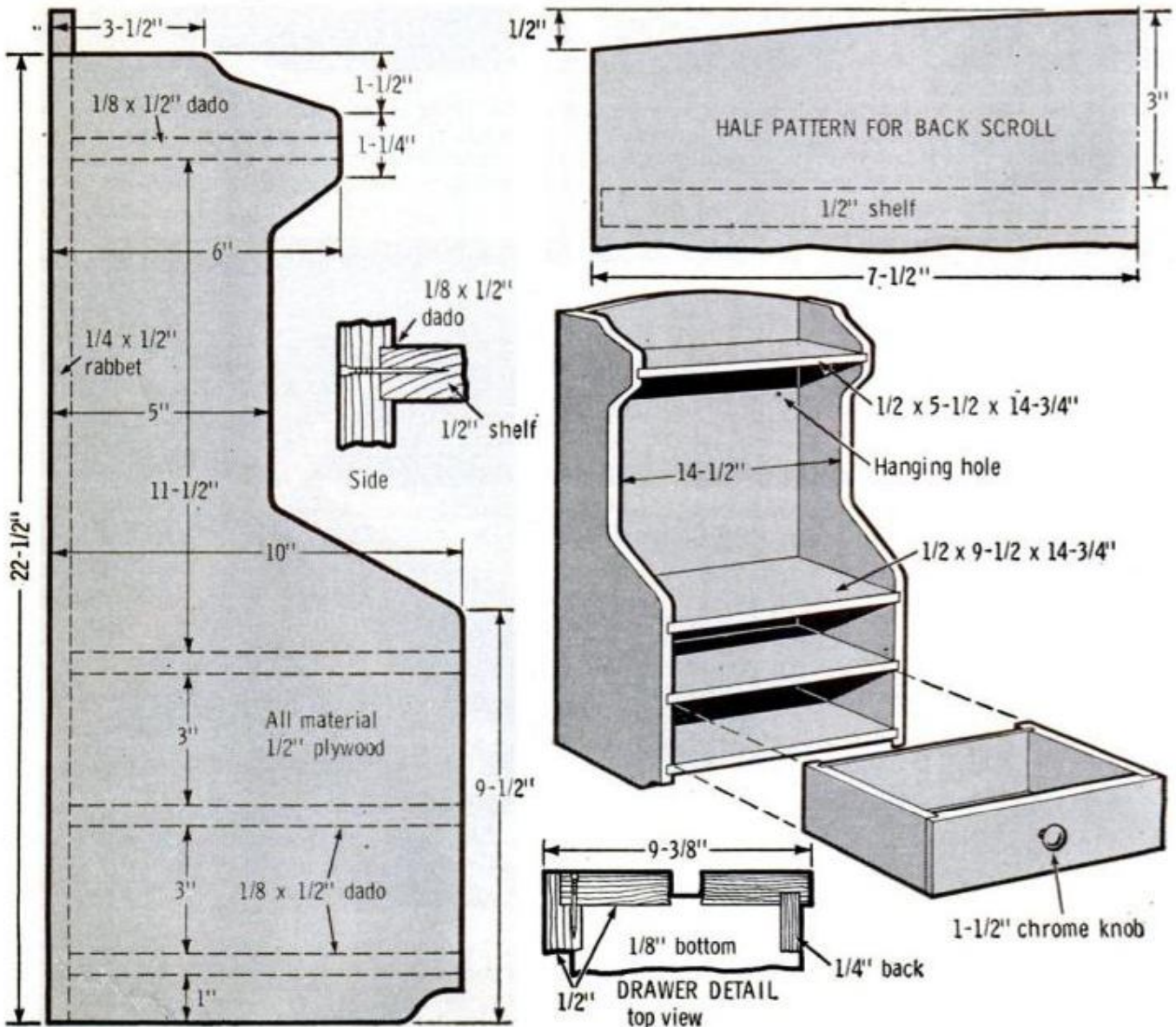
WHEN REPAIRING a broken link in a tiny chain, insert a toothpick in the two undamaged links next to it. This will hold the faulty link in place so you can pinch it together again with a pair of pliers



Build a Bookshelf For Your New PM Do-It-Yourself Encyclopedia

PLEXTONE, a color-flecked texture paint, is one of the best finishes for painting plywood. Covers plies, knots, joints. You apply it with a vacuum sweeper

By **WAYNE C. LECKEY**,
Home and Shop Editor



MAYBE YOU ALREADY have a shelf reserved in your den for PM's new *Do-It-Yourself Encyclopedia*. If not, one of your first projects when you get your set could be a bookshelf. The books are much too handsome to keep in a pile.

You have a choice of two designs. The one you pick will depend on where you prefer to keep your set. If it's in the workshop, the painted shelf below is more in keeping, whereas if it's in the den or family room, you'd probably pick the more sophisticated walnut shelf.

Both designs are made expressly to hold a full 16-volume set. One has a shelf to display pottery or a plant; the other has two drawers for shop items.

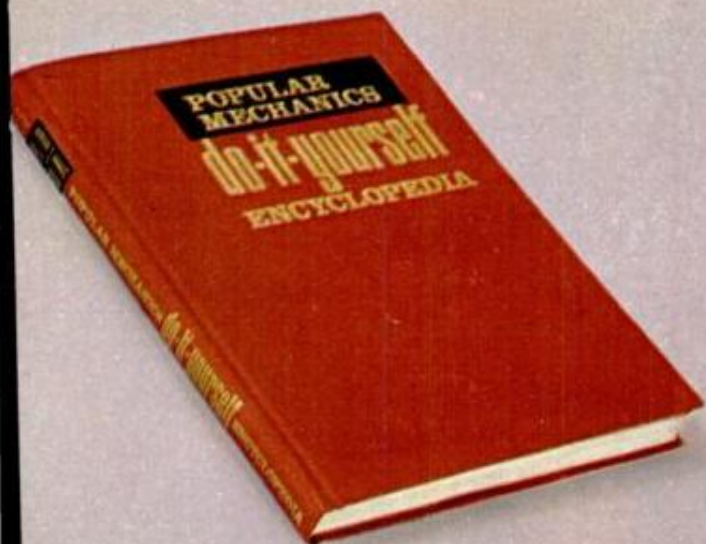
Since the shelves weigh about 40 lbs. when loaded with books, you should use Molly or toggle bolts to anchor them securely to a plastered wall.

The workshop bookshelf detailed at the left is made almost entirely of 1/2-in. plywood. The drawer bottoms are 1/8-in. hardboard and the drawer backs are 1/4-in. plywood. The two matching ends are made right and left-hand since they're dadoed for the shelves and rabbeted for the back.

Photos by Robert D. Borst



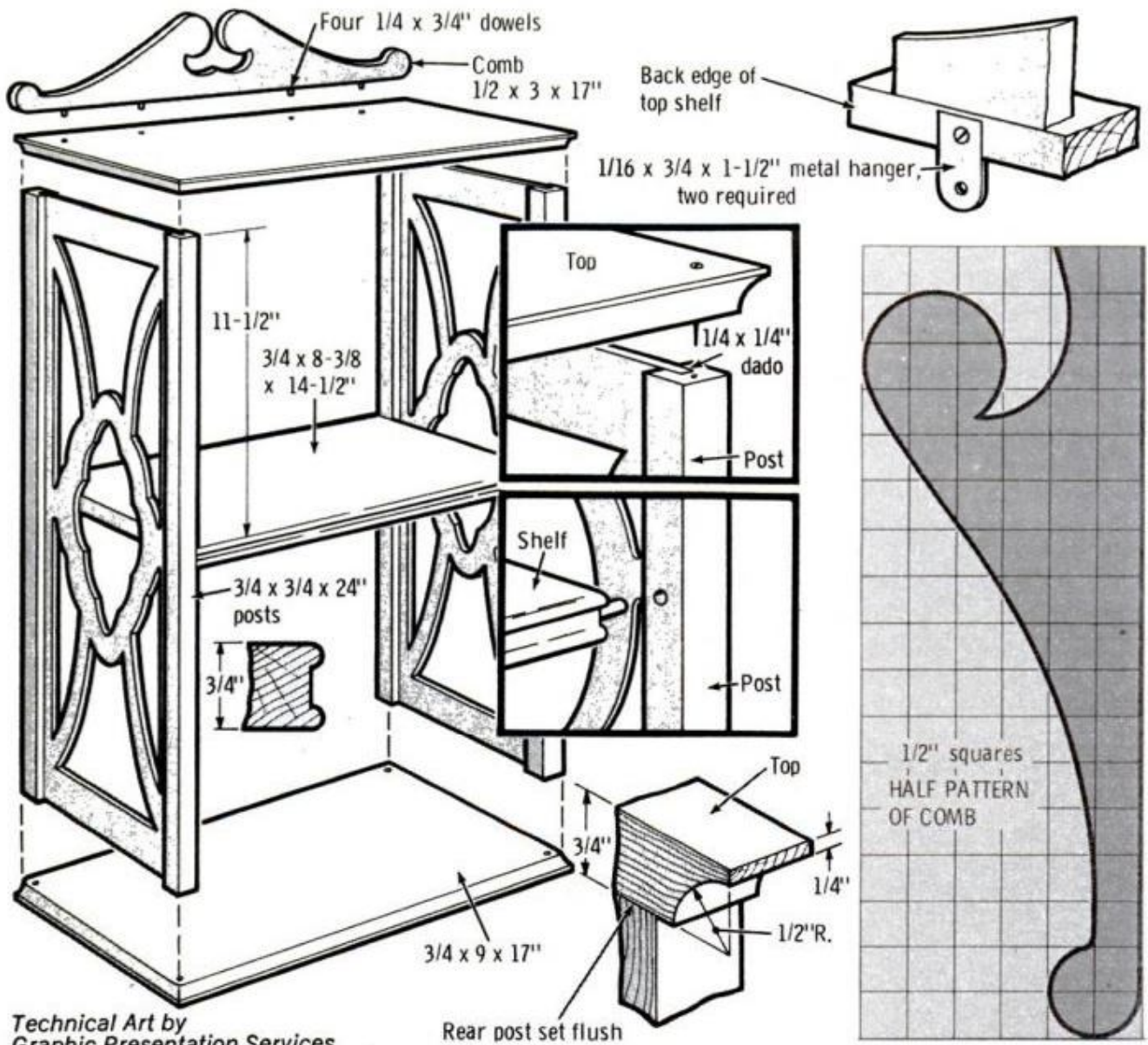
For your den



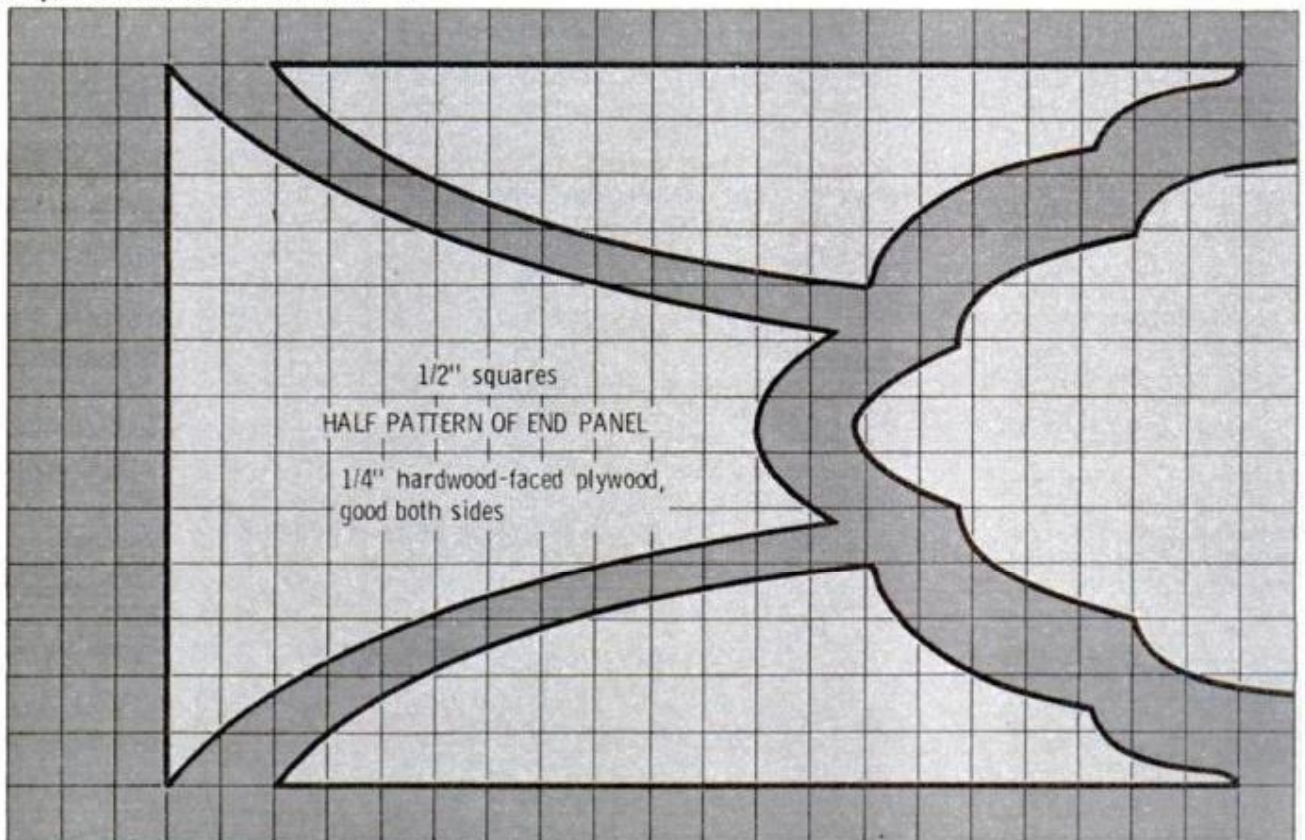
BOUND IN BRIGHT RED and imprinted in gold, PM's 16-volume, *Do-It-Yourself Encyclopedia* is an attractive set of books you'll be eager to display in den or workshop. Each of the wall-hung shelves shown is specifically designed to hold a complete set. The workshop version has two handy utility drawers for keeping rule, pencil and pad of paper

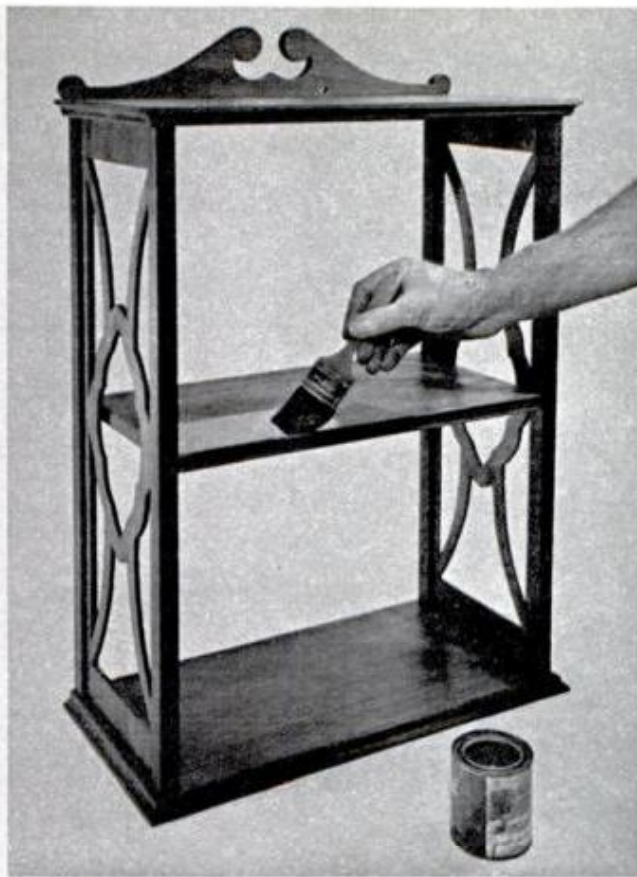
For your workshop





Technical Art by
Graphic Presentation Services





DANISH OIL STAIN is applied to bare walnut to even up any variation in wood tone, then is wiped off to shade desired. A coat of paste wax completes it

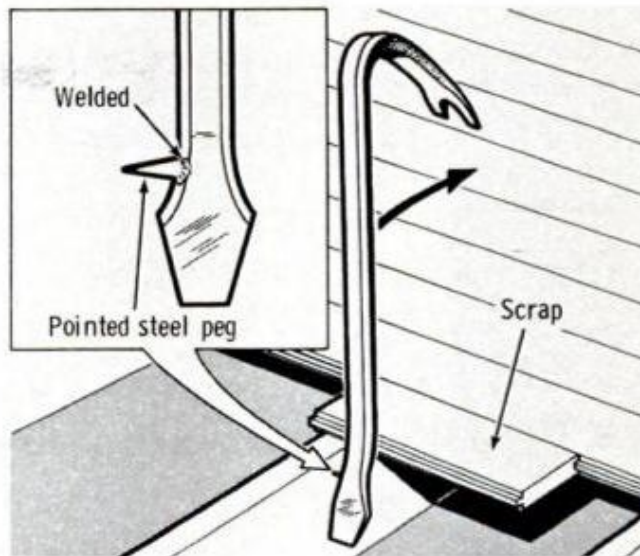
It's smart to cut the dados before cutting the ends to shape. If you use a bandsaw or jigsaw to cut them, it's smart also to tack the two together, back to back, in the waste and saw both at one time. Note that the depth of the drawers, $9\frac{3}{8}$ in., makes the fronts set in $\frac{1}{8}$ in.

The first step in making the walnut bookshelf detailed at the left is to draw the pattern for the jigsawed end panels. Both of these are cut out at one time from $\frac{1}{4}$ -in. hardwood-faced plywood which should be good two sides. Posts are grooved to fit over the edges of the jigsawed panels and glued to them.

All three shelves are $\frac{3}{4}$ in. thick and fit flush with the posts at the back. The beaded edge along the doweled center shelf is easy to make if you have a portable router or a shaper, but it also can be formed by running a $\frac{3}{8}$ -in. groove down the middle, then sandpapering the remaining shouldered edges round. Both top and bottom shelves are duplicates and are attached solidly to the posts with long flat-head screws turned into the ends. The scroll piece across the top goes on last after shallow dados are made to accept flush the metal hangers. ★★★

AUGUST 1968

HINTS FROM READERS

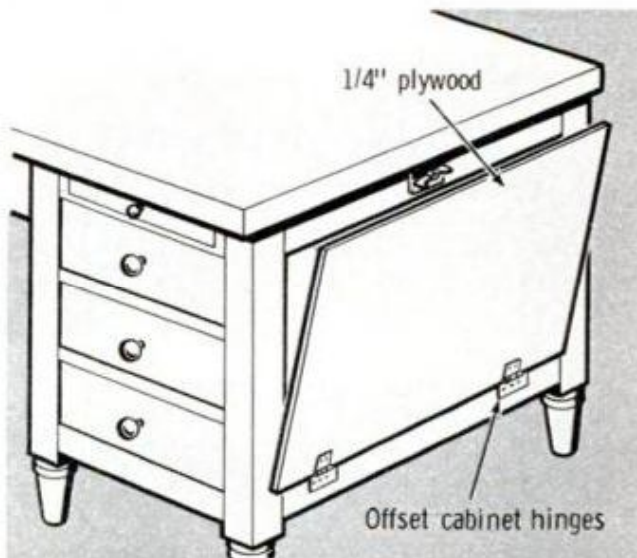


Steel peg gives added leverage

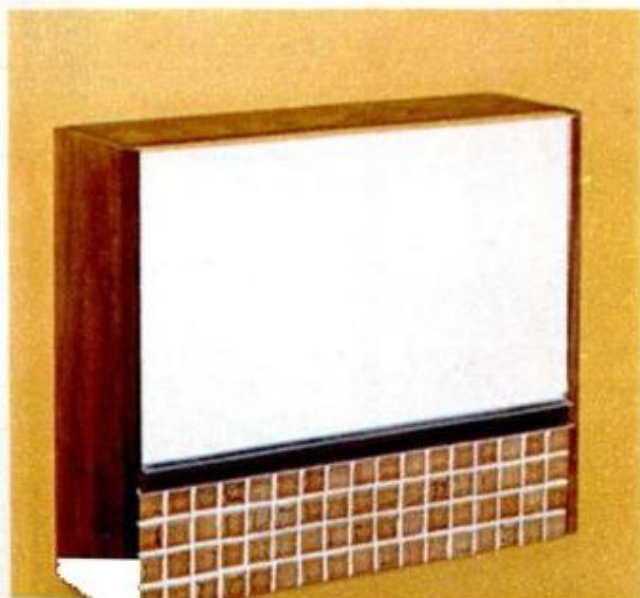
A tapered steel peg $1\frac{1}{2}$ in. long, welded to the side of a pry bar, provides added leverage in places where there's nothing present to pry against. It won't interfere with ordinary use of the bar, but when driven into the side of a joist, stud or cross blocking, it will act as a fulcrum where pressure can be exerted to force members in place. Flooring is a typical example.

Built-in drawing storage

You can put the recessed ends of a kneehole desk to work as a place to store large drawings and other papers by fitting them with drop-leaf doors to lap the recessed panel. The $\frac{1}{4}$ -in. depth will keep drawings flat and protected. Thin plywood is adequate for doors; two turnbuttons hold them shut.



Build These Handsome



GOT THE FEELING you're being gradually squeezed out of the medicine cabinet by teen-age daughters and your better half? When there's hardly room left for your razor, it's time to move out and into one of these handsome shaving bars. Placed off limits to everyone else, they'll keep everything right at hand to give you that well-groomed look.

Both designs you see here are wall mounted and have their own mirrors. Both feature counters, one a drop-front affair, the other an inside ledge. The former provides storage behind a lift-up mirror, the latter inside a swinging front. To

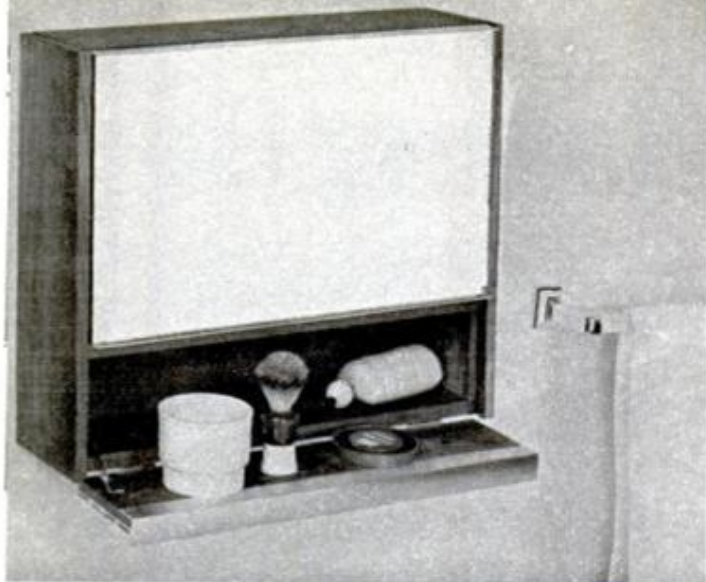
Wall-Hung Shaving Bars

top it off, both are smart looking and make handsome additions to any bathroom wall.

Styled by Gary Gerber, noted industrial designer, the bars combine select cabinet woods, with bright aluminum, glass and gleaming mosaic tile, and one of the handiest tools for putting all four together is a Thermogrip electric glue gun since it's made to order for bonding glass, tile and metal to wood. Using stick glue which bonds in 60 seconds, the gun eliminates the need for clamps. It's made by United Shoe Machinery Corp.

The cabinet shown at the left is made of $\frac{1}{2}$ -in. solid walnut and fitted with a hardboard back. The ends are made right and left hand, and the closeup detail shows how they are grooved at the rear for the $\frac{1}{8}$ -in. back and at the front for

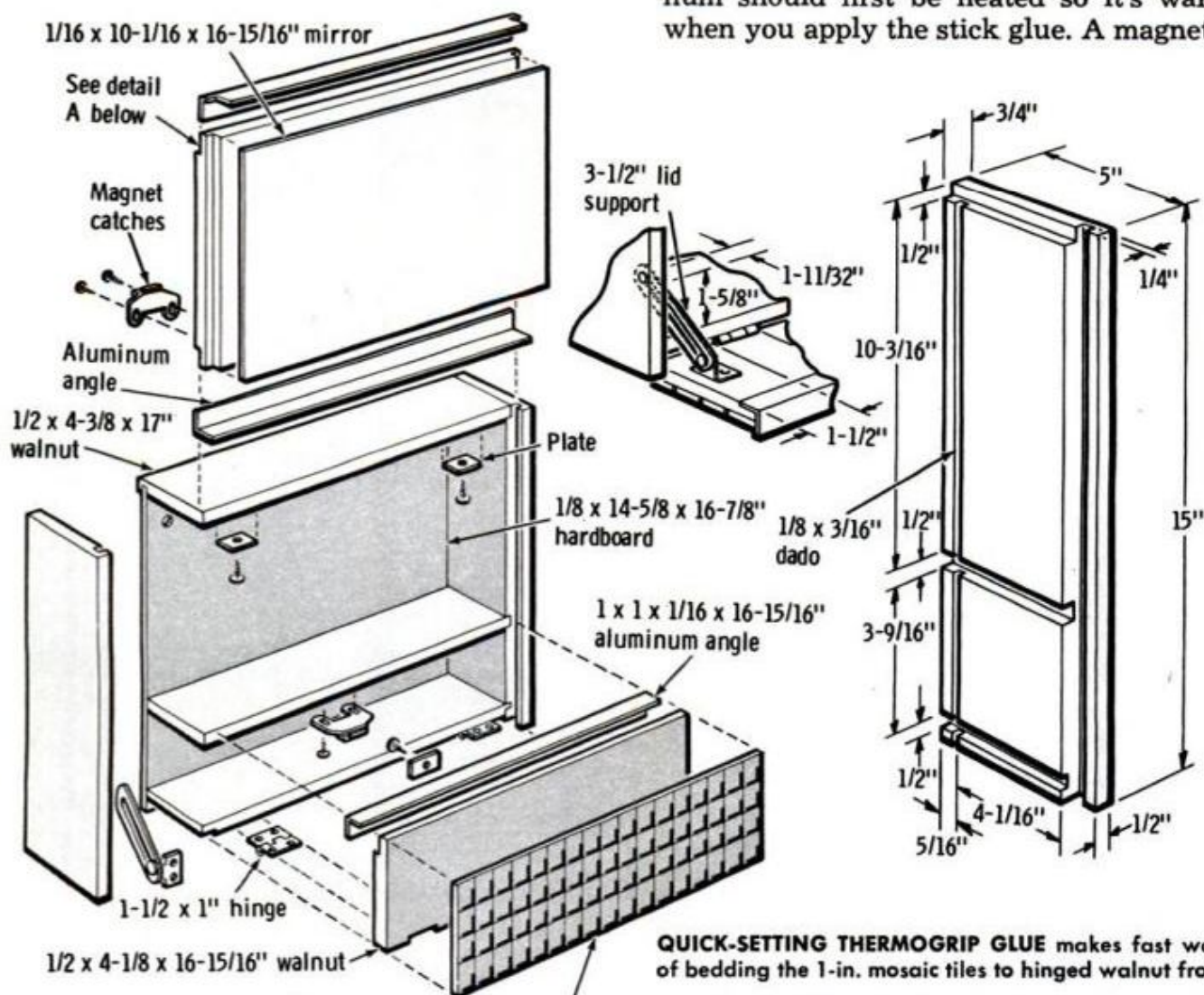




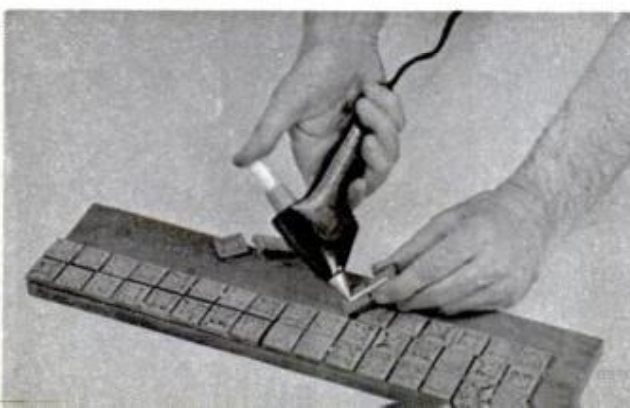
HANDY DROP-FRONT COUNTER reveals additional storage behind it. Magnet catch holds counter shut

the $\frac{1}{16}$ -in. sliding mirror. The latter is glued to a plywood backing which is rabbeted top and bottom for aluminum-angle handles, and along the sides to fit the grooved ends. The mirror is cemented to the plywood with the glue gun. Since magnetic catches are used to hold the mirror in the raised position and are screwed to the plywood from the back, the mirror assembly must be in place before the ends of the cabinet are finally glued. Because of the catches, you can't slide the mirror in place from the top.

