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Popular Mechanics

MAY 1972
50 CENTS

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Cover photo by Henry Artof

Bill Warwick's W-3 Bantam—first in a great new series of homebuilt aircraft to appear in Popular Mechanics (see page 89)

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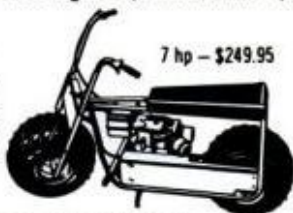
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LETTERS

TO THE EDITOR

If sugar doesn't work . . .

Regarding the item, "Stop hiccups with sugar," in *Science Worldwide* (page 36J, March PM), I have a pet cure that really works. Several spoonfuls of gelatin, any brand or flavor, swallowed rapidly, will do the trick. In the absence of gelatin, yogurt makes a pretty good substitute.
DALLAS, TEX. E. P. ALDREDGE

When my husband was in the hospital, he developed hiccups that lasted 11 days. Doctors and nurses tried everything they could think of. Finally, one nurses' aide suggested he take bites of peanut butter. Within an hour his hiccups left. He did get them back once or twice but always kept a supply of peanut butter on hand; after two days, they disappeared forever.
HUDSON, IOWA MRS. KENNETH SCHLICHT

Handsome buffet

I built the roll-out bar (*A handsome buffet that leads a double life*, page 140, Dec. '71 PM) and am very satisfied with it. I'm one of those guys who never seem to be able to do anything right with wood and am constantly learning from my first mistakes. Anyway, the bar cost me about



\$90, and it's an item anyone would be proud to have in his house.

The interior is a beautiful cherry red. I did not put in the bottom pieces for the wine rack, and I put a back on the cabinet, painted a flat black.
COURCELETTE, QUE. TOM McANENEY

There's one made in America

In *PM tests the Flottjet* (page 158, March PM) you erroneously state that no
(Please turn to page 8)

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LETTERS

(Continued from page 6)

U.S. manufacturer has ever made a combination jointer and thickness (surface) planer. I have used the 12-inch planer-jointer combination made by the Parks Woodworking Machine Co., Cincinnati, Ohio, and it is okay.

BRADENTON, FLA.

JOSEPH KEIL

I have one I bought new from Parks in 1939 and I still get good service from it—and with all the original flat rubber belts!

BROADWAY, VA.

E. C. LYNCH

'Hundreds of dollars of fun'

This winter I built this one-third-size stagecoach from the plans in 18-inch model of overland stagecoach (page 115, Jan. '46 PM). It is mostly made of oak,



and it took me about 250 hours. The wheels in front are 28 inches and 32 inches in the rear. It cost me around \$130 and provided hundreds of dollars of fun.

GRAFTON, N.D.

SIG JAGULSKI

'Too rich for my blood'

PM is too rich for my blood! The March *Detroit Listening Post* (page 30) states that you might not make money on the new energy-absorbing bumpers . . . that if your insurance is \$500 and you save 20 percent, then you will just pay for the bumper. This implies you intend to trade in the car every year. What about those of us who must keep the car three or more years? Won't we save this \$100 every year we keep the car?

RICHARDSON, TEX.

LEO B. MARX

Yes, you will. Guess we got swept along by that *Detroit* thinking: a new one every year.

Shoes on backwards

In the *March Bicycle Shop* (page 76) Eugene Sloane stated that when you're

replacing brake shoes, you should "be sure that the closed end of the block faces toward the rear of the bicycle." Shouldn't this be the other way around?

WORCESTER, MASS.

MICHAEL MARTIN

Yes, it should be the other way around. A critical line was dropped from the manuscript during typing. The line should read: When replacing, be sure that the closed end of the block faces toward the front and that the open end of the block faces toward the rear of the bicycle. Otherwise, the brake shoe will slide right out of the block when brakes are applied.

Remote lift for snowplow

Since I did not have an outside tire carrier to anchor the lift chain of the snowplow I built (*Clear your drive the easy way*, page 166, Dec. PM), I decided to add a remote lift.

I added cleats to an eight-foot 2x4 to make it pivot on the tailgate 24 inches from the end of the 2x4. I removed the rear seat so this lever could travel from the floor to the roof between front bucket seats. A length of chain was used to attach the plow to the lever. This arrangement gives about 16 inches of lift to the plow with about 20 pounds of effort. I



hook the left and right seat belts together and loop the connected belts over the lever to hold the plow in a raised position.

FORT WAYNE, IND. HOWARD R. PLETCHER

Mooring assembly, not air valve

You made one small error in regard to Goodyear airships in *Up, up and away! Very slowly* (page 76, Feb. PM). The small inset picture is not an air valve, as you stated, but a mooring assembly similar to that on the nose. It is used as a secondary secure point should the weather conditions prevent the use of the portable mast; we would secure the blimp to the

(Please turn to page 10)



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LETTERS

(Continued from page 8)

top of the Goodyear bus and lock it in place.
SPRING, TEX. CREW, GOODYEAR AIRSHIP AMERICA

'Grandmother' clock in spare time

Here's a photograph of a "grandmother" clock recently completed by my father, Barney B. Grigg, from instructions in the October and November 1969 issues of *PM* (*PM's handsome hall clock*, page 124, Oct. '69 *PM*). The wood used is wormy chestnut, and it is finished with a chestnut stain. Needless to say, I and other members of our family are quite proud of the clock. My father has subscribed to and been an avid reader of *Popular Mechanics* for quite some time.



This clock was made entirely in his spare time as he is a barber by profession.
RALEIGH, N.C. MRS. BLENDA HARPER

Shame on you!

Shame on you for not warning your readers to put the car on stands when working underneath it (*Replace mufflers yourself—and save*, page 112, March *PM*). Granted, the screw-type jack supplied by Volvo is better than a bumper jack, it is still a safety hazard to work under a car without using stands.

SCOTT AFB, ILL. CAPT. JAMES SHANAHAN

I find I can save still more by putting brass nuts on the clamps or U-bolts. That way your bolts and nuts are never frozen, and you can always use the same clamps and nuts. Get heavy-duty brass nuts at any hardware store.

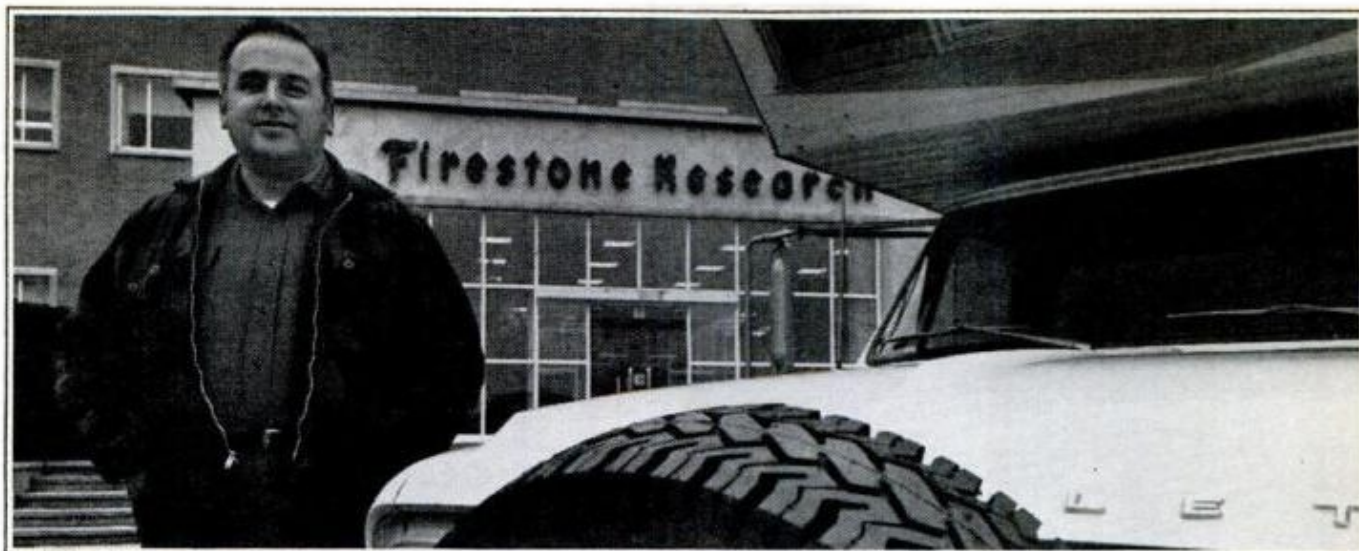
RIDLEY PARK, PA. HAROLD A. MILLER

Don't sacrifice for show ring

I must protest the statement regarding steadiness and reliability being sacrificed for the physical standards needed to win blue ribbons at dog shows (*How to get a well-trained dog*, page 84, Feb. *PM*).

Very seldom will a breeder of quality

(Please turn to page 12)



**STEVE PETRASEK, TIRE ENGINEER,
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LETTERS

(Continued from page 10)

dogs—that is, dogs bred to conform to a set standard—"sacrifice" temperament (soundness, steadiness, reliability) for physical structure. A dog, particularly a German shepherd (as you have pictured), is nothing in the show ring if he lacks steadiness. A serious breeder studies the backgrounds of his animals and knows the temperament expected in the puppies.

BETENBIL KENNELS ELIZABETH A. SAVOCA
ALTAMONT, N.Y.

Works with d.c., not a.c.

The wiring diagram on page 151 of the February issue (*Make this shaper for \$60*) would work only with a d.c. motor. Any change of wiring connections to alter direction of an a.c. motor would have to be done internally to the motor itself. Some a.c. motors would require a change of starting brush position.

GRAND RAPIDS, MICH. JAMES BUFFINGTON

Credit unions make loans, too

Mort Schultz apparently didn't do his legwork before he wrote *How to save money on your next car loan* (page 78, March PM).

We're amazed that credit unions got only passing mention as a favorite source for car loans. That's like talking about the auto industry and leaving out one of the Big Three manufacturers.

Credit unions make one out of every five new-car auto loans in Michigan. They offer a maximum 12 percent annual percentage rate, and a great many give interest rebates ranging to 35 percent. Credit unions offer free loan protection insurance.
MICHIGAN CREDIT UNION LEAGUE G. A. CHARBONNEAU
MANAGING DIRECTOR
DETROIT, MICH.

In addition, a credit union does not "discount" (deduct interest in advance). Therefore you can make prepayments at any time and without penalty. This gives you the advantage stated for a life insurance loan without the disadvantage, as you still have to make your regular monthly payment even after a prepayment. The banks' form of discounting increases the rate of interest for longer periods of loans, and since the average auto loan is for 36 months instead of the sample table shown for 24 months, a true comparison would show the banks generally much higher than the average credit union.

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HARRY JACOBY
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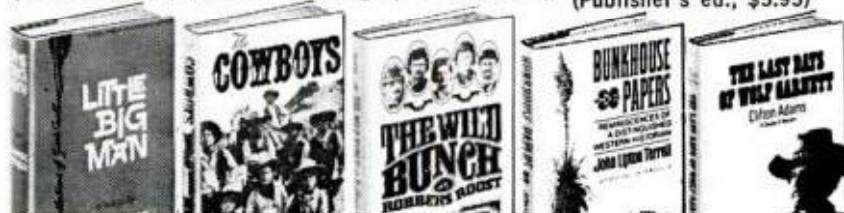
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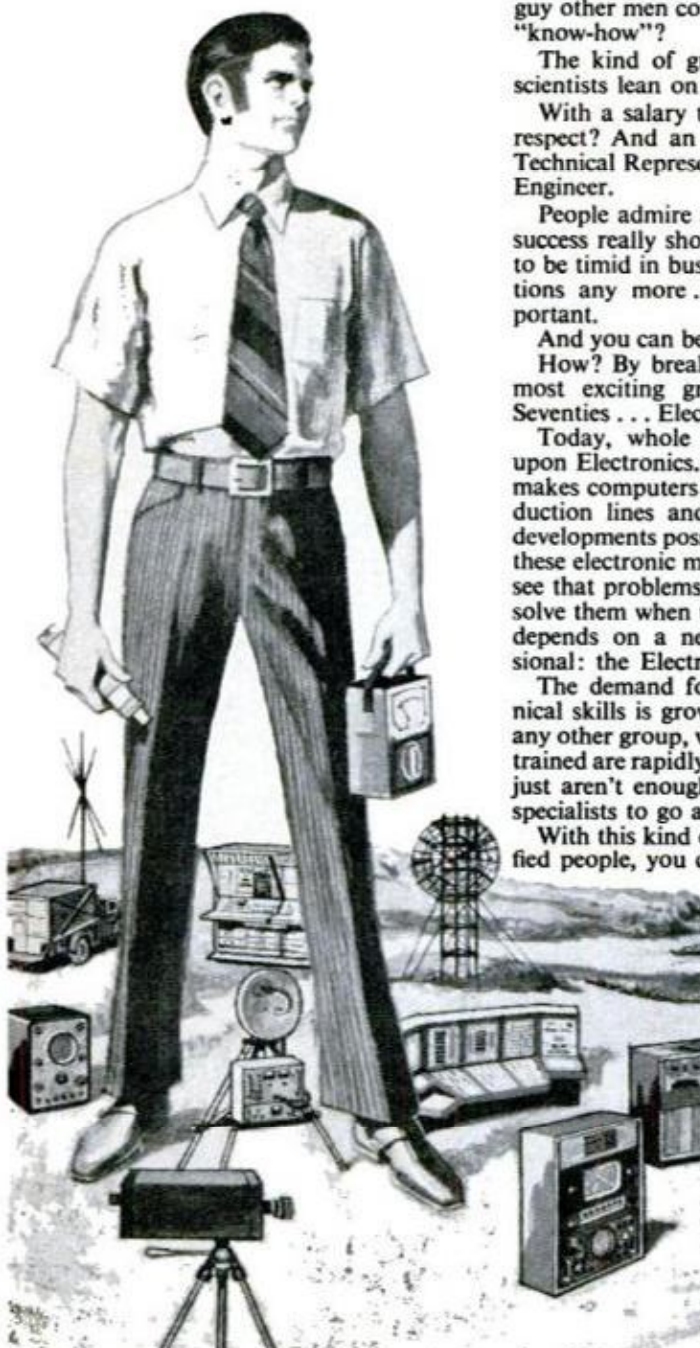
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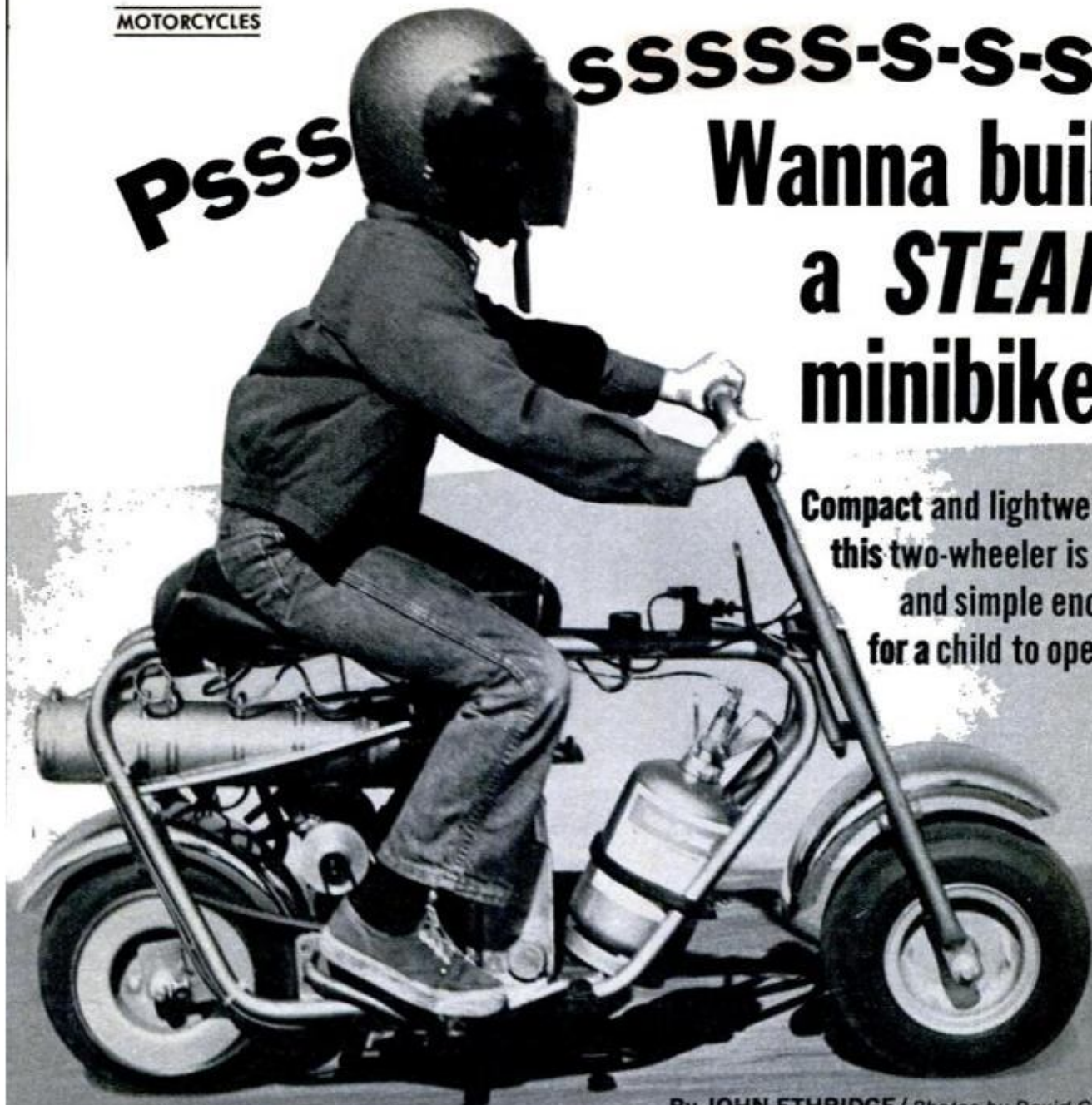
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PSSSSSSSSSS-S-S-S-t Wanna build a **STEAM** minibike?

**Compact and lightweight,
this two-wheeler is safe
and simple enough
for a child to operate**



By JOHN ETHRIDGE / Photos by David Gooley

THE FASTER YOU GO, the better the engine seems to run—right up to the 6000-rpm red line. The designer, Richard J. Smith, revved it all the way up to 8000 rpm and still couldn't break it.

This minibike was custom-built for Robert Noble, chairman of the Western Div. of the Steam Automobile Club of America, and may still be the only steam minibike on the road. Smith has used his steam system in a variety of vehicles during years of full-time innovation with steam engines, but this is his first steam minibike.

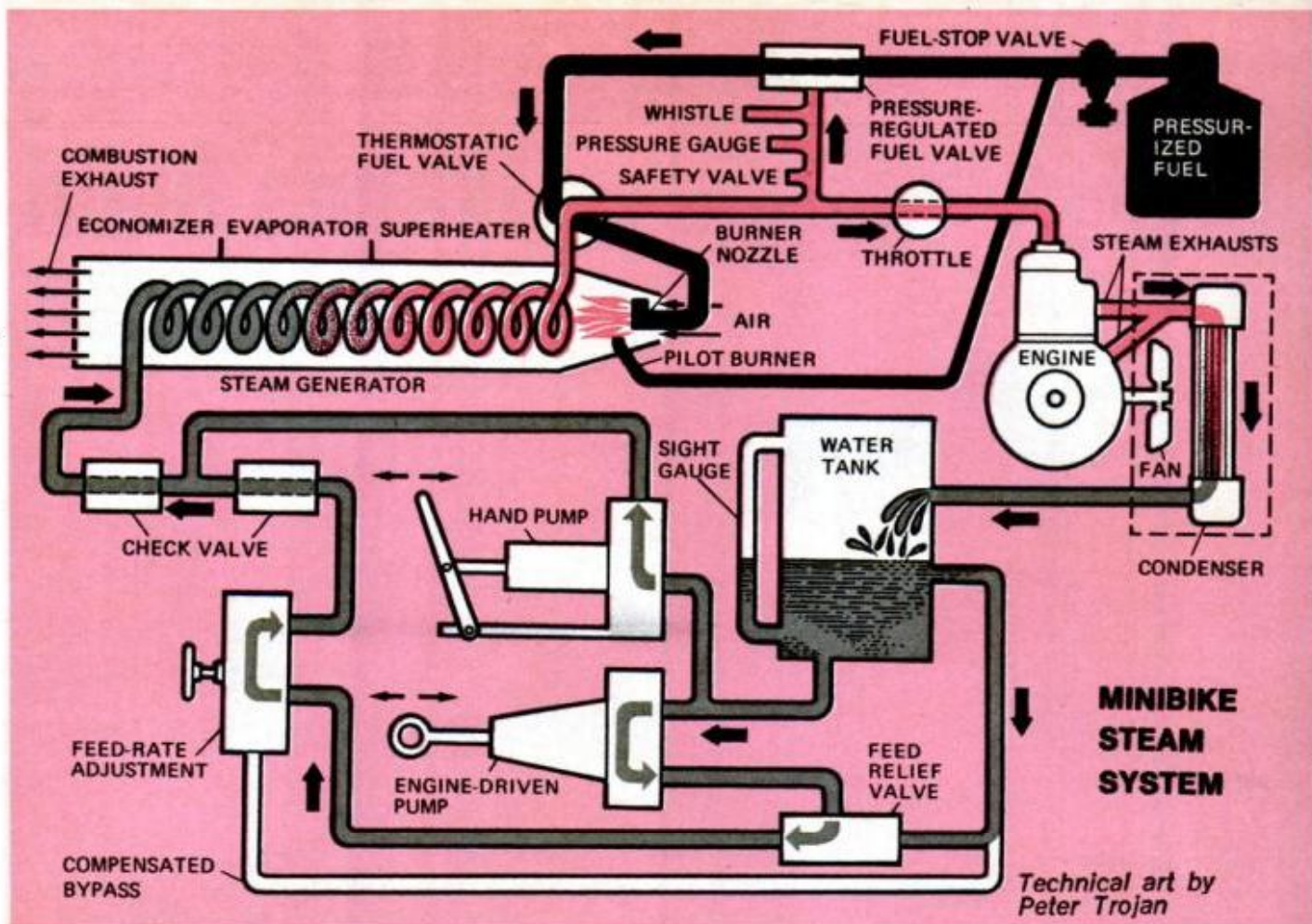
Combustion and steam generation take place in a cylindrical housing not much bigger than a motorcycle muffler mounted under the seat. The housing, open at the rear to exhaust burned gases, encloses the flash boiler, a long piece of .031-inch-wall steel tubing, coiled and folded many times

upon itself to expose a large area to the burner flame. The housing is lined with refractory fiber to prevent heat loss, and is made from stainless-steel sheet held together at joints with stainless hose clamps. This construction permits rapid access to the burner and boiler tube for cleaning and inspection.

Propane fuel passes from a commercially available bottle of three-pound, four-ounce capacity through two valves that automatically control combustion within safe operating limits by regulating fuel flow.

The first valve is operated by boiler pressure and controls fuel flow so that a pressure of 400 to 450 p.s.i. is maintained. The second senses temperature and thermostatically keeps temperature in the 650 to 750° F. range. This double safety

(Please turn to page 22)



STEAM MINIBIKE

(Continued from page 21)

feature guards against overpressurization and assures that heat damage to the boiler tube will not result, even if the water supply fails.

Feedwater (in this case a 5 percent mixture of steam-cylinder oil and water with an emulsifier) is normally supplied by a pump driven by the engine via an eccentric on the primary shaft. However, a hand-operated auxiliary pump can also be used when starting from cold or if the engine stops. Check valves to prevent back flow, bypasses and a feed-rate adjustment (set initially to match boiler demand and then left alone) complete the feed system.

Steam vehicles don't require, and usually do not have, clutches. For the sake of practicality, however, this one does. The engine is single-acting, meaning that steam only pushes the piston down, with the momentum of the crankshaft and flywheel required to return it, and is therefore not self-starting. So, both for convenience of operation and running the feedwater pump, it was desirable to have the engine running while the vehicle is stopped. Smith accomplished this by driving through a centrifugal clutch of

(Please turn to page 24)

STEAM SYSTEM is diagrammed above. Condensing system, including fan, condenser and tubing, is shown in dashed box. Actual hardware was not yet installed on minibike at the time photos were made



CANADA AT ITS BEST



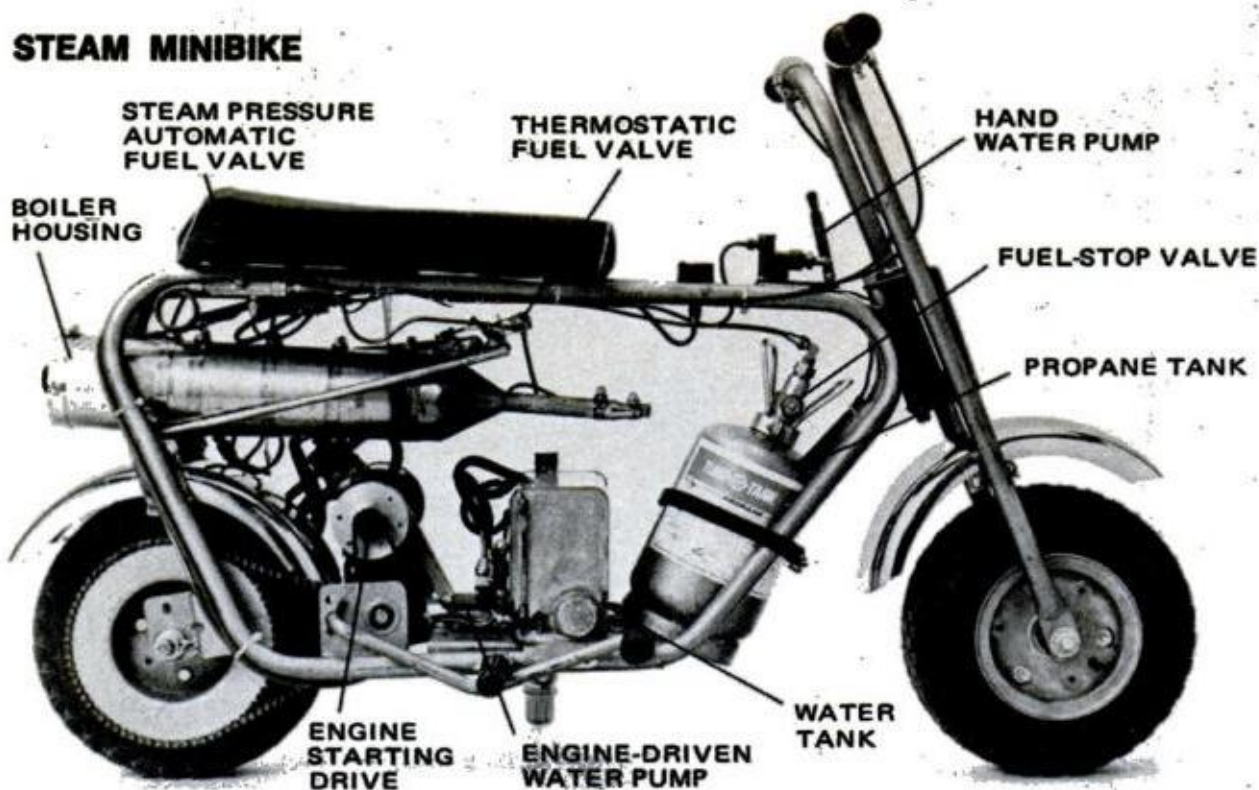
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STEAM MINIBIKE



COMPONENTS OF STEAM SYSTEM are easily accommodated on even the smallest conventional bike frame

STEAM MINIBIKE

(Continued from page 22)

the type normally used on simpler gasoline-engine minibikes.

An overrunning, or one-way, clutch installed in a chain drive working between the engine crankshaft and the primary driveshaft is used for starting. The one-way clutch is installed so that when the bike is pushed, the engine turns. With steam up, starting is simply a matter of cracking the throttle and nudging the bike forward.

The engine is based on an Ohlsson & Rice 1.2-cubic-inch, two-stroke miniature engine. Superheated steam is fed through a fitting screwed into the spark-plug hole. Incorporated in the fitting is a piston-actuated poppet valve that cuts off admission of steam at around one-twelfth of cylinder stroke. This means the steam is expanded approximately 12 times its original volume during the working stroke, which Smith says accounts for the high efficiency of the engine.

Expanded steam was exhausted through both the original intake and exhaust ports into the atmosphere when pictures of the minibike were taken. But a condensing system has been added. Spent vapor is piped to a fan-cooled condenser (an automotive heater core) where it becomes liquid and is returned to the water tank. Lubrication is by oil droplets in the working fluid, very similar to premix two-stroke practice.

Even without the condensing system, the minibike will run for about an hour on just less than one gallon of water/oil mixture, which isn't any great inconvenience or expense. The bottle of propane is good for nearly two hours running, depending on how fast the bike is driven.

Starting from cold is easier than with most miniature steam locomotives and tractors. You just turn on the fuel and light the burner, which can be done with a match or cigaret lighter, but Smith finds a spark igniter of the kind used to light acetylene torches is the handiest. Lighting takes place at the rear of the boiler housing, and it catches with a whoosh about like that of a gas hot-water heater. A pilot flame relights the burner on subsequent demand cycles as long as the fuel is left on. Full pressure and temperature are reached in only 15 seconds after lighting, but if you're in a big hurry, you can get underway as soon as 200-250 p.s.i. shows on the gauge.

At 6000 rpm, speed of the bike is about 30 mph. Smith estimates the output of the engine at 1.5 hp, but as is characteristic of piston steam engines, it feels like at least twice that amount. The throttle, controlled by the right twist-grip, has a nice progressive feel and requires no getting used to. The muffled nutt-putt of the exhaust isn't noticeably different from that of small internal combustion engines, but a twist of the left grip produces a shriek from the whistle just to let the

(Please turn to page 190)

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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Lighting bug

The left directional signal light of my 1967 Chevrolet Impala is giving me fits. Sometimes it works—sometimes it doesn't. When it doesn't, I get no green light from the indicator. Different mechanics have done different things. One looked for loose connections. Another put in a new bulb. Now a third says I need a new switch, which requires removal of the steering wheel. He says the job will take about two hours. Do you agree?—M.H. Schnakenberg, Kansas City, Mo.

About the switch—yes! I think the car needs one. But he sure is a slow worker. The job should take about an hour. . . that's what the flat rate manual says. The manual is used by mechanics to judge time requirements of mechanical tasks.

Hes-i-ta-tion

I have a 1968 Ford Mustang with a 289-cu.-in. engine, two-barrel carburetor, automatic transmission and a very serious hesitation problem between start and warm-up. When I step on the accelerator, the engine dies way down or cuts out completely. After it warms up, it runs great. The engine has been tuned up many times and has had three new carburetors. The automatic choke has been adjusted and readjusted from here to Sunday. Is there a solution or am I spinning my wheels?—Max McComb, Monsey, N.Y.

Okay, let's assume it's not the automatic choke. Has the engine ever been checked for vacuum leaks when cold? Also, you should have the accelerator pump in the carburetor set for maximum stroke.

Where has all the current gone?

When my battery failed not long ago, I replaced it with a new one. Now the new one has discharged, too. What causes a good battery to run down like this?—Edmund Kellerer, Fort Wayne, Ind.

I can think of a half-dozen good reasons. Look for a faulty alternator and voltage regulator unit, a short circuit in the car's wiring, a stuck stoplight switch that allows stoplights to burn continuously, a slipping fan belt that isn't turning the alternator at the correct speed, operational

errors such as forgetting to turn off lights, and not enough driving to keep the battery sufficiently charged.

Dropped digit

In the Jan. 1972 Automobile Clinic (Service Tips), you mentioned that Ford service bulletin 16 (7/2/71) provides revised front-wheel alignment specifications for 1971 models. My dealer is not familiar with this bulletin. Can you tell me what it contains?—Ken Williamson, Kansas City.

It should have contained another digit! Ford issued no service bulletin 16 on July 2, 1971. The number is 168.

Shiftless Cad

My 1968 Cadillac Eldorado has become very hard to shift. The shift lever seems to bind, and I have to actually force it into gear. Is something wrong with the transmission?—James F. Vesey, Tucson, Ariz.

Not likely. However, the shift linkage bellcrank assembly of Eldorados does require a little lubrication to keep it moving freely. If the part isn't lubricated, water running down the bellcrank shaft can cause corrosion that hampers operation. Disassemble, clean and repack the bellcrank with a multipurpose grease. When reinstalling the part, make sure whoever does the job readjusts the neutral switch.

Trouble by the numbers

During the 18,000-mile warranty check of my 1970 Ambassador (360-cu.-in. V-8, two-barrel carburetor), I complained of spark knock during acceleration. I have tried many different grades of gasoline with no relief. My dealer's "fix" was to remove the dual-diaphragm vacuum unit from the distributor, plug the inlet hose at the carburetor and replace it with a single diaphragm unit. Since that time I have experienced (1) no relief from spark knock, (2) a drop of five miles per gallon of gasoline, (3) choke stuck closed, causing "flame out" on the open highway, (4) an inability to kick the automatic choke off the last fast-idle notch until the temperature is up to normal and (5) a flooding effect during cold starts. I asked that the
(Please turn to page 26D)

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AUTOMOBILE CLINIC

(Continued from page 26B)

dual-diaphragm vacuum unit be reinstalled, but was told the factory recommends only the single diaphragm unit. Is this true? What is the solution to all my problems?—H. Jolly Jr., Burlington, N.C.

It is true that an American Motors service bulletin has recommended that the dual-diaphragm unit be replaced with the single-diaphragm unit. However, I think it is coincidence that you are experiencing problems other than spark knock. If you analyze these other troubles you will see that you can't attribute them to the vacuum-unit—they are carburetor-related conditions. Perhaps when you had the car serviced a carburetor adjustment wasn't made properly. . . maybe the automatic choke isn't functioning as it should. . . perhaps a bad job was done in plugging the inlet hose at the carburetor and you have a vacuum leak at this point. As for the spark knock, you may be able to get rid of it by retarding the timing 2° - 4°. But no more.

Bearing down

My car is a 1968 Tempest station wagon with 350 V8 engine and automatic box. It has gone 45,000 miles. The rear-wheel bearings have had to be replaced on both sides a number of times. The car always has to carry a load of about 400 to 500 pounds in the rear, but I don't think this weight is the cause of the trouble. Do you?—Gordon M. Edwards, Califon, N.J.

Not weight alone, but something is probably combining with it to give you the problem. I'd say it is a bad axle or a bent axle housing. If the axle housing is bent, for example, an additional load would be placed on the bearings.

Oil strike

I have the last of the 1969 Corvair Monzas, and it's giving me a pain. It throws oil all over the back of the car because of leaking push rods. The dealer has replaced the seals twice. It's just the right side—the left's okay. I called the dealer again today. He's stunned, doesn't know what to do. Can you help?—Henry W. Konopka, Woodbury, N.J.

Look for distorted push-rod tubes or a

thermostat on the right side that's not opening. If the thermostat is bad, it will get real hot on the right side, and the heat could be ruining the seals.

Another wearing bearing

The left rear-wheel bearing of my 1970 Chrysler Newport burned out. The dealer suggested I have both the bad bearing and the one on the opposite side replaced. Okay—I went along. Now, 110 days and 5000 miles later the same thing has happened. The dealer says, "Sorry—out of warranty." What's wrong?—Stephen Feinberg, Atlanta.

Other than your timing being bad—this job is covered by warranty only for 90 days or 4000 miles—probably one of three things: the bearing wasn't installed properly, it wasn't greased correctly, or you have a bent axle on the left side.

Service Tips

● Chevrolet has emphasized that cleaning a brake master cylinder or wheel cylinder with a cleaning solvent is absolutely forbidden. These solvents—including gasoline, kerosene, carbon tetrachloride, acetone and paint thinner—cause the rubber parts to become soft and swollen. Nothing but denatured alcohol or brake fluid should be used.

● AC Spark Plug Div. of General Motors gives good advice here that every mechanic—professional or amateur—will want to heed. Watch that sparkplug gap setting when installing plugs in 1971 and 1972 models. After years of recommending a gap of .030 to .035 in., some manufacturers have now switched to .040 in. in certain applications. The wider gap is needed in some engines for more complete combustion of the leaner fuel mixture. According to AC engineers, "exposure of the mixture to a larger spark increases the probability of ideal combustion at each ignition cycle." If gaps are set too tight, low speed misfiring may occur.

● 1972 Chrysler, Plymouth or Dodge owners with the 340 or 440-cu.-in. engine and four-barrel Thermoquad carburetor may have difficulty with hot starting and in rough running at high speed. For a cure, have your dealer apply service bulletin 14-01-72C (Chrysler and Plymouth) or 14-02-72D (Dodge). The trouble is caused by incomplete sealing between the carburetor air horn main well casting and the plastic main body. ★★

GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

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ALL By BILL McKEOWN OUTDOORS

SEPTEMBER 23RD, the fourth Saturday of the month, has been named National Hunting and Fishing Day—a date that, hopefully, indoorsmen and outdoorsmen alike will hear a lot about before it arrives.

It's to be an outdoor open-house affair. Members of fishing, hunting, boating, camping, bicycling and hiking clubs—and, for that matter, any group from sky-diving to skin-diving—should begin now to take an active part. Every individual who likes outdoor action should start asking his local sportsmen's clubs, sporting goods stores, scout troops and chambers of commerce where the activities are going to be.

Warren Page, one of the country's premier shooters and now president of the National Shooting Sports Foundation, previewed some of the possibilities for the occasion in an exclusive interview with *Popular Mechanics*.

"This will be an opportunity for hunters, fishermen and other outdoorsmen to explain their

sport," he pointed out, "and receive some of the conservation recognition they deserve as wildlife's best friends." It's no secret that the press of population growth, together with the growth of communities and industries, has resulted in the pollution of waterways and the reduction of wilderness areas for wildlife. Sportsmen aren't the cause of it. On the contrary, money from hunting and fishing licenses, game permits, ammunition taxes and camping permits, in fact, and the fish and game limits that prevent both overgrazing and overharvesting, have made outdoor sportsmen the leading contributors to ecology improvement in the last decade.

"NHF Day should give people a chance to try archery and skeet," says Page, "learn how to set up a tent or hook up a recreational vehicle, watch the fine points of fly casting or a fine gun dog retrieving, look over the latest in camping gear or the proper way to start a youngster with an air rifle. The local rod and gun club can demonstrate

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NATIONAL HUNTING & FISHING DAY

September 23, 1972

its activities, the Boy Scouts show how their SOAR (Save Our American Resources) program works."

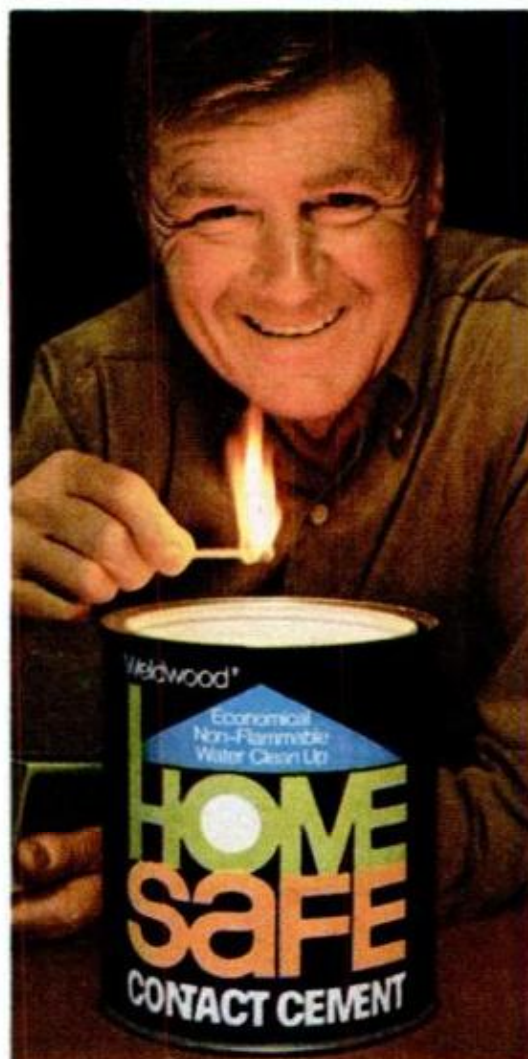
Already this open house day to explain conservation and outdoor skills for the general public has the support of such groups as the National Wildlife Federation, Izaak Walton League of America, National Assn. of Conservation Districts, Keep America Beautiful, Trout Unlimited, National Recreation and Park Assn., National Con-

servation Committee of Boy Scouts of America, The Wildlife Society, International Assn. of Game, Fish and Conservation Commissioners, and many others. Groups can obtain planning suggestions in an Open House Manual for \$1, Page reports, from various sponsoring associations or NHF Day, 1075 Post Road, Riverside, Conn. 06878.

Reasons for the observance were well summed up by Sen. Thomas McIntyre in a Congressional resolution he introduced. Due to the congestion, complexities, tensions and frustrations of today's life, he stated, and the need for outdoor recreation and a chance to "get away from it all," plus the fact that over 15,000,000 hunting licenses and 24,000,000 fishing licenses were sold last year for \$200,000,000, recognition of the hunter and angler was very much in order. Outdoor sportsmen, he recalled, have traditionally led conservation and wildlife preservation efforts, promotion of respect for private property, courtesy in field and forest, and in boating and firearm safety.

A YOUTH CONSERVATION CORPS program will be sponsored again this year by the Departments of Agriculture and the Interior. Starting late in June, 95 youth camps will be opened for eight weeks and employ
(Please turn to page 26H)

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ALL OUTDOORS

(Continued from page 26G)

about 3000 young men and women, age 15 to 18. About half the YCC participants will work in National Forests operated by the Dept. of Agriculture's Forest Service. The other half will be under the direction of the Department of the Interior's Bureaus of Indian Affairs, Land Management, Reclamation, Sport Fisheries and Wildlife, National Park Service and Office of Territories.

KAMPGROUNDS OF AMERICA, largest of the private campsite chains with 700 campgrounds open or under construction in the United States, Canada and Mexico, have announced a public offering of stock in the corporation, Kamper Klub, and packaged camping tours in Europe this summer. Campers on the budget tour fly TWA to Frankfurt, Germany, pick up a Fiat 238 camping bus from Avis, and head out at their own speed through France, Spain, Italy and Switzerland. Tour information is available from KOA headquarters, Box 1139, Billings, Mont. 59103.

A RESORT COMMUNITY with a resident environmentalist is the claim of Marco Island on the Gulf Coast of Florida. In order to prevent dredging from damaging the notable fishing on the edge of the Everglades, a barrier dike was installed under the direction of conservation manager George Spinner after approval was received from the Corps of Engineers. Reefs of automobile tires were used to stimulate growth of mangrove islets, and first reports indicate the famous snook and tarpon catches have not diminished. An experimental artificial aerie for eagles was also constructed on a high pole as a substitute for rickety nests they had built in aging tottering trees. Late reports indicate Marco eagles have carefully inspected the ersatz roost—and will have none of it.

IF THIS SUMMER'S OUTDOORSMAN looks like equipment manufacturers hoped he would last February in Chicago at the National Sporting Goods Assn. trade show, we'll be overloaded with some of the following assorted gear. Probably we should be wearing backpacks. Suppliers have noticed the booming sales of this item of duffel and a wide variety is offered. Lightweight sleeping bags, foam pads, tents and freeze-dried foods go in them. You're likely to have a rubber inflatable boat, and a light-action fiberglass rod along to land the lunkers. For cooking them, all trends point to LP gas to power the campstove, with batteries or LP popular for lights as well. ★★ ★

APPLIANCE CLINIC

By PAUL MANN

Won't spin

I have a Maytag top-fill washing machine that stalls as it is about to go into the spin cycle. To get the spin cycle going, I must get behind the machine, reach under and grab the two pulleys, and pull them back. I have been told my problem is caused by a bad transmission and that the cost of repair will be considerable. Does this explanation sound reasonable to you?—Samuel S. Carideo, Everett, Mass.

Possibly the transmission has incurred damage, such as a broken spring, that would prevent the spin cycle from engaging. However, from your description, I'd say your trouble may be no more serious than a very loose belt that is slipping and needs to be tightened or replaced, or some other friction-part malfunction far less serious than transmission trouble. For example, if your machine employs motor reversal for cycle changes, a centrifugal clutch may be used to allow the motor to pick up the load of the spinner gradually. This clutch may be slipping, causing your problem. Other factors to check out before the transmission is tackled include a faulty solenoid, a bad timer and loose wiring.

Compressor complaint

Our 8-year-old upright frostless Cold-spot freezer stopped freezing. The Sears Roebuck repairman said the compressor had failed and that a new one would cost \$125. What causes this part to go bad? Is there no way of repairing it?—Mrs. Carolyn Pratt, South Haven, Mich.

Among the causes of compressor failure are low voltage, high voltage, dirty condenser, defective condenser fan, defective thermostat, and location where the temperature is too cold. Compressors are sealed units, and repair would be more expensive than replacement. The unit would have to be cut open with a torch and then re-welded after repairs are made. This task is usually beyond the capability of local repair shops. According to Sears, that \$125 you mentioned should cover the cost of parts and labor.

Sticking waffles

Our waffle iron is only three years old, but it appears the Teflon has deteriorated, for the waffles stick. Is there some way of restoring Teflon?—N. M. Dietrich, Redwater, Tex.

If you believe the Teflon has deteriorated just because waffles are sticking, you may be wrong. One sure way of knowing whether the coating is damaged is to actually see it peeling off so that metal is exposed. The waffle iron just may need a Teflon cleaner you can buy in a hardware or appliance store. Use it as directed; apply cooking oil to relubricate the grids.

Teflon can be restored, but this is expensive. All the old Teflon must be removed by sandblasting. It would probably be more economical to order a new set of grids from an appliance dealer.

Loss of pep

I have a GE dishwasher (model SD306C1 NP). It began losing its action (flow of water) about three weeks ago. The soap dispenser would open, but the water jet wasn't strong enough to rinse the soap away. Now there's no action at all—water leaks out on the floor when I turn on the unit. What do you figure—pump failure? Can I replace the part myself?—Alfred Atkins, Bronxville, N.Y.

The loss of water pressure at first was probably caused by a clogged screen in the water valve. Continued operation, in turn, caused the seal in the pump mechanism to become damaged, since it depends on water for lubrication. When there is a lack of water in the dishwasher, this seal runs hot and deteriorates.

To replace the seal you must remove the impeller from the motor shaft. This isn't too tough if you have the proper puller. You should also make sure that every sealing "O" ring is replaced with a new one. Failure to do this will result in possible leakage through the motor. The water-valve screen that likely started the trouble is easily removed for cleaning—just turn off the water and remove the nylon valve body from the mounting bracket. If the screen is so clogged that it nearly stops the water flow, replace it.

Coming apart

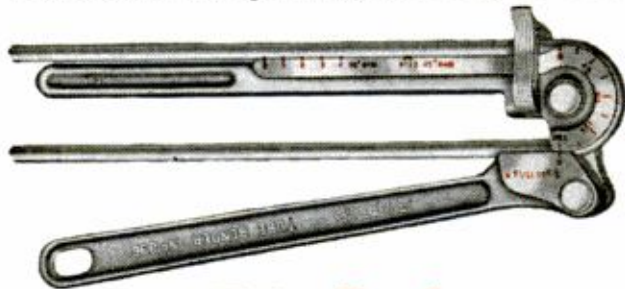
I repair small appliances and often find that ceramic insulators of thermostats used on irons, baking ovens and other "heat-up" units are loose or have fallen off. They are usually cemented on with a white ce-

(Please turn to page 36)

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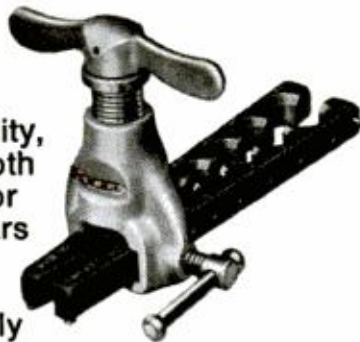
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APPLIANCE CLINIC

(Continued from page 35)

ment. Where can I get this product? Would a two-part epoxy adhesive work as well?—Leon G. Wurtz, Elmwood, Wis.

The small-appliance makers that I know of prefer that when a ceramic insulator breaks loose from a thermostat you replace the thermostat. If you can find a two-part epoxy that will withstand a temperature of around 500° F., it will probably work. However, adhesives that I know of that are generally available, including epoxy, can withstand only 250°.

Continuous power

What's the difference between testing an appliance for power and for continuity?—Bert Kline, Phoenix, Ariz.

A power test tells you if the appliance is getting the power it needs to operate. An appliance designed to run on 115 volts a.c. has to have that line voltage available. You can check this with a voltmeter.

A continuity check tells you whether power is flowing continuously through the circuit, which is a closed loop. If an "open" circuit (no continuity) exists, the appliance won't work. You can check this with an ohmmeter.

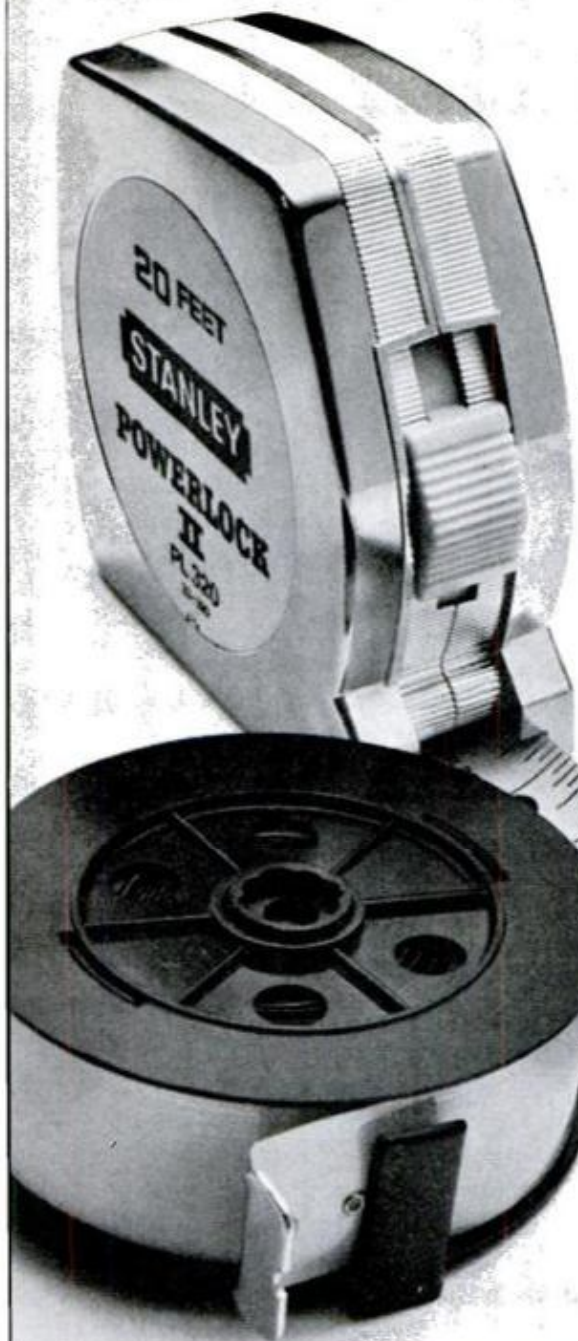
Correction

Word comes from Kelvinator, Inc., that contrary to what we said in the January *Appliance Clinic* Kelvinator is no longer an American Motors division. Should you have to write, the company is now located at 1545 Clyde Park, S.W., Grand Rapids, Mich. 49509. Concerning the addition of an automatic icemaker to a refrigerator that doesn't have one, the company feels it is best not to attempt this unless the refrigerator is designed to accept one.

