

Are Cars Really Getting Better? Page 80

POPULAR MECHANICS

APRIL 1968
35 CENTS

IN COLOR
Small
Submarines:
How to Tell
Who's Who
In the Deep

Build This 3-Stage VACATION HOUSE

See Page 138
For Others
You Could
Be in by
Summer



Exploring
Florida's Treacherous
Underground Rivers

Riding Up Front on
Japan's 132-mph Train

Page 94

A NEW PAINKILLER—
Merciful as Morphine,
Safe as Aspirin

HANDSOME HOME PROJECTS: Coffee-Table Aquarium, Built-In Bookcase

Saturday Mechanic:
Tune-Up Tips •
Also Dan Gurney

What Those New
Grades Tell You
About Plywood

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**FRAM FILTERS TALKS
TO THE EXPERTS**



Bill Jenkins talks about high performance engine tuning



FRAM visited Bill ("Grumpy") Jenkins, super-stock driver and engine preparation expert at his shop outside of Philadelphia. Jenkins is one of the best stock tuners and drivers on the scene. His specially tuned car ("Grumpy's Toy") is a consistent winner all over the circuit.

FRAM: Bill, you're one of the hottest super-stock drivers around. But we know your first love is engine preparation. Why is this?

JENKINS: Engine preparation is the most challenging thing about racing. It's a matter of taking a complex piece of machinery and coming up with a combination that lives.



FRAM: Just how do you go about hitting that combination?

JENKINS: Whenever I build an engine, I start from the ground up. Everything—including ignition, carburetion, and exhaust—must be in perfect balance and complement the work I've done on the engine. The right combination comes about when every single component does its job with maximum efficiency.

FRAM: Bill, you mentioned carburetion and exhaust. Isn't it just a matter of opening up the system as much as possible and reducing back pressure in the exhaust?

JENKINS: It's a lot more than that. Let's take the carb first. The basic problem is keeping enough gas in the float bowls to cover the jets. In other words, it's not so much the carb itself as getting a correct combination of pump pressure, flow rate, necessary auxiliary fuel pumps and—finally—making sure there's no restriction in the line.

Now, about the exhaust system. What you've got to keep in mind here is that the configuration of the headers is entirely dependent on cam. The two are completely interlocked. When the exhaust and cam are perfectly r

you'll find it's probably necessary to lean down a bit.

FRAM: Bill, what about "fit" and "cleanliness?" How important are these two?

JENKINS: Very. "Fit" is a combination of the tolerances called for and absolute equality on all bearing clearances. It involves a lot of work. "Cleanliness" is what protects all that hard work. Cleanliness starts with removing all burrs from the oil galleries and foreign material left in the engine at the factory and includes total cleanliness in the internal oiling system.

So. After I've gone to all the trouble of fitting, measuring and modifying that engine, I naturally want to protect my time and effort. That's what cleanliness is all about—protection.

FRAM: And this is where Fram Filters come in, right?

JENKINS: Right. I know I can depend on Fram to remove harmful contaminants from the oil and also stand up under the terrifically high pressure differential that the filter material is subjected to every time I rev up. I'd hate to see all my time and effort blown out through the exhaust just because a piece of grit snuck into the bearings or the filter element collapsed under the strain. With Fram this is something I just don't have to worry about—ever.



Fram Performance-Proven Filters
They work on the track.
They work on the road.

This One



GRLS-KHN-1HRY

How Renault scrimps on gas without scrimping on car.

The average price of a gallon of gas in Europe is 68¢. And since the price never has been very reasonable, we have always been faced with a very unreasonable task: Design automobiles, comfortable automobiles, which merely sip at gasoline.

The Renault 10 can sip at the rate of 35 miles a gallon.

One of the chief reasons for this remarkable mileage is the Renault 10's engine. Quite simply, if you don't waste power, you don't waste gas. Which isn't all that simple.

In practice, it meant developing a new casting technique to get a more compact engine block. By keeping the block size down, we keep the car size down, which keeps the gas consumption down.

It meant anchoring the crankshaft with 5 main bearings (as much as most V-8's) to cut vibrations down to an irreducible

minimum. No vibration, no power waste, no gas waste.

The next bit of gas-saving isn't easy to explain. See that brick sitting on that pleated paper?



A PIECE OF PAPER CAN SUPPORT A 4½ lb. BRICK

Without those pleats, the same paper would never even support another piece of paper. That, in



principle, is the kind of extra wrinkle we design into the steel structure of the Renault 10. It

allows us to increase strength and rigidity without increasing sheer dead weight. And by not increasing dead weight, again, we don't increase gas consumption.

Sealed liquid cooling. Every engine uses gas most efficiently at a particular temperature. And there is no better way to maintain this optimum temperature than with liquid cooling. Therefore: liquid cooling. Which also means we don't have a big, oversized fan stealing power (and gas) from the engine.

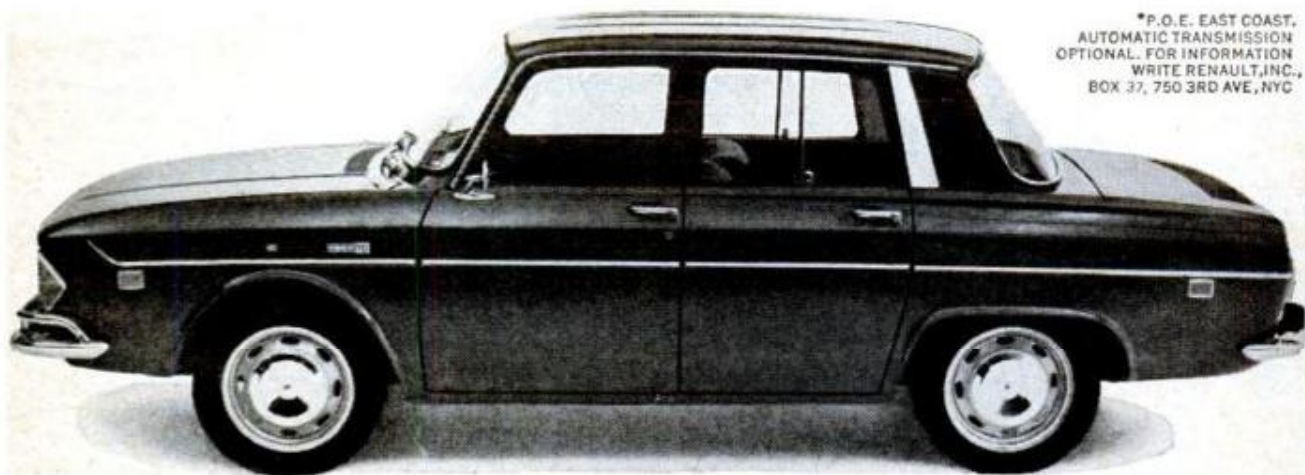
As you can see, to scrimp on gas we've had to be rather lavish on engineering. Over the last 10 years, in fact, Renault has averaged a new patent every 3 days.

Now, with your permission, a little documentation on how little scrimping there is on car. Included in the \$1,745* price: Seats that have been compared with the seats in a Rolls-Royce. And which convert into twin beds. 11 cubic feet of trunk. Top speed, 85. Self-adjusting 4-wheel disc brakes. 4-wheel independent suspension. 4 doors. 4 speed synchromesh transmission.

If there's any scrimping on the Renault 10 at all, it's on the gas tank. It only holds ten gallons. (About 350 miles worth.)



*P.O.E. EAST COAST.
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AUTOMOBILES AND DRIVING

- [22 Detroit Listening Post](#)
- [38 Drivin' With Dan](#)
- [70 Automobile Clinic](#)
- [80 Are Cars Really Getting Better?](#)
- [90 PM Owners Report: Buick Special Deluxe](#)
- [100 PM Owners Report: Chrysler Imperial](#)
- [184 Saturday Mechanic: Three Steps to an Expert Spring Tune-Up](#)

HOME AND YARD

- [60 Homeowners' Clinic](#)
- [136 Make This Sod Plugger for a Better Lawn](#)
- [138 Vacation Homes to Live in This Summer](#)
- [146 How to Square a Foundation](#)
- [147 Build These Weekend Projects for Your Vacation Home](#)
- [150 Build PM's Coffee-Table Aquarium](#)
- [156 How to Build an In-a-Wall Bookcase](#)
- [161 How to Tune Up Your Mower](#)
- [164 Solving Home Problems](#)
- [171 How to Install Your Own Garage-Door Opener](#)

BOATING, OUTDOOR RECREATION

- [34 What's New Outdoors](#)
- [108 Deep-Squeeze Diving in Florida's Underground Rivers](#)
- [124 We Took Our Boat Along](#)
- [132 Catch More Trout by Telemetry](#)

PHOTOGRAPHY

- [20 The Mysterious Mirror That Doesn't Move](#)
- [128 Two Bright Ideas for Better Photo Lighting](#)

AEROSPACE, AVIATION, MILITARY

- [59 Aviation Jetstream](#)
- [86 They Hunt for Floating Death](#)

ELECTRONICS, RADIO AND TV

- [132 Catch More Trout by Telemetry](#)
- [182 Motor Speed Control and Built-In Timer](#)

SHOP AND CRAFTS

- [116 Stretchiest Rubber Yet Lets You Cast Anything](#)
- [137 Hints from Readers](#)
- [147 Build These Weekend Projects for Your Vacation Home](#)
- [150 Build PM's Coffee-Table Aquarium](#)
- [166 What the New Plywood Grading System Means to You](#)
- [170 Hints from Readers](#)
- [175 Hints from Readers](#)
- [176 How to Sharpen Tools on Your Radial-Arm Saw](#)
- [178 Pick the Right Clamp for the Job](#)
- [188 Hints from Readers](#)

SCIENCE AND INVENTIONS

- [14 Science Worldwide](#)
- [77 A Computer in the Basement?](#)
- [94 The Train That Gives the Jets the Jitters](#)
- [102 Don't Throw It Away—Send It to Kidwell!](#)
- [106 At Last: A Powerful, Safe Painkiller](#)
- [111 The Big Rise of the Little Sinkers](#)
- [122 Just Patented: PM Picks the New Inventions](#)

REGULAR FEATURES

- [6 Letters](#)

NEXT MONTH IN POPULAR MECHANICS

On-the-Go Camping '68. This colorful, 32-page save-it section is loaded with tips on buying and using a camper. You'll want to keep it in your glove compartment on your next camping trip.

Rodger Ward's Indianapolis Preview: Will the turbines take over?

Those New Tabletop Radios: How hi is their fi?

PM Owners Reports. See what they say about the Mustang and Olds F-85.

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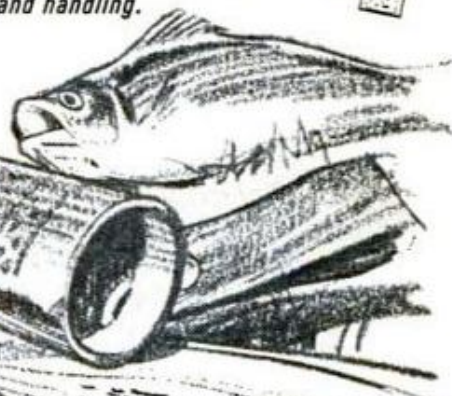
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5

The Lazy Pipe Tobacco



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Just to give you an idea: you can watch about half of an old Charlie Chan movie on one filling of Bond Street. You'll be quite happy with the good Bond Street flavor (and unless you're alone, someone will surely say something nice about the aroma).



Lights easy—
takes its own
good time about burning.

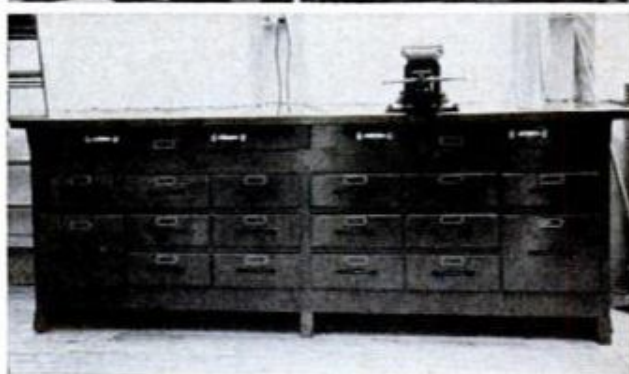
LETTERS TO THE EDITOR

Royal do-it-yourselfer

I have been an avid reader of your magazine for quite a number of years. I have always been interested in do-it-yourself projects for relaxation as well as for their economic and time factors.

I have an old World War II Jeep, which I got in 1944. I maintain this car by myself 90 percent of the time, and three years ago with my wife stripped the whole thing down to the smallest unit and reworked everything. Now it is like new.

I am enclosing pictures of my new workbench. Plans for it appeared in your



magazine a number of years ago (*Equipping the Home Workshop* page 344, Aug. '32 PM). I have never seen a workbench that's such a good and practical design.


GENEVA, SWITZERLAND KING MICHAEL
OF ROUMANIA

The king has a better memory than we have. It took us a couple of days to locate the workbench article. Incidentally, if any other readers want a workbench fit for a

(Please turn to page 8)


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LETTERS

(Continued from page 6)

king, you can order Xerox copies of the article for 60 cents plus 15 cents for mailing from PM's Bureau of Information.

Not in the bay

I read with considerable interest Bob Crossley's Report from Japan (page 34, Feb. PM). The first Japanese car to roll off the assembly lines up here was an Isuzu Bellett, which had its debut Jan. 31.

However, the car was not produced in Sydney Bay, but in Sydney. To be more specific, it was made in Point Edward across the harbor from Sydney.

SYDNEY, N.S.

GLEN GRAY

Likes those auto stories

You have the best magazine (along with *Hounds and Hunting*) in the U.S.A. I like *Drivin' With Dan* and would like more stories by "Pops" Curtis Turner like *Can Ford Halt the Petty Parade?* (page 89, Feb. PM). Could this be a regular feature? Bill Kilpatrick has some very good and timely articles on automobiles. Mort Schultz must be a fine mechanic. Here's

hoping I'm never without your magazine.
ENGLEWOOD, TENN.

JIM BROWN

We'll keep Dan, Bill and Mort appearing in every issue and "Pops" as often as possible. Doubt if they'll be writing much about hounds, but they'll sure keep you up-to-date on cars and driving.

Camping in Europe

My husband read *We Camped Our Way Through Europe* (page 128, Jan. PM) with a great deal of pleasure and amusement.

In the summer of 1966 I took my three teen-age girls on a camping trip through Europe in a VW camper also. My husband had planned to join us during his vacation in July, but was unable to do so—so he has only our stories and pictures to judge the trip by. If he had any doubts about the accuracy of these, John Linkletter's article must have dispelled them. One would swear that he and I had gotten together on that article. Many of his comments and descriptions sound like a recording of things I have said.

MOUNTAINSIDE, N.J. MRS. FREDRICK GROSS

The modest author comments: "Mrs. Gross is obviously a perceptive, intelligent" (Please turn to page 10)

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size—
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Trouble like poor gas mileage. Trouble that can mean high gas bills.

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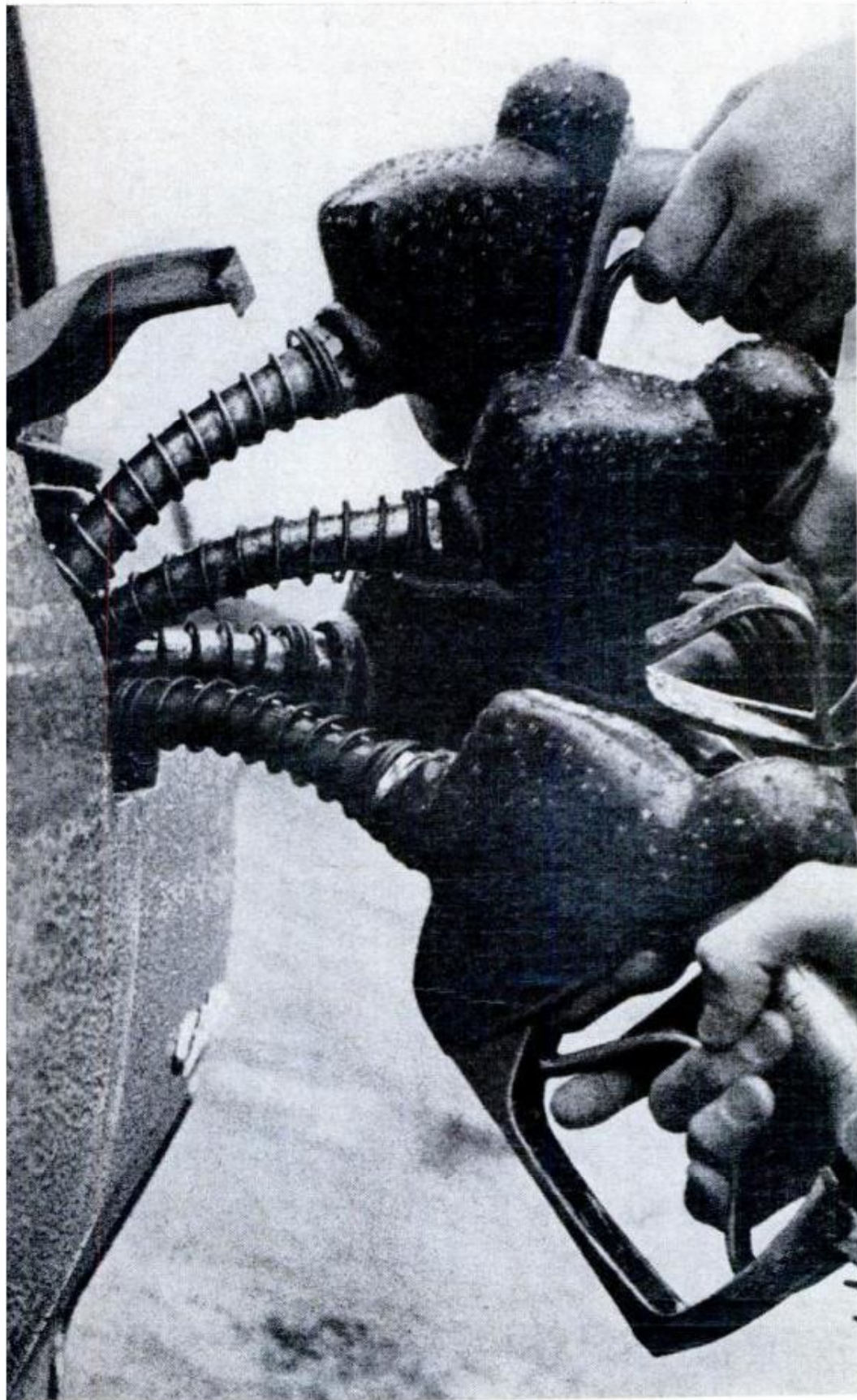
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LETTERS

(Continued from page 8)

gent and literate lady. I wonder, though, if she says the same things I do when a tent has to go up at night in the rain?"

I couldn't agree more with the Linkletters that this is the way to see Europe. The campgrounds are excellent (we even stayed in some of the same ones they did), and part of the fun of the trip was looking for a good spot each night. We are sorry they missed Bois de Boulogne in Paris as it is one of the best and even had shuttle service to the metro so that Paris was easy to tour. The carnet they didn't have, we feel, is a must; it gained us entrée to many campgrounds. It seemed more important than the passport at times.

SIERRA MADRE, CALIF. MRS. MILTON VALOIS

Curio planter mistake

You've made an error in the measurements of the Curio Planter (page 167, Jan. PM). There's a 5 where a 3 should be.

My husband bought his wood, cut it for the shelves and found the mistake when he went to mark it off for scroll-cutting. He had to buy more lumber.

We received the magazine on Friday, and by Tuesday he had it made and hanging. The planter is very lovely.

MOKENA, ILL. MRS. ALVIN SCHULDT

Hoo boy. This is the kind of goof that grays our hair as well as yours. Any other readers who plan to build the Curio Planter should change the 5 $\frac{3}{4}$ -inch measurement in the side view to 3 $\frac{3}{4}$ inches.

Time's up!

In July 1957 you printed an article about Your Aerial Sedan for 1967 (page 74). It is now 1968, and there is no such thing. I just wanted you to know that they were wrong.

NEWARK, N.J. DAVID VALDES

Were they ever! Let's give 'em just one more year either to get it flying or to find a new crystal ball.

Anyone for High-Tailing?

Exactly a year ago, we printed Meet PM's High-Tailer (page 110, April '67 PM) and—somewhat hesitantly (we thought it was a tough project)—offered plans. No one was more surprised than we when more than 4000 ambitious souls bought those plans. Now we're curious: Were all 4000 just dreaming, or did you really build it? ★★★

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Naval Jelly is an extremely active cleaner that removes rust by chemical combination, sticks to verticals and overheads. Brush it on, let it work, then hose it off! Use on pipes, fences, tools, tanks, all machinery. Ideal for old automobile work, contractors, maintenance men. Eliminates sandblasting and scraping, is easy and quick.

Recent imitations of Naval Jelly cannot compare with Naval Jelly which is assigned Naval code designation numbers, is now used throughout the world. Naval Jelly is the trade mark for this remarkable rust remover, manufactured by and owned by Meredith Separator Co. We want you to try it. This is why we are offering a FREE SAMPLE of Naval Jelly. Please include 25¢ handling charge in stamps or coin. If you order other merchandise from this page the 25¢ will not be necessary.

PUT DOWN an INSTANT LAWN

- In Your Yard
- On a Roof
- Inside the House!

7000
BLADES



per
Sq. Foot!

MADE IN USA

New permanent grass looks and feels like real grass. Molded into 12-inch squares with hidden tabs that assemble squares quickly into seamless, perfect grassy carpet of any size. Cement square down, or let them lie. Ideal for walkway areas since it will not wear out. Even a car will not damage it. Non-flammable, non-toxic, non-allergenic, can be vacuumed or washed! Each square contains a full 7000 individual green blades, inert, tasteless, oil, acid and stain resistant, waterproof, safe, never fraying or cracking in hot summer or bitter winter cold!

SAMPLE SQUARE FOOT



We know you will want to see and feel Instant Lawn for yourself. Prices per sq. ft. depend upon quantity you order, as low as 90¢ per sq. ft.! Much cheaper than any floor covering! We will ship you a sample Sq. Ft. for \$3 to cover our costs of handling one unit. Any later order will earn you a rebate on this first sample. Send \$3.

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INCREASE Your Seeing Power

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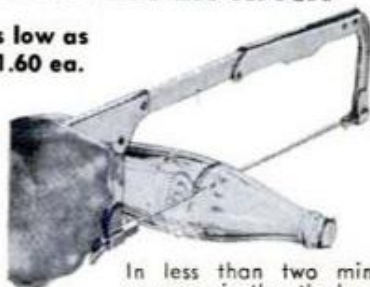


TREE STUMP REMOVER

disintegrates wood all the way to the bottom of the roots themselves by safe, chemical action. Saves you chopping, and digging. Full 8 ozs. only \$1.49 ppd. 16 oz. \$2.50. 5 lbs. at \$2. per lb. \$10. ppd.

CUT ANY MATERIAL WITH SUPER-HACK

as low as
\$1.60 ea.



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 Stump Remover 8 oz 16 oz 5 lb.
 Super-Hack as checked at left
 Beer Can Lighters 6 2
 Bugmaster H Bugmaster G
 Extra H Crystals G Crystals

Name _____

Address _____

City _____ State _____ Zip _____

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Die Hard

Die Hard

Naked Power

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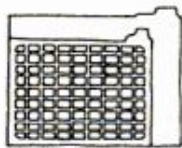
This is not the DieHard you have been reading about. (The most powerful car battery of its size in America.)

This one is even more powerful and you can see through it. With a battery this good we have nothing to hide.

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The high, wide plate

extra 680 square inches of plate area in contact with the battery acid.

And that produces a lot of extra power.

This is no ordinary advertising claim. We aren't giving you an inch and calling it a mile.

We are giving you 35% more usable starting power than the best battery of its size made by anyone else in

the business.

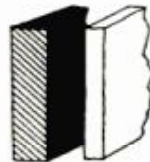
Try that out on a balky engine some freezing morning and see what we mean.

If you want to thank something, thank polypropylene. This weird sounding plastic is one of the leading miracle materials in an age of miracle materials. Even with 50% thinner walls, it is far stronger than the old black battery case ever was.

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So we did something else to the new DieHard. To make sure you know you're getting the strongest battery case there is—the polypropylene case—we left it the natural color of polypropylene.

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Thinner but stronger.

plates. And the acid.

You can also see when your battery needs water. And if this helps you take better care of your DieHard, that's fine with us.

Because we guarantee the DieHard for five long, happy years. And when Sears guarantees, Sears guarantees.

There are over 2000 places you can buy the DieHard. They're all Sears, Roebuck and Co. stores. You can Charge It on your Sears Revolving Charge.

The Sears 5-year guarantee: "Free replacement within 90 days of purchase if battery proves defective. After 90 days we replace the battery, if defective, and charge you only for the period of ownership, based on the regular price less trade-in at the time of return, prorated over number of months of guarantee."

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Calves' hearts for humans? That's a distinct possibility, according to Georgetown University's Dr. Charles Hufnagel. He has been working trying to find ways of treating the hearts of unborn calves so that the organs can be grafted into humans. Dr. Hufnagel says that if the human body can be made to accept calves' hearts, a living heart bank could be established, eliminating the need for human donors. In a recent operation performed in Israel, the valve from a calf's heart was used successfully to replace a human heart valve.

Sea creatures never before known may lurk in deep, nearly oxygenless basins beneath the Gulf of California, according to marine biologists at the University of Southern California. During a recent research cruise, the basins, formerly believed to be uninhabited, were found teeming with life. "We are not yet certain, but there probably are species of animals among the bottom dwellers that never have been classified or studied," said the leader of the research team.

A plan to investigate the atmosphere of Venus by means of a balloon-borne experiment station is under study for NASA by scientists at the Martin Marietta Corp. Here's how the study might be carried out: A Mariner space vehicle, on a flyby mission, would eject the balloon with its attached lab package as it passed Venus. The buoyant station would float for at least a week in the dense cloud layer surrounding Venus, drifting with wind currents as it relayed data to Earth. Small instrument packages would be dropped to measure temperatures and pressures near the surface of Venus.

Big step forward in the human-ape dialogue has been achieved by a two-year-old female chimp named Washoe. Using sign language, she can indicate her desire to eat or drink, to go in or out, or to have her blanket pulled over her. If she wants more food, she puts her fingertips together. She makes the sign for "please" by drawing an open hand across her chest. For "I'm sorry" she rubs a bent hand on her chest. Washoe is being trained by a husband-and-wife team, Drs. R. Allen and Beatrice T. Gardner, psychologists at the University of Nevada. Chimps have proved complete duds at learning human speech.

Key health information on all the people in Sweden's greater Stockholm area will be stored in a central computer. Closed-circuit TV will link the data bank with hospitals in the system. By dialing a patient's registration number, a doctor will be provided with clinical information such as a history of previous illnesses, present health status and blood type. The system, scheduled for operation by 1972, is similar to a program being developed here (see *Computers . . . They Supply Answers When Your Doctor Needs to Know*, page 134, March '67 PM).

What wiped out the dinosaurs? Their extinction might have been caused by a bombardment of radiation from a star that exploded relatively near the earth. That's the theory of Dr. Kellend D. Terry, a University of Kansas geneticist, and Dr. Wallace H. Tucker, a Rice University astrophysicist. Basing their calculations on current knowledge of exploding stars, or supernovas, the scientists say that the earth has been hit by huge doses of radiation 182 times in the past 600 million years. Each of those doses could have been potent enough to kill or make sterile many higher forms of life.

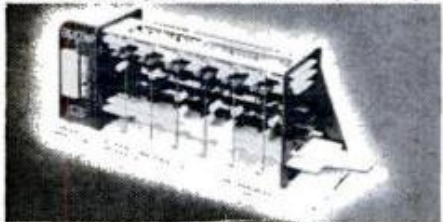
A man-made river nearly 1000 miles long, running from Nebraska to Texas, has been proposed as a way to irrigate 53 million acres of arid land in six western states. The plan would divert 13 million acre-feet of water annually from the Missouri River below South Dakota's Fort Randall Dam. (An acre-foot is an acre of water one foot deep.) The water would flow almost due south through a concrete canal 22 feet deep, with a width of 60 feet at the bottom and 148 feet at the top. The plan is the brainchild of R. W. Beck & Associates, a prominent firm of consulting engineers. ★★★



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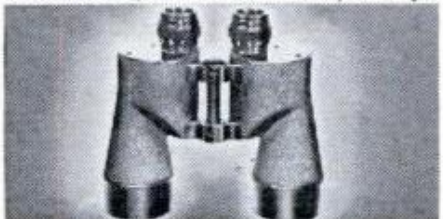
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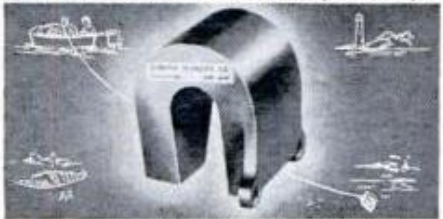
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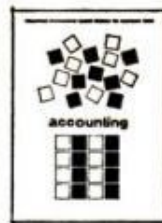
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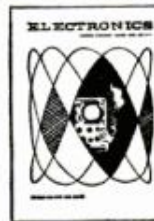
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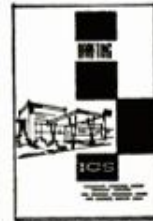
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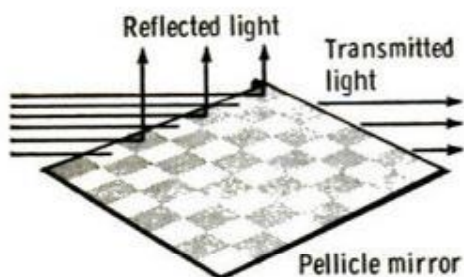


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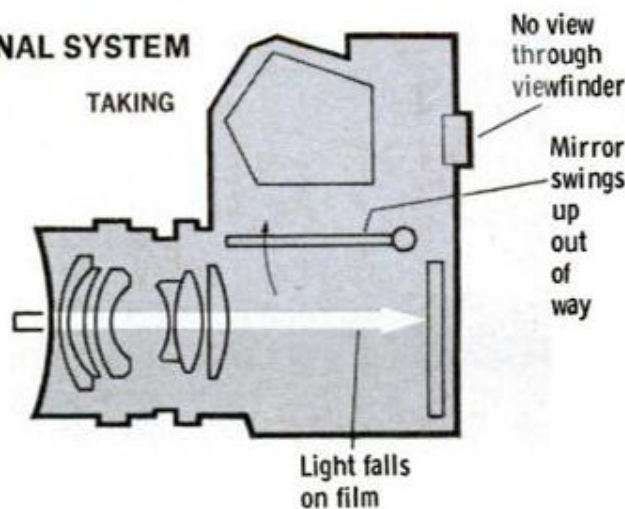
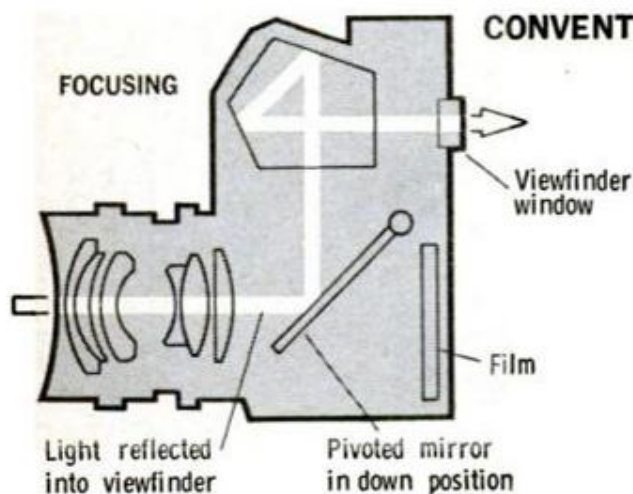
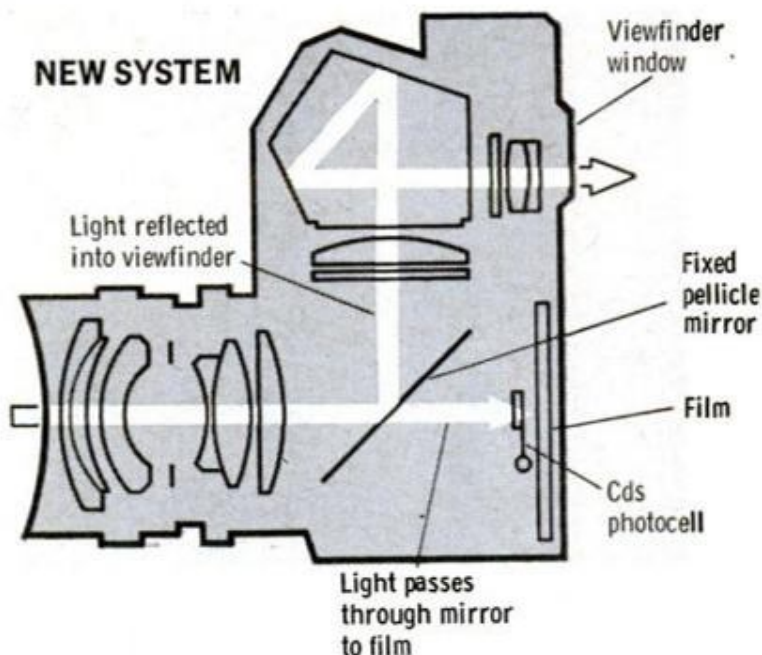
PICTURE THIS:

The Mysterious Mirror That Doesn't Move

By SHELDON M. GALLAGER



GRIDLIKE COATING on new mirror reflects some light, lets rest through



ADMIRERS of the popular single-lens reflex have something new to get excited about—a mirror that doesn't move. Mounted at a fixed angle in front of the film, it reflects light into the viewfinder in the usual way. But here's the switch: At the same time, light passes right through the mirror to expose the film. The conventional SLR mirror must swing out of the way to take the picture.

This means no delicate mechanism to get out of adjustment, no jarring flip-flop inside the camera, and no blackout of view in the viewfinder. You see just what you're shooting the whole time.

First camera to use the stationary mir-

ror is Canon's Pellix QL, a swank SLR that also has through-the-lens metering. The mirror is a transparent membrane with a thin metallic coating. The Pellix gets its name from "pellicle," meaning skin or film. Its Japanese designers aren't telling exactly how the coating works, but it both reflects and transmits light—sort of like a shiny cheese grater.

The mirror does block some light, but not as much as you'd think. The loss, says Canon, is only 1/2 or 1/3 of a stop—no problem with today's fast films and lenses. The Pellix lists at \$299.95 with 50-mm f/1.8 lens. It's sold by Bell & Howell, 7100 McCormick Rd., Chicago 60645. ★★

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LISTENING POST

BY BOB IRVIN

FORD'S WRIST-TWIST STEERING PROJECT is still alive and kicking. In recent months, police in Washington and California tested cars equipped with two small wrist-twist steering wheels similar to those introduced a few years back on an experimental Mercury (See *Look, Ma—No Wheel!*, page 91, April '65 PM). The Washington police found they could negotiate an obstacle course quicker with wrist-twist steering than with a conventional steering wheel. Word at Ford, however, is that odds are still against production for the foreseeable future.

TIRE GRADING may stir up yet another battle between federal safety officials and industry. Federal officials have only a few months in which to establish tire grading standards. The idea is to emulate insofar as is possible recent grading standards established for meat. And this idea, sources close to the rubber industry report, isn't going to sit well with tire dealers, who for years have marketed tires under an often-confusing blanket of company-inspired terms. Beneficiaries of the new standards will probably be the tire-buying public, who presumably will find it more meaningful to buy a tire marked "Grade A" than one labeled, say, "Super Deluxe Premium."

STEERING-COLUMN LOCKS will be standard on all 1969 General Motors cars. Ford will follow in 1970, the year by which government regulations require them. Some European subsidiaries of U.S. auto firms have been installing such devices for years, and many PM readers will recall such locks on pre-World War II Ford products. The idea, of course, is to cut down on car thefts. Speaking of which. . . .

MASTER CAR KEYS—the kind distributed by mail order firms—are probably not worth the metal they're stamped out of. (See *Car Stealing Made Simple*, page 57, July '66 PM, an article that started much of the current crackdown on car thefts.) General Motors cars this year, for example, can have one of 2100 different key-lock combinations. According to one Fisher Body engineer, a thief would have to lug around 20 pounds of master keys to be sure of opening a GM car. What's more, this year's keys won't fit next year's lock cylinders. The government wants each carmaker to have at least 1000 different key-lock combinations on 1969 cars. Hopefully, in the near future, skeleton keys for cars will be put to rest.

A BREAKTHROUGH FOR ALUMINUM CAR RADIATORS may be in the cards. Alcoa, a leading aluminum producer, claims it has worked all the bugs out of building and servicing aluminum radiators, says it hopes to have a large chunk of the radiator market by the early 1970s. But copper industry officials, long top dogs in the car-radiator business, say the bugs involved in use of aluminum are a long way from being solved. Copper officials aren't complacent, however; they know cost-conscious auto manufacturers are on the prowl for newer, less expensive materials out of which to make both radiators and battery cables.

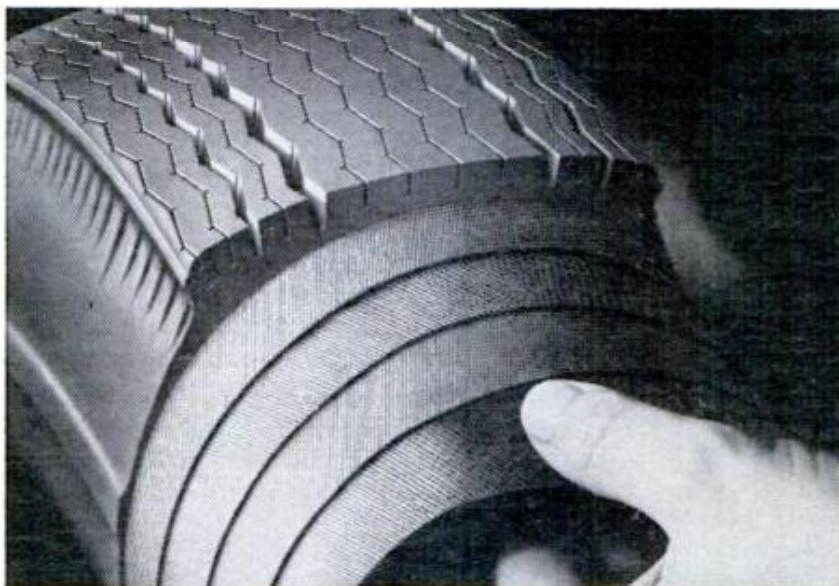
FORD'S TURBINE ENGINE, now strictly experimental, may be put out for truck fleet testing before the end of the year. Ford had hoped to get a few out by mid-year, but last fall's strike delayed things by about six months. Both Ford and GM are aiming for truck turbine production by the mid-70s. International-Harvester also has an experimental engine that could be in production about the same time.

A GM SMALL CAR for the North American market would probably be built in Canada; that is, if GM decides to produce such a car. It would be an obvious way for the auto

(Please turn to page 24)



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DETROIT LISTENING POST

(Continued from page 22)

giant to meet its commitment under the U.S.-Canadian auto free trade agreement. Under the terms of the pact, the car—should it be made, and in Canada—could be brought into this country duty-free. It would be the first truly Canadian car, a fact that might help north-of-the-border sales. Also, the fact that it would be Canadian might give it enough of a foreign flavor to appeal to some of the import car buffs, a market segment expected to buy more than 800,000 foreign-built cars this year. The rumor is that before GM will commit itself, it wants to be reasonably sure of a market calling for at least 250,000 a year.

A MINI-PUMP to inflate tires, air mattresses, beach balls and similar stuff a vacationing family might carry is being offered by Pontiac. Actually, the gadget is an emergency air pump that operates via a hose running from a vacuum fitting on the car's engine to whatever is to be inflated. It's an old concept, similar hardware dating back to the earliest days of motoring.

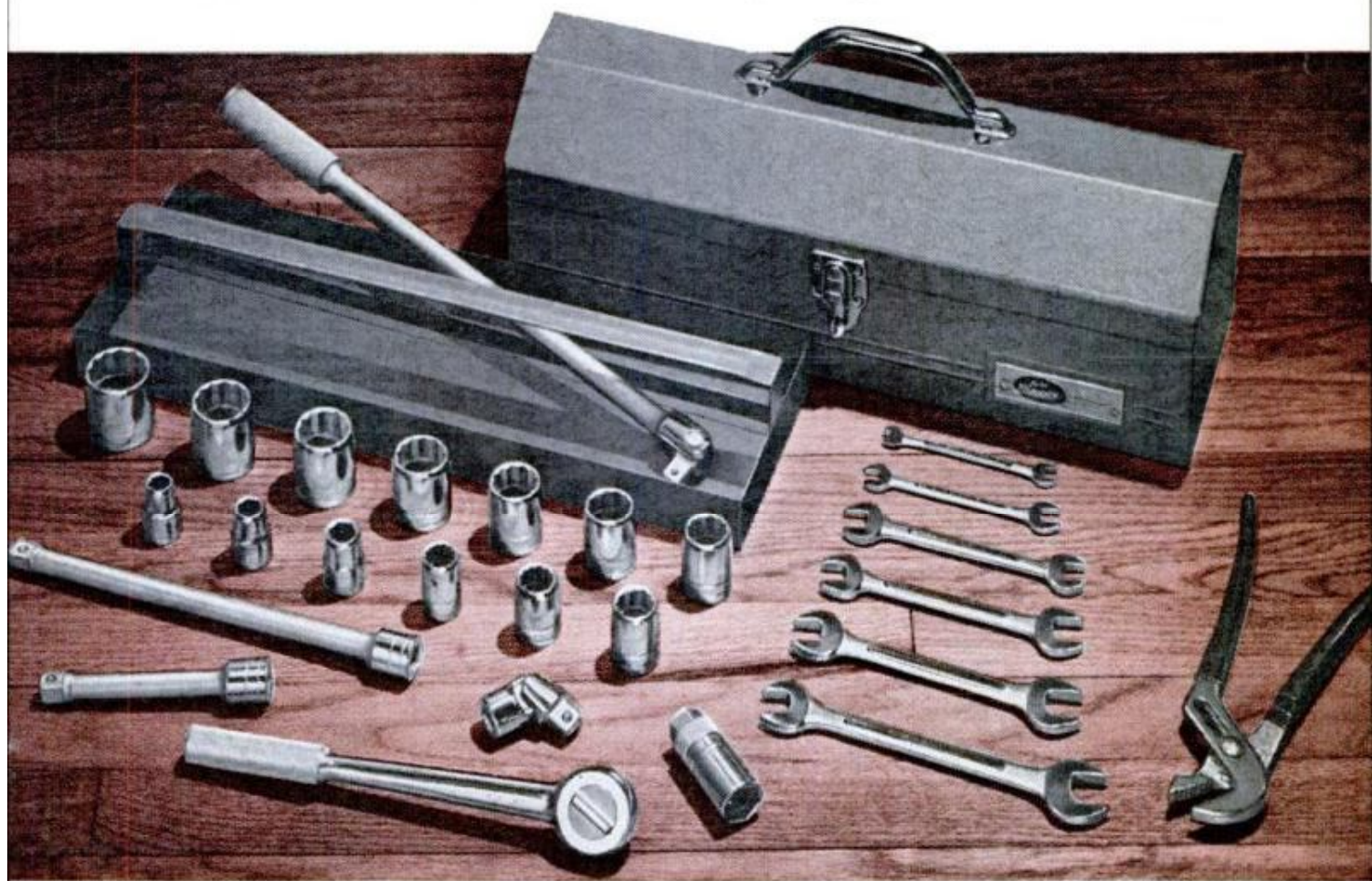
PSYCHEDELIC HIGHWAYS may help people drive with more safety. Well, not psychedelic, really, but studies made by highway officials in Ohio and New Jersey indicate that painting freeway ramps, highway intersections, and such in bright reds, yellows and greens seems to result in safer driving patterns. In daylight, that is. Modern, fluorescent types of streetlighting make it difficult for drivers to see the colors at night.

THE ELECTRIC CAR made by Westinghouse—dubbed the "Marketeer"—has been yanked off the production line because it can't meet federal safety standards. The company says it hopes to resume production if the government will set up standards for such vehicles. Thus, a quiet death for a car born in a glare of publicity only a year ago. Sort of makes you wonder whether or not other electric car projects, each of which was launched in a similar fanfare, will follow the same route.

VOLKSWAGEN'S POPULAR BEETLE can, at last, shift for itself. If you look at it a certain way, other imports may be the reason why. VW's "Automatic Stick Shift," introduced early this year, is designed to meet competition from Japanese and other European carmakers who have offered automatic transmissions in small sedans for some time. ★★★

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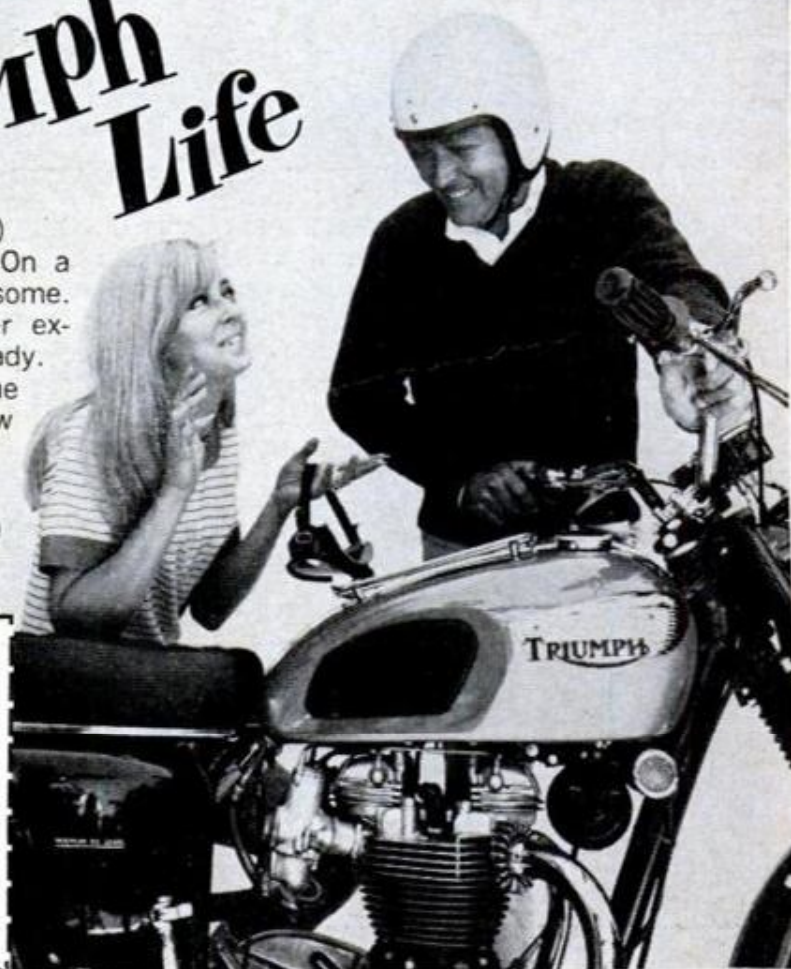
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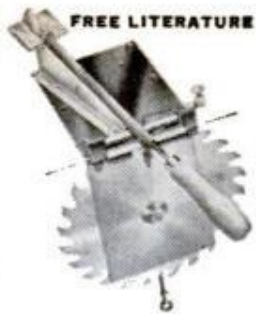
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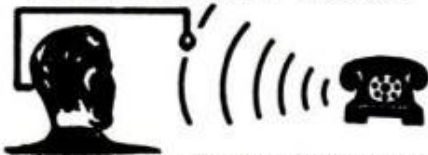


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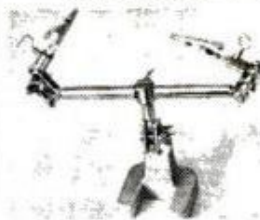
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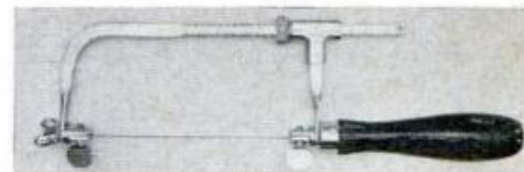


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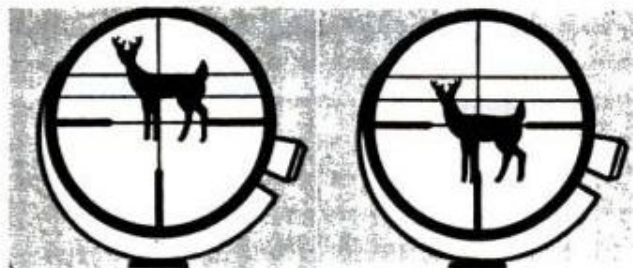
BY DAN FALES

REALIST has really upset the rifle-scope picture. The company has just introduced a new telescopic sight that ends hunter hair-pulling over a missed, long-range shot. Now you can get a scope that automatically compensates for bullet drop.

After thousands upon thousands of shots, researchers at Realist tabulated the bullet drop for different calibers and makes over 100 to 500-yard ranges. They



then produced a cam (arrow in the photograph) that tilts the scope to create an elevation correction compensating for bullet drop at various ranges. Once you have your target in the sights, you adjust the cam rotating knob so the two horizontal




cross hairs in the upper part of the scope picture bracket the animal's shoulder and brisket (left-hand drawing). Once done, you sight the animal through the regular cross hairs (right-hand drawing), and squeeze off a round. Adjusting the horizontal cross hairs establishes the range and moves the cam so the scope is elevated to compensate for bullet drop.

You can easily change cams on the scope. This lets you choose the right compensator for the caliber and make of ammunition being used. The only thing the scope doesn't do is allow for windage. Here you're on your own—Kentucky style.

Right now, the Realist system is available on the 6X Leatherwood Auto/Range Riflescope. (Leatherwood is the name of the inventor.) But you can't tell, they might put it on a variable scope after awhile. Who knows, they may even put a little anemometer on the front sight so you can figure windage too. Anyway, this new Realist scope costs about \$99. For more info, write Realist, N93 W16288 Megal Dr., Menomonee Falls, Wis. 53051.

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Drivin' with Dan

Why is Ford racing Cyclones rather than Torinos in major stock-car events? How long should a car be warmed up? What do you think of diagnostic centers? Dan Gurney answers these and other provocative questions



THE GURNEY GRIN, as much a part of Dan as his deft driving, lights up for the camera moments before he folds himself into a new Eagle to run a tire test

Q. You won at Riverside in January in a Ford Torino. But now, Ford seems to be putting its major stock-car effort behind Mercury Cyclones. How come?—Herb Atkinson, Des Plaines, Ill.

A. No one seems to know just why, but wind-tunnel tests showed the Cyclone body to be aerodynamically a little faster than the Torino. Perhaps the Cyclone's grille is a bit smoother, which could result in higher speeds. This can be very important at the big super speedways—Daytona, Charlotte, and so on, where the emphasis is on all-out speed. So Ford's idea, as I get it, is to run the Cyclones on the super speedways, the Torinos

on the smaller tracks. Riverside is not a "nail it on the floor" race, the track being primarily a road course. But I can assure you that Torino I drove at Riverside stepped right along.

Q. I read somewhere that Porsche 911s are being used as police cars. Can this be true?—Jody Cooper, Boston.

A. Yes, it's true. It's my understanding that something like eight countries throughout the world use the Targa 911 for police work. I'm told that Porsche would like to sell such cars in this country. If it does, watching some cop take off after a speeder might be more exciting than a lot of sports-car racing.

Q. A friend of mine told me there are outfits that manufacture devices that enable a driver to avoid police radar. He said they warn a driver that he's approaching a controlled radar speed zone, thus giving him time to slow down to posted limits. Isn't this kind of sneaky and self-defeating?—Harold Overstreet, Tucson, Ariz.

A. I would think so. It's true that many posted speed limits are far too low for today's cars and traffic patterns. But I like to feel most speed limits exist for the greatest good of the greatest number of drivers. Police have to draw a line somewhere, particularly in our more crowded areas, and I should think the best idea—from both a social and safety point of view—would be to go along with them. Driving should be a pleasure, either for its own sake or as pure transportation. I don't think outwitting the police, or somehow foiling their traffic controls should have any place in a driver's thinking.

Q. Who do you think is going to win this
(Please turn to page 40)

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DRIVIN' WITH DAN

(Continued from page 38)

year's Indy 500?—Steve Korbick, Geneva, N.Y.

A. Boy, Steve, if I could answer that one, I'd either save or make an awful lot of money. The big thing about racing, of course, is that anything can happen. It's true that the better cars usually are driven by what I guess could be called the better drivers, but Indy history is full of surprises, as is the race itself every time it's run. All drivers and car owners are there to win, yet some appear to have a better chance than others, usually because of superior equipment, more experience on the part of the driver, more efficient pit crew work, and so on. You can name such fellows yourself, I'm sure. It ought to be an interesting race; the whole world, I suppose, will have its eye on whatever turbine-powered cars make the race. I know I will.

Q. What do you think of car diagnostic centers? Are they any good?—Peter Main, Miami Beach.

A. The answer, I guess, is somewhat like a hospital operating room—assuming the equip-

ment does what it's supposed to do, the success of the operation depends upon the skills of the operating team. If a diagnostic center's equipment is accurate and skillfully operated, there's no reason why it shouldn't be the best, least expensive overall, least time-consuming way to find out exactly what's wrong with an ailing car. In fact, as cars become more and more complex, a diagnostic center is about the only way a car can be totally tested. I'm very interested in this whole electronic approach to automobile servicing and I think we'll see dramatic developments in the field in the near future.

Q. On the Interstate the other day a guy cut from right to left lane smack in front of me. I almost hit him. The only warning he gave me was a flick or two of his lanechanger. Do you think people depend too much on direction signals?—Tony Lebow, Elkhart, Ind.

A. As I hinted in these pages before, Tony, all the direction signals in the world aren't going to replace good and thoughtful eyesight. Personally, when I'm about to veer the slightest bit off a straight line, I grab a fast

(Please turn to page 42)



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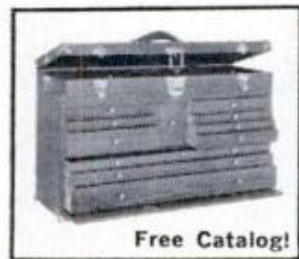
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DRIVIN' WITH DAN

(Continued from page 40)

look out either side to see if anything's coming. In fact, using my mirrors and just plain direct vision, I try to keep aware of my position as to other cars at all times.

Q. Please settle an argument. How much warm-up time is necessary in the newer cars? I say, little if any; my Dad says, at least a few minutes.—Dennis Bronsky, Chicago.

A. I would say the big thing here is outside temperature. If it's below freezing, I'd let the car warm up, period. If it isn't, then I don't suppose much harm is done by driving right off. One thing you don't want to do, however, is race a cold engine, or take off in a cold car as if you were competing at a dragstrip. Personally, I have too much respect for machinery to abuse it, and I think charging off in a cold car puts too much strain on its various components. You needn't wait long, but at least let the oil get flowing.

Q. In racing, what does "nerfing" mean?—Harlan Bates, Portland, Me.

A. It's a slang term used by some drivers to describe bumping another car during a race. Bumpers on a race car are sometimes called "nerfing bars." Don't ask me why.

Q. Seat belts for passenger cars aren't a recent development, are they?—Ken Goebel, Dallas.

A. Yes and no. I've seen makeshift seat belts on a few antique cars, but whether or not they were installed with safety in mind is something I can't tell. A man named William Stout, a well-known aircraft and auto designer in the '30s, said back then he thought seat belts for safety might be a good idea. Just after World War II, a man named Preston Tucker tried to produce a revolutionary (for the times, anyway) car that would have offered seat belts as standard equipment. Only in the past few years has their use become widespread. They work, too. ★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 70).

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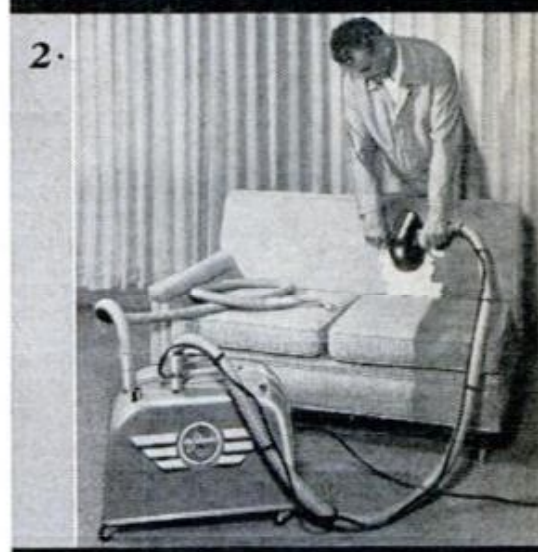
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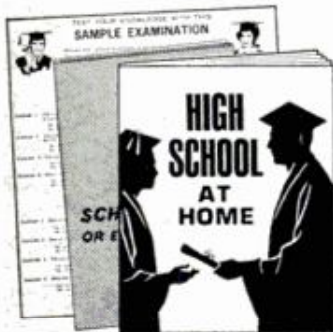
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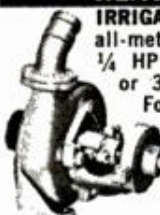
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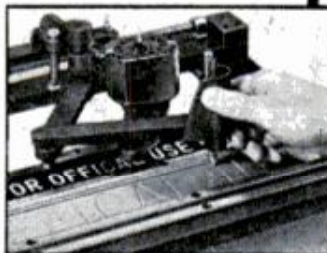
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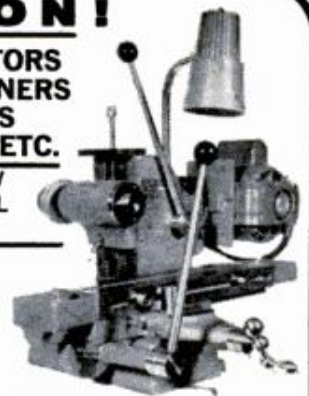
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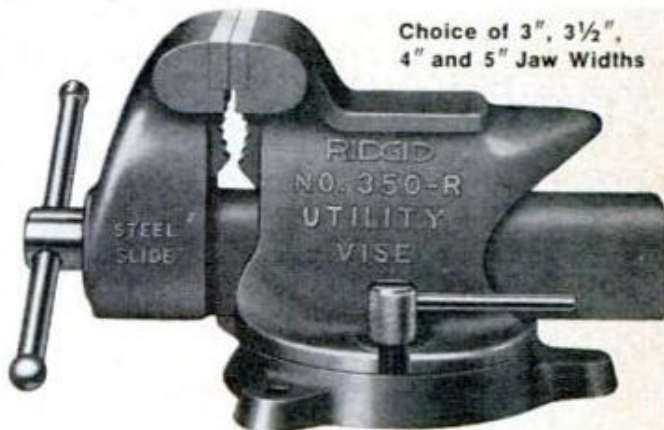
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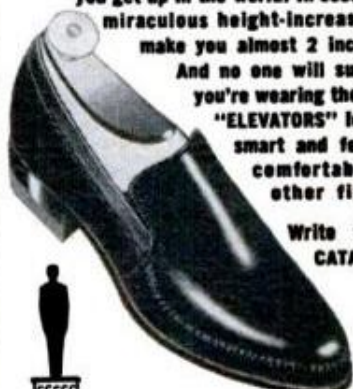
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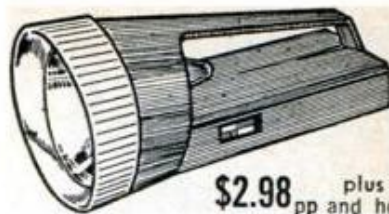


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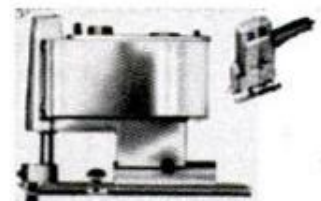
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QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Motor needs oil

I have an old secondhand sewing machine and am sure that at some point grease was forced into the oilers where it hardened. I'm also quite sure the bearings are dry. The nearest service center is miles away. Is there any way I can oil the bearings?—O.L., Minn.

Your service center can give you much better advice than I can at such long range. I suggest that you get in touch with it by phone or letter, giving detailed information including serial number. Or you can detach the motor and send it to the service center, along with a letter of explanation. Be sure to mark the wiring with numbered tabs so that, later, you can rewire the motor correctly.

If circumstances make this impractical, you'll have to try to get lubricant to the bearings temporarily. Old sewing-machine motors have wick-lubricated sleeve bearings and it is possible the lubricant has hardened. Usually there's a small oil hole at the top of the felt retainer. Insert a straight pin into the hole and press down as far as possible. Work with care so that you do not damage the wicking or other parts. Place a single drop of *light* oil (not crankcase oil) in each retainer. Then snip off the point of the pin, insert the blunt end of the pin in the hole already made in the felt and work the pin down as far as it will go. In time the oil should soften the hardened lubricant and reach the bearing. But don't operate the motor until the shaft turns freely. Your best bet, however, is to ask your service center for advice.

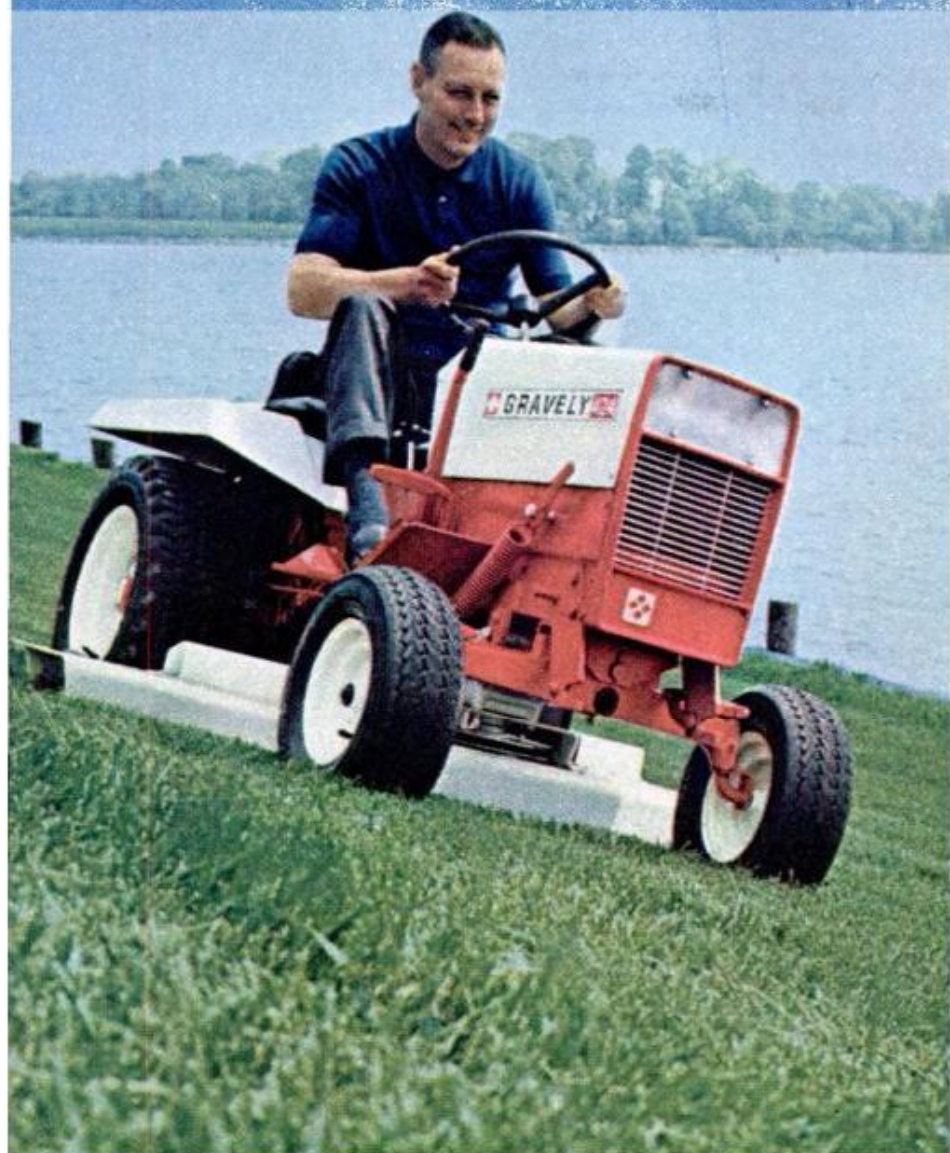
Loose chair arm

I have a platform rocker on which one arm is loose. The arm is supported by a turning which is attached to the frame by what I think is a single screw with its head hidden by a wooden plug. The exposed head of this plug is rounded and finished. Apparently the plug is glued in place. How can I remove it so I can tighten the screw?—T.A., Ariz.

What you describe is known as a screw-hole button, commonly used in furniture construction to conceal screwheads. Usually the only way to remove it is to drill it

(Please turn to page 64)

fun machine



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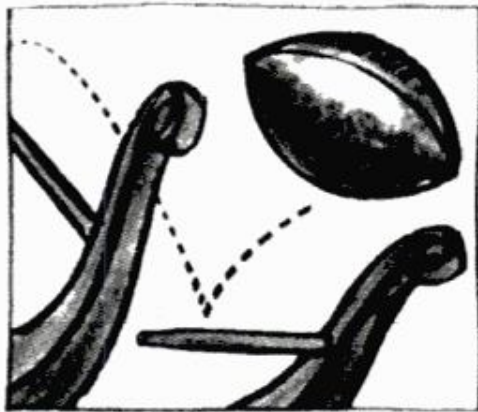


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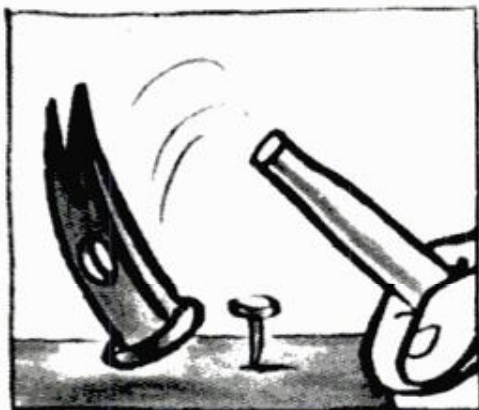
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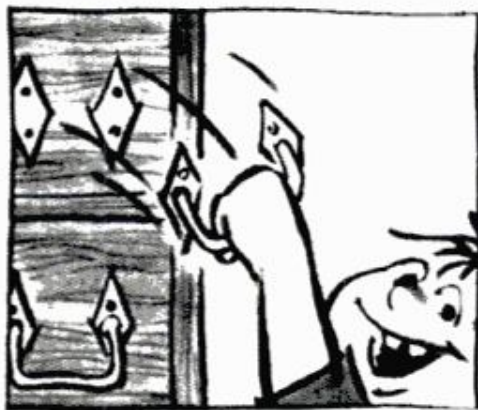
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HOMEOWNER'S CLINIC

(Continued from page 62)

out, using a drill bit slightly smaller than the diameter of the shouldered portion. If the outer diameter of the exposed head is $\frac{1}{2}$ in., for example, the chances are that the button was driven into a $\frac{3}{8}$ -in. counter-bored hole. Center a $\frac{5}{16}$ -in. twist drill and go through to the screwhead. Then break away the waste with a small chisel, taking care not to mar the finished surfaces. Back off the screw a few turns, insert glue into the joint, then tighten the screw and wipe away all excess glue.