An aluminum angle across the top provides a handle for the tile-faced drop front. When gluing this, as well as the two metal strips to the mirror, the aluminum should first be heated so it's warm when you apply the stick glue. A magnetic



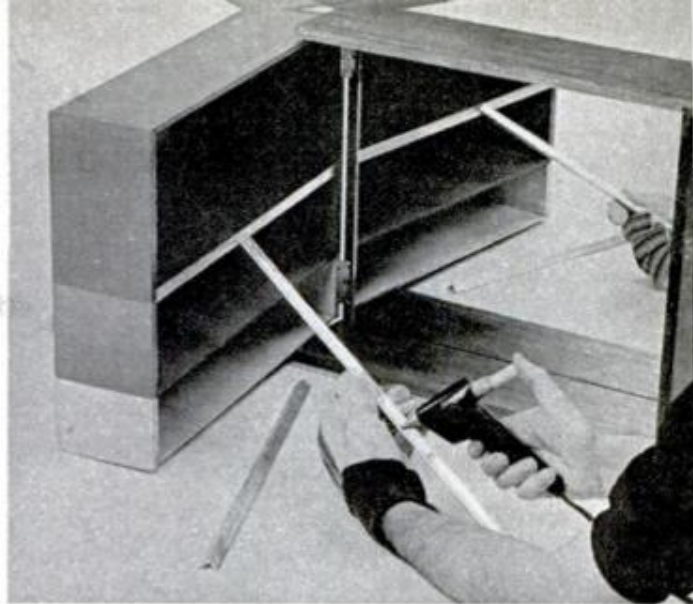
QUICK-SETTING THERMOGRIP GLUE makes fast way of bedding the 1-in. mosaic tiles to hinged walnut front



catch holds the drop front shut, and a desk-lid support holds it level when open.

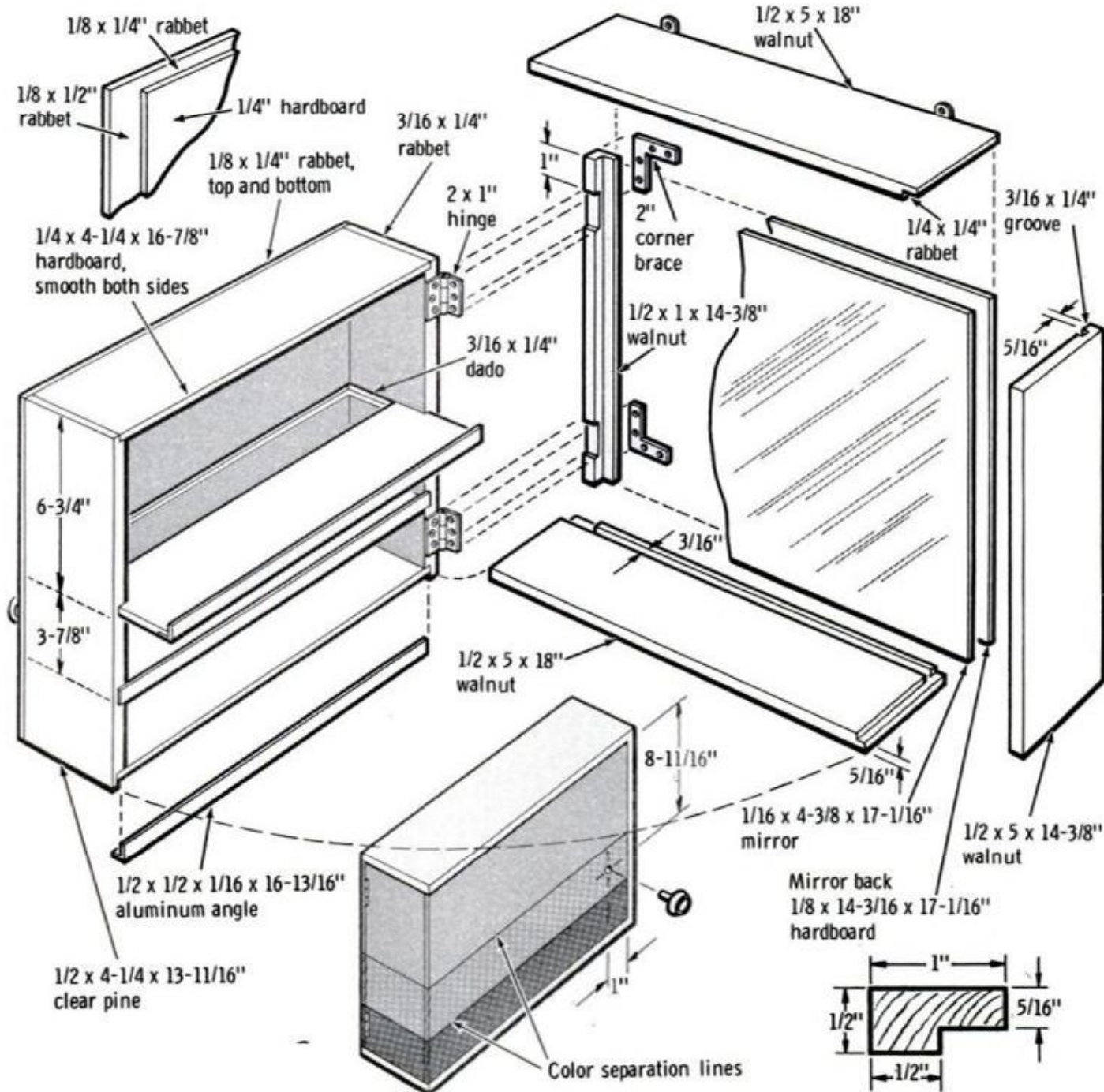
The swing-front cabinet detailed below consists of two separate assemblies, one nesting inside the other. The three-sided box holding the mirror is made of 1/2-in. solid walnut and has a hardboard back. Note how the parts are grooved and rabbeted to accept a post to which the swinging front is hinged. Since the weight of the latter is on this post, metal corner braces are added for extra support.

Pine and hardboard are used for the front unit, the pine for the ends. Aluminum angle cemented to the three shelves provides retaining edges. The swinging front is completely painted in a three-color pattern, whereas the walnut members are stained and varnished. ★★★



BETTER BOND IS ASSURED when cementing aluminum to the wood shelves if metal strip is first heated

Technical Art by Don Evans



Build PM's Turn-on-a-Dime Mini-Mover



WITH OR WITHOUT CANOPY, the Mini-Mover is an eye-catching utility vehicle that will perform many yard hauling jobs — and do it in style. The secret to its highly maneuverable action lies with its independently controlled, front driving wheels and its rear casters.



It's a rare combination of a fun-type lorry and a down-to-earth workpony. It's a delight to drive, a cinch to maneuver—and you build it for \$400!

Part 1: Chassis and Drive Train

By LEONARD E. SABAL, Workshop Editor

THE FIRST TIME you spin it around in a circle, you'll marvel at the extreme responsiveness of the Mini-Mover. And with only 10 or 15 minutes of practice, you'll completely master its novel method of operation.

Just pull back on one control handle, push forward on the other, and the rear end will swing around with blurring speed. Reverse the positions of the handles and the rear quickly swings in the opposite direction.

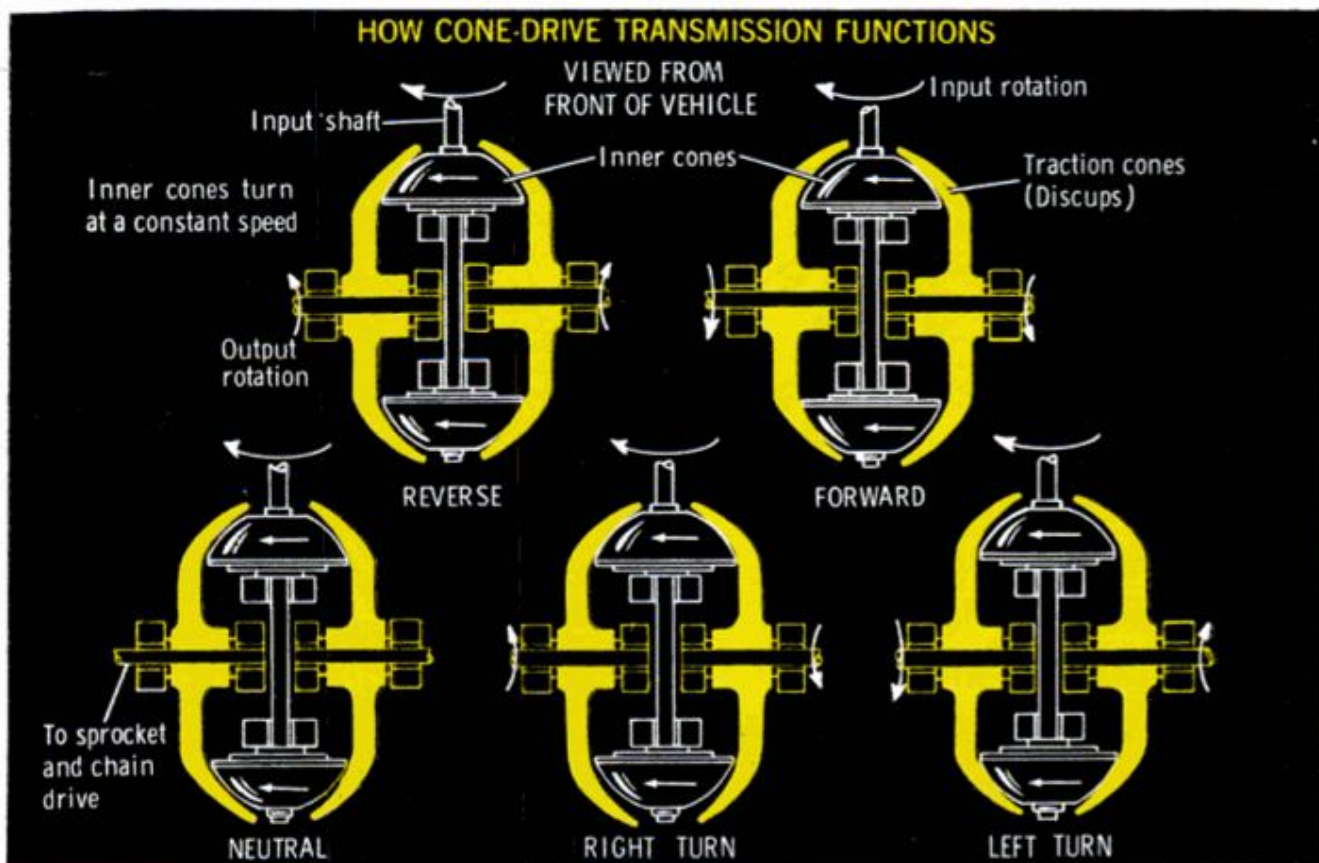
To move forward, simply push both handles out in front of you, while to back the Mini-Mover into a tight spot, pull back on both handles. The degree of handle movement determines both forward and reverse speed. Thus, crawl speed is achieved by barely moving the handles out of the spring-loaded neutral position, while top speed is reached by moving the handles as far as possible.

The unusual performance of the vehicle is due mainly to a unique design that combines a transmission, clutch and differen-

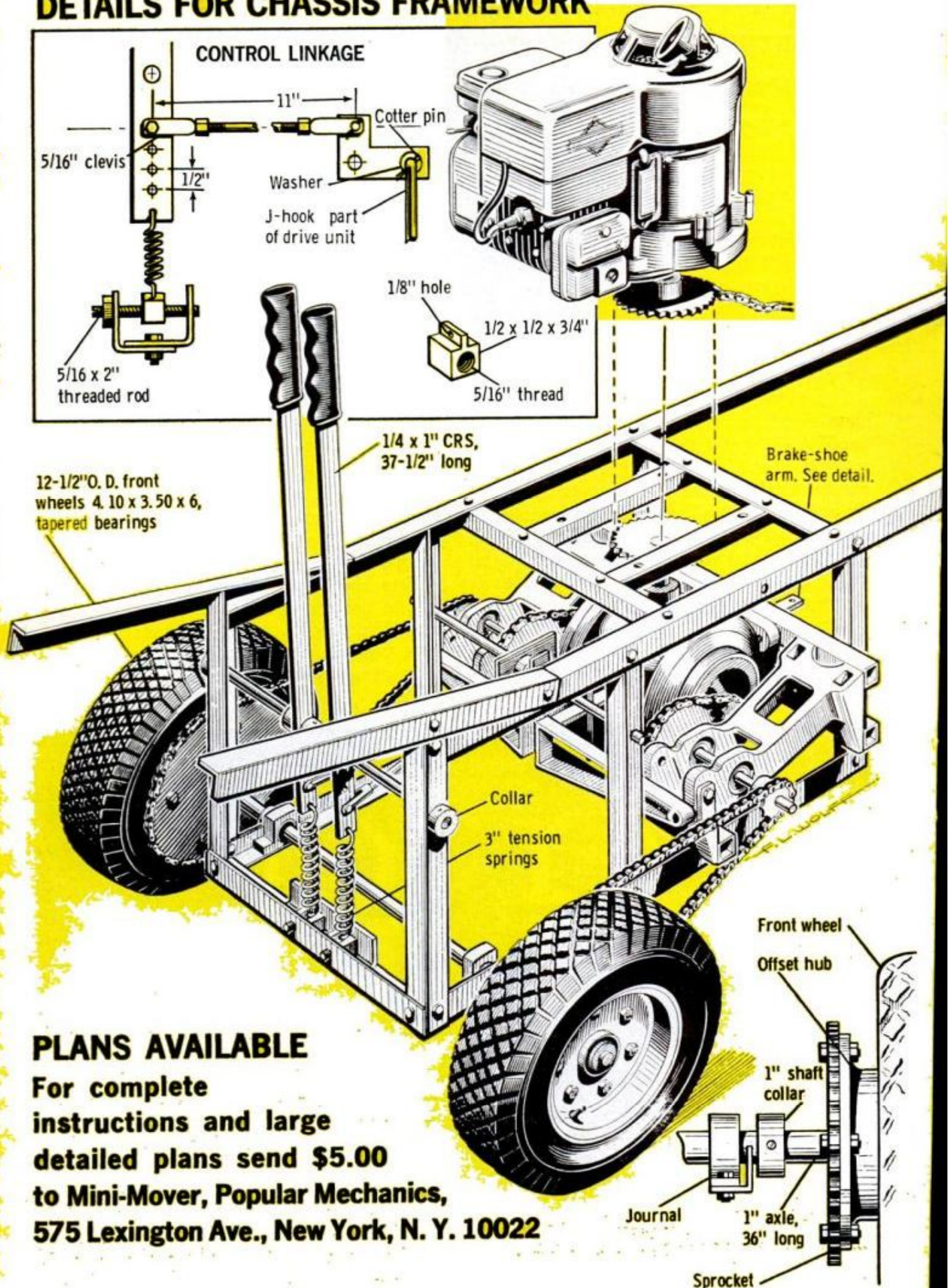
tial in a single mechanical unit. Called a Triple Action Transaxle (TAT), it differs from most other drive conversion units in one important aspect—it allows you to control each of its output shafts *independently and without regard to speed or direction*. Thus, it's possible to turn the right wheel, for example, in a forward direction, and the left wheel in a backward direction so that the vehicle actually *spins* around a centerpoint located midway between the two wheels.

On this particular vehicle, the point of rotation falls almost directly beneath the feet of the driver, so you can turn the vehicle exactly 180° and still have the front wheels, and your feet, in the same spot—only reversed. In either forward or reverse, of course, TAT will turn both wheels in the same respective direction.

How the TAT unit operates can be seen in the basic cross-sectional drawings below. The top input shaft connects the engine output to the two inner cones spinning at a variable or a fixed speed. For

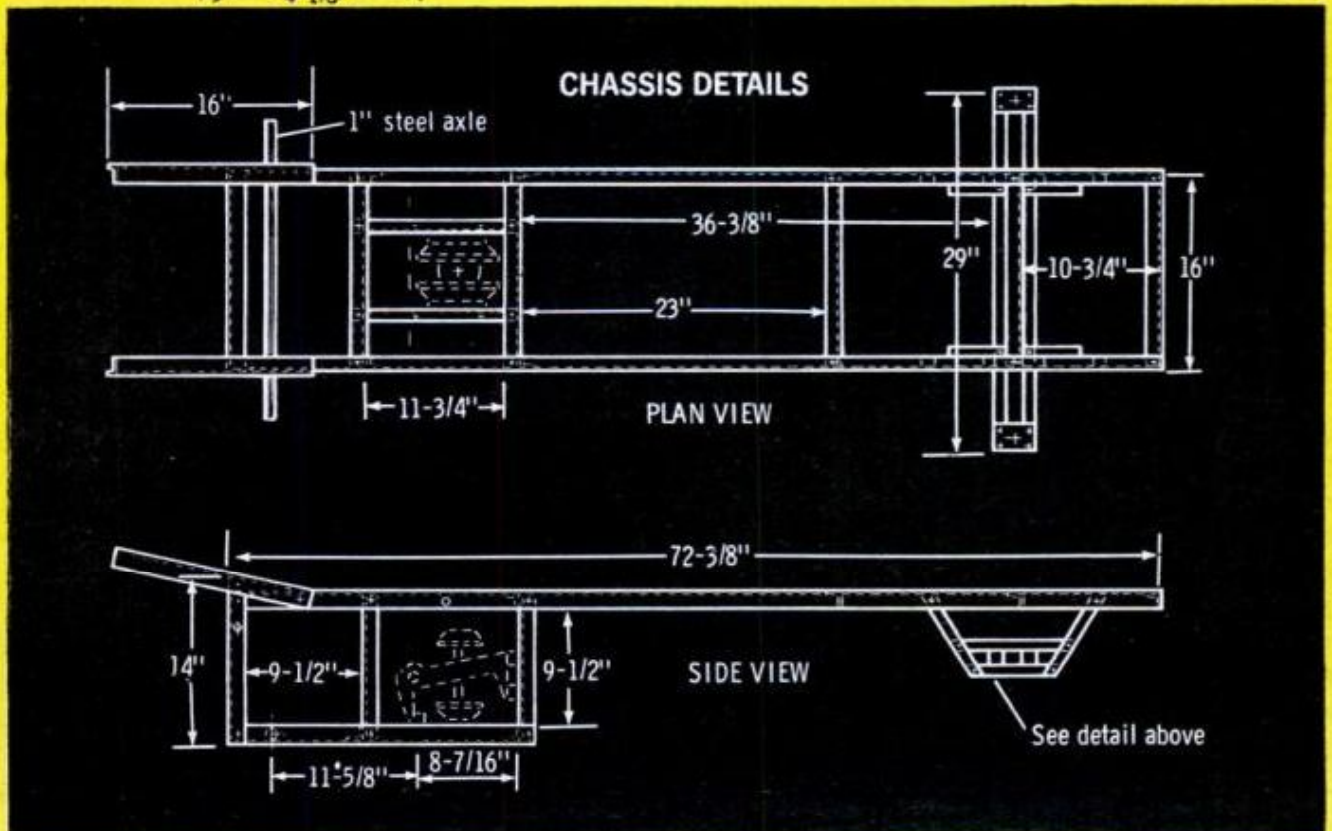
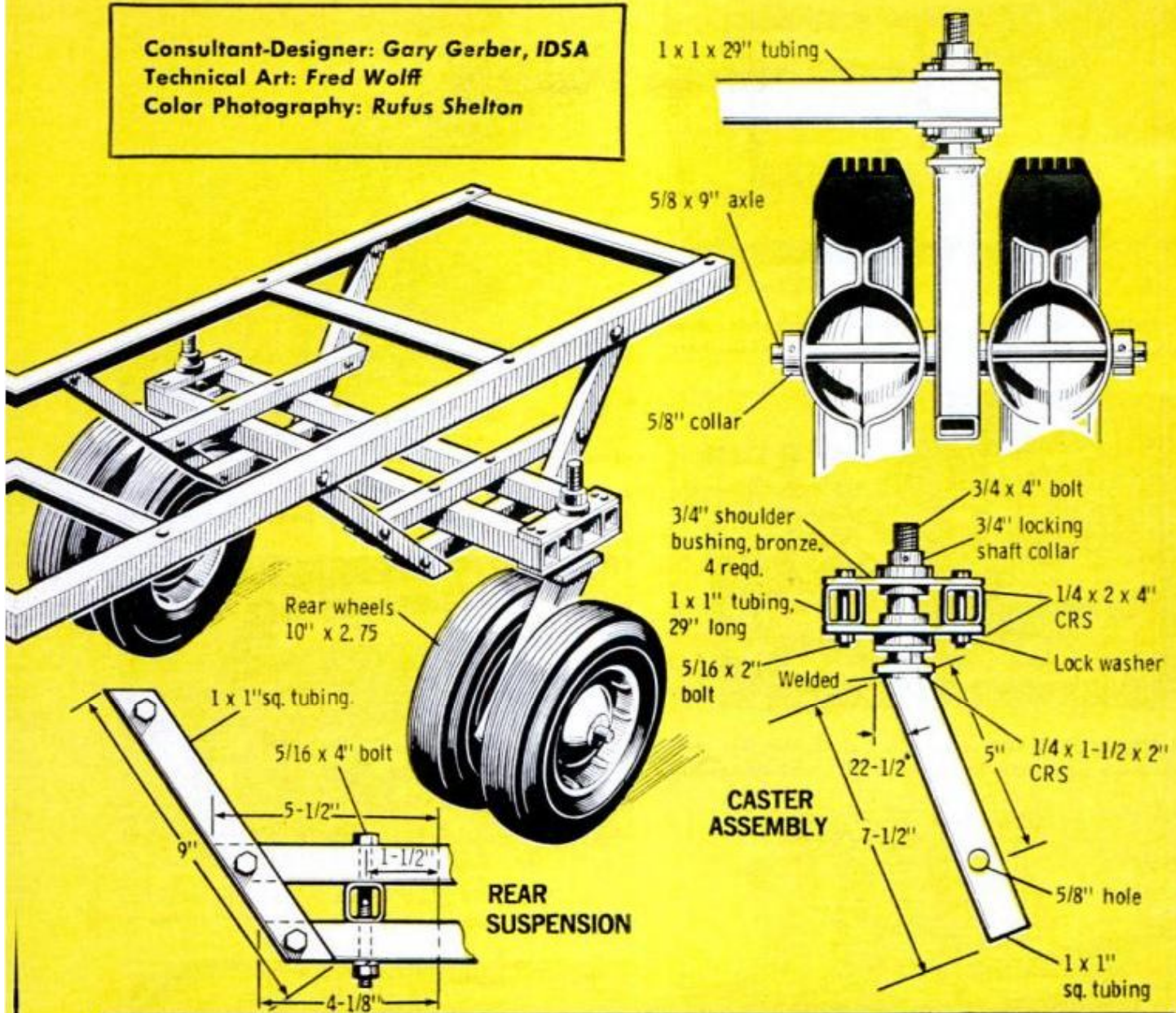


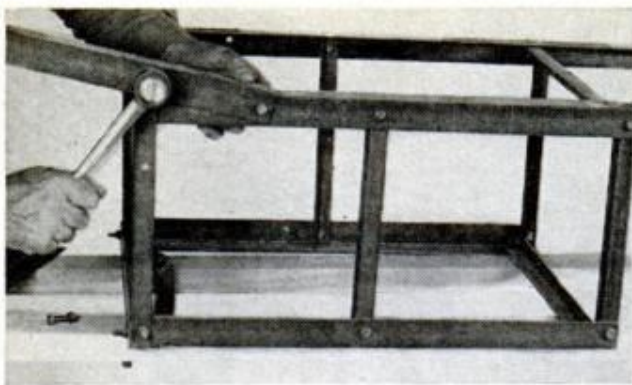
DETAILS FOR CHASSIS FRAMEWORK



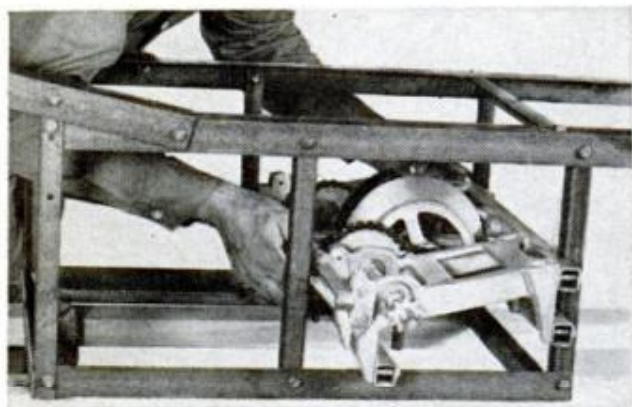
PLANS AVAILABLE
For complete instructions and large detailed plans send \$5.00 to Mini-Mover, Popular Mechanics, 575 Lexington Ave., New York, N. Y. 10022

Consultant-Designer: Gary Gerber, IDSA
 Technical Art: Fred Wolff
 Color Photography: Rufus Shelton

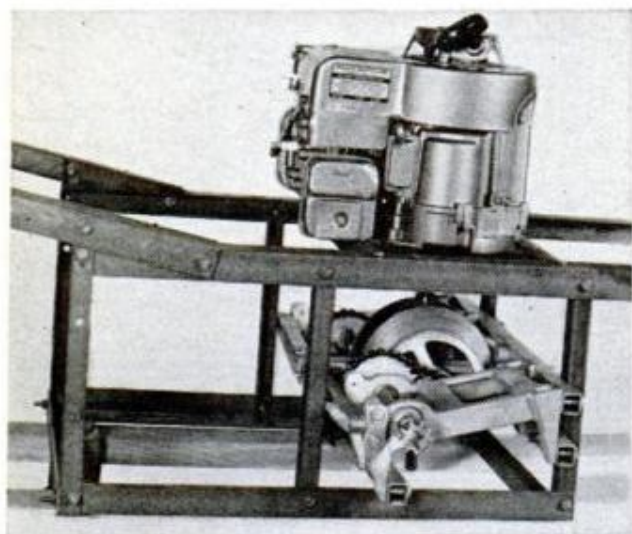




1. MARK AND CUT frame members separately, then assemble the main frame with bolts and lockwashers



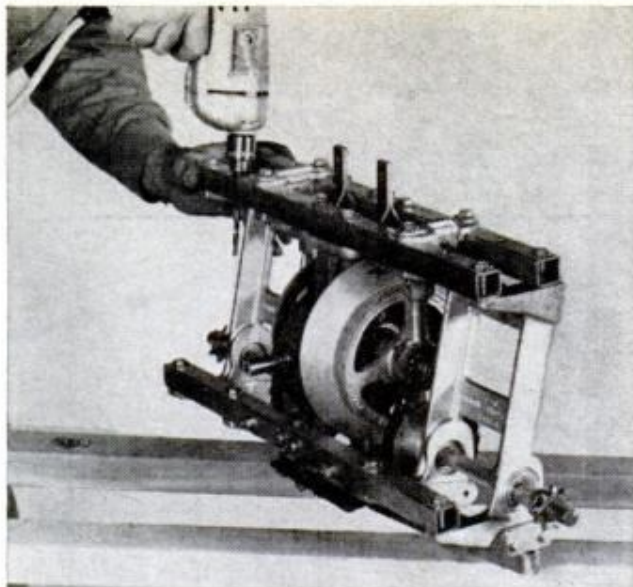
3. INSTALL THE TAT unit so its bottom member rests on angle-iron stub. The input shaft must be vertical



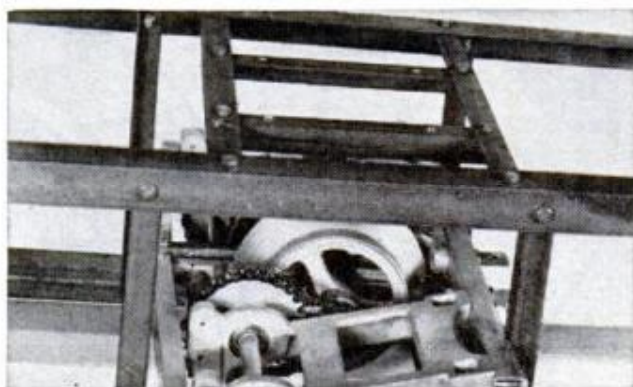
5. FOUR-HORSE, VERTICAL CRANK ENGINE has a low silhouette, is a perfect match for the TAT drive unit

our purposes, however, the engine is set to run at a constant speed, so a variable throttle control is not needed. Instead, the output of the TAT unit, and thus the speed and direction of the vehicle, is determined by the *location of the contact point and the amount of pressure between the mating surfaces of the inner cones and the outer traction cones* (or "discups," as the manufacturer prefers).

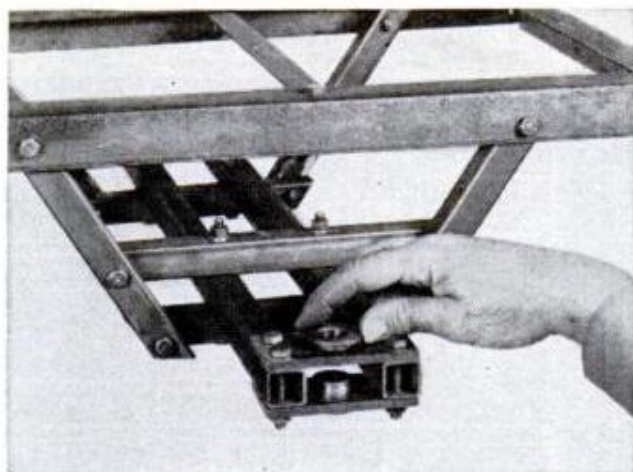
It's easy to see now that if one cradle-



2. DRILL MOUNTING HOLES through square members of TAT unit, then drill matching holes in main frame



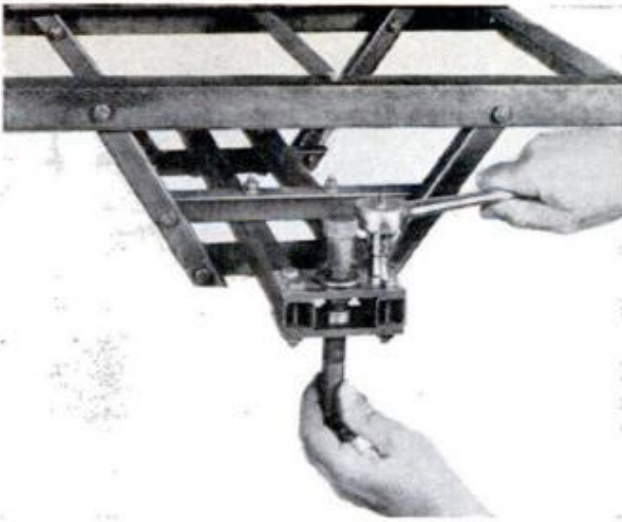
4. BRACKETS FOR MOUNTING MOTOR are attached after TAT is installed, then are drilled for the motor



6. STURDY REAR SUSPENSION MEMBERS are cut from 1-in.-sq. tubing. Then the bushing supports are added

mounted discup is forced up against a bottom inner cone, power will be transferred to its output sprocket; whereas forcing the same discup *down* against the upper inner cone will transfer engine power to the same sprocket, forcing it to turn in the *opposite direction*.