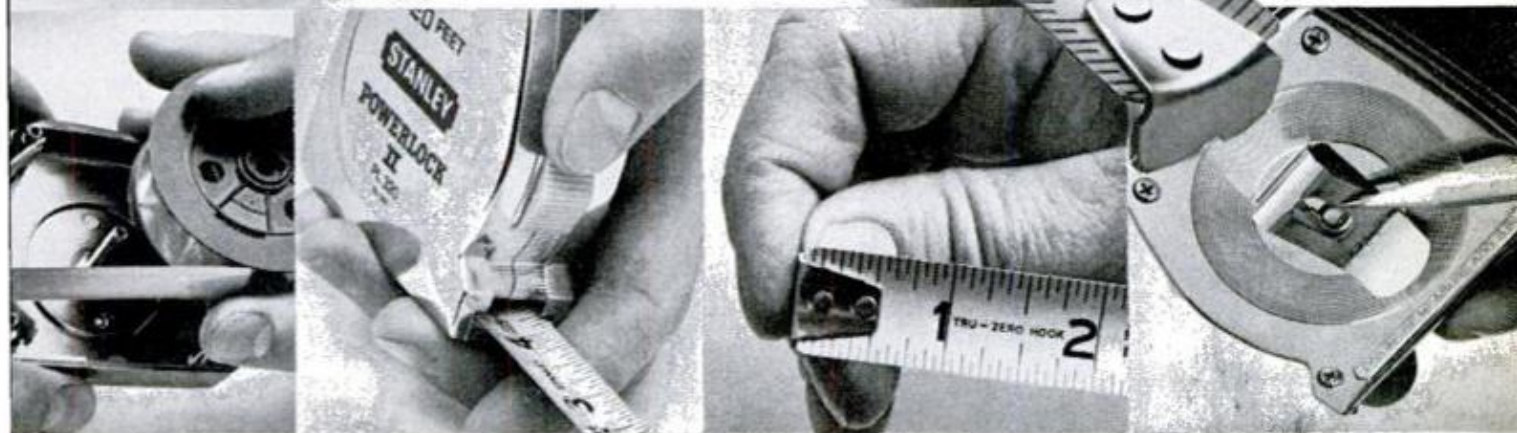
Maintenance tips

● Check an electric fan guard if a rattling noise suddenly begins. A weld can give way. If you find a loose rod, repair it with a dab of epoxy resin cement.

● When you replace worn brushes in an appliance with a universal motor, "run" them in. The contact end of a new brush is flat, preventing full contact with the commutator. You can file the new brush to shape, but it's easier to put the brushes in place and let the motor run about 10 minutes. ★ ★ ★



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DETROIT

LISTENING POST

BY ROBERT LUND

MAJOR VISUAL CHANGES ON THE '73s—here is a rundown of what you'll see:

From GM: all new intermediates and top-of-the-line cars from Chevrolet and Pontiac. Mid-size machines will have thick center pillars. Olds will have its something-new, something-old small car—a carriage-trade version of the Nova. All A-body cars will have new wagons, but with conventional tailgates—not the clamshell, which has been a service headache.

From Ford: new front ends—hoods, grilles and fenders—on Mustang, Torino, Montego and T-bird. Front ends get a heavier styling treatment to balance the more massive 5-mph bumpers for '73.

From Chrysler: Valiant and Dart will be reworked above the beltline; other cars will get minor modifications in the rear and on identification trim. Chrysler's said to have done an impressive job prettying up its two-doors.

From American Motors: a honey of a Hornet, a three-door hatchback.

Not what you'd call a blockbuster of a year in styling, but still a fair number of changes, considering the carmakers say they can't afford to plunge on reshaping the metal because they have to save the big money for gear to satisfy government decrees.

NEW TYPE OF CAR-DOOR HINGE, supposedly a two-way improvement on that used now, is being checked out by engineers at one of the Big Three. First, it's stronger. Where two hinges are required now, one of the new ones will do the job better. Second, the new version has a tricky mechanical action that tilts the door forward and

outward when in the open position so it's easier to get in or out of the car. There's still some testing to be done before the new hanger can be used, but it could show on some '73s.

COMPLETE RE-ENGINEERING OF INTERIORS

is coming in the fall of 1973. Carmakers will have to comply with at least five new standards covering interiors when they begin producing '74 models. Steering gear will have to be improved two ways; more padding on the wheel itself and a five-inch limit in the amount of rearward travel of the steering column in a 30-mph collision. The government wants better seat and head restraints. Another standard calls for a ventilation system that'll prevent toxic fumes from building up in the passenger compartment. Finally, there will be a specification on fireproofing fabrics—establishing a burn rate on seats, carpeting and headlining.

NO TOOLING UP FOR WANKELS YET? Companies making tools used by carbuilders say they're getting no orders from GM that would indicate it's anywhere near ready to roll with a Wankel. Machine tools are usually ordered 18 to 36 months before a new piece is put in production. Wankel enthusiasts are worried. As they read machine-tool-firm reports, GM won't have a rotary for '74. But this doesn't mean that GM's behind schedule. GM never promised a Wankel for 1974 or any other specific year.

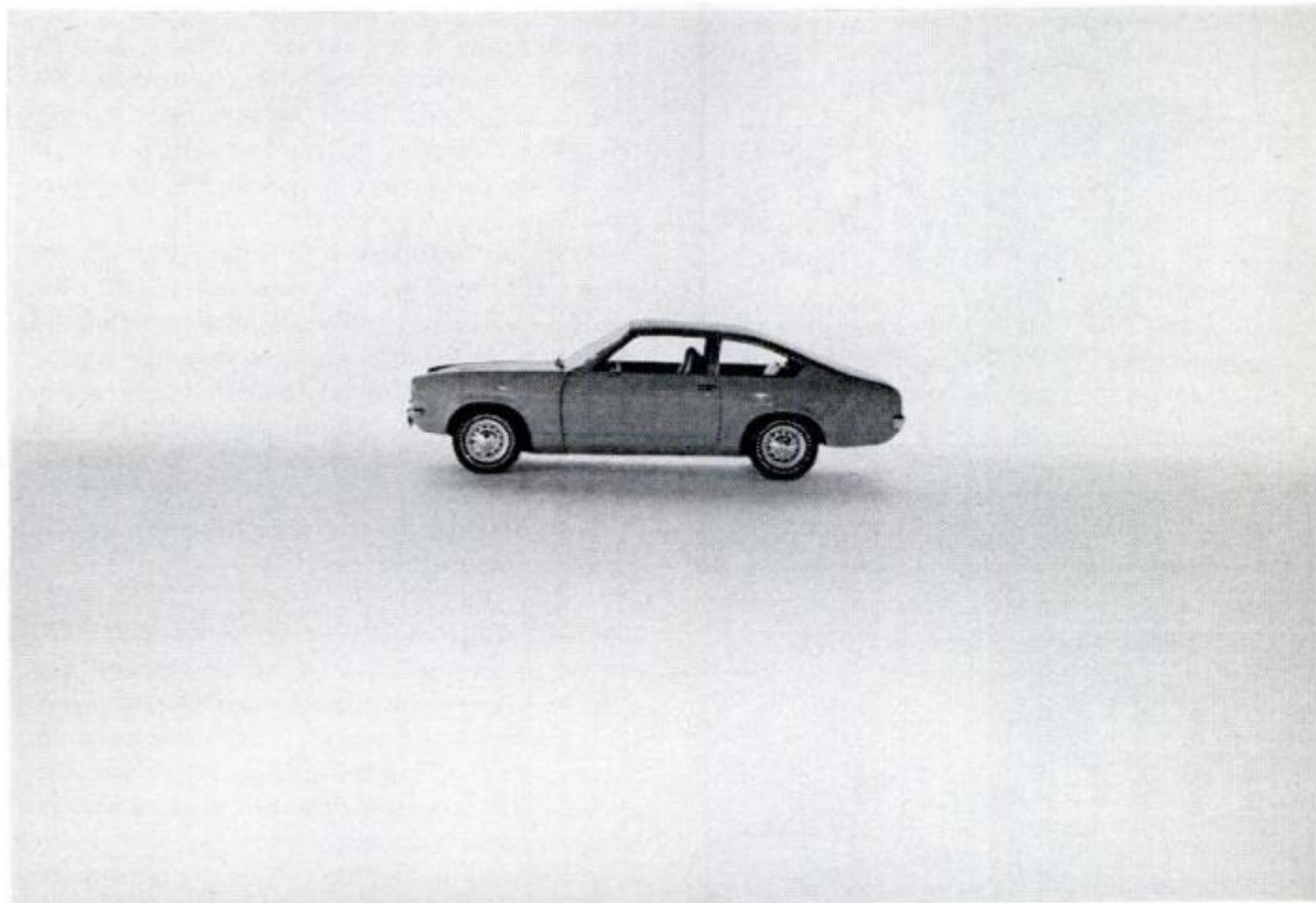
GM may still put a few two-rotor rotaries on the road in '74—without the machine tools. That's no double-your-money-back prediction

(Please turn to page 40)



1972 BRUBAKER looks like a one-of-a-kind show car, but it's in production and coming off the assembly line at Brubaker Industries in California. The fiberglass body, which sits on a '72 VW Beetle engine and chassis, was designed for versatility: It can be set up as a passenger car, delivery van, camper or in almost any other special-interest configuration. The rear-engined vehicle is slightly longer than the Beetle, a little lower and two feet wider. Production began at five per week and it is expected to be around 50 this summer. Price of the new nameplate is \$3950.

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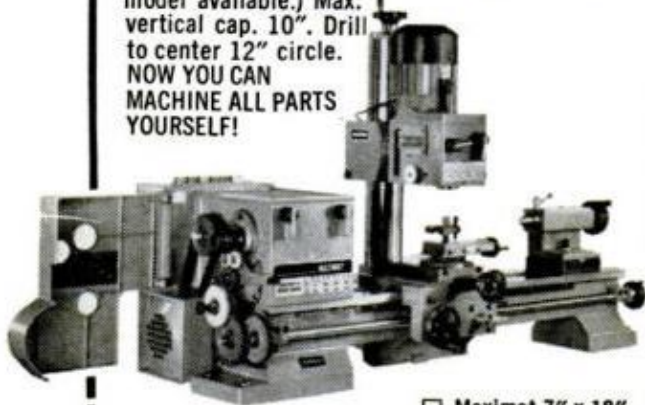
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DETROIT LISTENING POST

(Continued from page 38)

if it doesn't pan out. It's based on speculation that the first Wankels from GM will be toolroom assemblies—not hand-made engines but the next thing. In other words, this will represent an interim step between hand-made and mass production.

GM will have between \$75 and \$100-million riding on the Wankel before it produces Job 1. But that's pocket change stacked against the investment the company will have to make to get revved up for mass production. Before putting more chips on the board, GM would like to supplement its testing of the Wankel by placing a few cars in the hands of owners to get a feel of in-use situations.

If GM will sell you a toolroom special, the price will probably be around \$3500. But you'll have to get in line. GM wants to keep close tab on the first cars, so it might decide to deliver the entire lot to fleet operators or other mass users who'll agree to let GM technicians come in periodically to strip 'em down for examination.

The Wankel's on the way—but not in substantial volume before 1975.

BACK-OF-DASH COMPONENTS IN CLUSTERS

are being worked on in a standardization program for Chrysler by a special engineering group. The project has two goals: (1) to develop uniform components that can be used in all of the company's U.S.-made cars, and (2) to isolate the different clusters from each other, so that if one unit has to be pulled out for any reason (to redesign, repair or relocate it), there's access to the individual cluster without disturbing any of the others.

EVER HAD THE ACCELERATOR PEDAL STICK

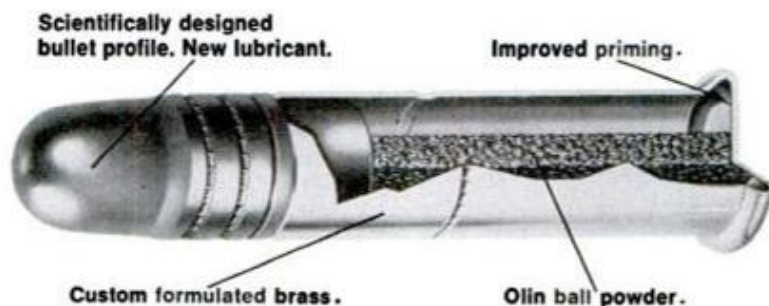
so you had to bang down on the brake to override it? Doesn't happen very often, but once in a lifetime is enough for most drivers. The auto companies are trying to develop a fail-safe pedal in order to deny you even a once-in-a-lifetime experience.

It's not just a matter of installing an automatic cutoff to prevent the car from racing out of control. The device must also have a secondary feature to prevent a sudden loss of power in high-speed traffic, because you can get in just as much trouble slowing too rapidly going 70 on a freeway as in a reverse situation—going too fast in slow traffic. Different devices are being worked up and you'll probably see this item installed on some '74 cars.

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game or pests. You get a lot of action, too, when you're just popping cans in a safely-backstopped sandpit. And you stay in top form for the big target matches, without top expenditure. T22s are the finest all-purpose rim fires you can buy.

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By JOHN PEARSON



Braille text from a computer



Covering a 150-foot-wide swath



Robots know their way around

BOON FOR THE BLIND. The slow process of printing braille has been speeded through the use of a new method developed at MIT. A computerized system translates text—at the same time it's being typed the standard way—into clusters of raised dots on paper. These are the braille letters that can be read by the fingertip touch of a trained blind person. In the past, a hand-operated embossing machine could turn out one page of braille text every six or seven minutes. The new system can process from 20 to 30 pages a minute.

IMPROVED EYEGLASSES MAY BE A SPIN-OFF from our space program. The chemical process that strengthens the glass windows of the Apollo lunar landing module may be used to make stronger and safer lenses for eyeglasses. Tests at the Corning Glass Works, maker of the "lunar" glass, show that the chemically strengthened lens is four times stronger than a standard glass or plastic lens. Basically, the Corning process involves a chemical exchange of large potassium ions for small sodium ions in the surface of the glass.

AN EFFICIENT WAY TO CAST FERTILIZER over a large area is with a helicopter and an airborne spreader. Rotating vanes in the spreader, which is powered by its own engine, broadcast a 150-foot-wide swath of dry chemical plant food as the copter moves up and down a field. Some 3000 pounds of fertilizer can be spread during a single flight. The system is used on farmlands in the Pacific Northwest and Alaska.

FIRST FULLY AUTOMATIC LANDINGS by a full-scale, manned helicopter were made recently at a NASA facility at Wallops Island, Va. The accomplishment is considered a milestone in a continuing research program aimed at enabling helicopters and future VTOL (vertical takeoff and landing) aircraft to fly their routine missions under poor visibility conditions. An Army CH-46 copter was used. Guidance for approaches and landings was provided by a ground-based tracking radar linked by telemetry with onboard equipment. Landing approaches were fully automatic from a point about three miles from the intended landing spot.

ROLLING ROBOTS, roughly the size of a large filing cabinet, deliver meals, linens and medical supplies at a hospital in Fairfax, Va. Powered by three 12-volt batteries, the unmanned steel carts follow courses set on a control panel. On a typical trip, a cart rolls from the basement kitchen or laundry to the nearest elevator. It signals for an elevator and rides to whatever floor has been programmed, continuing its journey

(Please turn to page 44)

**Ron Fisher was out all day
giving his car a beautiful shine.
Now he's out for the night.**



Poor guy. Worked so hard shining his car today, that it outshines him tonight. Too bad he didn't use Vista Soft and Easy. Soft and Easy's special formula of high-gloss silicones and jeweler's polish glides on like a liquid and buffs up to a dazzling, hard-wax kind of a shine. With none of the hard-wax kind of work.

Next time you want a shine, pick up a can of pre-softened Vista Soft and Easy. Because a shiny car is no substitute for a dull date.

Simoniz® Vista® Soft and Easy

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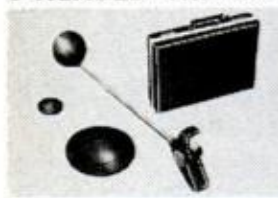
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See moon shots, orbits, stars, phases of Venus, planets, close up. 60 to 180 power. Aluminized, overcoated 3"-diam. $f/10$ primary mirror, ventilated cell. Equatorial mount with locks on both axes. 60x eyepiece and mounted Barlow lens. 3x finder telescope, hardwood tripod. FREE: "Star Chart," "Handbook of the Heavens."
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Best value solid-state metal detector we've seen. Extremely versatile—3 easily attached search heads: 10"—for quick, large area coverage; 5"—general search; 3"—extreme sensitivity. Telescoping aluminum rod (15" to 30"). Sep. volume, tuning control set for 1 hand operation. All fit snugly in handsome locking foam-lined attache case. Incl: 9V trans. batt., earphones, instruct., 196pp. Book.
 Stock No. 71.446H \$49.95 Ppd.
 SAME BUT ONE 5" HEAD, NO CASE,
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AMAZING NEW WANKEL ENGINE KIT!



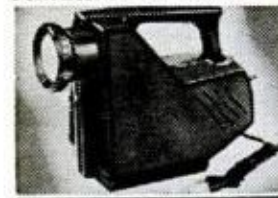
Thrill to the fun of building your own see-through motorized model of revolutionary pistonless type engine . . . only engine experts think economically modifiable to meet new pollution standards. Replaces piston, cylinder, crank assemblies with rotating discs (sections removed for firing chambers). Smaller than conventional: fewer parts, greater reliability, same speed w/less horsepower. Feat: flashing plugs, rubber fan belt, stick-shift on-off switch. Req. 2—1.5V batt. (not incl.).
 No. 71.424H (4 1/2" X 5" X 9") \$6.75 Ppd.

GIANT WEATHER BALLOONS



"Balls of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologists. Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Amateur meteorologists use to measure cloud heights, wind speed and temp. Made of heavy-duty neoprene. Inflate with vacuum cleaner or auto air hose; or locally available helium for high rise.
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 Stock No. 60.632H (16' size) \$7.00 Ppd.

AMERICAN MADE OPAQUE PROJECTOR



Projects illustrations up to 3" x 3 1/2" —enlarges them to 35" x 30" if screen is 6 1/2 ft. from projector, larger pictures if screen is farther away. No film or negatives needed. Primarily intended for children. Projects charts, diagrams, color or black-and-white in darkened room. 115 v. A.C. . . . 6 ft. cord and plug included. Size 12" x 8" x 4 1/2" wide. Weight 1 lb. 2 ozs. Plastic case.
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Go treasure hunting on the bottom! Fascinating fun & sometimes profitable! Tie a line to our 5 1/2-lb. Magnet—drop it overboard in bay, river, lake or ocean. Trawl it along bottom—your "treasure" haul can be outboard motors, anchors, other metal valuables. 5 1/2-lb. Magnet is war surplus—Alnico V Type—Gov't cost \$50. Lifts over 150 lbs. on land.
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SCIENCE WORLDWIDE

(Continued from page 42)

there. After unloading by attendants, the cart returns to base. The vehicle, called an Amscar, stays on course by means of sensors that react to wires embedded in floors. It travels at 1 mph.

The Environment

THE NEXT ECOLOGICAL DISASTER to hit the Great Lakes may be the spread of arsenic. That warning comes from the University of Michigan's Prof. Edward Callender, who says that nuggets containing the deadly poison, as well as iron, manganese and other metals, have accumulated over thousands of years. Formed through natural processes, the BB-sized chunks are harmless in their present state. But increasingly polluted water threatens to dissolve them. "I'm not screaming that doomsday is upon us," the geologist emphasizes, "but I am pointing out this potential hazard exists and should be faced up to before it becomes a reality."

A NEW PROCESS FOR RECYCLING metal lathe turnings and machining chips was recently announced by the General Motors Research Laboratories. The plant-generated scrap is converted into a coarse powder suitable for making powder-metal parts. Called Macro-Mesh, the powder is said to exhibit nearly the same properties as conventional iron powder but is considerably less expensive.

A POLLUTANT DETECTOR developed for NASA is thought to have real potential in monitoring big-city smog. Called a high-speed interferometer, the device can detect traces of ozone, carbon monoxide, carbon dioxide, sulfur dioxide, ammonia, acetylene, methane and a number of other pollutants. The instrument is so sensitive it can "sniff out" as little as five parts of carbon monoxide per one billion parts of atmosphere. As this is written, plans are under way for using the sniffer to check smog in Los Angeles.

RAINWATER is not as pure as most people think, says Undersecretary William T. Pecora, Department of the Interior. Annual rainfall in the United States brings down more than 44-million tons of sulfates, chlorides, nitrates and bicarbonates. ★★

Caught without enough education?

Home study could be the way to catch up.

Find out today. Free.

You realize it by now: What you don't know *can* hurt you. Today. Tomorrow even more.

But you're not sure where to go for specialized education or training. And still have the job and family life you want.

Perhaps you're wondering. About going back to school. About competing again for attention in a classroom. And maybe you're wondering about the real value of home study as an alternative. About its fit to your exact needs, your life style.

Take a look at the 12 careers outlined on this page. Each of these careers offers excitement, growth, satisfaction—for those who are prepared. Select a career which turns you on—the one for which you'd like to prepare. Then fill out the coupon and send it to us. We'll give you complete details on the new ICS Career Program in the field of your choice. We'll tell you how you can fill in the gaps in your education and training, without having to go back to the classroom.

If you have good, sound, career preparation you greatly boost your chances for job success, for security

... promotion... and the satisfaction that comes with getting ahead. Mail the coupon today. It could be a real turning point in your life.

Accounting

Public Accounting and Industrial Accounting offer many excellent opportunities with high-income potential for the trained man or woman.

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To be a successful executive in industry or in your own business, you should be trained in many areas—accounting, law, labor relations, production controls, etc.

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A marvel of the electronic age... but people are needed to make them work. Designing programs for modern computers is one of the most exciting, expanding career fields today.

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Industry and the legal and medical professions offer exciting and rewarding careers and opportunities for high income to well-qualified secretaries.

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Qualify for any one of several jobs in this exciting, fast-moving field. There's plenty of opportunity in a wide variety of areas.

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Skilled, trained men and women are needed who can plan, design, build,

install, maintain and repair the electronic machines that run the world.

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Learn TV and Color TV Servicing/Repair. Test and troubleshoot your own 25" (Diagonal) Motorola Quasar II Color TV training chassis.

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Prepare for a career in the basic profession, engineering. Every major area of endeavor begins with engineering... civil, mechanical, industrial, chemical and electronic.

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PHOTO HINTS



FLOATING LIDS will prolong the life of photo solutions by keeping them airtight as they're used. You can make perfect-fitting lids by casting them in place with wax. Fill a container with hot water and set in a pan also filled



with hot water (right). Drop in a cake of canning paraffin and let it melt. As it cools, stick in a thread spool for a handle. Hold can briefly under warm water to release it when hard.—*Jackson Hand, Westport, Conn.*



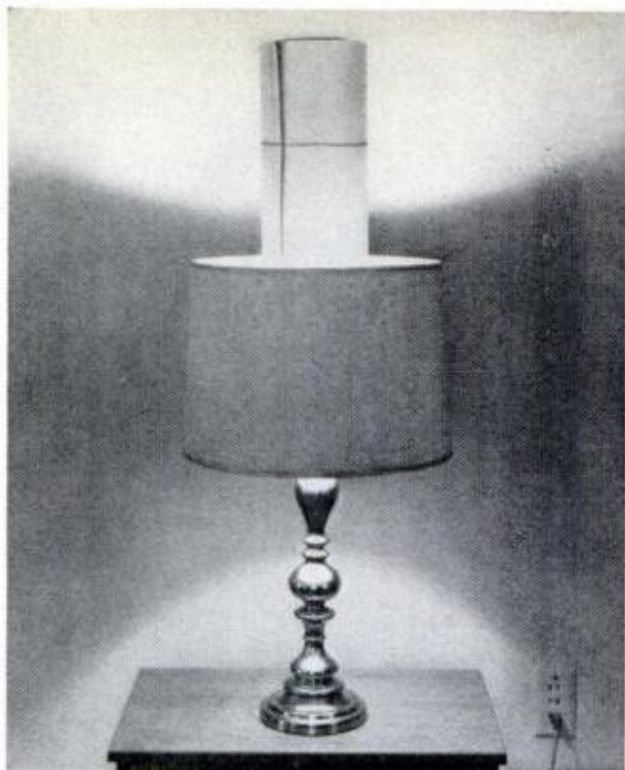
A SAFE, EASY WAY to store extra lenses is in a rack like the one above. Obtain rear lens caps to fit your particular lenses and mount them on a small wood base with two screws in each. If there's any danger the rear lens elements will touch screwheads when racked in, use flathead screws countersunk flush.—*Frederick C. Bourbeau, Manchester, N. H.*

Tripod Light Mount



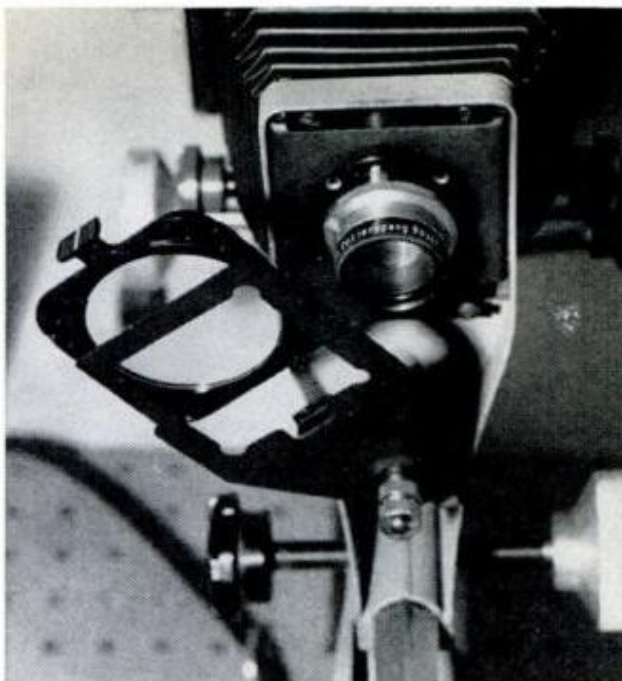
PHOTOFLOOD HOLDERS of the spring clamp type don't grip well on round tripod legs and frequently slip out of place just when you're all set to make a shot. This split block, easily made from a scrap of two-by-four stock, clamps around a tripod leg and gives the floodlight a firm, flat surface to clip onto.

—*Peter Legon, Malden, Mass.*



YOU CAN SPEED PRINT DRYING by placing the blotter roll over a lighted table lamp. The warm rising air cuts drying time to a fraction of what it would normally be.

—E. B. Silsby, Granby, Mass.



A HANDY SWING-OUT HOLDER for variable-contrast filters can be made like the pivoted red filter on most enlargers. Use the existing holder as a pattern for making a similar one from light aluminum to fit the contrast filters. The red filter can be mounted in a cardboard frame so it can also be used in the new holder.—Arthur L. Ramos, San Anselmo, Calif.

Freeze-a-Ferrari.

Not all 35mm reflexes let you keep up with the action. When you look away to adjust the camera, you lose the race.

With a Minolta SR-T 101, you never lose sight of your subject. Because you set shutter speed and lens opening by simply aligning two indicators in

the viewfinder. So you can frame, focus, adjust exposure and (Varroom!) get the shot, fast and easy.

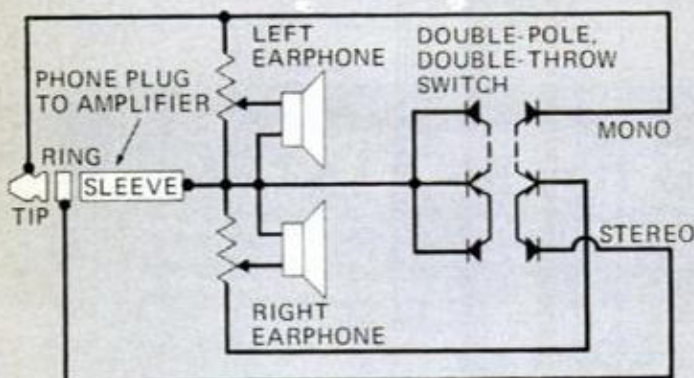
Minolta SR-T 101, from about \$300. The Minolta SR-T 100, about \$250. For literature, write Minolta Corporation, 200 Park Avenue South, New York, New York 10003. In Canada: Anglophoto Ltd., P.Q.

When identified by a factory-sealed "M" tag, Minolta 35mm reflex cameras are warranted by Minolta Corporation against defects in workmanship and materials for two years from date of purchase, excluding user-inflicted damage. The camera will be serviced at no charge provided it is returned within the warranty period, postpaid, securely packaged and including \$2.00 for mailing, handling and insurance.

Minolta



NEW IN ELECTRONICS



THREE HEADPHONES that do special tricks reflect rising interest in private listening. Latest Audiotex stereo model (upper left) has slider-type volume control on each ear-cup for balancing sound without leaving your chair. It's \$29.95. With "wireless" headset at upper right, you can walk around listening to radio or television without trailing a cord. Tiny battery-powered receiver in this monaural type picks up sound by induction. Made by Superex, \$29.95. Two-way headset at lower right lets you switch to stereo or monaural. With switch in monaural position, a mono source is channeled into both ears (see diagram, left). Made by Koss, the \$45 KO-747 phones also have individual volume controls.



NEW RECHARGEABLE BATTERY is said to combine power of a wet cell with convenience of a dry cell. Using electrolyte in gelled form, it costs one-fifth as much as nickel cadmium batteries, can be recharged 300 to

1000 times. Still experimental, the Burgess Gelyte battery is being tested for use in portable power tools like electric hedge trimmer above. Gould, Inc., Box 3140, St. Paul, Minn.

(For more New in Electronics see page 50)

GLAS-GUARD, the double fiberglass belted tire specially made for panels and vans...

It can keep your business running



Bruise and cut-resistant rubber in sidewalls



The pickup and delivery business runs on tires.

And it's rough on tires. With fast starts, sudden stops, plenty of hard knocks.

Goodyear tire engineers studied this kind of driving, and built a tire for it. **GLAS-GUARD.**

It has a combination of features no other Goodyear tire has ever had before, for long mileage, stability and strength.

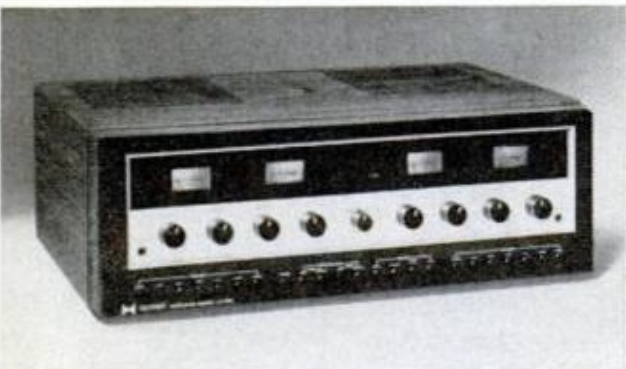
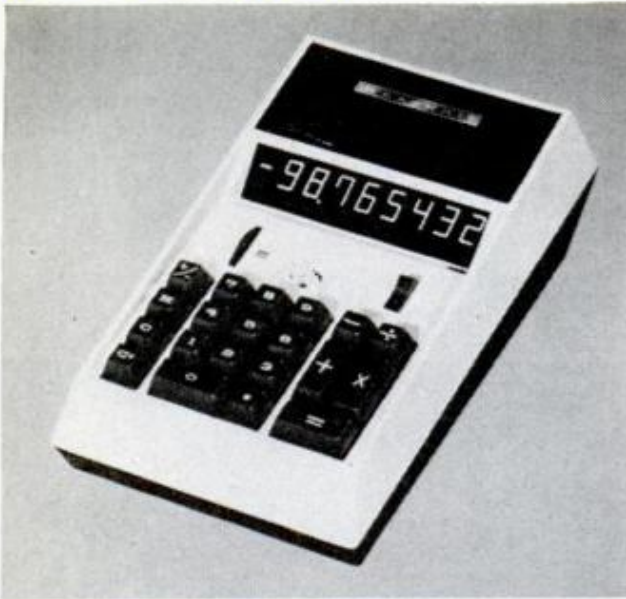
Ask your Goodyear Dealer or Goodyear Service Store for **GLAS-GUARD**, the tire that means business.

GOODYEAR

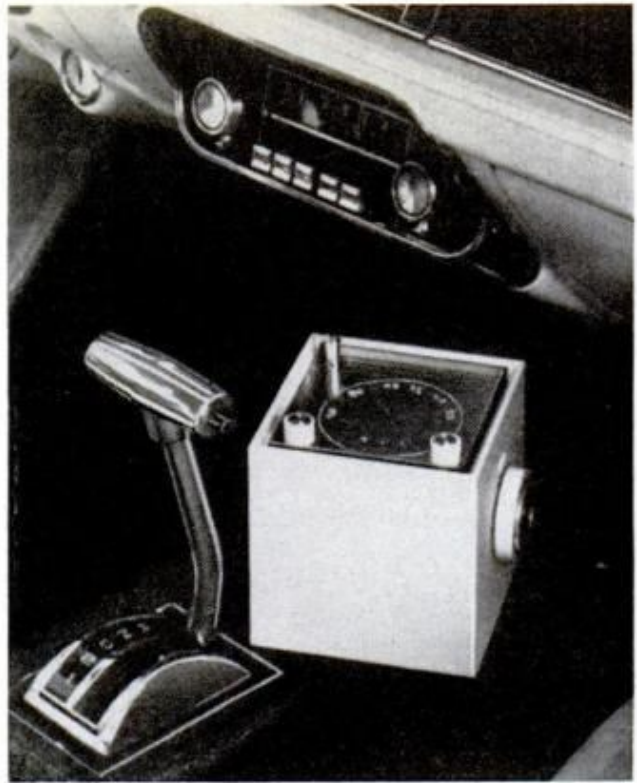
...big on the road

NEW IN ELECTRONICS

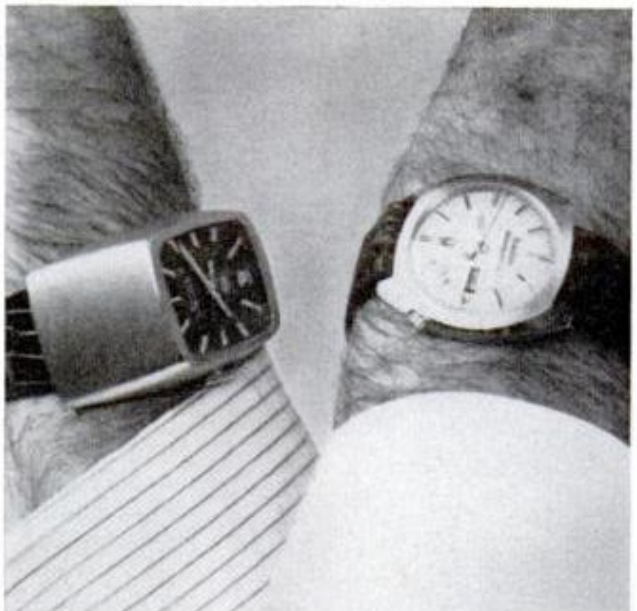
(Continued from page 48)



THREE UNUSUAL NEW KITS from Heath above are digital calculator for home use (top), digital FM stereo tuner (center) and four-channel amplifier (bottom). The trim little desktop calculator, Model IC-2008, adds, subtracts, multiplies and divides electronically, is \$129.95. For the quadraphonic enthusiast, the AA-2004 four-channel amplifier is a versatile, all-in-one package providing four modes of operation: monaural, standard stereo, discrete four channel and matrixed four-channel with built-in decoder. Kit price, \$349.95. The AJ-1510 digital FM tuner lets you punch out desired station frequencies on a pushbutton keyboard and displays them in lighted numbers on the tuning dial. Kit price, \$539.95. Heath Co., Benton Harbor, Mich.



YOU CAN LISTEN TO TV even when you can't watch it with the special FM receiver above. Designed to let you hear your favorite TV programs when you're away from a set, the portable battery radio picks up VHF frequencies used to broadcast video sound and plays the programs through a built-in speaker. Called Video-Voice, it will play in a car, boat or other remote locations. \$29.95, Concept Plus, 12509 Beatrice St., Los Angeles, Calif.



FIRST QUARTZ WRISTWATCH in conventional size (right) is one-third as big and almost one-third the price of costly, bulky earlier model (left). The slim Bulova Accuquartz timepiece is \$395 compared to \$1000 for previous version. A tiny quartz crystal vibrating 32,768 times a second keeps the watch accurate to within a second or two a week.

There may be a great future in your past.



Think back to that time in your life when you felt like you belonged, had enthusiastic friendships, and a sense of contributing to your country's strength. When you could actually look forward to a secure and comfortable future.

Chances are, the last time you felt like that was when you were in the service. The question now is, is it too late to do something about bringing back the good old days of military life?

In a word, the answer is "No." The Air Force Reserve needs good men with their service skills intact. And, if you've got what we're looking for, you can look forward to a second income, specialized training, and rediscover what benefits and rewards an Air Force career can bring to your life.

Think it over. For one weekend a month and 15 active duty days a year, you could find yourself in the Air Force

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I understand there is no obligation.

**Find yourself
in the Air Force Reserve.**



GROUND STATION was flown to Peking prior to the President's visit. Made by Hughes Aircraft, the facility boasts a 24-foot-diameter antenna and enough electronics to transmit 1 color TV broadcast, 9 voice commentaries and 60 two-way phone conversations. It beamed transmissions to Intelsat IV, as shown in the drawing



How satellites put you on the scene—instantly!

By RONALD SCHILLER

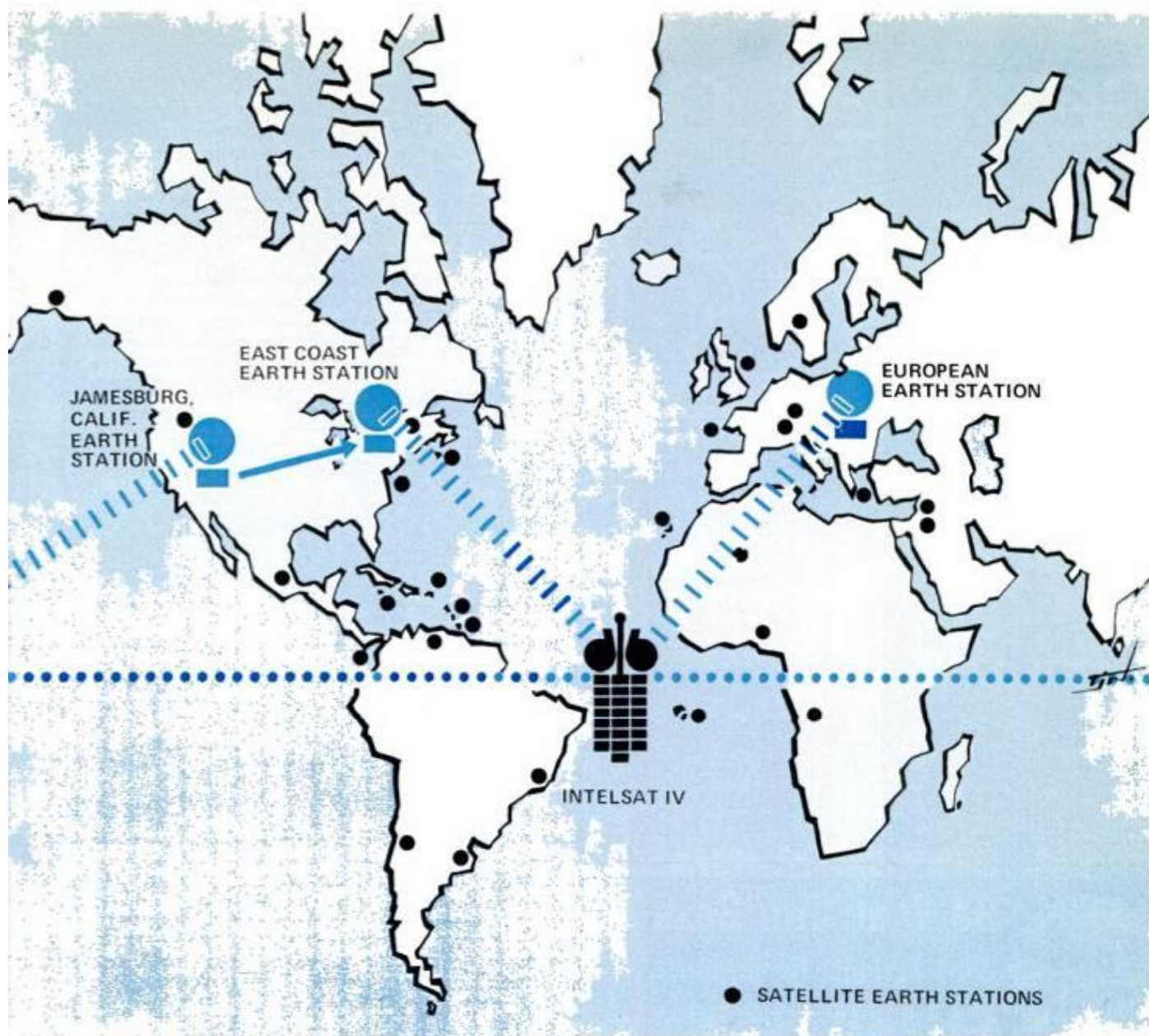
ON A JULY MORNING IN 1969, television broadcasting faced what could have been an operational disaster. The long-awaited ceremony at Caernarvon Castle in which the heir to the British throne would be invested as the Prince of Wales was about to get under way.

Across the Atlantic Ocean over 200 U.S. and Canadian television stations had reserved an hour of expensive time to broadcast the event live—when, suddenly, the Atlantic communications satellite that was to transmit the pictures suffered a temporary “outage,” or malfunction.

But there was no panic. When the “trouble light” flashed red at the operations center of the Global Satellite System in Washington, D.C., engineers quickly coordinated a rerouting plan with Earth stations in the Pacific and Indian Ocean areas.

After a brief conference, various small

POPULAR MECHANICS



switches were thrown, whereupon the electronic signals that were to have been beamed westward over the Atlantic reversed direction and began flowing toward the east. Traveling at the speed of light, they shot across Europe and western Asia to strike a small metal dish 22,300 miles above the Indian Ocean, from which they caromed progressively down to another dish-shaped antenna in Yamaguchi, Japan, up to another satellite above the Pacific, down to the Earth station in Jamesburg, Calif., across the United States via microwave to New York, then out to the stations of the broadcast network. North American viewers watched the start of the mounted parade without missing a hoofbeat.

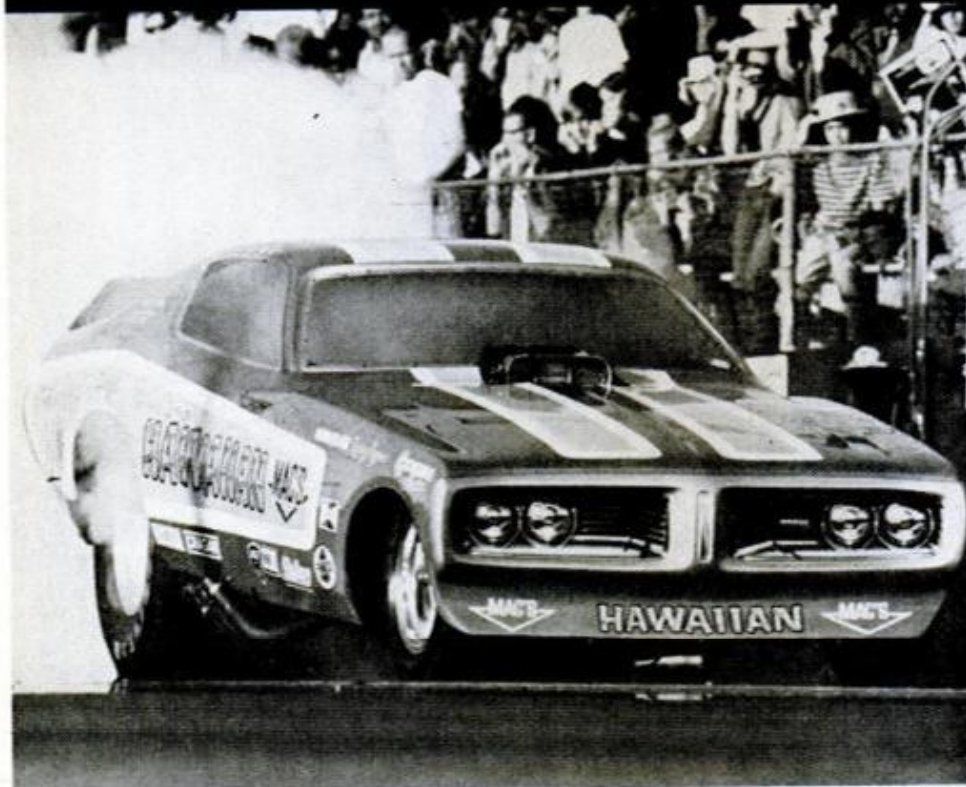
The distance those television signals traveled was 113,000 miles. Elapsed time: six-tenths of a second. Unusual? Not in the least. In fact, the exercise was almost trivial as compared with the vastly more intricate procedures that enabled one-

sixth of the human race to watch American astronauts walk on the moon or witness President Nixon's historic visit to China. They involved every communications satellite and Earth station of the globe. Indeed, without the little "talking birds" to relay messages and computer data, these electronic achievements would have been impossible.

So routine has instant global voice and picture communication become that we are apt to forget that it was unavailable just seven years ago. Live television stopped at the water's edge. Nations could talk to one another only if connected by strands of copper wire, by 100-foot-high microwave relay towers strung out in line-of-sight intervals every 30 miles across the continents, or, when the static was endurable, by high-frequency radio. Telephone messages between adjoining nations of Africa had to be relayed through London. A call from Chile

(Please turn to page 186C)

GET S-E-T...GO!



Roland Leong and the Mac's Hawaiian are a winning combination on the Funny Car circuit. Now Mac's has a winning combination for your car. Mac's S-E-T Super Engine Treatment products. Mac's S-E-T Gasoline Booster keeps the fuel system clean including emission devices, boosting power. Mac's S-E-T Carburetor Tune Up improves performance as it cleans and lubricates carburetors, automatic chokes and P.C.V. valves.

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Start a steady repeat CASH business in your basement or garage. Earn \$3 to \$6 an hour in your spare-time! Excellent profits in saw sharpening business! Automatic Foley Saw Filer, easy to operate, files combination saws, hand, band, and circular saws. No experience needed. H. C. Delbert wrote us: "Since I got my Foley Filer 5 years ago, I have averaged 4½ saws each day since I started."

Every saw you sharpen brings you more customers. "I rented a two-car garage and have all the work I can do," writes Charles H. Smith.

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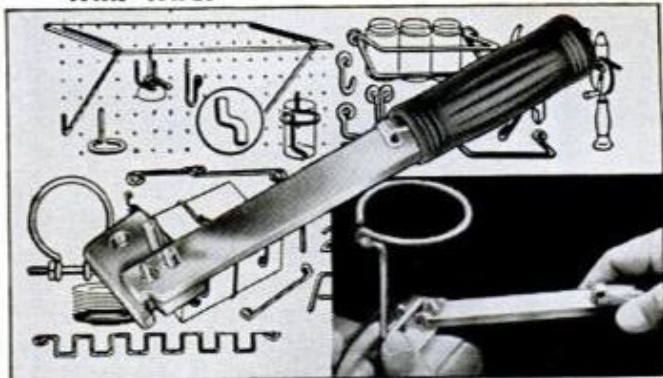
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WIREFORMER is a simple, precision made, vise-held tool of innumerable uses. Make your own peg board hooks, clamps, handles, braces, brackets, etc.—any shape you want. Forms an eye of 3-16" inside diameter (just right for any nail, screw, or bolt up to that size). Even uses coat hanger wire. No pliers needed. WIREFORMER does the work with the pressure of one finger. Straightens the wire if you make a mistake. Cuts the wire just where you want it. Forms any angle, arc or circle. Bends both right and left. Tool is case hardened, plated, with a plastic handle. Fits in your pocket. Complete instructions, illustrated brochure showing many things to make.

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ing pan which prevents scalping and gouging. Altogether, Fairway's got it! Take a close look at the reinforced all-steel frame, wide pneumatic tires, baked-on enamel finish and front fenders that serve as foot rests. Other models available in 5 and 7 H.P. with recoil starting. Get carried away on a Fairway for '72. See Ariens complete line of Gard-N-Yard equipment at your nearby dealer . . . (He's listed in the Yellow Pages.) ARIENS COMPANY • BRILLION, WISCONSIN



A plug for people who change their own

We figure you power buffs have lots of interests and lots of equipment to go with them. So NGK builds a plug for practically every internal combustion engine made.