You can get a replacement button from any well-stocked hardware store or from Craftsman Wood Service Co., 2727 S. Mary St., Chicago, Ill. 60608. Be sure to give the correct size. However, you may not have to remove the original button. You may be able to drive screws into the loose arm support from the back of the framepiece. Check this first before removing the button.

Unruly door

My front door persists in sticking—no matter what I do, it still sticks. The house is two years old and the door is located in a recess. I've planed the door to nearly $\frac{1}{8}$ -in. clearance. Can it be expanding, the house shrinking, or what?—C.K., Ga.

Could be both, plus a settling of the whole structure. When a door has been planed to $\frac{1}{8}$ -in. clearance as you say, then there must be abnormal settling, abnormal shrinkage or expansion which might cause it to restick after a relatively short time. The most probable cause is settling of the structure. This could result in sufficient distortion of the door opening to cause the recurring trouble. But have you checked to make sure the hinges are correctly installed, that the hinge pins are in line, or reasonably so, and that the screws holding the hinge leaves to the jamb are tight? If one of the hinge leaves is incorrectly seated, it may tend to develop stress or twist as the door is opened and closed and, in time, loosen the screws. I think it would be well to check this possibility. Also it's just possible that the builder forgot to nail the jamb on the hinge side of the opening.

The chances are good that settling of the structure will stop at some future time and then the door should give no further trouble. In the meantime, there really is little that you can do, unless you find a hinge out of line or that installation of the jamb is faulty. This you can correct by nailing and wedging of the jamb or re-seating a hinge leaf. ★★★



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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Gas flows in Brooklyn

My 1966 Ford Fairlane 500 leaks gas out of the vent tube. Ford people tell me pressure builds up in the tank and forces it out. A vented cap, they say, won't fit. The tank and vent have been replaced with no help. I have a six-cylinder engine and I'm getting only eight miles to the gallon. Can you help me?—Fred Intoccia, Brooklyn, N.Y.

I hope so. Take an ice pick (or a $\frac{3}{16}$ -inch bit) and put a hole in the center of your gas cap. I'm not promising anything, but I bet it works.

A buggy problem

My 1966 VW, model 1300, has been pronounced fit by the VW people, and the best tune-up shop in town can't find anything wrong. So, maybe it's my imagination that the car starts perfectly, idles and runs fine, and then at a traffic light begins idling slower and slower, and finally stalls. Maybe it's my imagination that this will happen until the car warms up over a six to eight-mile drive, and is then okay? My "imaginary" problem only happens in cold weather. Anything you can suggest to rid myself of this strange phenomenon will be appreciated.—John A. Marchner, Rochester, N.Y.

Antihallucinatory therapy consists of installing a new bimetallic choke end cover with automatic choke spring. Your present choke probably has a real case of binding in cold weather, which has been a problem with this model car.

Torsion-bar tremor

I'm quite upset over a rattling noise coming from the underside of the floor pan of my 1967 Imperial. The local dealer can't seem to eliminate it, and I hate to think of driving this expensive car with this annoying noise. I realize you can't tell much without driving the car yourself, but have there been any reports of a similar nature sent to you?—L.T. Van Ness, Baltimore, Md.

There have been, and in many cases the noise has been traced to a torsion bar that is offcenter in its frame holes. The

offcenter condition can often be corrected by adjusting car height to specification. If this doesn't help, remove both torsion bars and the anchor cross member. Carefully grind a maximum of $\frac{1}{4}$ inch from the top of all four holes in the stub frame cross member with a rotary file. This will provide the clearance needed to keep the torsion bars from hitting the tops of the holes. Reassemble and adjust car height.

I write myself a letter

My car developed an awful miss shortly after I did some work inside the distributor. It took me hours to find the reason. Guess what it was?—Mort Schultz

Your carelessness, pal. When you clamped the cap back on the distributor, you pinched the primary pigtail lead leading to the points between the cap and housing. Next time be more careful.

More accurate timing

Here's a tip I'd like to pass along. As you know, many guys paint or rub chalk on scribed timing marks to make them more visible. But this practice can lead to trouble, because the chalk laps over each mark and can span a distance equal to several degrees of rotation. This, of course, results in inaccurate timing.

To make marks highly visible and exact, wipe the area as clean as possible and rub chalk back and forth at right angles across the marks or brush paint into them. Now, wipe off excess chalk or paint. What's left are easy-to-read chalk-filled or paint scribes that are the right width. Makes for pinpoint timing.—Herb Kessel, New Brunswick, N.J.

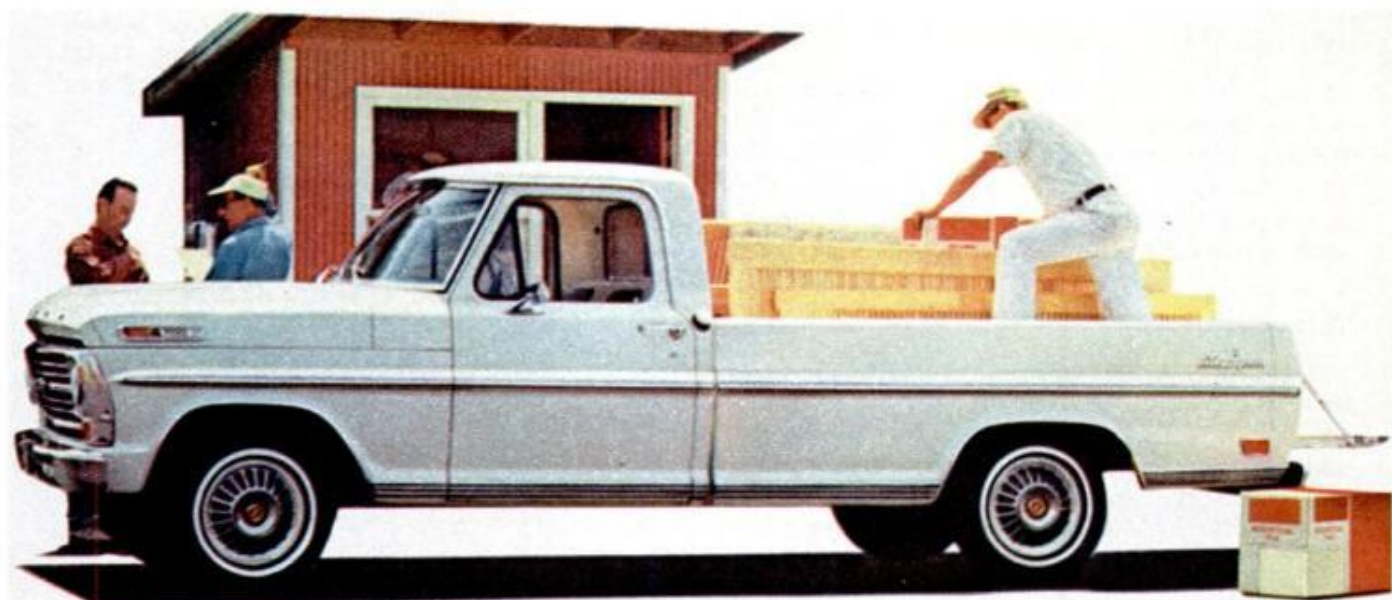
Chalk up one for Herb. Thanks.

PCV diagnosis

Is there a quick way to test a positive crankcase vent valve?—John Horesch, Daytona Beach, Fla.

Sure is, and you don't have to rely on warning signs that occur after the valve goes bad—such as an odor of crankcase fumes, a sudden rise in oil or fuel consumption, fouled sparkplugs, smoking at

(Please turn to page 72)




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AUTO CLINIC

(Continued from page 70)

the oil filler cap and rough idle. Pull the valve from its seat in the engine. Let the engine idle and hold your thumb over the open end of the valve. You should feel good pull. That's vacuum; lack of it means the valve or system is plugged.

A 'wink' light

I just bought a used 1965 Rambler. The generator indicator light keeps winking at me. It glows dimly with the engine running at all speeds. If the first owner didn't mind, I do. Can you take me out of the spotlight?—Fred Wolff, Cincinnati.

I assume the alternator and voltage regulator are okay and all leads are secure. If not, these parts would have pooped out before now. So, the trouble is probably the over-sensitive indicator bulb factory-installed on your car. Ask a Rambler dealer to replace the original bulb and socket with those in kit part No. 3207588. The same goes for you fellows having this trouble with 1964 and 1966 Ramblers.

Stopping a surge

No one seems to know why my 1967 Plymouth surges at about 35 mph. Do you?—Jack Gomez, San Francisco.

I do, if the car has a WWC3-276 carburetor, which tends to run on the lean side. Drill the idle tubes in the venturi cluster to .031-inch using a No. 68 drill. Replace the main jet with one carrying part No. 389323-055. But why do it yourself? The repair is covered by a technical service bulletin and will be done free by your dealer. The same goes for Chryslers and Dodges with this carburetor.

Thumping transmission

My 1966 Plymouth with automatic transmission emits a thumping sound at very low speed or when I stop with the transmission in forward gear. Do you have any dope on this?—Steve Sardo, Boston.

No bother, Steve. The fix, though, depends on the car's being equipped with an

A-904 transmission. If so, the noise might be coming from a cycling governor valve. Have the dealer install a snap ring (part No. 1638461) at the valve end of the governor shaft. It's easy, and it might be the cure.

Loop-the-loop

It's the craziest thing I ever heard, but it worked for me—maybe it'll work for someone else. The problem was a knocking fuel pump in a Dodge with a 383-cu.-in. engine. I finally found a mechanic who could fix it. He looped a piece of hose, and inserted it in the line from gas tank to fuel pump. Voila! No more noise!—Arthur P. Baumann, Saginaw, Mich.

Thanks for the tip, Art.

Service Tips

● **Dodge owners:** Before running back to the dealer because your fuel gauge doesn't register full in your 1967 or 1968 Dodge Polara or Monaco station wagon, consider this. The tank filler tube is very short, so the service station fuel-pump hose nozzle can be inserted into the tank almost to the $\frac{3}{4}$ level. Unless the pump attendant removes the automatic nozzle and manually completes filling the tank, it will only be $\frac{3}{4}$ full and register as such. This applies to 1967 and 1968 Chrysler and Plymouth Fury station wagons as well.

● **1967 Chevrolet owners** with a 396-cu.-in., 375-hp engine may not be getting top performance if they haven't heard of the revised timing spec. It calls for timing to be set at 6° BTDC; not 10° BTDC. This applies to 1967 Chevys only. The 1966 spec for this engine is still 10° BTDC.

● **1966 Valiant or Barracuda owners** with a six-cylinder engine and automatic transmission should keep an eye on their power-steering pump belt. It could be rubbing against the oil-cooler tube and, in time, wear through the tube, allowing transmission fluid to leak. If enough is lost, the transmission may be damaged. Keep a check to make sure the clearance between oil cooler tube and belt is no less than $\frac{3}{4}$ inch. If the tube looks shiny, indicating rubbing, bend it away from the belt. When making the bend, firmly hold the tube at the radiator to keep from damaging fittings or the brazed joint at the radiator lower tank.

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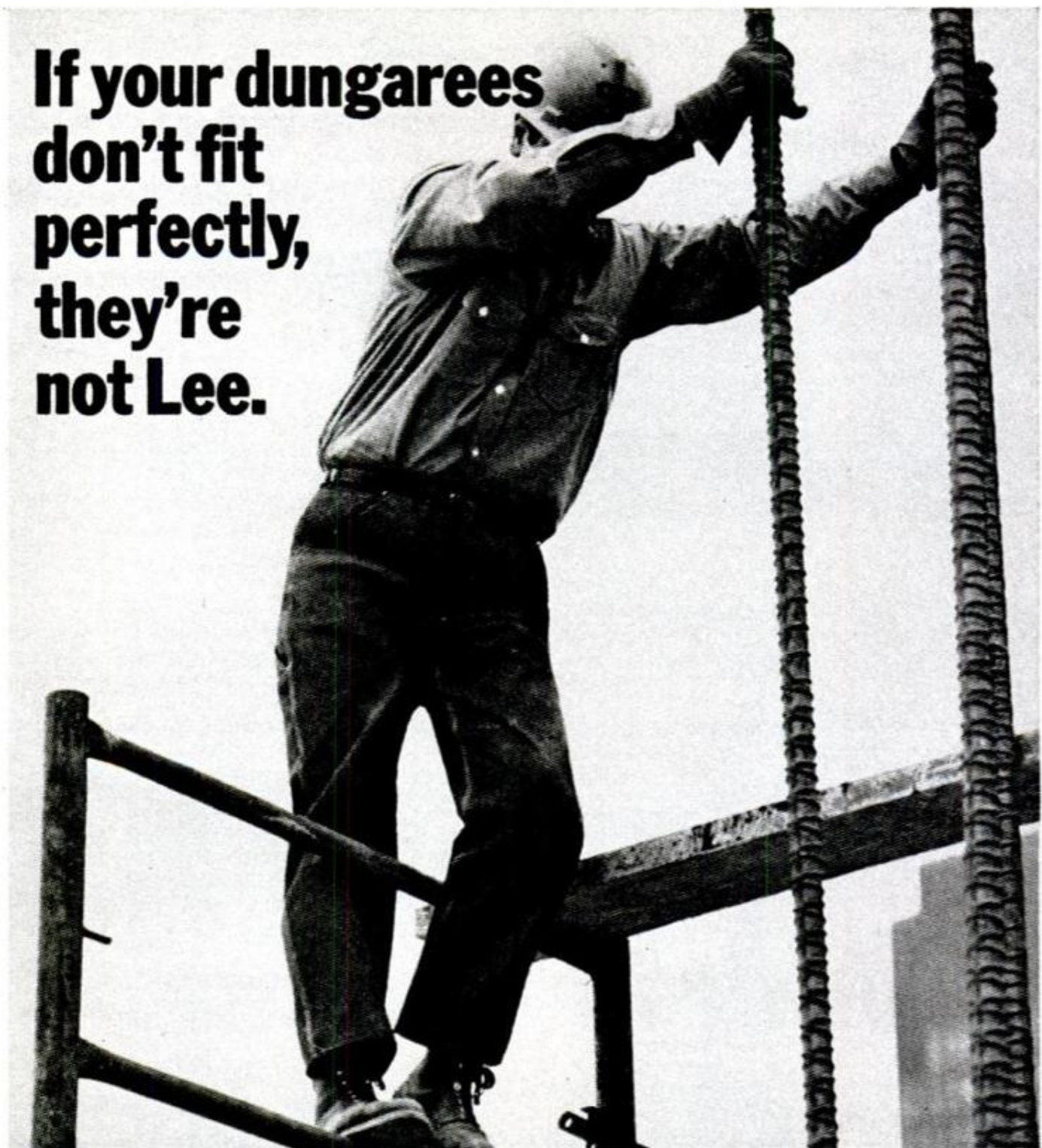
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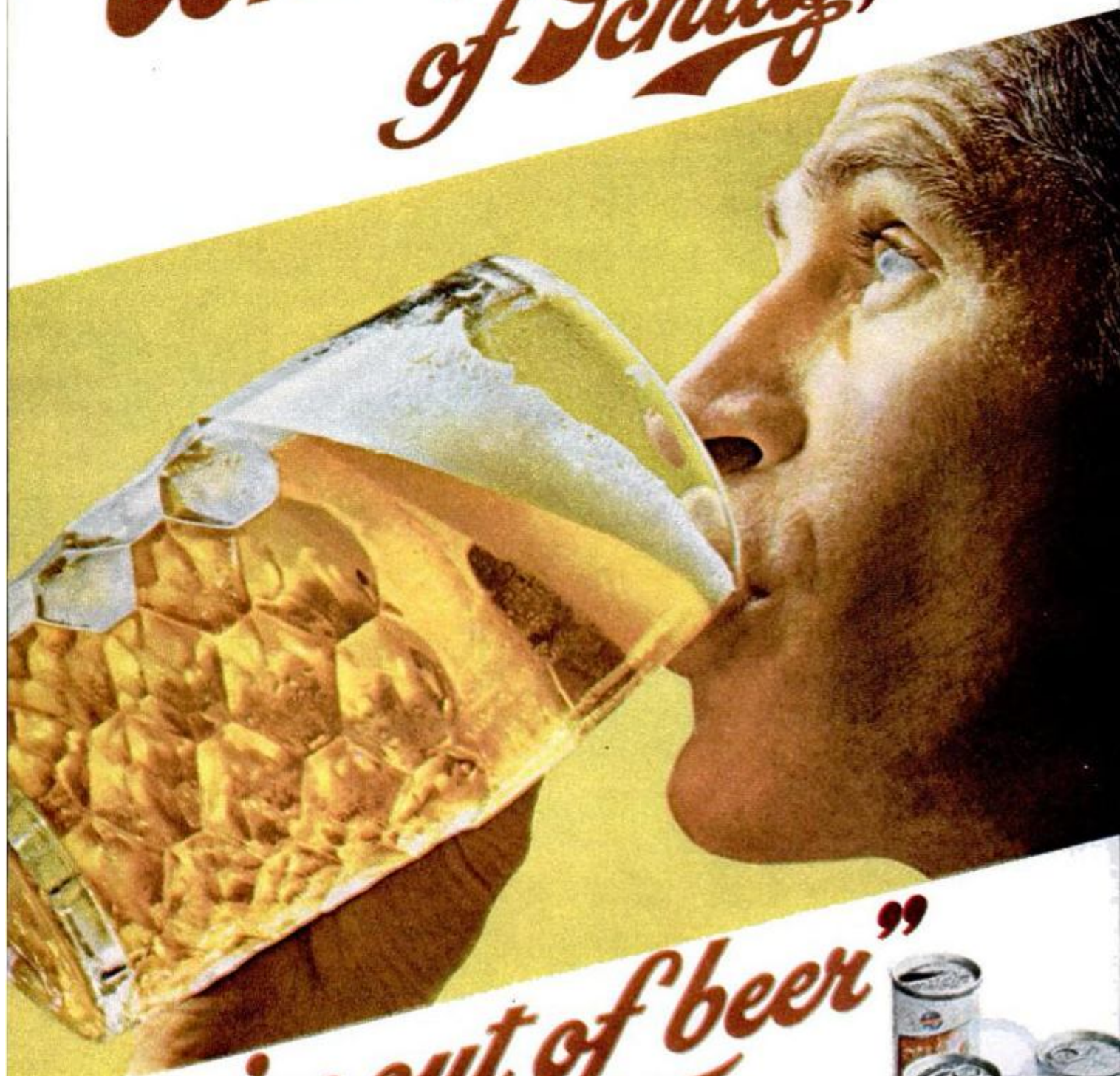
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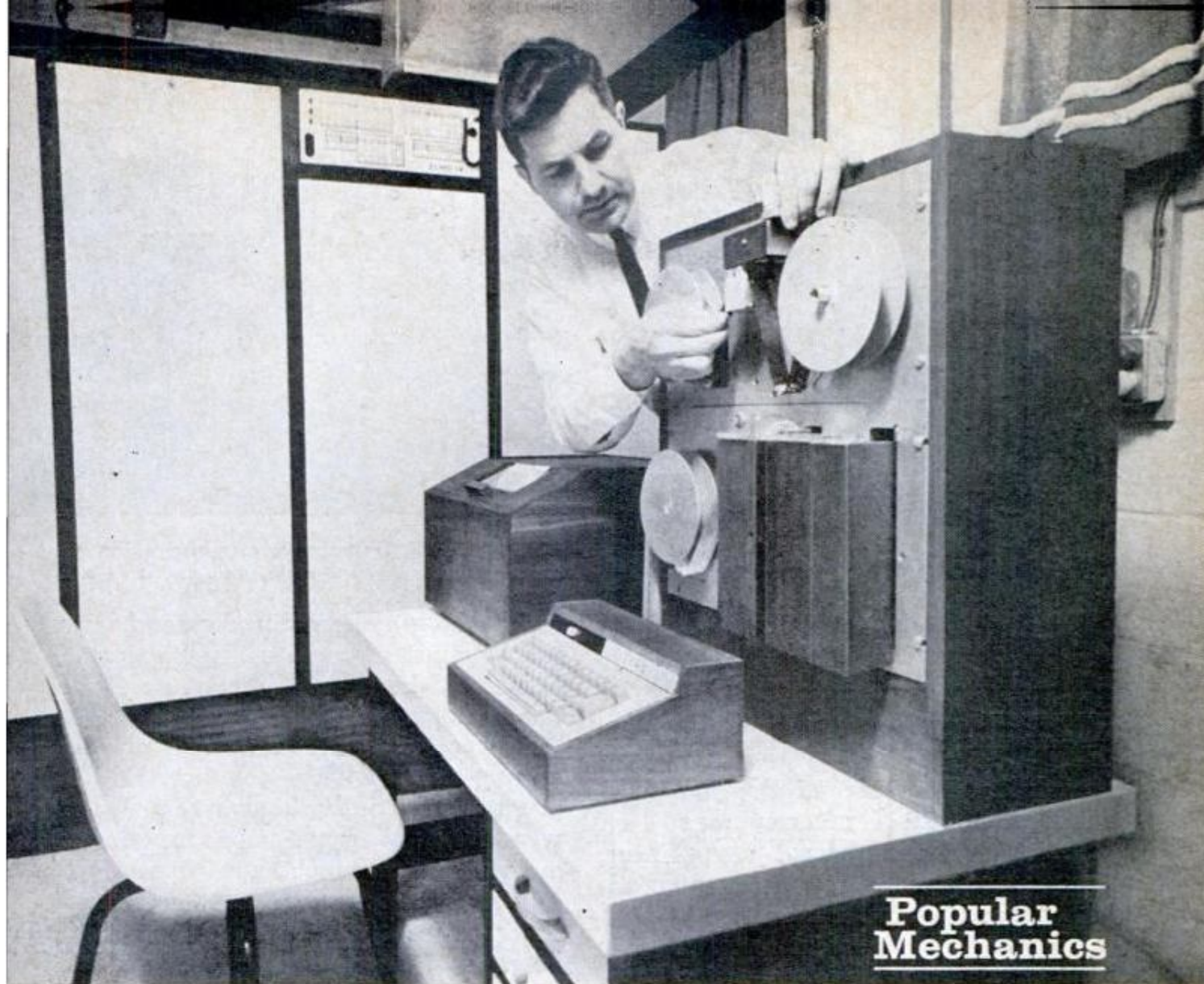
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HOMEMADE PROGRAMMER'S DESK contains keyboard, page printer, paper tape punch and paper tape reader

A Computer in the *Basement?*

Jim Sutherland's home-built computer is not very sophisticated by today's standards—or tomorrow's. But as it takes on more tedious household tasks, it's proving what can be expected of the future home computer

By GLENN INFIELD

THERE HAVE BEEN many predictions that the home of tomorrow will be radically different from the home of today, because it will be run by a computer. But no one knew precisely what a computer could do in the home until Jim and Ruth Sutherland of Pittsburgh, Pa., designed, built and programmed "ECHO IV." ECHO means Electronic Computing Home Operator, and building it has been a family affair.

Jim is a computer-systems design en-

gineer with Westinghouse Electric Corp., and his wife, Ruth, is a home economist. Their home-computer venture began two years ago when, as a hobby, Jim started buying obsolete computer parts and sketching logic circuit diagrams. Actual wiring of 11 printed-circuit module mounting panels began as soon as the design stage was completed. Within the year, ECHO was running simple programs but was limited by an inadequate input-output



SUTHERLAND goes over the intricate wiring required to build ECHO. Each of four units has such a panel

capability. To overcome that handicap, Jim produced a programmer's desk consisting of a keyboard, page printer, paper tape punch, and paper tape reader in oiled walnut enclosures.

Before the end of the second year what was formerly the family basement playroom had been taken over by the home computer and its peripheral equipment and Ruth was wondering, "Will it replace *me*?"

She isn't worried about this now, since she has learned that *home* computer programs must first be flow-charted by someone who knows *home-making*. Flowcharts define the job graphically, so that the programmer and the user can understand each other.

Usually, shortcuts and time-saving features show up when the flowchart is prepared for a task prior to translating it into computer language. Later, if program revisions are needed, the flowchart provides a quick review of how the program operates. Changes and/or corrections in the flowchart can easily be inserted into the program listing of instructions.

The Sutherlands feel that if the homemaker programs some of her own



RUTH SUTHERLAND programs computer which can control temperature, set clocks, tabulate home bills

tasks, she will better understand how the computer operates and become skilled in determining best household applications.

Simple keyboard entry and printer output routines were the first ECHO programs the Sutherlands wrote. These were followed by the paper tape input and paper tape punching routines. Subsequently these programs permitted other, more complicated programs to be entered into the computer, verified on the printer, and stored permanently on paper tape. Jim is now devoting his time to writing such programs as multiply, divide, multiple precision add, subtract, and message writer routines.

As more jobs are loaded into ECHO,

INPUT-OUTPUT UNITS are made from an electric typewriter keyboard and a surplus teletype printer



POPULAR MECHANICS

its core memory storage capacity of 8192 words may be exceeded, and that's when Jim will begin building some magnetic-tape auxiliary bulk memory units. The computer understands 18 commands—or machine language instructions—which can be arranged into computer programs and stored in memory for future use. Some of the larger programs will be stored on paper tape and loaded into the computer when needed.

Now that the basic routines are running in ECHO IV, the Sutherlands are planning to delegate the chores of bookkeeping to the computer. Tabulating monthly budgets and accounting for monthly expenditures is a time-consuming job that ECHO will reduce to simple end-of-the-month routine. Specifically, when April 15 rolls around, income-tax deductions can be identified and grouped so that tax forms can be filled out readily.

One important task which ECHO performs reliably is the updating of the hour portion of binary-coded decimal clock displays found in four different rooms of the Sutherland home. Jim designed and built the timepieces several

years ago, and even though the clocks have no hands, the children learned to tell time by them before they understood ordinary clocks.

ECHO will also be programmed to keep track of real time so that events can be scheduled up to a year in advance with one-second accuracy. Ruth isn't interested in running their home on a second-by-second schedule, but she feels Jim won't be able to make excuses about forgetting birthdays and anniversaries ever again.

Ruth believes that the kitchen is where the computer will really perform well and save time in routine jobs. Recipes will be increased or decreased proportionately to provide any number of servings, with the necessary shopping lists printed out automatically.

"To be really effective," Jim says, "the computer must know how much and what kind of food is on hand so allowances can be made in shopping lists."

Jim plans to modify the kitchen cabinets to allow ECHO to take inventory automatically. Later, as more complex programs are tried, the computer will

(Please turn to page 209)

ECHO with two of the front panels removed. Computer takes about 20 square feet of basement floor space



Pure Oil Performance Trials BRAKING TEST

AUTOMOBILES



Are Cars Really Getting Better?

The annual Union/Pure Oil Performance Trials indicate the U. S. automobile has changed, but not much

By BILL KILPATRICK, Auto Editor

HOW ABOUT the '68 American-made cars? Are they better than the '67s? Are they better than cars were, say, five years ago? Do they get better mileage, have more get-up-and-go, make quicker and safer stops?

The closest to meaningful answers are provided each year by the Union/Pure Oil Performance Trials, a strictly impartial shoot-out covering just about all U.S. auto production.

Under rigidly controlled conditions supervised by a small army of NASCAR (National Assn. for Stock

Car Auto Racing) officials, I watched cars from small Sixes to big V8s undergo tests for economy, acceleration from 25 to 70 mph, panic braking to a stop from 65 mph. True, the cars are not tested for many other things a potential new car buyer might want to know (handling, for one), but what the Trials do test is tested exhaustively.

And it's this thoroughness, I would think, that ought to prove somewhat embarrassing to Detroit. Carmakers would have us believe that automotive "progress" is second only to Mom's ap-

ple pie on their scale of cherished values. Yet, as the Trials often indicate, "progress" can be a matter of marking time, even marching backward.

For example, at Daytona last year (the '68 Trials were held at Riverside Raceway, Calif., which alternates with the Daytona Speedway as the annual site) the overall economy winner was a Chevy Corvair 500, which posted an mpg figure of 26.045. This year a car of the same name and specifications slipped to an mpg figure of 23.432. Last year the Corvair accelerated from 25 to 70 in 20.8 seconds, stopped from 65 in 168.4 feet. This year the acceleration took 22.3 seconds; the stopping, 185.9 feet.

What happened? It could have been the driver, the wind, more or less weight, whatever. But even allowing for these and other variables, the car—at least in economy, acceleration, braking—obviously hasn't improved.

Five years ago, the same car—with 15 more hp—got 26.8 mpg, went from 25 to 70 in 17.7 seconds, stopped from 65 in 186.3 feet. In five years, that's hardly a sparkling record of progress.

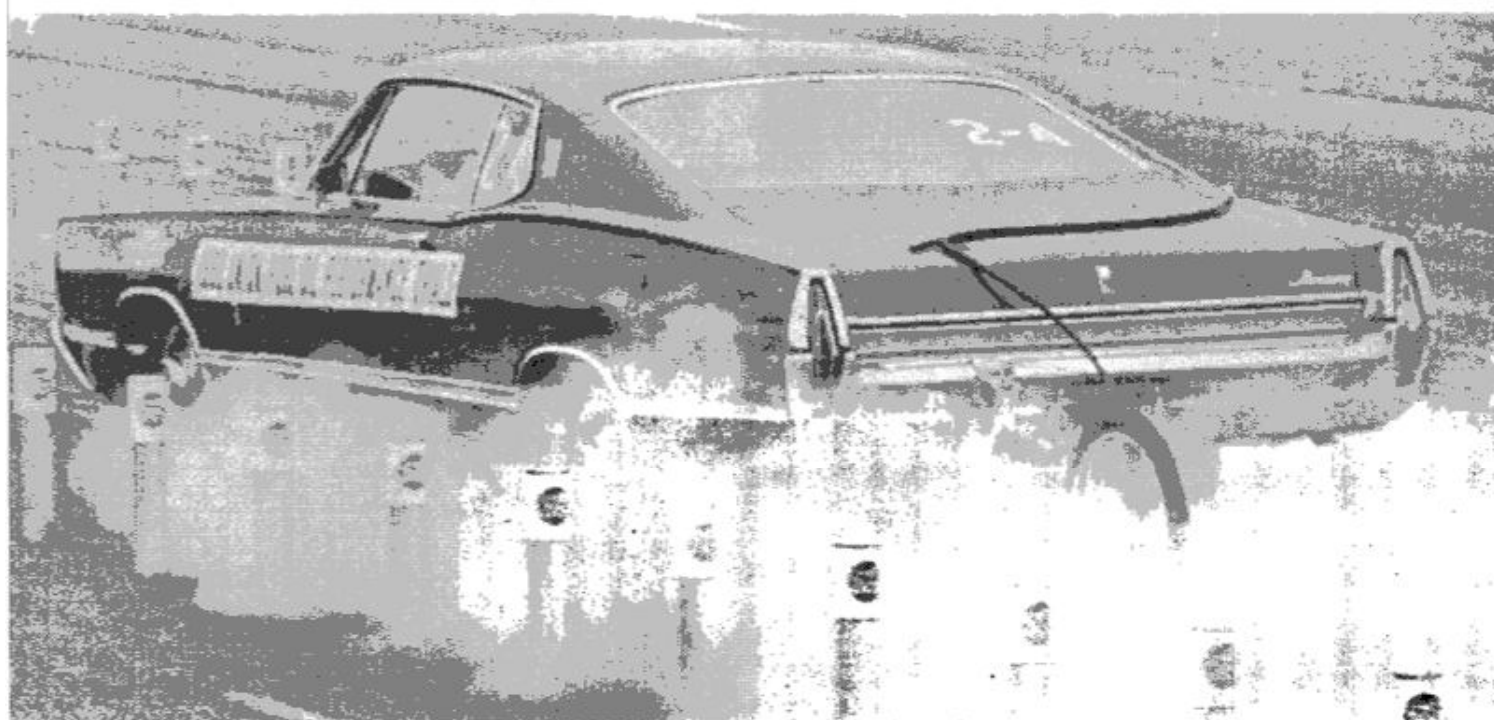
The idea here isn't to belabor the Corvair, which—despite its Nader-ized troubles—is and was, particularly in its now-abandoned hotter versions, a trim

and brisk little package. The idea is to suggest that under the torrent of "Madison Ave." superlatives heaped on Detroit's offerings each year, the Trials prove things are not necessarily what the copywriters say they are.

The difficulty in making an "over the years" comparison, of course, is that cars really *have* changed. Engine displacements, wheelbases, overall dimensions, weights, and so on have been juggled up and down as manufacturers scramble to keep tabs on the car-buying pulse. Two Chevys bearing the name "Impala" in the '64 Trials, for example, featured 409-cu.-in. engines putting out 340 hp. The '68 Trials "Impala" had a 307-cu.-in. engine cranking out 200 hp. (Incidentally, although it's apples and oranges, the best the two Impalas did in '64 was 16.225 mpg, an acceleration time of 7.65 seconds, a stopping distance of 181.2 feet; in '68, the Impala got 16.67 mpg, hit 70 mph from 25 in 14.55 seconds, stopped from 65 mph in 176.7 feet.)

Perhaps a more realistic comparison can be gleaned from the overall trials results of the past five years. From, say, 1964 to the present, engine displacements throughout the range of U.S. cars have remained pretty much the

BRAKING TEST requires car with prewarmed brakes to panic-stop from 65 mph. Hitting pylon means penalty





PRECISELY MEASURED FUEL supply powers car during economy run. All cars run over the same distance

NASCAR OFFICIALS administer all test procedures, meticulously supervise each and every Trials phase

same. So have weights, power ratings, transmissions, carburetion, and so on. Roughly the same number of cars have been entered in the Trials, too, and procedural penalties are about the same.

In the 1964 Trials, the 57 cars tested averaged 18.886 mpg in the economy test. In 1965, 57 cars averaged 19.844; in 1966, 59 cars averaged 18.762; in 1967, 76 cars averaged 18.664; this year, 70 cars averaged 17.420. Braking distances averaged 209.4 feet in '64, 196.2 feet in '65, 193.1 feet in '66, 207.1 feet in '67 and 194.8 feet in '68. Acceleration times averaged 10.14 seconds in '64, 11.86 seconds in '65, 11.71 seconds in '66, 11.49 seconds in '67 and 12.85 seconds this year.

Granted, during this time cars may have improved in any number of ways. But when you study the figures that reflect what counts with most car owners and drivers year after year—that is, economy, acceleration, braking—you can't help but wonder what all this talk of automotive "progress" refers to.

Does this mean cars really *aren't* any better, that they haven't improved over the past five years? Of course not. Considered generally, the average U.S. automobile today handles better, is more reliable, offers improved creature comforts, has better tires, whatever, than its five-year-old counterpart. Also, it's safer, which means a lot of industry money that might have gone into development of more efficient engines, quicker acceleration and better brakes

has been earmarked for the many features included in the average standard "safety package." But to find significant changes, you have to go back to when the Trials started.

"In 1958," says Union Pure's Dick Dolan, Trials head man, "Chevrolet, for example, was selling one car size and three engines—a Six and two V8s. In 1968, Chevys come in four sizes and there are eight engines."

This broadening of a single car line may mean change, but in the "gut" issues of mpg, zoom and stop, the figures indicate the auto industry's motto is, "Business as usual." ★★★

FACTORY ENTRANT TEAMS are allowed to prepare cars within strict limits. Entries meet exact specs

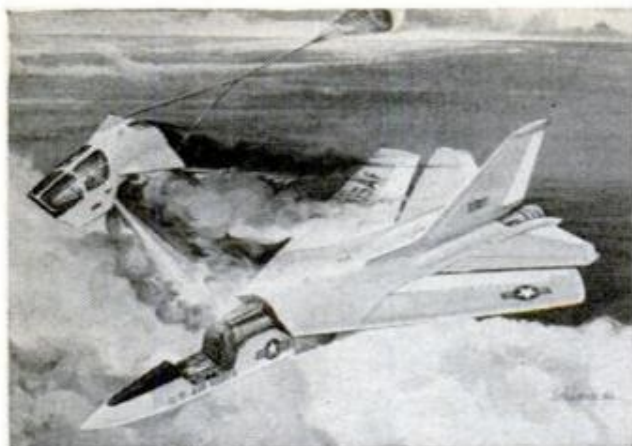


RESULTS OF 1968 UNION/PURE OIL PERFORMANCE TRIALS

CAR AND MODEL	ENGINE	ECONOMY			ACCEL.		BRAKING		Total Pts.		
		Type	Cu. In.	Carb.	HP	MPG	Pts.	Time in Secs.		Pts.	Stop in Feet
CLASS I—SUPER DELUXE											
Buick Electra 225	V8	430	4V	360	15.266	8	9.715	5	190.0	9	22
Buick Riviera	V8	430	4V	360	14.676	5	8.720	10	201.3	8	23
Chrysler New Yorker	V8	440	4V	350	15.397	10	9.235	6	160.0	10	26*
Oldsmobile 98	V8	455	4V	365	15.305	9	8.875	8	203.8	7	24
Oldsmobile Toronado	V8	455	4V	375	15.025	6	8.975	7	218.7	6	19
Thunderbird 4-Dr. Landau	V8	429	4V	360	15.158	7	8.770	9	240.1	5	21
CLASS II—DELUXE 8-CYLINDER											
Buick Wildcat	V8	430	4V	360	14.957	8	10.060	7	180.1	9	24
Chrysler 300	V8	440	4V	350	14.757	6	9.380	10	199.7	5	21
Dodge Monaco 500	V8	383	2V	290	15.886	10	10.670	5	192.8	6	21
Mercury Park Lane	V8	390	4V	315	15.806	9	9.535	8	182.4	8	25*
Oldsmobile Delta 88	V8	455	2V	310	14.599	5	10.100	6	175.7	10	21
Pontiac Bonneville	V8	400	4V	340	14.805	7	11.865	4	191.2(E)	7	18
Pontiac Grand Prix	V8	400	4V	350	14.528(A)	4	9.495	9	212.3	4	17
CLASS III—MEDIUM 8-CYLINDER											
Buick LeSabre	V8	350	2V	230	16.192	8	16.390	5	192.8	5	18
Chrysler Newport	V8	383	2V	290	14.010(B)	5	11.225	9	182.8	9	23
Dodge Polara	V8	318	2V	230	17.187	10	12.745	6	183.1	8	24
Mercury Monterey	V8	390	2V	280	16.227	9	10.515	10	184.0	7	26*
Oldsmobile Delmont 88	V8	350	2V	250	16.014	7	12.320	7	178.8	10	24
Pontiac Catalina	V8	400	2V	290	15.692	6	11.840	8	189.1(E)	6	20
CLASS IV—STANDARD 8-CYLINDER											
Ambassador	V8	290	2V	200	16.445	7	15.320	4	191.6	6	17
Chevrolet Biscayne	V8	307	2V	200	15.862	6	15.195	5	182.8	9	20
Chevrolet Impala	V8	307	2V	200	16.670	8	14.555	6	176.7	10	24
Ford Custom	V8	302	2V	210	18.078	10	13.160	9	188.1	7	26*
Ford Galaxie 500	V8	302	2V	210	17.286	9	13.505	8	187.5	8	25
Plymouth Fury I	V8	318	2V	230	14.892(C)	5	13.095	10	204.1(F)	4	19
Plymouth Fury III	V8	318	2V	230	14.688(C)	4	13.825	7	199.3(G)	5	16
CLASS V—INTERMEDIATE 8-CYLINDER											
Buick Skylark Custom	V8	350	2V	230	17.175	1	12.420	2.5	181.0	7	10.5
Chevelle Malibu	V8	307	2V	200	17.296	2	12.420	2.5	189.3	3	7.5
Dodge Coronet 500	V8	318	2V	230	18.565	8	11.050	6	191.5(H)	2	16
Dodge Charger	V8	318	2V	230	18.515	7	10.990	7	200.3(H)	1	15
Dodge Coronet 440	V8	273	2V	190	19.181	10	12.480	1	177.9	10	21
Ford Fairlane 500	V8	302	2V	210	18.508	6	11.235	5	180.6	8	19
Mercury Montego	V8	302	2V	210	18.911	9	10.980	8	179.3	9	26*
Oldsmobile Cutlass	V8	350	2V	250	16.704	—	10.765	9	184.7	4	13
Plymouth Belvedere	V8	273	2V	190	17.937(D)	5	13.150	—	183.9	6	11
Plymouth Sports Satellite	V8	318	2V	230	17.603	4	10.740	10	358.0(E)	—	14
Pontiac Tempest Le Mans	V8	350	2V	265	16.440	—	12.150	4	204.3	—	4
Rebel	V8	290	2V	200	17.300	3	14.225	—	184.1(H)	5	8
CLASS VI—INTERMEDIATE 6-CYLINDER											
Buick Special Deluxe	OHV6	250	1V	155	18.403	2	17.540	4	180.1	8	14
Chevelle 300	OHV6	230	1V	140	20.125	6	15.535	10	180.4	6.5	22.5*
Dodge Coronet	OHV6	225	1V	145	20.480	7	16.740	6	182.8	4	17
Ford Fairlane	OHV6	200	1V	115	21.872	10	21.815	2	173.0	10	22
Mercury Montego	OHV6	200	1V	115	21.759	9	20.845	3	173.9	9	21
Oldsmobile F85	OHV6	250	1V	155	19.508	4	15.760	9	191.3	2	15
Plymouth Belvedere	OHV6	225	1V	145	20.548	8	17.025	5	187.6	3	16
Pontiac Tempest	OHC6	250	1V	175	18.525	3	15.840	8	180.4(I)	6.5	17.5
Rebel	OHV6	232	1V	145	19.772	5	16.380	7	181.5	5	17
CLASS VII—COMPACT 6-CYLINDER											
American Rogue	OHV6	232	1V	145	24.295	10	15.495	10	419.8(M)	2	22*
American 220	OHV6	199	1V	128	23.243	7	17.980	7	184.9	7	21
Chevy II Nova	OHV6	230	1V	140	21.680	3	16.720	8	181.2	10	21
Corvair 500	H6	164	2x1V	95	23.432	9	22.320	4	185.9	5	18
Dodge Dart	OHV6	170	1V	115	23.348	8	19.050	6	185.7	6	20
Ford Falcon	OHV6	170	1V	105	22.243	6	24.690	3	188.5	4	13
Ford Falcon Futura	OHV6	200	1V	120	22.135	5	19.170	5	190.9	3	13
Plymouth Valiant 100	OHV6	170	1V	115	21.723	4	26.670	2	184.0	9	15
Plymouth Valiant Signet	OHV6	225	1V	145	21.517	2	15.580	9	184.7	8	19
CLASS VIII—SPORTS INTERMEDIATE											
Buick GS 400	V8	400	4V	340	16.396	9	8.045	3	191.3	6	18
Chevelle SS 396	V8	396	4V	325	16.689	10	7.135	4	179.5	10	24*
Dodge R/T	V8	440	4V	375	14.760	4	5.895	9	219.3	4	17
Ford Torino GT	V8	390	4V	320	16.196	7	6.915	7	223.4(J)	3	17
Mercury Cyclone GT	V8	390	4V	320	15.368	5	7.050	5	182.0	9	19
Oldsmobile 442	V8	400	4V	325	16.310	8	6.955	6	186.3	7	21
Plymouth GTX	V8	440	4V	375	13.518(C)	3	5.875	10	197.1(K)	5	18
Pontiac GTO	V8	400	4V	350	15.895	6	6.850	8	185.2	8	22
CLASS IX—SPORT COMPACT											
Chevrolet Camaro	V8	327	2V	210	18.263	7	11.330	6	179.0	10	23
Ford Mustang 2+2	V8	289	2V	195	19.492	10	10.895	9	191.4	6	25*
Mercury Cougar	V8	302	2V	210	19.319	9	10.745	10	225.1(L)	5	24
Plymouth Barracuda	V8	318	2V	230	17.818	6	10.925	8	180.6	9	23
Pontiac Firebird	V8	350	2V	265	16.788	5	11.160	7	181.2(E)	8	20
Javelin	V8	290	2V	200	18.368	8	12.730	5	182.6	7	20

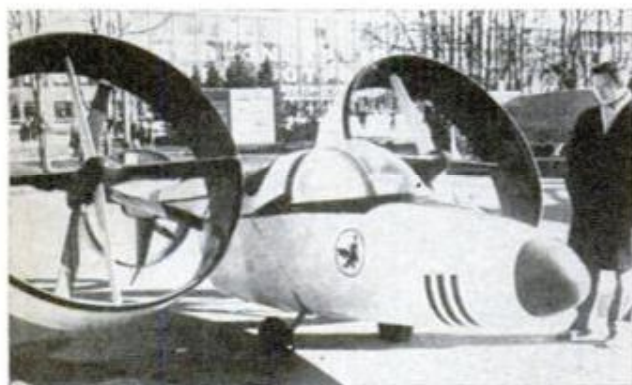
FOOTNOTES:

(A) .9 mpg penalty deducted (overall speed); (B) 1.1 mpg penalty deducted (speed zone); (C) 1 mpg penalty deducted (rolling stop); (D) .3 mpg penalty deducted (overall speed); (E) 4 extra penalty stops (decelerator); (F) 4 extra penalty stops (under 70 mph); (G) 4 extra penalty stops (under 500 ft.); (H) 4 extra penalty stops (over 500 ft.); (I) 2-ft. penalty included (pylons); (J) 42-ft. penalty included (pylons); (K) 4 extra penalty stops (decelerator), also 4-ft. penalty included (pylons); (L) 24-ft. penalty included (pylons); (M) broken wheel cylinder. * DENOTES CLASS WINNER



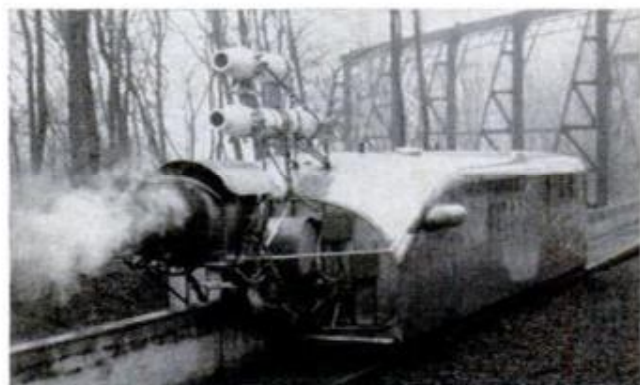
F-111 crew-escape module works perfectly the first time

Two crewmen recently ejected from the F-111A variable-wing fighter at 480 mph and rode the crew-escape module to safety from 27,640 feet. The painting (left) shows how the module blasted free, then rocketed over 300 feet upward while a stabilization chute streamed behind. The photo (right) shows the module after it descended on a giant chute.



Russian VTOL

Displayed at the recent Exhibition of National Economic Achievements in Moscow was this tiny VTOL craft. Built by the Kazan Works, it's powered by a 210-hp engine.



215-mph experimental train

Le Zinc, a jet-powered, air-cushion train, recently streaked 215 mph in a demonstration run in France. (See page 94 for the fastest regularly scheduled train in the world.)



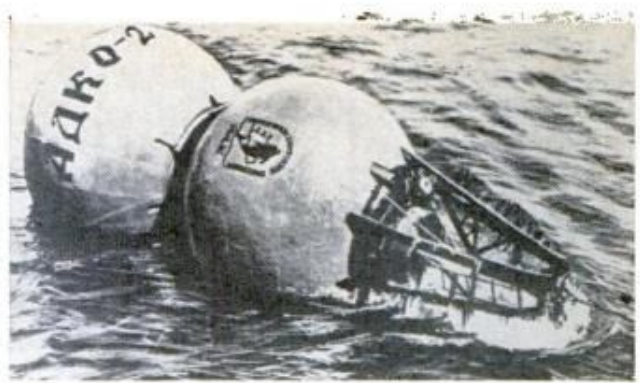
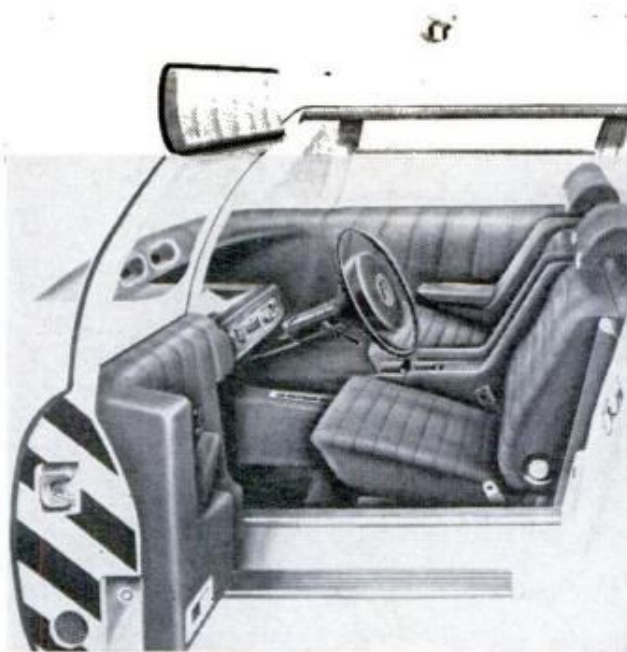
Electronic commuter car

The Amitron, a three-passenger, electronic commuter car, is being developed by American Motors and Gulton Industries. A lithium-nickel fluoride battery system will give it a range of 150 miles and speed of 50 mph.



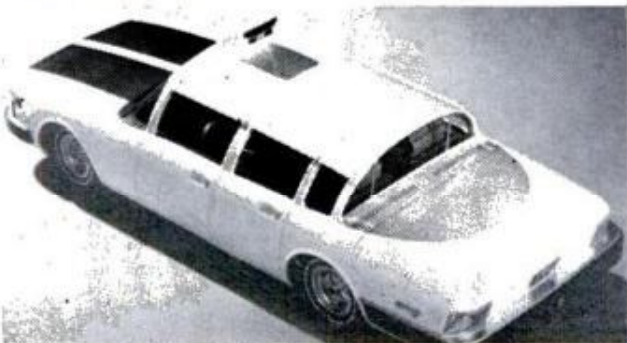
Catamaran car

Built like a catamaran, the Silver Fox has the driver's seat in one "hull" and the engine in the other. The car, which has been driven over 100 mph, was on display at the 49th International Motor Show in Turin.



Soviet undersea station

Sadko-2, a new Soviet underwater research station, has room for two men to sleep, eat and pilot the station in one of its two spheres. The second sphere carries weights which vary according to the depth desired by the crew.



Built for safety

Designed to cut collision casualties by 50 percent, the New York State safety car features such equipment as four rigid rollbars, padded roof, energy-absorbing doors and a periscope that houses the rear-view mirror system and signal lights. The contoured seats have headrests and integrated harness and lap belts. The car design is by the Republic Aviation Div. of Fairchild Hiller Corp.



Where there's a will . . .

When hoof-and-mouth disease forced cancellation of the race for the Massey-Ferguson Gold Cup, a London newspaper staged the horse race on a computer. Millions of television viewers saw a sports broadcaster give a running commentary on the contest as the results came out of the computer.



Chopper keeps tabs on Britain's third nuclear-powered sub

The Royal Navy's third nuclear-powered fleet submarine, the HMS Warspite, is watched by a Navy helicopter during recent exercises off the coast of Scotland.



REAR MINESWEEPERS
IN STARBOARD
ECHELON

LEAD
SWEEPER



They Hunt For Floating Death

New techniques are being developed to combat one of the oldest weapons of water warfare recently revived by the Vietcong—explosive mines

By MORT SCHULTZ

Illustration by Howard Schafer

THE LANDING at Inchon, Korea, 15 days before had been a snap. If anything, the amphibious assault on Wonson in October, 1950, looked even easier.

It became one of the greatest fiascoes in U. S. naval history. For more than a week, 60,000 troops in 120 ships cooled their heels offshore as a nation without a navy held the world's greatest seapower in check with pre-World War I weapons.

In anticipation of the invasion, North Korean fishermen, using 30 ancient sampans and junks, had sown the harbor with sea mines, many made before the 1904 Russo-Japanese War.

Unaware of what awaited them, U. S. ships steamed toward shore like yachts on a cruise. Five never came back.

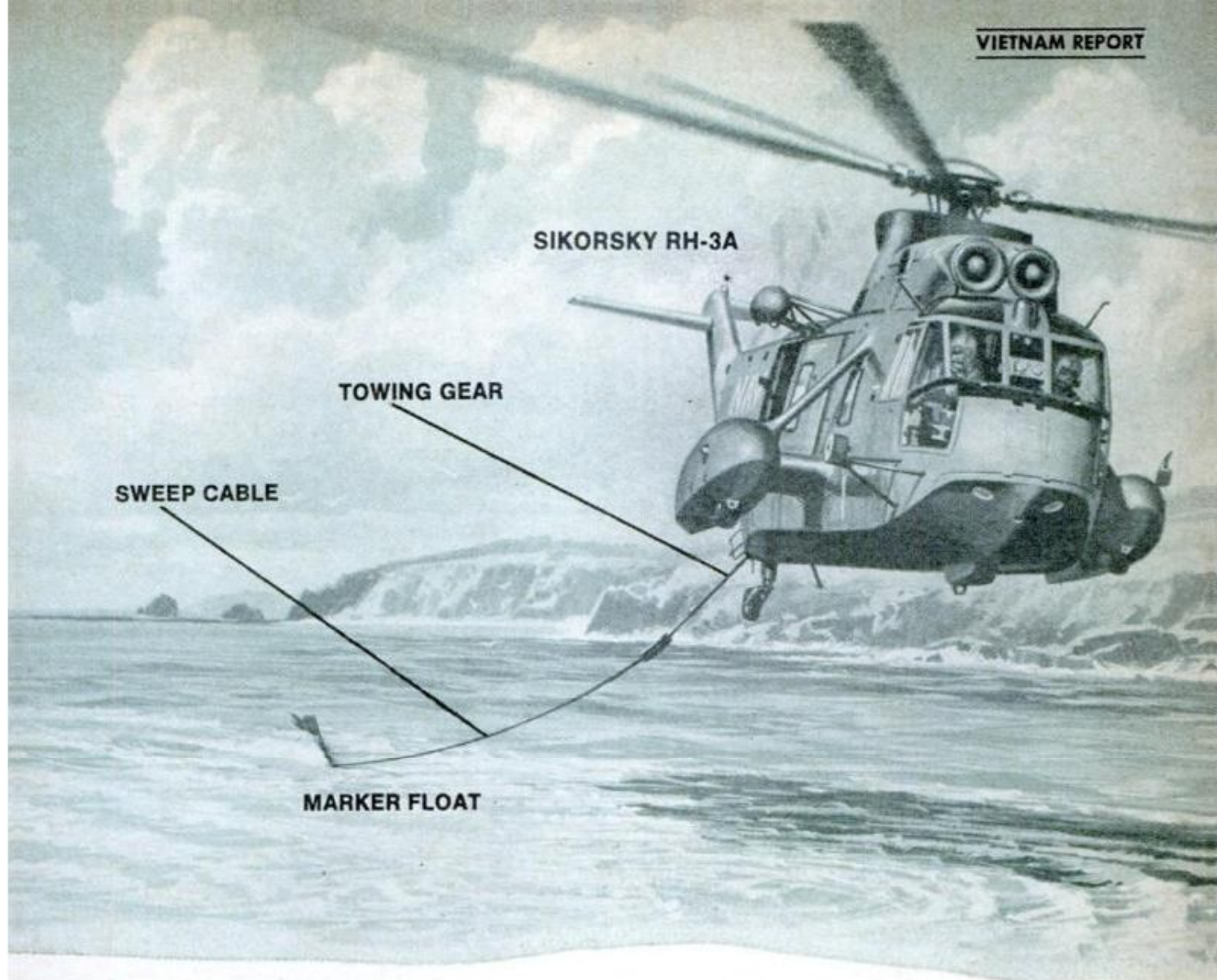
When channels were finally cleared,

the planned noose for the North Korean army had become a slip knot.

Adm. Forest Sherman summed up the debacle: "When you can't get where you want to, when you want to, you haven't got control of the sea."

If the mines laid at Wonson nearly 20 years ago looked like a joke, mines being used today by the Vietcong would make ordnance experts hysterical, were it not so serious. They don't compare in sophistication to our Civil War mines, being nothing more in most cases than sealed cans filled with TNT.

A guerrilla plants the mine in the middle of a vital waterway, hoping to sink a vessel and block the channel. Wires connected to a dynamite cap inside the mine extend to an electrical control on shore. He then waits for his



IN ECHELON, and led by helicopter, minesweepers clear river of such mines as Russian 1000-pounder (inset)

pigeon to pass over the sunken charge.

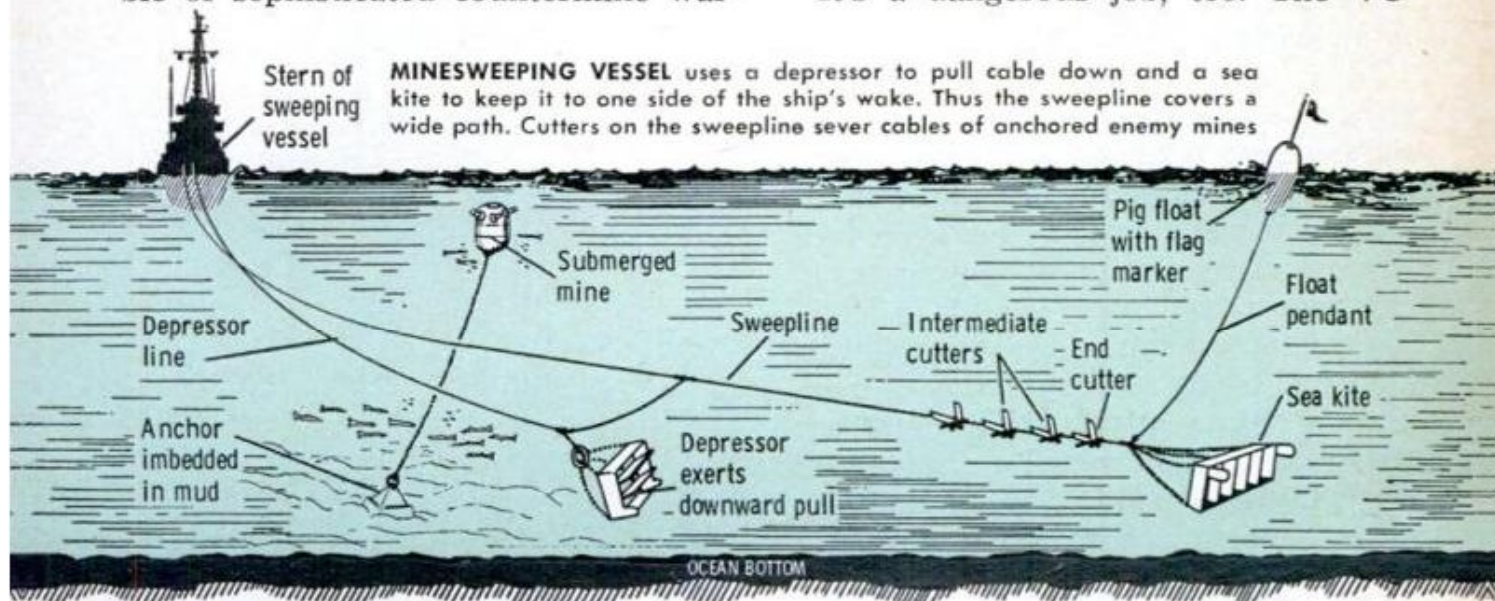
These crude devices have sunk two merchant ships and two minesweepers in the Long Tau River, the major shipping channel to Saigon.

To combat them, minesweepers capable of sophisticated countermine war-

fare must revert to crudeness, too. They drag heavy chains up and down the shore line to cut detonation wires.

"It's a daily job," one sailor explains. "A couple of Vietcong in a junk can lay a hell of a lot of mines in a night."

It's a dangerous job, too. The VC



usually defend their mines with heavy small-arms fire from shore.

The big worry for U. S. defense planners, however, is whether the Soviets, who are probably more expert at mine warfare than other nations, will soon supply the Vietcong and North Vietnamese with modern marine ordnance.

"If they do," a skipper of a minesweeper told me, "we could wake up tomorrow and find not only the shipping channels of South Vietnam denied to us, but all the water that laps the Vietnam coastline."

Why they haven't is a matter of conjecture. One theory offered by Capt. William B. Hooffstetter, commanding officer of the USS *Ozark*, is that mine warfare is a two-edged sword.

"It can deny you access as well," he explains. "By mining South Vietnam's waterways, the VC can't make use of them either. Furthermore, indiscriminate laying of mines is a serious problem that all have to face after a war."

If Soviet supplies cause mine warfare to begin in earnest, a ship like the *Ozark* would be welcomed in southeast Asia. It represents the Navy's newest method of countering mines.

Officially designated a mine countermeasures support ship, the *Ozark* serves as a mother ship for 20 small minesweeping launches and two minesweeping helicopters.

The *Ozark's* conversion from a World War II transport and the commissioning of the USS *Catskill* for similar duty underline the importance placed on mine warfare by the Navy.

Many people have the idea that a mine is a black, spiked, bobbing thing they've seen on a late-night TV movie. But mines are not only the explode-on-contact variety. In fact, for a modern seapower, these are pretty obsolete.

A newer type mine, capable of blowing the largest ship out of the water, is activated by acoustics, pressure or magnetism. Mines attracted to metal are the reason that vessels engaged in sweeping are made of wood or fiberglass; all metal aboard is demagnetized.

Magnetic mines are usually laid on the bottom, but can also be moored. Designed to explode beneath the surface as a ship's magnetic field activates it, the mine emits a tremendous shock wave and bubble that cripples the ship.

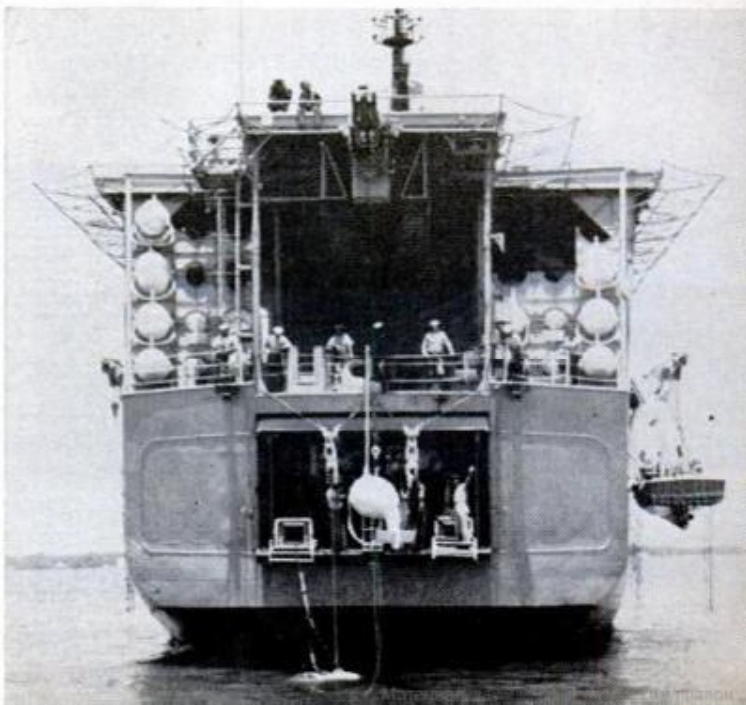
An acoustic mine is activated by sound waves sent through the water by a ship. An internal frequency device is set to a preplanned wavelength to explode the weapon.