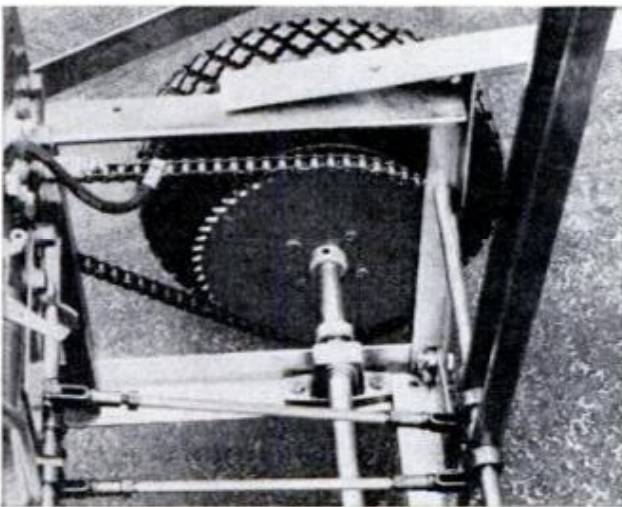
The basic theory of the TAT's operation



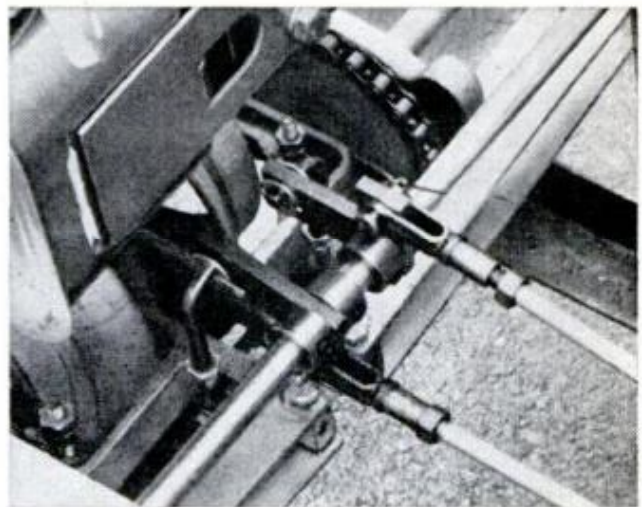
7. BEFORE TIGHTENING BOLTS holding bushing support plates, align shoulder bushings with a 3/4-in. bolt



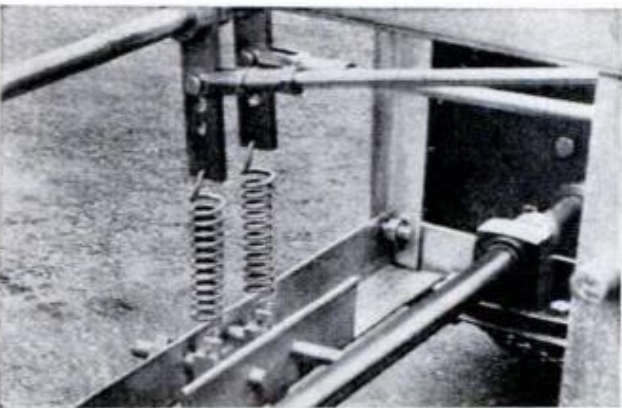
8. DOUBLE-WHEEL CASTERS move almost effortlessly, are the only parts of vehicle that require welding



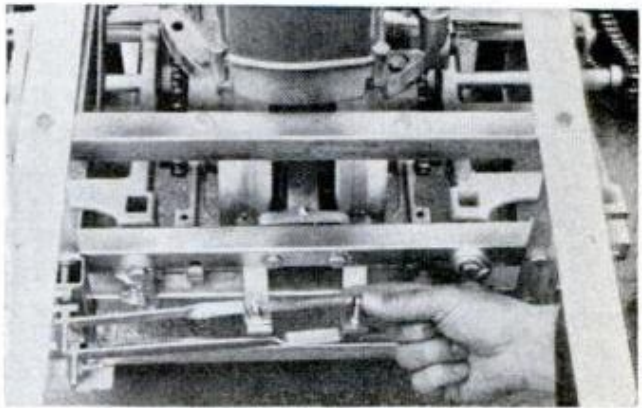
9. SPROCKET BOLTED TO OFFSET HUB is in background. In foreground are the control linkage tie rods



10. OPPOSING BELLCRANKS are used to produce proper relationship of wheel movement to handle position



11. SPRINGS RIDE ON BLOCKS for neutral adjustment. Vehicle response is varied by repositioning clevis

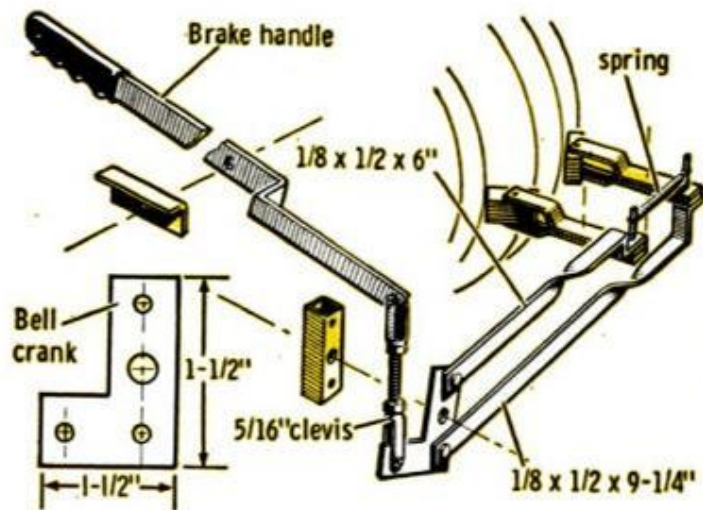


12. BRAKING SHOES appear puny, but are sufficient. Spring tension keeps brake off until lever is pulled

is that simple. Move a disc up and its respective wheel will turn; move it down and the wheel reverses its rotation. Similarly, apply maximum pressure on the disc and you transfer optimum power from the inner cone to the wheel. Apply less pressure to allow some slippage between the two surfaces, and you decrease the

power transferred by friction, thereby decreasing the speed of the wheel. Thus, one lever for each wheel is all you need to control the speed *and* direction of PM's Mini-Mover.

Performance-wise, the prototype vehicle shown on these pages is capable of approximately 12 to 15 mph, in both forward



HANDBRAKE LINKAGE also incorporates a bellcrank to maintain the proper relationship between the two opposing sides of TAT

and reverse. Loaded with three hefty adults in its cargo area, the Mini-Mover performs as well as it does when empty, provided the riding surface is fairly hard and level.

Therein lies the only difficulty encountered with the prototype model—steep grades, rough trails, gravel beds, sand dunes and muddy roads are not the best job sites for this vehicle. However, there are only two reasons for this drawback, both of which can be overcome. First, a 4-hp engine can hardly be expected to move a 300-lb. vehicle with a 180-lb. operator and a 300-lb. payload up a 20-percent grade or through a muddy marsh. Thus, using a larger engine would appreciably increase the vehicle's all-around capabilities.

ably increase the vehicle's all-around capabilities.

The second reason is a bit more complicated, especially as it involves *another* principle of the TAT concept, one not already mentioned. Referring back to the drawings on page 141, imagine that one discup is forced down on an inner cone, just enough to start it revolving. At this point, some slippage will occur naturally and maximum power will not be transferred to the output sprocket. However, imagine now that the amount of discup travel is limited, but that the pressure exerted at the contact point is increased. Obviously, less slippage

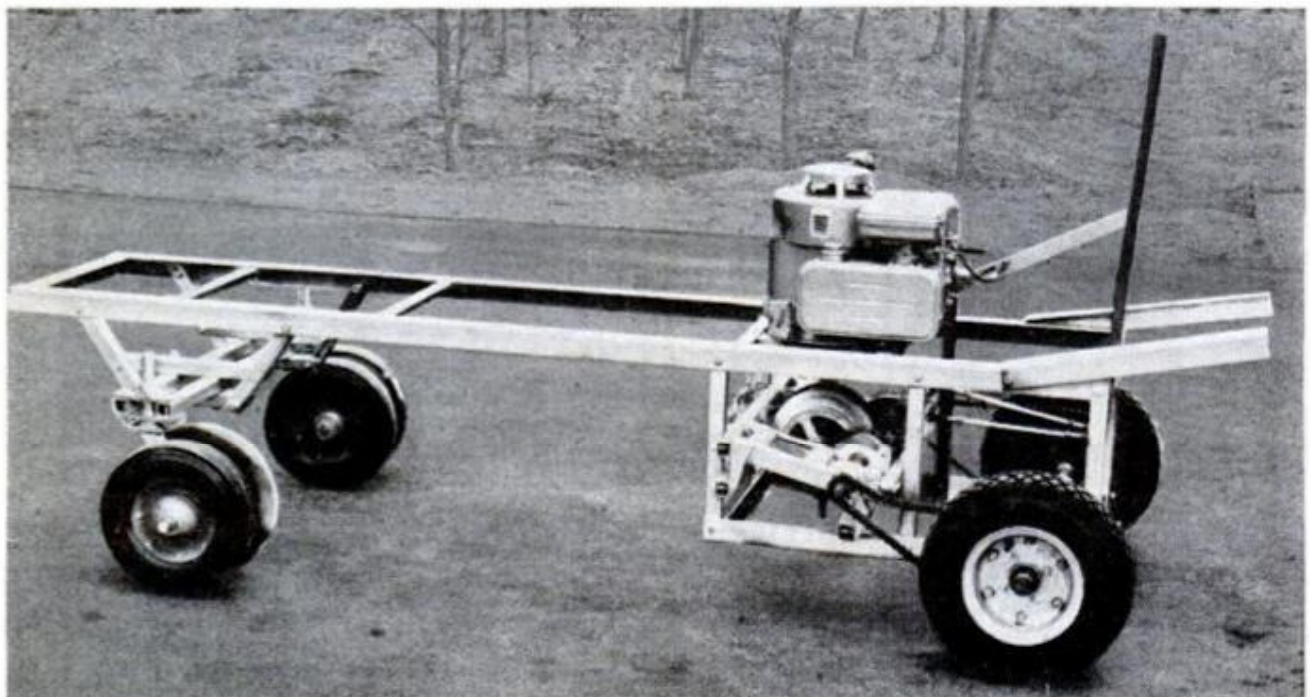
occurs and *more power* is transferred to the output sprocket.

Next imagine the discup travel limit is removed and that the discup is forced inward against the cone so that the contact point between the two is moved towards the inner flange of the discup. Moving the contact point closer to the axis of the discup in this manner *decreases the transfer ratio*—and *increases the output speed*.

In effect, then, limiting the amount of travel while increasing contact pressure produces peak power at low speed, while moving the contact point closer to the output centerline increases output speed. In other words, the TAT unit can also be

(Please turn to page 194)

READY FOR A TEST WALK? Fire her up, idle the engine and adjust the springs until you find neutral position



HINTS

FROM READERS

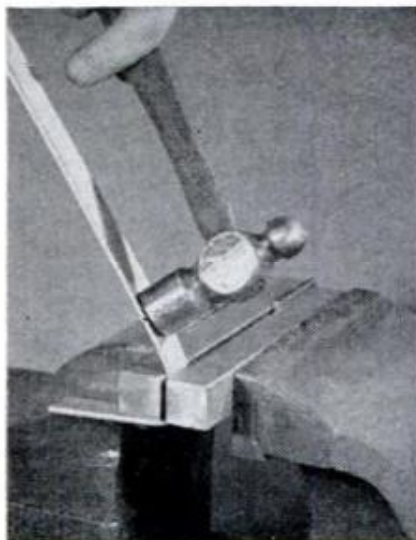


Screw gripper

When starting a small screw in a tight space, fold a tab of double-sided tape over the tip of your screwdriver. Stick the screw firmly to this, and you'll have no trouble guiding it in the most hard-to-reach spots.

Bending vise

Making sharp return bends in flat steel stock is often impossible in a regular vise because the jaws do not allow room. By clamping a pair of steel bars in the jaws with the work between, you can extend the grip beyond the vise.



Improvised compass

To turn a pair of scissors into a compass, place a small cork between the blades and slide it up or down until the points indicate the desired radius. A rubber band over the blade ends below the cork will hold that radius.

Polishing tool

Try using a small block of rigid plastic foam when polishing intricately shaped objects. Trimmed with a knife to reach in grooves and corners, it's an efficient tool to apply polishing compound. However, be sure foam is clean.



Bushing holder

If a drill-press vise isn't available when you have to drill a small bushing, place it in the hub of a steel pulley and tighten the setscrew. Pulley will keep it vertical, is large enough to be held firmly during drilling.

Lever hammer

Pulling rusty spikes with a claw hammer will be much less work if you slip a length of pipe over the head to turn the hammer into a two-handed lever. It will yank the most stubborn nails with surprisingly little effort.

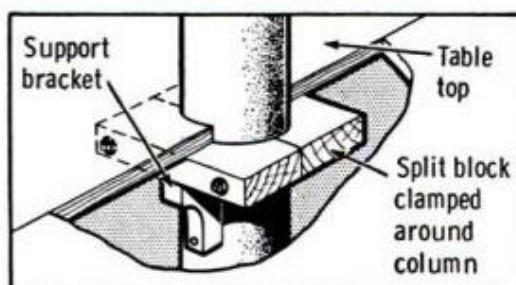


Weekend Remodeling Ideas



Lally - Column Table

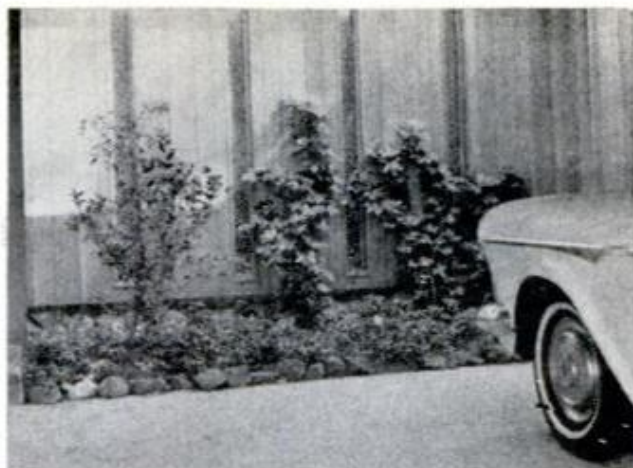
You can look upon lally columns as a necessary evil—mighty important items when it comes to holding up the house, but not too welcome when fixing up the basement. However, a clever way of making one a part of a recreation room is to put it to work supporting a snack table. In this example by Armstrong Cork Co., the table's square shape is repeated in the floor with red and blue feature strips. With the upper part of the post decorated, you forget it's a lally column. The detail shows how to attach the table.



Foyer Bench

A highly functional bench for a modern entryway is this "masonry" one which offers storage for boots and other rain gear. Basically, it's a plywood box fitted with doors and covered with simulated sheet stone such as Decro-Wall. A slab of cored latex rubber, fitted with a tailored cover, provides a comfortable cushion.

Fir plywood, $\frac{3}{4}$ in. thick, is used for the rough box which has a top but no back or bottom. A brace across the back at the bottom helps to reinforce the ends. Typical cupboard-type lip doors are made to lap a frame in the opening and the edges of the stone. The stone treatment goes perfectly with a simulated slate-tile floor, such as the vinyl asbestos surface shown.



Narrow Slots of Fiberglass Solve View Problem

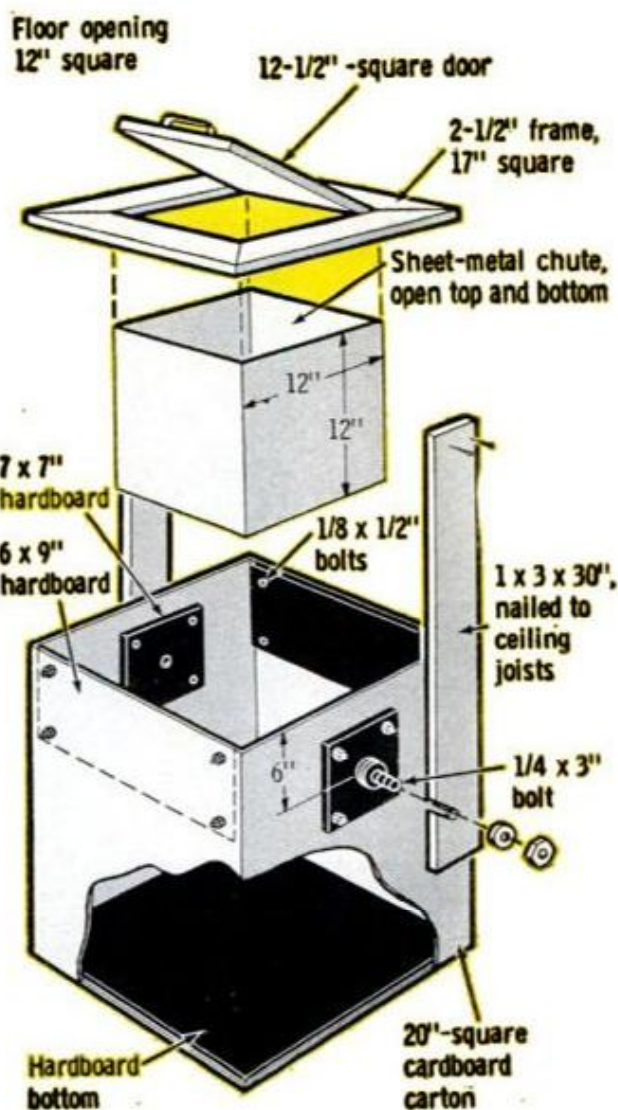
Tall panels of colorful fiberglass provide interesting "stained-glass" windows in this paneled wall facing an unattractive view. Designer Gregory D. Ivy found the windows blended with the vertical paneling, gave a colorful glow to the formal atmosphere of the dining room and solved the view problem perfectly.

The 8-in.-wide rough openings (12 in. apart) were framed with $1\frac{1}{8}$ x $6\frac{1}{2}$ -in. members to project $\frac{1}{4}$ in. beyond the interior and exterior paneling. A rabbet for the fiberglass was formed with $\frac{3}{8}$ x 1-in. strips placed 3 in. in from the inside edge. A second strip was used to hold the glass in place.—*Dorothy Swanson*

Closet Clothes Drop

If you have a linen closet over or near the basement laundry room, you can make washday a lot easier for your wife by installing a trapdoor in the floor and hanging a pivoted hamper below it. The hamper is simply a king-size, reinforced cardboard carton which tips forward to dump the soiled clothes.

Beginning in the basement, pick an open area between the floor joists directly
(Please turn to page 196)



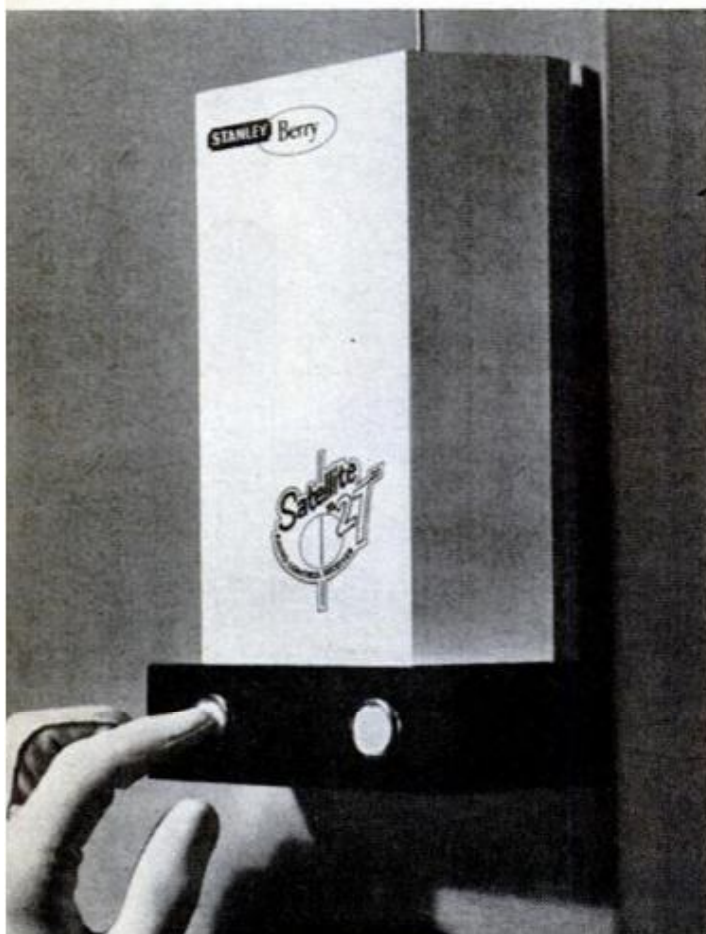
EXCITING NEW PRODUCTS

By CAROL SCHULTZ



DISPOSABLE FLASHLIGHT provides light for at least a year, eliminates recharging and replacement of batteries. When flashlight fails, discard it and buy a new one. \$1.98. By Tensor Corp., 333 Stanley Ave., Brooklyn, N.Y.

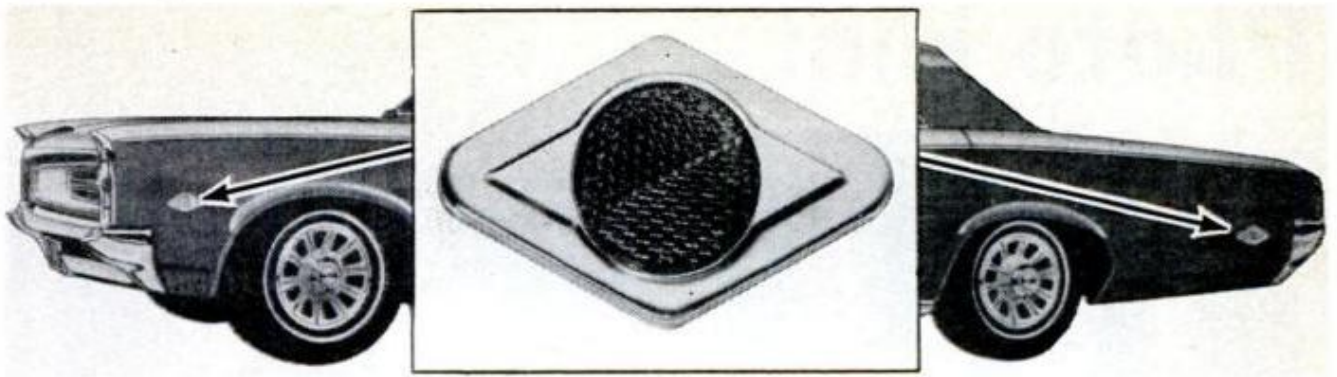
TRANSISTORIZED GARAGE-DOOR CONTROL is wall mounted and easily removed for servicing. Satellite "27" is available in either single or dual channel models. By Berry Doors, Div. of Stanley Works, New Britain, Conn.



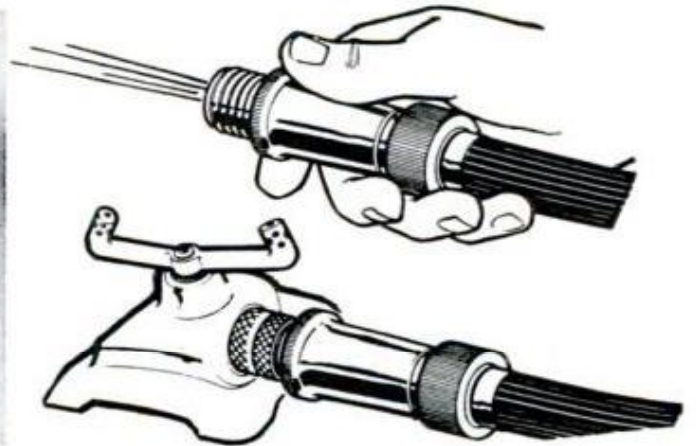
SPRAY-GUN KIT is for any liquid not available in a spray can. Gun is powered by can of nontoxic, nonflammable propellant gas; \$3.95; extra jars, propellant available. Tempo Products, 6200 Cochran Rd., Cleveland.

MOBILE BASKETBALL BACKBOARD is the answer where a permanent installation is not available or permitted. When not in use just fold it, and store. Sells for \$195 from Duvirage Corp., Box 828, Hagerstown, Md.





AUTOMOBILE SAFETY REFLECTORS are ideal for broadside protection during the night. An adhesive backing holds the reflectors in place. A set of four—two amber and two red—costs \$1.95 postpaid. From Simmons Specialty Sales, 1184 Durkee Drive W., Jacksonville, Fla.



COMBINATION NOZZLE-COUPLING has a fully adjustable spray and shutoff and stays on the hose when attaching it to a sprinkler. The "Schnozzle" is available in plastic for \$1.79, chrome plate for \$2.69. Made by Freemar Co., 18055 James Couzens Hwy., Detroit, Mich.



UTILITY SHELVES for efficient storage has a convenient ledge work surface. The shelf units are available in a selection of sizes for open or closed styles. Further information from Bay Products, 155 E. Somerset St., Phila., Pa.

REPLACEMENT TOWEL BAR takes the place of a broken, chipped or discolored one. Made of polystyrene the bar is 24 inches long and can be cut to any length. Its spring-loaded end-caps hold the bar in place. Available in five finishes, from \$1.98 to \$2.49. By Lenape Products, 120 Stokes Ave., Trenton, N.J.