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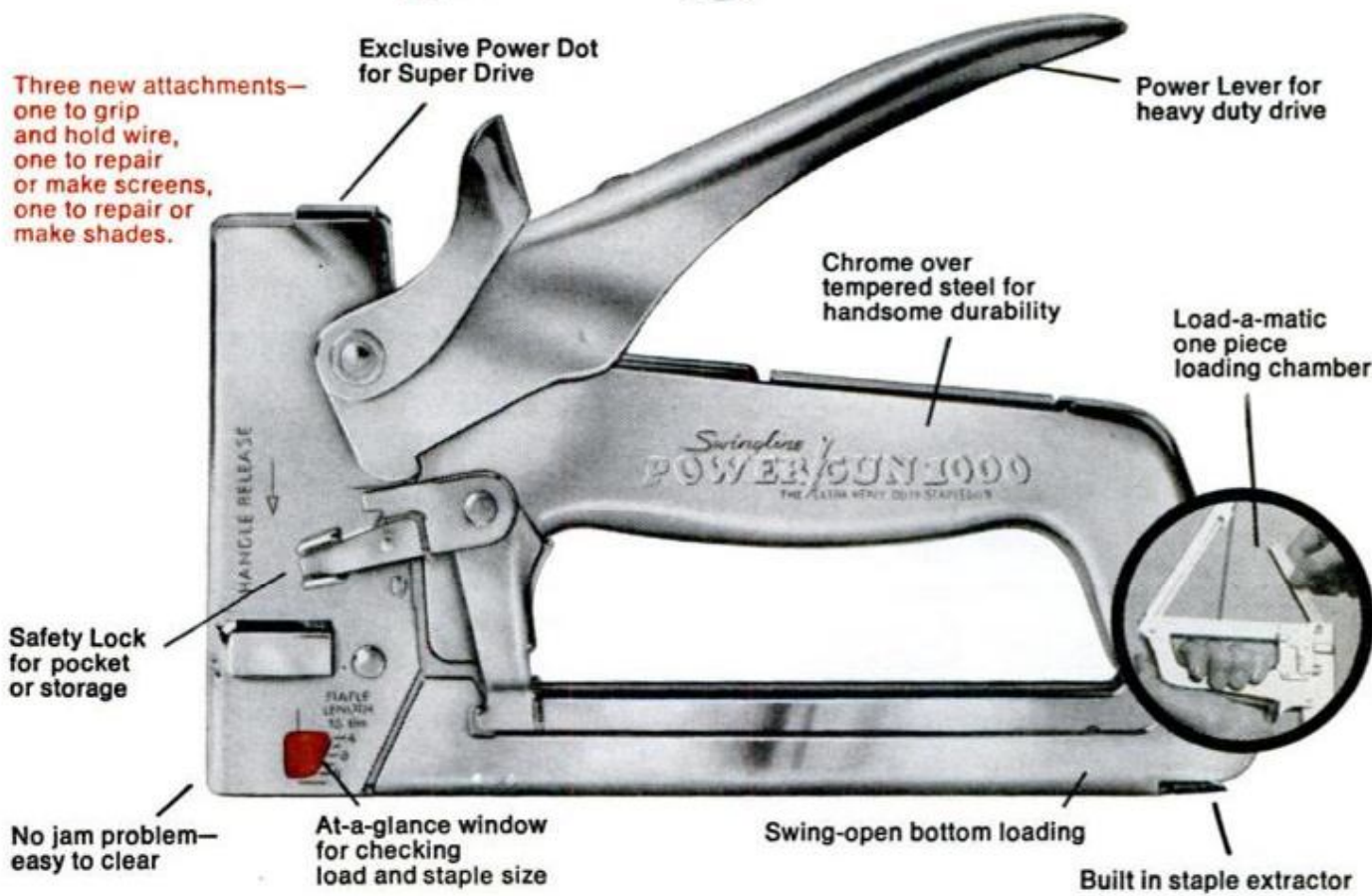
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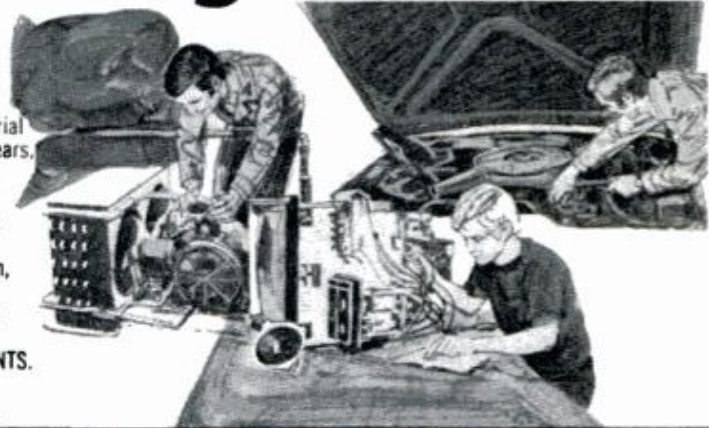
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Removing moss from brick wall

Moss is appearing on the brick walls of my home in several shaded areas. How can I remove it?—Edward Lassiter, Charleston, S. C.

Try to eliminate the condition that encourages growth of this objectionable plant, perhaps by removing or pruning shrubbery to let air circulate more freely and sunlight penetrate to the wall.

You can usually remove the existing moss by a vigorous scrubbing, first with a wire brush and then with a stiff-bristle scrubbing brush dipped in full-strength laundry bleach. Then hose the wall to remove all residues of the bleach. Wear rubber gloves when applying the bleach; also protect your eyes from spatters.

Spreading lawn 'weed'

A patch of what appears to be a new "weed" is spreading in my lawn. No one seems to know what it is and I seem to be the only victim. The leaves are shorter than lawn grasses and light green in color. The stuff pulls up easily, but eliminates the lawn grass where it's growing. What is it and what will kill it?—Bert Phillips, Bloomington, Ind.

Without a sample, I'll guess it's a variety of "creeping bent" grass. To kill it, cover it with a sheet of opaque or translucent plastic, or just pull it up, taking care to get all the root systems. Then spade the soil, rake out all remaining debris, add peat moss and a little sand, and reseed with a lawn grass. Keep the seeding well watered, but not too wet, until growth is well along into the season.

Pictures 'print' papered walls

How can I eliminate the lightened areas that hanging pictures leave on papered walls? The wallpaper has a colonial pattern on a tan background.—Mrs. John Tate, Racine, Wis.

I have no positive remedy; repapering is probably the only practical solution. However, I once tried this stunt: I squeezed an artificial sponge nearly dry after dipping it in water to which were added a few drops of vegetable coloring

that matched the exposed areas of the paper as nearly as possible. I sponged this colored water onto the areas, then dried them by "pouncing" the surface with cotton. The procedure very nearly eliminated the lightened areas. You might try it experimentally.

Old finish bleeds through

Woodwork in my old home has a dark finish. I applied an enamel over it in one room and now the old finish is bleeding through, making an unsightly mess. What do I do now?—F. S., Miss.

You should have first used a sealer such as B. I. N. Try it on the rest of the job and you'll likely have no more trouble. As for the woodwork you treated, take off the enamel with a wash-off paint remover and start over, using the sealer as an undercoat for the first application. Or, a lazy man's approach would be to sand the gloss off the enamel, apply the sealer and then re-enamel.

Easing screws into hardwood

What can I use to make screws easier to drive into hardwood?—Harlow O'Brian, Trenton, N. J.

Beeswax is best as it leaves no objectionable stain on light-colored woods. Just rub the threaded portion of the screw across the surface of a beeswax cake. Be sure to remove any wax that may extrude around the head of the screw with a solvent.

Most finishing materials and stains won't "take", or bond, if applied over wax. So I'd suggest you use a counterbore of a size to fit the screw you are driving. Counterbores are inexpensive and usually make the use of wax unnecessary.

Musty odor in chest

I have a fairly old chest with lid which is painted. Paint is still good but the interior has a musty odor. How can I "sweeten" it?—A. R. Parks, Boston.

Washing it with a mild to medium detergent solution, and drying it in the sun for several hours usually will do it. When it's thoroughly dry treat the interior with several fine coats of a spray lacquer. ★★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.

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American Motors

Drivin' with Dan

Why do some drivers oppose road-racing guard rails? Is the Wankel engine quieter than a piston engine? When is an engine called 'square'? 'Over square'? Dan Gurney answers these and other automotive questions

Q. Dan, who will win the Indy 500 this Memorial Day weekend?—Andy Golon, Euclid, Ohio.

A. It's hard to be objective about that one! Let me just say that at this writing (beginning of March), our Championship car (see photo below) hasn't seen competition yet but it has broken a couple of track records—not only at Ontario but now also at the fast Phoenix track. Bobby Unser circled the mile in 25.35 seconds. That clipped time from the track record of 26.68 seconds and was even faster than Mike Mosley's 26.1-second practice run.



READY FOR INDY! All American Racers' 1972 Eagle is on its way to Indianapolis for the May qualifying runs. The car's sensational performance in the early tests at Ontario and Phoenix promise a top spot in the lineup for Dan's AAR team and driver Bobby Unser. Roman Slobodinskyj, chief design engineer, and Phil Remington, chief fabricator, are confident not only of that top spot in the lineup but of top finish for the most prestigious 500-miler!

58

Q. Why don't some racing drivers want guard rails alongside road-racing courses? Don't they make racing safer?—Sam Wolf, Tulsa, Okla.

A. Not according to detractors who feel that wide grassy areas on either side of the track would be better. The argument is that when spinouts or accidents occur, the cars involved are confined to the racing circuit, endangering other cars. Advocates of guard rails for entire course lengths are mainly the Grand Prix Drivers Assn. and the safety committee of the Commission Sportive Internationale (CSI). They feel that with the barriers a car that leaves the groove doesn't have far to go. It'll glance a barrier and not wind up in a head-on with something else.

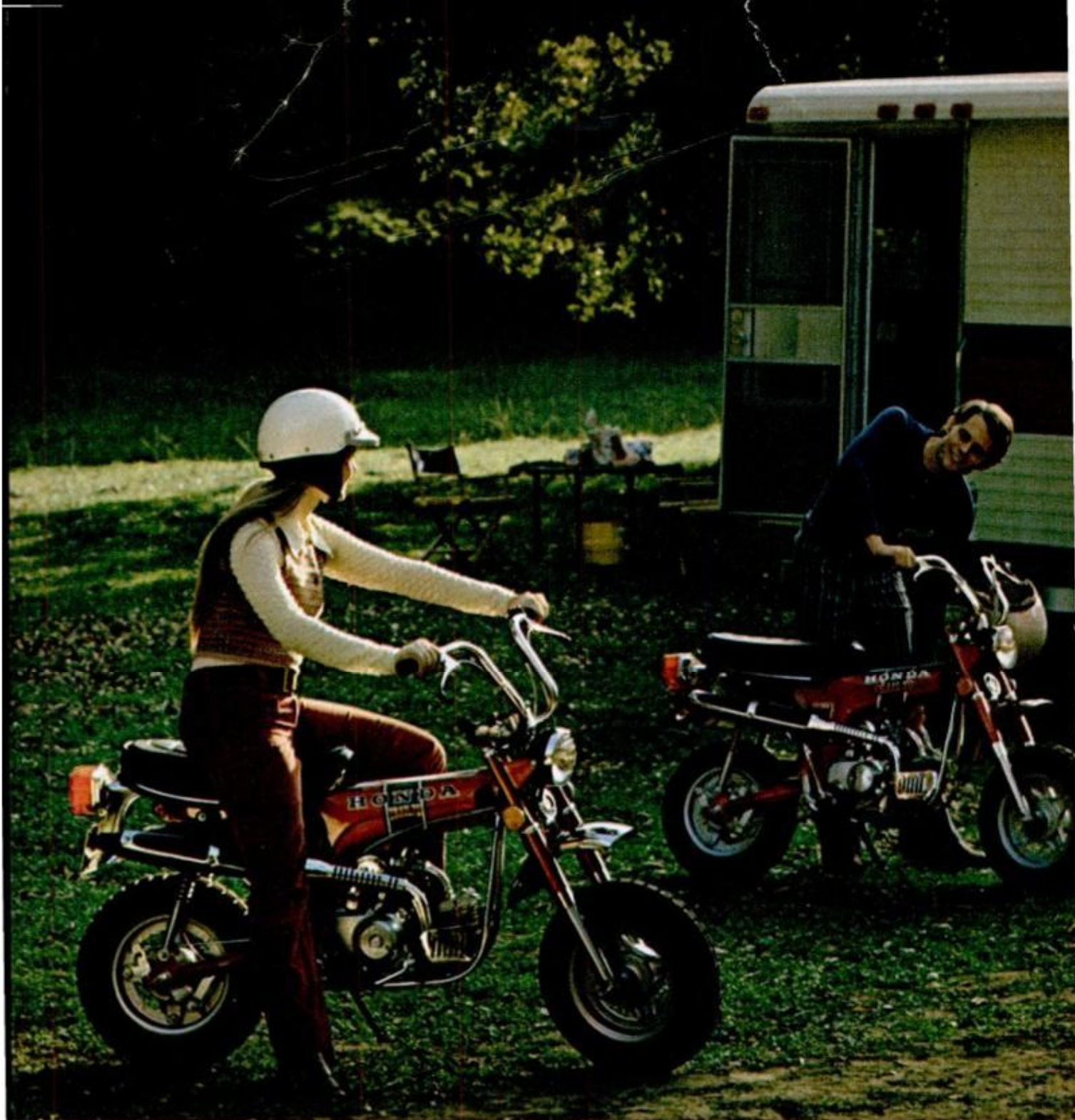
Q. It is true, Dan, that the Wankel engine runs much quieter than a conventional, reciprocating piston engine? I know it has less vibration because the rotors spin and there isn't the up and down motion of the pistons, but what about noise level?—Al Levin, Merrick, N.Y.

A. With fewer parts clicking and thrashing about and changing direction inside the engine, it is indeed a lot quieter. In fact it's so quiet that one of the few Wankel-powered cars made, the German NSU Ro 80, now has as standard equipment an audible alarm that goes off when engine rpm goes over 7000. Without the valve chatter that normally tells an enthusiast that he's revving high and better check his tach, drivers of the "too-quiet" Ro 80 have been unintentionally over-revving.

Q. I've heard the guys in the motorcycle shop talking about "over square" engines on some bikes. I couldn't see they were "square" at all. How do you tell?—Bill Clark, Iowa City, Iowa.

A. You can't tell how "square" an engine is
(Please turn to page 60)

POPULAR MECHANICS



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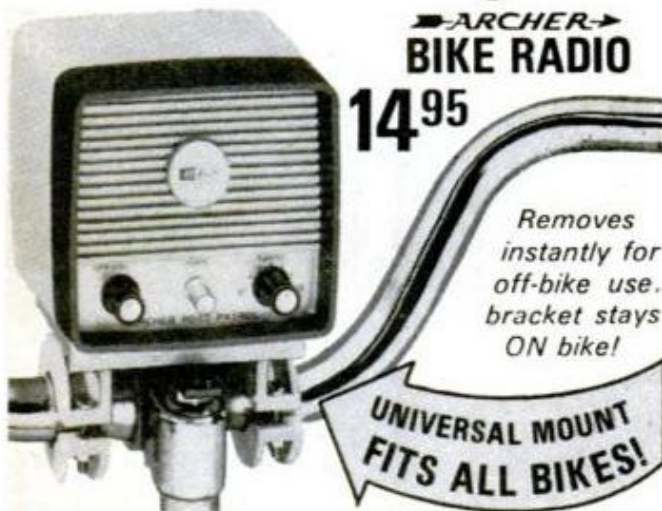
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DRIVIN' WITH DAN

(Continued from page 58)

by looking at it. "Over square" is a term referring to the ratio of bore to stroke in both motorcycle and automotive piston engines. It's one of many factors the engine designer has to consider. Cylinder displacement depends on both bore (diameter of the piston) and stroke (distance the piston travels in going up and down). A square engine is one where bore and stroke are equal measurements. Over square is when the bore measurement is greater than that of the stroke. A typical over-square spec (given in both inches and millimeters) would look so: Bore x stroke . . . 3.50 x 3.15 in., 88.9 x 80.0 mm.

Q. On new Porsche cars, a flap on the right rear fender opens up so you can reach the dipstick and check the oil in your crankcase. Why is there such a clumsy arrangement on this supposedly finely engineered car?—Jim Ralston, Syracuse, N.Y.

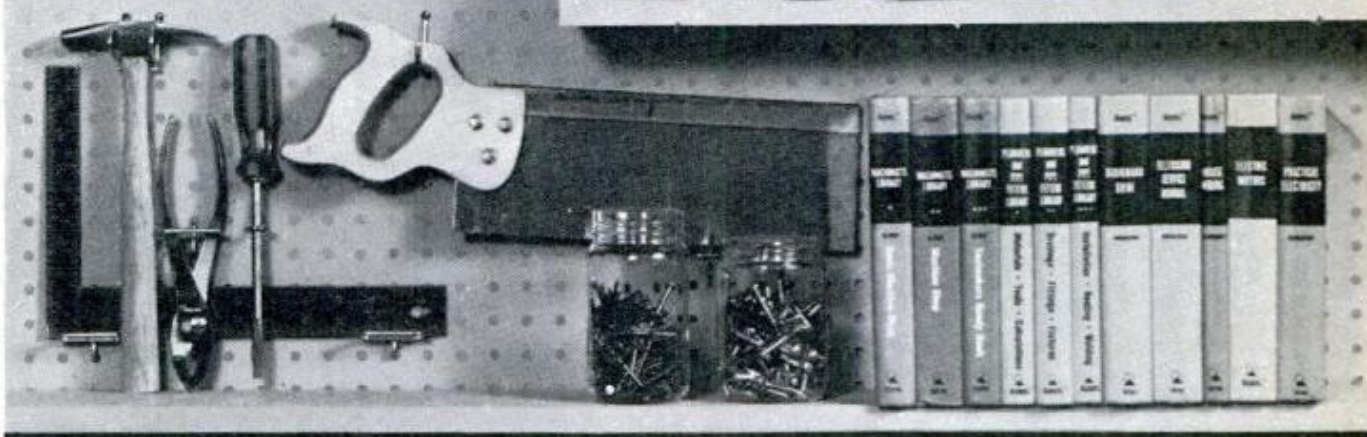
A. Because in the Porsche 911 series there is no crankcase! The 2.4-liter, flat-Six engine uses "dry sump" lubrication. That means that the engine lubricating oil is in a separate tank or sump and is pumped through the engine and back to the tank. This positive system is different from the wet-sump arrangement where the oil lies in a crankcase under the block.

Q. What's the difference between "net" and "gross" horsepower and why did manufacturers change to the lower, net horsepower?—Jeff Oldenburg, Laramie, Wyo.

A. The old way manufacturers used in advertising—gross horsepower—was measured in the laboratory with fan and air cleaners removed, low exhaust back pressure with carburetor and ignition set for maximum power! The automakers now give a more realistic, net figure, which is the output of the engine when it is operating normally in your car. Horsepower figures have been downgraded by as much as 35 percent when measured this way. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 268).

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THE BICYCLE SHOP



By EUGENE A. SLOANE

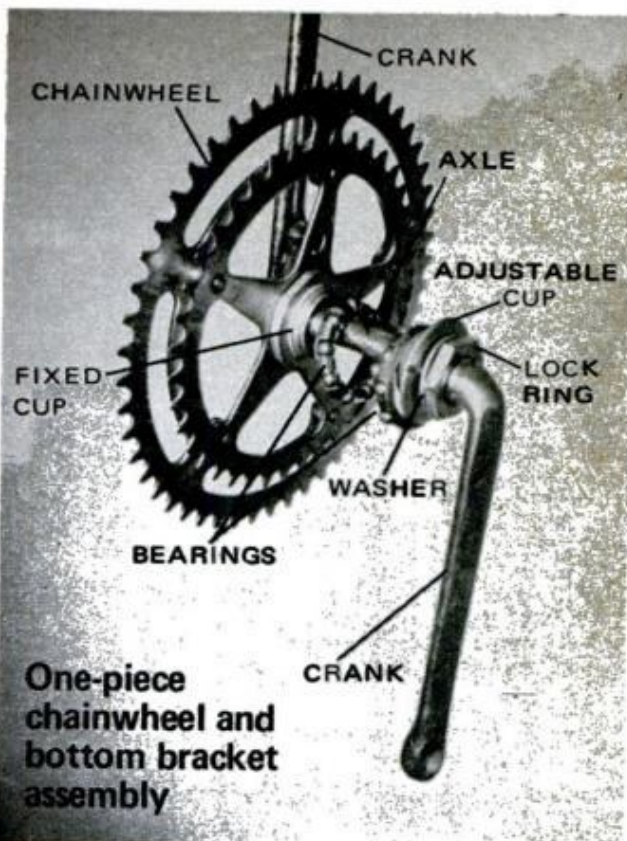
PM's newest columnist, the author of *The Complete Book of Bicycling*, offers many valuable tips for the care and repair of bottom brackets

THE BOTTOM-BRACKET ASSEMBLY holds the axle, to which are attached the cranks and chainwheel. Bottom brackets should be regreased once every six months to a year, depending on how much you ride and in how much dust, dirt and sand.

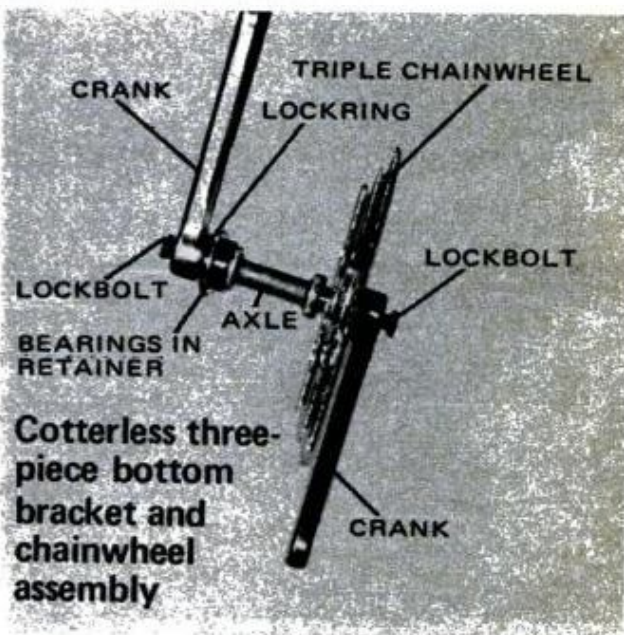
To tell if your bottom bracket needs cleaning and a re-lube, slip the chain off the chainwheel, spin the cranks and listen for grinding noises. Then rotate the crank slowly with fingers on the bottom of the bottom bracket. If you feel any sign of rough operation, the bottom bracket is overdue for overhaul.

There are three types of bottom brackets: three-piece steel cottered, one-piece steel cotterless and three-piece light-weight alloy cotterless.

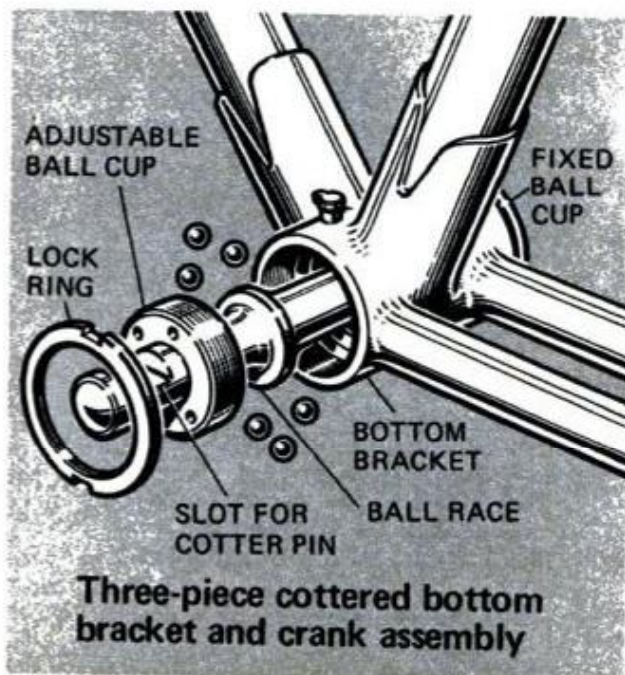
One-piece assemblies are on more bicycles than either of the other two types. They are used on most Schwinn and other American-made bicycles, and on some models made in Sweden and Norway. The only tools you need to disassemble a one-



One-piece chainwheel and bottom bracket assembly



Cotterless three-piece bottom bracket and chainwheel assembly



Three-piece cottered bottom bracket and crank assembly

piece bottom bracket are a 6-inch crescent wrench, 10-inch crescent wrench, 12-inch screwdriver and light hammer.

Follow these steps: 1. Remove both pedals. 2. Slip the chain off the chainwheel. 3. With the 10-inch crescent wrench, remove the lock ring (clockwise). 4. Remove the adjustable ball cup. This is splined and threaded into the bottom-bracket hanger. The ball cup also comes off clockwise, with just a screwdriver pushed into the spline or notch. 5. Remove the bearings. 6. With the left-hand bearing race removed, slide the bottom-bracket assembly gently out the right-

(Please turn to page 68)

BICYCLE SHOP

(Continued from page 67)

hand side. Make sure the bearings on the right side of the bottom-bracket axle come out at the same time. 7. Slide the right-hand bearing set off the axle, down the crank into a pan of kerosene. Clean all bearings and bearing surfaces. Be sure to wash all grit and dirt out of the bottom-bracket hanger. Inspect bearings. If the race is so worn that the bearings fall out, you need a new set of bearings.

To reassemble: 1. Pack bearings with grease, such as Lubriplate Autolube type "A" sold in auto supply stores, or Lubriplate Marine Lube sold in marine supply houses. 2. Slide bearing back over crank and axle, making sure the correct bearing race curvature faces the right-hand side of the axle. The bearing race should fit very snugly against the curvature or "land" of the axle. If not, slide the bearing off, reverse it and slide it back on again. The same holds true for the left-hand bearing. 3. Slide bottom-bracket assembly back the way it came out, through the right-hand, bottom-bracket hanger. 4. Slide remaining bearing set down the left crank and in place on the left side of the axle. Screw adjustable ball cup counterclockwise into the bottom bracket until snug; then back away $\frac{1}{8}$ turn. Screw locknut on counterclockwise and tighten with the crescent wrench. Check for side-play by twisting cranks. Readjust if necessary by loosening lock ring, backing off or tightening adjustable cone, retightening lock ring. 5. Reinstall pedals, slip chain back on and you're ready to roll.

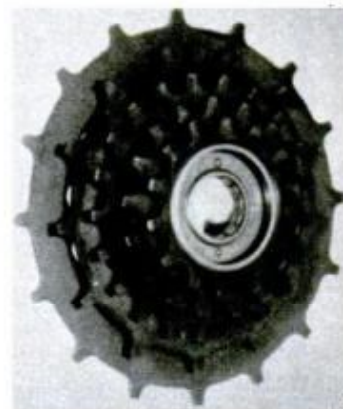
Three-piece cotted assemblies are the most difficult to disassemble. But the job must be done yearly to avoid ruining the axle and bearing cup. Tools you need are a Raleigh-type bottom-bracket spanner for the locknut, Raleigh bottom-bracket wrench, machinist's ball-peen hammer, a good vise and a piece of 2x4 long enough to reach from the floor to about 4 inches above the jaws of your vise. You may also need a steel center punch if your adjustable cup has small holes in it instead of a squared protrusion you can grab with a bottom-bracket wrench. The wrenches come with Raleigh bikes and are sold at most bike stores.

To disassemble follow these steps: 1. Remove both pedals. 2. Remove both wheels to lighten the bicycle. 3. Cut a V-notch $1\frac{1}{2}$ inch wide tapering to $1\frac{1}{2}$ inch deep on one end of the 2x4. Put the 2x4, notched end up, in the vise. 4. Have someone hold the bike with the left-hand crank over the V-notch (not the *bottom-bracket hanger*) so that when you

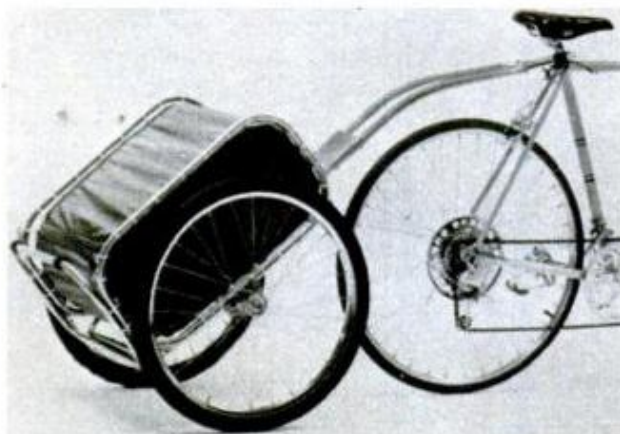
hammer out the cotter pin, the stress of hammering is through the crank, not the hanger and bearings which could be damaged. 5. Unscrew the cotter-pin nut about four turns. With the ball-peen hammer hitting *squarely* on the nut, hammer the cotter pin until the nut is flush with the crank. Loosen nut two more turns and hammer it flush with the crank again. Remove the nut and washers and, with a piece of hardwood over the pin to protect the threads, hammer the pin down flush

(Please turn to page 70)

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BICYCLE SHOP

(Continued from page 68)

with the crank. If it does not fall out at this point, use a center punch carefully in the center of the cotter pin and punch it out the rest of the way. 6. Now remove the cotter pin from the right-hand crank.

7. Remove the left-hand bottom-bracket lock ring with the Raleigh spanner, which has a notched projection to fit the lock ring notches. With the hammer, tap the wrench lightly to loosen the lock ring. If it won't loosen clockwise, reverse the spanner and try turning it counterclockwise. Some bikes have right-hand bottom-bracket threading, others left-hand. The bottom-bracket assembly of most Raleigh bicycles is threaded so the lock nut and adjustable cup unscrew clockwise. Remove the lock ring and unscrew the adjustable cup about 10 turns. Lay the bike on its left side over a rag, to catch the loose ball bearings, and unscrew the adjustable cup the rest of the way. Pull the axle out of the left-hand side. 8. Clean bearings, cups and bottom-bracket hanger in kerosene. Check balls and cups for cracks, rust or galling (shiny spots which are flatter than the rest of the cup). Replace cups or bearings as necessary. If you have to replace the right-hand cup (rare), take the bike to a professional shop: special tools are needed.

To reassemble: 1. Put a light layer of grease inside each cup and roll the loose bearings around in a spot of grease and set them inside the fixed cup, leaving a small space between each bearing. 2. When the balls are in the right-hand cup, stick a layer of grease over the balls and gently push the axle, long end in first, into the left-hand side of the hanger. 3. With the balls stuck in a layer of grease in the adjustable cup, thread the cup counterclockwise into the bottom bracket carefully and take it up snug by hand, with a wrench or center punch and light hammer. Back off $\frac{1}{8}$ turn. 4. Thread the lock ring counterclockwise on the left-hand axle and tighten with the spanner. Use hammer to tap spanner to bring the lock ring tight. 5. While someone holds the bike frame, install the right-hand crank on the axle and hold the base of the crank over the V-notched 2x4 as you did when you removed the cotter pin. Reinstall the cotter pin, and hammer the blunt end (not threaded end) down until it can go no farther. Thread washer and nut on the pin and tighten. Install the left-hand crank the same way. 6. Check for side play and binding.

Next month we'll treat cotterless three-piece bottom-bracket assemblies. ★★★

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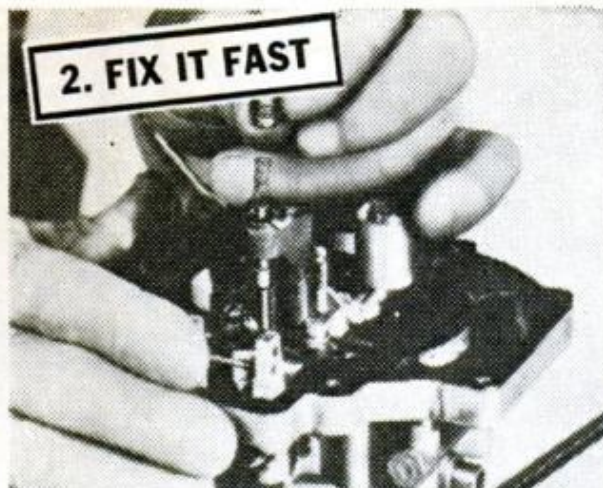
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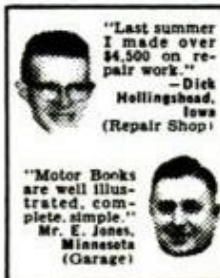
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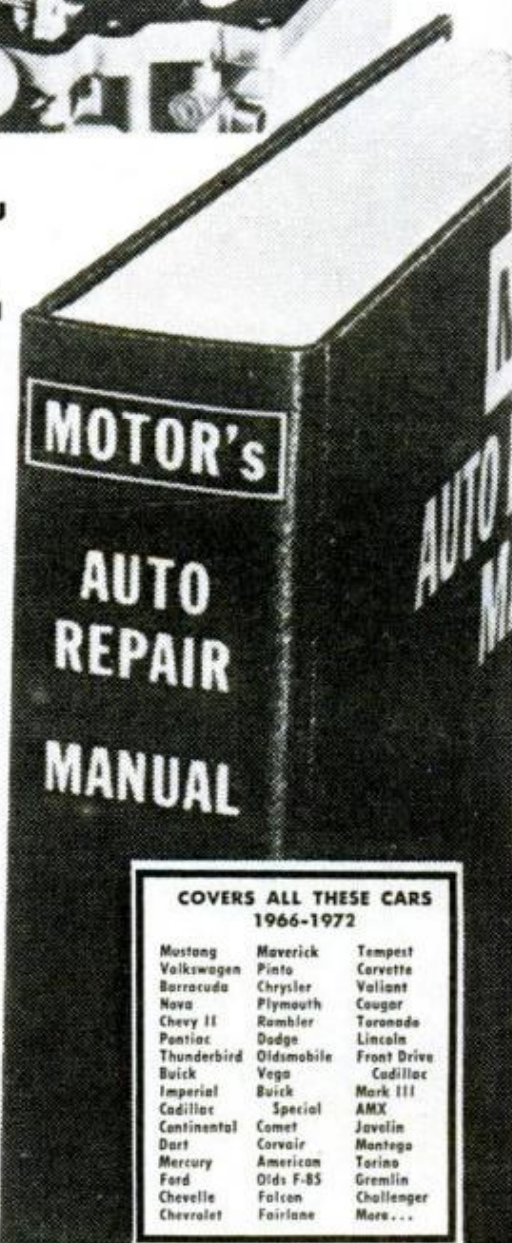
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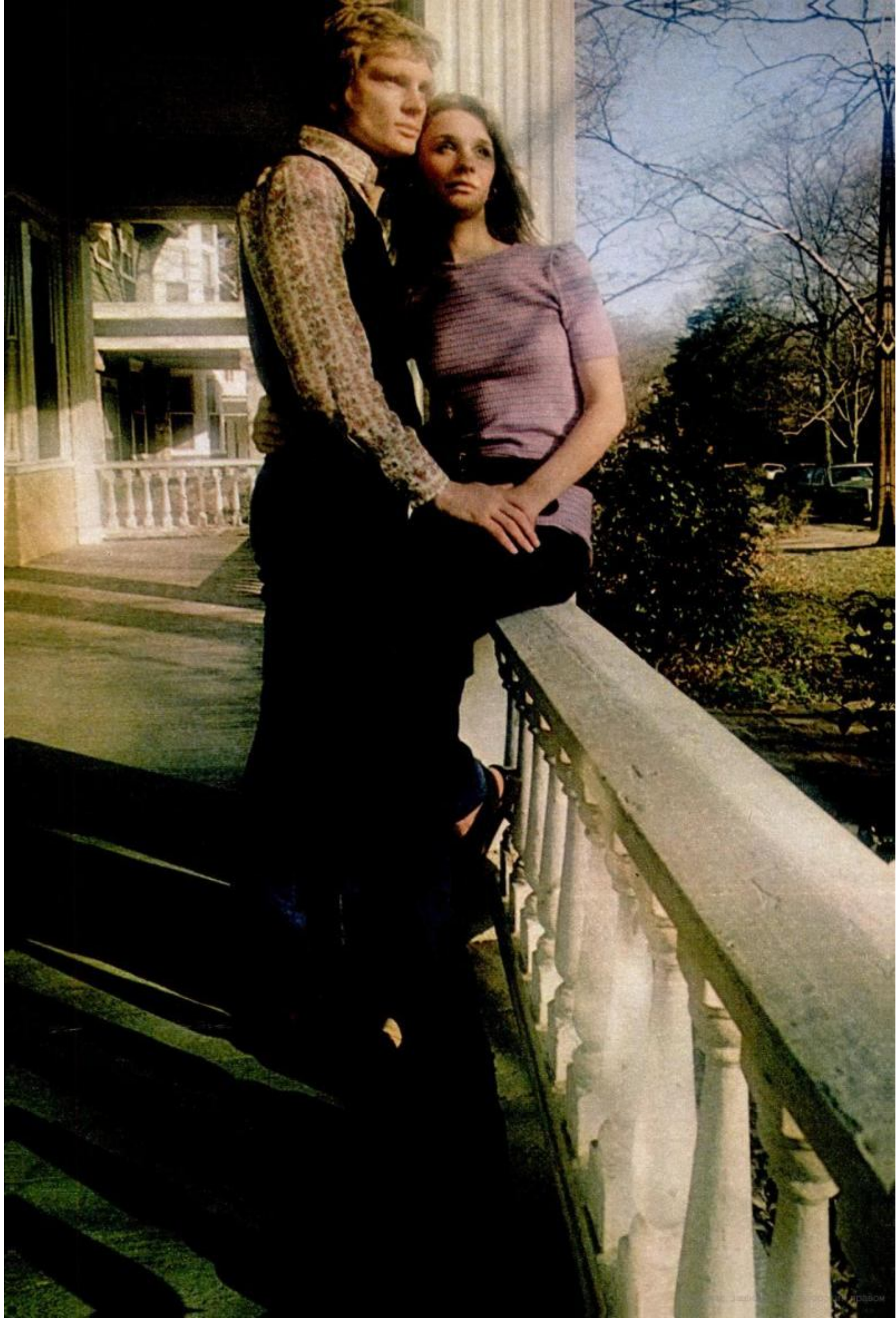
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20 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report AUG. '71.

Vacation homes: Year-round casual living

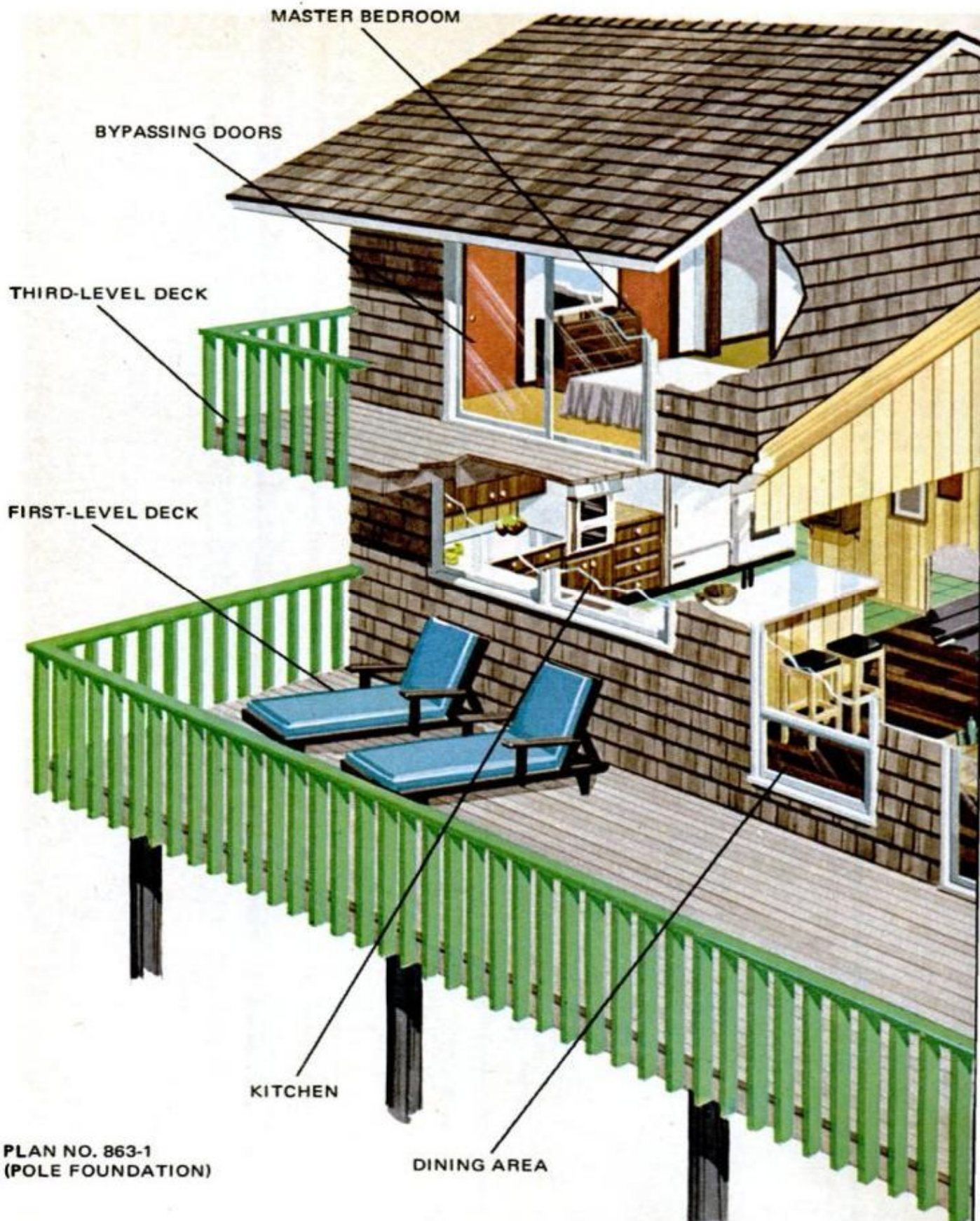
Here are four handsome houses you can live in during the hunting, skating and skiing seasons as well as in summer

OUR COLLECTION of vacation homes this year includes four delightful houses of varied architectural styles; two are of contemporary design and the others are new versions of perennial favorites. Each one shown, in addition to offering a year-round vacation site, is a home you can count on for retirement years. The designs are by architect Ralph Rittenour. Two of the houses (plan Nos. 4 and 6L) were created to suit specific design criteria originated by the Western Wood Products Assn. Plans are available for all four; to order them see page 87.

THE POLE HOUSE The first home, shown below and through page 81, is somewhat of an



PLAN NO. 863-1

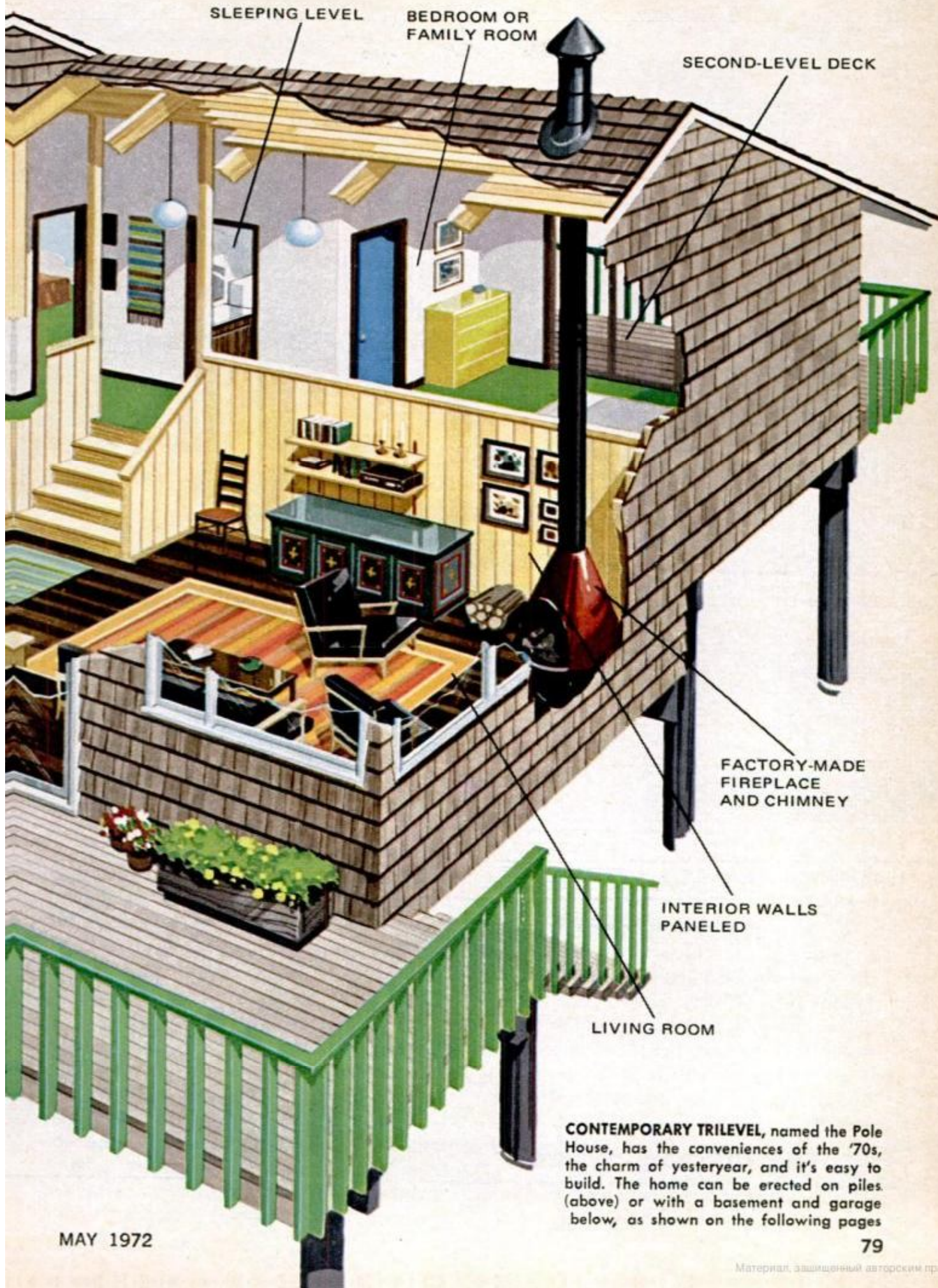


PLAN NO. 863-1
(POLE FOUNDATION)

innovation in recreation home design. It is used to particular advantage where the owner prefers to leave the landscape undisturbed or wishes to take full advantage of irregular contours on his building site. It is a dramatic structure, though modest in size.

If you study the plan, you'll notice there are three floor levels. The lowest includes the main living area and kitchen with dining facilities. A few steps lead to the second level with two bedrooms and a full bath. The third level (a separate dormer) is ample

POLE HOUSE FOR HILLY TERRAIN



SLEEPING LEVEL

BEDROOM OR
FAMILY ROOM

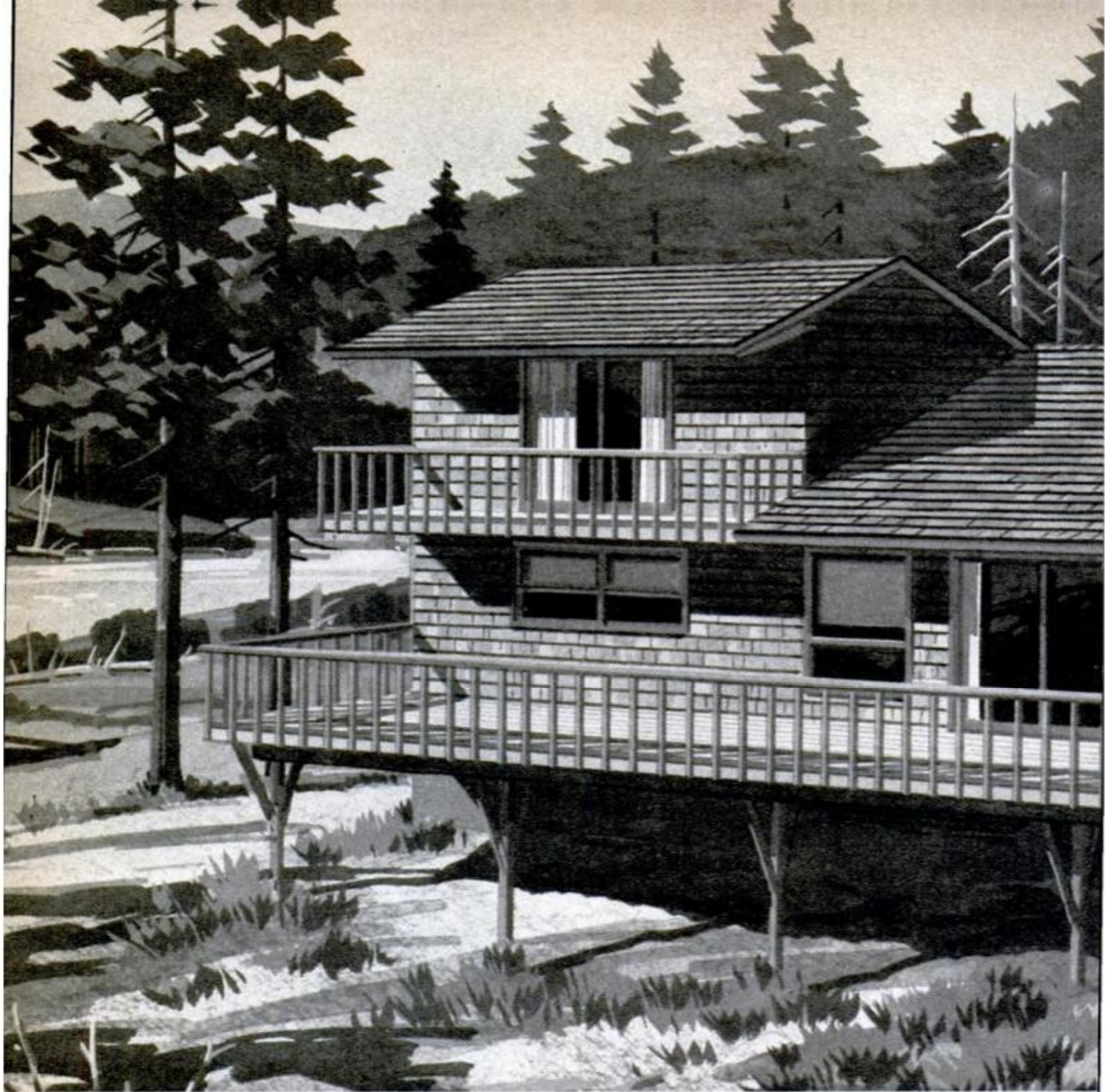
SECOND-LEVEL DECK

FACTORY-MADE
FIREPLACE
AND CHIMNEY

INTERIOR WALLS
PANELED

LIVING ROOM

CONTEMPORARY TRILEVEL, named the Pole House, has the conveniences of the '70s, the charm of yesteryear, and it's easy to build. The home can be erected on piles (above) or with a basement and garage below, as shown on the following pages



for a third bedroom and a complete bath. The plan number for this home is 863-1.