Since each class of vessel emits a dif-

MINESWEEPER FORMATION places rear boat inside float of boat ahead, insuring a clean sweep of area



USS *OZARK*, in charge of U. S. minesweeping operations, prepares to launch gear for another day's work



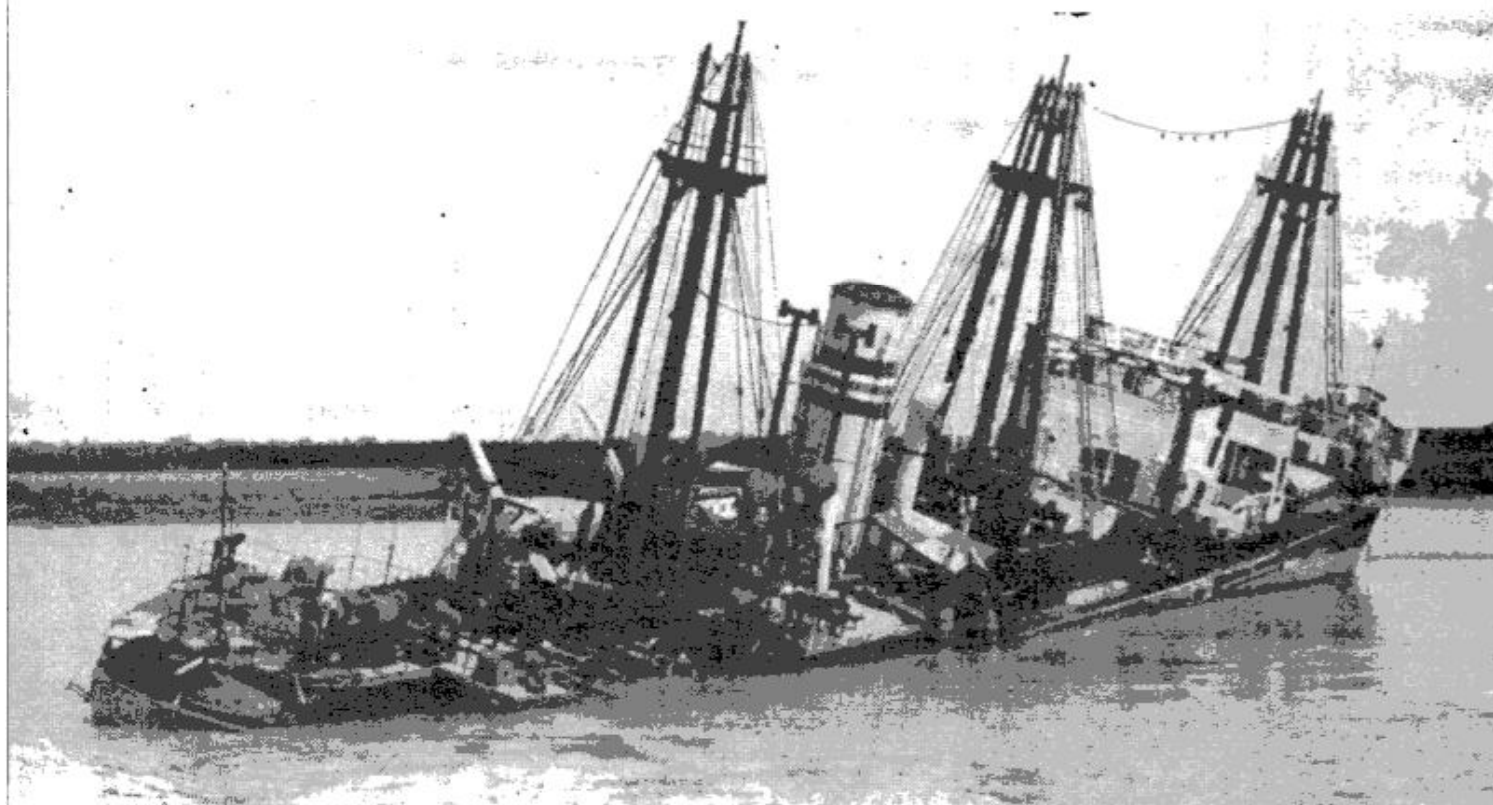
ferent kind of sound wave, the setting of the frequency device depends on what type of ship an enemy wants to attack. Some ships, for example, are propelled by turbine engines, while others have diesels. Some ships are single screw; others are double screw.

Pressure mines work similarly. As a ship goes through water, it creates a pressure wave. Every class of ship makes a different kind of wave. Pressure made by an aircraft carrier, for instance, is stronger than that of an oil tanker. A device inside the mine is set

There's another interesting way to set a mine. Use a counterdelay fuse that counts off the number of ships that pass above until the unlucky one comes by. Then, the fuse explodes the mine.

Minesweeping is tedious and dangerous. If a mine can sink a battleship, it can obliterate a 36-foot wooden launch.

When sweeping moored contact mines, for example, sweepers often play hopscotch with one another. In echelon formation, they drag long, weighted wires at an angle behind them that extend and fan out below the surface.



GRIM EVIDENCE of mine hazard. This U. S. boat was sunk in Vietnam waterway with primitive Vietcong mine

to clobber the type of ship you're after.

As with magnetic mines, acoustic and pressure mines explode beneath the surface, sending forth a vicious wave and bubble to cripple its prey. These mines are called influence mines.

Whether buoyant in the water or laid on the bottom, a mine is usually held in one spot. Moored mines are planted below the surface, but are held in tow by an anchor. Bottom mines are weighted to lie on the bottom.

The most dangerous type of mine is a floater. It's allowed to go anywhere the current takes it.

These sweep wires are equipped with sharp cutters. One type of cutter operates like a pair of scissors. As it engages the mooring wire, a small explosive charge is set off to close the cutter-blade jaws, snipping the line. The mine then bobs to the surface.

The lead boat has the highest mortality rate. The one behind follows the outer rim of the channel the lead has swept, extending its sweep beyond that rim. And so on back.

The first boat, though, must hunt and peck its way through the water,

(Please turn to page 214)



BUICK SPECIAL DELUXE | **Road Handling: Bravo! (59.8%)**
Dealer Handling: Boo! (14.4%)

Owners like its handling and style but some are miffed about mileage; others beef about dealer preparation and service

By **BILL HARTFORD**, Associate Auto Editor

ENVY OF US ALL is a machinist in Ashtabula, Ohio, who bought a Special Deluxe and two weeks later, lo and behold, his Buick dealer called him to see if everything was all right! As this lucky owner says:

"It is the first time that I bought a new car and two weeks afterwards they called me and asked if everything was all right."

Especially is he the envy of many Special owners whose dissatisfaction with their dealers ranges from mild irritation to total despair. An Illinois clerk says:

"If I had to go through another dealer like this last Buick dealer, I would rather walk."

If he does choose to walk, he may find, as some of his fellow pedestrians,

STYLE WAS THE LURE that led almost half of owners to the Special. Buick reputation and price were next



other Special owners who are taking forced exercise while waiting for their cars to be fixed, or not fixed.

A Navy man in California actually had a dealer talk his wife out of fixing a hard-start problem. The dealer said "it would loosen up and start easier," but, the sailor concludes, "it hasn't."

"**MORE HEADROOM!**" is a very loud cry among owners



WORKMANSHIP COMPLAINTS include sheet-metal fit

A young woman bank operations assistant in California, tells us that sales service was "great," but when it came to a minor adjustment of her air conditioner and repair of an oil leak, "service, as usual, was horrible and finally I had my dad fix the trouble after three fruitless 60-mile trips to the dealer."

Not all owners specified the nature of the work they wanted done, but half had mechanical trouble, with carburetor adjustments and electrical malfunctions taking top honors. Of these owners, incidentally, 70 percent received satisfactory repairs. One who didn't, an Arkansas attorney with rocker-arm

trouble and a rattly muffler, still awards an honor to his dealer, an "A" for effort: "They keep trying—give a gold star for that." Their effort, courtesy and fair dealing impress him, but repair service is something else:

"The quality of Buick service is very

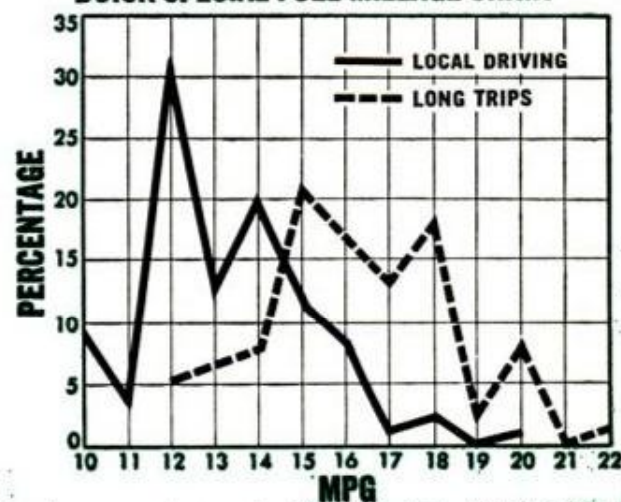
DASHBOARD and knob design need improvement



GLOVE COMPARTMENT is panned as entirely too small

FUEL CONSUMPTION averages for 350-cu.-in. V8 were reported as 13.2 and 16.2 miles per gallon

BUICK SPECIAL FUEL MILEAGE CHART





REAR VIEW MIRRORS, both inside and outside the car, are criticized as being in awkward positions

poor. Example: Had it [the car] in some seven times. Finally found out rocker arm is bad. Still can't keep muffler from rattling."

The last word on dealers comes from an Ohio homemaker. She hasn't had a bit of trouble with car or dealer:

"I buy my Buicks each year from my

son who is a dealer in Upper Sandusky, Ohio. He is very fair and courteous."

► Does this mean that a good relationship with an automobile dealer is better born than made?

The Special earned top praise for road handling, but this didn't originate in the driving bravura of hot rod owners. The bravos aren't forthcoming as a result of manhandling their cars for hours on the twists and turns of a gymkhana course, but for ease of handling in everyday driving situations. *Ease* is the word that sums up the feeling most owners have about getting their Specials around on the highways.

This being the case, owners' remarks about handling (their car's favorite attribute, mind you) have a dull sameness. And they would seem to portray a fear that getting behind the wheel of a car is like mounting the back of a self-willed beast that's going to run off denting any fenders in its path. Comments such as "it's easily handled," "ease of handling in and out of traffic," "handles on road very nicely," "holds road, corners well," "easy to park," infer that owners are surprised their powerful, 1968 newfangled machines can actually

(Please turn to page 216)

Summary of Buick Special Owners Reports*

Total miles driven 382,551
Average miles per gallon:
350-cu.-in., local driving 13.2
long trips 16.2

Specific likes:
Handling 59.8%
Style 52.1
Comfort 35.0
Ride 25.6
Power 18.8
Performance 18.8
Gas mileage 10.3
Quiet 9.4
Economy 8.5

Specific dislikes:
Gas mileage 17.8%
Dealer preparation, service 14.4
Workmanship 13.3
Poor headroom 12.2
Wind noise 11.1
Rear-mirror visibility 11.1
Ignition switch location 8.9

What changes would you like?
Rear-mirror location 11.6%
More headroom 10.5
Ignition switch location 9.3
Better control knobs 8.1
Bigger glove compartment 8.1
Better dashboard 7.0

Model:
2-door coupe 64.3%
4-door sedan 29.4
Station wagon 6.3

Transmission:
3-speed manual 1.6%
Automatic 98.4

Had any mechanical trouble?
Yes 50.8%
No 49.2

What kind of trouble?
Carburetor 23.4%
Electrical 17.2
Speedometer/cable 9.4
Gear indicator not aligned 7.8
Overheating 7.8
Transmission 6.2

Dealer repair satisfactory?
Yes 69.4%
No 19.4

Why the Buick Special?
Style 45.1%
Past experience 31.1
Price 20.5
Performance 14.8
Size 13.9
Handling 9.0
Economy 8.2

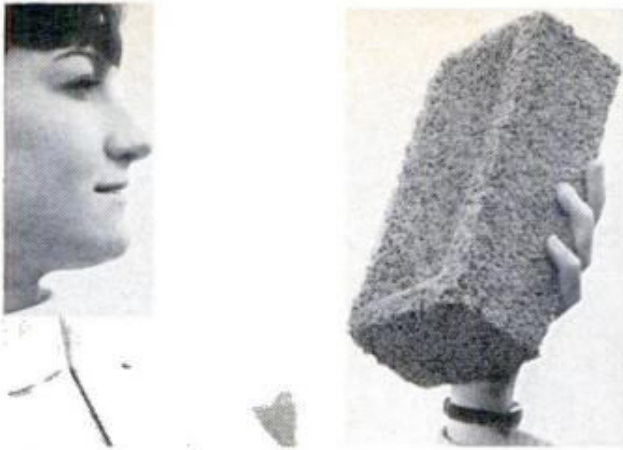
Is Buick Special your only car?
No 50.8%
Yes 49.2

Other cars owned:
Buick 36.4%
Chevrolet 12.1
Oldsmobile 10.6
Ford 9.1
Pontiac 7.6
Cadillac 4.5
Volkswagen 4.5
Opel 4.5

What options/accessories?
Power steering 95.3%
Radio 66.7
Power brakes 55.5
Airconditioning 50.0
Tinted glass 21.9
Whitewall tires 21.1
Heater 14.0
Wheel covers 14.0
Vinyl top 11.4
Tinted windshield 8.8
Remote side-view mirror 8.8

Age distribution of owners:
15-29 20.3%
30-49 38.2
50 plus 41.5

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



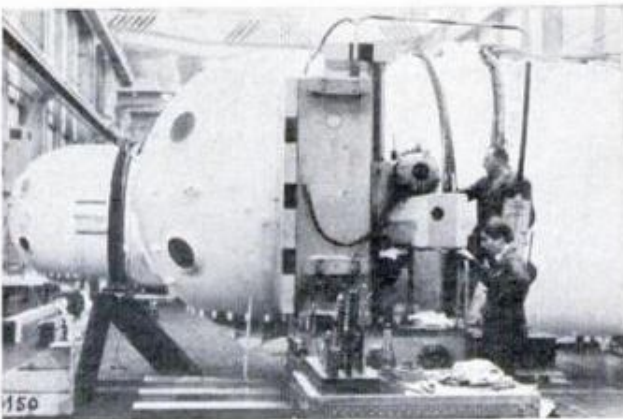
Snap, crackle, pop?

Rice husks can be made into load-bearing bricks that are suitable for inside or outside walls of buildings, reports the Tropical Products Institute of London. Five parts of rice husks are mixed to one part of cement.



Paris underground

In an effort to solve the parking problem in one congested area of Paris, private builders are constructing a three-story parking trench under Avenue Foch, one of the broad boulevards radiating from Place de l'Etoile.



PX-15 gets ready

Shown in final stages of construction is the PX-15, which was built in Switzerland and shipped to the United States. It'll be used by Jacques Piccard in a six-weeks undersea voyage, drifting in the Gulf Stream from Florida to Nova Scotia. (See *Big Rise of the Little Sinkers*, page 111.)

APRIL 1968



Slide-rule diagnosis

The British locoscope, a giant slide rule, helps diagnose 337 diseases. While interviewing a patient, the doctor inserts "symptom strips" (top); where horizontal lines on the strips join to form a continuous line (center), they point to the most probable illness. A copy (bottom) goes into the patient's records.

93



Come Ride Up Front on The Train That Gives The Jets the Jitters

The Tokyo-Osaka shuttle was flying high when Japan's 132-mph express zeroed in three and one-half years ago. Now it's the airlines who are fighting to stay in business!

By ROBERT P. CROSSLEY, Editor

FOUR YEARS AGO the air shuttle between Japan's two largest cities, Tokyo and Osaka, carried nearly a million and a half passengers—up 300 percent in three years—in antiquated DC-6s and 7s and obsolescent Viscounts.

Preparing for a predicted 2.6 million by 1966, the airlines converted to jets. But in 1966 they carried fewer than a million people. Something had happened.

What had happened was the world's fastest train. It goes 132 miles an hour, not for a mile or two, but mile after mile. To say that it has thrown the airlines into a tailspin is being polite.

When I rode on it last fall, the famed New Tokaido Line had just carried its

110 millionth passenger. The *Old Tokaido Line*, whose narrow-gauge tracks loosely parallel the standard-width new route took 6½ hours between Tokyo and Osaka. The NTL does the 320 miles in 3 hours and 10 minutes. America's idea of a fast train, the *Afternoon Congressional*, takes nearly half an hour longer to go 100 miles less.

I had made three trips in the NTL's luxurious first-class coaches, with their reclining airplane-type seats—the second class is almost as fancy—before I got up the courage to ask my host, Mr. Hiroshi Tsuyama, of the Japan External Trade Organization, if I could ride with the engineer. This was like asking to ride in an Apollo capsule. I would have bet 100 to 1 against my re-



MOTORMAN TAKASHI TOMIIE grips shiftlike throttle with right hand; next to it is the reverse control

quest being granted. My last day in Japan called for a visit to the Suzuki motorcycle factory in Hamamatsu, roughly halfway between Tokyo and Osaka. When Mr. Tsuyama announced the day before that Japanese National Railways had said okay, you could have knocked me over with a chopstick.

Our train, No. 201, was a *Kodama*, a "Limited Express," leaving five minutes after the *Hikari*, a "Super Express." The *Hikari*—"Light" in Japanese—stops only at Nagoya and Kyoto. The *Kodama*, or "Echo," goes just as fast but makes 10 stops.

Tokyo, a sprawling Los Angeles with more people than New York, seems end-



CIRCLE (arrow) lights up to show top speed allowed on any part of run; speed is controlled by Tokyo

less, but at 100 mph all cities have limits. We were down off the elevated right-of-way and speeding through the country west of Yokohama when I opened a small door at the front of the first coach and entered the head-end cab. (There's a cab at the other end too, so the train doesn't have to be turned around.)

The 12-car streamliner (How long since you've heard that word applied to a train?) has no locomotive. Electric power from an overhead wire is fed to motors on each of the 48 axles. Each motor puts out 185 kilowatts for a grand total of 8880. The train is made up of six two-car units, with one pantograph on each unit.

The cab resembles an airplane cockpit. A narrow platform, perhaps four feet wide, stretches across the front. Everything is spotless, including the white gloves of Motorman Takashi Tomiie. Perched on an upholstered seat, Mr. Tomiie, an experienced motorman who took six months' special training before he was allowed to guide the *Kodama*, keeps his eyes on a big

CRACK NEW TOKAIDO LINE is well equipped. Author counted 66 sections scheduled to leave Tokyo in one day





BUFFET COUNTERS in two of train's second-class coaches enable travelers to enjoy meal en route

speedometer to the left of the "dash." (Japanese trains, like Japanese cars, keep to the left.) Over on the right, Technician Tetsuo Yoshitomi sits in a chair, with no controls or instruments to tend. Both men are qualified as motormen—the Japanese don't call them engineers—and draw the same pay.

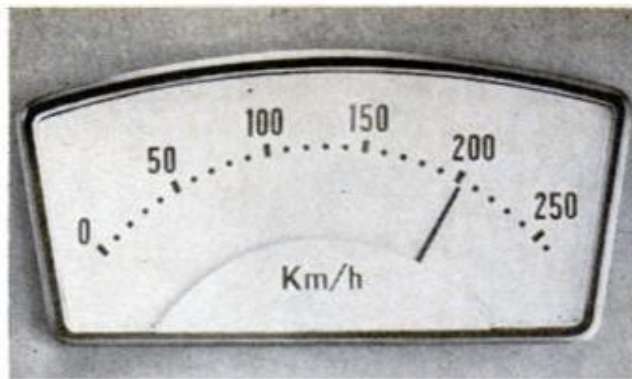
Now the horizontal line on the speedometer is touching 210 kilometers an hour—132 mph—as we eat up the gravel-ballasted, dust-free roadbed. I spot, directly above the 210 mark on the speedometer, a small circle, illuminated from behind like those that light up on a pinball machine. It, too, reads "210."

A tunnel yawns. Before it can say "excuse me," we're swallowed whole at 132 mph. I don't notice it, but the air vents have closed automatically to prevent a build-up of pressure in the coaches.

We're out of the tunnel in seconds, then into another. Forty-three miles, 13 percent of the entire route, are in tunnels. The longest is 5 miles.

There's a duplicate speedometer on top of the dash, so Mr. Tomiie can change his angle of concentration to avoid fatigue. Below in the center are eight trouble lights to indicate power or mechanical trouble in any unit. (Although there are usually six two-car units in a train, it can be expanded to eight units if necessary.)

There's a light to indicate when all doors are closed; the train can't be started if one is open. A pair of telephones hangs between the motorman



BUFFET-CAR SPEEDOMETER tells passengers how fast train is going. Here the speed nears 132 mph

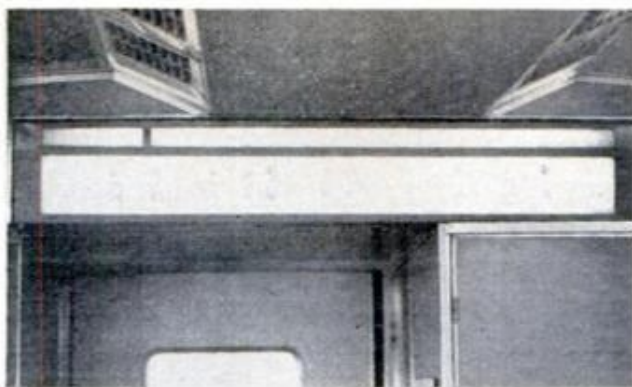
and technician. One is for making announcements in the coaches. The other provides radio communication with the Centralized Traffic Control in Tokyo. Other phones, back in the buffet cars, let passengers call direct to any number in Tokyo, Yokohama, Nagoya, Kyoto and Osaka.

Mr. Tomiie's right hand grips a shift-like throttle extending a few inches through the top of the dash. Next to it on the left is a second throttle with a shorter slot. This is reverse. Next to the window at the far left is a brake.

I climb up on the step below the motorman's platform to shoot pictures of a long straightaway and closeups of the speedometer to prove we *are* going 132 mph. Suddenly a bell jangles. I feel a sudden, though not jerky slowing of the train.

"What happened?" I ask Mr. Kazu-





STATION STOPS appear on lighted panel at end of coach. Indicator (above) shows location of train



OSAKA STATION of the New Tokaido Line. Only big-city airline terminals look like this in America

mitsu Uozumi, my guide from Japanese National Railways.

"The brakes," he replies. "They just went on."

I haven't seen the motorman touch the brake lever and I say so.

"He doesn't have to," Mr. Uozumi explains. "It's automatic. We're coming to a station. The automatic train control put on the brakes. Take a look at the speedometer."

I do. The circle of light has gone out over 210. Another has come on over 160.

"The brakes are on. That's as fast as he can go," Mr. Uozumi says.

Mr. Tomiie's hand eases forward on the throttle.

"What's he doing?" I ask. "I thought you said it was automatic."

"It is. He's letting up on the power. You don't keep your foot on the gas

when your brakes are on, do you?"

The bell rings again, and the light jumps to 70. We slow some more, the brakes still untouched by human hands. Not till we're down to 30 km h can the motorman take over to stop the train at a precise spot along the platform.

Every speed change for a curve, a bridge, a station or any other reason is automatically controlled by an impulse from the track.

"No wayside signals," Mr. Uozumi notes. "No worry about fog or smog."

"That little light on the speedometer?" I ask. "You mean that's not just an indicator? It really governs speed?"

"Right. The train can't go any faster than it says, no matter what the motorman does."

I can understand that, but I'm still bothered by one thing. We slowed down

NAGOYA-OSAKA toll road hasn't hurt NTL. Train is so fast officials don't fear road's extension to Tokyo



to a stop at Shizuoka. The *Hikari*, following us on the same track, went right on through. How can a signal system send different orders to different trains?

The answer lies in the control center in Tokyo. Before starting his run each motorman "registers" his train's number into the Automatic Train Control (ATC) by setting the dials in the motorman's cab. From then on, the ATC controls each train individually, according to the particular type of service and circumstances.

We kept passing trains going the other way. They were just like ours. In Tokyo there had been two others waiting to load at the long platforms where overhead numbers indicate boarding positions for each car and painted lines on the platform tell you where to get in line.

66 crack trains—one way—daily!

This was the most impressive thing of all—the *number* of trains, all identical bullet-nosed, blue-and-white 12-car streamliners. If an American railroad advertises a crack train, it usually means it has only one a day. I expected the NTL to be like that—two or three trains at the most. Instead, I counted 66 sections, *Hikaris* and *Kodamas*, on the schedule board at Tokyo. And that's only in one direction! There's an *Hikari* every hour and every half hour from 6:00 a.m. until 8:30 p.m., and a *Kodama* leaves five minutes after each *Hikari*. That's a lot of trains—compared to our one-a-day between New York and Detroit.

The NTL is designed to handle 120 trains a day in each direction. On a typical day trains on this one 320-mile line cover nearly 40,000 miles—more than 1½ times around the Earth at the equator!

Each *Hikari* has two first-class and 10 second-class coaches. (*Kodamas* have only one first-class.) The run's too short for a fancy diner, but two second-class coaches contain buffet counters.

Each train can carry approximately a thousand passengers (equaling the capacity of eight jets). The cars, built by six Japanese companies, are 25 meters (82 feet) long and are supported on air springs. After three years' service they're still spotless. They're completely cleaned at each end of the line, and fresh headrests are put on each seat. The whole train gets a shower at the end of each round trip.

Pretty hostesses, a welcome contrast to the weatherbeaten news butchers on American trains, sell oranges, soft drinks and cups of custard. On another train we rode—not the NTL—there were five hostesses for three cars. The first thing they did was to bring us a hot towel, or *oshibori*. What that wouldn't do for a tired commuter in this country!

Except that seating is three-and-two and nonreclining, the second-class coaches are identical with first-class, with one important (to Americans) difference. Only first-class cars have both "Western" and Japanese-style toilets. I won't go into detail, but, take my word, there's a difference. Across the corridor is a small compartment marked "Gentlemen," equipped as you might expect. It's all very convenient, especially the window that lets you see if it's "occupied."

A new road from the rails up

Despite what you might be asked to believe here at home, you don't just build a jet or turbine-powered train and go out and run it lickety-split on your old track. The Japanese did it the hard way. They built a whole new railroad: new right-of-way, new rails nearly a mile long; new cement ties; 67 tunnels whose total length is nearly 43 miles; over 35 miles of bridges; and the most modern train-control system in the world. It took them 5½ years and it cost them a billion dollars.

There were no railroads at all in Japan before 1872. By then Americans had been riding trains from coast to

(Please turn to page 194)



After this, combat is easy

The fifth week of training for the Navy's Underwater Demolition Teams (UDT) is especially tough—and two days of that week are classics of misery. That's when the trainees take their orientation in mud, which is climaxed by a "Mud Olympics." The events include dashes through mud, a game of king of the hill on an inflated raft and a nonwhite-gloves inspection.



Pop-up top for a Land-Rover

A pop-up top that allows more head space inside is one of the features of the Dormobile Caravan—a conversion of the famous Land-Rover. The four-person camper version of the four-wheel-drive vehicle is the work of Martin Walter, Ltd., of Folkstone, England.



CHRYSLER IMPERIAL | Gorgeous on the Outside Gusty on the Inside

Hurrahs for handling, raves for ride and cheers for comfort can't hush the high-speed whistle from wacky workmanship

By BILL HARTFORD, Associate Auto Editor

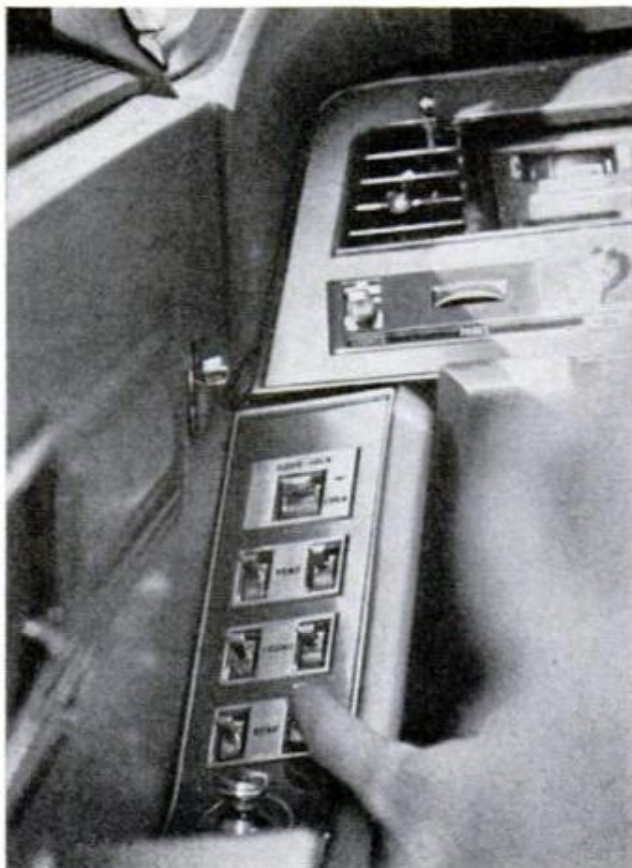
WHISTLING DOWN THE PIKE" isn't the thrill to some Imperial owners that it is to others. The problem is that high-speed driving only worsens the problem of air and water embarrassingly leaking into this regal automobile. Imperial owners tell us there's only one reason for their discomfort: poor workmanship.

It seems that spending twice as much money as most of us spend for a car doesn't guarantee immunity against the ills of the assembly line. An owner in Texas who labors in mortgage banking, investments and cattle ranching tells us about it. He says, "The body is *poorly* put together, there are cracks around all four doors, they don't close tight," and that the "right front and left rear doors leak in the rain." But, a persevering Texan, he's going back to his dealer for the third time to see if he can get this Imperial, his fifth, waterproofed.

Water leaks, drafts, spotty paint jobs, sloppy trim and upholstery fit, and so on, are all legitimate complaints. Not too many owners, however, are concerned about the "very thin leather" that annoys an Arkansas physician's

wife. Whether or not it's thin, it's comfortable. More than comfortable, it's "luxurious," say the owners, half of whom are over 55 years of age and

ARMREST CONTROL for power windows and door locks contribute to high comfort rating for Imperial



enjoying easy going in top-of-the-line luxury.

Plush as the going may be, mechanical difficulties with the car's automatic temperature control, airconditioner and electrical system can, at times, result in an uncontrolled environment. A New York sales engineer "gets a cold blast after the set temperature is received," and an Ohio broker has the problem that "at present the electric windows do not operate."

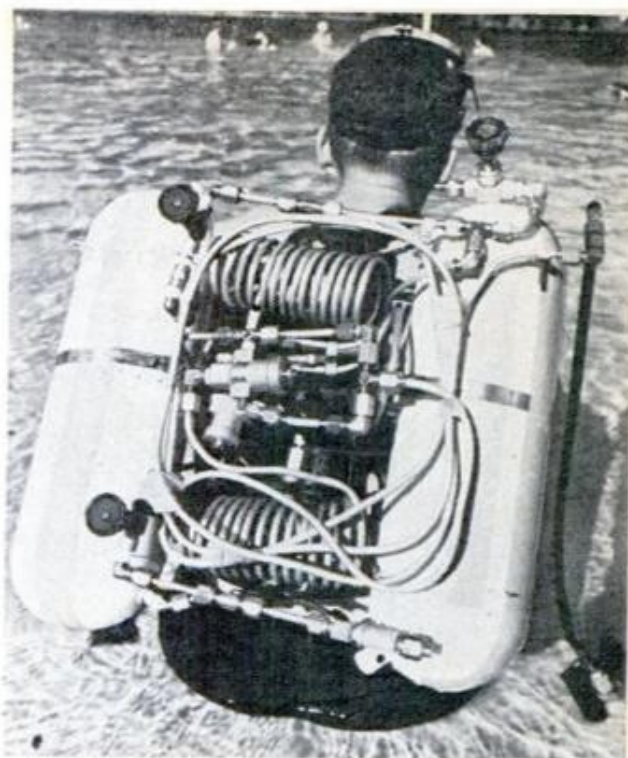
Aware that it's not a malfunction, the fact that the Imperial's windows are designed to operate only when the ignition switch is "on," annoys many owners. But practically no other inherent design elements are criticized. Neither is the fact that the Imperial is available only with a 440-cu.-in. engine, Chrysler's largest. It's not too big or too small, and owners, generally unconcerned with fuel mileage, indicate an average of 12.3 mpg. But, most importantly, those miles are driven in a car that they consider to have a good

(Please turn to page 228)

Summary of Chrysler Imperial Owners Reports*

Total miles driven	780,607
Specific likes:	
Handling	43.8%
Comfort	37.7
Ride	36.0
Style	23.3
Performance	20.5
Power	17.2
Specific dislikes:	
Workmanship	37.8%
Dealer preparation	16.2
Wind noise	11.5
Gas mileage	11.5
Dealer service	10.1
Automatic temperature control difficulties	8.1
Finish/paint job	6.8
Model:	
Four-door sedan	13.0%
Crown four-door hardtop	54.3
Crown two-door hardtop	17.3
Crown convertible	2.9
Le Baron four-door hardtop	12.5
Mechanical trouble?	
Yes	46.1%
No	53.9
Type of mechanical trouble:	
Automatic temperature control	27.0%
Carburetor	17.0
Airconditioning	14.0
Electrical	11.0
Why did you buy Imperial?	
Past experience	47.5%
Performance	16.0
Quality	11.0
What changes would you like to see?	
Better workmanship	21.5%

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



Supercold air for divers

Newly developed equipment using supercold liquid air rather than compressed air for scuba diving can extend breathing time from one or two hours to six or eight hours. Photographed during tests, the prototype is shown here with its tanks filled with a 318°-below-zero mixture of nitrogen and oxygen.

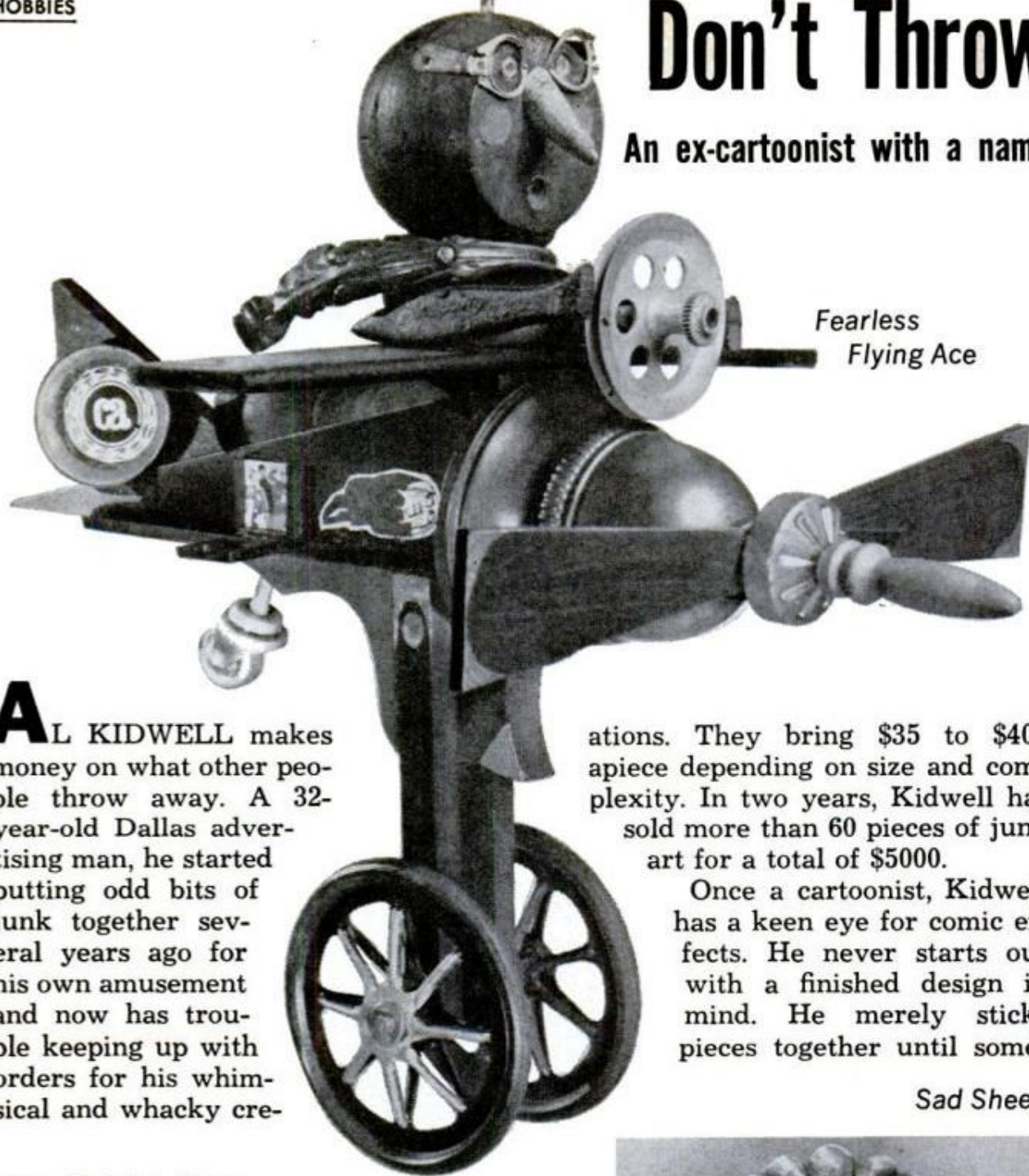


It wasn't easy

Hitting a pole backwards looks like the hard way to wreck a car. A German driver did it when his car left the road and spun 180°.

Don't Throw

An ex-cartoonist with a name



*Fearless
Flying Ace*

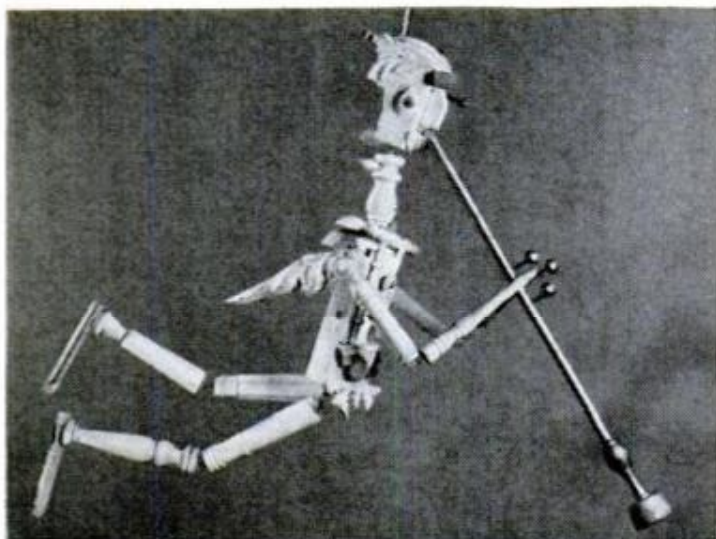
AL KIDWELL makes money on what other people throw away. A 32-year-old Dallas advertising man, he started putting odd bits of junk together several years ago for his own amusement and now has trouble keeping up with orders for his whimsical and whacky cre-

ations. They bring \$35 to \$400 apiece depending on size and complexity. In two years, Kidwell has sold more than 60 pieces of junk art for a total of \$5000.

Once a cartoonist, Kidwell has a keen eye for comic effects. He never starts out with a finished design in mind. He merely sticks pieces together until some-

Sad Sheep

Blow, Gabriel, Blow



It Away—Send It to Kidwell!

you wouldn't believe has Texans bidding for sculpture he creates from scrap

thing takes shape. This way the results are fresh and spontaneous, not forced.

The raw material for Kidwell's "sculpture" comes from junkyards, house wreckers and friends all over the country who eagerly send him useless cast-offs in a sort of challenge to him to make something out of them. The most commonly used items include old newel posts, parts of church pews, gingerbread woodwork, lamp shades, chair legs and wheels from wagons.

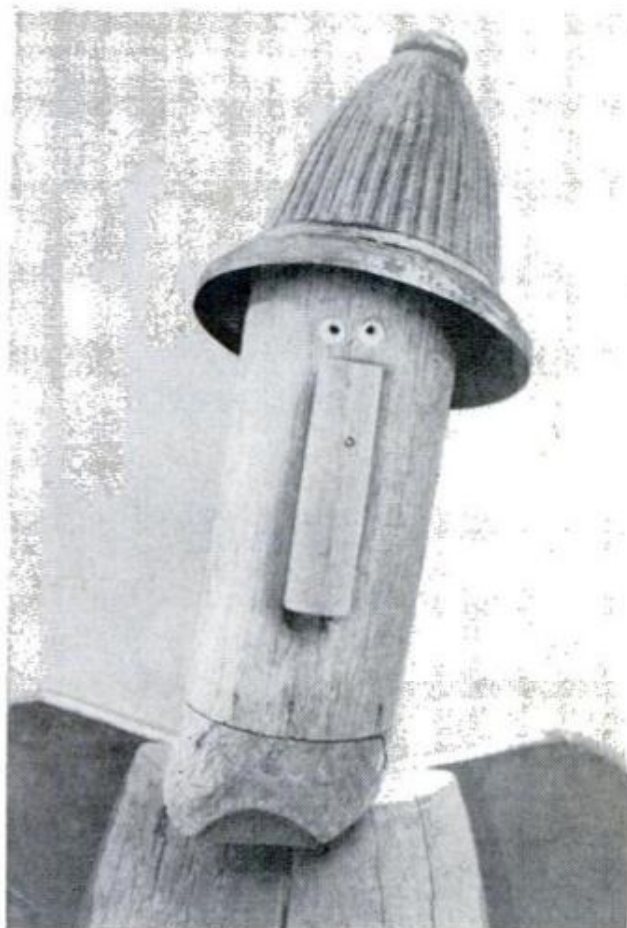
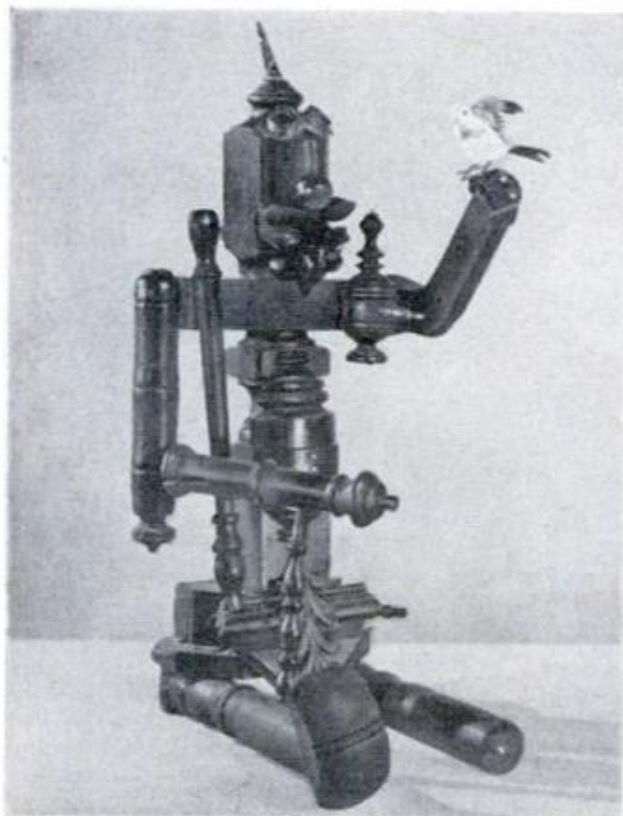
Kidwell lives at 9735 Tralee Drive, Dallas, Tex. He'll gratefully accept contributions, but pleads: "Please don't ship anything collect or anything that's too big to handle easily." ★★★



KIDWELL'S GARAGE, which hasn't held a car for years, is heaped with junk from which the imaginative creator puts together his humorous figures

British Bobby

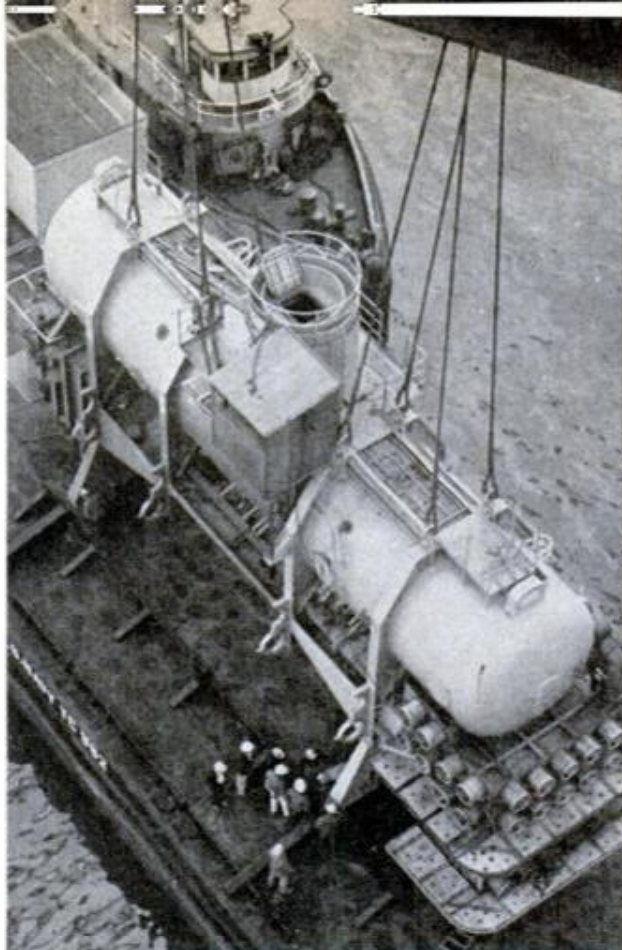
Mechanical Man





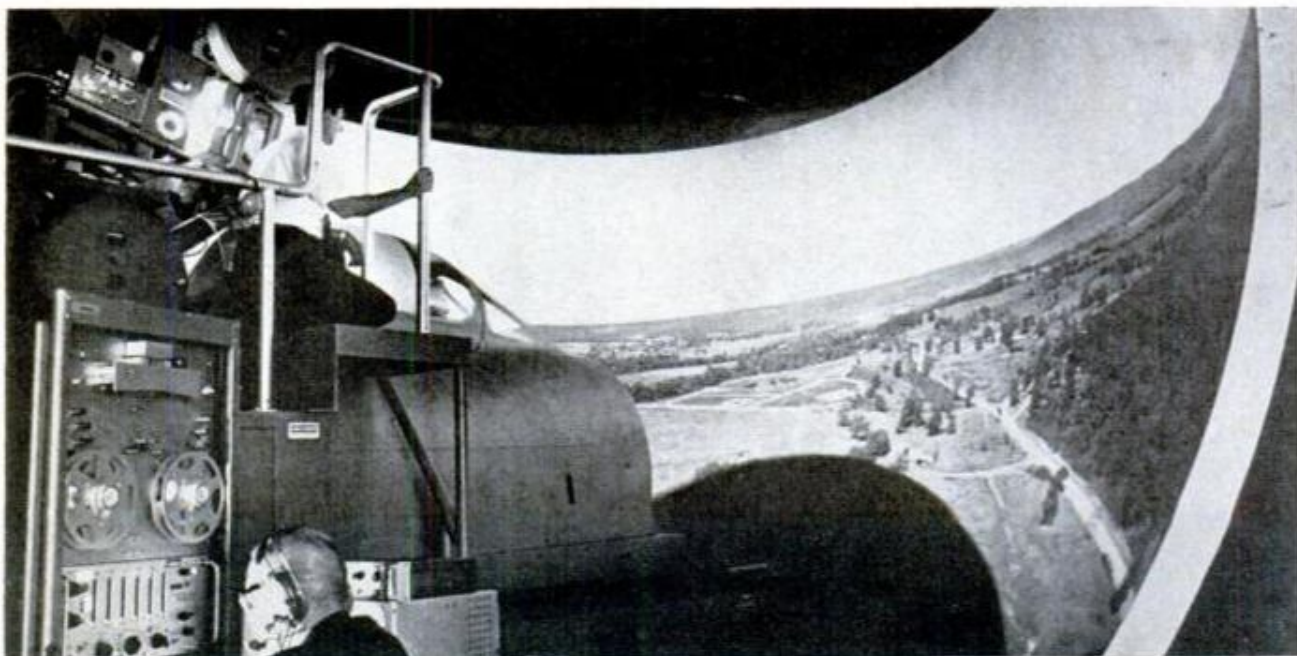
The old lamplighter . . . zap!

Police in one section of England switch on roadside fog warning lights by a radio beam that's fired from a moving police car at a control in the light housing.



Underwater residence

The Sealab III habitat is fitted out in San Francisco Bay as the Navy prepares to place it 450 feet in the ocean. Teams of eight men will spend nearly two weeks each in the lab.



Pilots learn to spot targets while flying low and fast

How well a pilot can pick out targets from the cockpit of a high-speed aircraft during low-level flight can be determined with a new full-color, wide-angle display system developed by Fairchild Space and Defense Sys-

tems. The equipment realistically presents the view from a low-flying plane at high speed. A film taken with a special 160° lens is projected onto a spherical screen from a projector with a similar lens. When the pilot



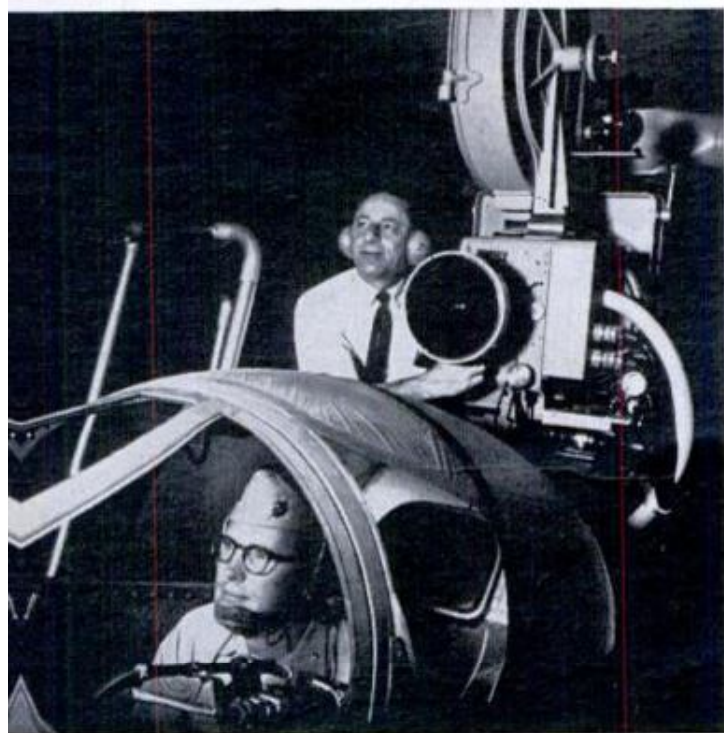
Porpoise watcher

An 18-foot auxiliary jet fuel tank was turned into a porpoise watcher by Marineland of the Pacific. Suspended below the "semi-submersible," an observer watches the mammals.



Five—count 'em—five

The first five-engine outboard ever to race was this 17-foot Stylecraft catamaran at Lake Havasu. The stock 75-hp McCulloch engines were increased to 85 hp for the race. A pit fire and broken cable limited performance.



recognizes a target, he presses a thumb switch; his reaction time and visual capabilities are then measured. The screen appears at left, and the projector is shown behind a cockpit mock-up directly above.

APRIL 1968



Space-age antique

A massive turret lathe, built 40 years before the Wright Brothers flew the world's first airplane, shapes ablative heat shields for Apollo space vehicles. It's used by Space Systems Div. of the Avco Corp.

105

SHE COULDN'T JUMP CLEAR. The skidding scooter wedged her leg against the curb and crushed the left foot. The look on her face made the ambulance medic reach for Talwin—medicine's newest weapon against pain. Deftly he drew the clear liquid into his syringe, then jabbed it into the injured girl's arm. Minutes later, her tortured face relaxed. The twisted agony ebbed into restful calm: "The pain's all gone."

Since the new drug was cleared by the Federal Drug Administration last summer, it has proved successful in countless similar cases, blotting out even the most intense pain. At present, it is given by injection. But a Talwin pill is already under test and seems to be effective. If the FDA okays the pill for nonprescription use, it may become a standard first-aid item. It would bring immediate and complete pain relief in many agonizing situations—notably on-the-job injuries and traffic accidents. You might carry it in your glove compartment.

Unlike other painkillers, Talwin (also known by the generic name, pentazocine) is both powerful and safe. Up to now, painkillers strong enough to suppress the most severe pain were addictive—like morphine. "I've known cases where you could either let the patient suffer, or maybe turn him into an addict," says Dr. Alan Lans, a New Jersey clinician. "That's a pretty grim choice."

The odd thing about Talwin is that—for all its success—nobody knows how it works, or why. In fact, pain itself is a mystery. We know that it travels over nerve pathways from the point of injury to the brain. We also know that special pain receptors are spotted throughout most parts

AT LAST: A POWERFUL, SAFE PAINKILLER

As powerful as morphine, Talwin offers immediate relief—without danger of addiction—to those suffering excruciating pain

By HANS FANTEL

of the body as an alarm system for signaling trouble—cuts, burns, contusions, fractures, or infections. But we have only the fuzziest notion how these signals are perceived and interpreted in the brain.

In one respect, pain differs from other perceptions, such as sight, sound, taste or smell. It cannot be shared. By its nature, it is utterly solitary, private and incommunicable.

As for controlling pain, we have a choice of three basic methods: 1) general anesthetic; 2) local anesthetic; 3) analgesic.

A general anesthetic, such as ether, knocks out consciousness so that the patient senses nothing whatever. Such anesthesia is potentially dangerous because the dividing line between unconsciousness and death is often very narrow. The concentration of a general anesthetic in the bloodstream must be accurately monitored to avoid killing the patient by overdose. That's why general anesthetics are usually given only for major surgery.

Local anesthetics—for example, the dentist's Novocain—prevent pain by blocking the nerve between injury site and the brain. By injecting them into the spinal cord, entire body areas can be insensitized, but the effect usually doesn't last long.

Talwin belongs in the third group of painkillers—the analgesics. These substances apparently seek out and paralyze the pain-registering parts of the brain without affecting other portions. Nobody knows the nature of this selective action. The most common analgesic is aspirin. Nearly 13 billion of these handy tablets are

(Please turn to page 190)



Deep-Squeeze Diving Florida's Underground

A broken string in the dark 100 feet down put PM's explorers at the end of their rope.

By STU SUP as told to Daniel C. Fales, Boating and Outdoors Editor



A SLIGHT TWINGE of fear creeps through my body as I slip into the luke-warm water. I've heard that seven divers lost their lives exploring this very spring—and in just four months four more will die in nearby Jenny Spring.

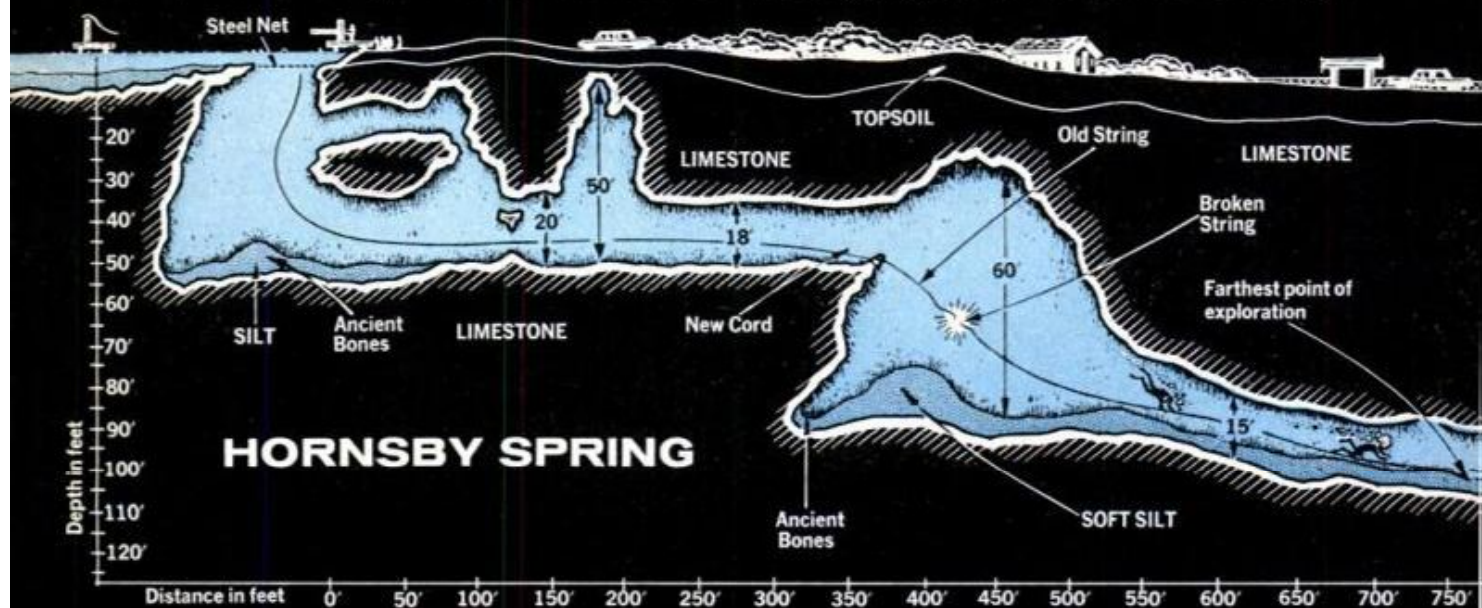
But I push fear aside, as the hollow echo of my own underwater breathing fills my ears. Bob Roth, my diving partner, and I have spent hours rechecking gear. I'm confident. Bob gives the "thumbs up" sign. Mentally, I go over our diving checklist as we drift down to the cold bottom of Hornsby Spring. Everything seems okay.

Though Bob and I have been diving in the wide-open sea for seven years, this is only the second year we've entered the

dark, cold, restrictive world of "spelunk" diving in fresh water. In our first year, we tracked through the underwater maze of Jenny Spring.

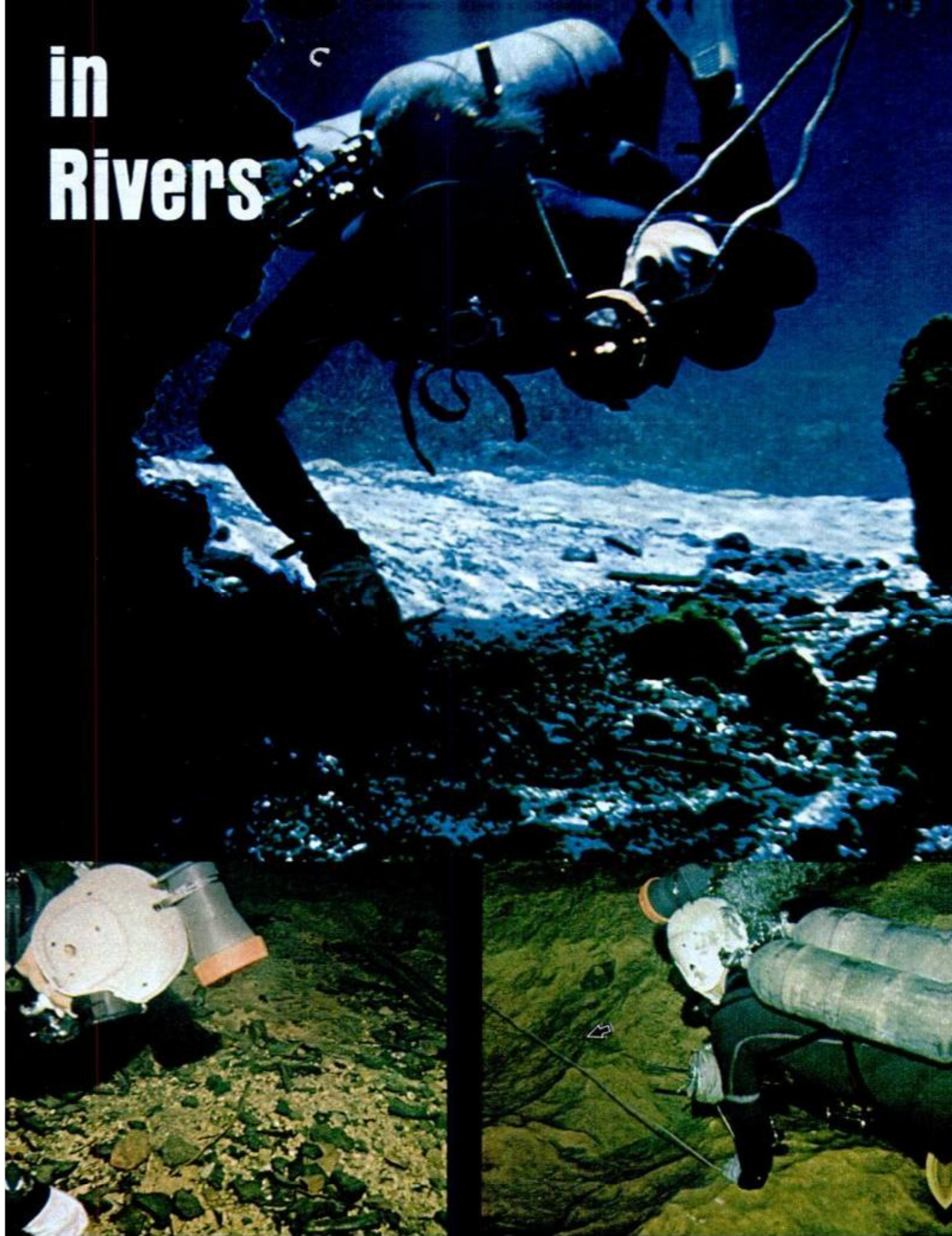
We don't know it now, but four active college lads, having fun during the Christmas holidays, will run out of air, will panic and drown deep in the tangled, water-filled caves of Jenny Spring.

The mysterious underground rivers at both Jenny and Hornsby Springs are part of a 700-mile network that runs from Northern Florida into North Carolina. Each river passes through limestone strata, quickly eating it away and leaving huge water-filled "rooms." This erosion is often so close to the surface that the earth weakens and sinks, taking with it land, houses, cars, trees. But this has been going on for centuries. So long, in



A STEEL NET is stretched across the opening of Hornsby Spring to keep out unauthorized people. The entrance is on the property of Camp Kulaqua, a Seventh Day Adventist camp in High Springs, Fla. The only living thing the two divers saw was an all-white crab with no eyes—no need for protective color or eyes in the pitch dark of this freshwater river

in Rivers



BOB ROTH SWIMS into the entrance of the treacherous Jenny Spring, top, carrying a hand light and a guide rope. At Hornsby Spring, above, PM's divers picked up dozens of bones about 20,000 years old

BLACK ARROW points to string in Hornsby Spring which broke, leaving divers lost in a dark, murky cave. Note the football helmet with light attached worn by Bob. White cord is a new guide rope

fact, that explorers of this system have found bones belonging to animals extinct for thousands of years.

It is in Hornsby Sink that such ancient bones can be found scattered within the soft rug of silt that covers the spring floor.

We're here to get some of these bones—bones of mastodons, bones of giant tree-sloths, bones that are 20,000 years old.

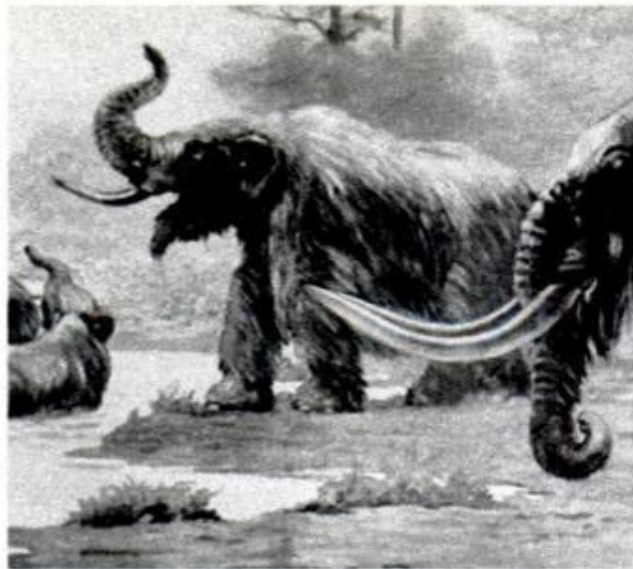
But we are about to get more than we bargained for.

It's 10:34 a.m. My depth gauge shows 50 feet. Bob and I have decided to make an exploratory dive this morning. We just want to see the layout. Usually we take two air tanks, but now we carry only one apiece. We don't plan to stay down long.

Hanging from Bob's waist is a spool of quarter-inch nylon cord. We'll use this as a guide rope.

I motion to Bob to tie one end of the cord to a boulder. Silt rises as he works. Slowly we swim toward a small, gloomy hole just ahead. The water's getting colder as my eyes widen to see in the dark. I fumble for the switch on my underwater light. Bob reaches up and

STU SUP sorts and checks the treasure of bones that he and Bob Roth gathered from the Hornsby Sink



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

MASTODONS have been extinct for many thousands of years. But they once roamed the Florida area

turns on the large light he's attached to a football helmet. It works like a miner's light. This gadget leaves his hands free to operate his movie camera.

Weird yellow colors show up on the pockmarked limestone when our lights reflect from the walls. We must look odd decked out in black wet suits, flippers, pressure gauges, air cylinders, masks, knives, decompression charts, nylon-mesh "goodie" bags. In the weightlessness of water, I feel like an astronaut walking in space.

Our plan calls for a 30-minute dive. But should one of our lights go out, or something else go wrong, we'll surface immediately.

It's 10:40. I figure we're 100 feet in. My gauge shows we're 55 feet down. Bob's cord slowly pays out. We're swimming in a tunnel that ranges from 15 feet to 25 feet in diameter. I feel my air tank scraping the ceiling.

I spot a few bones, but when I try to wipe away the silt that covers them my visibility drops to zero. The silt hangs suspended. There's little if any current to carry it away.

It's 10:55. We're in about 400 feet, still 55 feet down. Bob motions that he's running out of guide cord.

Suddenly, the tunnel floor seems to end. I check the time—10:56. We still have plenty of air left. I notice a thin

(Please turn to page 218)

The Big Rise of The Little Sinkers

A population explosion has occurred among research submarines. These small underwater craft are now preparing to invade man's last frontier—the ocean floor.

By WALLACE CLOUD

ALEXANDER THE GREAT went down into the sea in a "glass barrel" in 323 B.C. and reported he saw a fish so big it took three days to swim past. That story nearly finished off oceanography. Sensible men knew their observations below the surface wouldn't be believed, so they refrained from eyeballing the undersea environment for a good long while.

