

POPULAR MECHANICS

JUNE 1967
35 CENTS

**Electric
Cars:
Are They
Kidding?**

'68 CARS: HOW NEW WILL THEY BE?



Color-TV Antennas

How Much Can They
Improve Your Picture?

Page 93

Exclusive!

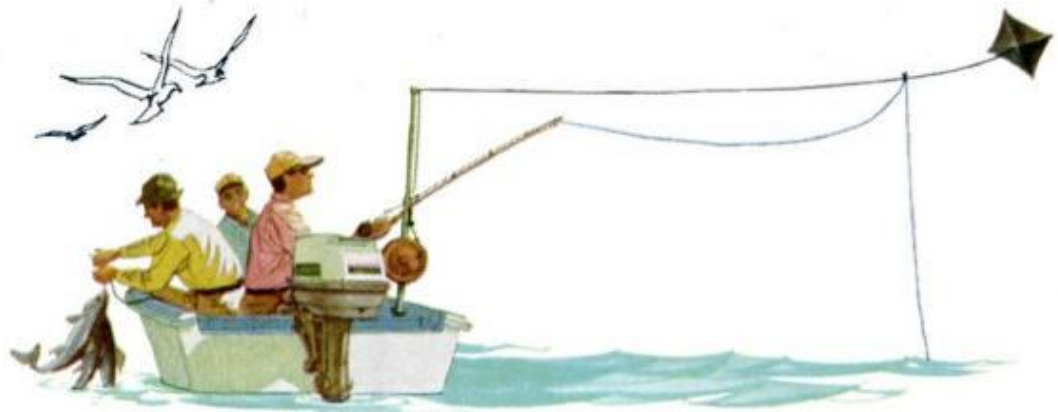
PM Editor Catapults from
JUNGLE FLATTOP

Build PM's Minibike
Complete Plans — Page 160

First Reports!
COUGAR AND FALCON
How Owners Rate Them

U.S. and Vietcong
Weapons
How They Compare

Weekend Furniture Projects • Driving Tips from Dan Gurney • Saturday Mechanic: Overheating



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more
scenic
miles!

Smart travelers know they can go a lot further on an Atlas PLYCRON*—The Round Tire. It performs better because it's built better.

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Get your extra miles with The Round Tire!

ATLAS PLYCRON

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8CZA-8C4-R58C

JUNE 1967

1

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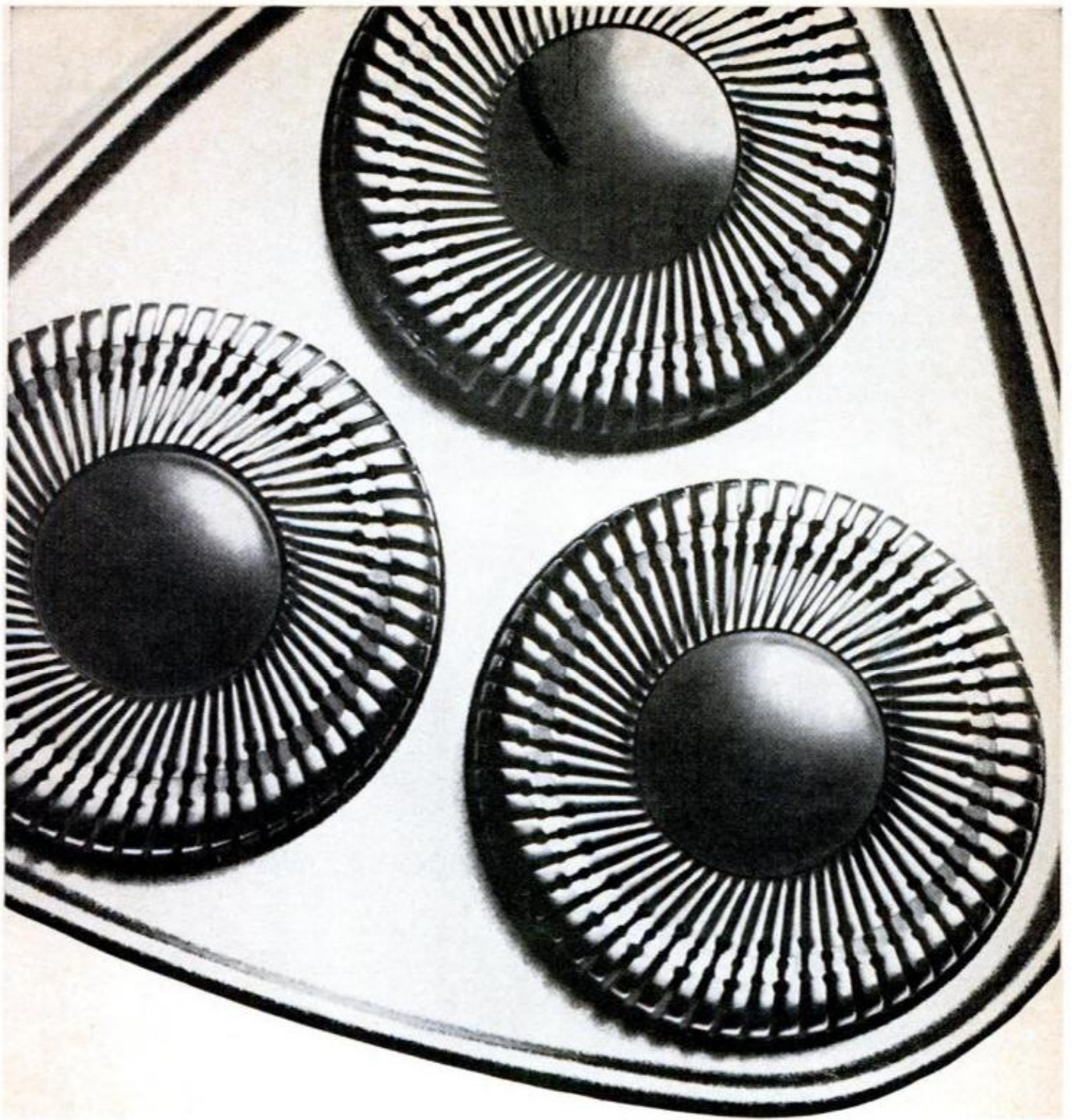
An easier job when you *do* paint.

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Better Things for Better Living . . . through Chemistry



Three good reasons why Norelco dares to match shaves with a blade

You're looking at them.

The three Microgroove heads on the new Norelco Tripleheader Speedshaver® 35T.

Norelco shaved those heads down 35% thinner to get 35% closer to your beard. Actually thinner than the paper of this page. So close, Norelco dares to match shaves with a blade.

And they're 'floating heads,' so the Norelco rotary blades underneath can stroke away your



whiskers without a nick, without a pinch, without irritation. Best of all, with this Norelco you're shaving nearly 40% faster!

Pop-up trimmer, too. Plus more shaving features than any other shaver in its class.

P.S. For close shaves anywhere, see the Norelco Rechargeable 40C — two weeks of shaving on a single charge. And the Norelco Cordless 'Flip-Top' 20B; it works on four penlight batteries, with convenient battery ejector.

Norelco® the close, fast, comfortable electric shave

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

AUTOMOBILES AND DRIVING

- [14 Automobile Clinic](#)
- [26 Detroit Listening Post](#)
- [49 Drivin' with Dan](#)
- [59 '68 Cars: How New Will They Be?](#)
- [84 PM Owners Report: Ford Falcon: More Faithful Than Flashy](#)
- [110 PM Owners Report: Mercury's New Cougar](#)
- [118 Electric Cars: Are They Kidding?](#)
- [122 Cook While You Drive](#)
- [140 Saturday Mechanic: How You Can Find Those "Hidden" Causes of Engine Overheating](#)

SHOP AND CRAFTS

- [133 Hints from Readers](#)
- [139 Hints from Readers](#)
- [146 Weekend Projects for Your Home \(Flagged for Filing\)](#)
- [151 Hints from Readers](#)
- [157 How to Make a Good Sprayer Better](#)
- [160 Build Yourself a Minibike \(Flagged for Filing\)](#)
- [165 Hints from Readers](#)

BOATING, OUTDOOR RECREATION

- [28 What's New Outdoors](#)
- [68 The Ordeal of the Petrel](#)
- [114 Look What They've Done to the BB Gun](#)
- [128 Tomorrow's Marine Engines Are Running Today](#)
- [134 Starting a Stubborn Outboard](#)
- [138 Running Water for Your Runabout](#)

REGULAR FEATURES

- [6 Letters](#)

HOME AND YARD

- [56 Homeowners' Clinic](#)
- [102 Make This Handsome Home-Office Room Divider](#)
- [106 Now: You Can Lay a Spanish Tile Floor](#)
- [116 Instant Concrete House](#)
- [126 Now: Take-Apart Appliances You Can Fix Yourself](#)
- [144 Solving Home Problems](#)
- [146 Weekend Projects for Your Home \(Flagged for Filing\)](#)
- [152 How to Reroof Your House \(Part 1\) \(Flagged for Filing\)](#)
- [158 New Remodeling Materials for the Do-It-Yourselfer](#)
- [166 Exciting New Products](#)

SCIENCE AND INVENTIONS

- [10 Science Worldwide](#)
- [52 New Inventions](#)
- [78 Earthquakes Made to Order](#)

AEROSPACE, AVIATION, MILITARY

- [12 Aviation Jetstream](#)
- [64 Jungle Flattop](#)
- [74 Cheese It . . . The COPTers!](#)
- [97 VC Firepower—Can We Match It?](#)

ELECTRONICS, RADIO AND TV

- [93 Hot Antennas for Cool Color](#)
- [168 Two New TV Kits from Heath](#)

PHOTOGRAPHY

- [90 Shoot Swirling Color from a Swinging Light](#)
- [156 Photo Hints](#)

Cover Art Concept by Ed Valigursky: Ling-Temco-Vought A-7A Corsair II being catapulted from a new SATS mobile airfield.

NEXT MONTH IN POPULAR MECHANICS

I Skipped a Swift. The commander of one of the Navy's tiniest "battlegions" tells what it's like to fight on the waterways of Vietnam.

PM Owners Reports on the Plymouth Fury and Chevy Camaro. Two more revealing, straight-from-the-owner's-mouth appraisals of new cars.

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JUNE 1967

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LETTERS TO THE EDITOR

Don't look for it in Delaware!

There's an error in 'Gee Whiz' *Vacation Guide for the PM Man* (page 100, April PM) in the caption referring to the location of the U.S.S. *North Carolina*. It is not at Wilmington, Delaware; it's at Wilmington, North Carolina (as you indicated in the listing on page 200).

I was misled a couple of years ago by some tourist information, and after making a trip to Wilmington, Del., I know for a fact that the ship is in North Carolina. Albany, Ga. FENTON L. GLASSCOCK

Please give us back our battleship. Greenville, N.C. STUART M. SHINN

The ship was purchased by many pennies, nickels, dimes and quarters donated by school children throughout North Carolina, thus saving it from the scrap heap. Over a million visitors have been aboard since the ship became ours. Wilmington, N.C. JAMES W. COPELAND

Now hear this: The U.S.S. North Carolina is now and forevermore anchored in North Carolina. But don't give up your trip to Delaware; you'll have a chance to see our caption writer who will be permanently anchored there.

Good flight

Congratulations on a well done and accurate story (*You 'Fly' This Car with a Stick*, page 87, April PM). We were pleased to see our research described so well. On receipt of the issue, our research production promptly ground to a halt while the entire staff read your article. Communication and Control Systems Laboratory, Ohio State University ROBERT E. FENTON Ass't Professor

Unconfuser

I want to congratulate you on your *Racewatchers Guide to Competition Cars* (page 95, March PM). This is something that has needed doing for a long time. The public is totally confused, and I am afraid the manufacturers are frequently as confused as the public.

If the formulas and their ultimate relation to the production car had been better understood in the post-war period, some of the present problems with gov-

(Please turn to page 8)

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322

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LETTERS

(Continued from page 6)

ernment regulations on emission might have been averted. Rigid adherence to formulas increases the ultimate efficiency of engines.

Product Information,
Ford Motor Co.

J. T. JURGENSON,
Manager

And even if you're not confused, you'd enjoy having the full-color 35 by 23-inch wall chart of 32 racing cars. Just send your name and address plus \$1.50 to *Race-watchers Guide*, Popular Mechanics, 575 Lexington Ave., N.Y. 10022.

Thank you very much for including MicroMidgets in your article. Too often this type of racing is neglected.

You may be interested in knowing that the most popular powerplants are not "bike" engines, as mentioned, but are two-cylinder, two-cycle outboard engines in the AA Class.

Modified Midgets, Inc.
Logansport, Ind.

BOB BLUME
Secretary

Privy counsel

I read with interest the article, *Build a Pretty Little Privy for Your Weekend Retreat* (page 156, April PM).

For your information and future guidance, however, I would like you to know that Article VI, Sect. 9 of the Suffolk County Sanitary Code prohibits the use of privies in our county. I am informing you in case you have inquiries from a resident.

County Dept. of
Health
Riverhead, N.Y.

SIDNEY E. BECKWITH
Chief, Housing and
Camp Sanitation

Privy-builders in any area should, of course, check local codes before starting construction. Your choices may be limited to: (1) building indoor facilities, or (2) beating a path to the next county.

Extra special

The February issue carried an excellent article on boating safety (*How to Avoid Getting in Trouble with Your Boat*, page 161). However, on page 165 in another article, you described a self-contained blower unit powered by a 12-volt d.c. motor to ventilate explosive vapors. It would seem to me that unless something extra special is done to provide an explosion-proof motor, this is hazardous.

Beloit, Wis.

E. L. DAHLUND

Something extra special was done, reports the manufacturer. The motor is completely sealed and explosion-proof.



WE CAN'T FIX UP THE ROADS...

but Goodyear gives you The Workhorse—
tough-job tire for pickup and delivery work.

The Workhorse is built for the stop-and-go grind of pickup and delivery.

In addition to triple-tempered nylon, the Workhorse has Tufsyn, toughest rubber Goodyear ever used in tires. And more of it. 14% deeper tread. Thicker undertread, too. Up to 17% more rubber between the cord and the road. The Workhorse delivers up to 25% more mileage than ordinary tires now used in most pickup and delivery work.

So pile on the tools, appliances,

sand and gravel, camping equipment, logs or livestock. The Workhorse can take it because it has stronger sidewalls for extra load-carrying strength. Helps you haul more. In fewer trips.

Prices start at about \$15.00.*

If you drive a pickup, panel, or light delivery truck—get the tough-job tire. The Workhorse, at your Goodyear Dealer's or Goodyear Service Store. Goodyear, Akron, Ohio 44316.



The Workhorse tire gives you a choice of two tread designs. Extra-traction design for on and off-the-road. Rib-type for on-highway work.

GOODYEAR

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*(Size 6.00 X 16, 6 PR. Rib-type, black sidewall. Plus \$2.38 federal excise tax and recappable tire. At all Goodyear Stores. See your local Goodyear Dealer for his competitive prices.)

JUNE 1967

9

BY JOHN F. PEARSON
SCIENCE
WORLDWIDE

A HIGH-PITCHED VOICE, among other feminine characteristics, is an occupational hazard for male workers in a Canadian factory making birth-control pills. To avoid inhaling hormones used in the pills—and it's the hormones that cause the trouble—workers wear "space suits" connected to an oxygen system. Women can't do the job because the work is too heavy for them.

NEWEST HOUSEHOLD PET is the gerbil, a small, big-eyed rodent with long back legs. It is found in Asian and African deserts and is said to be more friendly than the hamster. The gerbil drinks little water, dealers say, and so the cage requires little cleaning. Price for a gerbil is \$10 in Chicago and between \$6 and \$7 in New York. And they're selling very well even though you can get a hamster for about \$1.

TREES THRIVE ON ELECTRICITY. Passing a current through a tree will make it grow faster, experiments at the University of California indicate. In the case of citrus trees, jolts of electricity will cause ripened fruit to drop off the branch. Exactly why electricity produces such effects is not yet known.

PLASTIC HOUSES ARE HERE. That's the word from a Cleveland company that reports developing a new process by which a plastic structure can be sewn together by machine. Then this "skin" is inflated and the sun "cures" or hardens the plastic in a matter of hours or days. Structures up to half a mile in diameter are possible, the company claims.

WANT A 3-D EFFECT from your ordinary flat TV picture? It's possible with a pair of special glasses produced by a New York City company, the Marks Polarized Corp. Here's how they're reported to work:

Light receptors in the eye are in the form of cones and rods, each type responsive to different intensities and wavelengths. The lenses in the glasses filter light so that the viewer "sees" only with the cones of one eye and the rods of the other. There is said to be a time differential between the signals transmitted to the brain by the cones and the rods, causing

an apparent displacement of the two images received in the brain. This displacement is what results in an apparent 3-D effect. The glasses work with either black-and-white or color TV.

AIR POLLUTION SLOWS RUNNERS. This was determined in a recent study of performances of cross-country runners at a high school near Los Angeles. Researchers found that the slowest races were run on days when the heaviest air pollution was recorded. Factors such as temperature, relative humidity and wind velocity and direction reportedly showed no correlation to runners' performance.

STRONGEST SUBSTANCE PRODUCED on earth is reported to be a crystal of tungsten only two ten-thousandths (.0002) centimeters in diameter. The crystal was produced by Russian scientists who claim it can withstand 230 tons of pressure per square centimeter. The strongest known steel is puny by comparison, having a limit of only 30 tons per centimeter.

CITY NOISE is more than a nuisance—it's bad for your health. It not only can damage hearing, according to a Columbia University scientist, but it can affect blood pressure, the heart and eventually "disturb every bodily function." It has been found that blood vessels contract when the ear, through a reflex action, attempts to shut out excessive noise.

DISTANCE TO THE MOON is now known to within 150 feet, according to scientists at Caltech's Jet Propulsion Laboratory in Pasadena. Until recently the most accurate measurement was within 6500 feet. Measurements obtained from our moon-orbiting vehicles have made the difference.

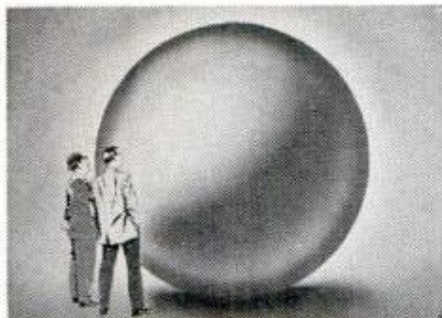
UNCONTROLLABLE NEED TO CURSE manifests itself in psychiatric patients suffering from Tourette's disease, a disorder that has been resistant to established methods of treatment. But now, according to *Medical World News*, a researcher at the University of Iowa's State Psychopathic Hospital reports that an experimental drug has completely cleaned up the language of a group of child patients.

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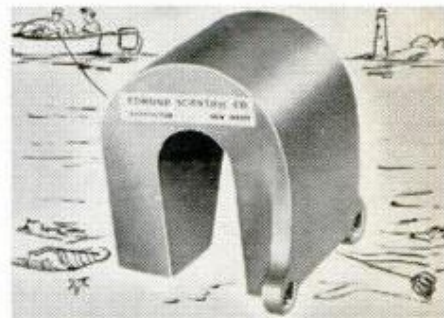
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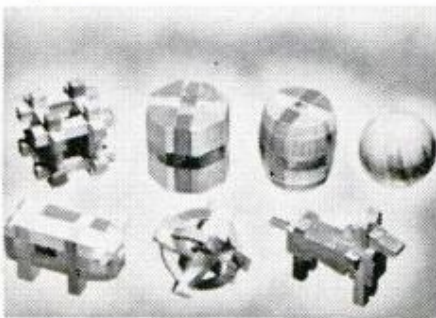
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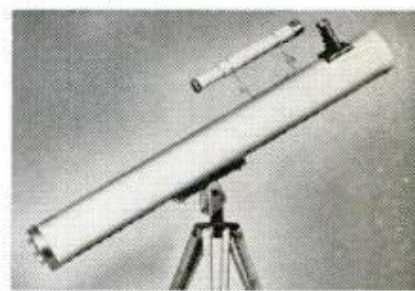
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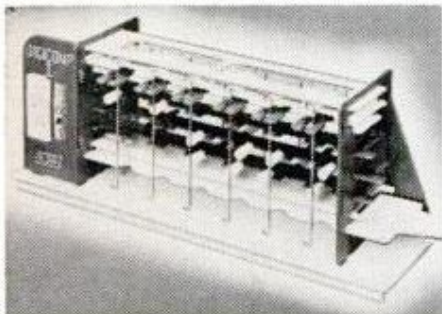
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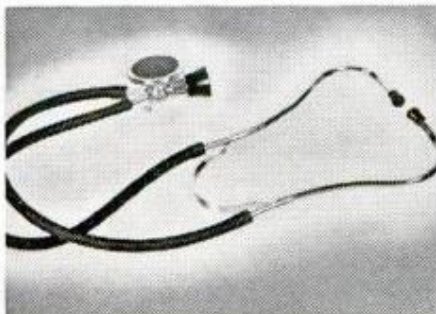
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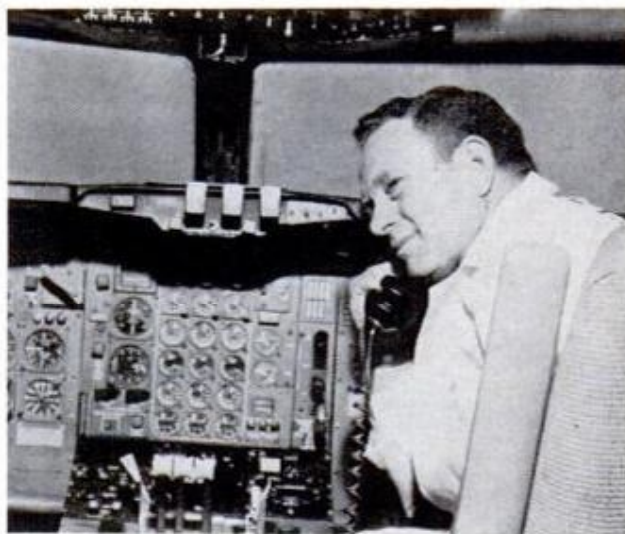
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BY KEVIN V. BROWN

**AVIATION
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AIRCRAFT MECHANICS are no longer the "grease monkeys" of 20 or 30 years ago, according to one who recently won the Federal Aviation Agency's national safety award. Now they need an education.

W. R. Gilliland, an instructor and specialist in aircraft instruments at American Airlines' Tulsa (Okla.) shop, says that most people think of the mechanics' field as a refuge for high-school dropouts. "They can't get by today," he says. "The



TOP MECHANIC, W.R. Gilliland, at his post, checking instruments in cockpit of American Airlines' 727 jet

planes are too complex. We need smart kids with a high-school diploma, preferably a vocational school, and at least two years in a technical college."

The rewards are worth the effort, he adds. Both government and management are beginning to recognize the mechanic specialist as an artist in his own field. Gilliland, who started out at \$90 a month 20 years ago, says the young man with the proper credentials can expect from \$600 and up to \$750 a month today.

Gilliland won his award for devising a test for a motor that controls the horizontal-stabilizer trim on Boeing 727 jets without removal of the motor from the plane. Too many of them, some with zero time, were being removed as defective. He wrote to the manufacturer (not Boeing) about this and, getting no response, "just got curious." American has had no "down time" on the motor since.

The FAA award, established four years ago, is the second to go to an American Airlines' mechanic. The award, to be made this month in Washington, D.C., includes a plaque and \$500 cash. ★★

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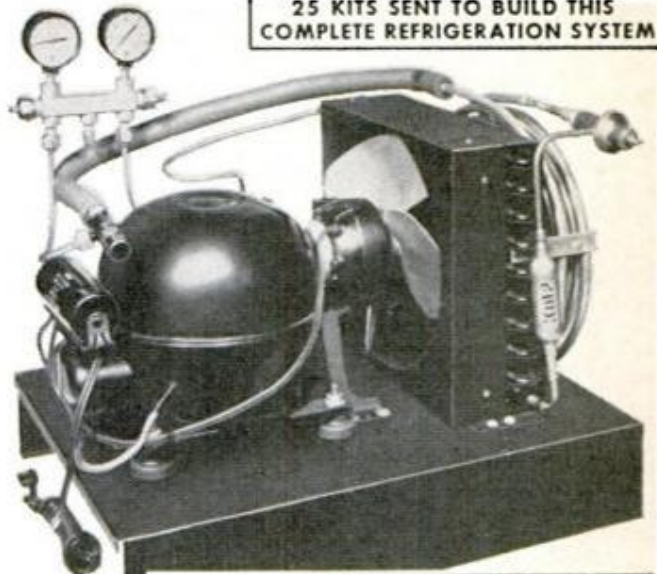
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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Carburetor hijinks

Since the day I bought my 1966 Chevy II (6 cylinder, standard shift), I've had trouble with it jerking when I slow down to about 30 mph. It's been to several Chevy service shops a number of times. They try—that's all. Can you tell me what's causing this?—Lorell Pittenger, Stoddard, Wis.

Try a richer fuel mixture first. If that doesn't work, change the carburetor jets to the next larger size. Finally, if all else fails, it's possible that you have a carburetor with a defective casting. If you do, it should be replaced *in toto*, but at no cost to you.

Gasket groping

I was surprised to find that there were no gaskets on the sparkplugs (Champion N14Y) of my 1963 Plymouth, because I thought plugs always had gaskets. I found it difficult to remove the plugs. Is this because gaskets should have been used?—Harold Friedman, Queens Village, N. Y.

This car did not use sparkplug gaskets. Plugs are recessed into aluminum tubes that have rubber seals at the tops. These tubes last long and seldom fail. So, if plugs are hard to remove, they may have been overtightened to begin with. There's also a tendency for torque to increase somewhat over a period of time and mileage. When you install new plugs, make sure to torque no more than the specified 30 to 35 ft.-lb.

'SAN'

I own a 1965 Pontiac GTO with four-speed transmission. A problem has developed that no Pontiac dealer has solved. It is a ringing noise that occurs at 19 mph in first gear and at 40 mph in fourth. It sounds the same as a phone ringing. Your help in solving this will be greatly appreciated.—John J. Donovan, Arlington, Va.

I don't know what help I can provide. From what I've been able to find out, this is considered S (standard) A (and) N (normal). It is a drive-line noise. In 1966 models, springs were added to the counter-gear to absorb this noise. Unfortunately, you can't convert your car to allow for

these springs. So, I'm afraid you'll have to live with the noise.

Falcon valve adjustment

The 1965 shop manual for the Ford Falcon with 200-cu.-in. engine shows a valve rocker arm without an adjusting screw and tells how to adjust. However, my 1965 has adjusting screws. Could you tell me the proper way to adjust my valve clearance after a valve grinding job?—Lamar Wray, Kilmichael, Miss.

Position the piston at top dead center after the compression stroke. Turn the adjusting screw so that all clearance is just removed, then turn it down 1½ turns more. The job's done with the engine off.

Corvair tip

I've noticed several references in past issues of Auto Clinic about the sticky gas-pedal problem in the Corvair. My experience has been that the shaft in the gas-pedal bracket freezes up with age. To correct it, I removed the carpet and gas-pedal bracket and used penetrating oil until it worked freely. I've made it a maintenance policy to periodically oil the shaft. Thank you for your magazine and especially for the tips to us Saturday mechanics.—Davis S. Fales, Auburn, Mass.

And thank you, Dave, for this tip for Corvair owners.

Clickety clackety

I'm the owner of a 1966 Buick Skylark. A month ago the heat riser began to click when the engine was idling. My dealer says he can't do a thing. Is he giving me the brush?—C. S. Kwiatkowski, Milwaukee.

No. This has been characteristic of this model. However, your dealer can now do something about it. According to Buick, the 1967 heat riser valve is "much improved" over the 1966 valve and is interchangeable. What do I suggest? Get a 1967 valve and idle smoothly again.

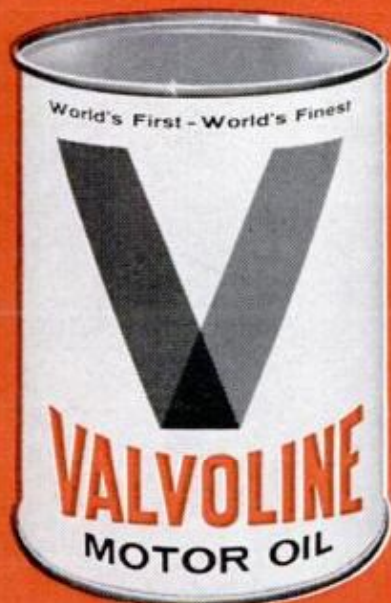
Bait for the Barracuda

I own a 1965 Plymouth Barracuda with
(Please turn to page 20)



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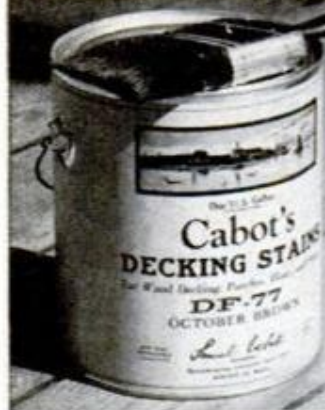


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AUTOMOBILE CLINIC

(Continued from page 14)

a V8 engine and automatic gearbox. When starting from a dead stop, I get a slight shudder—like what you'd get with a chattering clutch. I've been hearing several differing stories from the agency, depending on the person to whom I speak: "It's common to the car"; "It's the way in which the rear engine mount is designed"; "Can't do a thing about it." It really isn't bad, but I'd like to satisfy my curiosity. Have you had complaints of this sort?—William R. Jarvis, North Babylon, N. Y.

Can't say I have, Bill. One of the agency's stories may be correct, but I surely wouldn't settle for it until I've checked the condition of the universal joints and drive line, and also the U-joint working angles for correct specs.

Breathing fire

My problem is with a C6 three-speed automatic transmission in a '66 Mercury Montclair. The fun starts when I tow my 16-foot travel trailer. I'm careful to start my roll easy and never drive at speeds over 55 mph. But the transmission doesn't like it, and starts to pump out fluid to the tune of one quart in 90 miles. It seems to be coming from the breather pipe, but I've been told this is impossible.

Impossible or not, the fluid ends up all over the car and trailer. The pan gasket has been replaced, there are no apparent leaks and I've been told the diaphragm is okay. Ideas, please—I'm desperate.—H. G. Maxwell, Southport, Canada

There are four reasons for this kind of trouble. I'll list 'em for you—take your pick where you want to start:

1. Water contamination of the fluid.
2. An internal oil cooler leak.
3. Overfilling the transmission.
4. Use of the wrong dipstick and/or filler tube.

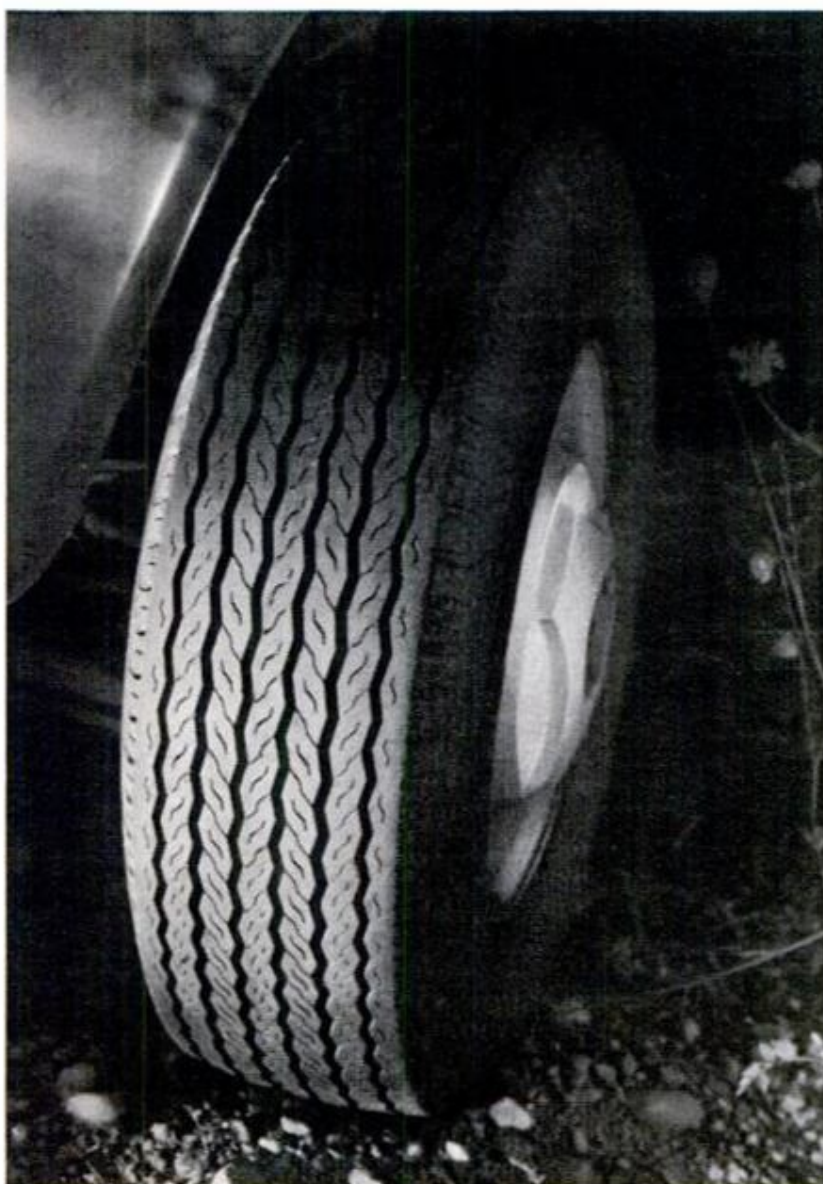
Sick, sick, sick

I have a sick airconditioner in my 1964 Cadillac, Doc, which qualified mechanics have been unable to cure. It started when the unit failed to produce cold air and started to leak. We've replaced the seal in the compressor, recharged the unit, and have traced and traced but have not turned up the source of the leak. It's apparent the unit is leaking Freon, because we see drops on hoses. Yet, the gas flame when run over hoses and connections in-

(Please turn to page 22)



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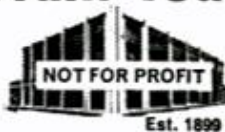
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AUTOMOBILE CLINIC

(Continued from page 20)

icates no leak. Where do we find it?—Your patient, Dr. M. G., Toledo, Ohio.

You're going under the assumption that there is a refrigerant leak. Causes of insufficient cooling are many, and drops of moisture are not an indication of a refrigerant leak. They do indicate, though, that cooling is taking place in an area other than the evaporator.

I don't know which mechanics checked this, but I surely wouldn't let any but a Caddy man do this. And make sure he's consulting the airconditioner diagnosis chart in the 1964 shop manual (pages 13-77 through 13-79). If you peek at that chart you'll note 33 reasons for insufficient cooling; leakage of the coolant is just one.

Service Tips

● **GM transmission leaks** can be cured. Here's a tip you can relate to your mechanic when he tells you he can't trace an oil leak from your car's Powerglide or Hydra-Matic transmission. One area in which a leak is common, but hard to trace, is at the base of the filler pipe. If investigation fails to reveal the cause of a leak from another source, have the mechanic remove the filler tube and check its base for concentricity. It's also a good idea to check the condition of the "O" ring seal at the same time.

● **'64 Oldsmobile radio noise** is usually caused by your ignition. To eliminate it, solder a 220 mmfd. capacitor (available from a radio-supply house) to the speaker lead at the radio, and ground it at the speaker mounting screw. You can do this job with the radio in the car, but keep capacitor leads as short as possible.

● **1965 or 1966 Dodge Darts or Coronets** with 273 or 318-cu.-in. engines may have a knocking fuel pump. If yours knocks, check the number on the pump flange. If it is M3673S, you can eliminate the knock by getting a new pump which incorporates rubber bumpers on the pull rod. This new pump can be identified by the number M3962S stamped on the pump flange and is available from a Dodge dealer under part No. 2495527.

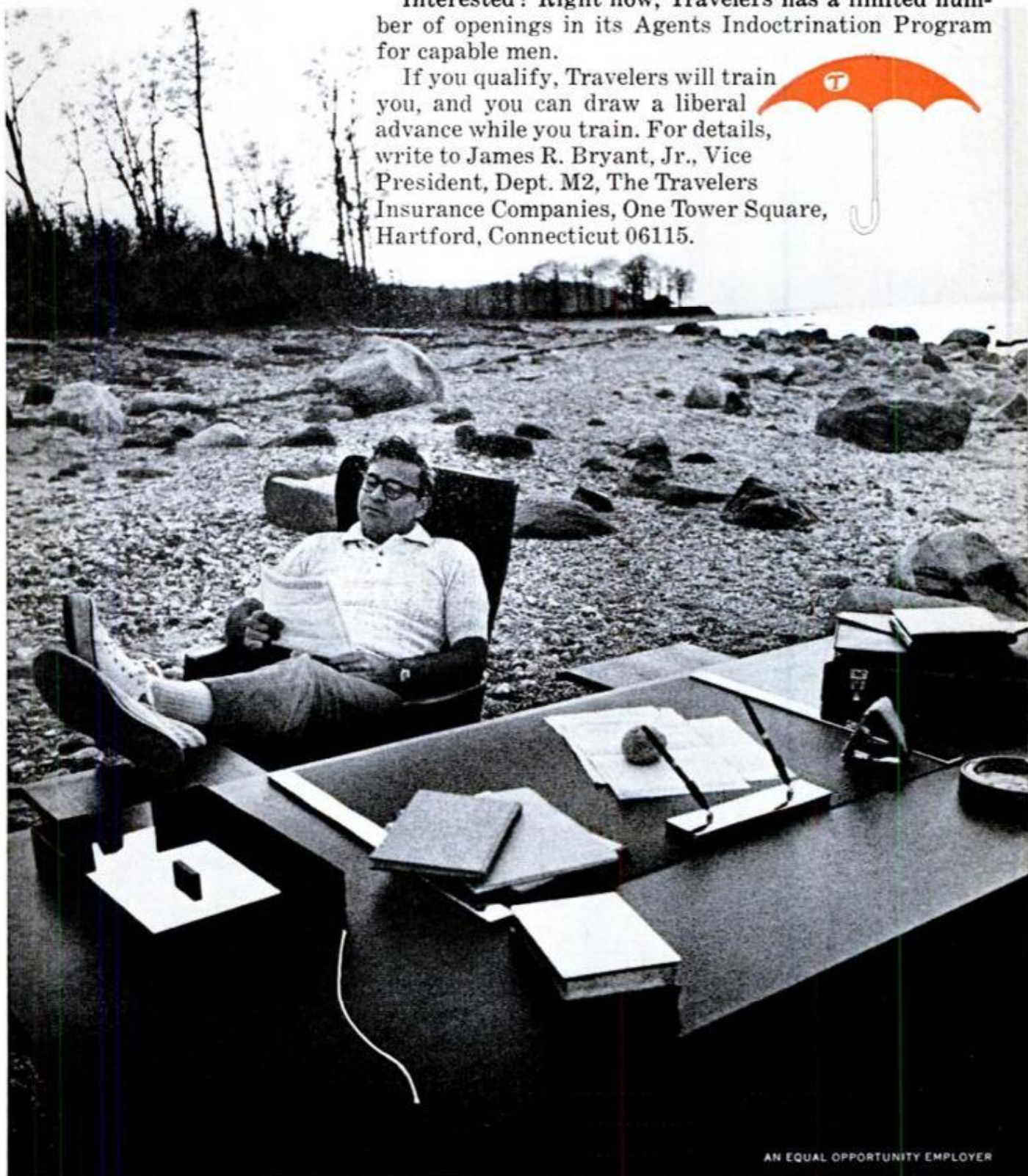
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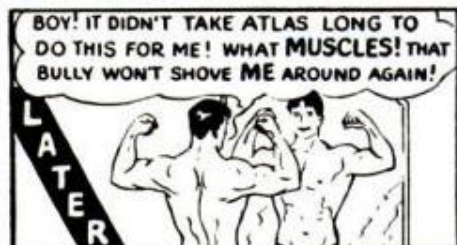
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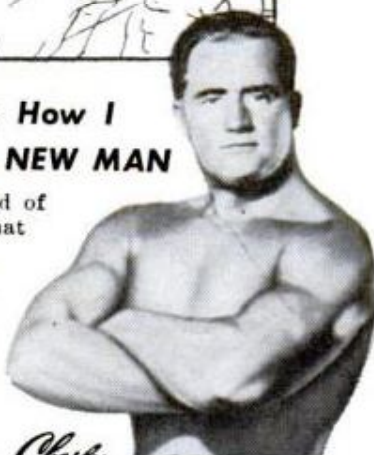
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DETROIT LISTENING POST

BY BOB IRVIN

GOVERNORS MAY BE REQUIRED ON CARS in a few years. The last time speed-control devices were seriously mentioned was during the "speed and horsepower race" of the late 1950s. President Johnson's traffic safety chief raised the prospect again when he said he is going to consider 90-mph governors as one of the future auto-safety standards. "I believe it would not be possible for any single manufacturer to introduce such a limit on his own because of the possibility of competitive problems," safety chief William Haddon Jr. said. But this wouldn't be a problem if everyone was required to install them, Haddon added.

INERTIA REELS FOR SAFETY BELTS may finally start appearing on American production cars sometime next year. The manufacturers will be forced to install them because of the prospect of a buyers' revolt against the shoulder belts that will be on all 1968 cars. They dangle like limp spaghetti when not in use. Auto critic Ralph Nader even regards loose shoulder buckles as "potential lethal weapons." Inertia reels would solve all that by rolling up the belts when not in use. Moreover, they would allow freedom of movement while the belts are being worn, would only clamp tight in an accident. Automakers weakly claim lack of experience with the belts when asked why they are not now on cars. However, jet pilots have had them for years and they already are on some European cars.

WAR ON THE AIR POLLUTION caused by automobiles is creating new problems as old ones are being solved. As the unburned hydrocarbon level is reduced, "we wind up with more oxides of nitrogen—and this produces smog," said one U.S. senator. Standards are being developed to solve this problem, too. The same senator—Howard Baker, of Tennessee—also believes the electric car isn't the "final solution." He says that in the Los Angeles area "a high concentration of electric cars could produce quantities of ozone which is far more deadly than the levels of monoxide and hydrocarbons from the present automobiles." The auto industry believes that within ten years it can virtually eliminate the problem of air pollution from automobiles. "I believe that with research and development, the hydrocarbon emission level will drop to about 100 parts per million and carbon monoxide to three-tenths of one percent," says Ford V.P. Michael Ference Jr.

A "TALKING SPEEDOMETER" has been invented by an employee of the Atomic Energy Commission. It automatically announces a car's speed at regular intervals. The inventor says road tests have proven that a motorist using the "talking speedometer" actually feels less driving tension while traveling close to posted speed limits. The principle, employing stored male or female voices giving the various speeds, is similar to the automatic message-announcing systems used by pilots of high-speed aircraft.

A "SNIFFER" is needed by the auto industry: "What we want to develop," says Ford service manager Bob Graham, "is some device which will 'sniff' a car's exhaust and tell us if it is meeting the government air pollution standards." The present testing system, used in California, requires an engine to stand idle for 12 hours, then be put through a 45-minute test with a plastic bag connected to the exhaust pipe. All the exhaust gas is collected and a sample taken to see if it meets the standard of no more than 275 parts per million of unburned hydrocarbons and 1.5 percent carbon monoxide, a test that's obviously impossible to run now that all 1968 and later cars will have exhaust emission control systems.

THE FEDERAL GOVERNMENT is stewing in its own broth. The U.S. General
(Please turn to page 30)

Introducing the cool tire

Armstrong has developed a new tire made with fiber glass that resists heat—even at high speeds. It virtually eliminates blowouts. And it can give you at least 10,000 more miles of wear than you can get with an ordinary tire.

For years tire manufacturers have struggled with a problem.

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What to do? One answer was to put belts of steel inside the tire. That's the way racing tires are built. And there's no tougher, no cooler-riding tire made than a racing tire.

But most people aren't racing drivers. And their cars aren't designed to bounce along the Indianapolis Speedway at 150 mph. Steel belts were out because they produced a rough, hard ride.

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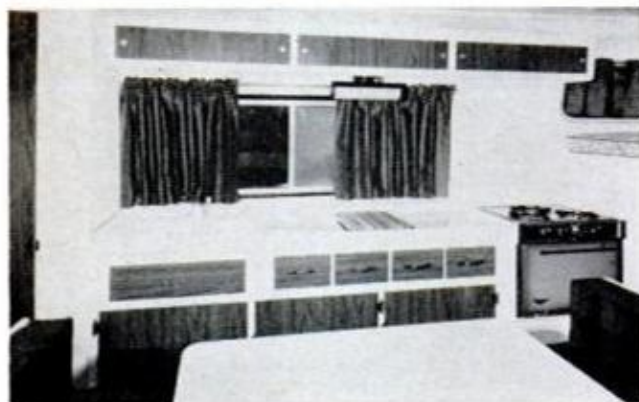


WHAT'S NEW OUTDOORS

BY DAN FALES

A BRAND-NEW CONCEPT in camper construction could revolutionize the market. Travel Industries is using a new plastic and a new process to build styling into pickup campers. Designed specifically for the Ford 250 series of $\frac{3}{4}$ -ton pickups, this new Gold Line camper is available through many Ford dealers. I've seen the camper, and it looks very sleek.

The camper body is made of Cyclac, a tough plastic being used in football hel-



mets, golfclub heads, baseball protective caps, rifle stocks, fishing rods and reels and color telephones. Use of the strong, light material makes the camper 33 percent larger inside and 40 percent lighter than others of comparable size. The extra space is possible because of a new vacuum-mold construction process.

This 10½-foot camper doesn't have wooden framing covered by an outer skin. It's made of two extremely thin sheets of plastic separated by an inch of foam insulation. The walls are just over an inch thick—about four inches less than many wood-framed models.

Cyclac has permanent color. This "through" color means no painting. Just

wash and wipe. The wash feature also makes interior cleaning a snap. With its plastic sides and top, plus a fiberglass floor, you just remove some fixtures and hose out the inside.

The new plastic enables construction of a dent-resistant camper body that has rounded corners, a low-top look, and is light in weight for driving ease. (Note: no external fixtures in sight to mar camper lines.) Only the 10½-foot model is in production right now. Prices run from \$1995 to \$2895 (f.o.b. Oswego, Kans.), depending on camper accessories. Base price for the Ford 250 is about \$2400.

FISH BY MAIL is the newest offering of Sears, Roebuck and Co. Now you can send away for fingerlings to stock a pond or stream. You have five different choices: rainbow trout, largemouth bass, bluegills, fathead minnows and channel catfish. Prices, including prepaid air express, range from \$32.50 for 1000 fathead minnows to \$64.50 for 1000 trout.

Shipped in plastic bags containing water, the average fish is two inches in size, but will go to 12 or 14 in two years, depending on variety.

Sears says that some states have conservation laws that require special procedures for stocking. So, for a complete run-down on stocking, plus dates when fish are available, write Sears for a pamphlet called *Guide to Water Management and Fishing for Fun*, at 925 S. Homan Ave., Chicago, Ill. 60607.

ANOTHER MATCH AIR RIFLE, I have just learned, will be available in this country in January. The Anschutz Div. of Savage Arms will be marketing a Model 250. This single-shot competition air rifle fires a .177 pellet through a fixed barrel. A compensating piston in the air chamber eliminates recoil.

The 10.5-pound model requires no lubrication and has an anti-backlash control preventing cocking lever snapback. Weight and styling of the Model 250 makes it a natural for indoor practice to keep your eye for small-bore shooting.

This model will sell for about \$175. It is entering the market to rival other match air rifles (see page 114) that will be used in the National Rifle Assn.'s new 10-meter (33-foot) match competitions. ★★ ★

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JOE E. WREN says, "Paid entire tuition and made \$800 besides in spare-time, even before completing training." *Overland Park, Kan.*

306

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DETROIT LISTENING POST

(Continued from page 26)

Services Administration (GSA) has had serious trouble this year buying cars which fit its highly touted safety standards. Trouble involved establishing a system for certifying that the vehicles did, indeed, meet the GSA standards. What's worse, though, is that the GSA standards for 1968 cars, which were published many months ago, can't be met by the U.S. firms. This put the GSA in a dilemma: withdraw the standards which are objectionable and run the risk of attacks from auto critics, or keep the standards and run the risk of not being able to buy any vehicles for the U.S. government next year.

FORD could have had a collapsible steering column four years ago, but turned down the invention of a local Detroit tool-and-die shop. The firm eventually sold the idea to General Motors, which introduced the column on its 1967 models and sold the unit—or key parts of it—to American Motors and Chrysler. Ford contented itself with its "flowerpot" steering wheel this year, is going to buy the collapsible shaft from the local tool shop for its 1968 models. The Ford shaft will be available a year late, but it is said to represent an improvement on the GM column.

A SUPER SPEEDWAY is being planned for Talladega, Ala. Bill France, head man of the National Assn. for Stock Car Auto Racing (NASCAR), has set the spring of 1969 as the target date for the opening of the new 2.5-mile track. Plans for the new track have been drawn by Charles Monypenny, designer of the 2.5-mile Daytona International Speedway. The new track, a quad-oval not as steeply banked as Daytona, will cost \$3.5 million exclusive of its land site of 1600 acres.

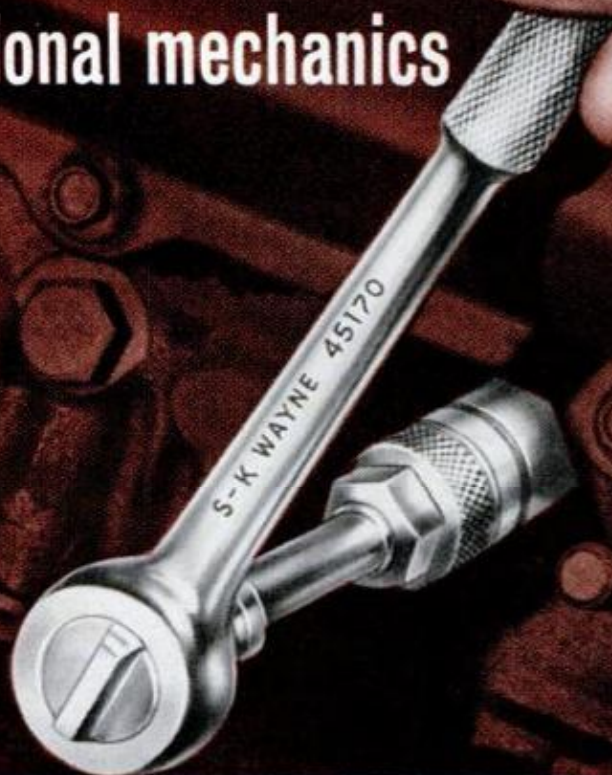
SIMULATED VINYL ROOFS are the latest accessory. A Detroit area company has devised a method of spraying a vinyl coating on a conventional metal-roofed car to make it look like one of the factory-made vinyl-top cars, "wrinkles and all." Late report from the firm indicates a brisk demand.

TRAFFIC CONGESTION SUPREME exists in Tokyo, world's largest city. Would-be car-buyers must first show police on a map the exact spot where the car will be parked. Perhaps this helps explain the recent upswing in Japanese car exports. ★★★



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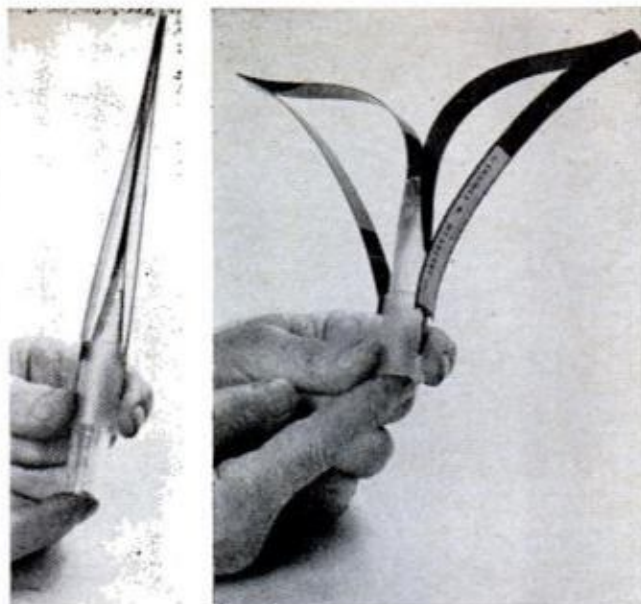


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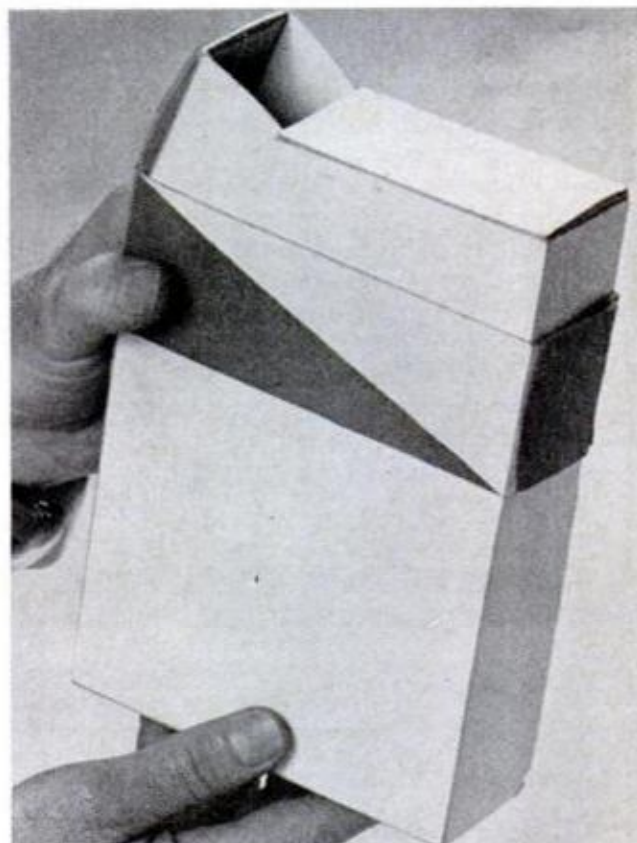


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'Umbrella' opens new doors

A principle of "transformable structures"—which the inventor likens to an inverted umbrella and demonstrates with the device above—can be put to such everyday use as a self-opening pouring-spout lid for a box of soap flakes. (Sliding the collar up and down on the box, below, causes the spout to open and close.) Other applications may include a structure for a collapsible tent or for a landing device that expands into assembled form when air-dropped. Basically, the invention is a structural system that transforms some of its members from a linear, side-by-side position to an expanded non-linear arrangement. A patent has been applied for by Thomas McSherry, North Babylon, N.Y.



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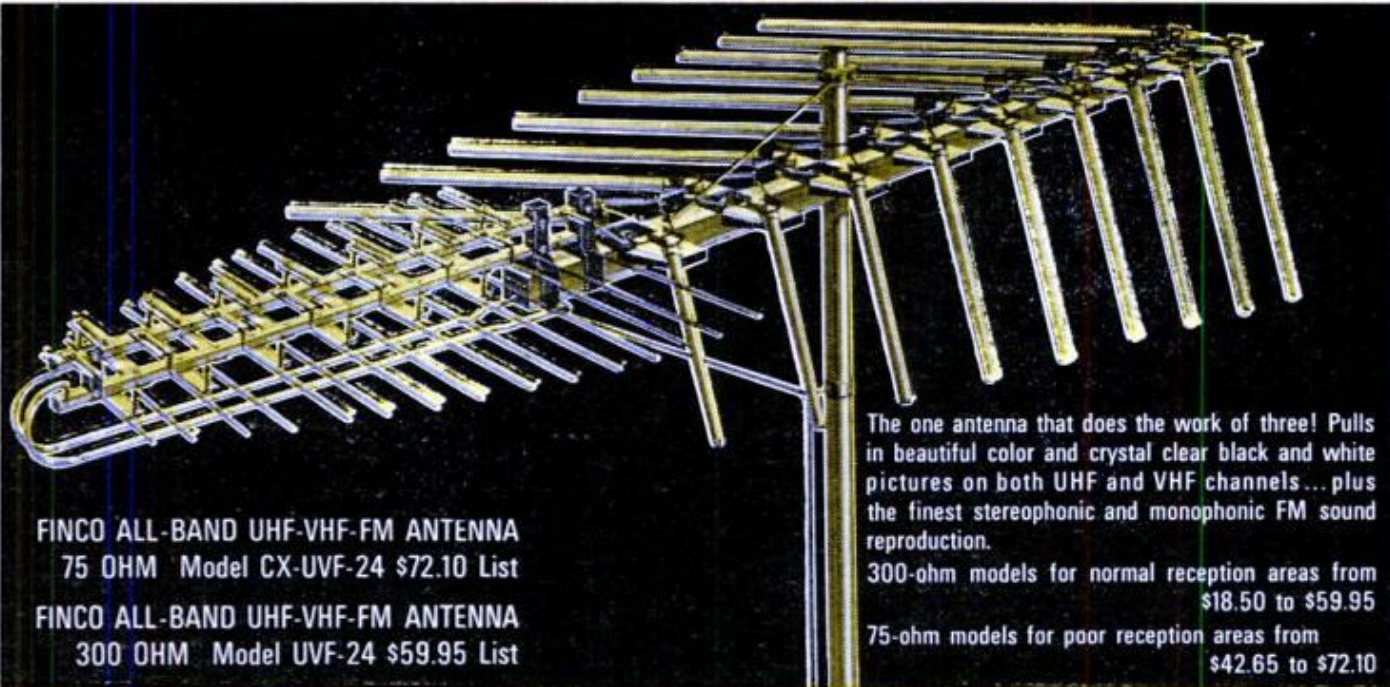
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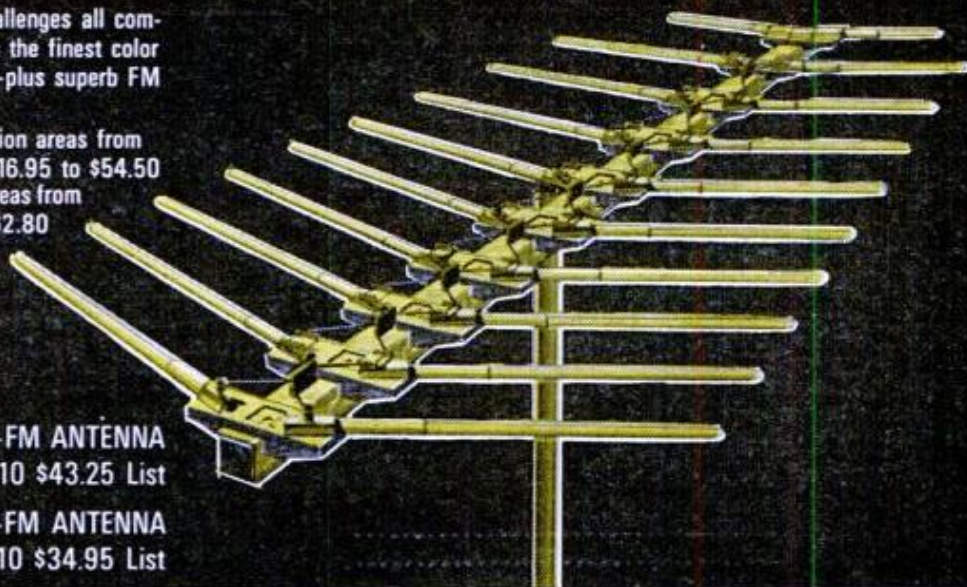
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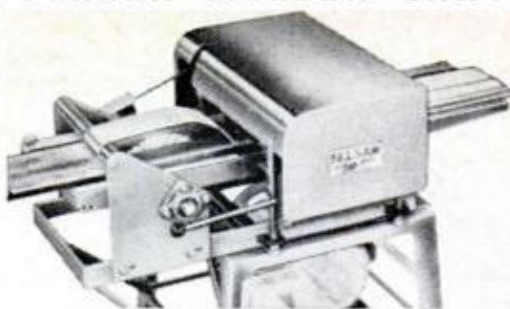
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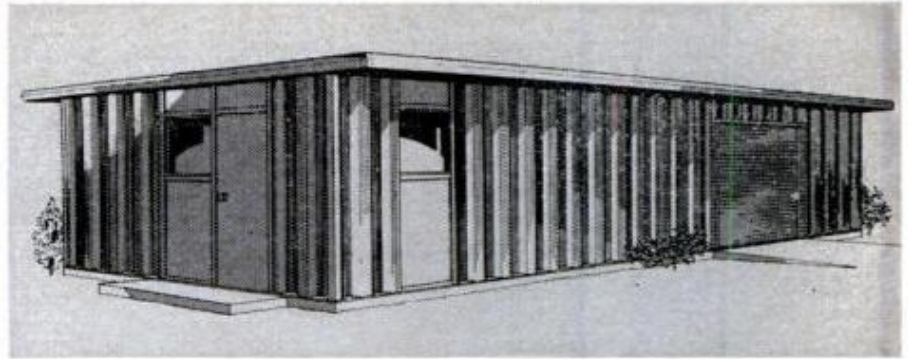
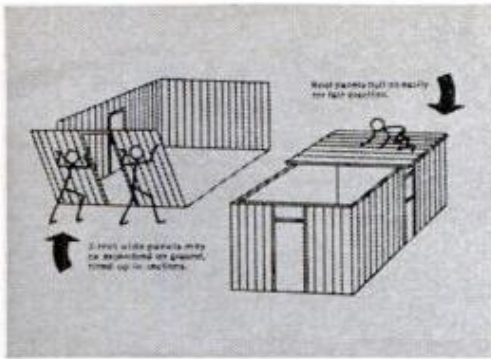
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Drivin' with Dan

Could an Offy engine run in Formula 1? What is the best way to break in a family car? Can race drivers recognize faces in the crowd as they whiz by? Dan Gurney answers these and other interesting questions



TEXAN FOR THE DAY, Dan drove a Mercury Cougar to a win in that state's Green Valley 300 this spring. The 1.58-mile, seven-turn Green Valley track kept average lap speeds for the race below 80-mph mark

Q. I read where Jackie Stewart can recognize faces in the crowd as he goes by them at 150 mph. Do you believe this and can you see this good?—Warren Hazlitt, Geneva, N.Y.

A. It depends on the face. There are 150-mph faces and even some 200-mph faces. Also, some 40-mph faces. Seriously, that's not nearly the problem it might sound like. If you were to go up in a lightplane and fly low past some friends you would see that it's no particular trouble.

Q. Can you give me the time and place schedule for the major stock car races upcoming? And can you tell me in what section to try for seats? I would like to travel 500 miles or less.—Charles Schmitt, Quincy, Ill.

A. Although NASCAR is considered the pri-

mary stock car league in America, USAC and one or two other organizations also sanction stock car events, many of which are closer to you than the major NASCAR races in the Southeast. Most racing magazines carry schedules, or you can write NASCAR headquarters in Daytona Beach, Fla., and/or USAC headquarters, Indianapolis, Ind. Your vantage point depends on the track. Generally, I like to watch from the corners rather than the straights. The closer you get, the more you can appreciate what these men are doing. Closeness makes it more meaningful and makes you feel more of a participant. It goes without saying that you first of all use discretion, with a healthy respect for safety, in picking your spot.

Q. Would a destroyed Offy Indianapolis engine be competitive on the Formula 1 circuit? If so, why didn't you use one in your Eagle while the big Gurney-Weslake was being prepared? Also under similar circumstances, who would you pick to win a 500-mile race run on an oval track between Jimmy Clark and A. J. Foyt?—Burly Batton, Brookville, Fla.

A. I don't think an Offy would be competitive in the Formula 1 racing, primarily because Formula 1 is limited to 100-octane gasoline, while the Offy is based on an alcoholic diet. That's why we used the four-cylinder Coventry-Climax in our Formula 1 Eagle rather than an Offy while we were waiting for our 12-cylinder Gurney-Weslake. As for your hypothetical race between Clark and Foyt, it would be a tremendous race. There's no telling who'd win.

Q. Where does the money come from for Formula 1 races?—Fred O'Brien, Santa Monica, Calif.

A. Formula 1 purses are well below what Indy pays, although a good deal of money is spent on getting the participating cars

(Please turn to page 50)

DRIVIN' WITH DAN

(Continued from page 49)

and drivers to the event. Formula 1 purses come from gate receipts, private sources, advertising sold by promoters, and from some manufacturers.

Q. I read somewhere that when you were driving for Porsche you won a German race called the Solitude Grand Prix. What does the "Solitude" mean?—Frank Barnett, Birmingham, Ala.

A. In this case, "Solitude" is the name of the track near a village of the same name, just outside of Stuttgart. It is about six miles per lap, smooth and fast with many sweeping S-curves and several hills. It rains frequently there. On that particular day the crowd was estimated at 350,000 people. It was a big thrill for me.

Q. What is the best way to break in a car for racing? How about family use?—Wally Keihler, Mt. Clemens, Mich.

A. As a rule, a racing engine does not need breaking in, since it should be set up with

proper clearances right from the beginning. Generally, racing clearances tend to be larger than ordinary family car fits because the parts operate at higher temperatures and need more room for expansion.

As far as the whole car goes, you generally start a race car at considerably reduced speeds, paying close attention to the gauges, and pulling back into the pits early for a stem-to-stern check for loose parts, rubbing, leaking, and so on.

The modern family car requires little, if any, break-in; it can operate at high speeds right from the start. I think it's important to be sure it has the right kind of lubricants, as prescribed by the manufacturer, and that all temperatures remain within the normal range.

I usually try to apply the gas on-and-off for the first few hundred miles under the assumption I'm sucking some oil up past the rings when backing off, but I've never proven to myself whether I'm doing any good. Naturally, the racing-car procedure on checking for loose items, rubbing, leaking, and so on, also applies with equal importance to the family car. ★ ★ ★

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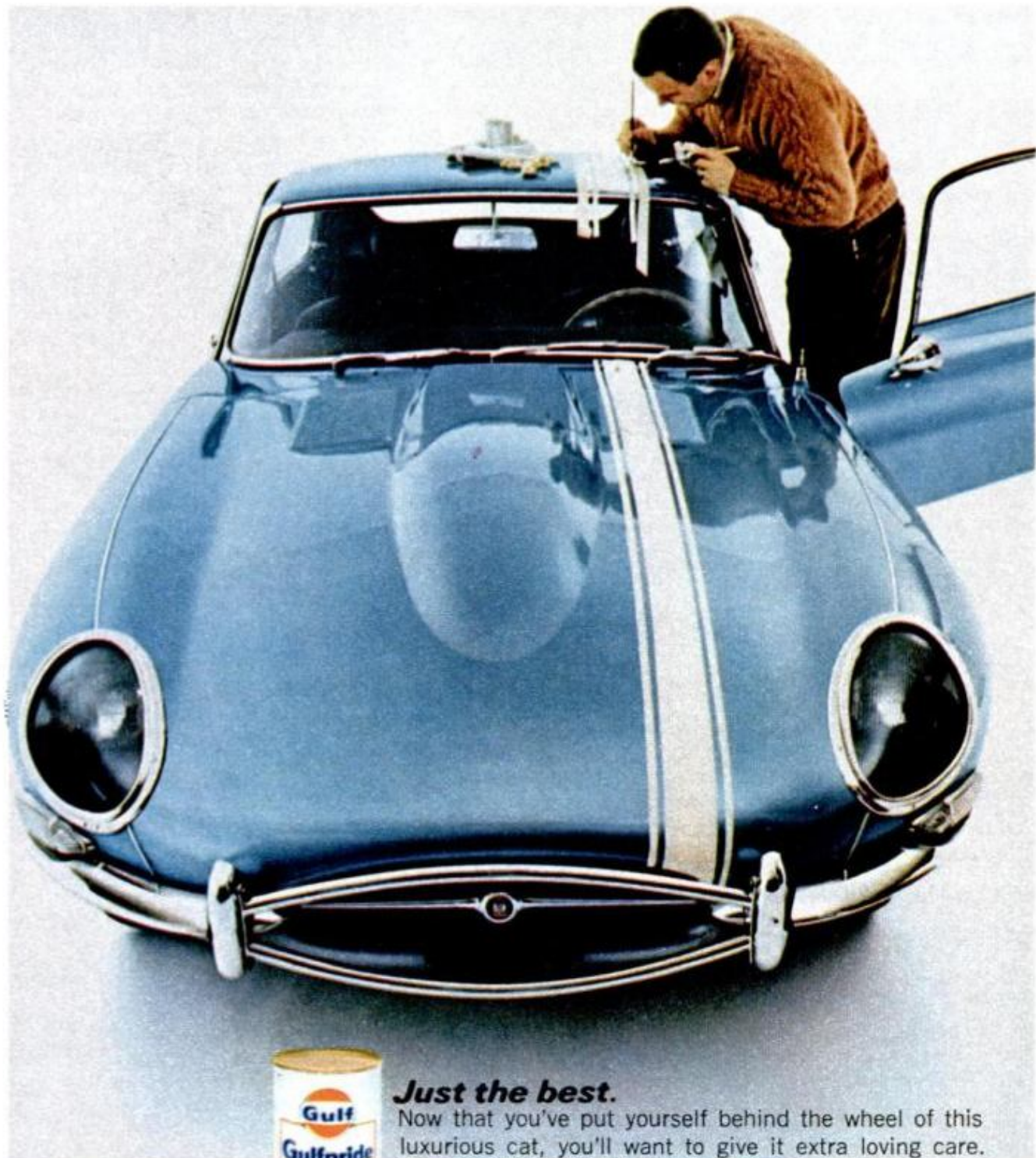
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FROM THE PATENT OFFICE **NEW INVENTIONS**

BY M. J. PEDERSEN

A LASER is used as a welder in a device to connect subminiature electronic units, such as transistors and integrated circuits, to other components. Conventional soldering guns are too large and too hot for use on microscopic items. Patent 3,304,403, received by James G. Harper, utilizes a laser in the infrared range to join wires from two thousandths to seven ten-thousandths of an inch thick. The patent rights have been assigned to Texas Instruments, Inc.

PADDED BOWLING PINS made of metal but designed to simulate the sound and bounce of traditional wood pins earned patent 3,301,560 for Fred E. Satchell and William L. Jolitz, who assigned rights to Brunswick Corp. Metal pins are more durable and easier to manufacture, but their metallic ring and "strange" bounce were expected to prove unpopular with bowlers. Both problems were solved by stuffing a foam material in the hollow core of the metal pins.

TRAILER WIGGLING is a nuisance that many drivers have to put up with. The trailer follows the towing car into a turn and then continues to oscillate long after the turn has been made. A supplementary hitch, consisting of a simple rig with ropes, pulleys and a strong spring, is designed to restrict the trailer's tendency to whip. As the trailer swings to either side, tension on the spring gives it a self-centering action. According to the inventors, Donald and John Gonczy, Franklin, Mich., who received patent 3,305,246, this enables the driver to maneuver his car without fear that the trailer will start fishtailing back and forth.