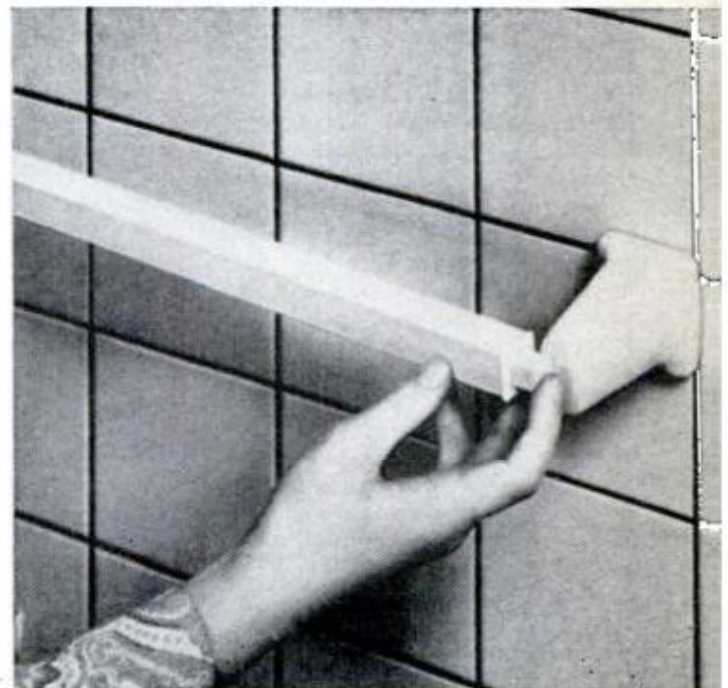
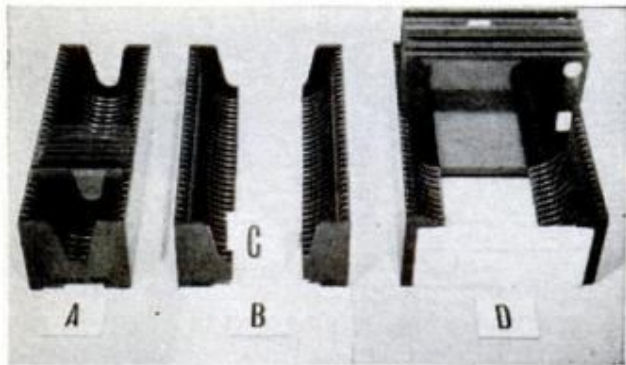
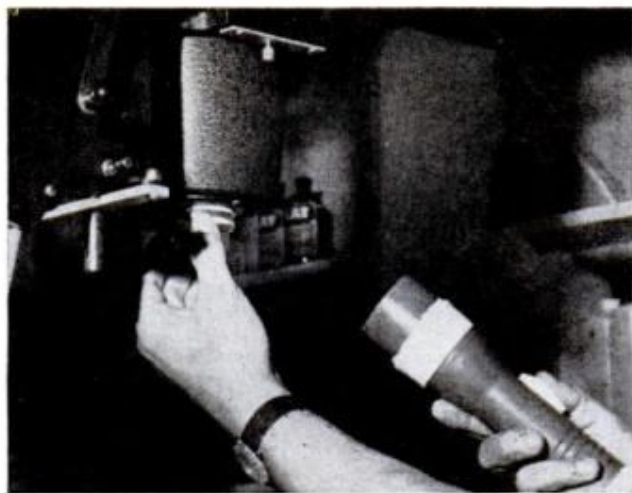


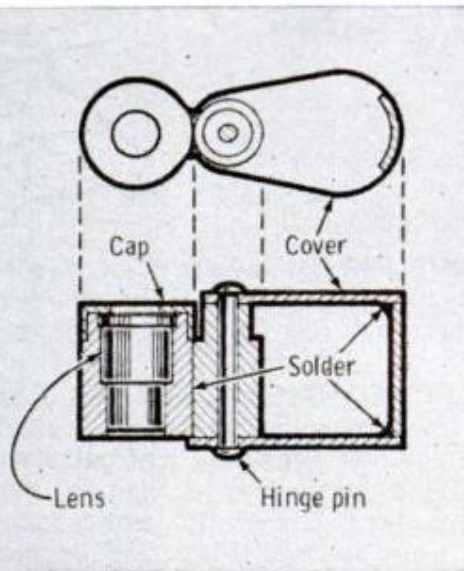
Photo Hints



LARGE-SIZE TRAYS for 3 1/4x4-in. lantern slides are rare. Anyone working with this special format can make his own from ordinary 2x2-in. plastic slide trays. Saw a tray in two, then fasten the halves together with spacers of scrap plastic. Use plastic cement. The widened trays make fine racks for washing as well as storage.—Harry A. Tucker

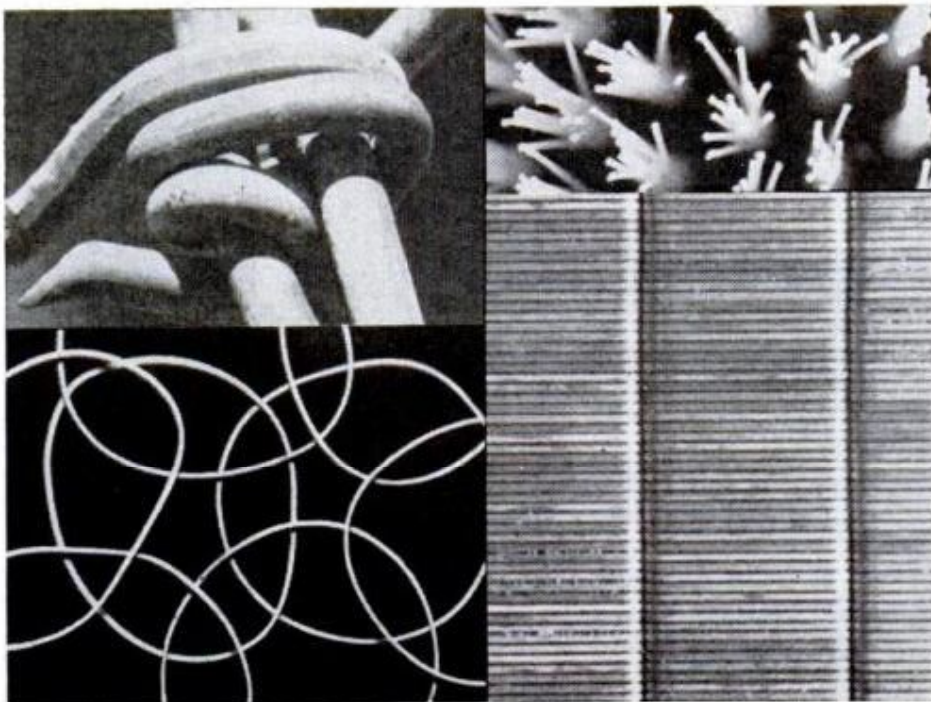


A PORTABLE SAFELIGHT will end fumbling around a dimly lit darkroom when you're trying to find something. You can make one by taping a small safelight filter over a flashlight. For a quick job, try using a red plastic aerosol cap as the filter. The device is especially handy for reading the f-stops on an enlarger in the dark.—Arthur L. Ramos



A DISCARDED LENS from an old movie camera makes a good pocket magnifier for checking small contacts and other uses. The drawing at left shows how you can make a housing for the lens with a pivoted cover. A length of brass rod is machined to hold the lens and is soldered to a brass tube for the pivot pin. The cover is sheet metal soldered together. Old lenses are available at shops specializing in secondhand photo equipment. A focal length of 20 mm gives a magnification of about 12X and is a good choice.—Walter E. Burton

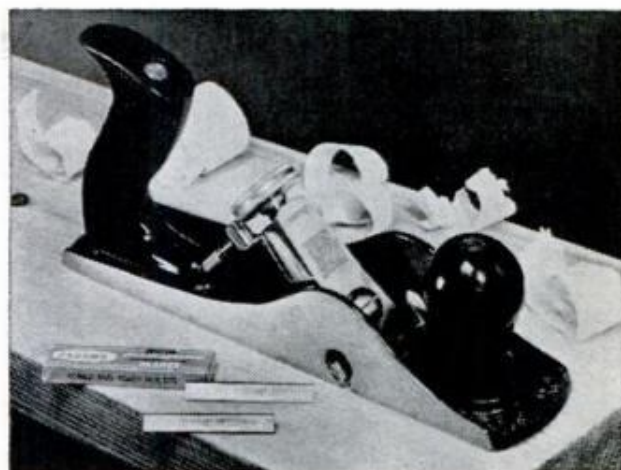
CLOSE-UP PHOTOS of common objects create unusual artistic effects and make an intriguing hobby. The examples at right are all of familiar articles. Can you guess what they are? They are: a barb on barbed wire (upper photo, near right), rubber bands on a black background (lower photo, near right), hair-brush bristles (upper photo, far right) and rows of staples (lower photo, far right). Such photos are easy to make with a single light and inexpensive close-up attachments available for most cameras. These were made with a plus 1 accessory lens. On cameras having removable lenses, you can use extension tubes to increase magnification.—Rod Moon



New Tools You Should Know About

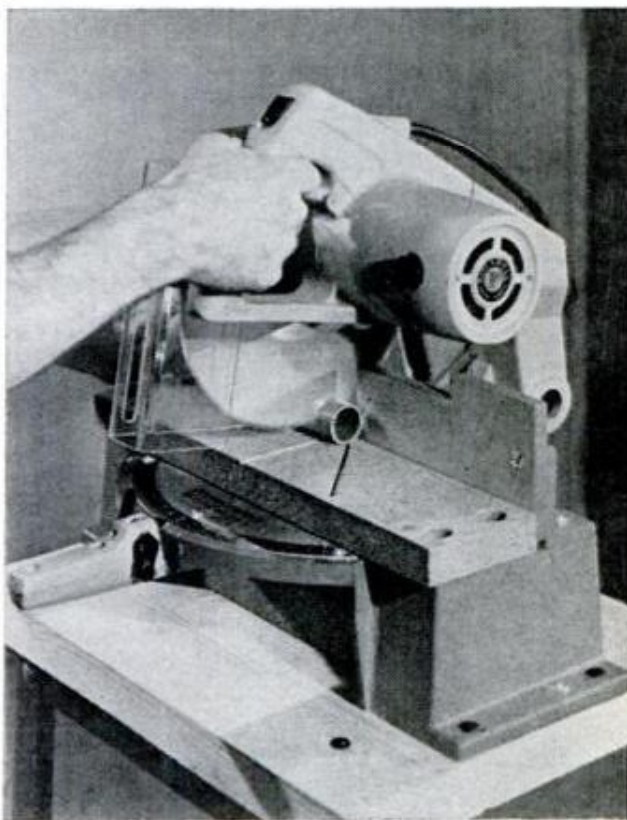
Three planes in one

A woodworking plane that combines jack, smoothing and rabbeting capabilities in one tool is now being imported from England. The Paramo Planemaster comes in 10 and 12-in. models, each selling for \$9.95. A rabbet gauge is included with smaller model. Plane is distributed by Mac S. Krasnow & Assoc., Box 5552, Sherman Oaks, Calif.



Motorized miterbox

Designed to save time for builders, a new "miterbox" includes a 9-in. saw powered by a 10.5-amp motor that develops 1.6 hp. The 43-lb. tool has a pushbutton blade brake and a plastic blade guard which allows the operator to see the cut. It sells for \$169.50 from Rockwell Mfg. Co., Pittsburgh, Pa. 15208.

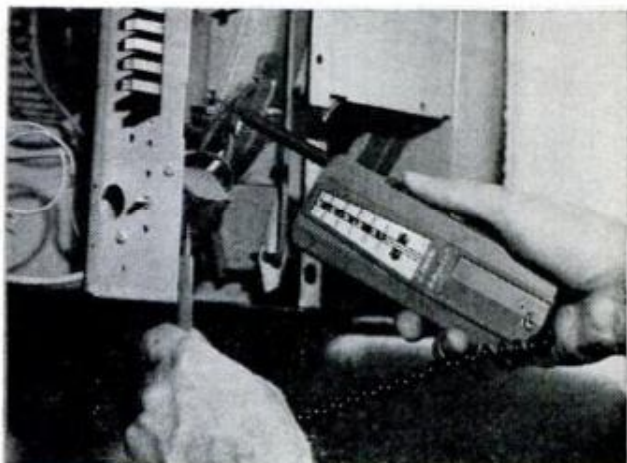
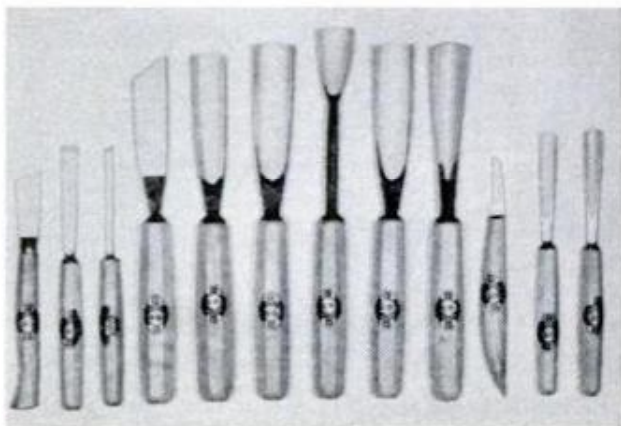


Compact voltage tester

Small enough to fit in a shirt pocket, the new Voltprobe voltage tester (lower right) incorporates a sliding probe that pushes up through the body and a separate probe on a 3-ft. coil cord. It reads nominal voltage to 550 v.a.c and 750 v.d.c, and sells for \$9.50. Amprobe Instrument, Lynbrook, N.Y. 11563.

Woodcarving tools

A complete line of carving tools suitable for wood, linoleum and leather work is being imported in blank form from West Germany by a California firm. All grinding and sizing is done in America. For price data on these professional-quality tools, write to Beval Products, 451 Moss St., Burbank, Calif. 91502.



A Decorative You



Technical Art by Don Evans

LIKE MANY GOOD PROJECTS, this old-fashioned well house came about through a combination of coincidences.

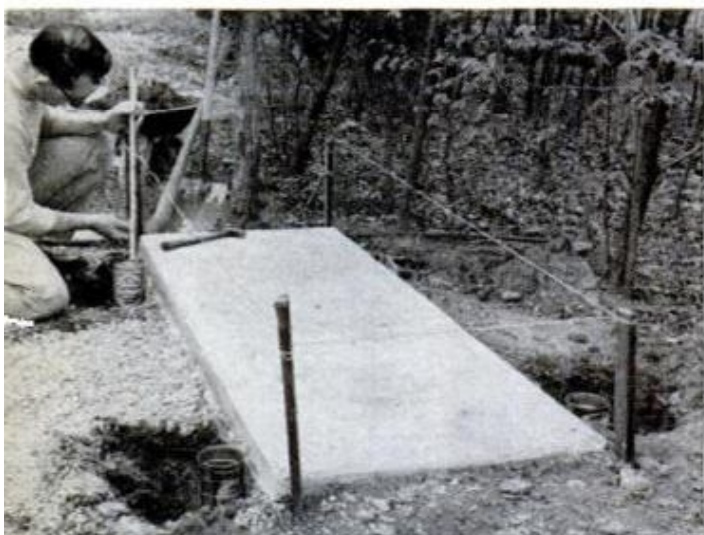
First, I had recently acquired a gold mine of scrap lumber in the form of box-car dunnage, all mine for the hauling away. It was stacked in a corner of the back yard, just waiting to be used.

Second, my wife was worried about our garbage cans. Frequent hints were dropped that I really should build some sort of shelter to screen them from sight and prevent their being knocked over by neighborhood dogs and hungry raccoons.

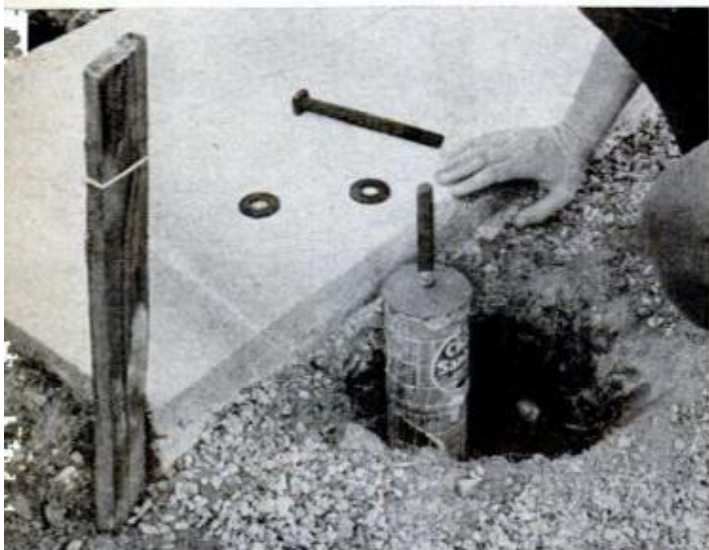
Finally, I'd always admired the genuine well house that ornaments the lawn of one of our friends.

One weekend, everything suddenly dropped into place, and the result is shown here. The plan at right is tailored to dimensional lumber and includes a plywood door, an improvement on my original design.

While perfect for hiding garbage cans, it could also be used to store firewood, lawn furniture or a portable barbecue. The kids think it makes a great playhouse. With a counter board, it could easily be turned into a service bar for lawn parties. Not bad for an "unplanned" project! ★★★



PIER FORMS are stacked coffee cans extending below frost line. Level them before you pour the piers



HOLD-DOWN BOLTS are set in tops of piers. Slope top with a pointing trowel so it will shed water



SHEATHING can be any scrap 1-in stock. Random gaps don't matter, since the shingles will cover them

Well House Can Use

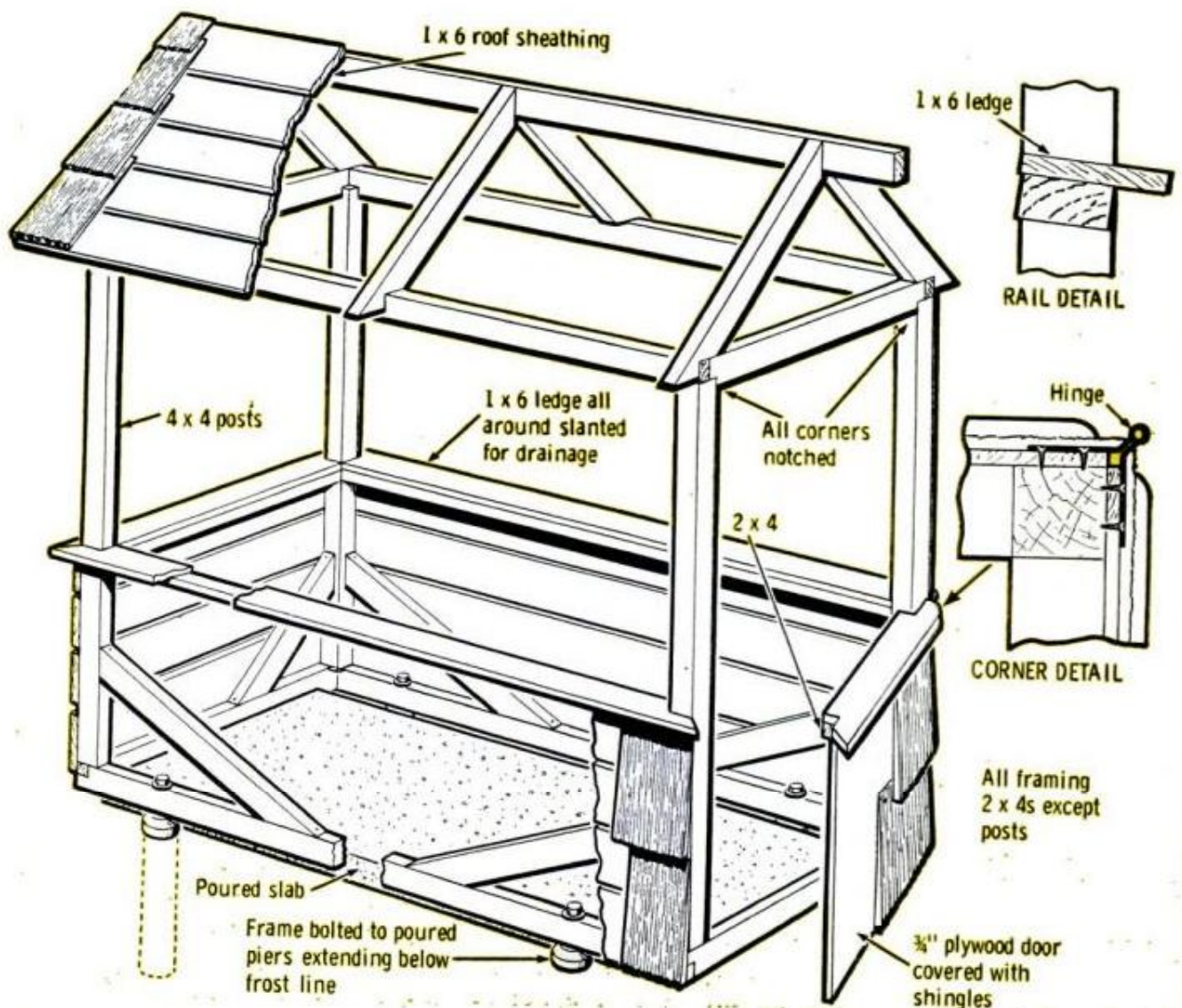
By B. W. POWELL

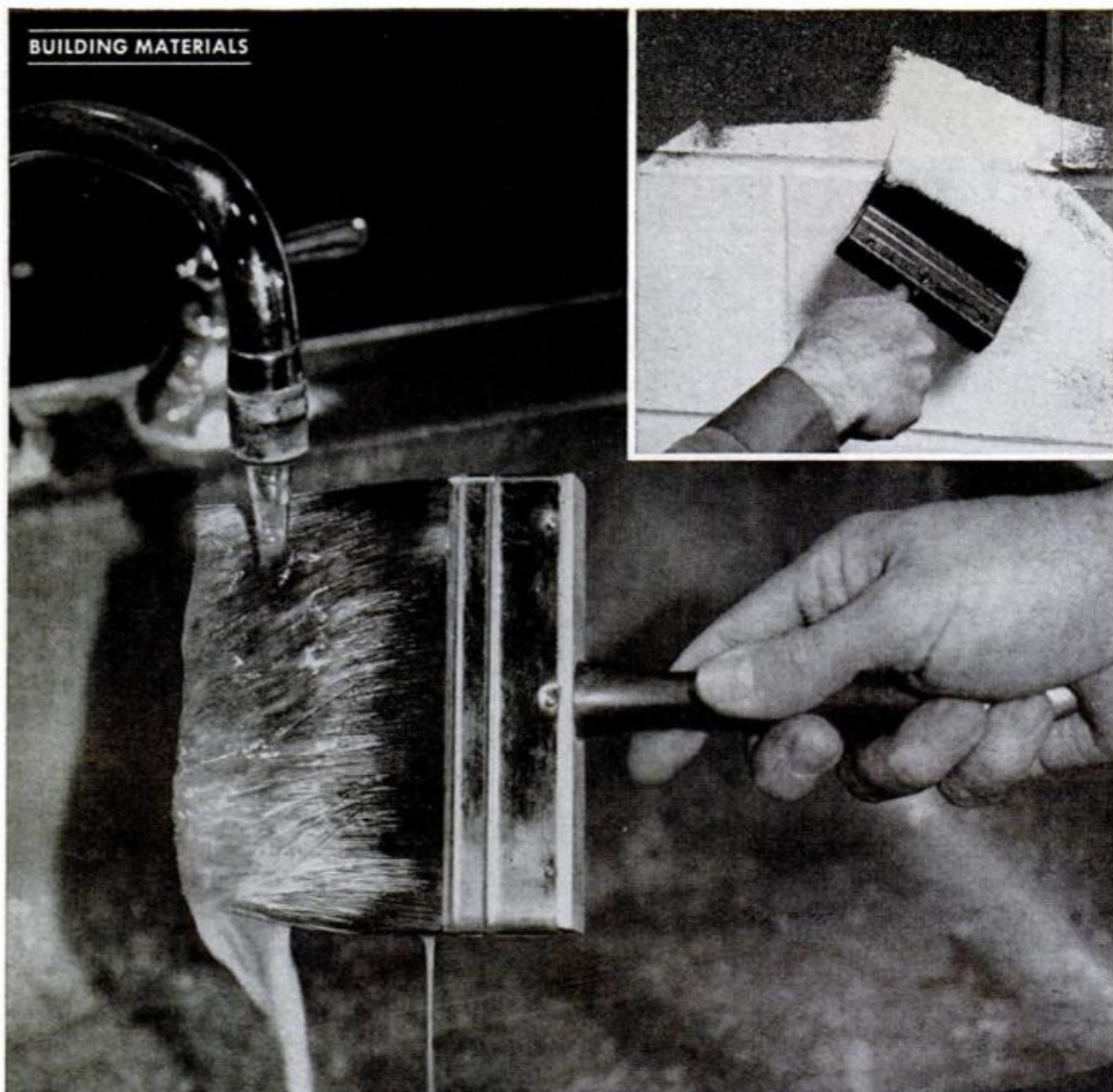


SHINGLES were chosen to match those on author's house. Well house was then painted to match house



SAME SHINGLES were used on roof, since quantity hardly justified buying a bundle of roofing shingles





NO NEED TO THROW the brush away. When the job is done, just hold it under the faucet to clean it

Now: Water-Base Epoxy Paint

Completely odor-free, this new civilized epoxy cleans up as easily as any latex house paint

By STEVEN J. HOWARD

THEY'VE FINALLY TAMED epoxy paint. No more noxious odors. No more discarding brushes after one use. No more hurry-up-and-wait during application. General Mills has come up with a totally new development that changes all the rules—a water-based epoxy paint.

Called Versamid, this amazing new paint offers every advantage of traditional solvent-based polyamide-resin epoxy,

yet has none of the disadvantages. It's odorless. You can clean your brushes in water. Even the catalyst-emulsion ratio has been changed for the better.

Your local paint store probably doesn't sell it under the name Versamid, since other companies have made arrangements with General Mills to market it under their own brand names. Just look for water-based epoxy. At present, it's available

in four forms—block filler (for use on cinder block and masonry), primer, semi-gloss and gloss enamels.

Like other epoxies, Versamid is comparatively expensive (\$10-\$15 a gallon), but it does a superb job where you need top protection against wear, moisture or chemicals. Use it on concrete walls, floors and steps, both interior and exterior. It's fine for swimming pools. Applied to bathroom walls, it will give new life to old ceramic tile which has suffered minor surface damage. Garage floors, metal cabinets, appliances, back-yard play equipment—there are dozens of applications where the extra cost is more than justified by epoxy's superior protection. And what's more, it offers the home handyman several obvious advantages over solvent-based epoxies.

For one thing, there's the time element. After mixing a solvent-based epoxy, you have to wait at least a half hour before you apply it in order to give the chemicals time to react with one another. If you try to rush this, drying time is lengthened and you end up with a film of less than maximum strength.

You can start using water-based epoxy right after mixing it. Drying time is the same whether you apply it immediately or an hour after mixing. As for strength, the film produced by immediate application matches that of any solvent-based epoxy put on after 30 minutes.

Speaking of mixing, water-based epoxy requires only a one-to-four ratio of catalyst to emulsion. Most solvent-based epoxies specify equal amounts of each. This means that water-based epoxy is both faster and easier to mix.

As for safety, solvent-based epoxy paint is flammable and should never be used near an open flame. Water-based epoxy, on the other hand, could be applied safely right next to a roaring bonfire.

Another problem with solvent-based epoxies is coating a previously painted surface. The National Paint, Varnish and Lacquer Assn. warns, "Epoxy enamels may penetrate and wrinkle the old paint." Standard procedure is to apply a test smear. With water-based epoxy you can paint over any previously coated surface without danger of wrinkling or lifting.

Solvent-based epoxies carry all sorts of warnings concerning use on exterior surfaces where gloss retention is impor-



MIXING RATIO of water-based epoxy paint is one part catalyst to four parts emulsion, much lower than that of solvent-based epoxy. This simplifies mixing

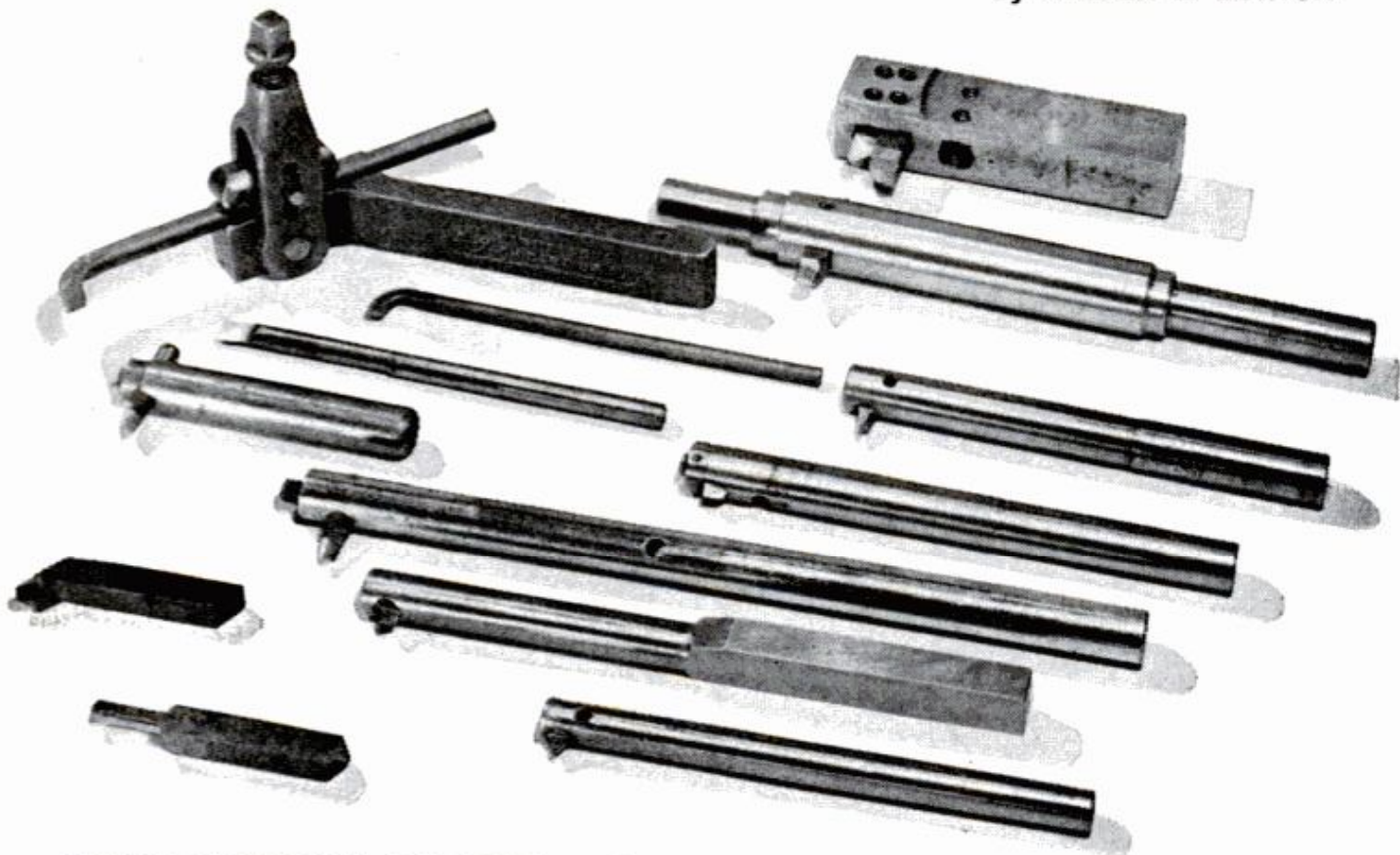
tant, since high temperature and rain will dull the gloss quickly. Water-based epoxy isn't a great deal better in a rain department, since rain will cause run-off during the six-hour period before the water base evaporates. Once it hardens, however, rain won't affect it. Below 90°F., you don't have to worry about losing gloss.

How does the two-part, water-based epoxy stack up against ready-mixed solvent-based epoxy coatings? The same as the two-part solvent-based systems. Both two-part systems adhere better to most surfaces and resist chemicals better than the ready-mix systems. More important, though, the two-part systems are much more resistant to wear. The ready-mixed solvent-based epoxies won't last nearly as long when used on floors, for instance.

If you have trouble locating water-base epoxy paint, write to Product Manager, General Mills, Inc., Kankakee, Ill. 60901. He'll tell you the nearest source. ★★★

How to Make and Use LATHE BORING TOOLS

By WALTER E. BURTON



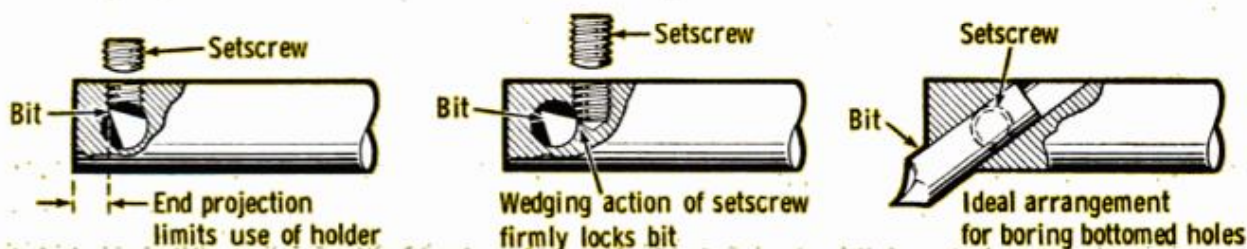
YOU CAN'T USE A LATHE too long before running into some boring work—not monotonous, but “boring” as a means of increasing the diameter of a hole.