Courage has revived, however, and now it's the fish who can hardly believe their eyes. A population explosion among scientific submersibles has mushroomed in the last

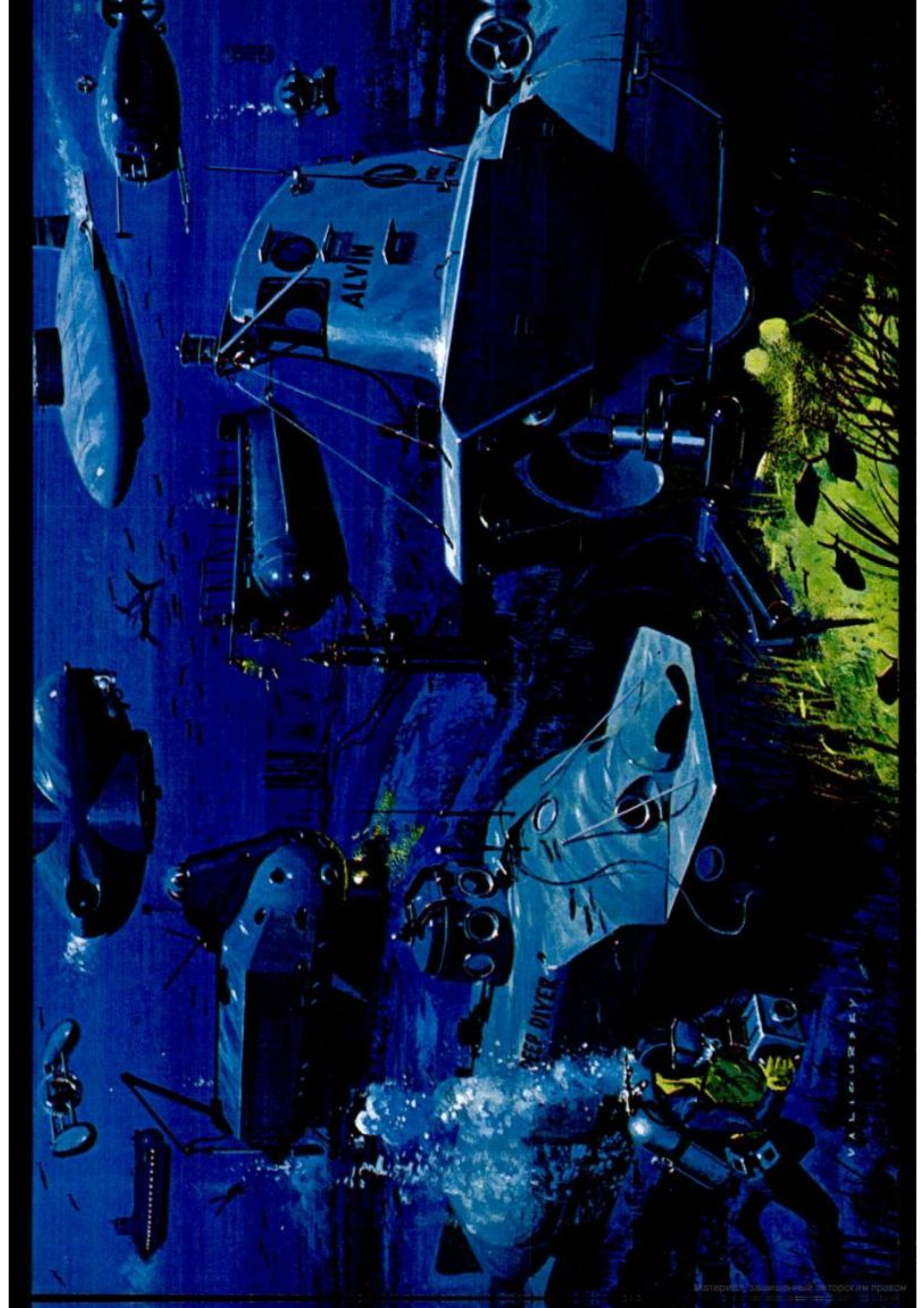
[\(Text continues on page 114\)](#)

Artist's concept of most significant research submarines, painted especially for *Popular Mechanics* by Ed Valigursky, appears on next two pages.



DEEPSTAR 4000 is one of most successful of new research submarines

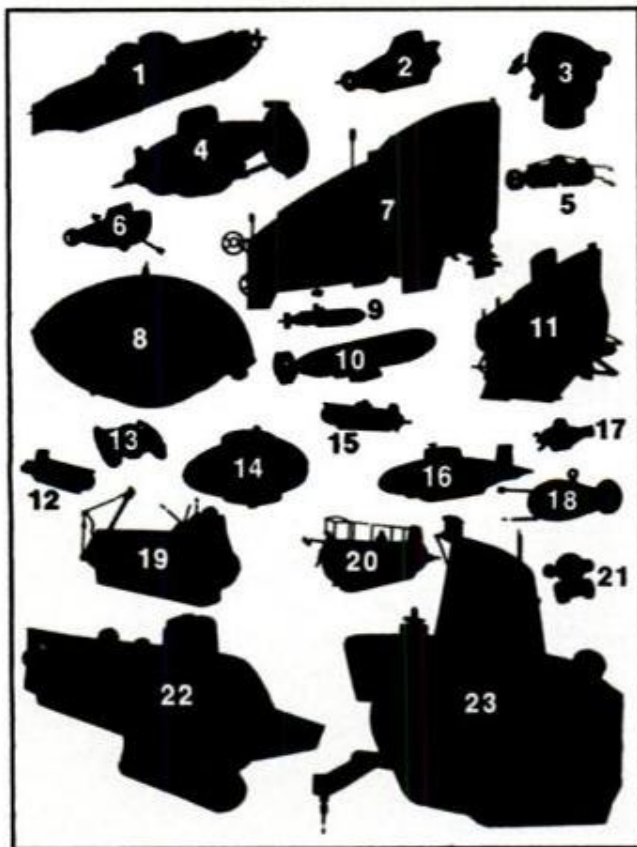




ALVIN

DEEP DIVER

VALLEY



KEY

1. CUBMARINE PC3B 2. JES (Japanese Experimental Submarine) 3. DEEP JEEP 4. STAR III 5. YOMIURI 6. AUTEC I 7. TRIESTE II 8. DEEPSTAR 4000 9. DOLPHIN 10. DSRV (Deep Submergence Rescue Vehicle) 11. ARCHIMEDE 12. AUGUSTE PICCARD 13. HIKINO 14. DOWB (Deep Ocean Work Boat) 15. NR-1 16. DEEP QUEST 17. ASHERAH 18. BEAVER MARK IV 19. PX-15 20. ALUMINAUT 21. SPUVA (Self-Propelled Underwater Viewing Apparatus) 22. DEEP DIVER 23. ALVIN

MOST FAMOUS small submersible is probably Alvin which found missing H-bomb off coast of Spain

few years. Since Prof. Auguste Piccard took the first dive with *Trieste* in 1953, nearly 40 of the little sinkers have been built, and more are under way.

They *do* look odd. A typical research sub generally has a maze of scientific hardware dangling from it, including instruments, cameras, lights, sonar gear, manipulating arms, bottom-sampling devices and corers. Fish never saw anything like that!

Aluminaut, built by General Dynamics for Reynolds Metals, discovered a "smooth, black pavement" consisting mainly of manganese oxide at a depth of 3000 feet on the Blake Plateau off Florida, and explored it by trundling along on *wheels*.

Deepstar 4000, a follow-on to Jacques Costeau's original diving saucer, sneaks up on unsuspecting marine life and, with a device bearing the scientific nomenclature, "the slurper," slurps up animals for study on the surface. *Deepstar* is one of a family of small submersibles built by Westinghouse Electric Corp.

Between dives to inspect earthquake cracks on the sea floor, *Yomiuri*, a Japanese sub named after and owned by a Tokyo newspaper, brings back live



specimens for the aquarium at Yomiuriland, a Japanese Disneyland.

Ed Link's *Deep Diver*, built by Perry Submarine Builders, is the first "lock out" sub. It delivers divers to the deep through a bottom hatch, enabling scuba scientists to get an intimate view of such things as the mating maneuvers of giant squid.

Submarine pilots have reported that squid sometimes take fright, squirt a cloud of black fluid at an intruding vehicle, and scoot off. *Alvin* topped that. A disturbed swordfish charged the vehicle and got its sword wedged between a porthole edge and the fiberglass fairing. *Alvin* surfaced, undamaged, with the fish still attached. That night the crew ate what they consider the best swordfish steak they'd ever had. *Alvin*, built by Litton Industries, is operated by Woods Hole Oceanographic Institution for the U.S. Navy.

With the finding of the *Thresher's* mangled hull by *Trieste* and the recovery of the missing H-bomb in the sea off Palomares, Spain, by *Alvin* with the aid of *Aluminaut* (see *How We Found the Missing H-Bomb*, page 72, Aug. '66, *PM*), the prestige of deep-diving subs really took off.

The Navy is spending millions on a series of search and rescue submarines, including the *DSRV* (Deep Submergence Rescue Vehicle), being built by Lockheed (see *Rescue from the Deep*, page 124, Jan. '68, *PM*), and *DSSV* (Deep Submergence Search Vehicle), builder as yet undetermined. Another \$30 million in Navy funds is going into the construction of *NR-1*, the first research sub powered by a nuclear reactor. Another General Dynamics vehicle, the seven-man vessel may be able to cruise submerged for 30 days or more, ideal for long-range mapping missions.

Some other research submarines and some of their purposes include:

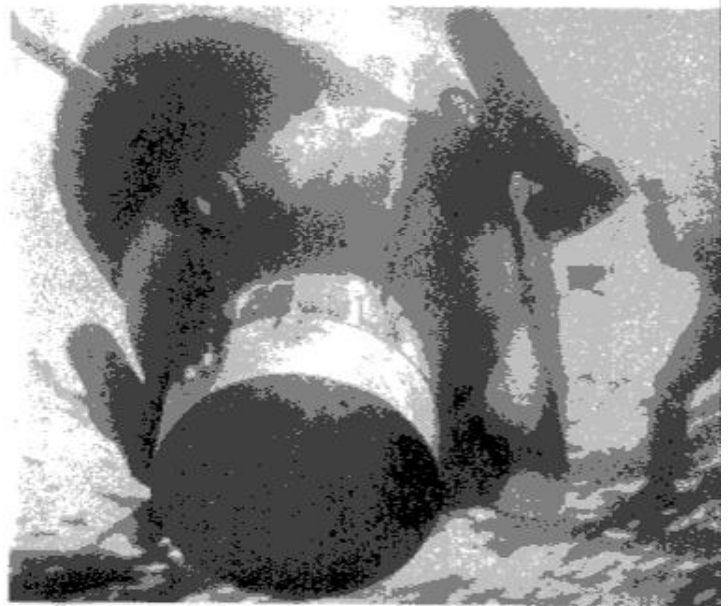
PX-15, being built by Grumman Aircraft for Dr. Jacques Piccard, will drift underwater for six weeks, following the Gulf Stream at a depth of around

1000 feet from Florida to Nova Scotia.

Auguste Piccard, built by Dr. Jacques Piccard, was used as a tourist vehicle during the 1965 Swiss National Exposition, carrying 30,000 passengers (40 at a time) to the bottom of Lake Geneva. It has since made at least 20 scientific dives.

Hikino, built by the U.S. Navy's Ordnance Test Station, has a glass sphere with a catamaran structure for low-budget operations. Still in the development stage, it will have an unlimited operating depth.

DOWB (Deep Ocean Work Boat) is



DEEP JEEP, one of smallest of small submersibles, is also one of the oldest, operating since 1964

General Motors' two-man research vessel, built by and for its AC Electronics Defense Research Laboratories. Windowless, it has top and bottom "fish eye" lenses, plus television cameras, for full 360° vision.

Beaver Mark IV, North American's "lock out" submarine, will be used to take divers to underwater sites for construction, oil operations, rescue, salvage, surveying or sampling.

Dolphin, another Navy vehicle, may be a prototype of future military subs. The Navy says its operating depth is "in excess of any known submarine." It uses a conventional hull of special steel with considerable use of fiberglass parts

(Please turn to page 220)



Stretchiest Rubber Yet Lets You Cast Anything

This highly tear-resistant compound produces thin-skin rubber molds which are so pliable you can turn them inside out like a glove.

By WAYNE C. LECKEY

Color Photo by Robert Borst

THERE HAVE BEEN rubber-mold compounds before, but none like this, believe me. Here is the stretchiest "test-tube" rubber yet made. It's so flexible and tear-resistant, you can literally turn the mold inside out to remove it from its casting.

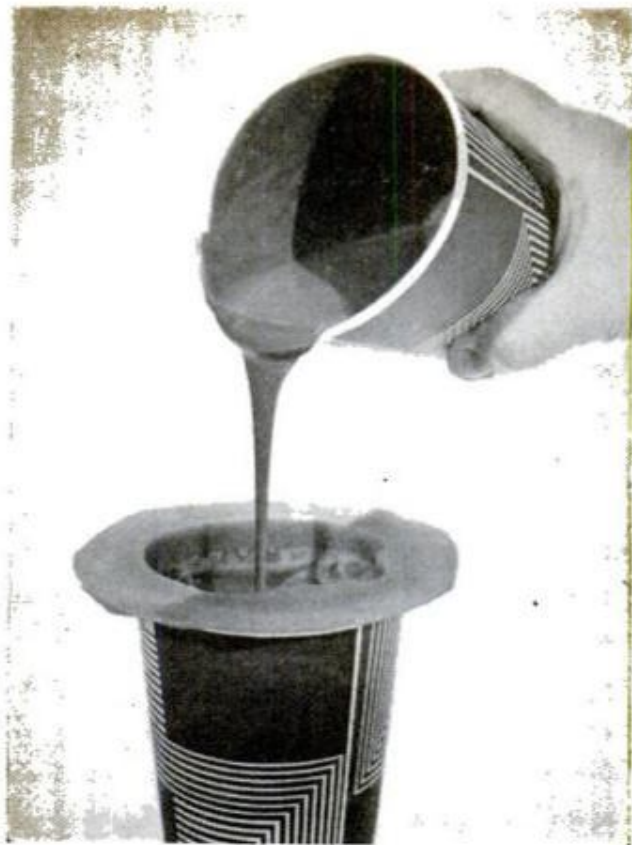
I was amazed when I first saw this done, and even more so when I later noted the exceptionally clean, hairline detail reproduced in the finished casting. While you can repeatedly stretch the mold like a rubber glove, it springs right back to its original shape so it can be used over and over to make duplicate castings.

The sculptured objects shown in color on the opposite page are only a sampling of the many art items you can produce with rubber molds made from a compound called Adrub Stretchy RTV. Essentially, it's a two-compound liquid system which, when parts are blended at



SIMPLE AS ABC, you first pick model (below left), wax it, then give it three coats of liquid rubber (below right). After curing overnight, rubber mold is pulled off model like glove as shown above. Wax keeps mold from sticking. Rubber mold for Buddha figure costs about 45 cents, requires only 45 minutes to make





SMALL MOLDS CAN BE SUPPORTED in paper cup (above) to make casting. Mold is first coated with casting compound by swishing small amount around inside, then it's filled level with top. After the casting cools enough to handle, rubber mold is pulled off as before. Finished casting (above right) is exact copy of model

room temperature, produces a tough vulcanized rubber.

A specially formulated liquid polyester called Monzini is used as a casting compound. It shrinks very little, can be cast solid or hollow, and like the rubber compound, it, too, is a two-part mixture which hardens chemically in minutes.

It's available in many textures, one having the whiteness and translucency of Carrara marble. Others look and feel like aluminum, cast iron and pewter. You can even color the compound.

You can make two types of molds—one called a glove, or blanket, mold; the other a pour mold. The latter is made by placing the model (one having a flat back such as a plaque) face up in a shallow wooden tray and pouring the rubber over it, level with the top so that this rubber cover is at least an inch thick. In the case of a glove mold, the rubber is applied to the model by painting with a brush.

Start out with a small model for your first try. It can be of plaster, wood, metal, clay and even plastic. The first step is to stick the model to a board with clay so the rubber won't flow under it. Then the board and model are coated with paste wax. The wax acts as a parting agent and keeps the rubber from sticking. If the

model is porous, it may be wise to seal the surface with lacquer before waxing.

The rubber compound comes in two separate cans, one being a hardener. To mix it you add one part hardener to two parts rubber and stir for three minutes.

Coating the model can be done with a brush or spatula. On a large model the rubber can be poured on although brushing reduces the chance of air bubbles. Several rubber molds can be made at a time, but when making just one, mix only enough rubber for a single coat.

Start painting at the top and work down, carefully filling all crevices and undercuts as you go. The excess which runs down to the base of the mold will begin to thicken in about five minutes. A bit of it can be picked up with a spatula and reapplied to build up thin spots.

Within 15 minutes, the liquid rubber will no longer flow. At this time you should be ready to apply a second coat and, within another quarter hour, a third coat. No more than 20 minutes should pass between coats; once the rubber sets, successive coats will not adhere.

Three coats are usually enough for small molds; large molds may require up to five. Total thickness of the three coats should not exceed $\frac{1}{16}$ in. If too

thick, the mold won't stretch properly.

Your finished mold should be allowed to set and cure overnight at room temperature before it is stripped from the model. Here a solution of soapy water applied to the outside of the mold will make it strip off easily.

How to pour a casting

Small molds up to 8 in. tall can be cast by supporting them upside down in a carton or paper cup. Large molds usually require extra support such as a plaster of paris cast to prevent sag and distortion by the weight of the casting compound.

The casting compound (Monzini) which comes in two separate cans, is mixed in a plastic bowl to the proportions of one part hardener and 100 parts compound by weight. Since the syrupy mixture will set in about 20 minutes at 75° F. once the hardener is added, mix only an amount needed to fill the mold to prevent waste.

The first step in filling the mold is to coat the inside to avoid air bubbles. The simplest way to do this is to pour a small amount of casting compound in the mold and slowly rotate the latter to make the liquid flow and coat the entire mold. This done, the mold is supported upside down and slowly filled to a level with the top. Since the compound hardens by chemical reaction, the liquid generates heat as it solidifies and becomes hot to touch. As soon as it cools and becomes comfortable to handle, the mold can be stripped off.

After several hours you can go on to finish the casting in several ways. As it comes from the mold it has a matte finish. If you want to make it look like beautiful, polished marble, you merely have to wax and buff it. To achieve a bronze patina finish, the white casting is sprayed with gold paint, then rubbed when dry with black pigments. Castings made from the aluminum and cast-iron texture compounds can be rubbed with fine steel wool to produce a patina effect. *Caution:* In working with Adrub RTV or Monzini, take the usual precautions to avoid breathing vapors and contact with eyes and skin. Adequate ventilation is a must.

Adrub Stretchy RTV comes in various quantities. A 1½-pt. kit which includes the hardener, sells for \$6.50. A gallon kit of Carazini Monzini sells for \$7 f.o.b. from Adhesive Products Corp., 1660 Boone Ave., Bronx, N.Y. ★★★



Forest on 42nd Street

Seventeen full-grown trees and hundreds of other plants grow in the 12-story high, skylit "park" (top photo) inside the new Ford Foundation building in New York. Offices in the structure open to the planted court. The bottom photo shows the building's exterior.



Travels by arm power

It takes just two hands to propel this new British three-wheeler, the Whizz-Bang. The toy is made of tubular steel.



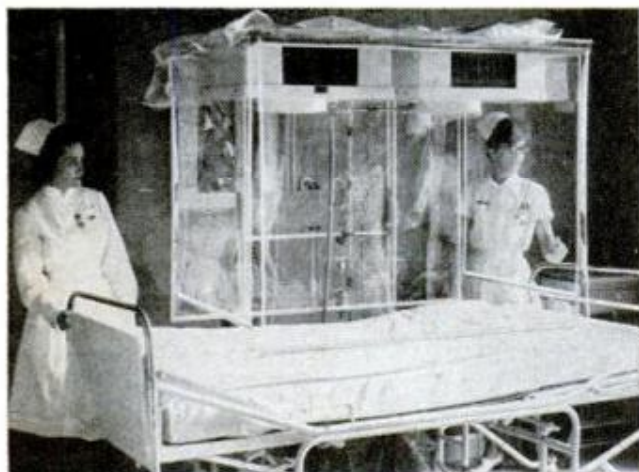
Safety seat

A seat equipped with a molded plastic shield fitted with a foam pad has been designed by Ford to protect young passengers.



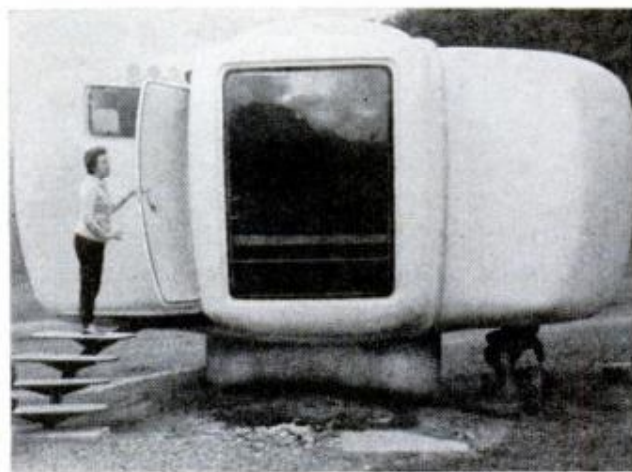
Is that a fire drill?

Army's ideographic composing machine is the first electronic typesetter to set Chinese, Japanese and Korean from a keyboard.



Patient cooler

A tentlike canopy is being used by a Danish doctor to encase patients in cold air and hold down their temperatures.



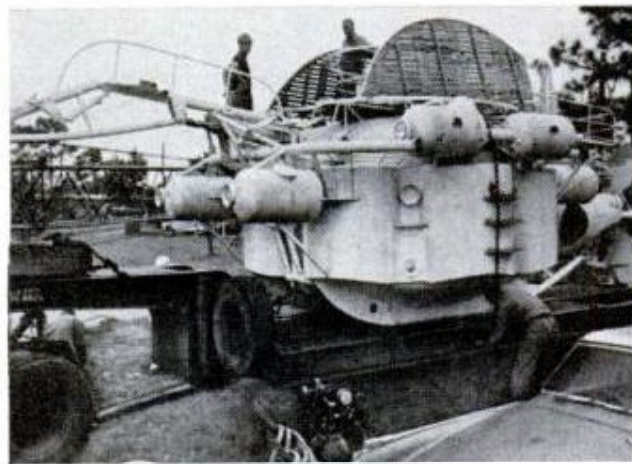
Winter sports bubble

A plastic-bubble winter sports house is being made by a firm in Rouen, France. Without furniture, it sells for less than \$4000.



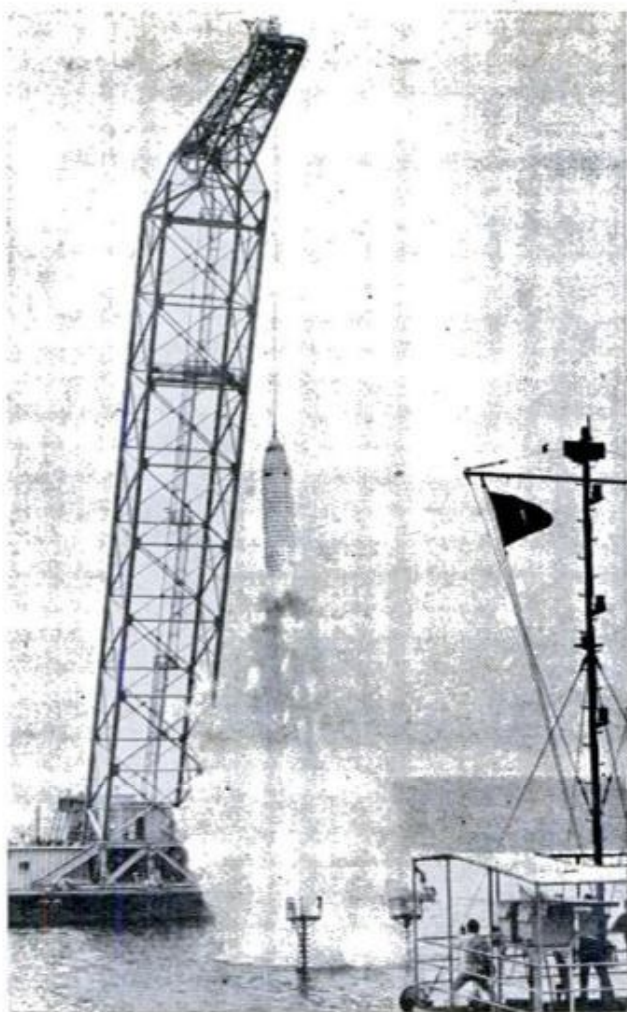
Welder for auto trim

A new automatic welding gun will attach ornaments and trim to automobiles without making holes in the car body. It's made by Omark Industries' KSM Div., Moorestown, N.J.



New sub in Florida

Another small sub that'll soon be joining the growing underwater fleet (see page 111) is this 20-ton submersible. It was built by Peter Lutjens of Sarasota.



Poseidon on a tether

The first underwater launching of the Poseidon missile—successor to the Polaris—took place off the coast of Southern California recently. Towed into place in a launcher (above), the missile was ejected by pressure just as it will be pushed from a sub. A giant crane (left) caught the missile to keep it from falling back onto the launcher.



Bucketful of stars

An ingenious teacher in Germany turned a paint bucket into a planetarium. A light inside the revolving bucket shines through holes, projecting "stars" onto classroom walls.

APRIL 1968



Artillery computer

A portable computer called FACE (Field Artillery Computing Equipment) operating behind the lines gives British artillerymen complete firing data in just 10 seconds.

121

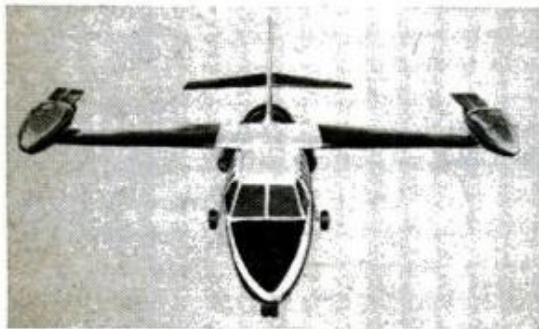
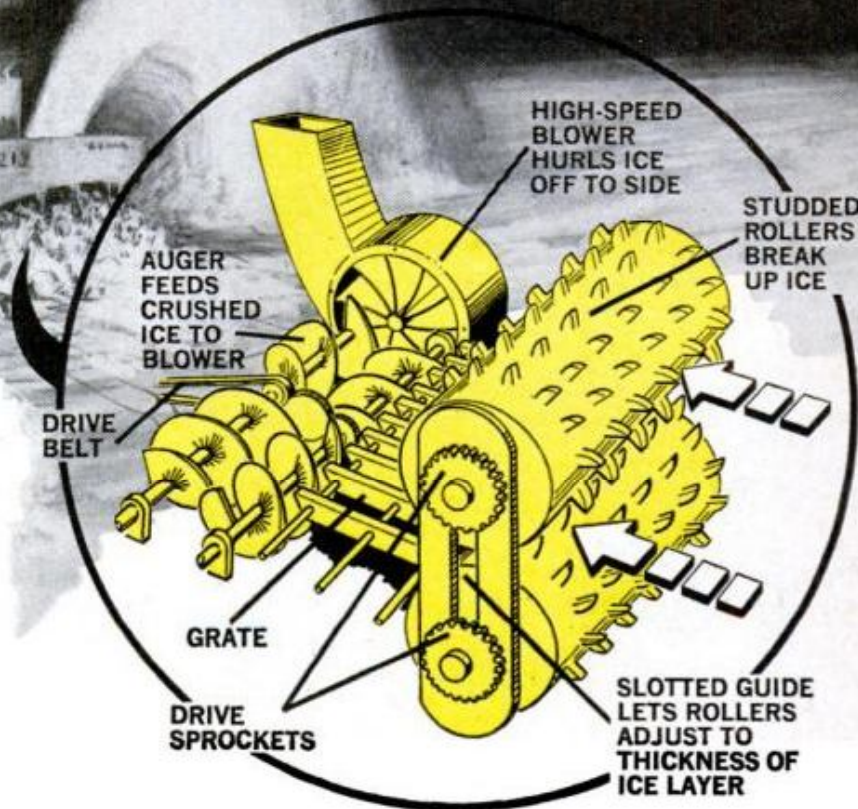
Just patented

PM'S PICK OF THE NEW INVENTIONS

Illustrations by Jack Mitchell



1. GIANT TOOTHED ROLLERS in the bow of this icebreaker literally chew a path through frozen lakes or rivers, grinding ice into small pieces. The idea is to get rid of the ice completely so it can't refreeze. Conventional icebreakers use their weight to plow through the ice, but leave large chunks behind them that can sometimes jam together and reblock a channel that's just been cleared. In the new system, ice is crushed between the spiked rollers, then fed by an auger to a blower that spews it away from the ship like the plume of spray from a snowthrower



2. TWO-WAY JET TRANSPORTS that can land and take off like a helicopter may not be far away. The design shown here was just announced by the Messerschmitt Works in Germany—that's right, the same people who made the famous World War II fighter. Two collapsible rotors unfold from wingtip pods for safe maneuvering at speeds below 150 mph. A single tail jet will give a 460-mph cruising speed

1. BLADES FOLDED AND STORED IN WINGTIP POD



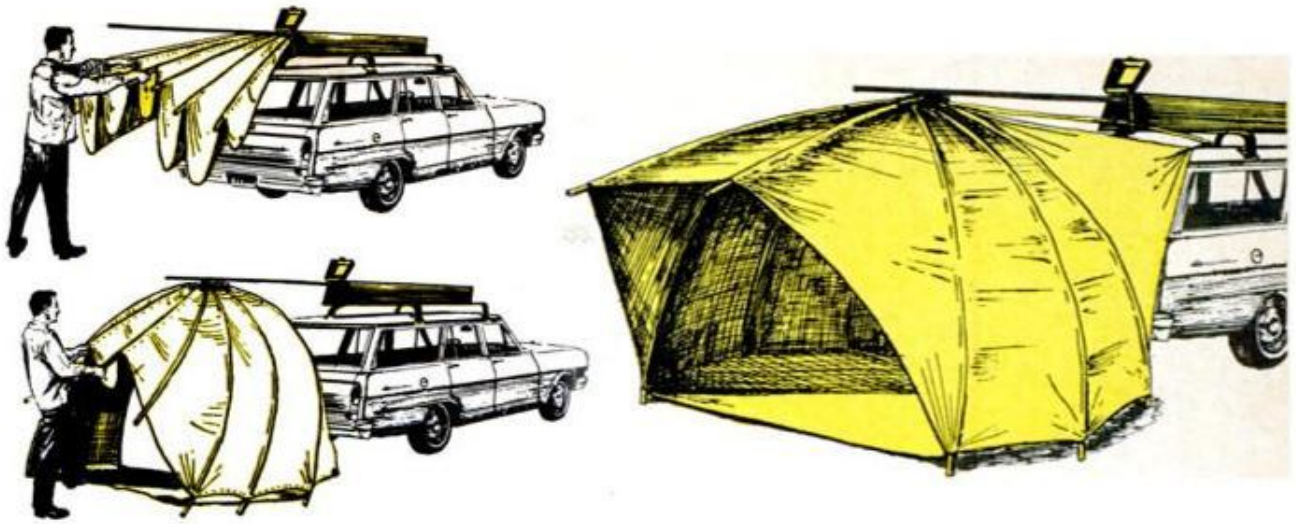
2. POD DOORS OPEN AND ROTOR HUB RISES



3. BLADES UNFOLD AND POD DOORS CLOSE



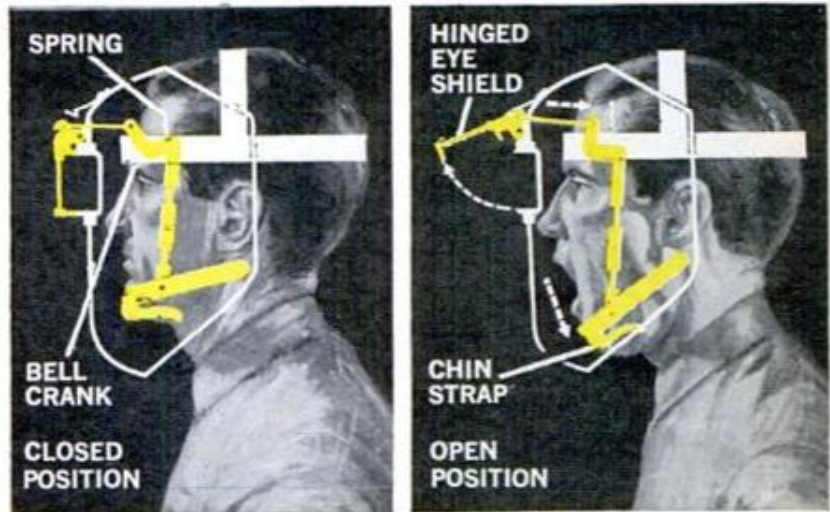
Inventors of the devices shown on these pages are as follows: 1. Roger Pontbriand, Montreal, Canada, and Jean Pontbriand, Rawdon, Canada (No. 3,335,686); 2. Messerschmitt Works, Augsburg, Germany;



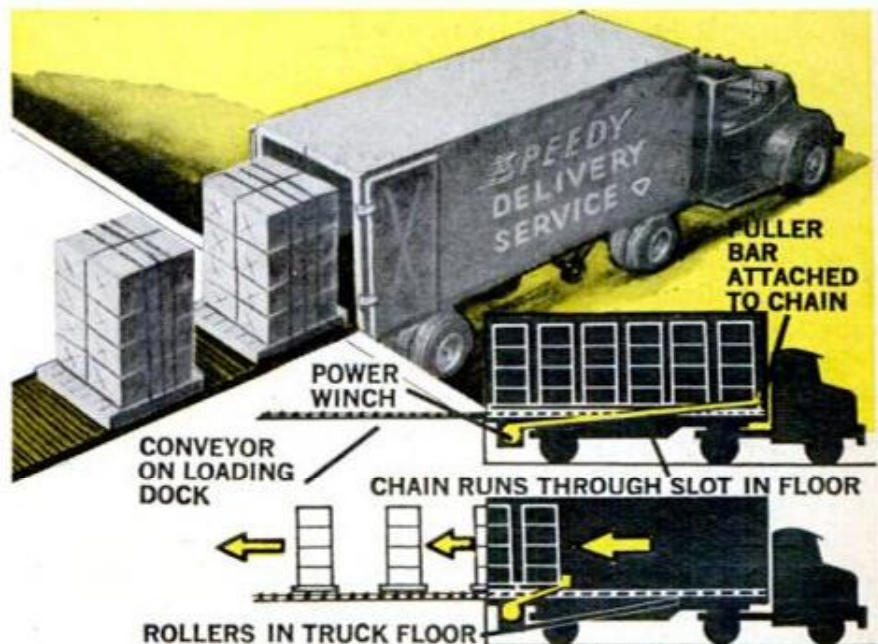
3. SETTING UP A CAMPING TENT takes only a minute with this piggyback rig designed for station wagons. The fabric shelter, supported by flexible ribs, folds up like an umbrella and stores in a rooftop housing. All you do is slide it out and

spread the ribs in a circle. Fastening the lower ends of the ribs to a ground mat automatically locks them in position and makes the shelter rigid. With the tailgate open, the tent and cargo space form a combination eating and sleeping area

4. THE CHIN-OPERATED MASK at right makes it easy for a welder to inspect his work every few minutes without having to stop each time to remove the entire mask or swing it up. Pressing the chin against a strap flips open a hinged eye shield, giving the wearer a clear view so that he can see how the weld is progressing. Moving the chin upward allows the safety shield to snap closed for protection from the intense glare during welding. The chin strap is connected to the shield through a bell-crank arrangement so that only a slight chin movement is needed to open and close the window



5. NO ONE IS NEEDED to unload the truck at right. The driver merely backs up to a loading dock and presses a button. A motor-driven winch slowly pulls a crossbar toward the rear of the truck. The bar engages stacks of cargo piled on pallets and sweeps them along on rollers in the floor of the truck. One by one, the cargo stacks are pulled out of the truck and onto the dock. Here they're fed onto an automatic cargo conveyor or are picked up by forklift trucks for distribution elsewhere. The system is designed to speed unloading so valuable trucks aren't tied up for long periods. The rollers in the cargo floor are removable so the truck can be converted to conventional use if desired



3. Charles W. Moss, Ann Arbor, Mich. (No. 3,333,594); 4. Harry J. Perry, St. Charles, Mo. (No. 3,339,207); 5. Joseph W. Hepburn, Chicago, Ill., and Jesse T. Shipley Westchester, Ill. (No. 3,333,715).

We Took Our Boat Along



Our three-week vacation covered over 3,700 miles of beautiful boating country, yet we didn't have a single breakdown. The "secret" was careful planning

By PAT PERRETT

LAST SUMMER we trailered our boat more than 3700 miles on a 21-day vacation, and we enjoyed every mile of it.

Starting in Southern California, we rolled across scorching deserts, crossed high mountain ranges and followed backwoods roads to camp, cruise and fish in a variety of remote regions.

In the lonely reaches of southeastern Oregon we slept on the shore of Lake Owyhee near sheer cliffs rising straight up for hundreds of feet. We camped in the hushed solitude of Payette Lake in the green wilderness of central Idaho, then

loafed through the Salmon River Canyon country, skirted vast Coeur d'Alene Lake and made our way to Indian Creek Campground on isolated Priest Lake high in the Idaho Panhandle.

When it was time to head for home, we took the long way around and swung north into Canada. There we embarked on the longest free ferryboat ride in North America, across Kootenay Lake, and tested our angling skills in its trout-rich waters. Finally, after a lazy sun-soaked campout on the northern shore of the Columbia River's Lake Roosevelt, we turned

toward home, arriving late in the evening just 21 days after our departure.

The thing that surprised most of our friends about this idyllic trip was that we had absolutely no difficulties with the boat trailer. This wasn't just luck, of course. Our experiences on previous trips had taught us that the keys to successful long-haul boat trailering are planning, preparation, proper equipment and a few simple driving rules.

Most neophyte boat buyers start out with two strikes against them in trailering. Handicapped by inexperience, lack of knowledge and, sometimes, by an over-enthusiastic marine salesman, they break the cardinal rule of trailering by purchasing a trailer which lacks the capacity to carry anything more than the bare boat. Forgotten are the life preservers, anchor, fuel tanks, fuel, fishing gear, water skis, first-aid kit, canvas top and boat cover, plus that mass of paraphernalia required by the modern camping family.

Tire capacity is critical

The capacity of a trailer depends on its structural design, materials, assembly, coupler, axle, springs, hubs, bearings, wheels and tires. It's a complicated engineering equation, so for the most part, the average trailer buyer has to rely on the manufacturer's capacity rating. However, the most likely candidate for weak-link-in-the-chain is tire capacity.

We became acutely sensitive to tire capacity during our first major boating-camping expedition several years ago. Previous trips had included little gear, but this time we were loaded to the gunwales. Though tires fairly groaned, we thought we had capacity to spare.

Following a necessarily careful drive home we discovered the capacity of our 6.70x15 four-ply tires—a standard installation by many trailer manufacturers—was just under 1200 pounds. This meant that the total weight of the rig, with trailer, should not have exceeded 2400 pounds.

Convinced that no one, including ourselves, could accurately estimate our payload, we left the boat loaded and the next morning drove it to a public scale where we paid \$1 to find out the true weight. You can imagine our consternation when we received a slip listing the certified weight of our 17-ft. runabout as 3458 pounds! It was \$1 well spent.

The message here is twofold. First, know for sure how much weight you're going to be towing by adding the weight of the trailer, the boat and all conceivable gear, then tacking on an ample safety margin. Second, be positive your tire capacity is sufficient for your load.

You can increase tire capacity by using larger tires or switching to a tandem trailer which has four wheels. Generally, though, it's better to stay with a two-wheel trailer until you're forced to use a tandem. One high-capacity tire is a 7x10.5 tube-type tire designed for use on mobile homes, which has a 2000-pound rating.

Long-distance hauling

For long-distance hauling with a boat over 16 ft. long, we suggest automotive-sized wheels and tires. The advantages are many: increased load capacity, greater traction, longer tire life, better road handling, greater clearance, longer wheel-bearing life and easier handling. When practical, it's advantageous to have similar wheels on trailer and towing vehicle.

Tire inflation should be maintained at pressures recommended by the tire manufacturer. Under-inflated boat trailer tires will cause accelerated and uneven tread wear, sway (especially at high speeds) and excessive internal heat.

The most common cause of trailer failure is bearing failure—one problem that's easy to avoid. Few novice trailer boaters are aware of the potential trouble resulting from submerging trailer wheel hubs while launching and retrieving their craft.

When bearings become wet—usually from submersion, but also from condensation—they corrode. This causes excessive friction between the bearings and the bearing race, and the resulting heat melts the protective grease inside the hub. As long as the bearings are smooth, the temperature of bearing grease is about equal to the traveling speed plus the air temperature. That is, at 55 mph on an 85° day the grease temperature would be approximately 140° F. High-quality greases will not melt and lose their effectiveness until the internal hub temperature climbs to 300° F. Around 1500° or 1600°, plastic deformation occurs and metal softens to a buttery consistency. At 2500° to 3000° the bearings melt and then fuse to the axle.

Believe us, it's no fun when you are

It's impossible to emphasize too strongly the importance of good trailer brakes

driving happily toward your launching site and suddenly hear the screech of a bearing which has collapsed for just this reason. We know, because it happened to us during an Oregon boating jaunt. It cost us two precious vacation days and indelibly registered the importance of meticulous bearing care.

The obvious solution is never to submerge the wheel hubs while launching. However, this is impossible on the majority of back-country ramps and, depending upon the boat design and trailer construction, may even be impossible on an ultra-modern ramp.

Three ways to protect bearings

There are three basic protective devices designed to keep water from the bearings. They may be classed generally as grease under injection pressure, inflation under pressure and oil bath. We've used them all and, while not completely fail-safe, they all work. Fortunately for boaters, these devices have recently become standard or optional equipment with most major trailer manufacturers.

With the grease system, you fill the hub with grease through a device which replaces the dust cap. A piston creates a slight pressure inside the hub, and there's a pressure-relief device to prevent rupture of any seals. With the hub full of grease under controlled pressure, water cannot enter.

The air-pressure system utilizes air under pressure to do the same thing. The hub is sealed off and, prior to each submersion, air is pumped into the cavity through an air valve, using a hand bulb pump.

The oil-bath system maintains a reservoir of oil within the hub cavity to insure that bearings will remain water-free and constantly lubricated. The dust cap is replaced with a transparent cover which has a filler plug for oil replacement. The level is easily checked by visual examination.

We can't recommend any one system as the best, but we strongly urge every trailer boater to install one of these devices and keep it properly maintained.

During our trip last summer we used a grease-under-pressure system. (There's something very satisfying about being able to fill the hubs with grease prior to each submersion.) We discovered that day-long towing at top speeds caused some grease loss due to wear. However, it was a simple matter to check and add grease as necessary during service station stops.

It's impossible to emphasize too strongly the importance of good trailer brakes, especially if most of your experience has been in short-haul, flatland trailering. For the light rig, of course, they're not necessary.

There's no specific point where brakes are definitely required, since many factors are involved in the ability to stop. The most important of these are the braking capacity of the vehicle, weight of the tow load, extent of grade, speed and road surface conditions. However, when the gross weight of a two-wheeled trailer approaches 3000 pounds, or exceeds 3500 pounds with any tandem trailer, brakes are not a luxury but a life-saving necessity. One major automobile company even recommends brakes for any trailer weighing more than 1200 pounds.

Electric or hydraulic brakes

Most auto manufacturers state that electric brakes are far superior to hydraulic brakes, whether operated by an activator on the trailer coupler ("surge" brakes) or connected directly to the vehicle's hydraulic brake line. The one danger of the direct connection is the possibility of losing all braking power through a malfunction in the trailer's vulnerable external system.

Most electric brakes used today operate automatically when the car's brake pedal is depressed. If desired, the trailer brakes may be applied manually by moving a small lever similar to a turn-signal control. A simple adjustment at the activator switch adjusts the brakes for varying loads. The trailer brakes are applied just before the vehicle brakes make contact, thus preventing the boat from pushing the vehicle forward. This keeps the entire rig on a true course while slowing down.

State laws requiring brakes on boat trailers vary, so check your state's regulations for the exact legal requirements.

As for towing power, you just can't beat a husky pickup camper. We've towed boats with automobiles, station wagons, vans and even our VW sedan, but they all had one

common failing—they just weren't designed to go ranging about the countryside with a 3000 to 6000-pound load behind.

Inherent advantages of a pickup

The inherent advantages of a pickup are obvious—heavier springs, greater stability, better cooling ability, low ratio axle and better braking. Even with trucks, however, you have to buy one that will match your towing weight requirements. Of course, manufacturers offer optional equipment for both pickups and automobiles to make towing safer and easier. Among the options are higher-capacity cooling systems, four-speed or automatic transmissions, lower axle ratios, anti-spin differentials, larger springs, power brakes, extra-capacity batteries and alternators, flotation tires and dual trailering mirrors.

We think the best all-around outfit for the camping-boating family is a pickup camper and a 17-foot runabout, either outboard or inboard-outdrive. We've driven our Dodge camper thousands of miles and it has almost become a member of the family, just like our boat.

Boat towing generally means slow going, but we make good time with the camper, because of fewer and shorter stops. Meals are quick and easy with the conveniences of a gas range, refrigerator (not an ice-box), hot and cold running water, and even a toilet and shower, if you like. You can roll past motel no-vacancy signs without a worry, because your bedroom's right behind you.

At overnight stops the boat's lounge seats and canvas top give us a spare bedroom where the youngsters can be bedded down while the camper is still in use. On the road, the boat functions as a luggage trailer which keeps the camper unclut-

tered. It's perfect for carrying bulky, light objects, such as a couple of comfortable aluminum chaise longues for predinner relaxation.

Part of our *modus operandi* has been two or three long days of traveling to reach the area we're going to explore, and we do the same on the return trip.

Plan for a high-mileage day

If we want to get in a high-mileage day, we'll let the children continue sleeping in the camper in the morning and drive for two or three hours before stopping to roll up the sleeping bags and prepare the bacon and eggs. Perhaps we'll fix sandwiches to save time at noon. In any case, we always prepare mid-afternoon snacks during this morning stop.

Once you have the equipment, a camping-boating vacation is surprisingly easy on the budget. Our principal expenses for boat-camping, other than for groceries, are limited to gasoline and minimal campground fees. Otherwise, for our gang of six it would cost a minimum of \$50 per day for motels and meals.

Driving techniques on a long trip are similar to other towing situations. The main rule is to allow plenty of time so you won't feel a need to hurry. Avoid driving at night. Plan to arrive at your stop with ample time to park the vehicle and get set before dark.

On the road, allow ample distance to stop smoothly and gradually. Let faster drivers have the right of way. You'll find that just plain courtesy pays off. When climbing a grade, use low gears to avoid overheating. Always use the lower gears on down grades of any length of steepness. It's much better to creep down a grade at

(Please turn to page 230)

PROTECTIVE DEVICES which keep water out of the hubs let you submerge wheels without wetting bearings



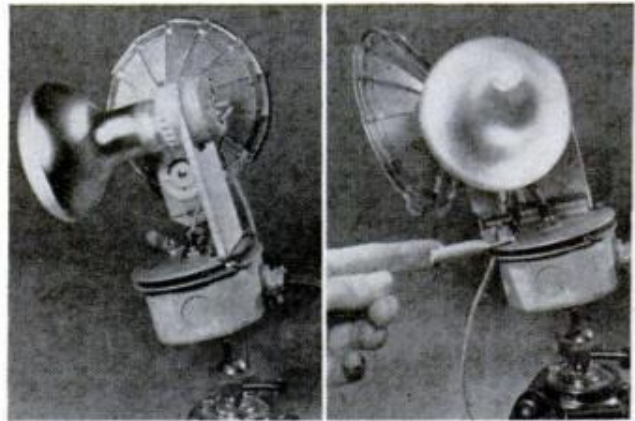
TWO BRIGHT IDEAS FOR

Make a Modeling Light For Your Flash

THE PROBLEM of working with flash is that you're never quite sure just where the highlights and shadows are going to fall until you see the results on the film. This rotating flashgun holder incorporates a small floodlamp that helps you see what the light pattern will be *before* you fire the flash.

First you set up each light, using the floodlamp as a guide to good balance and modeling. Then you swing the flood out of the way. This automatically brings the flash into the same position, ready for firing. A switch inside is arranged so the flood goes on as you turn it toward the subject and off as you swing it away.

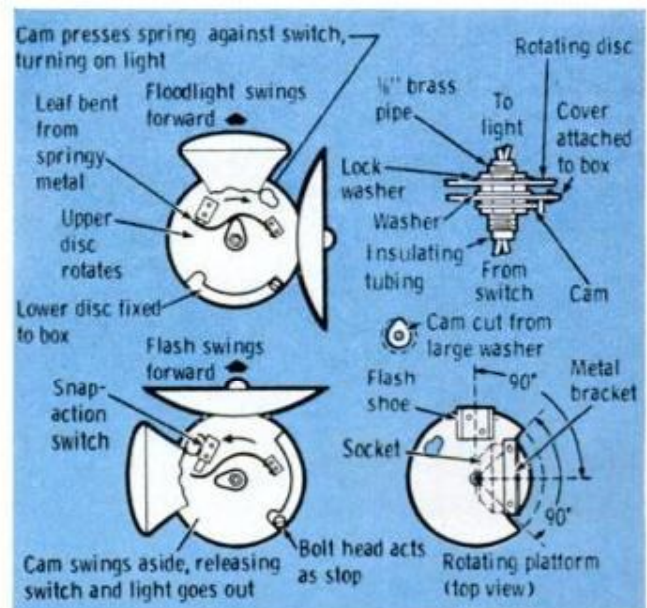
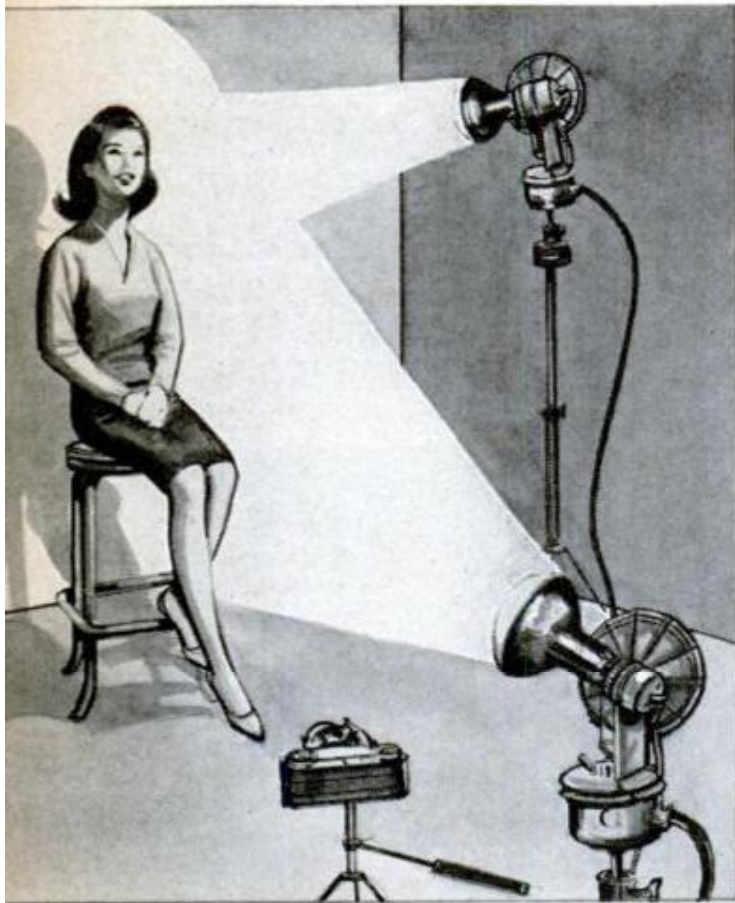
The unit is built around a standard 3-in. octagonal junction box with two plain cover plates. One cover is fastened rigidly to the box in the usual way. The other becomes a rotating platform on top of the



TURN IT ONE WAY and it's a test lamp to check your setup (left). Turn it the other way and the flash swings into position to take the picture (right)

box, turning on a short length of 1/8-in. threaded brass lamp pipe. As the platform is rotated, it turns a cam inside the box. A snap-action switch and a strip of springy steel are mounted as shown on the underside of the fixed cover. As the cam swings one way, it presses the spring strip against the switch, turning on the floodlamp. As it swings the other way, the switch opens and the light goes off.

The floodlamp is a small 75-watt, mushroom-type bulb. The snap-action switch can be any 115-v. normally open type rated at two to three amps. These are available at electrical-parts stores. The spring strip can be any springy metal, such as steel carton strapping. A standard



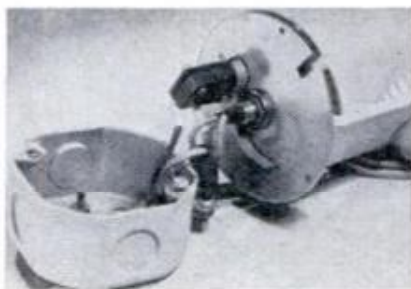
BETTER PHOTO LIGHTING

flash shoe, available at photo stores, is mounted on top of the platform to take a small flashgun or strobe head. The flood-lamp is held in a porcelain socket of the screw ring type. This is clamped in an L-shaped bracket bent from sheet metal.

Note that the lip on the platform is notched out along a 90° arc. This forms two shoulders that strike a bolt in the lower plate, preventing the platform from being turned any more than 90° in either

direction. A short length of aluminum tubing or other metal can be fastened to the platform to form a handle if desired.

The unit can be mounted on a light stand or tripod by drilling a hole in the bottom for a ¼-20 bolt. Threaded adapters are available at photo stores to fit over light stands. You can also drill a small block of wood to slip over the stand and bolt the block to the underside of the box.—Walter E. Burton



UNDERSIDE of cover plate shows how snap switch and spring strip are mounted near rotating cam



ROTATING PLATE (left) is held to fixed plate (right) by a short length of ⅛-in. threaded brass lamp pipe



SCREW-RING SOCKET for flood is shown with bracket that holds it, notched plate and flash shoe

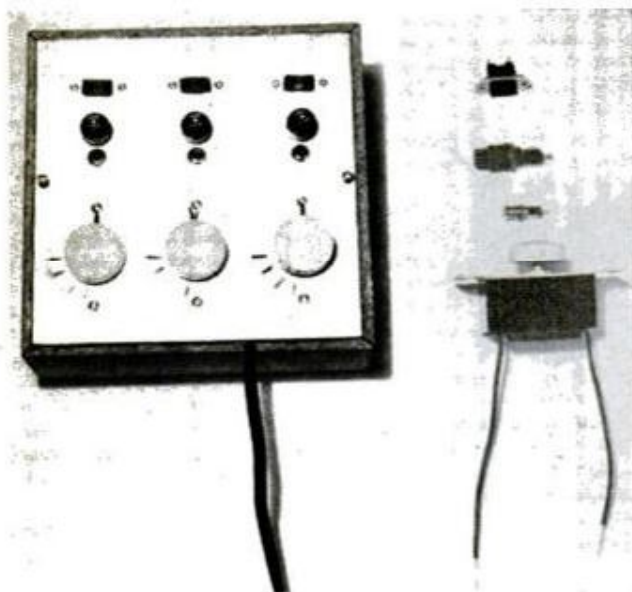
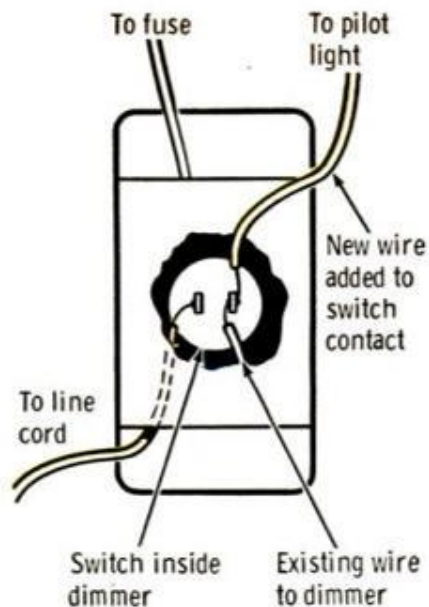
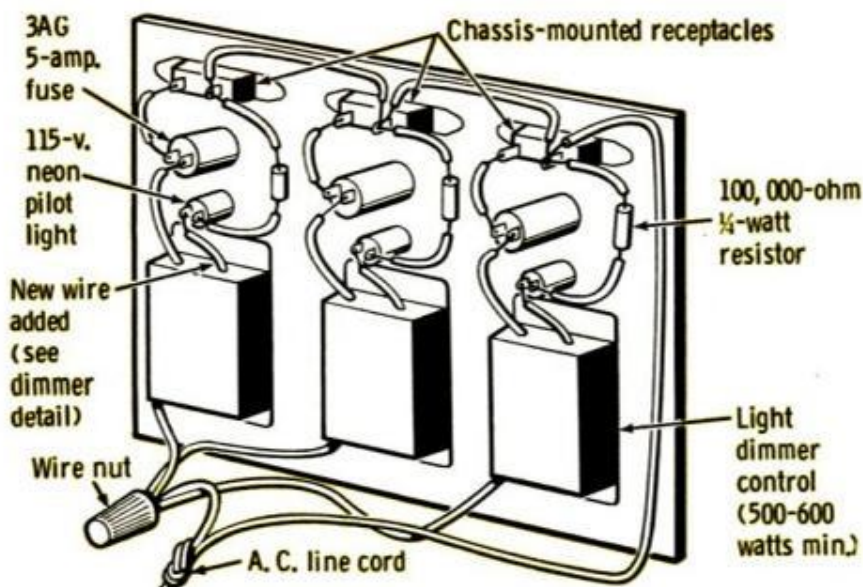
Make a Dimmer Control For Your Floods

SETTING UP PHOTOFLOODS usually calls for a lot of pushing and hauling of the lights toward or away from the subject in order to achieve the proper amount of illumination. With a central dimmer control, you can vary the intensity of each light at the touch of a knob without having to leave the camera.

Commercial flood controls are costly, but the one shown here, based on simple household-type wall dimmers, can be built for under \$30. It will handle up to three lights and can be expanded to take more if you wish. Each dimmer circuit consists of a dimmer unit, a neon pilot light with resistor, a five-amp. fuse in a panel-type fuse mount, and an outlet for plugging in the photoflood.

Household dimmers are available for about \$7.50 from hardware stores and electrical-parts dealers. The other components can be obtained at radio-parts





FOUR BASIC PARTS (right) make up each dimmer circuit. Use any thin panel material to mount them



ADJUSTING FLOODS in multiple-light setups like this is easy with dimmer control alongside camera

stores. Be sure to buy the type of dimmer that's continuously adjustable from zero to full intensity, not the kind that goes only to half intensity and then jumps to full on. Be sure, too, that each has enough capacity to handle the kind of lights you intend to use—this should be at least 500 to 600 watts for the common 500-watt photoflood lamp.

It's necessary to modify each dimmer slightly if you want the convenience of a pilot light. An extra wire must be run from the output side of the dimmer switch to the pilot light. This feeds current directly to the pilot so it will burn brightly no matter how the dimmer is set. Without this wire, the pilot would be fed through the control and would go out as the floods are dimmed.

Remove the cover plate from the rear of the dimmer. In the center, you'll see two terminals. These are for the dimmer's on-off switch. A black 115-v. lead should run directly to one terminal—the input side. The other terminal—the output side—will have a wire running from it to the dimmer's innards. Solder a second wire to this terminal and run it to the pilot light, as shown in the wiring diagram. If there's any doubt about which is the output terminal, check with a continuity tester. With the input lead connected, the input terminal will be hot all the time, while the output terminal will be hot only when the switch is closed.

For best results, the control is not recommended for use with color film since dimming a photoflood changes its color temperature and can affect tones in the film.—James B. Johnstone



Farmers use longest bridge

Local farmers were allowed to use the longest floating bridge ever built by an army after a German unit recently assembled the 3700-foot structure in 34 minutes near Schleswig.



Slingshot for rockets

Rockets could be launched from a sled that travels 680 mph on tracks across a valley floor and up a mountainside. The new launching concept is by Douglas Aircraft Co.



Looks just like the big one

Crewmen of the USS *Calcaterra* were startled to see a tiny replica of their ship sail by at Jacksonville, Fla. The radio-controlled model was built by Peter Tagg.



Son of Allegro

A second-generation version of Ford's 1963 Allegro, this sporty roadster is called Allegro II. Built on 99-inch wheelbase, the experimental car is just 41¼ inches high at its rollbar.



Double-duty gun

Over-and-under weapons on Coast Guard cutters and Navy patrol craft offer versatility of firepower. Each weapon consists of a 50-cal. machine gun over an 81-mm mortar.



120-mph model

Winner of a recent model-airplane meet at Hamburg, Germany, was a remote-controlled Mirage that flew 120 mph. It'll appear at the world meet this year in Dortmund, Germany.



CB WALKIE-TALKIE
(RECEIVER)



Make Your Own Electronic Fish Sensor TROUT BY TELEMETRY

YOU CAN GO from a frustrated bobber-watcher to a space-age fisherman in only a few evenings. That's all the time it takes to build this project. By next weekend you'll be able to lure the fish to your line and detect even the feeblest nibble from trout, pike, pickerel, bass or other fish you're after.

Here's how it works: Floating on the surface of the water is the main electronic unit called a "sonobuoy." It contains a fish lure that generates a steady high-frequency electronic signal for about 10 seconds each time the sonobuoy is rocked by wind or a wave. This signal is then piped down to a saucer-shaped underwater hydrophone, suspended directly below the sonobuoy at the end of a length of speaker wire. The hydrophone's speaker converts the signal into high-frequency sound waves, which travel through the water for a considerable distance in all directions to attract fish.

At the same time, the line from your rod and reel runs through a swivel attached to the bottom of the hydrophone by means of a small magnet. When a fish strikes, a tiny mercury switch mounted inside the hydrophone is triggered by the movement, sending a signal up to the sonobuoy on the surface. It, in turn, relays the alarm in the form of "clicks" to the fisherman located in a boat or on shore by way of a transistorized radio transmitter inside the sonobuoy.

By listening to a radio receiver near you, you know exactly when a fish is taking the bait. You also hear the random 10-second signals sent out by the sonobuoy's electronic fish lure.

Once you know the fish is hooked, you begin reeling it in in the traditional manner. The magnet easily separates from the hydrophone disconnecting the line so you can play the fish freely. A second line, incidentally, anchors the sonobuoy right



TRANSMITTER ANTENNA

and Catch More...

By JAMES G. BUSSE

Illustration by Ron McKee

over the best fishing spot or moors it to a boat or deck.

To simplify construction of the telemetry system, two inexpensive, low-powered Citizens Band walkie-talkies are used. One is kept intact for use by the fisherman as a receiver, and the other is removed from its case and inserted in the sonobuoy to serve as a transmitter. A power of 40 milliwatts should be adequate to cover about 100 yards and, conveniently, walkie-talkies under 100 milliwatts output don't require licensing by the FCC. The only circuit you wire is the electronic fish lure.

To begin, cut a 9-in. length of 3¼-in. (inside diameter) clear plastic tubing to house the electronic components. Buy a

FISH TILTS HYDROPHONE and opens mercury switch which relays "clicks" to sonobuoy. The sonobuoy houses an electronic fish lure and a CB walkie-talkie transmitter that sends information to the fisherman's receiver in the boat

SONOBUOY

HYDROPHONE



foot-long piece of tubing from a plastics distributor; you'll need another couple of inches for the hydrophone housing.

Cut three discs the same size as the outside diameter of the tubing and two discs the same size as the inside diameter from a sheet of 1/4-in. clear plastic. The three larger plastic discs cap the ends of the sonobuoy and the top of the hydrophone. One of the smaller discs separates the sonobuoy's electronic components from its battery compartment. The other is used together with the top cap for additional support for the antenna.

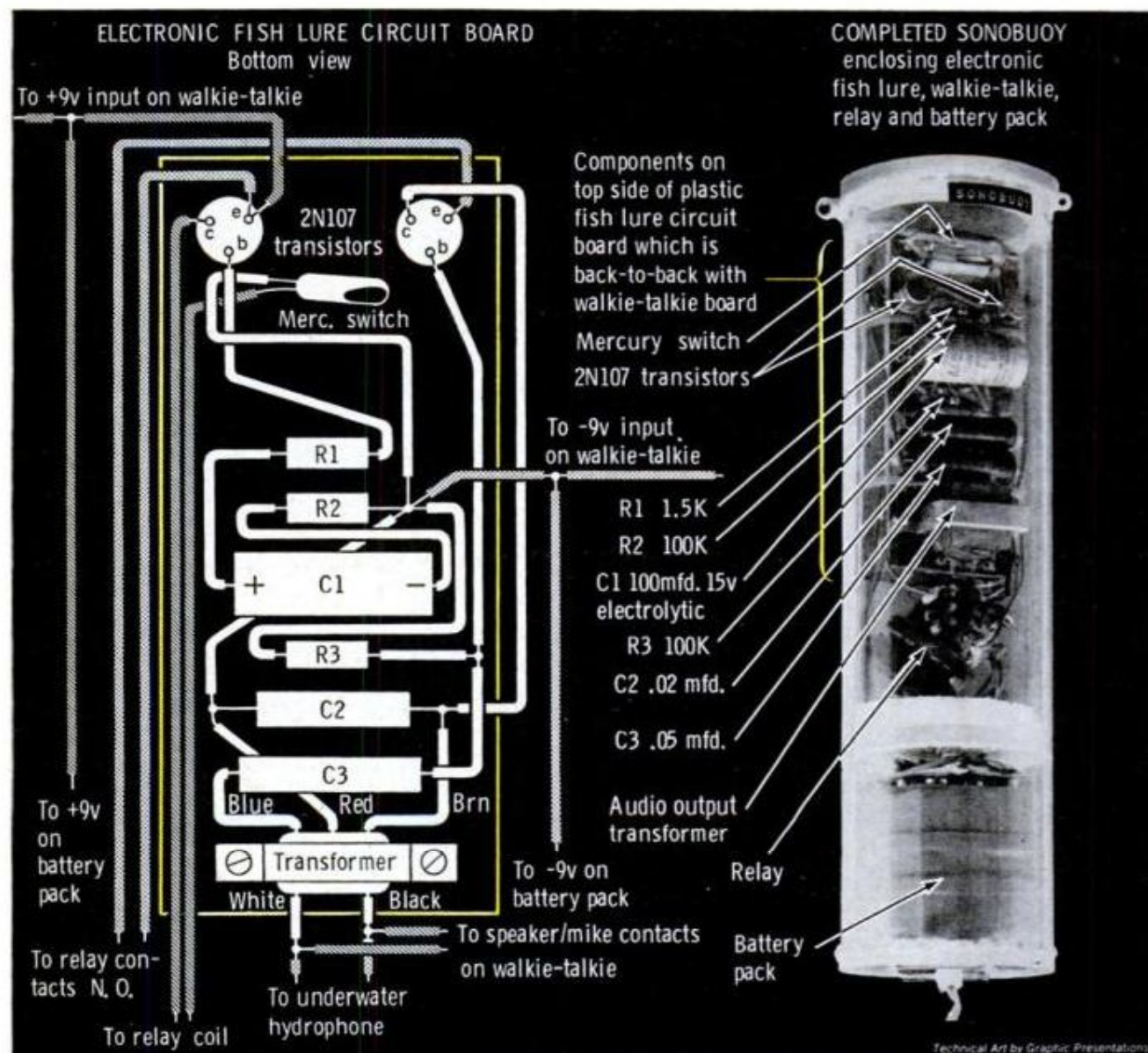
Use a waterproof plastic-bonding glue to seal all of the discs in place, with the exception of the bottom cap on the sonobuoy. This is held in place by several small, self-tapping metal screws and can be removed in order to replace the batteries. A thin rubber gasket assures a

watertight seal. Drill pilot holes slightly smaller than the screws in the plastic tubing in order to prevent cracking.