IRRIGATION PUMPS can be turned off when it rains by an automatic switch that earned patent 3,309,474 for Elmer G. Heinrich, Goodland, Kans. Key to the apparatus is a cup attached to a lever arm. As the cup fills up with rainwater, it weights the lever, which eventually triggers a switch that cuts off power to the irrigation pumps. The cup can be fixed at any point along the lever arm so that the amount of rain necessary to flip the switch can be varied according to the particular crop and season. ★★

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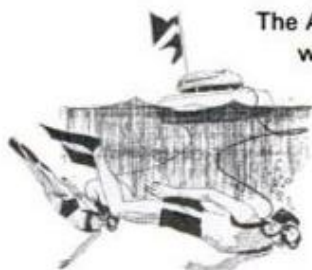
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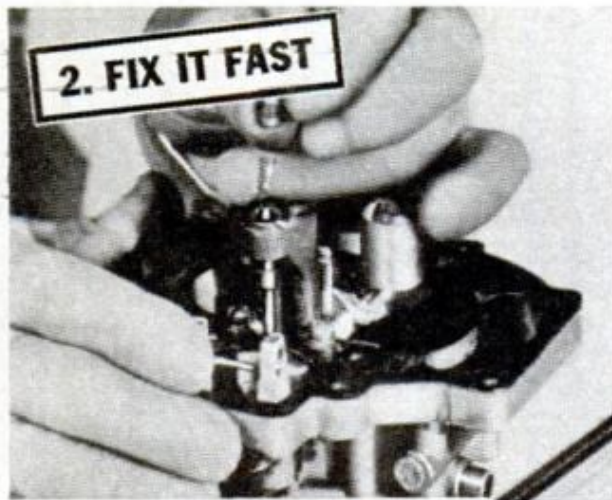
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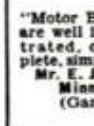
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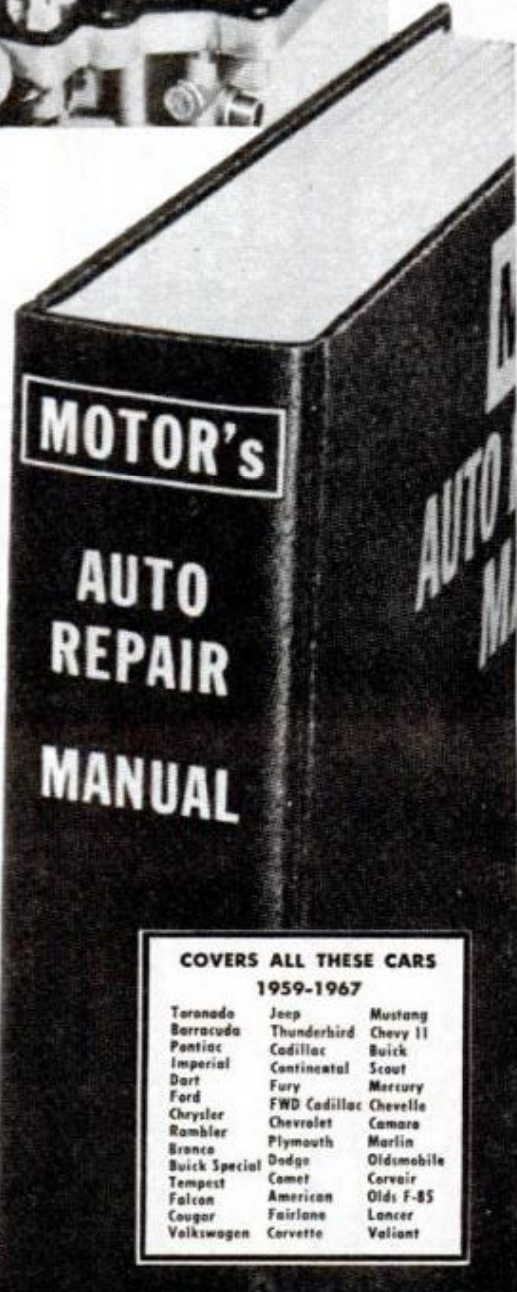
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Bubbles?

My new basement wall is very smooth, having been poured in plywood forms, but there are several holes on the inside surface (caused, I suppose, by air bubbles in the mix). I want to apply a waterproofer, but how do I fill the holes?—N.E., Pa.

I think perhaps you would do best using a concrete patching mixture. I'm assuming that the holes you describe are not more than an inch deep and are of the oval shape that would be formed by an air bubble (also that there are no cracks running through the wall).

Before mixing and applying the patcher, undercut the edges of the openings with a small cold chisel to form a "key" for the new material. This must be done with care to avoid chipping the edges of the opening and enlarging it. Be sure to remove all loose material after undercutting. Then mix the patcher according to the instructions on the container. Take care not to get the mix too thin, as this would make it unmanageable on a vertical surface.

With a small trowel, build the patch a trifle overflush with the wall surface. Then before the mix sets, smooth the area flush with a whiskbroom or paintbrush and wipe off any excess with a damp cloth. Usually it's advisable to keep the patches damp until the mix has hardened.

Gold rush

I always have trouble applying gold paint to wood. Even though I spray the stuff from a pressurized can, it never looks quite right—can't get a smooth surface and the grain shows right through several coatings. Just what does one do to get a smooth, uniform finish?—M.O., Fla.

Gold paint, one of the so-called metallic paints, is quite sensitive to the surface over which it is applied. It will "reproduce" the surface in just about every small detail. I've always had fair success applying ordinary gold paints over an enamel coating. If the wood is open grained, apply a filler and sand the surface smooth. Then apply at least two coats of enamel, allowing ample drying time between each. Smooth the surface of the enamel with fine steel wool. This gives a surface that's smooth yet with sufficient

"tooth" to hold the gold paint. Finally, although gold paint can be applied with a fine, soft brush, spraying gives a more uniform coating and a more realistic appearance of gold leaf, which most gold paints are intended to simulate.

Some newer types of gold paints contain special vehicles which are, in effect, self-leveling. They give very good results when applied as directed. However, in the end it's the surface you prepare that really determines the quality of the finish you get. A common rule, but one especially true when applied to metallic paints.

Winter mold

This spring my lawn turned up a number of patches of dead grass—and I mean dead. I've been advised to rake off all the residue, rework the soil and reseed, but I don't want to do this until I'm sure of the cause. Can you name it and tell me what to do?—R.Y., Minn.

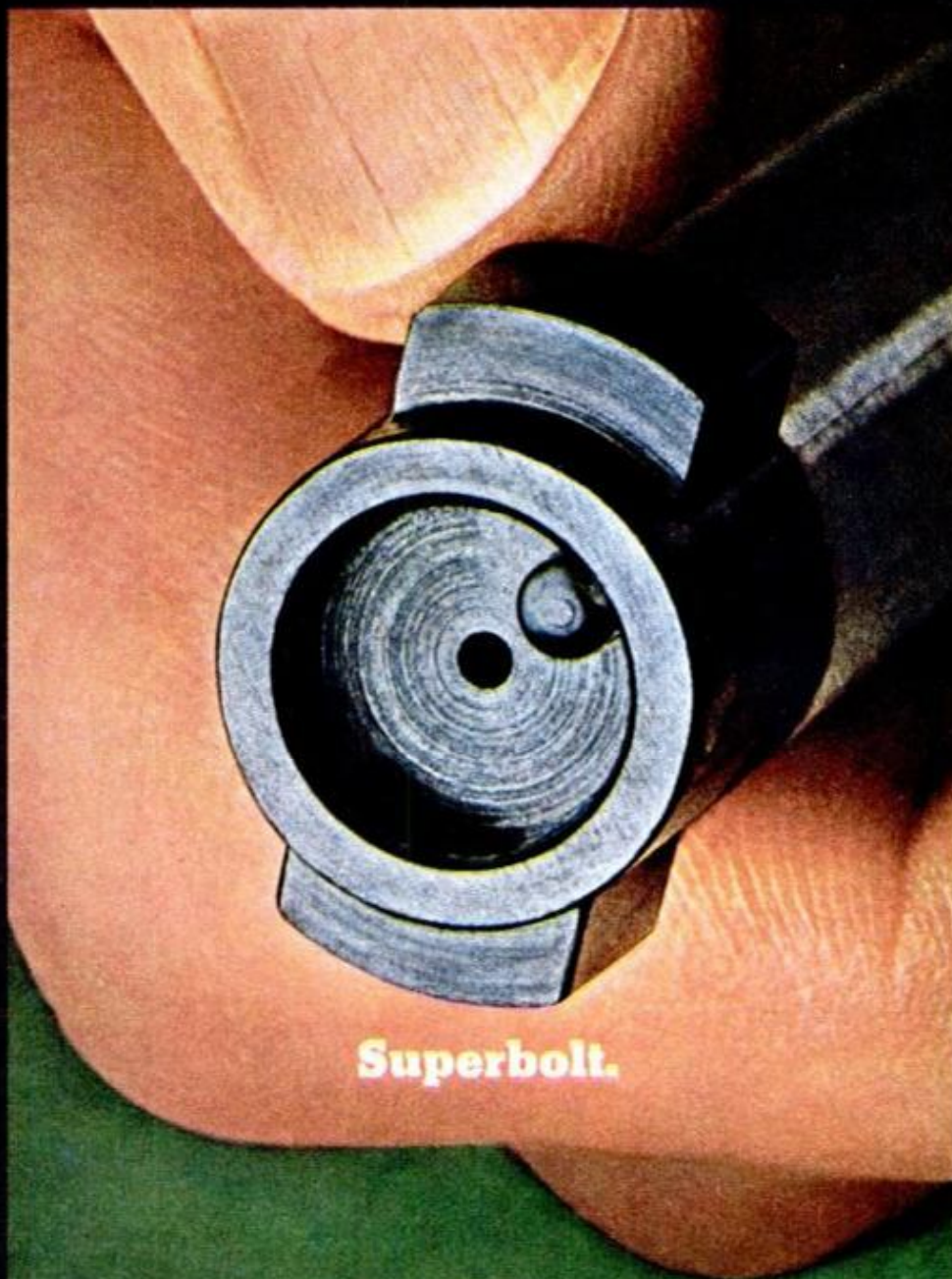
The cause is probably what's known as "winter mold," or perhaps more properly, "snow mold." Usually it's traceable to a fungus, so you'll need to remove the dead grass, plants and roots. Burn these and then treat the soil with a suitable fungicide. The latter, with instructions, will be available through your local dealer.

New seat for old chair

On my old cane chair the seat frame is split away at the back where the holes for the cane are located. The split part is still hanging, but must be repaired before caning can be done. How can I fix it without going into great expense?—F.R., Ariz.

Question is, does the split-off portion fit back into place tightly? If it does, you're lucky. Glue and long screws should do the trick, but there must be some preparation of the "joint" before applying the glue and screws.

If possible, pry away the split portion so you can insert a discarded toothbrush between the surfaces to be rejoined. Clean out the dust and other loose debris that must have accumulated. Then drill holes through the split portion and into the solid stock, spacing the holes between those that take the caning. The new holes should take screws long enough to turn at least $\frac{3}{4}$ in. into the solid seat stock. Then spread glue on the joining surfaces, tightly clamp the split-off part back into place, and drive flathead screws into the drilled holes. Wipe away excess glue with a damp cloth and fill any exposed cracks with a suitable wood filler. Be sure no glue hardens in the holes for the caning. ★★★



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'68 CARS: HOW NEW WILL THEY BE?

Hard-pressed carmakers, under the gun of rising costs and growing government regulation, will release a few trial balloons in 1968, but in the main will stick to their lasts and go along with minor modifications and face-lifts of existing models.

By Bob Irvin

THE BIG NEWS out of Detroit for the 1968 model year will center on new and revamped intermediates, those seemingly "just right" middleweights that appear to be capturing an ever-larger share of the U.S. car market.

Also big news will be higher prices stemming from ever-increasing costs of manufacture, plus installation of mandatory safety equipment and antipollution devices.

Intermediates will get the big styling play. General Motors and Ford have all-new body shells for their 114 to 117-inch wheelbase entries. The key word being bandied about regarding the basic styling theme of both manufacturers is "torpedo-shaped."

In general, the standard-size cars of both GM and Ford will appear as only minor face-lifts of current models. The exception will be Chrysler, where changes in the so-called "family" sedans are expected to be more extensive.

There will be two additional entries in the sporty car field—one at the high end of the market by Lincoln-Mercury, the other in a more popular price range by American Motors.

Starting Jan. 1, all cars will be "certified safe" under the federal government's new safety standards. The terminology here—"certified safe"—is obviously a slight exaggeration. The automakers will state only that the cars meet government regulations. People will still



NEW LINCOLN-MERCURY MARK X? Lines aft on this L-M hybrid indicate semi-fastback styling approach said to be a dominant feature of the division's forthcoming luxury-priced entry in the "personal" car market

have accidents, but the hope—even the prospect—is that some fatalities may be prevented.

Car prices could go up \$75 to \$100. A good chunk of the increase will be attributable to the air-pollution control system required for all cars. Whenever possible, manufacturers will employ improved carburetion rather than an air pump to reduce the amount of harmful gases exhausted to the required level of 275 parts per million of unburned hydrocarbons and 1.5 percent carbon monoxide. The system enjoying the greatest favor so far is the "cleaner air" package developed by Chrysler. It's cheaper than the air pump, but could still add \$20 to the price of a car.

More seat and shoulder belts will add another \$25 to \$30. The government wants two shoulder belts in each car. Six-passenger cars will also require two additional lap-type belts to go with the four now in cars. Add 'em up. With two pieces of webbing per belt, the average car will have 16 straps. Buyers may revolt when they see all that spaghetti and the auto companies admit they're worried. If for no other reason, the "neatness counts" concept

may force manufacturers to install inertia reels.

In a way, more than half the 1968 cars will be noisier. GM, for example, is equipping its new cars with buzzers which sound when a driver opens a door without taking the key out of the ignition. The idea is to cut down on auto thefts. Reports indicate that in at least half the cars stolen the owner left the key in the ignition. Another possible "noise" device is a buzzer that will sound at the rear of a car when a driver puts it in reverse gear, thus warning pedestrians that the car may back up. This gadget, however, is strictly rumor at this point.

Company by company, here's a rundown on what to expect in the 1968 cars:

General Motors

Chevrolet will give its new Camaro a minor face-lift with some new trim molding and taillights. But the most notable change is expected to be elimination of the side vent windows.

The Chevy II will have a new body shell and curved side windows. Some major body parts will be interchangeable with Camaro's. Although there's

no definite word, don't be surprised if Chevy II station wagons and hardtop models are dropped.

The biggest change at Chevrolet will be in the Chevelle line. These cars will be more streamlined, lower and wider. The belt line will be lowered almost an inch. Curved glass will meet the roof rails about one-half inch inboard. Width will be about 74 inches, two more than at present. Chevelle will add a nine-passenger station wagon and a four-door hardtop. The two-door hardtop will have a new, distinctive roof line. Windshield wipers will be recessed.

The standard-size Chevrolet will undergo major sheet-metal changes. The Impala two-door hardtop will have a fastback roof line even more pronounced than the present model. A new series is being added—the Impala Custom. The top-of-the-line Caprice will have a two-door hardtop with a squared-off roof line and the "Caprice" signature in the side glass where the vent window used to be. Rear taillights will be located in the bumper as on the Concours show model a few years back. A new grille will have more of a horizontal than checkerboard look. Headlights will remain horizontal. All 1968

Chevrolet standards are said to have recessed wipers.

There has been little, if any, mention of the Corvair and rumors persist it will be dropped for 1968. A Corvette with an amidships engine may appear as a '68½ entry.

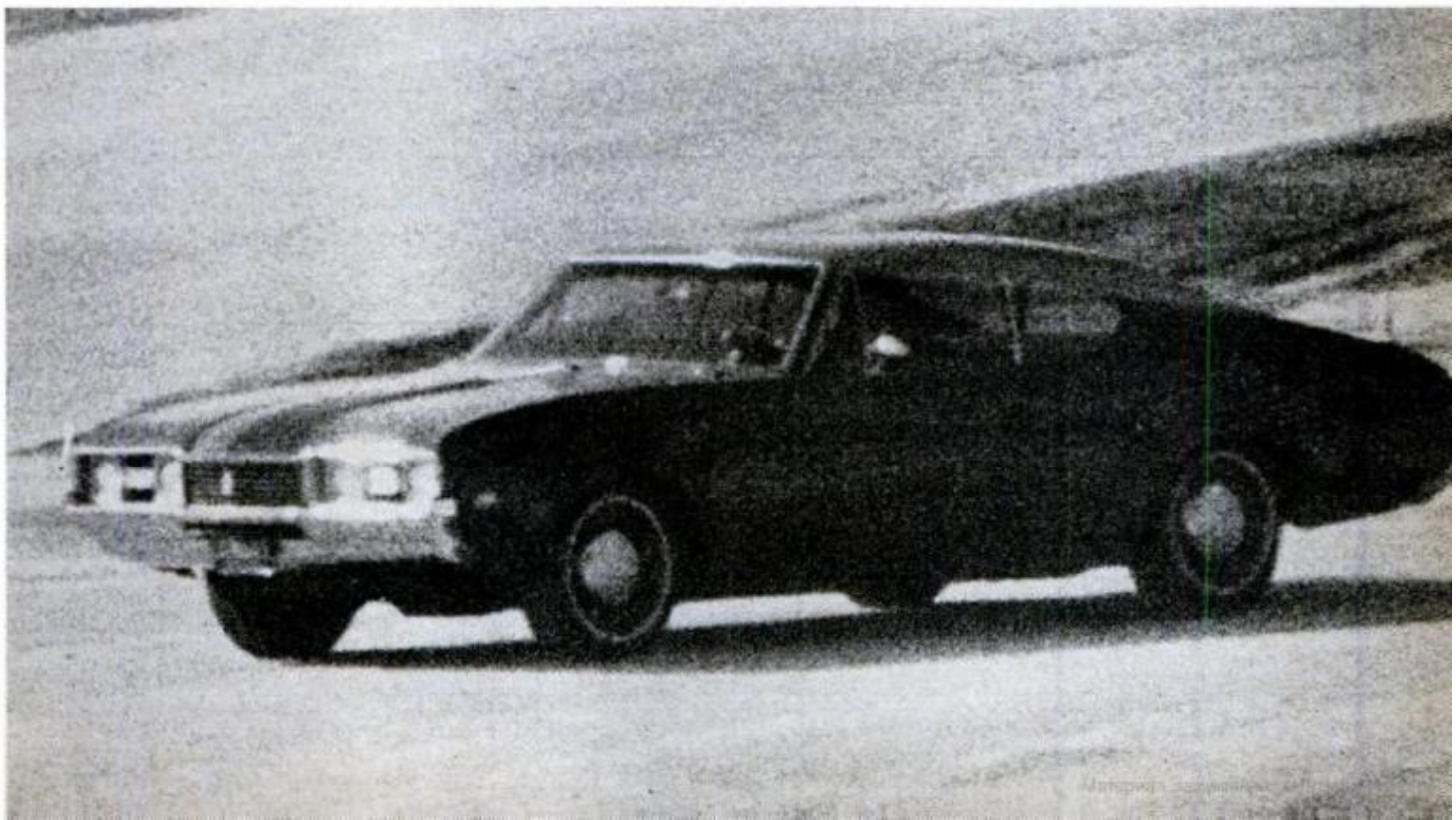
Pontiac is eliminating the side vent window on its Firebird. The car, introduced in February, will feature a new grille and ornamentation in an attempt to break away from the Camaro look it now has.

The Tempest series, presumably including the LeMans and the GTO, will feature recessed wipers, a styling trend begun in the larger 1967 Pontiacs. The Tempest body shell will be all new and, if viewed from above, might resemble a Coke bottle—the front and rear fenders bulge out and the car has a low, sleek appearance. The front bumper wraps around the grille.

The Catalina will join the '67 Grand Prix in dropping vertical headlights. Although they will now be horizontal, the split-grille theme will carry over with the bumper in front surrounding the grille. Taillights will be changed, too. An OHC V8 is a distinct Pontiac powerplant possibility.

Oldsmobile will offer an all-new F-85

TORPEDO-SHAPED OLDSMOBILE indicates industry trend to more sporty styling for 1968. Car here appears to be a Delta 88 with top hood lines emphasized and rear side windows rounded off in torpedo theme



featuring semi-fastback lines and a distinctive "torpedo-shaped" look, à la Toronado. The Toronado theme will carry over into other Olds lines. Hoods on the standard-size Olds, for example, will be lengthened. Also, standard models will feature recessed wipers. The Toronado itself will have but minor changes, mostly ornamentation. Whether the front-wheel-drive system will appear on other Olds models remains pure conjecture, but don't be surprised if it does.

Buick is coming out with a line of Specials featuring new body shells, roof lines and grilles. The division will boost its 340-cu.-in. V8 to 350 cu. in. Riviera will carry over just about as is and the rest of the Buick line will get relatively little face-lifting.

The word for Cadillac will be—as usual—restraint. Appearance changes will be minor, the division having taken its now-and-then radical step last year with Eldorado. The division will, however, offer a new 472-cu.-in. engine—at this point, largest in the industry.

Ford

An all-new Fairlane is due. Length will be up from 197 to 201 inches, height slightly lower and width up a fraction.

One model, possibly with an eye on hoped-for stock-car racing success, will be a "torpedo-shaped" fastback.

There will be a lot of new sheet metal on the Galaxie, but the car still retains its somewhat boxy look. Headlights will be vertical. Grille themes will be altered slightly through the Ford line.

As in 1967, Mustang will have only minor sheet-metal changes. The car is successful as is, and is not likely to become bigger and heavier next year. Along this same line, not much is being done to Thunderbird, which was all new for '67.

Lincoln-Mercury's Comet will have a new body shell this year. Lines will be new too, the styling stressing a racier, less boxy look. Both Ford and L-M lines will have a new 285-cu.-in. engine.

Biggest news at L-M will be the new Mark X, a so-called "personal" car built off the two-door T-Bird body shell. Cougar may offer a convertible; otherwise the car will remain about the same as the highly successful '67 model.

Chrysler

Dodge Dart, which had a new body shell this year, has new trim and ornamentation for 1968, but that's about all.

(Please turn to page 182)

AMERICAN MOTORS JAVELIN will enter sporty car field in '68 to compete in price with Mustang, Camaro. New car will be modified (as shown below) fastback version of the company's all-new AMX III show car





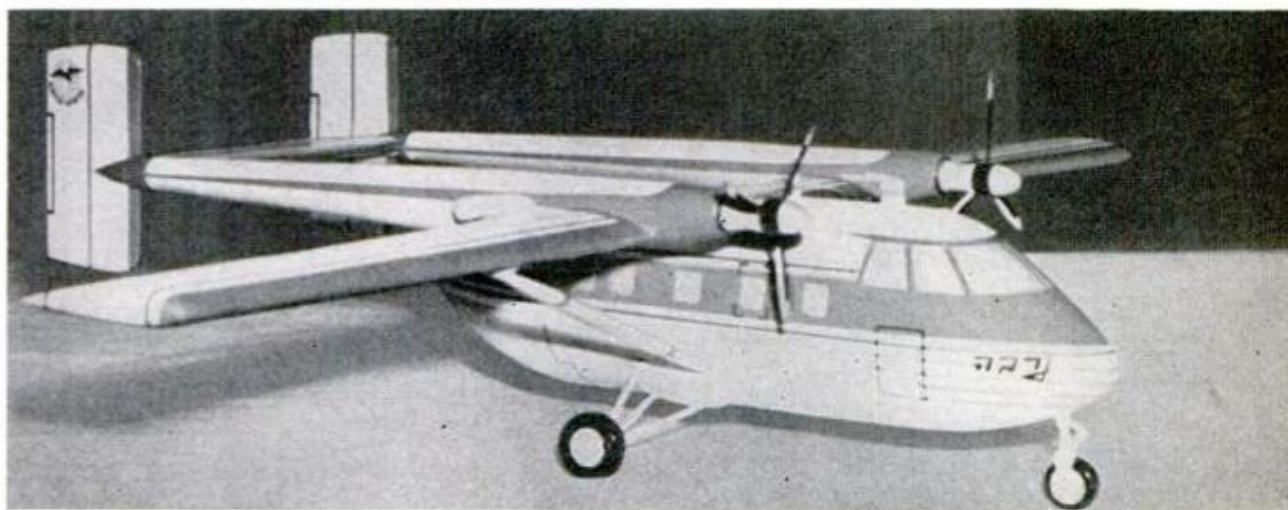
New German copter has fiberglass blades

The rotor blades of a new German helicopter are made of fiberglass-reinforced plastic. Two engines combine to drive the machine. Called the Bolkow BO 105, the new chopper made its first flight earlier this year at Munich.



Try this one for size

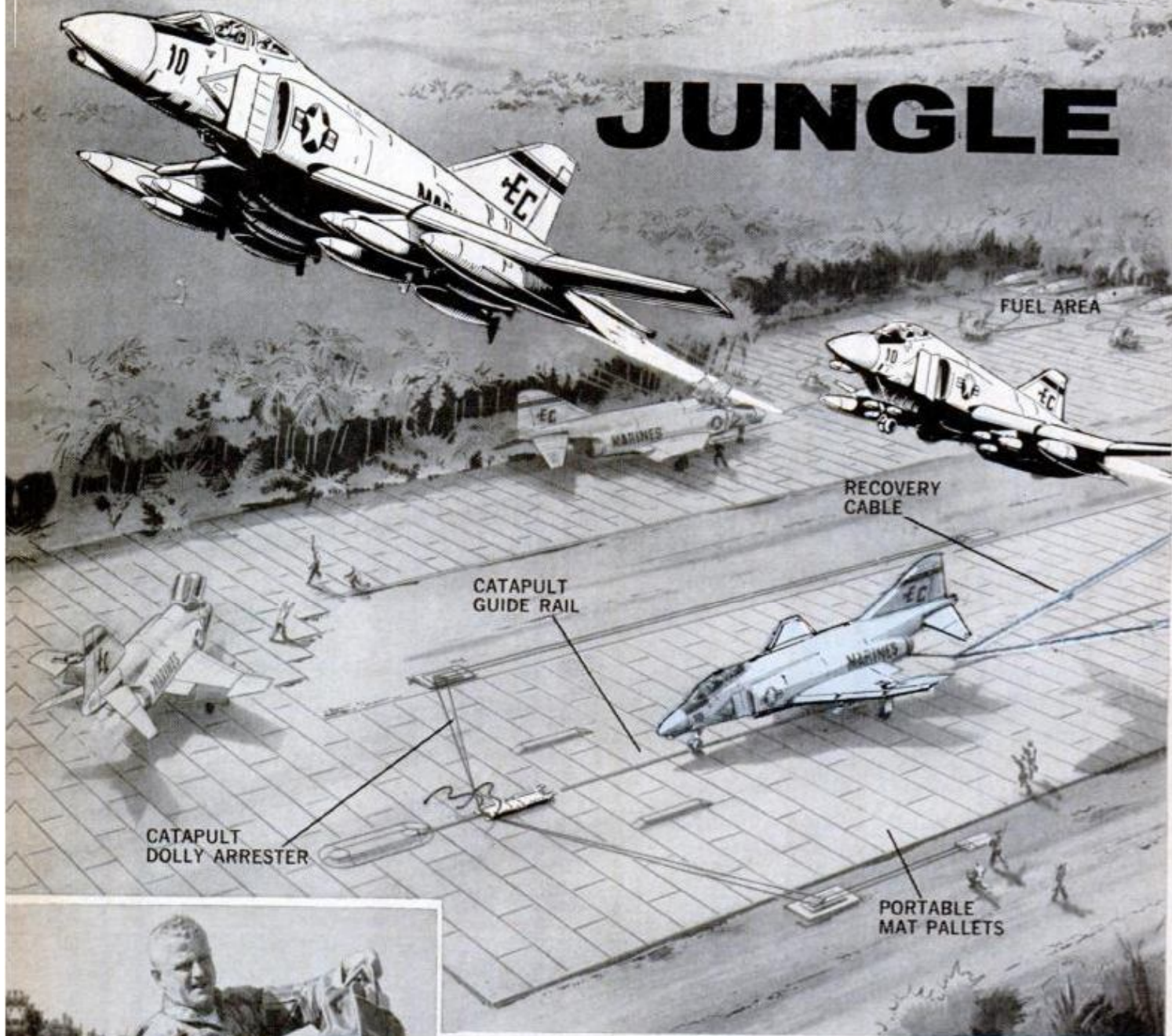
If you and the kids are taking separate vacations this year, you might try sending them off in something like this. The car and trailer have everything the big ones have—except that they're built on a pint-size scale. The car's motor is described as being "very small in horsepower; hardly equal to that of a motorbike." The mini-camping rig was an attraction at the Paris Trailer Show this spring.



Israel's first airplane is on the way

Shown here in model form is the first airplane scheduled to be turned out by the Israel Aircraft Industries. It's expected to be airborne by late next summer. The craft is a light twin-turboprop STOL (short takeoff and landing) plane that will be capable of operating from short, rough airfields. It is being designed to carry a maximum payload of two tons of freight or 20 passengers. The aircraft will be known as the Arava.

JUNGLE



AUTHOR vaults from F-4 wing after catapult and arrestment at Bogue Field

Stymied by fluctuating guerrilla warfare, Air Marines now carry a stubby, portable airfield with them, complete with catapult and arresting gear

By KEVIN V. BROWN, PM Aviation Editor

THE MAN in the colored jacket and oversize headset hand-signaled us into place and Marine Maj. Ron Kron gunned the two big engines, nursing the huge jet toward the catapult dolly, then jockeyed it into position. A swarm of colored jackets converged on the plane, connecting the tail with a hold-back cable and hooking the front with a bridle to the dolly.

FLATTOP



Artist's conception by Fred Wolff

Another colored jacket flashed fingers at us, and in order, Major Kron released the brakes, checked his instruments, gunned the engines to full power, slapped his helmet against the backrest, pulled the control stick into his stomach, then saluted toward the catapult officer.

The man gave us the "go" sign, and, after about five seconds of nothing but noise, we shot forward, and I was pushed backward as if tons of sludge had been dumped on my chest.

We were airborne within a few hun-

dred feet and flew out over . . . the briny Atlantic? . . . the white-capped Pacific? No. We flew out over the pine trees of North Carolina.

I was in the rear cockpit of a supersonic F-4 Phantom and we had just been catapulted—not from an ocean-going carrier—but from one of the Marines' new jungle flattops at Bogue, N.C., an airfield that tries to duplicate the catapult takeoffs and arrested landings of carrier operations. One such field is now operational in Vietnam.

It's one more Marine reaction to



F-4 PHANTOM roars off short airfield, outrunning catapult dolly. Dolly slides over shallow groove in matting where "Chinese fingers" grab firm hold on continuous cable. It can throw aircraft into air in much less than 2200 feet required for SATS airfields. Pilot keeps stick "full aft" for quick getaway

guerrilla warfare. The idea is move into a jungle close to the action, clear the trees, lay the runway matting, install the catapult and arresting gear, fill the huge refueling bags and set up the

tower and other communications equipment—all within three days.

The speed is possible because, by duplicating the carrier-type catapult-and-arrestment launches, only 2200 feet of runway are required, instead of the normal 10,000.

Bogue is typical of a SATS setup (for Short Airfield, Tactical Support), according to Lt. Col. A. F. McCaleb, the base commander. The catapult consists of a continuous cable that runs in a groove in the matting and is driven by two jet engines, identical to those in the F-4, and set off to one side of the runway. A braking system holds the cable still while the engines are run up to full power, and "Chinese fingers" from the dolly grip the cable—the more tension, the harder they grip.

When the catapult officer signals "Go,"—and both the catapult and aircraft engines are going full blast—the



MATTING PALLETS are mated together, then bolted into place at overseas base. Smooth surface leaves only catapult dolly and arresting cables above ground

cable brake is released, the cable springs into action, the Chinese fingers grip, and the aircraft goes — like, “whoosh”!

Colonel McCaleb said, “The F-4, because of its power, is the only aircraft that can outrun the dolly.” The others are flung into the air.

The landing system is separate and set in the center of the strip. It consists of a cable stretched across the runway (during landing sequences) and attached to two wide nylon tapes. The tapes are wound around drums on either side of the runway, and the drums are set in hydraulic fluid. Paddles on the drums, working against the fluid, provide the arresting force.

Major Kron demonstrated a SATS landing, flying a racetrack pattern over the field. When we decelerated to 250 knots, he dropped the gear and moments later the flaps.

The F-4 and other high-performance aircraft have an angle-of-attack indicator that can be adjusted for gross weight. When the pilot is slow and has a high angle, it indicates “high chevrons”; when fast and low, he gets “low chevrons”; when just right, he gets a “doughnut.”

Kron got the doughnut quickly and turned into a 180° final—no base leg here.

“I’ve got the meatball,” he told me on the intercom, meaning he had picked up the light from the Fresnel-lens landing system set alongside the landing strip. The “meatball” is a light that tells him whether his approach is too high or too low. A landing signal officer (LSO) is also on hand to give radio advice or a “wave-off.”

Kron touched down just in front of the arresting cable, the hook caught and I lurched forward against the shoulder straps. The landing was good and definite.

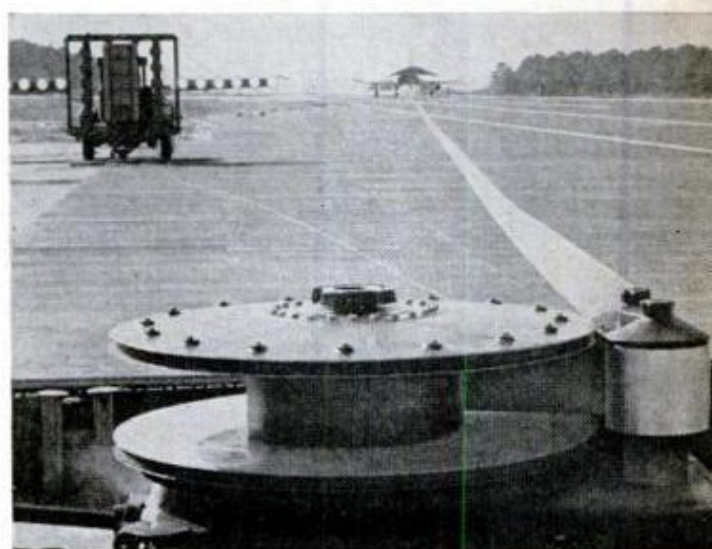
After I climbed out, one Marine officer, summed it up: “You might say our slogan is, ‘Have airfield, will travel.’”

★ ★ ★

JUNE 1967



ANOTHER F-4 hooks arresting cable and attached nylon belt, wound around hydraulic drum, begins to play out, bringing aircraft to abrupt landing



ARRESTING GEAR TAPE, still not fully played out, makes the “long stretch” as F-4 finally stops in background. Fresnel lens can be seen at left



MARINE GROUND CREW wipe antiabrasive on arresting tape to prevent it from sticking. Tape is disconnected from arresting cable during takeoff sequences



THE ORDEAL OF THE PETREL

She had taken everything an Atlantic gale could throw at her, but the pumps had quit and water was rising in the engine compartment

By E. D. FALES JR.

Illustrations by Ed Valigursky

IT'S A FUNNY THING about a boat in a storm—any boat, from a 14-foot outboard to a 70-foot yawl like *Petrel*. A storm is relentless. If there's *anything* wrong with your ship a storm will find it out and punish you.

It could be dirty gas, a worn line (*all* worn lines are dangerous) or a rope that falls into the water. It could be something not lashed down. It could be debris sloshing in the bilge and clogging pumps, or even a bit of sticky varnish in the wrong places.

As the crew of the *Petrel* learned last winter, in a storm one weakness leads to another and another. Then suddenly you're in trouble.

Hours before last New Year's Eve, the Coast Guard heard a faint SOS in an Atlantic gale: "We need assistance. There are 10 aboard, 7 males, 3 females." It was the big yacht *Petrel*.

Nothing was visibly wrong aboard *Petrel* when she sailed from Connecticut on a 2500-mile cruise to tropical Antigua last Dec. 26. She had been the Coast Guard Academy's own training yawl until sold last year. She had fine new equipment. Her 60-hp diesel engine had just been reconditioned. Her sails were by one of America's finest sail makers. Her skipper, Gordon Van

VAN NES LIGHTED a flare. The wing light of a Coast Guard Albatross danced over a wave

Nes, 26, had even insisted on such details as seven coats of varnish on her mast and a new bronze strainer on her main pump. To keep the strainer from clogging, the bilge had been vacuum-cleaned.

Even *Petrel's* towering mast had been inspected by her crew. Up this 85-foot spar ran a narrow bronze track. And on this would run the little slides to which a sail is tied. It is terribly important for a sail to slide smoothly in an emergency. No varnish must be on the track. A single slide sticking could be serious.

But no sticky varnish was found.

At 1:30 p.m. on sailing day, Monday, a fine light wind blew from the northwest. When the sail was hoisted it stuck briefly, halfway up the mast. Then it went on up and no one thought more about it.

At midnight *Petrel* bucked big eight-foot seas, rounded Montauk Point, L.I., and slid into the open Atlantic. Her bow wave threw phosphorescent sparks; Montauk lighthouse winked. Someone quipped: "If anyone gets sick we have lots of talent."

Van Nes and three shipmates were medical students on holiday from Western Reserve University, Cleveland. Two others were from the University of Chicago. The seventh was an able British professional skipper, Barry Conway, who was to take command of *Petrel* in the Caribbean and sail her on charter.

As *Petrel* trimmed for Bermuda, 700 miles southeast, her three cabins were lighted. Up forward, preparing for bed, were two pretty 17-year-old girls: Van Nes's sister Heidi, and a friend, Mary Shapiro. In the portside cabin were Englishman Barry Conway and wife Evelyn. Next aft, the main stateroom was for the six college men. They would stand two-hour, two-man watches. Barry Conway would navigate.

All looked forward to hot steaks tomorrow to be cooked in a new microwave oven. The girls would cook. This would be a well-fed crew, ready for any emergency.

Husky young Van Nes had checked weather. No storms forecast. All hands, except two, now retired.

Van Nes was surprised when he and watchmate George Jackson came on deck at 2 a.m. to find high wind, huge seas. *Petrel* was driving hard. At the wheel John Osmond, a tough, able helmsman, said: "I'm having trouble holding her on course." It was time to reduce sail.

"Turn her into the wind so we can drop the mains'l," said Van Nes.

To help hold the ship in the teeth of the gale, Osmond started the 60-hp diesel. The ship's bow made an 180° turn and paused. This is the only way a sail can be lowered.

Van Nes freed the halyard—the long rope on the mast that hoists and lowers the mainsail. Then the two other



Suddenly the wind took over and the enormous sail went thundering out of control. The storm had found its first opening.

men on deck grabbed the cloth. It was important to snatch the sail down in seconds, for a big sail loose in a gale is a runaway 100-hp engine.

It was just a little thing that went wrong. As the huge cloth tumbled down the mast *it stuck halfway*. Forty feet of sail was left hanging in the wind. Had a bit of unseen varnish clogged that vital track? Had the track bent? Suddenly the wind took over and that enormous sail went thundering out of control. The storm had found its first opening.

And then in quick order:

Because (1) the sail jammed, the next largest sail, (2) the staysail, flogged too hard and too long. This (3) tore it loose from its tether—the important line called a “stays’l sheet” . . . which (4) fell into the sea . . . and (5) became tangled with the propeller . . . which (6) stalled the engine . . . which (7) let the ship swing out of control . . . which (8) then set the half-lowered mainsail shaking with worse violence. Six men lay on it, but this was like lying on a mad whale. The sail fought back, threw the men off. Someone finally got a rope around it. At last it was all down and secure. Then the runaway staysail was subdued.

But meanwhile, (9) because of the flogging, a shackle pin had worked loose . . . which (10) let a heavy bronze hoisting block start swinging against the mast like a hammer . . . which let the important hoisting line—the halyard—go aloft and wrap around the top of the mast—out of reach. And in all the confusion (11) the third sail now acted up. Van Nes himself was steering when the mizzen behind him slammed over from left to right in a wild uncontrolled jibe . . . and this (12) snapped the boom needed to keep it working. To make matters worse, the three girls became terribly seasick. So the steaks that would have sustained the tired crew next day never got cooked.

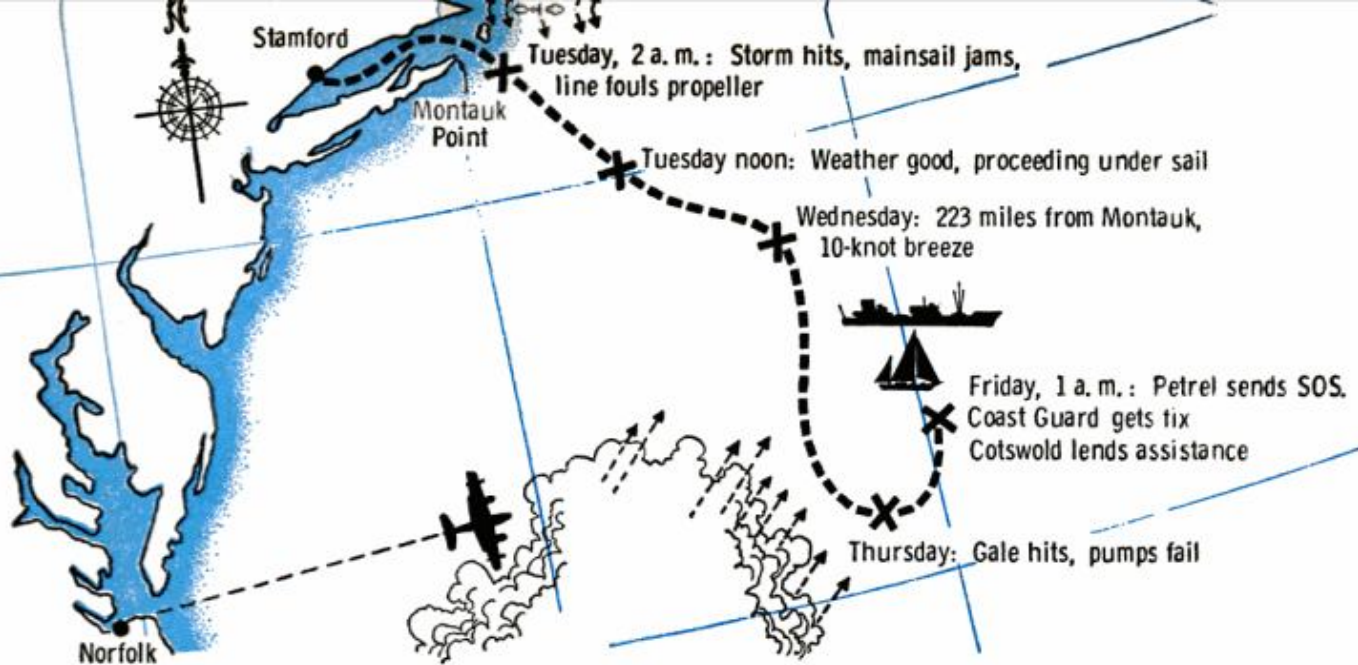
Such emergencies are not rare. In some degree, they beset all ships. Controlling them is the headache (and adventure) of yachting. The first question now was how to recapture that runaway halyard from the mast-top so the mainsail could be hoisted again when the storm abated.

The crew could see the line flopping wildly, 75 feet up. It takes real courage to go up a mast even in harbor. It takes guts in a rough sea. Young Van Nes had his shipmates hoist him in a bosun’s chair. They did it by using another halyard—the hoist for the staysail. Van Nes was slammed and shaken. At last, 70 feet up, rolling in dizzy arcs, he captured the halyard and its heavy block, brought them down and once more attached them to the mainsail. The sail now was ready for use when the wind dropped.

Little by little, Van Nes & Co. got everything under control and by dawn *Petrel* was

Van Nes, 70 feet up, rolling in dizzy arcs, captured the halyard and its heavy block.





sailing slowly southeast. Everyone relaxed; no one knew that a worse storm was brewing.

Tuesday dawned easier, and Wednesday was even better. But seas were still too rough for anyone to dive and clear the fouled propeller. Nevertheless, they got the big mainsail up. Its partner, the torn staysail, had been replaced by a bigger sail, the mighty genoa. The broken mizzen boom had been spliced.

The rope was still wound around the propeller, but the diesel could be run in neutral to power the main pump and keep batteries charged for light and radio. On Wednesday night a ship passed close. Navigator Conway asked for a position report, since accurate sun or star sights had been impossible. The ship disappeared, lights twinkling, without replying.

At daylight Thursday a new wind boomed up from Florida. At 7 a.m. the helmsman saw a small tear in the mainsail. It was lowered and this time came down quickly. Now the ship was pulled by its genoa, a triangle of Dacron that tugged like a locomotive. *Petrel* hissed toward Bermuda, only 400 miles away.

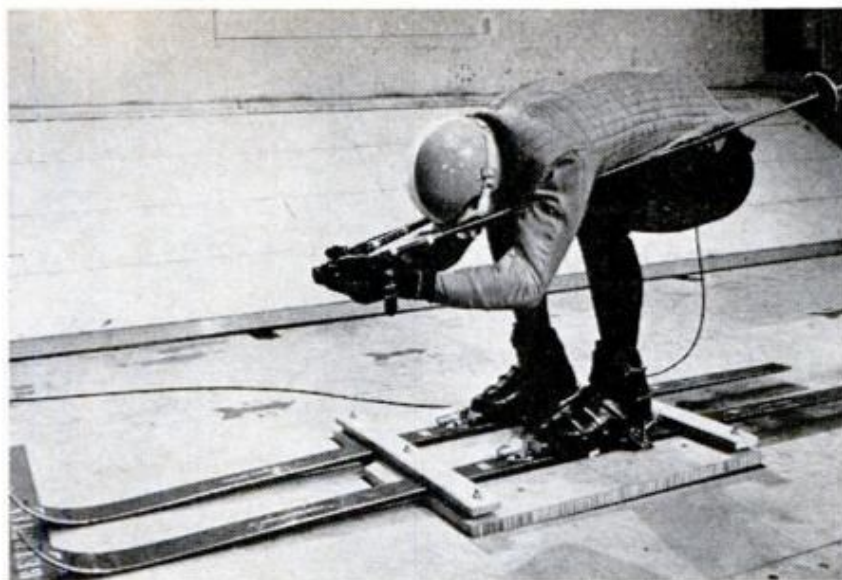
But the sky now darkened; the wind rose and screamed in the rigging. Seas worse than Van Nes had ever seen came from the southwest. Across these came other seas from the west. Where the seas met, pyramidal waves were flung upward. Then came a jarring shock. *Petrel* stopped dead, shook all over. Van Nes thought: *We've hit a rock*. But it was only the strange waves. The storm kept trying to find a weakness.

About 10 a.m. it found one. With a noise like a cannon, the genoa pulled away from its sheet. Then someone heard water gurgling where no water should be. As *Petrel* rolled, water sloshed up in the walls behind a bulkhead. The seam compound at the end of one plank in the hull had loosened. It was a small leak but it grew worse.

At this time even large liners were slowing. To the north

(Please turn to page 186)

**Someone heard
water gurgling
where no water
should be.**



Head down, eyes up with prismatic lenses

Swiss skiers now have a secret weapon for winning racing events. Special prisms that fit over their snow goggles enable the skiers to tuck their heads in while in a crouched position (left) and reduce air resistance, yet still see straight ahead in the direction of travel. Such "streamlining" saves valuable seconds in timed events.



She's got connections

This young lady is a live wire. She's plugged into a 24-volt battery that heats her socks, sweater and, when she's wearing them, her gloves. Plastic-covered copper wire is knit into the garments to form the heating network. A transformer with control knob adjusts the heat. The manufacturer recommends heated clothing for outdoor workers and arthritis victims.

JUNE 1967



Portable tourist guide

Battery operated, a small tape recorder is rented by the day to London tourists. Commentary on it tells the visitor, on cue, about the various London attractions. The kit includes a map of the city, and the tourist can go where he likes, just turning the dial on the tape recorder to select the point of interest he wants to hear about on the tape recorder—thus getting an expertly guided tour.

73

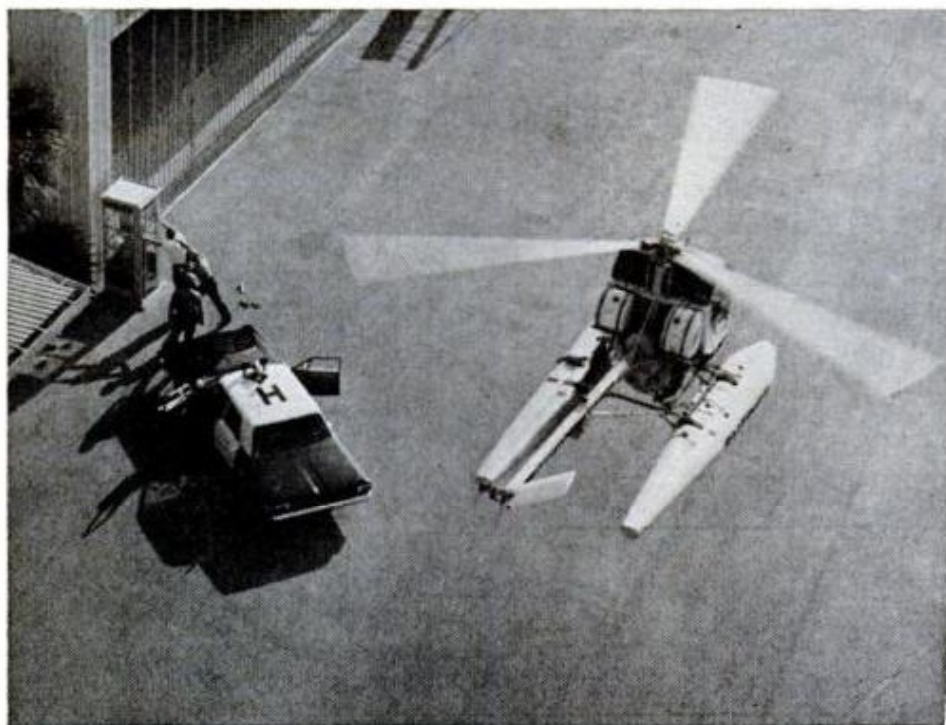
Cheese it... The COPTers!

From out of nowhere a police-manned whirlybird swoops down to catch an unsuspecting crook right in the act. Pioneered by Los Angeles lawmen, these tough, highly mobile crime fighters also speed help in emergencies

By TOM STIMSON



ANY STREET'S AN AIRFIELD when a police chopper answers a call for help. Above, a whirlybird sits down in a residential street to confer with a patrol car



▲ **HOVERING OVERHEAD,** a police chopper directs deputies on the ground as they move in to make an arrest. Such close teamwork gives L. A. County police a powerful weapon to fight crime

◀ **FROM THE AIR,** a police patrol car is easily spotted by its white-painted roof with a large black "H" in the center. This helps helicopter pilots to follow a chase or come to the aid of ground forces in a hurry

POPULAR MECHANICS



THERE WAS NO WARNING as the chopper swooped in low over a hilltop, landed smartly beside a cabin, and disgorged two police officers with guns drawn. Three burly thieves, caught in the act of looting the cabin, threw up their hands meekly. It was all over in a minute.

The cocky thieves had expected no trouble. Only a few patrol cars were assigned to the remote reaches of California's Antelope Valley where wealthy Los Angeles residents had built sumptuous weekend lodges. It would be easy pickings to back a rented truck up to the door, strip a cabin of everything valuable, and be off. Any approaching car would kick up a dust trail visible from miles away, giving the gang

plenty of time to pull out if they had to.

So it didn't seem quite fair when a helicopter full of cops sneaked in and sat right down beside them. A week later, the flying cops paid a similar surprise visit to four men happily loading the contents of another lodge into their furniture van. Word got around after that, and isolated weekend cabins have been a better insurance risk ever since.

When the night watchman of a big warehouse in Bell Gardens, Calif., was told he could earn an easy thousand bucks by leaving the gate unlocked Saturday night, he told his boss and the sheriff all about it. They told him to go right ahead.

Saturday night a big cargo hauler backed up to the loading dock, and

three men stuffed it full to the roof with such choice items as FM receivers, electric toasters and tape recorders to a value of \$60,000. The truck then made its way unmolested to another warehouse 20 miles away. Here, the proceedings were rudely interrupted by a dozen deputies. One of them kindly explained that a high-flying helicopter had watched the truck every foot of its journey. "If we had stopped your truck, we might have picked up only the driver, so we let the truck lead us right to its destination. This way, we rounded up your whole bunch!"

The Los Angeles County sheriff's department operates one fixed-wing airplane and eight helicopters and keeps all of them busy. Typically, the chopper assigned to the Malibu substation patrols crowded beaches in the summer, searches for cars that have tumbled unseen off mountain roads, and sights brush fires while they are still small enough for easy control. It can search in 10 minutes a rugged area that would require hours of hiking by a ground party, find an injured mountain climber, and fly him straight to a hospital.

But until a few months ago no helicopter had ever been assigned to a job for which it seems especially suited—that of regular night and day patrol over a city as a spy in the sky to assist patrol cars on the ground. A helicopter can check a rooftop, the alley behind a building or a line of shrubbery in one quick, sweeping glance. It can follow a suspect in a car no matter how the car dodges to avoid law-enforcement vehicles that are chasing it. It can reach the scene of a disturbance faster than a car and even land on a city street if necessary.

All this has been apparent to Sheriff Peter J. Pitchess of Los Angeles County. Last year, he worked out a test program involving his own department, the aircraft division of Hughes Tool Co. (which would furnish three helicopters), the federal Office of Law Enforcement Assistance, and the city of Lakewood, Calif. Lakewood was chosen



STAKE-OUT IN THE SKY: Cruising at 750 feet, a chopper pilot has a clear view of city streets for blocks. Little can happen without his spotting it



TROUBLE AT NIGHT is quickly detected with this high-intensity searchlight that can illuminate an area as big as a football field from up in the sky

for the demonstration because it is a "typical" community of 82,000 people. Its nine square miles of territory contain 157 miles of streets.

The plan was to maintain an aerial patrol 20 hours a day, including all the hours of darkness. Each surveillant helicopter would remain in the air for 40 minutes, then its duties would be taken over by another copter before the first pilot landed. Each would carry a trained observer. The units would be able to talk back and forth with patrol cars on the ground and with the sheriff's dispatcher. They would cruise at 750 feet.



But Project Sky Knight had hardly gotten off the ground when a flood of complaints began to be heard. Typical was one irate housewife:

"That 'guardian angel' overhead sounds like an angry hornet! It wakes up my husband, it wakes up my children, it wakes me up! Please turn it off!"

The flying deputies raised their patrol level to 1500 feet where the noise was less offensive and took up the problem with the Hughes factory. "What the people here want is a 'Silent Knight.' Can you cut down the racket these choppers make?"

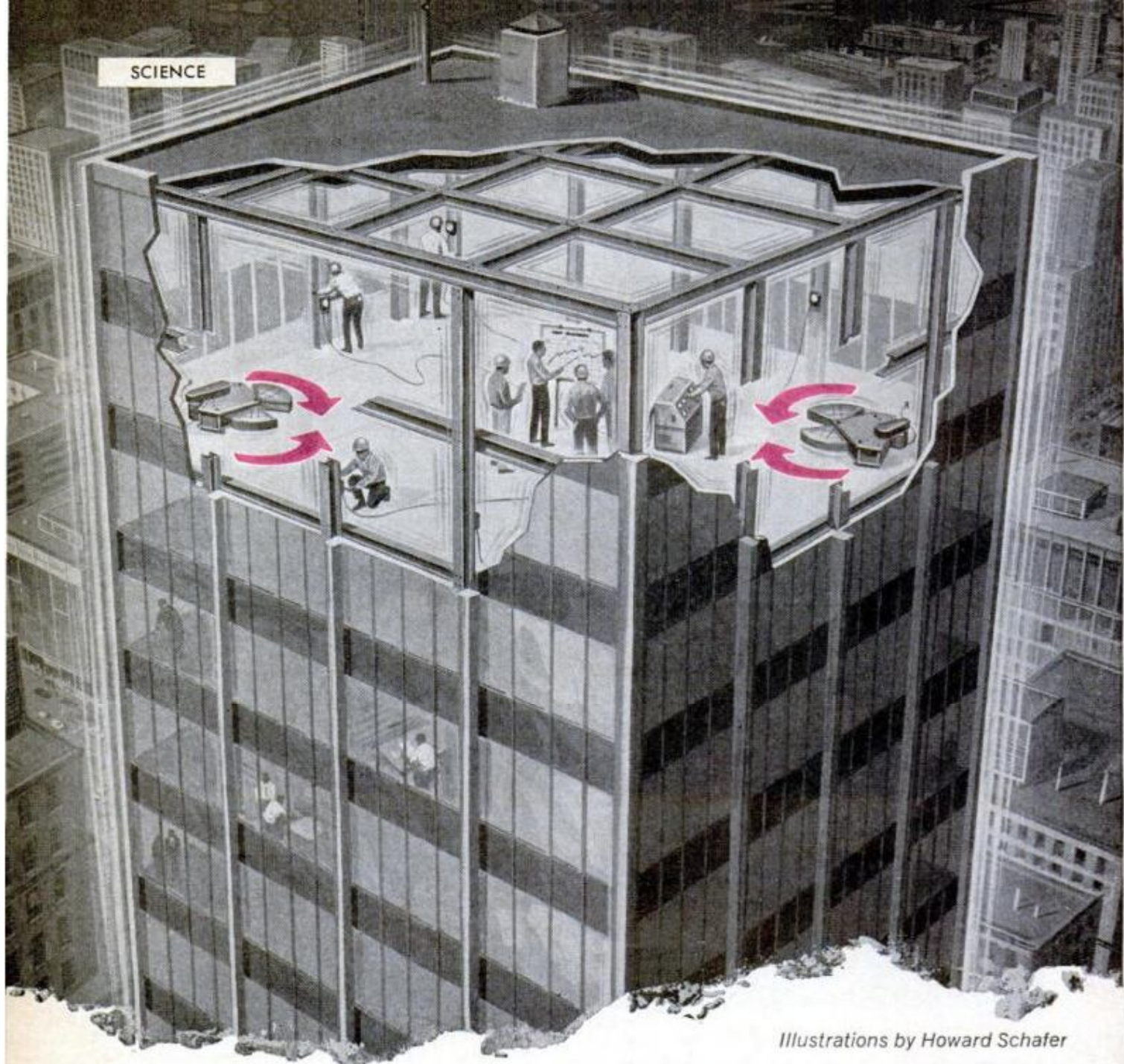
The Hughes engineers analyzed the noise spectrum and found that much of it was coming from the tail rotor. They

A FLASHING LIGHT atop Lakewood's bank (arrow) tells cruising copters to come on the double. Light goes on automatically if burglar alarm is tripped

designed a larger, 46-inch rotor and geared it to turn a third slower. They installed partial mufflers on the engine tailpipes. Now, instead of the previous irritating high-decibel whine, the helicopters emit a muffled note that disturbs no one. The pilots like the change, too, for the larger tail rotor materially increases a chopper's stability. Patrol has been resumed at 750 feet again, and pilots can drop down to 500 feet without waking a light sleeper.

The first few months of operation were a shakedown period for working out procedures and correcting mistakes;

(Please turn to page 190)

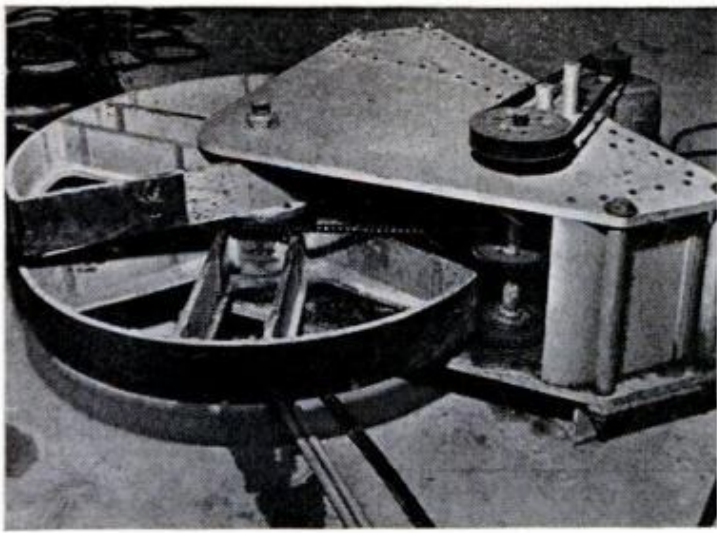


Illustrations by Howard Schafer

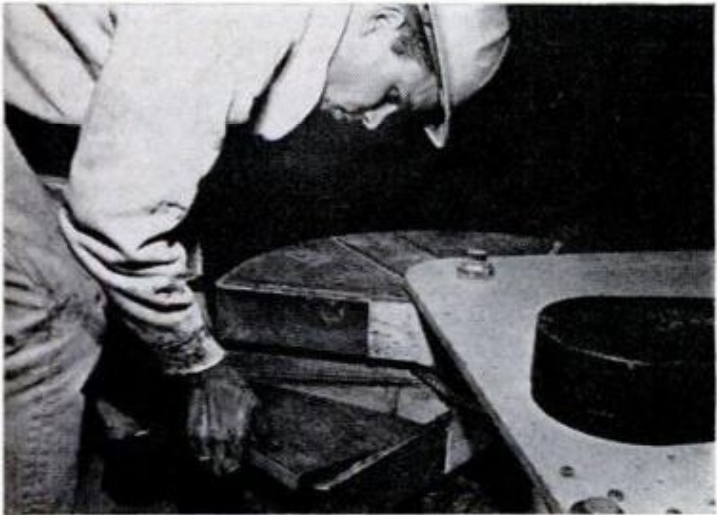
**TO PREVENT FUTURE DISASTERS,
SCIENTISTS ARE NOW PRODUCING**

EARTHQUAKES MADE TO ORDER

Giving a skyscraper the shakes artificially is one of the latest research tools in man's fight against a dread natural enemy. Another weapon: Early-warning quake predictions like daily weather forecasts • By Kenneth N. Anderson



NEAREST THING TO A REAL QUAKE are tremors produced by these spinning weights. Bolted to the floor, the pie-shaped rotors whirl around in opposite directions, as shown in the drawing at left, to jolt a building with 5000 pounds of centrifugal force. Below, lead ballast is loaded into the rotors to adjust their weight for the desired effects



SUDDENLY, the entire building started to shake. The huge panes of glass in the outer walls rattled savagely. Water sloshed out of a dish on a window sill. Startled workers high up in the 16-story structure in San Francisco exchanged anxious glances. Was this the beginning of the long-feared repeat performance of the disastrous 1906 earthquake?

A slim young man smiled and pointed to a strange-looking machine fastened to the floor of the building. "We're producing an artificial earthquake," he explained. "That machine is a vibration generator. It exerts 5000 pounds of force. There's another generator down the corridor. By controlling the rotors, we can shake the build-

ing up and down, side to side or make the framework dance a twist."

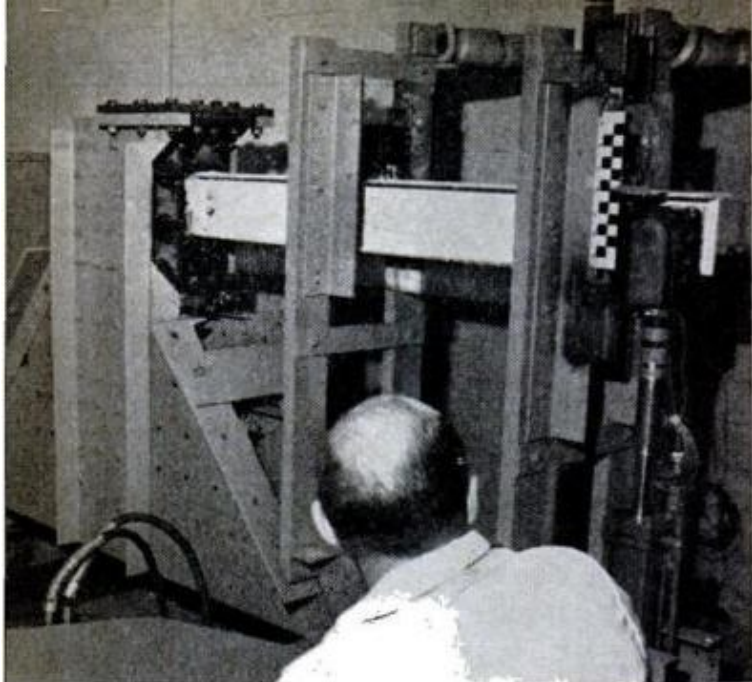
The pleasant young man was Prof. J. G. Bouwkamp of the University of California. The building, a new one erected as part of the University of California Medical Center, was being subjected to one of many violent torture tests designed by engineers to help make buildings earthquake-proof.

Prof. Bouwkamp's earthquake machines each consists of two large, pie-shaped rotors whirling like flyweights around a common shaft. The rotors, weighing hundreds of pounds and spinning in opposite directions, can give a massive building the shimmies and shakes in the same way that an out-of-balance crankshaft can pound the daylight out of an auto engine. Electronic sensors located at key points in the building record the effects of the shaking for later analysis by a computer.

Meanwhile, another big machine puts steel beams through agonizing compressions and strains in a University of California laboratory across San Francisco Bay. A powerful hydraulic jack bends the ends of the beams through an arc of 10 inches to learn how much abuse a piece of structural steel can take before it fails.

Across the Rocky Mountains, in Denver, U. S. Bureau of Reclamation researchers are assembling still another machine to produce artificial earthquakes. This is a hydraulic pump that can shake model buildings, dams and other structures at forces of up to 50 Gs—far greater than the shaking produced by the most violent earthquakes ever recorded. And at Lehigh University in Bethlehem, Pa., scientists are testing the endurance of new kinds of steel columns and beams in a three-story frame prototype of shock-absorbing "plastic" structures of the future.

After thousands of years of enduring the terror, death and destruction of earthquakes, man finally is beginning to fight back against these catastrophic



BIG SQUEEZE: This powerful hydraulic jack bends steel girders through a 10-inch arc in University of California tests to see how much they can take

convulsions of nature. There is nothing science can do to prevent earthquakes, some of which pack a greater wallop than an A-bomb. But researchers are rapidly gaining knowledge that will help them to forecast earthquakes just as long-range weather trends are predicted. And when the ground trembles, tougher buildings will let their occupants ride out the quake as safely as they now weather a summer storm.

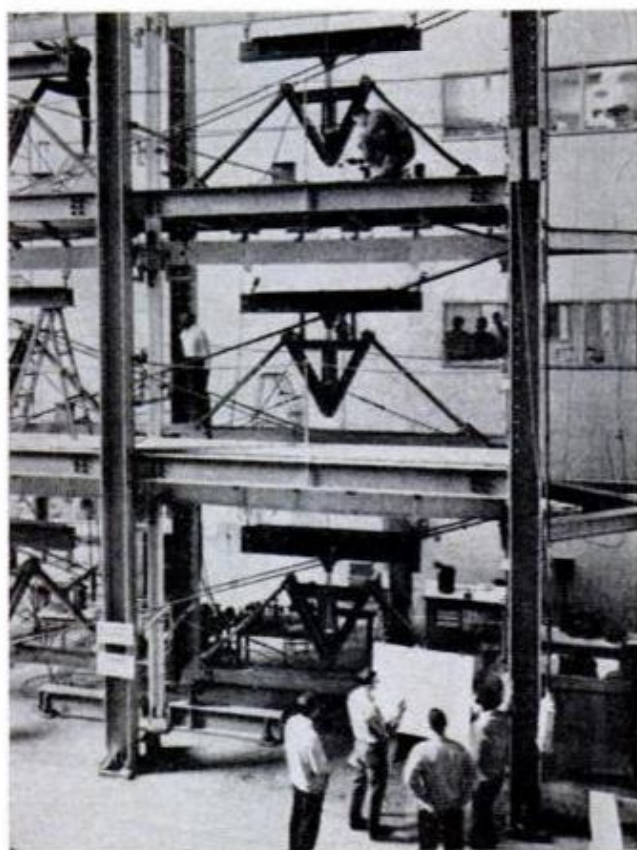
Our planet has been compared to a soft-boiled egg hurtling through space. More accurately, perhaps, it is like an egg that is still boiling on the inside, while the shell trembles almost constantly from tremendous internal and external pressures.

The apparently solid surface of the earth rises and falls about 14 inches a day because of the tidal effects of the moon. Lava and gases forced toward the surface near volcanoes make the surrounding area swell upward like the chest of a breathing giant. But the best known of the earth's vibrations are the destructive earthquakes that have been changing the face of our planet for thousands of years.

The shell, or crust, of the earth is only a few miles thick under the oceans and perhaps 25 to 30 miles thick under the continents. Towering mountain ranges seem to float some-



PILE OF RUBBLE above was all that remained of six-story apartment building in Anchorage, Alaska, after '64 quake. Connections between floors and columns gave way, collapsing the whole structure. Below, hydraulic jacks simulate earthquake stress on an actual-size test frame at Lehigh University



what like icebergs partly submerged in the semi-solid materials that extend to the earth's center.

The tremendous strains of the earth's internal forces tear at the crust, producing fractures, called faults, or realigning blocks of the crust along faults produced earlier. The land yields to the strain by shifting horizon-



CENTER OF ALASKA SHOCK, 12 miles below ground level, is shown in drawing at right. Earth's crust only three miles thick in spots, is like the thin, brittle shell of an egg. Note how its thickness varies according to surface contours—the higher the mountains, the deeper the crust is under them

tally or vertically, playing havoc with anything sitting on top.

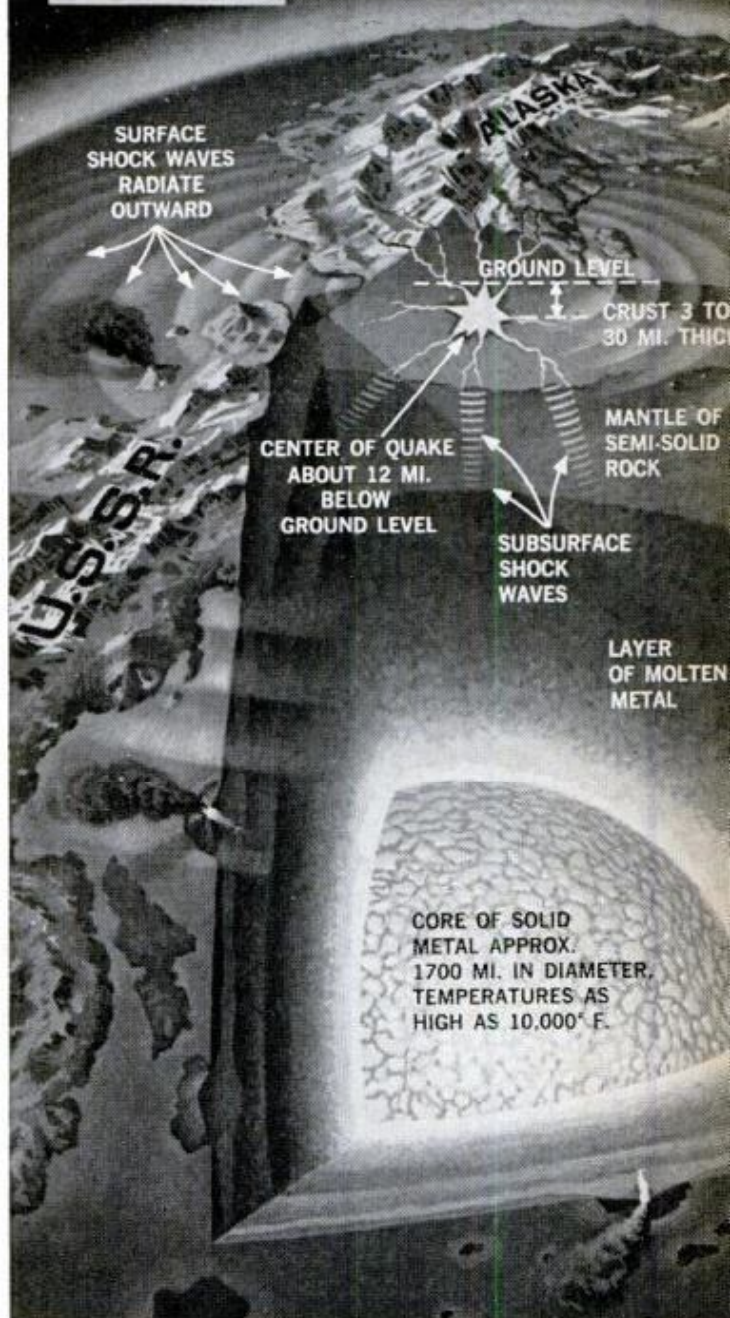
The energy released in a severe earthquake may be greater than that of an atomic bomb. The Hiroshima blast, for example, would rank about 6.3 on the Richter earthquake scale—a yardstick for measuring the intensity of tremors based on shock readings recorded on a seismometer. The Alaska earthquake of 1964 had a Richter magnitude of 8.4—more than two degrees higher than the Hiroshima devastation. The San Francisco quake of 1906 was of about the same force.

An increase of only a point or two on the Richter scale represents a tremendous difference in a quake's intensity because the scale is based on a mathematical progression in which each degree of magnitude is 32 times greater than the preceding one. A quake force of 7 is 32 times more powerful than one with an intensity of 6, and a magnitude of 8 is 32 times 32 or about 1000 times more powerful. Thus the San Francisco and Alaska quakes make the Hiroshima bomb seem gentle by comparison. The most powerful quakes ever recorded range around 8.9 on the scale.