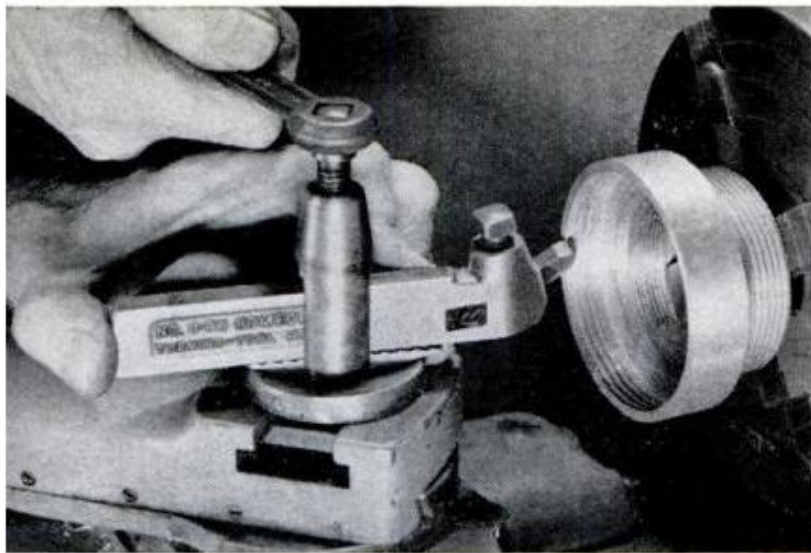
Boring customarily begins with a pilot hole, either drilled into solid stock or the inner diameter of a tube. Then using just the regular toolholder and a high-speed bit, you can bore out the hole to the required diameter. However, with just a holder and regular bit, the depth of the cut is limited to an inch or so on a moderate-size bench lathe. Thus, special lathe boring tools are needed to increase the

depth of cut. Such tools can be roughly classified as follows:

- *Solid or one-piece tools.* These typically are bars with one end curved and ground to produce the desired cutting edge. Most often, these are made of drill rod or other hardenable stock.
- *Inserted-bit tools.* With these, a hole is drilled in the end of a round or square holder to accept either a round or square bit. A setscrew or other arrangement is

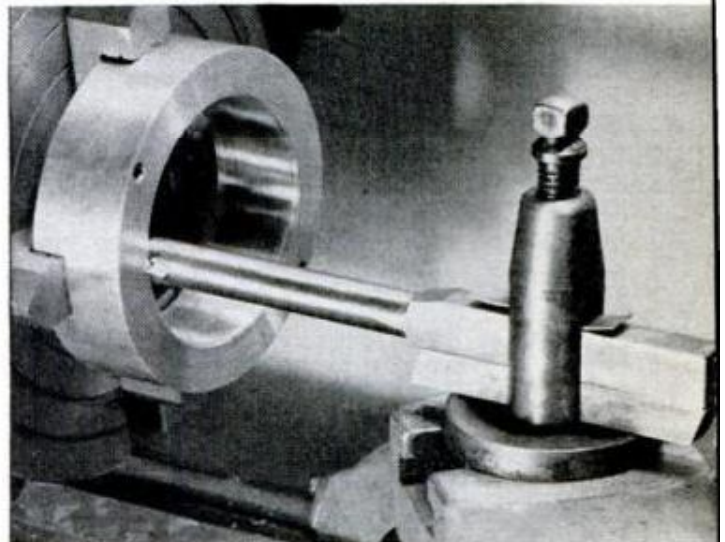
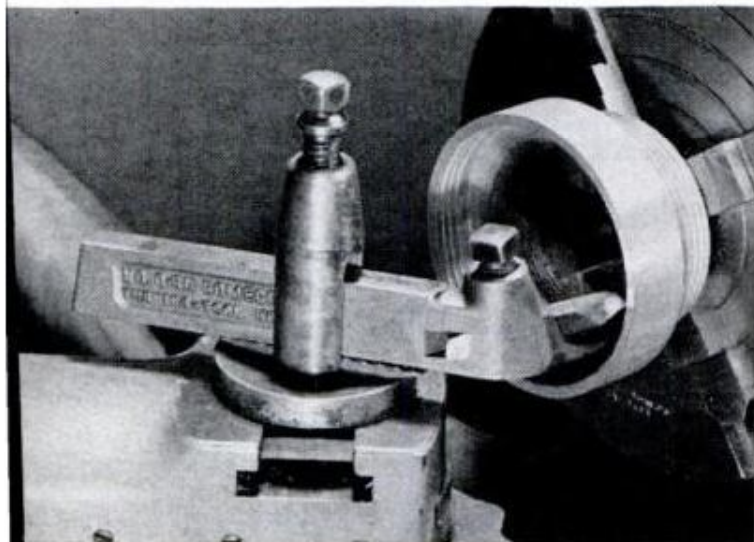
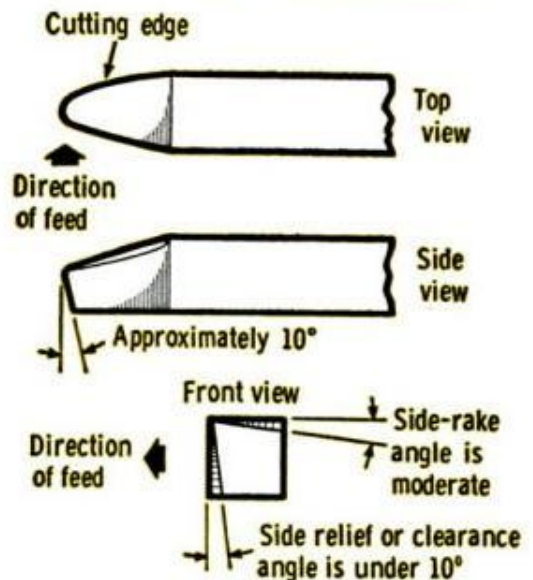
METHODS OF MOUNTING BORING BITS IN HOLDERS





BORING TO MODERATE DEPTH can be done with bit in regular holder (top), but it's easier to watch cutting on opposite side (below). Modified bits (top right) are used in regular, special holders (below right)

TYPICAL BORING BIT CONFIGURATION



used to lock the bit in the hole. The advantages of this particular type of boring tool are many: the bit can be removed easily for sharpening or replacement; the boring tool can be made reversible with both ends fitted for different bits, and the tool is easy to make.

● *Inserted-bit boring bars.* These are usually intended for mounting between centers or between a chuck or tailstock center. Often they will have more than

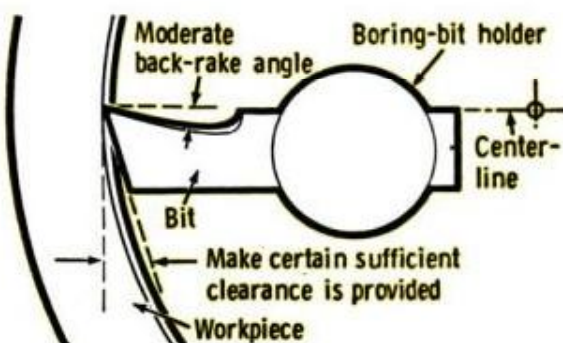
one inserted bit for boring two or more diameters at the same time.

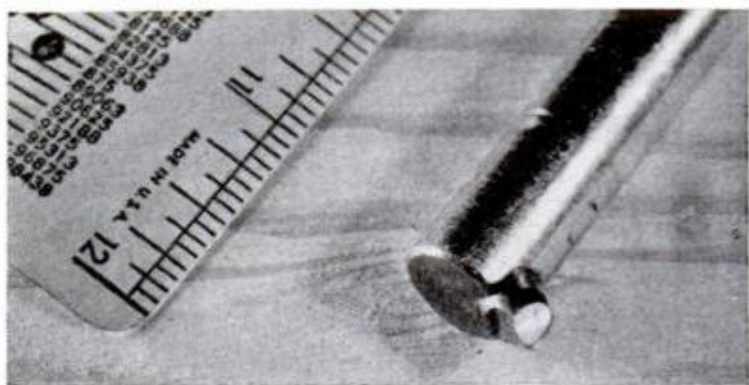
Making your own tools

Among the easiest boring tools to make are center-supported boring bars and boring tools that mount in the regular toolpost, or in a holder that fits or replaces the toolpost. Cold-rolled steel rod is suitable for the popular inserted-bit type of tool.

Drill the mounting hole through the end of the rod (either straight through or at an angle) and drill and tap a second hole for a setscrew. This way, you can use round bits made from the shanks of broken twist drills or other suitable stock. If you would rather use square bits made from standard lathe-bit blanks, simply file the drilled hole until it's square.

For boring very small holes, a solid, one-piece tool generally is used. You can





BORING TOOLS FOR BOTTOMED CUTS must have bit inserted at an angle so cutting edge projects beyond holder. The three steps shown above illustrate a typical tool made of 1/2-in. steel bar and 1/4-in. dia. bit

forge, file or grind such tools from tool-steel stock and then harden them; or you can grind them from hardened high-speed-steel lathe bits.

Mounting the tools

Dependent upon the particular job at hand, boring tools can be mounted directly in the toolpost, in a holder clamped to the toolpost, in a rigid holder that replaces the toolpost, or in a milling vise mounted on the lathe carriage. There are also boring units that can be mounted on the tailstock spindle or gripped in a head-

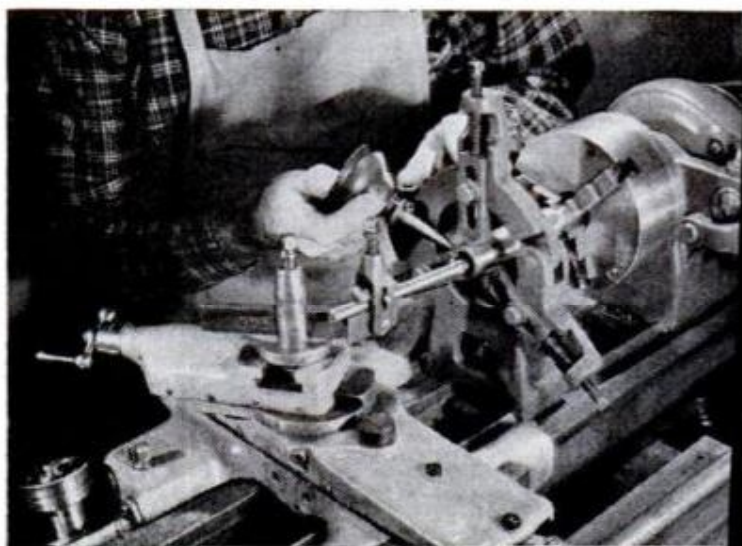
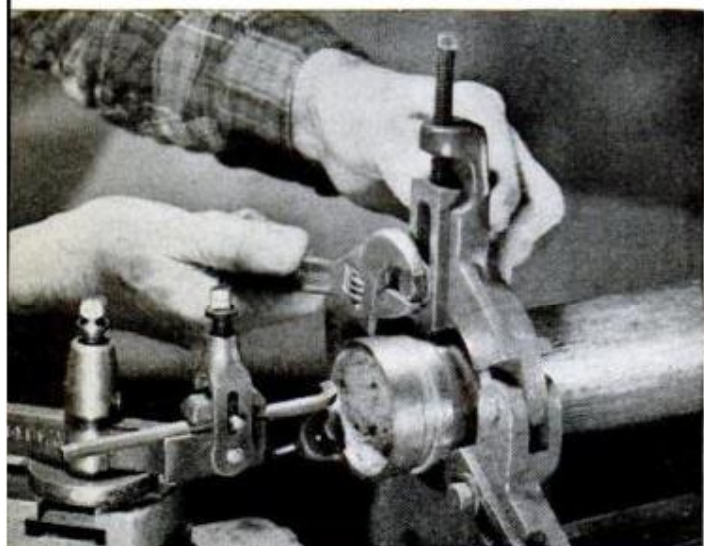
stock-spindle chuck, and which have their own cutter adjustments for determining bore diameters.

Sharpening the bits

An inserted boring bit or a one-piece boring tool can be ground in the same manner as a conventional bit, although it will require more clearance and less rake since it will be cutting into a concave surface. Thus, for all-purpose tools, front or end clearance should be 10° to 20° as determined by the radius of the bore. Side clearance should not exceed 10°; the an-

WHEN BORING LONG CYLINDRICAL WORK, run one end in steadyrest and mount other end in chuck

TO TAPER-BORE A HOLE, use a taper attachment (foreground), mount outer end of work in steadyrest



gle of the end cutting edge should be approximately 10° , and the side rake and back rake will be about half that of conventional bits. Bits for boring brass, however, or those used to cut threads should have zero rake.

For aluminum, steeper side and back rakes are desirable.

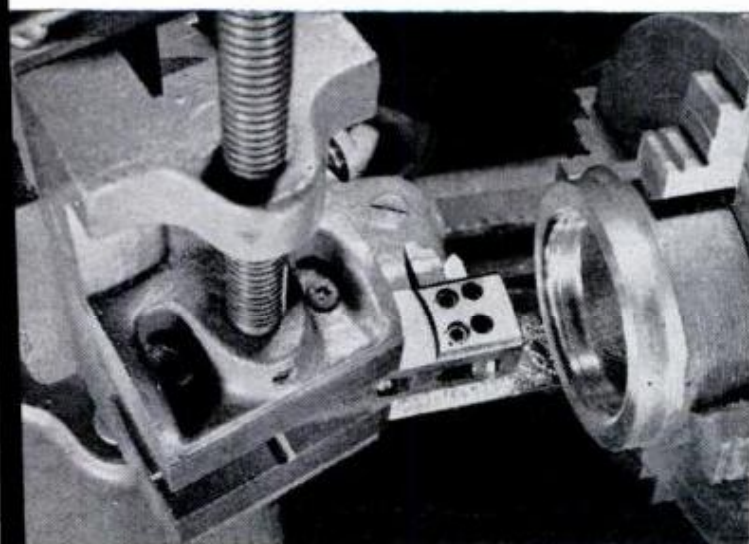
Mounting the work

Rings, short cylinders, nuts, washers, plates and other items of moderate thickness generally are mounted in a chuck or faceplate. Always keep in mind that there must be enough clearance behind the work so the boring bit can pass through the work without jamming up against the chuck or faceplate.

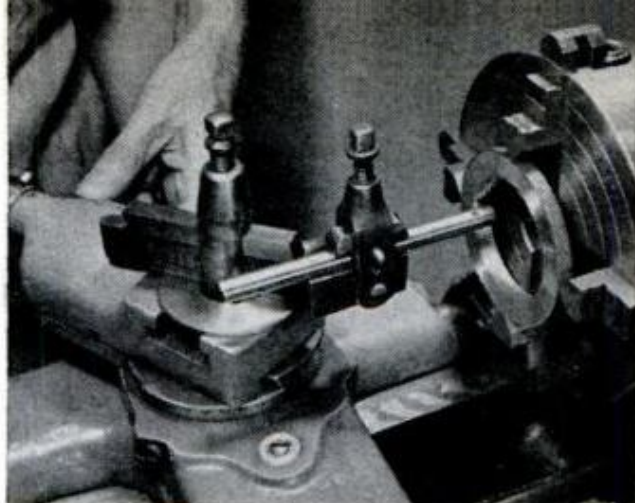
Long pipes, tubes, rods and other cylinders too large to extend back through the headstock-spindle hole can be bored with the aid of a steadyrest. Here, one end will generally be clamped in a chuck, although it also is possible to use a headstock center and dog, the dog being lashed securely to the faceplate with cord or wire to prevent endwise shifting. Then the end to be bored rotates inside the trio of steadyrest jaws.

When a center-supported boring bar is used, the workpiece is mounted on the lathe carriage. This is a useful setup for aligning two or more holes. Thus, two bearing holes some distance apart, such as in an electric motor frame, can be bored in exact alignment. The work can be mounted in a milling attachment or in a jig clamped to the carriage. Of course, accurate vertical positioning—with the help of shims, if necessary—is very im-

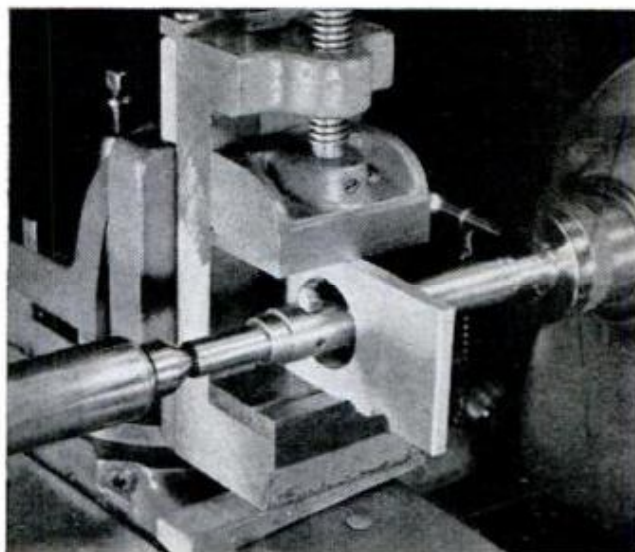
DOUBLE-BIT TOOL is shown clamped in a milling attachment, but also could be mounted on carriage



AUGUST 1968



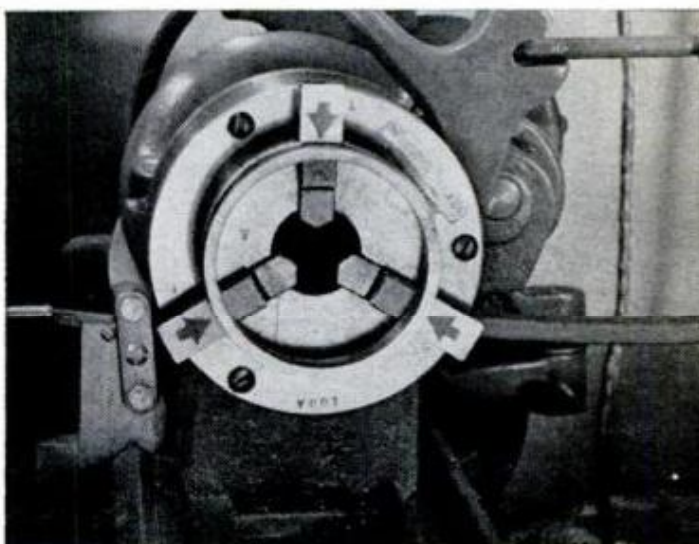
CUTTING INTERNAL THREADS (above) is boring function. Bit is aligned with center, feed is closely controlled. Large hole in plate (below) can be converted to oval by varying the amount of cross-feed slightly



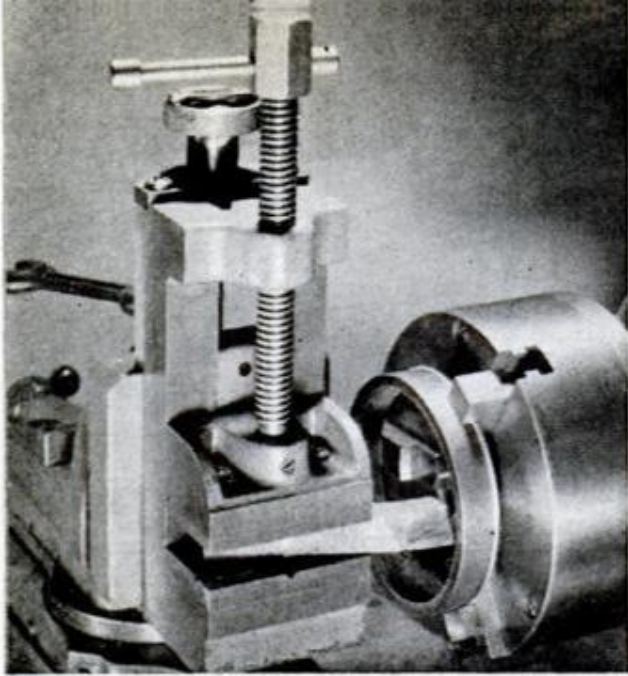
portant to assure exact alignment.

Keep in mind that the chuck-jaw pressure on a ring, especially if it's thin-walled, can make it impossible to produce a truly round bore. This condition can be minimized by using no more jaw pres-

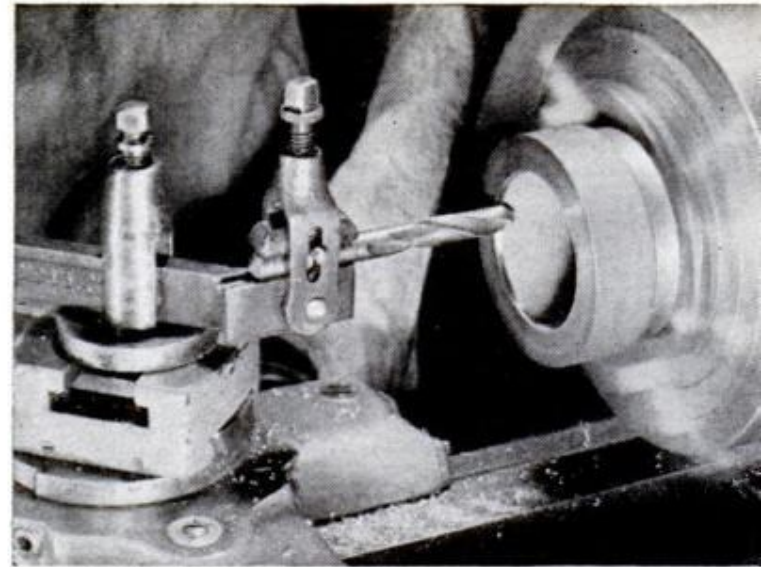
JAW PRESSURE indicated by arrows produces out-of-round holes in thinwall tubes. Use different mounting



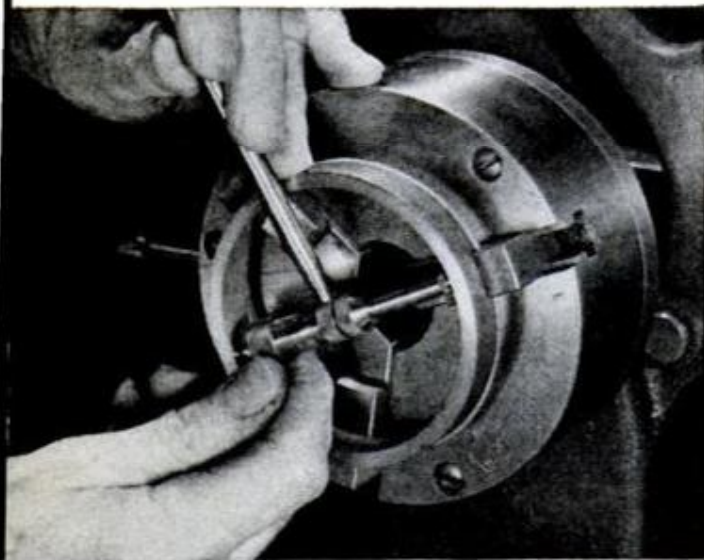
161



MILLING ATTACHMENT on the lathe carriage can be used as holder for oversize tungsten-carbide bit



FOR SIMPLE JOBS, an old drill bit mounted in the toolpost holder will do just as well as boring bits



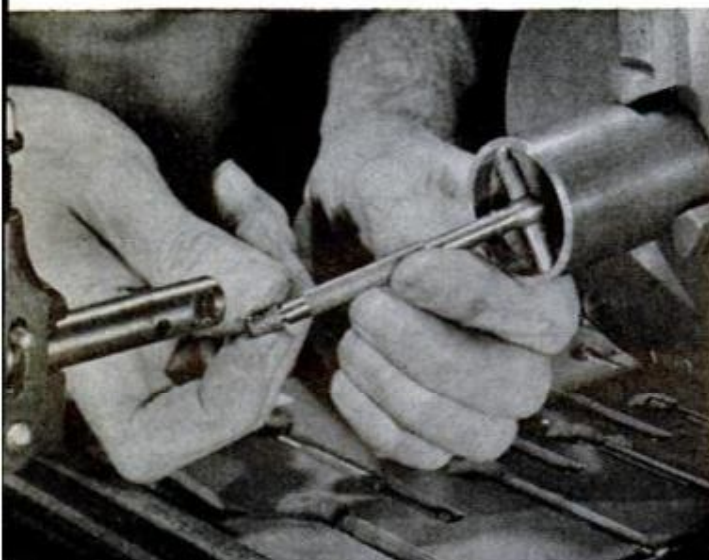
INSIDE MICROMETERS are invaluable when it comes to checking of tolerances for precision boring

sure than absolutely necessary, or by clamping the workpiece in a faceplate-mounted or chuck-mounted fixture that applies pressure evenly around the circumference of the ring.

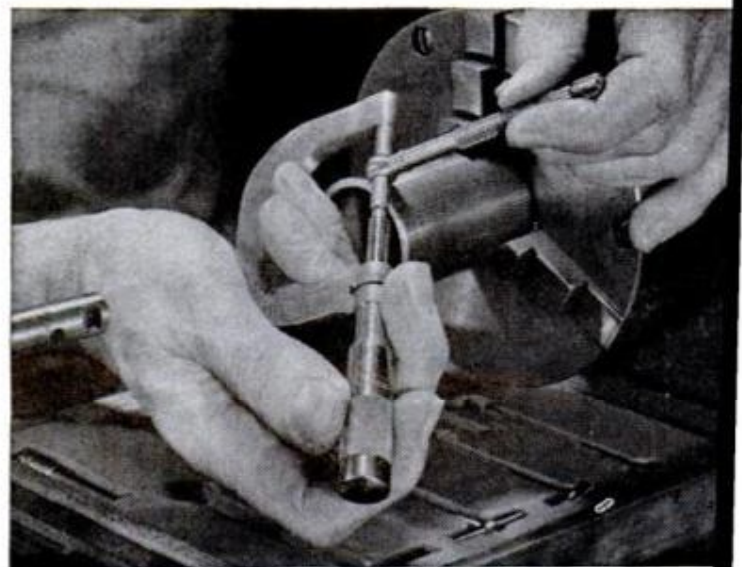
Speeds and feeds

At optimum spindle speed, the boring tool will cut smoothly and without excessive effort. However, because of the variable conditions encountered with every job, the best way to determine the optimum speed is to start slowly and increase it in steps. As soon as chatter occurs, decrease the speed.

Similarly, feed also must be controlled so that material is removed cleanly and smoothly. Here again, the best practice is to begin slowly and then work upward. ★ ★ ★



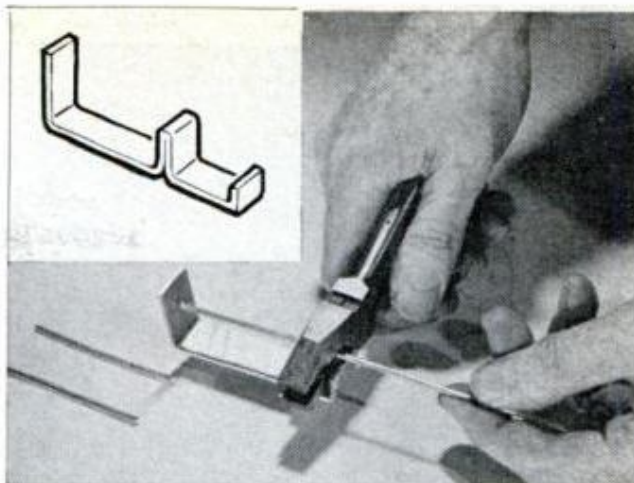
TELESCOPING GAUGES are used to check the inner diameters of smaller work. Tighten knob to lock the arms of gauge (above), then remove gauge, use micrometer to accurately measure diameter (above right)



HINTS FROM READERS

Wire-cutting gauge for pliers

When a job requires several short, uniform lengths of wire, this simple gauge for use with your wire-cutting pliers will enable you to cut them to identical lengths. Make it by bending a strip of sheet metal to form two troughs—a narrow one for the pliers and wider one to match the wire length. The narrow one should be a press fit over the pliers.



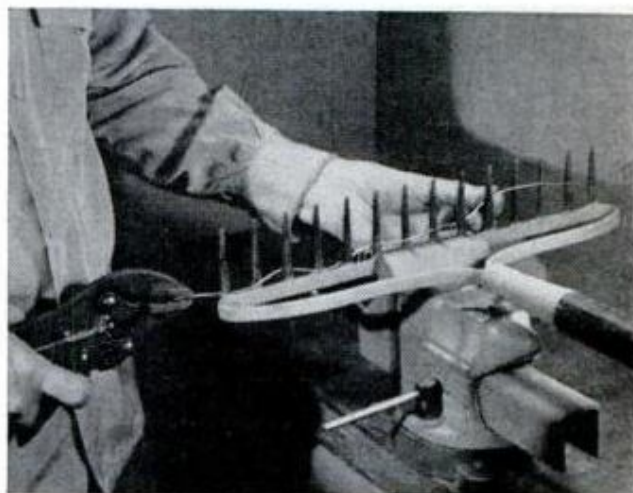
Improvised pipe wrench

Using one jaw of a pair of pliers, you can easily turn a monkey wrench into a pipe wrench. Place the plier jaw between the wrench jaws and tighten it against the pipe in the usual way. This will allow you to turn the pipe in one direction. By reversing the position of the plier jaw, you can turn the pipe in the opposite direction. Naturally, the thicker the jaws of the pliers, the more teeth area to grip the pipe, so use as large a pair of pliers as possible.