Additional waterproofing, particularly where the thin cable linking the sonobuoy to the hydrophone passes through the plastic discs, is provided by Dow Corning Silastic Clear Sealer or other silicone rubber sealant. Knot the cable where it passes through the plastic. Apply a generous amount of sealant on both sides; let it cure at room temperature overnight.

The battery pack consists of four 9-v. transistor radio batteries taped together and connected in parallel. Use convenient snap connections to make replacement easier. A mercury switch is mounted in the middle of the battery pack with its contacts at the bottom. Since this switch is wired in series with the battery pack, inverting the sonobuoy opens the switch

FISH LURE CIRCUIT BOARD is wired and connected to sonobuoy circuits as shown in the wiring diagram. Positioning of the circuit boards, relay and battery pack is shown in the photo of the completed sonobuoy



and disconnects the batteries from the rest of the circuitry. This makes it easy to turn off the sonobuoy. Just tip it upside down and store it in that position.

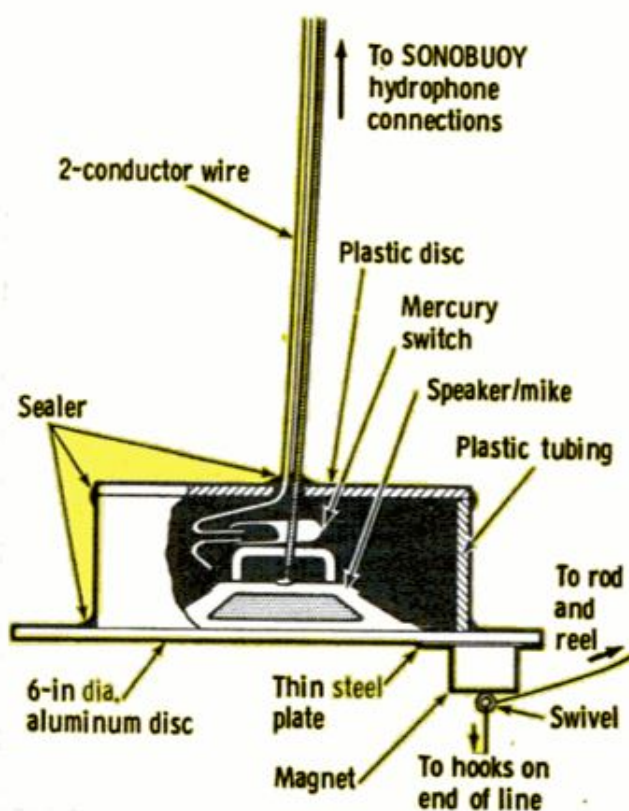
Modifying one walkie-talkie for use as the transmitter in the sonobuoy is an easy job if done carefully. Just make sure the walkie-talkie circuit board will fit inside the 3¼-in. tubing with plenty of room to spare. A second circuit board with the electronic fish lure circuitry will have to fit back-to-back with it. Choose a walkie-talkie with a long, narrow circuit board and one that uses a 9-v. battery. First, disconnect the battery. Remove the circuit board and, at the speaker microphone, disconnect the two wires that connect it to the circuit board. Finally, remove the speaker microphone.

Examine the two switches on the walkie-talkie circuit board. One is a simple on-off switch. Remove it, and solder a permanent connection across the leads, so that the walkie-talkie will always be "on." Low-cost units don't have volume controls built into the on-off switch. However, if your unit has one, shorting the switch will keep the volume at maximum.

Next, check the receive/transmit switch on one side of the circuit board. When it's pushed in, the unit transmits sounds picked up through the speaker microphone. Note which contacts are made when the switch is held in the transmit position. Solder permanent connections across the proper contacts so that the walkie-talkie will continuously transmit when it is "on." Temporarily reconnect the speaker microphone and 9-v. battery to determine whether the unit is transmitting properly. Extend its antenna, and check the line-of-sight range outdoors, using the other walkie-talkie as a receiver.

To make the hydrophone, place the speaker microphone from the walkie-talkie in the center of a 6-in. thin aluminum disc. Maintaining metal-to-metal contact, glue the edges of the speaker/microphone to the aluminum. Now glue a mercury switch to one side of the speaker microphone with the switch positioned at a slight angle to keep it closed. The slightest tipping motion of the hydrophone should cause the mercury to break contact, opening the switch.

Finish wiring the hydrophone and connect it to the cable from the sonobuoy. Glue its plastic housing in place around



HYDROPHONE CROSS-SECTION shows details of construction and wiring to walkie-talkie speaker/mike

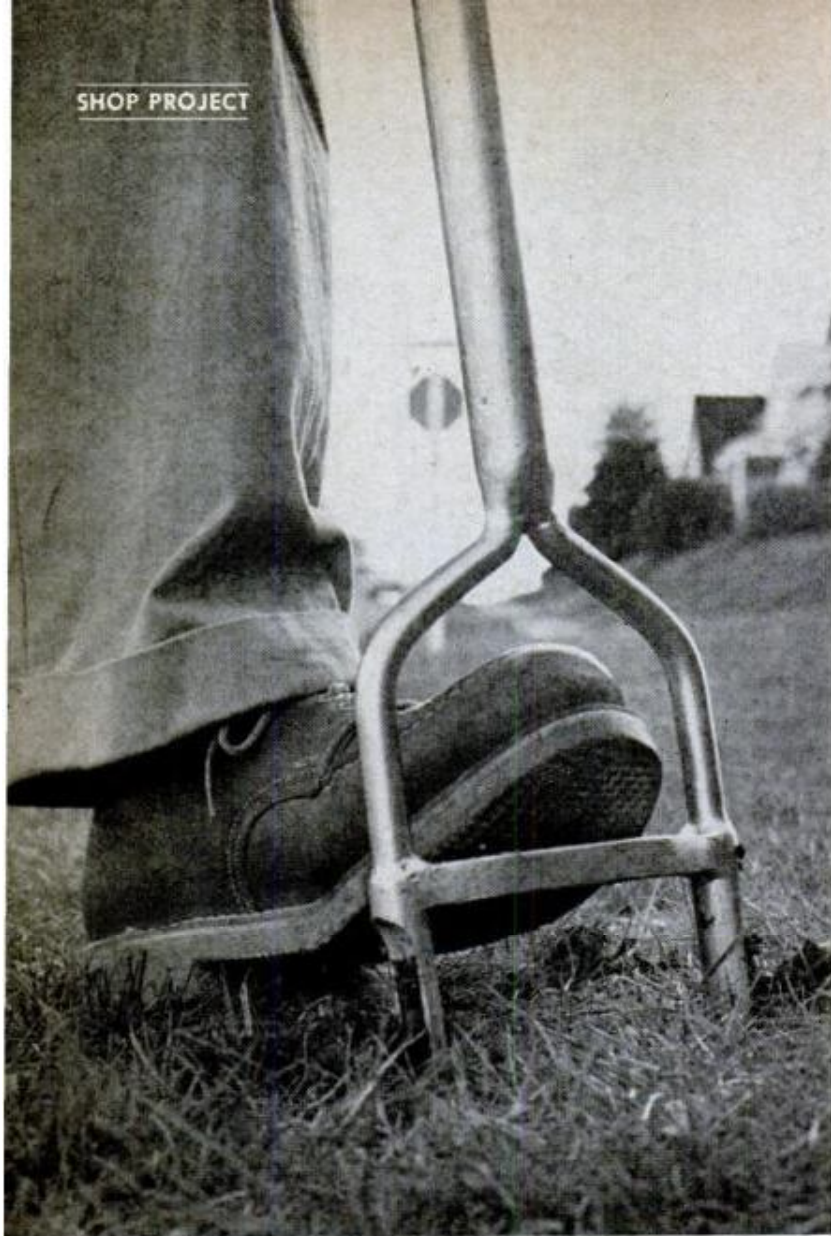
the speaker microphone. Apply Silastic to the inside of the housing, where it makes contact with the metal, to assure a watertight seal. Glue the top on. Finally, spray the top of the hydrophone blue to keep it from reflecting light from the surface of the water.

The electronic components inside the sonobuoy are assembled on a small strip of thin sheet plastic by drilling holes for each component's leads. The two transistors used can be any of the type designated simply "PNP, General-Purpose Audio." They can be obtained for less than 50 cents each from any electronic supply store. The transformer can be almost any push-pull audio-output type with a 200 to 500-ohm primary and 4, 8 or 16-ohm secondary (such as Allied Radio 54E2367).

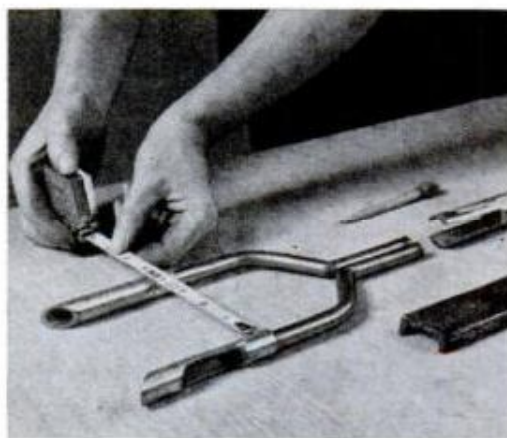
There are three leads on the primary winding of the transformer, usually color-coded red, blue and brown, but consult the little diagram that comes with the transformer for primary and secondary connections. Try to match the resistance of the secondary with the value stamped on the back of the speaker microphone from the walkie-talkie—generally 8 ohms.

The relay is a 5000-ohm (coil resistance), 1.4-ma. type, such as Lafayette Radio's little "Jewel" remote control relay

(Please turn to page 224)



PLUG CUTTERS are lengths of steel pipe with side channels to release the plugs



FOOT BAR is made by cutting and bending the steel channel, then welding it

Make This Sod Plugger For a Better Lawn

By JOHN BURROUGHS

A SOD AERATOR works like an apple corer. It's used to extract slim plugs of turf, an operation which is often the key to renovating problem lawn areas.

The two-tined aerator shown here can easily be welded up from odds and ends. Since its efficiency depends more on general design than specific measurements, dimensions (facing page) aren't critical.

With it, you can open up tightly packed soil, which is the most common cause of bare spots in lawns. The perforations not only loosen soil, but allow water to penetrate through the surface thatch and dense mass of top roots to the lawn's bottom roots. This also prevents run-off.

Another advantage is that fertilizers, insecticides and lime can be washed down deep into the soil where they're most needed. Lime sprinkled on the surface ordinarily penetrates very slowly, perhaps an inch per year. If the lawn is first plugged, however, an application of lime will begin neutralizing acid soil at the root level immediately.

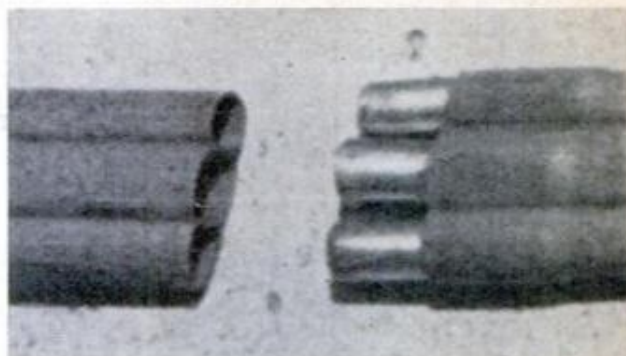
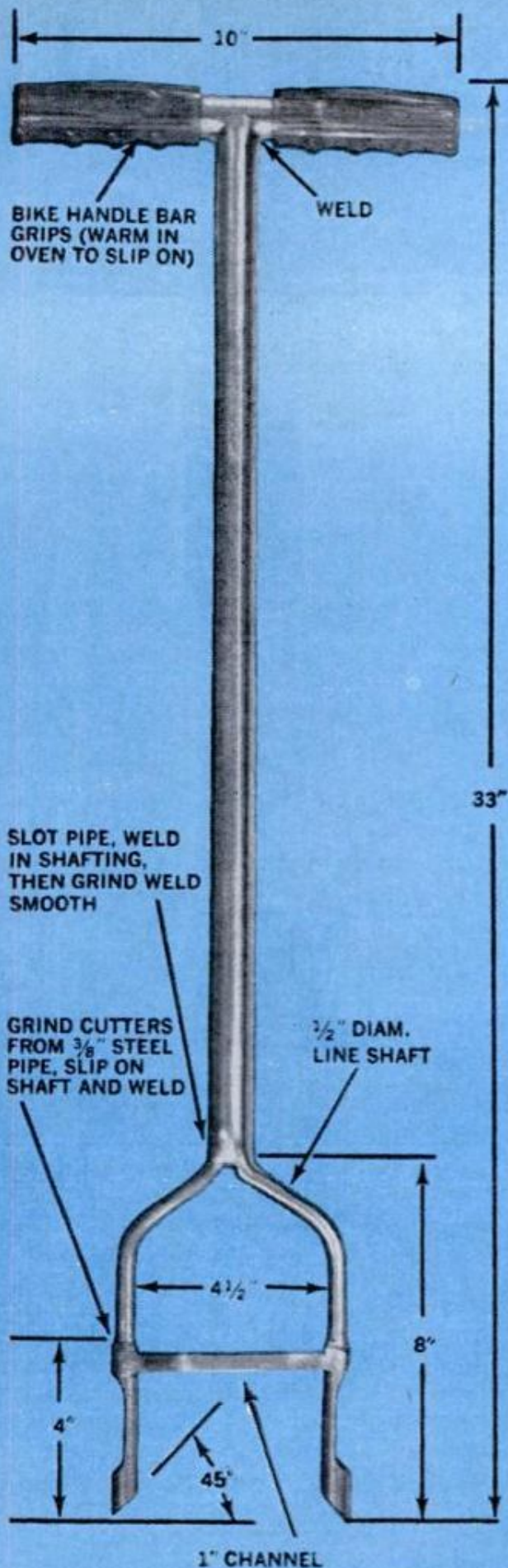
Some experts believe that aeration encourages the growth of microorganisms that decompose humus materials, and so promotes the release of nitrogen.

The advantages are many, so build this simple aerator now and enjoy a healthier, greener lawn this summer. ★★★

HINTS

FROM READERS

DETAILS OF CONSTRUCTION



Easy patch for soaker hose

You don't have to throw away your soaker hose if it falls victim to the lawnmower or a thorny rosebush. Just cut out the damaged area and make a sleeve patch from two sizes of copper tubing. I used $\frac{1}{4}$ -in. tubing on the sides and $\frac{5}{16}$ -in. in the center. Wrap the patched section with several turns of electrical tape and you'll have a repair job that will last the life of the hose.—William G. Waggoner

Retaining wall of bagged cement

If you need a retaining wall where it will be concealed by vines or shrubbery, here's the simplest way to build it. Just stack bags of cement as though they were sandbags, staggering the joints as you would when laying brick and curving each course to conform to the slope of the bank. Soak the whole thing well with a hose. When it sets, you'll have a sturdy retaining wall.—Philip S. Kistler



VACATION HOMES TO LIVE IN THIS SUMMER

By LEONARD E. SABAL

Illustrations By Roger Chapin

Ambitious though it may seem, you **can** build your own vacation home in time to enjoy it this year. To considerably shorten your way to a leisure-filled summer, complete construction plans are available for the first five homes shown. The sixth, a refreshingly new concept in second homes, will give you ideas for the 'different' vacation home you've been wanting.



SPORTSMAN, FAMILY MAN, banker man, thief—all need a hideaway to get away from it all. Only nowadays, it's got to be a hideout big enough for the rest of the gang.

And, when you consider that it also must be inexpensive, comfortable, trouble-free and adaptable to any location, the obvious solution is a vacation home—preferably one you can build with a minimum of time, skill and cash outlay.

With these points in mind, *PM* took a **good look at** the vacation-home market, or as some prefer, the second-home industry. The result is this collection of five homes

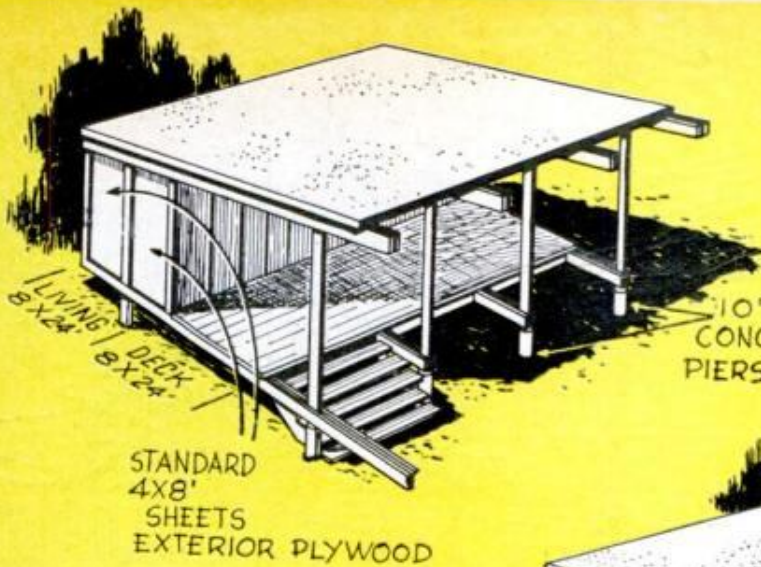
you can build *now* and enjoy later, while the last house is presented for what it is—a brand new idea in stylized retreats.

Complete plans for each of the first five are available for 35 cents from the American Plywood Assn., 1119 A St., Tacoma, Wash. 98401. An important part of each set of plans is a detailed bill of materials listing plumbing and electrical supplies, as well as lumber, miscellaneous hardware and foundation materials.

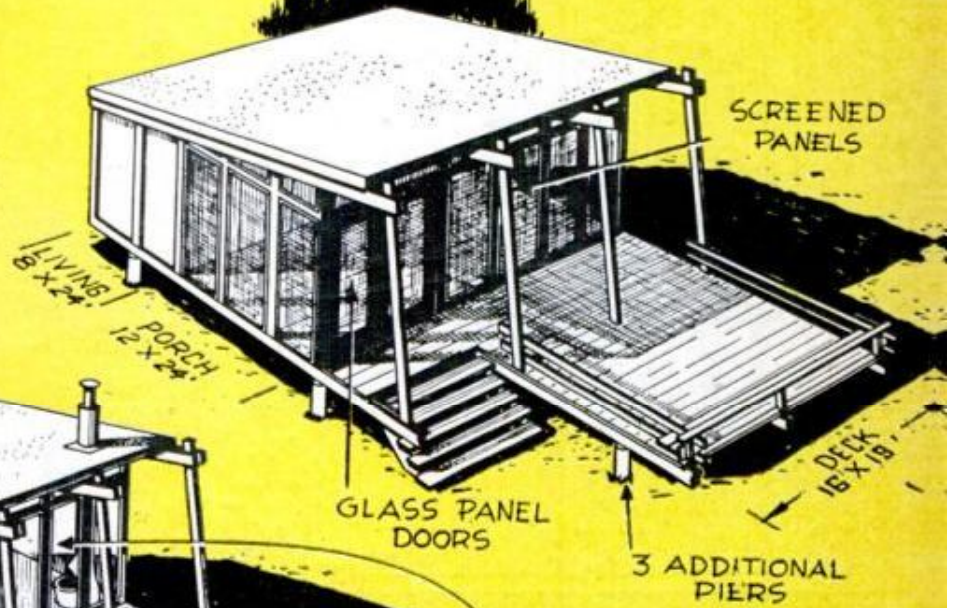
The first home, as shown on the cover and these two pages, is a three-stage affair that can be built quickly in first-stage form, then expanded as the need arises.

3-stage expandable home—it will grow with your family

FIRST STAGE is a streamlined camping center that's locked up in about 10 minutes. The basic structure goes up very quickly



SECOND STAGE includes improvements of water heater, cooking gear, toilet, shower. Screen part of deck for porch



THIRD STAGE becomes a true vacation home with the addition of a prefab fireplace to a fully enclosed living room

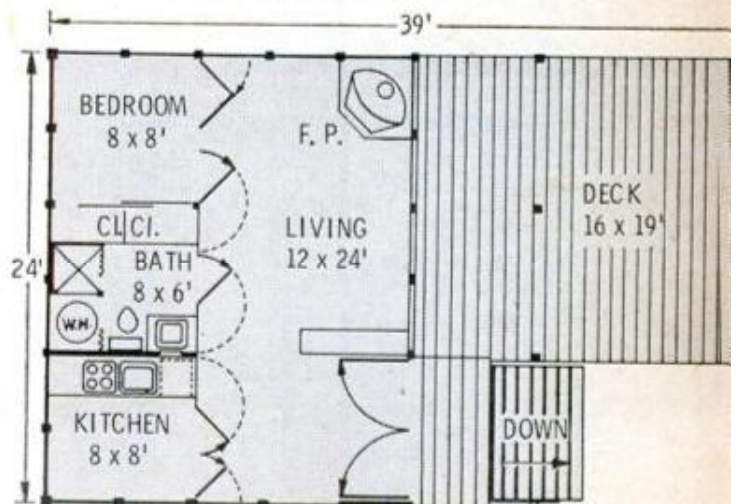


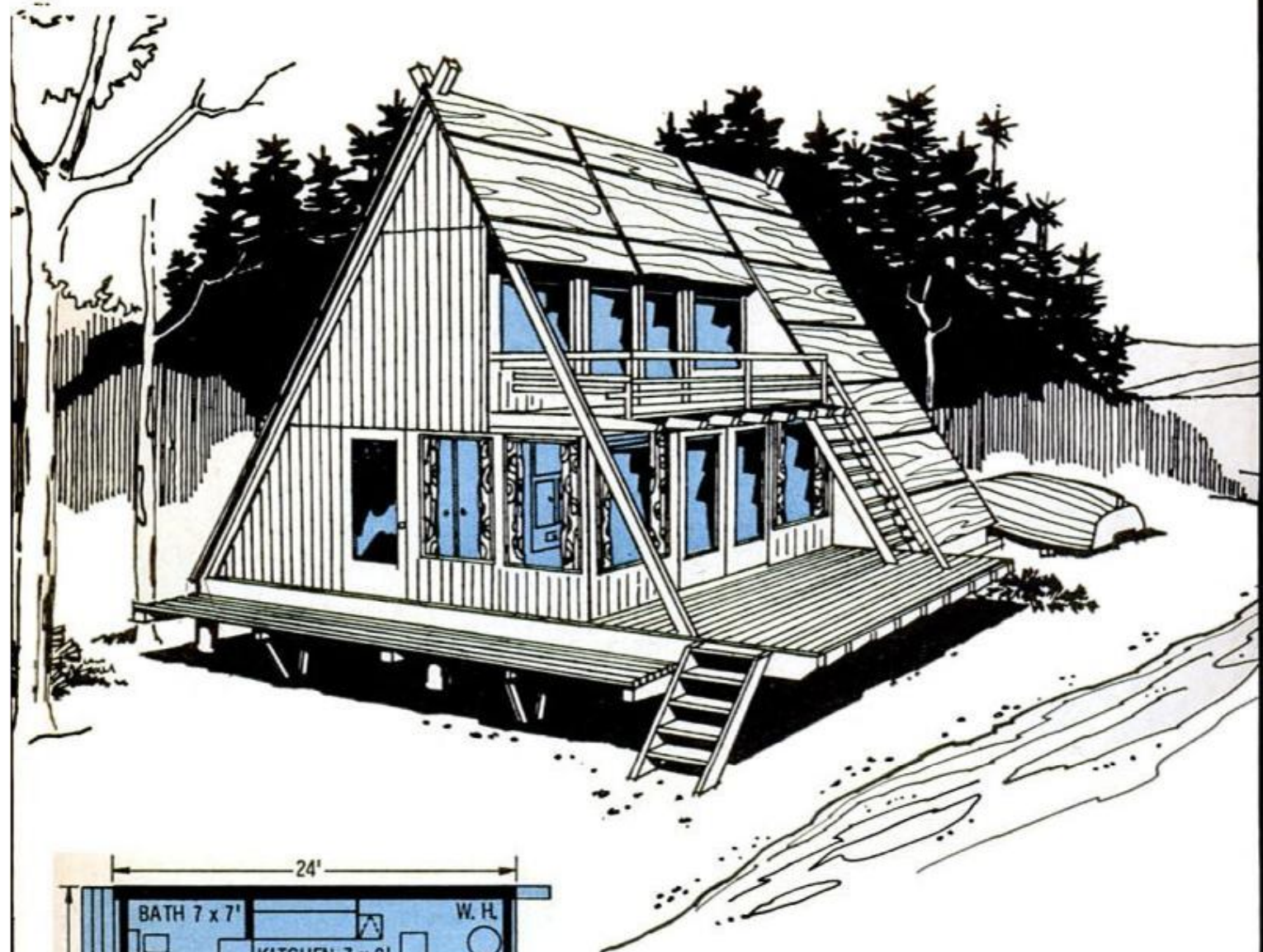
Technical Art by ZIK Associates, Inc.

You could, however, complete all three stages at once, because the house is designed around the 4x8-ft. modular concept, and therefore requires a minimum of cutting during the actual construction.

About \$900 worth of materials go into the first stage, which basically is a simple shelter that doubles as a camping center. Add a cooking unit, water heater, shower, toilet and more deck area to convert the basic module into an easy-to-live-in cabin. To complete the third stage, enclose the living area, install a prefab fireplace, insulate if desired, and add those personal touches that makes a home. (Continued)

THIRD STAGE FLOOR PLAN





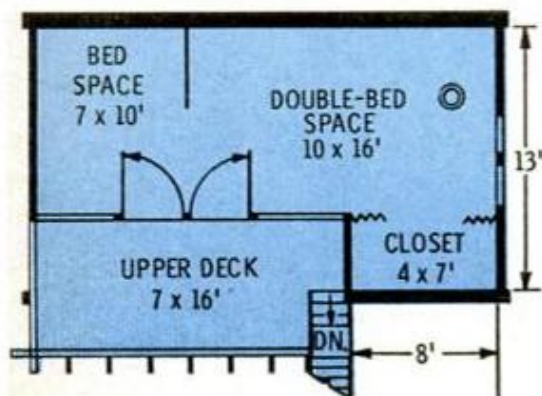
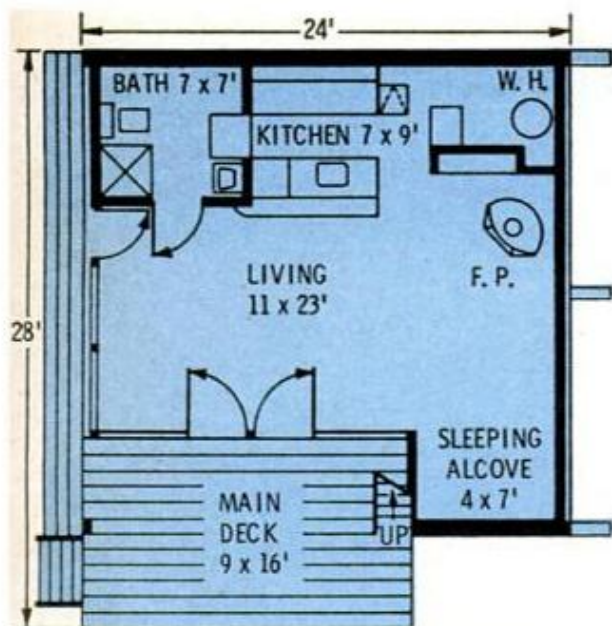
Stepped A-frame for split-level convenience

Well-proportioned and inviting, this double-deck A-frame integrates the desirable features of upstairs bedrooms with spacious living areas to provide the privacy and appeal of a split-level home.

The dual-deck arrangement also contributes to this split-level effect while simultaneously providing a natural borderline for the upper and lower walls of windows and doors. The end result is an interior that's always bright, airy and cheerful.

Should the upper bedrooms prove large enough for the members of your family, the lower sleeping alcove can easily be converted to a convenient 4x7-ft. closet like that on the upper level.

The structure rests on nine concrete pilings, while panels of Texture 1-11 act as both roof and walls to provide the lateral rigidity required for an A-frame.



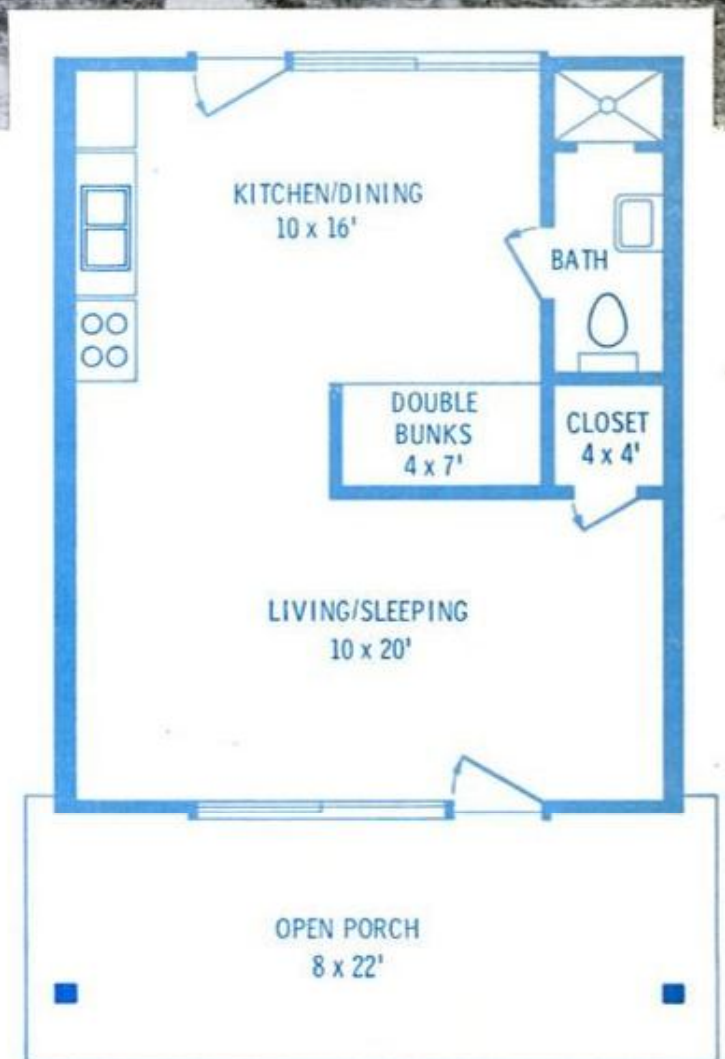


Rigid-frame cabin for remote homesites

"Vacation home" is the term you'll use to describe this cabin to your wife and mother-in-law; but for you and your cronies, it makes a beautiful hunting lodge.

Its rigid-frame construction offers two distinct advantages. First, the cabin goes up in a hurry because all the framing members are identical and, thus, can be prefabricated before the actual erection. Second, the absence of load-bearing interior walls means the floor plan can be varied to suit any requirements without affecting the strength and rigidity of the cabin.

Although normal spacing of frame members is 2 ft. on centers, you could double up on each and space them 4 ft. o.c. for larger sidewall openings. Inside the cabin, the large frames can be left uncovered for a handsome "exposed beam" look. However, if you're already planning on next season's hunting, you can add insulation between the frames and then panel the interior with decorative plywood. (Continued)



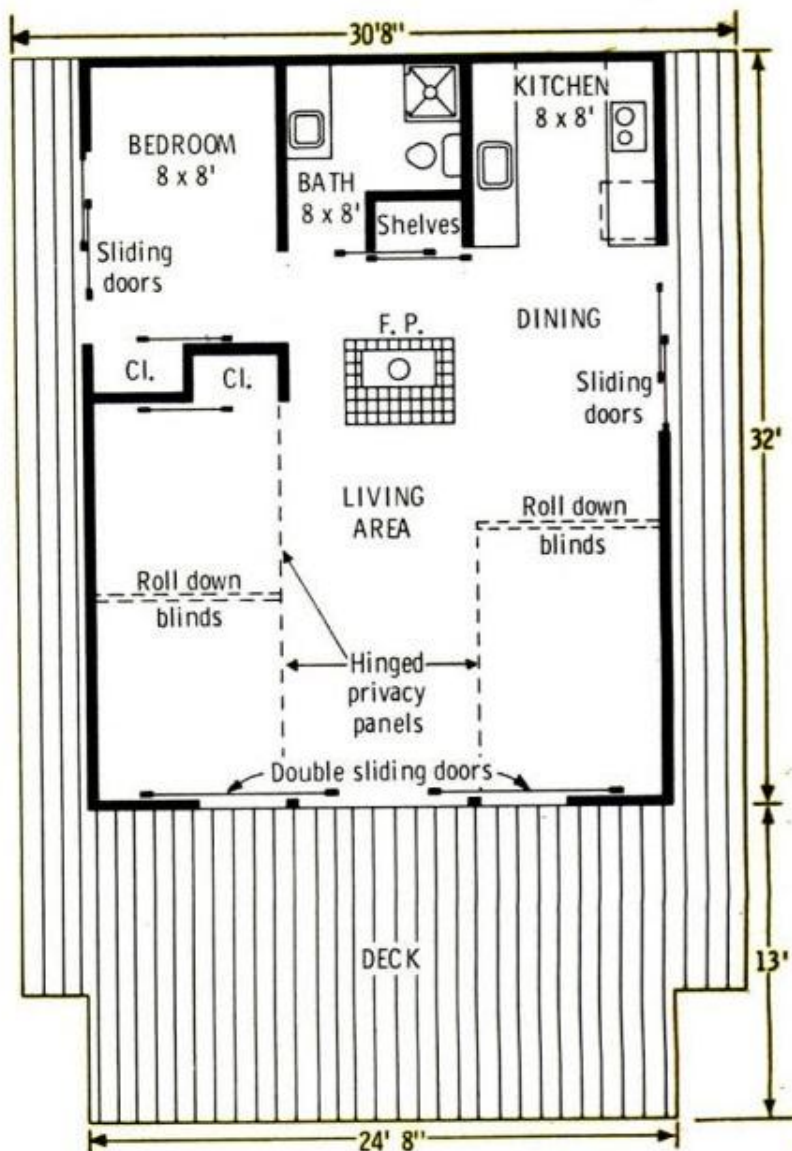
Palatial hideaway for peaceful afternoons

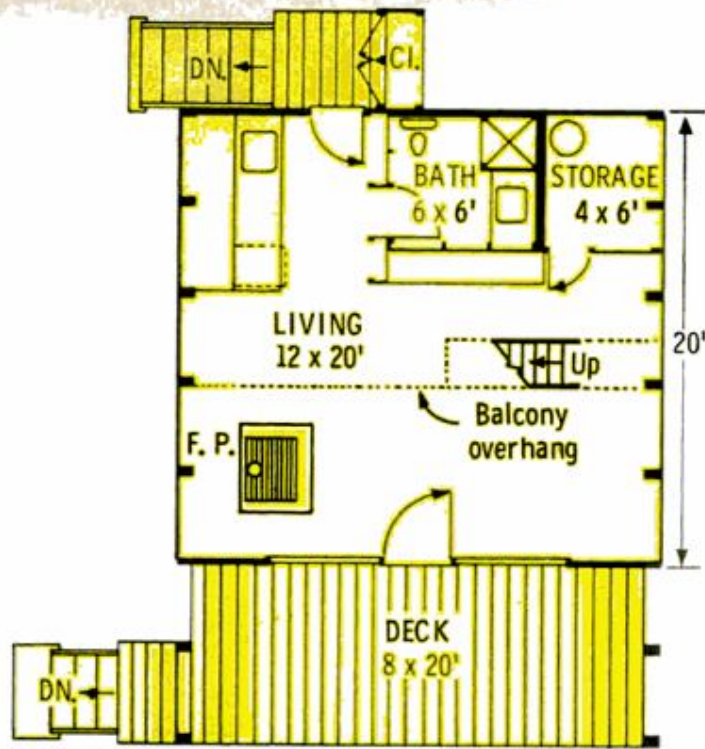
Designed for easy building on remote sites, this luxurious retreat can be put together in a week, using preframed plywood panels and precut lumber.

When you're through, you have a vacation palace—a true second home—with 770 sq. ft. of enclosed living space and another 700 sq. ft. of outdoor deck space.

The attractive clerestory arrangement in the roof not only adds to the appearance of the house, but it also serves a utilitarian purpose by flooding the interior with light, even on cloudy days.

Another unusual feature is found in the living room, where hinged privacy panels drop from the ceiling to create three separate sleeping areas for weekend guests. Yet even when the panels are lowered, there's still plenty of space remaining around the fireplace for informal entertaining and relaxing. Using sliding doors throughout also adds a touch of casual elegance.





Spartan A-frame for rugged vacationers



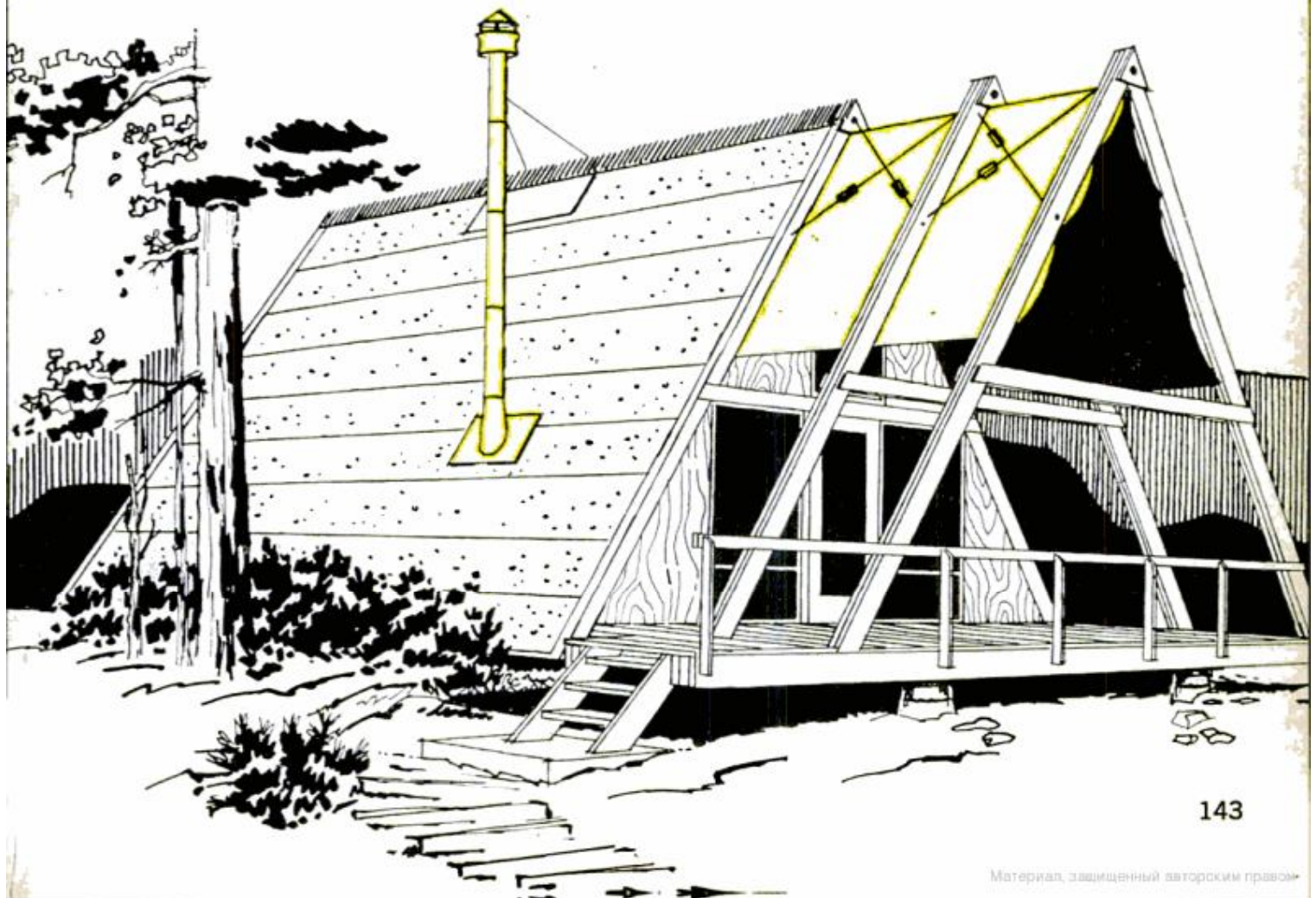
Nested atop a rocky mountain, this striking A-frame withstands gusting winter winds as well as sudden summer storms to make it an ideal weekend refuge.

To relieve the bare A-frame lines, an extra pair of frames and a canvas canopy extend over the deck to form a shelter from sun, rain and snow. Inside, a neat plastic skylight provides natural illumination, while the front wall of windows and door takes full advantage of the view.

The living room contains 240 sq. ft. of space with a prefabricated corner fireplace that's perfect for warming up after a hard day's skiing. The 144-sq.-ft. sleeping balcony overlooks the living area and is accessible via a ship-type stairway. The rear of the A-frame has a second entry (into the kitchen) on the lower level, while cool summer night breezes can enter the balcony area through a pair of swinging windows.

As with all the homes designed for the American Plywood Assn., it's best to lay the foundation *in strict accordance with the plans* before the delivery of the other construction materials.

(Continued)





Idea home for year-round vacations

Because the desire for a second home is often coupled with a wish for something different, yet practical, the need for useful new ideas in the vacation home field has grown tremendously.

Typically, families like yours prefer conservative or traditional architecture in a city or suburban home, yet would like a leisure home featuring (a) comfort, (b) low maintenance, (c) reasonable cost and (d) *architecture that's different*.

Nicely filling all these requirements is the Mansard A-Frame, a new design that combines certain aspects of the mansard roof and the always popular A-frame. Actually, it is neither, because the mansard roof has a vertical wall beneath it, and the A-frame does not reach a peak.

This home idea was developed by the architectural design department of Georgia-Pacific Corp. as a concept from which you can have an architect develop working drawings to fill your family's specific

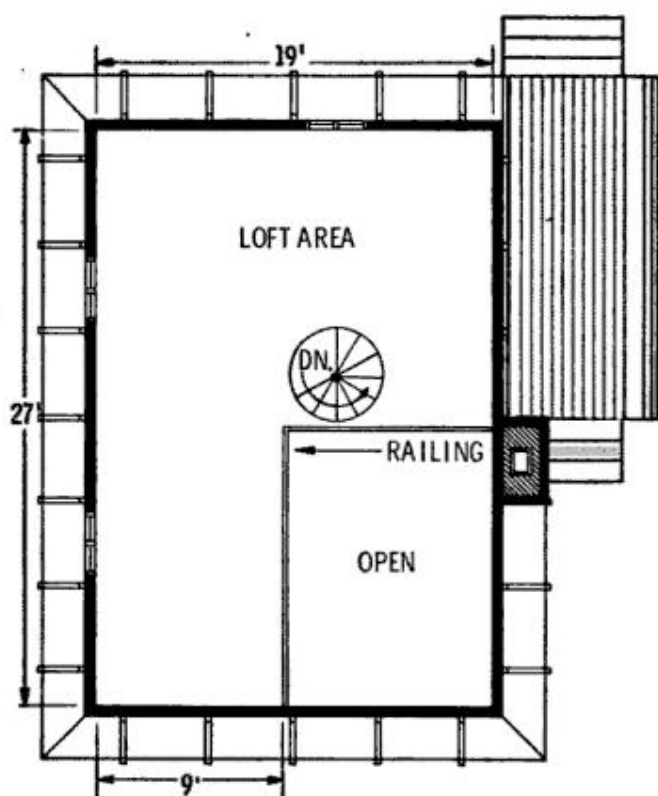


needs. Although G-P envisions homes built with this principle in the near future, it does not yet have available detailed construction plans.

However, as can be seen in the drawing at right, the materials for the Chateau-Bateau (so-called because it can be a lake, mountain or beach chateau, yet it resembles the bateau boat of Mississippi River fame) are mainly standard-size plywood panels. This brings down the cost, decreases construction time and minimizes on-the-site labor, especially if the framing and footing members are precut.

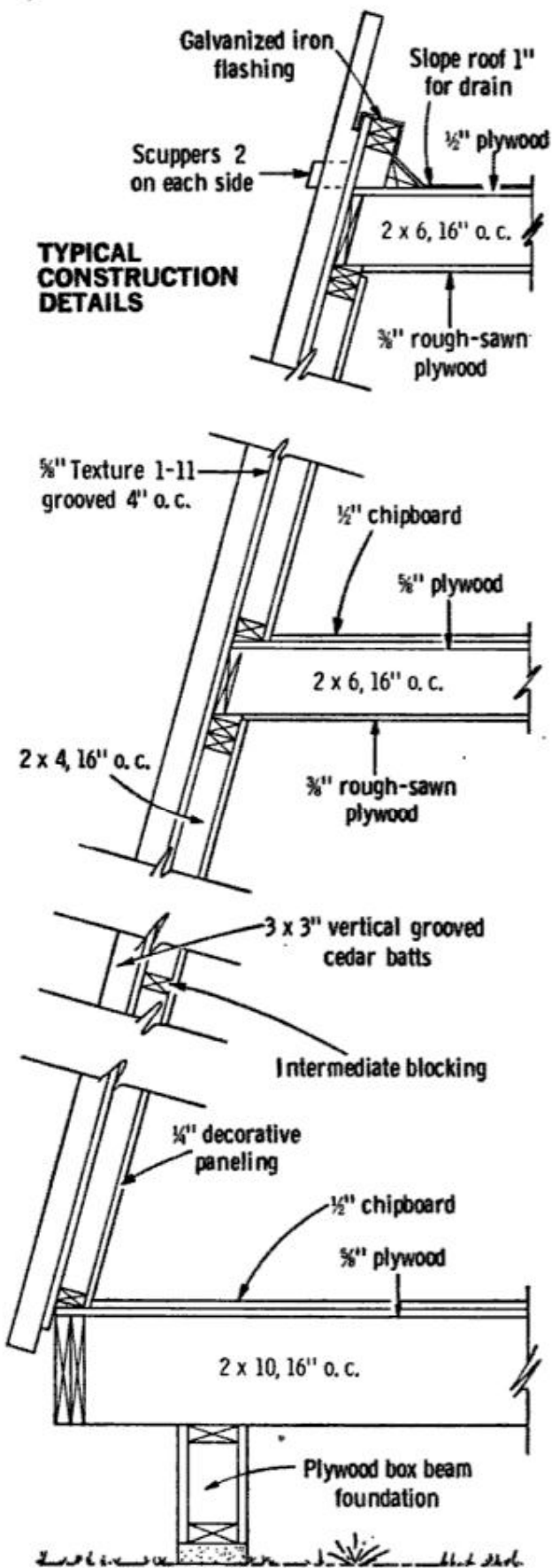
There are other features to be considered. One obvious advantage is the liberal amount of floor space squeezed out of the 24x32-ft. area. And, when you realize that the wall slope is less than that of a conventional A-frame, and therefore more efficiently put to use, the reason for crossing the mansard with the A-frame principle becomes apparent.

The loft, as seen in the floor plan below, can serve many purposes, since it is not required as a sleeping area. It's open to the living room, and thus is not really a second floor, but more of a raised level for recreation and relaxation. However, should your family need a third bedroom, or should you have a bevy of summer weekend guests, the loft can be modified without disturbing the highly functional floor plan of the lower level. ★★★



APRIL 1968

TYPICAL CONSTRUCTION DETAILS

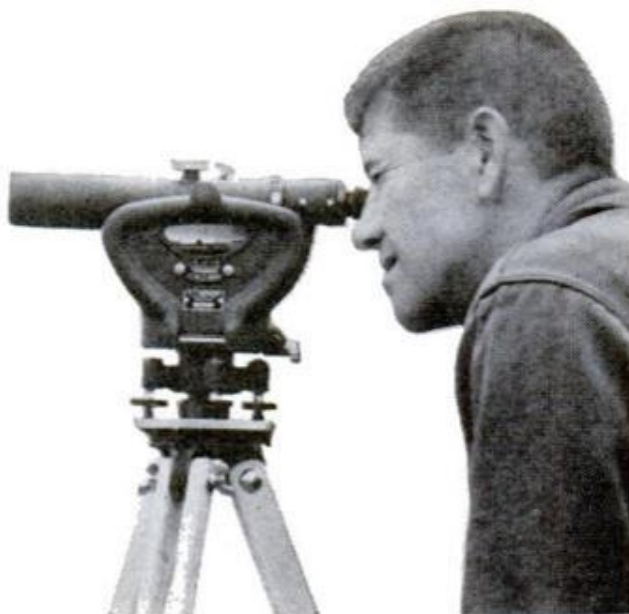


FOR MINIMUM COST, tentative materials list could include 5/8-in. Texture 1-11 siding nailed directly to the studs; rough-sawn and grooved plywood for the siding-roof; 5/8-in. plywood subfloor; 1/2-in. underlayment; 1/2-in. roof sheathing. Exterior accent panels and chimney coverings are medium-density-overlaid plywood

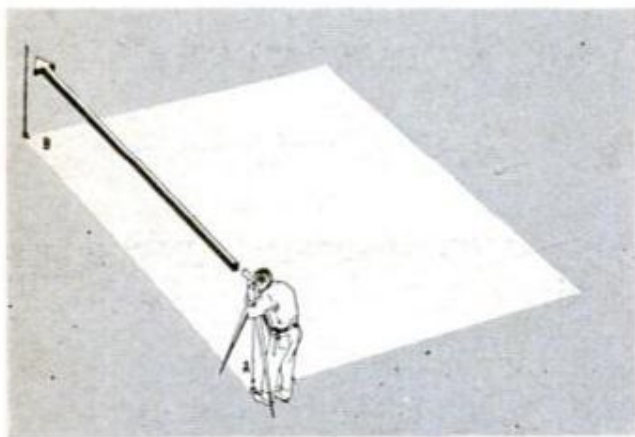
How to Square a Foundation

THE MOST ACCURATE WAY to lay out a foundation, set grade stakes for a driveway or run drainage lines is with an instrument called a transit-level. That's because the line of sight through a telescope is continuous and perfectly straight as far as the eye can see. Compared to string, it is weightless and, therefore, can't sag. Any point along the line of sight is exactly level with any other point.

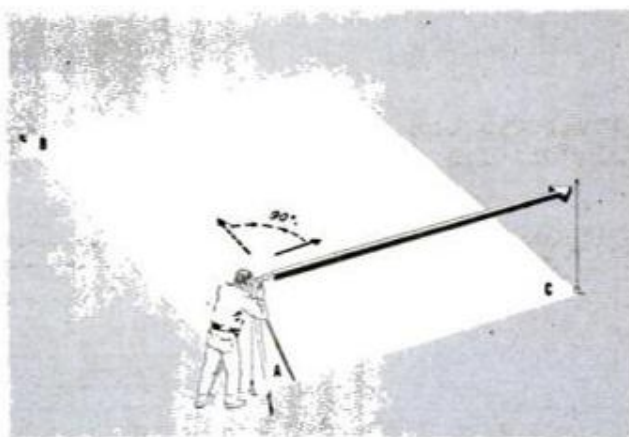
Squaring the four corners of a foundation is one of many things you can do with a transit-level. The diagrams below, taken from a surveying booklet offered for 25 cents by C. L. Berger & Sons, 37 Williams St., Boston, Mass., show how easy it is to lay out a rectangle far more accurately than you can with a length of string, compass or carpenter's level. ★★★



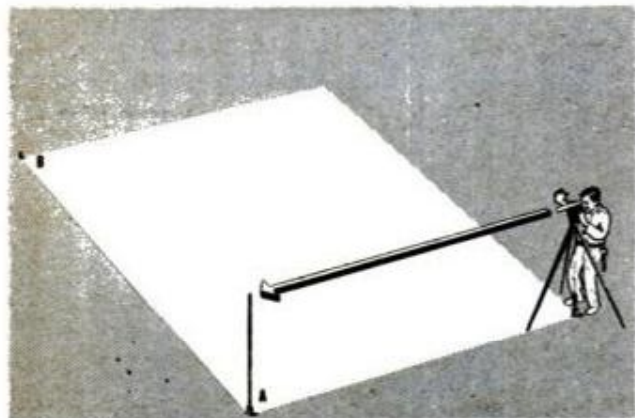
THE TRANSIT-LEVEL is a combination instrument which not only turns sideways, but also up and down



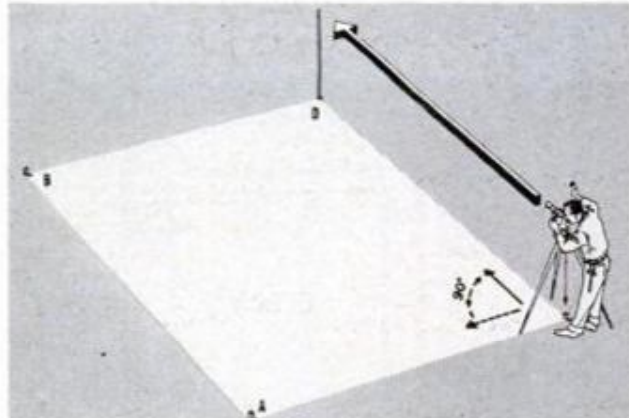
STEP ONE. After establishing the front of the building line, A-B, the transit-level is set up at stake A, leveled and sighted toward stake B. Then the circle, or pointer, is rotated and set at exactly 0°



STEP TWO. Next, and without moving the tripod, the telescope is swung 90° , which establishes the direction of point C. The correct distance from A to C is measured off and then a stake is driven at point C



STEP THREE. Now the transit is moved and set up over stake C. After checking that the plumb bob is centered exactly, a sighting is made back toward stake A. The horizontal pointer is set at 0° as before



STEP FOUR. Finally, without disturbing the transit, the telescope is swung around 90° and sighted toward point D. Distance is measured off as before and a stake is driven. You have a perfect rectangle

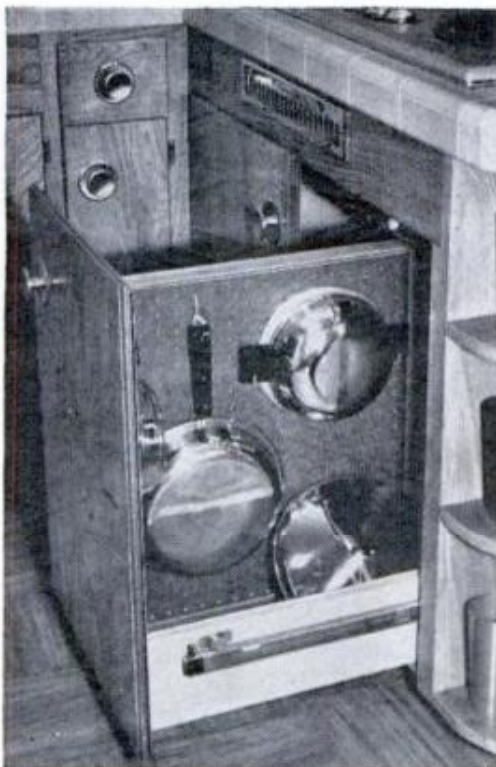
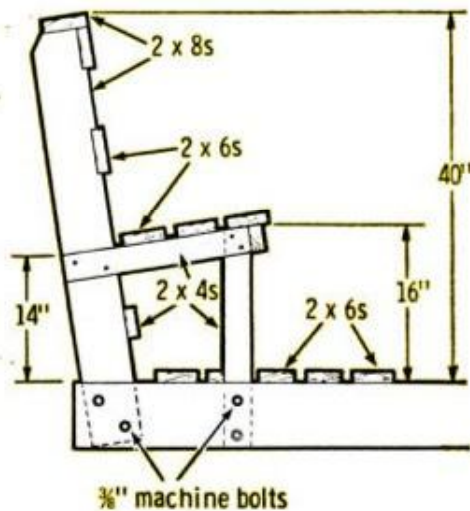
Build These Weekend Projects For Your Vacation Home

Technical Art by Don Evans

DOUBLE-DUTY SEAT-RAIL

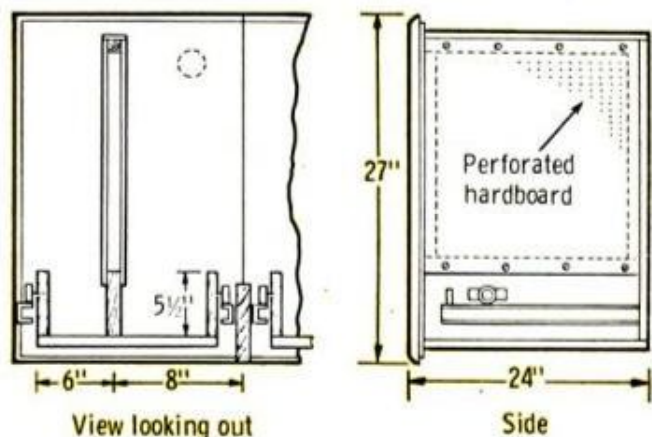
That new deck you may be planning for your vacation home will need a railing as well as outdoor furniture. By building

benches into the railing you can wind up with both. Durable redwood, of course, is best for permanent deck furniture. Use aluminum or hot-dipped galvanized nails and fastenings to avoid rust stains.



POTS AND PANS AT FINGERTIPS

Pull-out bins will not only make order out of chaos in the pots and pans department of the tiny kitchen, but will keep you from doing the usual headstand to reach a utensil. You use the existing cabinet door in each case and simply attach a divider and shallow drawer to it.—Hi Sibley

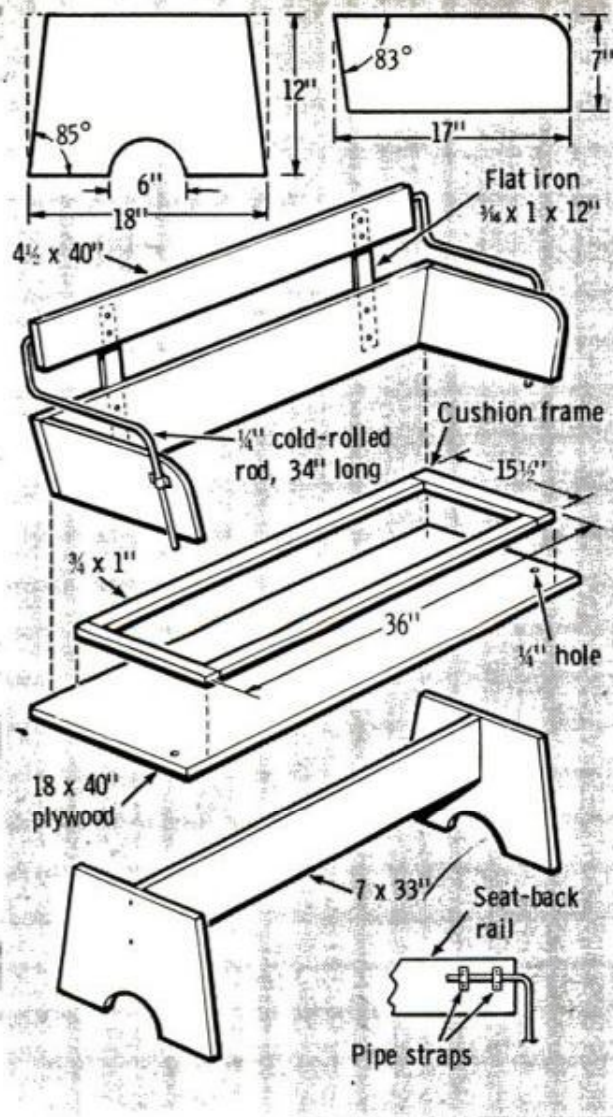




BUGGY-SEAT SETTEE

Reminiscent of the horse-and-buggy era's leather carriage seat, this quaint piece will add a nostalgic touch to a rustic vacation home. The wooden part is simple enough. For upholstery, 1-in. foam rubber is used to pad the back, a 4-in. slab for the lift-off seat. The slab is rabbeted around the bottom for a $\frac{3}{4}$ x 1-in. frame to which the black leather-grained covering is tacked. Regular $\frac{5}{8}$ -in. shank-type buttons are used to tuft seat and back. In the seat, a hardboard panel, cut to fit the bottom frame and drilled for six fishline ties, permits pulling down and tying the buttons.—Willard and Elma Waltner

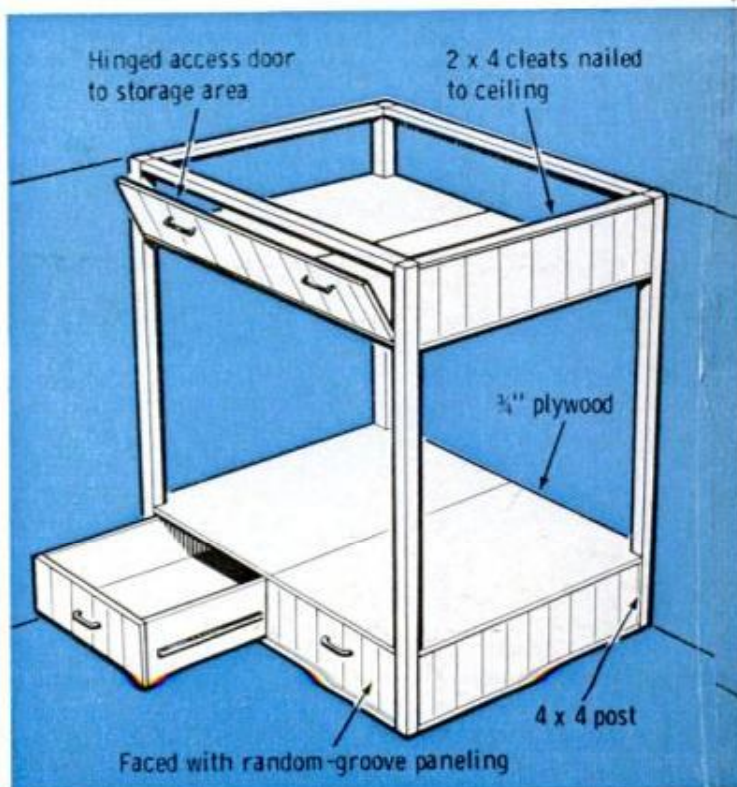
(Please turn to page 222 for additional photos)



BUILT-IN BED AND STORAGE

There's no space going to waste under or over the smart four-poster shown in color on the opposite page. Built-in storage sections above and below the bed make full use of space normally wasted.

The detail at the right shows how the bed is permanently framed in a corner, using 2x4s and 4x4s, and then paneled to match the walls. Armstrong's new deep-textured colonial chestnut was used in the original. After wedging the 4x4 posts against the ceiling, 2x4s are butted against them and spiked to floor and ceiling. Then a second set of 2x4s is added to support the mattress platform and floor of the overhead cabinet. A single drop-leaf door provides access to the latter, while two king-size drawers, fitted with regular roller guides, are made to fit the lower cabinet. Overall size of the bed should accommodate a standard-size mattress.



How to Build an In-a-Wall Bookcase

By **WAYNE C. LECKEY**

*Technical Art by Stanley Cohen
Color Photo by Robert Borst*

WHEN FLUSH IN THE WALL, bookshelves not only take on a built-in look but have a way of transforming an uninviting wall into a dramatic center of interest. More important, perhaps, they're not in the way to interfere with room furnishings.

Most any wall will lend itself to built-in bookshelves, but an inside wall presents fewer problems. An ideal spot is a blank wall across the end of a room.

The bookshelf wall you see in the photo at the left was built along an inside wall of our family room which separates the room from the foyer. Since it was a divider wall in a sense, I went farther and built a planter at the end, filled it with greens and spotlighted it from above. Whether you can borrow this idea depends on your wall.

Where the wall concerned is plastered, it isn't necessary to remove the lath and plaster. In my case, the wall was paneled to begin with and it was no problem to pull off the plywood. However, exposed studs do make it easier to get at any wiring and bring it out to the new wall.

You can make the niche any size you want, of course. I started out by nailing a 44 $\frac{1}{4}$ x 67 $\frac{1}{4}$ -in. sheet of Masonite's "Travertine marble" hardboard horizontally (and level) to the studs 34 in. up from the plate and then blocking out the ends with 2x4s. Next I framed the panel all around the edge with 1x2s and nailed them at points where they crossed the studs.

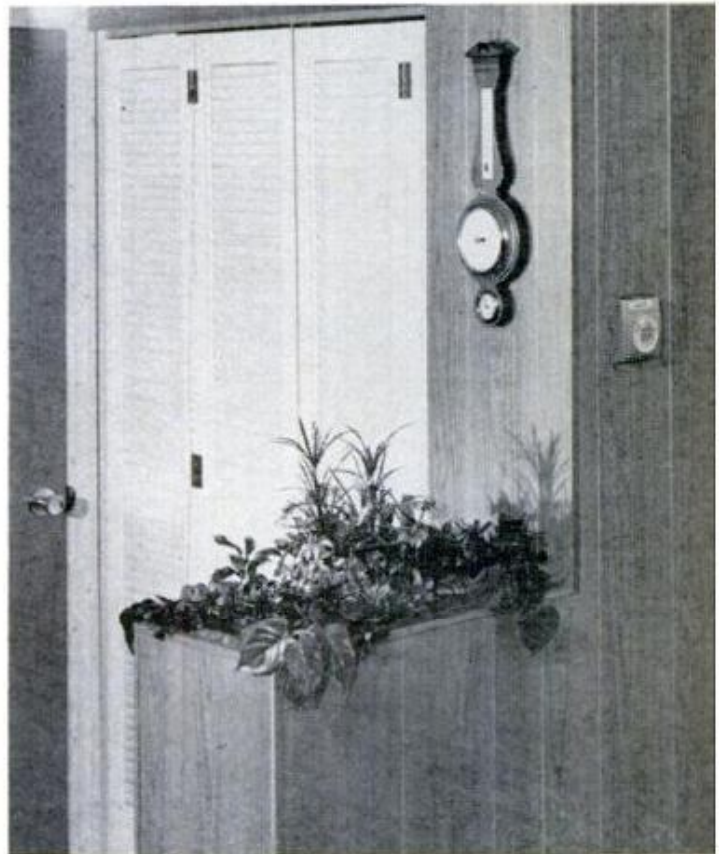
This done, I started to frame the second wall. First you nail a 2x4 soleplate to the floor, locating it 9 $\frac{3}{4}$ in. out from the first wall. Next you nail another 2x4 plate to the ceiling. Here you will need to prop this against the ceiling with a couple of studs and then plumb it so it aligns with the bottom plate. If you're lucky to have the ceiling joists run at right angles to the wall, you can spike the top plate to them. If they run parallel and miss the top plate, you'll have to anchor it with toggle bolts.