There are about 20 major earth-



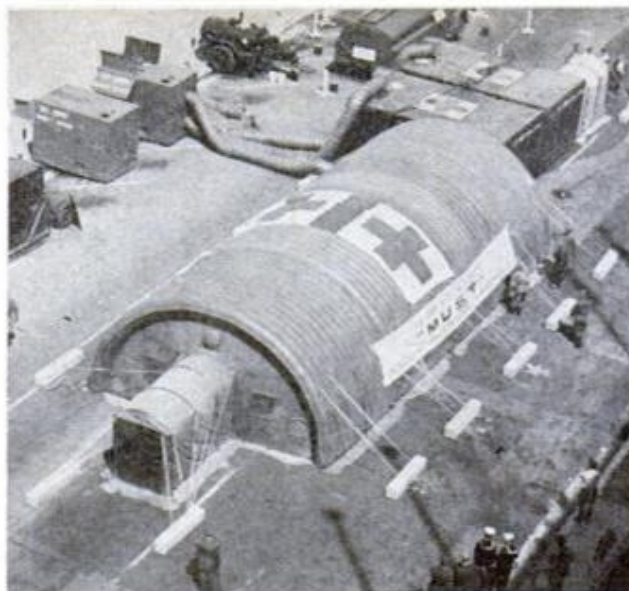
EARTH'S CRUST—
LIKE A THIN
EGGSHELL



quakes a year and almost a thousand tremors of varying intensity each day. In Matsushiro, Japan, the earth shakes about 200 times a day, and the once-popular resort center has become a ghost town. Some of the most disastrous quakes in history have occurred in Japan and China. And the tremors of the West Coast are well known.

Predicting earthquakes is considerably more difficult than making weather forecasts, although seismologists expect 80 percent of all quakes in the immediate future will occur near

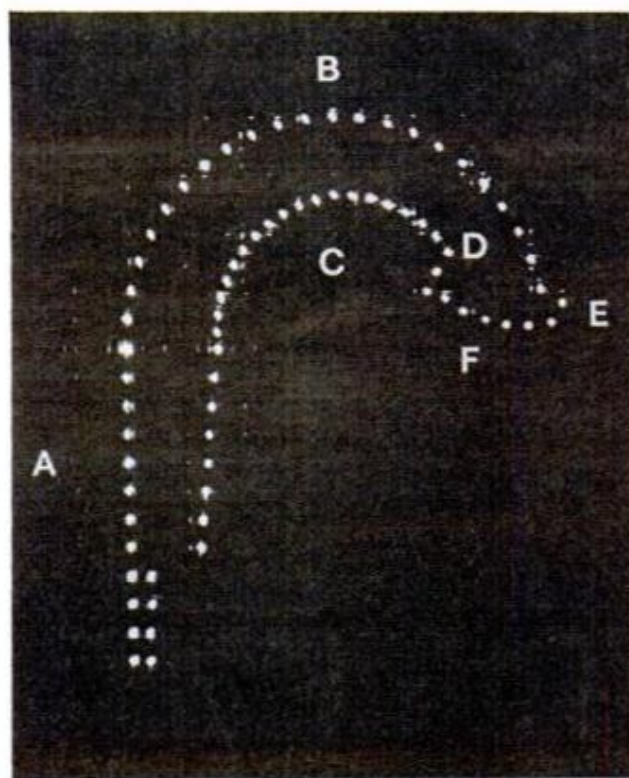
(Please turn to page 172)



Army's portable hospital is erected with air

Brought in by helicopter and unfolded and set up in minutes, an inflatable hospital is now sheltering the wounded in a war zone in Vietnam. It consists of a 60-bed ward, three surgery rooms and a laboratory and sterilizing room, the total package costing about \$2 million. The large ward has a dacron shell which is pumped full of air to hold it in place. The smaller collapsible rooms are made of paper and aluminum. A separate unit provides power and utility elements.

Called MUST (for medical unit self-contained transportable), it was developed by the Army



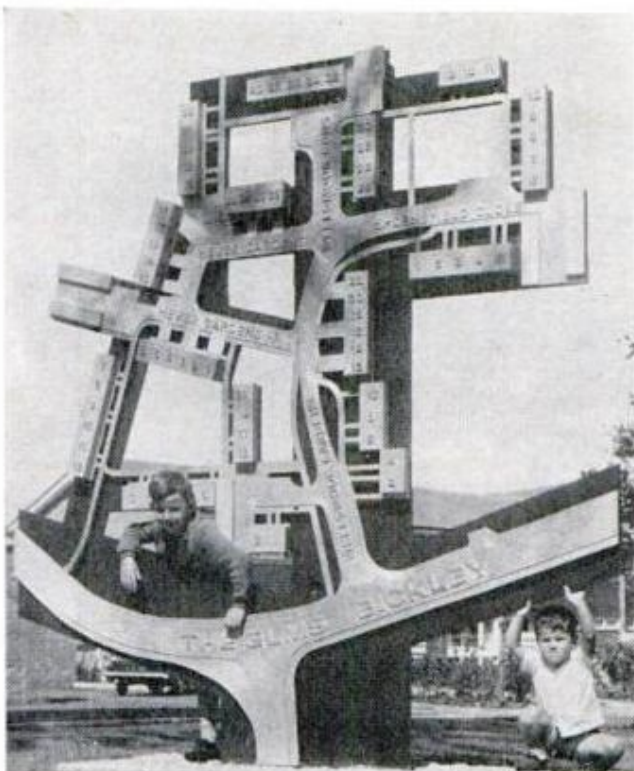
They taught a computer to speak!

Synthetic speech is now being produced in both sound and pictures by a computer. The picture is actually a graphic reproduction of the human vocal tract (right) including (A) pharynx, (B) palate, (C) tongue, (D) tongue tip, (E) lips and (F) lower jaw. Their relationships are positioned on the oscilloscope to duplicate the human vocal apparatus when making basic sounds. The computer calculates the characteristics of the picture and sends signals to a speech synthesizer which converts them into sound. The experiments, done at Bell Telephone Laboratories, may eventually lead to sending speech signals over communications lines or "reading out" computer data.



medical service and Airesearch Manufacturing Div. of the Garrett Corp. Garrett makes environmental controls for our spacecraft.

The Army plans to build a number of these hospitals for forward combat areas. The unpleasant problem of transporting wounded through the rugged jungle terrain forced the decision. The hospitals, which are airconditioned, are able to withstand outside temperatures up to 120°. If struck by small-arms fire, the inflatable sections will not collapse. Like the watertight compartments of a ship, each section can lock itself off from the others.



Lost? Climb the map!

Visitors to a housing development in England have no problems finding the right house. The whole subdivision is cast in aluminum—streets, houses, numbers and all—and the unique signpost stands upright on the village green. A by-product is that it has been accepted by the children of the neighborhood as something new to play on.

JUNE 1967



One for the (smoggy) road

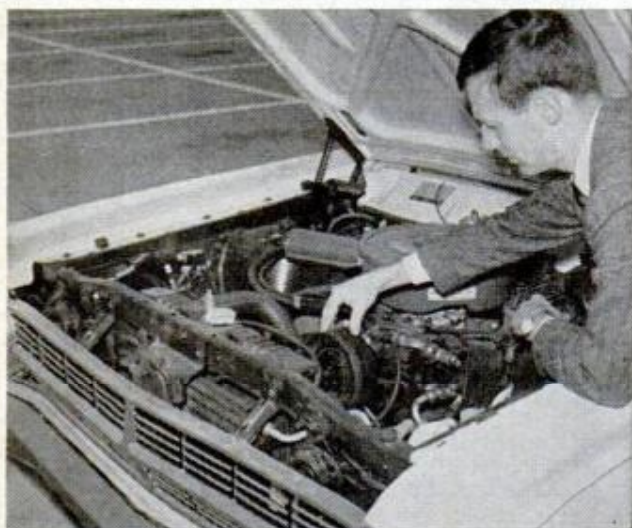
Even when he's smogged in by harmful or lethal chemical agents, a soldier can still pause to quench his thirst without contaminating either himself or the drink. A new Army protective mask incorporates a flexible hose and attachments which make it possible to drink or even administer mouth-to-mouth resuscitation.

83

PM OWNERS REPORT

Ford Falcon: more faithful than flashy

By BILL HARTFORD
PM Associate Auto Editor



MECHANICAL-PROBLEM COMPLAINTS were few and far between. Of those owners who had trouble, first source was carburetor, the second was electrical



LIMITED ROLL-DOWN of rear window was not objectionable to owners, and, surprisingly, rear-seat comfort in popular coupe models was reported good

THE "FALCON UNDERGROUND" would seem to be quite an unlikely term in which to lump the owners of one of the country's largest-selling automobiles. But the Falcon owners in *PM's* survey fulfill the first requirement for an "underground": They're all bound by common sympathies to values that happen to be in the minority.

The minority view, in this case, is that a car should be designed and built for *function!* Who cares if it's not an "in" car, if it's not one that goes "where the action is." What's important is if it did, it would get there on the least amount of gas, oil and initial dollar outlay.

One subversive owner—a New York film producer—goes so far as to say of his Falcon:

"I would like to see a cleaner, simpler body and interior design. Same size, but more efficiency. No more horsepower. Better quality and less glitter."

Glitter! The Falcon's a bit of a dray horse next to most of the slick and slinky beasts and birds slithering out of Detroit. But who am I to argue with a man who owns one? He's paid for one thing and got too much of the other. Frill or function—how much of one at the expense of the other?

Falcon owners want and for the most

part are getting the function, however. The big reasons for buying their cars, Falcon owners tell us, are economy, past experience (which usually means that their last Falcon was economical), size, and good price and trade-in. Economy-mindedness on the part of Falcon owners goes beyond financial means. It's not a matter of wondering where the next 30.9 cents is coming from for a gallon of gas. The reason is more in keeping with a remark received from a Maryland credit manager:

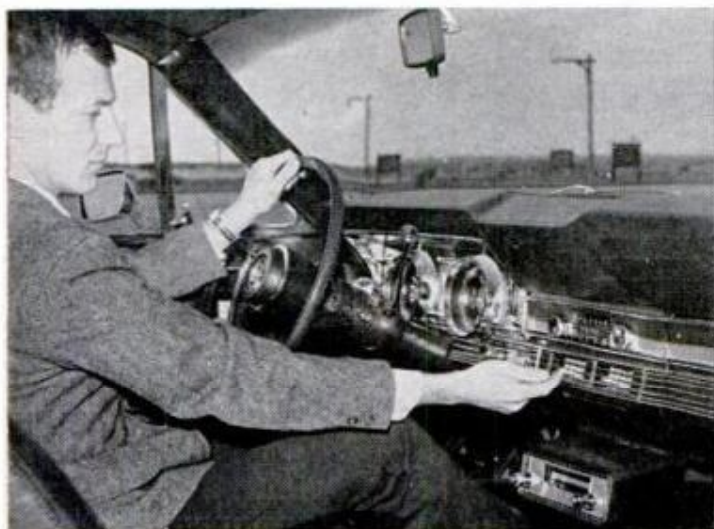
"We would rather have a less expensive model and spend the rest of our money for things other than a car."

But it's Falcon's long-run economy that was really tops on the reason-for-buying list. And after a short time on the road, some owners were actually surprised at the gas mileage they were getting:

"The gas mileage amazes me. I get nearly as good gas mileage with the Falcon as the VW."—Minnesota superintendent of schools.

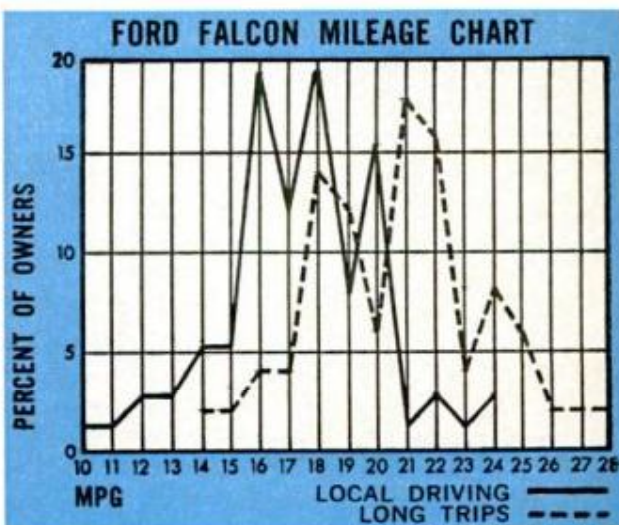
"It's economical. Original cost, operation and maintenance are all low."—Maryland realtor.

A few members of the fuel-watchers club felt that they weren't getting the good-to-the-last-drop mileage they deserve from their Falcon. Things aren't getting any better for one owner, a



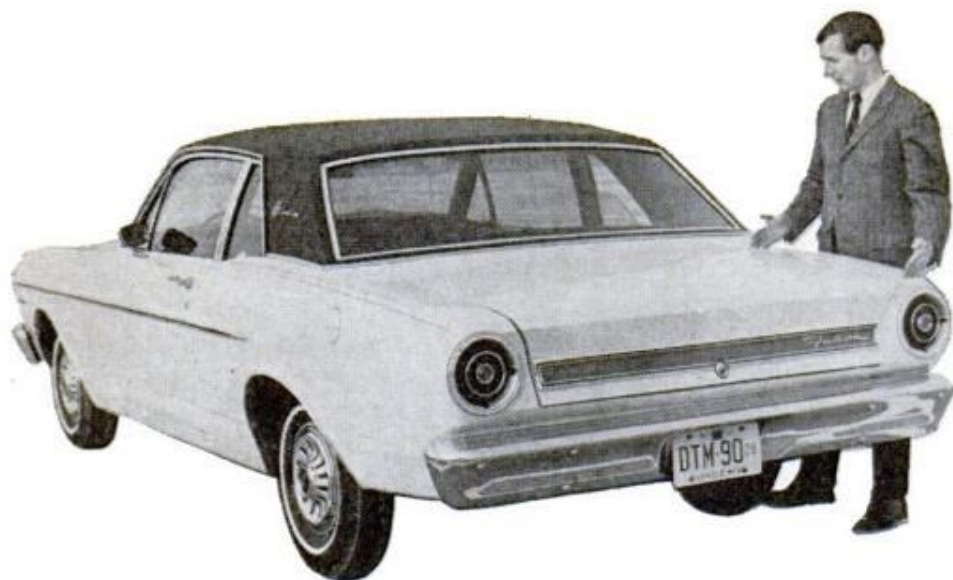
OPTIONS AND ACCESSORIES are at a minimum with owners surveyed. Over half ordered no power options and, except for a radio, most owners have basic car

JUNE 1967



MOST POPULAR ENGINE, standard on Futura models, is the 200-cu.-in. Six, which is averaging 17.4 mpg around town and economical 20.6 mpg on long trips

85



SHORT REAR-DECK styling philosophy has its shortcomings. Trunk space drew complaints from owners who want more room. Also on list of changes owners would like to see in future models is a unique request for an even plainer style

Missouri printer, who laments the passing of the good old days:

"My 1964 Falcon gave me 23 mpg. I think a drop of 7 mpg is too much."

He's driving a Futura wagon with a 240-cu.-in. Six for which, unfortunately, we received too few returns to indicate how he's doing compared to other owners with the same model and engine. But chances are they're not doing much better since the smaller 200-cu.-in. Six is averaging between 17.4 and 20.6 mpg. Nevertheless, owners are finding these figures kind to

their pocketbooks and letting us know about it.

When it comes to size, the Falcon has cheerleaders en masse. This is one area where Ford advertising has hit the nail on the head. "Compact on the outside but not inside" actually sums up owner opinion.

Owners regard their Falcons as "small" but big in interior room:

"Real roomy for a small car."—Indiana college staff worker.

"Everyone is surprised at the room

(Please turn to page 184)

Summary of Ford Falcon Owners Reports*

Total miles driven 750,805

Average mpg by engine

170-cu.-in. Six (16.2%)
 Local driving 19.3
 Long trips 22.7
 200-cu.-in. Six (46.0%)
 Local driving 17.4
 Long trips 20.6
 240-cu.-in. Six (7.1%)
 Insufficient sample
 289-cu.-in. V8 (30.8%)
 Local driving 14.9
 Long trips 18.1

Model:

Futura Sports Coupe 18.4%
 Futura Club Coupe 18.0
 Futura 4-door Sedan 12.0
 Falcon Club Coupe 23.5
 Falcon 4-door Sedan 8.8
 Futura Wagon 7.4
 Falcon Wagon 12.0

Transmission:

3-speed manual 27.3
 4-speed manual 1.9
 Automatic 70.8

Specific likes:

Handling/parking 51.0
 Economy 46.9
 Style 28.1
 Comfort 18.4
 Power 16.3
 Performance 14.8
 Ride 13.8
 Room/size 12.8

Specific dislikes:

Workmanship 17.7%
 Gas mileage 13.8
 Dealer service 8.5
 Trunk space 8.5
 Roadability (traction, cornering, weight) 7.7
 Finish 6.9
 Transmission 6.2
 Wind noise 5.4
 Pickup/power 5.4

Had mechanical trouble?

Yes 52.5
 No 47.5

Kind of trouble:

Carburetor 16.4
 Electrical 10.3
 Transmission 7.8
 Ignition switch 6.9
 Minor 6.9
 Shifting difficulties 6.0
 Door fit 6.0
 Gas fill pipe broke or fell off 5.2
 Window fit 5.2

Dealer repair service satisfactory?

Yes 57.4
 So-so 5.6
 No 25.9
 Not back yet 11.1

Why did you buy Falcon?

Economy 37.3
 Past experience 37.3

Size 21.7%
 Price/trade-in 18.0
 Style 17.5
 Performance 11.5
 Handling 6.9

What change would you like to see?

Workmanship 6.4
 Better seats 5.7
 More trunk room 5.0
 Plainer style 4.3
 Better gas mileage 3.5

What power options?

None 53.8
 Power steering 43.8
 Power tailgate 21.4
 Power brakes 8.9

Falcon your only car?

Yes 49.3
 Two cars 43.5
 Two or more 7.2

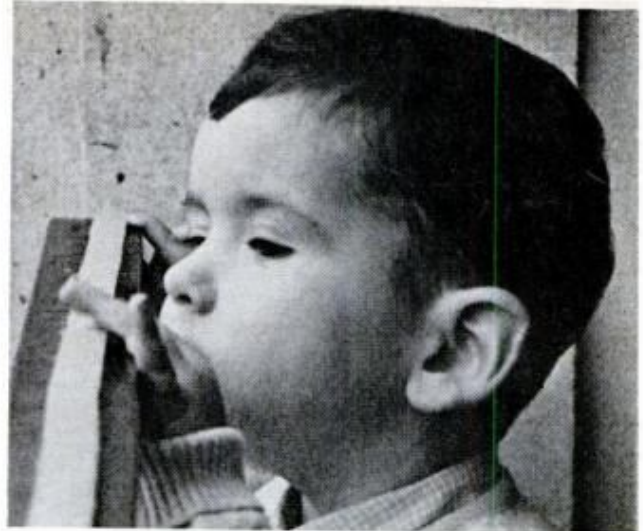
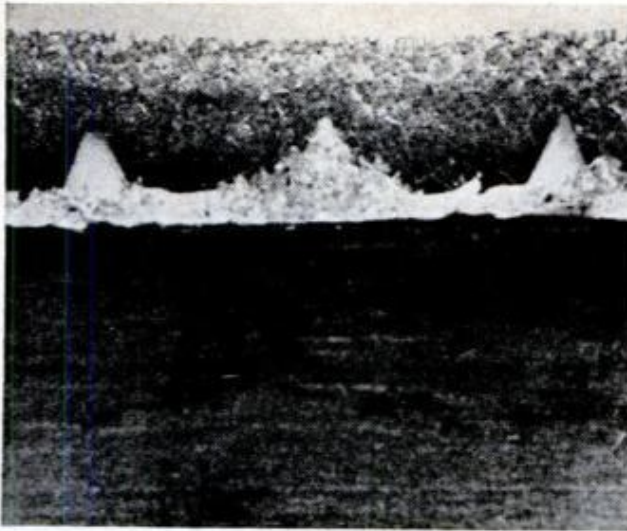
Other cars owned?

Ford 32.7
 Falcon 21.2
 Chevrolet 7.1
 Dodge 5.3
 Pontiac 5.3

Age distribution of owners:

20-29 19.5
 30-39 18.1
 40-49 19.4
 50-59 21.3
 60 and over 20.4

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



Cushioned persuaders keep little boys from big falls

Plastic spikes, hidden inside a foam strip so they are harmless yet persuasive, save small children from large falls from beds, balconies or windows. The strip, with the spikes built in (cutaway view, left), glues easily to the surface of railings or sills. Slight pressure gives the child a slight tingling sensation, enough to warn him not to increase the pressure by grabbing and climbing over. The material is made in Germany.



Guardian angel

Stranded motorists on New York City's crowded expressways can now look for help from above. A local radio station, which uses helicopters to report traffic conditions to its listeners, also relays locations of stranded vehicles to police. The station even furnishes the huge "HELP" signs for those who write in for them.

JUNE 1967



Monument to (no) mowing

Tony Lewis got tired of the vicious cycle. Water the grass, watch it grow, cut it. Water, cut, water, cut. One Saturday he chucked it, tore up the lawn, spread gravel around and, rather than throw out the mower, erected a monument to his courage, by turning it into a lawn decoration—with flowers in the grass catcher. Now he spends weekends camping.

87



Far-out furniture for the future living room

London, home of mod fashions, is going far out in its furniture, too. Top attractions at a recent designers' show were the two oddball creations above. The two-person, double-ended rocker at left seesaws back and forth on its semicircular frame, while its occupants recline on spaceshiplike contour seats. The doughnut-shaped seat at right starts out as a completely round ball, full of stuffing inside. As you sit on it, it squashes down, shaping itself snugly to your anatomy. It's said to be the nearest thing to floating on air.



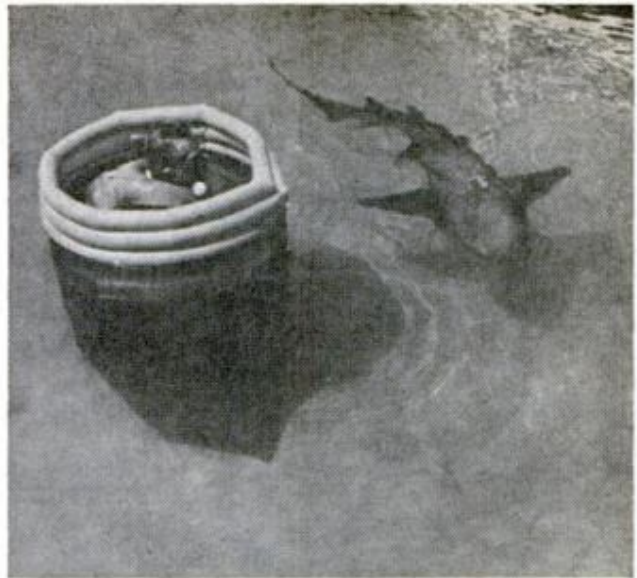
He carves rock with a high-pressure air gun

The helmeted figure at left above isn't a sandblaster as you might guess. He's British sculptor William Mitchell, and he wields a compressed-air jet as delicately as other artists use a brush or chisel. The high-pressure airstream, mixed with abrasive grit, etches away stone to produce intricate designs in relief. The spectacular mural carved out of rock at the right fills a whole wall and was created entirely by Mitchell's air-blast technique. The clouds of fine dust produced by the process are so thick that the sculptor must wear a helmet with a separate air supply piped in for breathing. Mitchell specializes in decorating large expanses of stonework in public and private buildings in London. His "studio" is a rock quarry from which he gets much of the raw material for his unusual sculpture.



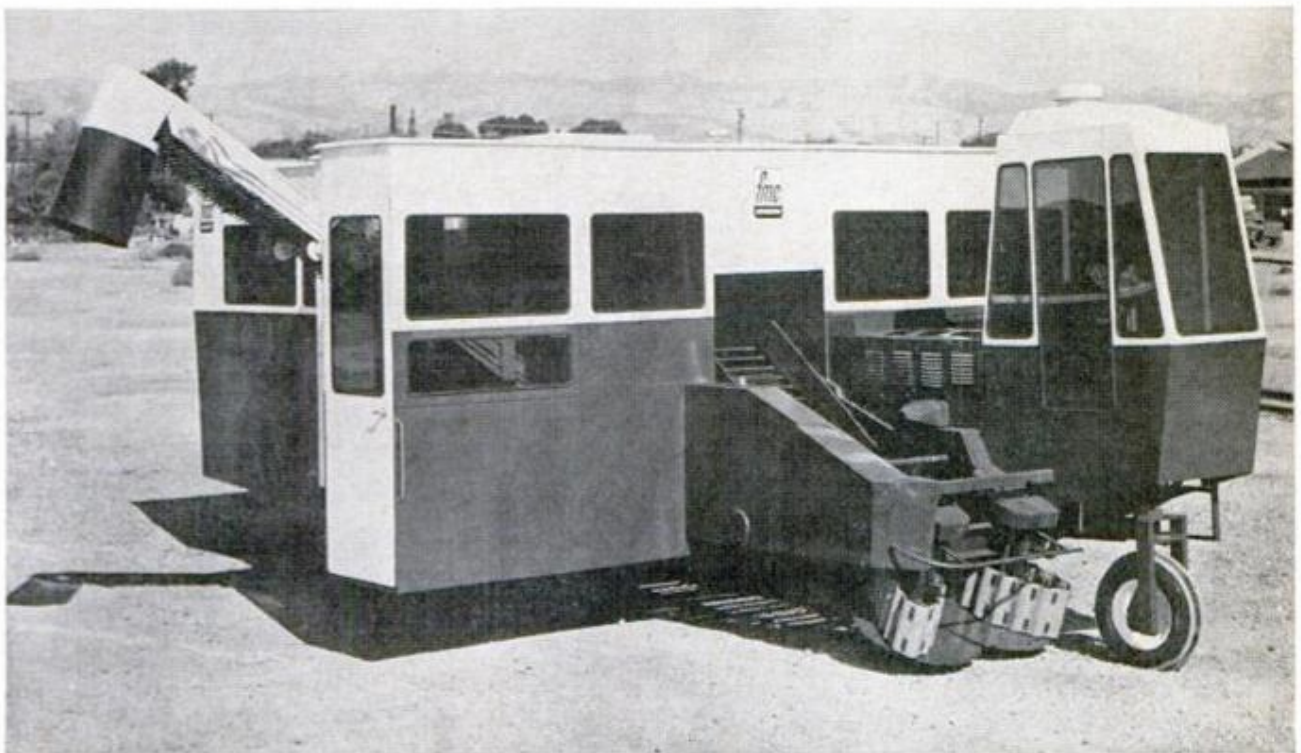
Clothes washer is kidney

Ordinary washing machines are serving as artificial kidneys at Ohio's Cleveland Clinic Hospital. Each is fitted with coils carrying blood from a patient's body. The agitating action circulates liquid around the coils to purify the blood. The object: low-cost artificial kidneys for home use.



Bag keeps sharks away

Inside this plastic bag, a shipwrecked seaman is safe from shark attacks, says the Navy. The bag, supported by an inflatable collar, seals in blood if the man is injured and his body scent so as not to attract a shark's attention. It is designed to be included in a standard life jacket.



How to pick tomatoes without even going outdoors

You won't see this rubber-tired monster coming down the highway—and it's a good thing. Representing the latest in mechanized tomato-harvesting equipment, it is literally a factory on wheels. As tomatoes are scooped in the front on endless conveyor belts, workers inside sort and pack them, sitting in airconditioned comfort on softly padded seats. For entertainment while they work, radios provide popular music and news broadcasts. By old methods, harvesting tomato crops was a backbreaking job in scorching heat with little appeal for working hands. The idea behind the modern rolling "factory" is to provide conditions more like those in real big-city factories in order to lure workers back to the fields. The mighty harvester was developed by the FMC Corp. of San Jose, Calif.

SHOOT SWIRLING COLOR FROM A SWINGING LIGHT

A simple bulb and battery setup you can make in minutes yields dazzling color photos like this

By **WALTER S. SCHENCK**

THE SPECTACULAR PICTURE at right was made by a tiny lightbulb swinging like a pendulum in a series of arcs. You can make eye-catching photos like it with any camera that takes time exposures.

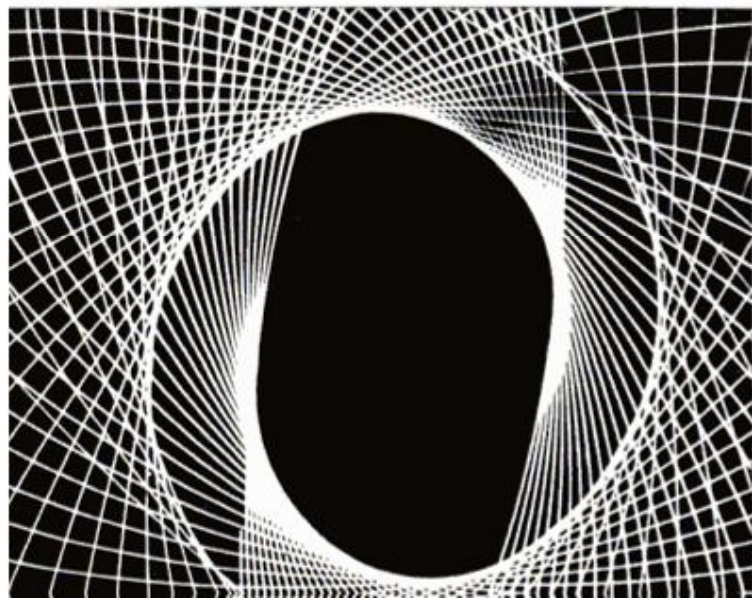
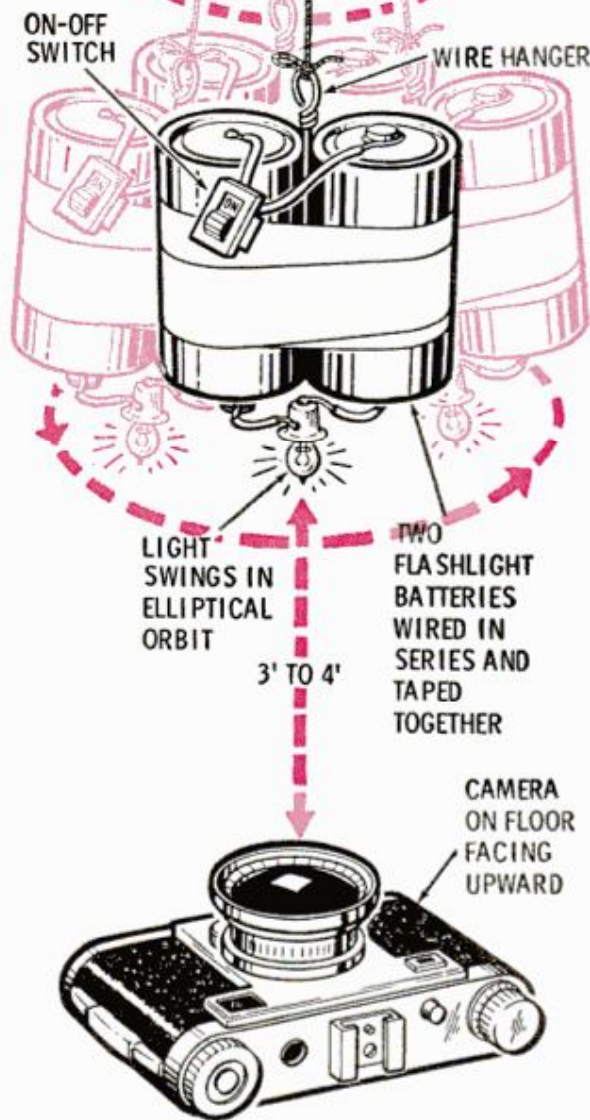
The setup is simple. Two flashlight batteries are wired in series and taped together. Suspend the assembly three to four feet above the floor, and place the camera under it. Start the light swinging in an oval path, darken the room, and open the shutter.

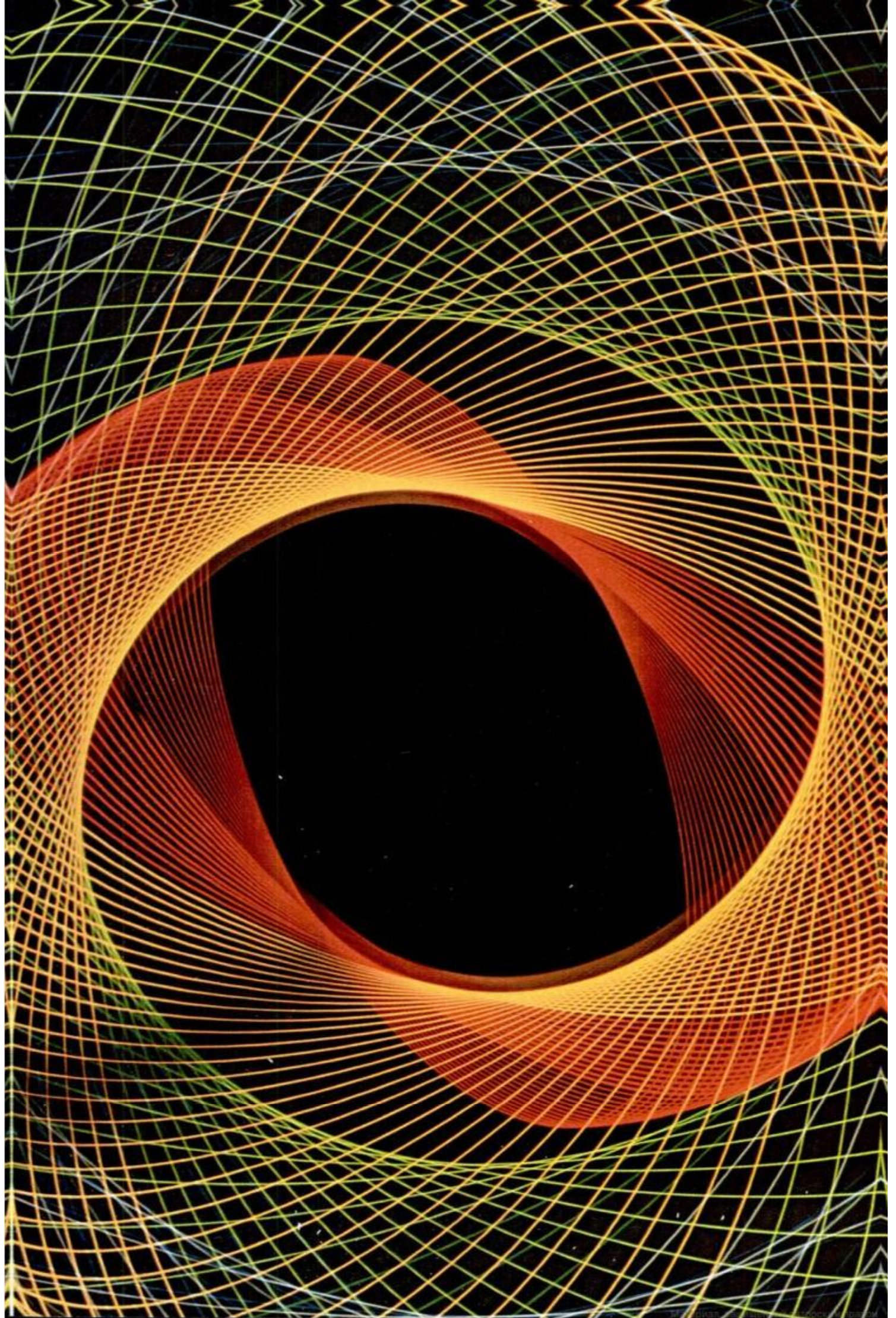
As the light swings, it traces a path on the film like car headlights in a time exposure at night. The axis of the oval orbit gradually rotates as the bulb swings, at the same time becoming progressively shorter. These two motions produce an ever-changing pattern of lines on the film.

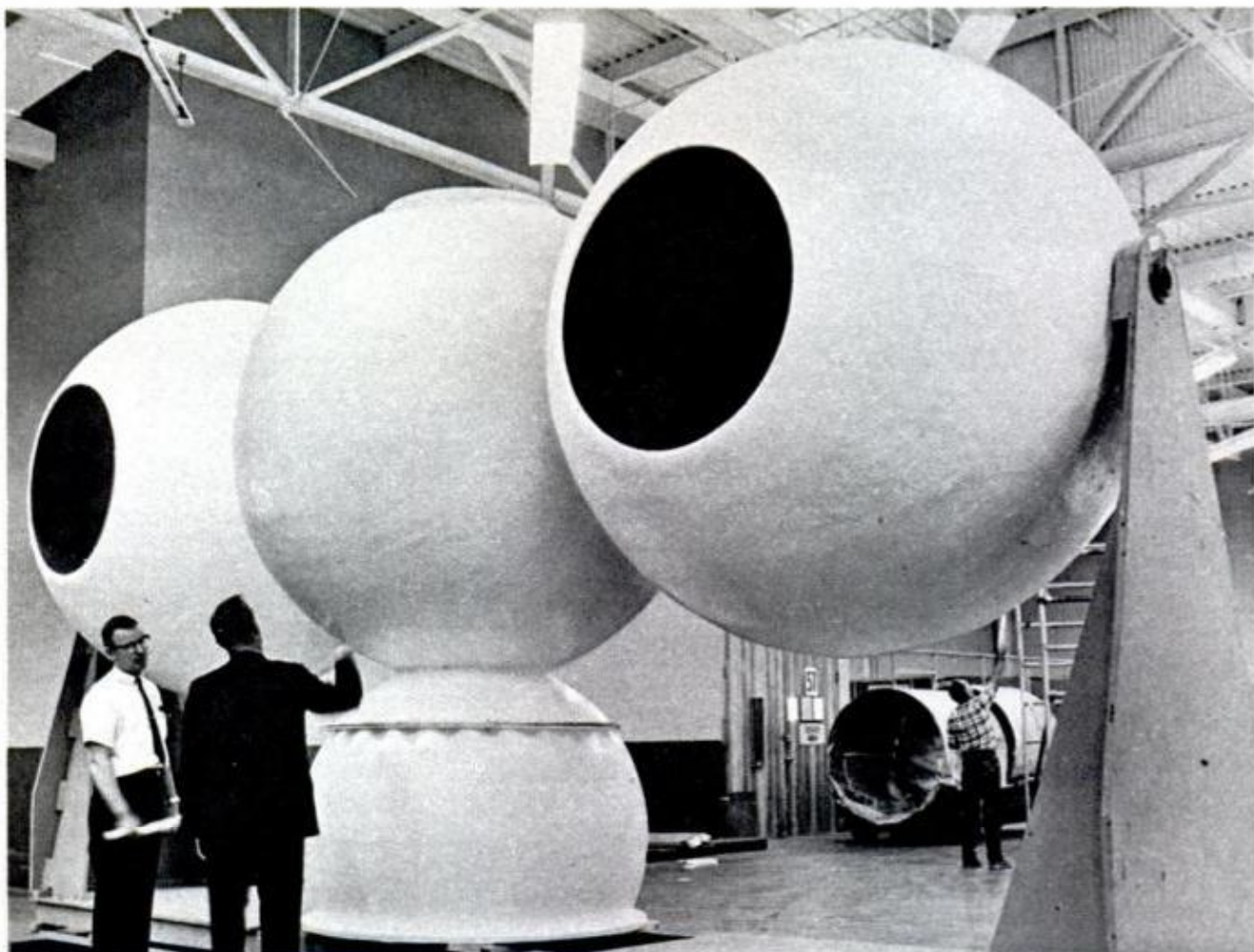
The variations in color are created by placing different photographic filters over the lens every few minutes. The best filters to use are vivid ones like A (red), G (orange), K2 (yellow), X1 (green) and 80C (blue).

A slow film (ASA 25 to 50) and a small lens opening (f/16 or f/22) are preferable. Exposures from 5 to 10 minutes are typical. Since you can't focus the camera from the floor, measure the vertical distance to the bulb and prefocus the camera at the same horizontal distance. ★ ★ ★

INTRICATE LIGHT PATTERNS, traced on film by a swinging lightbulb, are most dramatic in full color, as seen at the right, but can also be effective in black and white, as at left. Colors are created merely by placing colored photographic filters over the camera lens during the exposure







Rescue's on the way for submariners

This is a mockup of the inner hull of a deep-submergence rescue vehicle being built by Lockheed Missiles & Space Co. for the Navy. The three interconnecting spheres will go inside the rescue sub's outer hull. The vessel will withstand pressures at a rescue depth of 3500 feet. The bell-shaped structure at bottom, which attaches to the distressed sub, is a transfer hatch for the crew. The two openings for fitting equipment will be closed in final model.



Turret-topped electric car

In Pisa, Italy, Marquis Bargali has developed a two-seat electric car called Urbania. The car weighs about 750 pounds including 190 pounds of batteries. Top speed is 33 mph. It can travel 53 miles before batteries need recharging. The turret top rotates to discharge passengers. Cost: about \$800.



Little red 408

With this car, the Soviet automobile industry is trying to break into the German car market. The Moskvich 408 sells for about \$1450, has a 60-hp motor, gets about 30 miles to the gallon and has a top speed of about 80 mph. The four-door sedan comes equipped with radio and other extras.

HOT antennas for COOL color

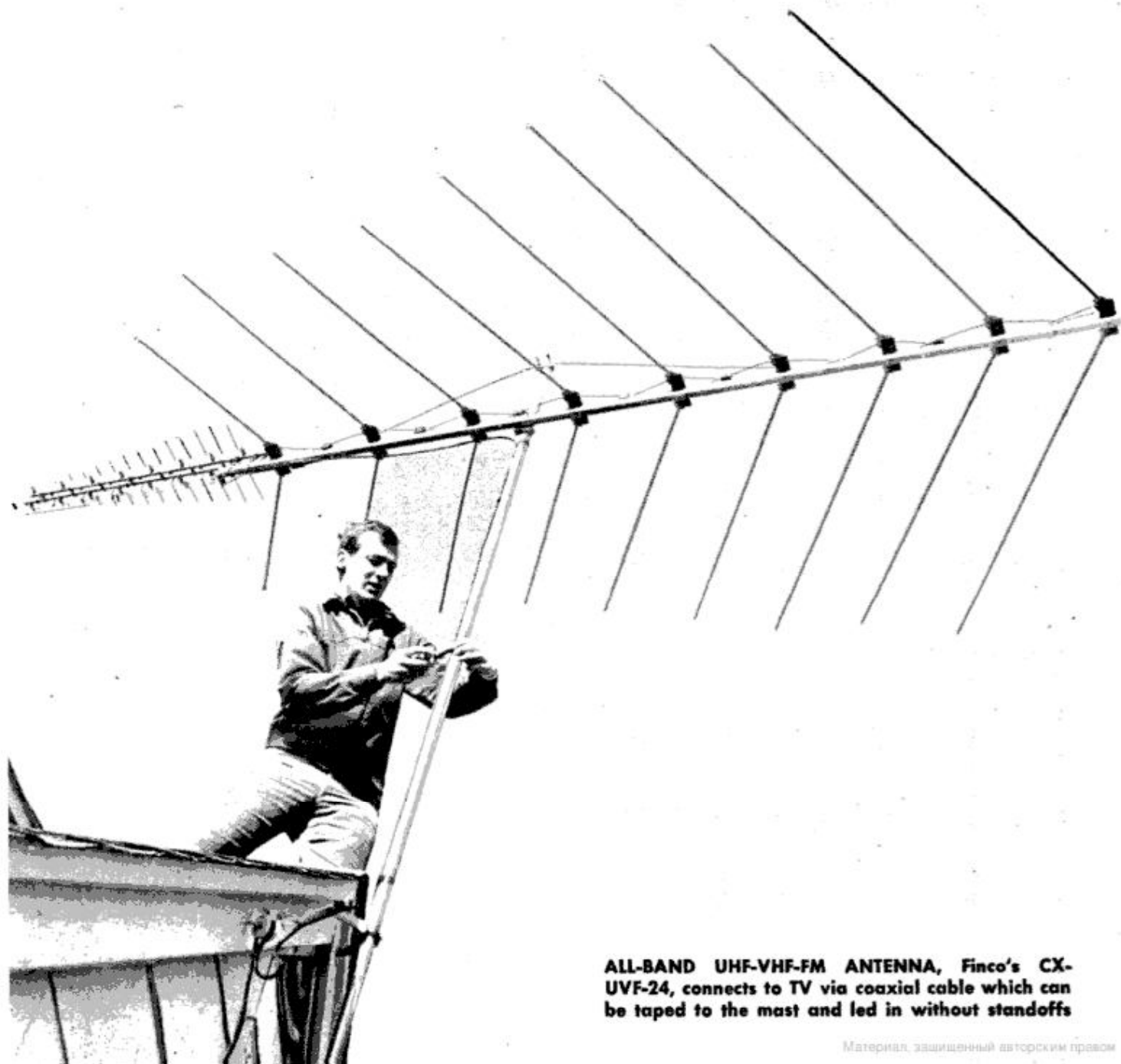
Your old antenna won't do for color. Here PM tests the special high-gain jobs you need for a perfect picture

By Larry Steckler

IF YOU LEARNED that a small, square patch of chicken wire may serve as a most effective UHF antenna (which it may), chances are you'd try a piece of it before you bought a new antenna. Most of us feel that "as long as it works" we're saving money. You always kick a radio to get it working before you give it up as broken. Everybody

who's ever owned a radio knows that.

Most of us apply the same reasoning when buying a color TV. No matter what the sales pitch about "color" TV antennas, we first try our new color set with the antenna that's been on the roof for 10 years. Sometimes it works, but more often that old antenna, designed for the simpler black-and-white



ALL-BAND UHF-VHF-FM ANTENNA, Finco's CX-UVF-24, connects to TV via coaxial cable which can be taped to the mast and led in without standoffs

GOOD COLOR RECEPTION DEPENDS ON:

High Antenna Gain:



Antennas designed for color will intercept and deliver the strongest possible signal to your set, reject random noise and give a perfect picture. Typical black-and-white antenna has half the gain of one for color and will give a picture often characterized by ghosting of image (right)



Another effect of insufficient gain is snow (right) which appears as colored confetti in picture



A third effect of poor gain is color changing, which results in the all-too-familiar green faces

Strong Directional Pickup:



Directivity is ability to receive signals from the direction the antenna is pointed and minimize signals from other directions. Poor directivity or alignment causes distortion and color washout



Other effects of poor directivity are ghosts, streaks and other interference in your picture (right)

Proper Lead-In Shielding:



Unshielded, flat lead-in—which is fine for black-and-white TV—picks up unwanted signals, such as ignition noise, and results in a color picture marked by herringbone patterns and streaks. Improper impedance match of antenna to receiver can reflect signals and cause color distortion

TV signal, will be the weak link responsible for reception difficulties of one kind or another.

If the signal your old antenna pulls in and passes to your TV set is too weak, you may get a good black-and-white picture, but no color. Even if you get a good color picture, ignition noises from passing cars may show up as bright confetti specks across the screen. But before you scrap the antenna get up on the roof and take a good close look. Take it down from the mast, loosen the lead-in connections, clean the wires and terminals, then refasten the connections and remount the antenna. Give it another try and if reception is no better, junk it and use the elements as garden stakes.

If you're getting a great color picture, ghost-free, snow-free, sharp and clear, forget about the new antenna. If the picture is good, but the colored confetti is showing up, you might try to

remedy the situation by using shielded coaxial cable to replace the existing ribbon-type lead-in wire. Use 72-ohm-impedance cable and get a matching transformer to fit between the cable and your set. If your set has provision for 72-ohm input, you won't need the transformer. The shielded lead-in should eliminate the confetti, which is usually caused by auto ignition interference.

If you've got a fairly good picture with color content, but one marred by ghosts, try relocating your antenna on the roof. A couple of feet one way or another often makes a big difference in reception. Your antenna should be on a 10-foot mast. If it isn't, put it on one.

A snowy picture, or a picture devoid of color because of a weak signal from the antenna, can often be cured by using an antenna booster. But if you're way out there—75 miles or more from

(Please turn to page 192)

COLOR ANTENNA RECEPTION TESTS*

Mfr.	Model	Total elements	Mfr.'s specified range in miles			VHF color reception (air miles from transmitter)			Suggested retail price
			VHF	UHF	FM	25	50	90	
Allied Radio	Colorset 55	55	175	75	90	G	G	G	\$34.95
	Colorset 47	47	135	75	80	G	G	S	27.95
	Mark 24A	24	150	75	80	G	G	S	29.95
	Mark 12A	12	100	50	60	G	S	U	16.95
Channel Master	3633G	37	Near fringe Metropolitan			G	S	S	59.95
	3640G	12				G	S	U	22.95
	3610G	22	Deep fringe Suburban	**	Deep fringe Suburban	G	G	G	59.95
	3614G	11				G	S	S	23.95
Finney Co.	CX-UVF-24	24	Deep fringe Fringe			G	G	G	72.10
	CX-UVF-16	16				G	G	S	42.65
	CX-VL-18	18	200	**	90	G	G	G	36.93
	CX-VL-10	10	125	**	50	G	G	S	25.43
Jerrold Co.	PIX105	10	Fringe	**	Fringe	G	S	U	43.95
	PIX225	19	Deep fringe	**	Deep fringe	G	G	G	81.95
	PXB50	33	Suburban Fringe			G	G	S	36.50
	PXB90	101				G	G	G	66.50
JFD	LPV-CL700	35	150	90	60	G	G	S	69.95
	LPV-CL200	18	50	40	25	G	S	U	22.95
	LPV-TV50	5	60	**	30	G	S	U	18.95
	LPV-TV190	19	200	**	40	G	G	G	46.98
Lafayette Radio	18C0180WX	28	225	100	100	G	G	G	34.95
	18C0183WX	12	125	65	75	G	S	U	15.95
	18C0189WX	18	200	**	200	G	G	G	30.95
	18C0186WX	7	100	**	100	G	S	U	13.95
Winegard	B-555	33	125	80	90	G	G	S	35.28
	B-335	17	60	30	50	G	S	U	20.58
	B-770	22	175	**	90	G	G	G	38.19
	B-550	15	125	**	75	G	S	S	20.55

*See text for test procedure and summary—and for explanation of Good, Satisfactory and Unsatisfactory ratings.
**No UHF coverage



DEADLY M16 RIFLE is carried through Vietnam swamp by Specialist John Rutchick of Colchester, Conn.

VC firepower—can we match it?

The enemy is using an international arsenal against our troops in Vietnam, including weapons made in the United States, but we've got a few new things going, too, such as a no-deposit, no-return artillery piece called LAW

By MORT SCHULTZ

Illustrations by Chuck Kramer of Zik Associates and Dale Gustafson

IF YOU DIDN'T KNOW BETTER, examination of captured weapons would make you believe that we're pitted against a United Nations contingent in Vietnam.

You expect to find small arms of Soviet, North Vietnam and ChiCom (Chinese Communist) manufacture, and you do. But there are also huge quantities of French, German, British, Japanese and Chinese Nationalist weapons in VC hands.

In fact, the Vietcong fight with no less than 45 different makes and designs of weapons. This makes a strange contrast to the basic baker's dozen used by U. S. forces.

To add even more paradox to an al-

ready paradoxical situation, there are as many American-made weapons in Vietcong supply dumps as those from any other free-world nation. This prompted one astute Pentagon spokesman to tell me, "We gave the Japanese scrap iron to shoot back at us at Pearl Harbor. Charley didn't bother with the scrap iron bit. He got the ready-made stuff, primarily by capturing it from the French and South Vietnamese."

The array of VC weapons is amazing, ranging from rifles one step removed from old breechloaders to modern small arms that compare to those used by Americans.

For example, a cache of guerrilla guns found recently in D Zone turned

U.S. weapons



M14, 7.62MM, is the infantryman's basic rifle. On automatic, it can effectively fire 120-150 rpm at a range of 460 meters. It can also be fired semiautomatically



M16, 5.56MM, newest shoulder weapon in Vietnam, is lightweight and deadly accurate at long range. It uses a .223 cartridge that tumbles after it hits the target



M67, 90MM RIFLE, is a recoilless weapon being employed against VC fortifications. It has a muzzle velocity of 700 feet per second and an effective range of 450 yards



M79 LAUNCHER fires a 40mm high-explosive grenade 400 meters. A percussion-type, single-shot weapon weighing only six pounds, it has a kill radius of five meters



M60 MACHINE GUN, a 7.62mm, gas-operated weapon, has a muzzle velocity of 2800 feet per sec., maximum range of 3500 yards. It weighs 23 pounds with bipod

Vietcong weapons



- * **CHICOM TYPE 53 CARBINE** weighs nine pounds and uses a five-round integral magazine. Its effective range is 400 meters, and its effective rate of fire is 10 rpm



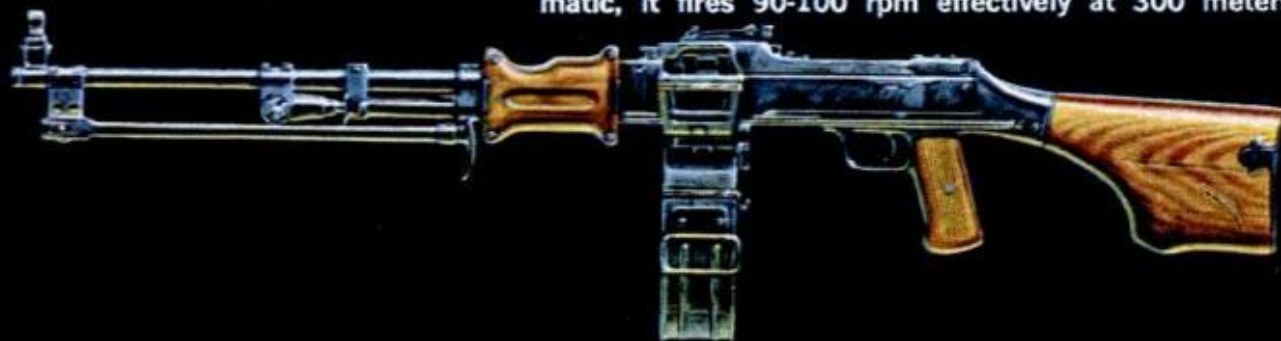
- * **CHICOM TYPE 56 CARBINE**, gas-operated and semi-automatic, uses a 10-round integral magazine. Its range is 400 meters, and it has an effective rate of fire of 10 rpm



- * **CHICOM TYPE 50 SUBMACHINE GUN** weighs 11 pounds, fires automatically or semiautomatically. Automatic fires 90-100 rpm effectively at a range of 100 meters



- * **CHICOM TYPE 56 RIFLE** is a selective fire weapon using a 30-round magazine and weighing 11 pounds. On automatic, it fires 90-100 rpm effectively at 300 meters



- * **CHICOM TYPE 56 LIGHT MACHINE GUN**, a 19½-pound gas-operated weapon, uses 100-round metallic belt in drum. Rate of fire is 150 rpm effectively at 800 meters

*These VC weapons fire a 7.62mm cartridge

up, among others, this varied display:

- Russian hand-operated bolt-action Mosin Nagent rifles designed in 1891; and variable semiautomatic-automatic, gas-operated Soviet-designed 7.62-mm assault rifles, AK-47, with a rate of fire of 100 rounds per minute.

- That sweetheart of "Roarin' 20s" tough guys and many an American GI during World War II, the .45-cal. Thompson submachine gun, or "Tommy gun"; and those Soviet-designed 7.62-mm submachine guns, PPSH, which you have seen in pictures dangling from the necks of Berlin Wall guards.

- Russian-designed Maxim heavy machine guns that came into style (in 1910) when the Gatling gun was just entering museums; and German 7.92-mm machine guns, MG 34, which were used by the Nazis in World War II and which are famous for their exceptionally high rate of fire (900 rounds per minute), making them ideal anti-aircraft as well as antipersonnel weapons.

And what of their North Viet comrades, coming south in increasing numbers? Well, these boys are equipped with only seven basic hand weapons, but they are the best in the Communist arsenal and many are as effective and efficient as our weapons.

Apparently, no modern, Communist-made hand weapon has been supplied the VC and North Vietnamese directly from Russia. (*Modern* means of post-Korean War vintage.) The huge number of newly designed Red weapons now in South Vietnam, although of Soviet design, are made in North Viet and ChiCom factories.

Older weapons, which only the Vietcong are equipped with, were accumulated primarily from stockpiles left in Vietnam by the French and Japanese. At Dien Bien Phu, for example, both the French and Vietminh were using U. S. 105-mm howitzers, as well as other made-in-America and French firearms. To the victors went the spoils.

The VC also have World War II weapons captured or stolen from American-equipped South Vietnamese,

including M1 rifles and M2 carbines.

"We still have a decided advantage," a Pentagon spokesman told me. "The VC and North Viets are well-trained and know how to use their weapons. But our weapons are at least as good as their best, if not better. And, frankly, our troops are the best. That's why we outgun the North Vietnamese and their modern weapons any time they come out to fight."

Americans go into battle with the newest weapons available. And as newer firearms are developed, they make their way into the hands of troops.

For example, the basic rifle is the M14, which fires the 7.62-mm NATO cartridge that is similar to the old .30-'06, but a half inch shorter. If you're a Veteran of World War II or Korea, you may be surprised to learn that the Browning automatic rifle (BAR) is no longer part of any U. S. infantry outfit. There's no need for it. The M14 puts an automatic, as well as a semiautomatic, rifle in the hands of a rifleman.

Positioned for semiautomatic firing, the M14 is able to lay down effective fire at the rate of 40 to 60 rounds per minute; the M1 could do only 16 to 24.

Switched to automatic fire, the M14 will put out exactly what the BAR did: 120 to 150 rpm.

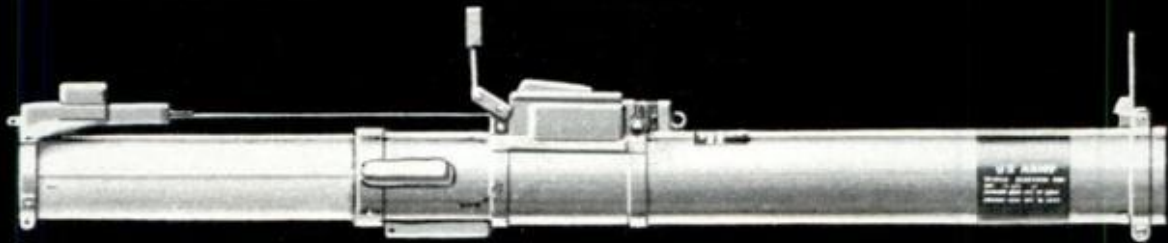
But even the M14 is obsolete when compared to our newest rifle, the seven-pound M16, which is now being used by Army air assault outfits, special forces units and the Marines in Vietnam. It is pure murder.

The M16 makes a man a crowd, allowing him to lay down a fantastic 100 to 120 rounds per minute, providing he can change the 20 or 30-round magazine that fast. Accurate beyond description—a soldier 300 yards away can get endless groupings in a foot-square target—the M16 fires a .223 cartridge.

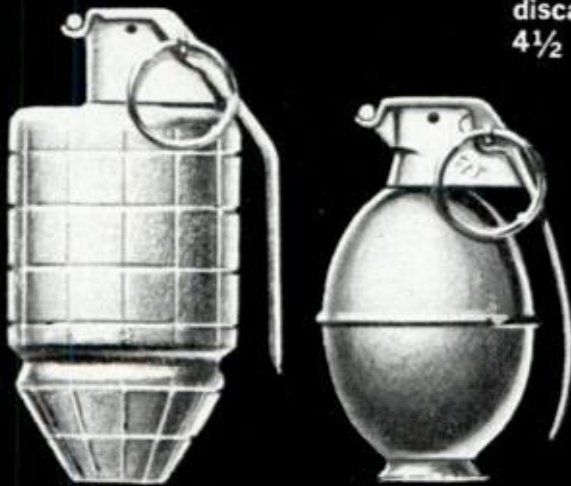
How effective can a bullet little heavier than a .22 be in combat? According to its manufacturer, the bullet is one of the most destructive made to date. It tumbles after it hits the target, and

(Please turn to page 194)

U.S. weapons



M72 LIGHT ANTITANK WEAPON—the LAW—can fire an armor-piercing projectile 1000 meters. In use, a soldier pulls the end caps, aims and fires. He then discards the entire tube. The weapon weighs only 4½ pounds and is great against VC fortifications



GRENADES in use in Vietnam are the M34 White Phosphorus (left) with a bursting radius of 15 meters and the M26A2 Fragmentation (right) with a bursting radius of 25 meters. Both weigh about one pound and can be tossed from 35 to 50 meters



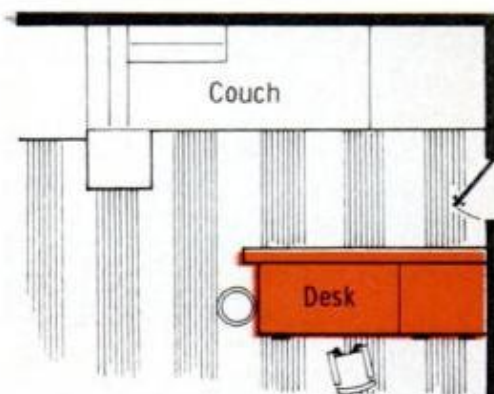
CAL .45 AUTOMATIC PISTOL (effective range: 50 meters), dating back to World War I, is used by officers and weapons crews



81MM MORTAR is a smooth-bore, drop-fire, hand-loaded piece weighing 93½ pounds. It fires finned projectiles at velocities of 570 to 770 feet per second, depending on type of projectile, to top ranges of 2300 to 4000 yards

Weapons on these pages are not shown in relative scale.

Make this handsome



FLOOR PLAN

Drawings by ZIK Associates

TAKE ANOTHER LOOK if this handsome affair appears too difficult for *you* to build. Its framework can be as rough as the walls of a house for it's all later hidden by a facing of 1/4-in. prefinished wall paneling which will cover a multitude of sins.

Joints don't have to be perfect, the wood can be second rate. Even the sawed edges of the hardboard covering itself are neatly concealed with matching metal molding to further simplify construction. What's more, you don't have to touch a brush; the whole thing is already finished when you have it completed since the paneling comes with a slick factory finish.

There are no nails to deface the paneling for it's all glued to the framing with a special mastic.

The home-office room divider you see here in beautiful color-gravure was covered with a hardboard paneling called Marlite, one of a number of prefinished, simulated wood-grain boards available at lumber dealers. The nautical mural over the desk is Marlite's Catalina, one of several designs which come in gold on white. The moldings are all stock shapes normally used in wall applications.

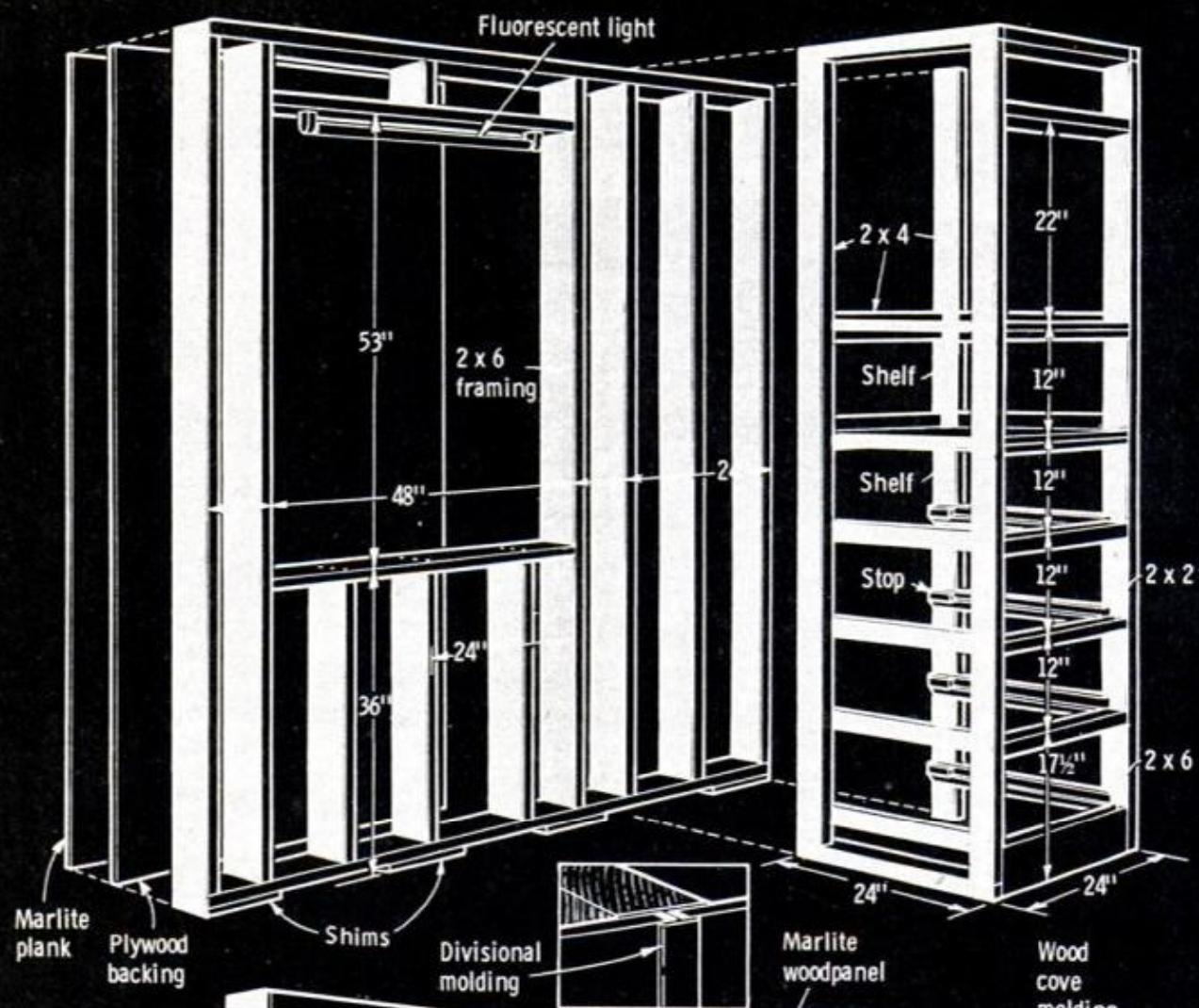
If you build it as a freestanding room divider, follow the 2x6 framing



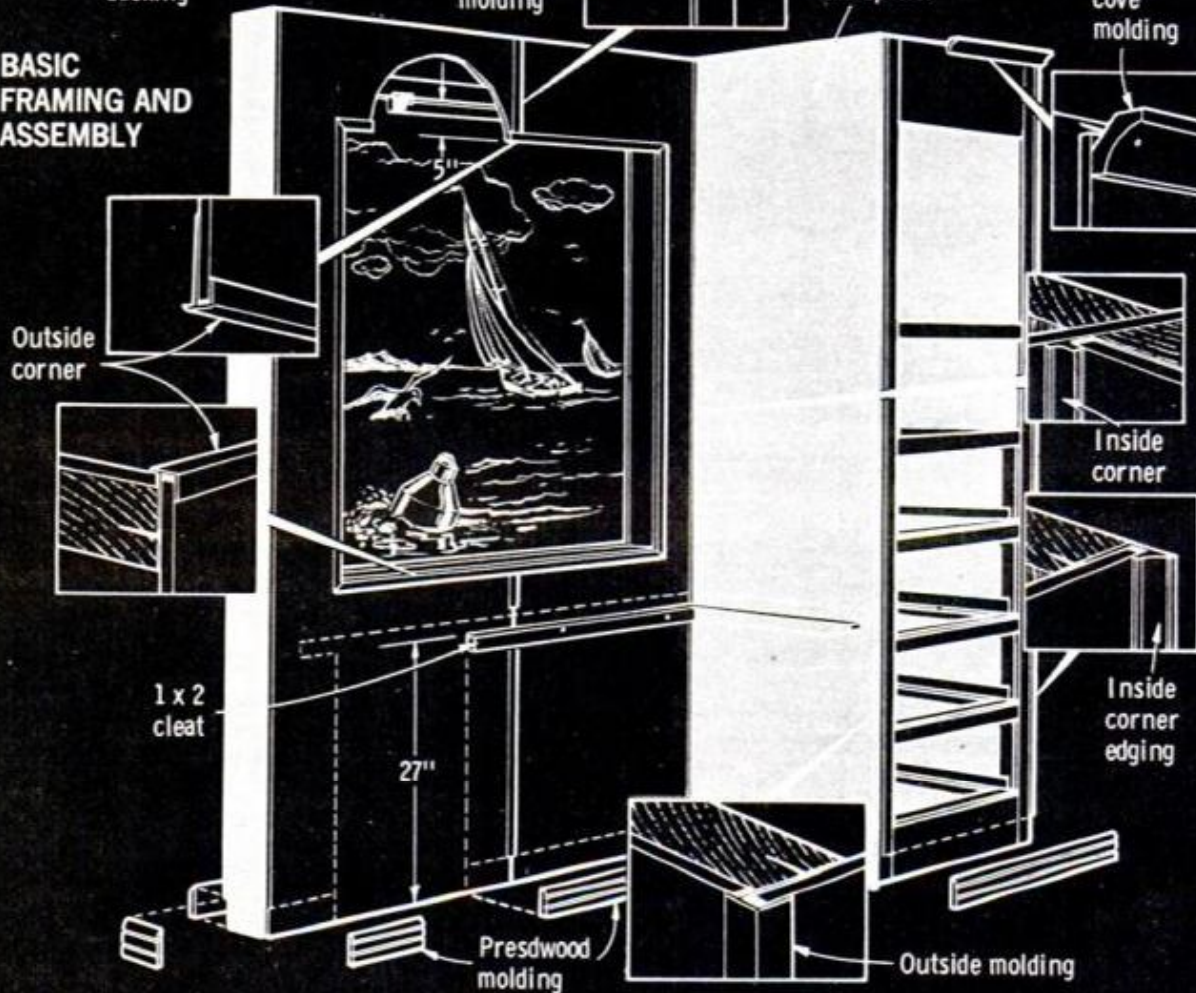
home-office room divider

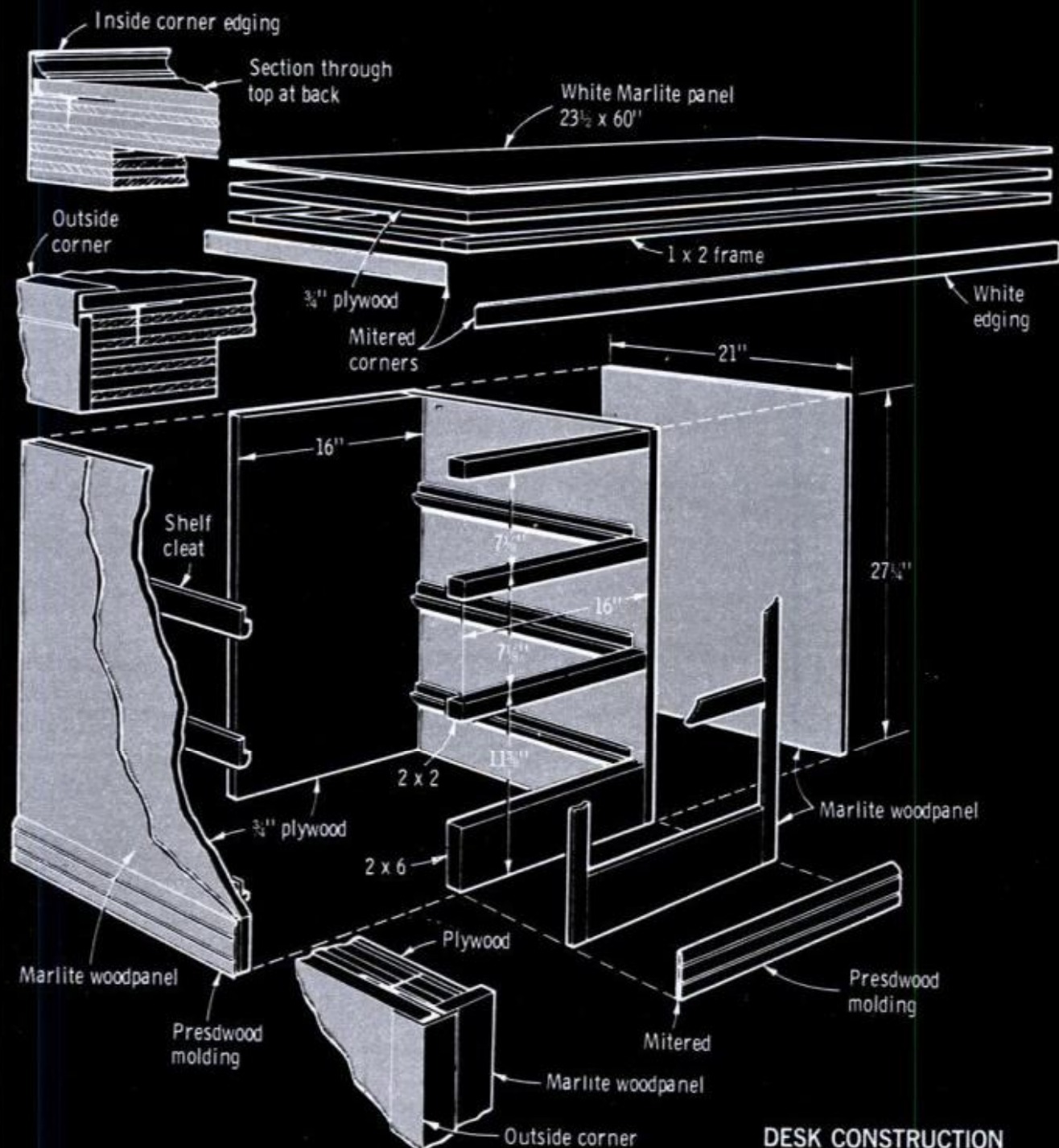
Can be built as free-standing divider or into an existing wall. Lighted mural, plus facing of prefinished hardboard paneling, provides smart decorator look





BASIC FRAMING AND ASSEMBLY





DESK CONSTRUCTION

for the back wall as detailed. If you build it into an existing wall, the wall itself will serve as the back wall and the recess for the mural will be the depth of the studs.