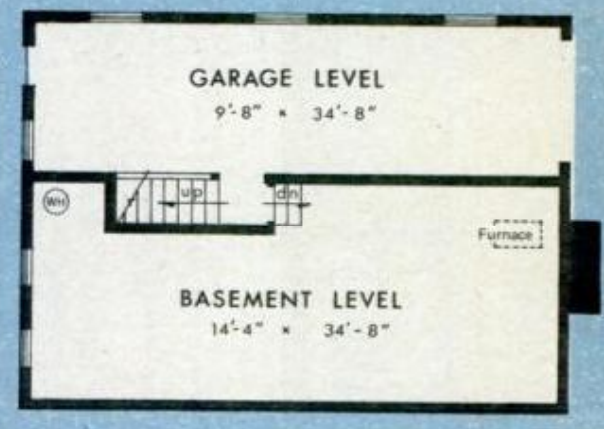
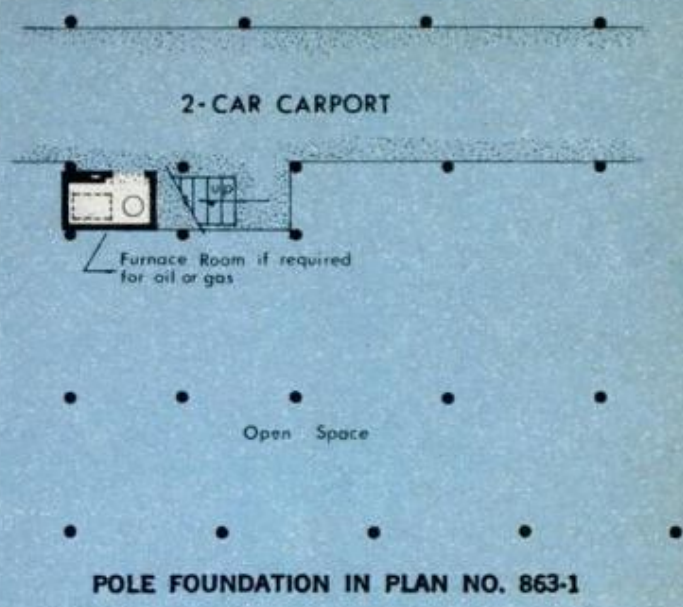
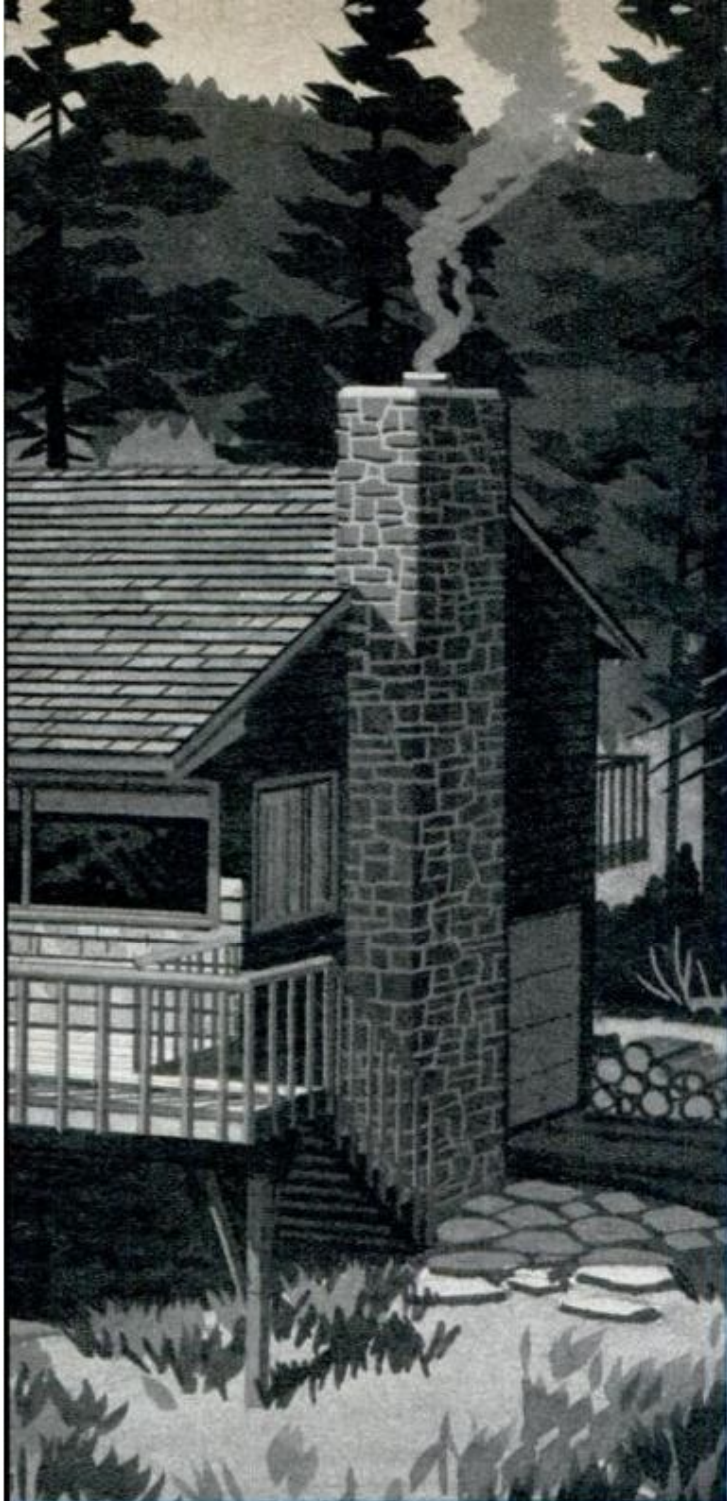
If you prefer, and the site will accept a standard foundation, you can build the Pole House variation shown above (plan No. 863-2). Here you gain a basement and garage (instead of the carport). Overall depth of the house is 26 feet and width is 36 feet, less projection of decks. The total living area is 1192 sq. ft.

THE CONTEMPORARY

The pleasing appearance of the home on page 82 is the result of a combina-
80

tion of open planning, site development and building sculpture. Without formal designation of hallways to direct traffic, the kitchen, dining and living-room areas flow into each other to give a feeling of spaciousness.

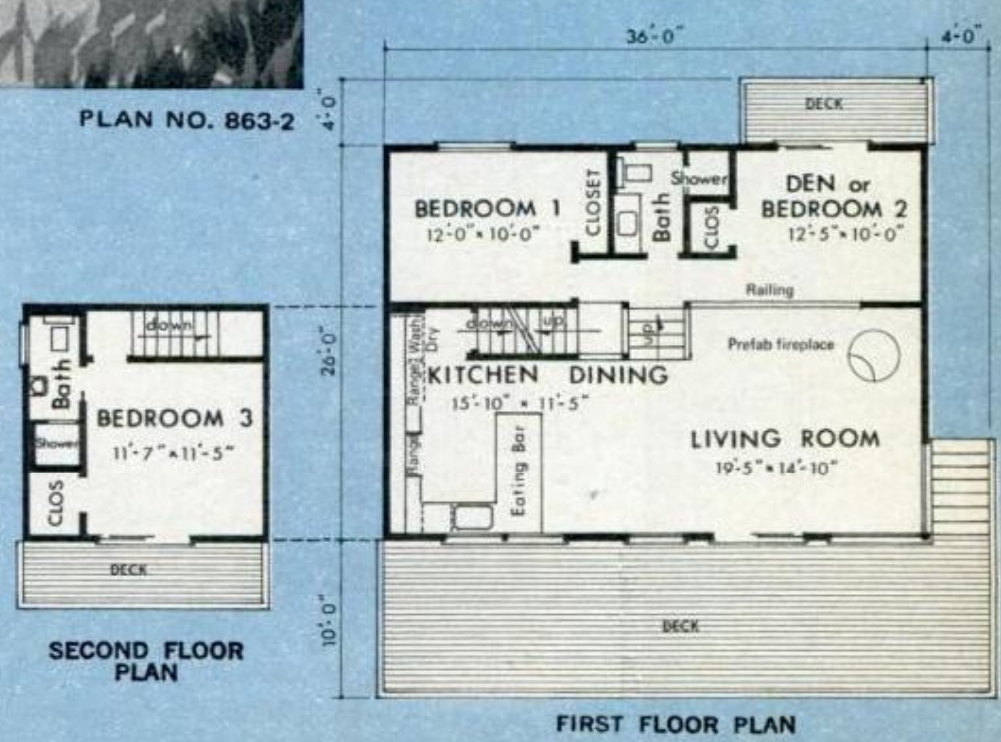
Several obvious convenience (and practical) details include proximity of the front entry to the kitchen work area, breakfast bar that doubles as a counter for quick snacks and the handy half-bath at the center of these activities. The spacious deck can be entered from the dining or living room through sliding glass doors. There's convenient storage for sundeck furni-



GARAGE-BASEMENT VARIATION IN PLAN NO. 863-2

PLAN NO. 863-2

POLE HOUSE is designated Plan No. 863-1 for structure with carport or No. 863-2 for basement-garage version. Other good design features include spacious outdoor living area and deck that extends across the complete frontage of the home parallel to the kitchen and living room. Notice that the carport, or garage, is accessible through an interior hallway and stairway leading from the kitchen alcove



A good view— both indoors and out

SLIDING DOORS and windows flanking the living-room fireplace make this wall of the house the side that should face the most spectacular scenery



ture in the closet outside. The interior wall of this unit acts as a backdrop for a prefab metal fireplace in the living room.

Perhaps the most singular feature of this design is the balcony extending the width of the house and connecting all rooms on the second floor. A complete bathroom with shower is located on

this level. From this balcony loft, there is a clear view through the glass outer wall of the living room to the countryside beyond.

The strong interior form matches the dramatic exterior appearance of this home and is typical of good contemporary design.

Overall width of this dwelling is 40



PLAN WWPA NO. 4

feet; its greatest depth is slightly over 29 feet. The deck extends 20 feet in front of the house and runs along its complete width. To order this home, specify plan No. WWPA-4.

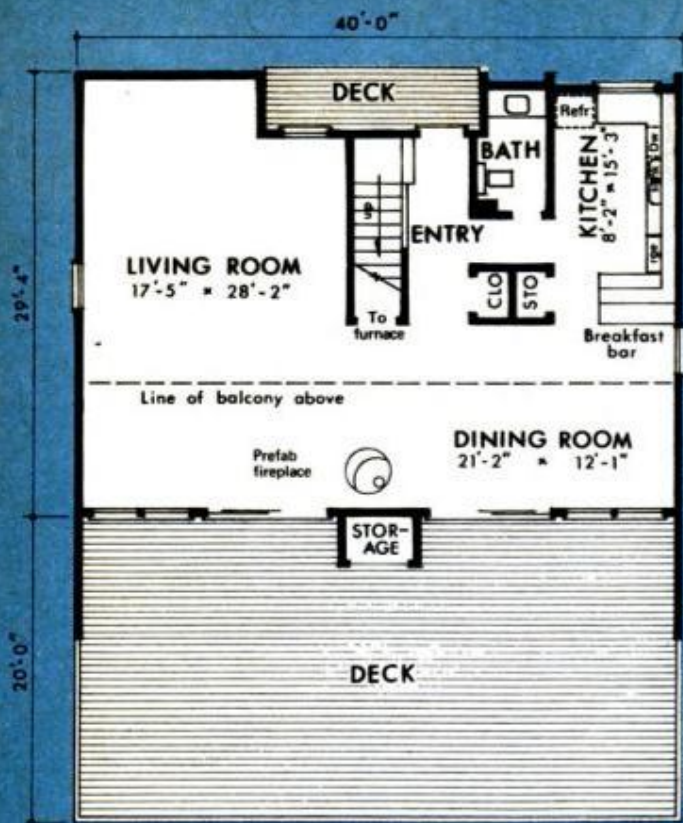
THE CHALET

Often compared with the Cape Cod for its efficient and space-saving floor

MAY 1972

plans, the chalet has become one of the most popular types of vacation and recreation housing. The plan at the top of pages 86 and 87 includes all the comforts for a large family without wasting space. Four generous-sized bedrooms have ample closet and storage space. Two complete bathrooms are tucked in convenient, readily accessible loca-

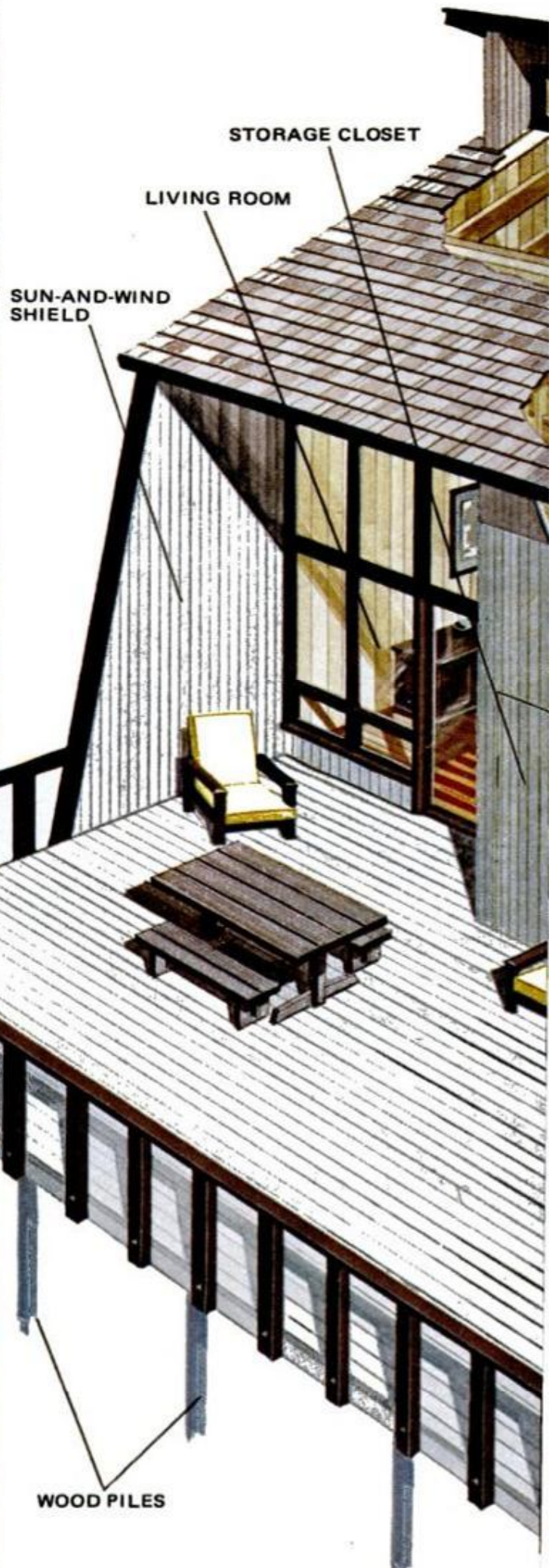
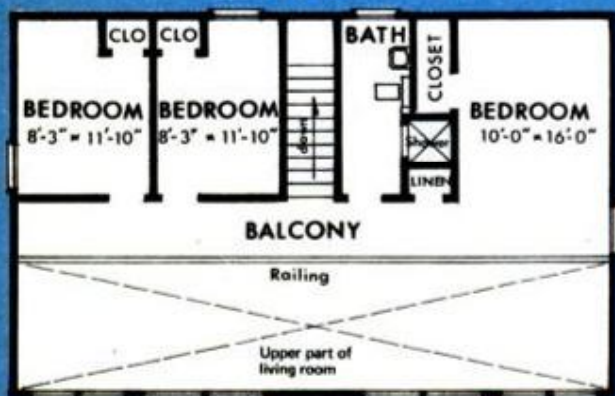
83



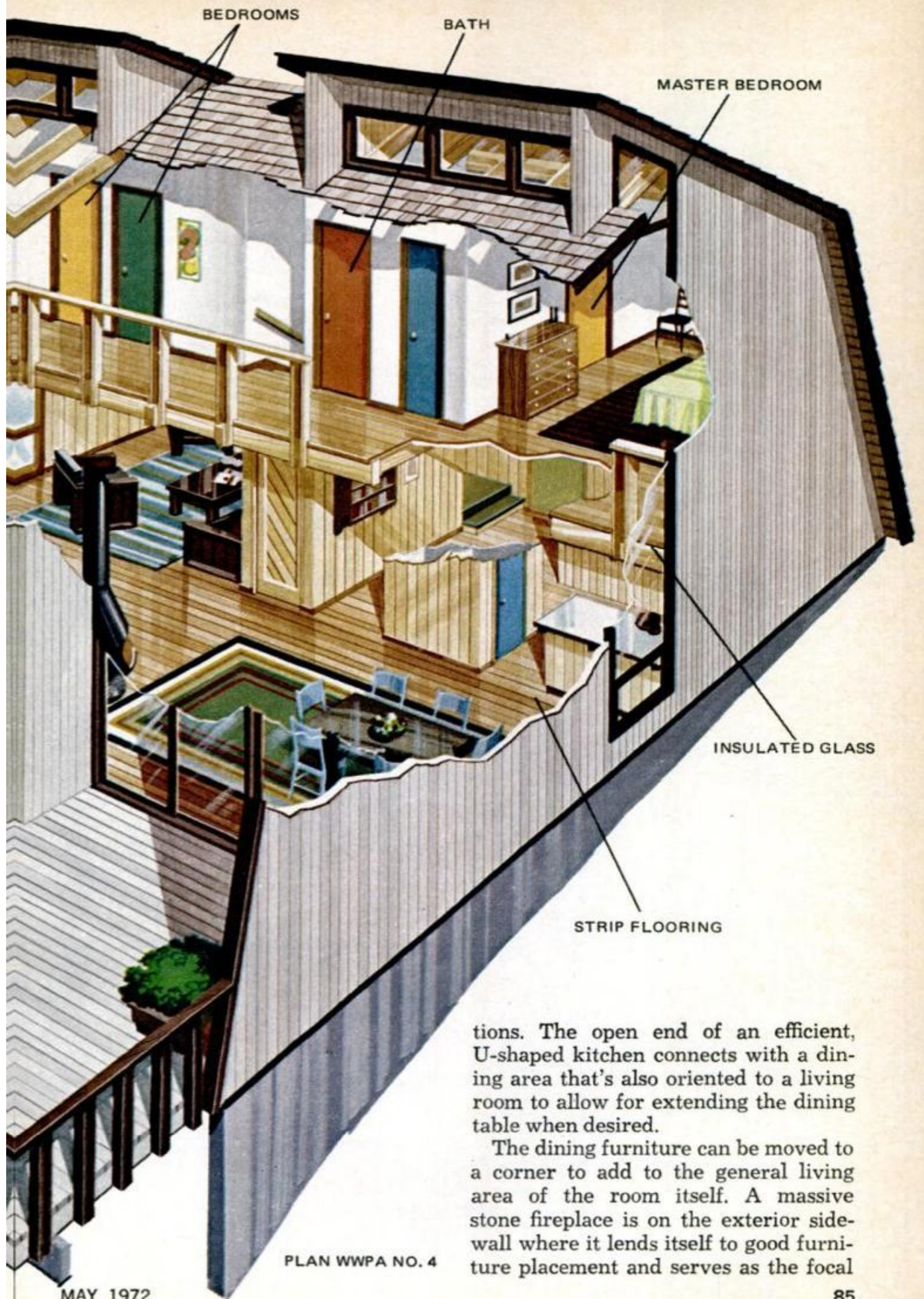
FIRST FLOOR PLAN

A GOOD VIEW often means a lot of heat, too. Here, because sidewalls and roof are extended, glassed areas are shielded from the rays of a midday sun

SECOND FLOOR PLAN



WOOD PILES



BEDROOMS

BATH

MASTER BEDROOM

INSULATED GLASS

STRIP FLOORING

tions. The open end of an efficient, U-shaped kitchen connects with a dining area that's also oriented to a living room to allow for extending the dining table when desired.

The dining furniture can be moved to a corner to add to the general living area of the room itself. A massive stone fireplace is on the exterior sidewall where it lends itself to good furniture placement and serves as the focal

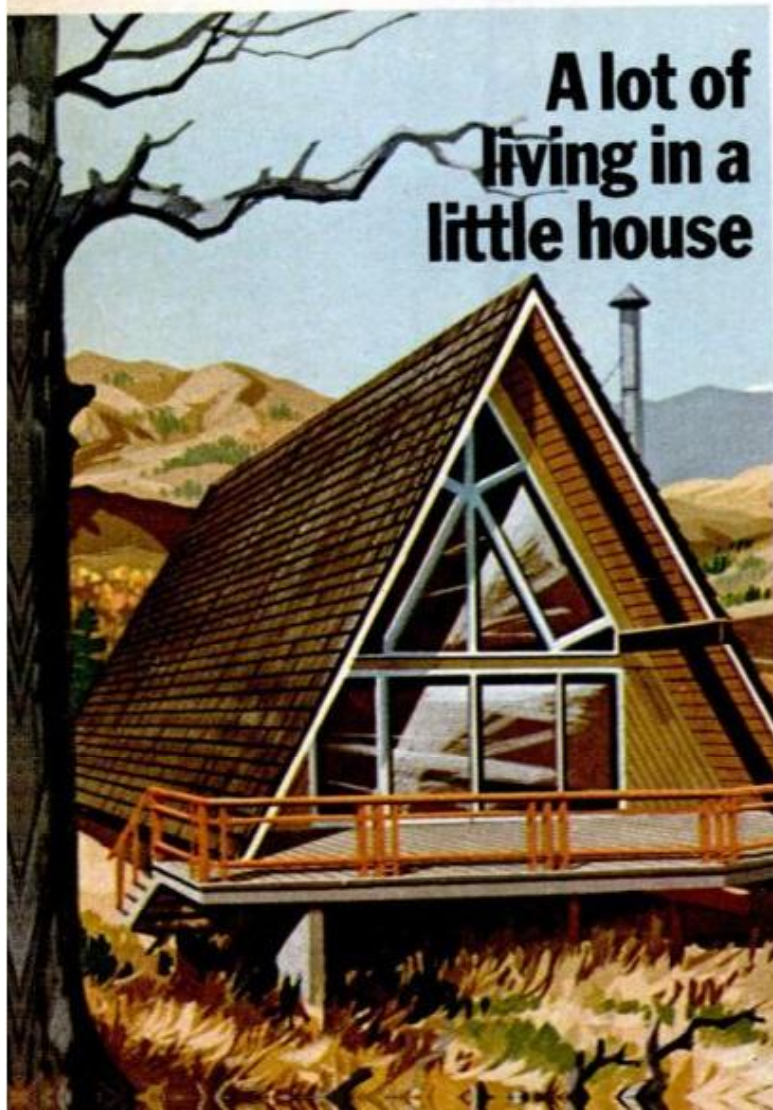
PLAN WWPA NO. 4

MAY 1972

85



Spacious chalet near the slopes



A lot of living in a little house

point of the room. Adding to the spacious look is the open staircase leading from one corner of the living room to the second floor.

A large deck space wraps around the front of the living-dining area and wide sun decks serve the two bedrooms upstairs. Plan No. 755-1 shows this house with complete basement; a variation, plan No. 755-1A, excludes the basement, but in its place provides for a laundry space under the stairway leading to the second level.

SIMPLE A-FRAME

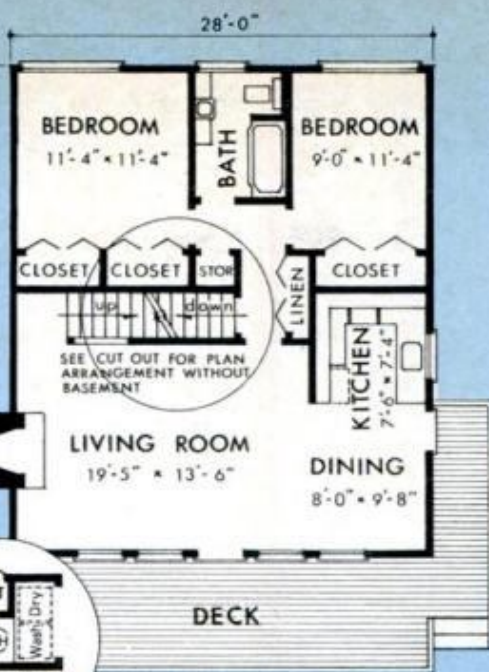
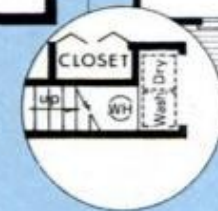
All features considered especially important by outdoor sportsmen are incorporated in the design shown at the

SIMPLE A-FRAME
PLAN NO. WWPA-6L

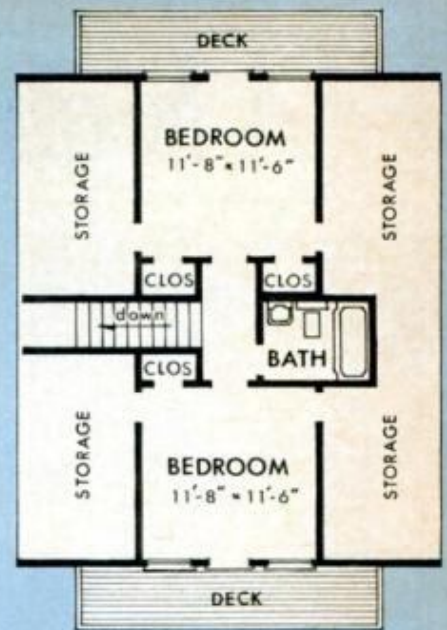
**PLAN NO. 755-1
(WITH BASEMENT)**



**LAUNDRY PLAN FOR
NO. 755-1A**



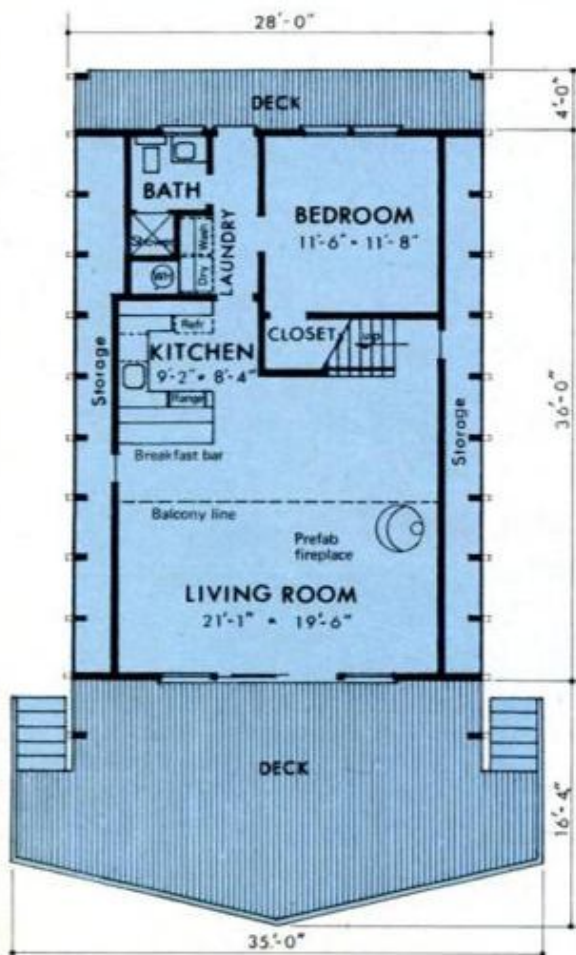
**FIRST FLOOR PLAN
896 SQUARE FEET**



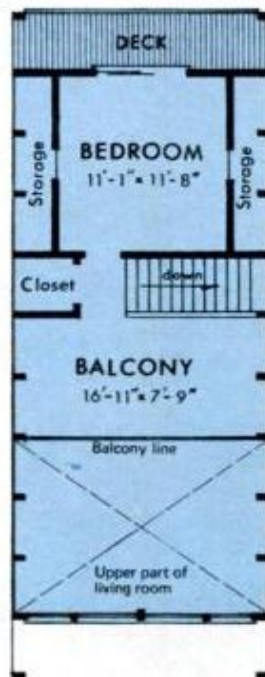
**SECOND FLOOR PLAN
450 SQUARE FEET**

HOW TO ORDER PLANS

You can purchase complete plans for any house featured in this article for \$30 per set per house or \$40 for four sets of the same plan. Add \$5 for a materials list. As a rule, four sets of plans are needed for permits, cost estimates, financing and construction. Send your order to Home Building Plan Service, Dept. PM, 2235 N.E. Sandy Blvd., Portland, Ore. 97232. Be sure that you specify the plan number for the house you want.



**MAIN FLOOR PLAN
760 SQUARE FEET**



**UPPER FLOOR PLAN
303 SQUARE FEET**

PLAN NO. WWPA-6L

bottom of these two pages, including both front and rear-door access, a full bath, two bedrooms and storage area on the first floor, and a balcony sleeping loft for use by hunting companions. To order this plan, specify No. WWPA 6L.

All these vacation homes share two important points: Each can be built by a do-it-yourselfer in stages, as time and funds permit. And each home is readily adaptable to winterizing for all-year use.

Plans and materials lists are offered by Home Building Plan Service; ordering information is given above. Such plans can help you get price estimates if you decide to build a house by contracting heavy work to others and handling finishing details yourself. ★★★

A high-flying hobby really



AMAZING SKILL of homebuilders is seen in these four good-looking birds. Like the other planes shown in this article, they appeared at the Oshkosh Fly-In. Mustang replica (upper left) is two-thirds the size of the World War II fighter. The Wickham B (left), the work of a Boeing engineer, is a four-seater with a range of 400 miles. The Skybolt (above) was built for aerobatics by high-school teacher. Helistar is a prize-winning two-seat copter. Its builder, a professional test pilot, puts value at \$30,000



takes off

Thousands of homebuilt aircraft are flying—and the number is growing. They're the work of craftsmen whose main resources are skill and devotion—not a big bankroll

By HOWARD LEVY

Photos by Henry Artof and the author

THE ULTIMATE TEST of craftsmanship must surely be this: the willingness to stake your life on the quality and thoroughness of your work.

That's what members of the Experimental Aircraft Assn. do every time they take their planes up. The EAA was started in 1953 by a group of flying enthusiasts in the Milwaukee area. Today, the organization has 30,000 members in 53 countries. Among them, they've put 4000 homebuilt planes in the air and currently have some 7000 in construction.

The planes are designated "Experimental," a special category created by the Federal Aviation Administration for licensing purposes. To qualify, more than half of the plane must have been constructed by the builder.

The FAA inspects the planes during construction to make certain that structural requirements are met. Then the plane must complete 50 hours of flying within a restricted area—a shakedown program calculated to disclose elements of poor design or faulty flying characteristics. If the plane clears this hurdle, the builder-pilot, who must hold a regular pilot's license, is free to fly it where he wants.

Not only does the hobby provide a real sense of accomplishment, it permits the budget-minded craftsman to get a lot more plane for his money. A simple

[\(Please turn to page 91\)](#)



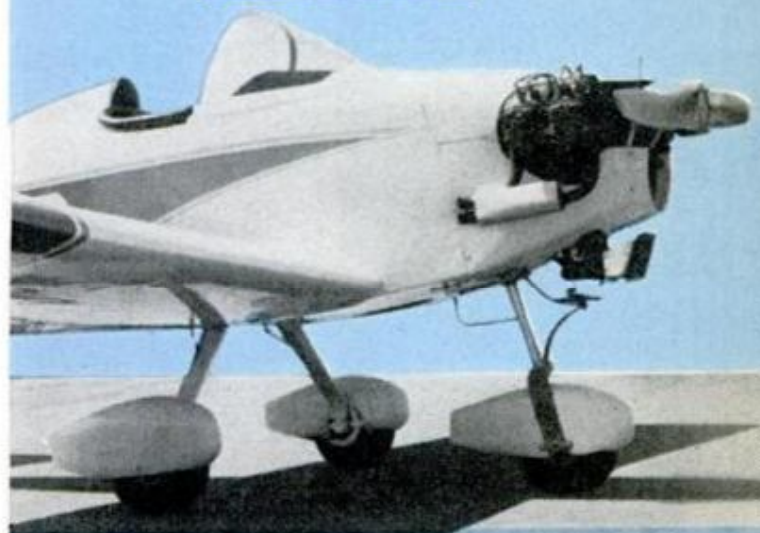
THE BANTAM —a homebuilt beauty

BILL WARWICK, a 41-year-old lab technician who lives in Torrance, Calif., started designing and building aircraft in the late '50s. The Bantam, which has been flying since 1966, is his third plane. He estimates that the basic configuration can be built for \$1200.

This slick one-seater is powered by a 65-hp Lycoming, but other engines (up to 100 hp) may be substituted. The tricycle landing gear (see below) is fixed, but a retractable type can also be used.

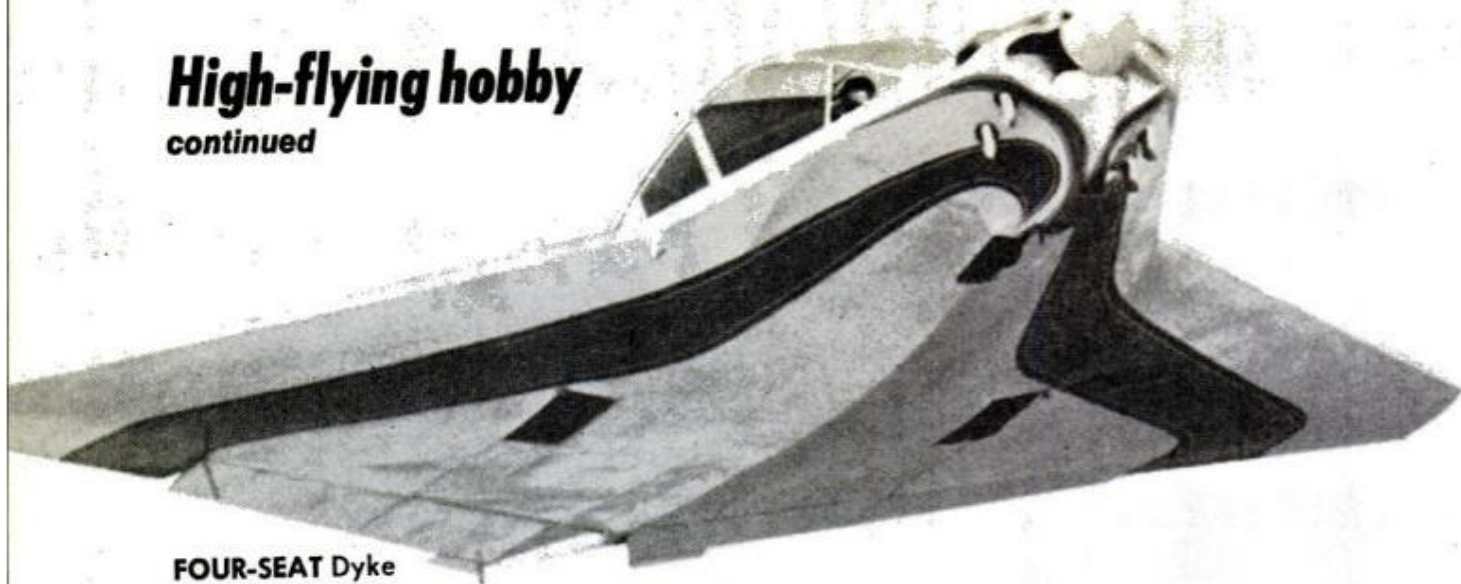
Except for fiberglass tips on wings, stabilizer and fin, the Bantam is an all-metal plane. It has a wing span of 18.5 feet, is 13 feet, 9 inches long

[\(Please turn to page 91\)](#)



High-flying hobby

continued



FOUR-SEAT Dyke

Delta has fiberglass covering over tubular steel frame. Clever design allows wings to fold for towing on plane's own retractable landing gear. Delta can hit 200 mph and has 700-mile range. It cost \$2000 to build. Plans are available.



EXOTIC TEAL was built by professor of aeronautical engineering. The plane cruises at 180 mph, has set closed-course speed marks, and has a range of 2000 miles. The all-metal single-seater has pusher prop driven by engine aft of wing.

SIX YEARS, three months and \$4000 were needed for completion of this award-winning Pazmany PL-1. All-metal two-seater has top speed of 150 mph and 450-mile range. Plans cost \$75.



THE BANTAM

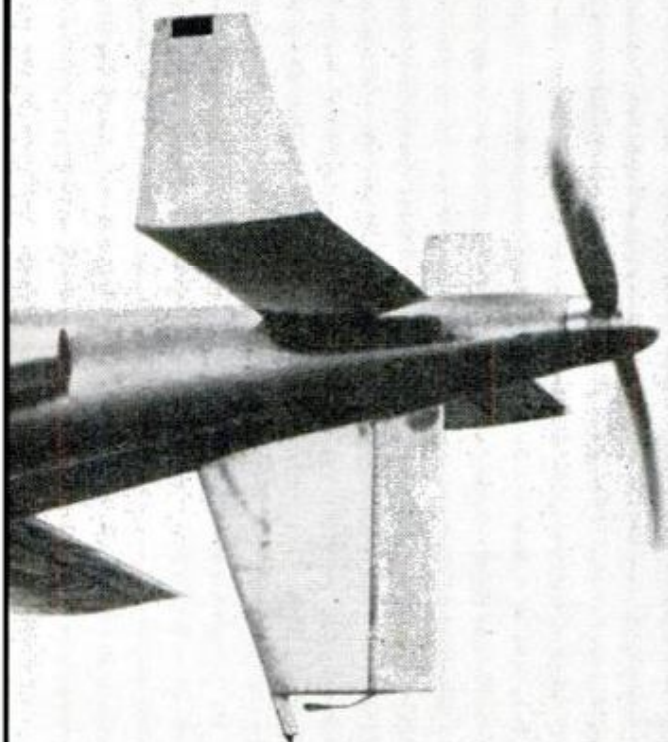
(Continued from page 89)

and 6 feet high. Its gross weight is 790 pounds. Cruise speed is 115 mph and rate of climb 1000 feet per minute. The Bantam needs 550 feet to take off and 500 to land.

Instrumentation in a homebuilt de-



AEROBATIC WICHAWK features side-by-side seating. Twenty-four coats of dope were applied to linen covering fuselage's steel frame.



single-seater may cost from \$1500 to \$2000, while a high-performance two-seat job may run about \$3500.

Some hobbyists create their own designs. Others build from plans and kits. Plans start at \$25 and go as high as \$350, depending on the aircraft. Working at night, on weekends and vacations, some builders complete their planes within a year. The average project requires one and a half to three years to complete.

Homebuilders come from many different walks of life and more than a few are pretty gals. They work in basements, garages—even apartments.

Once a year members of the EAA get together at a Fly-In. Last year it was

(Continued on next page)



pends on how the plane will be used and on the pocketbook of the builder. (The well-heeled hobbyist may even install a small auto-pilot.) In the Bantam's cockpit (as seen in photo above), the top row is comprised of flying instruments—altimeter, air-speed gauge and such. Engine gauges, providing oil pressure, rpm and other readings, are on the console; at its bottom is the radio.

The plane can be flown without a canopy—and what could be pleasanter on a warm, sunny day? But a

(Please turn to page 93)



High-flying hobby

continued



FOR ECONOMY, it's the Scooter, which cost only \$800 to build. It's powered by a modified 58-hp VW engine, has a maximum speed of 95 mph, a range of 200 miles and a service ceiling of 10,000 feet. Hinged nose provides access to small cargo space



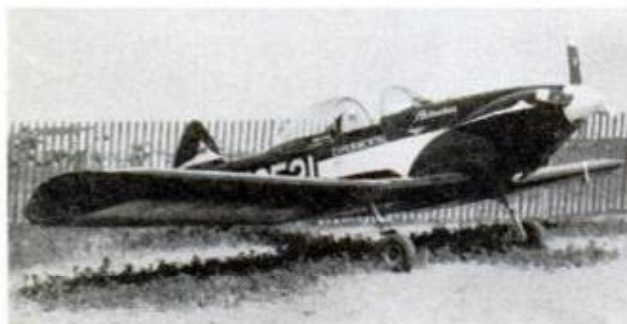
SHARP MIDGET MUSTANG, the work of a commercial pilot, won award at Oshkosh as best all-metal mono-plane. Construction required three years and cost \$4000. Equipped with 150-hp engine, the plane has a maximum speed of 250 mph and range of 400 miles



RED BARON, LOOK OUT! Here comes a neat replica of a World War I British fighter. It's an all-wood plane with a fuselage made of mahogany plywood and fiberglass. Engine is an 85-hp Continental. Craft took 20 months to build and cost about \$1500



A MODIFIED VW ENGINE, its horsepower upped to 65, makes it easy for the Volksplane to cruise at 90 mph. This very popular craft is of all-wood construction. There are said to be 22 of them now flying in the United States, maybe 60 by year's end



FIRST FLOWN IN '67, the Ladd-Taylor monoplane has been modified since then. First a bubble canopy was added, the retractable landing gear. Latest addition is a four-bladed propeller. Original cost of the plane was \$2000; working time, one year

held at the Oshkosh, Wis., airport, where all photos shown here—except those of the Bantam—were shot. In all, 828 planes were registered, representing these EAA classes: Homebuilt; Antique (built prior to World War II); Classic ('45 to '50) and Warbird (military-type). To see the best homebuilts, visit Oshkosh July 30 to Aug. 5 for EAA's 1972 Fly-In. ★★★

EDITOR'S NOTE: Each month PM will feature a different homebuilt. The Bantam was the first. Next month: the Taylor Coot, a handsome amphibian.

For information about plans for any planes shown or described here, write: Experimental Aircraft Assn., Box 229, Hales Corners, Wis. 53130.

POPULAR MECHANICS



A 47-YEAR-OLD FIREMAN spent four years building this Mohrbacher-Smith Miniplane. It has wingspan of about 18 feet, is better than 17 feet long and weighs 633 pounds empty. Wood was used in wings, steel in the fuselage. The plane cruises at 97 mph



BY ADDING HIS OWN MODIFICATIONS to basic plane, an air-freight salesman built this good-looking version of the Minicab. He altered landing gear and engine cowling, added fiberglass wingtip tanks. Construction of this two-seater took three years



MONNETT SONERAI was judged best formula V Racer at Oshkosh. The builder, a 28-year-old high-school teacher, says plane will do better than 160 mph. Its engine is modified 1600-cc VW that develops 65 hp. Wings fold, permitting plane to be trailered

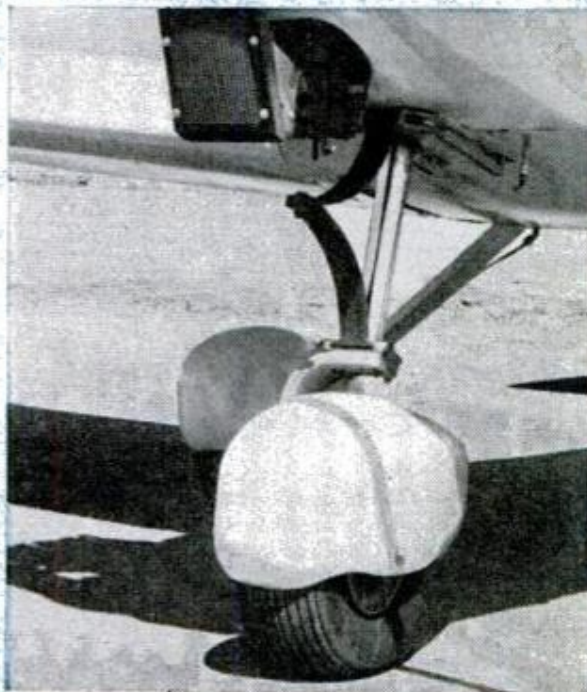
THE BANTAM *(Continued from page 91)*



Plexiglas canopy certainly adds zip to the configuration in addition to being practical.

Close-up (below) shows steerable front wheel with its spring-leaf shock absorber.

Warwick estimates he spent 300 hours designing the plane and another 1100 in fabrication. He explains that basic tools can be used

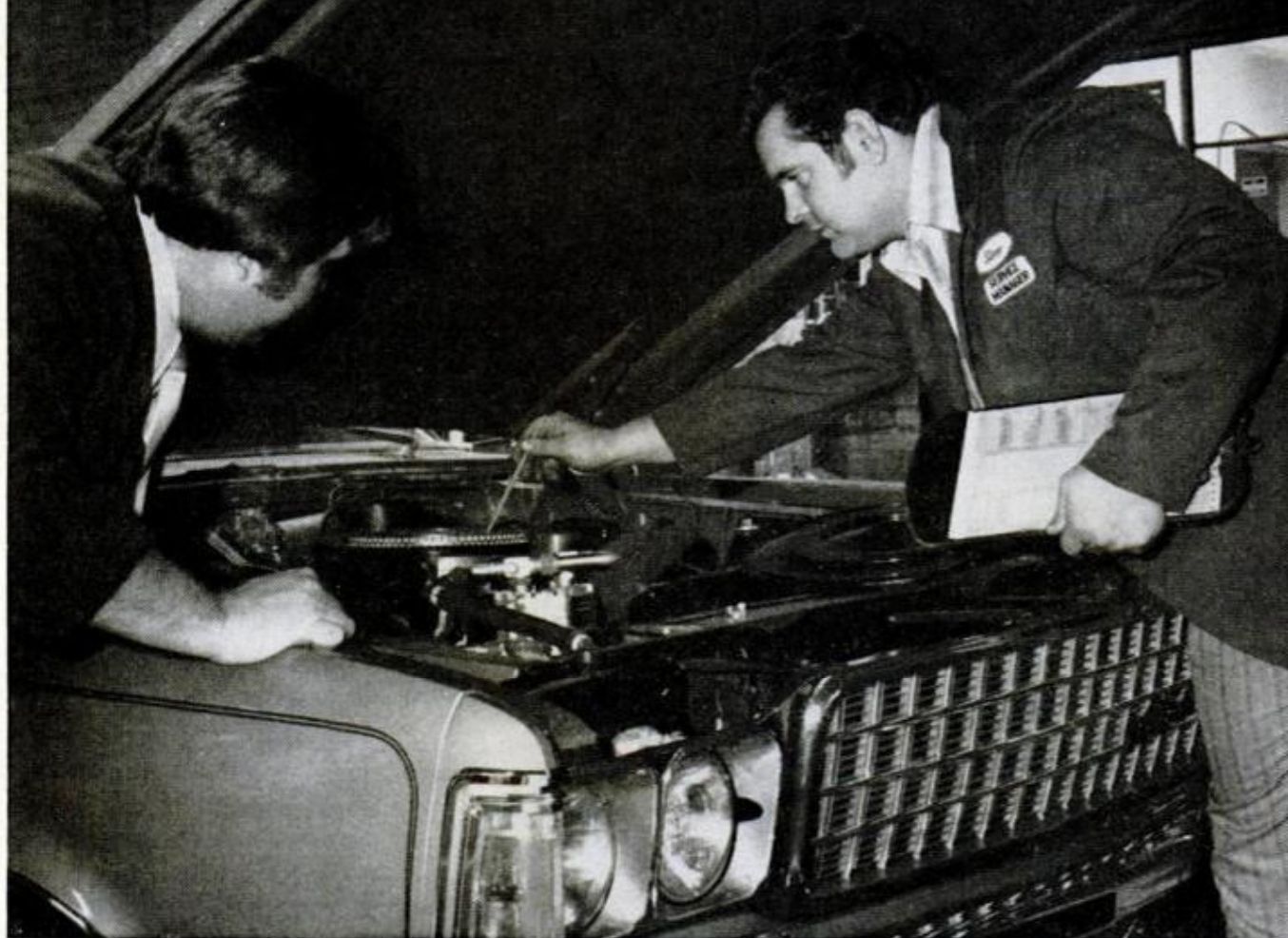


throughout—including heavy-duty straight shears and cutters, a conventional rivet gun and assorted bucking bars.

Some 50 sets of Bantam plans are in the hands of builders. About 20 planes are under construction and 5 are reported to be flying. Blueprints cost \$55. Interested? Write: Bill Warwick, 5726 Clearsite, Torrance, Calif. 90505. ★ ★ ★

PM AMC Ambassador
OWNERS REPORT...

A nationwide survey based on
1,000,000 owner-driven miles



American Motors' 'Guaranteed Car.' Is it?

By MICHAEL LAMM, West Coast Editor /Photos by the author



BUYER PROTECTION PLAN covers everything but tires for 12/12, assures a free loaner on overnight fixes

94

AMERICAN MOTORS has been tooting its "guaranteed" horn since the 1972 introductions, sparking quite a bit of interest in the company's line of cars.

But how guaranteed is the Guaranteed Car? The idea sounds good, but is it? Do customers like it? How about dealers? We tried to find out by asking Ambassador owners as part of this Owners Report, specifically; we also asked dealers and factory officials.

An Independence, Wis., farmer

POPULAR MECHANICS

wrote of his dealer's service, "It's fine except the company advertises loan cars while servicing, and the dealer wouldn't accommodate us with one." We telephoned the farmer and asked why. "The dealer has this sign in his shop," he told us, "that says his insurance doesn't cover loaners."

So we called AMC in Detroit to find out if this is common. "It's not," AMC general service manager George Brown assured us. "Only about 70 dealers out of a total of 2025 aren't in our Buyer Protection Plan program. Now this could be one of those dealers. But insurance would be his responsibility, since regulations vary so greatly from state to state."

In fairness, only one other owner specifically complained that he couldn't get a loaner. When we called him, he said he was told that all the dealer's loaners were out, but it really didn't matter too much to him because he owns three other cars. Otherwise, all the rest of our surveyed owners mentioned that they either had had no need for loaners or that they got them when needed.

"How does the Buyer Protection Plan work?" we asked AMC.

"It's an amendment to the dealer's

franchise," answered George Brown. "It states that the dealer agrees to make a loaner available anytime he has to keep a customer's car overnight. Every time that happens, the factory reimburses the dealer \$2 per night per car. The loan car itself has to be a late model, and it has to be equipped with a minimum of automatic trans, air and power steering.

"In addition, if a dealer signs up for this program—and 99 percent have endorsed it enthusiastically—the factory agrees to sell him one car at a \$275 discount for every 100 he sells. That's the carrot. The net result, though, is twofold: First, it makes dealers do their darndest to give same-day service. Second, it assures our customers that they're going to either get service or wheels right away. To go along with this, we've set up 24-hour airfreight parts delivery to any point in the United States. So no owner should have to wait more than 24 hours for a part."

They shouldn't, but a few Ambassador owners have had their patience tried: An Illinois air force officer waited three weeks for a new windshield-wiper motor. And another Illinois owner, an insurance company manager,



AMBASSADOR OWNERS, divided on styling of their car, listed past experience as big reason for buying. Promise of good dealer service was also factor in purchase

says, "Work was done okay, but it took four weeks to get trim parts."

We asked AMC what can an owner do if he does run into problems or arguments on warranty service?

"Well, as you know, we maintain an Owner Hot Line. If he's got a gripe, an owner of a 1972 American Motors product is assured of getting immediate attention." (PM called the hot line and

did get a quick, friendly response.)