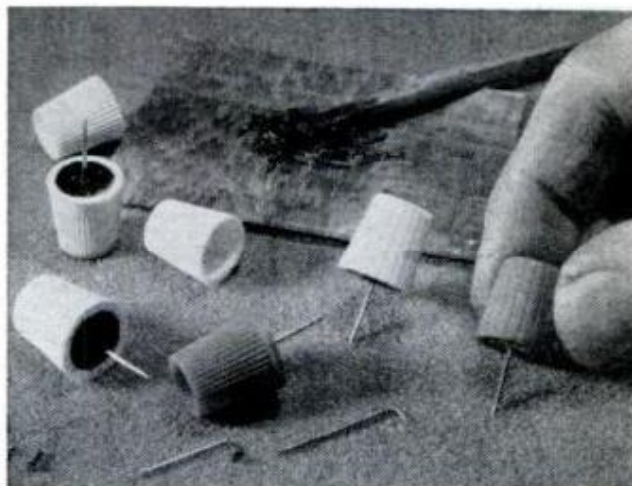
Straighten wire with a rake

If you want to take the kinks out of a length of small or medium-gauge wire, try drawing it through the tines of a garden rake. Just clamp the head of the rake in your vise, propping up the handle so as not to put an undue strain on the ferrule. Weave the wire between the tines, the spacing depending on the size of the wire and the amount of resistance needed to straighten it. Then grip the end with a pair of pliers and pull it through the tines. It's a sure cure for kinks.



King-size pushpins

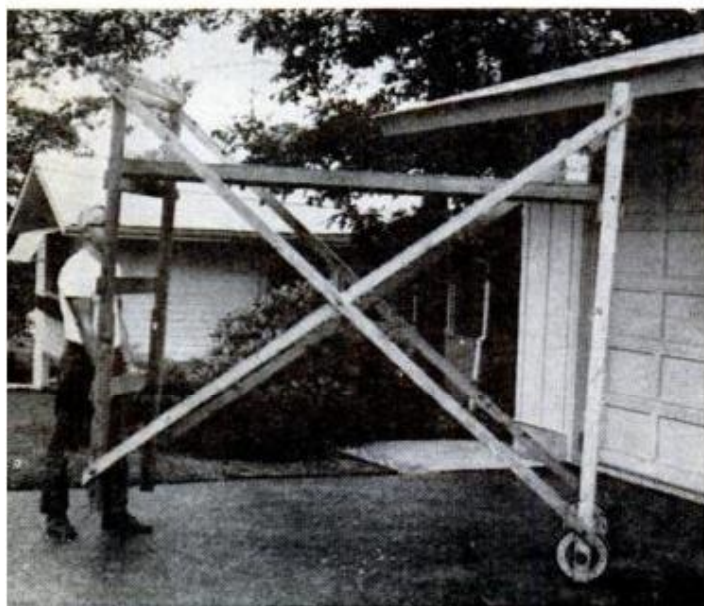
Save the plastic caps from toothpaste tubes or similar containers, and you can use them in making jumbo pushpins for your bulletin board. Just fill them with any material that will harden (plastic auto-body filler, plaster of paris or similar) and embed a pin headfirst in each so that it projects about $\frac{3}{4}$ in. If the pins are too long, cut off enough from the head end to make them the right length and bend this end to a right angle for better anchoring.





PAINTING EAVES of this split-level home is just as easy as ground-level work when the scaffold is used. With extension units added to the ladder sections, the painting platform can be raised as high as 12 ft.

WHEN YOU WANT to move the scaffold to another spot, simply lift one ladder section and trundle it along on wheels. While designed for painting, scaffold is also perfect for construction and repair jobs



BUILD THIS MOBILE SCAFFOLD

This simple movable platform not only speeds the job of painting your house but also cuts the risk of accidents

By **JOHN R. IAMONACO**

Technical Art by Don Evans

PAINTING FROM A SCAFFOLD is both safer and more efficient than trying to do the same job while standing on a ladder. Your footing is more secure. Also, you can cover much larger areas before having to climb down and move the scaffold. With less time spent moving equipment, the job goes a lot faster.

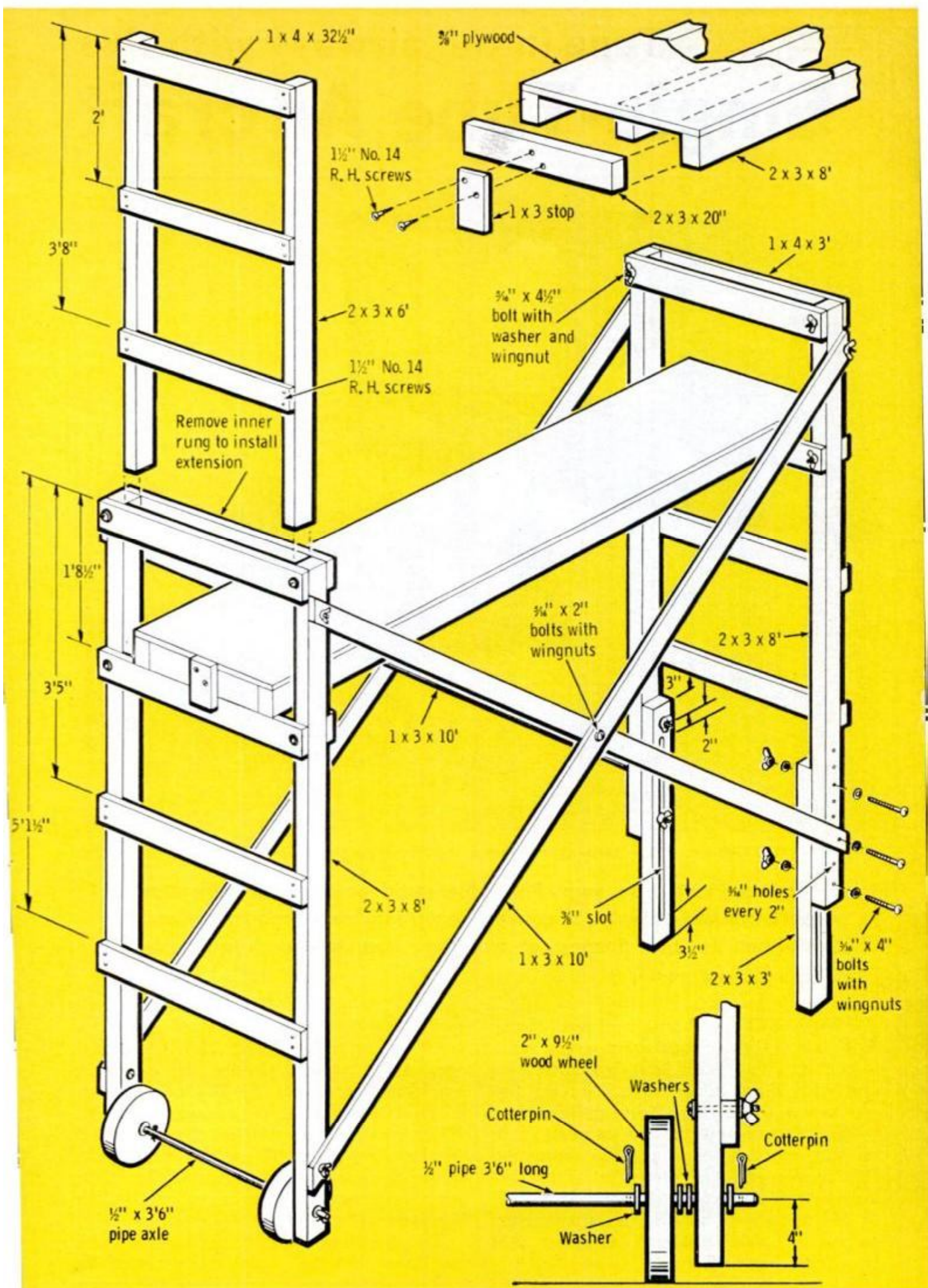
The simple scaffold detailed at the right cost about \$15 to build. Basically, it's just two 8-ft. ladder-type sections connected by a pair of X-braces. One section is equipped with wooden wheels to simplify moving the scaffold from one painting location to the next. If available, you could just as well substitute wheels from a discarded wagon or tricycle.

The other ladder section features adjustable legs which make it possible to use the scaffold on uneven ground. Extension units for both ladder sections allow you to increase the height of the scaffold to 12 ft.

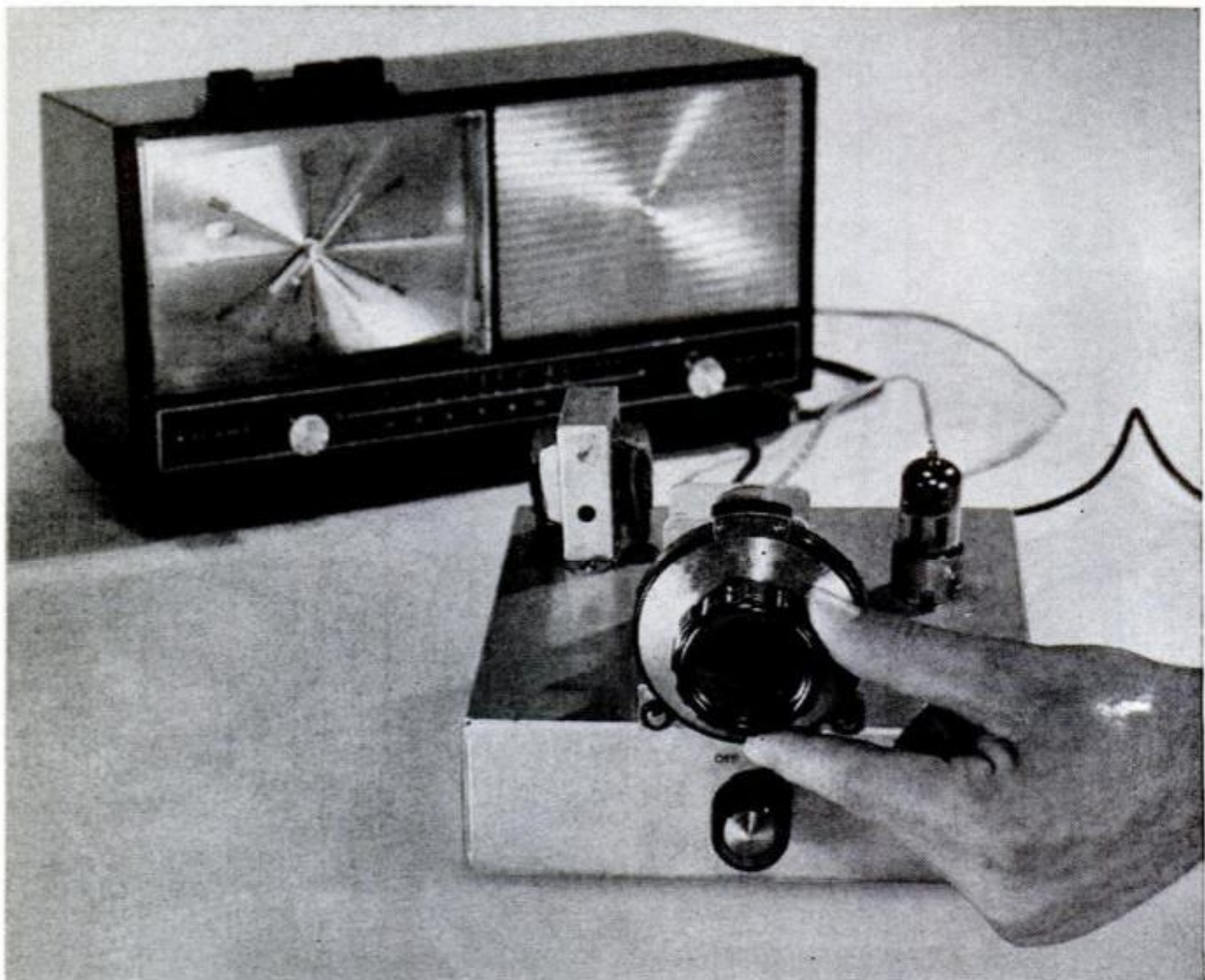
The box-type platform shown in the plan has the advantage of being much lighter than a solid plank. Retainer studs on either end fit over the ladder rungs and prevent the plank from slipping. Rung spacing permits placing the plank at height intervals of 2 ft.

When not in use, the scaffold can be disassembled and stored flat. Simply remove the wingnuts from the eight anchor bolts securing the X-braces and fold the braces together. Once you've taken it apart, the scaffold is compact enough to store in your garage. ★★★

POPULAR MECHANICS



Tune in the airways with this Single-Tube Aircraft



CONVERTER IS TUNED over 110 to 144 megahertz band with vernier dial for precise pinpointing of frequencies

Just connect it to your AM table radio or to your transistor portable and listen to it convert reception from broadcast band stations to the dozens of exciting aeronautical frequencies

By **CHARLES GREEN**

Photos by Robert Borst

GIANT JETS and small private planes are in the air constantly, using radio to contact airports for landing instructions and other flight information. You can listen in on these radio transmissions between control towers and aircraft with nothing more than your table radio and this simple one-tube converter. The converter tunes the aircraft band from 110 to 144 megahertz with a radio frequency output of 1500 kilohertz to your AM broadcast-band receiver.

Signals are fed from the antenna via

jack J1 to coil L1 and tuned over the band by tuning capacitor C1A. The tuned signals are coupled through the parasitic suppressor network R1-L2 to capacitor C3 and the grid of the mixer V1A. The RF output of the oscillator circuit of V1B is also coupled to the mixer grid via a gimmick capacitor and is tuned above the incoming signal's frequency by L3-C2A (ganged with C1A).

The frequency difference between the oscillator and the signal is converted by the mixer into an intermediate frequency

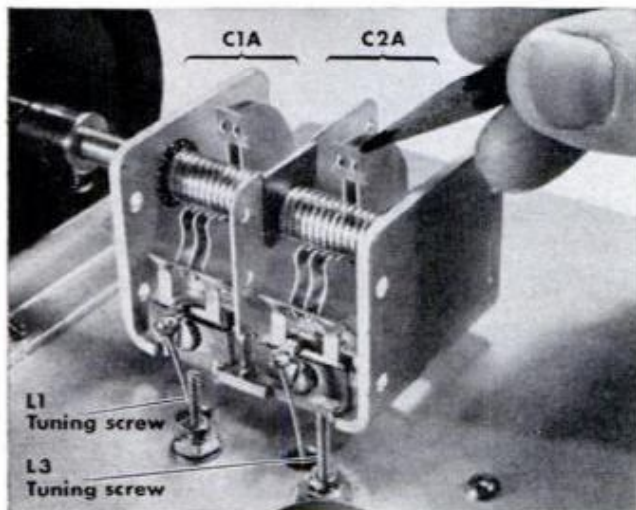
Band Converter

that is coupled to your AM receiver via coil L5, capacitor C7 and jack J2.

The power requirements of the circuits are supplied by transformer T1 and the half-wave rectifier D1, with the B+ voltage filtered by resistor R8 and capacitors C9A and B.

The converter is built on an aluminum chassis with a vernier dial for easy and accurate tuning. And a built-in a.c. power supply makes the converter a self-contained compact unit.

TWO-GANG TUNING CAPACITOR requires modifying. Remove a rotor blade from each end of both sections



The 7x7x2-in. aluminum chassis is roomy enough to work in without getting a cramp. The best way to start construction is to mount the vernier dial on the front center of the chassis. A 2 $\frac{3}{4}$ -in. section of $\frac{1}{2}$ -in. aluminum angle stock was handy for our use, but two small brackets can be used instead.

Temporarily position the tuning capacitor (C1A, C2A) behind the vernier dial and mark the mounting hole locations on the chassis. Remove the tuning capacitor and drill the mounting holes. Fasten the tuning capacitor to the chassis with spacing nuts to keep the frame level with the vernier dial. Make sure that the tuning capacitor is aligned so the dial does not bind as it is tuned.

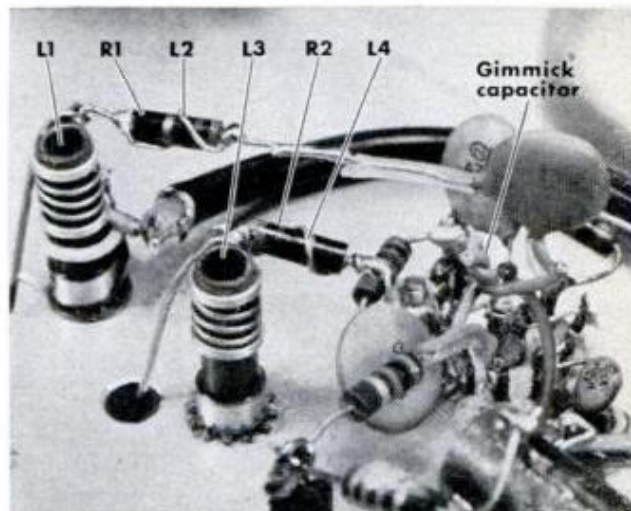
Lay out the position of the remaining components on the top of the chassis, keeping them in the same relative posi-

tion as shown in the photo. Because of the high-frequency operation of the unit, parts placement is critical. Drill two $\frac{1}{4}$ -in. holes as shown in the photo for connections to the tuning capacitor stator sections. Mount the tube socket and other components on the chassis.

Winding the coils

Wind coils L1 and L3 as shown in the drawing. Install a ground lug on each coil and mount them to the chassis. Care-

PARTS PLACEMENT around the tube socket should be as shown. Note configuration of gimmick capacitor



fully remove two rotor blades (one at each end) from each section of the tuning capacitor as shown in the detail photo. Best way to do this is to cut the insulating strip at the point it joins each blade and bend the blade out until it snaps off.

Wind the parasitic suppressor assemblies R1-L2 and R2-L4 as shown in the drawing. The wire is wound directly over the resistor body with soldered connections to the resistor leads at the point where they join the resistor body. Wire the components as shown in the drawing, keeping the leads as short and direct as possible. Keep the parasitic suppressor assemblies and C3, C4 up and away from the chassis and other components. After running the RG-58A/U coax cable from the antenna jack J1 to the coil L1, wind a one-turn length of No. 22 hookup wire around L1 (between lower end of the

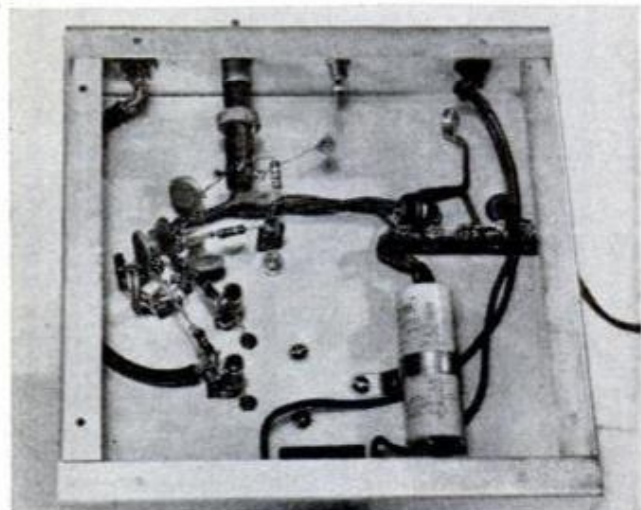
coil and the coil base) and connect the ends to the coil ground lug and the coax inner conductor.

The gimmick capacitor, shown in the detail photo, is made by connecting two lengths of No. 22 solid insulated wire to pins 2 and 7 of the tube socket. Tightly twist the wire lengths together two turns and cut off the excess wire.

Alignment with signal generator

To align the converter, preset the tuning screw of L1 $\frac{5}{8}$ in. from the top of the chassis, the tuning screw of L3 $\frac{3}{4}$ -in. from the chassis top, and L5 $\frac{5}{8}$ in. from the chassis side. Insert tube V1 into its socket and connect J2 to a broadcast receiver antenna input and ground terminal with coaxial cable or a twisted pair of

FOUR-LUG TERMINAL STRIP at right aids wiring of power supply. Mount R8 and D1 and make connections



wires. If the receiver does not have terminals for external antenna and ground connections, wind five turns of insulated hookup wire around the receiver's antenna loopstick and connect the hookup wire to J2 with coax or twisted pair.

Connect the converter's power cord to the a.c. line, turn on S1 and allow the unit to warm up for a few minutes. For best results, a signal generator is required to align the converter properly.

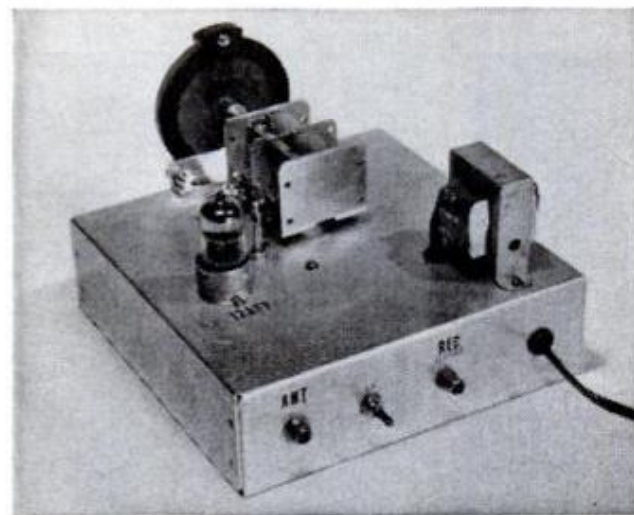
Set your AM receiver dial to 1500 kilohertz. If a strong station is received, set the receiver to a clear, nearby frequency. Connect the signal generator to J1 and adjust the signal generator controls for a 1500 kilohertz modulated output. Adjust the generator output control until the signal is heard in the receiver, then adjust L5 for maximum received signal.

Set the tuning capacitor so that the

blades are not quite fully meshed and adjust the two trimmer capacitors C1B and C2B for minimum capacity. Set the generator controls for a 110 megahertz modulated output. Adjust the tuning slug of L3 until you hear the signal in the receiver. The signal will be heard at two positions of the tuning slug, set it at the one that is highest from the chassis top. Adjust L1 for maximum signal.

Set the tuning capacitor so that its blades are almost clear of the stator (near minimum capacity), and adjust the signal generator controls for a 144-megahertz modulated output. Adjust the tuning capacitor until you hear the signal, then adjust C1B for maximum signal. If the 144-megahertz signal can not be

BACK OF CONVERTER CHASSIS shows antenna jack J1, receiver jack J2, L5 tuning screw and a.c. line cord



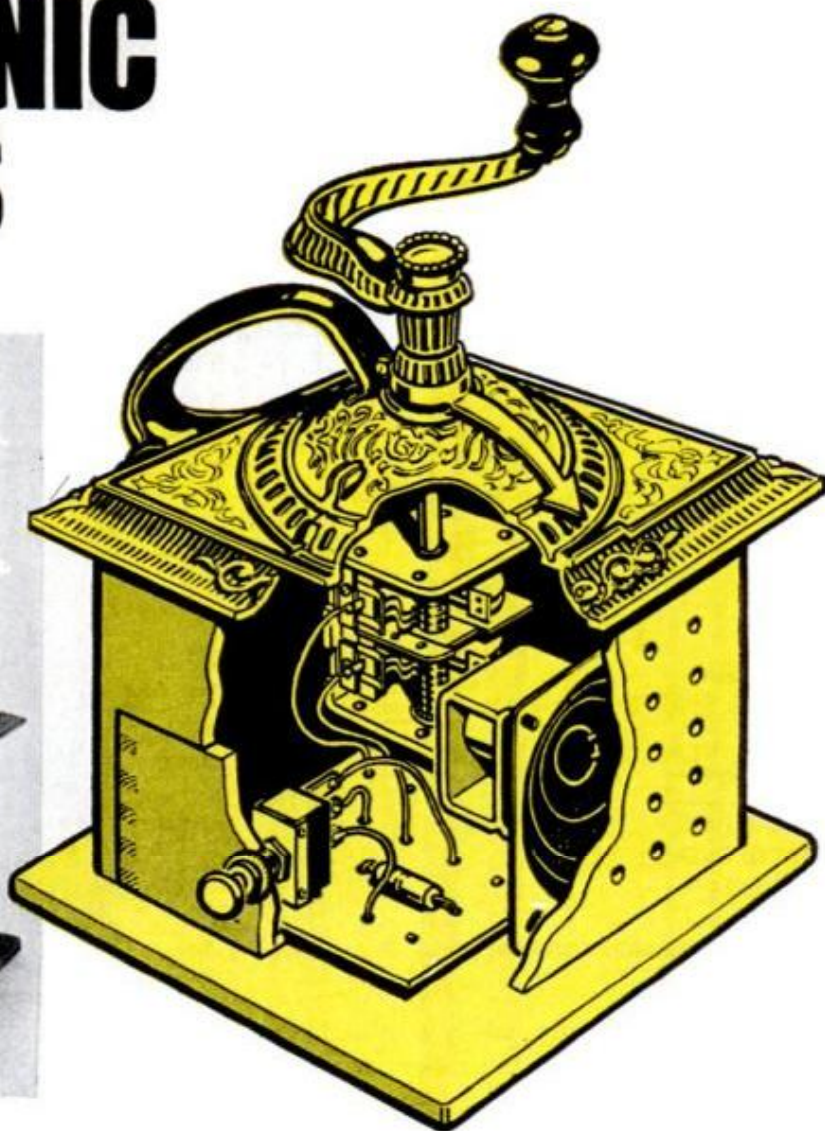
heard, adjust C2B until the signal is received. If you have no signal generator, try adjusting L3 (with an outside antenna connected to J1) for reception of an FM station around the top of the FM band (near as possible to 108 megahertz). Adjust L1 for maximum signal. Then try adjusting C1B and C2B with the tuning capacitor blades at minimum capacity for any 2-meter ham signals near 144 megahertz.

This method of adjustment without any signal generator depends on the availability of any stations on the air on these frequencies. Adjust L5 for maximum signal as necessary.

A few notes on operation of the converter should be helpful in getting you started.

Aircraft signals have a line of sight type of propagation, similar to TV signals. Aircraft signals are usually vertically

ELECTRONIC KINKS



Antique coffee grinder functions again . . . as a kitchen radio

If you've enhanced your kitchen with the charm of an antique coffee grinder, don't put that cold, plastic transistor radio next to it and destroy the effect. Put the radio in the coffee grinder!

The installation can be accomplished by removing the components of the radio from the plastic case. Then just remount them in the coffee grinder as shown in the cutaway drawing.

Details of your installation will depend on the type of coffee grinder and radio you have. On this one the drawer is eliminated and the pull is replaced with the on-off switch and volume control. The tuning capacitor is connected to the grinder handle and shaft, and a pointer is mounted under the handle. Finally, the top edge of the coffee grinder is calibrated for favorite stations.—*John De Madaler*



Flashlight checks fuses fast

Quickly test fuses by using a flashlight as a continuity checker. Turn on the switch, unscrew the base and insert the fuse as shown. If it's good, the flashlight will light.—*Wilfred Beaver*

How to clean tight spots in a radio or television chassis

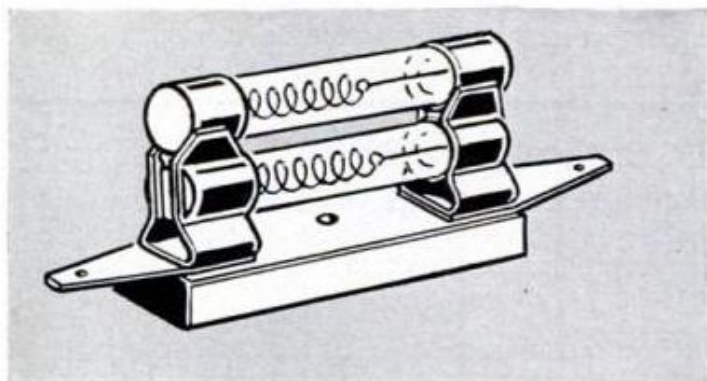
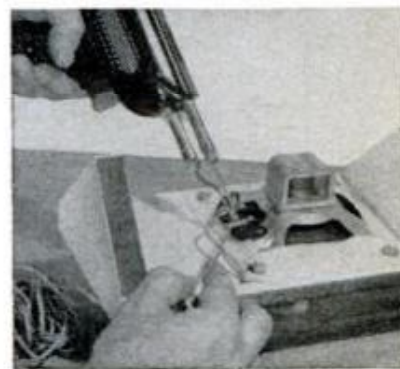
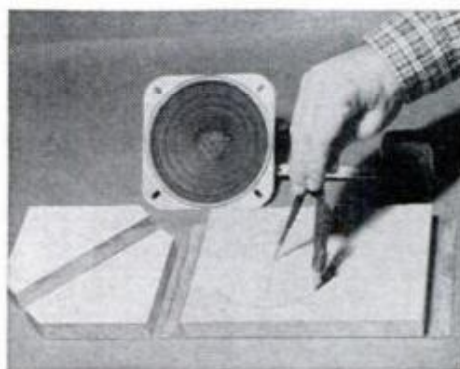
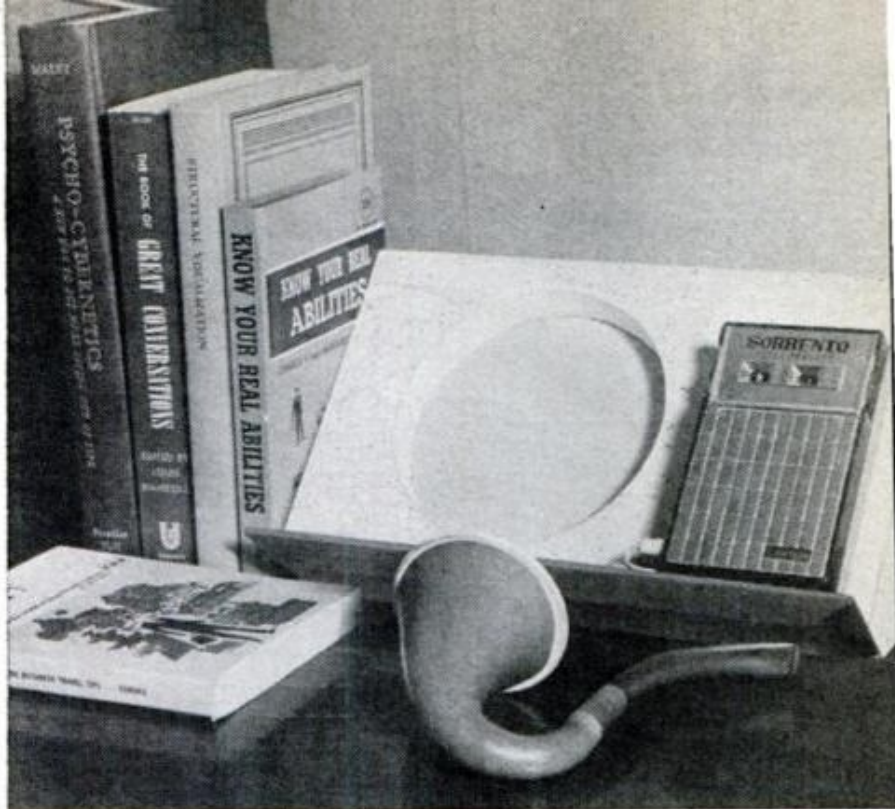
When you troubleshoot and repair a radio, television set or other piece of electronic equipment, it's a good idea to clean it up while you're at it. Use a common soda straw to get at dust trapped in tight spots. Just blow into one end of the straw while you direct the other end into the crevices.