Since the divider is made $\frac{1}{2}$ in. less than ceiling height, the framing for both the back wall and the file cabinet has to be built right in place in the room. You can't build them as separate units and hope to tip them up in place, particularly the file cabinet. You'll notice that a cove molding is finally used as trim around the top to cover the gap at the ceiling. While the file cabinet was

originally made to hold four roomy drawers, plus two door-fitted compartments, you can divide it up any way you wish. The rear side of the back wall is the only part of the wall which is first covered with plywood. The important thing in framing the back wall is to see that one stud is centered 48 in. from the end to support the joint of two full panels applied to the rear side.

With the plywood in place, cut down the 60-in.-square mural to fit the opening and cement it to the plywood. Next install inside corner molding around

(Please turn to page 179)



*now
you can
lay a*

SPANISH TILE FLOOR

by Al Lees

Luxurious beauty, durability and lazy-man's maintenance are yours with quarry tile. And a new epoxy compound lets you set and grout them yourself—at a saving of hundreds of dollars

APPRECIATIVE WHISTLES—and long ones—were the oft-heard “comments” from visitors to the Spanish Pavilion at New York’s recent World’s Fair. This much-praised building was the hit of the International Area—and the feature most admired was the spectacular tile floor.

“Now, that’s what *we* should have,” harassed mothers murmured to their husbands. “Oh, sure,” was the usual reply, “right after I buy my yacht.”

Quarry tile is luxury flooring. It looks it, and the skilled labor involved rockets the installed cost to a height well beyond the average home budget. Yet so strong was the appeal and influence of that famous floor (which still looked fresh after a two-year stampede of 10 million pavilion visitors) that leading resilient floor manufacturers quickly came out with ersatz Spanish tile designs.

Since I numbered myself among those who coveted that floor—and wouldn’t settle for a vinyl copy—I was intrigued when I learned that the Princeton, N.J., research center of the Tile Council of America had developed a revolutionary new material for both setting and grouting tile—and was having such good luck with it in quarry-tile installations that the old mortar techniques were being abandoned.

They’ve tagged the discovery AAR-II—code for “acid and alkali-resistant two-part system.” It’s packaged under a variety of brand names by a handful of licensed manufacturers; “two-part system” means that—like most other modern “miracle” adhesives and fillers—it’s a resin-and-hardener epoxy compound which must be mixed just before use. Since homeowners had mastered the use of other epoxy materials, I wondered if this one was the key to a do-it-yourself installation of quarry tile. A “Spanish” floor seemed a possibility.

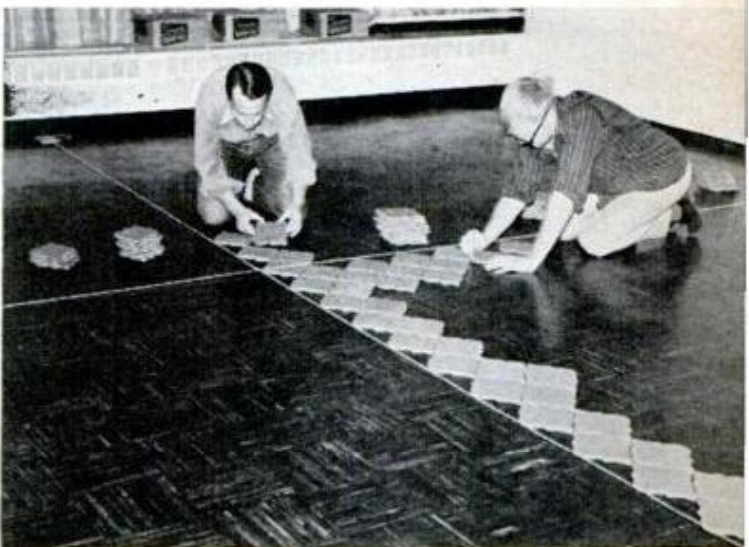
After consulting a number of experts and witnessing demonstrations, I decided to go all out and tackle an installation in my own living room. That was my first mistake: the room mea-



REMOVE WAX from resilient tile by mopping thoroughly with water to which a commercial wax remover has been added. If thick wax coat has built up, add few drops of ammonia to mop water to cut



START LAYOUT at floor’s most critical spot, where tile pattern will be conspicuous. Here, whole tile are run around a corner toward threshold border. The floor boundary is masked with tape and foil

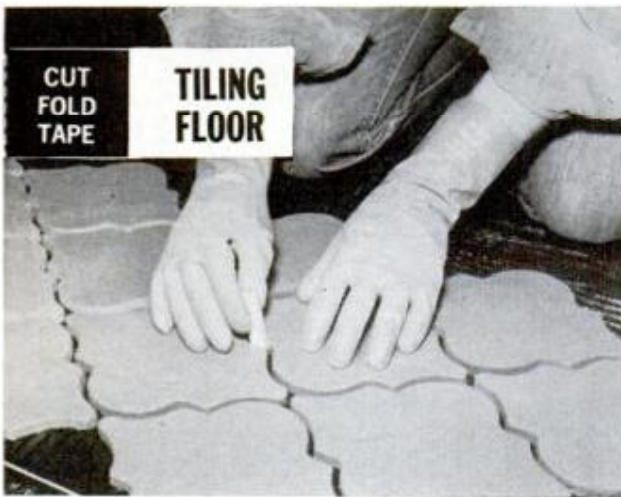


CROSSED CENTER LINES aid in continuing layout across room in both directions. Dry run gives you check on tile estimate and lets you shift center-lines if there’s awkward cutting to do at the walls

HOW TO SET SPANISH TILE



EPOXY CEMENT comes in two parts in 3-gal. metal bucket: a fibrous black hardener packed around a can of liquid resin. Full quantities must be mixed at once to assure proper proportions. For ease, motorized mixer may be rented, though mixing can be done by hand, pouring small amount of resin at a time while stirring



TEST SPACING with $\frac{3}{8}$ -in.-thick strip inserted between square shoulders. Though design is created for $\frac{3}{8}$ -in. grout lines, there's some leeway. Bed each tile firmly by a slight back-and-forth motion until ridges on underside "bite" floor. Cement smudges must be quickly removed (right) with a moist kitchen pad



CORNER BULLNOSE for threshold can be treated (who remembers to order one?) by mitring two standard border tile, using miter gauge on tile cutter (at right in photo) to get finished edge on two sides

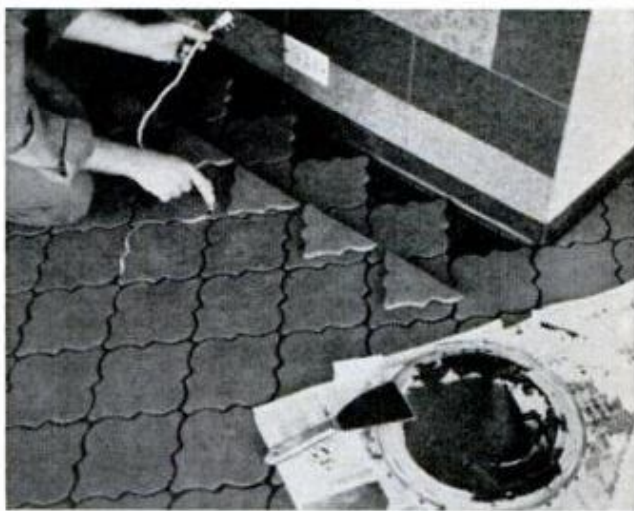
sures over 20 ft. on a side, which means more than 400 sq. ft. of floor. When the professional tile man who had agreed to advise me first saw the place, he bluntly suggested I was out of my head. But by this time I was committed. And besides, I reasoned, my floor was already "graphed-out" with standard 9x9 asphalt tile—wouldn't this speed the whole installation?

Well, what I learned in the next month or so can be of value to you whether you wish to tile over an existing floor, directly onto a plywood subfloor, or even on an exterior wooden porch or sundeck. (Quarry tile is an excellent patio surface, too, but when

WITH NEW EPOXY COMPOUND



SPREAD EVENLY with notched trowel (¼-in.-sq. notches) after dumping enough mix on floor to cover easily reached area. Push mix with figure-8 strokes, finish as shown (left) for thorough coverage. To set tile, work along center lines opposite the dry layout, leaving two rows of the dry layout as guide in positioning



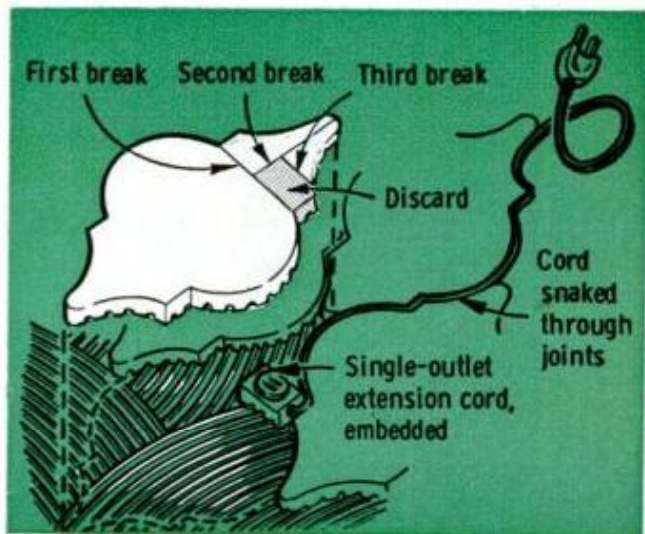
EDGE TRIMMING involves scribing with heavy-duty glass cutter and breaking across straight "anvil." Pulling up on handle of cutter brings scribing wheel against tile; pushing on it forces two fingers down that bridge anvil under the scribed line. Photo (right) shows trimmed tile ready for epoxy "buttering"

laying it on a concrete slab, you'd use a dry-set mortar rather than the epoxy.)

The Spanish-pattern tile I chose measure about 8½ in. from point to point, are over 6 in. wide and nearly ½ in. thick. You can estimate the number needed for a given area on the basis of 4½ tile per square foot. They're shipped 42 per box, and I used 43 boxes (including waste and extras) for my floor. That's about 1800 tile.

The per-tile cost depends on what arrangements you can make with local contractor-dealers. Remember, you're breaking fresh ground here, and they may try to dissuade you from doing the

(Please turn to page 198)



COMPOUND TRIMMING for special fitting is shown in this sketch for setting electrical outlet into tile. "Nibbling" out such a notch isn't practical; it takes a series of breaks to form a neat notch

Mercury's new

COUGAR

It's new, it's different, it's stylish and just about what most of those who bought it had in mind. Kudos are many, knocks few as sales of this medium-priced "personal" car go up, up

By BILL KILPATRICK, PM Auto Editor



INTERIOR STYLE, COMFORT received high praise from owners despite pointed asides citing cramped rear seat legroom and awkward location of front ashtray

ANY CAR selling upstream in a downstream year has just got to have a little something extra going for it. And if owners surveyed by *PM* are to be taken at their word, the Mercury Cougar is just such a car.

Typical of owner raves for the Cougar is this comment by a Connecticut sales manager:

"It's a great car—fun to drive, safe, responsive. Can't say enough for it."

A Missouri college professor said, "Of the 11 different 1967 cars I drove this past fall, the Cougar was the quietest and smoothest riding of all."

Mercury must be doing something right. As of the end of March, over 50,000 Cougars had been sold in less than six months. Lincoln-Mercury division headman E. F. (Gar) Laux has expressed confidence in the Cougar selling its second 50,000 in less time than it took to sell the first. Laux terms the Cougar "the unqualified success story of 1967."

He could be right. Certainly the car has made greater inroads in this year's shaky market than even its most optimistic advocates hoped for.

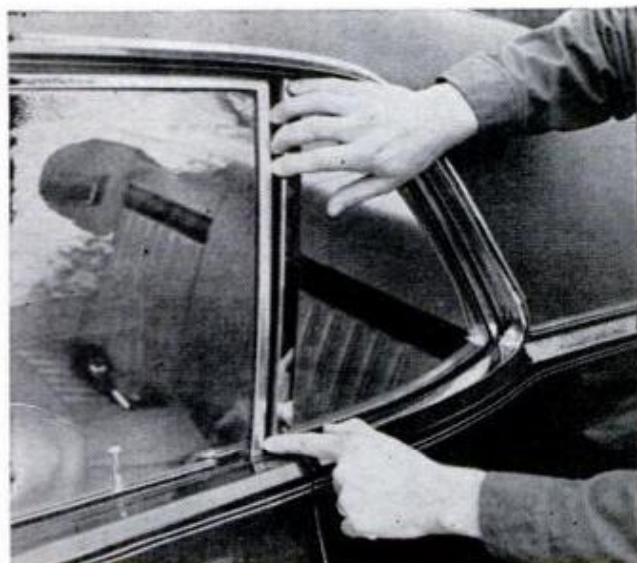
One big factor (maybe even the biggest) in the car's apparently favorable acceptance is a feature owners responding to *PM's* survey put right up there at the head of the praise list—

styling, an attribute to which they afforded an FMR (Frequency of Mention Rating) of 64.9 percent. Most had kind words for the car's "clean, uncluttered lines."

Owners also like the way the Cougar handles (64 percent), rides (25.3 percent), responds to power (22.2 percent), and delivers what most owners felt to be suitable operating economy (17.3 percent).

Sandwiched in like thorns in a rose garden, however, were some rather salty owner comments about poor gas mileage (earning an FMR of 12.4 percent), the usual and seemingly universal shoddy workmanship (10.2 percent), cramped back-seat legroom (9.6 percent), a glove compartment that seems to spill everything all over the floor every time it's opened (9 percent), and—at an FMR of 8.5 percent—some rather pointed beefs about the design and construction of the car allowing road dirt and mud to accumulate along the door sills.

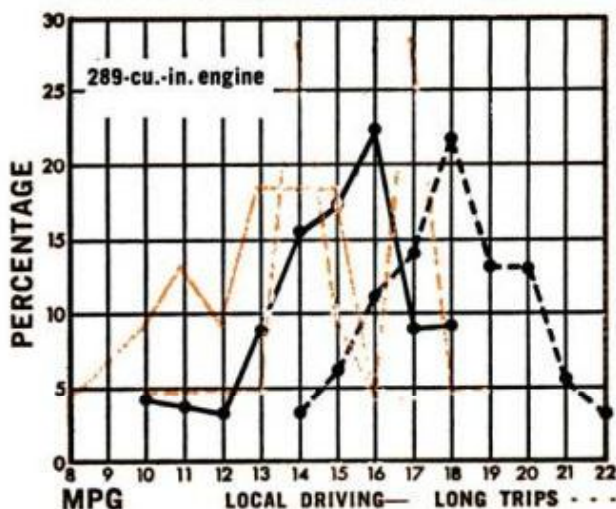
A summary of the likes, dislikes, opinions and general driving experiences of Cougar owners surveyed by *PM* appears on the following page. The percentages listed reflect the frequency with which the owners mentioned specific items. The summary is based on 1,120,767 miles of both around-town



SLOPPY ASSEMBLY, indifferent workmanship ranked second on complaint list, many owners mentioning poor paint jobs, bad fit of body panels, windows

JUNE 1967

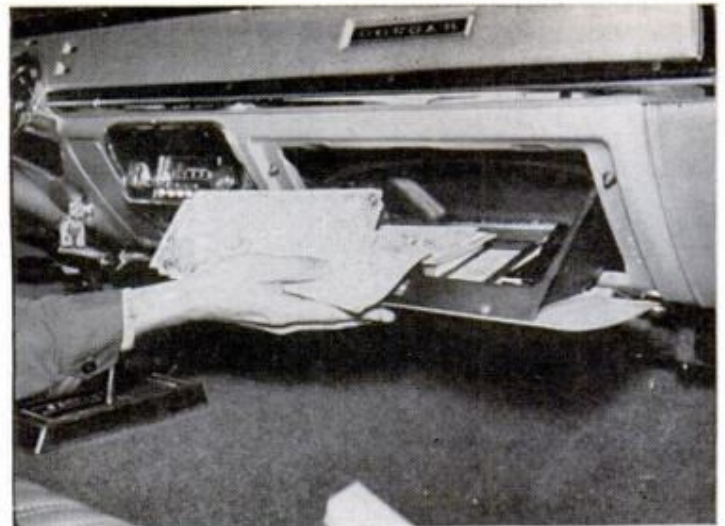
MERCURY COUGAR FUEL MILEAGE CHART



MILEAGE FIGURES varied with engine. The 289 cu. in. is standard, the 390 cu. in. optional. Reported was 16.5 mpg overall with the 289, 14.2 mpg bigger 390



REAR FENDERS, WHEEL WELLS bulge out a good six inches beyond visual reference point when backing up, yet few owners mentioned poor rear visibility



GLOVE COMPARTMENT was liberally knocked. Owners report contents spilling all over floor each time compartment is opened, construction as cheap

and highway driving.

Comments pertaining to Cougar owner cheers and boos follow directly, again in order of frequency mentioned. The boldface asides are mine.

As noted earlier, what owners like most about the Cougar is its styling.

"The sharpest, neatest car to come out in 1967."—Missouri route salesman.

"Has a real sporty, racy look about it."—Maine milkman.

"Everybody takes a second look at

the car."—Arizona aircraft worker.

"Not too big, not too small, just right."—Connecticut office worker.

Ranked second in owner affections is the way the Cougar handles.

"Sweetest thing I ever drove."—Louisiana welding instructor.

"Easy to maneuver in tight spots."—Iowa housewife.

"Handling is superb. It corners with very little sway and you feel you always have control of the car."—Mary-

(Please turn to page 202)

Summary of Mercury Cougar Owners Reports*

Total miles driven1,120,767

Average mpg:

289-cu.-in. engine16.5

390-cu.-in. engine14.2

Specific likes:

Styling64.9%
 Handling64.0
 Ride25.3
 Power22.2
 Economy17.3
 Comfort17.3
 Suspension15.1
 Performance12.0
 Quietness11.6
 Interior styling9.8
 Size8.0
 "Hide-away" headlights...5.8
 Workmanship5.3

Specific dislikes:

Poor mileage12.4
 Workmanship10.2
 Poor rear legroom9.6
 Glove compartment9.0
 Accumulating road dirt ...8.5
 No rear ashtrays7.9
 Sloppy handling7.3
 Poor dealer service6.8

Small trunk space 6.8%

Had any mechanical trouble?

Yes57.7

No42.3

What kind of trouble?

Electrical system33.6
 Carburetor21.4
 Automatic choke9.2
 Headlight mechanism8.4
 Windshield wipers6.1
 "Minor"6.1
 Transmission5.3
 Speedometer3.1
 Power brake unit3.1

Dealer service satisfactory?

Yes66.9

No24.0

So-so6.6

"Not back yet"2.5

Why the Cougar?

Style77.7
 Size20.0
 Handling14.0
 Price8.8
 "Different"7.9
 Past experience6.5
 Quality construction6.0

"Big car" ride for size 6.0%

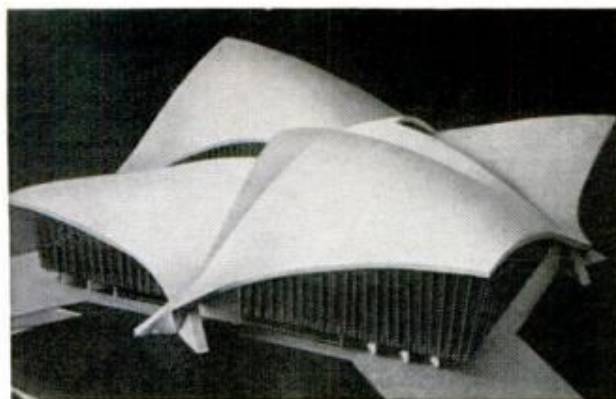
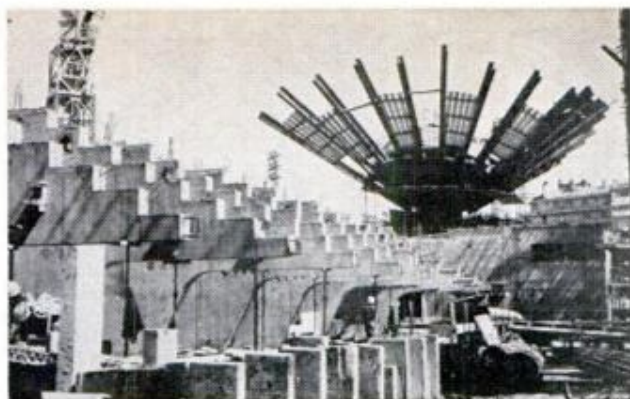
Other cars owned?

Ford19.2
 Chevrolet18.3
 Comet11.7
 Volkswagen10.0
 Mercury (full size)10.0
 Lincoln6.7
 Ford pickup6.7
 Falcon5.8
 Buick5.8
 Oldsmobile5.0
 Rambler5.0
 Dodge5.0
 Pontiac4.2

Age distribution of owners:

19 and under3.1
 20-2419.3
 25-2917.9
 30-3411.2
 35-397.2
 40-4413.0
 45-4915.2
 50-545.8
 55-593.6
 60-642.7
 65 and over0.9

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



It's a bird, it's a butterfly—no, it's a roof

Touching the ground at only four points, the roof of France's spectacular new Olympic skating rink looks something like a huge Martian butterfly poised for takeoff. The structure, being readied for the 1968 Winter Olympics at Grenoble, consists of two giant crisscrossing steel-and-concrete roof spans, one passing four feet under the other. The building, shown as it will look completed in the model at right, will seat 12,000. At left, partially erected roof girders stretch skyward from one of the four anchor points.



Wordless stop sign

This bundle of straw on a pole means "Stop—Proceed No Farther" in Bavaria. Its use dates back to ancient times when farmers marked the boundaries of their land with bunches of straw. It is roughly equivalent to the "No Trespassing" and "Private Property" signs used in the United States.

JUNE 1967



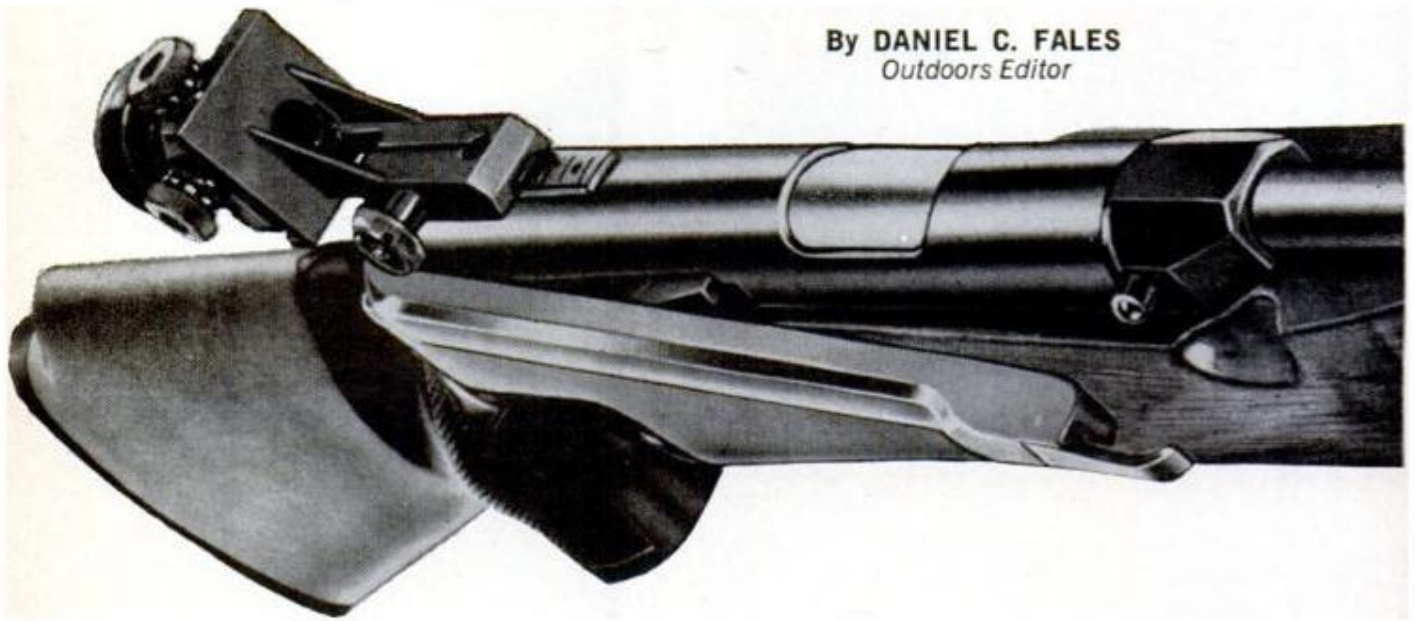
World's largest ship

The latest ship to claim the title of "world's largest" is this mammoth 210,000-ton Japanese tanker, the *Idemitsu Mara*. Nearly as long as four football fields, the giant will haul crude oil from the Middle East to Japan for its owner, Idemitsu Kosan, a major Japanese petroleum company.

113

LOOK WHAT THEY'VE

By DANIEL C. FALES
Outdoors Editor



NOT SO LONG AGO, the BB gun was only a toy to thrill youngsters. But today it's no longer a simple plaything. It's finding a major role in sports, recreation and even military training. BB guns now are used to teach novice shotgun shooters how to hit flying targets. The Army is using them to teach troops the basics of rifle shooting. And in homes, whole families spend evenings plinking away at special indoor BB ranges set up in living rooms and basements.

Even more exciting is the fast-growing sport of championship air-gun competition. Last year, there were at least 10 national and international championships in 10 different countries. Next month in

Hutchinson, Kans., the U. S. Jaycees will sponsor their second national BB gun championship. About 400 young marksmen from every state and many foreign countries will compete.

This year, for the first time, the National Rifle Assn. is organizing big-time air-gun matches in this country. These contests will be held on international style 10-meter (33-foot) ranges.

In fact, air-gun competition is growing so fast that the International Shooters Union proposes it as an Olympic event.

All this is ushering in a new air-gun era. Shortly, you will see major manufacturers of sporting firearms introduce sophisticated air rifles that are similar to

NOW AIR RIFLES (right) have the heft of firearms and need bench rests and spotter scopes (below) to sight them in



DONE TO THE BB GUN



Daisy's new air rifle is designed for air-gun championship competition. This highly sophisticated BB gun is the first of many to be offered for this growing sport.

the hefty 9½-pound Model 150 by Daisy.

This type of competition air gun is for use in tough 10-meter matches. These guns are not cheap. They're made like expensive sporting and military rifles.

Daisy, for instance, has added micrometer rear sights adjustable for elevation and windage. The front sight has four exchangeable inserts. A Monte Carlo stock and adjustable trigger are standard.

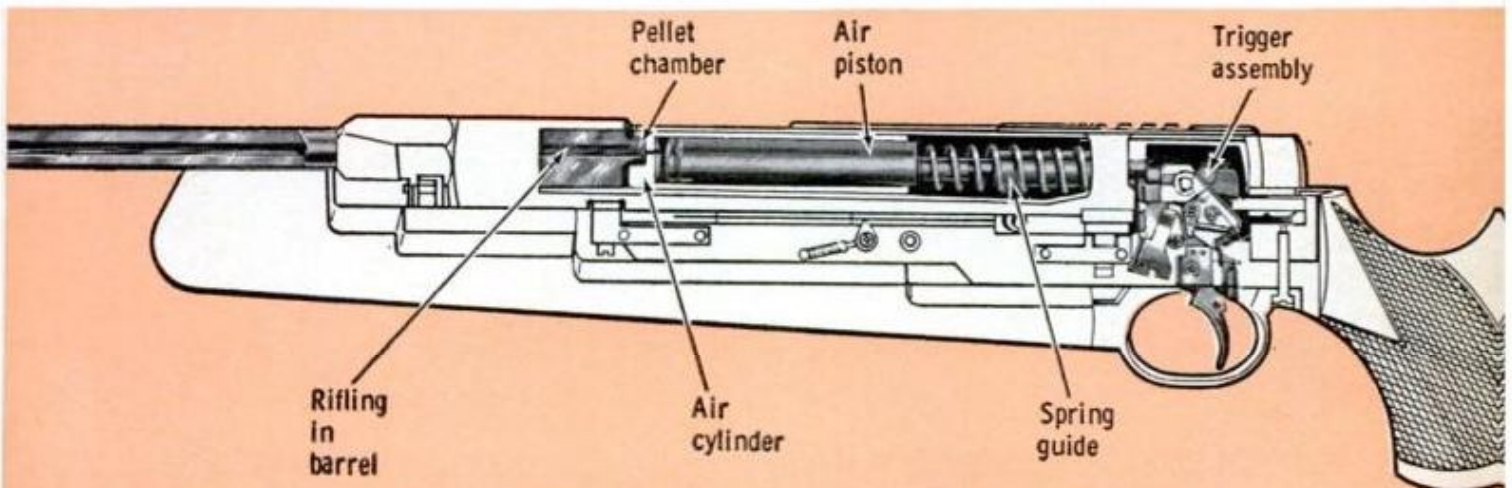
The Model 150, made for Daisy by Feinwerbau of Germany, shoots .177-cal. pellets at 575 feet per second. The average air rifle has a muzzle velocity of 400 f.p.s.

In this model, Daisy has two radically new systems. First is the horizontal positioning of the cocking lever along the

right-hand side of the receiver. This activates the whole air-compression system without wear on the main spring or air piston. Second, is a "floating" barrel that eliminates recoil.

Less than 10 pounds of pressure is needed to cock this single-shot model. The light-pull action cuts down on finger and arm fatigue always present in some models. When cocked, the air piston is back, slamming home with the pull of the trigger. Air piston rings assure adequate pressure for 575 f.p.s. regardless of air temperature and humidity.

Though many improved BB guns and air rifles are inexpensive, these sophisticated models will run about \$170. ★ ★ ★



CUTAWAY OF DAISY'S MATCH AIR RIFLE MODEL 150

Instant Concrete House



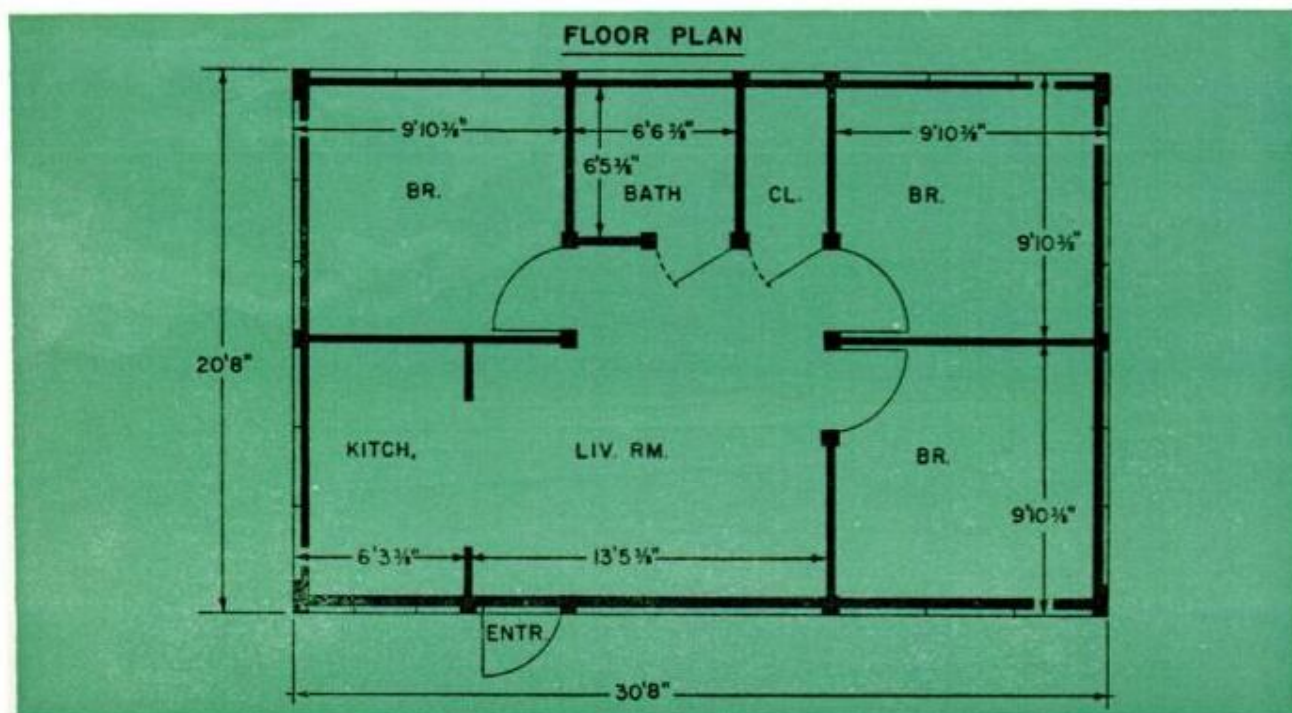
THIS FANCIER-THAN-USUAL MIAMI MODEL of an Instant House features floor-to-ceiling jalousie windows, stone facing and a stucco exterior. This is the larger 900-square-foot model. It has three bedrooms, a living room, kitchen and bath. Smaller 600-square-foot version of this house is shown in floor plan below

A COMPANY that doesn't even build houses may provide the "house for the masses" for anywhere in the world.

Instant Housing Corp., Miami, Fla., supplies builders anywhere in the world with an on-site machine that can manufacture enough precast concrete panels in eight hours for 11 houses. Four 600-square-foot, two-bedroom units can be erected in one day by a crew of six men. In the Miami area, the cost in materials for each shell

is an almost unbelievably low \$360—or around 60 cents per square foot. The cost would be even less in many foreign countries. According to Nathan Liss, president of Instant Housing, "The actual cost of constructing *and finishing* a complete house in an underdeveloped country can run as low as \$2 per square foot."

The key piece of equipment in this operation is a machine which produces the tongue-and-groove concrete panels





VERTICAL CONCRETE PANELS are fitted between grooved uprights with the aid of a small crane or a block and tackle. Joints are sealed with caulking gun

by extrusion. It makes one 8-foot long by 24-inch wide by 2-inch thick panel every 60 seconds. Each panel weighs 350 pounds and is held in place by 8-inch-square reinforced posts and beams.

The plant is operated by one trained supervisor and seven unskilled workers. This crew can produce enough building components in one eight-hour day to provide the shells for 11 houses.

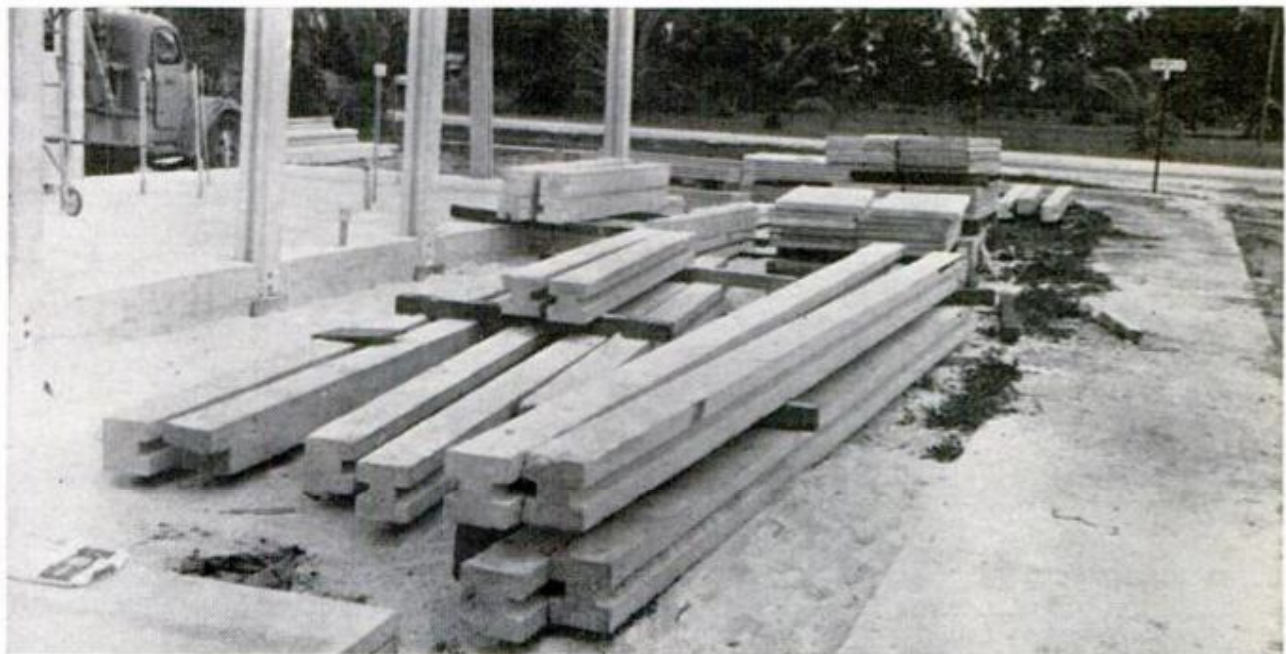
Depending on the amount and quality



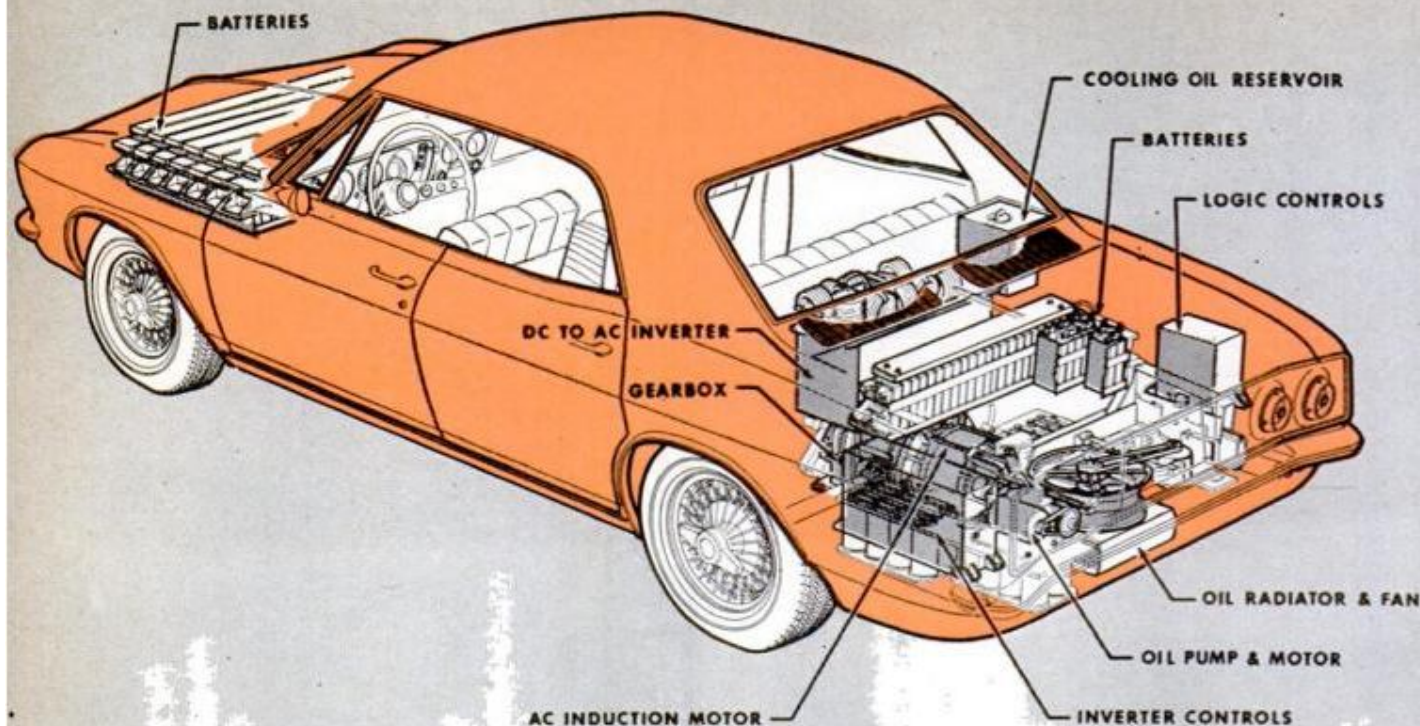
PRECAST ROOF BEAMS serve as channels into which roof panels slide. Each panel weighs 350 pounds. Cold asphalt is then used to waterproof the roof

of finishing that goes into a house, the cost-per-unit ranges from about \$1200 to \$2000.

Liss anticipates a booming foreign market for his Instant House when the expected approval for this building technique comes through from the U.S. Agency for International Development, a government department responsible for many American-sponsored housing programs throughout the world.—George X. Sand



PANEL, POST AND BEAM are the three basic concrete building units comprising an Instant House. The extruding machine used for their on-the-spot manufacture is sold to home builders who purchase a franchise



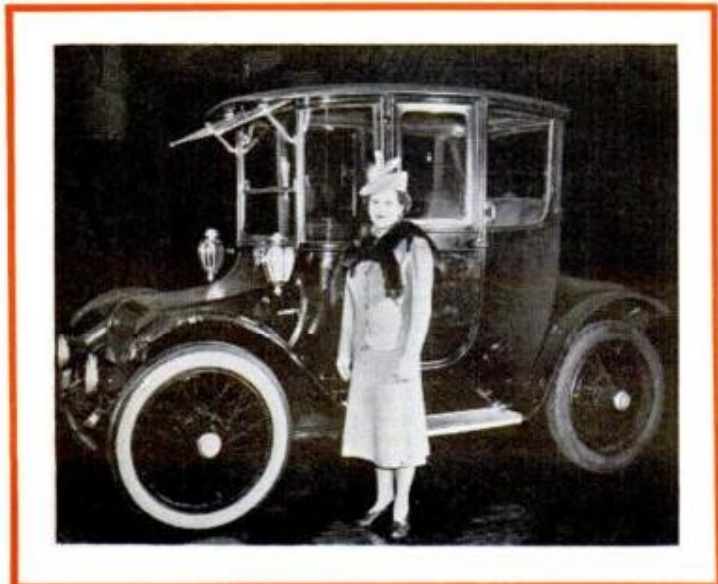
GM'S ELECTROVAIR, a converted Corvair, runs on a.c. motor fed by silver-zinc batteries through an inverter. Motor turns 13,000 rpm at 60 mph. Logic controls convert driver's demands into signal pulses

ELECTRIC CARS:

Mounting air pollution and diminishing petroleum supplies the fabulous old electric. Result? Just maybe a new breed

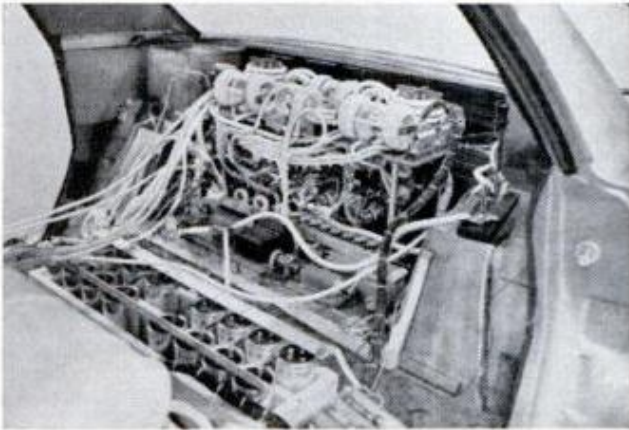
By **RICHARD DUNLOP**

SMOKELESS CARRIAGE: Battery-powered vehicles like this elegant Baker Electric flourished during the early 1900s. Clean and quiet, such cars did 25 to 30 mph, ran 60 to 100 miles without a recharge



YOU JUST TURN A KEY, step on a pedal and go. You glide along in an eerie, effortless silence. There's no roaring exhaust, no fumes, no lugging, bucking or stalling. There's no clutch, no gearshift and no brake. To stop, you merely rock back on the same pedal that controls acceleration. There's no gas gauge because you don't buy any gas. When you return home, you pull into the garage, plug a cable into an outlet, and your car is charged and ready to go again in a few hours.

An idle daydream? Not at all. A few years ago, such wishful thinking would have been dismissed as rather quaint nostalgia for the sweet but impractical relics of a bygone era. Today, it is no joke. In the face of mounting concern over air pollution and rising petroleum costs, automakers are taking a fresh look at the electric car. Optimistic forecasts see the commercial production of electric cars getting under way in as little as three to five years and probably not more than 10.



BANKS OF SILVER-ZINC BATTERIES fill front and rear compartments in the Electrovoir (top and right). Even rear seat (lower left) is stuffed with maze of switches and wiring, leaving no room for Grandma

ARE THEY KIDDING?

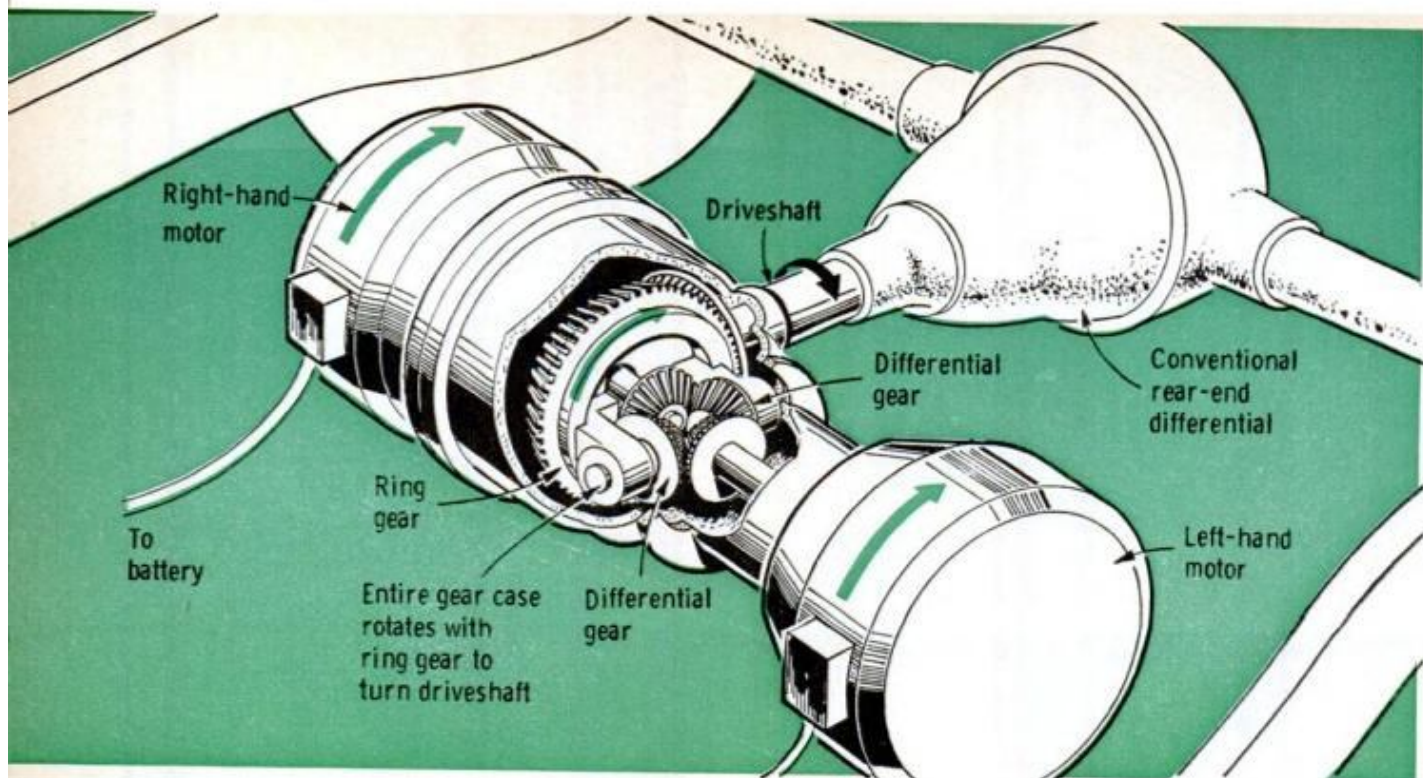
are forcing automakers to take a serious second look at of car that drives like a dream and costs peanuts to run

The electric car is not just a gleam in designers' eyes. Already there are an impressive number of experimental electrics prowling the streets in search of test data. General Motors has a converted Chevy Corvair running on batteries that, except for a limited cruising range, performs remarkably like its gasoline-powered namesake. Dubbed the Electrovoir, the car will accelerate from zero to 60 mph in 16 seconds and hit a top speed of 80—good enough for any superhighway. Its one shortcoming: You have to pull in every 40 to 80 miles and tell the garage man to "charge her up."

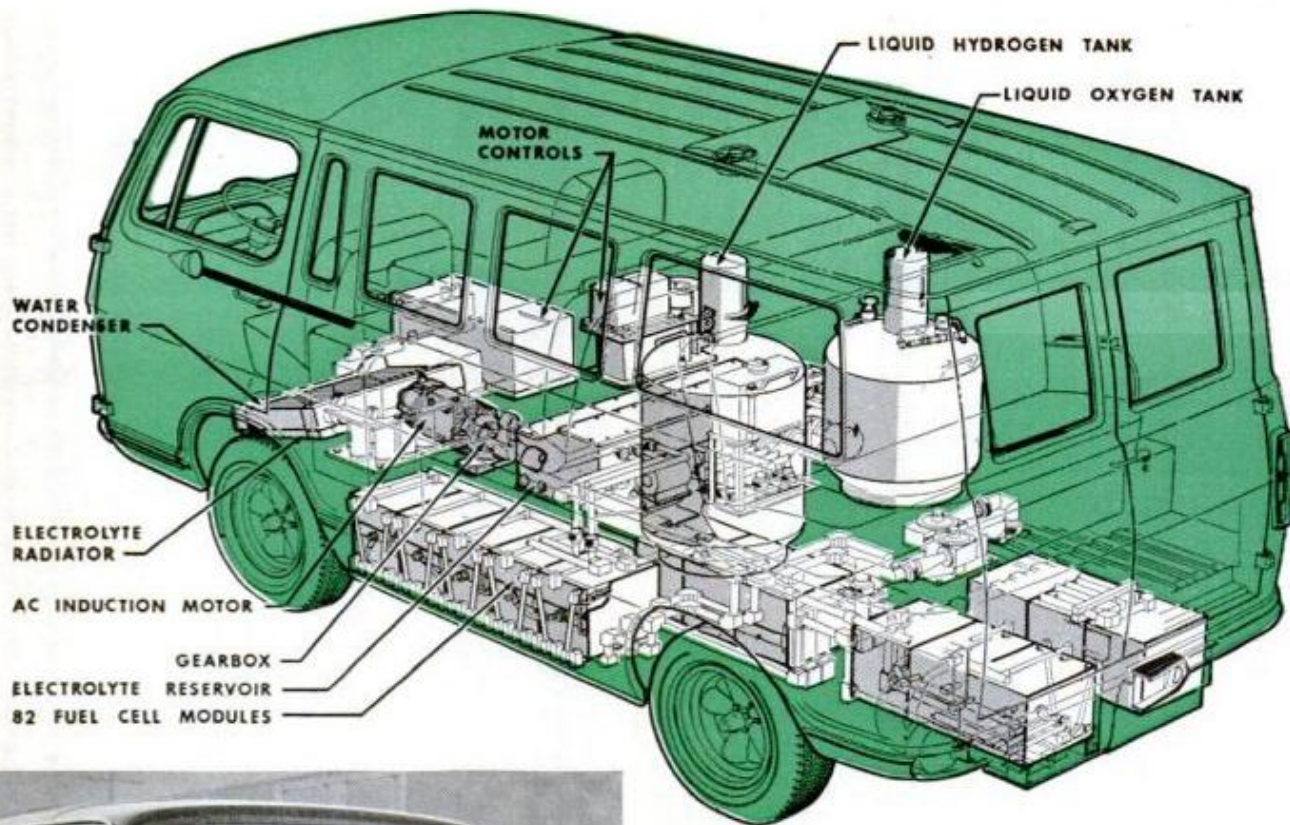
A New York City firm, Yardney Electrical Corp., has an electric-powered Renault that zips along at 40 to 50 mph. A tricky system of switching relays automatically shifts the batteries into various series and parallel connections, depending on whether you want high torque for hill-climbing or flat-out speed for straight-aways.

Among the "Big Three," Ford and Chrysler, along with GM, are hard at work on electric cars. Nor is this current quest for a smokeless carriage limited to automakers alone. General Electric and General Atomics have both built experimental electrics, and the U.S. Army has put an electric power plant into a three-quarter-ton military truck at Fort Belvoir, Va. Union Carbide, a major battery manufacturer, has been working closely with GM to produce a long-life, lightweight power source for electric cars. And Gulton Industries in New Jersey, which pioneered the rechargeable flashlight battery, has announced a power supply that will give a compact electric a range of 150 miles.

England, ahead of the United States, already has 100,000 electric-powered vehicles on its roads. Most of these are short-run delivery trucks, such as for milk and mail, but they're only a step away from a small, economical passenger car suitable for short hops around town. Your wife



TRICKY FORD DRIVE pairs two motors in a differential linkage that keeps their output constant. So long as both motors turn at same speed, differential gears remain stationary, and entire gear case rotates to drive rear wheels. If one motor overspeeds other, gears inside case turn without affecting overall speed



OUT FOR A TEST SPIN, GM's experimental Electrovan proves a fuel-cell-powered vehicle can be road-worthy. Chief drawback: Its precariously fueled hydrogen-oxygen system is touchy, takes up most of the van's cargo space with its parts (see drawing). Note large tanks needed for hydrogen and oxygen

would take it to the grocery store, park in front of a gadget resembling a parking meter, and plug the car into it. Upon her return, the car would be quick-charged and ready for the next stop—like a milk-wagon horse munching his bag of oats between deliveries. Or you might drive the car to work and plug it in for a day-long recharge in your company parking lot.

Such fascinating possibilities are only part of the electric's promise. A light, sub-compact suburban vehicle would be easy to handle, would park in half the space of a conventional car, and would spew no polluting fumes into the atmosphere. Estimated cost of operation with at-home recharging: as little as \$5 a month.

The basic simplicity of electric drive is expected to bring spectacular new control systems. You need virtually only a steering wheel and a single foot pedal. Not only could the motors be used to provide electric braking, but it's even conceivable that, through a regenerative process, they could help to recharge the batteries during braking. In effect, each downhill run would help to store up energy for the next uphill climb.

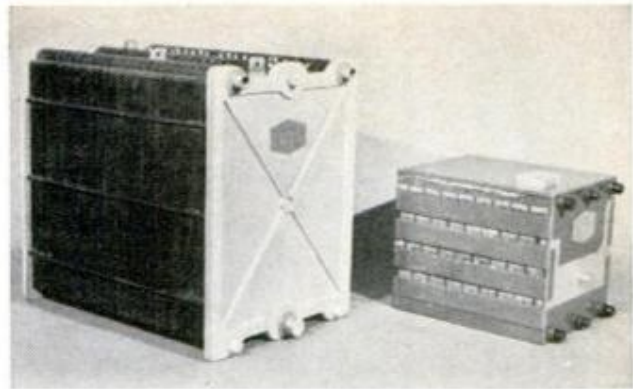
Controlling the speed of an electric car calls for some ingenuity. Batteries have a fixed output—you can't regulate their energy like a jet of gasoline. Early electrics used resistance-type controls that merely dissipated energy whenever full speed wasn't needed, wasting precious battery power.

Modern electrics can't afford to waste power. Energy must be fed to the motors in such a way that only the exact amount needed at any given moment is used. One method is to use electrical pulses that can be varied to provide the desired speed-torque ratio for any given road situation.

Another method is to keep juggling the connections between the battery cells, as mentioned earlier, to provide either a series or parallel hookup. In series, each cell's output is added to the others and the voltage is stepped up to give you more speed. In parallel, the cells give you high torque for starting up or climbing hills but at a sacrifice in speed.

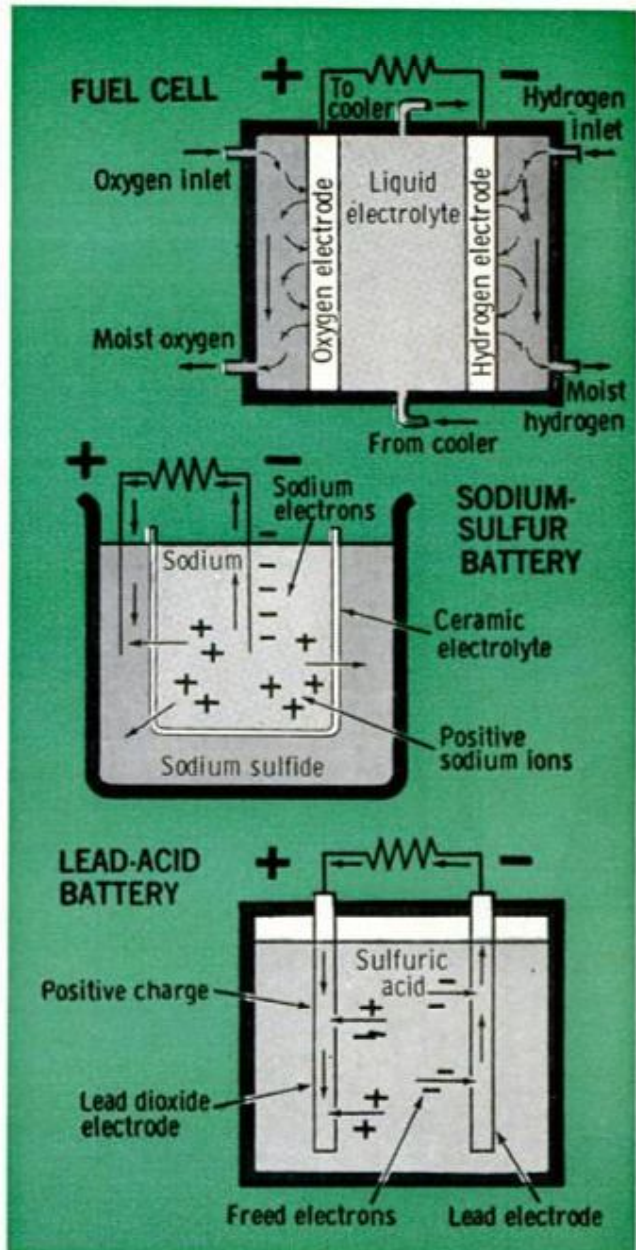
But the most serious problem still to be solved is the short range imposed by limited battery life. In addition to new types of batteries, one bright hope is the fuel cell. This is an electrochemical device that

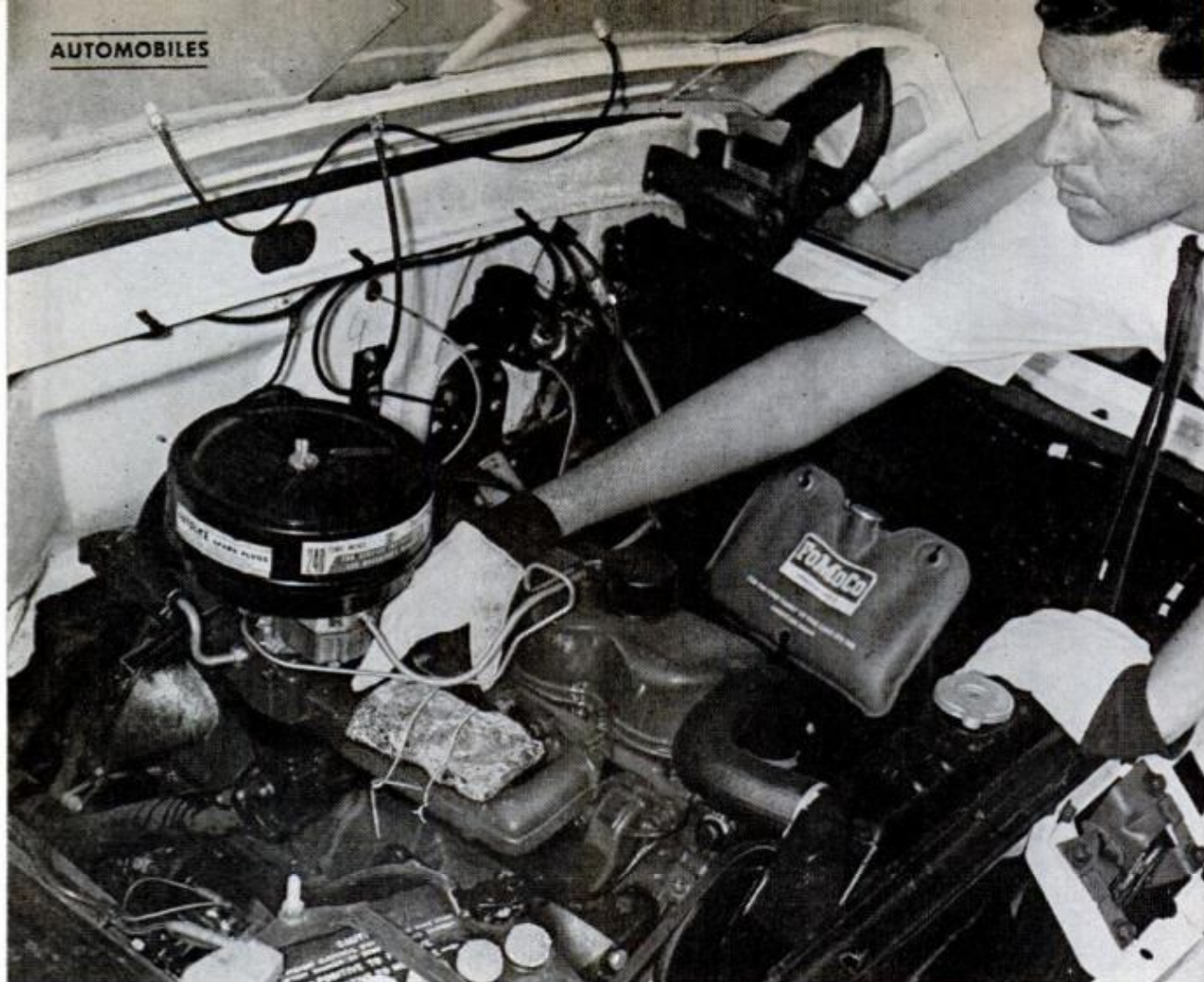
(Please turn to page 207)



SLIMMED-DOWN FUEL CELL at right above shows progress made in cutting its bulky size. Half as big as earlier model at left, the Union Carbide design made possible GM's Electrovan on facing page

TWO OF THE NEWEST POWER SOURCES for electric cars are shown below along with conventional lead-acid battery. In the fuel cell, hydrogen ions react with the electrolyte to produce a flow of electrons that becomes an electric current. In sodium-sulfur battery, positive sodium ions pass through the electrolyte, but electrons can't get through, are forced out at top to set up a flow of current





TIGHTLY WRAP food in foil and strap to exhaust manifold. Cotton work gloves protect hands from burns

COOK WHILE YOU DRIVE

It's an old traveler's trick, but now aluminum foil and modern engines make cooking on the exhaust manifold a snap

By George X. Sand

THINK OF FINDING hot dogs or hamburgers ready to eat when you stop driving at noon. Or having chicken or a vegetable stew sizzling and savory at the end of a long day's drive.

By placing foil-wrapped packages of uncooked food atop the engine exhaust manifold you can prepare a hot meal as you travel. When you stop, all you need do is lift the hood and dish out the meal.

Here's how it's done:

To prepare hot dogs, lay the frankfurters side by side atop three layers of heavy-duty foil. Fold the package over several times in one direction. Then make

A HOT lunch or dinner is always welcome after many hours on the road. There's no waiting to heat meals



at least two half-inch folds to lock seams at each end. This important step stops juice from leaking out. The lock seams also prevent engine odors from getting in.

Be sure you place the foil package atop the exhaust—not the intake—manifold. The latter doesn't get hot enough for cooking. If necessary, twist a couple short lengths of wire around the manifold and package to prevent the packet from slipping off from engine vibration. On V8 engines, the package is placed atop the block, between the cylinders.

The hot dogs will be ready to eat after about 25 miles of steady driving.

Hamburgers call for 50 to 60 miles; less if you like them rare. Form patties of the chopped beef and place side by side inside a foil package. Salt and pepper to taste. Add onion and barbecue sauce.

Beef stew: The serious car-engine chef quickly discovers it takes at least three hours to cook a full meal, even a stew. Cut into one-inch cubes enough lean beef to satisfy those end-of-the-trip appetites. Place this meat atop the three layers of foil. Drain a can of mushrooms and add the contents. Also add half a package of dry onion soup mix and a tablespoon each of barbecue sauce and butter.

In the same package, place carrots and small potatoes. (It is best to parboil vegetables first to insure cooking and to retain moisture: the carrots for 10 minutes, the potatoes for five.) If necessary, make two or more packages.

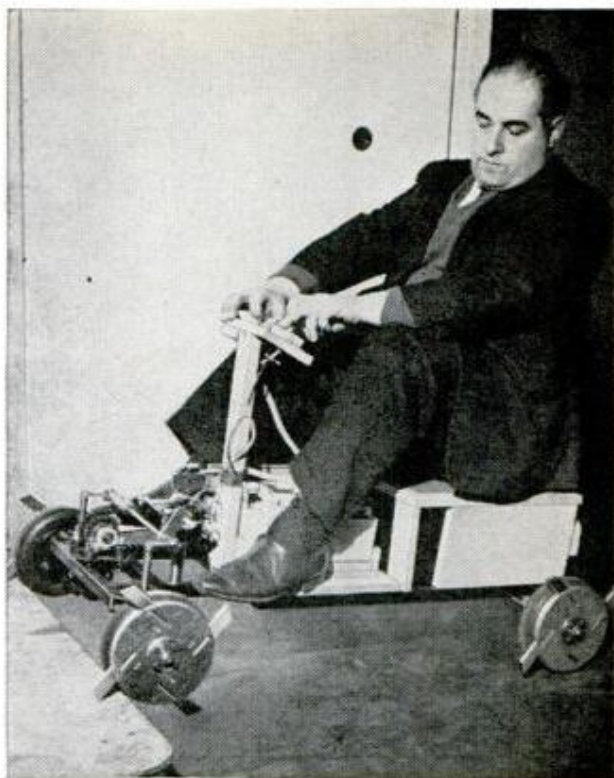
Chicken halves require approximately five hours of steady driving. Use only young chicken: fryers or broilers. Don't try to prepare a *whole* fowl at once. The legs and wings should be splayed outward, preventing close contact with the heating surface.

Season as desired with salt and pepper, barbecue sauce, perhaps minced parsley.

Rolls and French bread can be warmed during the final 30 minutes of driving.

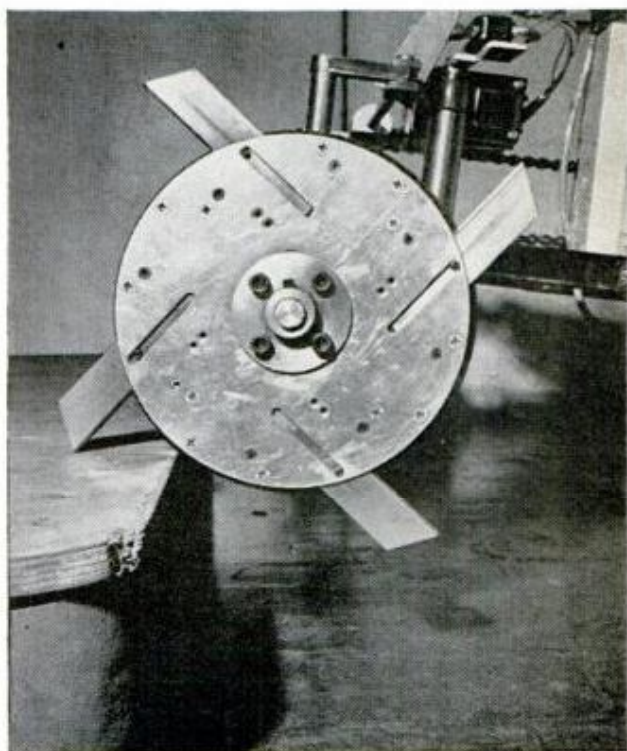
Roasts: A three-pound boneless beef roast will normally require about four and a half hours to prepare. However, such time can vary with weather and engine temperature. Don't forget to stop about halfway to turn the roast over else the top side is apt to remain too rare.

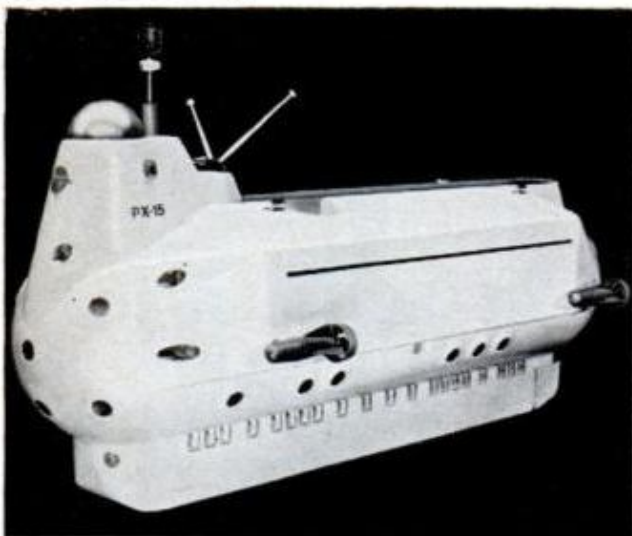
If you plan to be on the road several days a number of complete foil-wrapped meals can be prepared before departure and carried inside a small ice chest. ★ ★ ★



Stair-climbing wheels

Wheels that shoot out spring-loaded "legs" enable an experimental British vehicle to climb stairs and other obstacles. The vehicle, powered by batteries, is the "miniclimber," developed by Prof. Meredith Thring and Brian Shayer at Queen Mary College, London University. The small machine travels at about three mph. On level ground, the weight of the miniclimber pushes the climbing legs back into a hub that's located alongside each conventional wheel. The developers foresee the climber's use by handicapped persons.





New submarine is just a drifter

A five-man research submarine, the Grumman PX-15, is being built for Dr. Jacques Piccard. He plans to drift 1500 miles along the Gulf Stream from Florida to Nova Scotia in 1968. The journey will take four to six weeks. The vehicle will be submerged to depths between 300 and 2000 feet and drift with the stream at 1½ to 2 knots. Scientists will study marine life in a natural, silent environment. Men can work outside the sub to 600-foot depths.



Cop cozy

In Brussels, heaters are placed at strategic points along police beats so the men can get warm without coming off duty. These heaters are made of aluminum and burn any form of oil. The heat escapes through a ventilated shaft. The open flame is a hand warmer.



A-blast simulator

The U. S. Navy has developed this tube to create shock waves equal to those produced by the atom bomb that struck Hiroshima. In the shock tube, which is half a mile long, 1000 pounds of TNT will simulate a nuclear blast without use of radioactive material.



Oil-island skyscrapers

What appear to be skyscrapers off the shores of Long Beach, Calif. (above) are really oil drills. Four man-made islands have been constructed to support equipment for tapping a vast oil supply. Because oil rigs are so unsightly, the contractors have agreed to disguise them as 20-story buildings. About 1000 wells will be drilled by 1971, producing 200,000 barrels of oil daily. The islands are also being landscaped with palm trees (left). A true skyscraper in Long Beach proper appears in background.



Bronze Age burial

A tree coffin, which experts believe dates back to the Bronze Age, has been uncovered in Huesby, Germany. The coffin was located in a cairn which is a mound of rock used as a burial monument. The coffin is actually the trunk of an oak tree. Its age is estimated at 4000 years. Drs. Kersten (left), Hingst and Schafer of the Schleswig-Holstein department of prehistory made the discovery.