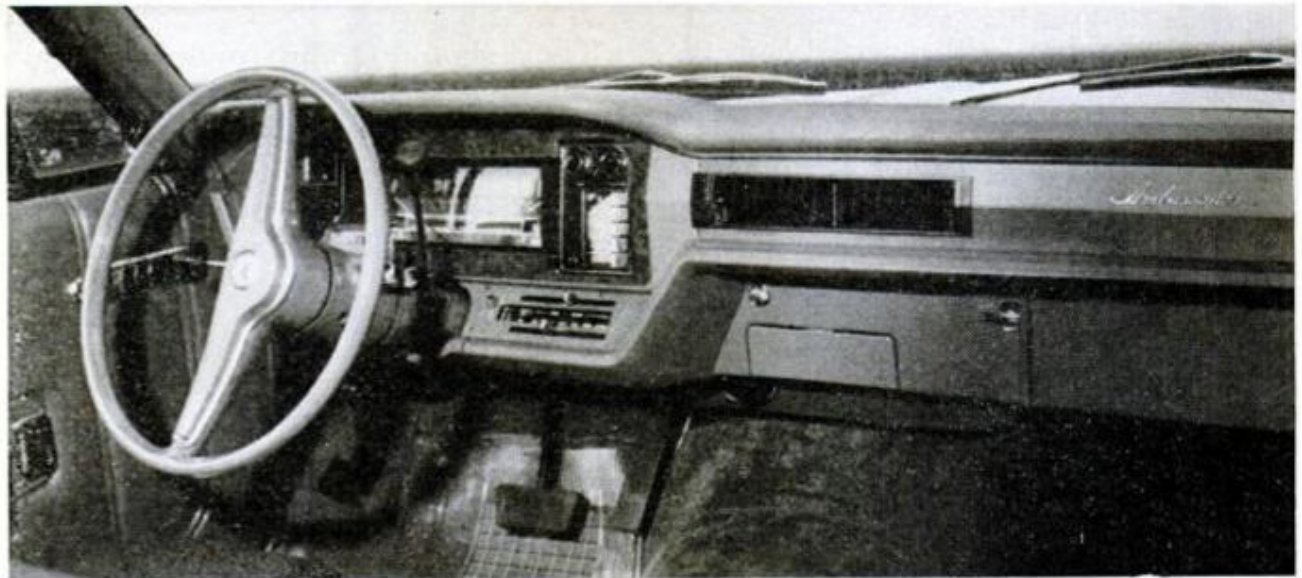
The most common complaint, if an owner has one at all, is with dealer prep. AMC ads and commercials stress a thorough dealer going-over before any 1972 car is released. Some buyers, though, felt this check wasn't so fine-toothed as they would have liked.

Here are some random comments about AMC service and the warranty



FOUR-DOOR SEDANS appear to be hardtops, but aren't. Owners who like the styling mentioned this finesse in design. Some owners thought that the C-pillars should be narrower in order to minimize blind spot in the rear

TOO MUCH PLASTIC used in construction, a few owners complained. They criticized ashtray locations and the gas-pedal angle, but mostly praised overall layout of the dash and instruments. Air-conditioning, power brakes and automatic transmission are standard on Ambassador



PM's AMC OWNERS REPORTS COMPARED

Car/issue	Percent owners with mechanical troubles	Percent owners satisfied by repairs
Ambassador (May '72)	42.3	78.8
Gremlin (June '71)	41.3	49.3
Hornet (Sept. '70)	31.7	53.5
Rebel (April '70)	33.3	77.8
Ambassador (July '69)	30.4	75.5
AMX (Feb. '69)	70.9	66.1

LOOKING BACK at AMC Owners Reports reveals more problems now, but service satisfaction is on upswing

situation: "Serviceman came to my home, got the car started. I drove it to dealer and waited while it was repaired."—New Jersey computer operator. A Minnesota minister says, "They were very helpful in explaining the entire AMC policy." "Our dealer has always stood behind his product, so the company policy has had no effect on us."—Michigan teacher.

An Ohio RFD mail carrier: "Bad

front brake shoe was replaced under warranty; had loan car to use." An Army captain from Arkansas mentions, "I feel the present guarantee is outstanding. Had a complete 6000-mile inspection plus adjustment to Cruise Command and sway bar reseated. Only cost was for oil and filter."

Owners satisfied with service point out that they have been treated surprisingly well and have not received arguments from service managers. "Nice—even though I didn't buy from this dealer. This I didn't expect!" exclaims a Colorado civil service employee. "Customer always given benefit of the doubt," says a New York jeweler who says he's bugged his dealer with minor complaints. A retired Ohio man telephoned his dealer about a no-start problem with his Ambassador with 4980 miles on it and received a prompt "house call" by a serviceman who replaced a defective condenser. A Massachusetts salesman was happy to receive a loaner—a loaner *radio* which he's using while his original unit is being repaired.

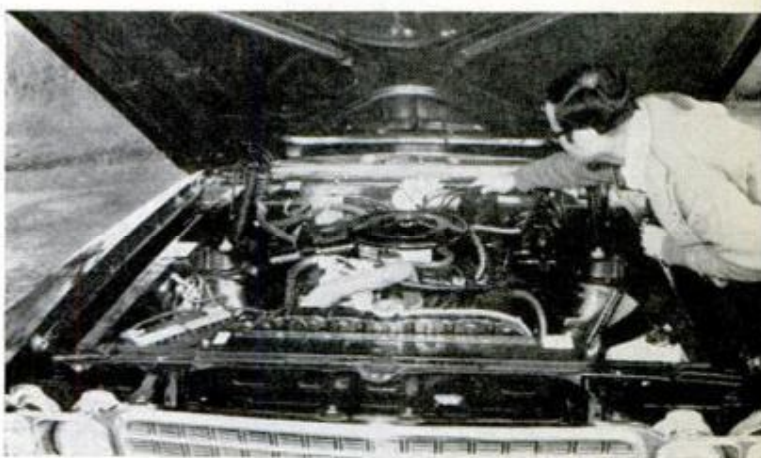
Among owners who had mechanical difficulties, 21.2 percent were *not* satisfied with dealer service. Biggest reason is having to make more than one trip to the dealer: "Dealer made all repairs but it took seven trips back to work out all the bugs," says a Missouri education official. "Took four appointments to complete repairs," says a Michigan man. A Wisconsin welder is unhappy because the dealer still has not boosted his fuel mileage: "Gas mileage still very low." He says he gets 11 mpg around town and 12 on trips with his 360.

How much grief have owners had in getting repairs? Less than one percent of Ambassador owners surveyed mention the necessity of their having to "come out fighting" to get their problems solved. A Michigan TV serviceman says "dealer lived up to warran-

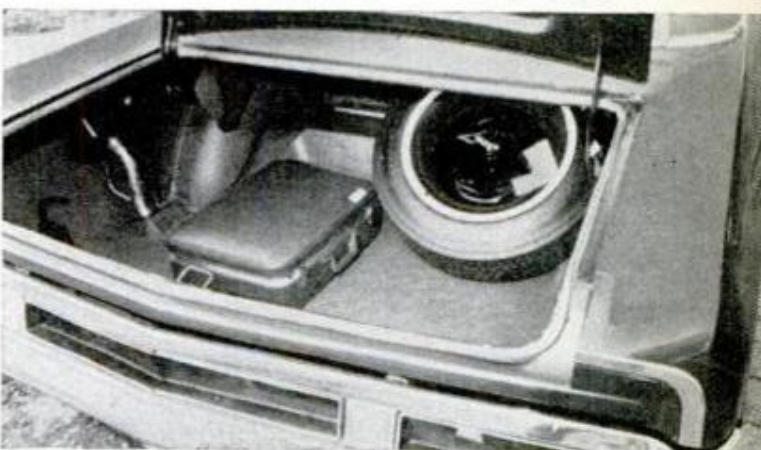
RECESSED DOOR HANDLES can't snag clothes, take a straight pull. Several owners said they bought Ambassadors because no rival make has vent windows



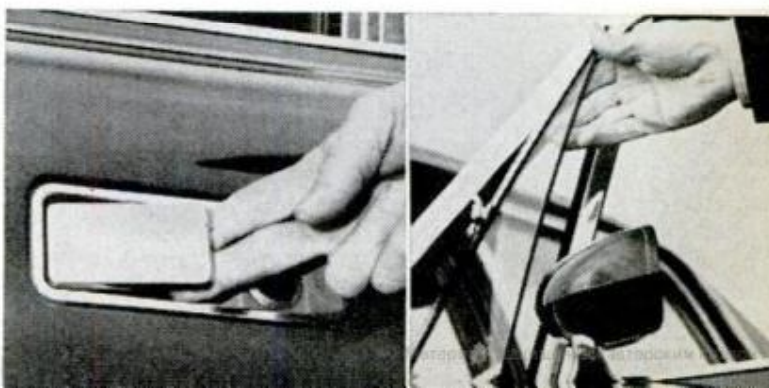
OPTIONAL RECLINING SEATBACKS are real favorites with Ambassador owners, but headrests tend to stick



AMAZINGLY, all Ambassadors get about same gas mileage—13-16 mpg—no matter which V8 buyers get



PLENTY OF ROOM back here; gripes are centered on the high trunk lip and placement of the spare tire



tee" even though "some personnel have been very, very discourteous." A Staten Island, N.Y., clerk tells us that his dealer "was very fresh" to his son when the boy brought in the car with a list of problems: "They asked him if he wanted a perfect car."

That's the kind of aggravation the Buyer Protection Plan is trying to eliminate. From our survey, we've found that AMC has certainly minimized it. That's a bonus for Ambassador buyers since only 8.5 percent of them listed guaranteed service as their primary reason for choosing the Ambassador. We had imagined the percentage would be higher. AMC spokesmen say it is much higher with buyers of Matadors, Hornets and Gremlins.

Ambassador owners are mostly re-

peat buyers. Over 55 percent listed "past experience" as their main reason for buying. The other AMC lines attract a good many new customers, but Ambassadors don't. This might soon become a problem, because the majority (52.6 percent) of Ambassador owners are over 50 years old—one of the highest age groups we've surveyed.

A 69-year-old retired engineer from Delaware said, "This is the 29th American Motors (Nash) car in my immediate family since 1913—and I own 700 shares of GM stock!"

What, specifically, do the owners like about their cars? "It is a luxury automobile within my means," says a Wisconsin draftsman. A Washington teacher: "The variable-ratio power steering

(Please turn to page 194)

Summary of 1972 Ambassador Owners Reports*

Total miles driven1,052,938

Average miles per gallon

304-cu.-in. V8, local driving .12.8
 long trips .15.9
 360-cu.-in. V8, local driving .12.5
 long trips .15.4
 401-cu.-in. V8, local driving .12.3
 long trips .15.8

Engines:

304-cu.-in. V851.5%
 360-cu.-in. V836.2
 401-cu.-in. V812.3

Body styles:

4-door sedan69.2%
 4-door wagon18.9
 2-door hardtop11.9

Series:

Brougham59.1%
 SST40.9

Why the Ambassador?

Past experience55.1%
 Economy9.9
 Dealer service/warranty ...8.5

Specific likes:

Handling50.0%
 Comfort32.3
 Ride27.3
 Style25.0

Economy17.7
 Performance15.0
 Power6.5

Specific dislikes:

Poor gas mileage14.1%
 Rattles12.6
 Poor workmanship8.4
 Harsh ride5.7
 Poor dealer service3.8

What changes would you like?

Different styling7.4%
 Different seat contour ...7.0
 Better workmanship7.0
 Fewer rattles7.0
 Better materials6.1
 Brake, hood releases too close4.4

Had any mechanical trouble?

No57.7%
 Yes42.3

What kind of trouble?

Carburetor12.7%
 Transmission7.6
 Electrical7.6
 Brakes6.8
 Cold starts5.9

Did you repair it yourself?

No98.3%
 Yes1.7

Dealer repairs satisfactory?

Yes78.9%
 No21.2

Is the Ambassador your only car?

Yes52.9%
 No47.1

Other cars owned:

AMC products42.7%
 Chevrolet13.2
 Ford7.4
 Plymouth5.2
 Dodge5.2

Accessories/power options:

Power steering62.3%
 Radio50.8
 Tinted glass33.5
 Disc front brakes17.7
 Padded vinyl top17.3

Age distribution of owners:

15-29 years7.3%
 30-49 years40.2
 50-plus52.6

Would you buy another Ambassador?

Yes92.0%
 No8.0

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



AMBASSADOR FOUR-DOOR is choice of most owners. Overall satisfaction with car is reflected by 92 percent who'd buy one again

Taking the high cost out of hi-fi



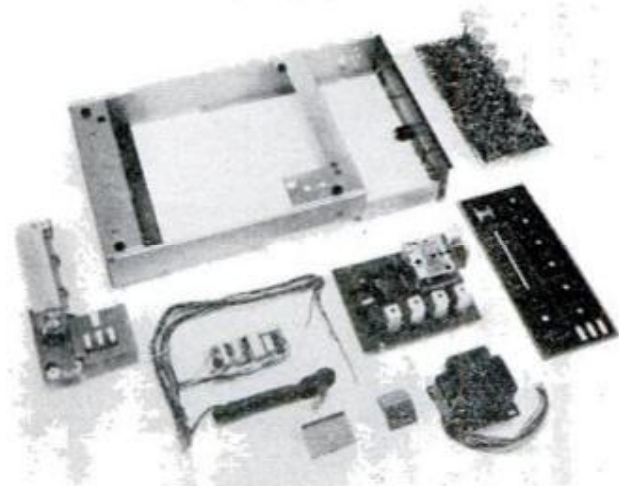
ONE EXAMPLE OF A FINE BUY in hi-fi at a bargain price is this Heathkit compact combining FM/-FM stereo receiver and BSR McDonald turntable in a smartly styled rolltop walnut enclosure. With top closed (lower photo above), the parts are neatly hidden and kept free from dust. Kit price is \$169.95

Good sound doesn't have to cost an arm and a leg. The trick is to be able to tell the inexpensive from the just cheap. Here's a rundown on some real dollar-stretching bargains

By HANS FANTEL

GOOD SOUND isn't as hard to come by as it used to be. Recent advances in audio engineering now make it possible to get more hi-fi for your dollar than ever before. Some prices are so low, in fact, that you wonder how the equipment could possibly be any good. Here's where the catch comes in—some is, some isn't. In many cases, there's no direct relationship between price and performance. This works both ways—while high price doesn't guarantee good performance, good performance doesn't necessarily have to come high, either. Good bargains can be found with a little sharp-eyed shopping.

One reason why low-cost equipment



TYPICAL LOW-COST RECEIVERS FOR GOOD LISTENING



LAFAYETTE LR-100, \$154.40



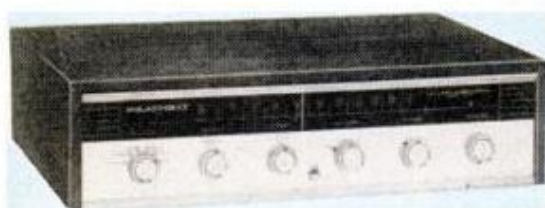
PANASONIC SA-5500, \$199.95



REALISTIC STA-18, \$129.95



REALISTIC STA-36, \$119.95



HEATHKIT AR-14, \$119.95



ALLIED 435, \$179.95



HEATHKIT AR-17, \$72.95



SANSUI 210, \$129.95



CRAIG 1506, \$84.95

INEXPENSIVE AMPLIFIERS WITH PLENTY OF POWER



REALISTIC SA-175B, \$59.95



LAFAYETTE STEREO 25, \$41.40



LAFAYETTE LA-324A, \$72.25



REALISTIC SA-500, \$99.95



HEATHKIT AA-14, \$67.95

is sounding better these days is the use of miniaturized, multifunction integrated circuits. These tiny chip-sized modules that do many jobs in one greatly reduce parts cost and assembly time without sacrificing quality. In equipment designed especially to sell at economy prices, such savings are passed on to the customer. This is not always the case in higher priced gear because the savings are often put into extra features and refinements.

Another reason for improved quality at lower cost lies in more efficient speaker designs that require less power. It used to take at least 20 watts per channel to drive an air-suspension speaker at full volume. Now many models thrive on a wattage-saving diet of half that. And watts mean dollars. They represent one of the biggest single factors in the cost of an amplifier or receiver. The less your speakers need, the less you have to pay for.

All in all, these developments make it possible to put together a basic stereo system for about half of what a comparable system cost a few years ago. A \$200 system today can sound like \$400 worth of outlay.

Bargain hunting requires careful checking of specifications, however. It pays to read the fine print. For amplifiers and receivers, a power output rating of 10 watts per channel is generally considered about minimum for good room-filling sound, or perhaps a bit less if your space is small. The reason for wanting good output is not so much that you're ever going to use it all, but that you can get room-rattling volume without having to crank your set up to full power. At peak output, an amplifier is straining, distortion sets in and your music begins to sound raspy and unpleasant. A 10-watt amplifier operated at half power will sound better than a 5-watt amplifier operated at full power even though both put out the same volume.

Also, be sure output ratings are realistically stated. The Institute of High

(Please turn to page 200)

If you've got the green, you can mow in style



Riding mowers for 1972: Makers offer wide choice of design, performance and cutting width. But it still costs more to ride than walk

By GERALD KRATSCH

THERE'S A LOT to choose from if you're shopping for a riding mower—not just in the number of machines offered, but in design, performance, horsepower and cutting size as well.

The hard starting, the pesky inconveniences and the bad design of early models has been eliminated. The industry, with years of field experience behind it, now has a line-up of riders that are attractive, functional and efficient.

You have good variety to select from, so good in fact, that it will pay you to visit as many dealers as you can to become acquainted with the range of choices awaiting you.

What's a riding mower? If you can ride on it and its primary purpose is mowing lawns, it's a riding mower. Some firms limit the classification to those machines having rear-mounted



GILSON LINE (top) offers mowers of 5 or 8 hp. Massey-Ferguson (middle) is powered by Tecumseh 5-hp engine. Jacobsen (bottom) has foot-pedal shifting

POPULAR MECHANICS

engines. Others include their small lawn tractors.

When you get down to it, what you are looking for is a machine that permits you to get the lawn cut as easily, quickly and safely as possible. Also, of course, you will want a mower that does a neat job.

Safety is more important than ever. It has always been a consideration of makers, but this year's models clearly show the results of the outdoor power equipment industry's own endeavors to "engineer in" safety features.

Safety interlock systems, separate brake and clutch pedals, external chute guards, safer steering systems—all are the result of more emphasis on safety.

Bolens, for example, has made a triple-safe starting system a feature of its riders. A key switch, a seat interlock switch and a brake-pedal interlock switch work together to prevent starting of the mower while either the drive clutch or the mower clutch is engaged.

Other manufacturers have shown equal concern for safety. Wherever logical, safety precautions have been clearly labeled. There is still the necessity for the operator to exercise

common sense and judgment in the use of this equipment. But manufacturers are doing as much as they can to raise the odds in your favor.

As for specifications you should be especially concerned with: You'll want a rider that cuts a wide-enough swath to get your mowing job done in mini-



ARIENS OFFERS redesigned Fairway rider (below), available in two 7-hp models and one 5 hp. Mowers all have safely-interlock systems. Toro's Whirlwind (top, right) has a 5-hp engine and lists at \$299.95. Electric start is extra. John Deere's Electric 90 (right) has three 12-volt batteries that run a traction motor for propulsion and two motors that power the twin-bladed mower unit. The system eliminates heat and exhaust fumes. Homelite, a new entry in the field, offers four riding machines. Shown (bottom, right) is its 5-hp RE-5, which has a gear drive and cuts 24-inch swath. It's priced at \$385

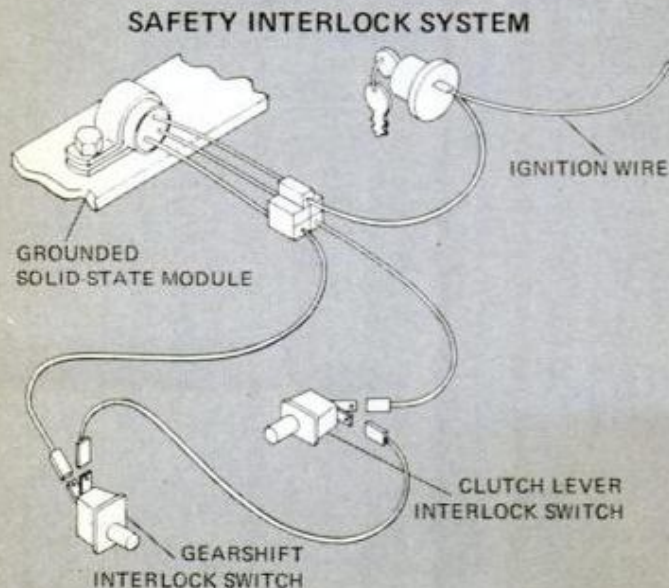


1972 RIDING MOWER SPECIFICATIONS

Make	Model	Engine	Horsepower	Electric Start	Forward Speeds	Cutting Width (in.)	Suggested Price	
AMF	1281	B&S	8	Yes	4	36	NA	
Allis-Chalmers	Scamper	B&S	8	Yes	5	36	\$619	
	Scamp	B&S	5	No	2	24	388	
Ariens	Emperor II	B&S	8	Yes	6	30	680	
		Tecumseh	7	Yes	6	30	600	
		Tecumseh	7	No	6	30	540	
		Tecumseh	7	No	6	30	480	
	Fairway	Tecumseh	7	Yes	4	26	530	
		Tecumseh	7	No	4	26	420	
		Tecumseh	5	No	4	26	350	
		Tecumseh	7	Opt.	3	28	525	
Bolens	728	Tecumseh	7	Opt.	3	28	525	
John Deere	90	Electric	8	Yes	3	34	885	
	57	Tecumseh	7	Opt.	2	34	535	
	56	Tecumseh	6	Opt.	2	28	470	
	55	Tecumseh	5	No	2	26	395	
Gilson	52015	B&S	8	Yes	3	34	NA	
	52014	B&S	8	No	3	34	NA	
	52033	B&S	8	Yes	3	30	NA	
	52032	B&S	8	No	3	30	NA	
	52031	B&S	5	No	3	25	NA	
Gravely	408	Kohler	8	Yes	4	34	NA	
	Conv. 7.6	Gravely	7.6	Opt.	2 or 4	30-40	NA	
Hahn-Eclipse	LTD. 500	B&S	7	Yes	3	30	650	
		B&S	7	Yes	3	30	600	
		B&S	5	Yes	3	26	500	
	UHD 130	B&S	7	No	3	30	550	
		UHS 130	B&S	7	No	3	30	500
		UHS 126	B&S	5	No	3	26	400
Homelite	RM-7E	B&S	7	Yes	3	30	609	
	RM-5E	B&S	5	Yes	3	26	539	
	RM-5	B&S	5	No	3	26	459	
	RE-5	B&S	5	No	2	24	385	
Huffman	H1541	B&S	8	Yes	3	32	NA	
	H1061	—	8	No	3	26	NA	
	H1014	B&S	5	No	1	24	NA	
	H1111	Tecumseh	10	Yes	3	32	NA	
International Harvester	Cadet 75	B&S	7	Yes	3	32	560	
	Cadet 75	B&S	7	No	3	32	485	
	Cadet 55	B&S	5	No	3	28	404	
Jacobsen	Mark II 730E	B&S	7	Yes	Inf.	30	610	
	Mark II 730	B&S	7	No	Inf.	30	510	
	Mark II 630	B&S	6	No	Inf.	30	470	
Lawn-Boy	9368ES	B&S	8	Yes	3	36	660	
	9368E	B&S	8	Yes	3	36	625	
	9368	B&S	8	No	3	36	540	
	9328ES	B&S	8	Yes	3	32	630	
	9328E	B&S	8	Yes	3	32	595	
	9328	B&S	8	No	3	32	510	
	9303E	Tecumseh	7	Yes	3	30	450	
	9303	B&S	7	No	3	30	400	
	9501	B&S	5	No	2	26	380	
MTD (Columbia)	436-2	B&S	8	Yes	Auto.	30	550	
	397-2	Tecumseh	8	Yes	4	30	510	
	391-2	Tecumseh	8	No	4	30	450	
	387-2	Tecumseh	5	Yes	4	25	460	
	381-2	Tecumseh	5	No	4	25	400	
	413-2	Tecumseh	5	No	1	25	370	

(Table continues on facing page)

BOLENS 728 RIDER features a safety interlock system that prevents starting unless all controls are in neutral. Though there are variations among systems, drawing shows basic setup used by most makers



Make	Model	Engine	Horsepower	Electric Start	Forward Speeds	Cutting Width (in.)	Suggested Price
Massey-Ferguson	MF 6	Tecumseh	6	Opt.	3	32	\$450
	MF 5	Tecumseh	5	No	2	26	360
McDonough (Snapper)	308XS	B&S	8	Yes	5	30	600
	308X	B&S	8	No	5	30	480
	268XS	B&S	8	Yes	5	26	560
	268X	B&S	8	No	5	26	440
	265XS	Tecumseh	5	Yes	5	26	490
	265X	Tecumseh	5	No	5	26	390
Montgomery Ward	97	B&S	7	No	3	32	460
	95	B&S	5	No	3	25	420
	93	B&S	5	No	3	25	370
	87	B&S	5	No	1	25	290
Murray	2-3633	B&S	8	Yes	3	36	560
	2-3233	B&S	8	Yes	3	32	540
	2-3063	B&S	8	Yes	3	30	500
	2-3043	B&S	8	No	3	30	450
	2-3013	B&S	7	No	3	30	390
	2-2513	B&S	7	No	3	25	370
	2-2503	B&S	5	No	3	25	330
National Mower	—	B&S or Wisconsin	10	Opt.	2	84	NA
	—	Wisconsin	9.2	Opt.	2	84	NA
	—	B&S	8	—	1	68	NA
	—	B&S	8	—	1	30	NA
Roof	Lariat 30	B&S	7	Opt.	4	30	542
	Lariat 302	B&S	7	No	4	30	499
	Lariat 26	B&S	5	Opt.	4	26	425
Sears	96363	Craftsman	8	Yes	3	36	629
	96361	Craftsman	8	No	3	36	529
	96323	Craftsman	8	Yes	3	32	549
	96321	Craftsman	8	No	3	32	469
	96326	Craftsman	7	Yes	3	32	469
	96263	Craftsman	7	Yes	3	26	409
	96261	Craftsman	7	No	3	26	329
	96251	Craftsman	5	No	1	26	249
Sensation	R-26ES	B&S	8	Yes	3	26	545
	R-26	B&S	8	No	3	26	455
	R-26	B&S	5	No	3	26	395
Simplicity	Broadmoor 728	B&S	8	Yes	3	36	879
	Broadmoor 728	B&S	8	No	3	36	775
	Yeoman 637	B&S	7	Yes	3	32	775
	Yeoman 637	B&S	7	No	3	32	699
	Serf 535	B&S	5	Yes	3	28	630
	Serf 535	B&S	5	No	3	28	554
	Wonder Boy 365	B&S	5	Yes	3	26	475
	Wonder Boy 365	B&S	5	No	3	26	399
	Swisher	Ride King A-40	Lauson	8	No	2	40
Ride King A-32		Lauson	6	Yes	2	32	351
Toro	55275	B&S	8	Yes	0-5 mph	36	NA
	55166	B&S	8	Yes	3	36	NA
	56173	B&S	7	Yes	3	32	NA
	56108	B&S	7	No	3	32	NA
	57228	Tecumseh	7	Yes	3	32	NA
	57131	Tecumseh	7	No	3	32	NA
	57017	Tecumseh	5	Yes	3	25	NA
	57003	Tecumseh	5	No	3	25	NA
	56010	Tecumseh	5	Yes	3	25	NA
	56005	Tecumseh	5	No	3	25	NA
56500	B&S	5	No	1	25	NA	
Yard-Man	Mustang 3420	B&S	5	Yes	2	25	450
	Mustang 3197	B&S	5	No	2	25	370
	Mustang 3170	B&S	5	No	1	25	300

Key: B&S, Briggs & Stratton; NA, not available

CADET 75, made by International Harvester, has a tough fiberglass body supported by a steel chassis



mum time. After all, if you're investing from \$250 to \$600, or even more, you should in return be able to get the job done faster.

Once you've settled on the cutting width—and you'll find a range of from 24 to 40 inches—check the horsepower. There are a number of good 5-hp riders, but, generally, a few dollars more moves you up to the more logical 7 or 8-hp size.

Most manufacturers offer you some models with electric start as standard or as an option. While manual starting today is no great chore, even for the

(Please turn to page 192)

New hinged tractor with front-wheel drive

By JIM LISTON



VACUUM PICKUP is powered by GMT's engine, feeds leaves, clippings into a 20-bushel box on carryall. A 15-foot snorkel attachment reaches under shrubs



The Hesston Front Runner was designed for professional grounds keepers—but anybody can buy one.

MOST BUYERS of small tractors want machines that look like something right off the farm. So do farmers—who also mow lawns—and know that today's harvesting machines put the driver up front where he can see what he's cutting. When the Hesston Corp., one of the world's largest manufacturers of farm equipment, developed a new kind of small tractor they styled it "years ahead" like their latest harvesters.

The Front Runner GMT (general maintenance tractor) has the square, compact look of a windrower or industrial payloader. Designed for use by professional grounds keepers, its principal function is mowing, but it is a versatile multipurpose unit that handles all the jobs the maintenance contractor—or homeowner with a large lawn or acreage—expects of commercial grade equipment: plowing, snow-throwing, dozing, cultivating, aerating.

Convinced that the ideal garden tractor should be propelled by the

front wheels—so the thrust of the machine will always be in the direction of travel for mowing, snowthrowing and using a blade—Hesston put the engine and driver over the front wheels for maximum traction and combined large (12-inch) wheels with center hinge construction. There are other hinge-type tractors, but Front Runner is the first to combine this principle with front-wheel drive. Hinging makes possible a 46-inch turning radius.

The GMT is a “frame steer” tractor: Neither front nor rear wheels alone do the steering; they steer in relation to each other at the hinge point of the front and rear sections. The tractor has automotive-type ball-joint steering (Chevrolet) that is positive and effortless. But unlike automotive steering, it is not self-centering. A spinner attached to the 15-inch steering wheel is standard and makes it easy to bring the wheels back on center with one hand while the right is free to operate the hydrostatic speed-control lever.

A unit tested by Suburban Lawn and Garden, a Kansas City lawn maintenance contractor, accumulated 497

(Please turn to page 198)

EIGHT-BLADE TANDEM DISC, as well as plow, cultivator and aerator, can be raised or lowered hydraulically from driver's seat. Mowers are available in 40, 60 and 80-inch widths. Front-mounted attachments include an angle dozer, rotary broom and snow thrower; rear-mounted include disc, mold-board plow, cultivator and aerator. Dual wheels and wheel weights improve traction on severe slopes



JACOBSEN GT-14:

The frame

This smooth-looking



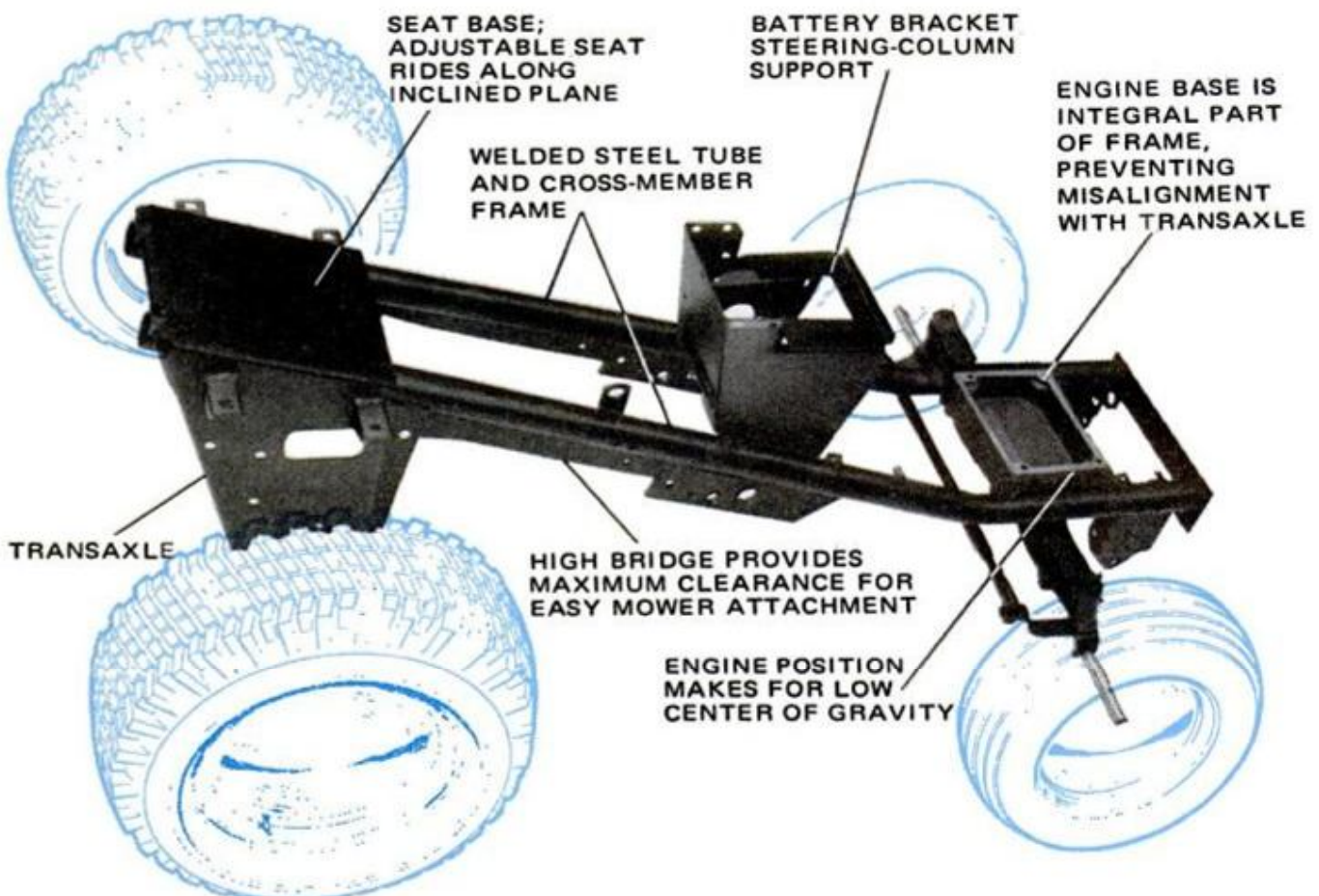
JACOBSEN'S NEW GT-14 has a unique frame design and construction. Each of four tractors—14-hp and 12-hp hydrostatic and 10-hp and 8-hp gear models—has a one-piece, welded, all-steel “Uni-frame.” Inside the protection of this frame are all the drive-train components of the tractor—in line with the frame as well as with one another.

The engine base, an integral part of the tractor frame, is at the frame's lowest point, resulting in a low center of gravity and a more stable, safer ride.

The first in-line component is a straddle-mounted Kohler engine. It has ball bearings at both ends of the crankshaft for longer life, a rotating intake screen that is said to keep the airflow cleaner for better cooling, and an automatic compression release to give easier starts.

Both the 12 and 14-hp Kohler engines used in the “GT” line feature Bendix-type starters and 15-amp. solid-state alternators. The hydrostatic-drive models have a “flex-coupled” driveshaft connecting the engine directly to the hydro gear with no power wasted on pulleys, belts or changes in direction.

A hydro gear provides a fluid connection between the engine and the transaxle. After the oil has passed through the hydro transmission, it is discharged into the transaxle, an arrangement called “sump cooling” because the large volume of oil in the transaxle sump insures an ample radiant cooling area.



makes the difference

performer mows over 3 acres an hour at a sporty 7 mph

The transaxle is equipped with a heavy-duty differential that incorporates a traction-assist mechanism. This is claimed to increase drawbar pull by 80 percent in low range, and 35 percent in high range, under conditions where one wheel doesn't maintain traction such as on ice or wet pavement.

Jacobsen engineers have designed the tractor for a 50-inch mower to reduce time mowing large lawns. Three tempered-steel blades do the cutting. Most chances of scalping a lawn are eliminated because of a special hanger arrangement that permits the mower to float freely.

Other Jacobsen GT features include shock-mounting of the fenders and seat deck to isolate vibration; narrow, sloping hood designed to give unobstructed visibility to front and both sides; uncluttered, logical arrangement of standard controls; convenient access to battery and gas cap-fuel gauge; easy accessibility to the engine (all minor servicing can be done without removing the hood); and a seat that's adjustable for driver comfort.

The GT-14 lists at \$1625—not out of line with the competition in 14-hp hydro-drive tractors. A buyer of any garden tractor will tend to justify the substantial outlay involved by the fact that he'll get year-round use from the machine. Jacobsen offers a generous array of attachments, including an efficient snowthrower—good news for folks living in heavy snow country.

—Gerald Kratsch

A 36-INCH TILLER (top photo) is one of about 50 accessories and attachments available for the GT-14

DRAWBAR HITCH allows for the pulling of carts and other equipment. One cart offered has a tailgate

TWO SNOWTHROWER ATTACHMENTS are available. Drawbar between thrower and rear axle aids "push"

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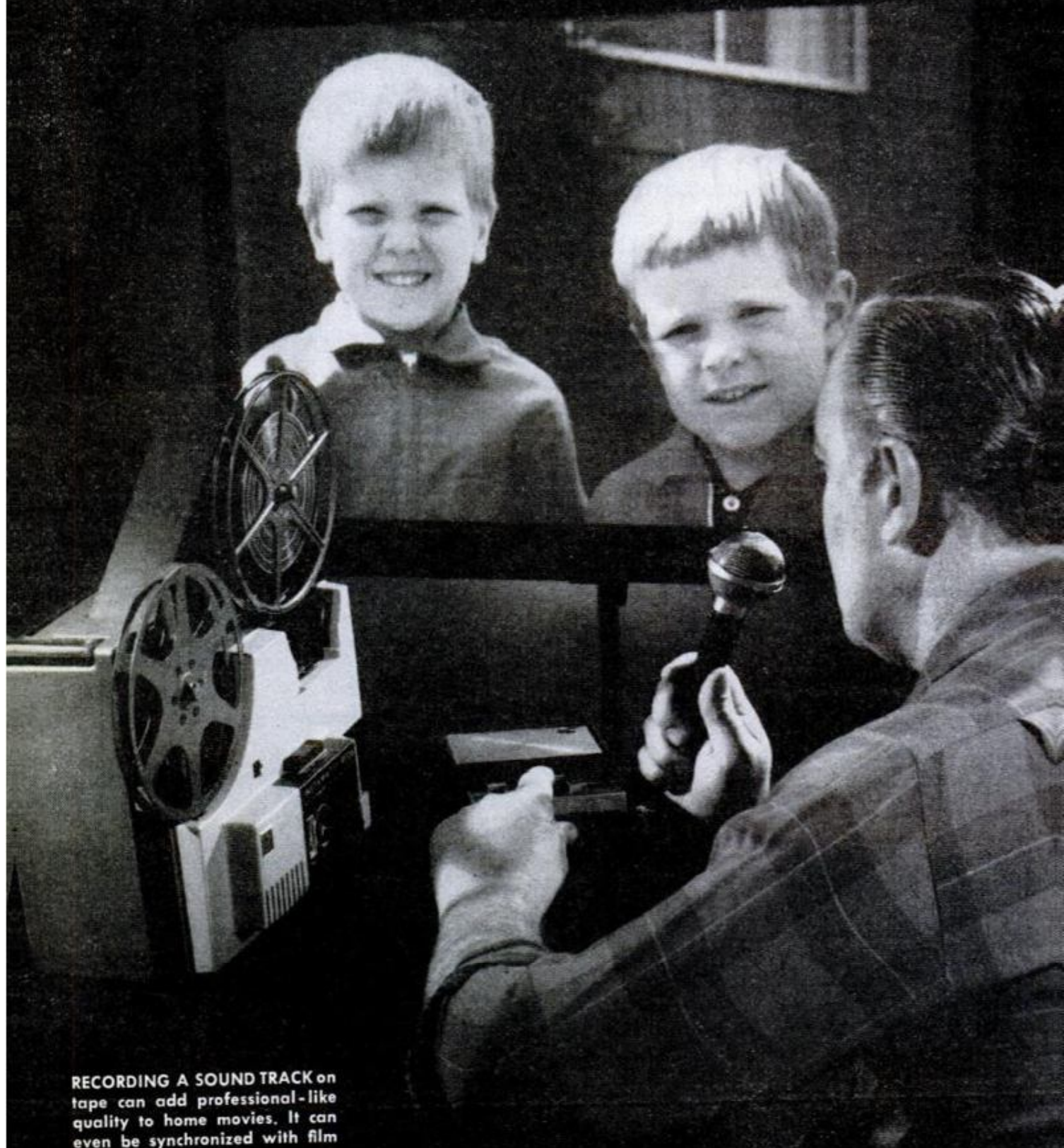


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PHOTOGRAPHY

Now home movies can sound good, too

By BURT MURPHY



RECORDING A SOUND TRACK on tape can add professional-like quality to home movies. It can even be synchronized with film

New systems for adding synchronized sound give you professional-like results with ordinary Super-8 film.

IT'S TAKEN A LONG TIME since the first commercial "talkie" was made to get sound into home movies, too, but the day has finally come. Synchronized sound using optical recording has long been available on high-priced professional 16 and 35-mm equipment, but has never been considered feasible for low-cost Super-8 amateur use. Now, with magnetic recording, things are beginning to happen.

To date, there are at least three systems for home use that provide so-called "lip sync" sound—sound that appears to come right out of your subjects' mouths in perfect synchronization with the movement of their lips. Such sound can be just as exciting to home-movie viewers today as it was when Al Jolson first sang his famous *Mammy* to stunned theater audiences 'way back in 1927. It can make your movies come alive, adding professional-like realism and drama. What's more, it can provide a lot of fun in the process—even if your first attempts won't win any academy awards.

What system you choose depends on the type of sound you're after and the amount you're willing to invest. If you want to start out simply, you need only a small tape recorder and a silent projector. By taping a narrative sound track to go along with your movie, then playing it back as the film is projected, you can make your show more lively and interesting. While this doesn't give you synchronized sound, it does permit you to add descriptive commentary, mood-setting music, even realistic sound effects.

A step up from this is to invest in a Super-8 sound projector. Here you record directly onto a magnetically striped sound track running along the edge of the film itself. However, since

MAY 1972

OPTASOUND



SYNCHRONEX



BELL & HOWELL



SYNCHRONIZED SOUND is possible with three recently developed systems shown above. All use tape for recording original sound track, but differ in playback. With the Bell & Howell system, you play the tape along with the projected film, using a synchronizing linkage to keep the sound in step with the picture. With Optasound and Synchronex systems, the taped sound is first transferred to a magnetic sound track on the film itself, then is played back through a sound projector as the movie is viewed

the magnetic striping must be added *after* the film is shot and processed, this still limits you to post-recorded narration. The advantage is that your sound track, once recorded on the film, always stays in step with the picture. You can say, "Now watch that fish jump" and the fish will jump at precisely the right instant every time. With a separate recorder, it's not possible to keep the tape as closely synchronized with the picture so your comments must be more general.

For the ultimate in home-movie sound, there are recently developed systems that enable camera and recorder to be synchronized *at the time*

your movie is made, thus giving you true lip sync. If you want your "actors" to talk on the screen, you just place a microphone nearby and their voices are simultaneously recorded as the film is exposed. You can also pick up real-life background sounds such as wind whistling across a mountaintop or the crash of surf in a beach scene.

Three such lip-sync systems currently on the market are Optasound, Synchronex and Bell & Howell's Filmosound. All three use tape to record the initial sound track in sync with the camera, but involve important differences in method and equipment.

Bell & Howell's Filmosound is a complete, all-in-one packaged system consisting of matched camera, cassette tape recorder and projector. In the taking stage, camera and recorder are electrically linked by cable. As the film is exposed, a tiny light in the camera flashes a series of timing marks along the film's edge at spaced intervals. At the same time, it also sends to the recorder a series of electrical timing pulses that are recorded on the tape at exactly the same intervals as the timing marks on the film. In playback, the recorder is connected to the projector, and a sensing mechanism uses the timing pulses on the tape to keep the drive speed in step with the corresponding timing marks on the film. Thus film and tape run along together in perfect sync.

Bell & Howell offers its Filmosound

system in several different combinations depending on specific features desired. Cameras rigged for Filmosound sync range from about \$105 to \$160, projectors from about \$180 to \$220. The matching recorder, available in only one model, sells for \$103.95 and can be used as a conventional portable cassette machine as well. Thus, a minimum Filmosound outfit can be put together for under \$390.

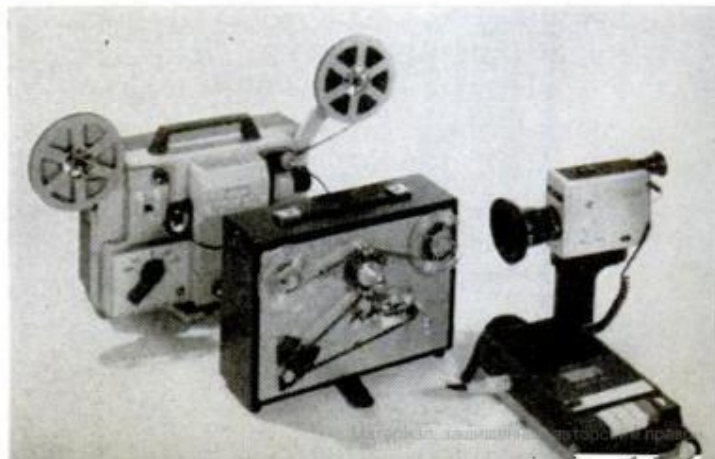
The Optasound and Synchronex systems are basically similar in the taking stage, but differ in playback. Instead of using the original camera-synced tape as the final sound track, you send both the tape and exposed film to an Optasound or Synchronex processor. At the same time the film is developed, it is magnetically striped, and sound from the tape is re-recorded onto this stripe in sync with the picture. The resulting sound-striped film can be viewed—and heard—with any standard Super-8 sound projector having 18-frame image-to-sound separation. The advantage here is that you don't have to purchase a special sound projector if you already own a conventional model or wish to rent or borrow one for occasional use.

Both Optasound and Synchronex do require a means of syncing camera with recorder, but there are interesting differences here, too. Synchronex offers two matched camera-recorder packages, the Mark I and Mark IV.

The Mark I is a handy, no-frills

TWO SPECIALIZED AIDS for adding sound to movies are shown below, both produced by Optasound. One, called Optasync, is a conversion unit you can attach to an existing reel-to-reel recorder to permit taping synchronized sound. At left, it is in-

stalled in a standard Uher 4000L recorder to sync tape with camera. At right is another adapter, Edisync, a reel-type device that provides a mechanically synchronized sound-track linkage with a silent projector, eliminating need for a sound projector



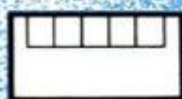
4 BASIC WAYS TO ADD SOUND TO MOVIES

1 SOUND TRACK IS RECORDED SEPARATELY ON TAPE AS FILM IS VIEWED



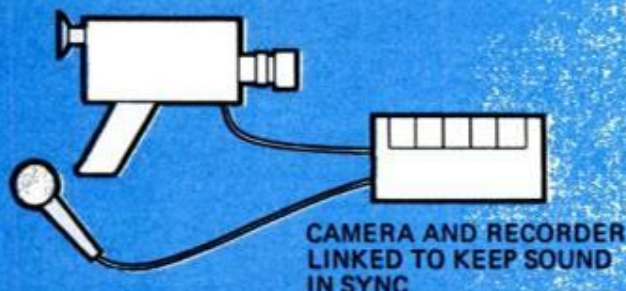
SMALL CASSETTE OR SIMILAR RECORDER

TAPED SOUND TRACK PLAYS BACK AS FILM IS PROJECTED BUT WITHOUT SYNC



SILENT PROJECTOR

2 SOUND TRACK IS TAPED AS CAMERA FILMS SCENE



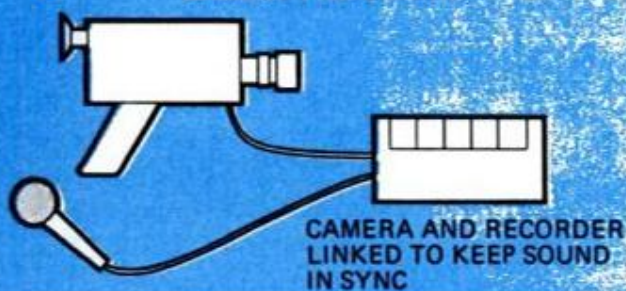
CAMERA AND RECORDER LINKED TO KEEP SOUND IN SYNC

TAPED SOUND TRACK PLAYS BACK AS FILM IS PROJECTED IN SYNC WITH IT



RECORDER AND PROJECTOR LINKED TO KEEP SOUND IN SYNC

3 SOUND TRACK IS TAPED AS CAMERA FILMS SCENE



CAMERA AND RECORDER LINKED TO KEEP SOUND IN SYNC

TAPED SOUND TRACK IS TRANSFERRED TO FILM AND PLAYS BACK THROUGH PROJECTOR



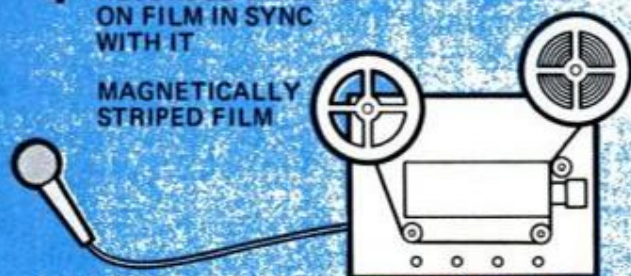
SPEAKER

MAGNETICALLY STRIPED FILM



SOUND PROJECTOR

4 SOUND TRACK IS RECORDED DIRECTLY ON FILM IN SYNC WITH IT



MAGNETICALLY STRIPED FILM

SOUND PROJECTOR

SOUND TRACK PLAYS BACK THROUGH PROJECTOR AS FILM IS VIEWED



SPEAKER



SOUND PROJECTOR

economy system priced at just \$99.95. It combines a fixed-focus, 2-to-1 manual zoom camera with a simplified cassette unit designed for recording only without playback facilities. The Mark IV is a more sophisticated version combining a full-focus, 4-to-1 motorized zoom camera with a cassette recorder that also doubles as a conven-

(Please turn to page 196)

YOU CAN ADD SOUND in several ways, as illustrated above. Choice depends on whether you want true "lip sync" or nonsynced commentary. Method 1 is the simplest and least expensive, requiring only a recorder to add previously taped description or music. Methods 2 and 3 let you record actual dialogue as film is made, then play it back in perfect synchronization with lip movements as movie is viewed. Both require camera and recorder to be electrically synchronized, but in method 2 original tape is used as final sound track, while in method 3 tape is transferred to a magnetic sound track on film itself. In method 4, you record directly on the film, but are limited to commentary without lip sync

PM Chrysler Town and Country OWNERS REPORT...

A nationwide survey based on
900,000 owner-driven miles



Ah, comfort and convenience, but there's a price to pay!

By MICHAEL LAMM, West Coast Editor / Photos by the author

IT TAKES ALL KINDS, so here go some of the offbeat reasons Town and Country owners bought this big wagon:

"To haul four German shepherd dogs," says a Chicago railway brakeman. A Lansing, Ill., superintendent: "For towing my race car." A dis-

gruntled Brooklyn window cleaner claims, "Because I lost my mind!" A North Carolina attorney admits, "My wife liked the color." And an Iowa ambulance driver confesses, "Because I've driven a Town and Country ambulance since 1968 for my boss, and I guess I just got used to it."

IT'S AN ELEGANT WAGON, say owners, many of whom chose Town and Country for its style. Three-seat configuration is a popular option



More typically, though, owners gave these reasons for buying: "Past success with Chrysler products." "Dual airconditioning with ducts in the rear." "The 1972 General Motors clamshell tailgate scares me, so this year we decided to try Chrysler." "Wanted a big, roomy, comfortable, heavy wagon, and that's what it is." "Like the handling of torsion-bar suspension." "To tow our boat and trailer." "I wanted the best wagon I could buy." "Holds good Blue Book (trade-in value) and recommended by police officers." "This is my fourth, and I'm well pleased."