Get bigger sound from a small transistor radio

It's no secret that a small transistor radio delivers a lot fuller sound if it's working into a bigger speaker than its own tiny one. The problem is how to connect a larger speaker without extensive modification and without destroying the radio's portability. Quite simply, you can plug a large speaker into the radio's ear-phone jack. This cuts off the radio speaker and lets the big one take over.

To make this speaker substitution convenient for tabletop listening, you can make a radio shelf and speaker baffle as shown. Based on a 5-inch speaker diameter, the shelf is designed with an earplug permanently wired to the speaker with a length of speaker hookup wire just long enough to reach the earphone jack.

—Robert Burgett



How to come up with the right fuse in an emergency

If you've just blown a 30-amp. fuse, have no spare, and there's no store open to get another, just solder two 15-amp. fuses together in parallel. The current will split in half and flow through each of the two fuses equally.—Joseph Braunstein

Tip for quick troubleshooting of tube-type electronic equipment

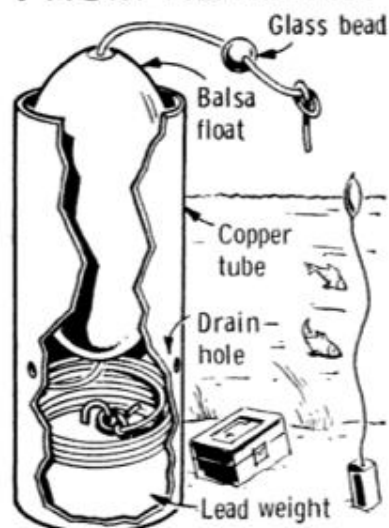
Get those tubes out without waiting for them to cool or burning your fingers. Cut a finger off a large, old rubber glove and use it as a sleeve to pull the hot tubes from the equipment.



Extension for hard-to-reach toggle switches

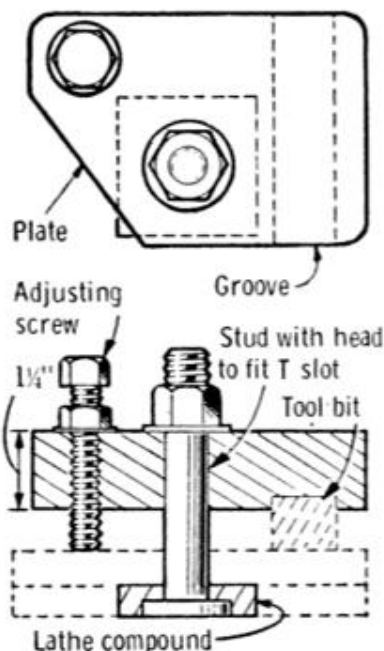
You sometimes have to throw a toggle switch in a hurry that's out of reach or perhaps partially obscured by dim light. You can make it more accessible by using a section of old ballpoint pen as a handy extension.

HINTS FROM READERS



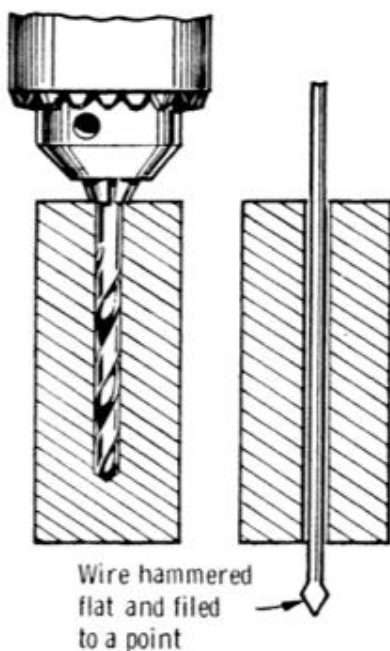
Instant buoy

Designed for marking the location of objects accidentally dropped overboard from your boat, this self-contained buoy and anchor will probably pay for itself the first time you use it. The copper tube holds a brightly painted balsa float and enough line to reach bottom in your boating water. Melt lead and pour it into the tube for ballast.



Tool-bit clamp

A conventional toolpost is too small to hold large form-type tool bits, but this simple clamp takes them with ease. The rectangular base fits into the T-slot on top of the lathe compound. Plate is grooved to provide side support during heavy hogging cuts. Bit can be adjusted to proper height with packing, if this proves to be necessary.



Long-reach drill

When boring a hole through a heavy timber, you may often find the drill is too short to go through. If it's impractical to drill from the other side, try improvising an extra-long drill from heavy wire on light rod. Hammer one end flat and file or grind it to a point. Partly drilled hole serves as guide, so completed hole is straight.

NEXT MONTH IN SHOP AND CRAFTS

40 PAGES OF BRIGHT, NEW, HOME-IMPROVEMENT IDEAS. Built-ins, add-ons and ingenious remodeling tricks that will make your house more livable without putting a painful strain on the budget—that's the big bonus featured in the September issue of PM. Among others, you'll find:

LOW-COST LUXURY FOR YOUR HOME. The cost may be low, but the return is high with these budget-minded improvements that make the difference between "just a house" and a home people remember.

EXTRA CLOSET SPACE. No home has too many closets, to hear wives talk. Here's the lowdown on turning that unused corner into a useful closet.

WONDERS WITH SHELVES. Modern shelf standards and brackets offer limitless possibilities for space-conscious remodelers. This grab bag of clever shelf arrangements may well include the solution to your problem.

NEW LIFE FOR OLD DOORS. Turn an ugly paneled door into a modern flush door. Match the rec-room door to your prefinished paneling. The secret is a new ultra-thin plywood paneling.

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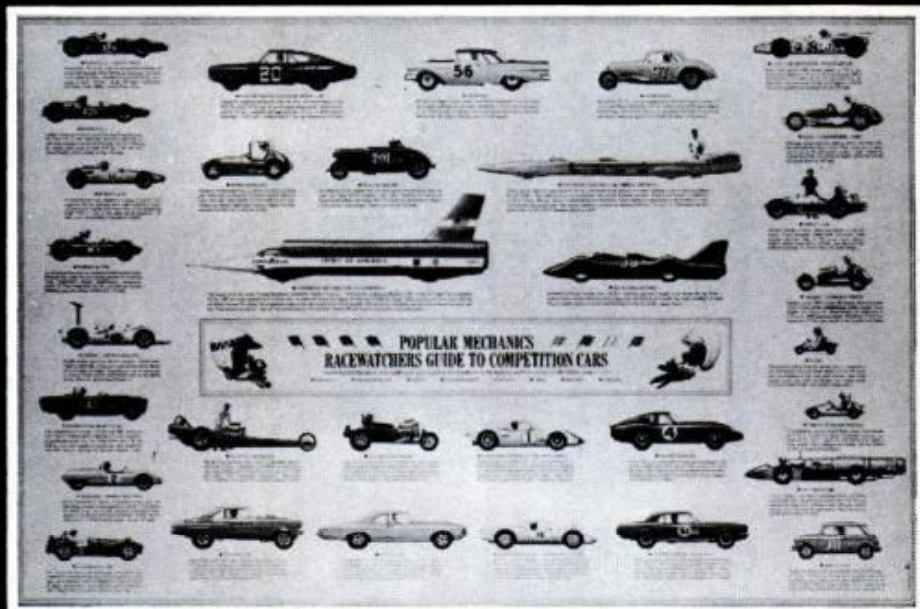
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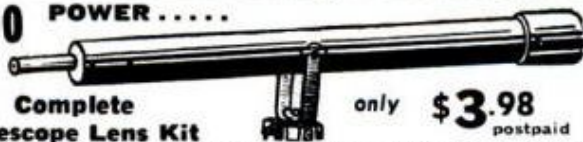
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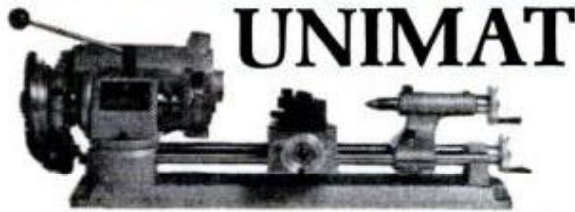
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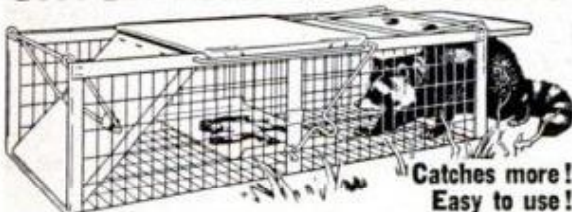
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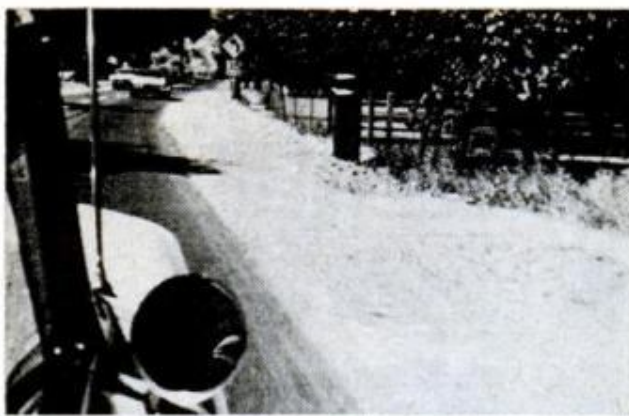
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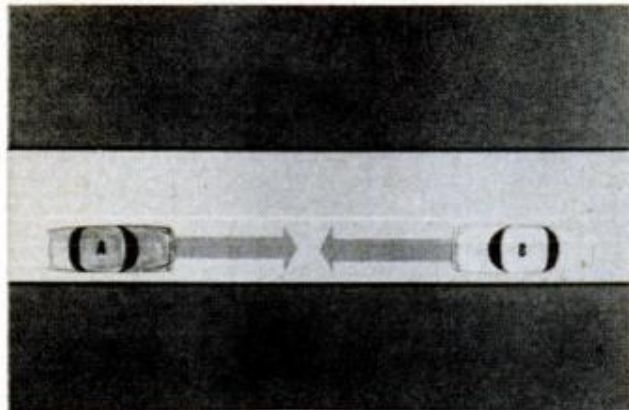


STRAIGHTEN UP, DRIVE RIGHT

(Continued from page 63)

SITUATION: Let's assume you had to use this gravel shoulder as an escape route. There's a telephone pole to your right, a traffic sign and pole ahead. What should you *not* do?

ANSWER: Stay off those brakes! Braking on a gravel surface could cause you to lose traction, throw you into a spin, meaning you might smack that pole, broadside into the fence, sign, and pole ahead. Best bet: Steer to avoid impact.



SITUATION: You're in Car A, driving down a two-lane road. The fellow in Car B fell asleep at the wheel and drifted into your lane. Looks like a certain head-on crash. Should you swerve left?

BEST BET: Not on your life! Never move left in such a situation. Why? If he wakes up in time, the guy in Car B will yank his wheel to *his* right; if you had swerved left, his swerving right would put you both on a collision course. Better you move to *your* right, even if it means going off the road.



SITUATION: You're driving down a winding mountain road. Another car gets onto your tail, weaves back and forth as though the driver is drunk. You want to shake him. How? Slow down? Speed up? Signal him to pass? Pull off and let him pass?

BEST BET: Pull off and let him pass. Getting off the road to let an erratic driver go by indicates your awareness of potentially dangerous situations, means you're exercising good driving sense.



SITUATION: You're gaining rapidly on that car up ahead. Is it safe to pass him?

BEST BET: No. There's a curve up ahead and you can't see far enough around it to tell whether something's coming the other way, or whether there's an obstruction in the road. You're not in *that* much of a hurry, so slow down until you've got clear sailing.



SITUATION: Look this one over carefully. In which lane would you choose to drive?

BEST BET: Lane B would be best in this situation. It's a fast lane, it's clear of traffic ahead, and it's not next to that center divider that has no fence on either side of the overpass. Lane B also gives you the possibility of going either way in case a sudden emergency blocks your lane. ★★

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THOSE VIETCONG ROCKETS

(Continued from page 73)

rockets. Not even our helios (helicopters) could spot 'em."

The Q-4 radar Hoskins mentions is the AN/MPQ-4A which is used to trace high-trajectory mortar rounds back to their guns. It's useless against rocket and artillery shells with their flatter trajectory, greater speed and sleek configuration.

"No country has yet been able to field a reliable radar system that will track flat-trajectory projectiles under all conditions," Lt. Col. Thomas N. Ellis of the electronics division, Combat Developments Command (CDC), Fort Belvoir, Va., states. "However," he adds, "a system to do just that is now in advanced development and hopefully will be ready for Vietnam in late 1969 or early 1970."

The new system reportedly will be able to pinpoint the location of any known artillery or barrage rocket. It will operate in a manner similar to Q-4.

An incoming round will pass through two scanning beams, sending blips to a scope. Azimuth and range strobes will be positioned over the scope, and a computer will figure out the coordinate location of the weapon. This information will be related to counter-rocket batteries.

Why wasn't the use of rockets by the VC anticipated, so this system could have been ready before next year?

Recent increased VC rocket action, which makes the need for this radar critical, opened the treasury. But there's another reason.

According to Col. Ellis, "We couldn't until now develop a practical system that would work. We had a system in 1965 called the AN MPQ-32, but stopped the project when its weight hit 60,000 pounds."

Radar tracker must be portable

"The system we need for Vietnam," Lt. Col. Edgar G. Miles, weapons division of CDC, points out, "must be light enough to fit on a vehicle. Three years of electronic development since Q-32 have given us answers."

Until the new system is ready, GIs will have to rely on sound-ranging and flash-ranging systems to locate barrage-rocket emplacements. Also on luck. Every so often a helicopter will spot them or a patrol will knock off a forward observer.

Sound-ranging devices date back to World War II. Several microphones are set up to try to pinpoint range and direction by sound waves. The problem is to distinguish the sound of rockets from the sounds made by other things, such as a flock of birds flapping their wings.

Flash ranging dates back to World War I. Several spotters use optical instruments to try and locate a weapon's flash by triangulation.

"Obviously," Col. Miles points out, "if you can't see the flash, you can't get an azimuth."

And the VC are very careful about hiding flash. They are also very careful about making sure of their shots.

"When a man lugs rounds on his back for weeks from north to south, he wants to make sure he hits what he aims at," Maj. Richard E. Nelson told me. Maj. Nelson, now in combat operations at CDC, was a senior advisor to the 1st Vietnamese Armored Cavalry before being wounded in the Iron Triangle (the area bounded by Phu Cuong, the Saigon River and Highway 13).

Unfortunately, the Vietcong have been aided in hitting targets by our own people.

"We've made some bad mistakes," Capt. Dennis J. Gresdo of Hawthorne, N. J., says. He commanded a platoon before a VC machine gun raked his back.

"Only after our base camp was clobbered by mortars and rockets did we understand just how fatal those mistakes were," he explains. "One was bringing in local women to fill sandbags. They paced off our camp and picked out prime targets for their men in the hills.

"But the worst mistake was when some of our own people acted like tourists and took pictures of the camp. They brought the film into town for developing. The VC had a perfect pictorial map of our installation." ★ ★ ★

TORINO OWNERS REPORT

(Continued from page 67)

thought we had purchased a new T-bird."

Not everything in the interior of the Torino is the way owners would have it if they designed the car, however. For one thing, more than enough Torino owners prefer a front vent-pane window instead of the one-piece side window to justify Ford offering buyers the option of choosing between the two designs. (And this goes for other manufacturers as well.)

Other interior complaints fall into the overall category of poor workmanship—the biggest complaints of Torino owners. Wind noise around the windows due to less-than-perfect fit bothers some; erratic or dead clocks tick off others; loose trim and sloppily operating control knobs annoy still more.

On the outside, the quality of the paint job is among the most mentioned workmanship complaints. ★ ★ ★



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DEAR MR. AUTOMAKER:

(Continued from page 79)

the "good job" talk is starting to fall on deaf ears. I'm not alone in saying this, Mr. Automaker; it's what I read in my mail, hear on my phone, distill from our *Owners Reports*. Here's what owners tell me:

Your prices are too high. People don't care much about *your* costs; they still think you charge too much. Few believe you when you say you have to get \$100 and more for a few yards of plastic billed as a "luxury vinyl top."

Your model lineup is too confusing. You've spawned so many new models and power transmission combinations that your customers don't know *what* to buy. For example, there are 15 allegedly different cars bearing the name "Chevelle." They can be powered by a choice of two or more of five different engines, coupled with a choice of three (or four?) transmissions. I'm for choice, but this loses me.

All dealers don't inspire confidence. Many—I'd like to say the majority—dealers are honest, but a lot of car owners tell us some incredible tales of dealer hanky-panky. By pushing dealers to high volume, you've allowed showrooms to take on the atmosphere of a gambling casino; a buyer is bucking odds that are *all* in the house's favor—and knows it.

Service leaves something to be desired. You urge owners to bring their cars "home" for service. Fine, except the fram-mis is busted *now*, and the service manager says he'll "try and work you in" in a few days, "maybe next week." Even then an owner may go back two or three times before the thing finally gets fixed. This routine probably loses you more friends than all your other headaches together.

The point in mentioning all this, Mr. Automaker, is that there's less joy out there in Mudville than you might think. It seems the old magic is dying. I think it's dying because—right or wrong—people feel you're not really in the car business the way you used to be. You don't *love* cars the way Henry Ford and Walter Chrysler and Ransom E. Olds and William C. Durant did. As a result, you've taken a lot of the fun, the excitement and romance out of cars for those who once waited with sweaty palms for the first Model A, the Chrysler Airflow, the post-war Studebaker, the Corvair, and so on. Why, even the Mustang is five years old.

I'm afraid too many of your customers have the idea all you care about a given car is, "Will it sell?" And this, Mr. Automaker, isn't good.

Sincerely,
BILL KILPATRICK

FUTURE AIRPORTS

(Continued from page 85)

Paris-Nord Airport far out in the country, plans a direct connection with its subway system. New York has also examined the feasibility of extending its subway system out to its bottlenecked Kennedy and LaGuardia Airports.

In addition, New York has looked at an altogether new concept, the railbus. A standard passenger bus was fitted with railroad wheels in addition to its regular wheels and run on a standard railroad track. The idea is that, once the bus has collected its passengers, it could get off the street and out of traffic and ride, rapid-transit style, on rails to the airport.

PM Editor Robert Crossley rode the Tokyo monorail out to the Tokyo airport on a recent visit, and found only one drawback. Few air travelers use it. The starting terminal is too far from the center of town. A monorail has several advantages for airport use. It's above traffic and can ignore it; it can handle large crowds of people, even for specific airlines or flights. The twin cities of Minneapolis and St. Paul are studying a plan which would link their downtown areas by monorail with their jointly operated International Airport, which lies south of them. The monorail would also link the two business districts.

Westinghouse's rubber-tired bus proposal is similar to the monorail—it rides above traffic on its own track. But the bus-train is completely automatic. It has no motorman or engineer. All trips are controlled from a central traffic complex. Tampa, Fla., is planning to install one.

Ultimately, however, the solution to the ground bottleneck may come in part from the air. STOL and VTOL aircraft may help break it. Helicopters are already shuttling passengers from downtown locations out to the airports in major cities. The new vertical-rising winged aircraft may open up a new era in pinpoint travel.

Meanwhile, the Los Angeles plan may combine the best of all systems. A bus would pick you up at your hotel or some other central location, drive to some satellite terminal such as the roof of Union Station, where it would be lifted bodily by a flying crane-like helicopter, flown to the airport and disengaged from the helicopter. It would then drive to the jetliner's door. The ticketing and baggage handling would have all been done beforehand or on the bus or plane. It's as close to a no-fuss system of getting to and from the airport as has been proposed.

Time will tell—that's what the game is all about. ★★



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IT ISN'T FISHING . . .

(Continued from page 90)

counts, and individually heavy fish are not wanted. In the big angling championships, when good sums of money may be taken in prizes and bets, a competitor hooking a three-pound chub will purposely break the line and tie on a new hook rather than waste time playing the monster. One extreme example of fishing small was the man who won an important competition with a top weight of 17½ pounds of fish in his keep-net at the end of the day. His *entire* catch was made up of bleak (*Alburnus*)—whose average weight is under two ounces.

Harling with ghillies

Scotland claims the invention of the most boring of all kinds of fishing. Indigenous to the River Tay, it is called "harling" and starts every year with a bang on Jan. 15, when the salmon season opens and bottles of Scotch are broken over the bows of the rowboats. To go harling, you hire a boat and two boatmen and sit in the stern with one or two spinning or fly lines drifting idly behind. All day long the ghillies row back and forth across the river, using *their* skill to drag *your* lures across salmon lies that have been known and studied for centuries. If you hook a salmon you are rowed to the bank to play and land it. Then you go on harling again. Harling seems unlikely to meet with popular approval among the casting purists of the Restigouche.

For some reason, the most successful of Irish fishing techniques is hardly used in other countries. Yet there are many Irishmen who will not fish at all unless it is to "dap." The dapping season starts in mid-May, when the Mayfly begins to hatch on the great limestone waters like Loughs Corrib, Sheelin, Derg and Deravaragh.

Dapping in a wind

Dapping can be done only from a boat, and in a strong wind. It is called dapping because you dap the fly on the water, rather like skittering for bass or pickerel. A great strong rod, up to 18 feet in length; any kind of reel that carries an 8 to 12-pound monofilament; a size-8 hook; and a box of live Mayflies: That's the equipment.

Impaled on the hook are two Mayflies (according to some experts, they should be one male and one female). When the rod is held up at about 45°, the great wind makes the light line billow out 20 or 30 feet before the boat, and the flies dip and dance on the water just as if they were

coming down to lay their eggs. Raise the tip of the rod, and the flies flutter uncontrollably in the air. Lower it too much, and they drown. (Wasting good flies is unpopular with the ghillies, who may have spent a couple of hours that morning gathering green flies from the lee side of rocks and from grass and reeds at the water's edge.)

In dapping there is no casting to be done; and when a great three-pound trout rises to the fly, the fisherman must forget all his previous learning, lower the point of the rod, and start patiently counting. Count up to three, or five, or eight, advise different experts, before tightening up to set the hook. Later in the season, when dapping with grasshoppers, you should count up to 20. One excitable novice missed his first 17 rises, but at last connected with the trout that became 18th; it weighed seven pounds.

Such is the appeal of dapping that small boys in the western villages are bribed to send urgent telegrams to Dublin as soon as the first hatch of Mayfly is spotted. In the city, fishing gear lives permanently in the cars of professional men—bankers, lawyers, doctors—ready for instant departure. It is said that provident Dublin ladies ensure that they will not, between mid-May and mid-June, require the services of an obstetrician, for one could certainly not be found.

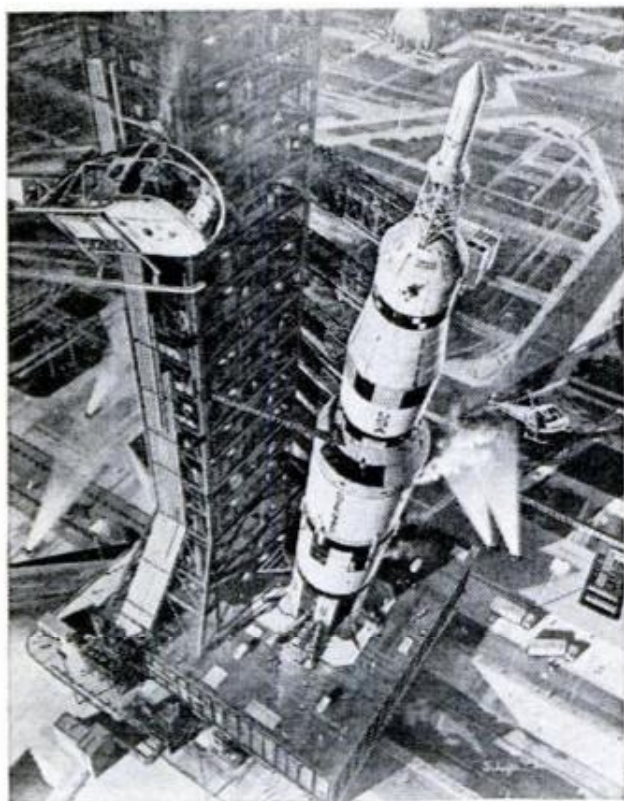
Smoo Cave

Fishing in Britain has some of the oddest aspects. Up in Sutherland, you can row a boat hundreds of yards into the pitch darkness of Smoo Cave and fish there for sea trout. In the middle of Peterborough, in Lincolnshire, there is excellent carp fishing in a certain stretch of water below an electricity generating works. Carp usually hibernate in the winter, but with a hot-water outflow from the plant's cooling system, the Peterborough carp think it's summer all year round and can be caught in a snow-storm.

Perhaps the strangest fish story in Britain concerns one of the few occasions when the police have been issued arms. The Marquis of Bristol has a lake which he was restocking with some exquisite rainbows. He also allowed the lake to be used by the county police for training their skindivers. One underwater cop reported that the troutlings were being decimated by a vicious criminal—a pike whose colossal weight was estimated at anything from 20 pounds upwards. The fortunate Bobbies were promptly ordered to bring the evildoer to justice—with spear guns.

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FOREST FIRES

(Continued from page 99)

bodies but for these specific skills, line bosses, sector bosses, cooks. . . .

From the Service also come the quick-strike forces, summer employees, college lads who protect instead of protest by parachuting or helicoptering into roadless areas to knock down infant fires. Nearly 400 such smokejumpers are on duty in northwestern forests and most were on the Idaho-Montana fires within hours. Nearly 1700 jumps were made on 360 outbreaks in this region, some "smokies" making a half dozen successive leaps on different spot fires as they sprouted.

Then came the "hot-shots," rugged 25-man crews designed for aerial shuttling between forest regions, fully equipped with saw, pump, and all the paraphernalia necessary to whip larger blazes. Often lifted by chopper to spots chopped out of the woods, the 400 western hot-shots came from as far away as Southern California.

Line fire crews, the infantry backbone of this army, fighting with Pulaski, ax and determination—many of these are recruited from western Indian reservations. Blackfeet from Eastern Montana, Paiutes from Northern Nevada deserts, Shoshones from Wyoming mountains, and the once-feared Southwest tribes of Mescalero and Santo Domingo: These and others have been organized into expert crews by Forest Service rangers. Each has a designated crew chief, through whom orders go, for reasons of language (many tribes here still have an imperfect understanding of English) and diplomacy.

"I can put a crew of Shoshone on a fire line a hundred miles from nowhere," one sector boss boasted, "and know that they'll still be there a week later unless I give the word to move out."

There are, of course, the inevitable hitches in obtaining tribal crews. Some of the long-braided Arizona and New Mexico Indians live in areas unreachable except by horse or four-wheel-drive vehicles.

Nevertheless, they came, and had to be moved fast. Fires in this type of forest can expand with unbelievable, fatal speed. Once having started its run before the 60-mph winds, Sundance leapt forward 20 miles in a single night. It increased its size from 4000 to almost 80,000 acres, with a final perimeter of 90 miles. At the height of this burn, foresters estimated that a square mile of prime timber was being devoured every six minutes.

As much as five miles ahead of the main blaze, spot fires were starting from flaming wind-blown debris. Little wonder the region recorded nearly 1500 sepa-

rate outbreaks during this onslaught, all of which had to be scouted and manned if possible. A veteran forester stated only the obvious when he declared, "Our only hope in containing such fires nowadays is the rapid mobilization of expert crews via our 'instant airline'."

Obviously, the whole system depends entirely upon air transport, quickly if not instantly available, comprised of feeder, long-haul and spot-delivery segments. Indians plucked from Santa Fe, N.M., and hot-shots from Ontario, Calif., were on fire lines 1000 miles away within a few hours after being called. Ranger bosses in Wyoming were picked up from outlying airports by light planes, flown to central Utah mustering points and loaded aboard large Forest Service transports which deposited them at Coeur d'Alene and Missoula. From these major ports light planes and choppers, as well as bus and truck, shuttled them to fire camps.