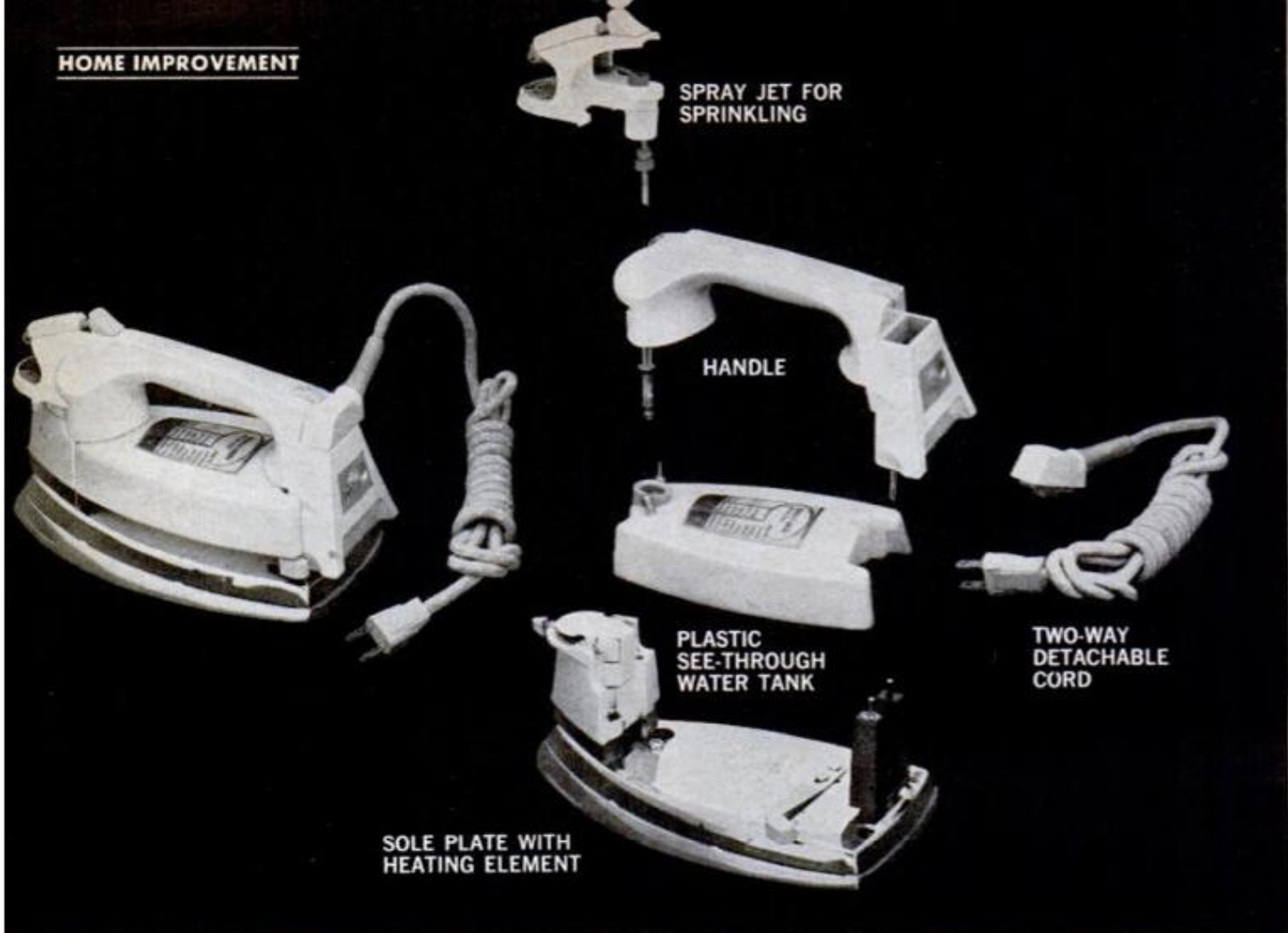
JUNE 1967



Hardy cabbages adorn street

Cabbage is the only plant that will grow along the streets of Luton-Bedfordshire, England. Toxic traffic fumes have destroyed all other types of plant. Cabbages were tried because they keep their green, yellow and red colors all year round. Residents feel the cabbages are ornamental and pleasant to view. Still, they worry about effects of traffic fumes on humans, who may be less hardy.

125



SPRAY JET FOR SPRINKLING



HANDLE



PLASTIC SEE-THROUGH WATER TANK



TWO-WAY DETACHABLE CORD



SOLE PLATE WITH HEATING ELEMENT

NEW THREE-WAY STEAM-SPRAY-DRY IRON breaks down into five parts, all of which are available separately for replacement. Prices range from \$1.50 for the spray jet to a top of \$6.95 for new heating element

NOW: Take-Apart Appliances

Low-cost, replaceable parts in this new line of housewares end the

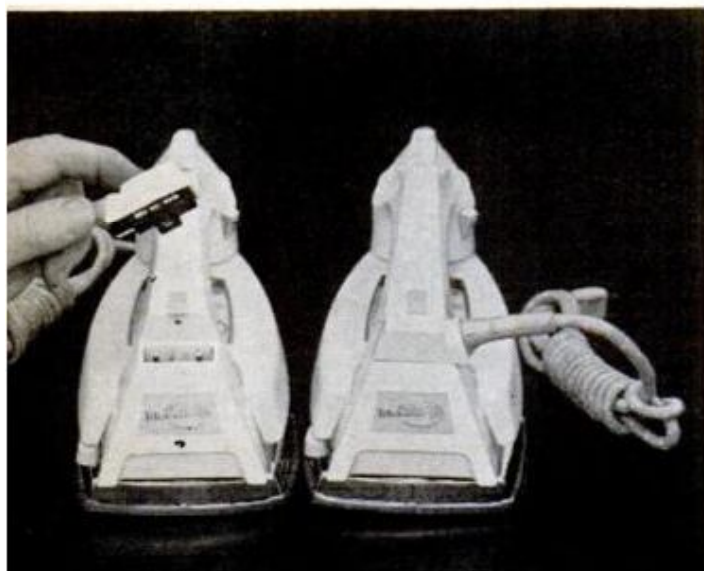
ANYONE who has ever tried to fix a home appliance will welcome this: Now there's a line of appliances deliberately designed for easy do-it-yourself repair—normally unheard of. If a

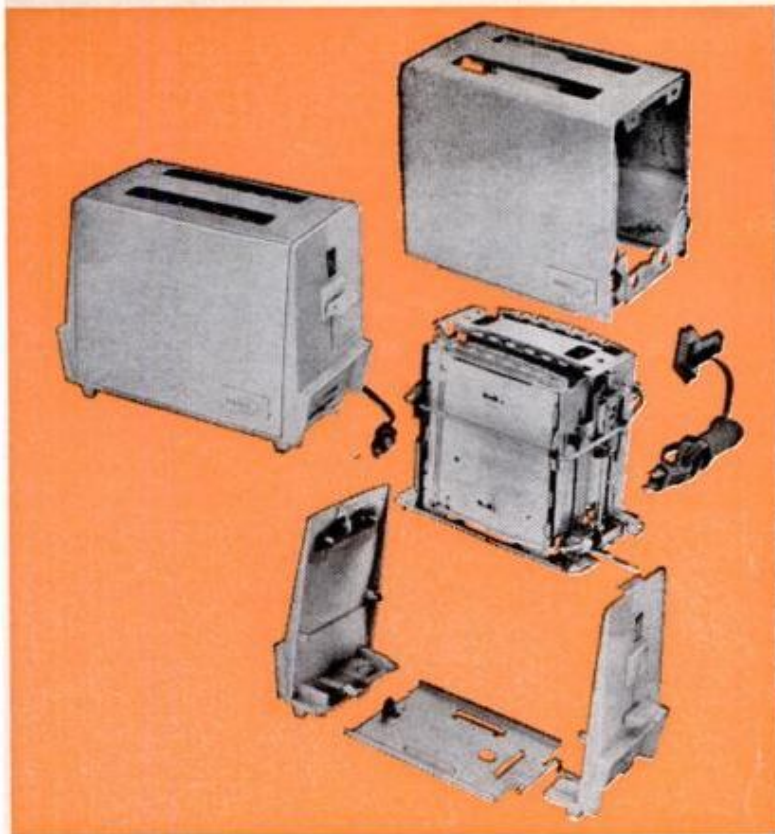
TWO-WAY CORD can be flipped to either side of the iron to accommodate left or right-handed users

part wears out or breaks, you just take it to a local store, buy an identical replacement, and you're back in business.

Many small appliances are junked while they still have years of useful life in them merely because replacement parts aren't readily available or the repair job costs practically as much as a new purchase. Now the Proctor-Silex people are making a bold move to end this annoyance. Their three newest models—an iron, toaster and automatic percolator—are designed around interchangeable parts that can be bought individually at any Proctor-Silex dealer.

Replacement parts range from 50 cents to several dollars. Even the heating elements—the most expensive parts





TOASTER CHASSIS, shown at center above, contains heating coils and controls. It slips out of its housing like the insides of a TV set. Entire unit can be replaced for \$4.95, giving you a like-new toaster for less than half the original cost



You Can Fix Yourself By SHELDON M. GALLAGER

old dilemma of what to do with a sick but still-good iron or toaster

—can be replaced for \$4.95 for the coffee-maker and toaster and \$6.95 for the iron. Assembly and disassembly take less than a minute by actual *PM* test.

There are some nice touches in the new designs, too. The iron has a trans-

lucent plastic tank that gives a visual check on water level. The percolator has a novel glass bowl that comes off for cleaning. Prices are \$16.95 for the iron, \$21.95 for the toaster, and \$17.95 for the coffee-maker. ★ ★ ★

GLASS PERCOLATOR BOWL lifts off for easy rinsing, costs only \$2.95 for a new one if you should break it. Light bulbs in base (below) give coffee a pleasant glow, are simple to reach for replacement



Tomorrow's marine engines are running TODAY

Rotating combustion engines with seal problems licked? A 285-pound turbine that turns 445 hp? A 50-hp diesel weighing only 125 pounds? All are market bound

By EDWARD H. NABB

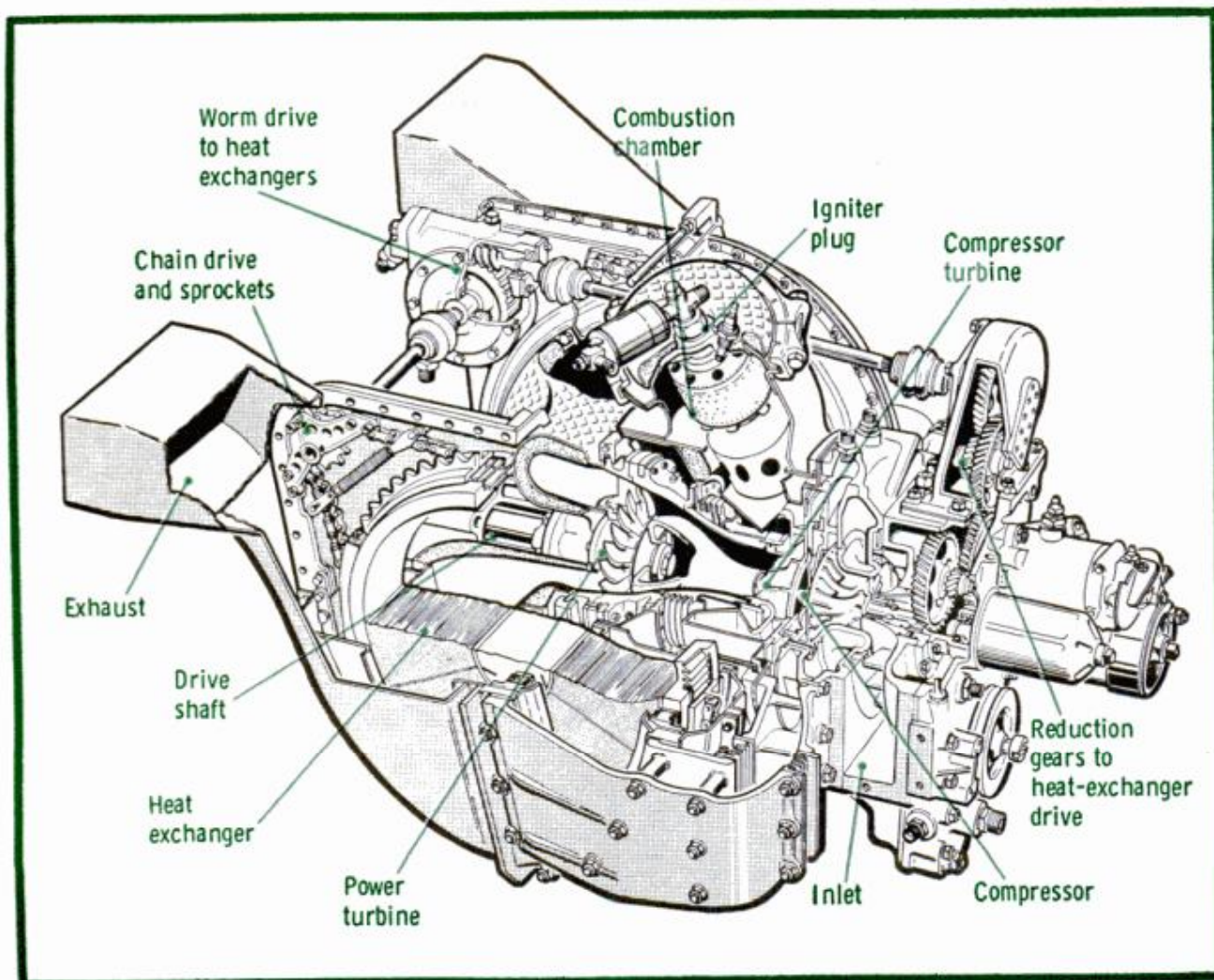
Technical illustrations by Donald Evans and ZIK Associates

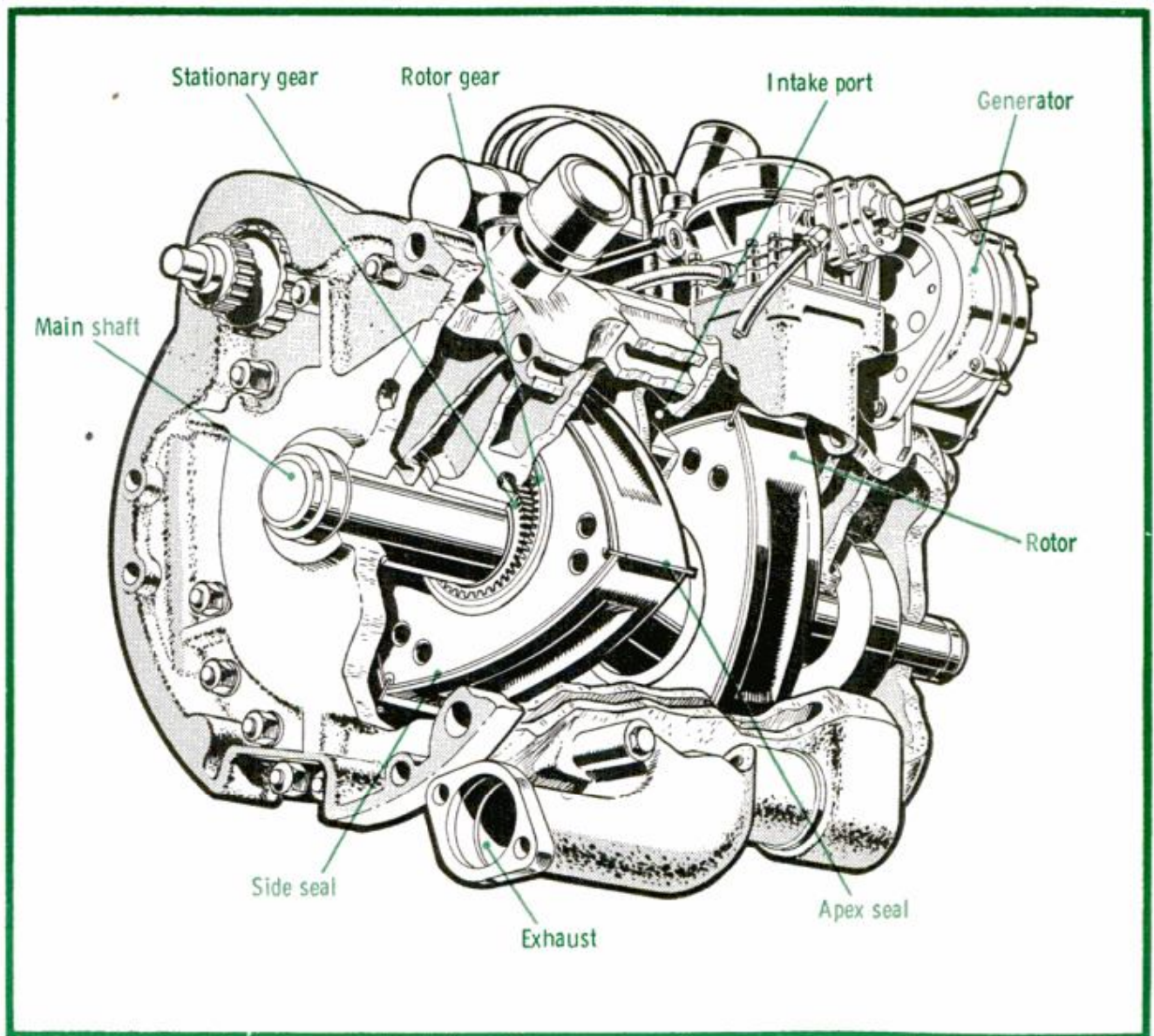
ONLY A FEW YEARS AGO, gas turbines were best known as aircraft engines. We called them "turboprops." Around the same time, rumors of a rotating combustion (RC) engine were filtering out of the Black Forest of Germany. Most sensible people were sure that it would never get off the drawing board.

Today, you can buy a pair of turbines for your boat (if you happen to be rolling in dough), and little RC rigs are pushing small sailing auxiliaries merrily over the waves. Both of these concepts are very much in your boating future, and probably much nearer than you think.

Felix Wankel (pronounced *von-kul*), a German specialist in rotary sealing, started serious experimentation on a rotating combustion engine in 1951, working on the idea of two rotors turning in the same direction at different speeds. He got the rig to run,

ROVER 25/150/R TURBINE which ran at Le Mans in B.R.M. chassis is a sophisticated model featuring ceramic heat exchangers which use exhaust heat to raise temperature of intake. (Drawing courtesy Motor, London)





CURTISS-WRIGHT RC2-60, a twin-rotor Wankel-type engine, is rated at 185 hp, has a compression ratio of 8.5:1 and burns regular gas. Oil circulating inside rotor not only lubricates seals and bearings, but cools rotor

but by 1956, after joining forces with Dr. Froede of the NSU auto company, he had switched to a single-rotor design. This is the model which was introduced to the public in 1959.

Since that time, a number of other firms have entered the field of rotating combustion engines.

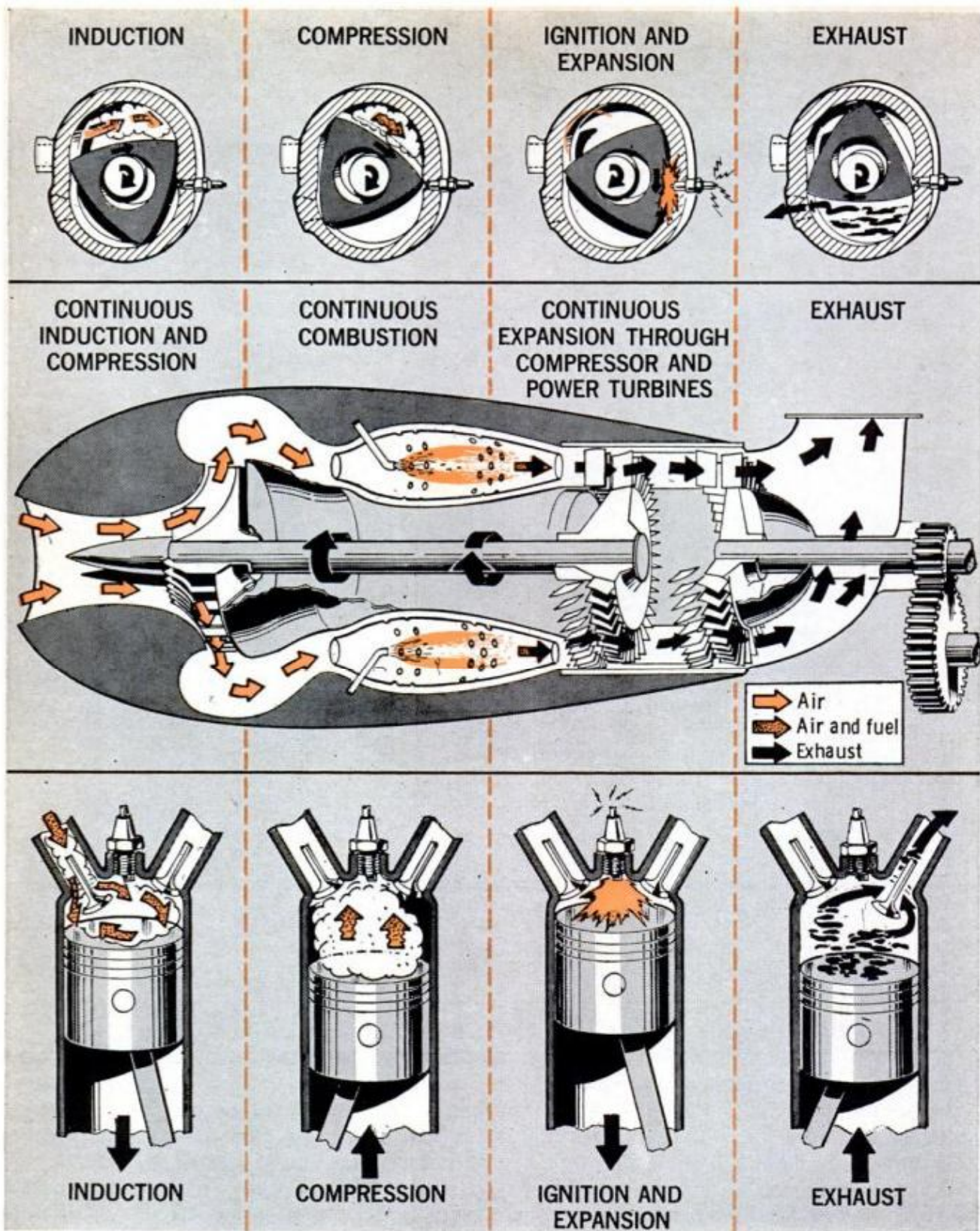
Recently, I visited the NSU plant to check on Wankel developments. The most troublesome problem has been sealing the combustion chambers, not only the apex seals on the corners of the rotor but also the seals along the sides of the rotor. Small springs installed under the side sealing strips held them in tight contact with the inner surface of the "engine-block" housing.

Numerous metals were tried on the blade-like apex seals, but the best proved to be old-fashioned piston-ring iron. NSU

reports that such seals easily lasted for the duration of a 1000-hour test.

Early apex seals developed a flutter, beat their slots out of shape and soon broke. This was caused by the seal leaving the inner surface of the housing as it passed the node, or flat spot, then returning with a bang and wearing the housing. Springs were tried under the seals (I understand they're still working on this idea, incidentally), but the best solution seemed to be to chrome the inside of the housing and let the seals hammer away, without wear damage to their slots.

Ignition is a simple breaker system, like that on small outboards, or a conventional distributor on multi-rotor engines. Conventional side-draft carburetors are generally used. The Wankel engine will operate in any position desired, so long



COMPARISON OF RC AND TURBINE operation with that of standard four-cycle engine points up the differences between the more efficient rotary action of the former and the reciprocating action of the latter

as the carburetor is mounted level.

One big ignition problem was the placement of the sparkplug. In Germany, I saw one test engine with about five plugs in different locations.

The prime licensee in the United States is Curtiss-Wright. This company has done no development work on the small Wankel which pushes NSU's Spider auto. It used

a 60-cu.-in. model for testing purposes, but the real target is a powerplant big enough for aircraft or fair-sized boats. Current Curtiss-Wright models make use of more C-W patents than NSU/Wankel patents, which shows that progress is being made.

An important new voice appeared on the scene a year ago when Outboard Ma-

rine announced that it had spent in excess of one million dollars in agreements with Curtiss-Wright and NSU for the right to develop and produce RC engines for marine use. Word is that OMC will devote its efforts to sterndrive rigs and outboards in excess of 50 hp.

Small Wankel engines have been available on the European marine market for several years. They have been used in small sailboats and also in water-ski towing devices (which are marketed in the U.S. by Rotomotive Industries of Seattle.)

However, Curtiss-Wright is the only American company to allow a peek at an RC marine rig of any size. It has allowed numerous boating writers to see, ride in and drive a 20-ft. Bertram powered by a prototype twin-rotor engine developing 185 hp at 5000 rpm. The RC2-60 marine engine weighs 310 pounds and has 120-cu.-in. displacement. The real clincher, though, is that the engine is compact enough to be tucked under the stern seat.

What design variations are likely? The primary one, of course, will be "stacking" to produce multi-rotor engines. Single-rotor engines are inherently rough running and require a flywheel to smooth things out. Add another rotor and you have an improvement; a third makes it run like silk. The Japanese have piled them six high, and the result must be something like a Rolls.

Variations are also possible in porting. The NSU people seem to favor intake

ports on the periphery of the housing, while C-W leans toward dual ports on the side. Each has its benefits; the edge gives more power, the side better economy.

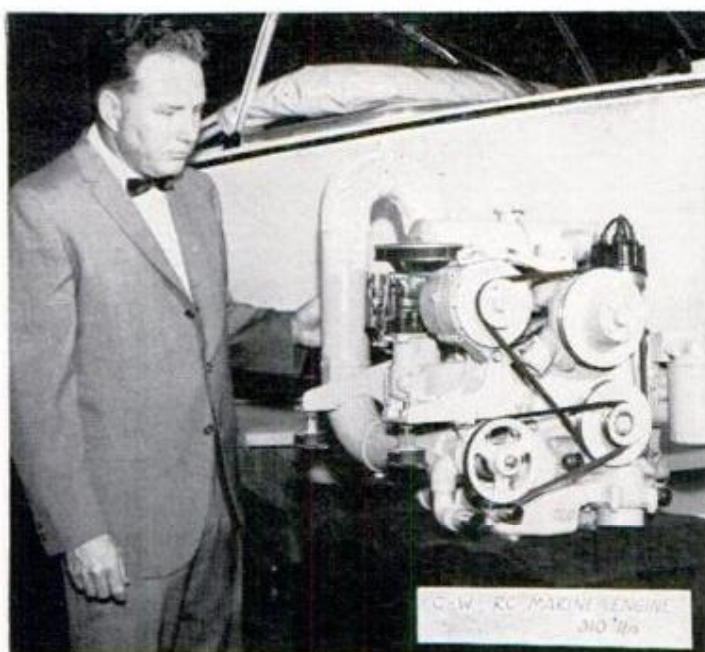
No company is rushing into print with test results, but both C-W and NSU have made numerous reports to the technical societies so some facts are available. For instance, it is obvious that the C-W test boat will run at speeds comparable to those produced by 225-hp conventional engines. Also, C-W is known to have run test engines from 3 to 1000 horses.

The Germans showed me test results indicating that their double-30 (60-cu.-in.) engine produced 143.8 hp at 6500 rpm and required 28 hp to "motor" at 6000 rpm (compared to a conventional overhead-valve six-cylinder engine's 45 to 48 hp to "motor" at 4000 rpm).

The early German engines required the use of outboard fuel mixture to lubricate the apex seals, but later models had an oil injector and what is termed a "100 percent loss" system (all the oil is consumed).

C-W has developed a system of lubricating the seals through small holes in the rotor, which is filled with oil for cooling. The 185-hp job uses the equivalent of one quart in 800 to 1000 miles—modest indeed.

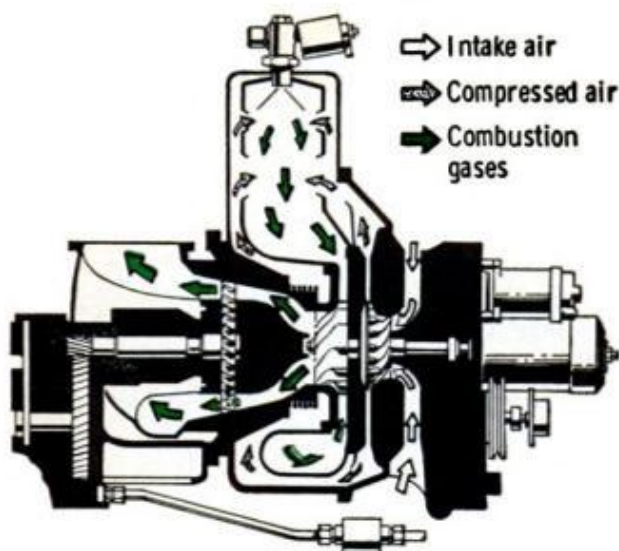
During my visit to Germany, I had a chance to test drive the NSU Spyder which is quite an impressive little machine. The engine starts *immediately*. It idles at about 800 rpm like a well-tuned



MARINE VERSION of Curtiss-Wright's rotary combustion engine is a low-profile unit which takes up very little space. It puts out a whopping 185 hp



RC POWER for this 20-ft. Bertram is tucked away behind the full-width stern seat leaving cockpit completely clear. Its 185 hp pushes boat to 35 mph



FLOW DIAGRAM of Rover 25/150 gas turbine shows how primary shaft drives the air compressor while the secondary shaft delivers high-rpm useable power

four-cylinder sports car and has a similar sounding exhaust. There is no "lag" in any part of its range. A little single-rotor 30-cu.-in. job drove the car at about 100 mph. I also rode in a military truck, which refused to "lug" in the conventional manner, even when driven at idle speed.

It is obvious that Wankel visualized his engine turning well in excess of the present 5000 to 6000 rpm. When this is realized we can look for a huge advance in output.

As for marketing plans for a marine RC, no company will admit anything beyond "we have signed a license and are working on the engine." It is obvious that the RC engine must have automotive approval and usage before it becomes economically feasible for inboard marine use, but that is true of all our marine engines today. Let's go way out and declare that if we aren't able to buy an RC marine engine or outboard by 1970, somebody isn't treating us right.

The Wankel-type engine may hold promise for the boat owner, but the gas turbine is available, here and now. If you can raise \$27,600 the United Aircraft people will sell you a model ST6B which produces 445 horsepower with 285 pounds. Jim Wynne drove a pair of them to win the 1966 Sam Griffith race.

A gas turbine is a machine to produce heated gas and direct it through a turbine

(Please turn to page 200)

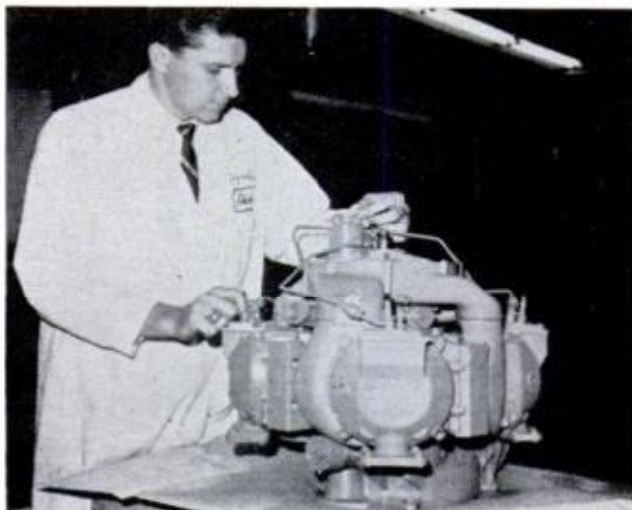
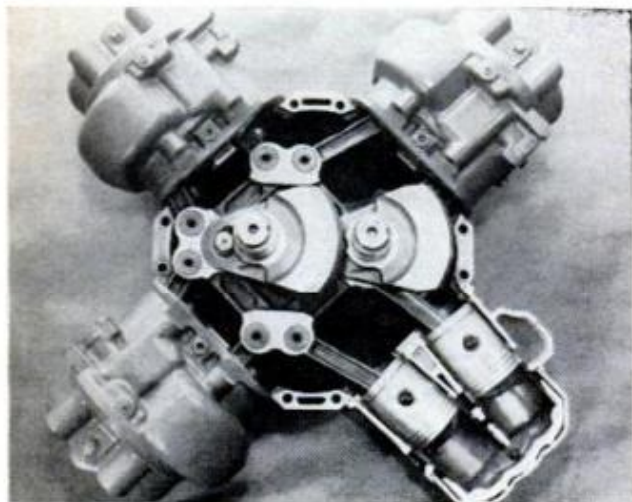
A new shape in piston engines

THE UNIQUE X CONFIGURATION of Thiokol's prototype two-cycle Dynastar engine may be a vision of things to come in piston engine design. Applicable to both spark-ignition and diesel power, it consists of four pairs of U-type cylinders in one horizontal plane, thus combining compactness with perfect dynamic balance. (Twin pistons were used because they weigh less than one large one of the same area.)

Each pair of pistons is connected to a

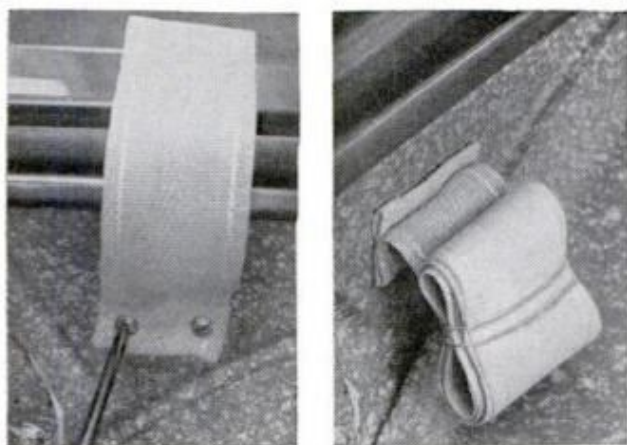
"true-motion" frame by individual connecting rods. This frame rides on the crankpins of two single-throw crankshafts, linking them so they rotate in phase. For more power, the units may be "stacked" or the bore diameter increased.

The 101-cu.-in. 50-hp diesel, below right, will probably be on the market by early 1968. It weighs 125 pounds (plus 75 pounds for gearbox) and measures 17¼ x 17¼ x 17 in.—Art Mikesell



HINTS

FROM READERS



Car-side carrier

If you're a homeowner who every once in a while picks up a long board at a lumberyard or borrows an extension ladder from down the street, it will pay you to equip your car with these built-in carrying straps. Like seat belts, they're always there, and they eliminate the chance of scratching the car's finish in carting long items.

The straps are lengths of lawn-furniture webbing permanently attached to the car's body, one inside the engine compart-



ment, the other in the trunk. They're attached with sheet-metal screws inserted through the doubled ends of the webbing. A length of foam rubber, slotted at each end, is slipped over each strap to protect the car. In use, the straps pass between the hood and trunk lids, are looped around the item to be carried and knotted.

—Frank L. Greenwald

TV in the doghouse

Few doghouses can boast of a picture window, but this one can for it once was a TV set. Making use of the ready-made window in the front, Morris Hults of Churubusco, Ind., stripped the cabinet of its works, added a roof, closed in the back and cut an entrance in the side to come up with this "instant" dwelling for his pet, Foxey. A few asphalt shingles added to the roof keeps the little fellow snug as a bug.



Barrel-post fence

There are no postholes to dig in building this unusual fence, which makes it both permanent and temporary. Oil-drum posts filled with rocks make it stay put, but the fence rails merely poke in holes torch-cut in the sides of the drums to make the fence demountable if you ever want to move it to a new location. The ends of the rails enter the drums only partway so the latter can be filled to the bottom and not be top heavy.



Starting a Stubborn Outboard

By HENRY B. NOTROM

THERE YOU SIT in the middle of the lake. You've been fishing, it's getting dark and you want to go home. But your engine won't start.

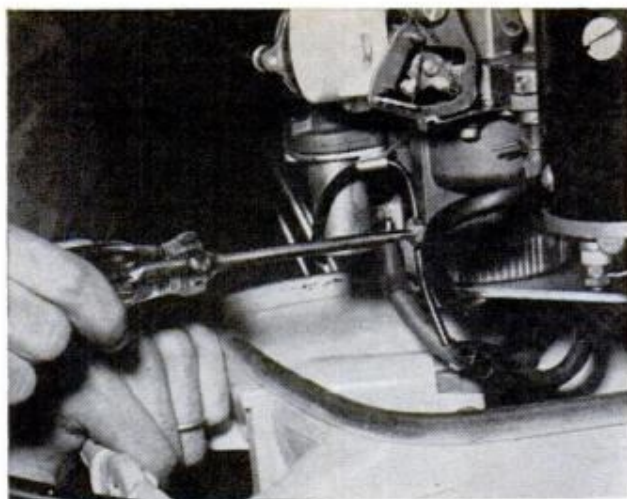
Cheer up. According to the outboard manufacturers, a little simple troubleshooting will solve your problem in nine out of ten cases. The question is, where do you begin?

Some 20 failings can keep an outboard from starting, so you'll have to follow a logical, step-by-step procedure to find the one troubling your engine. Incidentally, troubleshooting a no-start engine is essentially the same as troubleshooting one that starts but immediately cuts out. More on this later.

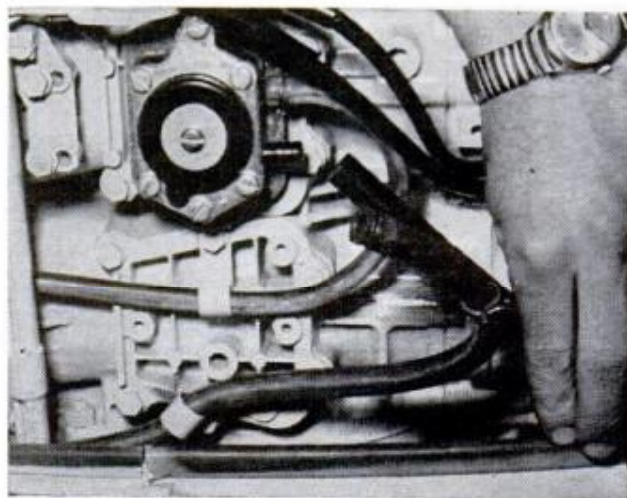
The fuel system is the commonest source of starting problems, so begin there. Before you do anything else, however, check the tank to make sure you're not simply out of gas. Don't laugh. I wish I had a quarter for every outboarder who wasted an hour tinkering with his engine before noticing that the tank was dry.

To find out whether fuel is getting to the carburetor, unscrew that high-speed screw at the base of the carburetor. If gas pours out, you know that fuel is getting through the high-speed jet. If not, the problem is farther back in the system.

While you're checking fuel flow, make sure that your problem isn't waterlogged fuel. Catch a little in the palm of your hand and blow on it. The gas will evaporate rapidly, and if any water is present,

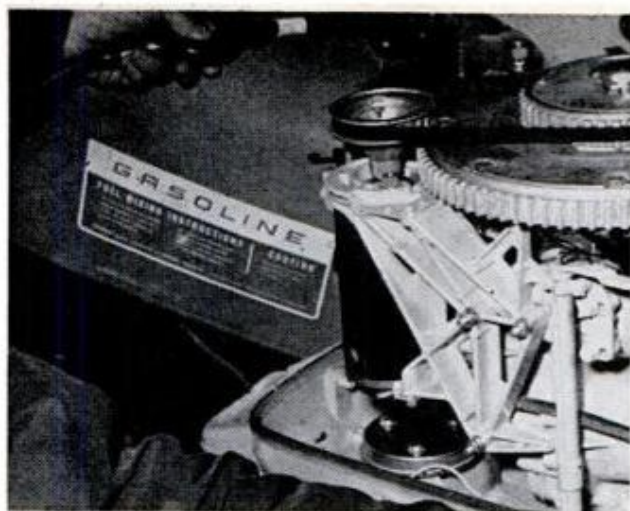


1 TO FIND OUT if fuel is getting from the fuel pump to carburetor, unscrew high-speed screw

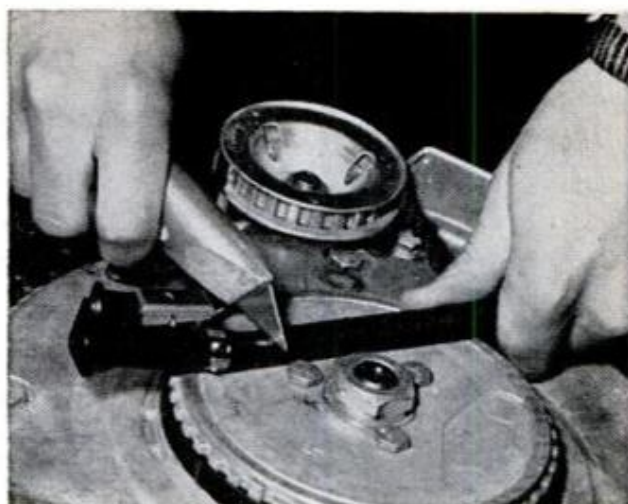


4 THEN DISCONNECT the regular fuel pump line and hook up the "modified" line directly to pump

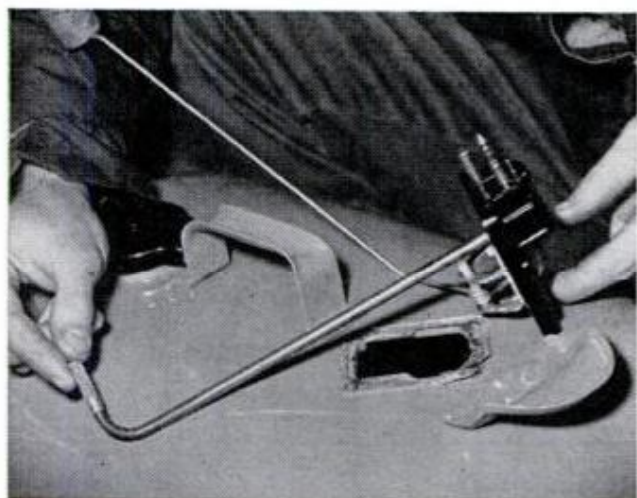




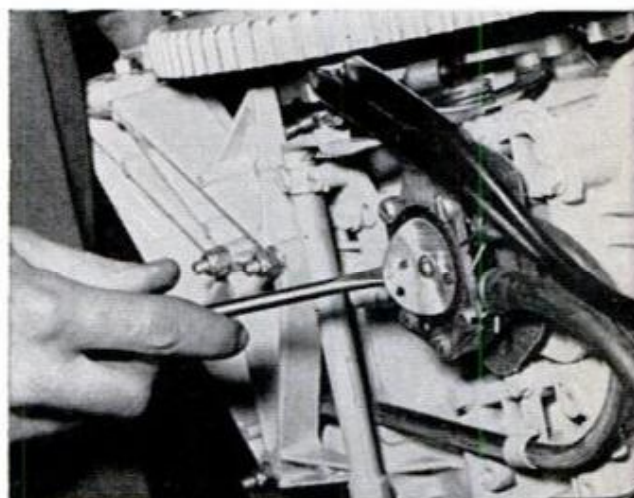
2 YOU CAN CHECK for stoppage in tank or line by disconnecting line and squeezing primer bulb



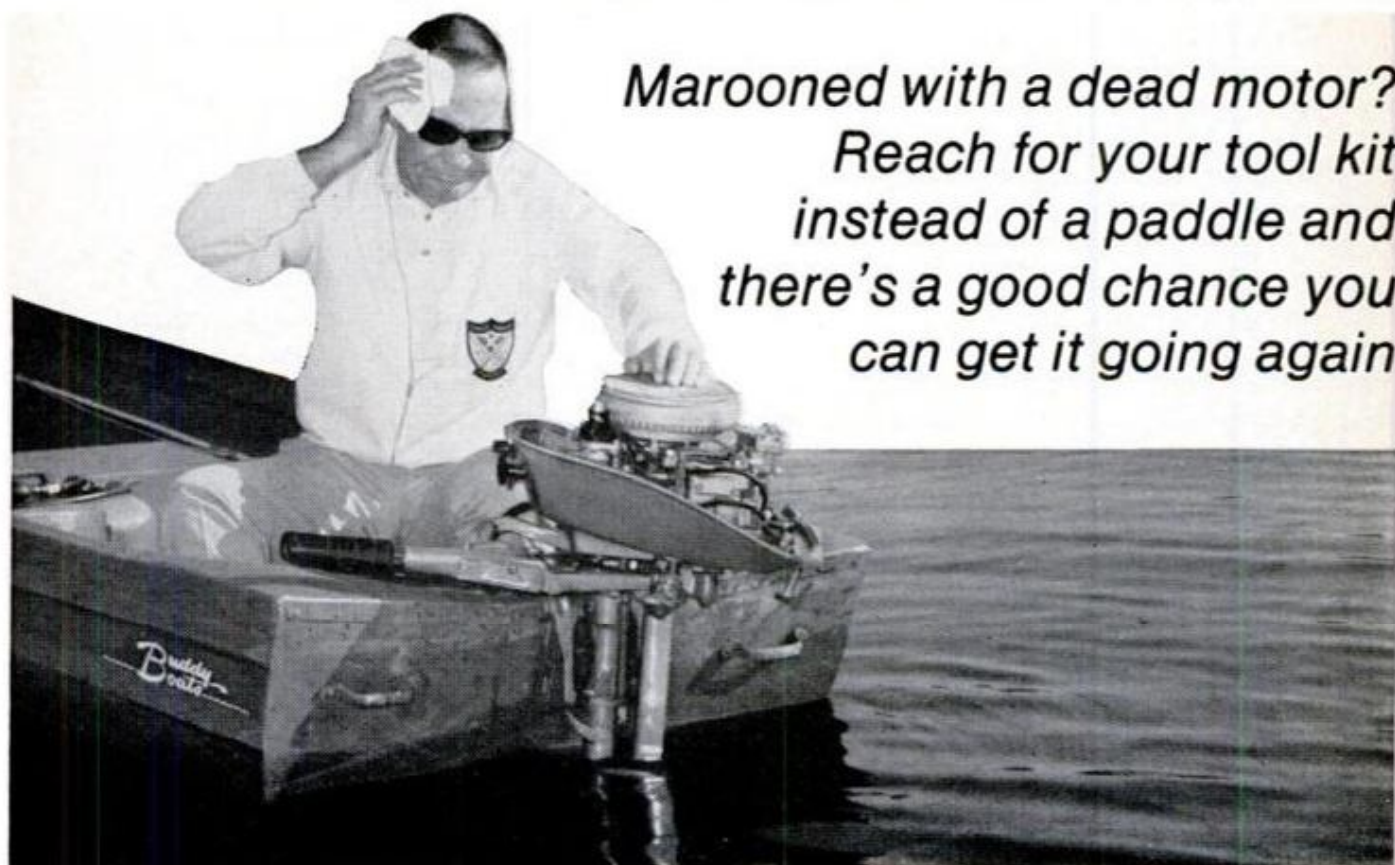
3 DAMAGED O-RING allows pump to suck air, thus starving engine. To fix, cut off the connector



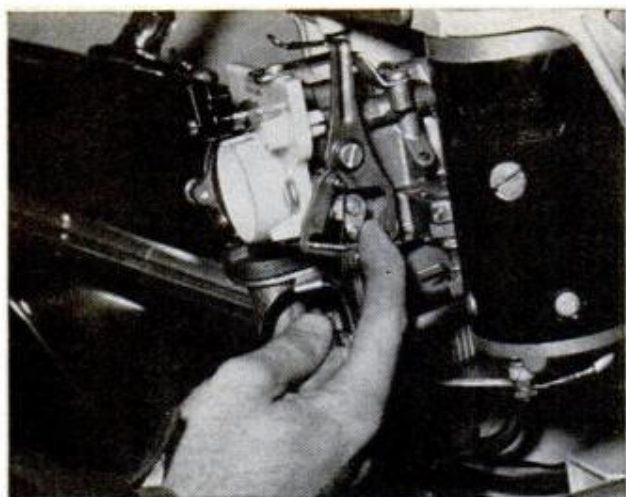
5 FILTER SCREEN on the outflow pipe of the fuel tank may become clogged, but is easily cleaned



6 TO GET AT the filter screen in the fuel pump, you'll have to remove the housing and the filter



*Marooned with a dead motor?
Reach for your tool kit
instead of a paddle and
there's a good chance you
can get it going again*



7 YOU CAN FREE stuck choke butterfly by operating the plate manually. (It often causes flooding.)

you'll find it still in your hand after the gas is gone.

If you find that fuel isn't getting through to the carburetor, disconnect the fuel line at the fuel pump and squeeze the primer bulb. If fuel streams from the line, you know that it's getting as far as the pump. If not, you'll have to double back and check the tank and line.

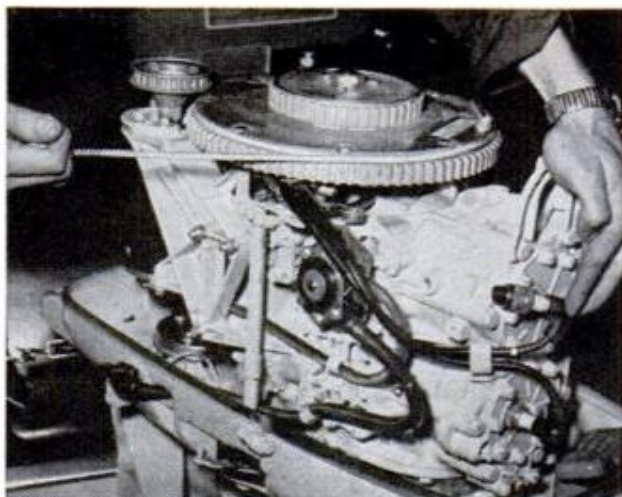
For the moment, let's assume the problem is in the fuel tank or line. Here's what to do and the order in which to do it:

1. Make sure fuel-line connections are properly attached, and the fuel line isn't restricted. (Perhaps it's kinked, or the tank may be resting on it.)

2. Make sure the air vent in the filler cap is open. Some tanks have vents in the cap; others are automatically vented. The best way to handle this is to remove the cap and allow air to rush in, then replace the cap and start the engine. If the vent is restricted, allowing no air into the tank, a vacuum is created and the fuel pump can't pump gas from the tank to the engine. (An indication of this is an engine that starts but cuts out.) Similarly, if your engine has an integral gas tank, be sure the gasoline shutoff valve leading from tank to carburetor is open.

3. Check the fuel line for breaks, especially around connectors. If you discover a break in the line and it's not near a connector, tape it up with that friction tape in your tool kit. If the line has broken at a connector, however, cut the line in front of the break, pull the bad segment off the connector and connect the line to the connector.

4. Check the O-ring inside the connec-



8 ONE WAY to find out if you have real ignition troubles is to ground plug and crank the engine

tor, especially the one that hooks to the engine. This often chips, causing the fuel pump to draw air. If the ring is damaged, cut off the connector and disconnect the extension hose at the fuel pump. You can now hook up the fuel line directly to the fuel pump.

5. If everything checks out up to now, the filter screen inside the gas tank may be plugged. Unscrew the fuel-line connector at the tank and pull it out. You'll find the screen attached to the bottom. Wipe it clean with a rag. So much for the first part of the system.

Now, if fuel is getting through the gas line to the fuel pump, but not from the fuel pump to the carburetor, troubleshoot the fuel filter first. Its location depends on the type engine you have. (If you're wise, you'll familiarize yourself with its location by consulting the owners' manual before leaving the dock.)

Remove the filter, and if it turns out to be dirty, clean it as best you can.

Naturally, a damaged fuel pump could very well be the cause of nonstarting, but all you can do is make sure the fuel-pump housing bolts are tight. If the diaphragm is damaged, you've had it (unless you happen to carry a spare diaphragm).

Two other causes can lead to no-start or to start-and-cut-out problems, but these don't necessarily involve restricted fuel flow. They could mean the engine is getting too much fuel, causing it to flood.

One of these is a choke plate that's stuck opened or closed. If you suspect this, operate the butterfly by hand to insure free and easy operation.

The other is the low-speed idle adjust-

ment. A change in climate can affect this, causing a fuel mixture too lean or rich. Turn the low-speed adjustment screw a little at a time to either side.

If the motor has flooded, close the needle valve completely and spin the flywheel several times to clean out excess fuel from inside the engine. Then, reopen the valve and try starting the engine.

If you've reached this point without success, the only fuel system trouble spots left are the internal condition of the carburetor and whether reed valves are seating properly. To check, remove the sparkplugs. Look at the firing tips. A dry plug means fuel is not getting to the cylinders and carburetor or reed valves are to blame.

No matter how good you are, trying to disassemble a carburetor while on the water is rough (impossible would probably be more accurate). And if the problem is reed valves, there isn't much you can do except get the motor to a shop.

Luckily, the ignition part most likely to be the culprit is the sparkplug. Check each one. If cracked or damaged, replace the plug. With what? With one of those spares you should be carrying in the tool kit.

But if you forgot the spares (tch, tch), you still may be able to get started. If the

tip of the plug is oil-fouled, for example, take some gas from the tank and swab the tip. Then, burn off the oil.

Maybe the plug's gap has widened appreciably. Okay, if you don't have a gapping tool, take two business cards from your wallet and use the double thickness as a gapper. Bend the *outer* electrode to change plug gap size. (Bending the center electrode could crack the porcelain.)

Also, check out sparkplug leads for breaks in the insulation that could be hampering full voltage flow. If you find any, that friction tape in the tool box will again come in handy.

Whatever you do, make sure the plug is seated tightly. A loose plug causes compression loss and a starting problem. In the absence of a torque wrench, run the plug in finger-tight. Then, wrench it up a half turn tighter.

If plugs are okay, starting trouble is probably beneath the flywheel in the magneto setup. What can you do? Only confirm your suspicion.

Ground the plug on the powerhead and crank the engine, using the rope if you're alone or the electric starter if you have one and there's a partner in the boat with you. You should get a good, bluish spark. If not, I just hope you're not up the creek without a paddle. ★★★

OUTBOARD CLINIC

Q I have a 1960 Mercury which is perfect, except for one thing. It practically refuses to start when the engine is cold. The starter seems to be taking all the current. Battery and electric choke have been checked and passed. Any thoughts?—N.C., Minn.

A I think it would certainly be in your interest to have a Merc mechanic conduct a series of continuity tests on this engine, checking for bad wires, shorts, poor grounds and the like. If he doesn't find anything, the next step is to tear into that starter.

Q I realize that at long range it is not possible for you to tell me why my outboard knocks so badly. However, could you give me a list of common ailments that I can look into?—H.H., Tex.

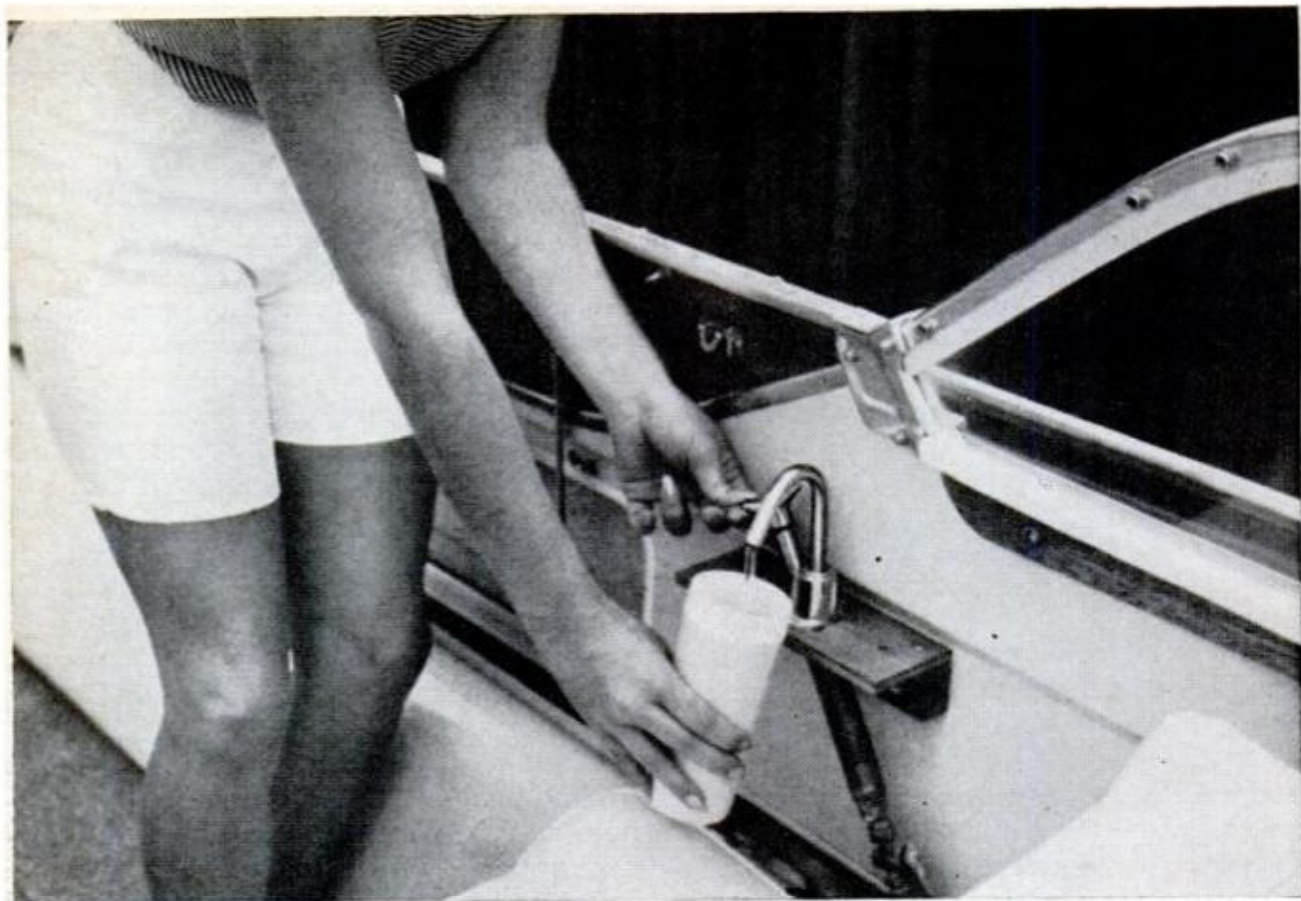
A I sure can, and I'll also present them in the order in which you should tackle them. Generally, there are nine common causes of excessive engine knock. They are: 1. too much or not enough oil in the gas; 2. advanced

ignition timing; 3. loose assemblies, bolts or screws; 4. a loose flywheel nut; 5. a flywheel that's hitting the coil heels; 6. a manual starter that's not centered; 7. a bent shift rod that vibrates against the exhaust tube; 8. excess carbon in the combustion chambers and exhaust ports; and 9. worn or loose bearings, pistons, rods or wrist pins.

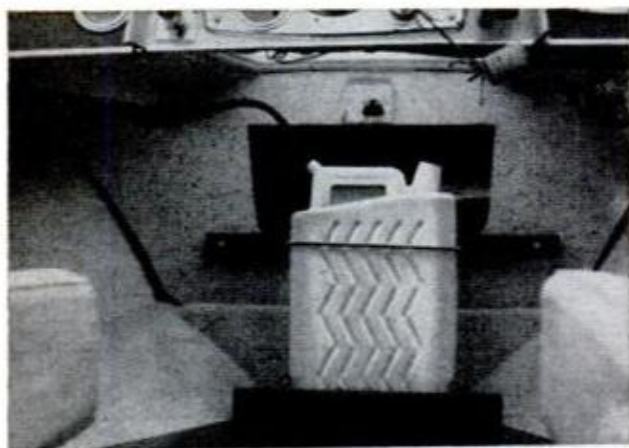
Q I have not been able to uncover the cause of frequent shear-pin failure in my 1959 Evinrude Fastwin. The funny thing is that every time a pin has sheared, I'm positive the propeller hasn't struck anything in the water. I hope you can help me.—L. J. A., Ore.

A I believe you should look into the possibility of a worn shear pin hole in the shaft. If it's worn, you'll have to replace the shaft.

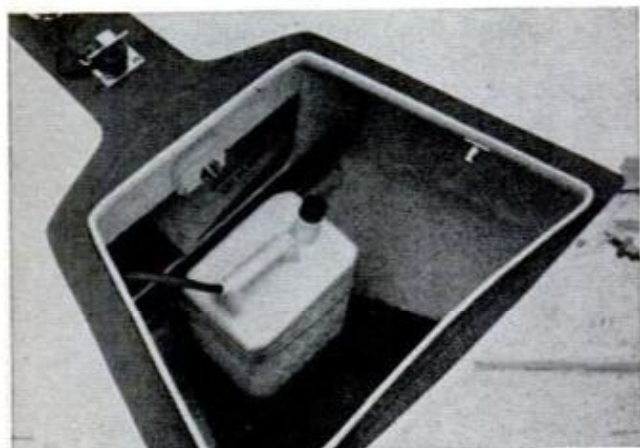
FOR PERSONAL REPLY to your outboard motor question, write *Outboard Clinic*, *Popular Mechanics*, 575 Lexington Ave., New York, N.Y. 10022. Enclose 25 cents in coin.



SPIGOT WITH PUMP is available at stores handling accessories for boats, trailers and pickup campers



WITHDRAWAL HOSE runs through a series of large eye-screws back to spigot/pump located in cockpit



TANK LOCATION directly under hatch makes it easy to fill at dockside without removing from the boat

RUNNING WATER FOR YOUR RUNABOUT

ALL YOU NEED for this simple water system is a five-gallon plastic "jerry can," a suitable length of withdrawal hose, a combination galley pump and spigot (try your marine dealer) and miscellaneous fastenings as required by your particular installation.

I installed the tank up in the bow of our Glasspar Sunliner, holding it in place with a wooden cleat and shock cord. Neoprene fuel line was used for withdrawal hose. It's strong, resists kinking and doesn't affect the taste of the water. To connect the withdrawal line to the tank, I simply reamed out the vent opening until it was large enough to fit snugly around the hose.—Patrick Perrett

POPULAR MECHANICS

HINTS FROM READERS

Tubing prevents fraying

Frayed ends of steel cable can be dangerous to handle if left exposed. You can prevent the steel strands from unraveling if you first slip a short length of copper or aluminum tubing over the end of the cable before tightening the clamps. The soft tubing still lets the clamps dig in and grip the cable tightly.—*Wayne M. Judy*

Candle improves tapping

Before starting to tap threads in a blind hole, stick a birthday-cake candle in the hole and break it off flush with the surface. The candle will not only serve as a lubricant, but will help carry the chips to the surface as the tap is turned, permitting you to tap to the full depth of the hole without having to keep backing out to clear the chips.—*Henry Mullen*

Clipboard tracing easel

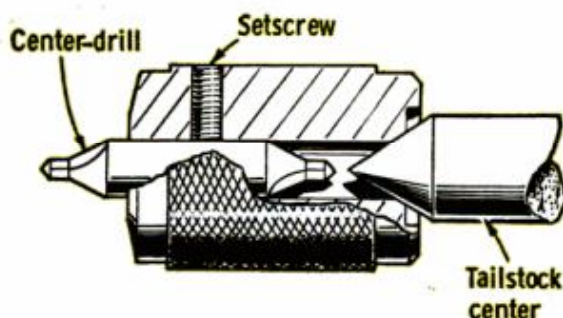
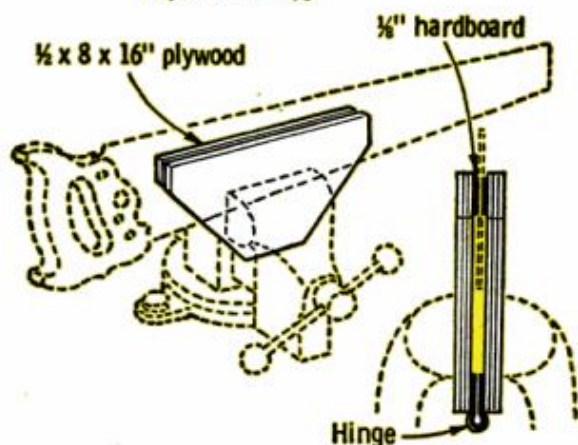
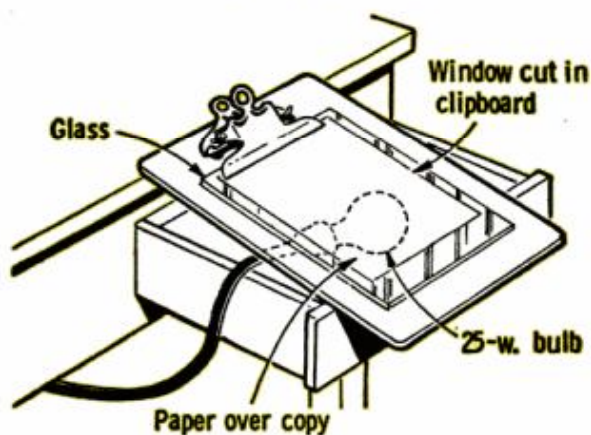
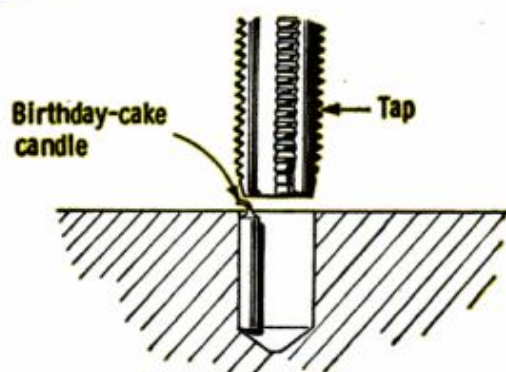
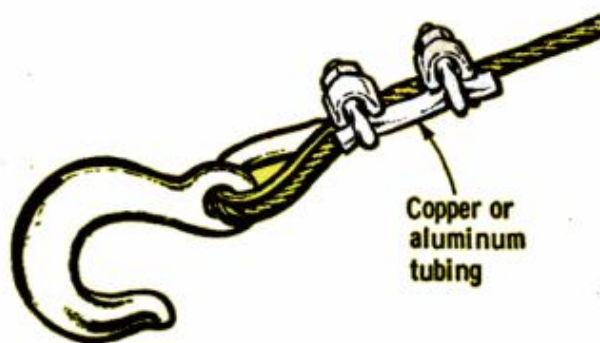
Handy for tracing small diagrams and pictures, this improvised easel starts out as a clipboard. All you do is cut a window in it somewhat smaller than the opal glass that covers it. The clip holds both the glass and the paper. To use it, you simply pull out a drawer, place a lightbulb in it and rest the easel on it.—*Peter Legon*

Quickie saw vise

For that occasional saw-filing job, this homemade saw vise fills the bill. As you see, it's nothing more than two pieces of plywood hinged at the bottom and fitted with hardboard strips at the top. It works best in a machinist's vise where the jaws are deep enough to bear against the plywood above the hinge.—*Victor H. Lamoy*

Holder saves tool changing

Here's a lathe accessory that will save you time when center-drilling work for mounting between centers. It's machined at one end to fit the 60° point of the tailstock center and to hold a center drill at the other. You hold it against the tailstock center with the left hand while you feed it into work by cranking the tailstock with the other.—*Frank L. Rush*

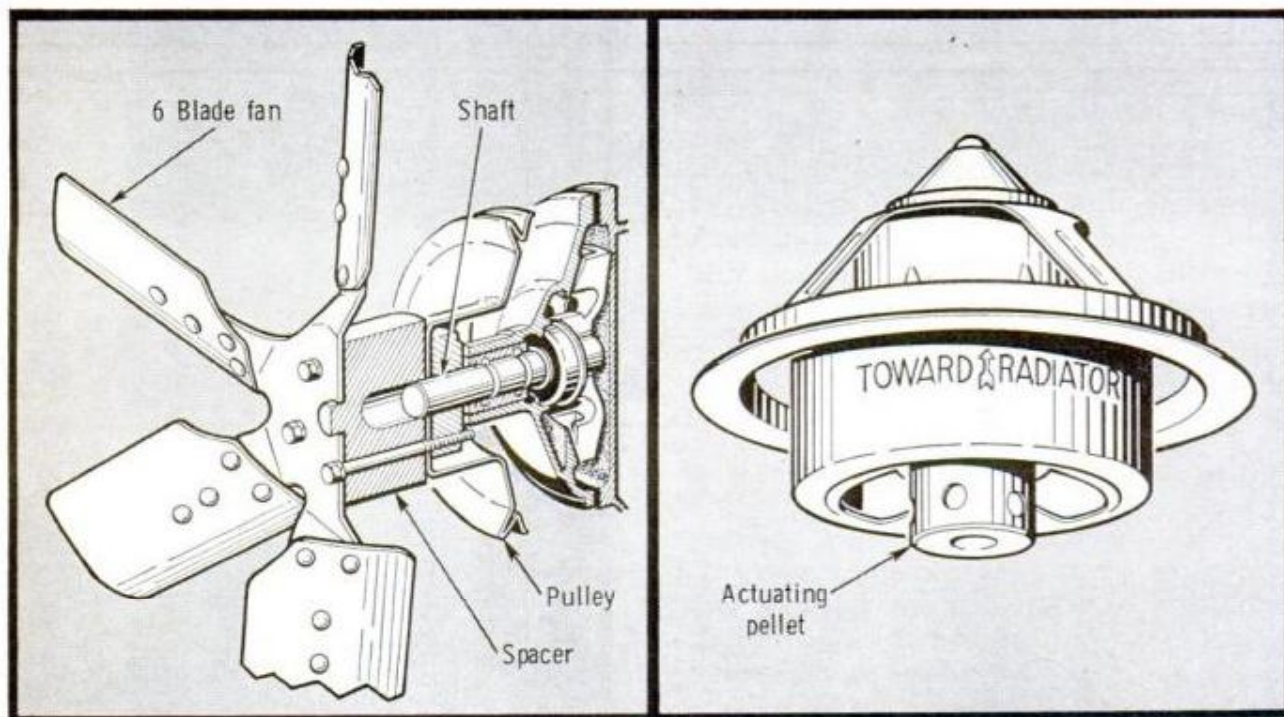


How you can find those 'hidden'

When you start with a full radiator and still your engine's running hot,



CHECKING FOR AERATION is a simple procedure which will tell you if overheating is resulting from air being drawn into cooling system passages through faulty hoses or water pump and mixing with coolant

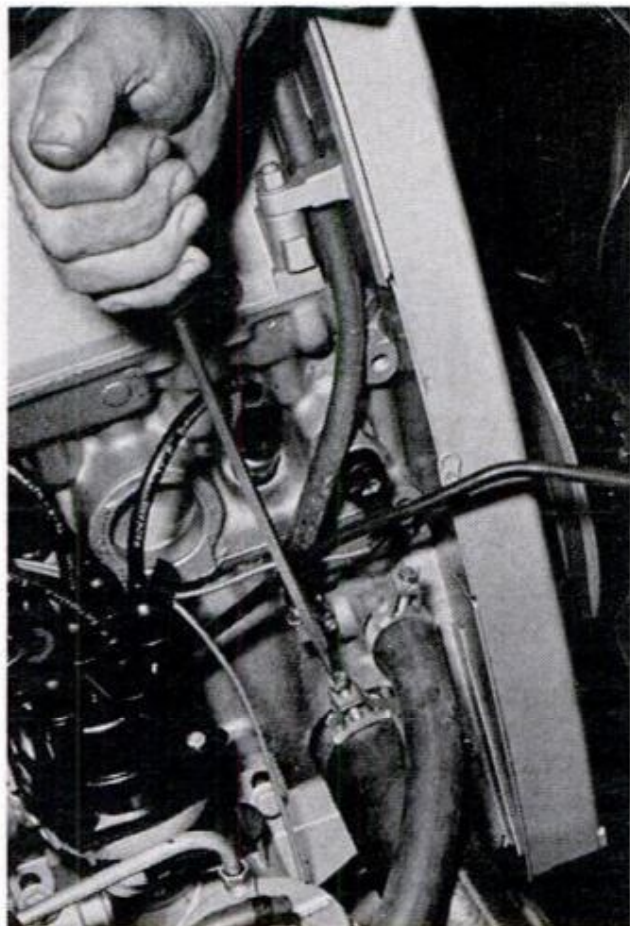


FAN DRIVE UNIT that is slipping somewhere along the line will decrease the flow of cooling air past your engine and result in an overheating condition

COOLING SYSTEM THERMOSTAT allows your engine to come up to operating temperature quickly, but can cause overheating when it sticks in closed position

causes of ENGINE OVERHEATING

you've got troubles that can only be solved when you know where to look



BOTTOM HOSE MAY COLLAPSE at medium and high speeds from suction pressure and restrict coolant flow

By MORT SCHULTZ

THERE ARE MANY REASONS why an engine will overheat, and they are not as simple as you might believe.