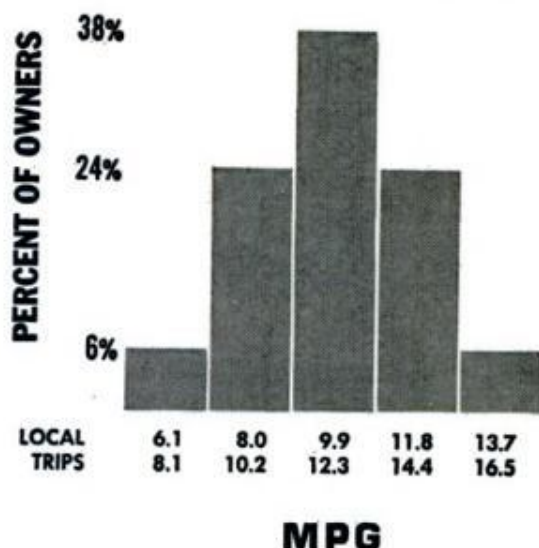
For this Owners Report, let's give several individual Town and Country owners their full say. Here are comments from a retired grocer of Rochester, N.Y.: "Gas tank leaked at first, had to be replaced. AM/FM radio was sent to Syracuse for repairs. My dealer's salespeople are okay, but not too hot in service department. We had a difference of opinion when the taillights wouldn't work. Dealer claimed it was fault of Ziebart rustproofing people, but Ziebart said they hadn't touched the taillights. I ended up paying the \$20. I bought this wagon to tow our 31-foot Airstream. Would rate workmanship fair—bubbles in wood-grain, sloppy paint, too much black goo around.

"If I weren't trailering, I'd buy a smaller car."

A 29-year-old Illinois insurance claims manager: "When I got it, I could start the engine in any gear; made no difference where the transmission selector was. Fixed that and the power windows failed. I've owned several new cars, and this dealer excels by far. Have bought GM and Ford products, but that's why I'll buy again from Chrysler. Dollar for dollar, Chrysler offers the most, both in standard equipment and options for less money. It's a very comfortable car, but when my wife drives, she shoves the seat all the way forward so my knees are against the dash.

"Specific likes are appearance, com-

TOWN AND COUNTRY FUEL MILEAGE CHART



TWIN ARMRESTS up front fold for center passenger. In two-seat wagons lockable storage is under floor



AUTO-LOCK SYSTEM for tailgate keeps it locked if key is on. Gate swings open even with window up



fort, easy access to rear seat. Complaints: no guts for passing with the 400 V8, misalignment of exterior trim and lack of resale value."

A Wisconsin manufacturer's agent, age 29: "Engine refuses to quit when key is turned off, hard to start on cold nights, brakes squeaked. Dealer fixed everything, but troubles were back within three days. I'd rate dealer courtesy good, sales methods fair, and repair service horrible. I bought this wagon because I've owned four Plymouths and have had excellent luck. Ride is superior, but I'd like front vent wings and quieter brakes. I'm 6-5, and the car is comfortable, although I could never wear a hat. Specifically, I like it because it's a nice-looking car, smooth-riding, plenty of room, but I'm not crazy about the way the engine starts and stops (or doesn't start and doesn't stop). I also don't like the blower fan always being on and the noisy brakes."

A Plainfield, N.J., housewife reports: "Found the car extremely difficult to start in the morning. Also, the entire electrical system died out one week after delivery. Had the car to the dealer six times with the starting problem. They say it's plugs, but they fixed the

electrical thing immediately. I'm not too happy with my dealer, because I had an overcharge on the car at delivery for items we didn't order. Hard feelings. I always feel the dealer is socking it to us. We bought this wagon because our last Town and Country was a real gem.

"Workmanship on the '72 is good, and the car is comfortable to drive and ride in. It would be great if the automatic choke worked and if the constant airflow inside the car (hot and cold) would turn off when all other systems are turned off."

A U.S. Treasury investigator living in Indiana says: "No mechanical problems—the 440 V8 is a good engine. Some nonmechanical troubles, though, included door locks, tire balance, headlight aim.

"One thing that I found out about dealers is the big price spread. With our '68 Mercury wagon as a trade-in the dealer in Hammond wanted \$3950, the Gary dealer said \$3750, and a Mishawaka dealer said \$3500. So we ordered it from the factory. We bought a Town and Country because we have seven children, 8 to 17, and the third seat in GM and Ford wagons isn't roomy enough. Workmanship is fine

Summary of 1972 Chrysler Town and Country Owners Reports*

Total miles driven	898,389
Average miles per gallon	
Local driving	9.9
Long trips	12.3
Model	
3-seat wagon	68.0%
2-seat wagon	32.0
Why the Town and Country?	
Past experience	28.3%
Styling	21.0
Size	16.1
Towing capability	7.3
Comfort	6.8
Specific likes:	
Comfort	43.5%
Ride	43.5
Handling	39.6
Style	33.8
Performance	14.0
Spaciousness	13.0
Roadability	9.7
Specific dislikes:	
Poor gas mileage	25.9%
Poor workmanship	19.0
Rattles	18.1
Visibility	10.2

Poor dealer service	7.8
Quality of materials	6.8
What changes would you like?	
Better workmanship	12.1%
Better gas mileage	8.8
Add vent windows	7.7
Fewer rattles	6.6
Better materials	5.5
Had any mechanical trouble?	
Yes	53.5%
No	46.5
What kind of trouble?	
Electrical	25.7%
Carburetor	18.6
Airconditioning	9.7
Door locks	7.1
Cold starts	4.4
Did you repair it yourself?	
No	97.4%
Yes	2.6
Dealer repairs satisfactory?	
Yes	59.6%
No	40.4
Is the Town and Country your only car?	

No	74.9%
Yes	25.1
Other cars owned:	
Plymouth	17.3%
Chrysler	14.9
Chevrolet	10.5
Dodge	10.5
Volkswagen	8.7
Ford	8.7
Accessories/power options:	
Airconditioning	71.7%
Radio	52.6
Luggage rack	36.4
Power windows	26.6
Trailer hitch	26.0
Stereo tape deck	23.1
Tinted glass	19.7
Cruise control	18.5
Power seats	17.9
Age distribution of owners:	
15-29	17.1%
30-49	67.4
50-plus	15.6
Would you buy another Town and Country?	
Yes	80.9%
No	19.1

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

but interior finish isn't as plush as I'd expected in a Chrysler. I'd like more interior refinement and less wind noise. Also, the gas tank sloshes.

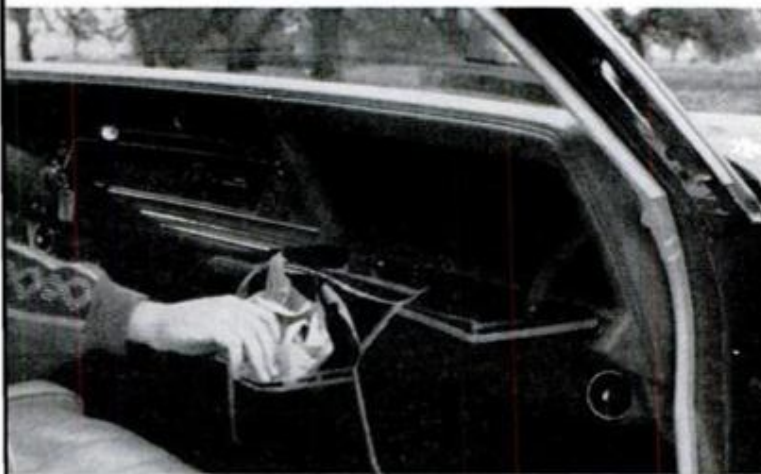
"As for comfort, at first the front seat seemed cramped for legroom, but after a while I found it very comfortable. Same with middle and rear seats. What I particularly like is engine response, roadability and comfort. I particularly dislike air and water leaks at side and rear doors, fender skirts and constant blower operation."

A New York engineer reports: "No mechanical problems, but . . . it had a lot of little things wrong, like the radio not hooked up, automatic tailgate locking system not secured, windshield leaked. Dealer fixed everything courteously and quickly, and I consider him to be very honest in his sales methods.

"What sold me was the way it handles and that the third seat faces rearward. I miss a ledge on the dash

to set things on—like the '69s had. It's a very comfortable car, and passengers are impressed, both front and rear. My primary praises are handling, ride and flexibility of uses."

Since owners tend to take standard equipment for granted, we should mention as did only several owners, the no-cost bonuses Chrysler offers in the Town and Country. Automatic transmission, power steering, power front disc brakes, and a two-barrel 400-cu.-in. V8 head the list. Subtler items include an "Auto-Lock" tailgate that automatically locks when the ignition is on. This keeps kids from opening it with the car in motion. The dual-action tailgate can be opened like a door with the glass rolled up, and an override switch lets it open with the engine running. Then, too, there's a plastic litter bag affixed to the inside of the glovebox lid, and the T&C's cargo deck (see photos below) has four storage bins for small items. ★★★



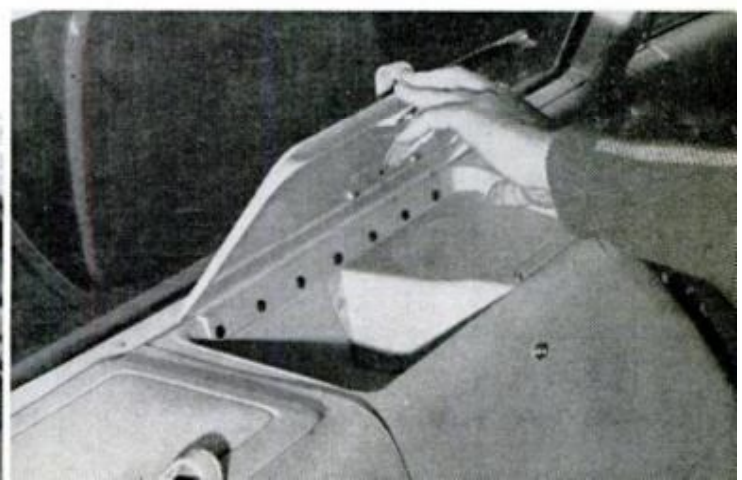
PLASTIC LITTER BAG in glovebox is temptation to leave door open; this could be lethal in panic stops

MANY COMPLAINED about gas mileage even though they knew it wouldn't be great when they bought



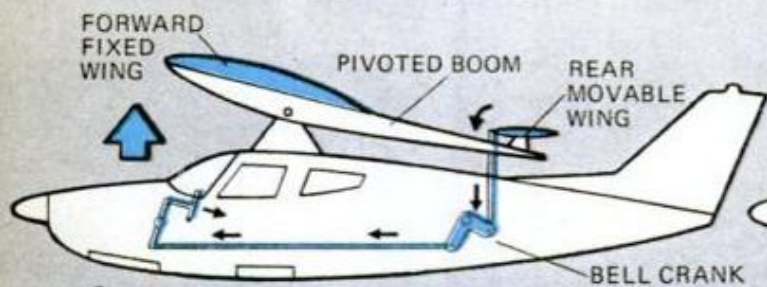
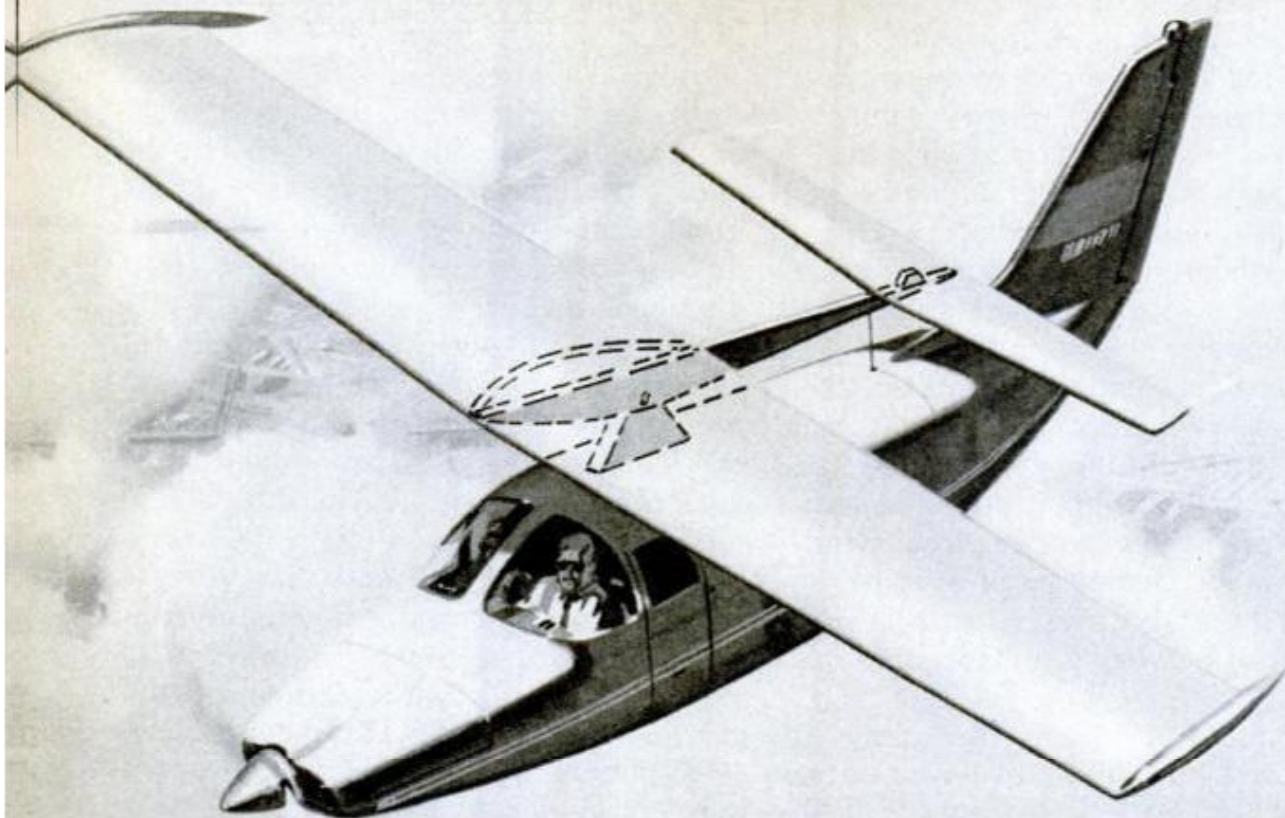
ASSIST GRIPS at roof make stepping into rear compartment easier. Spoiler on roof helps clear glass

FOUR HANDY BINS in rear deck hold small items; here they house speakers for optional stereo system

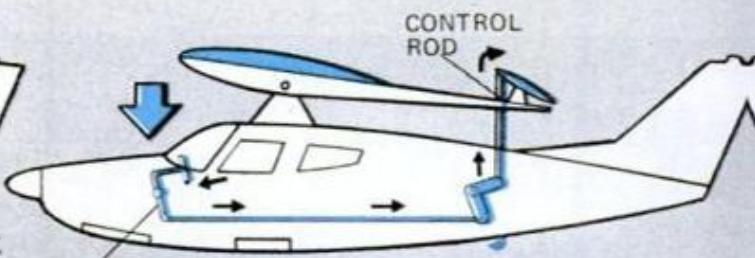


JUST PATENTED

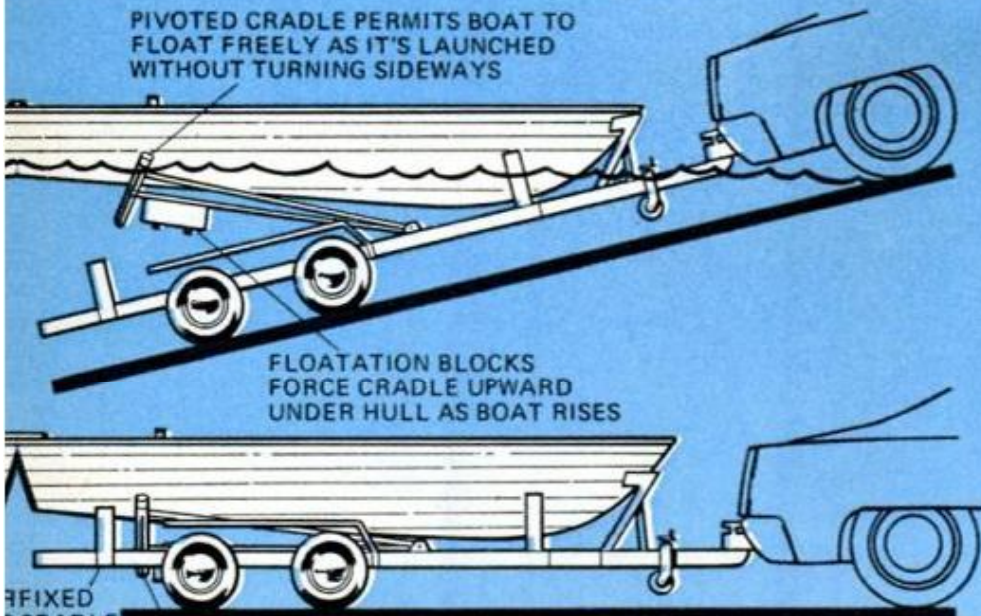
Rocker-wing plane almost



1 PULLING BACK ON CONTROL STICK TILTS REAR WING DOWNWARD, FORCING FORWARD WING UPWARD TO SHARPEN ANGLE OF ATTACK



2 PUSHING FORWARD ON CONTROL STICK TILTS REAR WING UPWARD TO FLATTEN ANGLE OF ATTACK



PIVOTED CRADLE PERMITS BOAT TO FLOAT FREELY AS IT'S LAUNCHED WITHOUT TURNING SIDWAYS

FLOATATION BLOCKS FORCE CRADLE UPWARD UNDER HULL AS BOAT RISES

FIXED CRADLE

IN NORMAL ROAD USE, AUXILIARY CRADLE RETRACTS BELOW HULL AND BOAT RESTS IN FIXED CRADLE

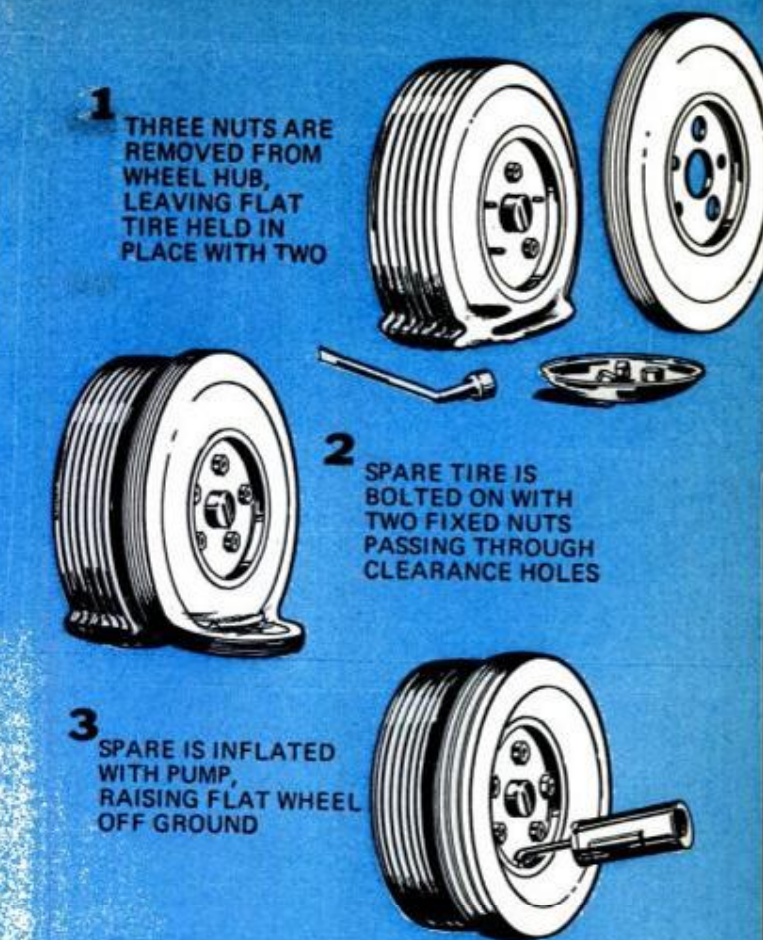
Boat launcher

You can back your boat trailer right into the water with this self-floating launcher. As the boat rises in the water, a pivoted cradle with buoyant blocks underneath is forced snugly up against the hull. This allows the boat to float freely, but keeps it from being swept sideways by wind or waves. To remove the boat from the water, just drive it onto the floating cradle. Inventor is Wallace Park, Louisville, Ky.

flies itself

A CRASHPROOF AIRPLANE? That's the astounding claim made for the unusual design at the left. Instead of a single fixed wing, it has two wings mounted on a pivoted boom, one behind the other. The rear wing is movable and is linked to a control stick in the cockpit. Pulling back on the stick tilts the boom upward, sharpening the forward wing's angle of attack for taking off and climbing. Pushing it forward tilts the boom downward for descending and landing. Once the desired angle of attack is set, the wing system attains its own state of equilibrium and the fuselage merely hangs below it like a pendulum. From then on, control is mainly by throttle: Increasing power causes the plane to climb; decreasing power causes it to descend.

Turns are made by tilting the boom sideways in the desired direction. Because the wing system is self-stabilizing, it is virtually impossible for the craft to stall out or go into a spin, says inventor Rudy Paspas of Melbourne, Australia. Other advantages: smoother rides for passengers because the fuselage remains level at all times and faster training of pilots because of the simple, goofproof control system that's easy to learn.



Spare tire spares you

Like to have a spare tire you could put on without jacking up the car and removing the damaged wheel? Well, here it is. It's a thin tire that bolts onto the existing wheel in a clever way. You remove three lug nuts, leaving two in place. These pass through over-size holes in the new hub, allowing you to attach the spare without taking off the flat; a pressurized hand pump inflates it. William Strumbos of Northport, N.Y., is the inventor.

Dims light glare

It's only a small strip of blue-tinted plastic, but it can do wonders to reduce annoying headlight glare from oncoming cars at night. As proof, upper photo at near right shows headlights as they normally appear; lower one shows same lights viewed through the antiglare shield. The shield, devised by Theron P. Weaver of Fort Wayne, Ind., is attached to an adjustable arm that clips on the visor. It can be positioned to dim approaching headlights without obstructing road view.





Troubleshooting by

You have to discover the cause of those strange shimmies and shakes that are transmitted back to you through your car before you can even begin to work on the repair job

By MORT SCHULTZ

BAD VIBRATIONS, whether slightly-felt quivering or car-shaking shimmying, mystify many owners. Some have written to *PM*: "My car vibrates *when idling*." "My problem is vibration that *begins* at about 67 mph." "The front end of my car vibrates as I drive along at *slow and moderate speeds*." Some owners have been to garages several times with no luck and have had no recourse but to find the cause themselves.

When doing the diagnostic job yourself it's important to analyze the condition correctly. Most times you feel vibration in the steering wheel, but you may also feel it in the seat of your pants. Determine which and then ask yourself under what circumstances you detect the sensation.

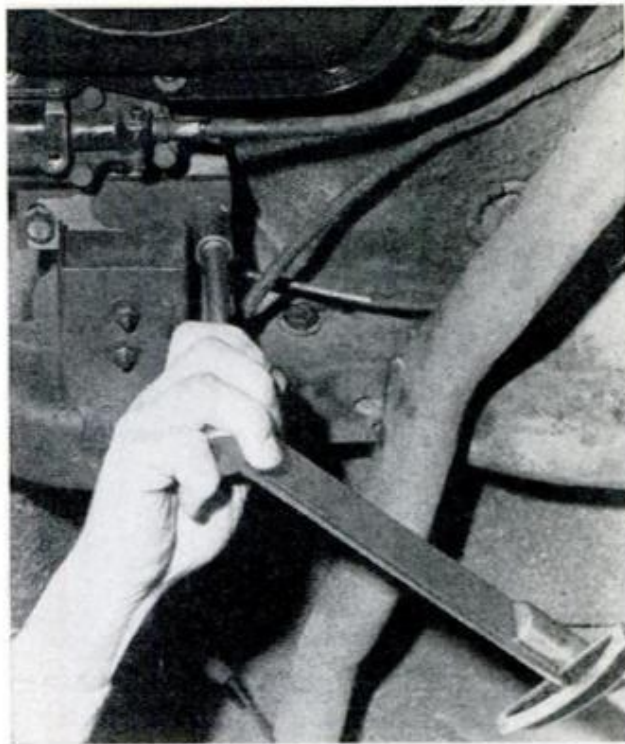
Don't mistake rough idle for a vibration, for example. Still other problems can cause a missing at high speed, slow speed or any speed. Again, this is not truly vibration. Missing and rough idle require engine service, such as a general tune-up, carburetor and distributor repair, or valve work.

There are three main causes of bad vibrations: front-wheel alignment, tire and wheel balance and shock absorbers, but many other things also cause vibration.

First check those areas that don't require a good deal of time or the use of professional equipment: Make sure that wheel lugs are properly tightened and that tire pressure is to manufacturer's specifications. Also examine tires for bulges. They can cause a vibration.



BAD SHOCKS can cause vibrations. Check for fluid leaks and that mounts are tight at top and bottom



LOOSE MOTOR MOUNTS should be torqued to manufacturer's specifications. If broken, replace them

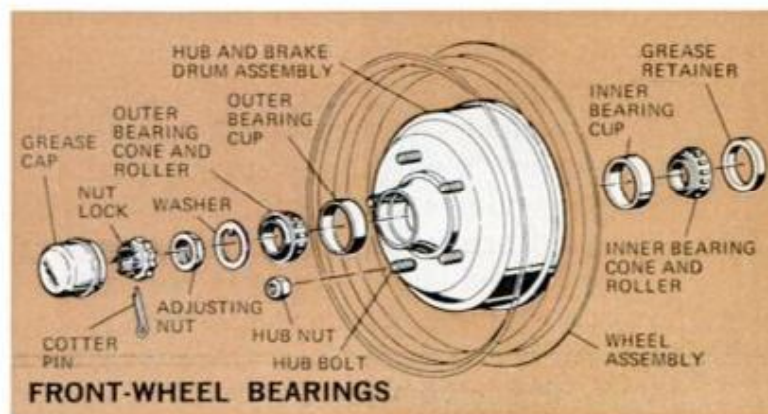
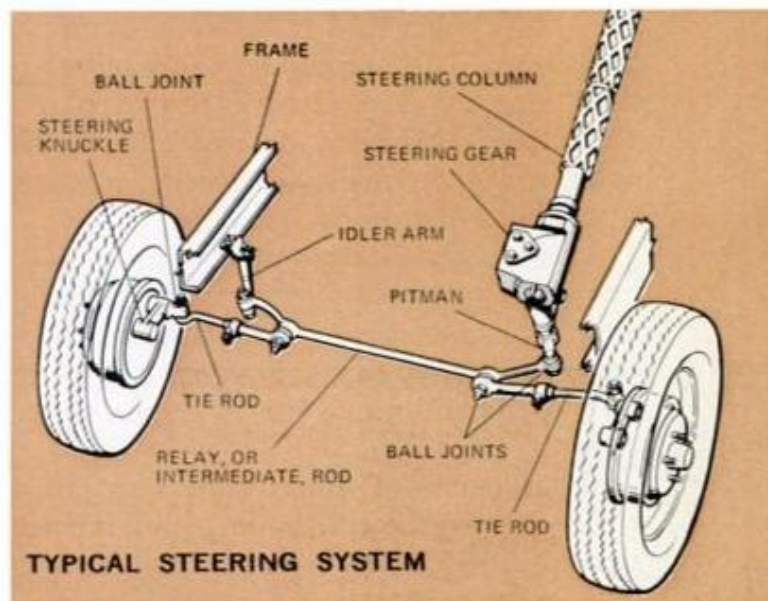
the seat of your pants

Next, check shock-absorber mounts, and check for leaking fluid indicating shock absorbers that have failed. If the car is equipped with power steering, examine the power-steering pump. Look for a worn or loose pump drive belt, a pump that has loosened up on its bracket, a loose pump pulley and a loose crankshaft pulley. There should be no play in pulleys.

If the car has airconditioning, make sure the compressor hasn't loosened up. Keep in mind that any heavy part component that has come loose in the engine compartment can create vibration.

Obviously, vibration can also occur if motor mounts are loose or defective. One way of discovering them is to start the engine and allow it to idle, pull up on the emergency brake, put the car in gear and watch the engine. If the car has a manual transmission, the engine will stall, but if mounts are loose the engine will lift violently.

A more careful way of checking motor mounts, especially if the car is equipped with automatic transmission,





LOOSE TIE RODS are a major cause of front-end shimmy. Also check steering idler and pitman arms



FRONT-WHEEL BEARINGS that are too loose can be felt as shimmy in steering wheel. Torque to spec

is to place a hydraulic or hand jack beneath the oilpan or an accessible part of the block. Put a 2x4 between jack and engine. Carefully put pressure on the engine. If mounts are loose or defective, the engine will lift and separation will be seen between the mount and engine. Be judicious in this jacking test. Don't put excessive pressure on the oilpan. If the engine won't lift with relatively light pressure placed against it, mounts are probably okay.

Loose body mounts of a nonunitized or semi-unitized body, and broken welds of a unitized or semi-unitized body can also create vibration. Look for body bolts and make sure they are tight (photo, page 120).

If the car is of unitized or semi-unitized construction, it is very difficult to determine if a weld has broken loose. You may want to get a professional judgment, but hold off until all other conditions that can cause vibration are investigated.

One main cause of vibration is a loose or defective part in the steering linkage—particularly a tie rod, idler arm or pitman arm. Jack up the car at each front wheel and try to move the components by hand. There should be no play.

The driveshaft is another part demanding close examination. Vibration

caused by shaft trouble usually occurs only through a particular speed range. There is a test you can conduct.

If you have a tachometer that can be installed in the car, use it. If not, use the speedometer, which is not as accurate. Take the car out and note the rpm or speed at which vibration is most pronounced. Now, shift to a different gear range and run the car at that same speed or rpm. If vibration occurs at the same speed or rpm regardless of the transmission gear range, the propeller shaft is *not* causing your vibration problem. If vibration decreases or is eliminated in that different transmission gear range, the shaft should be examined closely.

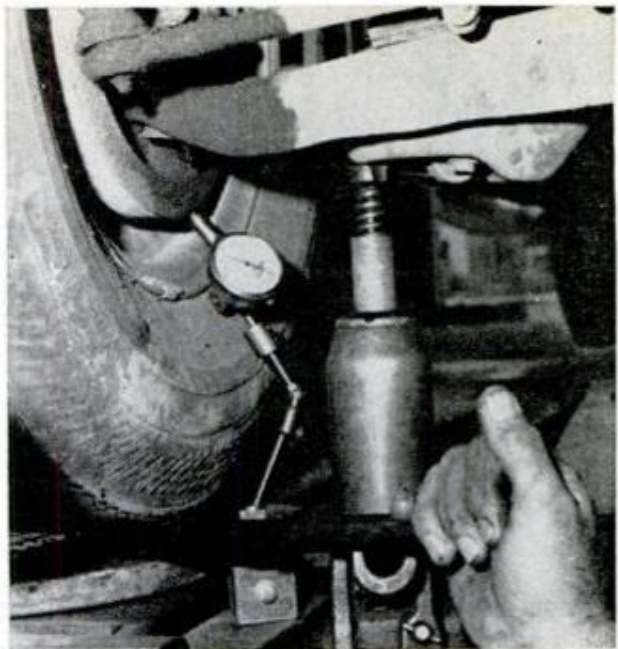
By using two different gear ranges, you permit the prop shaft to operate at different speeds.

Professional tools are frequently needed to cure a propeller shaft problem. For example, an angularity gauge is required to check shaft angularity. However, take the time to wipe down the shaft with gasoline or kerosene. You may find something that's causing the shaft to whip. Grasp the shaft and try to move it back and forth. There should be no play. If there is, universal joints may be defective.

Most other conditions that create vi-



CHECK BALL JOINTS after jacking your car to remove load from the ball joint you're working on



PROFESSIONAL GAUGE must be used if it's necessary to check ball-joint looseness against maker's specs

bration in a car require the use of professional equipment to detect and/or repair. But before you consult a professional, you may want to take the time to rule out the possibility of worn or loose front-wheel bearings.

Make sure first that bearings are properly adjusted. This requires the use of a torque wrench and the specification for your car. Specifications may be found in the manufacturer's service manual or a general automotive reference book.

Torque bearings to correct specification as you spin the wheel by hand. Now if vibration is still a problem, the bearings should be removed and examined for damage.

Causes of vibration—worn ball joints, out-of-balance wheels and tires or bent wheels, incorrect prop-shaft angularity or improper front-wheel alignment—may lead you to your service station or dealer. But do some work on your own first.

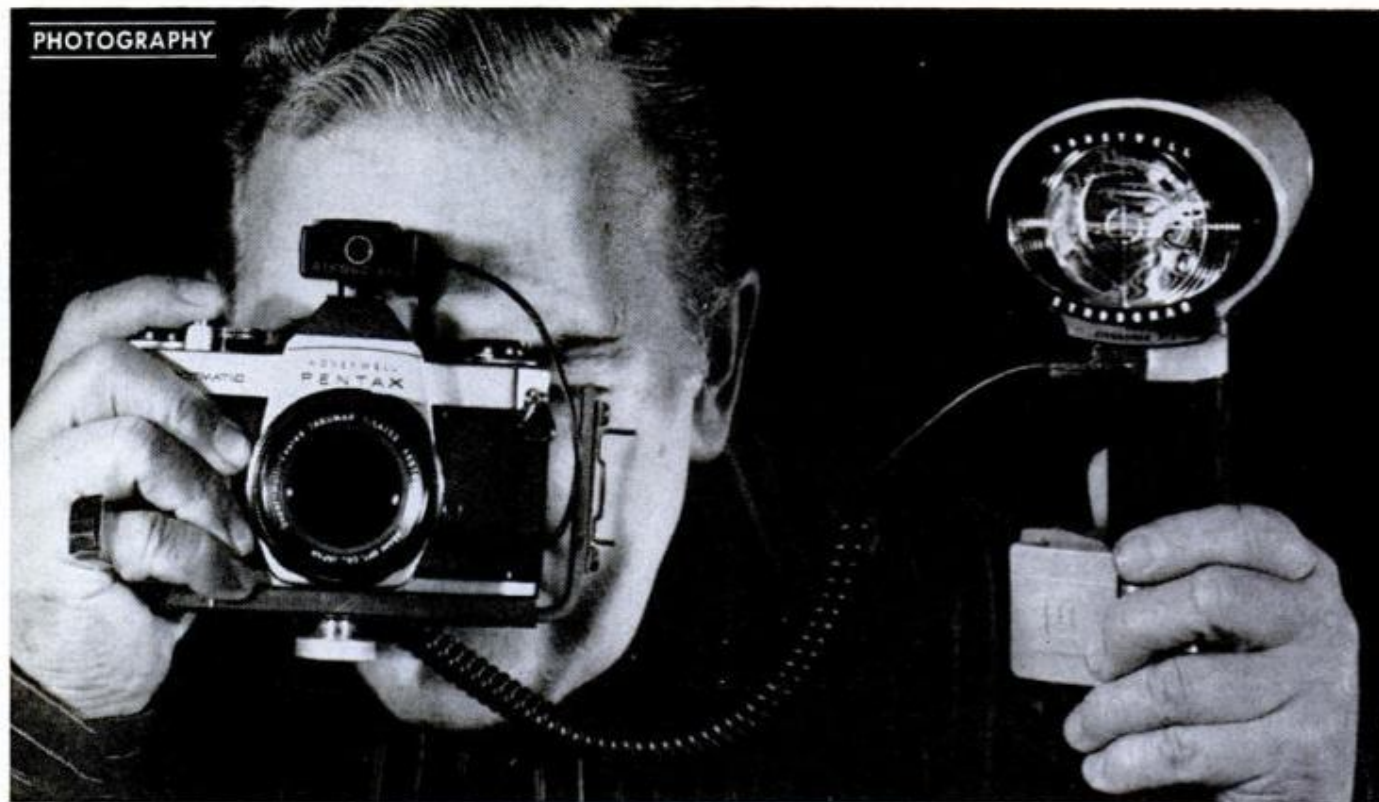
Ball joints should be checked particularly for vertical movement. It is possible for you to get an idea yourself if ball joints are badly worn. Take the load off the load-carrying ball joint. If the car's springs or torsion bars are attached to the lower control arms, it means that the lower ball joints carry

the load. Place a jack as close as possible to the coil spring and raise the wheel until it clears the ground. This relieves the stress on the lower ball joint.

If springs are attached to the upper control arms, the upper ball joints are the load-carrying members. To take the load off them, lift the car by placing the jack beneath the frame cross member. Slip a pry bar beneath the tire and lift up. If there is more than barely perceptible movement, the ball joint is probably worn.

Each car manufacturer has set a maximum amount of vertical movement that the ball joints should have. Specifications range from zero (no play) to .200 inch. If you suspect that the ball joints are causing vibration you should have them checked with an accurate dial indicator.

Although vertical movement of the part, which is also called its axial play, is most important, you should also have the part's horizontal (radial) movement checked. Generally, it should be no more than .250 inch, but manufacturer's specifications should be consulted. Vertical movement is of utmost importance, simply because a ball joint will usually wear out faster in that direction than horizontally. ★★★



YOU COULDN'T DO THIS with old-style automatic strobes requiring gun to be attached to the camera. In new Honeywell system, small accessory light sensor clips on top of camera, allowing gun to be removed. You can shoot with the gun held in any position and the sensor will correctly read light reflected from the subject and shut off the strobe automatically when the proper exposure is reached



SENSOR ON CAMERA PICKS UP LIGHT FROM SUBJECT AND SHUTS OFF FLASH WHEN EXPOSURE IS COMPLETE

SENSOR CONNECTED TO CAMERA'S X-SYNC OUTLET



GUN'S SYNC CORD CONNECTED TO SENSOR INSTEAD OF DIRECTLY TO CAMERA OUTLET



LIGHT FROM FLASH STRIKES SUBJECT, IS REFLECTED BACK TOWARD CAMERA

DIAL ON TOP of Strobe-Eye sensor lets you set system for ASA speed of film you're using. From then on, you have a choice of four f/stops, depending on the shooting range and desired depth of field



Now: A no-miss flash you can shoot from anywhere

This ingenious new automatic strobe lets you use off-camera, bounce and multiple flash with a properly exposed result every time

By SHELDON M. GALLAGER

AUTOMATIC STROBES are great except for one problem—until now, you had to keep the flashgun on the camera. The sensing eye in the gun had to be near the lens to record reflected light from the subject and shut off the flashgun at the right instant for a proper exposure. This produced the flat, pasty, washed-out effects you typically get with on-camera flash.

Now Honeywell has come up with a clever system that lets you put the flashgun anywhere you want. Instead of having the sensing eye built into the gun, it's a separate little accessory that clips right on the camera. It correctly reads the light from the subject no matter where the gun is located. You can hold the flash off camera for side lighting, bounce it off a wall or ceiling for soft, shadowless effects, even hook several guns together for multiple-flash shots.

Initially, Honeywell is introducing the system on its bigger model guns, the Auto/Strobonar 772 at \$159.95 and 882 at \$189.95. The sensor itself sells for \$30. Later, the system will be used on smaller, lower-priced units all the way down to ministrobes the size of a cigaret pack. ★★★

MAY 1972



Photos by Robert D. Borst

ACCESSORY FLASH SENSOR is shown above with new Honeywell Auto/Strobonar 772 gun. Flash connects to sensor by means of long coil cord, and sensor, in turn, connects to camera's sync outlet. It can be used with any camera providing X-type synchronization. Photo below shows 117-volt charger that can be used either to recharge batteries in the gun or to operate the gun directly on house current

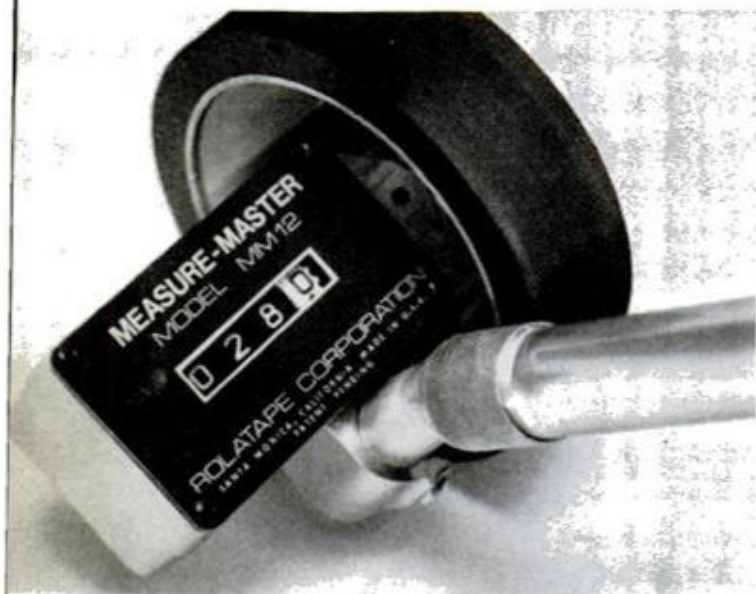


NEW HONEYWELL PENTAX will incorporate its own built-in flash sensor (small round window below), eliminating need for separate clip-on accessory. Spotmatic IIA will be \$30 more than standard model



EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



ACCURATE MEASUREMENTS of rooms, carpeting and the like can be made while you walk with the Measure-Master 12. Its handle extends to 38 in. and the counter records up to 1000 ft. in feet and inches. It can be reset to zero reading by pushing a button, and set to subtract as well as add. \$19.95 postpaid. Rolatape Corp., 1301 Olympic Blvd., Santa Monica, Calif. 90404.

LATEST VERSION of Sterno's fold-up campstove is this modern model in nonrusting aluminum. It's lightweight, portable, collapses flat and stores easily. Operates with Sterno Canned Heat, a safe cooking fuel. Handy for outdoor cooking as well as at home during power failures. Stove retails for \$2.49; 7-oz. can of heat, 60 cents. Sterno, Inc., Box 540, Jersey City, N.J. 07303.



RETREAD WORN BICYCLE TIRES easily by coating them with Black Strap adhesive. This black, pastelike material spreads on quickly and neatly, helps avoid flats, lessens the chance of wet-weather skidding and allows tight turns with very little slipping. A pint sells for \$3.95; a quart, \$5.95 postpaid. Made by Carpet Products Co., Box S, Central Square, N.Y. 13036.

HELP PREVENT THEFT of bicycles, motorcycles, spare tires, skis and other home and shop items with the Cable Lock Assembly. Made of 3/16-in.-dia. cable with 5/16-in. tough green plastic coating, it has stainless-steel terminals and hardened steel laminated lock with brass barrel and double-locking cam. \$7.95 postpaid from Cee-Jay Manufacturing Co., Box 722, Downey, Calif. 90241.



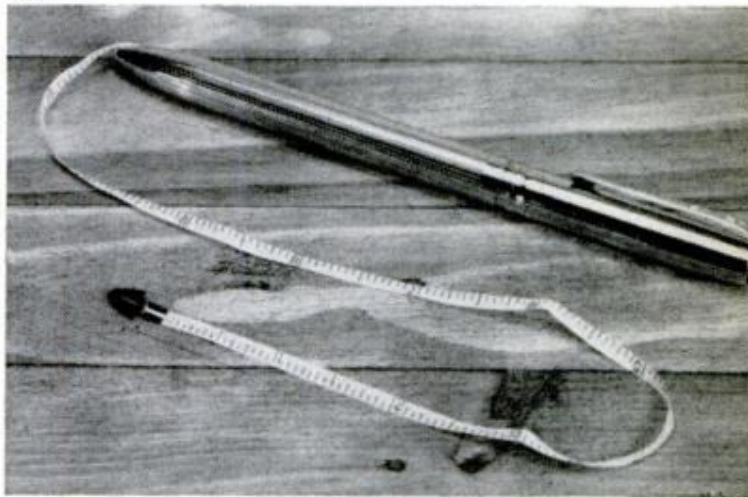


RAKING LEAVES is one of the most tedious of jobs; you can save time and work at this chore with a Wide Sweep Lawn Rake. Its 36-in. aluminum head with 36 spring-steel teeth is twice as wide as standard-size rakes, lets you clean up your lawn twice as fast. With 63-in.-long tubular steel handle, it sells for \$7.98 postpaid from Habny Products, 261 Huntington Ave., Buffalo, N.Y. 14214.

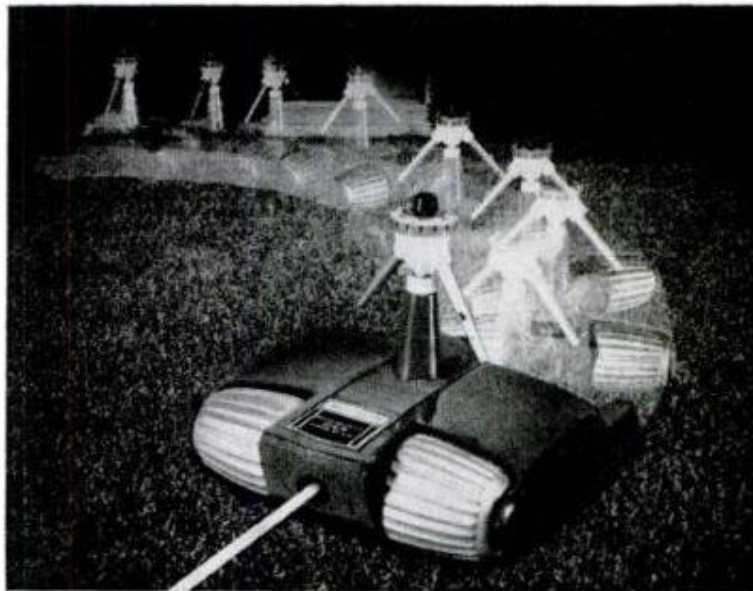


MAY 1972

MEASURE UP with this ballpoint pen that comes with a tape measure inside. The retractable tape is pulled out of the barrel of the pen. The combination tool has a carbide ball tip and is great for writing, marking and measuring all at once. It's available for \$2.95 postpaid from the David Schwartz Co., Dept. PM-11, Box 319, 340 West 42nd St., New York, N.Y. 10036.



WATERING YOUR LAWN is now easier than ever because the Model K25 Rain King Automatic Traveling Sprinkler does the job for you. Hooked up to a garden hose, it travels a preset course—up hills, around corners, along terraces, sprinkles areas up to 150 feet long and 50 feet wide. Sells for \$21.95 from Sunbeam Outdoor Co., 2001 South York Rd., Oak Brook, Ill. 60521.



RUGGED SWEEPING JOBS can be simple tasks when you use the Wet-N-Dry Squeegee Sweep broom. A tough-wearing squeegee set in the center of the block protrudes slightly above the bristles so that wet heavy debris will be moved along with water or other liquids with one easy thrust. Patio-sweep size is \$5.98. Vistron-Oxco Corp., 1712 Midland Building, Cleveland, Ohio 44115.

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Things to make for

Woodpecker door knocker



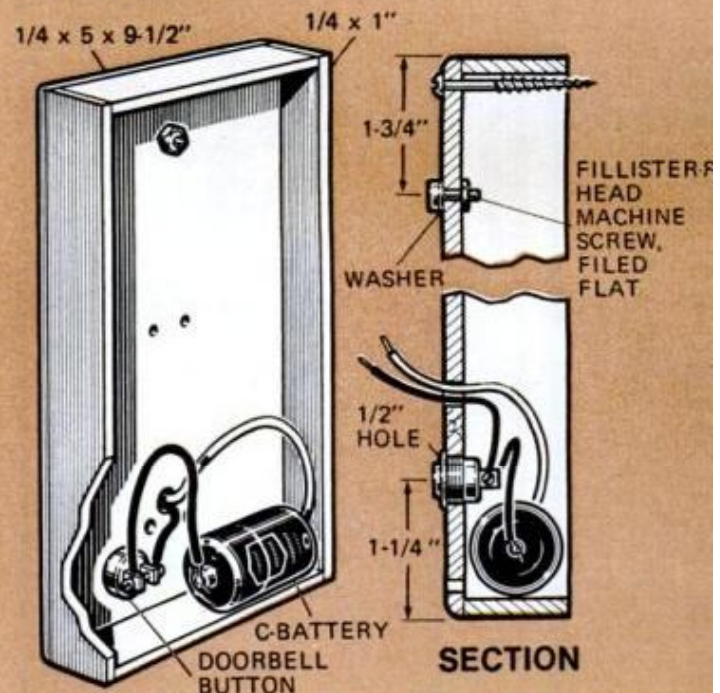
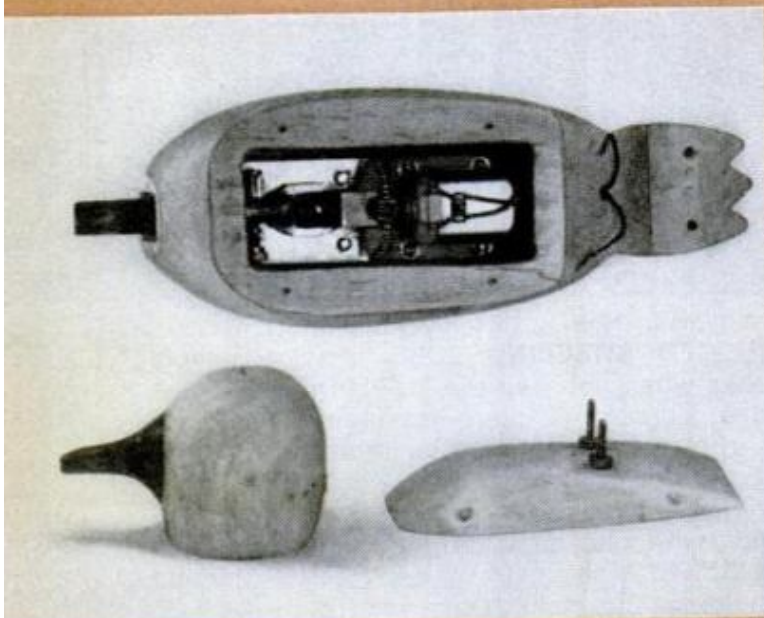
PRESS BUTTON and bird's head goes back and forth like a riveting hammer; box acts as sounding board

VISITORS will push the button again and again just to see this crazy woodpecker beat a most realistic rat-a-tat-tat to announce your arrival.