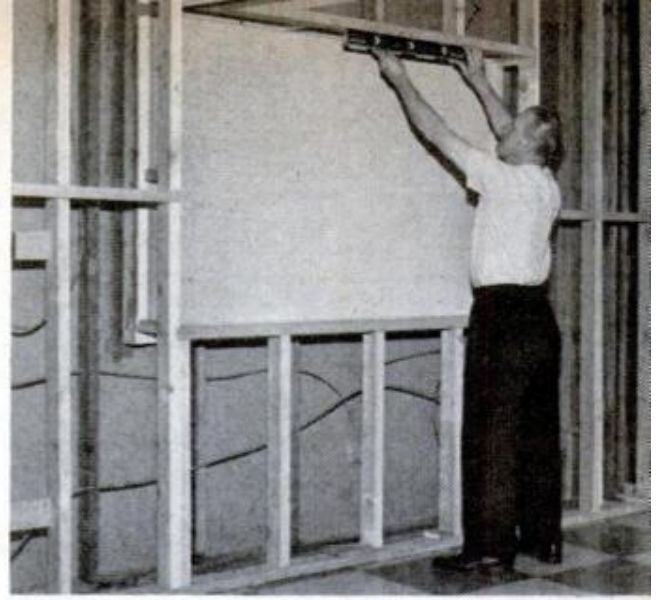
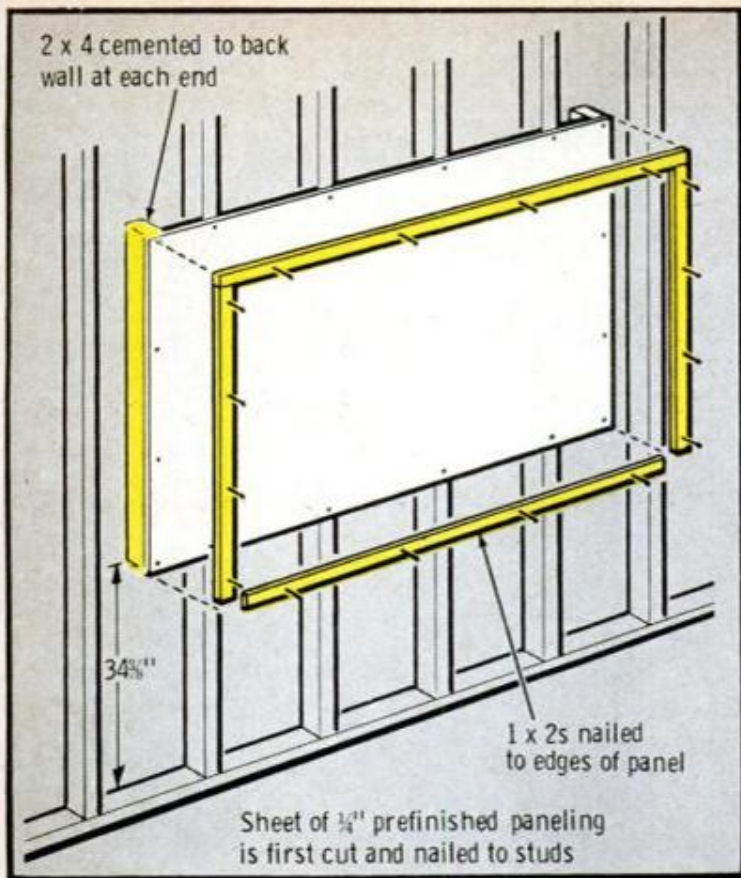
The front opening of the niche is framed to coincide with the 1x2s at the back;



EDGES OF PANELING at corners are concealed by a matching metal molding which is nailed to framing

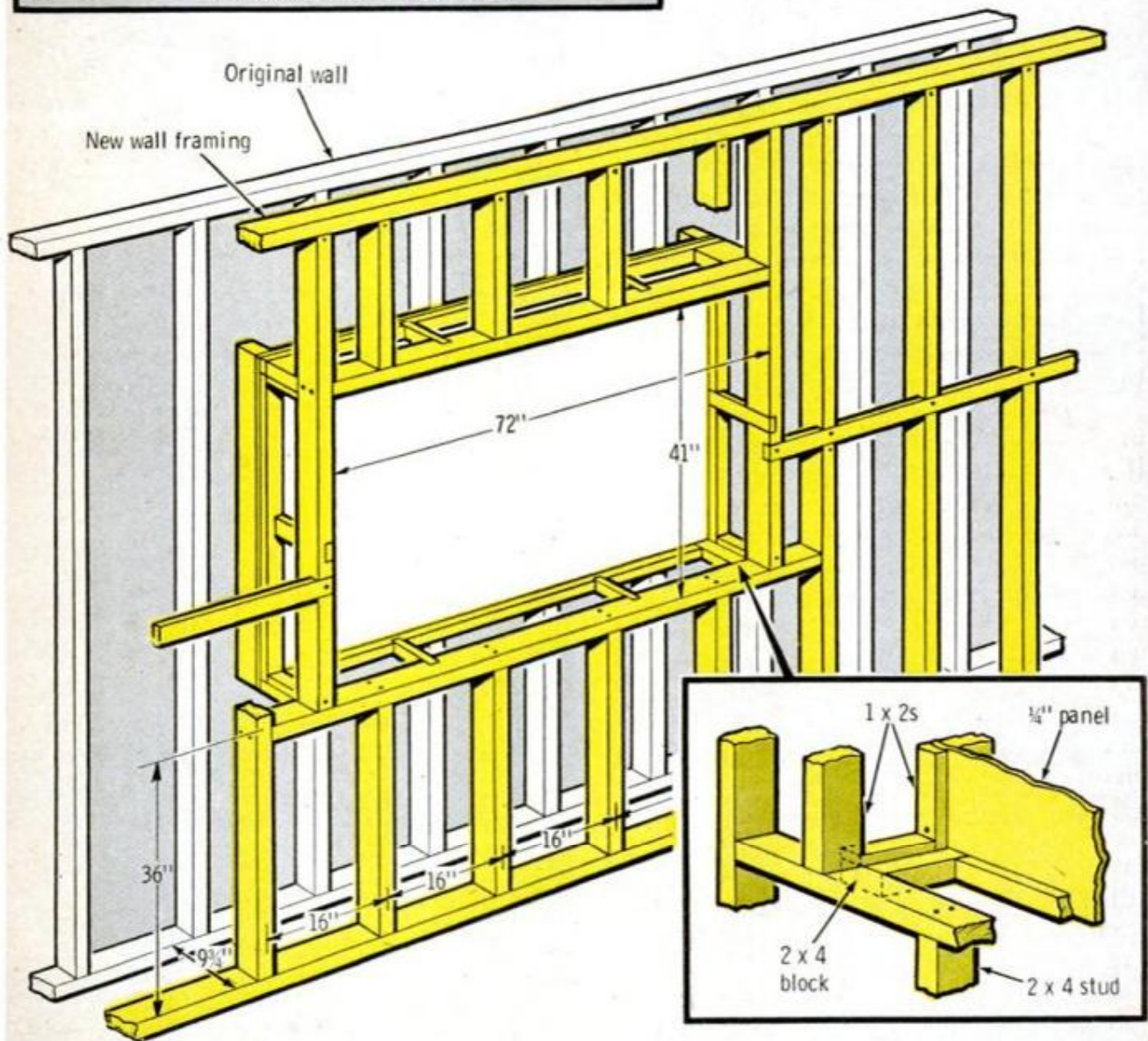
BUILT-IN PLANTER at end of bookcase wall helps relieve "sawed-off" look of extra wide divider wall

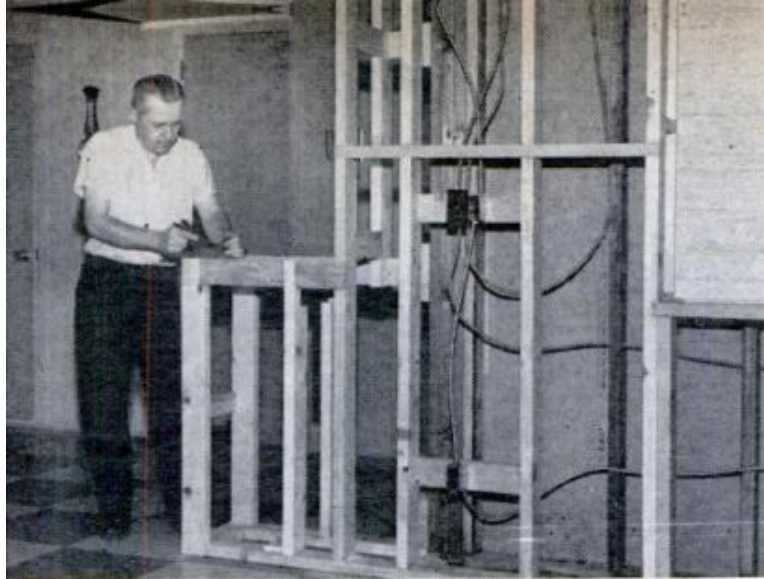




HEADER AND PLATE of bookcase recess must be level and even with back wall 1x2s

IF WALL SIZE PERMITS, make the recess equal the size of a 4x8-ft. panel and you won't have to cut it. Where bookcase wall is to match a painted room, plasterboard would be used to line the recess and face the wall. Here, regular plaster bead would be used to frame outer corners of recess





PLANTER FRAMING is a continuation of new wall. Top is left open to receive 4-in.-deep sheet-metal pan

whatever they measure from inside to inside, the opening at the front is made to measure the same. In my case it was 41x64 in. Your particular framing may vary somewhat from that shown in the drawing, but essentially it's framed as detailed. A 2x4 header is placed across the top of the opening, a 2x4 plate across the bottom and short studs installed above and below.

Now short blocks are cut to fit between the back and front wall for support. These are 2x4s at the corners and 1x2s elsewhere. I dadoed the latter into the front wall, but you can simply butt them—it's not that critical. If you want to notch them, do it when cutting the framing members. Finally, 1x2 blocks are added to the four 2x4 blocks to create gluing surfaces and the niche is ready to be lined.

I used Marlite's plastic-finished paneling in Italian cherry to line and face the wall. It's 1/4-in. hardboard, comes in random plank 16 in. wide for easy handling, and has tongue-and-groove edges to assure perfect fitting joints. There are any number of prefinished plywood panels from which to pick. If you're going to paint the wall, you'll want to line and face it with plasterboard, then tape and fill the joints.

Assuming you are using the same or similar paneling as I did, the narrow pieces which line the niche are ripped 9 5/8 in. wide to allow 1/8 in. for expansion. Cut and install the end pieces first, sawing them a trifle short. I used a panel adhesive to cement them in place. It's a sticky mastic that bonds in minutes once the panel is pressed in place.

Next, cut and cement the top and bottom pieces in place. Like the ends, they're



STICKS ARE USED to hold top and bottom panels in place when cementing lining in bookcase recess

butted against the back wall and cut to fit nice and snug against the end panels. Sticks wedged between them, at front and back, hold them in place while the cement sets. Any adhesive smears can be easily removed with a cloth dipped in regular rubber-cement thinner.

You're now ready to panel the wall. First you must cover the exposed edges of the lining with an aluminum outside-corner molding which you miter at the corners like a picture frame. It saws easily, comes in 8-ft. lengths and matches the color of the paneling. A flange permits the molding to be nailed in place so that the nails are later concealed by the paneling. Applying the paneling involves cutting the planks to fit and cementing them to the studs. Although I didn't use them, special metal clips are provided to self-space the joints, since they should not be forced tightly together. I watched this carefully

STARTING PANEL is inserted in channels of molding. Work from left to right; leave 1/4-in. space at floor

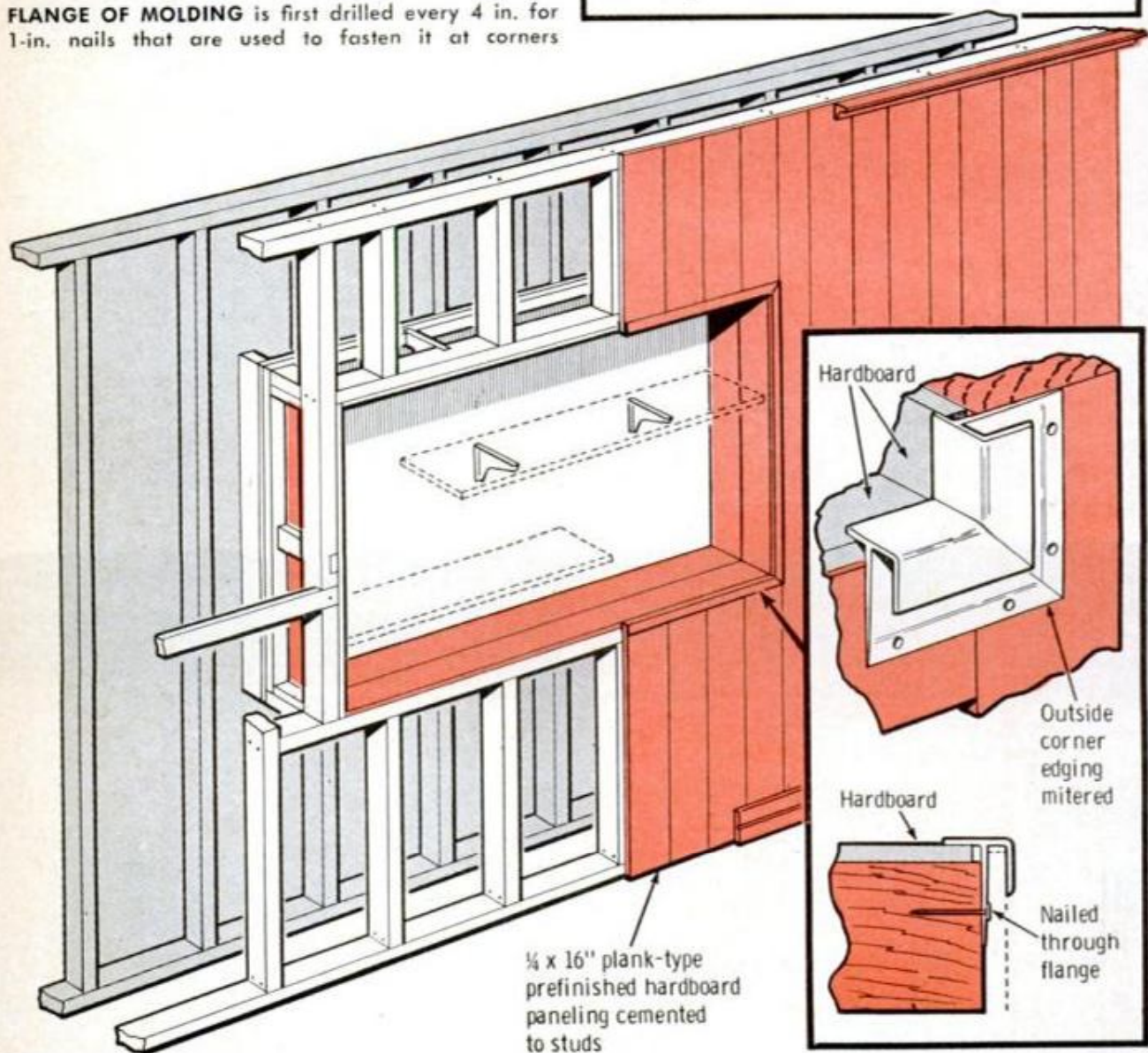
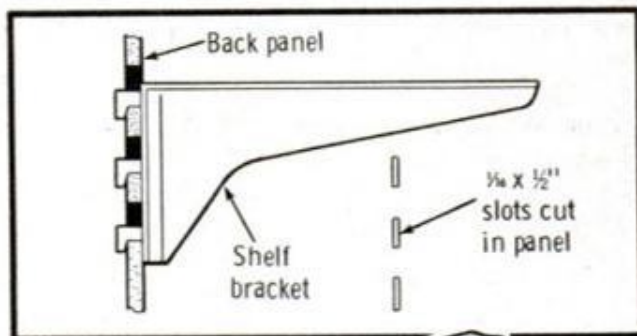


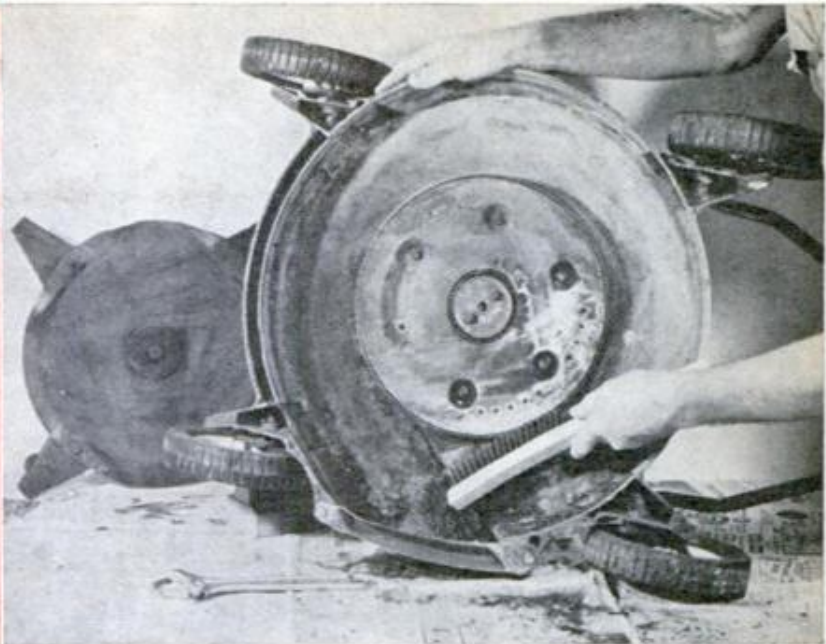


FLANGE OF MOLDING is first drilled every 4 in. for 1-in. nails that are used to fasten it at corners

in cementing panels, using the thickness of a dime to keep them properly spaced.

I used Masonite's new shelf brackets which need no vertical standards. They're designed to hook in slots in their Royalcote Living-Wall paneling, but I simply cut identical slots in the marble-textured hardboard, using a tiny burr in a hand grinder and a template to space the slots evenly. You can arrange the shelves as you wish. I found that two 10x48-in. ready-made shelves staggered as shown provided ample room for books, plus tall bric-a-brac. ★★★





How to Tune Up Your Mower

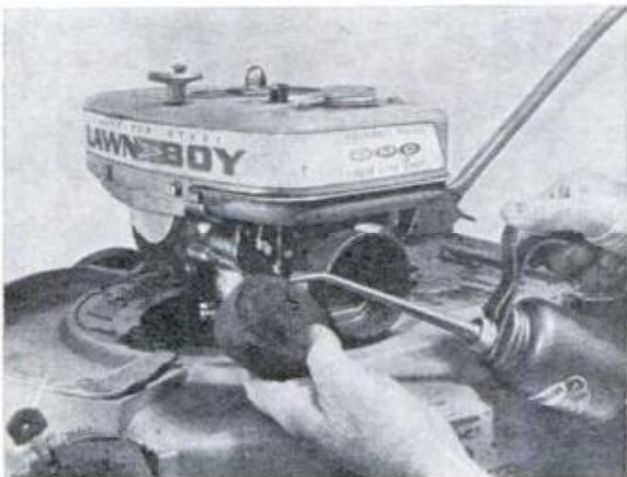
If a sigh of relief was all you gave your mower when you put it away last fall, don't expect it to run first thing. It'll need this preseason overhaul to put it in tune.

By JASON BLAIN

IF YOU'RE LIKE most of us, when you finished that last mowing job back in October you probably shoved the mower into a corner—where it sits today.

It may have seemed like a good idea at the time, but there are a number of things you should have done before putting your mower to bed. You can still do most of them, and you should if you want to swing into the coming mowing season without headaches from equipment failure.

AIR CLEANER is often overlooked. Clean the foam type with gasoline and then recharge it with oil



Start out by picking up a fresh can of gasoline. Use the old stuff to clean paintbrushes or something like that. While you're at the gas station, buy a new J-8-J or whatever sparkplug is specified for your mower. Back home, drag the mower out and run through this step-by-step check to put it in shape for the summer.

- Take out the old sparkplug. Pour a jigger or so of oil into the plug hole. Turn the engine over three or four times to distribute this oil over the cylinder wall, which is no doubt bone dry. Then put in the new sparkplug.

- Dump the old gasoline out of the tank and drain the sediment bulb on the carburetor, usually by depressing the small valve at the bottom. Old gasoline contains gummy resins which will foul up valves and carburetor parts, making the mower hard to start. Every engine maker cautions against using stale gasoline.

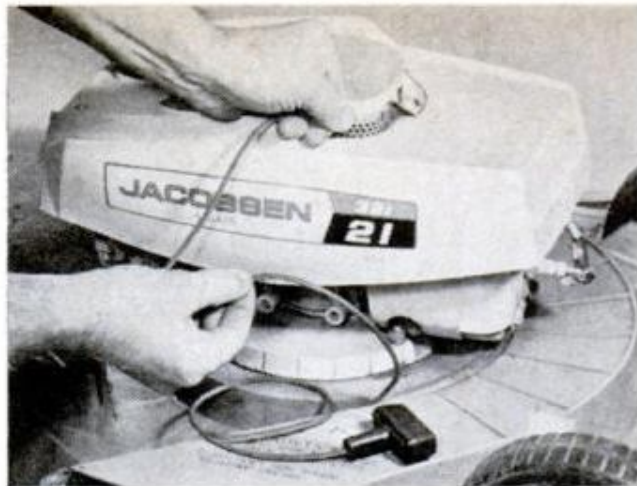
- Pour about a pint of the new fuel into the tank and push down on the mower handle several times to slosh it around.

- Start the engine and let it run for a minute or so to warm up, then shut it off.

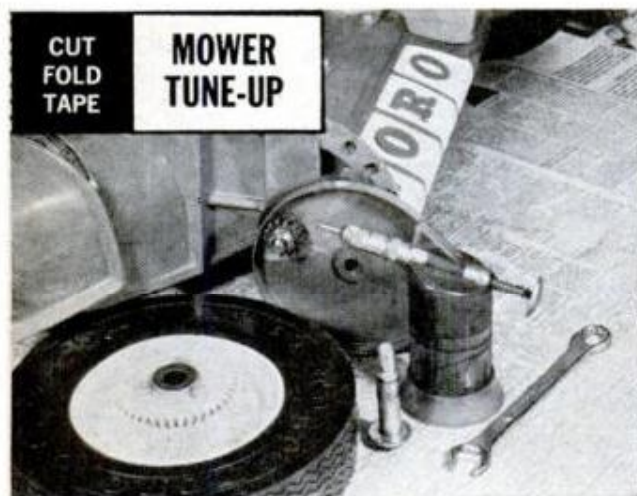
- If your mower has a four-cycle engine,



ADJUST BELT TENSION through idler or by tilting drive box, as on the Toro Pow-R-Drive shown above



CHECK STARTER CORD for its full length, not just where it comes out of the housing. If worn, replace it



REMOVE ALL WHEELS and lubricate axles and drive gears. Use a lightweight grease on these, not oil

drain the crankcase and refill with new oil. Be sure the grade is right.

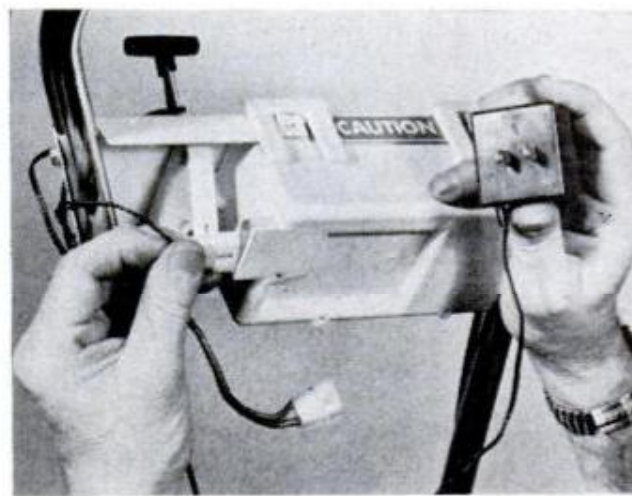
- Crank up the engine again and let it run for a minute or two. Now, drain out the oil you just put in and refill a second time. This double drain with a short run between will stir up sludge in the bottom of the crankcase and let it drain out.

- If you have a two-cycle engine, remove the muffler assembly and clean the carbon from around the exhaust ports. Any carbon build-up here will cut down on power and increase the chances of overheating.

- Check the condition of the sparkplug wire. If it's stiff, brittle and cracked, replace it.

- Similarly, examine the rubber tubes in the fuel system. They, too, may be getting old and stiff.

- Disassemble the air filter. Rinse it several times in gasoline, then let it dry. Charge the filter with oil—a teaspoon or so will do it—and squeeze the foam sev-



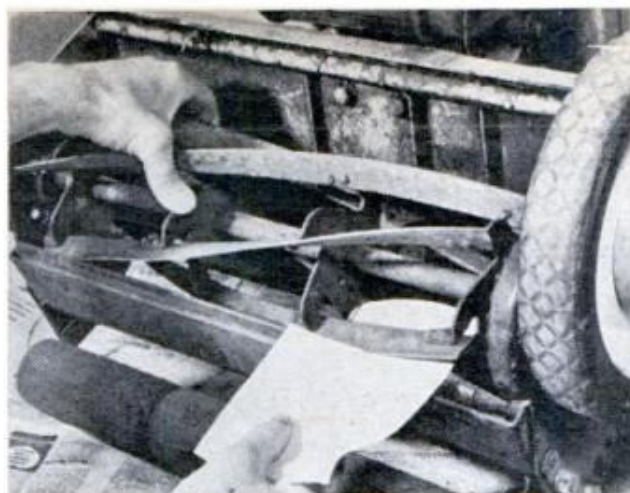
ELECTRIC STARTER with cds batteries is just about worry-free, but be sure to charge it before tune-up

eral times to distribute the oil throughout. (Although the urethane foam filter is most common, your engine may have another type, such as a throw-away paper filter or an oilbath. Check your instruction manual.)

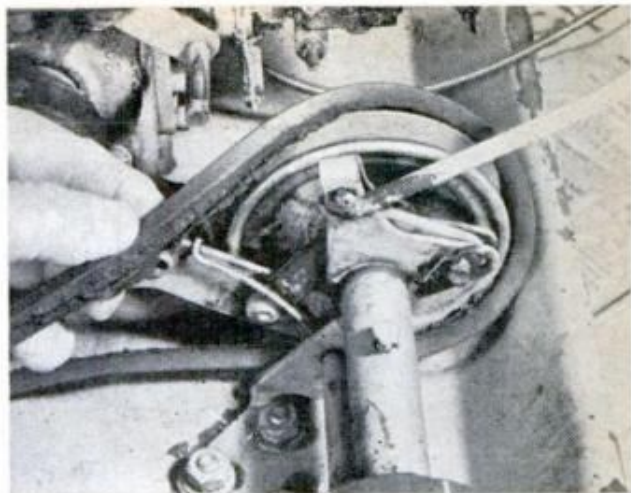
- Remove housings and covers to expose the flywheel, which on most engines incorporates fins to drive cooling air past the cylinder. Be sure all air passages are clear and not blocked by grass clippings or other debris. A blast or two of air from a sprayer compressor or even a tire pump will help. Also, be sure to clean out the spaces between the cooling fins on the cylinder.

- To make sure that the running gear and its controls will operate smoothly, squirt a drop of oil on lever pivots and in the ends of control cables. Work the levers a few times to spread the oil.

- Check drive belts for signs of fraying and excessive glazing. The glaze may cause slippage. Often it's a sign of slip-



WITH REEL-TYPE MOWER, check alignment of spindle with knife by cutting paper with each of the blades



EXAMINE BELTS for fraying, cracking and glazing. To restore glazed belt, use a multi-solvent cleaner



PROTECT WOOD ROLLER on a reel mower by treating it with as much wood preservative as it will absorb



TO CLEAN AN oil-bath air cleaner, take it apart and rinse well, then clean, reassemble and refill it

ping. Tighten belts if there is provision for it. Buy new belts if they are worn or stretched. Check the drive pulleys to make sure they are not loose on the shaft. If your machine has a gearbox, drain and flush it, then refill.

- Wheels and wheel-height adjustment mechanism will sometimes freeze due to corrosion. Break them loose now and lubricate them. Grease is better than oil for slow-moving things like mower wheels and infrequently used things such as adjustment levers. It doesn't drain off as time passes. Use "utility" grade grease.

- On a reel model, saturate the wooden rollers with a wood preservative. Then stand the rig on end and let oil run down along the roller shaft.

- Sharpening a lawnmower is easy if you do it often enough so that excessive grinding is not necessary. A fairly deft handyman can file a reel mower, and the same man can keep a rotary blade in balance. The trick is to remove a minimum of

metal and the same amount on both ends of the rotary blade or, on a reel model, to file evenly along the full length of each blade and the bed knife. However, when a reel mower gets pretty well worn, take it to a repair shop where the man has machinery designed to put things back in true shape.

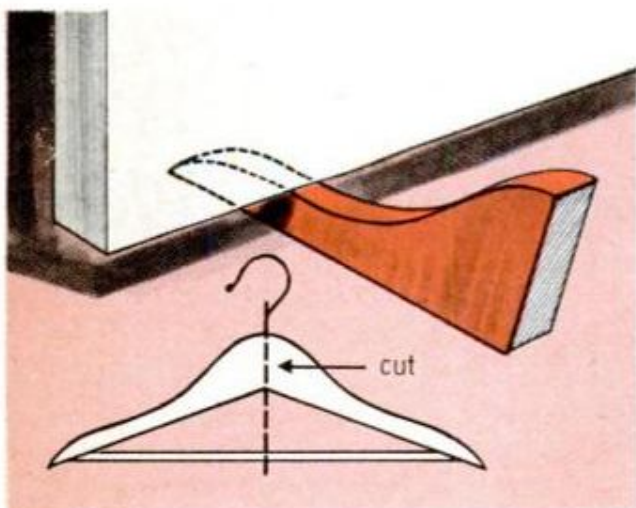
- One item often neglected in mower maintenance is the clippings bag. Some mowers have plastic-mesh bags which are long-lived. Others are ordinary fabric with preservatives. However, both are subject to deterioration if left dirty, so turn your bag inside out and shake the dirt away. *Do not wash* ordinary fabric bags with water. This removes sizing and preservatives, and will speed up deterioration.

- Finally, if your mower has to go to the repair shop, take it there *today*. The line is already forming, and if you don't hurry, you may not get the rig back before the grass is knee-high. ★★★

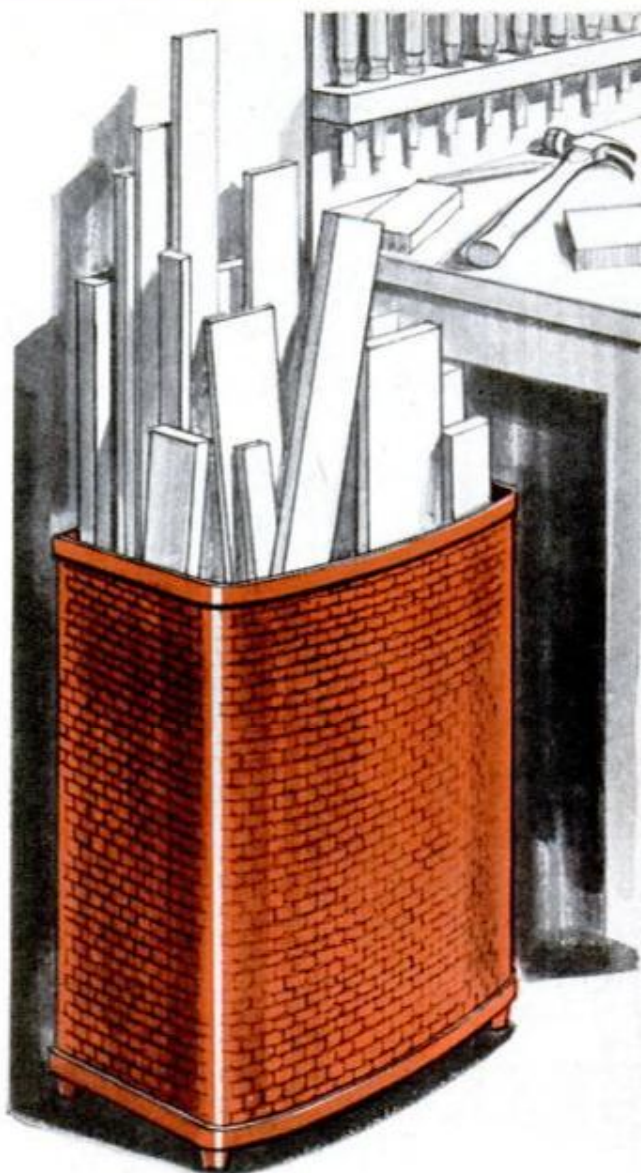
Solving home problems



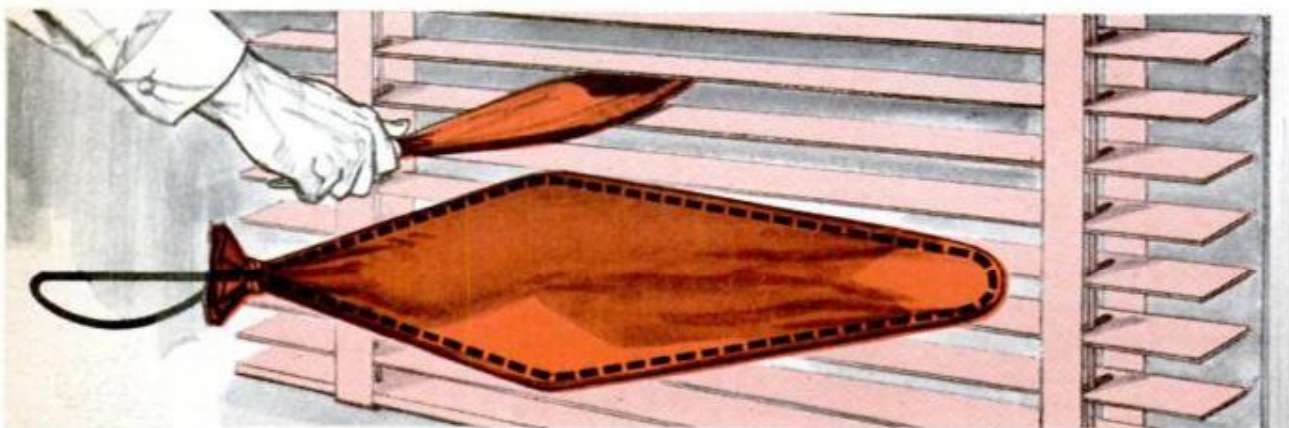
BROOM HOLDER mounted next to your front door will provide a fine place for the newsboy to put your newspaper. The paper can't blow away when pinched in its grip, and you won't have to stoop to pick it up



BY CUTTING the top portion of an old wooden coat hanger down the middle, you can turn it into two handy doorstops. Taper the narrow ends, if necessary, in order to fit the doors, then sand and varnish them



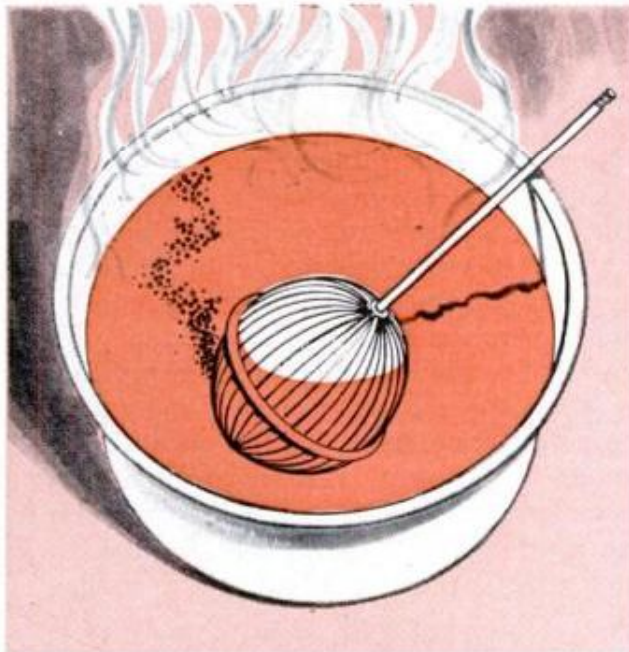
IDEAL STORAGE BIN for odd lengths of lumber can be made from a discarded laundry hamper. If your wife has been asking for a new hamper, buy it and put the old one in your shop after removing top



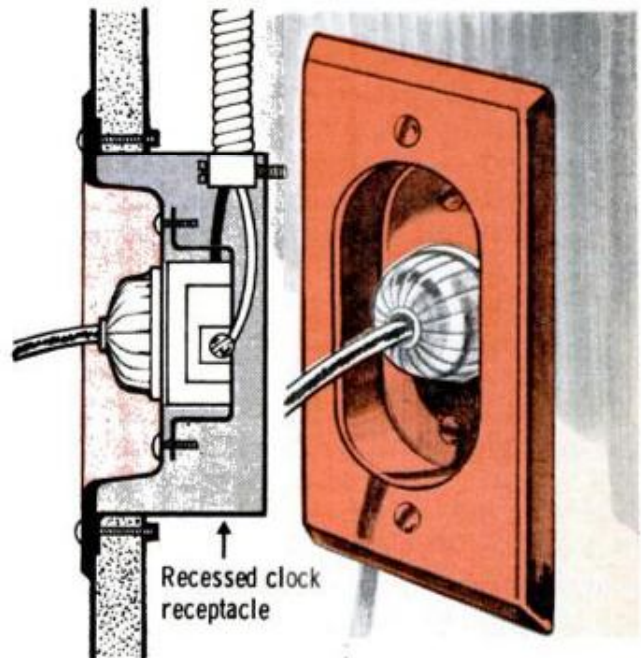
GOOD TOOL for cleaning venetian blinds is just a wire coat hanger bent as shown so two or three men's socks can be pulled over end. Use a rubber band to hold the sock tops in place and close hook to make handle



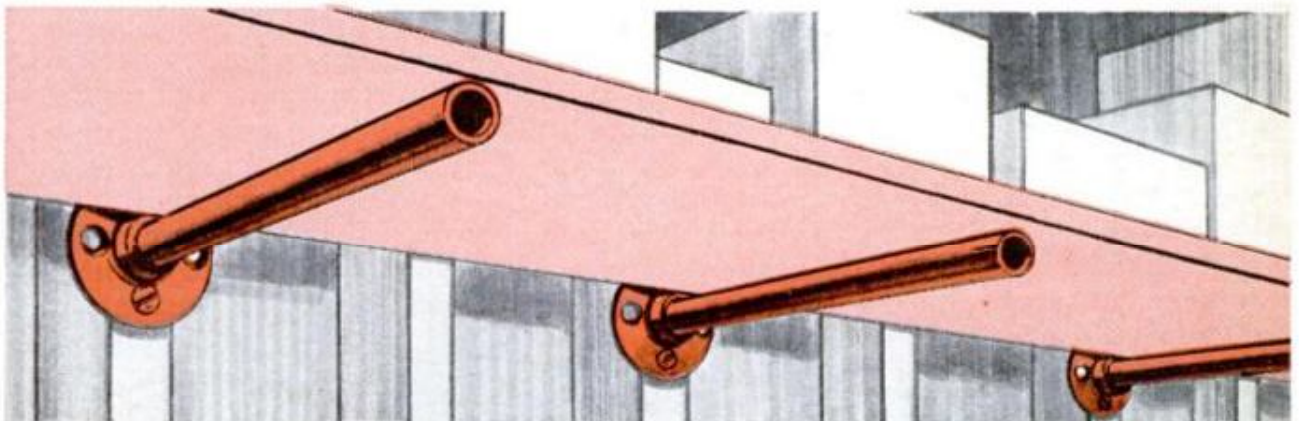
PATIO PICNICS will be even more pleasant this summer if you make a cover to keep insects away from the potato salad and cold cuts. Just remove the fabric from discarded lamp shade and replace with cheesecloth



TO LOCATE A LEAK in a metal toilet-tank float, chill it in the refrigerator for an hour or so, then submerge it in hot (but not boiling) water. Heat will make air inside expand and bubble out through leak



RECESSED RECEPTACLE designed for use with wall clocks is also great for locations where furniture is right against wall, such as a headboard or dresser. Prevents chafing wire and possible short circuit



BIG-LOAD SHELVES for garage or shop are supported on shelf brackets made by mounting 1-in. pipe flanges on every other stud and threading pipes of desired length into them. Be sure to align flanges carefully

What the New Plywood Grading System Means to You



The selection of a plywood panel for a specific job needn't be a pick-and-pray proposition any longer. The American Plywood Assn. has changed the system—changed it for the better

By LEONARD SABAL, Workshop Editor

ONCE A SIMPLE and uncomplicated product, plywood has grown to the point today where its family tree has sprouted a separate branch for some 30 different wood species—each with specific strength, stiffness and structural characteristics and capabilities.

Along with the growing pains came an expanding list of confusing symbols, terse abbreviations and fanciful myths that soon indicated the need for a change from the old "face/back and type of glue" method of selection.

The end result is Product Standard 1-66, a modernized system of designating plywood according to species, strength, stiffness, type of glue and appearance. What's more, this updated grading system covers plywood for both consumer and industrial applications. Previously, three different commercial standards were used—in fact, sheathing alone often required as many as 30 different panel markings.

What does this all mean to you? Simply that the new standard makes the right type of plywood for any job much easier to select and more economical to buy. Written in terms of your needs, the new system uses identification marks and stamps that show you at a glance the structural properties of any panel of plywood.

Some new terms have been introduced to help with the identification of plywood. The first of these is *Group*, an indication of stiffness. As shown on the opposite page, the 30-odd wood species have been classified into Groups 1 through 4, based upon the stiffness of each species. The lower its group number, the greater the strength and stiffness of a panel.

Structural I and *Structural II* are the new designations for C-D sheathing, made *only* with exterior glue. Structural I uses only Group 1 species and therefore is stronger than Structural II, which is made with species from Groups 1, 2 or 3.

Standard Sheathing replaces the old C-D grade, and is made with interior glue unless otherwise stamped. It may be made of any of the species listed, with no limitations on mixing species for the core or center veneers.

Identification Index is a pair of numbers separated by a slash (/) and is found in the grade-trademark printed on unsanded grades of plywood (Standard Sheathing, Structural I and II, and C-C). The number to the left of the slash denotes the maximum spacing of supports (in inches) when the panel is to be used for roof decking. The number on the right is the maximum recommended spacing of supports when the panel is to be used for subfloor applications.

Thus, a panel with an Identification Index of 32/16 means that for roofing applications, the supports should not be spaced more than 32 in. on centers, while for subfloor uses, the same panel requires that supports be spaced not more than 16 in. o.c. But if it's used as wall sheathing, no reference to the Index is required.

Class, a term used only for Plyform, refers to the different species combinations specifically manufactured for use as concrete forms. Prior to the new grading system, you were faced with selecting from eight different materials for concrete forms. Now, you can simply order Class I, which has a Group 1 face and back; or

SPECIES CLASSIFICATION			
Group 1	Group 2	Group 3	Group 4
Douglas fir 1*	Cedar, Port Orford	Alder, red	Cedar
Larch, Western	Douglas fir 2**	Cedar, Alaska yellow	Incense
Pine, Southern	Fir	Pine	Western red
Loblolly	California red	Lodgepole	Fir, subalpine
Longleaf	Grand	Ponderosa	Pine, sugar
Shortleaf	Noble	Redwood	Poplar, Western
Slash	Pacific silver		Spruce, Engelmann
Tanoak	White		
	Hemlock, Western		
	Lauan		
	Red		
	White		
	Pine, Western white		
	Spruce, Sitka		
		*Douglas fir 1—Washington, Oregon, California, Idaho, Montana, Wyoming, British Columbia, Alberta.	
		**Douglas fir 2—Nevada, Utah, Colorado, Arizona, New Mexico.	

VENEER GRADES	
N	"Natural finish" veneer, all heartwood or sapwood. Free of open defects.
A	Smooth and paintable with neatly made repairs. Also used for natural finish in less demanding applications.
B	Solid surface veneer with circular repair plugs and tight knots.
C	Knotholes to 1", occasional knotholes 1/2" larger permitted providing total width of all knots within a specified section does not exceed certain limits. Limited splits permitted. Minimum veneer permitted in Exterior-type plywood.
C	Improved C veneer with splits limited to 1/8" in width; knotholes and borer holes limited to 1/4" by 1/2".
Plgd.	
D	Permits knots to 2 1/2" in width and 1/2" larger under certain specified limits. Limited splits permitted.

you can choose Class II, which is made with Group 1 or Group 2 face and back.

Type designations haven't changed from those under the old standards. Plywood is still manufactured in two types: *Exterior*, with 100 percent waterproof glue; and *Interior*, with moisture-resistant glue. The only other difference between the two types is that under the new grading system, Interior plywood can have inner plies of a lower grade than those in panels of Exterior plywood.

Continue to specify Exterior plywood for all exposed applications or where extreme moisture is likely to be experienced often (a bathroom subfloor, for example). Where moisture is not a primary factor, choose Interior plywood. But if in doubt as to future moisture conditions, opt for Exterior plywood. The difference in cost for stock sizes is nominal—troublefree results are worth many times that.

Veneer grades of plywood also haven't changed much under the new Product Standard criteria. N-grade is the modern term to use when you want a top-quality panel for natural-finish applications (such as on desktops, coffee tables and finely crafted cabinets).

For less demanding applications, A-grade veneers either can be finished naturally or painted. Similarly, B-grade veneers also present a smooth surface suitable for painting. However, C, C-plugged and D veneer grades should not be used where they will be visible. Even when painted, these three grades have splits that mar the finished surface.

Thus, it stands to reason that for furniture and similar projects, your choice of plywood will depend primarily on the desired appearance. In this case, the chart on the next page should prove invaluable. For construction purposes, use the chart

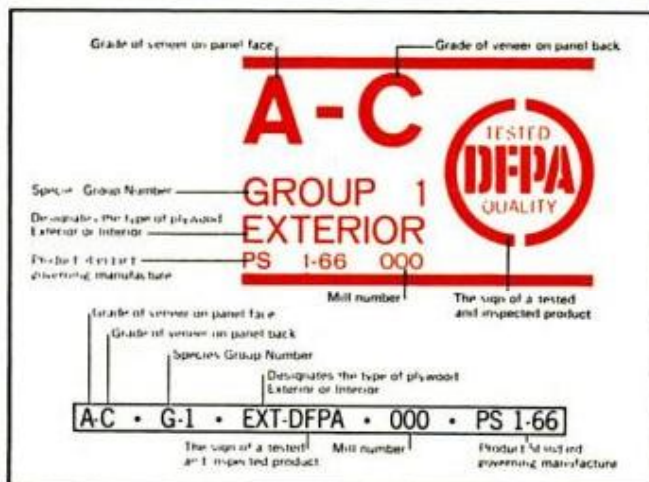
SELECTING FOR APPEARANCE

	Use these symbols when you specify plywood	Description and Most Common Uses	Veneer Grade			Most Common Thickness (4'x8' Panels)							
			Face	Back	Inner Plies	1/4	3/8	1/2	5/8	3/4	1		
INTERIOR TYPE	N-N, N-A, N-B, N-D INT-DFPA	Natural finish cabinet quality. One or both sides, select all heartwood or all sapwood veneer. For furniture having a natural finish, cabinet doors, built-ins. Use N-D for natural finish paneling.	N	N, A B or D	C or D								
	A-A INT-DFPA	For interior applications where both sides will be on view. Built-ins, cabinets, furniture and partitions. Face is smooth and suitable for painting.	A	A	D								
	A-B INT-DFPA	For uses similar to Interior A-A but where the appearance of one side is less important and two smooth solid surfaces are necessary.	A	B	D								
	A-D INT-DFPA	For interior uses where the appearance of only one side is important. Paneling, built-in, shelving, partitions.	A	D	D								
	B-B INT-DFPA	Interior utility panel for use where two smooth sides are desired. Permits circular plugs. Paintable.	B	B	D								
	B-D INT-DFPA	Interior utility panel for use where one smooth side is required. Good for backing, sides or built-ins. Industry: shelving, slip sheets, separator boards and bins.	B	D	D								
	DECORATIVE PANELS	Rough-sawn, brushed, grooved or striated faces. Good for interior accent walls, built-ins, counter facing, displays and exhibits.	C or btr.	D	D								
PLYRON INT-DFPA	Hardboard face on both sides. For countertops, shelving, cabinet doors, flooring. Hardboard faces may be tempered, untempered, smooth or screened.			C & D									
EXTERIOR TYPE	A-A EXT-DFPA*	Use where the appearance of both sides is important. Fences, built-ins, signs, boats, cabinets, commercial refrigerators, shipping containers, tote boxes, tanks and ducts.	A	A	C								
	A-B EXT-DFPA*	For use similar to A-A EXT panels but where the appearance of one side is less important.	A	B	C								
	A-C EXT-DFPA*	Exterior use where the appearance of only one side is important. Sidings, soffits, fences, structural uses, boxcar and truck lining and farm buildings. Tanks, trays, commercial refrigerators.	A	C	C								
	B-B EXT-DFPA*	An outdoor utility panel with solid paintable faces for uses where higher quality is not necessary.	B	B	C								
	B-C EXT-DFPA*	An outdoor utility panel for farm service and work buildings, boxcar and truck linings, containers, tanks, agricultural equipment.	B	C	C								
	HDO EXT-DFPA*	Exterior type High Density Overlay plywood with hard, semi-opaque resin-fiber overlay. Abrasion resistant. Painting not ordinarily required. For concrete forms, signs, acid tanks, cabinets, countertops.	A or B	A or B	C Plugged								
	MDO EXT-DFPA*	Exterior type Medium Density Overlay with smooth, opaque resin-fiber overlay heat-fused to one or both panel faces. Ideal base for paint. Usually recommended for siding and other outdoor applications. Also good for built-ins, signs and displays.	B	B or C	C								
	303 SPECIAL SIDING EXT-DFPA	Grade designation covers proprietary plywood products for exterior siding, fencing, etc., with special surface treatment such as V-groove, channel groove, striated, brushed, rough sawn.	B or btr.	C	C								
	T 1-11 EXT-DFPA	Exterior type, sanded or unsanded, shiplapped edges with parallel grooves 1/4" deep, 3/8" wide. Grooves 2" or 4" o.c. Available in 8' and 10' lengths and MD Overlay. For siding and accent paneling.	C or btr.	C	C								
	PLYRON EXT-DFPA	Exterior panel surfaced both sides with hardboard for use in exterior applications. Faces are tempered, smooth or screened.			C								
	MARINE EXT-DFPA	Exterior type plywood made only with Douglas fir or Western larch. Special solid jointed core construction. Subject to special limitations on core gaps and number of face repairs. Ideal for boat hulls. Also available with overlaid faces.	A or B	A or B	B								
SPECIAL EXTERIOR	Premium Exterior panel similar to Marine grade but in other species covered under new grading system.	A or B	A or B	B									

*Also available in Structural I (face, back and inner plies limited to Group 1 species).

SELECTING FOR CONSTRUCTION

INTERIOR TYPE	Use these symbols when you specify plywood (1) (2)	Description and Most Common Uses	Veneer Grade			Most Common Thickness (4'x8' Panels) (3)								
			Face	Back	Inner Plies	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1 1/8	
INTERIOR TYPE	STANDARD INT-DFPA (4)	Unsanded interior sheathing grade for floors, walls and roofs. Limited exposure crates, bins, containers and pallets.	C	D	D									
	STANDARD INT-DFPA (4) (with Exterior glue)	Same as Standard sheathing but has Exterior glue. For construction where unusual moisture conditions may be encountered. Often used for pallets, crates, bins, etc. that may be exposed to the weather.	C	D	D									
	STRUCTURAL I and STRUCTURAL II INT-DFPA	Unsanded structural grades where plywood strength properties are of maximum importance. Structural diaphragms, box beams, gusset plates, stressed skin panels. Also for containers, pallets, bins. Made only with Exterior glue. Structural I limited to Group 1 species for face, back and inner plies. Structural II permits Group 1, 2, or 3 species.	C	D	D									
	UNDER-LAYMENT INT-DFPA (4)	For underlayment or combination subfloor-underlayment beneath resilient floor coverings, carpeting. Used in homes, apartments, mobile homes, commercial buildings. Ply beneath face is C or better veneer. Sanded or touch-sanded as specified.	Plugged C	D	C & D									
	C-D PLUGGED INT-DFPA (4)	For utility built-ins, backing for wall and ceiling tile. Not a substitute for Underlayment. Ply beneath face permits D grade veneer. Also for cable reels, walkways, separator boards. Unsanded or touch-sanded as specified.	Plugged C	D	D									
	2-4-1 INT-DFPA (5)	Combination subfloor-underlayment. Quality base for resilient floor coverings, carpeting, wood strip flooring. Use 2-4-1 with Exterior glue in areas subject to excessive moisture. Unsanded or touch-sanded as specified.	Plugged C	D	C & D									
EXTERIOR TYPE	C-C EXT-DFPA (4)	Unsanded grade with waterproof bond for subflooring and roof decking, siding on service and farm buildings. Backing, crating, pallets, pallet bins, cable reels.	C	C	C									
	C-C PLUGGED EXT-DFPA (4)	Use as a base for resilient floors and tile backing where unusual moisture conditions exist. For refrigerated or controlled atmosphere rooms. Also for pallets, fruit pallet bins, reusable cargo containers, tanks and boxcar and truck floors and linings. Sanded or touch-sanded as specified.	Plugged C	C	C									
	STRUCTURAL I C-C EXT-DFPA	For engineered applications in construction and industry where full Exterior type panels made with all Group 1 woods are required. Unsanded.	C	C	C									
	PLYFORM CLASS I & II B-B EXT-DFPA	Concrete form grades with high re-use factor. Sanded both sides. Edge-sealed and mill-oiled unless otherwise specified. Special restrictions on species. Also available in HDO.	B	B	C									
<p>Notes: (1) All Interior grades shown also available with Exterior glue. (3) Panels are standard 4x8-foot size. Other sizes available. (2) All grades except Plyform available tongue and grooved in panels 1/2" and thicker. (4) Available in Group 1, 2, 3 or 4. (5) Available in Group 1, 2 or 3 only.</p>														



above to determine quickly the material best suited for a particular job, either indoors or out.

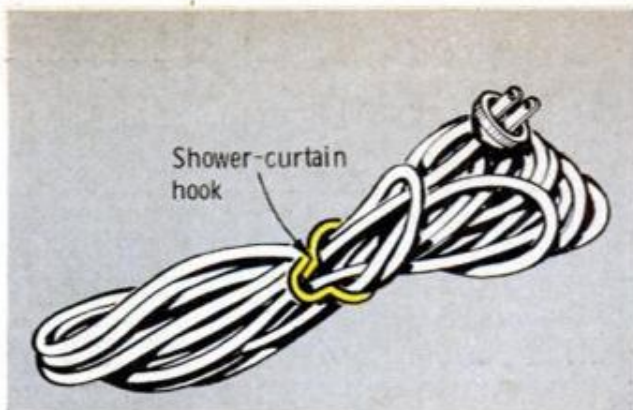
But regardless of whether the panel you buy is to become part of a kitchen subfloor or a stereo console, make certain that the panel bears the DFP A backstamp or edge-mark of the American Plywood Assn., as shown at the left. Either of these will show you exactly what you're getting for your money—either can be considered to be the Good Housekeeping Seal of the plywood industry. ★★★

HINTS

FROM READERS

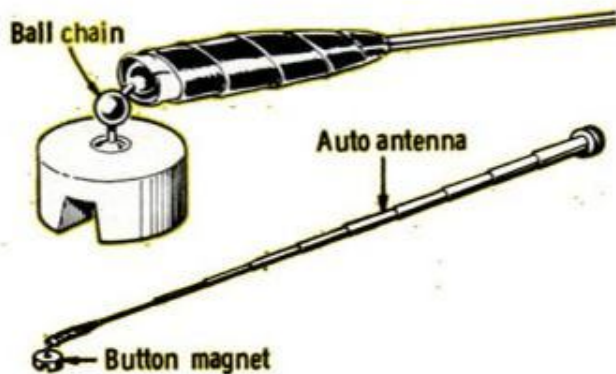
Clips hold electric cords

The simplest way of keeping electric cords neatly coiled is to fasten them with one of those metal shower curtain clips similar to a large safety pin. Keep this in mind for power-tool cords and extension cords.—*Henry Mullen*



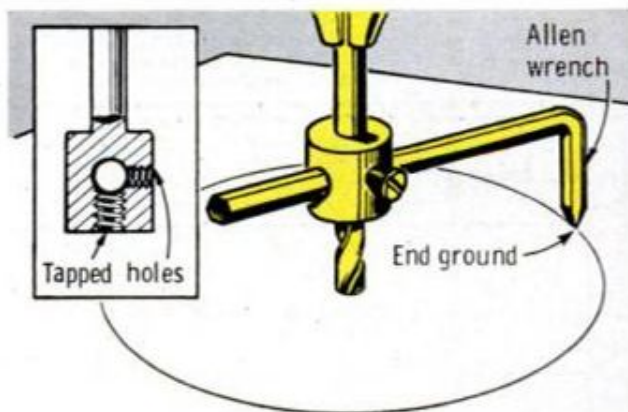
Make a long-arm retriever

When a steel screw or nut falls down where you can't reach it, you'll be glad to have this adjustable pickup rod. It's just a car antenna with a button magnet dangling from the end. The magnet is attached to the telescoping antenna with a short length of ball chain, secured with rubber tape. The collapsible rod will fit your toolkit perfectly.—*Joseph Braunstein*



Improved disc cutter

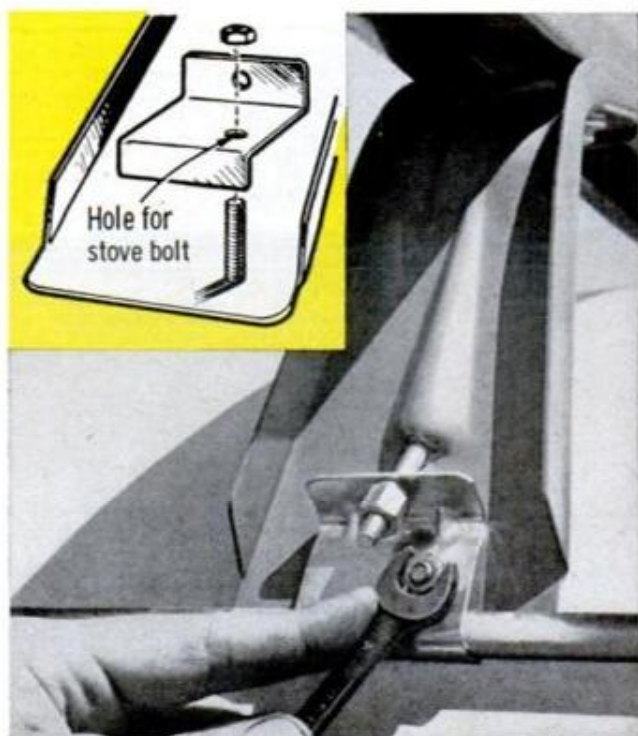
A worn Allen wrench can be turned into a useful disc cutter simply by grinding a bevel on the short end and making a holder for it to fit your drill-press chuck. Turn the holder to proper size, then drill and tap the shouldered end for a threaded drill's shank. Drill a hole cross-wise for the wrench. Drill and tap a third hole for a setscrew that is tightened against the drill to lock it.—*Peter Legon*



Lockbolt for cartop rack

If you have a cartop luggage rack of the type supported on metal brackets which rest in the rain gutter, here's an easy modification to prevent it from working loose, even on roughest roads. With the rack in place, drill a hole through the outer metal clamp which looks over the gutter; keep drilling through the inner piece that rests in the gutter. Don't rush the job or you might accidentally drill into the cartop. Now loosen the rack so you can slip a 1-in. stovebolt through these two holes. With the bolt in place push the clamp back down over the gutter and secure it by tightening a nut and lockwasher on the bolt.

Install one of these lockbolts on each of the four clamps and you'll find it's just about impossible for the rack to work loose.—*John Seginski*





How to Install Your Own Garage-Door Opener

No longer a luxury, an automatic door opener is now a necessity. From the standpoint of protection alone, you owe one to your family

By CLIFFORD B. HICKS

Technical Art by ZIK Associates, Ltd.

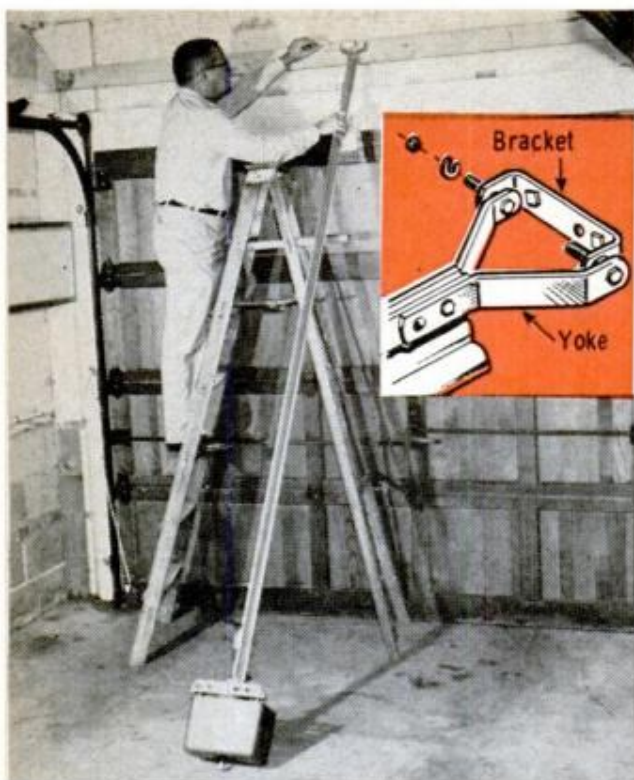
IT'S RAINING BUCKETS and black as midnight as you turn into the drive. Your wife is dressed to the hilt, and you have on your best suit. Who's to open the garage door?

You push a button in your car and the door rises smoothly upward. There's a welcoming light inside the garage, and it stays on for a short period of time after the door has closed, then turns itself off

automatically. What's more, you're inside—and dry.

Garage-door openers have been around for a good many years, but until recently they have been considered luxury items. Now they're priced low enough to fit almost every budget.

Best of all (and somewhat surprisingly so), improved design has made door openers simple to install. As a test, I in-



A BRACKET IS LAGSCREWED to the door header or (in this case) to a 2x4 spiked above the opening



BRIDGING TO SUPPORT MOTOR END of track is long enough to span three joists and bolts to them



OPEN DOOR supports track when anchoring motor end to bridging, permits working without helper

stalled the unit shown here in about four hours, without a lick of help.

The convenience of an automatic door opener is obvious, but there is one other advantage that is frequently overlooked: safety. The door is anchored firmly in the down position with steel bracing inside the garage. No one can break in by picking a lock; there's no way to get through that door without bashing it apart. Furthermore, if your wife drives home alone after dark, she can remain inside a locked car until she is inside the garage, with the garage door locked behind her.

There are two general types of door openers: One works on a worm gear, the other on a pulley-and-chain-drive arrangement. The unit shown here is the Alliance Genie, a compact worm-gear opener which sells for \$169.95.

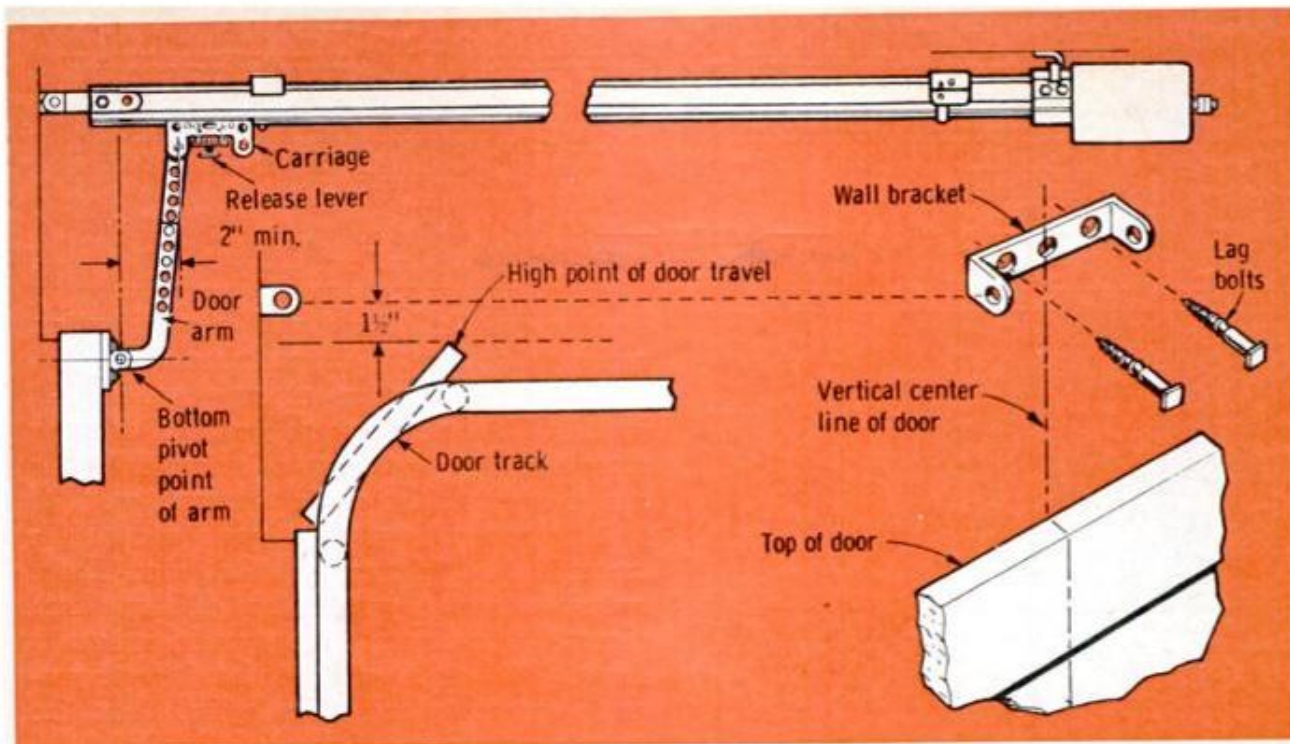
Installation is a breeze. The basic mechanism is delivered fully assembled. All you have to do is anchor one end of the track *above* the door, bolt a bracket to the door, and suspend the motor end of the unit from the ceiling. Only the latter step poses any problems, depending upon your own garage. The opener operates, in effect, on a tug-of-war principle against the header.