Recently I received a letter from an *Auto Clinic* friend in St. Louis, who complained that his 383-cu.-in. V8 engine was overheating in city driving. He had practically overhauled the cooling system, even removing the cylinder head to check water passages for obstructions.

Based on a tip I picked up while helping a mechanic buddy, I suggested to the St. Louisan that he try two things:

1. If he had a fiberglass pad beneath his hood, rip it out and allow more breathing space in the engine compartment;

2. To circulate even more air, replace the standard four-bladed fan with one having six or seven blades.

He tried both and put an end to his overheating problem. This started me thinking of other unsuspected causes of overheating. Before enumerating the real tough dogs that can plague you, let's remember to check first things first: The major cause of overheating is still a plugged-up cooling system.

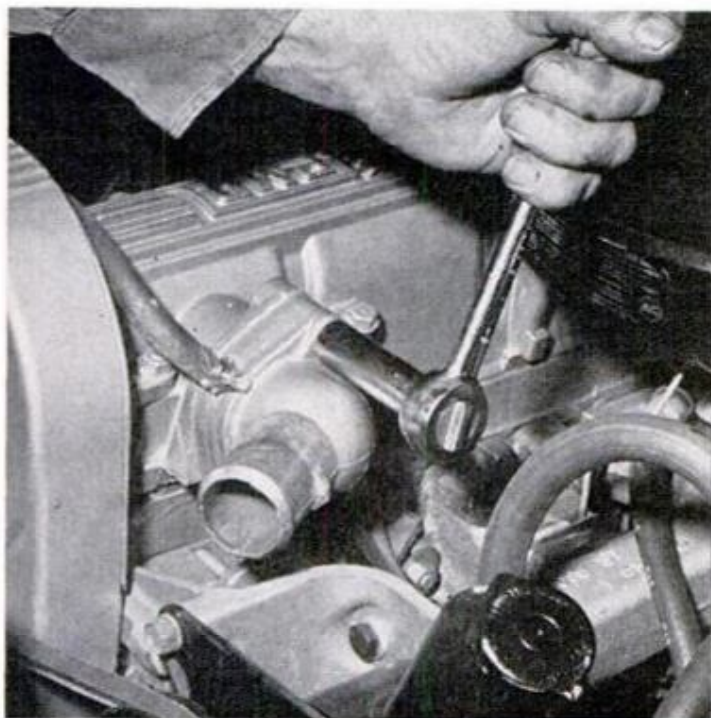
However, assuming the radiator and engine-cooling passages have been cleaned and you're as certain as you can be that they are clear, here are several "improbable" causes you'll want to check:

Collapsing bottom radiator hose: The problem of a hose collapsing to restrict the flow of engine coolant is one that's often overlooked. Why? Because it's deceiving.

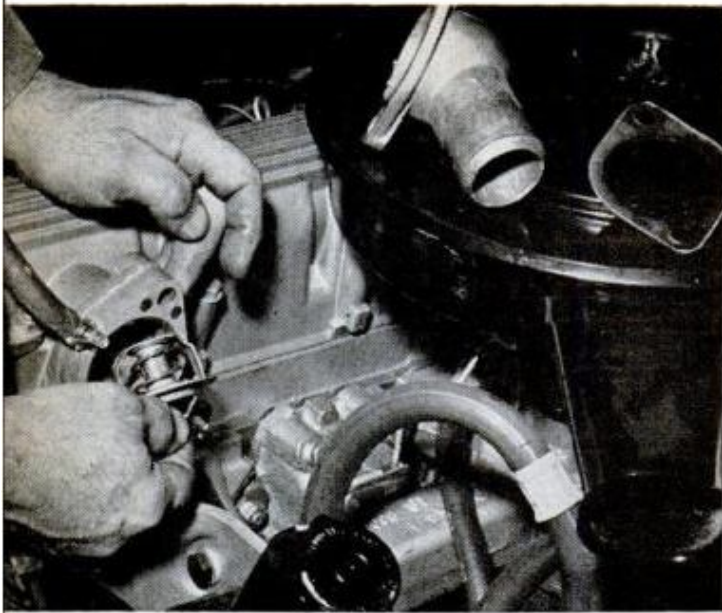
Under hand pressure, the hose may seem firm. However, there's a reinforcement spring inside this hose that's supposed to keep it from collapsing under the suction created at medium and high speeds. Once the hose collapses, it cuts off coolant circulation, and you've got overheating.

Tough to find? You bet, because when speed is reduced and the suction removed, the hose reverts to its original shape.

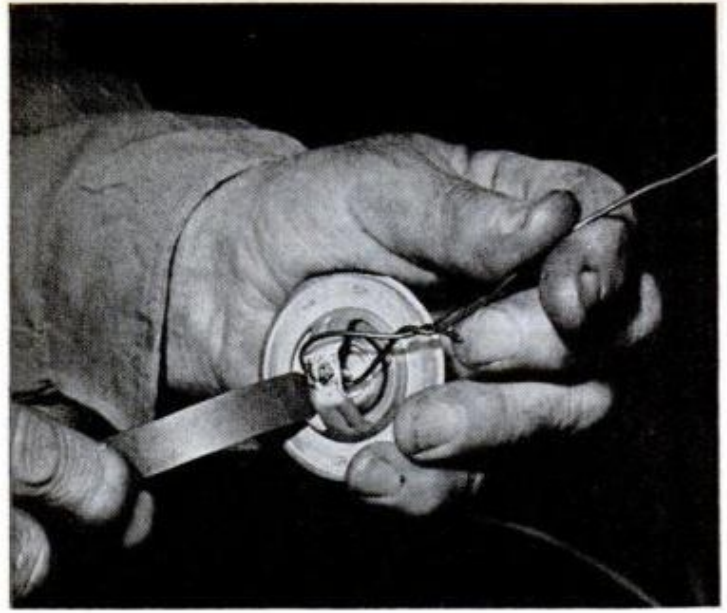
There is no way to check spring tension. So, if your engine overheats, particularly at medium and high speeds, spend



THERMOSTAT HOUSING is usually toward front of engine near radiator. Drain coolant level below the housing before removing it for access to thermostat



THERMOSTAT IS REMOVED from its housing to be checked and replaced, if necessary. Also, examine gasket between thermostat housing and the engine



THERMOSTAT VALVE OPENING is checked with .003-inch feeler gauge after the thermostat is removed from water heated to specified opening temperature

a dollar or two for a new bottom hose. True, you may replace one that's in good shape. But you may also replace one that has a bad spring.

Worn fan-drive unit: To check your fan-drive unit, warm the engine to operating temperature (at least five minutes of running at fast idle) and then stop it.

Now, check how much *oomph* it takes to turn the fan by hand. If it takes a good pull to move it, parts of the fan drive are okay. But if the fan turns easily, the fan drive—consisting usually of the fan, spacer and pulley—should be examined closely to determine the cause.

Faulty thermostat: Most of us know that a faulty thermostat can lead to overheating. But I get the impression that many car owners replace thermostats indiscriminately.

It's a waste of money to replace a part you can test.

A thermostat is actuated by a pellet of copper-impregnated wax. As the temperature of the pellet increases, the wax expands and opens the thermostat valve. Most cars are fitted with a thermostat rated to open at 180° or 190°, but this varies from car to car so check the specs.

If the valve sticks closed, or opens only partially or not at all, you get little or no coolant circulation. The result, of course, is overheating. Conversely, if the thermostat doesn't close completely as it cools off, the engine will warm up very slowly the next time you start it.

To check thermostat operation, drain the cooling system down or just below thermostat level. Remove the top hose and unbolt the thermostat housing. Pluck the thermostat from its seat and check the temperature (usually stamped on it) at which it's rated to open.

Clean off the sludge and hook a length of wire around the thermostat and hang it in a pot of water. Make sure the bottom of the thermostat, containing the pellet, doesn't touch the bottom of the pan. Heat the water, stirring continually to assure uniform temperature. Keep a check with a thermometer.

The valve on a 180° thermostat should begin to open between 175° and 180°. To check it, remove the thermostat and see if you can insert a .003-inch feeler gauge into the valve opening. If the valve is open wide or isn't open .003 inch, get a new thermostat.

If the valve opening checks out, continue heating the water with the thermostat in it to about 200°. At this temperature, the valve should be wide open. If it isn't, replace the thermostat.

Faulty radiator pressure cap: That cap sitting atop your radiator has a bigger job to do than just "bottle-stopping." A cap that's in good shape allows pressure to build up in the cooling system during periods of heavy engine load. This pressure increases the boiling point of the coolant, allowing the engine to meet the heavy load without overheating.

As with the thermostat, a pressure cap



PRESSURE TESTER checks integrity of cooling system and radiator cap to contain the increased pressure necessary to increase boiling point of the coolant

has a rated capacity. This capacity is stamped on the cap itself, but quite often when a cap is replaced, one not up to the requirements for the cooling system is accidentally used.

You can test the cap with a pressure tester, which is a real handy tool to have, because it's also used to detect leaks in the cooling system.

To test the cap, attach it to the tester and work the plunger, bringing pressure up to the poundage at which the cap is rated. If the tester's gauge shows that the cap doesn't hold pressure within one pound of the rated capacity, replace the cap. For example, if your cap is rated at a pressure of 14 pounds, it should hold that pressure within a range of 13 to 15 pounds.

By the way, that rubber tube coming off the nipple on the radiator filler neck and extending down the side of the radiator is an important part of the cooling system's pressurizing setup. When the pressure cap opens, the sudden surge of vapor or liquid it passes must escape through this tube. If the tube is clogged, pressure could back up and damage the radiator or hose connections. To clean, just run a wire through it.

Exhaust gas leakage: A cracked head or loose cylinder-head joint, which you can't usually see, lets hot exhaust gases into the cooling system under combustion pressure. And this can lead to more problems than overheating.

Leaking exhaust gases cause cooling-

system parts to rust and corrode rapidly. Also, because gas forces coolant out the overflow tube, dropping coolant level, repeated overheating from insufficient coolant takes place.

So, if you fill the radiator, overheat, have to fill again, overheat and so on—and there's no sign of an external leak—test for exhaust gas leakage.

Start with a cold engine—that's important. Remove the fan belt and drain the system until coolant is below the top of the engine block. Remove the upper radiator hose, thermostat housing and thermostat. Pour water into the radiator until the block is filled level with the neck. This removes trapped air, which could lead to bubbles and a false indication of trouble.

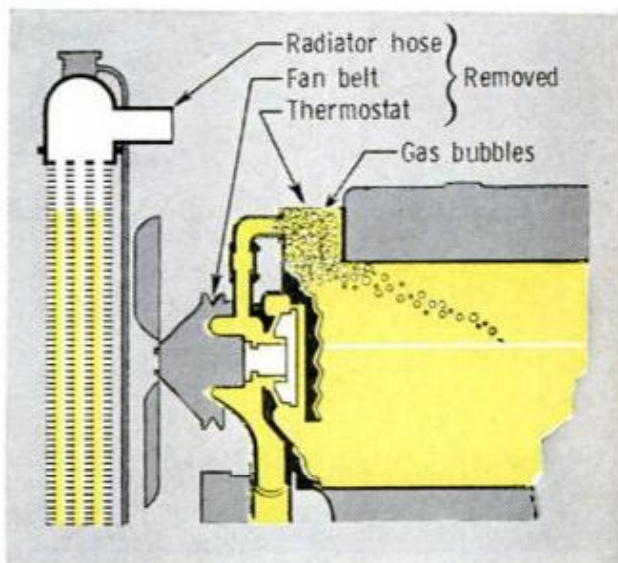
Now you have to put the engine under load. With a car having a manual transmission, jack up the rear wheels and run the engine in high gear. Loading is done by gradually feeding gas and braking simultaneously.

In cars with automatic transmission, set the parking brake and block the wheels. Put the transmission into Drive. Apply the foot brake and load the engine by easing down on the accelerator pedal.

While a buddy is loading the engine, check the block outlet to the radiator. If you see bubbles or there's a sudden rise of coolant, you've got an exhaust-gas leak and, I'm afraid, a real expensive repair job on your hands.

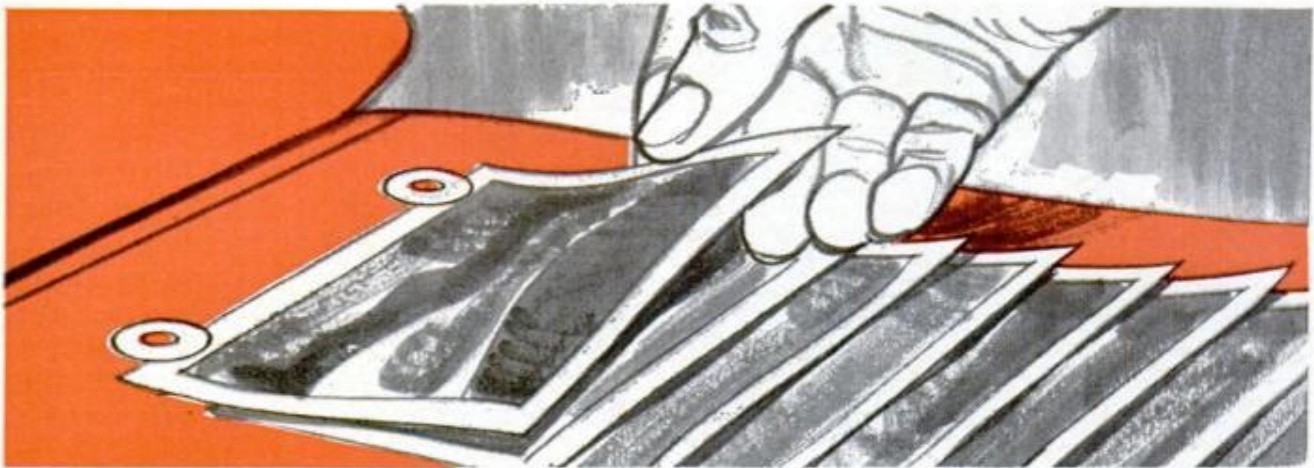
Don't take your time doing this test;

(Please turn to page 196)

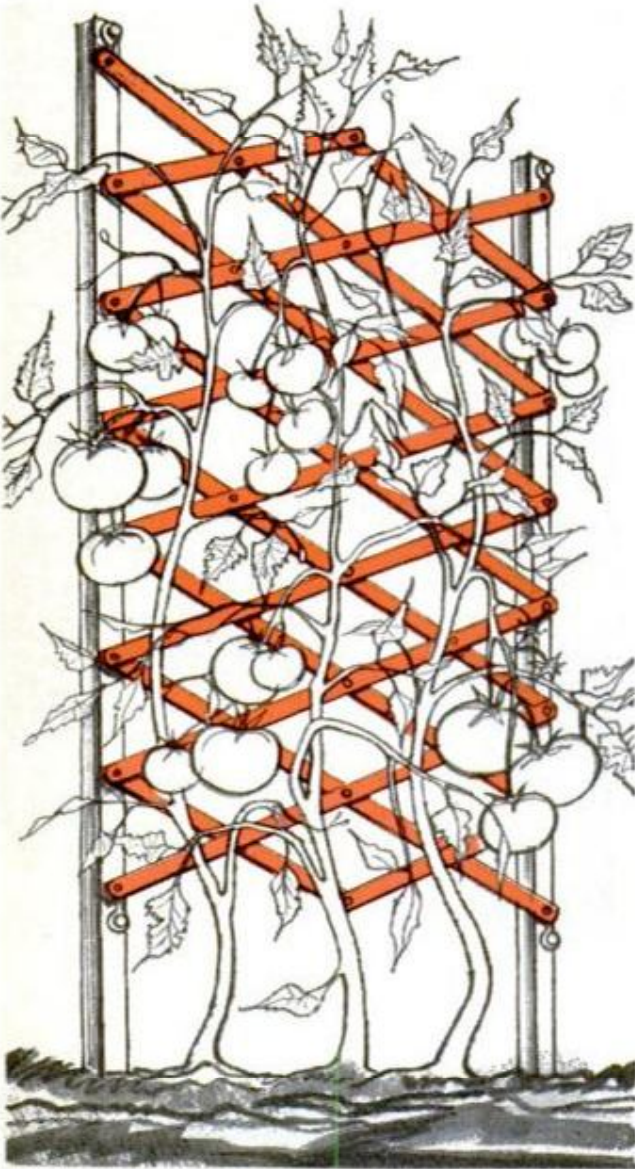


EXHAUST GAS LEAK shows up when the gas bubbles make their way to the surface. Remember to run test quickly before coolant reaches boiling temperature

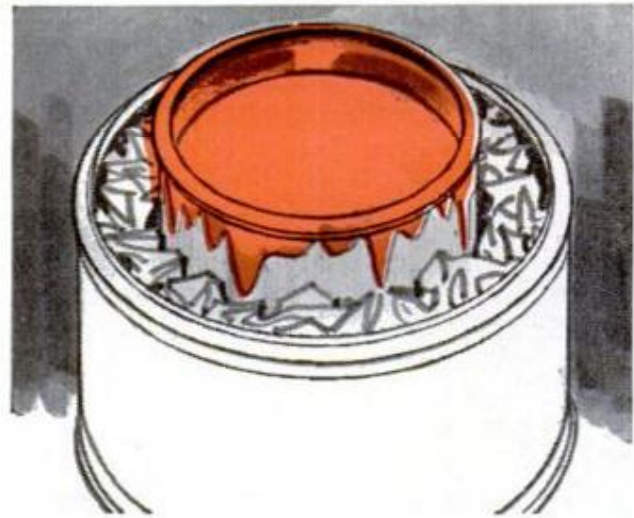
Solving home problems



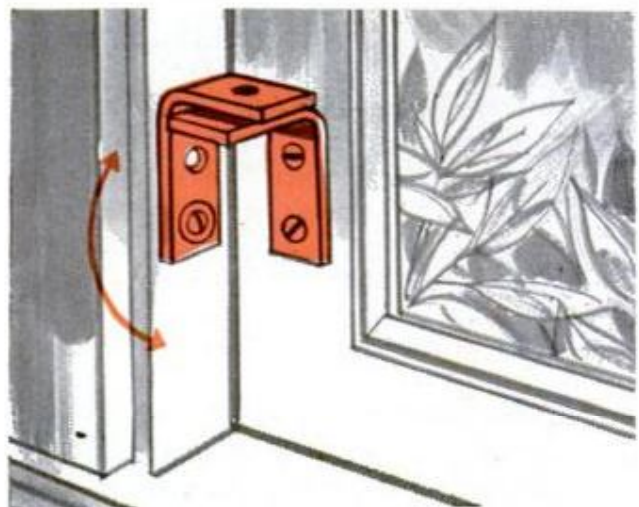
BY MOUNTING SNAPSHOTS file-card fashion, you can get five times as many on a page in your photo album. Simply overlap each print and hinge it at the top with a couple of gummed notebook reinforcements



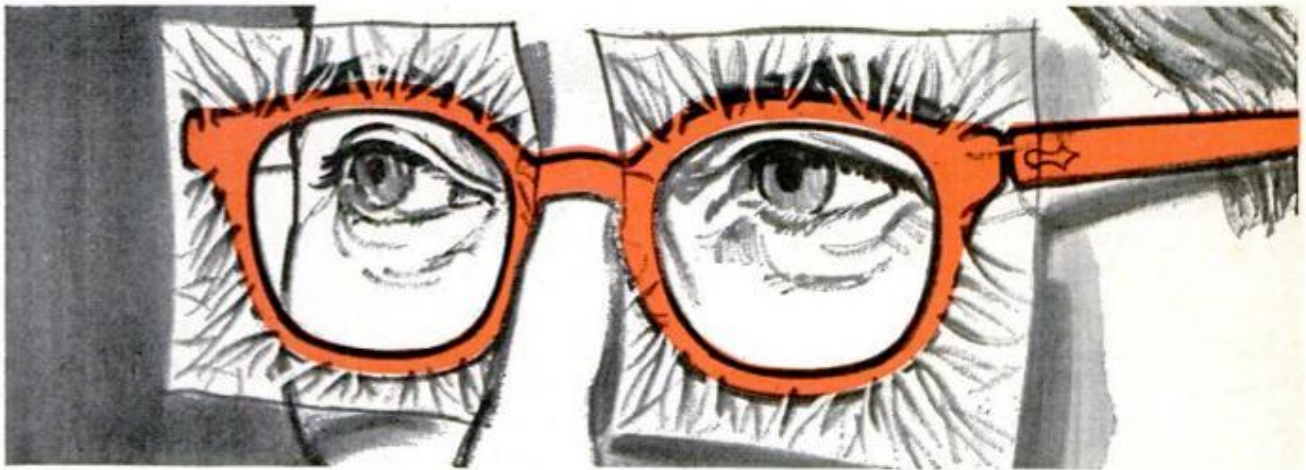
WHAT DO YOU DO with a baby gate when baby outgrows it? Stand it out in the garden. It makes a dandy trellis for roses or tomatoes. Drive a couple of stakes to support it and stretch it to suit



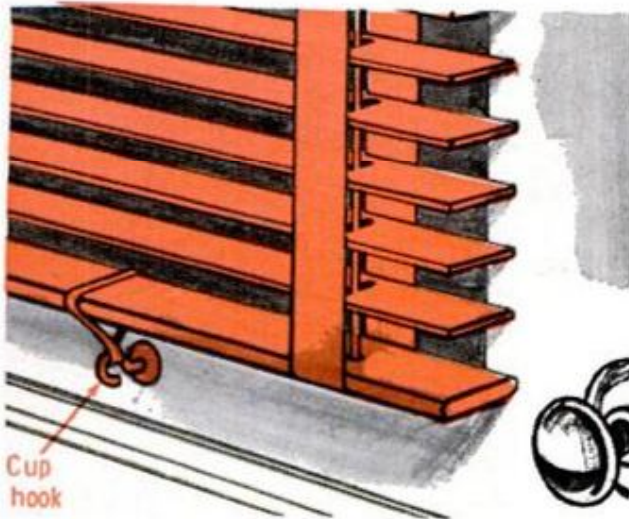
WHEN A TIN CAN IS USED as a paint can, play it smart and place the can inside another. Crowd newspaper around it to catch the drips and you'll always have a clean paint can to grip when picking it up



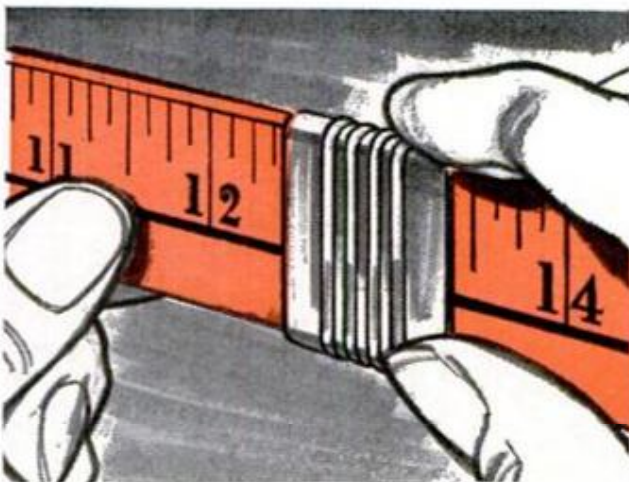
SIMPLE LOCK for a garage or shed window can be improvised from two metal angles attached as shown. One is fixed, the other is pivoted with a single screw so it can be swung down to unlock



IF YOU WEAR GLASSES, remember this stunt the next time you paint a ceiling: Cover them with sandwich wrap, like self-adhering Saran, before you start. You won't have to worry about roller spatter



WHERE A VENETIAN BLIND on a door is without hold-downs to keep it from banging and marring the paint, a cup hook and a rubber band will serve as a substitute. To raise the blind, unhook the band



WITH A SLIDING MARKER on your yardstick, you won't run the chance of miscuing when transferring measurements. Made so it fits snugly and stays put when set, the metal clip will remember for you



NOTHING SWEEPS UP WATER from your garage or basement floor like a rubber squeegee. You can convert your garden rake into a good one by simply stretching a section of inner tube over the tines

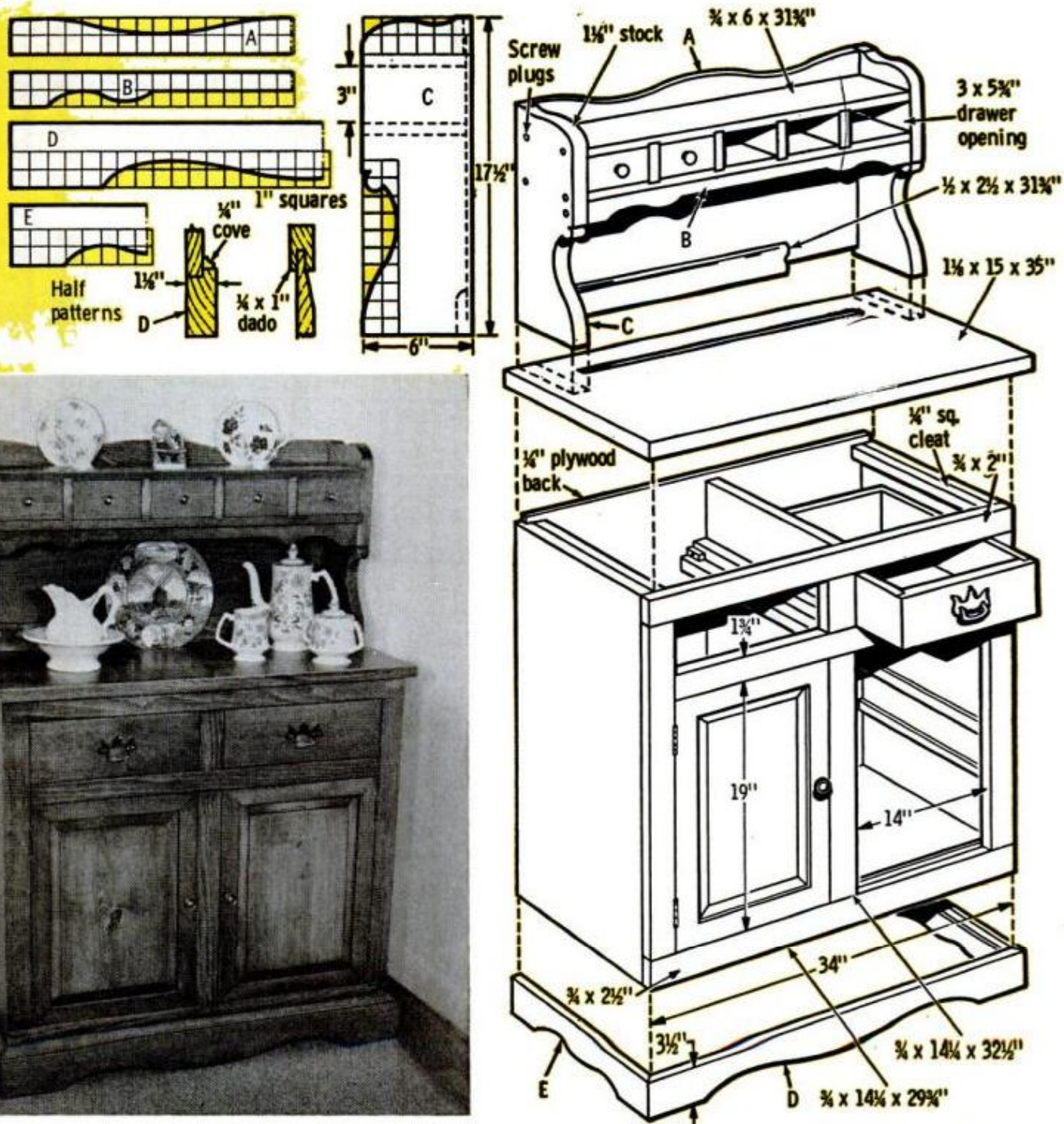
Weekend projects for your home

COLONIAL LOWBOY

Perfect in size for the small dining room, this charming Colonial lowboy provides a handy place to keep your china, stemware, silver and linens, and a plate groove lets you display your choice pieces.

Made entirely of pine and finished with knotty-pine stain and lacquer, it involves

two separate assemblies: the main cabinet and the upper drawer unit. The front facing for the cabinet is made first, butting and doweling the members, after which the rest of the cabinet is made to fit it, as shown in the pull-apart drawing. Screws driven through the top attach the upper drawer unit. All are in counter-bored holes and pegged.—Robert J. Loveling



CLOCK-BOOKCASE

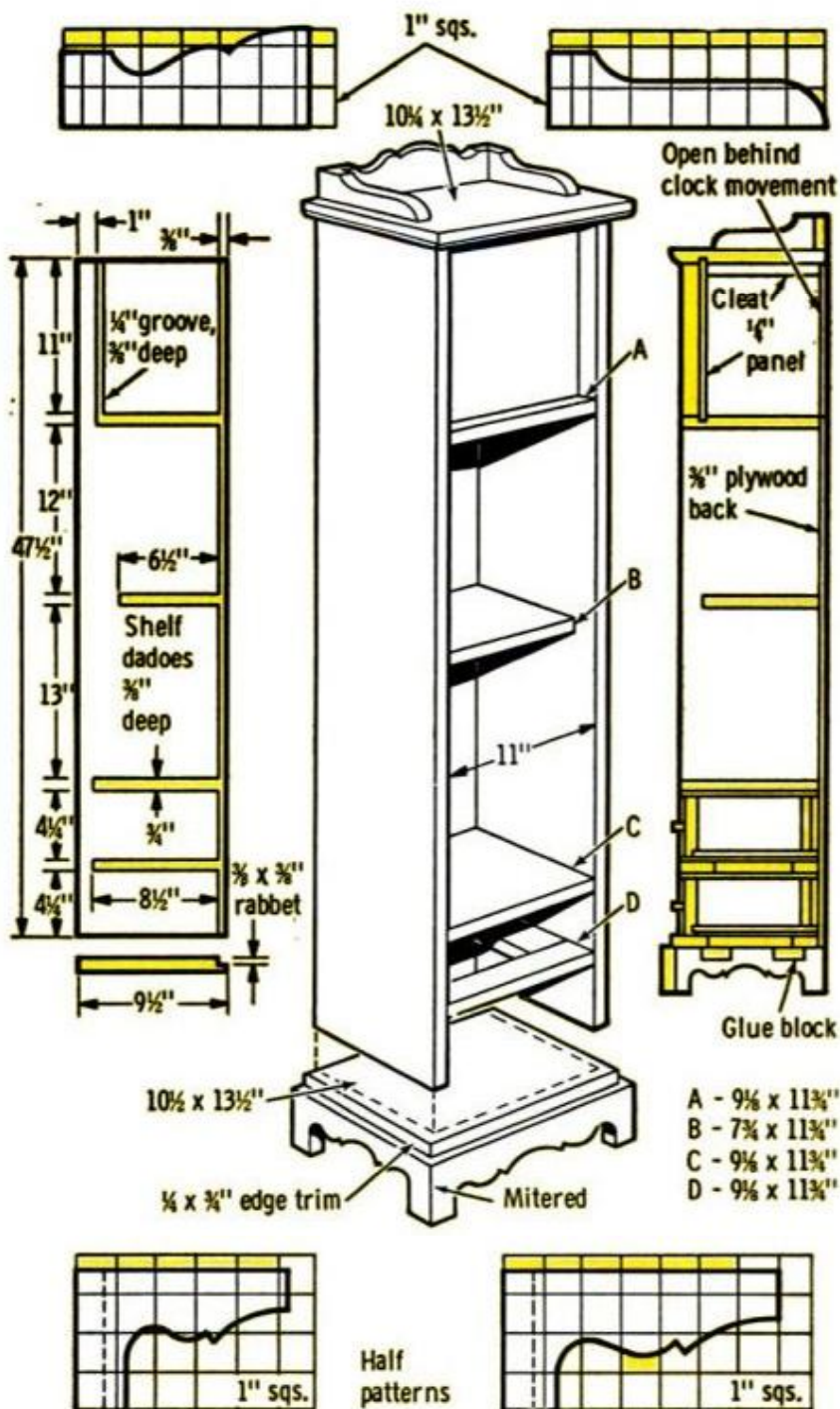
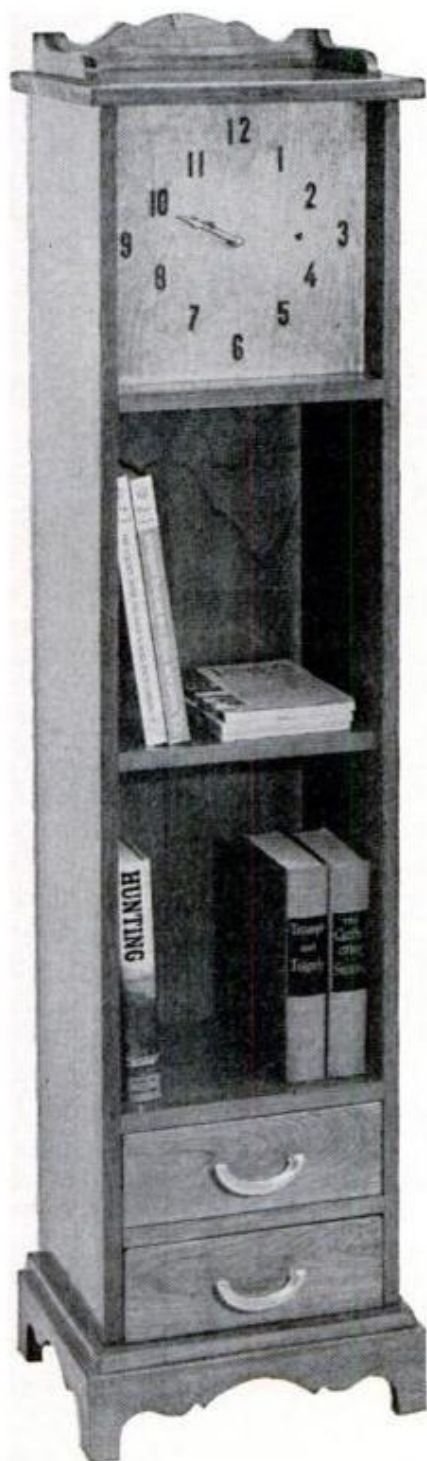
You'll have the time of your life, during and after building this handsome clock-bookcase. It is 54 in. tall, houses a battery-operated movement and is ideal for holding a set of fancy reference books.

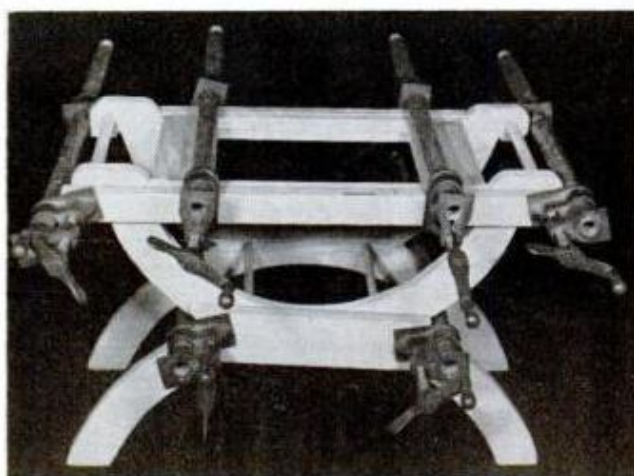
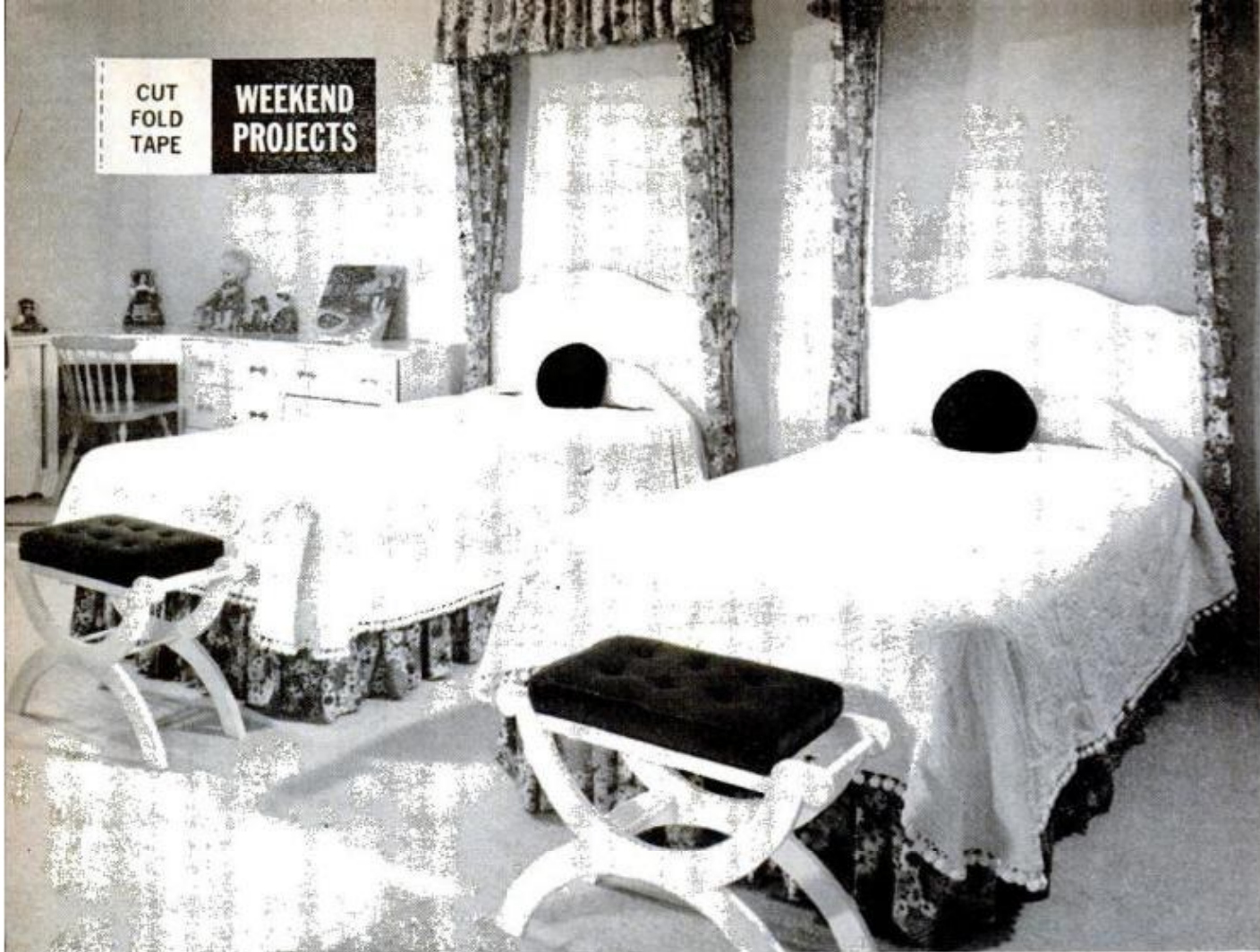
The $\frac{3}{4}$ -in. hardwood plywood sides are made right and left-hand, dadoed for the $\frac{1}{4}$ -in. plywood clock dial and $\frac{3}{4}$ -in. shelves, and rabbeted along rear edges for a $\frac{1}{4}$ -in. back. Taped edges hide plies.

Both the top and base are separate assemblies. The base is fastened with screws driven up from the bottom; the top attached by cleats.—C. L. Widdicome

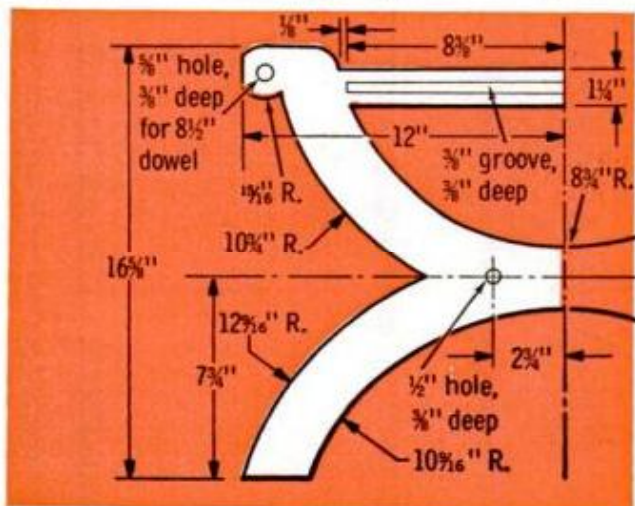


BLACK PLASTIC NUMERALS, $1\frac{1}{4}$ in. high, are cemented to clockface with spot of model plane cement





ALL THE PARTS are glued together at one time. Note scrap blocks which are used to prevent clamp marks



BOUDOIR BENCHES

Besides being handy at the foot of the bed for holding extra blankets, these good looking little boudoir benches will do a lot to enliven the room of any junior miss.

The sides of the benches are one piece and are laid out on $\frac{3}{4}$ -in. plywood following the radii given in the drawing. Run the $\frac{3}{8}$ -in. stopped dado in each side piece while the edge is straight. Although a jig or saber saw is required for internal cuts, the bulk of the cutting will go faster with a bandsaw. With this, you can cut both sides at one time, placing the grooves face to face and tacking in the waste.

Blind holes $\frac{3}{8}$ -in. deep are drilled for both sets of $8\frac{1}{2}$ -in. dowels, and $\frac{3}{8}$ -in. tenons are cut on the ends of two $\frac{3}{4} \times 3 \times 8\frac{1}{2}$ -in. pieces to fit the grooves. Then the whole affair is glued and clamped at one time. Fill any voids in the plywood edges with wood putty before sanding. Finish with a flat undercoat and two coats of white enamel. The cushion is upholstered around a $\frac{3}{4} \times 10 \times 17$ -in. seat board which is padded with a $2\frac{1}{2} \times 10 \times 17$ -in. slab of cored latex rubber.

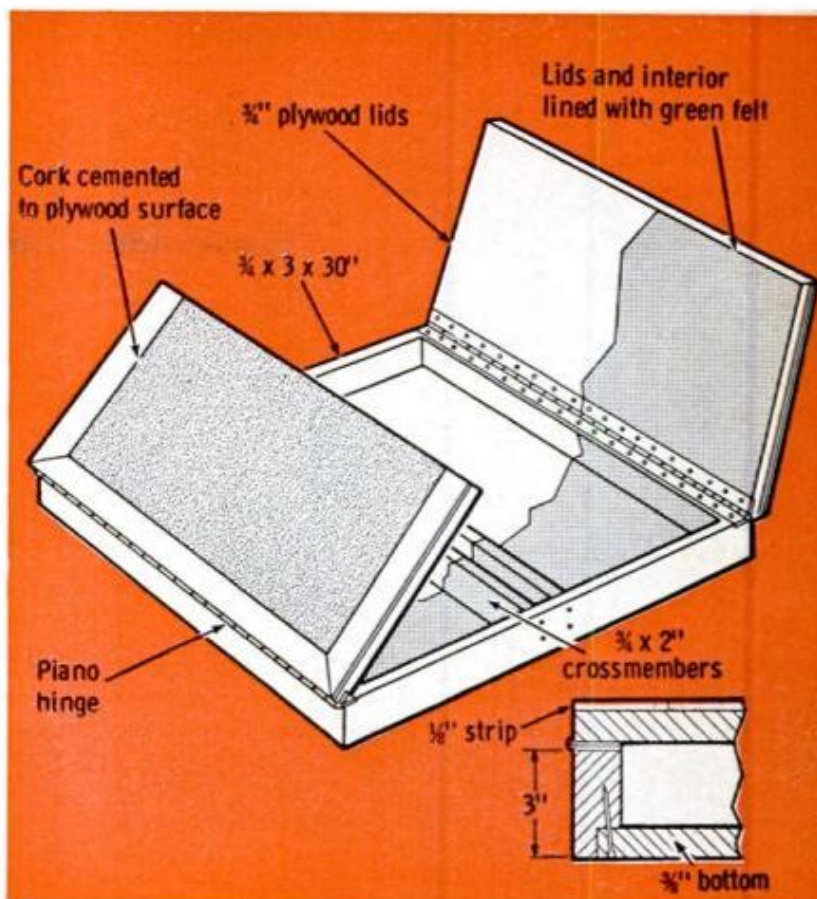
—Dr. C. E. Banister

GAME TABLE

Better than a card table, this pedestal game table presents no leg problem and lets you store games galore right under its top.

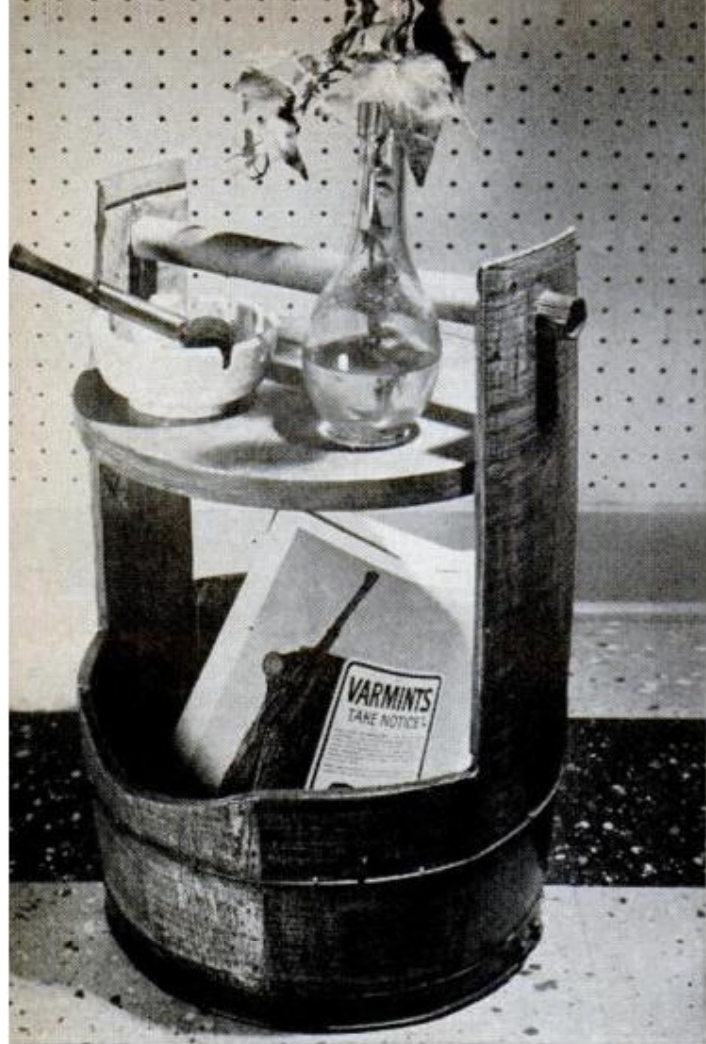
The storage compartment is nothing more than a simple shallow box fitted with hinged lids. Two cross-pieces down the middle provide solid support for attaching the cast-iron pedestal—a fairly easy item to come by in browsing through second-hand stores. As the details show, the plywood bottom fits in a rabbet made in the mitered members and the lids are attached with piano hinges.

The interior is lined with green felt. The playing surface can be inlaid with cork by adding $\frac{1}{8}$ -in. wood border strips around the edge. The compartment can be fitted with dividers to keep cards, chips, dice and what not corraled in one corner.—*Bill Barr*



WHETHER CARDS, CHECKERS OR PARCHEESI, you'll know where they are when kept in this novel table





PAINTED GREEN OR TAN with a dry brush so the wood shows through here and there, keg takes on worn antique look which adds to its rustic charm

MAGAZINE BUCKET

There's hardly a thing that can't be put to new use once it's tossed out, and that goes for nail kegs. By retaining their rustic look and cutting away part of their sides, you can come up with real conversation pieces in the form of magazine buckets, knitting holders, smoking stands—you name it.

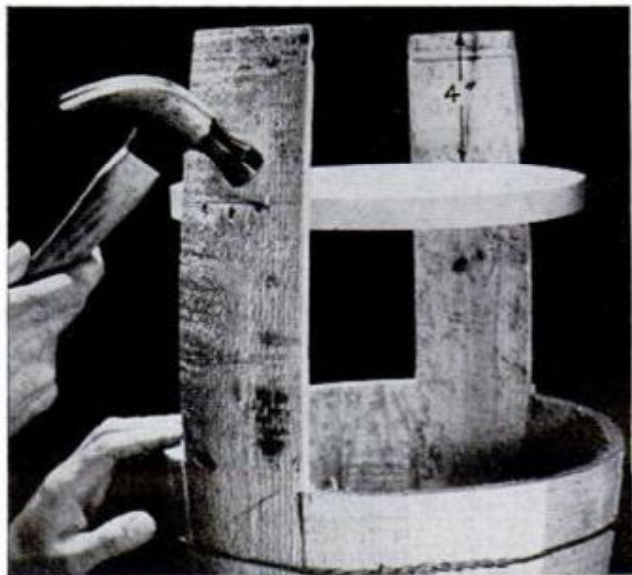
Chances are your hardware store will give you an empty. Remove the top band and select the two best staves opposite each other to support a circular shelf and a dowel handle. Draw a line 7 in. up from the bottom and saw off the other staves.

As a sewing basket, the keg can be fitted with a lift-out lid resting on three small blocks glued to the inside. A spool serves as a knob.

Finally, the keg is sanded a bit, inside and out, and given a painted, dry-brush treatment that leaves the wood bare in spots. Two coats of varnish complete it. This charming homespun item will be right at home with hooked rugs and spinning wheels.—*Don Shiner*



WITH TOP RIM REMOVED and discarded, the keg is sawed on a line 7 in. up from the bottom to cut away staves on each side. Two full staves remain



A CIRCULAR SHELF, 11 in. in diameter, is next nailed between the two upright staves that are left after cutting the keg. This is placed 4 in. down

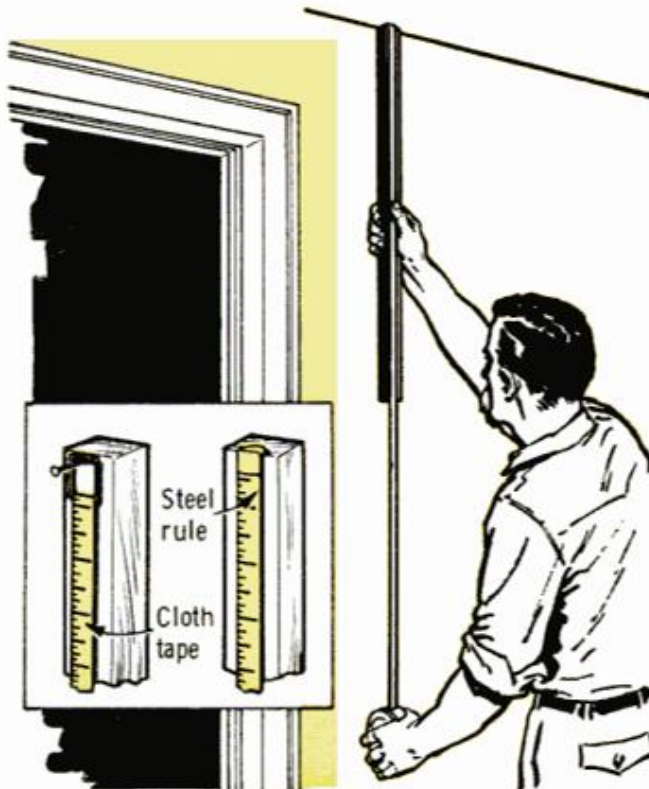
A DOWEL HANDLE is added last. Place it between the staves at the very top. A nail in each end holds it. Lift-out lid can be added to the bucket bottom



HINTS FROM READERS

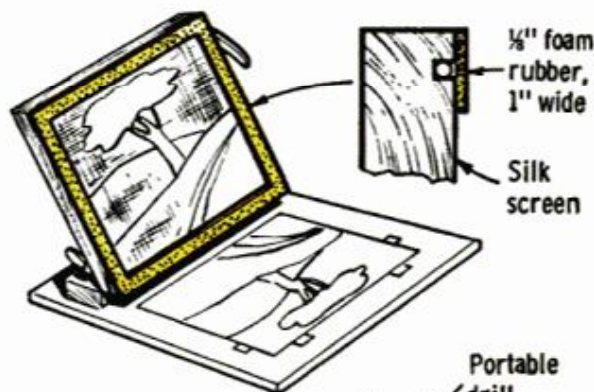
Reach for the ceiling

You can be independent of a chair, ladder, box or what not when it comes to measuring heights way above your head if you remember a stunt I always use to stiffen a flexible tape. I simply grab a stick long enough to reach the point to be measured, hook the tape over the end and raise the stick with the right hand while holding the tape with the left. If it happens to be a cloth tape, I hook it over a small brad driven into the end of the stick and measure with it the same way.—*Frank E. O'Connor*



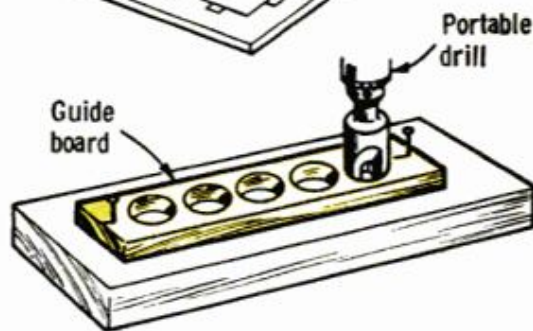
Silk screen won't stick

After becoming frustrated with my silk screen sticking and smearing the work, I hit upon the idea of gluing $\frac{1}{8}$ -in. strips of foam rubber around the frame on the underside. The rubber serves as a paper hold-down and at the same time keeps the screen off the work until it's forced down by the squeegee.—*Lou Bahlieda*



Template guides plug cutter

If you've ever tried using a plug cutter in a portable electric drill, you know how it walks all over the place. What you need is a template that can be tacked to the wood to guide the cutter. Perhaps a friend who owns a drill press can be talked into boring a row of holes in a scrap of $\frac{1}{4}$ -in. plywood. From then on it'll be no problem with a portable drill.—*R. C. Roetger*

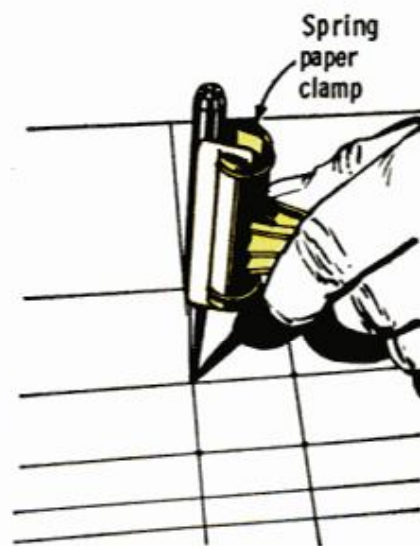


Hanging jars

A twist of the jar leaves the cap in place on the tool panel when you hang baby-food jars this way for nails and screws. Merely solder standard two-prong Pegboard fixtures to the caps.—*Will Thomas*

Punch handle

Your fingers won't obstruct your view when holding a small prick-punch if you grip it with a spring paper clamp and use it as a handle.—*Will Thomas*





1. While it isn't always necessary to remove the old wood shingles before installing asphalt shingles, those shown above were so badly warped and split that they had to be torn up. Once loosened at the bottom by prying with a spade, they could easily be ripped off by hand. After shingles were removed, the sheathing boards were checked.

How to Reroof Your House

Part I

This month we cover the techniques of laying asphalt shingles. If you prefer traditional wood shingles, see Part II in the July issue



2. Since sheathing boards were also in bad shape, new plywood roof sheathing was applied over them. Large span made it necessary to use $\frac{5}{8}$ -in. exterior-grade plywood sheathing; otherwise, $\frac{3}{8}$ -in. would have been sufficient. Old sheathing boards might have had enough structural strength, but couldn't be depended on to hold shingle nails.

3. After installing a metal drip edge, a course of wood shingles extending out beyond the plywood sheathing was nailed in place. These support the new shingles (Barrett three-tab square butts were used here). To make a solid-strip starter course of asphalt shingles, cut the tabs off strip shingles and align the edge with the wood shingles.

I NSTALLING A NEW ASPHALT-SHINGLE ROOF would be about the simplest job imaginable if you could work on a flat surface at ground level. The shingles are easy to handle, self-spacing and require a minimum of nailing.

Unfortunately, the roof is up there on top of your house, and it's pitched, not flat. These are two of the most important limitations for the do-it-yourself roofer. If your roof is steeply pitched or so high that you would risk life and limb to be up on it, better call in a professional roofing contractor. However, if it's low and fairly flat, you can safely tackle the job yourself and pocket a hefty labor bill.

The most difficult part of the average reroofing job is preparing the old roof for the new asphalt shingles. Usually, the new roof can be applied directly over the old shingles (wood or asphalt), provided the framing is strong enough to support the extra weight and sound enough to hold the new roofing nails solidly.

Before applying asphalt shingles over old wood shingles, remove any loose or protruding nails and re nail in new location. Split any badly curled or warped old shingles and nail down the segments. Loose shingles should be nailed securely and any missing shingles replaced. If those along eaves and rakes are badly weathered, cut them back far enough so you can install 1x6 boards in their place. Likewise, badly weathered trim should be replaced.

Ideally, you should nail "feathering strips" along the butts of each course of old wood shingles to provide a smooth deck for the new asphalt shingles. These are simply beveled wood strips with the wide edge cut to match the thickness of the butts. You can rip them on your table saw.

If the old shingles are in such bad shape that they have to be removed entirely, or if the roof framing isn't adequate, you will have to build up a solid deck for the new roof. This means either repairing the existing sheathing and filling in the gaps, or removing the old sheathing and replacing it with plywood.

Repairing the sheathing involves re nailing loose boards and replacing any rotted or warped boards. Fill the gaps with boards of the same thickness as the old deck. Use sheet metal to cover any large cracks, knotholes, loose knots or pitchy knots. Finally, just before you apply the new roofing, sweep the deck clean to remove all loose debris. From here on in, it's just like installing any new roof.

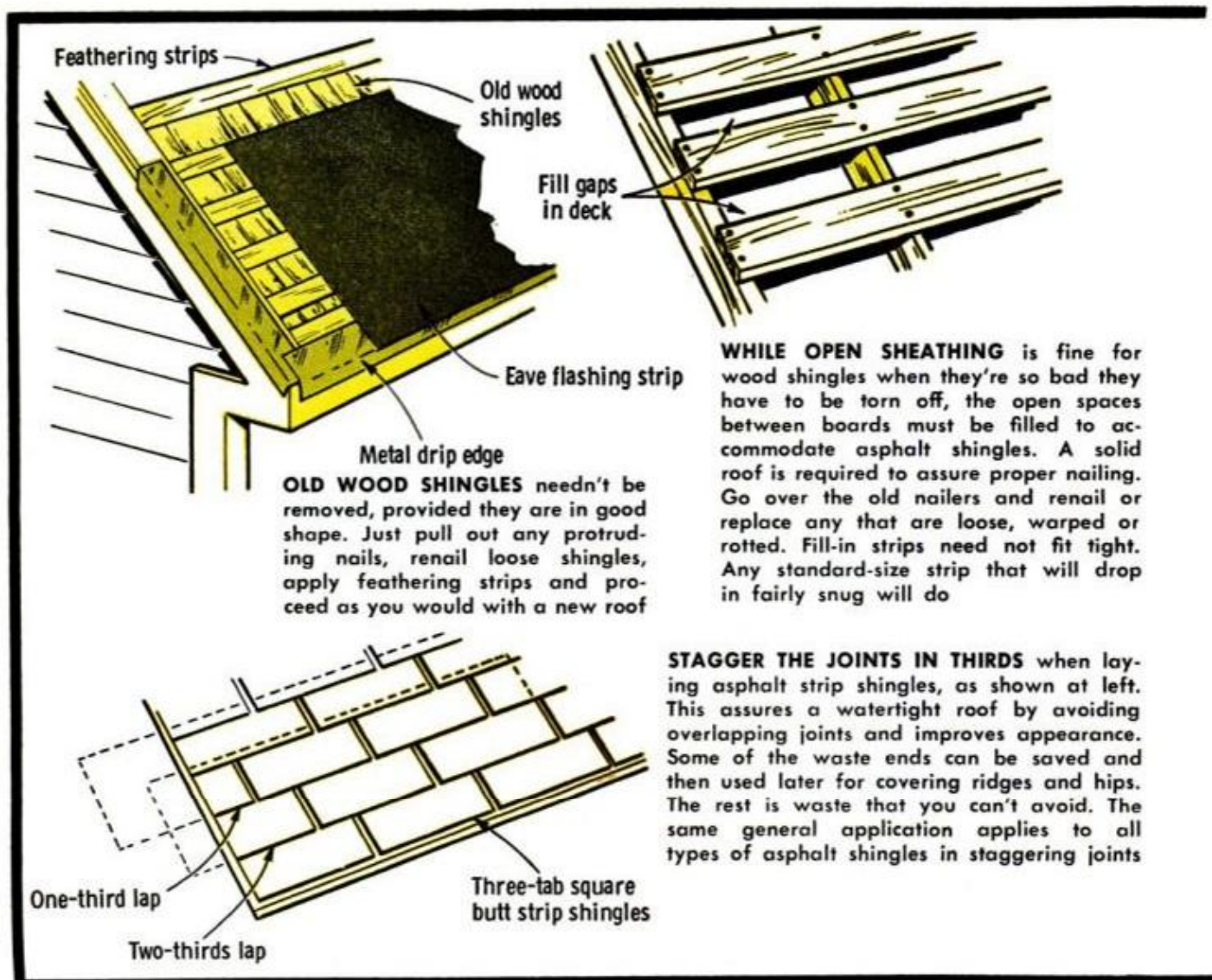
CUT
FOLD
TAPE

ROOFING HOUSE



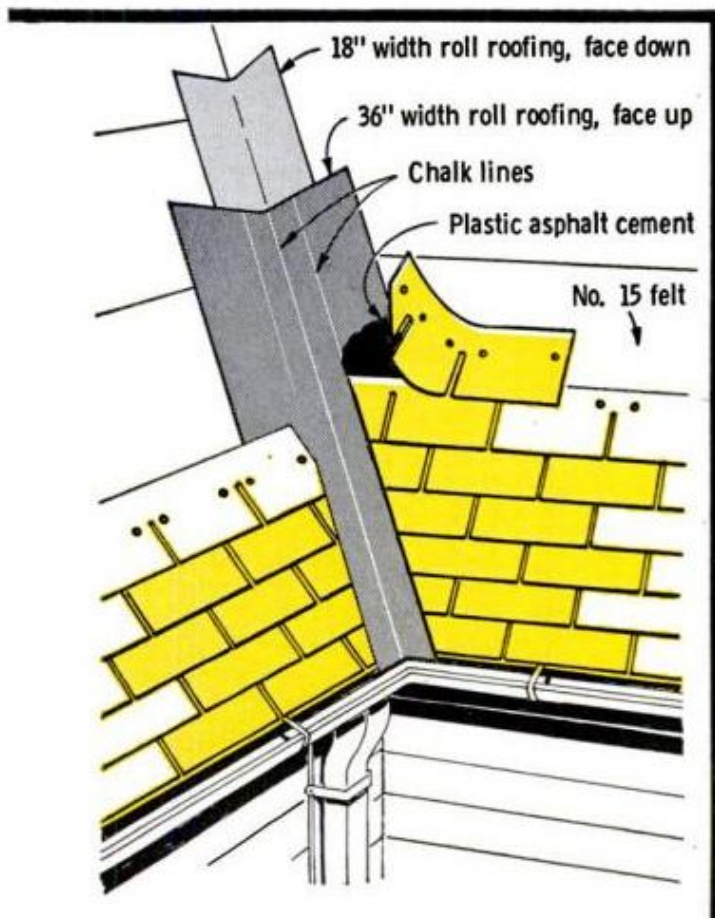
4. The second course is applied right over the solid strip. To maintain overlapping joints, start with a shingle from which one tab has been trimmed. Use one roofing nail at each end of each strip shingle, and one nail over each slot. Drive them just to the surface of the shingle; don't try to set them *into* the shingle.

5. To avoid unnecessary walking, start working at one corner and fan out from there, installing the shingles in step-like progression. Start each successive course with a shingle one tab shorter than the one directly below it so that the joints will always be staggered. First courses are best applied from scaffold.





6. Shallow pitch of this roof made use of ladders unnecessary. However, a 2x4 was mounted down near the edge of the roof (see drawing at right) to keep tools from rolling off. Ridge is covered with single tabs bent lengthwise to extend 6 in. down either side with approximately 5 in. of each one exposed.



TYPICAL OPEN-VALLEY flashing involves running courses of shingles up to guide line chalked on roll roofing lining valley. Shingle ends are trimmed to fit and cemented to the roll roofing

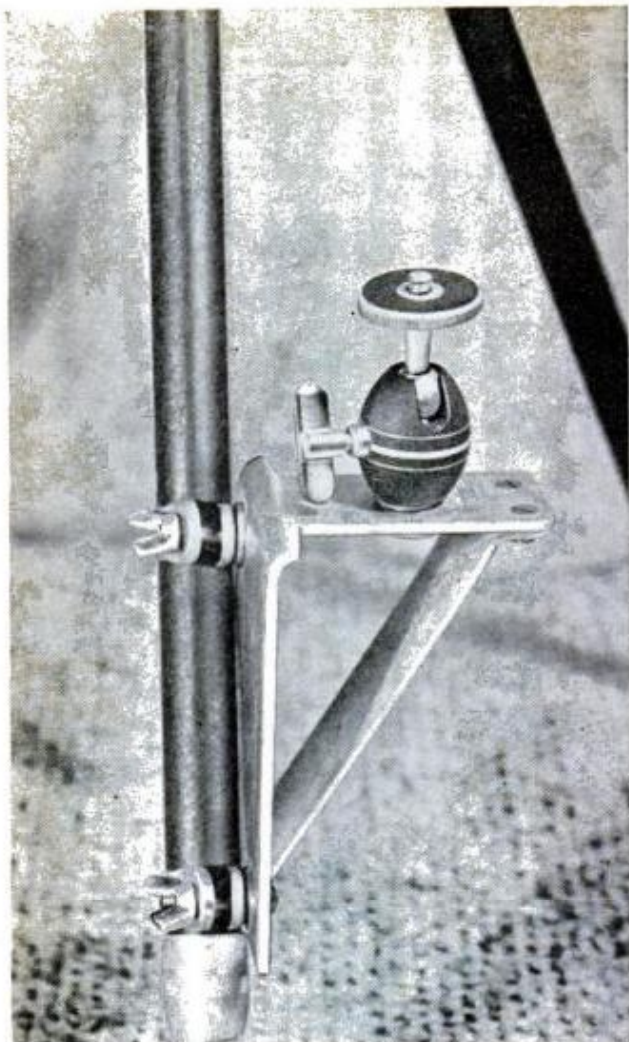
TOE BOARDS fitted with keyhole-type hangers are moved toward the ridge as the shingling progresses upward by unhooking them from nails under shingles



ASPHALT SHINGLES are not exactly the lightest of things, so, to make it easy on himself, W. P. Crowe of Long Beach, Calif., rigged up this clever shingle hoist. By making use of his extension ladder to provide suitable rails for the platform to slide, he loads the affair with a large stack of shingles on the ground, then climbs to the roof and pulls it up with rope and pulley. Saves many a trip

PHOTO HINTS

To Add to the Fun of Picture Making



ADD A LOW-LEVEL CAMERA SUPPORT to your tripod this way. Bend a bracket from $\frac{1}{8}$ " aluminum or similar stock and fasten it to one tripod leg with hose clamps. Drill the bracket to take a $\frac{1}{4}$ "-20 bolt for a tilt-top accessory as shown.—Fred Bourbeau

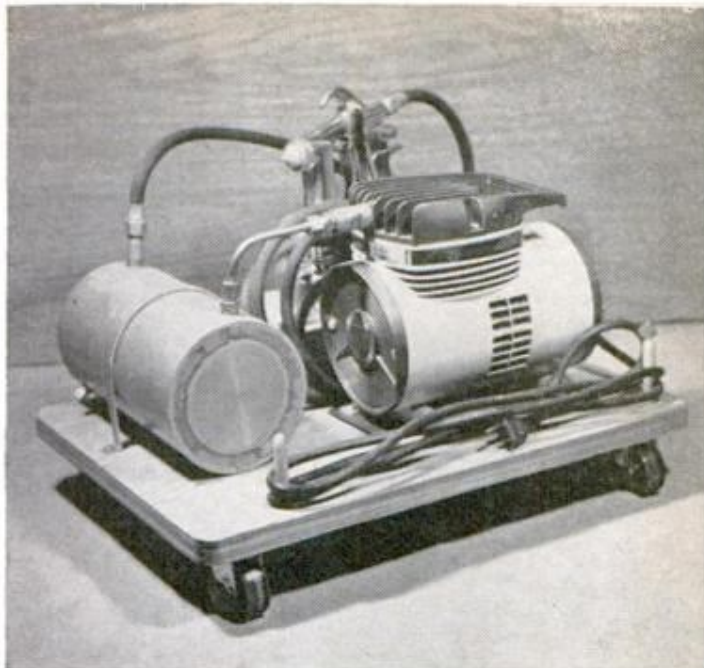
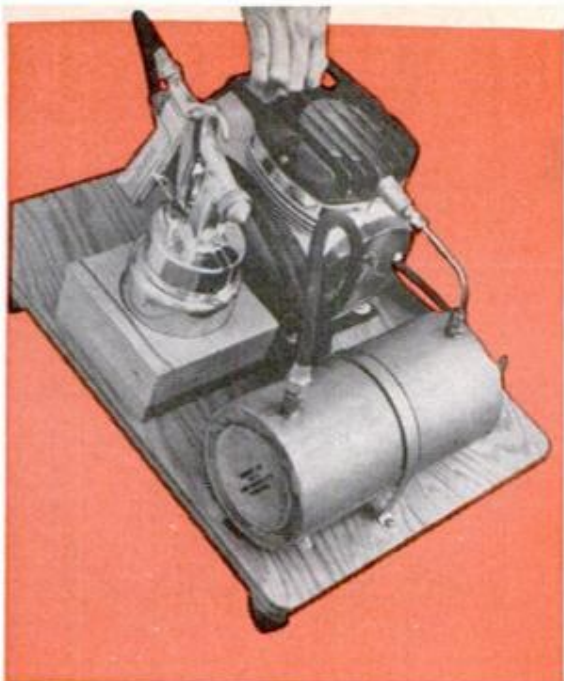
ELIMINATE CLOSE-UP PROBLEMS with a twin-lens reflex like this. Cement a cardboard target to coat-hanger wire, and bend the wire so the target's center and the bend point are the same distance apart as the lens centers. Tape the bend to mark it clearly. Compose the picture as usual, then place the bend mark at the middle of the object and raise the camera until you're centered on the target. Remove the target, then focus and shoot.—Michael Burn



STORE UNUSED DEVELOPER in amber beer bottles. These handy, light-safe containers let you take advantage of economical bulk chemicals. They can be sealed with a bottle capper or plastic snap-on caps.