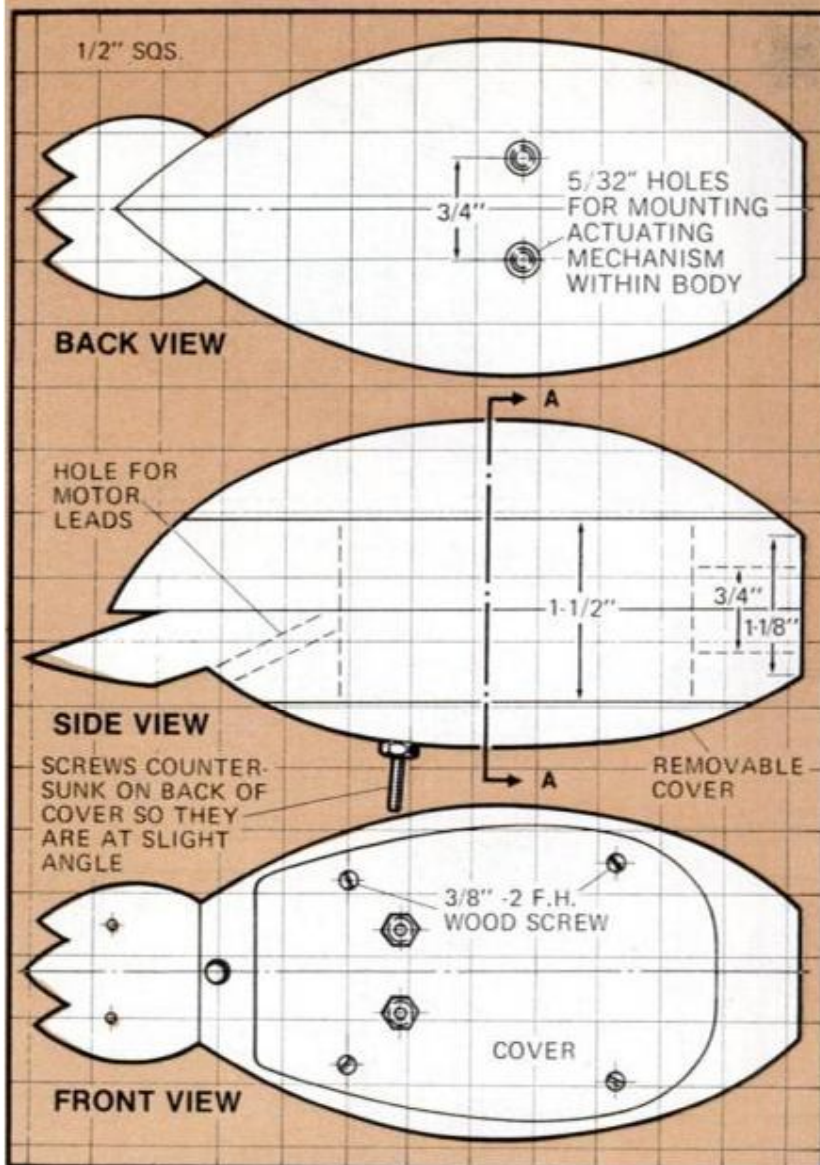
To make it you need four pieces of soft pine ($\frac{3}{4} \times 3 \times 6\frac{1}{4}$ in.) for the woodpecker's body. Cut $1\frac{1}{8} \times 3$ -in. openings in two of them for the operating mechanism and then cut the $\frac{3}{8}$ -in.-deep grooves in the ends for the clock spring actuating arm. When you glue the blocks together, you'll have a $\frac{1}{2} \times \frac{3}{4}$ -in. hole in the end. Glue the third block to the top of the others and attach the remaining one temporarily to the bottom with masking tape.

Make full-size paper patterns of the bird's body on $\frac{1}{2}$ -in. squares and transfer them to the built-up block with carbon paper. Bandsaw the profile outlines, tape the waste back on and bandsaw the back outlines. Complete the shaping of the body with a knife and sandpaper.

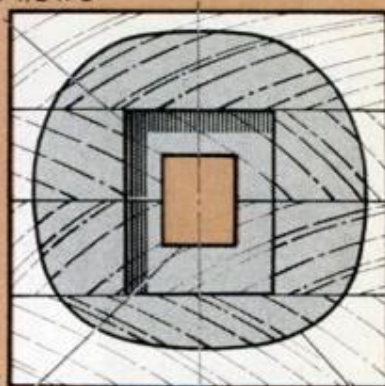
Glue the two slotted blocks together for the woodpecker's head, making certain that the slots are free of glue. Shape the head to the required size with a knife and sandpaper. The recess at the bottom of the head will permit the head to move freely on the body, yet conceal the joint between the two sections. Drill a $\frac{1}{4}$ -in. hole in the lower part of the



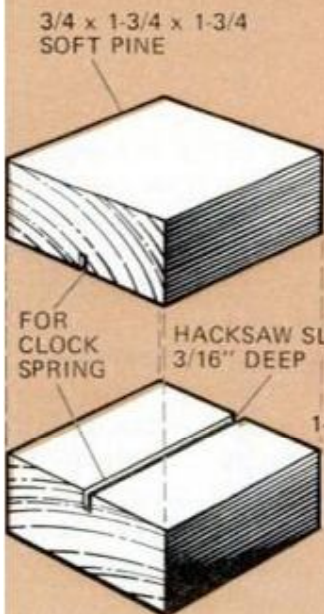
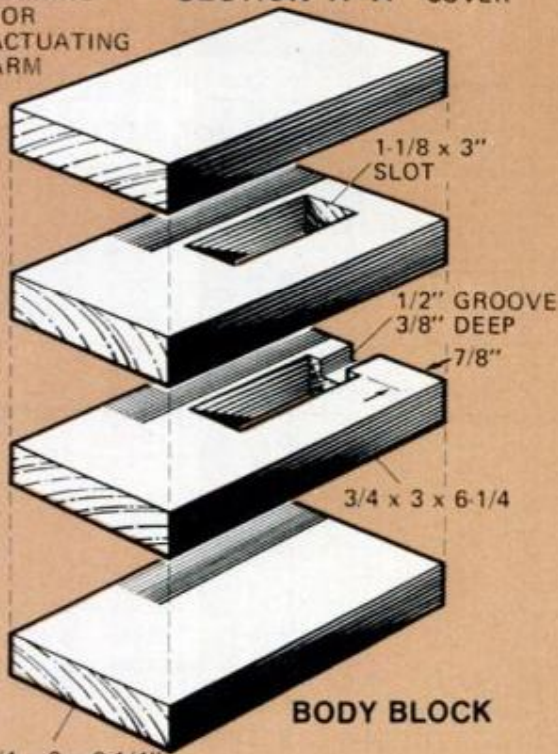
your home and yard



1/1-8 x 1-1/2 x 3"
 CAVITY



1/2 x 3/4"
 OPENING FOR ACTUATING ARM



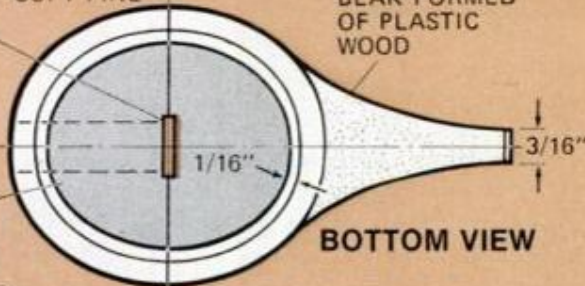
HEAD BLOCK

SLOT FOR CLOCK SPRING

3/4 x 3 x 6-1/4" SOFT PINE

BEAK FORMED OF PLASTIC WOOD

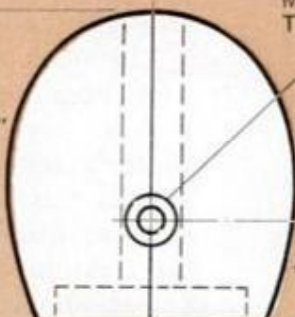
BOTTOM OF HEAD RECESSED 3/16" DEEP



1/4 x 1/2" METAL ROD, TAPPED

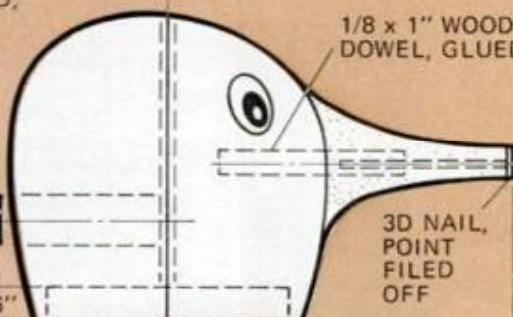
BOTTOM VIEW

1-11/16"



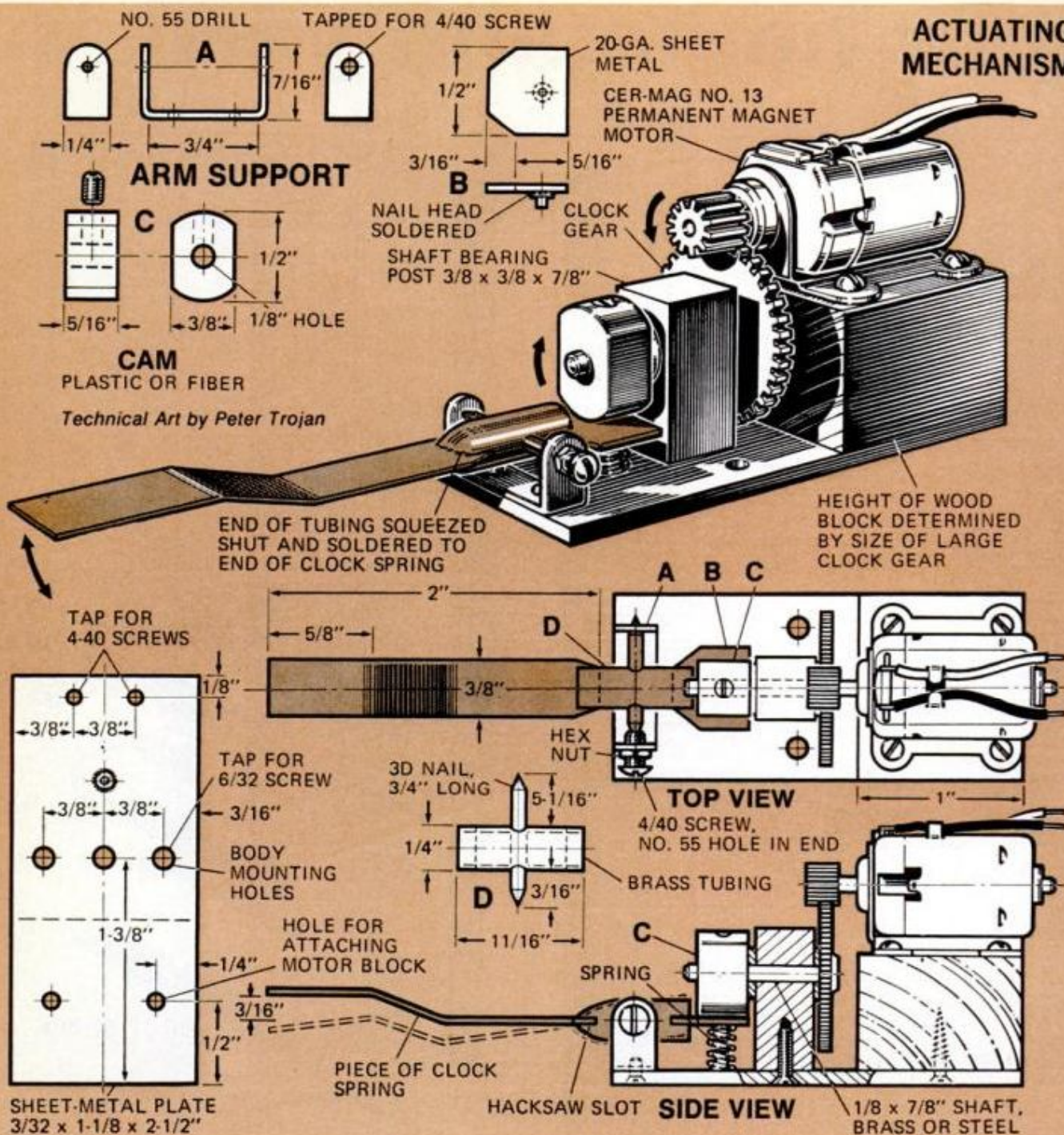
END VIEW

1/8 x 1" WOOD DOWEL, GLUED

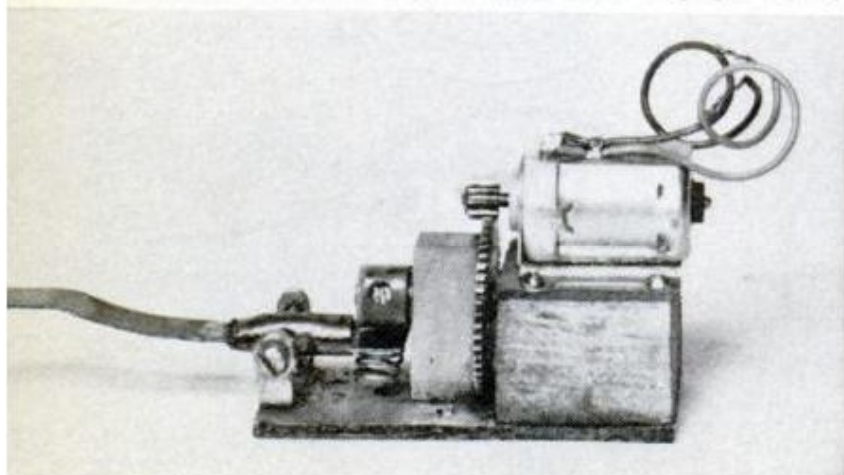


SIDE VIEW

ACTUATING MECHANISM



THE ACTUATING MECHANISM is operated by a tiny motor that gets its power from a single C-cell flashlight battery



head, place epoxy glue in the notches of the metal insert and press the insert into the hole. The retaining screw which clamps the head to the clock-spring arm, is turned into the insert and concealed.

The operating mechanism consists of a small battery-type motor and a fiber cam. The cam changes the motor's rotary motion to a reciprocating one. I used a Cer-Mag permanent-magnet motor, d.c.-type No. 13, obtainable at most hobby shops for about \$1. The gears, which have a ratio of about one to five, were

(Please turn to page 191)



Jungle-gym tree house for a summer of fun

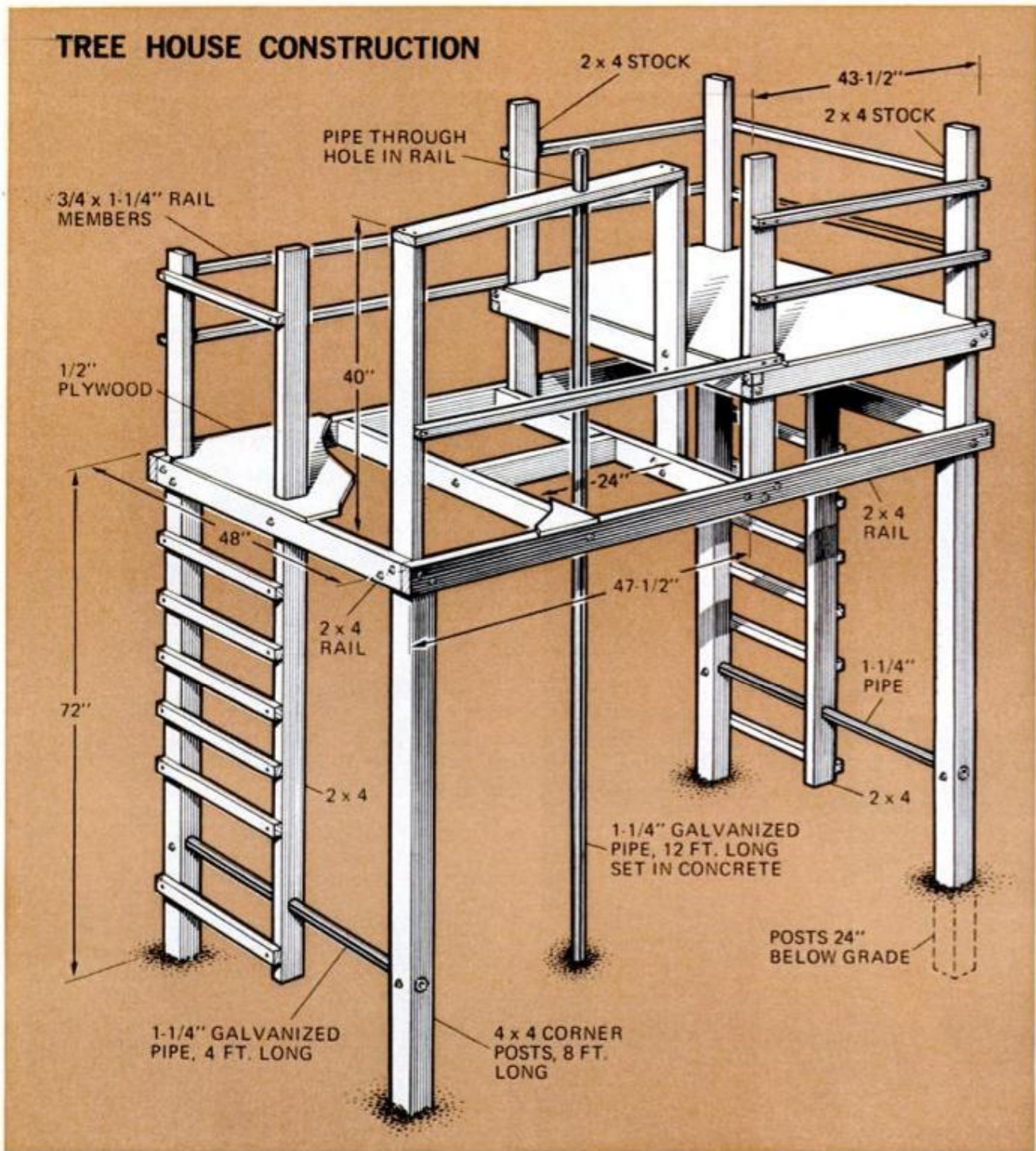
THIS COMBINATION jungle gym and tree house can be built for about \$65. The whole thing is designed to take advantage of standard lumber lengths and widths, which simplify construction to the point of merely cutting the various members to length.

The main platform is 6 ft. off the ground and supported by four 4 x 4 corner posts that are buried in 2 ft. of concrete. Each of the two levels measures 4 x 4 ft. square, which means that both plat-

forms can be cut from one 4 x 8-ft. sheet of 1/2-in. exterior-grade plywood. A 24-in.-square hole is made in the lower platform for a fireman's pole. The gym is fitted with two vertical ladders and a third one at approximately 60° to the upper levels. It also has a horizontal ladder that can be set at any height up to 6 ft. as the youngsters grow. An 8-ft. seesaw and a 12-ft. sliding pole round out the play equipment.

The pole, which is 1 1/4-in. galvanized

TREE HOUSE CONSTRUCTION

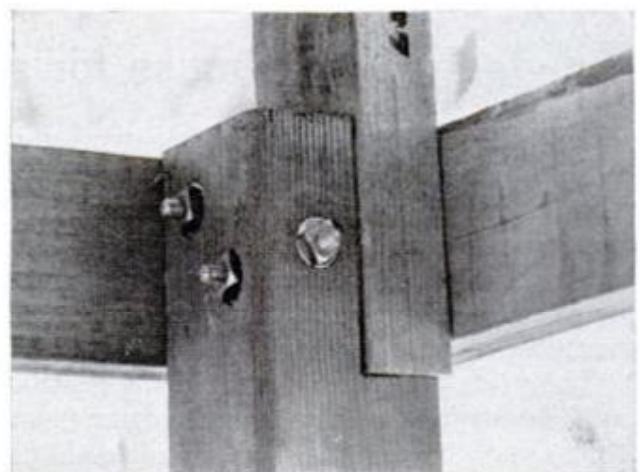


pipe, is anchored at the top in a hole in a 2x4 crossrail and is anchored at the bottom in a hole filled with concrete. The seesaw pivots on another length of the same pipe that is inserted through holes bored in the corner posts and one leg of the ladder.

You could install a second cross pipe so that the seesaw might be used at either end. The rungs of the vertical ladders were ripped from 2x3s, but they could be 1-in. dowels inserted in holes bored in the rails.

Give the whole thing two coats of good exterior house paint.

—James H. Pickerell, Washington, D.C.



TOPS OF 4x4 POSTS are notched like this so that the 2x4 platform posts can be bolted to them flush



DATA: BARBARA GORDER

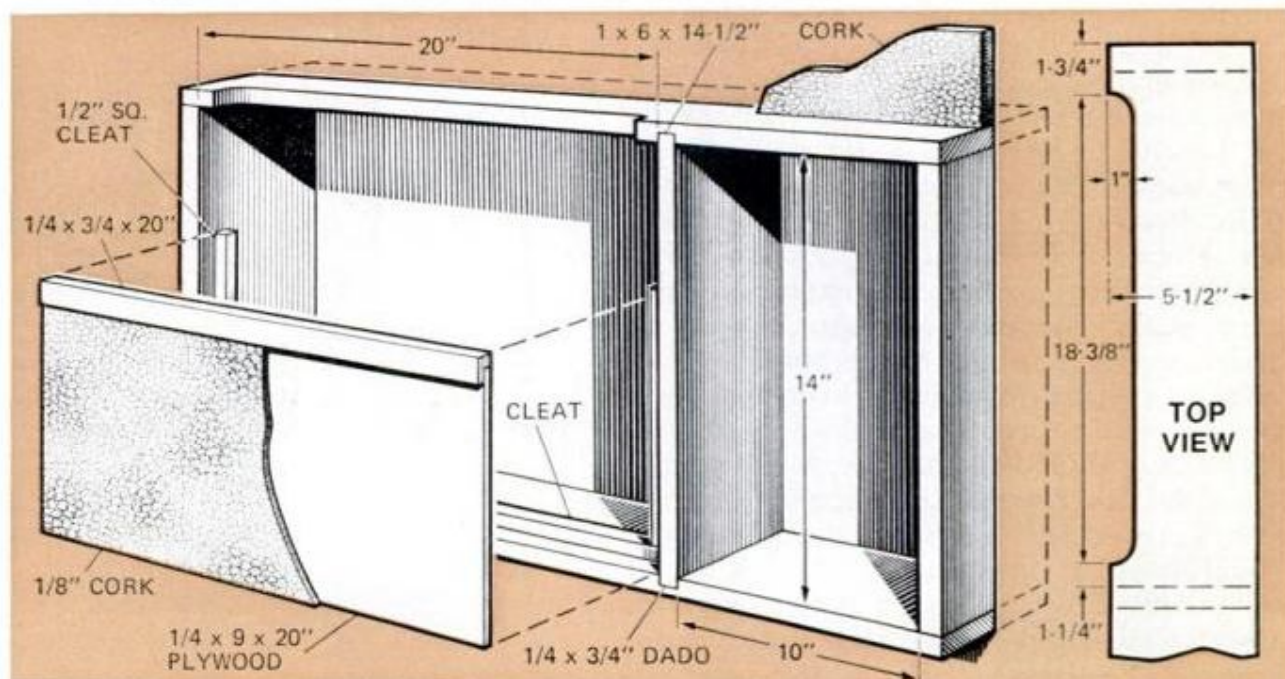
Message board keeps fat phone books handy

MOST TELEPHONE message boards forget the directories, but not this one. It has a pocket big enough to hold two big-city books (a yellow and a white) right next to the phone.

Architect Russell Zenk designed it for homeowner Peter Briggs of Minneapolis who built it into a floor-to-ceiling island wall that divides the kitchen.

The simple box frame is made of 1x6

stock fitted with a back and set into the wall to project about 2½ in. Thick insulation cork is cut to fit the length of the cabinet and fastened to the wall above it. A thinner piece of cork is glued to the front of the telephone-book pocket. While the original frame was built in, it could be made shallower and surface-mounted. In this case, no back is needed; the wall provides it.





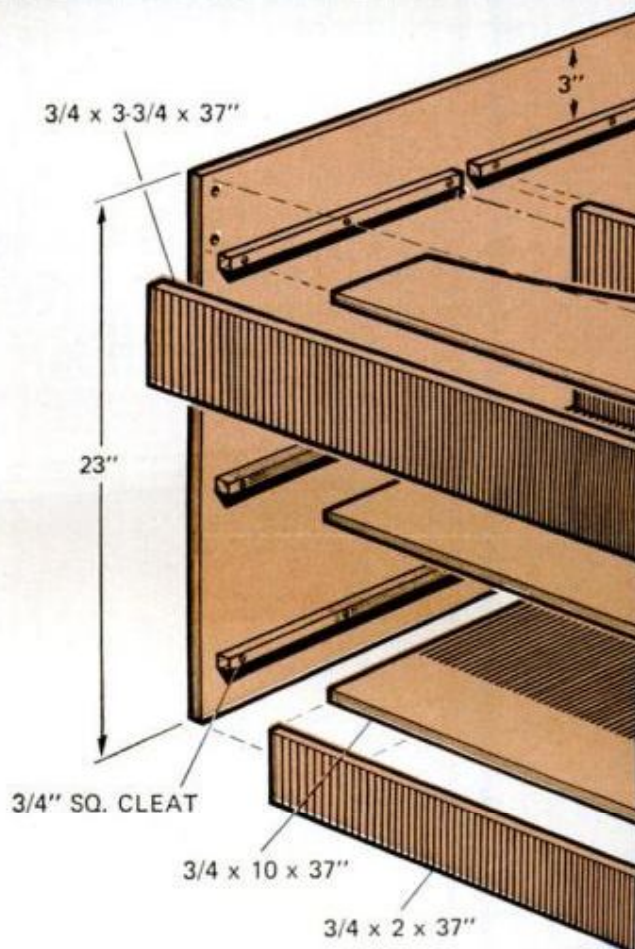
Bunk bed has built-in chest

NO NEED TO WORRY about getting this king-size bunk bed in and out of the room; it all comes apart with a twist of a screwdriver, thanks to special Selby Hardware connectors holding the 14 parts together.

The bed makes the most of space—four large drawers built in under the mattress swallow up lots of toys, extra blankets, sheets and pillow cases. Two “ladder” shelves at the foot of the bed provide still more storage space, and another shelf across the headboard will hold a lot of bedtime-story books. The bed accommodates a 36 x 75-in. foam-rubber mattress. The complete bed is built from $\frac{3}{4}$ -in. fir plywood. Half-round molding covers the exposed edges of the sides. The bed cost John Doherty of Greenlawn, N.Y., about \$75 to build.

The two-part connectors consist of a steel pin with a large head and a slotted 1-in. steel disc installed in the line with the pin. When the disc engages the pin and is turned with a screwdriver, it draws the joint tight. You'll need 28 connectors called Elite 25 with DU91 dowel. You can buy them from Albert Constantine, 2050 Eastchester Road, Bronx, N.Y.—*Laura LaBarge, Newton, N.J.*

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Technical Art by Peter Trojan

POPULAR MECHANICS

Материал, защищенный авторским правом

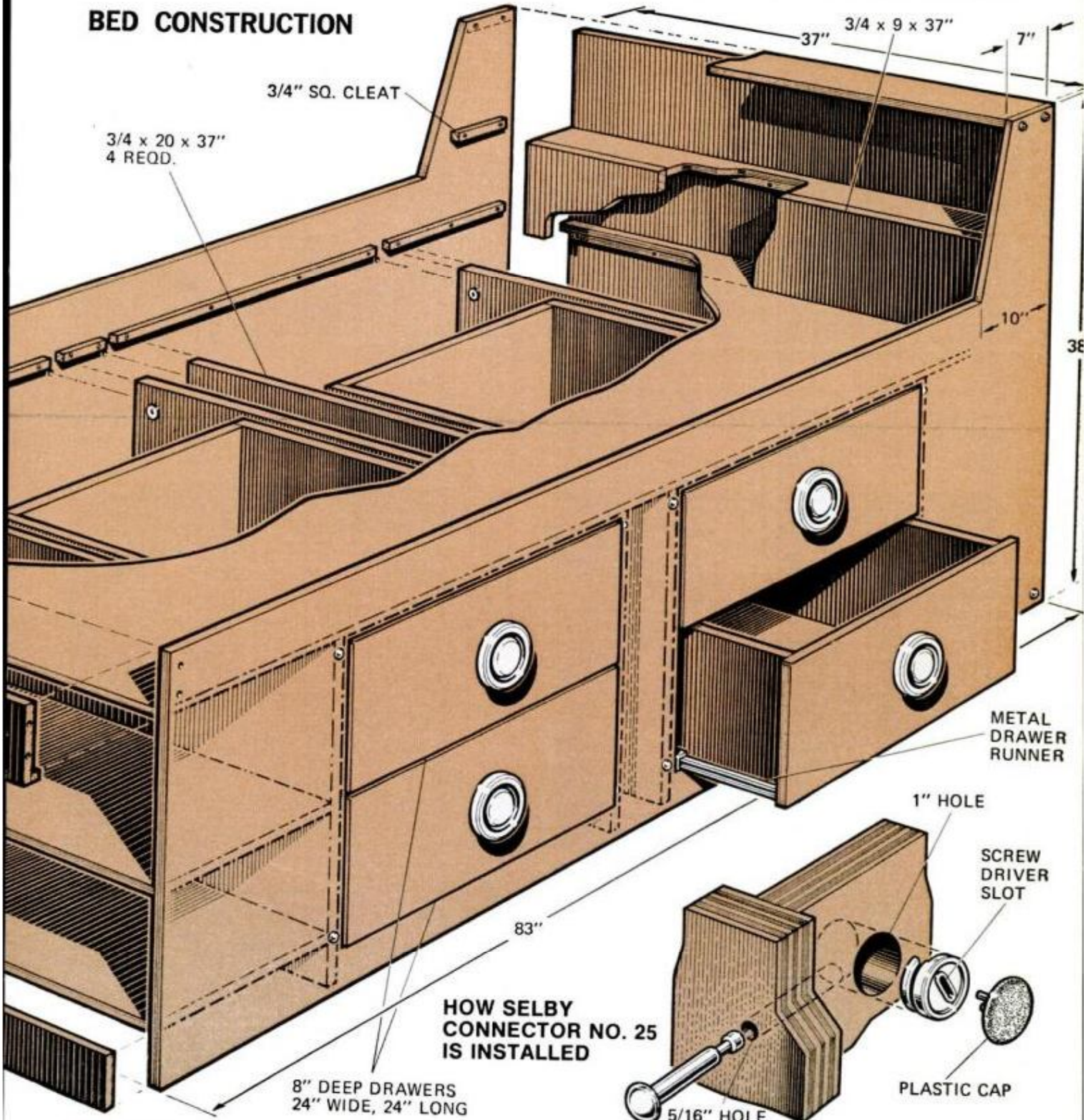


CLEATS SUPPORT PLYWOOD TOP where the mattress rests. They're glued and screwed 3 inches from top



DRAWERS ROLL SMOOTHLY on standard metal guides which are screwed to the dividers and drawer sides

BED CONSTRUCTION



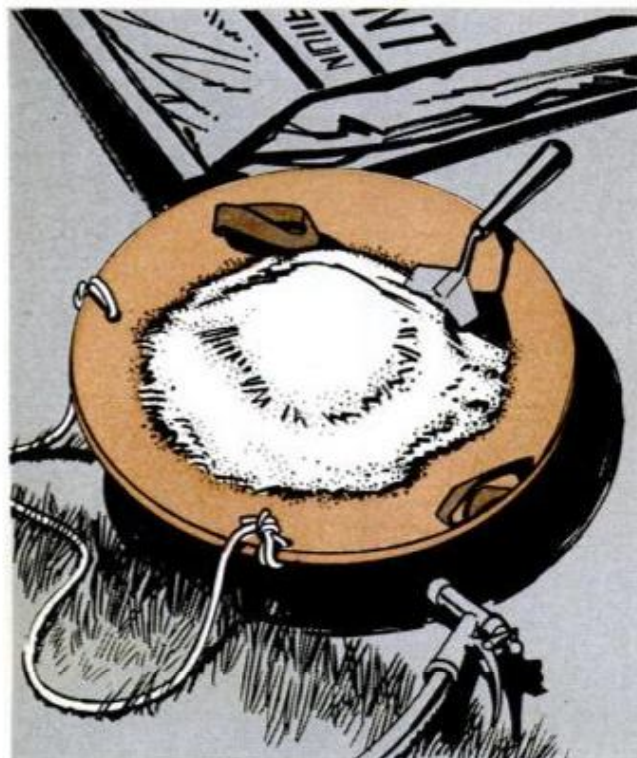
BETTER WAYS TO DO IT!



A LAWNMOWER parked in the garage can be a hazard if you have a toddler who might play with the reel. Put your mind at ease by immobilizing the reel with a bicycle lock.—*W. H. McClay, Pasadena, Calif.*



MOD BIRDBATH is fashioned from a bell-end drain tile and a discarded auto-wheel cover. Bath can be moved aside when it's time to mow. Bowl won't break if it's knocked off.—*John Krill, North Lima, Ohio*



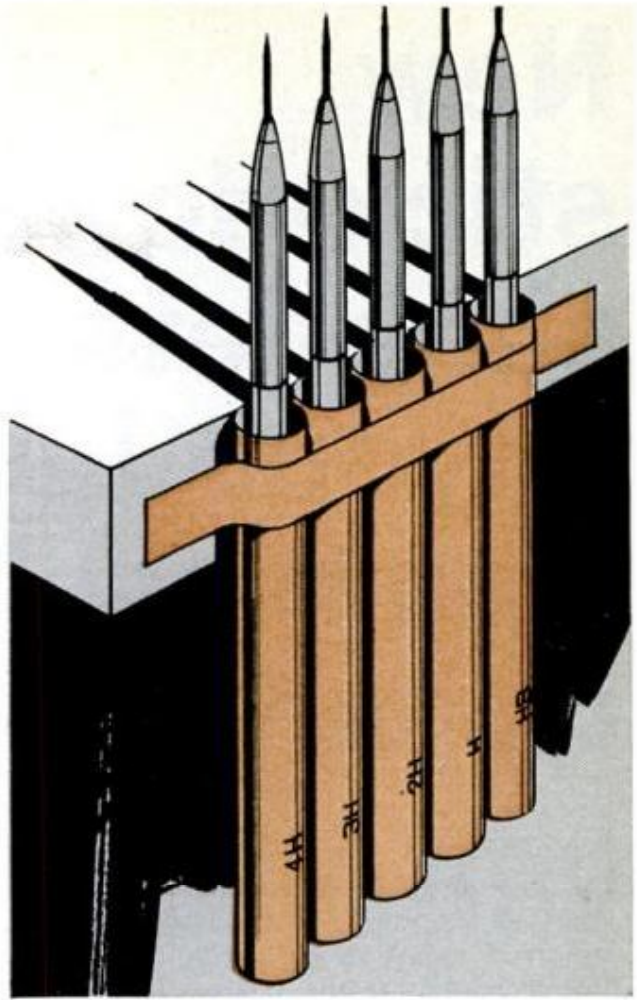
PORTABLE "MORTAR TROUGH" is actually a kid's saucer sled. Large enough for good-sized batches, it can be pulled to the job. When work is finished, hose the sled clean.—*James A. Long, Columbus, Ohio*



LEGS FROM A SNACK TABLE whose tray is shot can be put to good use. They make an ideal rubbish-bag holder for use in the yard. Same idea can be tried in the laundry.—*Marvin Duchoviner, Brockton, Mass.*



PATIO PRIVACY FENCE looks even more attractive when it's decorated with flowerpots. Just try these rustic "hooks" you can cut from short tree lengths with a branch fork.—W. H. McClay, Pasadena, Calif.



DRAFTSMEN usually keep several mechanical pencils loaded with different lead at hand. I corral them by taping empty lead containers to the edge of the drawing board as shown.—Lee Adams, Owensboro, Ky.

Illustrations by Adolph Brotman



PLASTIC CLOSERS of the kind that come on bread wrappers can serve as handy outdoor aids. At campsite or boat, they will work as clothespins on a small line.—Richard J. Cooper, British Columbia
MAY 1972

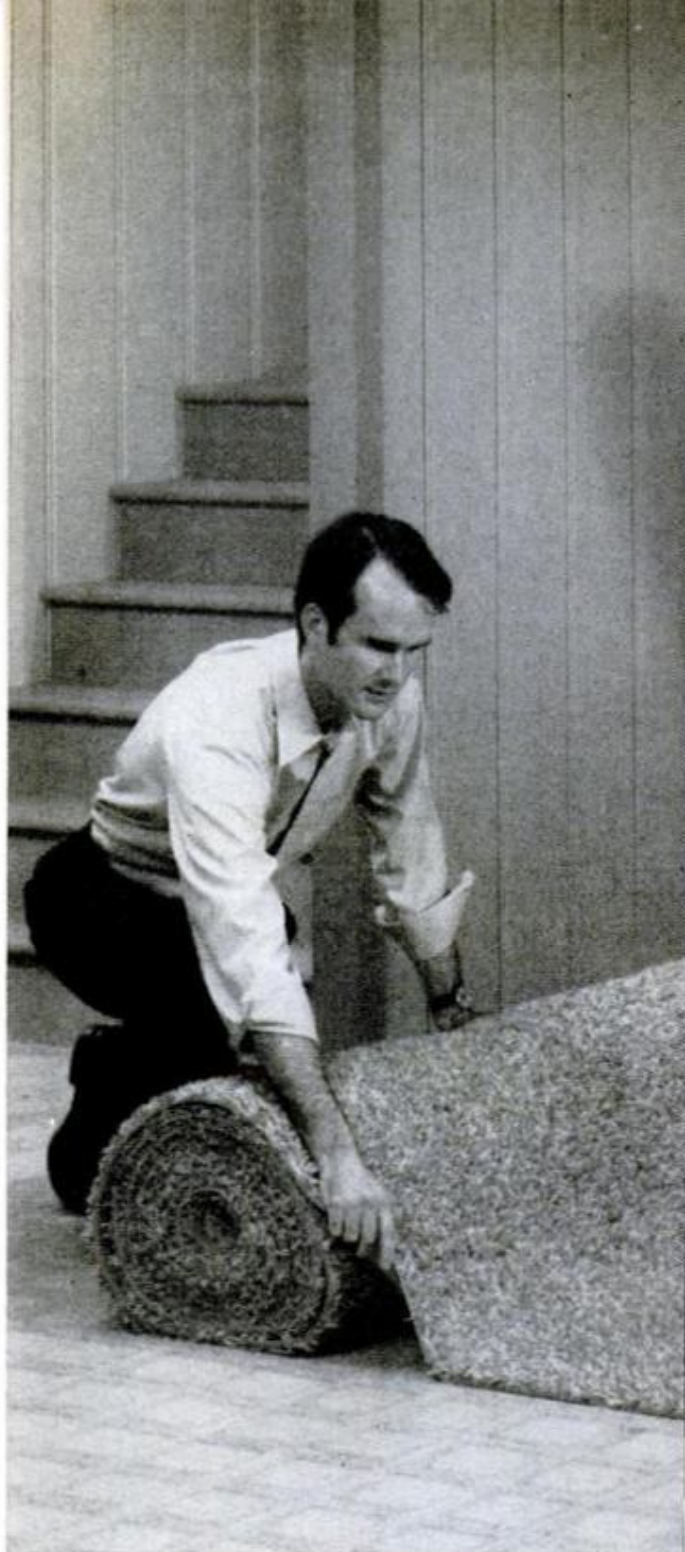


STIFF STYROFOAM BLOCKS can be used to keep the branches apart in young fruit or shade trees. Once the branches have acquired the set you desire, just remove the blocks.—John Krill, North Lima, Ohio

New stick-down shag lets anyone lay 'seamless' carpeting

LAYING seamless carpeting was always considered a job for the pros and still is when seams must be stitched with special equipment. But if you like shag carpet, Armstrong has made it easy for you to lay its new "seamless" stick-down with nothing more than scissors and tape.

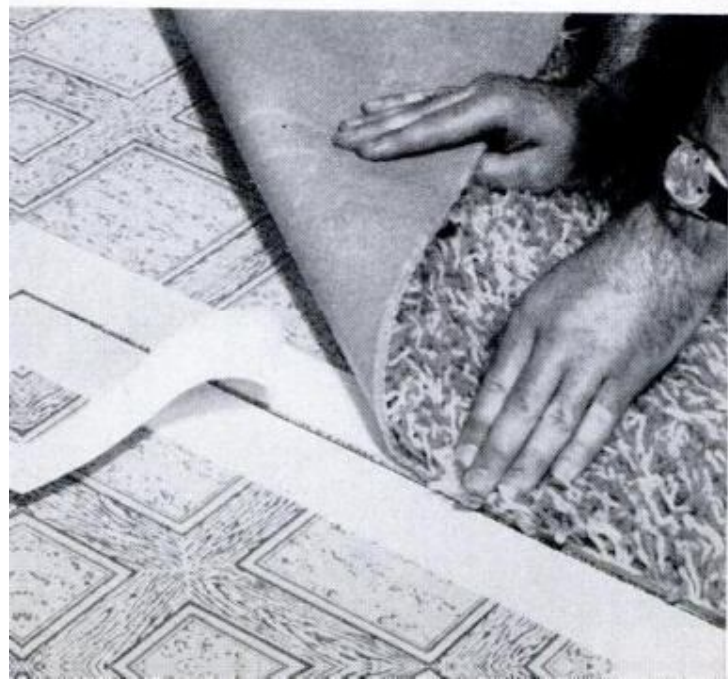
Bonded to a built-in pad of foamed latex, this all-synthetic shag is merely butted at the seams and stuck to the floor with double-faced carpet tape. The thick pile laps and merges perfectly with the adjoining edge so you see no seam. Called Showboat, it's woven on a polypropylene backing impervious to moisture—ideal for basement recreation and family-room floors. It sells for \$6 to \$7 per sq. yd. For more information, write to Armstrong Cork Co., Dept PM, Lancaster, Pa. 17604. ★★★



SHAG CARPET (above) comes in easy-to-handle, 6-ft.-wide rolls. Roll shag has an advantage over tile shag—there are considerably fewer seams to deal with

CARPET IS POSITIONED (left) so it laps walls a bit. Then it is trimmed while in place with ordinary household shears. It's backed with foam-rubber cushion, thus needs no separate pad

ABUTTING EDGES (right) are stuck with double-faced tape. No tape is needed under carpet or around edges to hold them flat. Shampoo won't cause seams to separate or edges to curl



SECOND ROLL (below) is fitted in place right alongside first roll and stuck to tape that straddles the seam. Shaggy texture of carpet meshes and blends perfectly to make overall job look like a single piece



Provincial charm— and you can build it yourself for \$41

Occasional table has tambour doors
that slide open on a curved track

By C. L. WIDDICOMBE

Technical Art by Fred Wolff



rails. The feet are bandsawed from blanks of $2\frac{7}{16}$ -in.-sq. stock. These can be either laminated or solid blocks. The front and side rails are of stock thick enough to follow the contour of the tops of the legs.

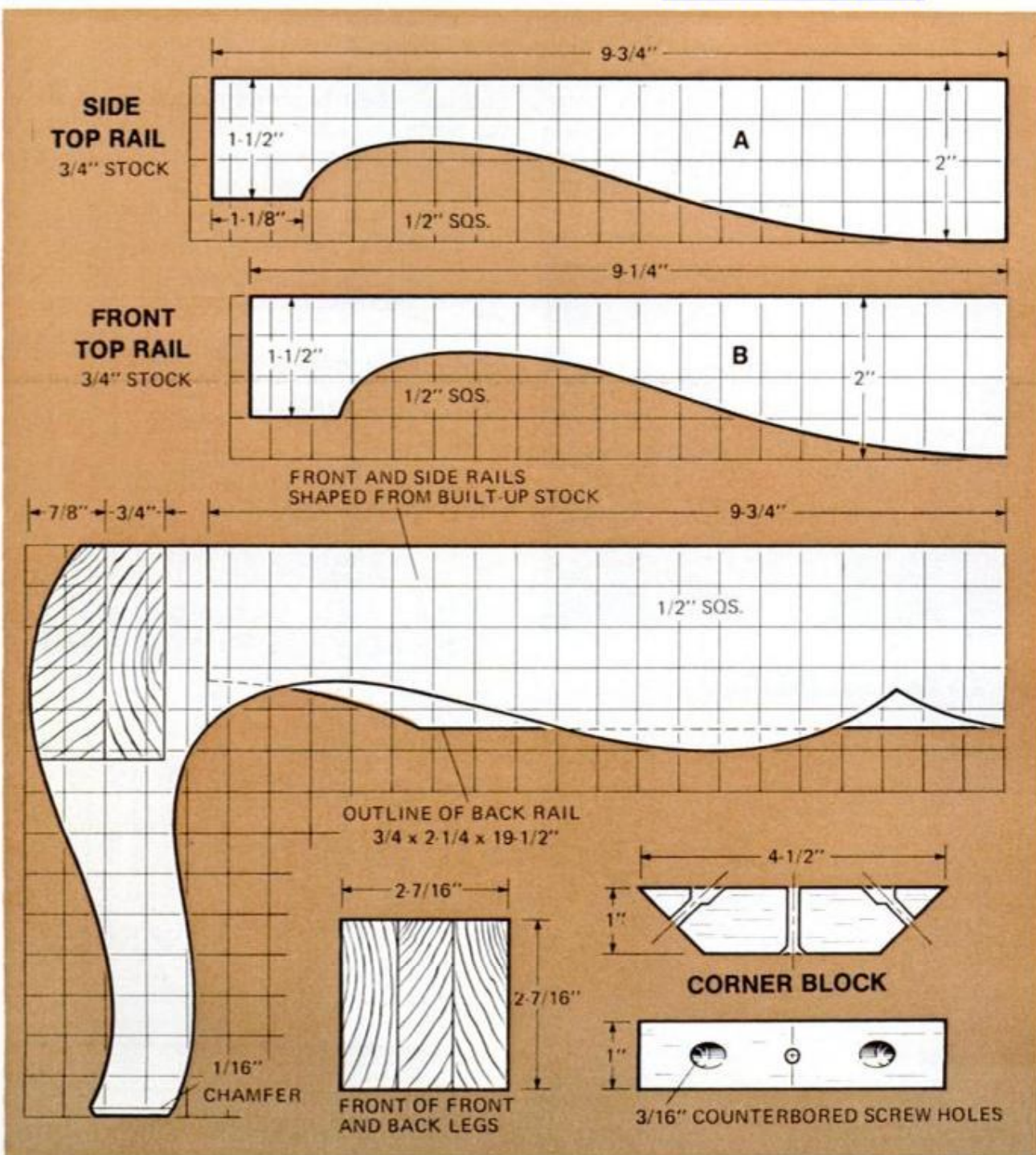
In the original, I used $\frac{7}{8}$ -in. mahogany backed up by $\frac{3}{4}$ -in. maple as shown in the details. Cut the leg and rail blanks to the correct lengths and mark them for dowels. Notice that the back rail is simply a flat board cut from $\frac{3}{4}$ -in. stock. Take care that the dowel holes are positioned in such a manner that they won't show when the contours of the feet and rails are cut. Bandsaw the four legs and remove excess material from the rails on your table saw. Now assemble the base section.

Plane the rails and tops of the feet to match and finish up with a thorough sanding of all members. After attaching the four corner blocks, the completed base should look like that shown on page 143.

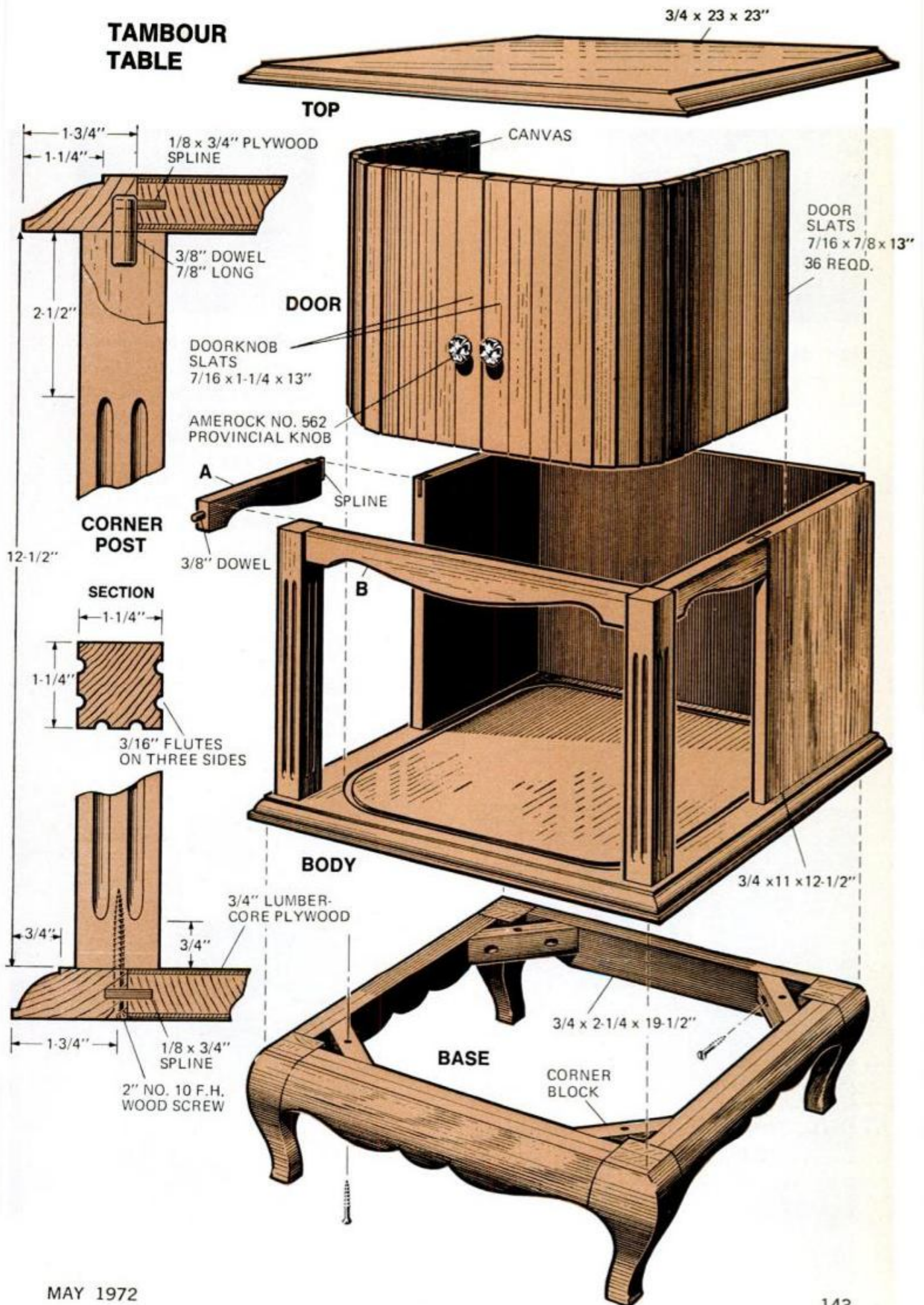
Now you can make the doors—they make the completed table stand out from run-of-the-mill furniture. With a little extra care along the way, you will be assured of a professional-looking piece of furniture. The slats are of $\frac{7}{16}$ -in. material; 36 slats are $\frac{7}{8}$ in. wide and two—the front ones where the knobs go—are $1\frac{1}{4}$ -in. wide.