Like the fire crews, these planes are made available long before the need arises. The Forest Service itself has a small fleet of transport craft which can be used, like military planes, in areas and duties where commercial carriers would be barred by the federal air regulations. In addition, each Forest Service region has an air officer whose job it is to locate and inspect the aircraft and pilots in his locale which could be chartered for fire duty. Under this plan, light planes are signed up for short hauls, spotting and even para-dropping. During the last two years these have included turbine-powered STOL (short takeoff and landing) planes particularly suited for operating from rough wilderness air strips. Aerial tankers and, even more important, qualified tanker pilots, are obtained on a contract basis by carefully scrutinizing competitive bids, then given mandatory training and experience before being stationed at ports near the most vulnerable summer woods.

Supplemental airlines properly certificated under Federal Air Regulations are approved and added to this list. In the direst emergencies, even military squadrons become available. In Idaho, a helicopter squadron stationed nearby was called to fire duty and served under combat conditions, ferrying crews through smoke and turbulence from camp to fire line. But even without these sources, the aerial force, strictly civilian, numbers fully 1000 planes of all types.

As the Sundance and Trapper Peak fires rampaged, more than 200 of these craft converged on the area—the largest number of planes ever used on a fire. Many

(Please turn to page 184)

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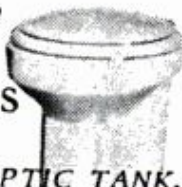
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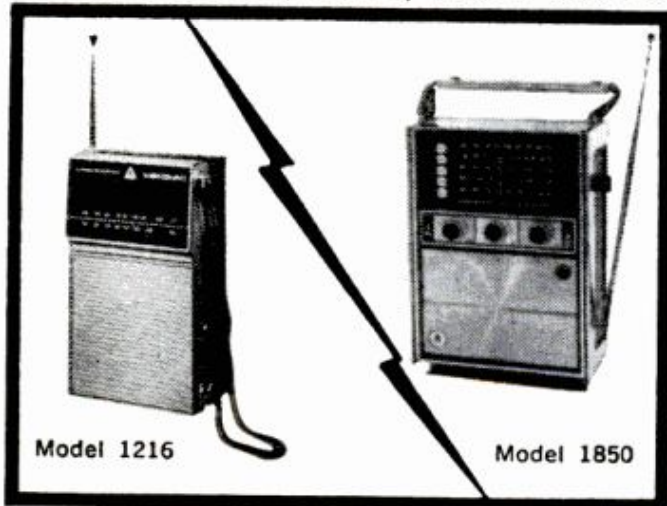
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FOREST FIRES

(Continued from page 182)

others, serving as feeder lines, did not enter the fire area but contributed nevertheless. Separated by types, the miscellaneous armada consisted of 29 tankers, 42 helicopters, 75 light planes carrying up to five passengers, and 59 multiengineed craft, each hauling as many as 100 equipped fire troops.

Inevitably, some of these were scratched. Two helicopters sustained severe damage; a dozen accidents of varying severity disabled fixed-wing craft. Despite the abnormal character of its assignment, the Forest Service long-haul instant airline has never suffered a passenger fatality. There have, however, been fatal accidents in the short-range fire support divisions—tankers, helicopters and light planes.

Anyone who may consider this an extravagant, exaggerated effort to put out a few burning trees has not really experienced a full-blown forest fire. Releasing more energy than several atomic bombs, these explosive holocausts are literally powerful enough to create their own weather. As the huge furnace, miles across, hurls its overheated air skyward, other air rushes in at the lower perimeter to form gale-force winds. Moisture is carried aloft to thunderstorm height, condenses and forms a cloud cap which may even precipitate. The uprush of air and smoke not only prevents this precipitation from reaching the ground, but even over the relatively calm edges of the fire hurls back the chemical retardant dropped from tankers.

A thousand feet over Sundance pilots could see burning tree limbs as thick as a man's leg being tossed by the geysers of super-heated air. To fly into such a maelstrom would be suicidal. But, carried above its dense smoke by a Forest Service Aero-Commander, infrared equipment accurately outlined the obscured fire areas on its Polaroid photos. These, delivered immediately to fire headquarters (they can also be dropped in canisters to fire bosses), were used to determine the exact location of hot spots and establish perimeter lines.

Racing, untouchable fires like this are not 'put out.' At best, they are contained until they burn themselves into a weakened condition and become vulnerable. In its rush, Sundance swept over a bulldozer and left its two operators dead. The thick steel beams of a forest bridge softened from the heat and collapsed like soggy macaroni. Two main fire camps were devoured only moments after their occu-

pants had been moved out. Despite two million gallons of retardant dumped on their skirts, the region's two big fires collapsed only when the wind died long enough for a stable line to be thrown around them. By this time 7000 men and 100 bulldozers were on duty, rural residents had been evacuated, the same was being considered for the towns of Doolin and Bonners' Ferry, and all available public and private heavy machinery within 400 miles had been commandeered. On one day alone more than 650 men were airlifted onto the Sundance fire.

After scorching the forests and the very earth for a week, Sundance and Trapper Peak settled down to die like great prehistoric beasts. By this time some 30,000 free tickets had been issued on the Instant Airline, 10,000 transients had been cared for at the Boise center, costs had reached a half million dollars a day, and 117,000 acres of Idaho and Montana had been set back a century. One might well ask, is all the effort and expense required to battle these giants worthwhile?

To answer this, try to estimate the total value of a square mile of forest—its timber, fishing streams and game. The lumber contained in only a small portion of the area burned last year would pay the entire cost of the effort. Much more valuable, though, are the intangibles: soil and beauty. Ask the citizen in Southern California whose home has just disappeared under a fire-scalped, muddy hillside. Ask the sportsman who will have to forget Trapper and Sundance for a long time.

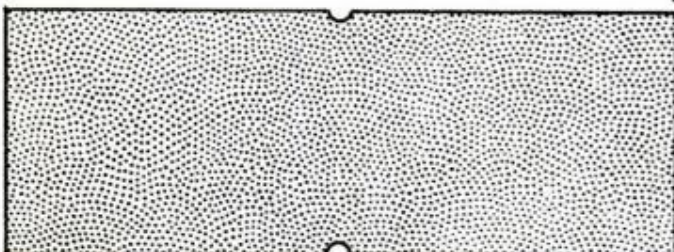
The fires cooled, but the job was not over by any means. Even while these blazes flourished, smokejumpers and inter-regional crews were being ferried to and from Oregon, where other forests were afire. These crews were used to strike whatever targets most needed striking, their talents being made effective only by their aerial transport.

Now these same crews were rotated back to base camps at Missoula, McCall and Redmond, to stand by for possible outbreaks elsewhere. The infrared planes cruised the burned area, outlining buried hot spots with their imagery, enabling crews to accomplish a quicker and more thorough mop-up. Even hand-carried infrared devices, rattling like Geiger counters when pointed at submerged hot spots, are becoming available to crews as the science of forest-fire fighting advances. But until the day, long distant, when such volcanoes can somehow be overwhelmed, the system of instant airline and professional fire crew remains the best—and most admirable—answer. ★ ★ ★

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COMPARING THE VERSATILE VANS

(Continued from page 104)

involves loosening a batch of hard-to-reach bolts.

The rear-mounted engine in the VW leaves room for an aisle up front between the seats. A hinged panel in the rear of the vehicle lets you get at the engine fairly well, except that the battery has to be removed each time you want to check the electrolyte level; and before you can do that, you have to remove the oil-bath air cleaner. Many VW vans may be running around with neglected batteries.

The VW's rear engine mounting helps make it the most maneuverable of the four vans—and the most sensitive to crosswinds. A passing semi can jiggle you around—and with a top speed of 67 mph, you can count on being passed often. Also, that engine bites a 30-inch long, 18-inch-high chunk out of the rear cargo space.

Of all the vans, the Ford had the softest ride and the Dodge by far the stiffest. But the Ford I drove had a standard suspension, while the Dodge had optional, stiff rear springs and the Chevy had heavy-duty suspension, front and rear. At the time of my test, these trucks were in short supply, even in Detroit. Identically equipped test models weren't available.

The VW, though not as easy-riding as the Ford on smooth roads, gives better ride control on rough surfaces, thanks to its sophisticated, fully independent rear suspension. The VW has generally better road manners than does its live-rear-axled competition.

Surprisingly, although the VW is the smallest of the four, it can handle a whopping 2205-pound payload. The Ford can haul 1265 pounds. With all the available heavy-duty equipment, its payload goes up to 3562. The standard Chevy carries 1572 pounds, but our stiffly sprung model hauled 2656 maximum. The Dodge normally carries 875 pounds; our test van—with stiff rear springs—carried 1690. With added heavy-duty options, the Dodge payload can increase to 2160.

You can pretty much tailor any of the American vans to suit your needs. The Chevy and Dodge also come in smaller, 90-inch-wheelbase models that carry a couple of hundred pounds less, and the Ford comes in a larger, 123½-inch model.

The three American vans also offer specialized equipment such as refrigeration or insulation, milk-bottle racks, and clotheshanger rods. But you have to take the VW just about the way they build it in Hanover.

To see how the trucks handle with full loads, I filled each to capacity with 80-

pound sandbags. Ride improved slightly in all but the Ford, which, with its light suspension, got mushy.

The VW is extremely sensitive to load placement. Dump most of your cargo toward the back, over the engine, and the van becomes pretty unstable. The American vans are affected much less by load distribution. The VW's 0-60 acceleration time, an agonizing 30.8 seconds without load, deteriorated to 55.4 seconds with the van full of sandbags.

While the Ford was empty, its poor traction kept 0-60 time up around 13.2 seconds; with a full load, the Ford needed 16.0 seconds. In spite of its two-speed Powerglide, the Chevy took only 11.2 seconds empty and 16.8 seconds loaded to reach 60. Dodge made the fastest times, 11.0 empty and 14.4 loaded.

The brakes on all four vans were unimpressive. I ran a series of consecutive panic stops from 60, with full load. The Chevy brakes felt "grab-b-by" during the second stop, but maintaining control wasn't too hard. By the third stop, the Chevy, Dodge, and VW brakes all faded noticeably. In the Ford, fade was so bad during the first panic stop that I didn't try a second. Ford offers larger brake drums at extra cost. Get them!

Loading convenience is very similar in the American vans. Rear loading height is 26 inches in all three. Rear doors all measure roughly four-by-four feet; the opening in the Dodge is a bit wider, but the extra inches are gobbled up by the rear wheel wells. A 4x8 plywood panel, for example, adds up to a workable but close fit in any of the three.

Because of its rear engine, the VW has a rear loading height of 38½ inches and an opening only 28½ inches high. Opening width is 48½ inches, but the spare wheel cuts this to 45; a 4x8 panel has to be loaded diagonally. Also, the side door is about eight inches narrower than those of the competition; but it slides instead of opening out—handy in tight quarters. The Dodge is the only one that charges extra for a side door; our test truck didn't have one.

Which van is best? It depends on your needs. If you want economy, aren't interested in performance, and carry compact cargo, the VW might be your choice. Dodge offers the best performance and the jazziest interior. The Ford gives a smooth ride; and the larger version, loaded with suspension options, can carry the biggest payload. The Chevy is a good all-around vehicle, with good load-carrying capacity and a long list of options.

Me? I hope I never see another sandbag. ★★★



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JUST TURN THE HOUSE

(Continued from page 110)

is securely attached to the stationary part of the pedestal.

The telephone connection—really a low-voltage electrical connection—is another piece of ultra-simple engineering. The line enters through that central service core mentioned earlier and runs up to the peak of the house. Here, it's connected to the stationary side of a slip-ring assembly. The signal is then picked up by the outer, rotating part of this assembly and carried by ordinary phone wiring down through the partitions to outlets in the rotating section.

The slip-ring assembly was specially designed for Foster by Airflyte Electronics, Bayonne, N.J., but according to this firm, it's merely a custom version of the connection used in rotating radar antennas.

Heating the disc

The heating system wasn't any problem, since the whole thing is contained in the rotating section. The house has an oil-fired hot-water system with fuel supplied by two 250-gallon tanks located in the attic. Radiators are recessed into the floor around the perimeter, below the Thermopane windows and doors. The house is fully insulated, both top and bottom.

In at least one case, Foster had to seek out a special material for reasons having nothing to do with the rotation of the house. The six-foot porch which runs all the way around the house is surfaced with Promdek, a surfacing compound originally developed for use on ships and in other applications where a waterproof deck surface is required, but a certain amount of flexing is to be expected.

Other special materials are strictly for esthetic purposes. The patio area directly under the house is paved with imported granite cobblestones from the Dolomites in northern Italy. To complete the effect, the underbody and pedestal are shingled to match the roof. A Neoprene gasket seals the joint between the pedestal and the rotating underbody.

Cost of the house is well over \$100,000, about 20 percent more than a stationary house of more conventional design built of comparable materials. While it would have been more economical to have built the house at ground level with an entrance hall set below ground, Foster was more concerned with the success of the house as pure architecture. He's well-satisfied with the result. The house is not only a successful architectural design, but it runs like a charm. ★★

PREVENTIVE MAINTENANCE

(Continued from page 123)

along the top of the lining. If it tapers down, you'd best pull the shoe for a closer look at the aft end of the lining.

A minor engine tune-up consists of cleaning and adjusting gap of sparkplugs, checking and adjusting distributor points, adjusting ignition timing, cleaning and inspecting the distributor cap and rotor, inspecting ignition wiring, and checking and resetting external carburetor adjustments.

A major engine tune-up consists of installing new sparkplugs, inspecting spark-plug wires and boots, testing cranking and starting voltages, checking the charging rate of the alternator, installing new distributor points and condenser, setting distributor dwell angle; adjusting timing; checking distributor condition (include the vacuum advance in this); cleaning and inspecting distributor rotor and cap; and performing any carburetor service that's necessary.

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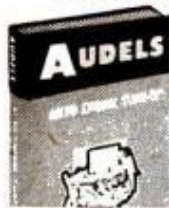
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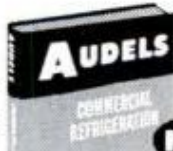
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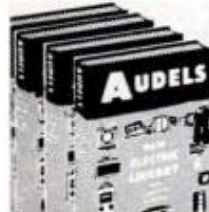
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STEPS TO EXPERT EXPOSURE

(Continued from page 118)

clear day. While this can vary slightly according to time of day and season, it represents for all practical purposes a constant amount of light. All films give the proper exposure for bright sun right on the instruction sheet. This is your "basic exposure." It varies only according to the film you're using. Basic exposure for a fast film like Tri-X at ASA 400 is 1/250 of a second at f/22. For a slower ASA 200 film, basic exposure is 1/250 of a second at f/16. Note that the shutter speed is the same—the diaphragm is merely opened one stop (one step) wider. There is a difference of only one step in exposure between these two films even though one is twice as fast as the other.

Knowing the basic bright sun exposure for any film, you can set up a brightness scale on which to calculate other exposures. Each step on the scale represents one step in shutter speed or one step in diaphragm opening. One step below bright sun is "hazy." It's still bright, but a thin haze or overcast dims the sun. Shadows are visible but faint. This means your subject will receive half as much light as on a clear day. You can compensate for this by increasing your exposure one step in either shutter speed or diaphragm opening. If your basic bright sun exposure is 1/250 of a second at f/22, you can go to 1/250 at f/16, increasing the opening, or to 1/125 at f/22, increasing the time.

The next step down the brightness scale is heavy overcast. The sun is blotted out entirely, and no shadows show. Here you'll need to increase your exposure two steps. When there's even less light, such as in rain, fog and under storm-blackened skies, use three steps of exposure increase.

You also use the step system when your subject is in shade. Moderate shade, sometimes called "open shade," calls for two steps of increase. This is where your subject is, say, in the shadow of a building, but is not covered by anything overhead. The scene is open around him. Where your subject is blocked off from the sky, such as under a roof overhang or thick tree branches, you'll need three steps of increase.

There are some special situations, too. Sunlight is strongest in the middle of the day and weaker in the early and late hours. For shots in the early morning and late afternoon, increase your exposure one step to compensate. In the very late afternoon or at dusk, you'll need two or three steps of increase. These steps are, of course, in addition to whatever steps

are called for by other conditions, such as shade or cloudiness.

Backlighting—shooting toward the shady side of a subject with the sun behind him—also requires compensation because there's no direct light on the face. Use two steps of increase here. This, incidentally, is an excellent way to photograph people because they aren't squinting into the sun.

On very bright subjects, such as water, beach and snow scenes, the reverse happens. The highly reflective surfaces direct more light into the lens than would normally be the case. Here you need to compensate by *reducing* your exposure one step. This means closing down the lens to the next smaller diaphragm opening or using the next faster shutter speed. Oddly enough, this is where a meter can sometimes get you into trouble. The bright glare fools it into thinking that there's even more light than there really is and it gives you a falsely high reading. As a result, you decrease your exposure too much and actually end up underexposing the scene.

When deciding which factor to vary—shutter speed or diaphragm opening—remember that fast speeds reduce motion blur and camera shake, while small openings give you greater sharpness and depth of field. Except in very bright light, you usually can't have both at the same time. You have to decide which is more important depending on the type of subject you're shooting. Where you want to stop fast action, keep the speed high and open up the diaphragm for more light. Where it's more desirable to be sure of a sharp focus, stop down to a small opening and use a slower speed.

Where two or more steps of increase are required, it's usually best to use a combination of reduced shutter speed and increased diaphragm opening. This gives you the greatest amount of both speed and sharpness without sacrificing one or the other drastically. When you're shooting at infinity, however, focus isn't a problem so you can go for maximum speed.

The accompanying table gives suggested exposures for different steps at a variety of film speeds. To use it, find the column that applies to the speed of film you're using, then follow it down to get the exposure for any step. You'll find two exposures listed for each step. There are, of course, many additional combinations of settings that will produce the same exposure, but those shown are a good compromise and offer a choice so you can pick the one that best suits the type of picture you're shooting. ★★★

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OUTBOARD TROUBLESHOOTING

(Continued from page 125)

outboard's refusal to start—a ruptured cylinder head gasket (15). If all else fails to this point, that's a good place to turn.

You'll be able to solve a number of simple problems that bug an outboard from time to time by following the systematic troubleshooting procedure out-

lined here. This is especially true of the rather simple small-horsepower motors.

Simple troubleshooting of today's larger and more complex motors can often reveal a minor problem that you can quickly put to right. But when it comes to digging deep into a large, sophisticated motor—75 hp and up—take it to trained personnel unless you're an experienced mechanic. ★★★

OUTBOARD CLINIC

Q. My 1960 40-hp Johnson seems to cut out on one cylinder, hot or cold. Could there be a valve hung up in my engine?—C.G.C., Ohio.

A. Not if you're defining valve as the type used in automotive engines. Your outboard motor has none. But the problem could be caused by a broken leaf in the reed valve. There are other causes for this condition, including bad sparkplugs; a leak through a high-tension wire; troublesome coil, condenser or ignition points; a grounded out primary lead; and a blown head gasket.

Q. Why is it that my outboard motor revs powerfully at dockside, but when I have it on the water it pokes along? A check of the engine reveals nothing.—D.M., Tex.

A. Hey, how long's it been since you checked the bottom of your boat for marine growth and grime? Whether your boat's used in freshwater or saltwater, a buildup of this stuff can cut as much as 30 percent off your top speed. I'd pull the boat and wash that hull down thoroughly.

Q. My outboard is contributing to the air-pollution crisis. It's smoking like a TV cigaret ad. What should I do?—F.B.F., Mich.

A. Seems like this is nothing more than our old enemy, incorrect fuel mixture. Most boatmen know the dangers of using too little oil in an outboard. Not many are aware of the problems created by using too much oil in the mixture. A smoking engine's only one. It could be accompanied by fouled sparkplugs and lousy engine performance. Make sure it's right.

Q. Think I got a problem. Pulled sparkplugs from my outboard and noticed that the electrodes were gap bridged. What do I do now?—T.S.E., Fla.

A. I know you've got a problem, but it's probably not as serious as you think. For those who aren't familiar with it, gap bridging is when combustion particles wedge or fuse themselves between sparkplug electrodes. Could be caused by excessive carbon in the cylinder, use of a nonrecommended oil, improper fuel mix ratio, or high-speed operation after prolonged trolling. The last three are in your hands, T.S. You might be able to solve the first one by getting some combustion chamber solvent from an outboard dealer. If the condition isn't too far gone, the solvent should clear it.

Q. Will the addition of resistor-type or filter-type noise suppressors to an outboard motor decrease efficiency?—A. W., Calif.

A. No—not if you use suppressors made for that engine. See your dealer.

Q. How do I get inside the exhaust housing of my Johnson outboard engine to disconnect the shift lever rods so I can drop the lower unit to replace a water pump?—C. W. K., Pa.

A. One of two ways, depending on the setup you have. Look behind the swivel bracket. If you spot a plate there, take it off to gain access to the inside of the housing. If not, you'll have to remove the bolts that hold the lower unit to the exhaust housing.

Q. Fouled plugs have led me to conclude that my Mercury 650 is running on an over-rich fuel mixture. I've tried to readjust the carburetor, but this hasn't helped. What do you suggest?—M.B., Ohio.

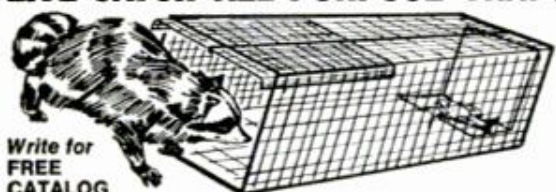
A. There has been a change in the high-speed carburetor jet for this (and the Mercury 1000 motor) which will cure the trouble. The new jet is .002 in. smaller than the one now in your engine. ★★★

GOT A PROBLEM WITH YOUR OUTBOARD ENGINE? Send your question to Outboard Clinic, *Popular Mechanics*, 575 Lexington Ave., New York, N.Y. 10022. Letters cannot be answered individually, but problems of general interest will be published in the column.



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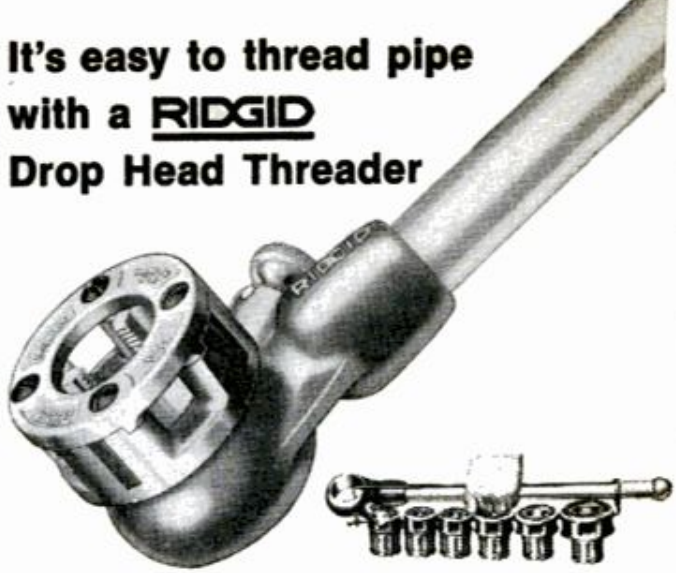
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BUILD PM's MINI-MOVER

(Continued from page 146)

used as a two-speed transmission.

Yet, although it potentially could be used as a two-speed transmission, the TAT unit used in the Mini-Mover was lacking the manufacturer's proposed torsion bar and linkage that shifts from low to high with the forward progression of the control handles. Thus, as a compromise, our prototype was initially locked between high and low (a manual adjustment) so that we might evaluate the overall performance of the vehicle on a somewhat adverse scale. At this writing, the manufacturer assured us, however, that his tooling would be completed by July and the linkages will be provided as an integral part of all TAT units supplied to PM readers. Needless to say, we also are anxious to fit the new linkage to our original vehicle.

Bolt-and-nut construction

The chassis was specifically designed so $\frac{5}{16}$ -in. bolts, nuts and lock washers could be used throughout. Thus assembly of the basic frame is remarkably uncomplicated. Just be sure to check the squareness of the frame members before you tighten each of the bolts.

The TAT unit is furnished ready to install with the exception of the four mounting holes you will have to drill in its frame. Be sure to install it so the lower support member of the unit rests on the stub frame rail.

Position and mount the engine so the power takeoff shaft is aligned with the TAT input shaft and connect the two using the flexible, dual sprocket-and-chain coupling shown in the detailed construction drawing.

The rear suspension is a simple but sturdy assembly of square tubing. The casters ride in bronze bushings inserted in support plates and should be carefully aligned before tightening the bolts. The casters are the only items in the vehicle that require welding, as shown in the caster assembly detail drawing on page 143. The complete caster assemblies, exclusive of wheels and the two square cross-members, can be ordered as listed at right.

The front-drive wheels receive their power from the drive sprocket through a No. 40 chain. The driven sprocket is a 54-tooth unit drilled to match the holes in the offset hubs. In lieu of the offset hub wheels, you'll have to drill into the wheel and use extension tubes to secure the sprocket to the wheel.

The control levers transmit their motion to the TAT unit's J-bolts by means

of push rods and bellcranks. Note, however, that to obtain the proper wheel rotation, one bellcrank must face up and the other must face down. Neutral adjustment of the levers is provided by moving the spring blocks along their threaded rods until the TAT drive is disengaged. Jam nuts are then used to lock the threaded rod securely.

Because the control handles and the vehicle can be moved instantly from forward to neutral to reverse, or back again, there is no need for a conventional braking mechanism. However, to prevent the vehicle from possibly creeping or rolling when the operator is loading or unloading, the emergency brake mechanism should be added. The brake shoes make contact with only a $\frac{1}{2}$ -in. square area on each discup, yet are effective enough to stop the vehicle when it's moving at 3 or 4 mph. The linkage from the rear of the TAT unit extends to the left side of the chassis, then is connected up to the front of the driver's seat through a lever. Normally, the tension spring keeps the shoes away from the discups, but when the brake lever is pulled, spring tension is overcome and the shoes rub against the discups.

After the driveline components and linkages have been mounted on the chassis frame, start the engine and adjust the built-in throttle control for minimum speed. Then adjust both the length of the clevis control rods and the spring-loaded threaded blocks until the TAT is in neutral. At this point the handles should be aligned so that one-handed operation for forward and reverse is possible.

PM's Mini-Mover Sources of Supply

Item	Supplier
TAT drive unit: \$99.50	V-Plex Clutch Corp.,
Flexible coupling: \$7.50	550 W. Main St.,
54-tooth sprockets: \$6 each	Hagerstown, Ind.
10 ft. No. 40 chain: \$21	47346
Rear caster assemblies (with axles and collars but without wheels): \$17.20 per pair	Armor Co., Box 290, Deer Park, N.Y.
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Front wheels, 12½-in. o.d. 4.10 x 3.50 x 6, with taper bearings, double flange hub: \$20 each	Nobman's Hardware, East Main St., Oyster Bay, N.Y.
	11771
Rear wheels: \$3.77 each	Sears No. 9G8736

(Next month, Part 2 will detail the construction of the Mini-Mover body and canopy.) ★ ★ ★

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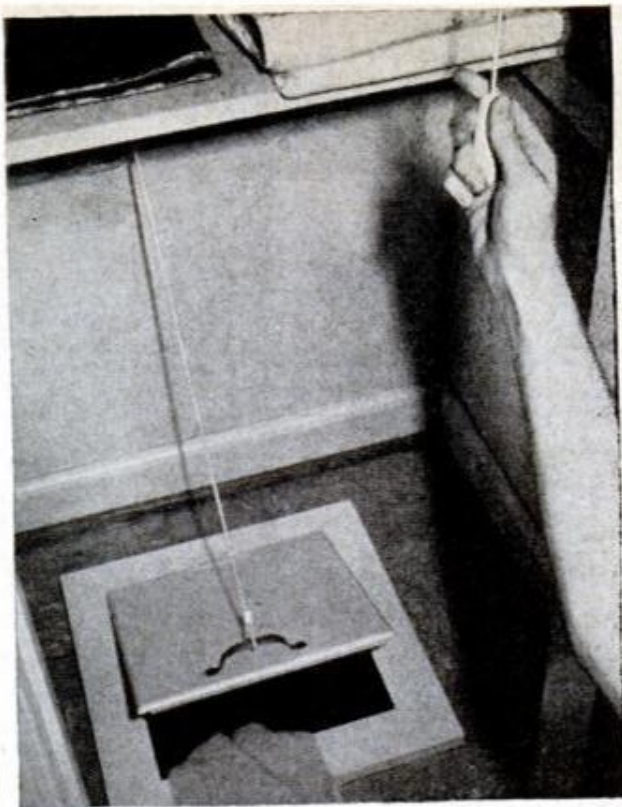
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WEEKEND REMODELING IDEAS

(Continued from page 149)

under the closet. Drive a small nail up through the floor in the center of the spot selected to pinpoint the position upstairs. Using the nail as a reference point, lay-out a 12-in.-sq. on the floor and saw a hole through the floor by first drilling holes at the four corners for a keyhole saw.

A sheet-metal chute 12 in. long is formed from aluminum to fit the hole in the floor and is nailed in place by driving nails into the edges of the boards.

The drawings show how the 20-in. carton is reinforced with hardboard and fitted with pivot bolts. Slanting slots in the 1 x 3 hangers permit the hamper to be lifted in place after the hangers are properly spaced and nailed to the ceiling joists. A coat of white paint not only stiffens the cardboard but gives the hamper a "clean" look.

The hole in the floor is finished off with a mitered casing and a hinged door which is rabbeted around the edges to lap the casing. A cord attached to the door's handle and run through pulleys or screw-eyes fastened to the underside of a closet shelf will permit the trapdoor to be opened from a standing position. (Or forget the cord if your wife likes daily bending exercises.)—Herbert G. Edison Jr.

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