CONSTANT-TEMPERATURE FAUCETS for photo baths are costly. You can get the same effect with an inexpensive hydrometer used to check auto antifreeze. Remove the glass tube containing a thermometer inside. Slip the upper end on your faucet and attach a spray hose to the lower end. Adjust the hot and cold valves until the thermometer inside the tube indicates the correct temperature.—Ray Whitman





HOW TO MAKE A GOOD SPRAYER BETTER

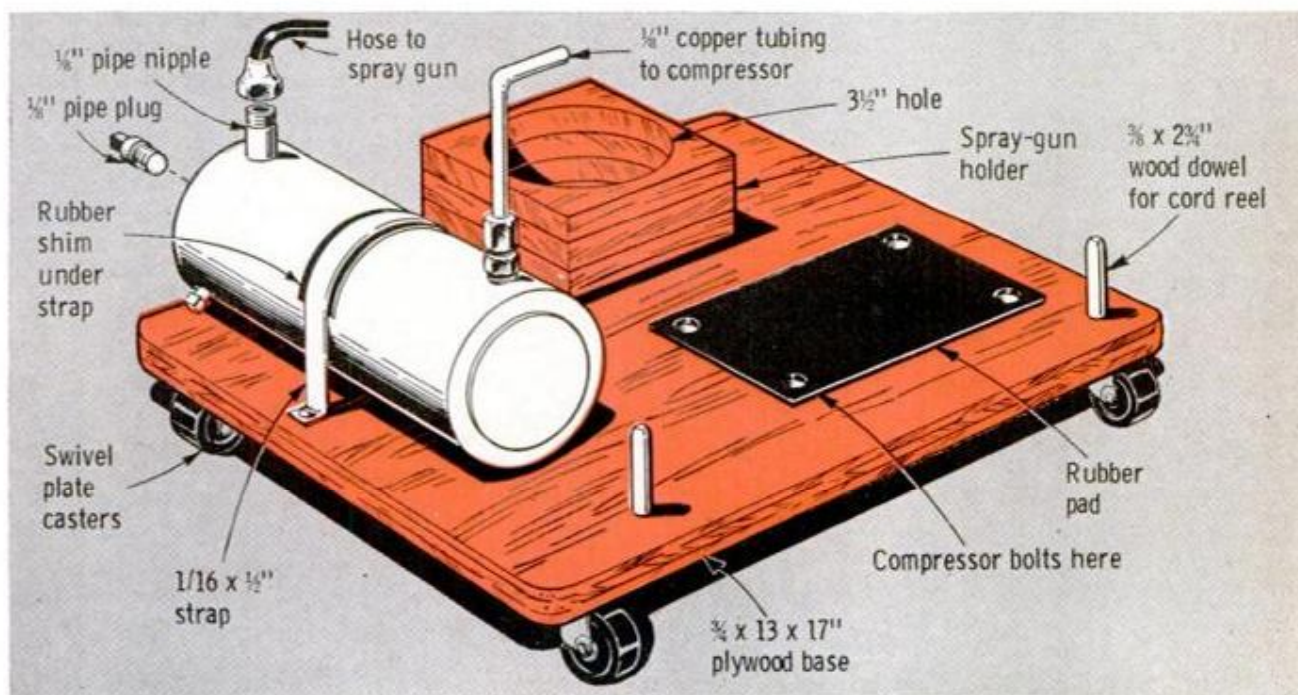
AN AIR ACCUMULATOR added to your diaphragm-type sprayer will improve it two ways: 1. It will smooth out the pulsations that cause the paint to be sprayed in "bursts"; 2. It will prevent the deposit of water droplets on the painted surface.

The accumulator is nothing more than a tank installed between the compressor and the gun to trap moisture and to store air in a sufficient quantity to provide a steady flow to the gun for fine spraying.

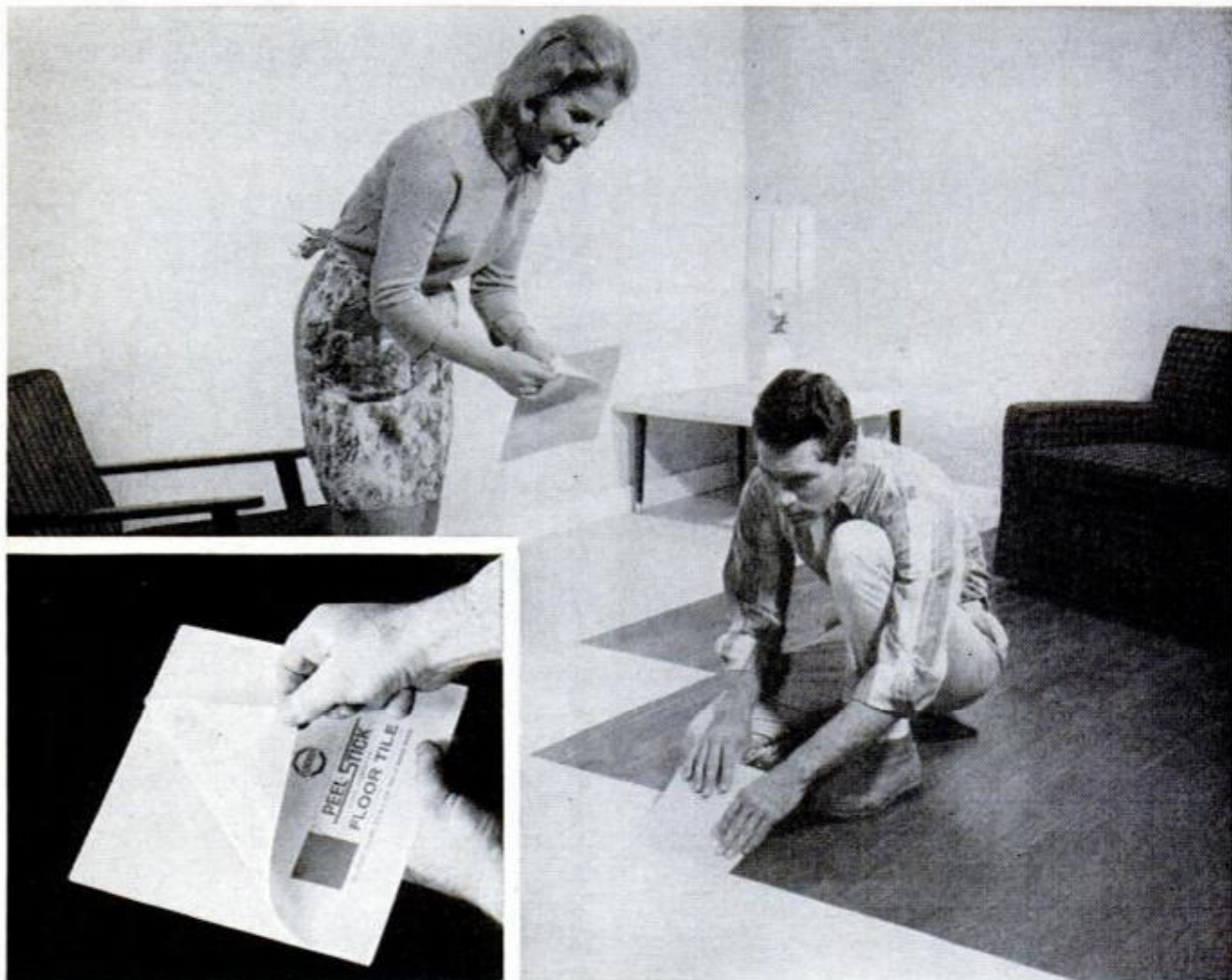
Try your used machinery and equipment dealer for a tank. It should with-

stand at least 20 p.s.i. air pressure. If it doesn't already have a drain, drill and tap it for a $\frac{1}{8}$ -in. pipe plug. The spray-gun hose is attached to a $\frac{1}{4}$ -in. pipe nipple installed in the tank's outlet hole. A $\frac{1}{4}$ -in. male connector compression-tube fitting is installed in the tank's inlet hole. Joint compound is used on both fittings. Tank, compressor and all can be mounted on the dolly detailed to improve a sprayer even more. There's a holder for the gun, which is cut from a built-up block, and pegs for stowing the cord.

—Eugene E. Florida



NEW REMODELING MATERIALS



Self-sticking tile

Messy cement is a thing of the past with Flintkote's new self-adhering, vinyl-asbestos floor tile called Peel and Stick. You simply peel off the protective paper cover on the back (inset) and press the tile in place, without dirtying your hands. The tile can be applied to wood, concrete or old tile floors, comes in standard 9x9-in. squares and is available in 10 textures and colors.

Narrow lap siding

From Masonite comes a new narrow lap siding called Williamsburg-X-ninety, which has a Colonial contoured profile that gives a deep shadow line. Factory-primed, both front and back, this 7/16 x 6-in. hardboard siding comes in 16-ft. lengths and has built-in guidelines to speed application, one for positioning the adjoining lap, another to mark nail locations.



FOR THE DO-IT-YOURSELFER



Textured tapestry

When you run your hand over the floral texture of Marlite's new tapestry paneling, you'll find it hard to believe that it's hardboard and not a fabric covering—the realism is that perfect. This wipe-clean, plastic-finished wall paneling is made in 16-in. tongue-and-groove planks, 8 ft. long. It comes in three colors—green, gold and red—and is cemented to existing walls to add a new dimension to the decor of any room.



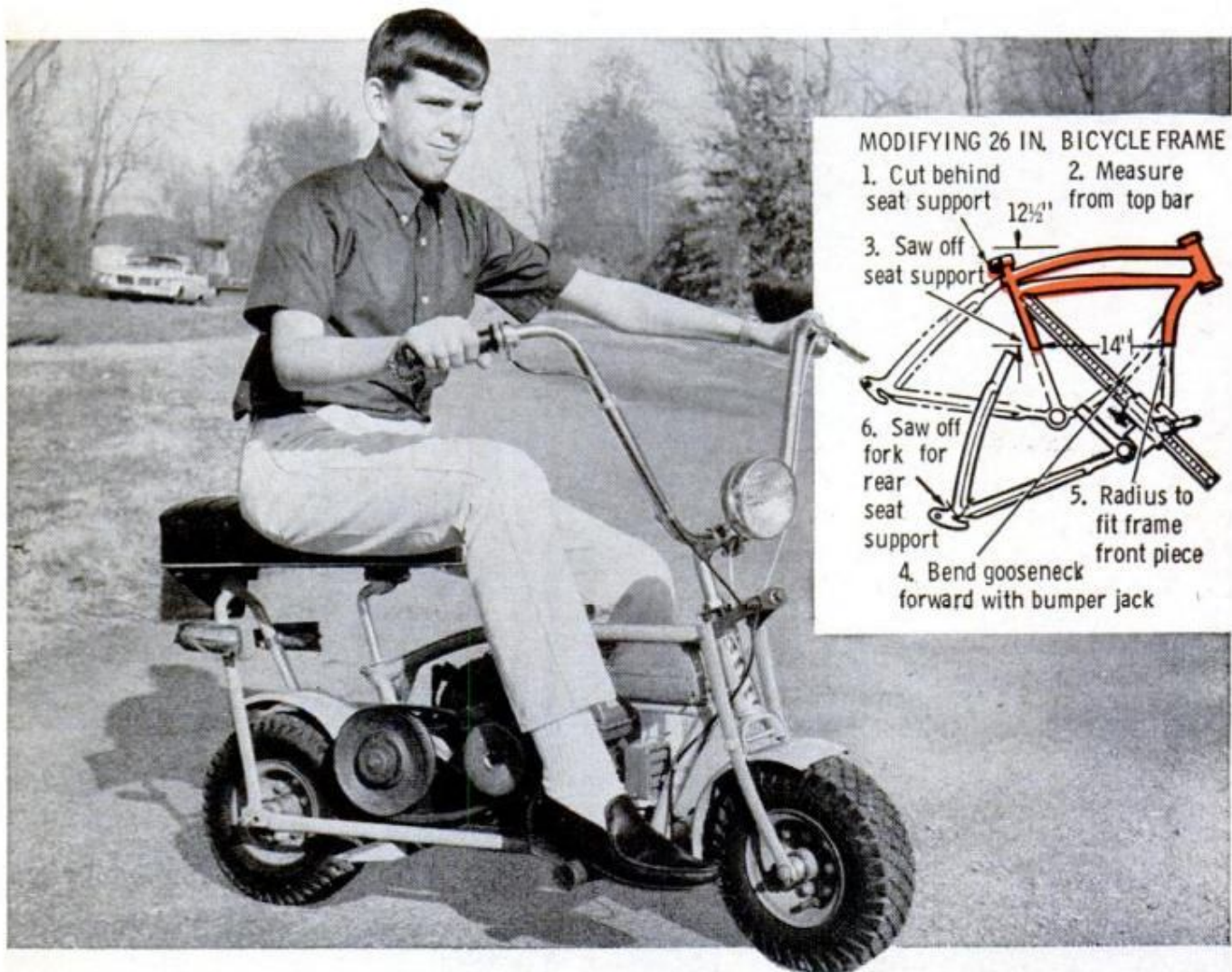
"Quarry-stone" tile

Although it's actually vinyl-asbestos, to the eye and touch Johns-Manville's new quarry tile comes as close to the real thing as you can find. Each 12-in. tile is divided into four squares with a simulated mortar joint all around to create an unbroken wall-to-wall effect. It comes in blue-gray, red and ivory.



Take a small kart engine, add a slick variable-ratio belt transmission and you'll have a real performance 'bear' for half the cost of a commercial motor scooter

Build



FLAT OUT, this scrappy little motor scooter will hit up to 32 mph on a straightaway. When you come to a grade, it automatically downshifts to a lower drive ratio to give you rugged hill-climbing power. Although designed around a modest $2\frac{3}{4}$ -hp engine, its variable-speed drive enables the *PM* minibike to equal or exceed the performance of many commercial scooters selling for twice as much. In most states, it can be licensed for road use with no difficulty.

The best part is the machine's lightweight, low-cost design. The basic frame comes from a discarded 26-in. boy's bicycle, which you can usually pick up for a few dollars at a bike shop or junk yard. Most of the parts are stock bike or kart items, easy to come by and easy to assemble. Even if you start with a new engine, the entire scooter can be built for \$100 to

\$120. With a used engine, the cost is considerably less.

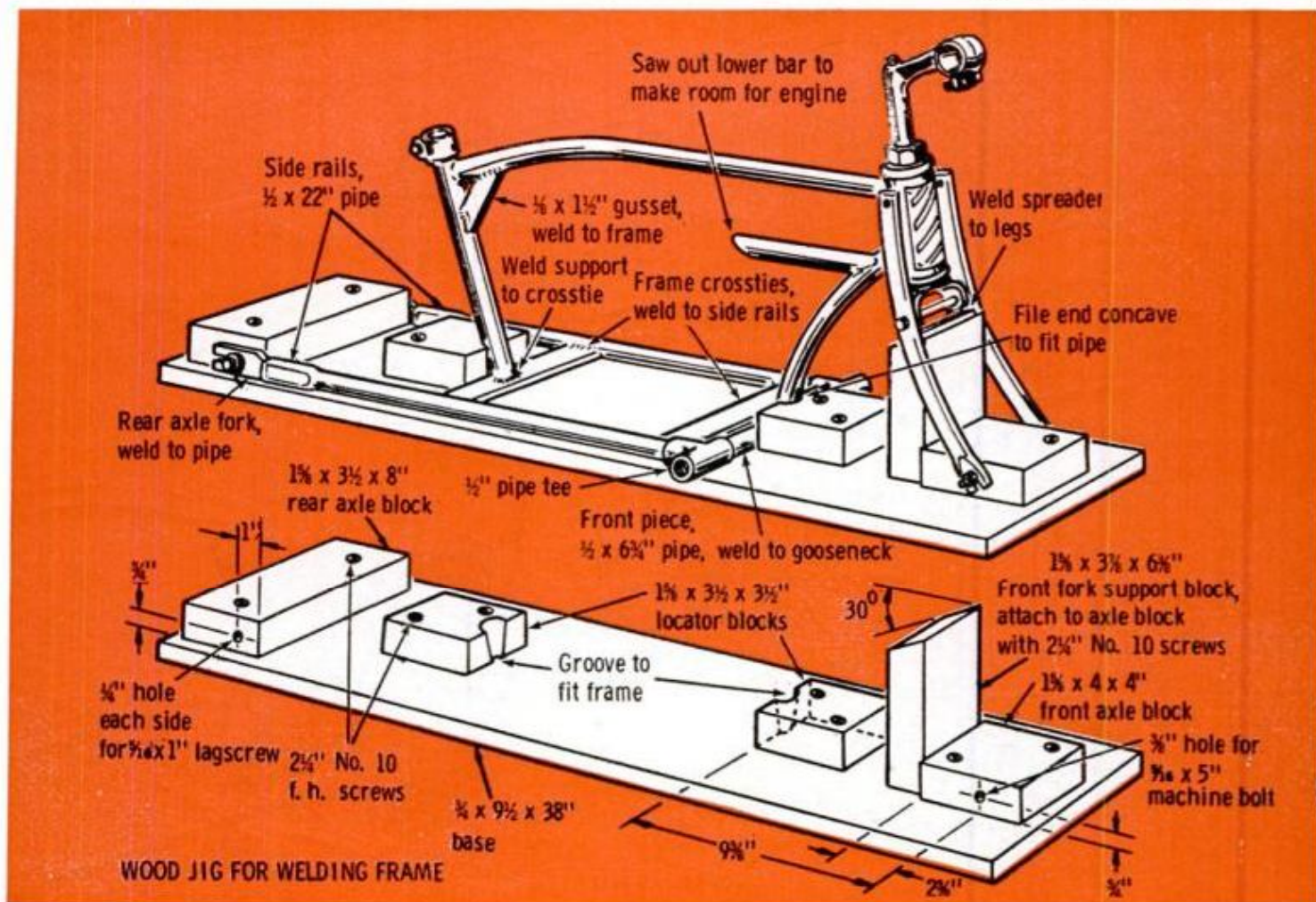
Special features include a two-passenger cushioned seat, a motorcycle-type twist-grip throttle and a novel, spring-action front fork made by modifying the conventional bicycle fork. The automatic belt transmission includes not only a centrifugal clutch but also a variable-diameter pulley system that adjusts drive ratio to load. For road use, lights and a horn can be added.

Start by cutting the bike frame so you come out with the portion shown in color in the drawing above. It's necessary to bend the "gooseneck" section of the frame forward to make room for the engine. This can be done with a bumper jack as shown. Bend carefully to avoid flattening the tubing. Heating with a propane torch will make the job easier.

Yourself a Minibike

Technical art by Donald A. Evans

By LYLE GILLIOM



Remove the rear fork as shown, but don't throw it away. It becomes the rear support for the double seat. After bending the gooseneck forward, cut it and the seat post so they are both 12½ in. long as measured from the top bar. Their ends should be spaced 14 in. apart.

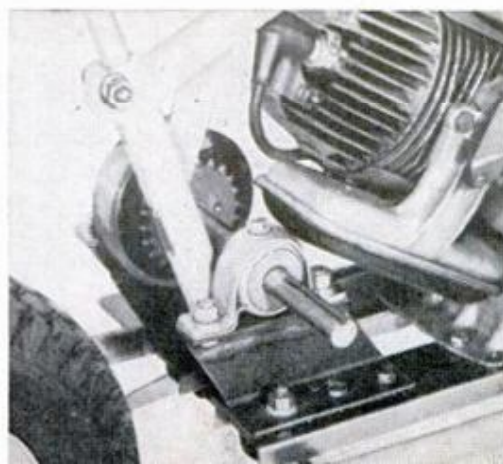
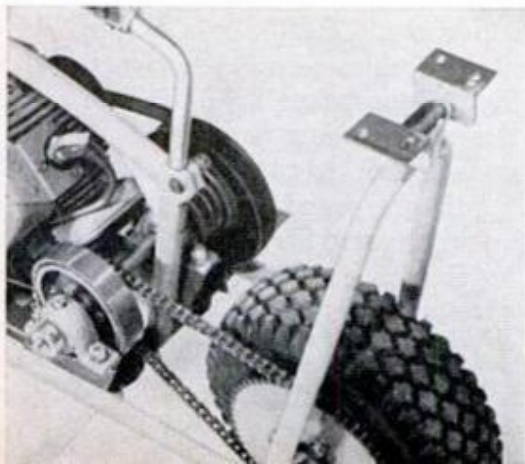
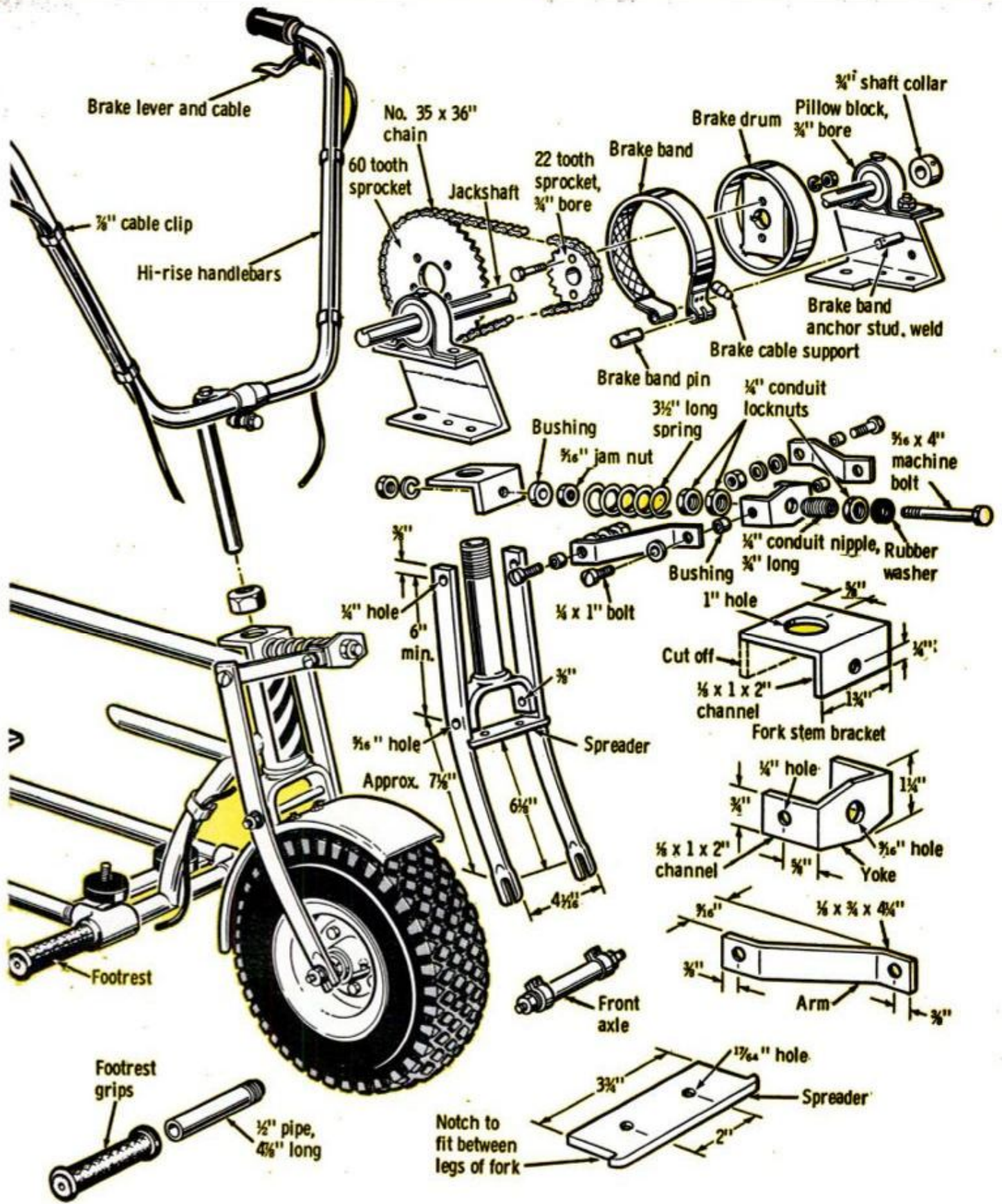
The next step is to make the simple wood welding jig shown above. This holds all the parts in correct alignment and makes assembly easy. It's especially handy if you don't do your own welding since you can bundle the entire jig off to a local welding shop and have all the parts set up and ready for a quick job.

The lower part of the minibike's frame is made from ½-in. pipe. You'll need two 22-in. lengths for the side rails, each threaded on one end, one 6¾-in. length threaded on both ends for the front crossbar, and two 4⅞-in. lengths threaded on

one end for the footrests. Cut the rear forks from ¼x1-in. bar stock, flatten the ends of the pipe side rails, and insert the forks in the flattened ends.

The spring-action front wheel is made by cutting the legs off a regular bike fork just below the post, leaving a stub fork. Bolt the legs to this stub fork as shown, with the spreader bar inserted between them. The upper ends of the legs, which now extend above the fork, are anchored to a spring that bears against a plate on the steering column. As the legs pivot on the fork, they compress the spring, giving the front wheel a soft, cushiony suspension.

Fasten the front and rear forks to the blocks on the jig, and you are now ready for welding. Shape the crossties as shown for a close fit inside the side rails. For clean welds, remove the paint from all weld points. Tack-weld all joints to hold



MINIBIKE

the assembly rigid, then remove the frame from the jig to complete the welding. Tack-weld the threaded joints at the tees to prevent their twisting.

Wheels and axles

Recommended wheels are the pneumatic kart type 4.10/3.50x5 in. (11½ in. in diameter). You could also use 4.10/3.50x4-in. wheels. The front wheel has a 4-in. centered hub. The rear wheel should be of the type that has an extended hub and mounting flange on one side to attach a drive sprocket.

The axles are ¾-in. cold-rolled steel. The front is 5¹³/₁₆ in. long overall, and the rear is 9¾ in. long. The ends on both are turned down for a length of 7/8 in. and threaded 3/8-24 for mounting in the forks with 3/8 in. nuts. Use ¾-in.-diameter shaft collars to position the wheels on the axles. (For convenience, if you'd prefer not to make the axles yourself, they can be purchased ready to install from Gilliom Mfg. Co., 1109 N. 2nd St., St. Charles, Mo. 63301. Also available from Gilliom are the parts for the spring-action front-wheel fork.)

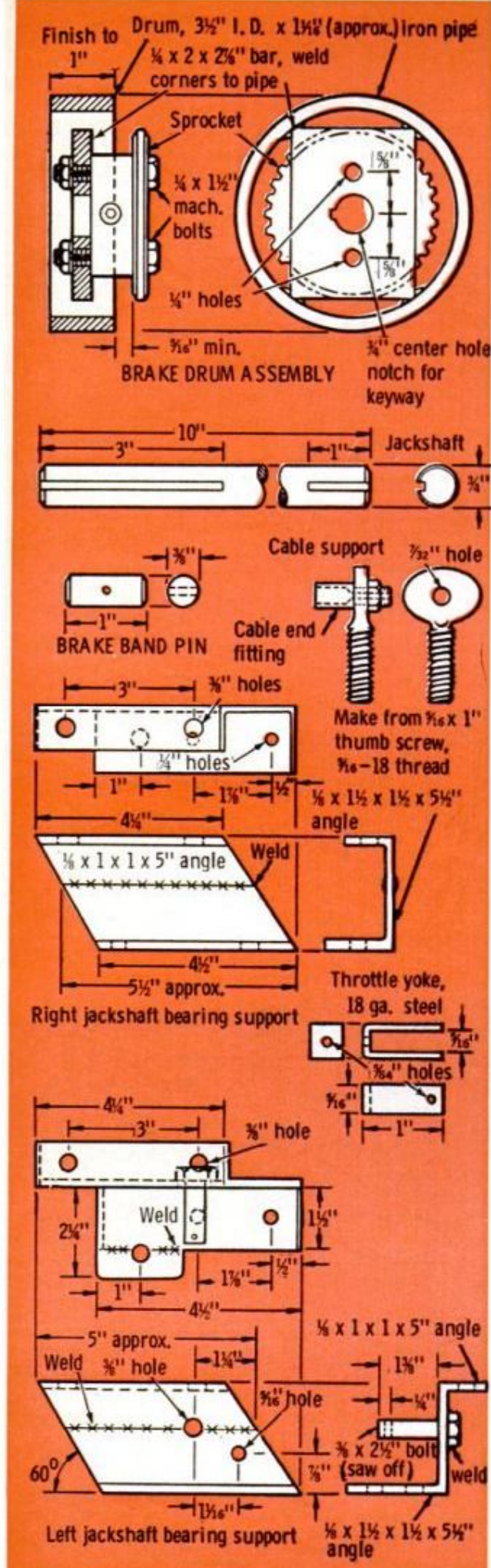
Engine and jackshaft

The engine-support rails are formed from 18-gauge sheet metal as shown. Any furnace or airconditioning sheet-metal shop can bend these up for you. Drill 3/8-in. holes at the ends of the rails to match the holes in the cross ties. Do this *after* the frame has been welded to insure precise positioning. The rails are mounted on 3/4-in.-thick rubber pads that serve as shock mounts to cushion engine vibration. You can purchase commercial mounts or run headless bolts through thick rubber pads.

The two jackshaft supports are each made from one piece of 1/8x1x1-in. steel angle and one piece of 1/8x1½x1½-in. angle welded together as shown in the detail drawings. Note that the two sizes of angle are joined to form a channel for the right-hand support and to form a Z-shape for the left-hand support. The Z-shaped left support also requires a 1/8x3/4-in.-wide extension welded to the base. A 3/8-in. bolt welded into the support forms a stud to anchor the brake band. A cotter pin and washer hold the brake band on the stud.

The two jackshaft supports are positioned flush with the rear ends of the

(Please turn to page 210)



HINTS FROM READERS

Squeeze-bottle water boy

When your plastic squeeze bottle of talcum is empty, don't throw it away. Filled with water, it will throw a stream five feet when squeezed, which, right away, makes it useful for a number of things. It's great for wetting down anything, fine for watering plants, and even makes a handy "poor-man's" windshield squirter which can be kept in the glove compartment. As a toy, it beats any water pistol for it will hold a pint of ammunition. Since the cap is sealed on, the bottle is filled by squeezing it and then siphoning water through holes in the cap.—*Joseph Braunstein*



Free brush holder

When you feel like taking a breather and lighting up a cigaret during a painting session, the brush usually ends up across the top of the paint bucket. This is fine until you go to reach for it again, and find the handle messed up with paint. Here's where a foil-lined, instant-food envelope comes in handy as a clean place to park the brush while taking ten. In fact, you can pour a little turpentine in it and use it as a place to store the brush overnight. A couple tabs of tape will hold the envelope securely to the can.



NEXT MONTH IN SHOP AND CRAFTS

THREE HIGH SPOTS FOR A HOBBY ROOM. Adaptable to many needs, these clever multi-purpose units are designed to pack a lot of work and storage space into a small area. You can build any one or all of them individually to fit the room you have. Includes three-way hobby bench, desk and dining table, a storage wall with shelves, drawers and snack counter and a quick-change sofa, guest bed and cedar chest.

DON'T SELL YOUR BANDSAW SHORT. Many bandsaws stand around doing nothing more than they should, mainly because their owners don't give the tool a chance to show what it can do. In continuing our series in getting the most from your shop tools, a July Toolsson puts you wise as to how this wallflower machine can join in to help make woodworking a ball.

WEEKEND PROJECTS FOR YOUR YARD AND PATIO. Maybe you've been wanting to build a sunken barbecue pit, an Oriental shade screen and bench, a wooden patio. If so, you'll want to take a look at the group of yard and patio projects we have for you in July. There could be one that will please your fancy.

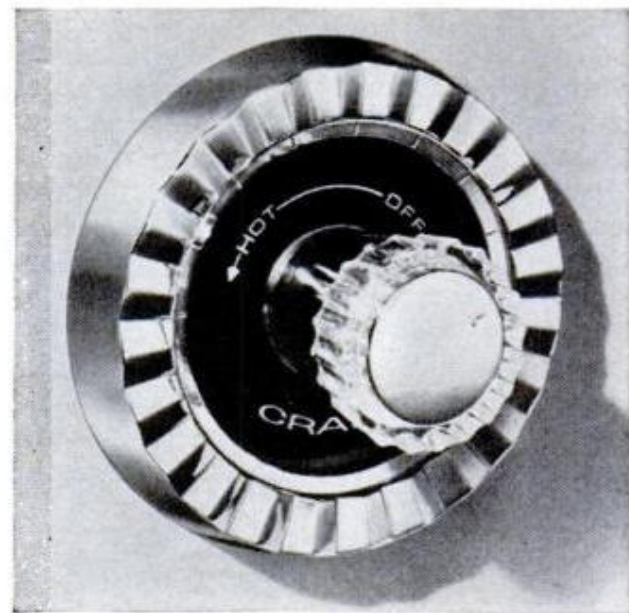
TUNING YOUR OUTBOARD FOR TOP SPEED. This informative boating piece in July contains a collection of tune-up tips aimed at getting the best possible top-end performance from your stock outboard. Though not a guide to setting up a motor for racing, it outlines some of the simple things you can do to "open up" a stock powerplant.

EXCITING NEW PRODUCTS

By CAROL SCHULTZ



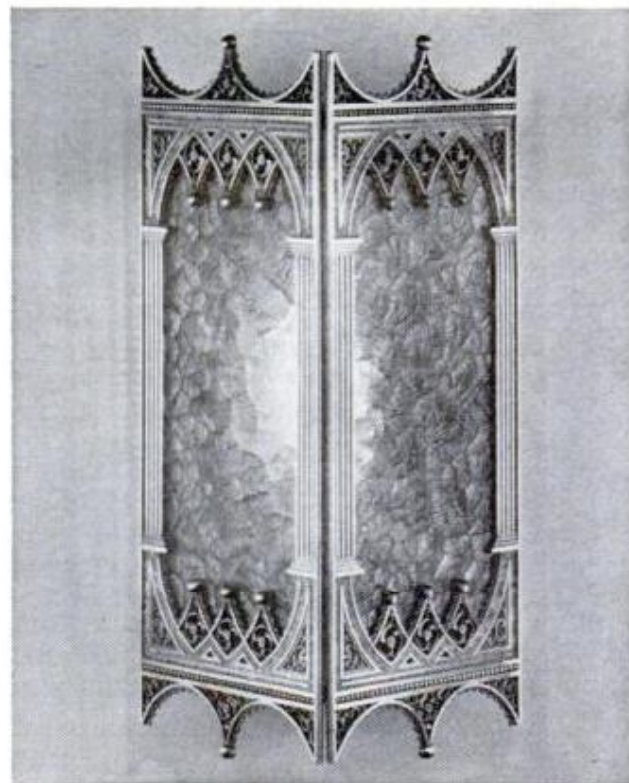
FOOD-PREPARATION CENTER includes attachments for blending, beating and juicing in a compact cabinet with carving-block top. Can be built-in or rolled anywhere. Console model \$199.50 complete. By the Ronson Corp.



SHOWER VALVE eliminates sudden bursts of hot or cold water by instant reaction to a pressure change. If the cold water supply fails, hot water is shut off, too. Under \$50. By Crane Co., 4100 S. Kedzie Ave., Chicago

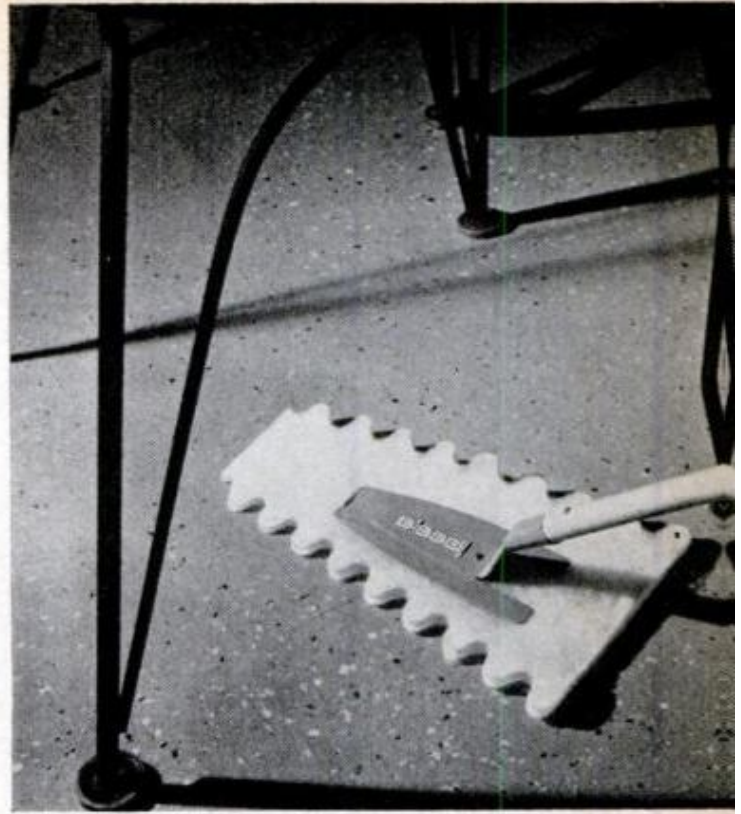
McCULLOCH'S 16-IN. CHAIN SAW is first completely assembled saw that's "ready-to-use" when you get it. Comes with clip-on guard, spare sparkplug, extra chain, tool kit. Under \$240. McCulloch Corp., Los Angeles

LIGHTED DOOR CHIME has a richly designed cast-metal frame with an antique brass finish. The soft light glows through amber, translucent panels. \$18.90. By Nutone, Madison and Red Bank Roads, Cincinnati, Ohio



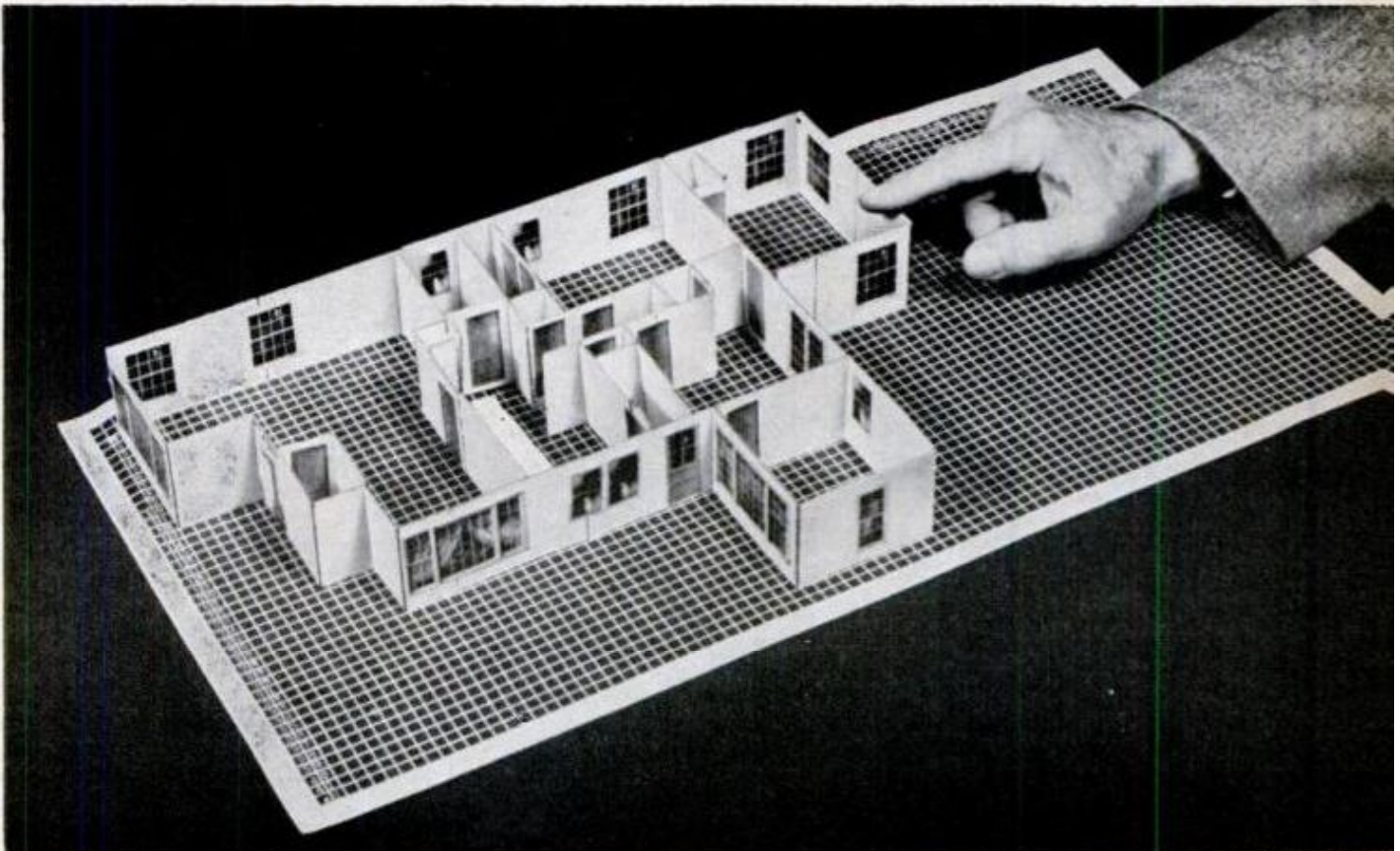


SCRATCH REPAIR FOR TEFLON renews the nonstick quality of scratched Teflon in one application. Simply brush the liquid over the scratch. 98 cents. Magic American Chemical Corp., 14215 Caine Ave., Cleveland, Ohio



"DISPOSABLE" DUST MOP with throw-away cleaning pads made of spun cellulose not only picks up dirt and dust, but also hard-to-get thread and hairs. Costs \$2.49. Refill package of three pads, 89 cents. By Bissell, Inc.

HOUSE-PLANNING KIT contains dozens of partitions, doors, windows, cabinets, all made to same 1/4-inch scale as blueprints. Gives you a perfect three-dimensional idea of how everything will look. \$3.95. By the Louis J. Falce Co., 7317 Lamar Dr., Springfield, Va.



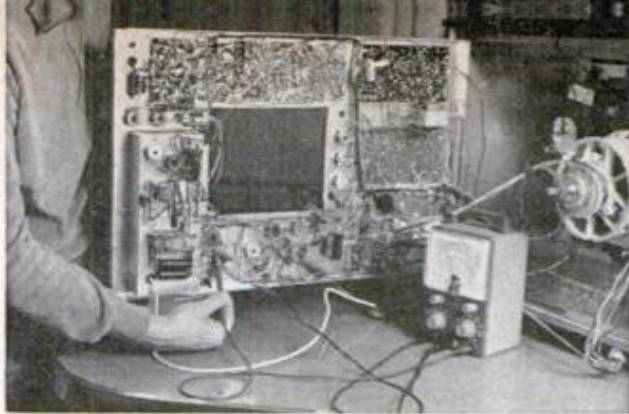


TWO NEW TV KITS FROM HEATH

One of the best color TVs on the market and one of the latest state-of-the-art portables are shipped in pieces. Can you put them together?

By BILL HARTFORD, PM Electronics Editor





COLOR-SET BUILDERS should own a vacuum-tube voltmeter to check power supply before turning on set and for troubleshooting after building, if necessary



YOU USE BUILT-IN DOT GENERATOR and convergence board to align red, green and blue dots one over the other, giving a resultant white dot for perfect color



YOU DEGAUSS CHASSIS and color tube initially with coil supplied with the GR-180. Thereafter, automatic degausser does the job whenever the set's turned on

ONE KIT is a 180-sq.-in. (19-in.) color set that tips the scales at 80 pounds and \$379.95. It can be built into a wall, housed in a versatile \$49.95 walnut cabinet that can be used with or without its set of legs, or mounted in a console-type early American cabinet that's \$75.

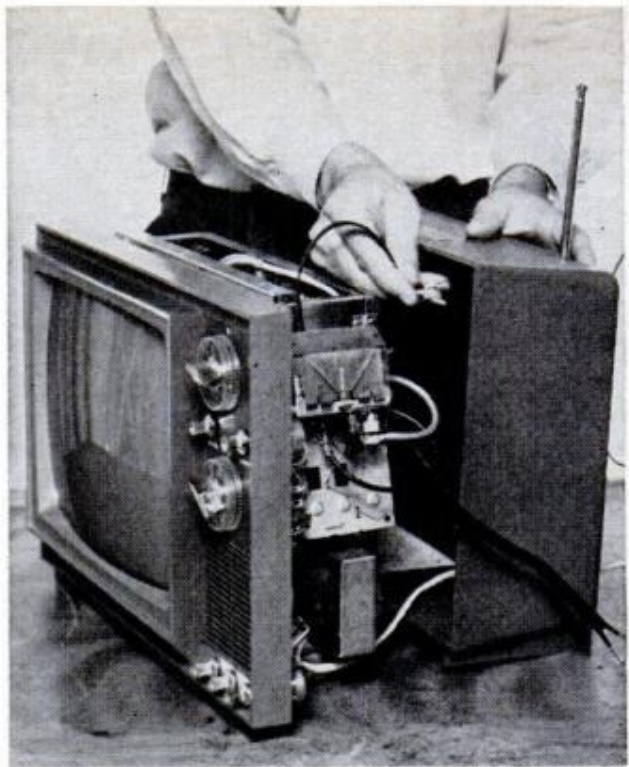
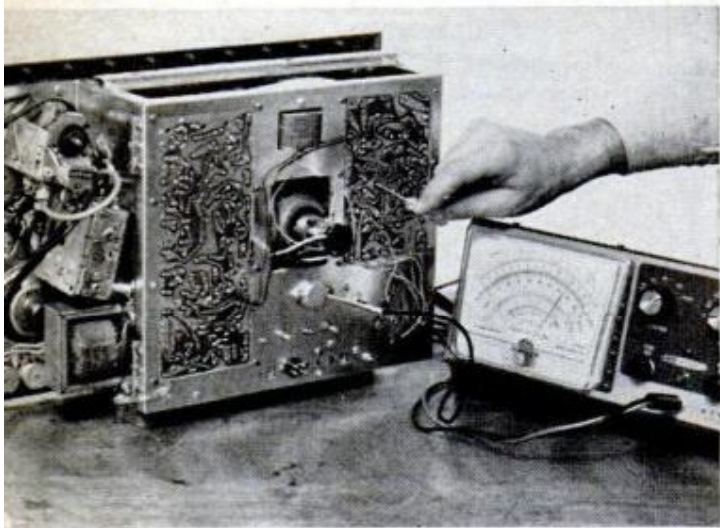
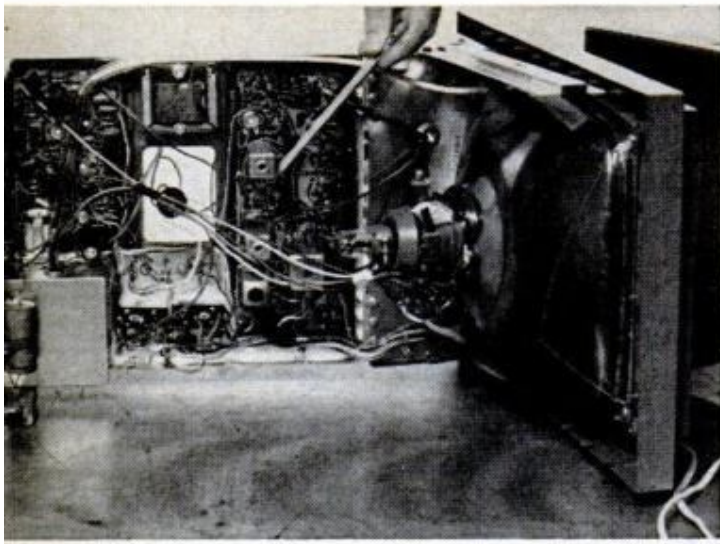
The other kit is a 74 sq.-in. (12-in.), 20-pound portable that's really portable in the true sense of the word. It operates on 117 v.a.c., on a 12-v. boat or car battery, or on its own battery pack, which adds an extra \$39.95 to the set's base price of \$119.95.

These are the bare facts and about all the facts you'll get shopping for a color or portable TV in the "pay your money and take your choice" atmosphere of a large showroom. With either of these kits, however, you'll get all the facts plus specs and theory from the assembly and operation manuals. Each manual actually consists of an elementary TV technician course. And you should study this course to understand how the receiver you're going to build will pull in next week's ball game.

The more you know about your TV, the better qualified you'll be to get it working and keep it working.

There's the rub with a TV in kit form: If you're not inquisitive enough to take the elementary course in the theory of TV reception, not ready to wield the leads of a vacuum-tube voltmeter to find a little bug, or not ready to put in a little time after construction to adjust your set for the best possible picture, then you'd best go to the store and buy a set that's ready to go. *Anyone* can build these kits, but enthusiasm helps in following through.

The color set: The Model GR-180 will probably be the most monumental and enthusiastic undertaking of your kit-building career. Although you start the kit simply by preparing three printed-circuit boards, you quickly move on to extensive chassis wiring. Unlike the conventional horizontal chassis, the main chassis of the TV is actually a large hinged door on which almost all components and assemblies are mounted. The chassis swings open for access to the picture tube, UHF



UHF AND VHF ANTENNA LEADS are connected to antenna terminals (above) as the final step before sliding the compact chassis into its plastic case

INTEGRATED CIRCUIT in the portable (upper left) does the job of 12 transistors, 12 diodes and other components in amplifying and detecting audio signal

ADJUSTMENT OF VOLTAGE REGULATOR circuit is most accurately made with v.t.v.m. (left), although bias can be set without it by referring to image on screen

and VHF tuners and controls mounted on the front panel.

The preassembled and aligned portions of the receiver include the IF circuit board, tuners and horizontal output assembly that encloses the high-voltage rectifier and regulator tubes and circuits where 24,000 volts are generated for the color picture tube. If you're nervous about fooling around with 24,000 volts, don't be. Just follow Heath's instructions and observe the rule of keeping one hand in your pocket when working around high voltages and you'll have no problem with that voltage getting under your skin.

As shown in the photos, all tubes are accessible from the outside of the chassis for convenient replacement when necessary. The convergence board is connected to the chassis and picture tube yoke by means of a long harness that allows you to position it where it is accessible from the front of the TV. This lets you make the dynamic convergence adjustments while closely observing the dot pattern on the face of the tube.

The dot pattern is generated by the set's built-in dot generator. This feature allows you to converge the beams from the red, green and blue guns over the face of the picture tube without owning expensive test equipment or buying the expensive time of a TV serviceman.

All black-and-white and color adjustments are within the ability of any PM reader who follows the instructions in Heath's manual. The manual includes a complete color section that shows normal and abnormal reception and dot patterns for making all adjustments.

There's only one word to describe the final stages of construction and the beginning of the adjustment procedure for the color set: exciting! The first "picture" that jumped onto my screen, however, was something less than intelligible. A single red, green and blue line running across the screen, however exciting after viewing black-and-white TVs for the last 20 years, was not what I bargained for after putting in slightly more than 25 spare-time hours

(Please turn to page 176)



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Taller than king size.



EARTHQUAKES TO ORDER

(Continued from page 81)

the shores of the Pacific Ocean. And, knowing where quakes are likely to occur, builders can avoid the use of dangerous sites and building materials and designs that would be vulnerable to earthquake damage. For example, the U. S. Geological Survey in 1959 issued a report warning that there were earthquake hazards in Anchorage, Alaska. The report pointed out that, because of a plastic clay formation underlying the city, big landslides could be triggered by an earthquake. Builders ignored the warning, according to Dr. W. T. Pecora, director of the survey, and the Good Friday earthquake of 1964 sent giant blocks of clay formation sliding seaward.

Out of sight, but not gone

Dr. Pecora adds that many California residents have taken an "out of sight, out of mind" attitude toward earthquake dangers in the San Francisco area along the San Andreas fault. The fault, which extends nearly 600 miles to the border of Mexico, is a major fracture of the earth's crust, extending 20 miles beneath the surface. The land on the ocean side of the fault is sliding northwestward from the rest of the state at a rate of two inches a year.

An offset in a fence line near San Francisco had shown more than eight feet of lateral movement along the fault. Bulldozers smoothed over the surface of the fault so a housing development could be built on the land. But the San Andreas fault is still there, beneath the new houses, and it is very similar to the North Anatolia fault responsible for the disastrous earthquake of Aug. 19, 1966, near Varto, Turkey.

A presidential commission headed by Frank Press of the Massachusetts Institute of Technology has recommended a 10-year program costing \$137 million to achieve an earthquake-predicting system that would approach the accuracy of weather forecasting. Other earthquake-research projects presently directed toward improved forecasting and reporting include:

- Use of the Earth Resources Observation Satellite (EROS) equipped with remote sensing devices and telemetry to analyze faults and other surface features associated with changes in the structure of the earth's crust.

- New instrumentation including lasers that can detect a change in land elevation of as much as a quarter of an inch over a 10-mile span, tiltmeters, and gravity and

strain gauges to record bending and compressing of subsurface rock.

- A supercluster of 525 instruments distributed over a 150-square-mile area of Montana sensitive enough to detect an explosion of 200 tons of chemicals in the Atlantic Ocean.

- Establishment of a National Earthquake Information Center at Rockville, Md., on the northwestern outskirts of Washington, D.C., with an early-reporting system linked with reporting stations in many parts of the world.

Since there is nothing man can do to prevent earthquakes, he must learn to live with the problem and avoid hazardous building practices. Although the San Francisco earthquake of 1906 has been used many times as a classic example of the kind of destruction that can be caused by a tremor of major magnitude, the Geological Survey contends that much of the damage of that quake could have been avoided. With a little Monday morning quarterbacking, the survey points out that earthquakes had occurred in the San Francisco area previously and that one had been of about the same magnitude as the 1906 quake. And the buildings suffering the most intense damage were erected on filled or "made" land near the foot of Market St., whereas buildings on solid rock suffered little or no damage.

Buildings that can take it

Aside from locating future buildings on safer ground, the best defense against earthquake damage is to build structures that can resist the stresses and strains of great earth shocks. That earthquake-proof buildings are possible was demonstrated during the 1923 tremors that struck the Tokyo area, shattering 250,000 homes. Nearly all of the multistory buildings in the city were damaged. The exceptions were the Imperial Hotel, designed by Frank Lloyd Wright, and buildings designed by Tachu Naito, who reportedly conceived the idea of using partition walls of reinforced concrete slabs after noting that partitioned suitcases withstood rough handling at railroad stations while ordinary suitcases were likely to be smashed.

To design an earthquake-proof building, you need some way of testing your design under earthquake conditions. This has led to a new type of science—machines that produce earthquakes to order.

Prof. Bouwkamp's whirling flyweights at the University of California subject real buildings to earthquake-like shocks. Two of the earthquake machines are

(Please turn to page 174)

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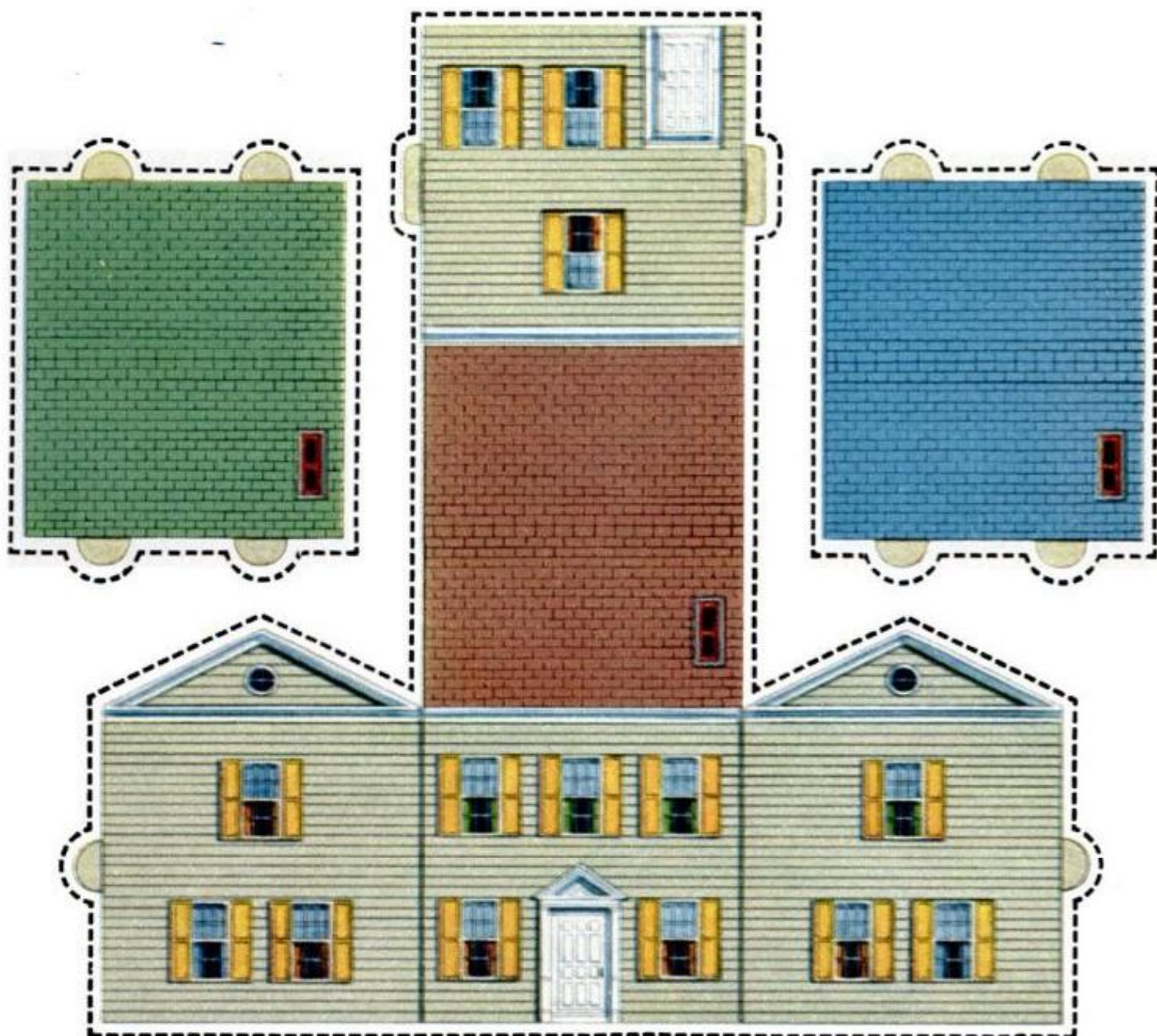
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EARTHQUAKES TO ORDER

(Continued from page 172)

used together in order to produce motion in two directions simultaneously—one along a building's east-west axis and one along its north-south axis. In addition, the spinning weights can be synchronized to produce lateral loads in the same direction at the same time, or they can be set 180° apart to apply torsional loads to the building. By varying the speed of the whirling weights and the ballast they carry, different types of vibrations can be induced.

Better connections needed

A second University of California study is aimed at improving beam-to-column connections in multistory buildings. An inspection of building failures after the 1964 Alaska earthquake showed that the most common structural weakness was the connection between the horizontal and vertical components.

Prof. Egor Popov has been testing beam-and-column assemblies with his own earthquake machine—a powerful double-acting hydraulic jack that alternately applies force up and down in what are called reverse-loading cycles. The jack starts with small up-and-down thrusts that gradually grow larger until the tip of a steel beam moves through a 10-inch arc. The simulated earthquake action induces a strain more than 15 times greater than the maximum elastic strength of the beam flanges. The flanges buckle and the beam eventually cracks.

According to Prof. Popov, steel beams and their connections can withstand a larger number of such reverse-loading cycles than might be supposed. The studies show that moderate flange buckling does not necessarily indicate a failure of the steel connection. In a good connection, the flange will regain its original shape when the strain is relieved.

The height of a building apparently has little to do with the way it will react to an earthquake. In Skopje, Yugoslavia, many small buildings collapsed in a 6.7-magnitude earthquake in 1963, but none of those of 10 or more stories in height failed. Even in San Francisco in 1906, a dozen steel-frame buildings between 10 and 16 stories in height withstood that city's earthquake, and some were still in use a generation later.

Man-made earthquakes in conjunction with computerized research are having an important effect on the height of new buildings. Until recently, skyscrapers were prohibited in earthquake-prone areas like California and Japan because

it was thought that tall buildings could not be made safe from quake damage. Buildings were restricted to 13 stories in Los Angeles, for instance, and even less in Japan.

Today, restrictions on building height are being lifted, and modern skyscrapers are shooting up all over California and Japan. The tallest of the new structures boast 40 stories or more, with promises of 50-story giants to come. Structurally, say experts, there's no reason buildings can't go to 100 stories or more, but economic factors rather than safety may eventually impose practical limits on height. One problem: The vast space eaten up by elevator shafts in tall buildings makes it unprofitable to build structures beyond a certain level. At the moment, the practical limit is thought to be around 50 stories.

Tall buildings actually give more in a strong wind than during an earthquake, according to California consulting engineer G. E. Brandow. A 30-story building, says Brandow, may sway as much as 10 or 12 inches during a strong wind gust. He adds that this is more motion than is likely to be caused by a Southern California earthquake.

What happens to an ordinary house during an earthquake? A study of tremors in earthquake-prone New Zealand shows the most common types of damage are toppled chimneys, with a possibility of bricks or concrete blocks crashing through the roof, and broken plumbing connections.

"Plastic" skyscrapers

One of the newest approaches to the design of earthquake-proof high-rise buildings is called "plastic" design—an improved technique that takes advantage of the reserve strength of steel beyond its yield point. Structural engineers used to design beams and columns so that stresses were kept below specified limits in the elastic range of the material. But, beyond the elastic range, steel still has a substantial reserve capacity, and the new knowledge of this reserve strength is used in high-rise designs.

Much of the research in the plastic design field has come from Lehigh University in Pennsylvania. It was applied originally to steel-frame one and two-story buildings, but now the lessons are being applied to taller structures. At the same time, newer knowledge of metals has enabled engineers to use steel in ways that simply were not possible before World War II. As a result, plastic design structures up to 20 or 30 stories high are in the offing, with no sacrifice of safety. ★ ★ ★

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TWO NEW TV KITS

(Continued from page 170)

over a somewhat impatient two weeks.

But this is the type of setback any kit builder must be prepared for. It usually only emphasizes the fact that when you slough off on all-important visual inspection, you pay for it in troubleshooting time. As Heath very well knows from working with its customers who report having trouble, 90 (!) percent of malfunctioning gear is due to defective solder joints—joints that should have been visually checked and probed more thoroughly than they were.

A quick reference to the troubleshooting section of the color TV's assembly manual will tell you that the horizontal lines that showed up on my screen were due to the absence of vertical deflection, provided by the vertical sweep circuits. The troubleshooting chart goes further into detail and pinpoints specific components that should be checked. I went directly to tube V302, the vertical oscillator and output amplifier, and began checking for the voltages that should be present at the tube socket. By this time, resistor R805 in the plate circuit of the tube began smoking, another indication that the trouble was this tube or its circuits.

As I was touching a v.t.v.m. probe to the cathode of the amplifier portion of the tube and reading zero instead of 60 volts, I spotted a small blip of solder that was grounding the cathode to the foil on the circuit board on which the tube socket is mounted. I had checked this board (with a magnifying glass) after completing the chassis wiring. That blip probably dropped onto the circuit board while I was wiring harness leads into the remaining holes in the board.

The problem was quickly remedied and happily I saw those horizontal lines bloom into a full picture. From here on it was just a matter of following the adjustment procedure systematically to perfect the black-and-white and color images.

Dynamic convergence adjustments do, however, require the touch of an artist. The closer you can come to minimizing color fringing on the white dots across the entire screen, the better the color picture you and your family will enjoy. After I got the hang of it, I received an excellent color picture—the same brilliant, sharp picture that Heath promises.

The black-and-white portable: What has been said about self-servicing in regard to the color set goes equally well for Heath's GR-104 portable. Only with this slim TV, the servicing should be nil once the set's in operation. While any col-

or receiver requires a periodic color convergence adjustment, the black-and-white picture is locked in as soon as you complete the initial adjustments. And future service on the portable, owing to its solid-state design, should be less than with a tube-type receiver that requires occasional tube replacement.

Among the solid-state transistors and diodes, which are not subject to damage from shock as are vacuum tubes, is an integrated circuit (IC) that further increases the reliability and ruggedness that should be expected of a portable design. This latest state-of-the-art device does the job of 12 transistors, 12 diodes, and 15 resistors in processing the sound IF signal, detecting the audio voltage and matching the detector circuit of the IC to the audio amplifier transistors.

Construction design of the portable is similar to that of the color set. A vertical, hinged chassis mounts two printed circuit boards—one comprising the audio-video stages and the other the sync and sweep circuits. Power transistors are mounted on the chassis, which also serves as a heat sink, and the tuners, controls and speaker are mounted on the front panel.

Construction of the portable was quick and simple from start to finish. Upon completion, however, fine tuning on the VHF tuner was found to be very stiff, and my first reaction was to suspect it was somehow binding in its mounting on the front panel. But the stiff tuning was found to be peculiar to this tuning mechanism.

The VHF and UHF tuners get their signal from two built-in antennas—a VHF telescoping whip and a UHF loop that hugs the back of the set. Both provided excellent reception 40 miles from New York City transmitters. The black-and-white picture was clear and sharp.

Despite the praise for picture quality of this little set, it wasn't achieved immediately after construction due to a single defective diode. The defective diode, D101, which follows the third video IF stage, caused a very weak dark picture when the portable was first turned on. Replacing it restored normal contrast.

It should be noted that this defective diode was found only by using an oscilloscope and v.t.v.m. To best avoid the problem of hunting out this type of difficulty *after* building the GR-104, I would suggest making a quick check of the transistors and diodes as you are building the kit. It's easier to detect a bad semiconductor before you wire it in than to find it by troubleshooting. Parts are warranted and, if necessary, you can send for a replacement or pick one up at a Heathkit service center. ★ ★ ★

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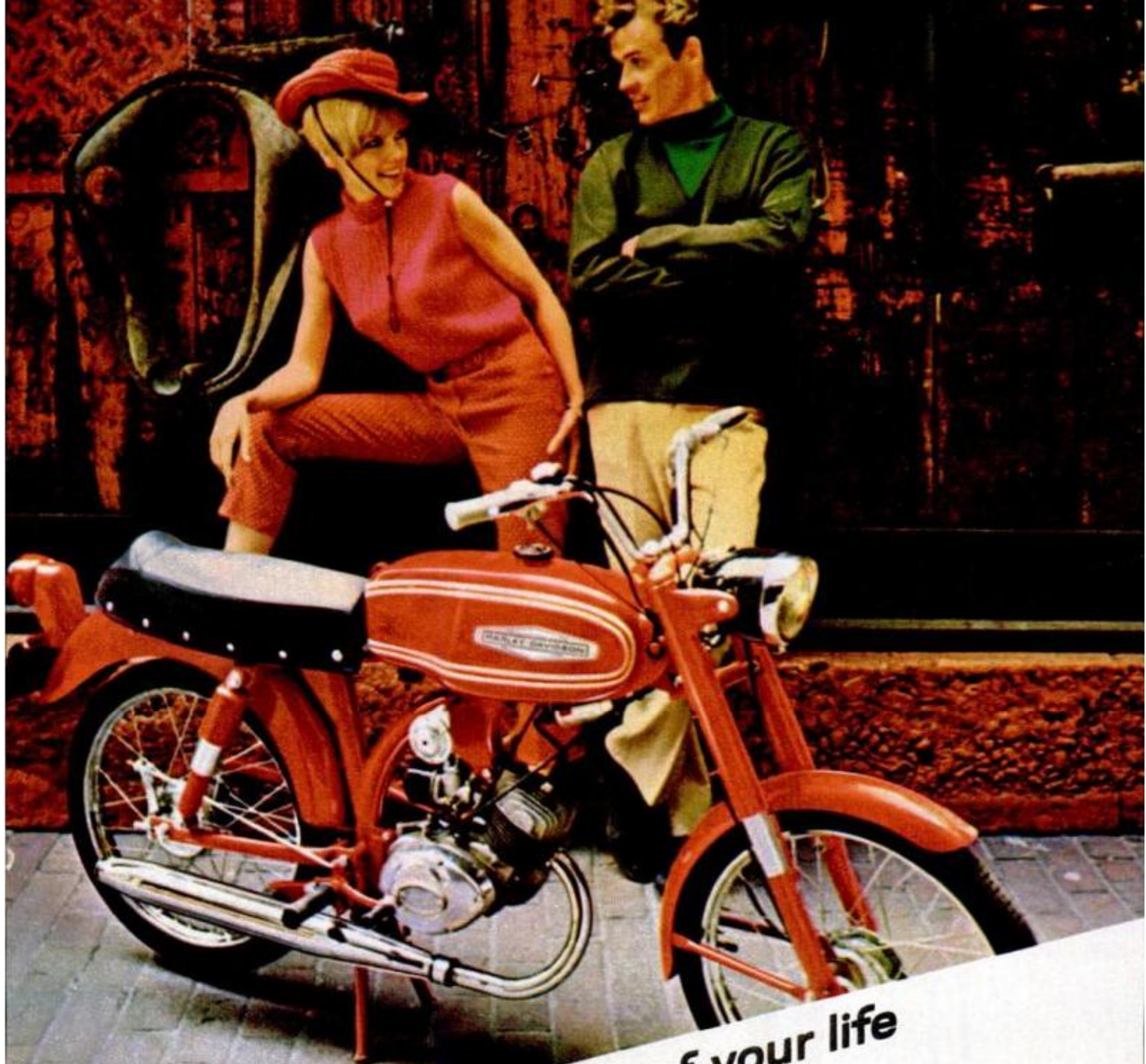


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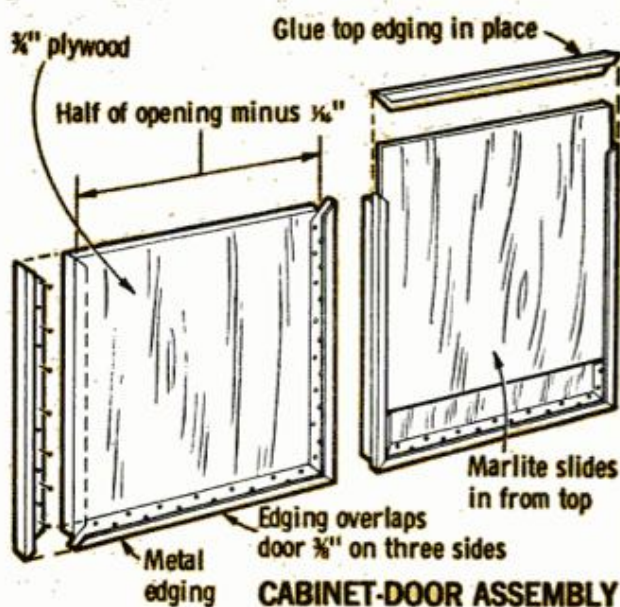


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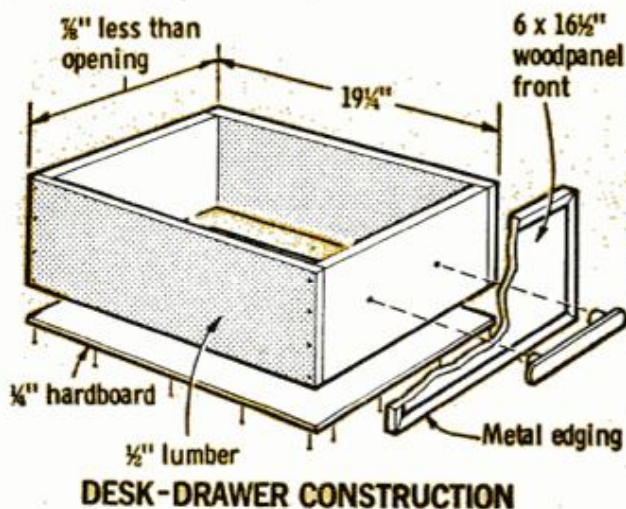
(Continued from page 105)

the four sides of the mural, mitering it at the corners and nailing it to the 2x6 framing. Line the recess next with the wood-grain hardboard, making the pieces come even with the front and sticking them in place with cement.

Now cover the edges of these pieces with strips of outside molding, mitering and nailing it as before.

Continue to cover the front wall, butting the paneling where it meets the file cabinet. Install a strip of inside corner molding at this point and nail it to the cabinet framing. Since the width of the back wall is greater than the maximum 4-ft. width of the paneling, a strip of division molding is used at the joint.

Continue around the left side of the cabinet and apply a strip of outside corner molding to the front edge. Narrow strips of paneling are cut to cover the exposed framing at the front of the cabinet, butting



the horizontal strips between the vertical ones and keeping them even with the drawer openings. These butt joints are really the only joints which are not concealed. You should note that a strip of inside corner molding must be first applied to the right-hand side of the cabinet where it butts the wall before the strips can be cemented in place.

The fronts of all drawers and doors are faced with panels of matching wood-grain hardboard set in frames of metal edge molding mitered at the corners. In the case of the drawers, the fronts are separate assemblies cemented to the drawer ends to provide a 3/8-in. lap all around. In the case of the doors, the mitered edging is first nailed to a 3/4-in. plywood backing, but only along three sides, letting it overhang to provide the same 3/8-in. lap. Then a facing of hardboard is slipped in place in front of the plywood and the remaining edge molding is glued in place across the top since it cannot be nailed.

The desk pedestal

Like the rest of the divider, the three-drawer pedestal for the desk is first roughly built of fir plywood and lumber and then faced as before with plastic-finished hardboard. Metal edging is applied to the two front corners after covering the exposed edges of the plywood with 3/4-in.-wide strips of hardboard. The 2x2s and the 2x6 cross members are covered. These four pieces are butted against the vertical members as was done in covering the cross members of the file cabinet.