The first step is to adjust the manual door operation so that it opens and closes easily. Then a bracket is lagscrewed to the header above the door. In the installation shown here (in a concrete-block garage), the header did not extend high enough to mount the bracket, so a 2x4 was bolted above the door to provide a firm anchor support.

The next step is what makes installation easy. The entire unit is simply leaned up against the header, and a Y-shaped yoke pinned to the bracket. One end of the opener now is solidly installed, and you're halfway home.

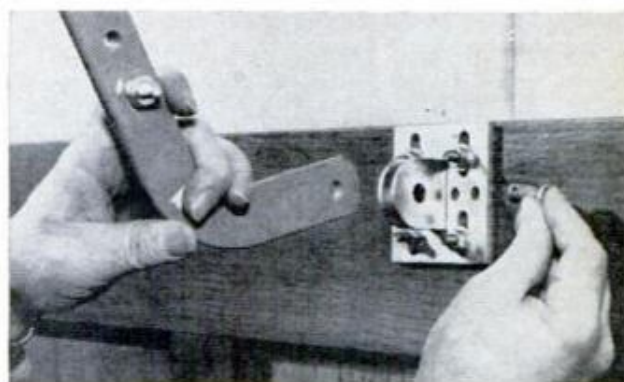
Next, you pivot the motor end upward until the track is approximately horizontal (you'll probably have to climb a step-ladder), hold it in this position, and holler for someone to open the garage door manually (okay, so you *do* need three seconds of help from someone else!). With the door in its overhead, or horizontal, position, you lower the track until it is resting on the door itself.

The track then is shimmed up with blocks of wood until it is level or will clear the high point of door travel. At this

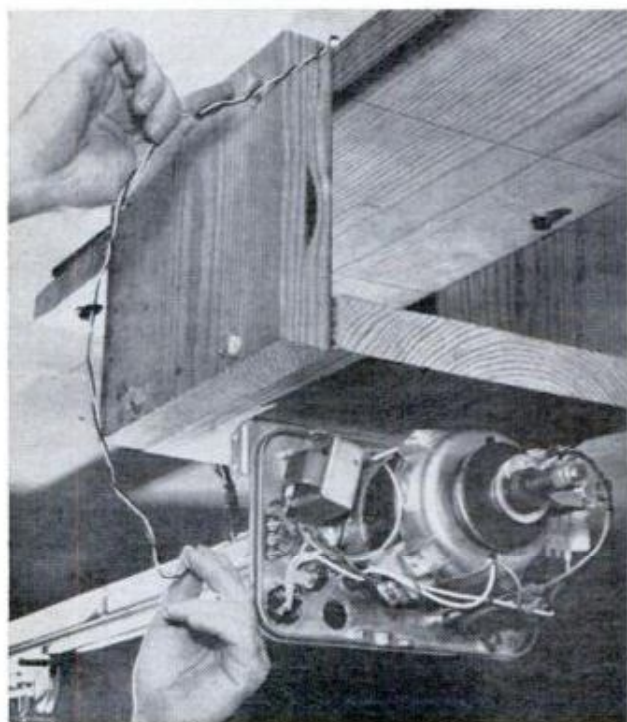


point you can measure the distance that must be bridged down from the ceiling (or overhead beams) to the motor end of the unit. This bridging should be strong enough to suspend the opener from the ceiling. The bridging shown here was made of 2x12s, with the base piece long enough so it could be lagscrewed to three different ceiling joists.

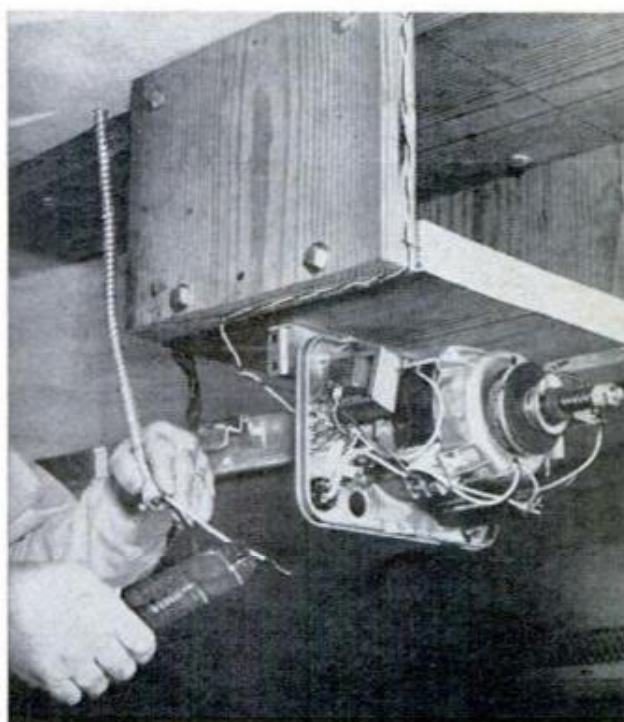
Now it's a simple matter to lagscrew the opener to the bridging, which completes the basic installation. You run in an electrical supply to conform with your



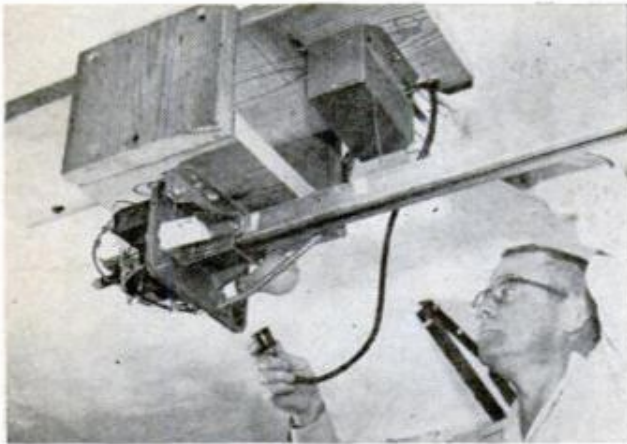
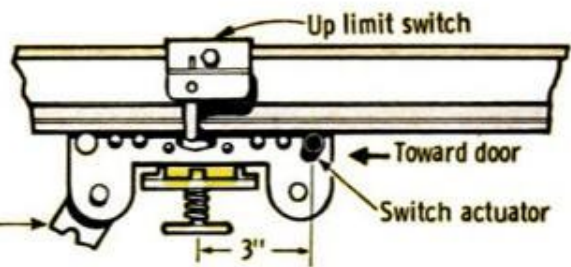
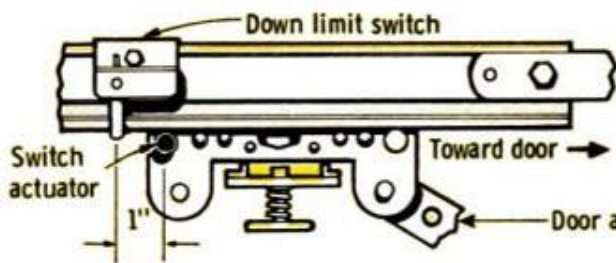
ARM WHICH TRAVELS IN TRACK to raise or lower door, is fastened to door bracket with a clevis pin



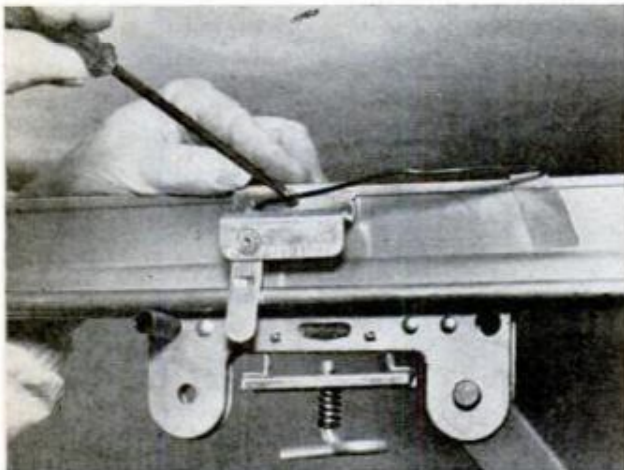
BELL WIRE is used for manual-control wiring. Here wire is run to any convenient location inside garage



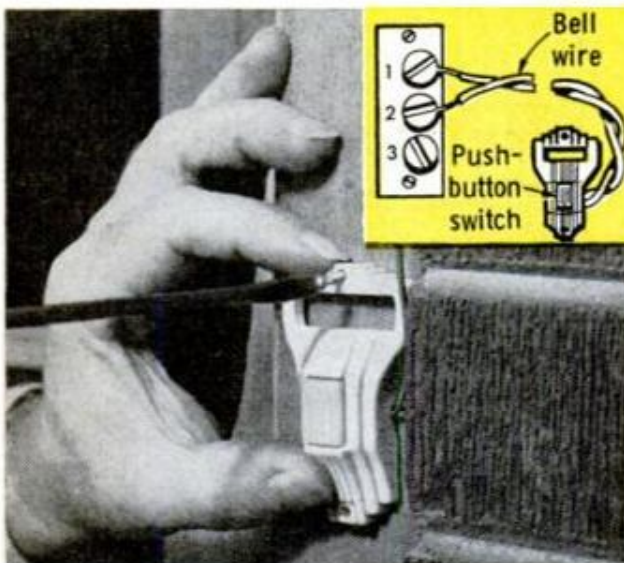
ELECTRICAL SUPPLY is run to unit as required by local code. It may be plugged in nearby outlet



RADIO RECEIVER can be installed anywhere near motor, then plugged in. Copper wire is the antenna



TWO LIMIT SWITCHES along top of track control door travel. Setscrews lock them in precise position



PUSHBUTTON AT HOUSE DOOR lets you open and close the garage door without access to transmitter

local code. Bell wire and a pushbutton are provided with the unit, and you install the pushbutton at any convenient spot inside the garage so you can open or close the door without climbing into the car to operate the radio transmitter.

An electrical switch at each end of the track limits the travel of the door. These switches are adjusted by sliding them along the track until they are in precisely the right spots to permit the door to operate smoothly and completely. Then the switch screws are tightened firmly.

The radio receiver is a compact metal box that can be installed with two screws anywhere near the opener. The control cord from the receiver simply is plugged into the socket in the door opener.

The little transmitter that goes in the car is about the size of a transistor radio. It fits inside a plastic case, which can be installed under the dash or clipped to the sun visor. In either case, the transmitter can be slipped out of the case if you want to move it from one car to another. If yours is a two-car family, you may prefer to buy an additional transmitter.

The final step in the installation is to adjust the safety clutch, which prevents the door from damaging anything—car, bicycle or even a child—that may inadvertently be in its way as the door moves smoothly downward. This is done by pushing upward against the door as it moves down. If excessive force is required to stop the door (a switch automatically turns off the motor when pressure is exerted), you adjust the safety mechanism by adjusting the nuts on the rear of the unit.

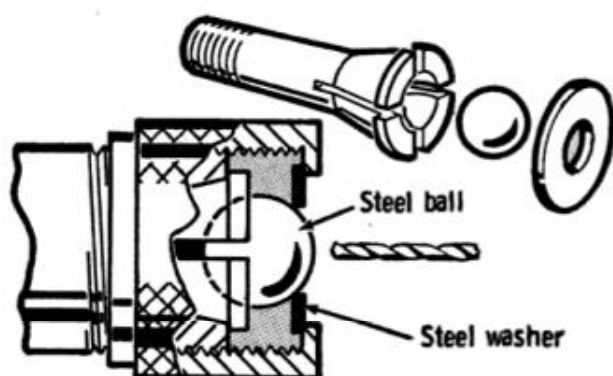
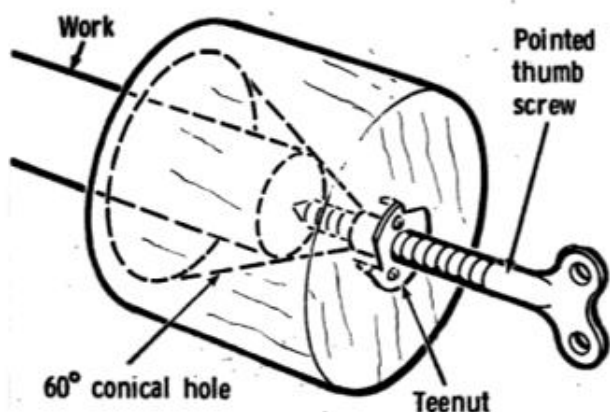
In case you ever want to disengage the automatic opener (for example, in case a local power failure occurs), you rotate and pull down a release handle and the door then can be operated manually.

You won't want to be without the garage-door opener for long, though. Like a garbage disposer or a dishwasher, a radio-controlled opener soon leaves the luxury class, and becomes a necessity. ★★★

HINTS FROM READERS

Dowel center marker

Here's an easy-to-make tool for center-marking various sized dowels. Center a round hardwood block in the lathe and drill a hole through its center for a $\frac{1}{4}$ -20 Teenut, then bore a tapering hole about two-thirds through. Anchor nut with two small screws through flange. Use a pointed thumbscrew as a marker.—Peter Legon

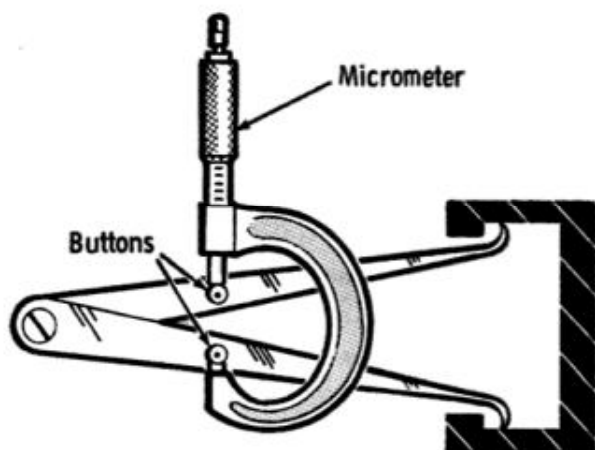
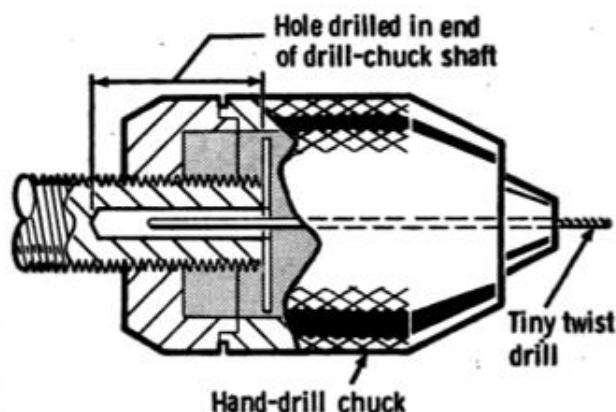


Drilling balls on lathe

A simple setup using the lathe's collet attachment makes it possible to drill small steel balls accurately. To accomplish this, use a collet that seats the ball deepest without letting it pass through, and place a washer with the same size hole inside the nose cap. Screw the cap on tightly and the work will center itself. Larger balls are held the same way in the collet closer. Be sure all work is seated deeply enough for the cap to catch several of the spindle's threads.—Peter Legon

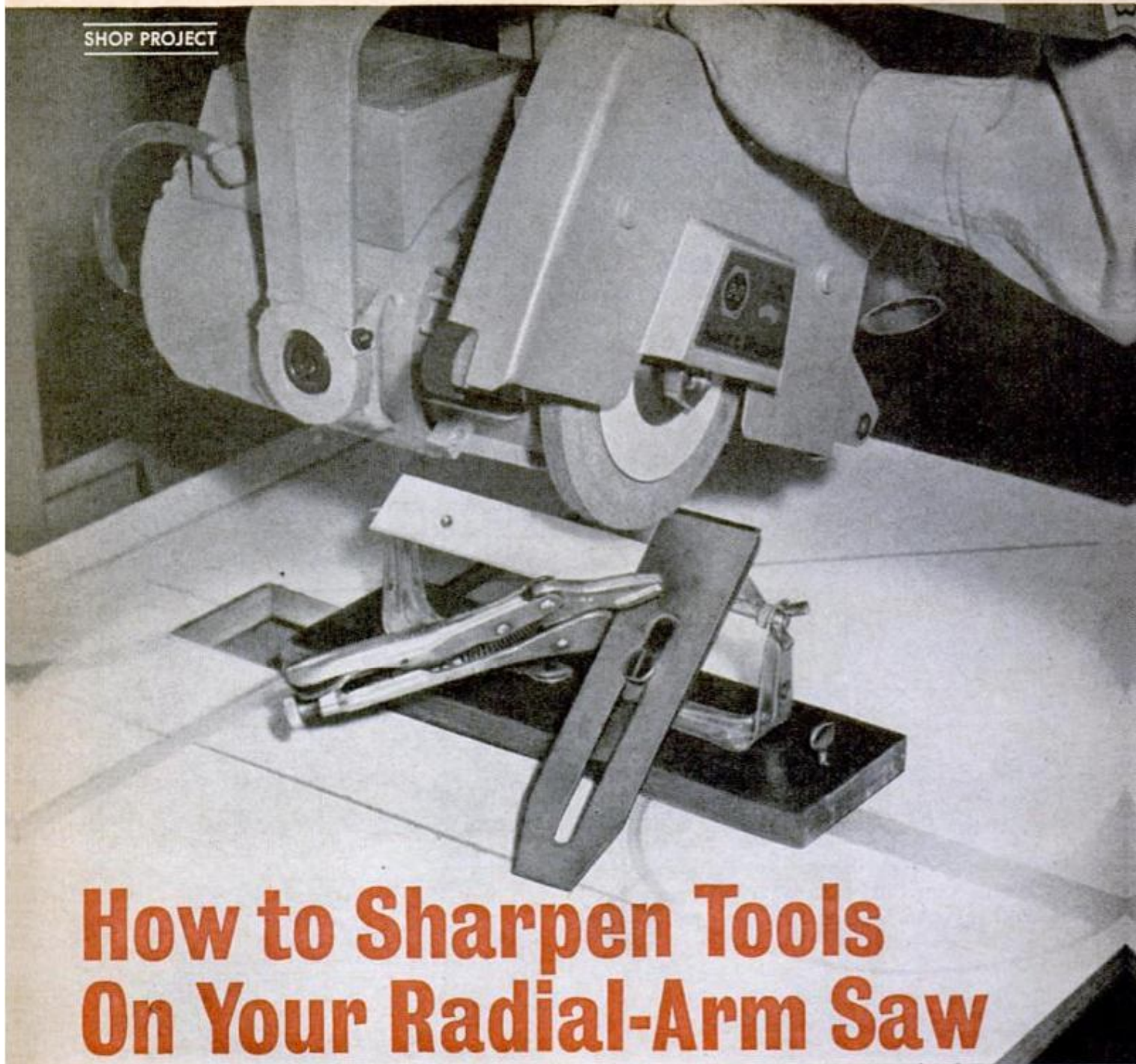
Deep chuck for small drills

Tiny drills of number size have a tendency to bend and break easily. However, you can prevent this by modifying the chuck so that small drills can be seated more deeply, leaving only enough protruding to accomplish the job at hand. Simply take the chuck apart and drill a $\frac{3}{16}$ -in. hole through the plate that pushes the jaws out. Also, drill a matching hole in the shank, making it deep enough so that the chuck will take the full length of a $\frac{1}{16}$ -in. or smaller drill.—James E. Kniseley



Measuring flanged holes

Adding toolmaker's buttons to a pair of inside calipers will make it possible for you to use them to take accurate diameter measurements inside flanged holes. Set the caliper points inside the flange and mike the buttons. Then remove the calipers from the hole and use the micrometer to reset them to the same distance between the buttons. Finally, measure the distance between points and you have an accurate measurement of the exact diameter inside the flange.—James E. Kniseley



How to Sharpen Tools On Your Radial-Arm Saw

By WILLIAM G. WAGGONER

TAKE FULL ADVANTAGE of your versatile radial-arm saw by adding this simple fixture that converts the saw to a precision sharpening machine.

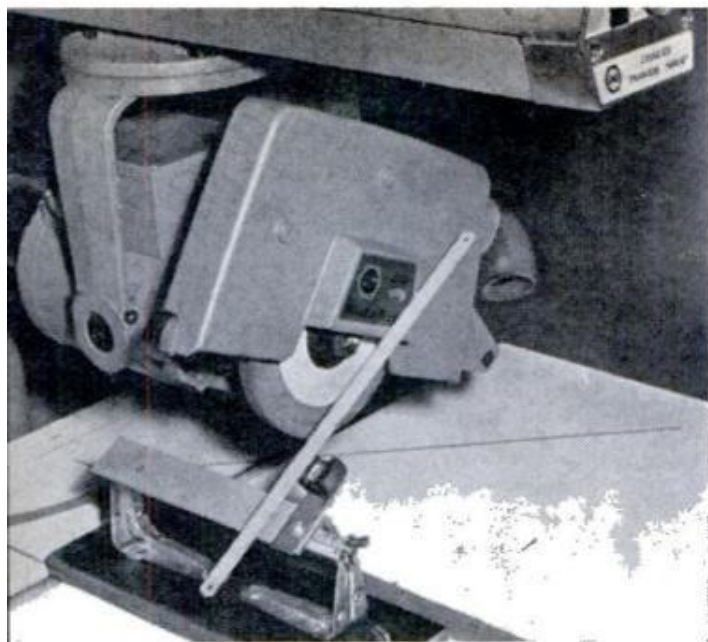
With it, you'll be able to sharpen precisely just about any tool around your home, shop or garden, including hollow-ground chisels, plane irons, jointer and planer knives, wood bits, hedge trimmers, tin snips and other cutting tools.

As shown on the opposite page, the threaded studs welded to the angle iron are headless $\frac{1}{4}$ -20 bolts 2 in. long, with about $\frac{1}{2}$ in. of the threaded portions

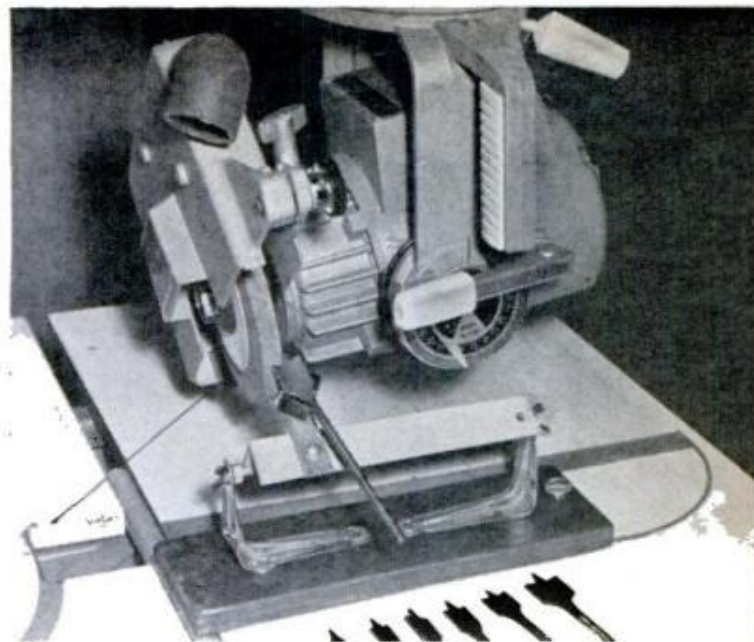
protruding at each end of the angle iron.

To insure alignment of the bolts with each other and with the holes in the shelf brackets, lay a section of $\frac{3}{4}$ -in. angle on the inside of the $1\frac{1}{4}$ -in. angle and position the bolts on the step formed by the smaller angle. Then clamp the two pieces in place and tack-weld the bolts to the $1\frac{1}{4}$ -in. angle. Remove the length of $\frac{3}{4}$ -in. angle and complete the welding.

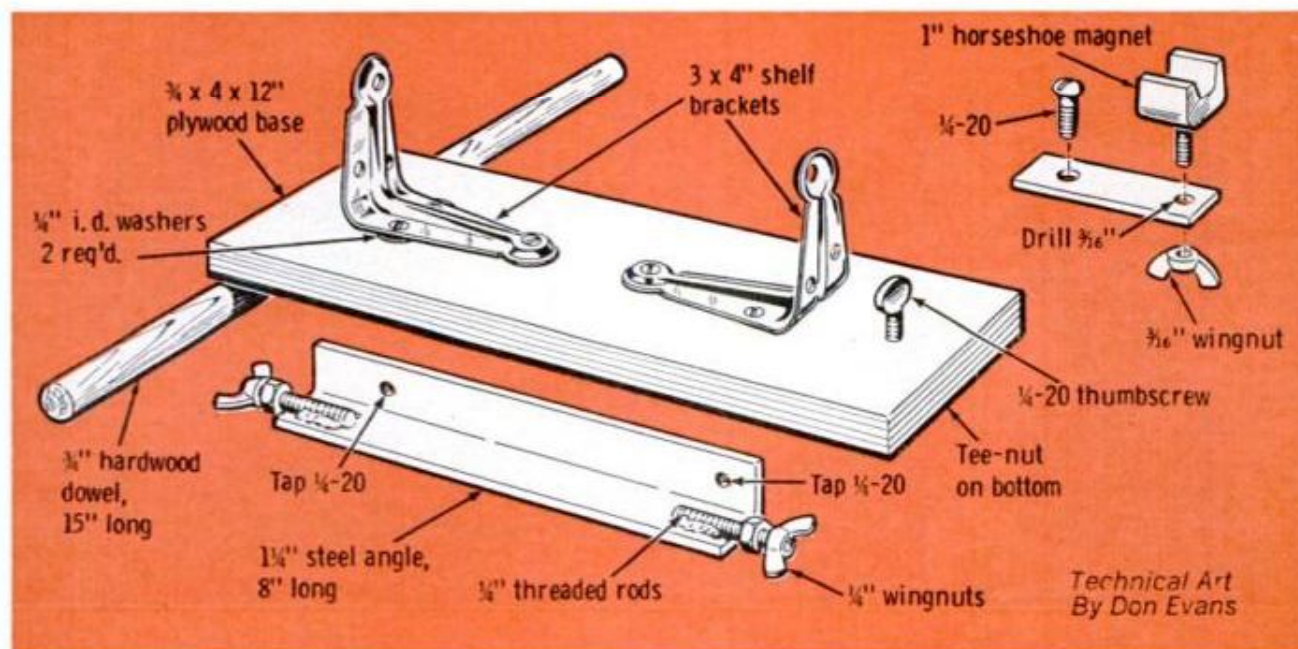
If necessary, enlarge the holes in the shelf brackets by reaming or drilling, then mount them on the bed of $\frac{3}{4}$ -in. plywood. Note that two $\frac{1}{4}$ -in. washers are placed under the bracket at the end of the bed fitted with the length of $\frac{3}{4}$ -in. dowel. At



CORRECT POSITION of the angle iron is indicated when hacksaw blade falls slightly below wheel arbor



WING-TYPE WOOD BITS are among many precision-ground tools you can resharpen quickly, accurately



the other end of the bed, a 1/4-20 thumbscrew and Tee-nut are used to permit adjustment of the bed for slight angles or bevels.

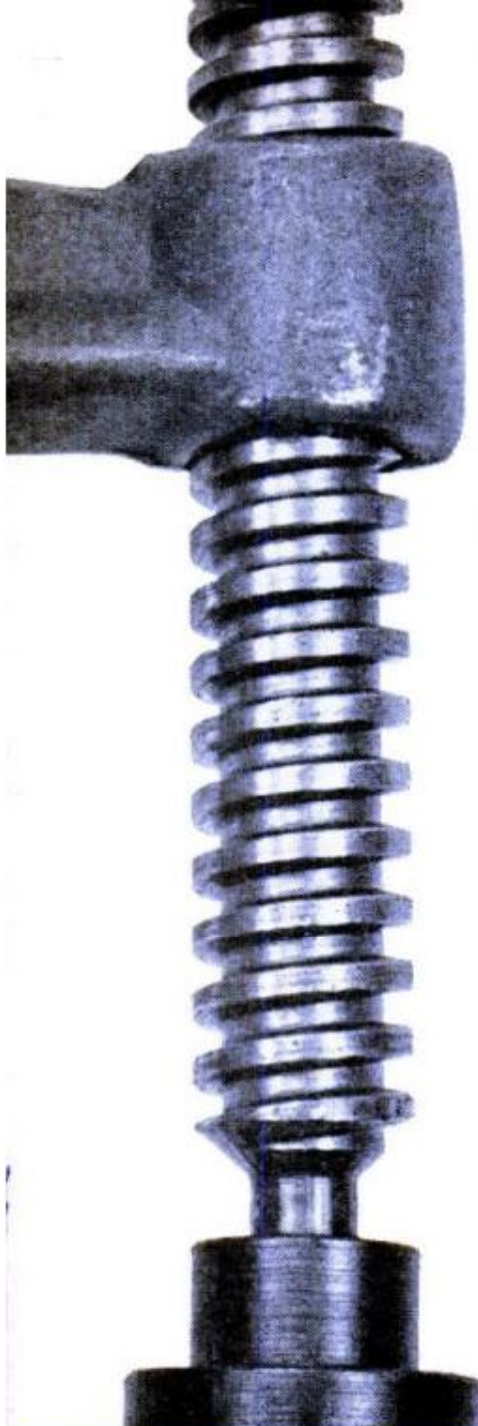
The magnetic toolrest assembly consists of a 1-in. horseshoe magnet fitted to a 2 1/2-in. length of 1/8 x 3/4-in. flat iron. For light sharpening operations, the work can be held by the magnet alone, but for heavier sharpening chores, be sure to clamp the work firmly to the angle iron.

A 100-grit, 6-in.-dia. emery wheel is used on the radial saw. Because the sharpening is always done under the wheel, you can see exactly what you're doing, especially since there is no toolrest, wheel

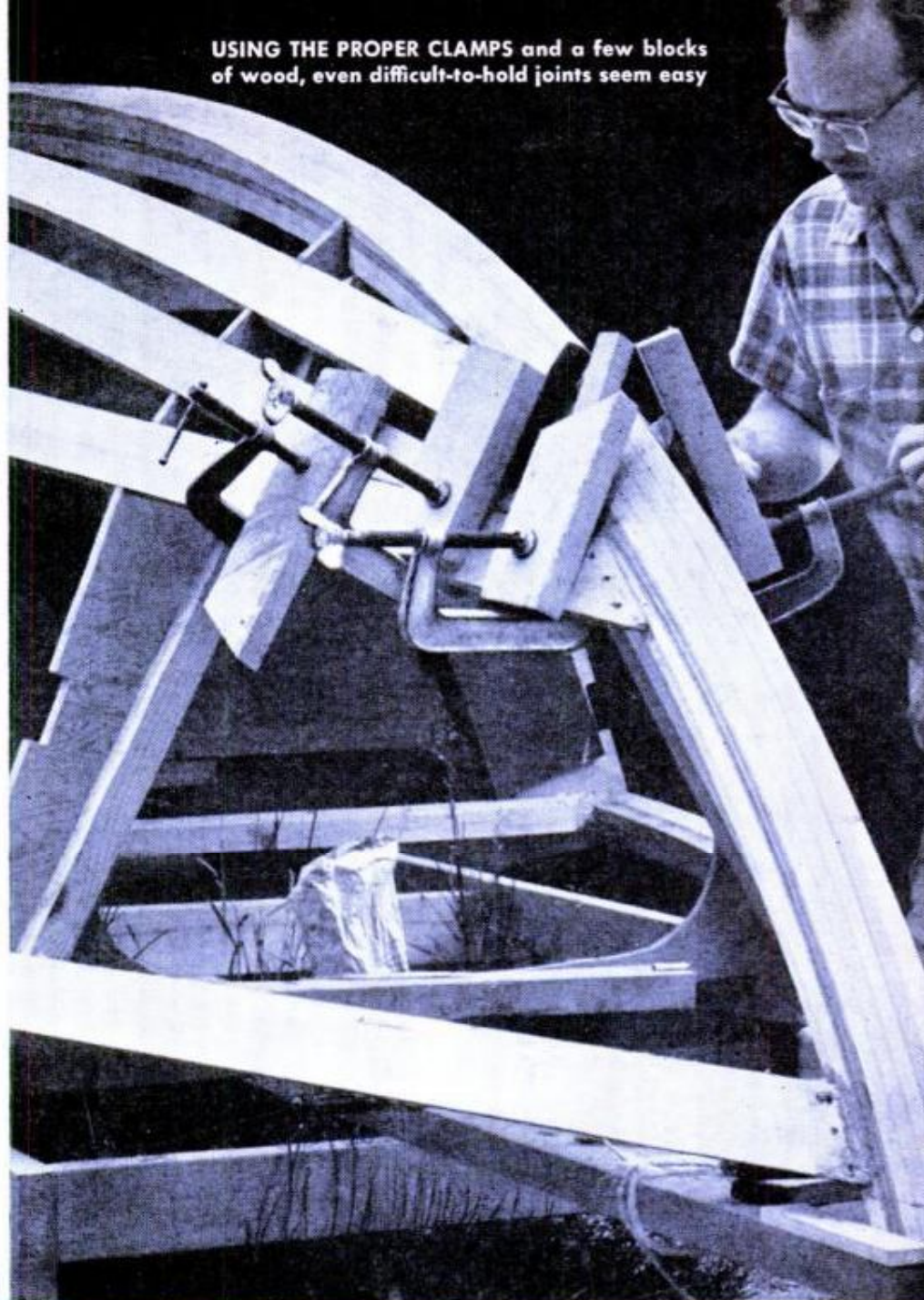
guard or motor housing in the way.

To get the proper plane for sharpening, lay a straightedge, such as a hacksaw blade, on the magnet and adjust the angle iron so the straightedge is slightly below the wheel arbor. Lock in this position. This procedure also provides the correct relief clearance.

Occasionally you'll find it necessary to dress the emery wheel precisely, using a diamond-tipped wheel dresser. Lock the dresser to the angle iron and position it so that it is at a "drag" position in relation to the wheel's rotation. This will also prevent the dresser from gouging pieces out of the wheel. ★ ★ ★



USING THE PROPER CLAMPS and a few blocks of wood, even difficult-to-hold joints seem easy




When It's Time to Put the Pressure on,

Pick the Right Clamp for the Job

Only after you've collected an assortment of the three basic general-purpose clamps should you consider buying special-use clamps. And then you should select carefully

By JOHN BURROUGHS



WHETHER IT'S ACTUATED by a screw, toggle or cam mechanism, a clamp has one prime function—to squeeze. Keep this in mind when searching among the clamps available commercially, and you'll

find that the selection of the right clamp for your shop or the job at hand will depend upon the size and the type of material to be squeezed or compressed.

Compression has three common uses in shopwork. Clamping glued joints is one. Securing stock to be worked with power tools is another. The third is the clamping together of temporarily assembled jigs and fixtures.

For all of these jobs, compression in the range of 100 to 200 lbs. is required. This is the optimum clamping pressure for glued joints. It's sufficient pressure to hold clamped-down work firmly and safely, and to keep jigs from slipping or sliding.

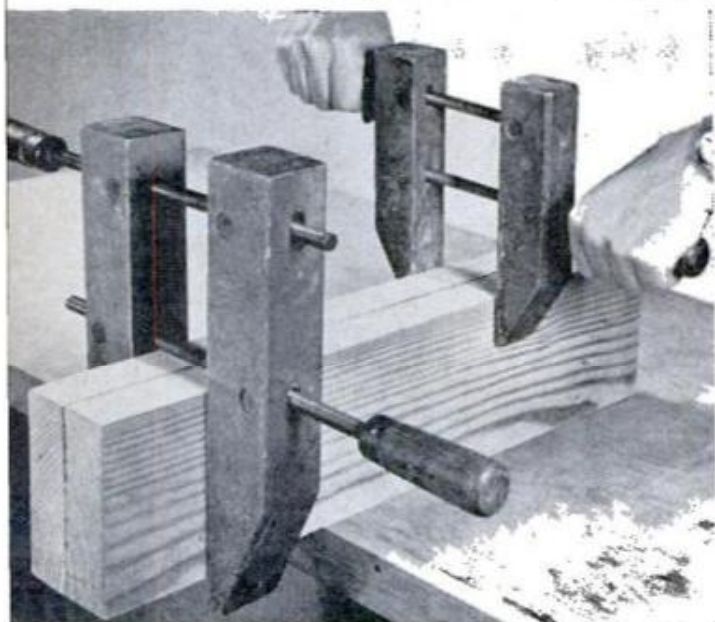
The many different shop clamps used to apply this compression—without damaging or marring the work—can be grouped into two classes: general-purpose clamps and special clamps for specific jobs.

C-clamps, handscrews and short-bar clamps are three useful general-purpose clamps that you should have in your shop. C-clamps (termed G-clamps in England) are so useful in everyday shopwork that they are considered basic hand tools. With enough of them—together with lengths of scrap lumber, blocks and wedges—you can easily improvise clamping setups for just about any job.

Most moderately-priced C-clamps have frames of malleable iron, while top-quality clamps have frames of drop-forged steel, heat-treated Acme-threaded screws and smoothly machined ball-swivel pads.

Frame patterns also differ. Standard-

MAPLE-JAW HANDSCREWS offer inherent advantage of distributing clamping pressure over a broad area



APRIL 1968

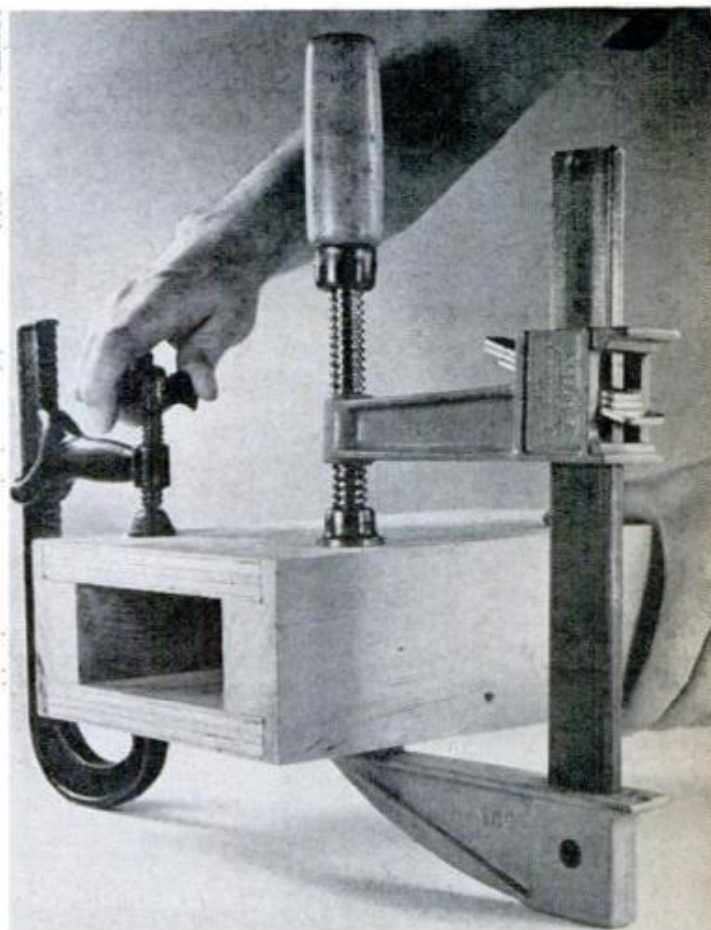
pattern clamps are fine for many jobs, but have a limited depth-of-throat. Both malleable iron and forged steel clamps are available in deep-throat patterns that will prove well worth their extra cost.

Large C-clamps can apply considerable pressure, but because the pressure is applied in one spot, you should always use strips of scrap wood to distribute the pressure evenly. If you're clamping wood, this will prevent the clamp pads from compressing and denting the surface.

Handscrews, for centuries the clamps preferred by fine-furniture craftsmen, have parallel jaws made of straight-grain hard maple. When properly adjusted, the oil-finished jaws apply the pressure evenly over a broad area to grip tightly without marring the work. After you've caught the knack, you'll find that you can adjust a handscrew very quickly by grasping the handles and swinging the jaws around the spindles. Screwing the outer spindle develops leverage and tightens the jaws which, in turn, should always grip the work squarely.

A handscrew's depth-of-throat is half

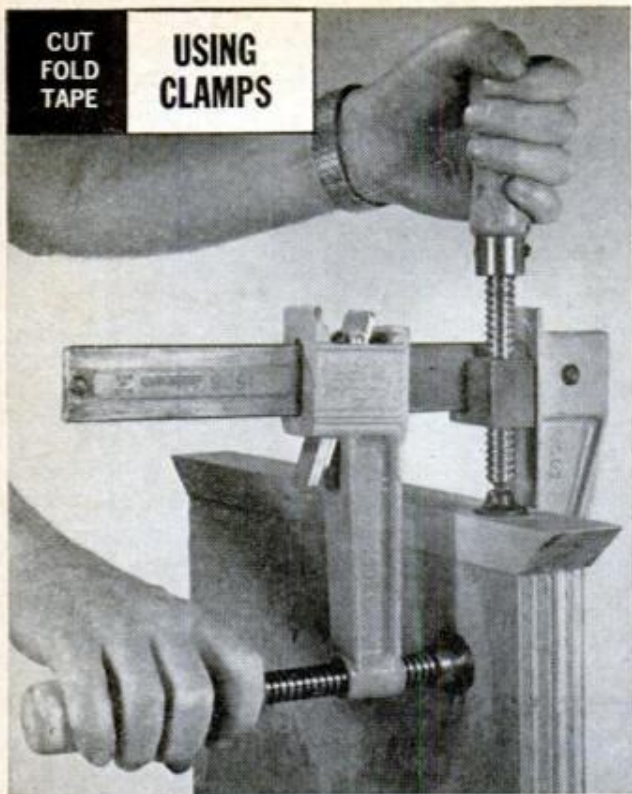
SHORT-BAR CLAMP with disc-clutch sliding head is modern descendant of old-time iron ratchet clamp



179

CUT
FOLD
TAPE

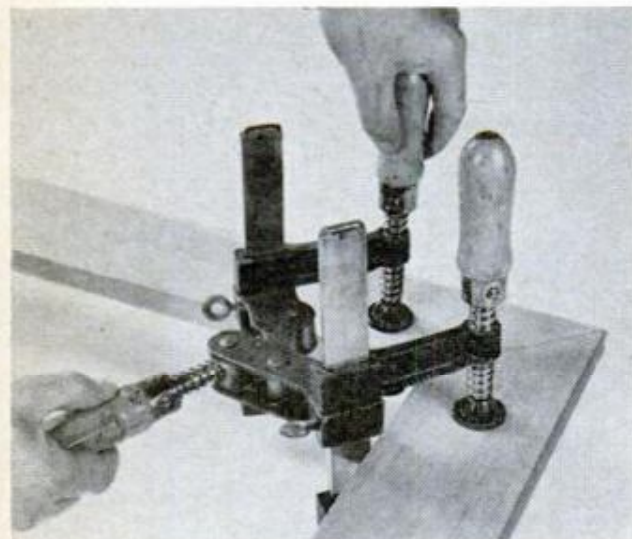
USING
CLAMPS



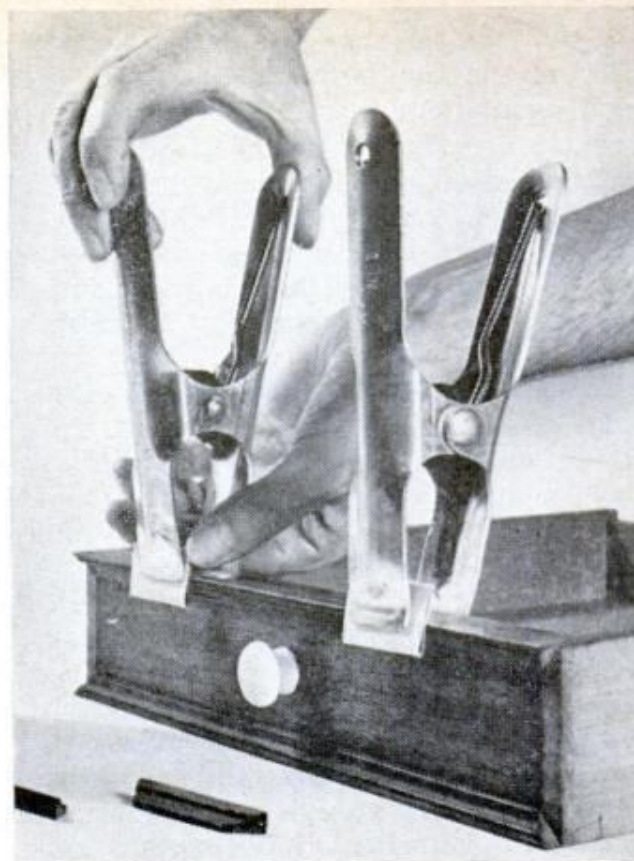
EDGE-CLAMP FIXTURES are auxiliary screws that attach to bar clamps, apply pressure at right angle



LONG CLAMPS for edge-gluing strips of lumber can be made of $\frac{3}{4}$ -in. pipe, commercial clamp fixtures



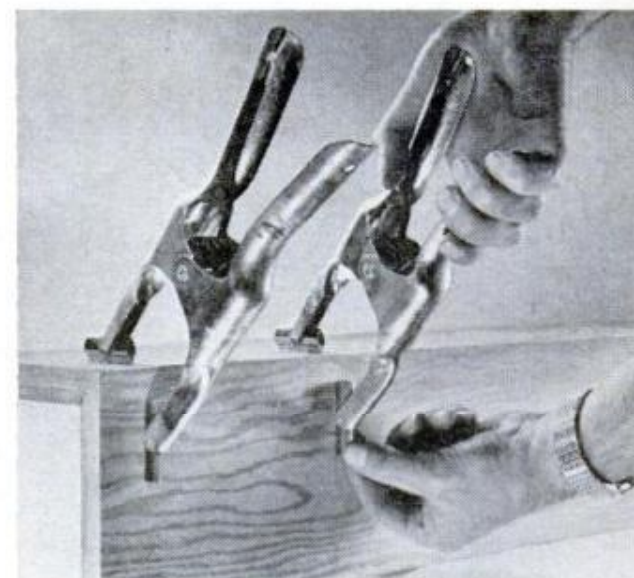
UNIVERSAL MITER CLAMP has two screws that grip halves of miter joint, third screw to tighten joint



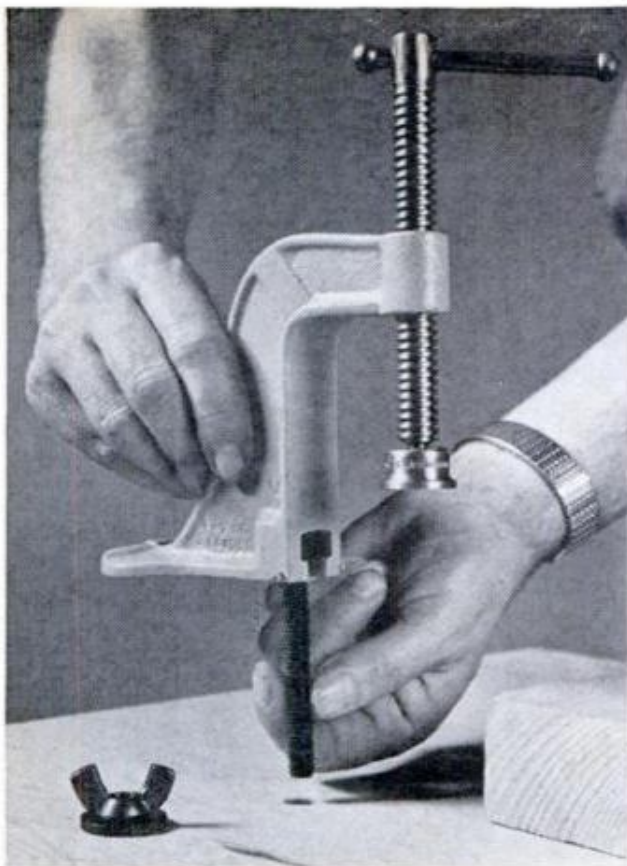
CLOTHESPIN-TYPE SPRING CLAMPS apply adequate pressure for small gluing jobs, positioning of parts



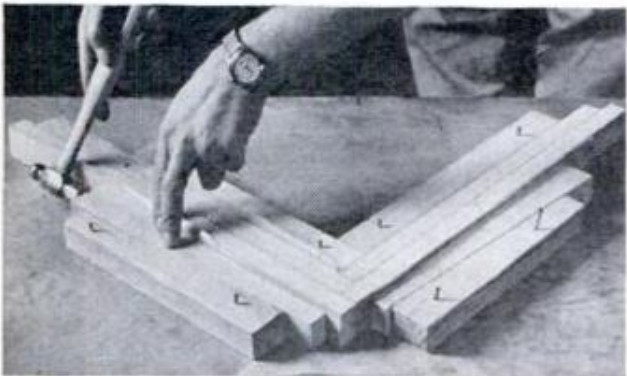
ALUMINUM-ALLOY CORNER CLAMPS are handy for gluing mitered joints in frames made of light stock



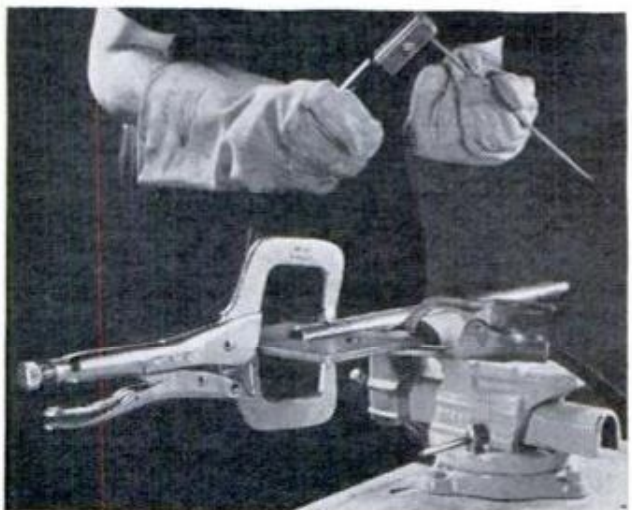
SPRING CLAMP has pivoting jaws, needle-sharp teeth to grip wood. Masking tape minimizes tooth marks



HOLD-DOWN CLAMP for benchtop requires drilling hole in top, inserting clamp and tightening wingnut

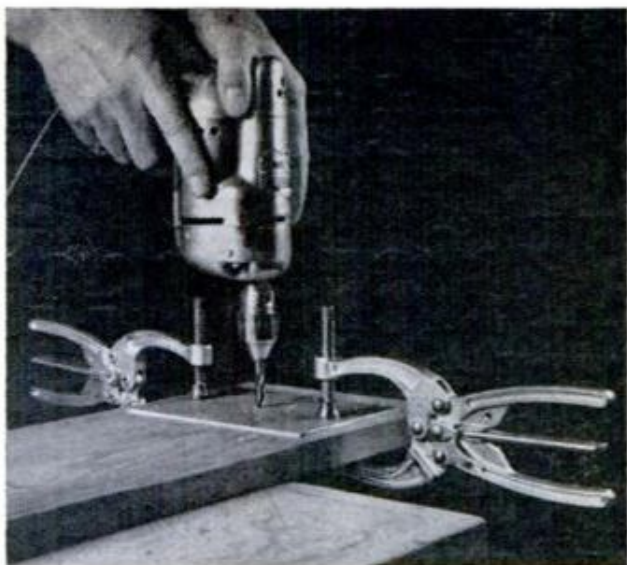


BLOCK-AND-WEDGE JIG is easy setup for gluing 90° joints. Nail blocks to scrap plywood, tap in wedges



TOGGLE CLAMPS grip tightly without twisting work. Quick-release model above aids welding, brazing

APRIL 1968



TRIGGER-RELEASE CLAMP is handy for securing metal stock to be worked safely with portable power tools

its jaw length. Commonly available are handscrews with jaws 4 to 24 in. long. Most cabinetmakers find that the 12-in. size (No. 2) ordinarily is the most useful.

Short-bar clamps, which essentially are quick-adjusting C-clamps, are also excellent general-woodworking clamps. The newer types have disc-clutch screwheads that slide on heavy spring-steel bars. Top-quality models have a depth-of-throat of 5 in., and capacities beginning at 6 in.

These three standbys—C-clamps, handscrews, and short-bar clamps—will take care of almost any common clamping job you're likely to encounter, provided you use enough of them. Clamping generally requires the application of evenly distributed pressure. Thus, because you'll need a clamp every 8 to 12 in. along a long joint, a number of clamps should be kept in your shop. You just can't have too many.

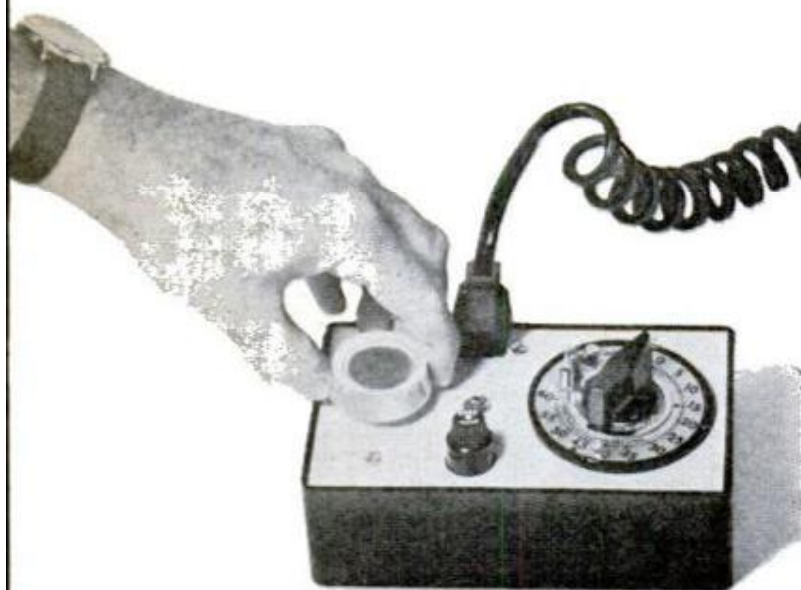
There are three other clamps you might find useful for common woodworking jobs. The first is a long-bar clamp, especially useful for edge-gluing and cabinet assembly. The second is a half-C-clamp that bolts through a benchtop to hold down work firmly. The third is a short-bar clamp with a hinged foot that screws under the edge of a benchtop.

Most other clamps are designed for clamping a particular joint or piece of work. For this reason, an experienced craftsman will purchase these special-purpose tools as the need arises.

Press screws, on the other hand, are special items sold for making veneering and laminating presses, yet they can be easily modified into special holding fixtures or other clamps. ★★★

Automate Your Kitchen with a

Motor Speed Control And Built-In Timer

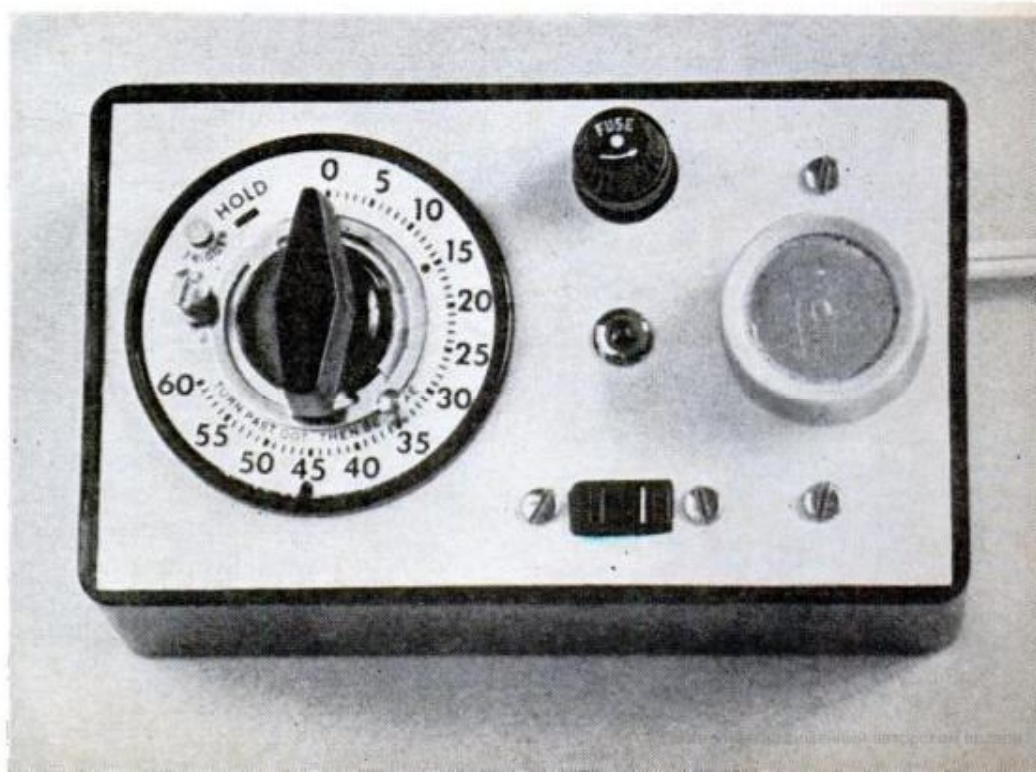


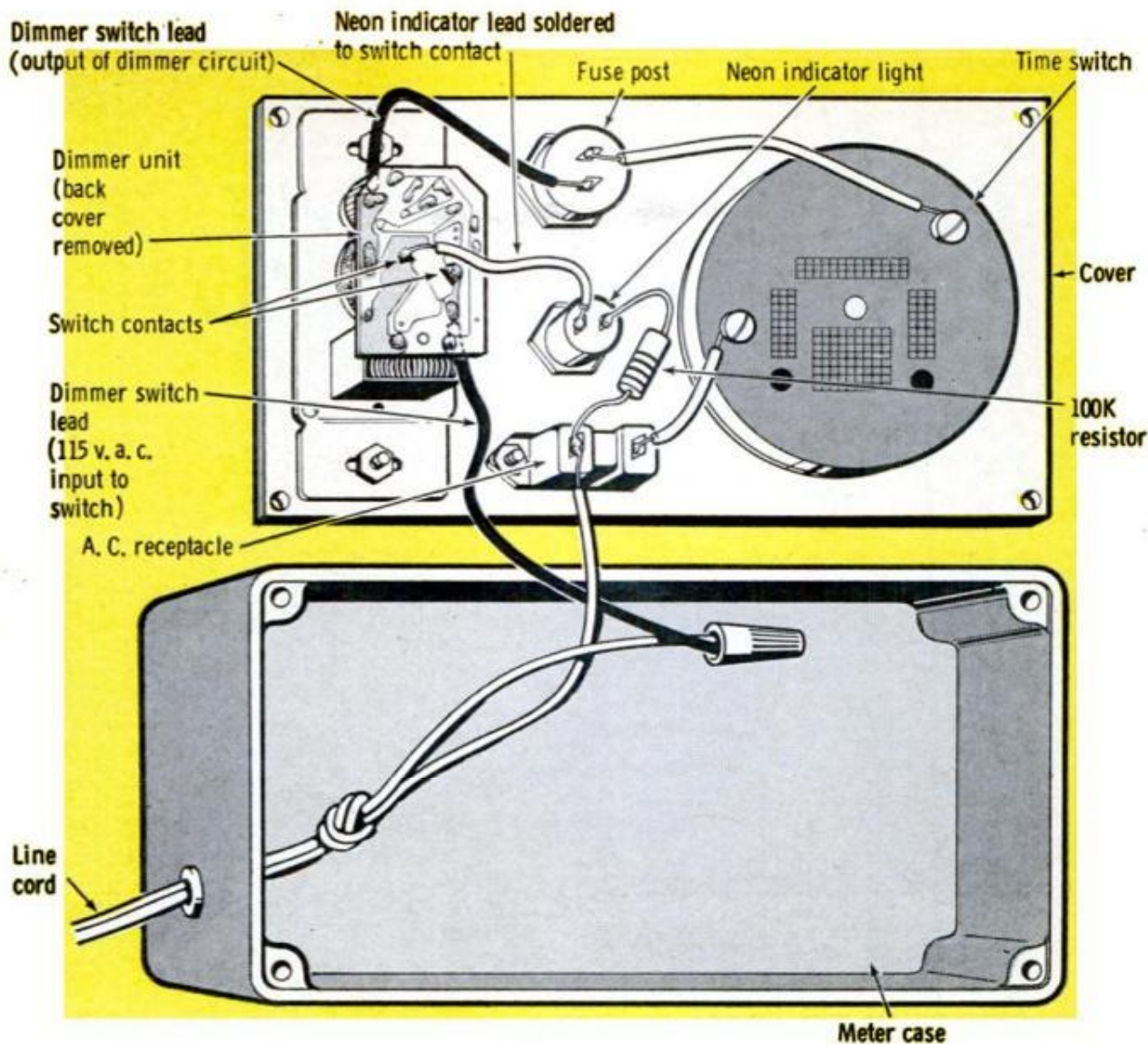
By JAMES B. JOHNSTONE

Technical Art by Graphic Presentation Services

When a recipe says, 'beat for six seconds' or 'slowly fold in egg whites,' your

COVER PANEL of instrument case mounts all components of the speed control except the photographic timer switch. The Rhodes timer was mounted to the back of the instrument case, using the screws that originally held it in the tabletop enclosure it came in when purchased. The timer takes up most of the space, but the fuse holder, neon indicator-light assembly and the dimmer control are not cramped in compact case





WIRING OF SPEED CONTROL shows dimmer, fuse, timer and receptacle in series and neon indicator connected from switch contact to ground as on-off light. Connected across the fuse, it would light if fuse blew

wife can do exactly that, automatically, with this 600-watt chef-in-a-box

YOU DON'T have to be a gourmet to appreciate the advantages of having zero-to-full-speed control of kitchen-appliance motors and the extra feature of timing them to do their job and then shut off. The control will make it easy for your wife to follow recipes accurately. And you don't have to be an electronics buff to put it together.

All you have to do is wire the parts together, following the pictorial diagram above. The back cover of the dimmer control has been removed to show where the switch contacts are soldered to the dimmer circuit board. If you don't want a neon indicator, you don't have to open the dimmer to add the lead and you won't need lamp assembly and resistor. ★ ★ ★

PARTS LIST

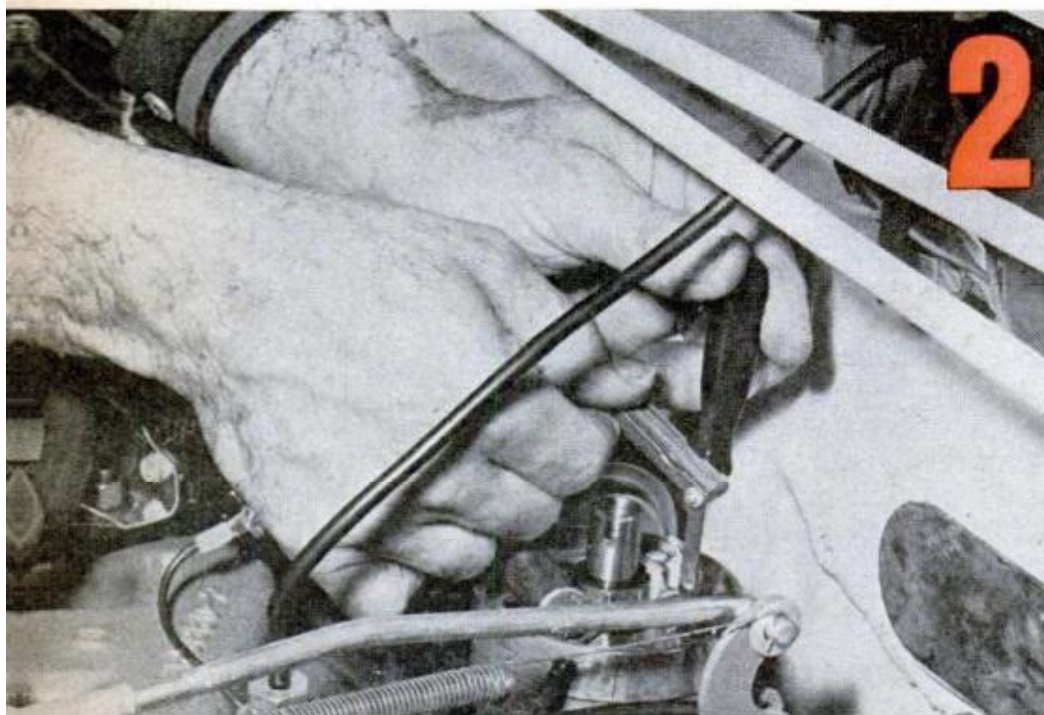
- Photographic timer switch**—Rhodes Mark-Time switch Model 78174 (Lafayette Radio 13H8504 or equivalent)
- Light dimmer control**—600-w. capacity for single-gang wall box (Lafayette 12H0101 or equiv.)
- Bakelite case and panel**—6 $\frac{1}{4}$ x 3 $\frac{3}{4}$ x 2 in. overall (Lafayette 19H2001 and 19H3701, respectively)
- A.C. chassis receptacle**—Lafayette 32H0904 or equiv.
- Neon lamp assembly**—Lafayette 99H6226 or equiv.
- Resistor**—100,000-ohm, $\frac{1}{4}$ -w. (Lafayette 32H0951C; specify value on order)
- Fuse holder**—Panel-mount Littelfuse post (Lafayette 13H1176 or equiv.)
- Fuse**—Type 3AG, 5-amp. (Lafayette 13H1018 or equiv.)
- Misc.**—Hookup wire, solderless connector, solder

1 CONDITION OF SPARKPLUGS should be checked at least every 5000 miles. At this mileage it should be necessary only to clean them with a wire brush and file and gap them to specification. Replacement is advised every 10,000 miles



Three steps to an

EXPERT SPRING



2

DISTRIBUTOR POINTS must be gapped to specification using an ignition feeler gauge. When the gap between points is too small, the points will burn and pit rapidly; if it's too wide, ignition failure will occur at high speeds. Gapping of distributor points should always be followed up by a check of dwell angle—the number of degrees of distributor cam rotation during which the points remain closed. If angle is off the gap must be readjusted

TAKE A HARD LOOK at your spark-plugs, distributor and carburetor and you'll be 95 percent of the way along the road to an expert tune-up.