Making built-up desktop

The desktop consists of a frame of 1x2s which is glued to a same-size, 3/4-in. plywood panel to form a 1 1/2-in. thickness. The end and the front edges are first faced with strips of white hardboard, mitered at the corners and glued. Then metal edging is applied along the two strips, nailing through the flange of the molding and into the top surface of the plywood. Like the hardboard edging, the metal edging is mitered at the corners. Since the molding is aluminum, it can be neatly mitered on your table saw. A strip of inside corner molding is nailed to the plywood across the back. Finally, a top covering of white hardboard is inserted into the molding by sliding the 1/4-in. panel in from the open end.

The completed top is screwed to cleats fastened to both the divider and file cabinet. Screws driven through the back of the pedestal are used to fasten it to the divider, while screws driven up through the 2x2 rail anchor the desktop to the pedestal. A matching hardboard baseboard, applied all around, completes the job. ★ ★ ★



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'68 CARS: HOW NEW?

(Continued from page 62)

The Coronet intermediate will feature new sheet metal front and back, the lines being somewhat "softened" to a semi-fastback look. Dodge's standard-size Polara and Monaco will appear with extensive sheet-metal changes. Standard on the 1968 Charger will be a 340-hp V8. Dodge's hustling fastback, incidentally, will look pretty much as it does now.

The Plymouth Valiant underwent more or less major changes this year and won't be much different for 1968. The Belvedere, however, will have new quarter panels, new front fenders and a new grille. The Belvedere will also appear in a new two-door fastback hardtop. Standard-size Plymouths will feature a new four-door hardtop roofline and minor sheet metal and ornamentation changes. The engine will be increased from 273 to 283 cu. in. The Barracuda was all-new in 1967, so don't look for much change in '68.

The Chrysler line was quietly new in '67 and won't look radically different this year. There will, however, be a number of sheet-metal changes, most aimed at achieving a more graceful overall appearance. Imperial, still having trouble finding its niche in the luxury car market, will have a new grille and bumper in addition to a number of refinements in interior appointments.

American Motors

Here's where the biggest news will be for 1968. AMC will market its new Javelin to compete with what one auto writer has termed the "Muscougaro" (Mustang, Cougar, Camaro) cars. The car will be almost a carbon copy of the AMX III, an "experimental, design-exercise" car shown at this year's New York International Auto Show. Powered by AMC's heated-up Typhoon 290-cu.-in. V8, the Javelin could be a winner.

The rest of the AMC line will be about the same for '68, though rumors have been flying that the Marlin faces an indefinite future and may be dropped.

Overall, don't look for too much in the way of change for 1968. Carmakers are playing their cards pretty close to their vests these days. Sales have been off and the specter of more and more government regulation of the industry haunts many Detroit executive suites. The watchword is caution, go easy, and if things prove fairly stable in the coming model year (and if Washington doesn't demand what the automobile manufacturers may consider the impossible), you can look for big changes in 1969. ★ ★ ★

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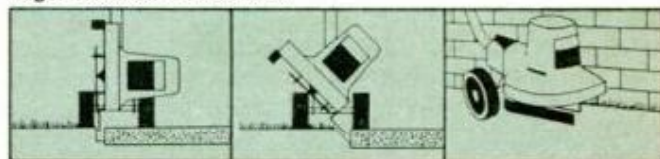
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FALCON OWNERS REPORT

(Continued from page 86)

and comfort of the Falcon for being a compact."—Illinois postal clerk.

Here's another, more active member of the underground:

"Smaller cars make sense! Better sense of driving, rather than just aiming the car."—Detroit custodian.

► **Sir, you couldn't have said it better! When driving a large car with power steering and brakes, I too often feel I have no touch with the road. I just "aim" it in the right direction and go along for the ride!**

Size is ample and comfortable for driver and passengers, say the owners, but there's not enough of it to give their luggage room to breathe. Trunk space, severely restricted due to the short rear-deck styling, is something that owners are complaining about and that they'd like to see changed on future models.

One retired pilot, living in Kansas, not only criticizes his Falcon for its "tiny trunk space," but for a "light rear end" as well.

► **You could try putting your suitcases in the back seat and a few cement blocks in the trunk—if they'd fit!**

A retired Maryland teacher implies a luggage-carrying problem in his complaint:

"The luggage space is cut up—three or four levels—and the spare tire should be somewhere else."

► **I don't know if you had a "somewhere else" in mind, but perhaps a Pontiac-initiated fold-up spare tire is the answer.**

The compact size of the Falcon goes hand in hand with owners' praise for handling and parking. With Falcon's 111-inch wheelbase and 184.3-inch overall length, most handling comments refer to the ease of parking the car and maneuvering in difficult, tight situations. One owner, a retired Air Force officer in Florida, found that handling ease contributes to all-around comfort during sustained driving:

"I drove the car fully loaded on a 1200-mile trip. I drove 65 to 70 mph most of the time. I got 15.8 mpg average and was surprised at the outstanding ease of handling on the highway. After a day's drive (approximately 500 miles) neither I nor my passengers were unduly tired or uncomfortable. I am extremely happy with this car to date."

And in short-trip, local driving conditions, the consensus is the same, with an emphasis on utility by a Connecticut marketing research consultant:

"It handles and parks easily. Good for

my wife who's forever chauffeuring kids, loading groceries, etc."

PM readers and *Saturday Mechanic* types may not give much thought to the dealer as being part and parcel of the car that they buy. They probably do all or most of the maintenance and repair work themselves. But to some Falcon owners, the dealer organization is the top reason for buying a particular car. A Michigan man tells us why he bought his Falcon:

"Main reason was location of service facilities—one block from employment. I can leave car and walk to work."

► **How's that for a reason for buying a Falcon! Too many of these convenience and function-first undergrounders will put Detroit's motivational research boys out of a job.**

This man specified no mechanical problems and no need to require his dealer's service facilities. But of those Falcon owners who did, 27.6 percent found it "poor," 24.1 percent found it "terrible" and, next in order, only 17.2 percent found it "excellent." These figures aren't much different from those for other cars in *PM Owners Reports*. They just illustrate the sad state of affairs existing between dealer and service customer.

If Falcon owners are like car owners everywhere, they are mostly on the defensive when they bring in their cars for servicing. After a few shockingly high service bills for mysterious parts of their car's innards and the labor charges for operating, car owners easily develop a case of paranoia. "Why this?" and "What was wrong with that?" are phrases that echo from service counters day in and day out. And if a car owner—Falcon or otherwise—has ever been a victim of unethical service practices, the dealer-customer relationship is only further strained by suspicion.

When it comes to service, the dealer is responsible for doing the job. But too often the job is correcting poor workmanship (Falcon owners' chief complaint) which originates on the manufacturer's assembly line. An Illinois Falcon owner gives us an anecdote illustrating the position of the dealer stuck in the middle between manufacturer and customer, and the customer's position which, he often feels, is on the short end of the stick:

"I overheard two service managers discussing the guy who spends \$2000 for a Ford and expects a Rolls Royce. I reminded them that Ford says that a Ford is quieter than a Rolls Royce in the advertisements on television where the Ford goes over the ski jump and down the rapids. Then I added that I thought I got the car they used!"

► **Anybody for a good argument? ★★★**

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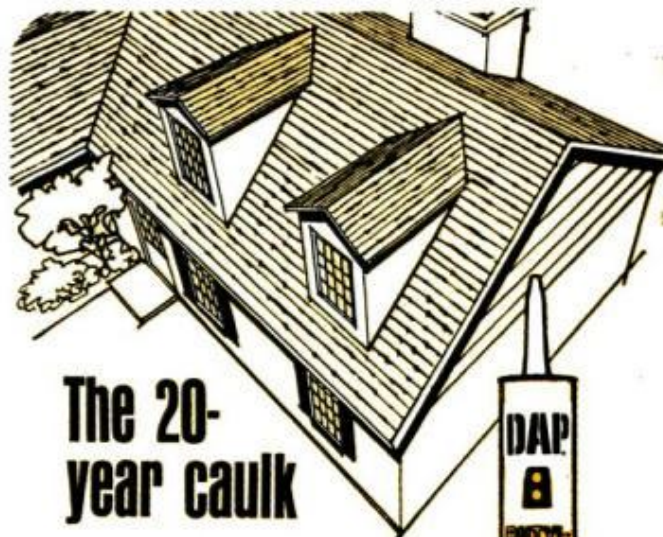
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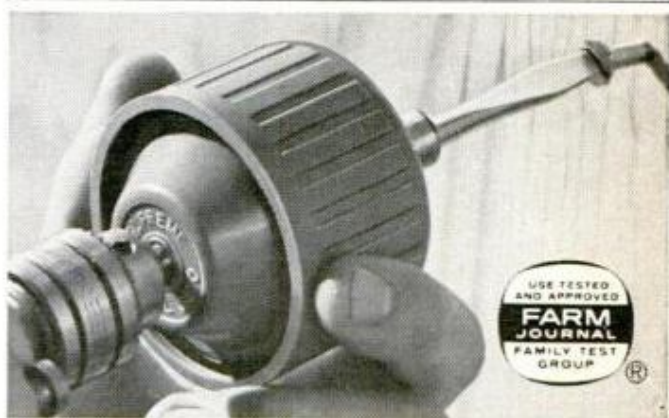
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ORDEAL OF THE PETREL

(Continued from page 72)

a German freighter radioed it was down to two knots—almost stopped. And a Liberian freighter was calling for help.

When Van Nes started the main pump to control the leak, more interlocked troubles began. The 60-hp diesel drove a generator, and the generator powered an electric pump. This pump's three-inch intake hose quickly sucked the bilge dry. But within an hour the pump quit.

Strainer comes off

Anxious now, the crew tore up stateroom floorboards to find the intake hose and clear the strainer. It was a shock to find that the new strainer had come off and was rolling useless in the bilge. From the unprotected hose Van Nes pulled handfuls of sawdust, shavings, nails, sticks. One block of wood wouldn't come out. Other debris had reached the pump and the impeller was ruined.

Thus the storm had found two more weaknesses: a loose strainer—and debris washed out of hidden places. It was noon Thursday when Van Nes started pump No. 2. This, with its little one-inch hose, was electric-powered by a new diesel generator. It worked for an hour. Then a spurt of steam shot up and the diesel stopped.

This automatic-demand diesel had a double cooling system: fresh water inside of salt. But *Petrel* was now rolling so hard that she exposed the salt water intake, although it was far down under her hull. Air was sucked in. The overheated diesel was shut down. Water began to gain.

At noon the ship was taking such a beating that, with sunny Bermuda only 365 miles away, Van Nes reluctantly ordered her put about. Running with the wind would ease her. But she was now on a course to wintry Maine.

So far, water had been kept below the cabin floors. The crew manned pump No. 3, a big hand pump. It took 1500 strokes to suck the bilges dry and no man now could pull more than 200. They took turns. Toward 9 p.m. crewman George Jackson said quietly, "This one has quit, too." The leathers had gone.

Bucket brigades were formed. To save strength, Van Nes told the men not to lift water to the deck but to pour it down the midships head. There one man pumped it out through the toilet. But at 11 p.m. the toilet pump handle came off.

Seas at this time were as high as a four-story building. *Petrel* was being thrown from cliffs into valleys. Van Nes already had 10 lives on his hands; to ask for help

in such seas was to risk others. He decided to wait and keep bailing, hoping that the relentless wind would drop.

Instead, it grew worse. Sleep had been impossible for four nights. To think and to restore his strength, Van Nes threw himself on his wet bunk. He had just put head to pillow when he heard hissing. He jumped up and removed the steps that hid the main diesel. Water had risen to the flywheel and again that chain of trouble) the flywheel was spraying it into the battery compartment. Water had risen almost to the terminals. Van Nes called Conway: "We'd better send a mayday."

In the doghouse Conway turned on the 65-watt radio. It was alive. He tuned the distress channel and called anyone who could hear. No one replied. Far away Conway could hear Coast Guard Miami talking to a ship. The voices faded. He kept calling:

"Mayday mayday mayday: the yacht Petrel proceeding NNE under storm try-sail only, approximately 250 miles SE of New York City. Taking water rapidly. Pumps choked. Request assistance."

Only static. Was the transmitter out? Conway's sixth call was interrupted by a strong voice: "To the yacht in distress: We read you. Say again, please."

Conway repeated the SOS. The voice said: "Give us a slow count so we can fix you." It was the Coast Guard at Plymouth, Va., 300 miles west.

Get radio fix

Conway began counting slowly 1 to 20 and then back to 1. Portsmouth said: "We've got you now. You're within 30 miles of your estimate." In a remarkable fix, stations in Virginia and New England had taken radio bearings. *Petrel* was where they intersected, 280 miles southeast of New York.

Portsmouth said: "Aircraft are en route to you." It was exactly 12 minutes after Conway's first SOS. Then came another message: "At 2:15 a.m. light flares."

So at 2:14 a.m. Friday, the fifth day, Van Nes ordered a mast floodlight lit. At 2:15 a.m., on deck he lighted a flare. Sparks flew. The red flame sputtered. Within 60 seconds an answering red light danced over a wave: the port wing light of an approaching Coast Guard Albatross.

All Friday three Coast Guard planes circled, but none could land, and the cutter *Tamaroa* would not arrive until Saturday afternoon. For 12 more hours the crew bailed. At 3 p.m. Friday all hands

(Please turn to page 188)

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ORDEAL OF THE PETREL

(Continued from page 186)

grain ship *Cotswold*, out of London. Slowly her white superstructure came up and then her hull. Called by the Coast Guard, she had approached unseen behind the enormous seas.

Cotswold achieved the near-impossible of launching a lifeboat in 40-foot seas to take off *Petrel's* crew. The girls went first, then, at Van Nes's order, the Chicago students. At the last minute Van Nes looked at his ship, still sturdy, and said, "I just can't let her sink without a fight. I'm going to stay." Barry Conway said, "I'm with you." The Western Reserve medics said, "Count us in, too."

The *Cotswold* could have left then. But, respecting the crew's courage, she stayed. All night the five bailed. When tired they would see her friendly lights and her protecting hulk between them and the wind. Saturday she was still there. Not until the *Tamaroa* hove in sight at 2 p.m. did she depart. Her whistle boomed. A British voice snapped over the radio: "Cheerio, and good luck."

Three days later, battered but still lovely and sound, *Petrel* was towed back to Stamford, Conn. Then Van Nes and crew talked honestly with me about all that went wrong—and their own mistakes. Older sailors will ask: Why didn't they heave to? Why couldn't they fix the pumps? Why were the big staysails used? They were a young crew. Next time, for example, the pin that pulled out of the shackle will be taped.

But Van Nes and his plucky crew deserve credit; they preserved their ship and ten lives until the *Cotswold* arrived.

But the big thing they'll never forget is: *If it weren't for that one sticky slide—or whatever it was—none of it ever would have happened.*

You see what I mean about little things leading to big troubles? ★★★

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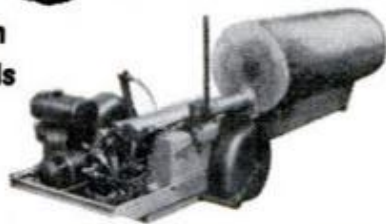
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Alfred Eisenstaedt



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Richard Avedon

CHEESE IT . . . THE COPTERS!

(Continued from page 77)

one mistake was made, and it had its humorous side. It involved the silent alarm signal lamps that the high-hazard merchants (such as banks, supermarkets and liquor stores) installed on their roofs. These silent alarm devices consist of a 2000-watt bulb in a rotating beacon. The bright white light is easily seen from the air for miles, night or day.

It seems that one liquor store rigged its alarm so that its roof lamp would flash when paper money was removed from a special compartment in its cash register. There were two false alarms when clerks accidentally picked up the wrong bills. Then, on the night that the store was actually held up, the nervous clerk completely forgot to lift the bills that would actuate the alarm!

Eventually, it's hoped that similar alarm beacons will be installed on the roofs of private homes, to be actuated by a bedside switch or made part of an existing burglar-alarm system.

Each cruising chopper carries a loud-speaker and a siren. "At first, a driver on the ground can't figure us out," one of the chopper pilots says. "He hears the siren chasing him and looks around, but can't see any car in pursuit. Then we talk to him through the loudspeaker. That's the system we used to break up a series of illegal drag-racing meets."

Rotor helps control mob

When a crowd of unruly juveniles ganged up on a patrol car and the driver had to radio for assistance, a chopper arrived almost at once and sat down on an adjacent vacant lot. Here it used its rotor to kick dust and pebbles into the crowd, helping to control the mob until surface help arrived.

Arrangements are under way for testing a new infrared "sniperscope" that covers large ground areas with its invisible beam, allowing an airborne observer to watch ground activities without switching on his ordinary floodlight.

Now that the word has spread that Lakewood has airborne prowler cars staked out in the sky, the city's crime rate has been going down, even though crime nationally is on the rise.

Project Sky Knight's formal evaluation period ends this month. Already, however, officials who have been watching the project have made up their minds about its value. "It's the first big break for law enforcement since the advent of the radio patrol car 35 years ago!" says Sheriff Pitchess. ★ ★ ★

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HOT ANTENNAS

(Continued from page 96)

the transmitter—a new antenna is the better choice.

When and if your attempts to save your old skyhook fail you'll have to face the music and buy a new one—one with the improved gain, directivity and band width necessary for receiving the extra information transmitted for color television.

One of the guides to the type of antenna best for your locale is the kind of antenna your neighbors are using. See what kind of reception the antenna they're using is giving them. If it produces a good picture for them, chances are it'll do so for you.

Another guide is the advice of a local TV technician. He knows from his experience "how much" antenna you'll need for your distance from the transmitter. As he'll tell you, one of the biggest problems in selecting an antenna is to get one that does the job, yet isn't too good. An overly elaborate antenna represents dollars down the drain.

To aid in simplifying the problem. I gathered up several dozen representative antennas designed for color-TV reception and tested them at three different spots on Long Island, N.Y. The locations were my own back yard in Hicksville (25 miles from New York City), Patchogue (50 miles from N.Y.) and Southampton (90 miles from N.Y.).

As test color receivers, I used GE's Portacolor and Heath's 25-inch color set. The antennas were erected on a 20-foot mast one at a time and connected to the receivers using 72-ohm coaxial cable.

I scored the antennas as good, satisfactory and unsatisfactory. "Good" means the antenna delivered a clear, snow-free picture. Color strength, picture stability and overall quality all were good.

"Satisfactory" means that the antenna delivered an acceptable picture. Color signal strength was not as high as might be desired, but high enough to insure a color picture. Picture quality was reasonable.

"Unsatisfactory" represents reception that would be unpleasant to watch. Color dropped in and out or required extremely critical fine tuning to hold. Snow crept into the picture and vertical and horizontal stability were poor. Overall picture quality was unacceptable.

For readers not familiar with Long Island, we are talking about reception over reasonably flat land, with no tall buildings. In hilly or mountainous areas, the results of these tests would be changed, perhaps as much as to make the results of the greatest-distance test apply to the nearest test site.

Due to the many factors of terrain and lack of testing standards, antenna manufacturers are abandoning mileage specifications for their antennas. We've all read fantastic claims for antenna reception. Manufacturers state, "Good for reception over 200 miles," and so on.

The figures a manufacturer states for reception distance are based on ideal installations. The specified range is based on an antenna mounted atop a tall tower often using a booster amplifier. In practice we put antennas on rooftops and get about half the specified range. So as a general rule, halve the figure specified for reception and you won't be misled.

More elements not always better

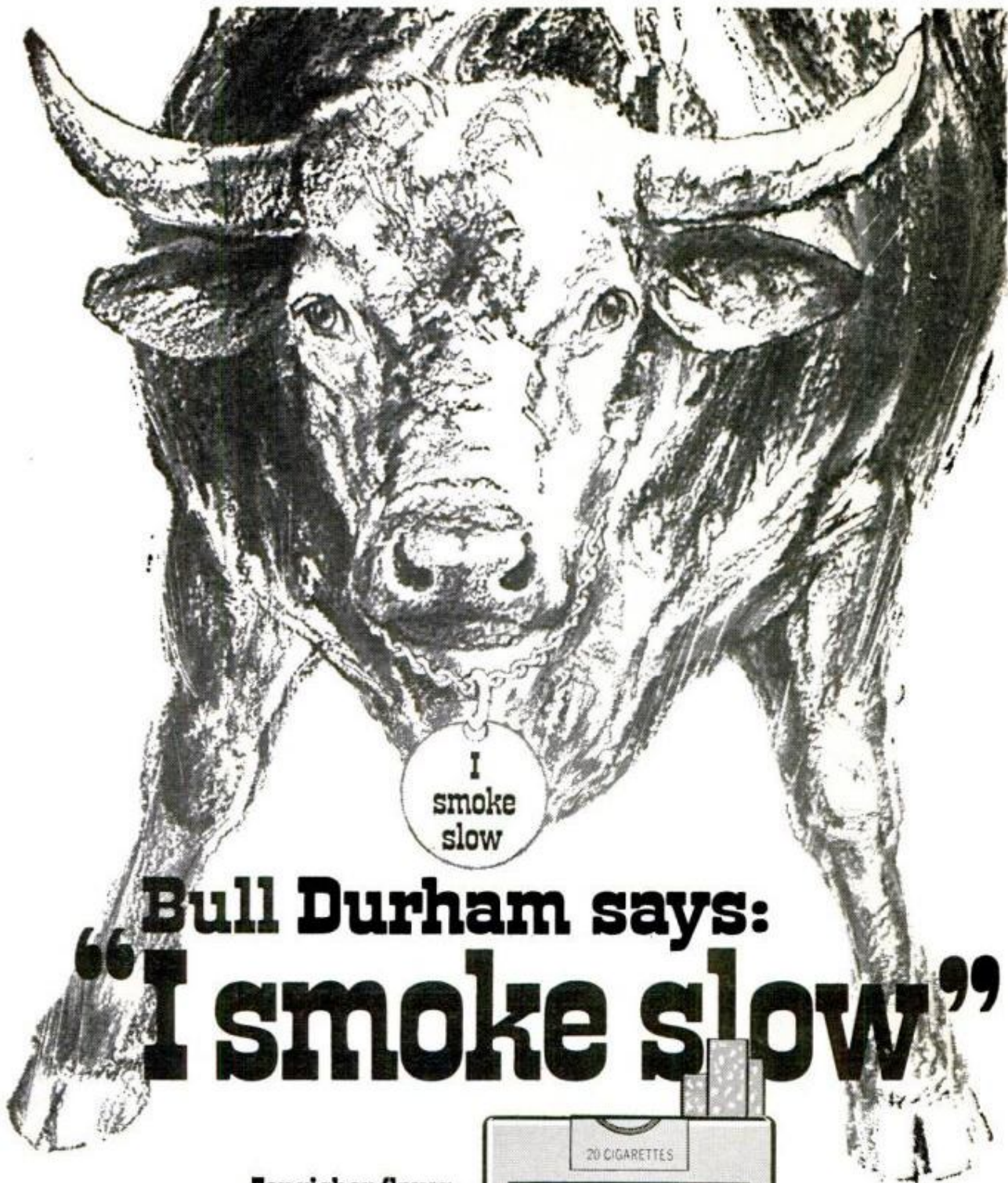
When you select an antenna don't automatically assume that the more elements it has, the better the reception it will provide. This isn't always true. For example, a VHF-UHF antenna that has 15 active elements is not better than a VHF-only antenna with only 12 elements. Why? Simple. Some of those 15 elements on the UHF-VHF model are VHF elements, while others are UHF elements. Although the VHF-UHF antenna will provide UHF reception without the need for a separate UHF antenna, when it comes to VHF, the 12-element VHF-only model is best.

I don't know of any antenna today that isn't made of aluminum, so you don't have to worry about it rusting away. But do watch for life-prolonging anodized aluminum construction. Also watch for gauges of metal. If you have lots of bad weather to contend with, look for the heaviest gauge antenna you can find.

The larger antennas with many elements all come with braces to support the long crossbar boom. These supports may consist of heavy-gauge wire, aluminum rods or other such braces. Make sure they are connected properly to relieve the strain on the main mast clamp.

Your choice of antenna will probably be narrowed down according to the provision you desire for VHF and UHF viewing and FM listening. Perhaps you bought a separate UHF antenna recently. Then you'll want a VHF-FM antenna for your VHF color reception with FM thrown in. On the other hand, you might be starting cold and will want an all-band VHF-UHF-FM antenna to combine reception for all your viewing and listening in one package.

Whatever the configuration of the antenna, one thing is certain: You want reception like the unretouched left-hand pictures on pages 94 and 95 that I photographed on the screens of the test receivers. Use our tips and antenna chart on page 96 to make sure you get it. ★★



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VC FIREPOWER

(Continued from page 100)

the massive wounds it inflicts have been compared to the old lead bullet.

To top it off, this variable-firing marvel is virtually indestructible. The rifle's non-corrosive aluminum alloy assures that rust will no longer cause stoppages. The only thing that will stop this baby is wearing of its parts.

Undoubtedly, more units will be equipped with the M16 if the Vietnam war continues. The Army recently ordered 400,000 more from the maker, Colt.

The M16 is quickly converted into a grenade launcher using the M148 adapter, giving each soldier both pinpoint and area firing capability. The M148, when placed on the M16, is as destructively effective as the M79 grenade launcher.

Both the M148 adapted to the M16 and the M79 can shove a high-explosive projectile 400 meters, and both will kill within a 5-meter radius of the exploding grenade. These two firearms turn every infantryman into a walking artillery piece.

Another unique weapon that quickly converts an individual infantryman into an artillery soldier is a thing the Pentagon calls the LAW. Officially it's designated as 66-mm M72, light antitank weapon.

"Although we tell troops that the LAW is officially an antitank weapon that should be conserved for such purposes, its use against tanks is somewhat limited in Vietnam," a colonel told me. "After all, Charley and the North Viets have no tanks.

"But that LAW sure makes a hell of a weapon against pillboxes, log emplacements, sandbag installations and enemy troops holed up in caves, and our boys ain't about to listen to that official stuff."

The LAW fires an armor-piercing projectile 1000 meters. It comes to a soldier in the form of a tube, closed on both ends by caps. The GI simply pulls the caps, takes aim and fires. Then he throws the tube away. It is excess baggage after that.

Naturally, some of the weapons that we used in World War II and Korea are being employed in Vietnam, but not many.

Old standbys, for example, are the .45-cal. automatic pistol, which has been in use since World War I and is still as heavy as ever, and a modified version of the World War II 81-mm mortar.

But basic infantry weapons have changed and are continuing to change, as the illustrations show. Today's individual infantryman, equipped with the M16 rifle, can provide firepower equal in force and deadliness to every M1-equipped soldier in a WW II and Korean War squad. ★ ★ ★

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ENGINE OVERHEATING

(Continued from page 143)

check it fast. Remember you have the fan belt and hose off, and the coolant can start boiling. As soon as you make the check turn off the engine.

Aeration—mixing of air with coolant—occurs when a bad joint at the water pump, for example, draws air into the cooling system when the pump is running. Aeration speeds up rust and corrosion of cooling system passages. It causes foaming, coolant loss and overheating.

Indications of an aeration condition are rusty coolant, rust particles clogging up the radiator and overflow losses. There is a method of checking for aeration that anyone can perform.

Bring coolant level down to 2 inches below the top of the radiator filler neck. Replace the pressure cap with an ordinary airtight radiator cap, and attach a length of rubber tubing to the lower end of the overflow pipe.

Have someone run the engine in neutral and at fast idle until normal operating temperature is reached. Maintain the same engine speed and put the end of the rubber tube into a bottle of water, making sure the tube doesn't kink or loop.

Now, watch for a stream of bubbles in the water, which means that air is being drawn into the cooling system. Before you take off the water pump, check the cooling system hoses for holes, tears and bad connections between the hoses and flanges.

A "buggy" radiator: Among the causes of overheating are hundreds of bugs, leaves and other obstructions that clog your radiator air passages. The chances are that you do keep your eye out for this accumulation, but when you look for it, check thoroughly. If foreign matter is rammed into the fins, use short spurts from an air hose to blow it out.

Incorrect ignition and valve timing: There's no reason to discuss the importance of ignition timing. We went into all the ramifications in the *April Saturday Mechanic* (page 166). Let's just say that retarded ignition timing can cause overheating.

Similarly, if valve timing is late, it causes overheating by trapping exhaust gases inside the engine. If all other causes of overheating have been ruled out, and ignition timing checks out, you'd best check valve timing. If you're still green when it comes to valve timing, leave it to a mechanic who has the proper tools, know-how and specifications. ★★

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SPANISH TILE FLOOR

(Continued from page 109)

work yourself. But if you persist they'll probably quote a delivered price per tile of over 20 cents. You'll have the cost of the epoxy on top of this, of course—and that varies widely according to locale and quantity involved. But when you learn that the *installed* cost for this tile would run around 50 cents per, you can appreciate your saving.

In estimating the amount of epoxy needed for *setting* a given area, I'd figure coverage at around 20 sq. ft. per gallon—if you're troweling it on an existing finished floor. Most brands come in three-gallon cans, and seven were plenty for my 400-sq.-ft. asphalt floor. It's more difficult to figure for *grouting* because standard charts don't cover pattern tile. But you should be safe with that same 20-per-gallon yardstick. In other words, a gallon should set and grout 10 sq. ft. of Spanish tile.

Once you've assembled your materials and the existing floor is prepared, your first step is a "dry run" to establish the most logical place to start your pattern, as shown in the photos. Logic is important, here, because, first of all, you're laying tile where the grout-lines are emphasized to *create* the floor pattern and secondly, you're not dealing with material you can snip with scissors when you come to a wall or corner. For reasons known only to tile makers, no half-tile are offered, so the fitting at all edges will be a laborious matter of scoring, breaking and—if the break's unlucky—grinding every "fill-in" piece around the full tiles.

You'll note from the photos that fitting was especially critical in my installation because I chose to run the tile right up to an existing black (rubber) baseboard, so the "cut" edges were exposed. I'd decided the wall-to-wall effect was more striking without a border; thus the only finish to my edges is provided by the black grout forced into the gap between the tile and the baseboard. Bullnose border tile were used, of course, for finished thresholds at the doorless entries to the room.

You'll find, as you lay out along the intersecting center lines, that contoured tile actually require less precise alignment than square tile, since crookedness and discrepancies in joint width are more immediately apparent where a rigid grid pattern is involved. In planning to avoid awkward trimming, you can play with joint spacing to stretch out or compress the overall design slightly. A joint much *over* the recommended $\frac{3}{8}$ in., of course, will

begin to look gross, and a joint *under* $\frac{1}{8}$ in. is impractical for filling, but there's a certain flexibility in fitting the file together that lets you make subtle compensations.

Now you're ready to trowel on epoxy, working the opposite sides of the center lines and leaving the "dry run" in place as a guide and a supply of reachable tile.

You'll find the epoxy surprisingly easy to work with—if you study our photos and follow label directions carefully. It's clean and relatively odorless. That potent whiff of ammonia when you first pry up the lid quickly dissipates, and as long as you work in a well-ventilated room you won't suffer discomfort. Since epoxy contains chemical irritants, it's a good idea to wear rubber gloves and long sleeves, but if you should get it on your hands, just wash it off with soap and lots of water.

The main thing to bear in mind is that once you've mixed the two parts you've started an irreversible chemical reaction. You must work quickly, especially on a hot day, since heat speeds the reaction. At a temperature of 75°, however, the mix has a pot life of at least 1½ hours and a worktime, once it's spread, of about 2½ hours. This lets you inspect a good section of the bedded tile and make minor adjustments for straight, consistent joints. And since this epoxy is water-soluble, you can easily do any cleanup, using an abrasive pad such as Scotchbrite to remove surface smudges.

Clean up if you quit

But once the epoxy *sets*, nothing will phase it—no solvent, not even a chisel! So it's essential that, when you "knock off" for any length of time, you carefully scrape up and discard all the troweled epoxy extending beyond your last-laid course of tile. If that stuff sets on the floor, you'll never be able to fit your next row.

It's best to cut your edge tile after you've bedded the last row of full tile along a given wall. Trimming is easier if you rent a professional tile cutter like the one shown, but quarry tile *can* be hand-trimmed with a heavy-duty glass cutter drawn along a straightedge with firm, even pressure. Score the tile face once only—don't attempt to go back over the line—then center each end of the score over a finishing nail slipped under the tile, press firmly on both sides of the score—and pray.

Trimming enough tile to finish off a wall line is a slow job, even with the rented cutter, so you'll probably want to scrape up the epoxy that was troweled beyond that final row of full tile, then bed the trim

SPANISH TILE FLOOR

pieces later by buttering each with a spatula. Be sure to pack epoxy into all furrows across the back face, and set each piece just as you would if the epoxy were on the floor, instead.

You'll note from the photos that the addition of this 1/2-in. surface permitted me to install a floor outlet for my "island" furniture arrangement. Previously, I'd had to tape an extension cord across the surface of the old floor to bring power to a table lamp, since the asphalt tile is laid directly on a concrete slab. Now, I simply installed a shallow single outlet in one of the tile and snaked a line cord from it through the joints to the wall outlet, as shown in the sketch at the bottom of page 109. Unorthodox, perhaps, but much safer than a surface cord, since the new one is embedded in epoxy—a good insulator.

The way to grout

Once all the tiles are bedded, let the floor set overnight and you're ready to grout. The procedure for mixing the epoxy is the same as before. If you've noticed that the epoxy *bed* that shows in the open joints has set to a high gloss that wouldn't be appropriate for grout lines, don't fret. The water wash that's required for the grouting operation kills this gloss and leaves the epoxy *grout* flat black.

After mixing a batch, dump it onto the floor and spread it with an unnotched trowel, working it firmly in several directions until it bulges up in the joints as the trowel is drawn across them. Now, scrape the excess back into the pot and quickly, but firmly, stroke the surface with a dry hard-rubber squeegee (this excess, too, can go back in the pot for the next pour). When the joint lines are sharp on both edges, wipe the tile faces with a flat wet sponge, then sluice the floor with hot water and squeegee again, but don't put this diluted epoxy into the pot. Instead, scrape it into a bucket partly filled with water, for later discard.

Be careful not to draw the epoxy out of the filled joints when you squeegee—keep the work area plenty wet. Take care to clean thoroughly and quickly because any ragged grout lines will be permanent, once the epoxy sets.

The next day, you'll probably notice an uneven glaze on the face of the tile. If it's objectionable, you can kill it by scrubbing with an abrasive pad, such as Scotch-brite.

That's all there is to epoxy grouting. Although red Spanish tile is traditionally set off with a black grout, you can order AAR-II in white or gray. ★★★

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2) Send as many entries as you like to Goodyear Pliobond Contest, P O Box 9115, Akron, Ohio 44305. Send a label or other evidence of purchase with each entry.

3) Individual contests run in May, June, July, August, September and October, 1967. Winners will receive a Sony 9" portable TV set. These awards limited to one for each contest. Entries must be postmarked during the contest month in which you enter. All entries become the property of The Goodyear Tire & Rubber Company. None will be returned.

4) Entries will be judged by The Goodyear Tire & Rubber Company, and decisions of Goodyear will be final relating to questions about contest winners.

5) The contest is open to everyone in the United States and possessions or Canada except employees of Goodyear, the distributors and dealers of Pliobond adhesive and their immediate families. Contest is subject to Federal, State and local regulations.

6) All winners notified no later than November 30, 1967. A list of winners will be available if requested, and self-addressed, stamped envelope is enclosed.

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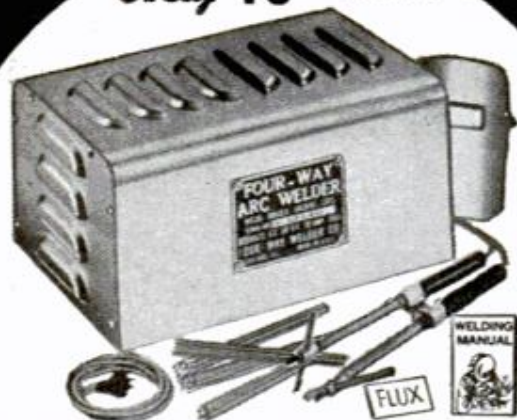
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TOMORROW'S MARINE ENGINES

(Continued from page 132)

wheel to develop power. It needs three main components—a compressor to build up intake air pressure, a combustion chamber to heat this air and a turbine wheel to change it to rotating power.

Let's stop for a moment and examine the operation of the Rover 2S/150, a gas turbine which is running in autos and has raced under FIA rules.

The 2S/150 has two shafts. The primary one has an air-compressor impeller on one end and a drive turbine on the other, which turns the common shaft. A starter, much like the one on your car, starts this shaft turning to drive an auxiliary air pump. As the shaft turns, the impeller sucks air in and compresses it to about 4-to-1 ratio, which produces some heat. The heated air flows into the combustion chamber to be mixed with oil. This vapor is ignited by a glow plug and the gas expands rapidly.

From here, it is channeled into the curved vanes of the turbine, and the shaft turns even faster, causing higher and higher compression. At this point we have a crude jet engine; if the excess power escaped by way of a nozzle it would exert some thrust.

The jet is no good to us on the water, so we add another shaft fitted with another turbine wheel. After the gases have been used to turn the air compressor, we channel them through the secondary turbine blades to produce the usable power. This secondary wheel and shaft turn at up to 65,000 rpm, so reduction gears are needed to make the power usable in a boat.

Serious development work on the turbine has been going on for at least 20 years and thousands are in use today. The gas turbine works best when it can be set at near peak output and run for hours. It is worst at stop-and-go work.

Chrysler, Ford, General Motors, OMC Kiekhaefer and a host of others are working on the turbine. E. C. Kiekhaefer, who is probably as well informed as anyone on the small turbine, told me that he expected the Rover people to be first with a small (150-hp) model and that Ford looked like the best bet for larger inboard power.

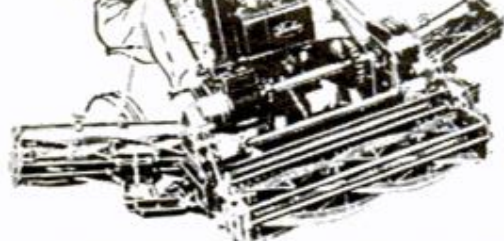
The first official marine turbine was the 330-hp Boeing Turbo-Marine, introduced in 1959, then withdrawn from the market. I rode in a 21-ft. boat powered with one, and it was an entirely satisfactory ride.

The government has a host of small boats running with turbine power, but these engines are too large for most pleasure craft. Many manufacturers of aircraft

(Please turn to page 211)

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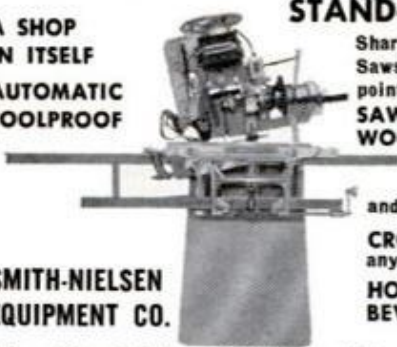
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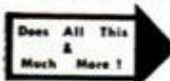
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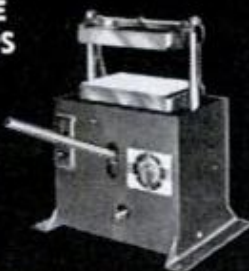
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MERCURY'S NEW COUGAR

(Continued from page 118)

land lithographer.

"Thought it might weave and wander, but it holds the road very well."—Kansas farmer.

Owners like the Cougar's ride, too.

"Solid, comfortable, quiet ride."—Minnesota fruit grower.

"Smooth ride over bumps."—Massachusetts computer technician.

"Has the feeling of a much heavier car."—Kansas bank teller.

"Somehow combines smooth ride with good road 'feel.' A miracle!"—Ohio plumber.

Next on the list of owner praises are bouquets for the Cougar's response to the throttle.

"Has plenty of snap, considering the small engine."—Michigan accountant.

► He has the 289-cu.-in. engine.

"Power on the highway exceptionally good."—Florida instrument mechanic.

"Plenty of passing power."—Indiana educator.

"Right there when you need it."—Maryland factory worker.

The Cougar delivers what most owners seem to feel is satisfactory gas mileage, too. But keep in mind most praises along these lines came from those whose cars were powered by the smaller 289 cu. in. engine.

"Very happy with the mileage."—Michigan salesman.

"Easy on gas under 80 mph."—Illinois tube winder.

► That over 80 mph business is also hard on other things—your passengers, other motorists, the statute books.

"Do very well on gas."—Indiana student.

"Fill up only once a week."—South Dakota dairyman.

In direct contrast to the above, our survey showed poor gas mileage to be the Number One beef of Cougar owners, most of whom, in mentioning their dissatisfaction, pointed out that their cars were powered by the big 390-cu.-in. engine.

"Am not getting the gas mileage I was promised."—Iowa engineer.

"Would like to get at least 13 to 14 mpg all the time."—Connecticut salesman.

"Had a Mustang with the same engine and got 4 to 6 mpg more."—Alabama laundry owner.

► For one thing, your Cougar weighs more.

"Poor gas consumption."—Illinois clergyman.

Ranked second on the complaint list

was poor workmanship, a *PM Owners Report* perennial. It must be heartbreaking to lay out over \$3000 for a car and still have to contend with such things as:

"Screws missing, screws not tight, trim misaligned, console shift indicator panel loose."—Illinois architect.

"Pin stripes crooked, even dripped in one place."—Florida engineer.

"Too many visible body imperfections."—Idaho contractor.

► Which kind of makes one wonder about what one can't see.

A Kentucky school teacher said his Cougar looked as if it was "thrown together." And so the workmanship complaints go—little things mostly, but no less annoying.

In third place on the gripe list was what owners felt was inadequate rear-seat legroom.

"Back seat is cramped."—Illinois salesman.

"Very uncomfortable in back. Hard to get in and out of."—Missouri consultant.

"The back is like riding in a little red wagon."—Georgia supervisor.

"Too crowded in the rear seat for adults."—Idaho salesman.

► Look. The car makes no pretense of being a family sedan. Join the owner who, in answering the question about the comfort of his rear seat passengers, said, "To hell with 'em. I bought the car for me, not them. They can walk."

Some of the most pithy owner comments were reserved for the Cougar's glove compartment, a feature many owners find less than satisfactory, to say the least.

"Glove box works like a dump truck."—Iowa quality control analyst.

"When you open it, everything falls out."—Missouri computer operator.

"Lord, it's clumsy!"—California teacher.

A complaint we haven't encountered before is listed next—whatever it is about the Cougar that enables road dirt and mud to build up along the door sills.

"Mud packs in under the doors on the rocker panel ledge."—Michigan toolmaker.

"Sand accumulates on the door sills."—Maine Red Cross field representative.

"Dirt and grime are sucked up through the front doors and build up along the door ledges."—Maryland bank trainee.

"I find I soil my overcoat every time I get it or out of the car."—Indiana bank president.

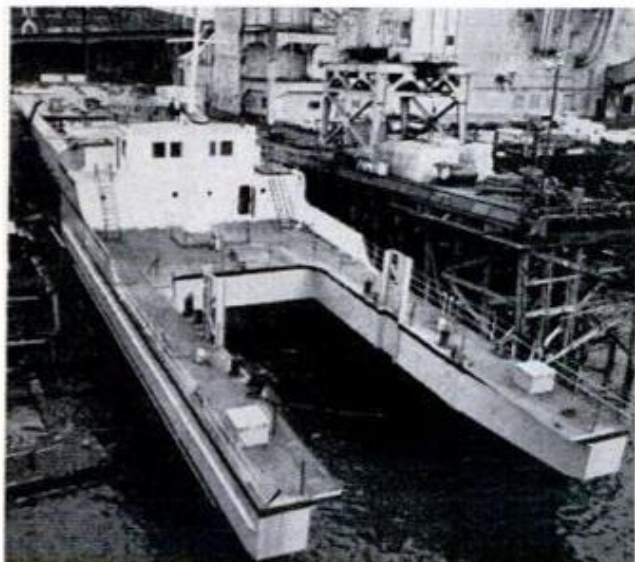
Back on the plus side, owners were liberal in their praise of Cougar's comfort.

(Please turn to page 204)



70,000—count 'em—70,000

During the war, George Flinders of Scarrington, England, started piling up horseshoes so people could guess the number and win a prize. The pile just grew and grew until there are now about 70,000 horseshoes stacked 15 feet high. At least, that's George's guess.



Seagoing harbor for sub

The divided stern of the *Transquest* (above) enables the 40-foot *Deep Quest* research submarine to have a berth at sea where it can be raised out of the water for servicing. Built for Lockheed by the Albina Engine and Machine Works, the *Transquest* is 108 feet long.

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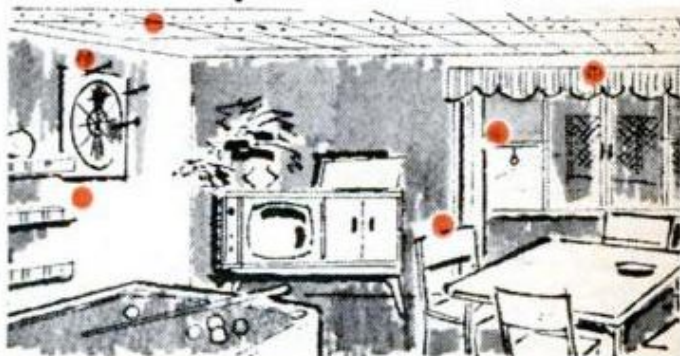
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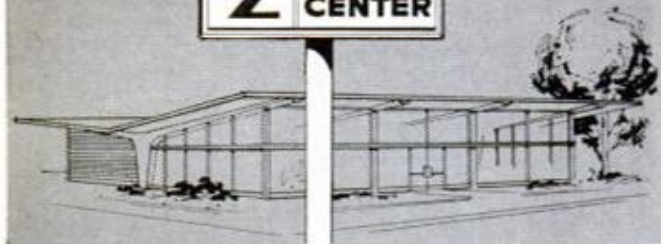
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MERCURY'S NEW COUGAR

(Continued from page 202)

"Very comfortable, especially on long trips."—Colorado teacher.

"Any trip, no matter the distance, finds you rested and relaxed at the end."—Kansas department manager.

► **Hmmmmmmmmmm.**

"Feel refreshed after a long trip."—California banker.

Rounding out the list of Cougar owners likes were—in order—praises for the car's suspension set-up, its quietness, its undeniably handsome interior styling, its size overall, the "hide-away" headlight feature, and—in contrast to Number Two on the gripe list—the car's workmanship.

Many owners responding to our survey said they didn't care much for the ashtray arrangement up front, deeming it awkward to reach. And those who ordered their cars without a console lamented the lack of any ashtrays for back seat passengers.

Another thing mentioned often enough to impress itself upon me was that several owners feel the car is less than stable at comparatively high speeds.

"Hard to hold the road at 70 mph and above."—Illinois computer programmer.

"Car has a tendency to wander at turnpike speeds."—Indiana factory worker.

"Bad handling at high speeds (60 to 70 mph)."—Michigan engineer.

"Car starts to shimmy at about 70."—Maryland management trainee.

► **I've said this before, but so do I. Take it easy, please.**

Winding up the list of dislikes were complaints about the Cougar's limited trunk space (actually ranked ninth) and, in eighth place, several bitter comments about dealer service. Consider this one from a Maryland printer:

"Two options I ordered never came through, and after almost four months they are running me in circles about installing one option which was paid for in the original price. Between the sales manager and the salesman, a better pair of actors I have never seen."

Our Maine milkman, in general happy with the car, says he has owned it three months and is still waiting for promised body work to correct flaws that were present when it was delivered.

And so it goes. It seems you pay your money and take your chances. But overall, our survey indicates that most Cougar owners are delighted with the car and got just what they had in mind. Maybe even a little bit more. ★★ ★

Lee and Richard Petty talk about high performance tuning and the role Fram Filters play.

Fram talked with Lee and Richard Petty at their home base in Randleman, N.C. When they're not out racing, they operate Petty's Engineering, a fully equipped speed garage catering to car enthusiasts. Lee, a champion race driver in his own right but now retired, sets-up and tunes high performance cars his stock car champion son Richard drives.



Fram: Lee and Richard, how do you tune a high performance engine?

Lee: If it's a factory modified job, we put it on our chassis dyno and tune it to get out every ounce of power we can. If it's an engine we engineer or rework, we start from scratch.

Fram: What do you mean, start from scratch?

Richard: Well, let's say you ship in a mill...first thing we do is find out all we can about it—tolerances, clearances, dimensions...usually the factory helps here. Gives us blueprints, spec sheets, performance dope. So we know where we're going—how much metal we can chop, grind, or polish off without weakening anything.

Lee: What we're after is to loosen the engine up. Increase breathing capacity. Reliability. Reduce friction. Take the strain off so it can handle high grand

rpm's without tossing its guts all over the landscape.

Fram: O.K. Now you've got the data—what's next?

Richard: Gut the engine. Not just pull it apart. But take it slow and easy, marking and measuring as you go...

Lee: Checking clearances between piston and crankpin...piston pin to con-

taper, front to back. That's not good. So we straighten it all out, then magna-flux every part.

Lee: A special point to watch is that every rod center has the same dimension. If it's off, it throws the compression ratio off in the cylinders. Also pay special attention to the bore-crank relationship. That's mighty important. At this stage we're ready to bore to over-size...

Fram: How do you correct for unbalanced parts?

Lee: Oftentimes, it depends on association rules that we're setting-up and tuning the mill for. If we can cut metal, we do. If we're limited to grinding or polishing, that's what we do. Rods we normally polish. Cranks, we throw in center counterweights. Clutch...each disc goes on a mandrel with its facing. Then we balance the clutch and fly-wheel together.

Fram: Naturally we're interested in filters because that's our business. Why do you use Fram air filters?

Lee: Quality. Reliability. Minimum restriction. We've tried others and lost horsepower, or got turbulence, or they let fine dust in. With Fram that never happens.

Richard: We've run some mighty dusty tracks...and we're glad that Fram air filter was in there. Every mill's an air pump. So the power you get depends on the amount of air it can pump. Some air filters restrict air flow—Fram doesn't. It's as simple as that.

Fram: We see you use Fram oil and fuel filters. How do they stack up, performance-wise?

Lee: They're the best. We've never had a Fram oil filter blow or clog on us during a race. And the fuel filters work like a charm with injectors or carbs... they don't restrict. They clean in one pass. That's the key to success. And to protect your investment, go with Fram filters. They live up to their slogan... They work on the track. They work on the road.



Fram Corporation, Providence, Rhode Island 02916



necting rod, insert to crankpin, crankpin to main bearing, piston skirt to cylinder wall...right on up to deck clearance—the works. Then we clean out the block.

Richard: You'd be surprised at the amount of core sand, metal chips we find in those water passages and oil galleries. We get them all out. Knock off all the burrs for good measure.

Lee: Next step is to check all alignments. Especially main and cam bearing circles. True them all up...

Richard: Most come through with a

You keep the eyes of the Army from going on the blink.

It's dark. The sky, hills, road and trees are all the same color. Black. No shades of grey. Just solid black.

But the radar keeps watch. It's the Army's eyes that see in the night. A lot of men depend on it. And it depends on you.

You're the expert, the radar specialist. Your job is to keep those eyes alert. You know every transistor, every circuit, every tiny component as well as you knew the plays for your high school football team.

If it wasn't for the electronic training you got in the Army, you'd still be playing games—trying one job and then another, looking for a career, never completely satisfied.

But now you're set, you've got Army training behind you. It was an 8-hour-a-day, 5-day-a-week program that taught you a skill to build a career on.

And the training you selected was guaranteed in writing before you signed up. You made the right choice.

But with over 300 career opportunities to choose from, how could you go wrong?

Army



ELECTRIC CARS

(Continued from page 121)

produces electricity somewhat like a battery but without running down. Instead of operating on a discharge-recharge cycle, it runs on a separate fuel supply and an oxidant. As long as it has fuel, it will produce electricity almost endlessly.

Fuel cells have their own problems, however. General Motors, one of the first to get on the road with an actual fuel-cell-powered vehicle, readily acknowledges this. For test purposes, GM researchers chose a hydrogen-oxygen fuel system—a combination that any schoolboy knows requires reverent handling. When chemists requisitioned a horse trough, an amused accountant slyly asked: "When are you fellows going to put through a voucher for a horse?" The suggestion was clearly intended to imply that things couldn't be going too well for the electric car.

Just good horse sense

Actually, the horse trough was a safety measure. Workers accidentally sprayed by dangerous chemicals needed something they could fling themselves into for a quick dunking. The horse trough proved to be ideal for the purpose.

From the start, it became evident that a hydrogen-oxygen fuel cell would not be the most practical form of motive power. The equipment is bulky. The fuels are expensive, highly explosive, and have to be stored in heavy pressure tanks. A typical tank containing a pound of hydrogen weighs 100 pounds.

Working with Union Carbide, GM was finally able to shoehorn a hydrogen-oxygen fuel cell into one of its small vans. In the system, hydrogen fed to the cell passes into the hydrogen electrode where it is ionized. These hydrogen ions react with hydroxyl ions from an alkaline electrolyte to produce a flow of electrons.

The electron flow passes through the external circuit as direct current to drive a powerful electric motor, then it moves on to the oxygen electrode. There, oxygen reacts with the electrons and water to produce hydroxyl ions, which return through the electrolyte to the hydrogen electrode to start the process over again. As long as new fuel replaces that used up, the flow of electric current is continuous. The fuel is carried in two huge tanks.

When the Electrovan made its first public appearance recently, GM engineers held their breath. They refused to let outsiders go near it until its fuel cells were de-activated. Afterward, they confessed

(Please turn to page 208)



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says

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Weber

Bowler
of the year



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Because I wasn't feeling well, I was advised to give up my chain smoking habits. It got down to this—either give up cigarettes or give up tournament bowling. Since I was earning my living as a professional bowler, I decided to quit smoking.

I had read about Bantron so I got some . . . and with its help I stopped smoking and haven't smoked for over a year.

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Bantron was discovered by doctors in the research department of a great American university. Tests on hundreds of people showed that it helped more than 4 out of 5 of all people who wanted to stop smoking to do so in five to seven days. It acts as a substitute for the nicotine in your system and curbs your desire for tobacco.

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ELECTRIC CARS

(Continued from page 207)

that they half expected the machine to blow up.

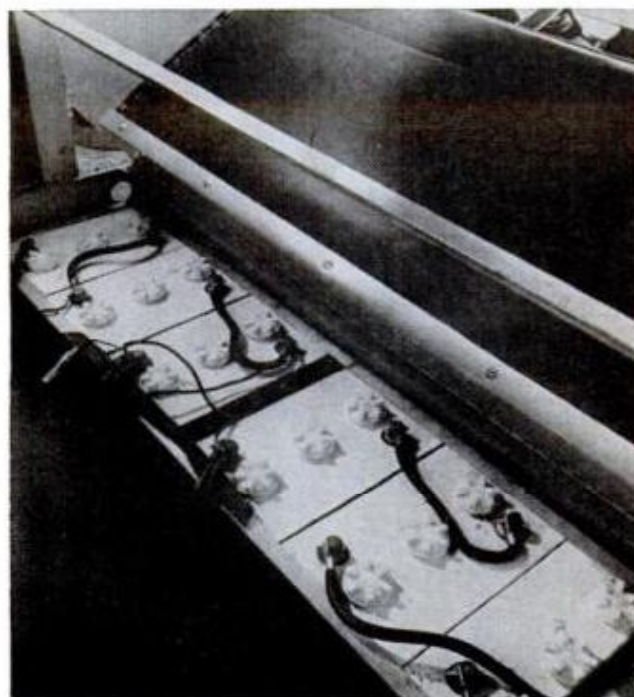
Chrysler for its part is at work trying to make a fuel cell using simply hydrocarbons mixed with air. General Motors is

(Text continues on page 212)

This one's for sale

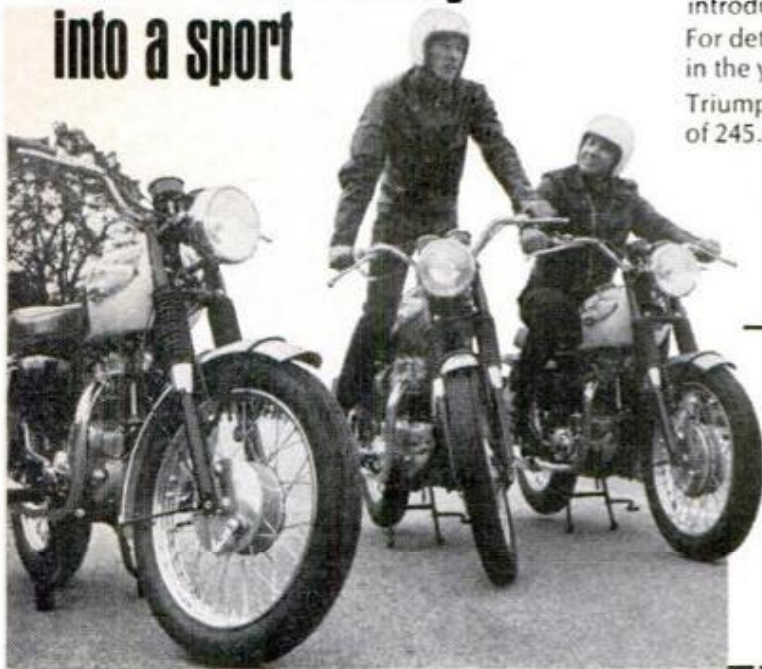


Westinghouse reports that its two-passenger battery-driven Markette will be available in June for under \$2000. Top speed of the 1730-pound car is 25 mph and range is 50 miles. Twelve six-volt lead-acid batteries, which can be recharged overnight from a 110-volt outlet, are carried in the car. Six are behind the seat (photo, below), and the others are underneath it. The car will use about a penny's worth of electricity to travel a mile, and batteries will be good for two years. Their replacement cost is about \$300.



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BUILD YOURSELF A MINIBIKE

(Continued from page 164)

engine rails. The rearmost holes in their flanges fit over the same shock-mount bolts that hold the engine rails to the crossties. The remaining holes are for short bolts directly through the rails.

The jackshaft is held in two $\frac{3}{4}$ -in.-bore pillow blocks bolted to the supports. Make the shaft from $\frac{3}{4}$ -in. cold-rolled steel rod with $\frac{3}{16}$ -in. milled keyways as shown. Mounted on the shaft between the two pillow blocks is a combined brake drum and drive sprocket assembly. The drum itself is merely a narrow ring sliced from a piece of $3\frac{1}{2}$ -in. iron pipe. A rectangular metal plate is welded inside the ring to form a hub.

Drill the $\frac{3}{4}$ -in. shaft hole in the hub only after welding to be sure of accurate centering. If a metal lathe is available, it's a good idea to chuck the shaft with the drum on it and turn the rim true. This is not a must, however, as exact roundness is not critical in this type of brake drum.

The 22-tooth sprocket is bolted to the hub of the brake drum with two $\frac{1}{4}$ -in. bolts. Lock the drum-sprocket assembly to the jackshaft with a $\frac{3}{16} \times \frac{3}{16} \times 1$ -in. steel key. Align the sprocket with the 60-tooth sprocket on the rear wheel and tighten the setscrew. With the jackshaft installed, temporarily set the engine in place to be sure there's adequate clearance. If there's any problem, the sheet-metal part of the muffler can be trimmed back slightly.

While you can make your own brake band, it's simpler to purchase a commercial band made for the purpose. A band like the one shown can be obtained from Automatic Steel Products Co., 1201 Cowden Ave. S. W., Canton, Ohio (part No. 4557).

One end loop on the band slips over the anchor stud on the left jackshaft support. A standard bicycle hand-brake cable is attached to the other end loop. Notch the loop as shown, insert a cross pin with a hole in the middle, and run the brake cable through the notch and the pin. A cable stop can be adjusted to lock the cable at the desired tension.

An anchor for the brake-cable sleeve is made from a thumb screw and mounted on the left jackshaft support. The cable runs to a bicycle hand brake on the handlebars. When the hand lever is squeezed, the cable pulls the brake band tightly around the brake drum.

Engine and transmission

The drive is by V-belt from the engine to the jackshaft and by No. 35 roller chain from the jackshaft sprocket to the rear-wheel sprocket. The engine used here is

a $2\frac{3}{4}$ -hp Clinton Model A-500 with clockwise rotation. The clockwise rotation is important and is available on order, but be sure to ask for it specifically.

The variable-speed drive consists of a pair of split-sheave V-belt pulleys, one on the engine shaft and one on the jackshaft. As engine speed increases, the centrifugally operated drive pulley forces the belt out toward the rim, increasing the pulley's effective diameter. At the same time, the belt is forced closer to the hub between the spring-loaded halves of the pulley on the jackshaft. This lowers the drive ratio and increases the scooter's speed. When the scooter slows down under a load, as in climbing a hill, the reverse occurs. The belt drops to the hub on the engine pulley and rides up the rim on the jackshaft pulley. This automatically increases the drive ratio to provide greater torque.

The drive specified here is made by the V-Plex Clutch Corp., Hagerstown, Ind. (part No. 66-535). It gives a low-gear ratio of about 8.5 to 1 and a high-gear ratio of 4.3 to 1. This produces a top speed of about 32 mph at 3,800 rpm. Alternate drive ratios can be obtained by changing the sprockets.

Engine speed is controlled with a motorcycle-type twist-grip throttle. These are available to fit on standard $\frac{7}{8}$ -in handlebars. The A-500's throttle linkage has a built-in spring return to the idle position. On engines not having this feature, it is necessary to install a separate return spring to pull the cable back when you let go of the twist-grip.

Final details

A two-passenger seat can be made as shown, or you can purchase a long "banana" seat from a bike shop. The rear support is made from the rear fork originally cut off the bike frame. A 90° seat post, a stock bike item, is needed to move the front seat support farther forward. High-rise handlebars, another standard bike accessory, complete the job.

If you're planning to fit out the scooter for road use, check with your local license bureau to see what extras are required by law. Fenders are optional, but are advisable for road travel. (In addition to the items already noted, the Gilliom Mfg. Co. can supply fenders, engine rails, engine shock mounts, twist-grip throttle, jackshaft, axles and a combined brake-drum-sprocket assembly—all designed to fit the PM minibike. Mail-order houses like Sears and Wards are sources for engines, wheels, sprockets, clutches, bearings, belts and chains. Kart-supply centers and motorcycle shops can also provide many of the items listed. ★ ★ ★

TOMORROW'S MARINE ENGINES

(Continued from page 199)

turbines also are experimenting with marine installations.

Greatly simplified, the marine trade is concerned with only two general turbine design variations. One type, already described, has two shafts. This is called "split spool," and the "hot wheel" (which produces the usable power) can be stopped for gear shifting. The other type has a single shaft with the compressor, drive turbine and driven turbine firmly joined.

Some of the small experimental auto turbines also have "regenerators" to use exhaust gas to preheat incoming air. This gives added power and a muffling effect on the exhaust. There are dozens of design variations on large turbines, but they are not likely to become important on small marine engines.

Turbine Troubles

The prime problem in gas turbines always has been compressing the intake air. In early models, all the power was needed to run the compressors—there was no "usable" power left over.

In recent years there has been tremendous progress in compressor design and efficiency. Some larger engines have used two turbines to run the compressor—a high-pressure and a low-pressure wheel. Others have used two compressors, running the compressed air through a cooler (to restore density lost in heating) then compressing this cooled air still further. Some engines use a ring of combustion chambers to heat the gases.

Another problem has been the high cost of machining the compressors and turbines. However, progress in casting heat-resistant metals for use in exhaust-driven turbochargers may provide the key to less expensive small gas turbines. One thing is certain: With all the money and know-how being pumped into these projects, something good is sure to result.

Every American company making marine turbines has a marketing plan, but they are all exclusively for Uncle Sam. The only turbine available to the public seems to be the one from United Aircraft.

Two Rovers showed up in the 1966 Paris Six Hour race, and a yachtsman will occasionally hear a turbine whistle past in a test boat. However, they are still several years in the future for most of us.

My money is still on the RC. It's too simple to miss, and too near the market to be ignored. A CW official says the first obvious application for the RC is marine use (he thinks in outboards). If I don't have one by 1970, I'm going back to sail! ★ ★ ★

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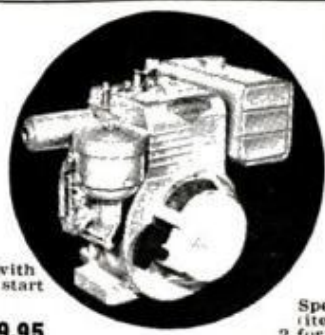
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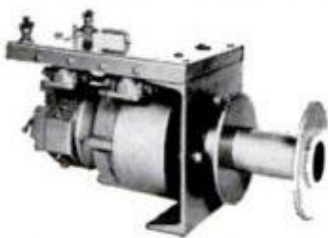
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ELECTRIC CARS

(Continued from page 208)

continuing battery research along with its fuel cells. Special silver-zinc batteries power its experimental Electrovaiv, capable of developing 100 hp.

Ford, while conceding that fuel cells may hold the ultimate answer to the energy problem, considers them far too bulky, heavy and costly in their present state of development. Instead, Ford of England is pioneering a "city car"—a subcompact holding two adults and two children—that will be powered at the outset by a conventional lead-acid battery. By the end of 1967 or early in 1968, a new "breakthrough" battery will replace it.

"The heart of the new battery system is a crystalline ceramic composed largely of aluminum oxide and based on a material known as beta-alumina," says Michael Ference Jr., vice-president for scientific research. "This material selectively passes sodium ions while containing all other liquids, including liquid sodium and sulfur."

Ford's new sodium-sulfur battery has 15 times the electrical storage capacity of the lead-acid battery. Coupled with new lightweight, powerful motors, it seems ready to propel Ford into the electric car

business at any early date. In all likelihood, however, Ford's "city car" will not attempt to compete with gasoline-powered juggernauts at freeway speeds. It is intended to provide low-cost city or suburban transportation—not long-distance inter-city travel. It will operate efficiently at 40 mph and can do 60 if required in a pinch.

On the bothersome question of cruising range, engineers are confident that new batteries under study—including such exotic concoctions as the zinc-air, the nickel-cadmium, the silver-zinc, the magnesium-silver and the lithium-chlorine—will push the current 50 to 100-mile limit to 250 miles. While this is still under what you can get on a tankful of gas, it is beginning to look hopeful.

It may be, in the end, that the real future for the electric car lies not so much in high-speed turnpike travel as in handy, low-cost local transportation for errand-running and commuting to work. If you can rid cities and towns of their bumper-to-bumper streams of exhaust-spewing gas-burners, you can go a long way toward ending the threat of air pollution. And you might just get, in the process, one of the sweetest-handling little dream jobs you've ever hoped to drive. ★★★

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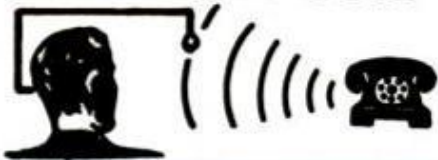
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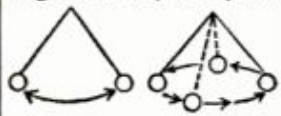
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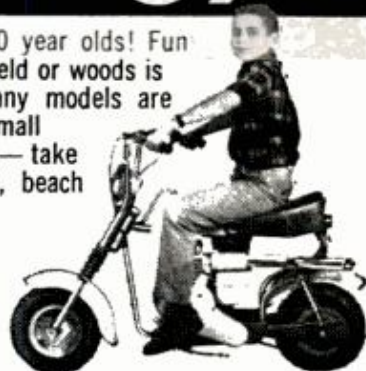
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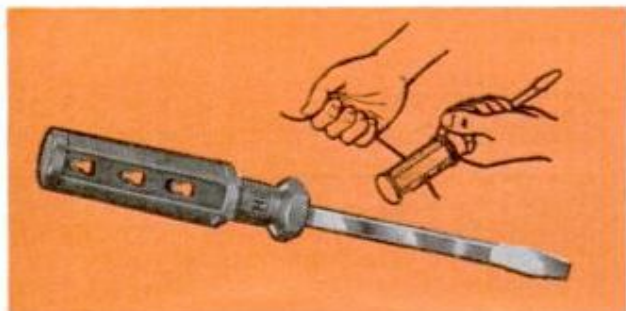
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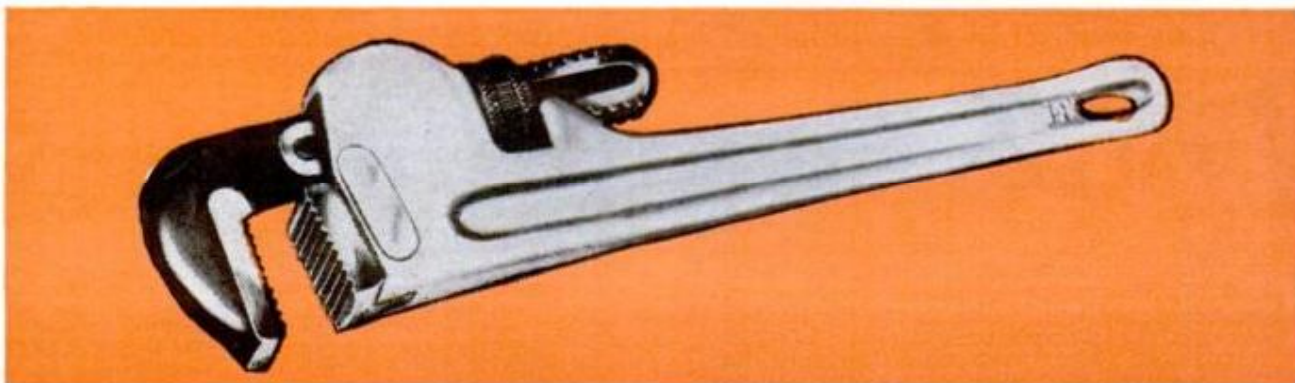
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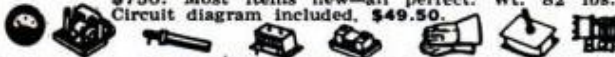
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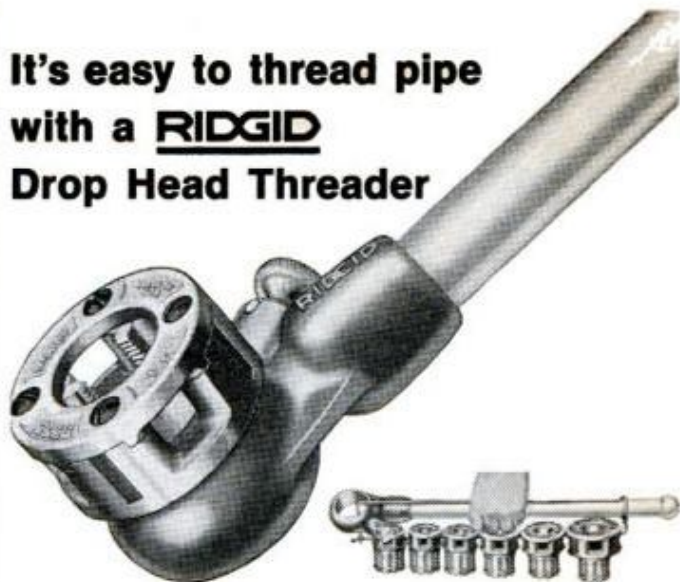
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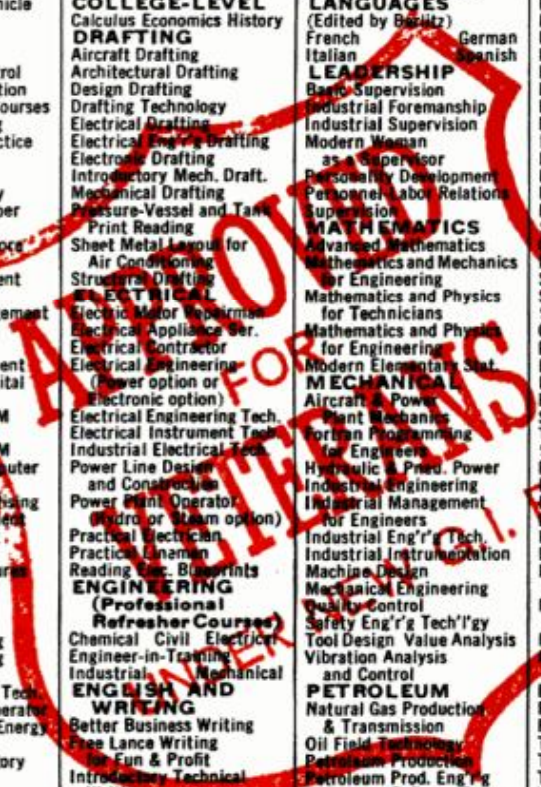
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