Before starting, however, you should obtain a manufacturer's service manual for your car. Most manuals don't outline a specific tune-up procedure since the tune-up section is often part of a complicated troubleshooting section. But the manual is necessary for specifications and details of mechanical procedures. A manual costs about \$5 and can be obtained from a manufacturer's service publications department.

After you've put 10,000 miles on your car, you're ready for a tune-up; every 5000 miles is even better.

Start with the sparkplugs. If this is a 10,000-mile tune-up, replace them. Make sure new ones are of the right type and are gapped to specifications.

Gapping of plugs should be done with a sparkplug wire gauge. The gauge contains an electrode bender and several wire gauges of varying thicknesses, usually from .022 in. to .040 in. You can get one for about a dollar.

If this is a 5000-mile tune-up, inspect the plugs. If the porcelain is cracked or

the electrodes are broken, replace the plug. If not, clean foreign matter from electrodes with a small wire brush. Then, using an ignition point file, which costs about 30 cents, file both electrodes flat and bright. Return each plug to the cylinder from which it was removed.

With plugs squared away, move on to the distributor. Remove the distributor cap and rotor, and wash the cap in water and household detergent. Dry with a clean, soft rag, and inspect both cap and rotor for hairline cracks. A crack may not be bad enough to cause a major problem, but could be robbing your engine of power.

On a 10,000-mile tune-up, replace distributor contact points and condenser, setting point gap to specifications. On a 5000-mile tune-up, place a piece of crocus cloth carefully between contacts and clean them. Only a pass or two is needed.

Point gap is set with a feeler gauge. Don't use the sparkplug gauge. It could give an inaccurate setting. Instead, get a standard ignition feeler gauge, which has flat feelers. Cost: about \$1.

You're probably concerned that these dollars for tools are starting to add up. And, indeed, the total cost of this tune-up, if it's the first you're doing yourself, will be as much as \$70. But this one-shot outlay for gauges, tach/dwell meter, timing light, and so on, will save you money, and lots of it, in the long run.

With points set, check dwell by following the simple instructions given with any tach/dwell meter. Dwell angle is the number of degrees of rotation through which the points remain closed. An improper

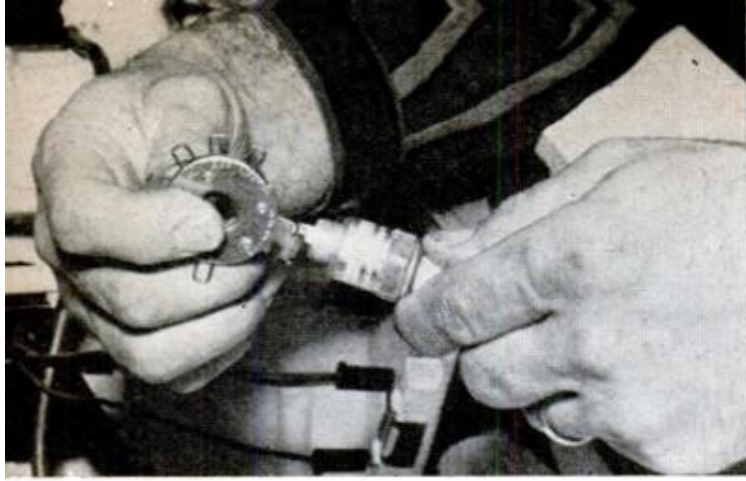
TUNE-UP

By MORT SCHULTZ

CARBURETOR ADJUSTMENTS

will be on the nose when you use a tachometer to measure engine rpm while you set air-fuel mixture and idle speed. If you don't have a tach, you can pay attention to some clues that will help you get a better-than-nothing tune-up. Sparkplugs, for example, indicate approximate fuel-air adjustment by color of the insulator. Mixture has been set to spec when color is light to medium brown; lighter it's too lean, when darker it's too rich





OUTER SPARKPLUG ELECTRODE is bent to adjust gap using the bender on this circular-type wire gauge



SPARKPLUG ELECTRODE GAP is set to specification when you feel a slight resistance on the wire gauge

dwelling setting causes missing on acceleration and at high speeds.

If the dwell angle is not within specifications, readjust point gap and recheck dwell. If dwell angle is low, decrease gap; if it's too high, increase gap. Failure again to get the proper dwell indicates that the cam, rubbing block or the contact point arm is in bad shape and needs replacing.

Now, check the terminals of your secondary ignition wiring by pulling them out of the distributor cap and coil. Use a piece of crocus cloth to clean off carbon. A bad carbon condition means that wires weren't fully seated, which caused arcing. Pull up the rubber boots, push the wires firmly into their seats and pull the boots down over the towers.

Next, time your ignition. This is one operation that's absolutely essential to a good tune-up. You'll need a timing light if you have an American-made car. Cost for a good one: about \$20.

Connect the timing light and run the engine at the specified idling speed. (With most cars, the vacuum advance line has to be disconnected before starting the engine.) The timed pulses of the timing light should make the timing mark appear stationary. The mark is usually found on the flywheel, vibration damper or crankshaft pulley. If the mark is not aligned with the pointer, loosen the distributor housing. Turn the housing against rotor rotation to advance timing and with rotor rotation to retard timing. When the correct timing mark aligns itself with the pointer, tighten the distributor and hook up the vacuum advance line, if it was disconnected.

Many foreign-made cars are timed by the static method, which consists of timing with the engine shut off and with a

continuity meter or test light connected into the ignition circuit. Points are adjusted to break at a specified time during the piston's reciprocal movement. The car's service manual will give the details.

American-made cars can't be timed statically for the simple reason that specifications in the manual call for a stroboscopic timing light with the engine running. These specifications could differ by as much as 10° to 15° from those called for if timing is done statically.

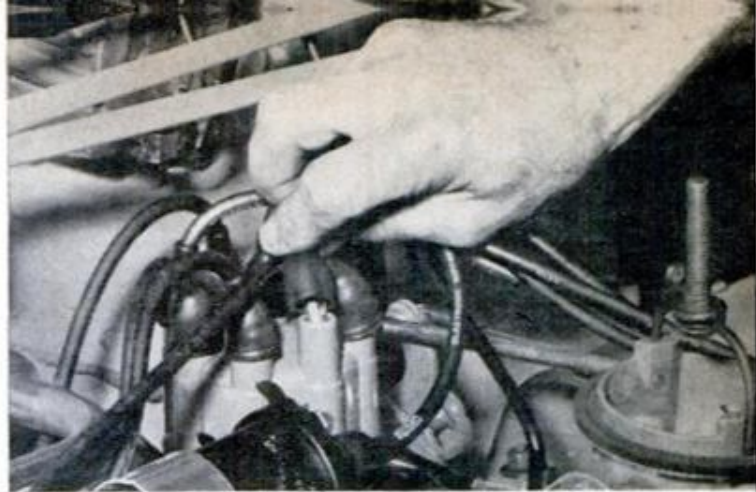
The first thing to do at your carburetor is to remove the air cleaner. A dirty air cleaner overchokes the carburetor, wasting gas and murdering engine performance. If you're doing a 5000-mile tune-up, tap the air cleaner lightly on a hard surface to remove as much dirt as possible and reuse the part. But at 10,000 miles, replace it. It's worth a couple of dollars to be sure that an air cleaner with deeply embedded dirt isn't overchoking the carburetor and wasting fuel.

FAST IDLE SETTING to a specified rpm is quick, easy and accurate when you make use of tachometer





DWELL ANGLE IS READ directly in degrees on tach/dwell meter after points are set to specification



IGNITION WIRES are seated firmly in the distributor cap towers and then the boots are pulled down tight

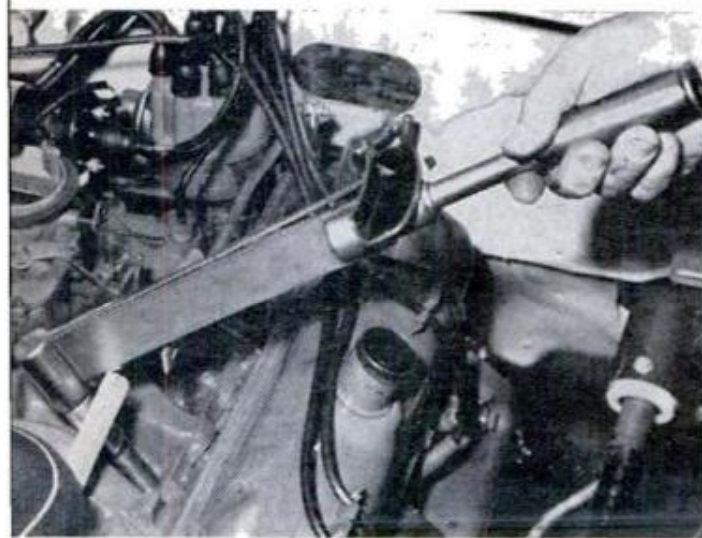
Those carburetor adjustments needed for good tune-up are idle mixture, throttle stop and fast idle. Fine tuning of each assures maximum engine performance.

Connect your tach and allow the engine to warm to normal operating temperature. Adjust the throttle stop screw—the manual will tell you where it's located—until the tach reads midway in the idling speed range. For example, if the spec calls for an idle speed of 600 to 650 rpm, set the stop screw so the tach reads 625 rpm.

Turn the idle-mixture screw clockwise until engine speed begins to fall off because of a reduced fuel supply. Now, turn the screw counterclockwise until speed gain falls off, this time because of an enriched mixture. Count the number of turns between the two extremes and set the idle mixture screw midway between the two.

If your carburetor is a two or four-barrel type, having two idle mixture screws, do the same thing for each one.

VACUUM LOSS around a loosely bolted manifold will cause rough idle. Use a torque wrench for tightening



The idle mixture screw (or screws) is located in the base of the carburetor.

At this point, check the tachometer again. If engine speed is now above specifications, turn the throttle stop screw counterclockwise until specified idling speed shows on the tach.

As for fast idle, you will need the fast idle rpm specifications for your engine, which the manual provides. With the tach connected, simply turn the fast idle adjustment screw until you get the specified reading. This takes care of 95 percent of your tune-up.

Wrap up the job by checking the manifold heat control valve, the mounting bolts on the intake manifold and carburetor, and the battery. A stuck manifold heat control valve can make an engine sluggish—enough to make you think you've done a lousy tune-up. If the valve's stuck, tap it lightly with a hammer. Keep it free with a mixture of graphite and alcohol.

Retighten intake manifold and carburetor attaching bolts to prevent vacuum loss that could affect engine performance. Tighten bolts with a torque wrench.

Finish up by cleaning all battery posts and terminals, using a wire brush cleaning tool. Coat battery posts with a dab of petroleum jelly to prevent corrosion.

When you get out on the road, run between 8 and 10 mph. Then, suddenly, jam the accelerator pedal to the floor and note the pickup. There should be no hesitating. Now, place the transmission in low gear and accelerate to wide open throttle. The car should have plenty of pep and power. Drive back to the barn and let the engine idle. If smooth, with no tendency to hop or stall out, you've got yourself an A-1 tune-up. ★★★

HINTS

FROM READERS

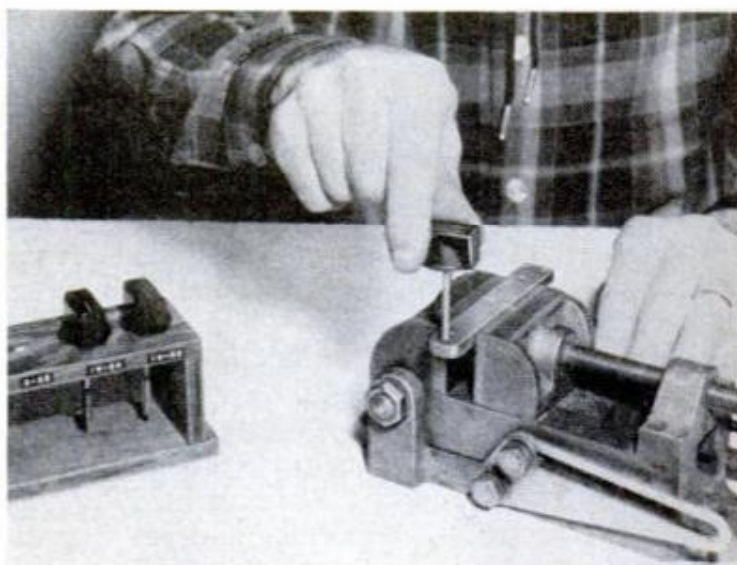
Foam-plastic 'cookie cutter'

When cutting discs from rigid foam plastic, or making circular openings in the stuff, a tin can "cookie cutter" does a neat job. Select a can of the right size, cut it down to an inch or so and sharpen the edge by beveling it with a file. Then make a hole in the bottom so you can push out the disc from the cutter. The cutter works best if you twist it as you press.—*Walter E. Burton*



Fit your taps with knobs

If a number of holes of different size are to be tapped in soft metal or plastic, it is somewhat of a nuisance to have to keep changing taps in a one-and-only tap wrench. However, if you have a few old-style radio knobs going to waste, you can put them to work as neat little tap wrenches. Tightened to the ends of the taps by their setscrews, the knobs will let you turn the taps with your fingers. Fitted with their own "wrenches," a set of small taps (4-40, 4-32, 6-32, 8-32, 10-32 and 10-24) become extra handy for model work.—*Harold P. Strand*



NEXT MONTH IN SHOP AND CRAFTS

HOW TO SWEAT-SOLDER COPPER PIPE. A propane torch and copper pipe go hand in hand to make home plumbing jobs a cinch. No threading or sawing of pipe; fittings are simply heated and fused in place with solder. A home-repair feature in May shows how easy it is to make leakproof joints the very first time.

TWO PICNIC TABLES YOU CAN BUILD. One is hexagonal, the other octagonal. Both have attached benches which will seat up to ten. Build them of redwood and you'll have a table that will last for years. The May issue will have complete plans.

NOW: TAKE EXCITING TIME-LAPSE MOVIES. An electric timer you build yourself automatically trips your camera shutter every few seconds to compress hours or days into dramatic action sequences. It can be used with any movie camera—even inexpensive types that don't have provision for single-frame exposure. Don't miss this ingenious project in the May issue.

HOW TO KEEP YOUR CHAIN SAW CUTTING. Chances are you won't have any trouble when it's brand new, but your chain saw won't keep purring like a kitten without periodic inspection. What to do to keep this handy workhorse in tip-top tune is outlined in a ten-point check in the May issue.

Lime?



Lime!

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we've got the
camera.



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POWERFUL, SAFE PAINKILLER

(Continued from page 107)

swallowed each year. They are safe, dependable and, for most people, provide the relief needed for low-intensity pain, sore muscles and common headaches.

For more intense pain, the traditional analgesics have been codeine and Demerol. But these are slightly narcotic—they affect the patient's state of mind and may cause him to form a habit. Talwin now extends the effective range of nonaddictive analgesics to the most agonizing pain.

A safe painkiller has long been one of medicine's urgent needs. Especially in wartime, the basic problem of pain has so far proved unmanageable. During the Civil War, morphine—then the only known pain-reliever—was given freely on the battlefield. Result: one in every 400 Americans became a drug addict—ten times as many as today. Army medics kept down the dosage in the two World Wars. Even so, large numbers of veterans became addicted due to war wounds.

Talwin has no appeal for addicts, so it sidesteps the problems of theft and the tight bookkeeping needed to prevent illegal drug traffic. But the chief beneficiaries of its nonaddictiveness are patients with chronic ailments. Sufferers from arthritis, neuralgia, kidney stones and gall bladder diseases used to endure long sieges of excruciating pain rather than risk morphine addiction. Now they can be kept comfortable on a long-term basis.

The discovery and development of Talwin is mainly the work of one man, Dr. Sidney Archer. Since 1942, he has been investigating drug effects on pain at Sterling-Winthrop Research Institute at Rensselaer, N.Y.

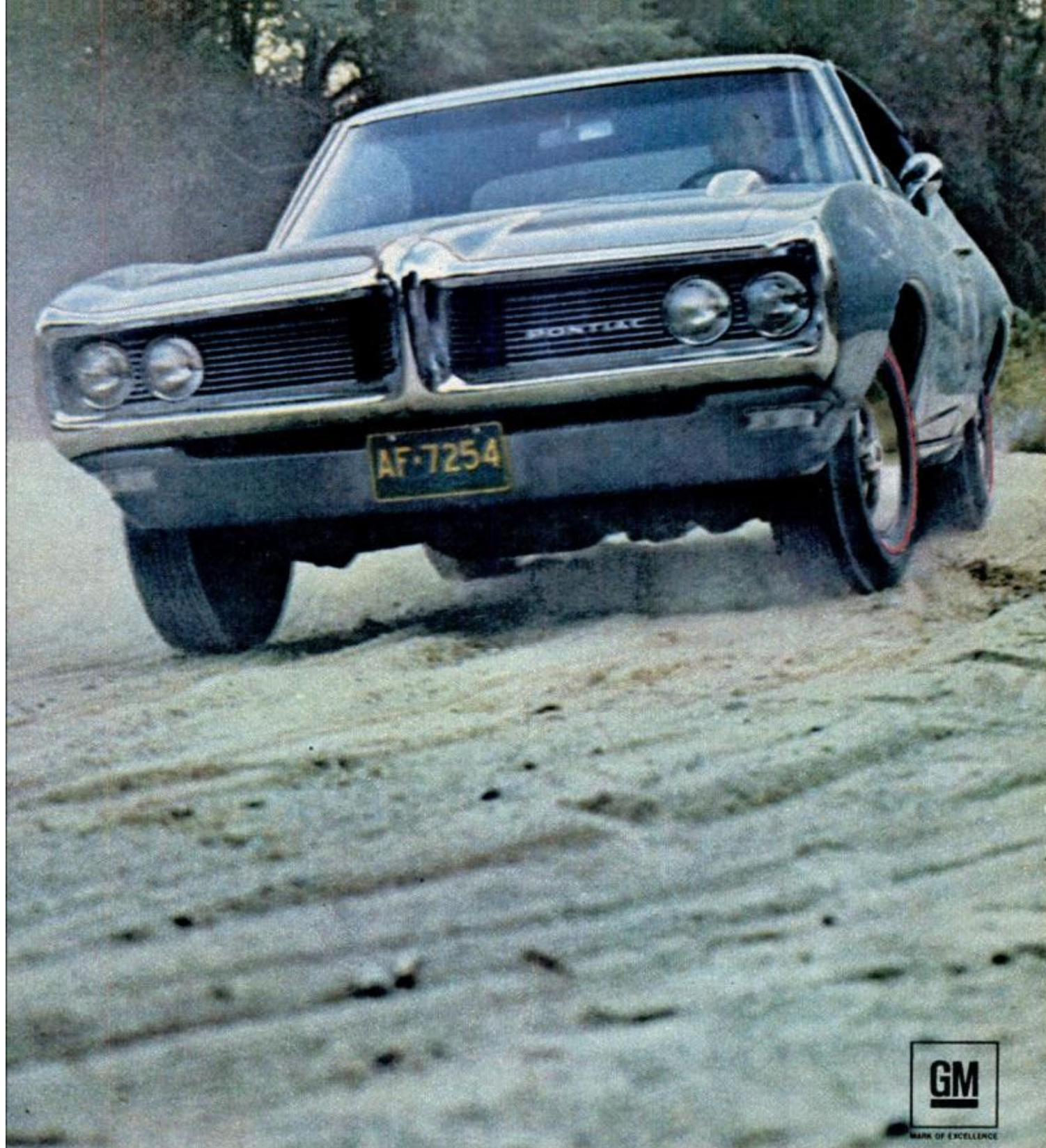
Frightening side effects

During World War II, a rival researcher came up with a synthetic morphine substitute called Nalorphine. It seemed the answer to urgent wartime needs—powerful in its painkilling effect, yet nonaddictive. But soon bizarre reports came in: "ghoulish hallucinations and creepy fantasies." Patients were overcome by horrifying visions. Some, already shaken by injury or weakened by disease, may have been literally frightened to death. Nalorphine was quickly withdrawn.

But the drug wasn't a total loss. One observation set Archer on his road to discovery: Nalorphine given to morphine addicts caused violent withdrawal symptoms. As he puts it: "It acted as a chemical antagonist to morphine."

If such "antagonists" can numb pain

(Please turn to page 192)



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POWERFUL, SAFE PAINKILLER

(Continued from page 190)

without forming a habit, he reasoned, they might hold the chemical key to the substance he was seeking. If he could only get rid of those weird side effects!

He twisted their complex molecules, chopping off a few atoms here, adding others elsewhere. Systematically testing the effects of such changes on animals, he gradually was able to pin down the chemical structure for an ideal painkiller.

Hundreds of Dr. Archer's formulations were subjected to a grueling array of animal tests. Guided by the data, he gradually narrowed his search to a small group of compounds. Among them was 2-dimethyl-allyl-5, 9-dimethyl-12-hydroxy-6, 7-benzomorphan. Archer wrote it on the blackboard for me. "Even I can't pronounce that," he cheerfully admitted. Somebody in the company came up with the trade name Talwin. It stuck.

Human volunteers

Still, a crucial question remained that animal tests could not answer. Would the drug prove addictive to humans? So Archer shipped samples to Lexington, Ky., as he had done with nearly all of his promising formulations. There, Dr. Harris Is-

bell of the Public Health Service Addiction Research Center injected the samples into human volunteers, mostly addicts who had, after long and painful withdrawal therapy, kicked the habit. Bravely they agreed to try the new drugs, knowing that if the drug didn't live up to expectations it might throw them back into the clutches of addiction.

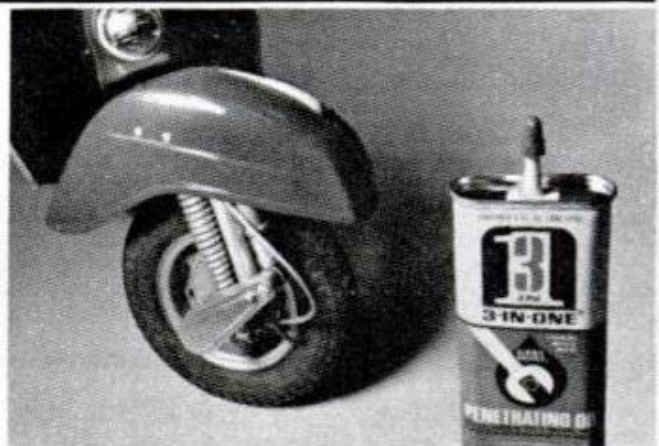
Another test uses active addicts who desperately need their daily dose. If they get a kick from the drug, it's probably narcotic. But the reaction to Talwin was reassuring. "Like dishwater," one snorted. That was in 1963, 21 years after Archer began his search. Talwin was promptly certified as nonaddictive by the Public Health Service. Now the stage was set for final testing: experimental use in hospitals under close supervision. Dr. Arthur Keats of Baylor University School of Medicine in Houston first took the new drug into the wards. He set up pain charts on which patients rated discomfort on a 1-to-10 scale. He found Talwin rated as highly as morphine for pain relief.

Side effects proved negligible. Of 12,000 patients tested, less than five percent complained of slight nausea, lightheadedness and constipation. As one doctor sums it up: "At last we have a drug as merciful as morphine, yet safe as aspirin." ★★

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GMC breaks open the engine room to show you where our pickup gets its pickup.

The Truck and Coach Division of General Motors

G M C

What a difference a name makes

JAPAN'S HIGH-SPEED TRAIN

(Continued from page 97)

coast for three years. When they finally got going, most main lines in Japan were narrow-gauge. Most were damaged in World War II.

The Old Tokaido Line, slow and congested, was plainly inadequate to handle high-speed passenger trains in a region where 49 percent of Japan's 100 million people live. Tokyo is the world's largest city. Osaka is almost as big as Chicago. Nagoya, Kyoto and Yokohama each have more than a million population.

The new line opened Oct. 1, 1964. The schedule was four hours, to allow the roadbed to settle and to see how equipment and passengers stood up under high speeds. Now the *Hikari* does it in 3 hours and 10 minutes, averaging 102 mph, including stops. On a test run, it hit 159!

You can beat the *Hikari's* time 40 minutes or so by taking a plane, but that includes long taxi rides (or a monorail in Tokyo) at each end. Fare on the *Hikari* is \$18.61 first-class, \$9.25 second-class, with a partial refund if the train is more than one hour late.

Air fare is \$18.90, plus ground transportation. To fight back, the airlines hope to

have 15 300-passenger Boeing 747s on the Tokyo-Osaka run in the 1970s. At that time they hope also to lower their fares to match the NTL's second-class. Undaunted, the NTL says it will cut its running time to 2½ hours. Meanwhile, it's building to Okayama, then (by tunnel) to Kyushu.

Meanwhile, back in the progressive old U.S.A., famous trains bite the dust even as railroad brass talk of high-speed operation between Boston, New York and Washington. Penn Central has run short, experimental trains over a few miles of track between Trenton and New Brunswick. One-hundred-miles-per-hour service was supposed to start between New York and Washington last October.

The gas-turbine trains United Aircraft and Pullman-Standard are building for the New Haven are supposed to go 160 mph, but you won't get me to ride in *their* cab at *that* speed on the New Haven's worn-out roadbed. I ride the New Haven every night. We average 35 mph. Five turbine trains going to Canadian National will average only 84 between Toronto—Montreal.

I rode 132 mph on the New Tokaido Line Dec. 1. I got back to New York on Dec. 2, the day they killed the 20th Century Limited. Its last run was nine hours late. ★★★

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COMPUTER IN HIS BASEMENT

(Continued from page 79)

generate balanced menus with specific calorie and nutrient content, from which the family can select their meals in advance.

ECHO provides the Sutherlands with a proving ground for experimental family games. The Sutherland children—Ann, 11; Sally, 7; and James Scott, 2—are looking forward to programming and playing games on the computer. As television displays are added to the system, many new games involving logic and strategy will provide family entertainment.

Recently Jim connected his color TV to a controller that will eventually allow ECHO to regulate the TV schedule. For instance, on a school night, the children might have to answer correctly some key questions via the keyboard before ECHO will switch on the set. The antenna rotator will also be controlled by ECHO to insure proper alignment of the antenna with the corresponding channel number entered through a control keyboard. This way, one manual entry directs both set and antenna to the desired channel.

Automatic temperature control

Jim will experiment with the computer as a temperature-controlling device for the home. After interrogating weather instruments on the outside of the house, the computer will be programmed to compensate for weather changes and make automatic temperature and humidity adjustments on the inside. Purely for his own interests, he hopes to use ECHO as an aid in short-term local weather prediction. Jim has a degree in meteorology from Penn State University, which was received while he was on active duty as a weather officer in the U.S. Air Force. He and Ruth also hold degrees from the University of Missouri which Jim attended through a Westinghouse scholarship won in a National 4-H Farm and Home Electric contest.

The Sutherlands are pioneers in the field of home computers and undoubtedly will discover that the best computer applications will evolve through everyday experiments. Although many of the uses planned for ECHO sound impractical and impossible, Jim notes that many of today's computers and their uses would have sounded farfetched to people 20 years ago.

For instance, at age 15, Jim constructed a model electrified farm to show various farm groups how they could do more work with the aid of electricity. "Several national magazines carried stories on the project; the one I value most appeared

(Please turn to page 229)

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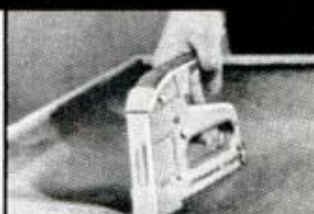
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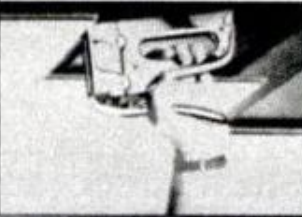
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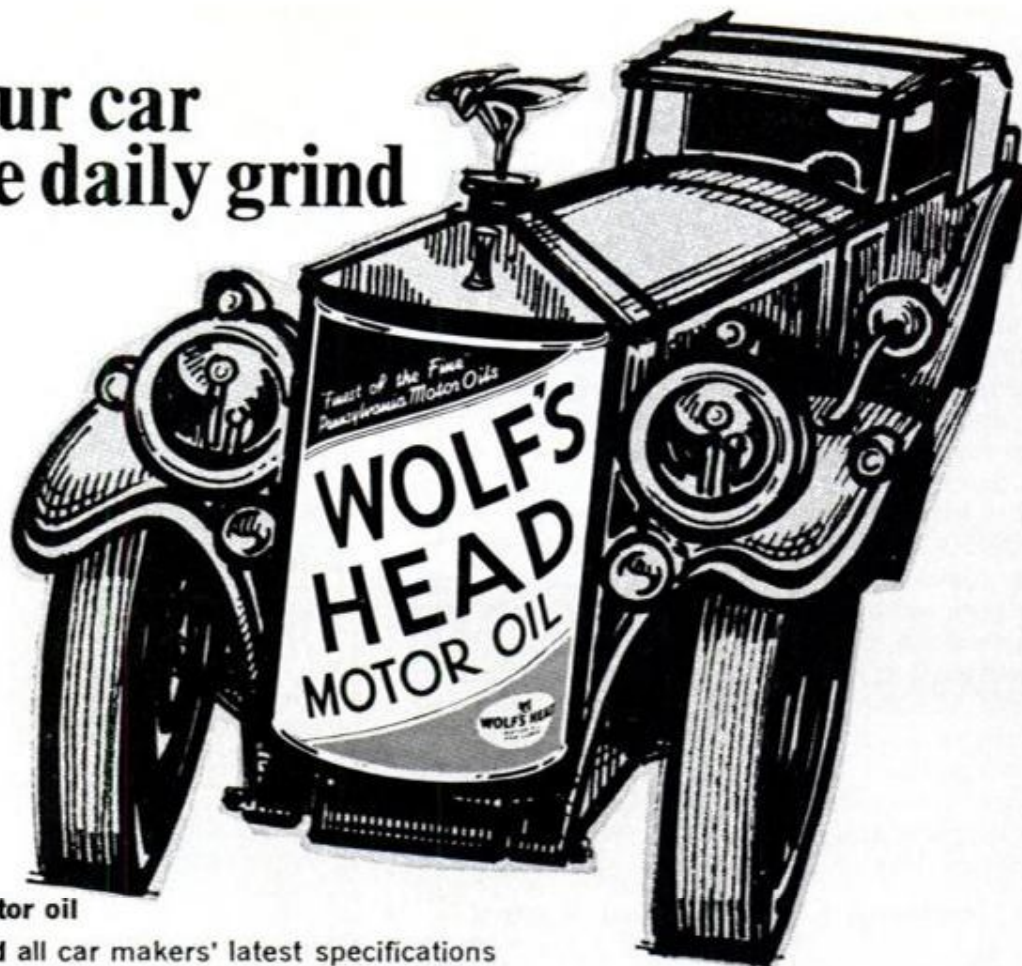


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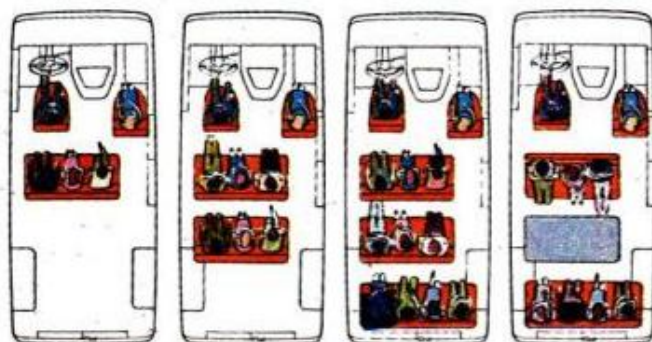
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HUNT FOR FLOATING DEATH

(Continued from page 89)

hoping the enemy has moored his mines deep enough to hit a deep-draft ship in a vulnerable spot, and not a lowly sweeper.

Recently, the men in the lead boats have had it better. Helicopters are making good minesweepers, and are not affected should they accidentally discharge a mine.

Outfitted with regular sweeping gear and flying, at times, only 40 feet off the ocean, choppers precede the lead boat, sweeping a channel for it. Although not a new technique—minesweeping helicopters were first used in Korea—the method is receiving increased emphasis.

After a moored mine is loosened, sharpshooters in launchers behind the sweepers destroy the mine with small-arms fire. They try not to hit the antenna or spike which would explode the mine.

"I did that once," a sailor told me, "and our boat was filled with all kinds of corruption. It smelled to high heaven."

When a mine is punctured with bullets, it floods and sinks.

To sweep influence mines (acoustic, pressure or magnetic), sweeping gear is used to simulate the influence far enough ahead of the launches so exploding mines won't damage them. The gear emits various frequencies. Many times, a suspected area has to be swept for days before the right pitch is found.

Magnetic sweep gear produces a magnetic field generated by electric current sent through wires that are dragged deep beneath the water's surface.

An important part of sweeping is mine hunting. It's done in several ways.

One is intelligence. The skipper of a sweeper tries to second-guess the enemy and figure where he would want to lay mines. Suspect areas get a going over.

Another way is to send out underwater divers equipped with high-resolution sonar. After detecting an object, they attempt to learn whether it's a mine and, if possible, recover one for examination.

How significant is mine warfare in this atomic era? As we found in Korea and Vietnam, the mine is a poor man's weapon anyone can make easily and cheaply.

Although U. S. mine capability was largely reduced after World War II, Wonson Harbor taught Navy men a lesson they'll not soon forget. Adm. Sherman, then Chief of Naval Operations, put it succinctly a week after Wonson:

"They caught us with our pants down," he said. "We've been plenty submarine-conscious and air-conscious. Now we're going to start getting mine-conscious—beginning last week." ★★★

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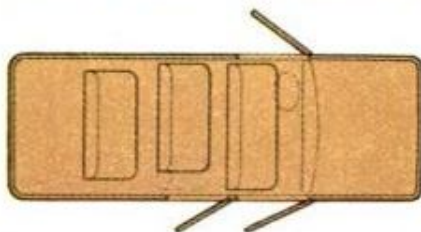


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Big load space without rear seats measures a van-like 181 cu. ft. with plenty of room to stack 4 ft. x 8 ft. sheets of plywood.



Seating for nine with available second and third seats that leave plenty of leg and elbow room. Even with the two front seats in place, there's more cargo room than you'll find in most conventional station wagons.

An extra door on the right side does wonders for easier loading of people and packages. At the rear of your Suburban take your pick of wide-opening panel-type doors or a convenient tailgate-liftgate arrangement.

The extra smooth ride rivals many family cars because Chevrolet provides Independent Front Suspension and coil springs at all four wheels.

Plenty of power for work or fun is yours with one of two economical Sixes or four hefty V8's (all the way up to a high performance 310 hp).

4-wheel drive is available to go almost anywhere, any time. Suburban 4 x 4's look low and have a special frame with tapered leaf springs.

Why not make more room for fun this year? See your Chevrolet dealer about a '68 Chevy Suburban soon. . . . Chevrolet Division of General Motors, Detroit, Mich.



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BUICK SPECIAL

(Continued from page 92)

be controlled. But despite the repetition, the remarks are all praise—it piles up high for the Special.

When it comes to styling, the auto-makers almost do a better job at keeping our eyes focused on the latest style than womens' fashion designers. With confident strokes drawn along their French curves they lay down lines that please most of the people most of the time. These lines sold almost half of the people who are now Buick Special Deluxe owners.

These owners, mostly men, admit to being hooked on style. A few owners, however, admit their wives have something to say. An oil-field worker from Oklahoma says he bought a Special because of "woman trouble. My wife looked at it and decided that it was the only car she wanted." Another owner, a Pennsylvania welding supervisor, admits that his "nineteen-year-old daughter was the influencing factor."

At least they're honest. If the women had any say other than, perhaps, the choice of color, no owners are admitting it. The comments on sheet-metal shape are all theirs and all on the plus side: "jazziest looking car in town," "smart appearance," "sharp looking," "sleek, distinctive lines," "beautiful body style."

For an Illinois couple their Special has brought unusual social success: The Buick is "beautiful, it's eyed by everyone. We have been the most popular people in the world since its purchase."

Among all these happy owners, however, there is at least one who is miserable, one whose aesthetic sense and trust in Buick's good taste have been violated. A Mississippian says: "I detest the appearance of it, it's an ugly thing." The car was ordered sight unseen and never again will I make that mistake, says this owner.

The outside of the Special got rave reviews, but the inside did not have as enthusiastic an audience. The reason was not overall comfort, which actually received considerable praise, but a host of inconveniences, some minor, a couple unsafe and others just plain irritating. Most frequently mentioned was the safety problem of the inside rear-view mirror, which, as summed up by a Kansas farmer, "should be narrower. It blocks forward visibility to the right. Should be raised or lowered, made smaller or something."

Other things are just as much a pain in the neck to Special owners as looking around a mirror—such as being scalped when it comes to headroom. ★★★

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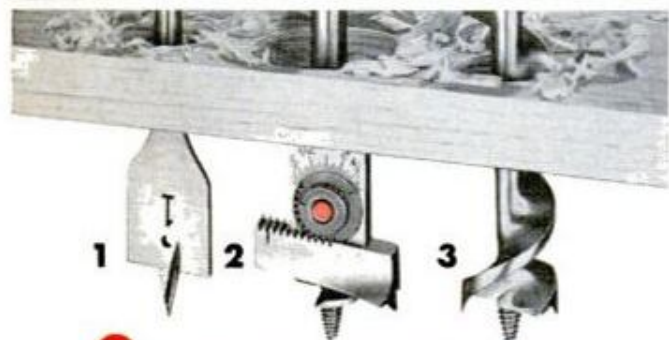
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DEEP-SQUEEZE DIVING

(Continued from page 110)

line, like kite string, trailing over the edge of what appears to be a cliff. This must be the guide line left last year by divers from the University of Florida.

Bob apparently reads my mind. He ties the end of his cord to a rock. We nod, and smoothly slip over the edge, following the string. Down, down and down we go. It's 10:58. My depth gauge reads 75 feet. We must be in a huge "room" that looks like the inside of a cathedral dome. The string leads down to a pyramid of sand and silt salted with limestone outcroppings.

The slope goes down at 45°. Bob and I follow the fall line closely. We bottom-out at 100 feet down. And there, reflected in our light beams, is a treasure of bones—all shapes and sizes. I push on a little farther. Bob is right alongside.

It's 11:01. I feel the pressure of 105 feet. I'm getting cold. We've found what we wanted. It's time to go back.

I swing my light—and suddenly can't see a thing. As we scooted over the bottom on the way down our flippers churned up silt. It hangs like fog. We'd had great visibility, but now we're flying blind.

Bob picks out the string, slowly following it back. It's 11:05. I check my air tank. Eighteen minutes to empty.

Then it happens. Bob quickly back-waters, almost banging into me. He grubs in the fast-rising silt. He turns and looks at me. Through his mask I see his stunned look. In his left hand dangles the frayed, broken end of the string.

Bob and I have been in tight spots before. We've been lost in muddy holes of sunken tankers. We've battled strange undersea currents. We've fought the drunken feeling of nitrogen narcosis at staggering depths.

But now, we're really scared. Floating all around us is nothing but a heavy mist of silt particles. I feel the first pangs of panic seeping into my gut. Years of diving have taught us that panic means the end.

I feel strange knowing Bob and I had checked and rechecked our gear before diving into Hornsby. We'd planned for every possibility—every one but this. I know now that we made two mistakes. We trusted an untested line, and we carried only one tank of air apiece for what we thought would be a routine dive.

It's 11:08. Slowly, very slowly, we drift to the side of this room. We rise, peering with our lights for that one small tunnel opening. No luck. We've missed it.

I motion to Bob—be still. We wait. My air tank is light now. I fight its buoyancy

(Please turn to page 226)

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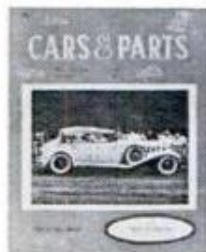
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BIG RISE OF LITTLE SINKERS

(Continued from page 115)

outside the hull, and will serve as a test-bed for advanced concepts of construction.

Autec I and *Autec II*, built by General Dynamics, resemble GD's *Star* series. (See below.) *Autec I* will be used by the Navy at its Atlantic Underwater Test and Evaluation Center in the Bahamas. *Autec II* will be operated by Woods Hole.

Star III, still one more General Dynamics craft, has been used in underwater acoustics research and sea-bottom mapping. Russia tried to buy it.

Cubmarine PC3B, another Perry product, is operated by Ocean Systems. One of the participants in the H-bomb salvage near Spain, it is one of the speedier research subs, clipping along at a brisk four knots.

Deep Jeep, another Navy vehicle, is also one of the smallest—10 feet long. It's operated by the Scripps Institute of Oceanography.

Deep Quest, built and operated by Lockheed Missiles and Space Co., is one of the most promising of the deep submersibles. Its rated depth of 8000 feet, payload (7000 pounds), and ability to "lock out" divers gives it wide potential for research.

Asherah, named for the Phoenician goddess of the deep, was built by General Dynamics and has been used in underwater archeology and in marine biology research.

Trieste II, Prof. Auguste Piccard's original bathyscaphe with new modifications, holds the world's diving record, 35,800 feet to the bottom of the Mariana Trench off the Mariana Islands. It is now used for pilot training in the U.S. Navy's Deep Submergence Systems Project.

Archimede, second of the bathyscaphe, made two plunges of more than 30,000 feet (off Japan and Puerto Rico), and nearly 30 of more than 10,000 feet. It's operated by the French Navy.

SPUVA (self-propelled underwater viewing apparatus) is driven by four outboard motors from Sears Roebuck and powered by six golf-cart batteries. Its builder, Makapu Oceanic Center of Hawaii, hopes to make an underwater trip from Oahu Island to Hawaii in a larger version later this year. Its whole body is a 1½-inch-thick glass sphere, 58 inches in diameter.

DDRV (Deep Diving Research Vessel) is an experimental submarine sponsored by the Japanese government. Still under construction, it will be about 45 feet long with an operating depth of nearly 2000 feet.

Early in the game designers abandoned the traditional approach to sub design, which called for a big, heavy pressure hull with almost everything inside, requiring large, air-blown ballast tanks for flotation and submergence. Instead, the pressure hull is kept small—just a personnel capsule—and as light as possible. All large hardware (batteries, motors, air tanks) is outside the pressure hull. Most of it is stored in the shell of fiberglass or thin metal, which is flooded and serves mainly as a fairing to reduce turbulence.

The idea is to keep the sub light and buoyant so that it can float to the surface in an emergency just by dropping a ballast weight, which could be a piece of equipment. Too much buoyancy, however, is undesirable. Neutral buoyancy is best, so that slight changes in displacement will make it rise or sink.

Generally, power is provided by storage batteries and delivered to several propellers, each with its own reversible electric motor. A typical arrangement uses a stern prop for forward and reverse movement, a sideward bow thruster for turning, and a vertically aimed prop for up and down. Or there may be swiveling motors on either side, serving all purposes.

Speed isn't great, averaging a brisk 1½ knots. It isn't important, however. Scientists prefer to take a good hard look at whatever they find.

Some basic differences

Otherwise, the research subs have some basic differences. The two bathyscaphe, for instance, *Trieste* and *Archimede*, use large tanks of light, relatively incompressible gasoline for buoyancy, and carry magnetic hoppers of steel shot as drop-pable ballast. They've plumbed the deepest trenches in the oceans, sacrificing maneuverability and becoming virtual deep-sea "elevators."

Aluminaut has an unusual design—6½-inch-thick aluminum rings bolted together with a paste of zinc chromate between them. The bolts, paste and pressure of the sea keep the water out.

Other hull materials, however, notably glass, may turn out better. Compression actually makes glass stronger, and small, high-strength glass spheres have turned out well. In its tests, the Navy avoids running control cables through holes in the glass by shooting light signals out.

Glass might solve another problem in underwater research, poor visibility. But deep water is so murky anyhow—and floodlights only produce back scatter—that the problem is better solved by sonar.

In spite of such minor difficulties as

(Please turn to page 229)

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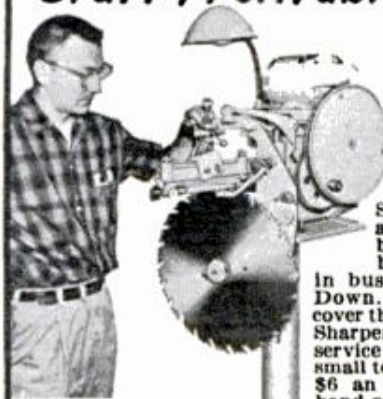
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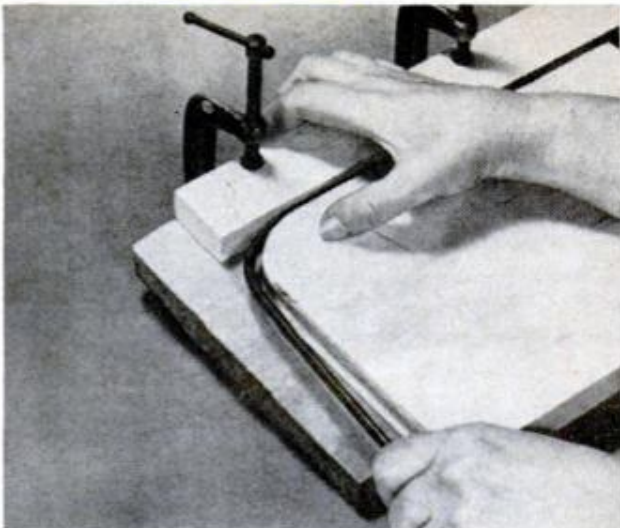
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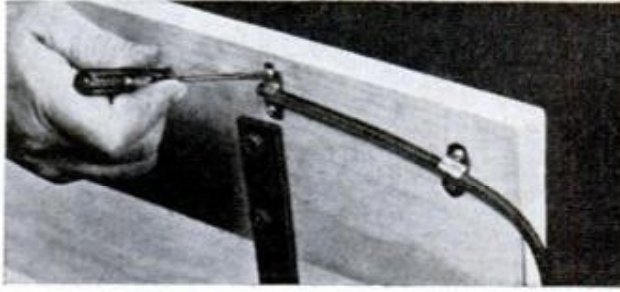
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WEEKEND PROJECTS

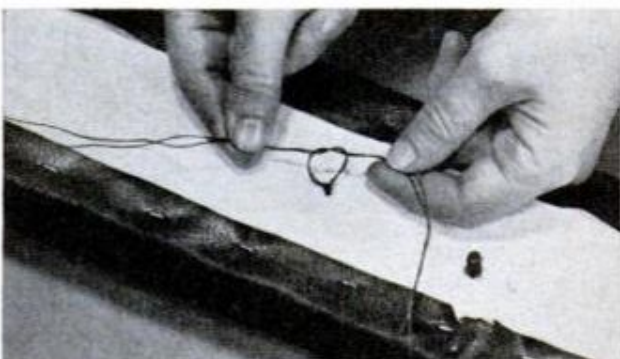
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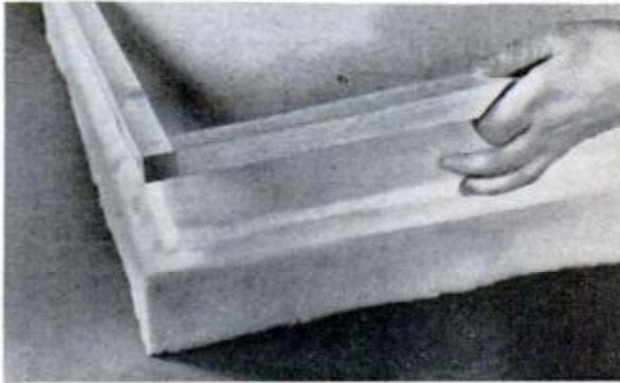
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CLIPS OF SHEET METAL attached with screws anchor metal arms to the backboard and to settee ends



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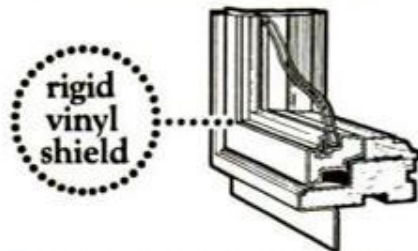
And when you are Lufkin, you make it very, very carefully. Start with extra-thick steel line so that it lies flat and measures accurately. Then, cover it with the best, non-yellowing white paint and add sharp-contrast black markings for easy reading. Next, flow on transparent, durable seamless epoxy to give extra line protection against wear. Put it in a rust-resistant steel case and cover it with tough vinyl to add long life. Install an easy-action winding handle that folds flush when not in use. Protect the line against kinking with a double-roller throat. That's how Lufkin makes it long. You will find it at your hardware or building supply dealer's right now.



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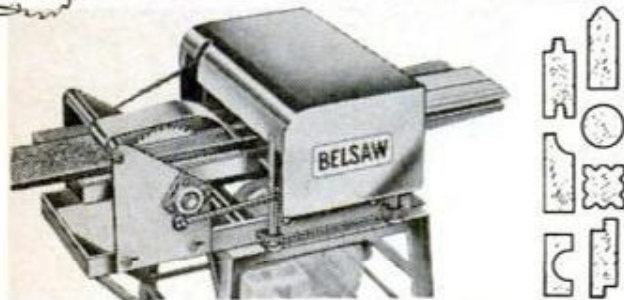
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TROUT BY TELEMETRY

(Continued from page 135)

(99H6091). Most any sensitive d.c. relay will do, although you may have to adjust its spring slightly to reduce the gap between its contacts in order to obtain maximum sensitivity. This type of relay is also sold by many model-airplane dealers for use in radio-controlled units. Since sensitive relays cost several dollars when purchased new, try picking one up at a surplus electronics store.

The three mercury switches are just simple, two-contact types. They are commonly used in pairs on room thermostats, so you might get them for next to nothing off used thermostats at a heating and airconditioning contractor's. Or you can order them for about \$1 each through any Honeywell sales office.

One of the mercury switches is glued in a slightly angled position across the top of the circuit board, as shown in the diagram. The angle is such that a light rocking motion sends the mercury up the tube to make momentary contact, closing the switch for just a second. When this happens, it activates the timing circuit that turns the sonobuoy's electronic fish lure on for about a 10-second period. Normal wave motion and wind movement will close the mercury switch at random intervals. This results in much more effective operation than the continuous tones emitted by most electronic fish lures.

After completing the electronic fish lure circuit board, make the proper connections between the circuit board and the battery pack, relay, hydrophone and transmitter circuit. Place a piece of acetate or some other suitable insulator between the fish lure and transmitter circuit boards and hold them back-to-back with a couple of rubber bands. Insert them in the sonobuoy, taking care that the wires and circuit boards do not hinder the operation of the relay below them. Extend the antenna attached to the transmitter board. Do not glue the remaining two discs to the top of the sonobuoy yet.

With a friend operating the sonobuoy, take your walkie-talkie into the next room and turn it on. When the sonobuoy is in an upright position you will hear the "carrier wave" eliminate the normal static at the receiver. This indicates that the sonobuoy's transmitter is functioning. Tipping the hydrophone should produce a loud click in your receiver. You should also be able to hear the tone emitted by the hydrophone when the electronic fish lure is activated.

Place the sonobuoy in a deep gallon-size

(Please turn to page 226)

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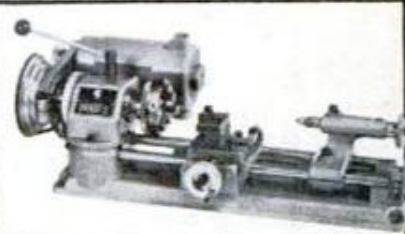
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TROUT BY TELEMETRY

(Continued from page 224)

jar of water to determine its flotation attitude. With all components inside, the sonobuoy should float with about its top one-third above the water. If, for some reason, yours floats much higher than this, you may want to add some lead weights to the bottom of the electronics compartment. The hydrophone should have almost neutral buoyancy, but it should not float.

Attach a small swivel to a light magnet for the underside of the hydrophone. If the weight of the magnet tips the hydrophone far enough to open the mercury switch, you'll need to add a counterbalance weight on the opposite side.

Before sealing the sonobuoy, place a foam rubber disc against the top of the circuit boards to hold them in place. Drill a hole for the antenna through the smaller plastic disc. Press the disc down slightly against the rubber and glue it in place. Apply Silastic around the edges and the antenna, and cap the sonobuoy with a larger plastic disc in the same manner. Put two screw eyes near the top of the sonobuoy for mooring and you're all set. ★★

DEEP-SQUEEZE DIVING

(Continued from page 218)

to remain level. This fight is taking extra air. We remain as still as possible.

Then I see an almost imperceptible drift to the silt. There's a current. I motion to Bob. He sees it. We rise slowly—a dozen feet, then stop to check the drift again. It's 11:16. I'm startled as Bob suddenly darts ahead. He's got the cord-spool and is kissing it.

I'm shaking when we break out into the warm, moist air at the surface of Hornsby Sink. I recheck my air—four minutes left. That's close, too close.

It takes a full day before Bob and I recover. Then we make other dives—recovering hundreds of ancient bones.

We check our find with two paleontology experts at the University of Florida—Dr. David Webb and Dr. Kelly Brooks. They identify the bones as belonging to tree-sloths, alligators, mammoths, deer and tortoise. Our big prize is a tooth in the jawbone of a baby mastodon. It must be 20,000 years old.

Months later, when Bob and I hear of the Jenny Spring tragedy, we know the panic that must have gripped those four adventurous lads as they groped their way through that murky fog until their air and time ran out. ★★★

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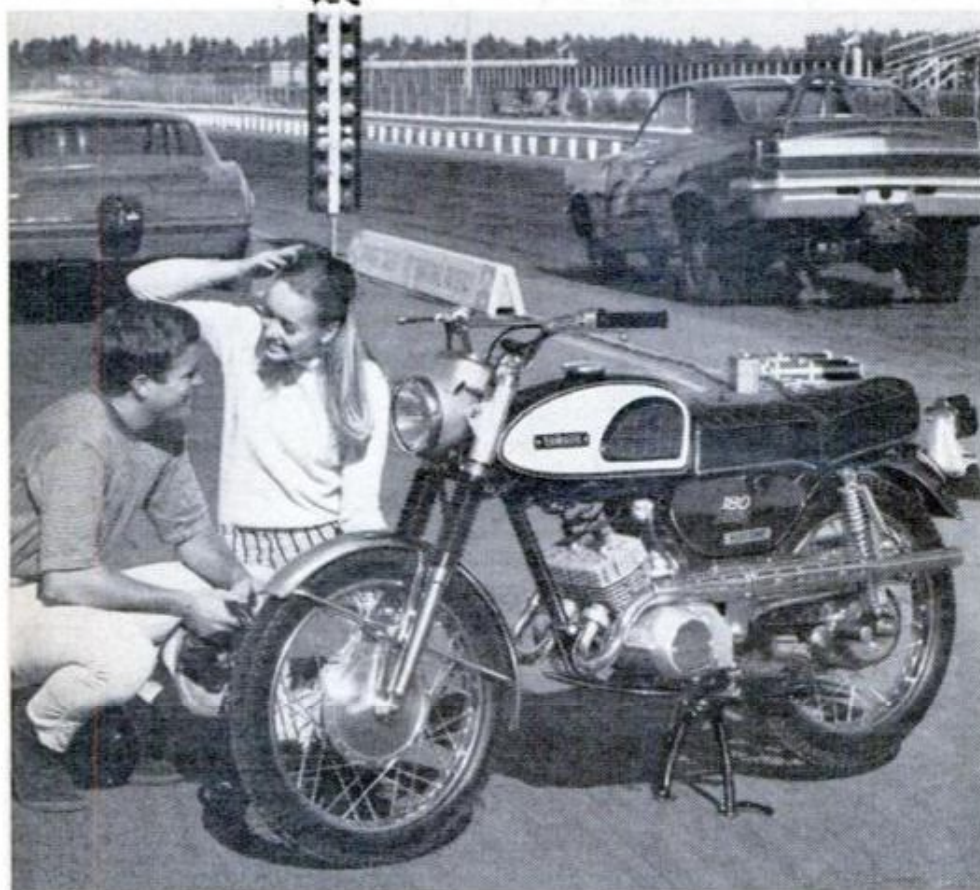
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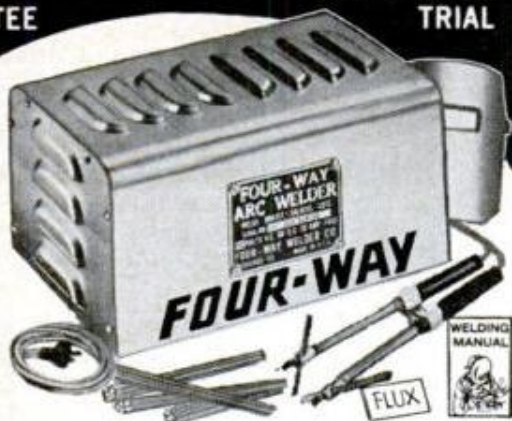
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COFFEE-TABLE AQUARIUM

(Continued from page 155)

is to press a continuous, unbroken bead of sealant from corner to corner.

After this initial test, continue to add more water until the tanks are filled to within an inch of the top. Let the tanks remain under test and prepare the top frame and well cover. Fit these on the table, check the top glass pattern in each opening, and have the top pieces cut by a glazier. You can attach the frame to the dividers with sealant, but the top panels simply slip in and out of the frame for easy cleaning and access. Just be sure to dowel the spokes of the top frame to the outer members. An alternative to increase the strength of the frame is to screw metal plates underneath the frame joints.

The pump used in the table is a quiet vibrator model that will easily take care of all six tanks, including ornaments. It's available from Canal Electric, 310 Canal St., New York, N.Y. for \$17.95. Heaters, filters and ornaments are available at local aquarium shops.

'Living picture' aquarium

An entirely different type of sealant is used for this Plexiglas tank. Called MC-25, it's a watery solvent that dries optically clear, yet is strong enough to eliminate the need for a separate metal frame. Thus, if you haven't a suitable wall with a closet at the rear, you can still build such a tank into a see-through room divider, bookcase or even a bar. Just make sure you have access for feeding and cleaning. Industrial Plastics, 324 Canal St., New York, N.Y., supplies the Plexiglas parts for this tank, cut to size, with 2 oz. of MC-25 for \$17.25, plus postage. ★★

CHRYSLER IMPERIAL

(Continued from page 101)

power-to-weight ratio, excellent handling characteristics, and a safe feel in ride and roadability.

The average owner, incidentally, has had 2.65 Imperials and some have had a dozen or more. A Virginia real estate manager, who's 75 years old, has "owned Imperials since 1948, about one every year." When he trades in again, he says he'll buy another even though he thinks the interior workmanship is somewhat "crude."

All in all, Imperial owners are an overwhelmingly faithful lot. They love their car and, even though there are some things that make 'em fighting mad, it's obvious they're not going to switch. ★★

BIG RISE OF LITTLE SINKERS

(Continued from page 220)

visibility, however, marine scientists and others with business in the deep are glad to pay substantial sums to use the small subs. The Navy, for one, leases a number of them for work on the development of military undersea techniques—submarine communication, detection and weaponry. Others use them as workboats for undersea construction, surveying, salvage, mineral prospecting and inspection of underwater equipment such as cables.

Daily rent \$300 to \$10,000

What does it cost to hire one? Prices vary, depending on the size, payload and depth capability, but a rough rule of thumb is \$1 or \$2 per foot of depth. The smallest, shallow-diving subs rent for \$300 to \$500 a day, but you could pay as much as \$5000 to \$10,000 a day for the deeper-diving vessels.

Obviously, it's too expensive for joyriders, so the money goes for jobs that are worth doing and worth risking in the harsh, alien, unforgiving deep seas.

Remarkably, not one life nor one small sub has been lost to date. Let's hope no one gets overconfident. ★★★

COMPUTER IN HIS BASEMENT

(Continued from page 209)

in March, 1949, in *Popular Mechanics*," Jim reminisces.

In that same issue, there was an article describing the first electronic computer built by Echert and Mauchley at the University of Pennsylvania. One of the predictions made then was that "Computers in the future might have only 1000 vacuum tubes and perhaps weigh only one and one-half tons."

However, since that time, transistors have replaced tubes and today's integrated circuits are replacing transistors. To illustrate the radical reduction in size which has been made possible by molecular electronics, one need only note that space-age computers now weigh only a few pounds.

"Computers are capable of being programmed to perform important household tasks today, but when we look ahead 20 years, even our wildest expectations will probably seem pale when compared to what ECHO, 1987 version, may be doing for us." One thing is certain, the Sutherland family of Pittsburgh will know from firsthand experience how to get the most from an ECHO "genie." ★★★

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\$34.95

2 for ... \$ 64.50
6 for ... \$189.50



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2 for ... \$ 67.50
6 for ... \$199.50

\$69.95 5 3/4 hp. Briggs & Stratton

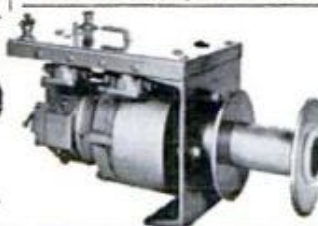
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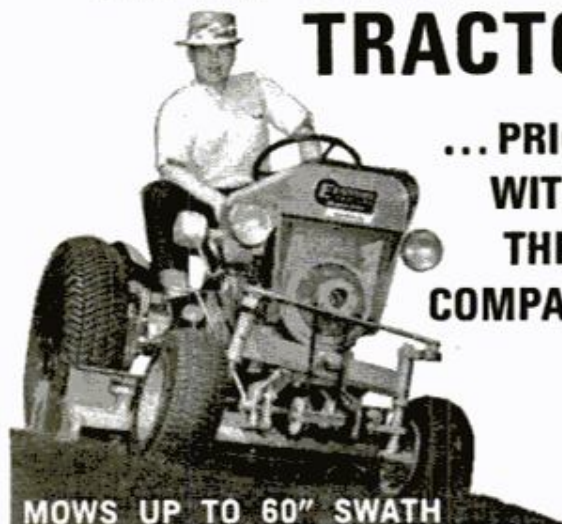
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WE TOOK OUR BOAT ALONG

(Continued from page 127)

25 mph in second gear than to try to save a few minutes by staying in third gear and have to ride the brake pedal all the way.

If you have to drive over a bumpy, unpaved road with your boat, drive extremely slowly (10-15 mph). Boats are designed for water-cushioned bumps and trailers for smooth highways. Both take an unmerciful beating on rutty roads.

The main thing we watch for in launching the boat on a wilderness ramp is to be positive there's a firm footing for our rear tires and that there's enough water depth to handle the boat. We always carry a tow rope, so if necessary, we can unhook the trailer from the camper and push it farther into the water. The same works in reverse. You can push the trailer into the water for loading the boat and then pull the trailer back to firm ground with the tow cable where you can hitch it to the vehicle. Tandem wheels or flotation tires are worthwhile if you use non-paved ramps with soft footing regularly.

The boat hull or engine installation may dictate the type of hull support. If there's a choice, we favor a roller system over straight padded cradles for easier launching operations and to keep wheel hubs out of the water.

The right kind of hitch

A frame-mounted hitch generally is completely adequate on pickup trucks, but with an automobile most manufacturers recommend using a load-equalizing hitch for loads over 2000 pounds and a tongue weight over 200 pounds. This type hitch redistributes the tongue load in such a way as to prevent all of the load from resting on the ball hitch. Some of the weight is transferred to the front wheels of the towing vehicle and some is shifted back to the trailer wheels. The size of hitch and torsion bars used must match the load.

The above rundown on towing weights, size of tires and other technical features may seem mighty complicated. Actually, it reduces to a very small checklist which is a real headache eliminator.

When it comes to outdoor vacation fun for the entire family we are convinced nothing equals the enjoyment of hitting the road in a camper with a boat trailering merrily behind. At least, that's what we've been doing the past few summers and right now we're studying road maps, camping guides, boating facilities folders and other tempters to decide this year's target.

So, fellow trailer boaters, time's a-wasting. Start plotting your summer safari right now. ★★★



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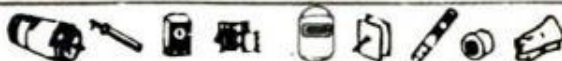


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Reversible. All ball bearing const. thru out. Turns approx. 68 RPM on 12 V.D.C. Also runs on 24 & 32 V. Gear ratio is 44.5 to 1. Measures 13" L x 7" H x 10 1/2" W. Incl. shaft. Exc. for small winches, boat capstans, electric cars, etc. Pulls in excess of 1000 lbs. GOVT COST \$381. Govt. overhauled cond. Shpg. wt. 35 lbs. \$37.50 (Stk. #2140)



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110 to 1 reduction. 1/2 HP @ 62 RPM under load @ 24 V.D.C. Reversible. Also runs well on 12 V.D.C. at reduced rating. Exc. as heavy door opener, sidewalk cart motor, winch or capstan. 5/8" shaft, 12" L x 4" W x 4 3/4" H. GOV'T COST \$249. Gov't overhauled cond. Shpg. wt. 12 lbs. \$17.50 (Stk. #2311)



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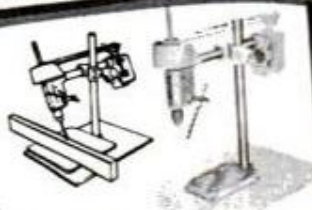


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