Remove the sharp edges from all pieces and sand the front faces only. There's no

(Please turn to page 190)



TAMBOUR TABLE



HINTS

FROM READERS



No-cost 'sky hook'

Most home handymen have a favorite way to hold a paint can when working on an extension ladder. But I've yet to see a simpler setup than the "hook" I use. I tighten a C-clamp anywhere on the ladder and hang the pail on the threaded portion.—*Jackson Hand, Westport, Conn.*



Stuck vise handle

To unfreeze a vise handle quickly use your lathe. Clamp one end of the handle in chuck with ball end inside to clear jaws and, with screw resting on a protective cloth, slide a file along handle as it turns. Reverse the handle to file the other half.—*B.W. Ervin, Kent, Ohio*

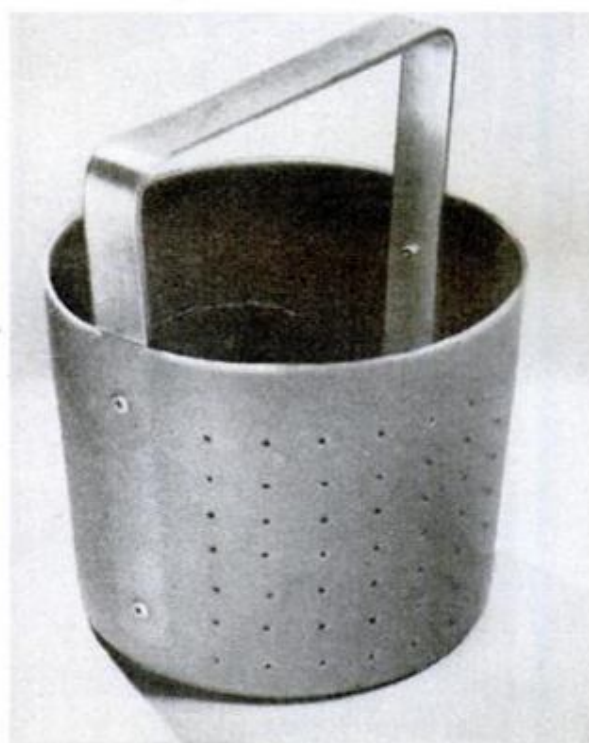
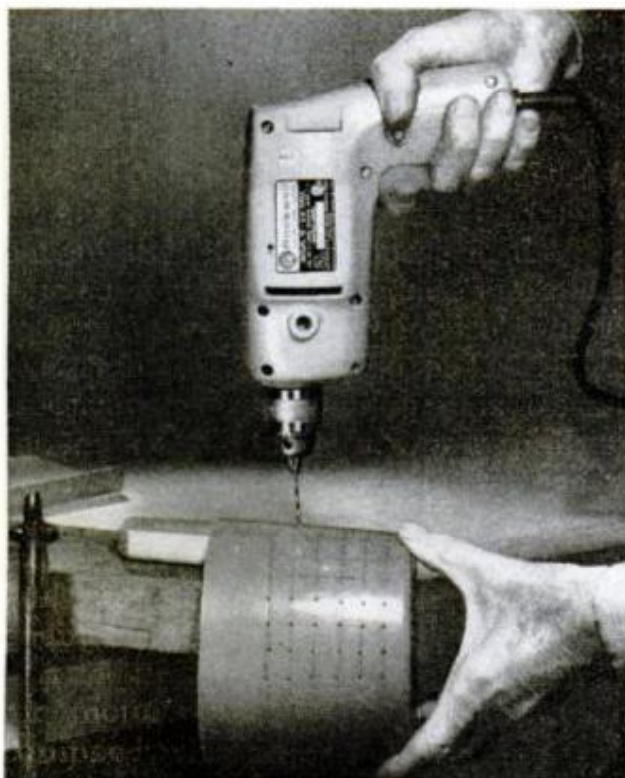


Funnel twine-holder

When soldered to a suitable wall bracket, a funnel makes a novel dispenser for a ball of twine that unwinds from the center. The twine is pulled through the spout. If you sharpen one bracket arm, you will also have a handy built-in twine cutter.—*Walter E. Burton, Akron, Ohio*

Pail makes pool-skimmer strainer basket

When the metal strainer basket for my swimming pool rusted out, I made a dandy noncorrodible one from a heavy plastic pail. I picked one that would fit the skimmer hole, cut it down to match the old basket, drilled countless $\frac{1}{16}$ -in. holes in the bottom and sides and finally attached a handle with Pop rivets. Making it saved the \$5.95 a new one would have cost me.—*John R. Orend, Orlando, Fla.*

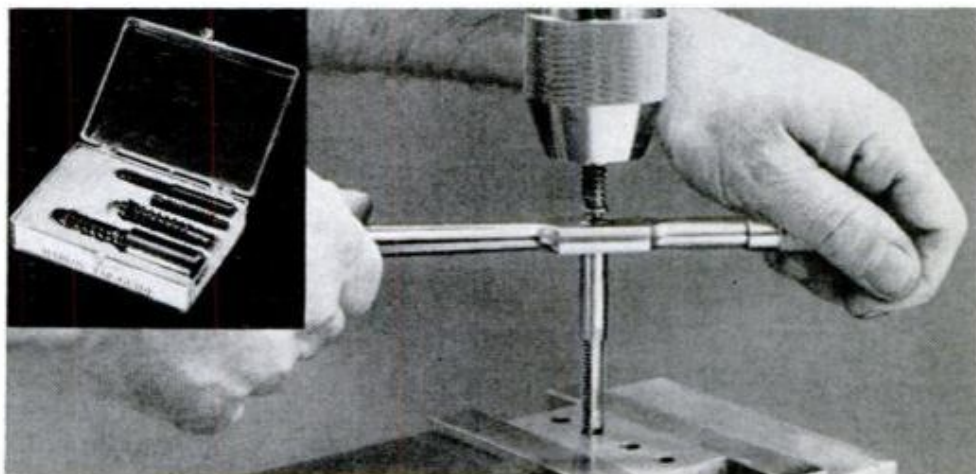


New tools you should know about



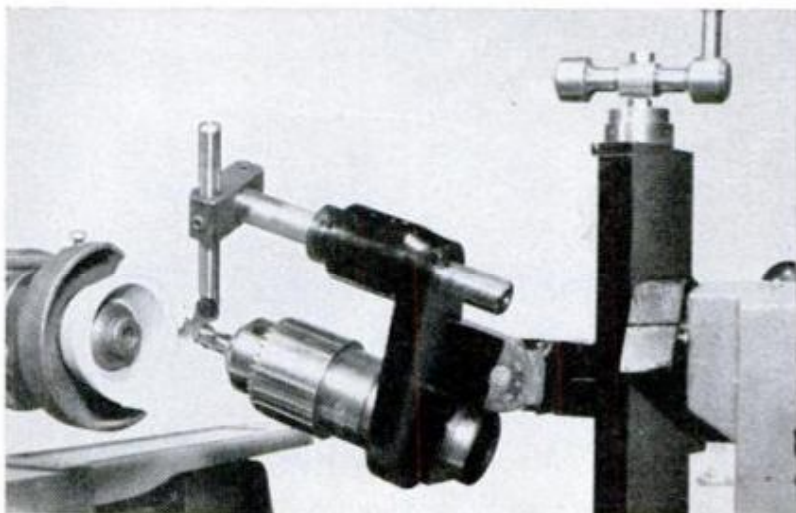
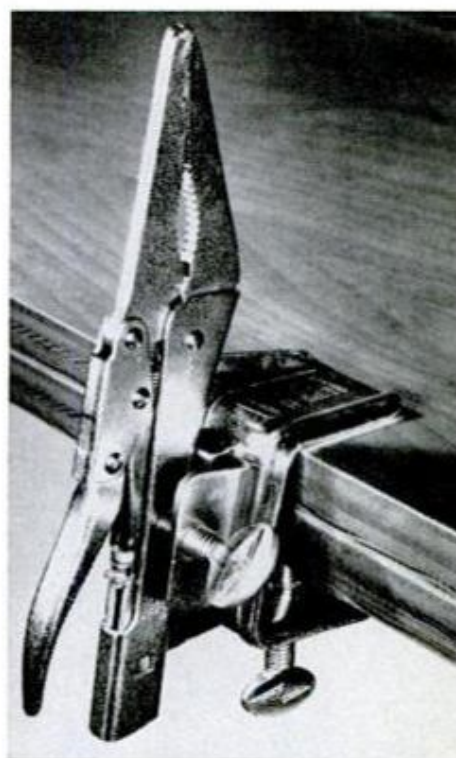
HOIST designed for do-it-yourselfers is rated at one-third ton and said to outlift comparable hoists. The Samsonite, \$19.75; American Gage & Manufacturing Co., 550 West Kinfoot St., Wausseon, Ohio 43567.

KEEP TAPS perfectly square with work plane using a Tap-Guide. Surface-hardened guides have 2-56 to $\frac{5}{8}$ -in. capacities; set sells for \$7.95. Available from MarLou Industries, Box 2177, Santa Clara, Calif. 95051.



SHINGLING HATCHET now being offered by the Estwing Manufacturing Co., Rockford, Ill. 61101, features a thin blade and special gauge that adjusts every $\frac{1}{2}$ inch. \$8.60.

HANDY CLIP called the V-1 Vise Bracket quickly converts a LeverWrench into a bench vise, sells for \$3. Leverage Tools, Inc., Box 68, Glenvil, Neb. 68941, is the maker.



DESIGNED for the tailstock of a metalcutting lathe, ReNewAll can be used with a toolpost grinder to sharpen a variety of tools and milling cutters, reamers, T-slot cutters and more. With a special attachment, helical fluted cutters can also be resharpened. Tool uses precision bearings and vernier scales, costs \$380. For brochure and more information, write Tri-B Products, Dept. PM, Box 1032C, Canon City, Colo. 81212.

By WALTER E. BURTON



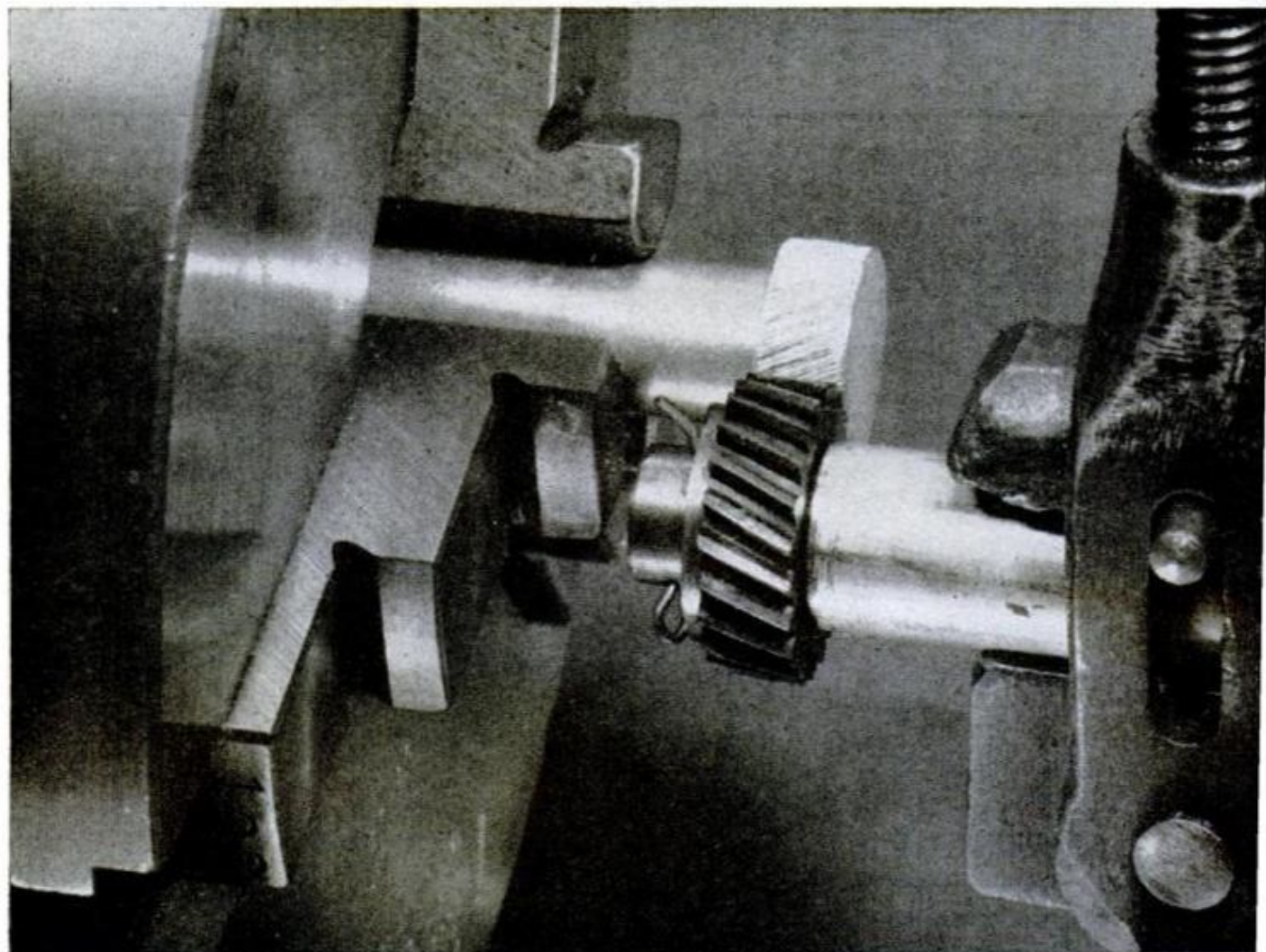
Machining aluminum?

RECENTLY, when I needed a knurl and a milling cutter in a hurry for work on aluminum, I made them quickly from small, steel helical gears in my scrap box. The gears measured $\frac{13}{16}$ in. o.d., and had a $\frac{3}{8}$ -in. hole, $\frac{1}{4}$ -in. face and 22 teeth each. They were not file-hard.

To convert a steel helical gear to either a knurl or cutter, it was necessary to re-shape the teeth. At first, I tried offhand grinding, but filing proved to be more accurate.

To make a knurl, a slope is filed on each tooth leaving a sharp edge along the center. (See drawing, opposite page.) To fashion a cutter resembling a Woodruff keyway milling cutter, a single slope is filed on each tooth to provide back clearance and a cutting edge along one side of the tooth, and some metal must be re-

...you can make cutters and



KNURLING ALUMINUM with converted gear. Ridges and valleys are finer than the knurl-teeth spacing

moved just below this edge to provide front clearance.

The modified gears were hardened in Kasenit No. 1 hardening compound. They were heated to bright redness (about 1675° F.), plunged into the compound until it thoroughly coated them, reheated to the same degree, quenched in water, and finally tempered to a light straw color (about 450° F.).

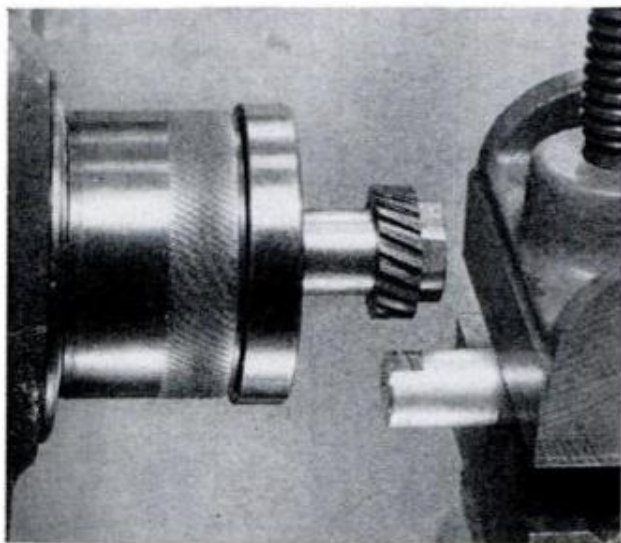
Cutters and knurls can be mounted in various ways. The knurl shown was simply mounted to rotate freely on the turned-down end of a 4-in. length of steel shafting; a cotter pin and washer hold it in place. In use, I clamped it in a boring-bar holder in the lathe toolpost, as illustrated. Where great pressure is involved, such a knurl probably should be in a "Y-type" mount fed endwise against the workpiece.

The milling cutter was similarly mounted except that a thinned-down $\frac{3}{8}$ -16

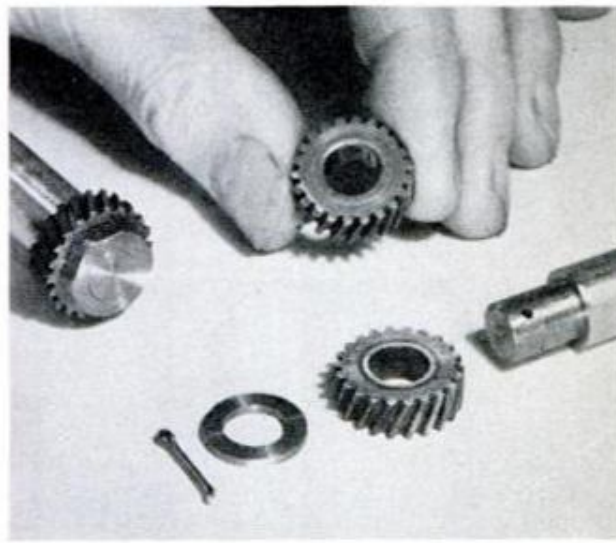
nut held it tightly against the shoulder of the $\frac{1}{2}$ x 3-in. piece of shafting. The cutter is positioned so the teeth cut as it rotates in the same direction as a conventional twist drill. Although the knurl teeth are rather widely spaced, it generally produces a pattern of rather fine ridges and valleys—apparently influenced by the workpiece diameter.

These "gear tools" have worked on aluminum that I have machined, and on some brass pieces. The milling cutter was used to form flats on soft steel. Resistance to wear, and the range of metal hardness that such knurls and cutters can handle, are influenced by the hardening and tempering treatment. This can vary with the nature of the gear metal, the hardening compound, and technique of the mechanic doing the heat-treating. Unhardened gear tools might be used on *very* soft metals and wood to a limited degree. ★ ★ ★

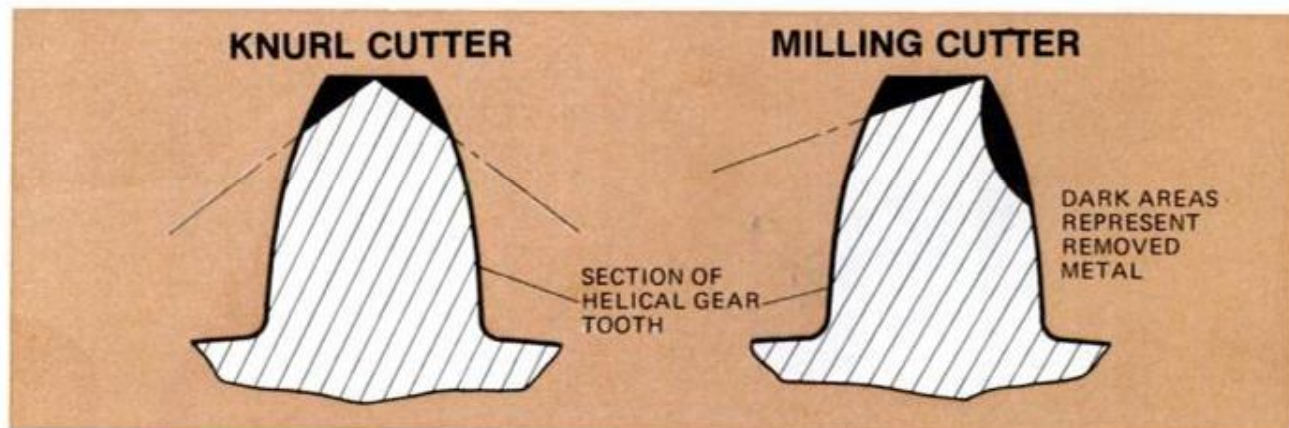
knurls from helical gears



FLAT IS MILLED on aluminum rod with cutter made from gear. Tool also works on brass and soft steel



HELICAL GEARS converted into milling cutter (left) and knurling tool. Sketch shows how to file teeth



Hints from



Reinforced white glue

White glue, when mixed with a quantity of nylon or similar strong fibers, forms a useful patching compound where breaks, gaps and cracks have to be bridged and reinforced. The fibers can be obtained by cutting up yarn or cloth. Trick is useful for repairing cardboard and wood.

—B. W. Ervin, Kent, Ohio.



Wax brightens old glass

By adapting the technique used to subdue abrasions on sheet acrylic plastic, you can improve the transparency of glass articles that have become dulled by fine scratches. Apply a thin layer of auto wax with a moist cloth, wait a half hour, then polish the surface with a soft cloth. Repeat steps if necessary.

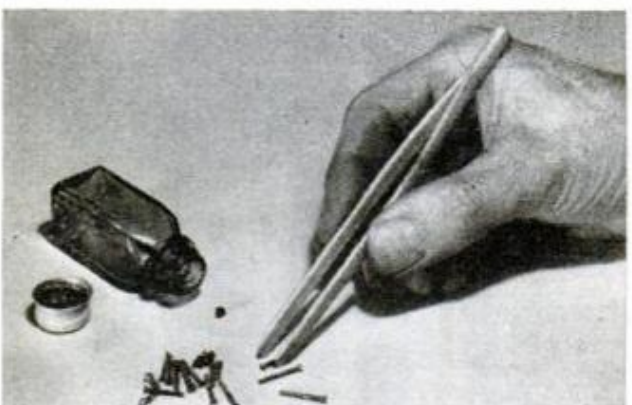
—W. B. May, Oak Park, Ill.



Shorten glue drying time

Most glues used in the workshop will set faster at warm temperatures. A good method that I have used is to place the glued parts in my car when it can be parked in the sun. As you know, an auto during summer months is a mini-furnace. Use paper to protect the seatcovers or seats, and, to keep heat around the glued parts, try aluminum foil.

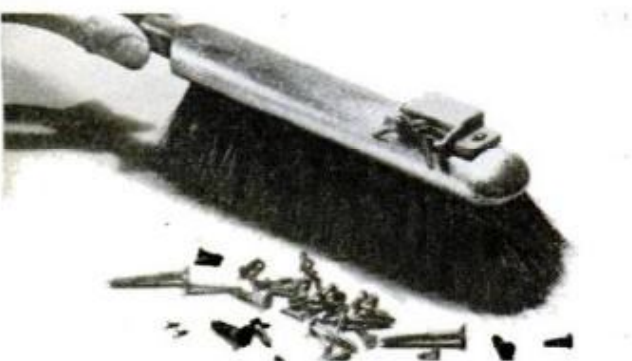
—Rosario Capotosto, Greenlawn, N.Y.



Bamboo tweezers

Serviceable tweezers for workbench use can be made from bamboo strips whittled from a retired fishing pole. The one shown here is 5½ in. long and consists of two halves. After tapering each leg from 5/16 to a scant 1/4 in., halves are heated and bent to separate tips. Then the halves are joined using a hot-melt glue gun.

—Walter E. Burton, Akron, Ohio.



Shop-brush magnet

A magnetic door catch mounted on the back of a workbench brush is handy for picking up steel chips, sheet-metal trimming and other metallic refuse. It is particularly convenient for separating steel screws, bolts, nuts and nails from non-magnetic types. Mount magnet with short screws so the bristles will be undisturbed.

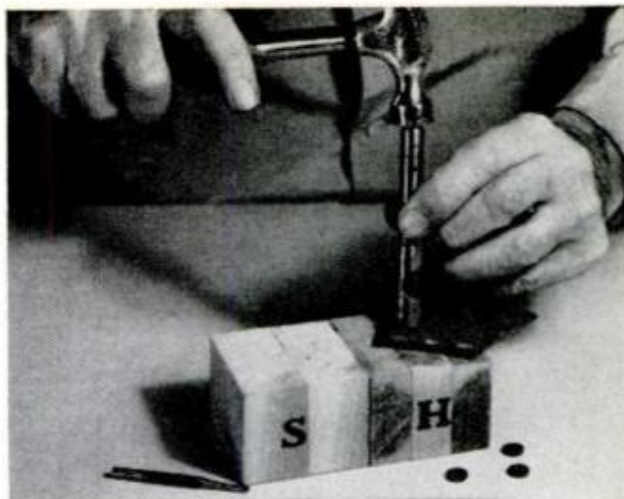
—W. B. May, Oak Park, Ill.

readers

Punch block for the shop

"Recycle" scraps of hard and soft wood by gluing them into a punch block of convenient size for use as a support when punching leather, felt and the like. Make the block of equal parts of hard and soft woods and you will have a surface selection to suit the punching operation.

—B. W. Ervin, Kent, Ohio.



Rubber-stamp handles for tools

Handles from discarded rubber stamps can be used to make excellent grips for small shop tools such as files, awls, carving chisels and scrapers. The photo at right shows such handles fitted to an ignition file for shop use and to a scraper-type carving tool. Crimp aluminum tubing to make the tool ferrule.

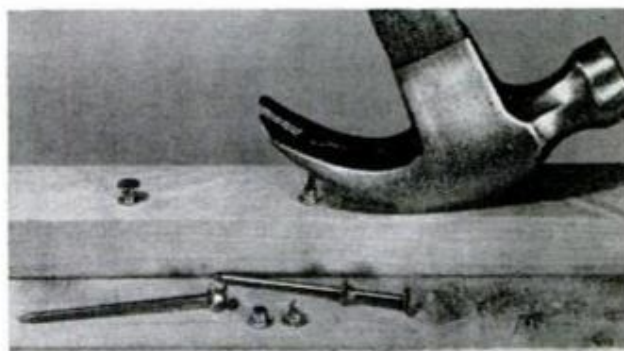
—Walter E. Burton, Akron, Ohio.



Two-headed nails

For temporary fastening, when regular double-head (scaffold) nails were not at hand, I slipped each nail through a metal eyelet, with eyelet head toward nail point, and drove the nail until the eyelet was firmly against the wood (but not collapsed). Later, the projecting nail head was easily pulled with a hammer claw for quick removal.

—Walter E. Burton, Akron, Ohio.



NEXT MONTH IN SHOP AND CRAFTS

THIS SHOP PAID FOR ITSELF—AND GREW. This fourth shop in *PM's* popular Great Workshops series is of factory-like proportions, yet you can duplicate it in part or wholly, as you wish. Its owner, C.E. "Doc" Bannister, of Pomona, Calif., added to his shop without straining his pocketbook by doing cabinet jobs for friends and neighbors. Learn about Doc's common-sense approach to a dream shop and how, perhaps, you can do the same.

FURNITURE WITH A TWIST. This unusual table and chair set, plus lamp, can be built quickly and inexpensively because they're made of corrugated cardboard. Complete instructions in the June *PM* will let you be first in your neighborhood to build paper furniture.

HOW TO BUILD AN AIR COMPRESSOR FOR \$70. More economical than buying a comparable commercial unit and a satisfying project to boot, this useful machine has an automatic switch that turns it off when pressure reaches 85 p.s.i. and on again at 55 p.s.i.

SPACE-SAVER DESK-BUNK BED—MAKE IT FOR \$50. Its good looks alone should start you on this project, but if not its two-in-one function will. Each youngster can have his own king-size desk—beneath his bed—so floor space serves usefully 24 hours a day.

THINGS TO MAKE IN YOUR WORKSHOP—contemporary bridge table, flame-carved candleholder, air rifle target, four-station bird feeder and illuminated watch stand.

Recreational Vehicles:



How to pick your new one

More luxuries in less space provide more kicks for compact motor camping. By BILL McKEOWN, Outdoors Editor

IN 1972, YOU CAN CHOOSE from more new motor-camping rigs than ever before. Recreational-vehicle trends show a widening span—now there are mininitrailers that seem designed for malnourished midgets up to bus vans big enough to take your favorite football team along. In between are so many vehicle variations you need a scorecard to figure what's right for you.

A selection equation could be stated: More size equals more conveniences and added cost. Not necessarily more fun and comfort. That depends on the kind of camping you enjoy. If you want to head out with everything *and* the kitchen sink along, you'll need a bigger rig. It will be handsome, too. The gypsy caravan look is long gone, and now you can go in style.

And if you're willing and happy to unfold a tent over a trailer bed, you can even hitch up behind a four-wheel drive and explore remote wilderness in your own modern covered wagon.

If in doubt about which rig, try the rental route. A week of camper living can also give you a good lead on your family's likes and dislikes as to outdoor essentials.

First, here are rigs your present car may handle:

Travel trailers are still the mobile motels that sell the most of all. Right now you can buy a conventional trailer from 40 companies, or one that looks like an astronaut's capsule from Apeco, Amerigo or Boler. There's a railroad caboose replica from Semaphore Industries, or a Boles Aero with a compartment that slides out to provide an extra room. Want a line

where you can start small and shop your way up through a dozen choices? Starcraft, Holiday, Blazon, Airstream, Avion and Boise Cascade companies and many others offer good examples of variety.

The new tiny trailers may measure only 13 to 18 feet and still sleep four or more. At about 20 feet come refinements like bathtubs and compact conveniences that may offer more than the comforts of home. While trailers are made with standing headroom, some like Larson's Rolite Retractable Wall, Snyder telescoping HiLo models, Tow-Low from Ratcliff and others lower to five feet for easy towing and fitting in a garage. Several feature an open back porch to carry snowmobiles or motorcycles, or a larger rear door to stable horses inside. The largest trailers need a



PIGGYBACK POP-UP: This 400-pound fiberglass four-sleeper, called the Tripper Car Camper, sits in car trunk after removal of its lid and rides in lowered position shown. Parked for night, its top is raised to get six-foot headroom. Canvas sides enclose cab-over double bed, dinette aft that lowers into two more berths. Garage hoist to store the \$1190 camper overhead off car is made by builder, Tripper Industries, 1533 Monrovia Ave., Newport Beach, Calif.

POPULAR MECHANICS



MINI-MOTOR HOMES (above), most rapidly growing of popular motor homes, were once called chopped vans because builders had to cut off the van body up to the cab to get a suitable chassis to overload. Now units like this 19-foot Kayot are built properly on a body prepared by the manufacturer for this use. Dodge, Chevrolet, Ford and GMC are all supplying van chassis ready for this conversion. The mini-rigs offer the walk-through passageway from the driver's seat to the camper that many pickup campers do not have and, unlike travel trailers, allow passengers to ride legally in the camper body. The rigs can travel at highway speeds, sleep four to six

VAN CONVERSIONS come in assorted types, with Travco one of the leaders in the field. New Royale Deluxe van conversion (above) is latest addition to the Travco Family Wagon line. It's a Dodge B-200 Tradesman van adaptation that allows the owner to travel and garage the vehicle with the top down and then raise it for headroom at night. The rig sleeps two in double bed that converts from the rear dinette. Power steering and brakes are standard. Travco, a division of PRF Industries, is in Michigan where the complete line of Dodge motor homes is produced as well as Commercial Travelers for business use (a popular motor-home application). Other PRF Industries companies that make RV models include Compact Equipment Co., maker of Dodge Family Wagons; Sightseer Corp., maker of Sightseer Motor Homes; and Motor Homes, Inc., producer of Ford Minihome, a popular Econoline conversion whose name has come to define an RV type



FIFTH-WHEEL TRAILERS usually hitch onto a pickup-truck cargo bed, but this new Shadow design from Harmon Industries, Warrensburg, Mo., tags onto a passenger-car rooftop. A removable steel plate, bolted to brackets along the roof gutters, takes advantage of the roll-resistance built into modern roofs to firmly anchor the trailer hitch. Great maneuverability and easy tow handling are claimed for these rigs. Models of 18, 23 and 27 feet are being produced, and unfinished units are available for extra savings. Shell for the Shadow 18-foot Mini will start at about \$1700; price is \$6500 for the completed 27-footer fully equipped. Driver reports indicate the design is aerodynamically suitable and does not buffet at speed or in strong winds



FIFTH-WHEEL TRAILER, in a conventional model of this unconventional hookup system, shows characteristic large size, split-level upper windows of two-sleeper area over cargo deck hitch, tandem wheels, large living room. Model above, the Roadcruiser V from Apeco Corp. towed by an International Harvester Travelette with six-passenger two-door crew cab for the family, comes in 26 and 28-foot lengths and optional interior layouts that can sleep six. Hooking up averages three minutes, and hitch can be removed to permit normal loading of cargo in the pickup. Airconditioning, eye-level oven and stereo are popular options for luxury travel

big car or small truck for towing. Trailer prices range from \$800 to \$10,000 and up.

Camping trailers are more familiarly known as tent trailers, the low-profile lightweights any car can tow, that open out into canvas-walled cabins to sleep as many as 11. Following Apache's lead, with plastic "solid-state" rigid walls replacing the canvas, similar models are appearing. Big names in tent trailers include Coleman, Starcraft, Nimrod and others. Costs run from \$300 to \$2000.

Fifth-wheel trailer is the strange name for a large unit that hitches to a connection in the cargo bed of a pickup truck. These, plus **mini-trailers** and **mini-motor-**

homes, are newly popular rigs discussed more fully in pages that follow. Interesting variations are a fifth-wheel trailer, called the Shadow, that hitches to the top of a passenger car. Another hooks to a post in the middle of the car trunk, or like the Tripper, sits piggyback inside.

Pickup camp covers and **pickup camper bodies** of cabover design cost \$200 and up for the caps; \$1000 to \$4000 for turtleback camp bodies that fit pickup trucks.

Motor homes, fastest growing of all RVs, range from \$5000 for van conversions and \$7000 for a Winnebago 18 up to \$25,000 and up for the biggest of camping's self-propelled palaces. ★★★





TRAVEL-TRAILER LUXURY can include extensive accessories. Holiday Rambler offers as options only upholstery color selections for its new 31-foot Royal Holiday. All other equipment aboard the \$14,210 rolling palace is included in price. Listed as standard equipment are built-in color TV, centralized vacuum cleaner system, filtered and purified water system, airconditioning, under-floor heating, name appliances, free-standing living room furniture, telephone, 26-foot fold-out awning, front and rear travel awnings, built-in stereo tape deck, AM/FM radio and power antenna, Uni/Ryde suspension, electronic sway control and more

PICKUP CAMPER CONSTRUCTION is now rugged enough to last for a number of years and suitably styled so that it no longer resembles a box. Frolic truck camper from the Frolic Homes Div. of Midas-International reduces wind resistance and offers an increase in roadability with a new slanted front window for cabover section. A brightened interior is also reported. Typical of the overall lengths that are now popular for pickup mounting, the Frolic is available in four lengths from 8 to 11 feet. Standard equipment in the 7½-foot-wide units includes an LP gas light, urethane-foam cushions, camper jacks, plus an optional shower and swing-up bunk. Midas production experience covers 180 models from Travelmaster, Noris, Volunteer, Smokey, Ken-Craft and Frolic Divs.



MOTOR HOMES, the most expensive of RVs, also have the most to offer and are the fastest growing in overall popularity. Advantages include ability to sleep six in a unit like this Chevy-chassis Chinook at far left, most of the comforts and appliances of home, a chance to ride with and talk with the driver—unlike pickup campers and trailers—and portable accommodations that require no setting up. But once parked in a campground the motor-home man may not want to pull out again and run the chance of losing his site while driving to town for a few groceries and facing the problem of finding a big enough parking space on a busy street. Many motor homers are now seen towing a family compact, like this Vega, behind the rig. The car needs manual stick-shift transmission in neutral and transmission oil topped off. Boats, horse vans or mother-in-law trailers can be similarly towed

Convert your van to an inside- outside camper

By GENE RAPP

ACCOMMODATIONS for four or more at night plus versatile arrangements that provide camping conveniences during the day are the result of the workshop project shown here. Though the installations pictured illustrate the setup for making a Ford Econoline into a camper, Dodge and Chevy vans can be fitted out equally well. Even a station-wagon family could adapt features of this arrangement to their needs.

Units shown are roof rack, a pop-up shelter to fit on it, bench-bunk with storage space under the seat and a food-storage cabinet with drop-leaf table. Without the rooftop shelter, the platform serves as an overhead luggage rack to carry supplies and camping gear. Even with the lean-to type pop-up top installed, there is still a forward luggage space the width of the car and about 43 inches long available for stowage. Since the shelter hinges to the roof rack with removable pins, it is easy to convert the platform from elevated sleeping porch to luggage carrier or spectator deck.

Starting point in the construction of the rooftop camper is the placing of 2x6s across the roof at the rib support points of your vehicle. Sketch an outline of the roof contour on each 2x6 and then cut on a bandsaw. Exact dimensions of the 1/2-inch plywood deck sections will be determined by the width of your vehicle roof. These sections are screwed to the contoured ribs and edged with 1x10 white pine side rails. White duck canvas strips are glued to the underside of the rib supports to prevent scratching of the van roof. Trailer skin sheeting

VAN becomes more versatile than ever with the addition of the easy-to-build gear shown here. Night can find five sleeping in and on top of rig



covers the side rails and the pop top; it is edged with aluminum trim. Eyebolts or loose-pin butt hinges are placed on the deck forward of the shelter top as hinges; more eyebolts or pad eyes provide anchor points for lines securing gear boxes and equipment. Turnbuckles snug the platform to hooks that catch under drip rails.

For the pop-up top, 1x10s form end-pieces, and ribs and sidepieces are of 1x4. The 1x2 longitudinal stiffeners are covered with 1/8-inch hardboard and trailer skin sheeting. Suitcase latches hold down the aft edge of the top. A light ladder can be made of tubing, or a conventional wood ladder can be cut in half for stowage under the shelter top and assembled by bolting it together with wingnut bolts that secure steel bar stiffeners.

The food-storage cabinet and combination bunk bed and bench can be altered from the measurements shown here to accommodate smaller or larger vehicles. Vinyl-covered particleboard or 3/4-inch plywood can be used for the major components of both units. Vary construction to allow for rear wheel-well positions in your own vehicle. With the spare tire removed a Coleman refrigerator can be fitted in its place next to the food cabinet.

Especially for spectator sporting events, a vehicle of this type will prove valua-

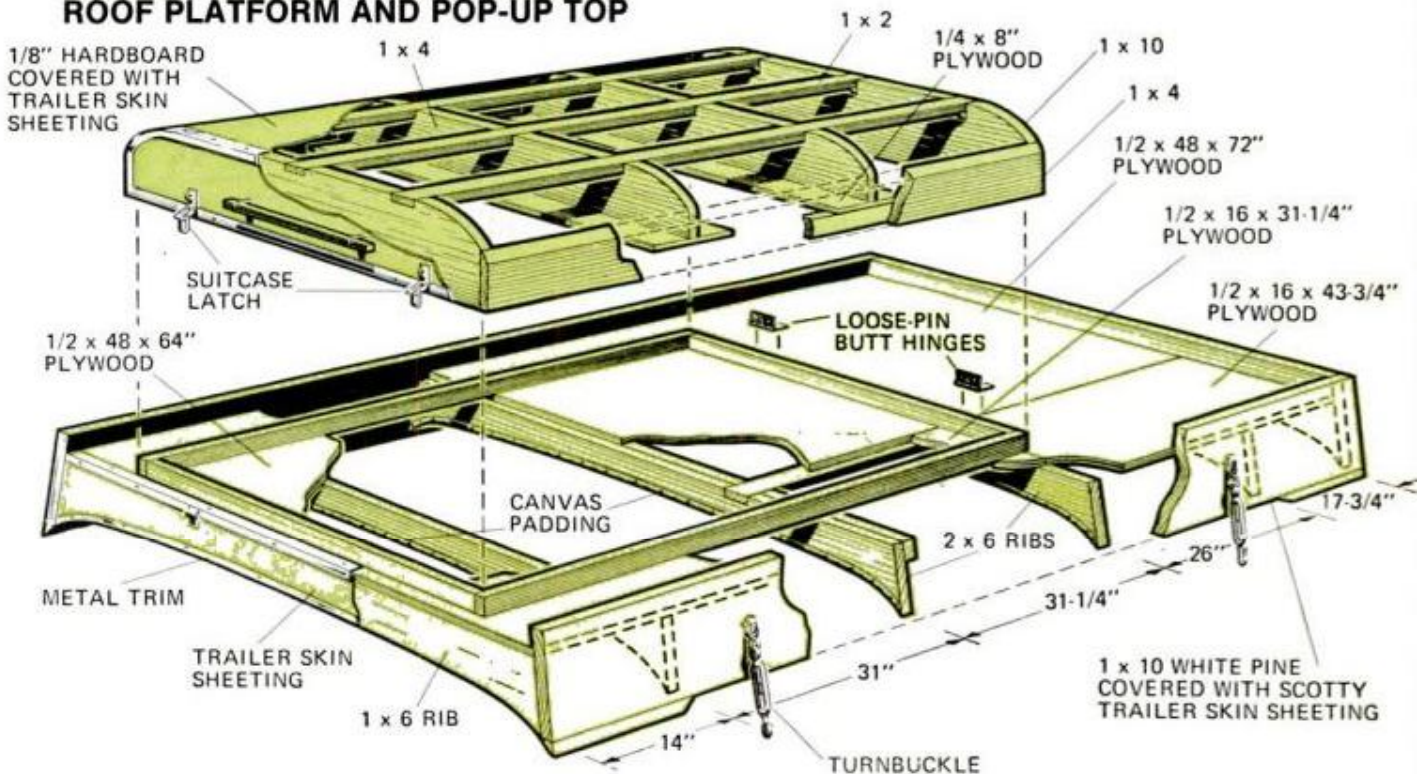


ROOF PLATFORM is light enough to allow youngsters to mount it on a cartop. The pop-up shelter follows



SETTING UP the rooftop pop-top is a simple one-man operation. Two can then sleep in this shelter

ROOF PLATFORM AND POP-UP TOP





FRONT-ROW BOX for spectators at sporting events results when shelter bunks are left off and deck chairs and umbrella positioned instead (left). Add on the pop-up top, tilt it up and rig curtains, as shown above, and the kids have their own compartment

ble. While he's waiting for the action to start, a camper can stretch out on the bunk bench, out of the sun, or lift the top berth into place and watch activities outside the van through rear or side windows. Once the race or the game begins, the roof

platform, complete with sun umbrella and deck chairs, becomes an ideal vantage point. For the photographer particularly, a cartop platform affords unobstructed shots over the heads of the crowds.

Youngsters would enjoy pitching a small

SETUP FOR CAMPING requires only the removal of rear seats and sliding in of the bunk and storage units

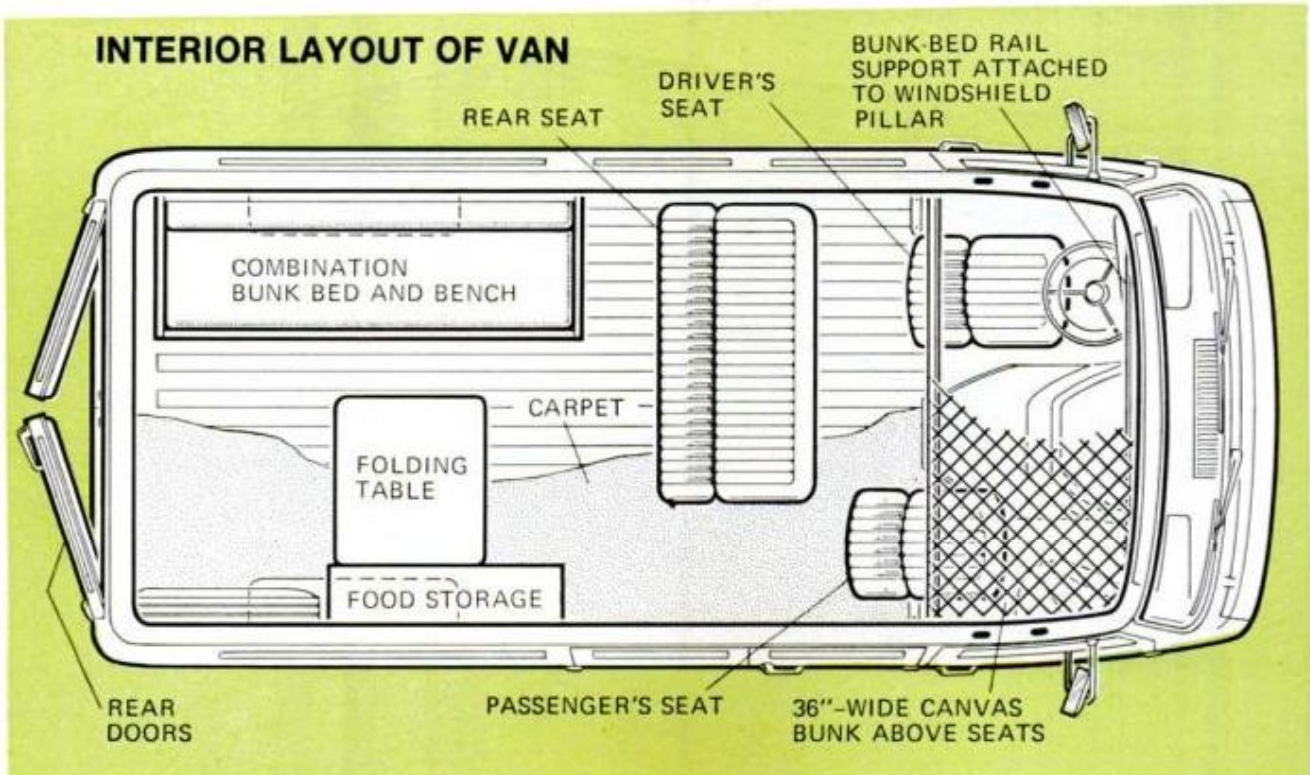
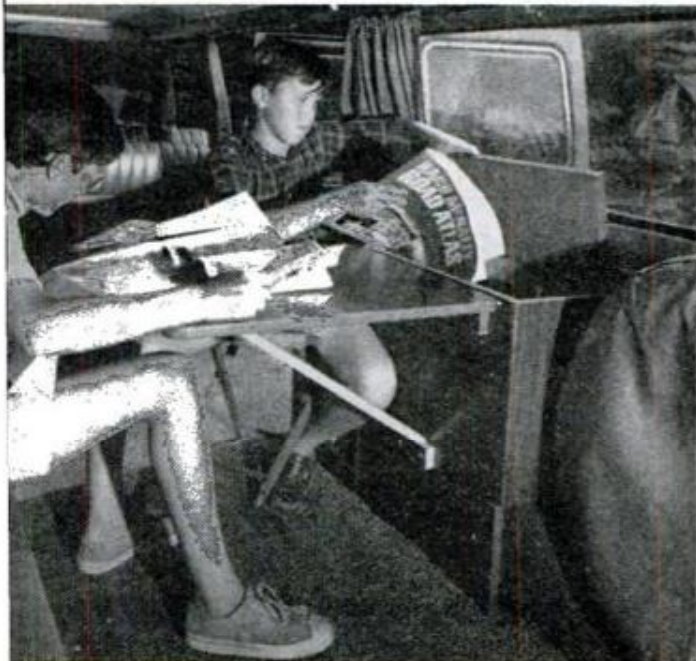
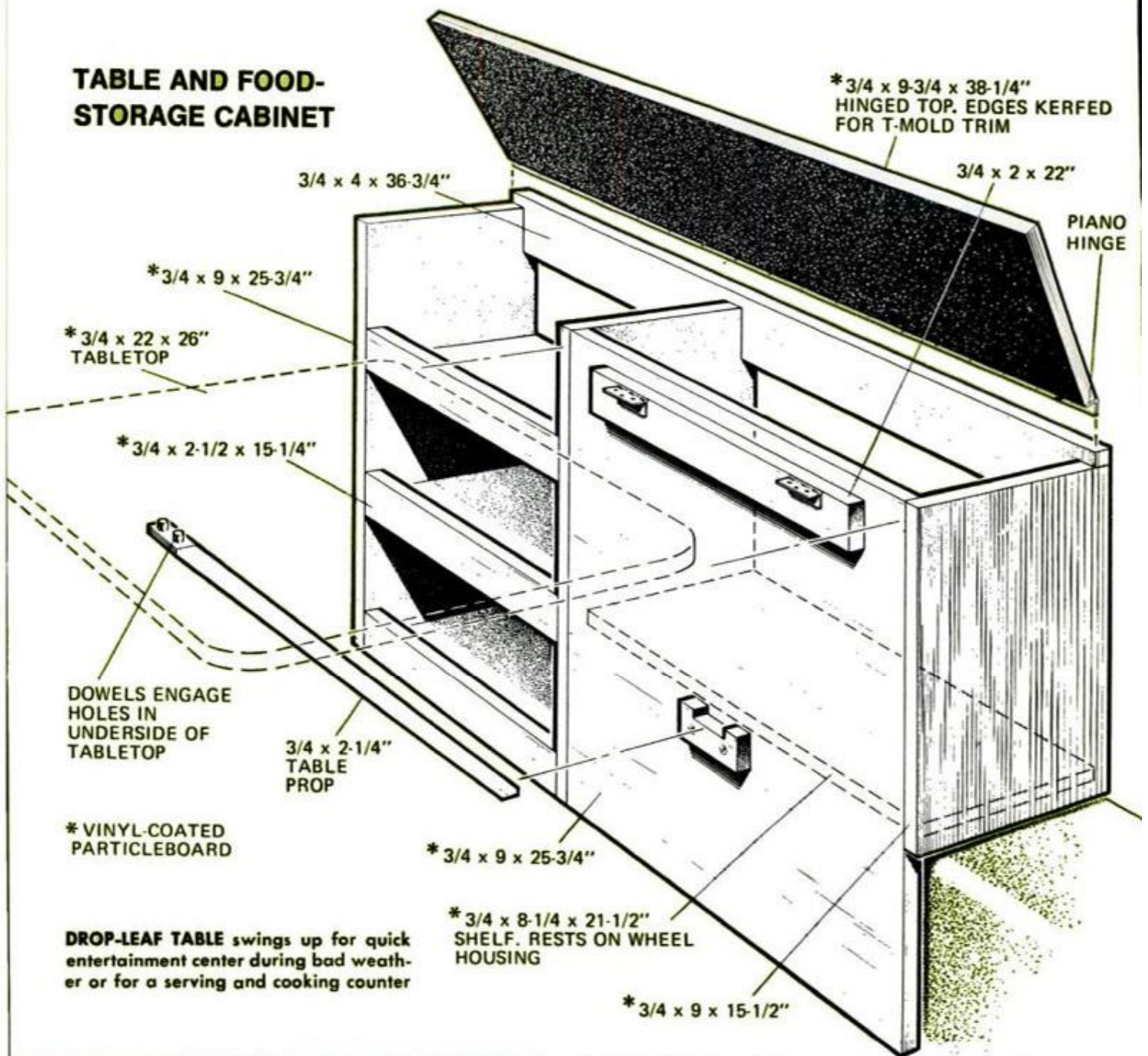


TABLE AND FOOD-STORAGE CABINET

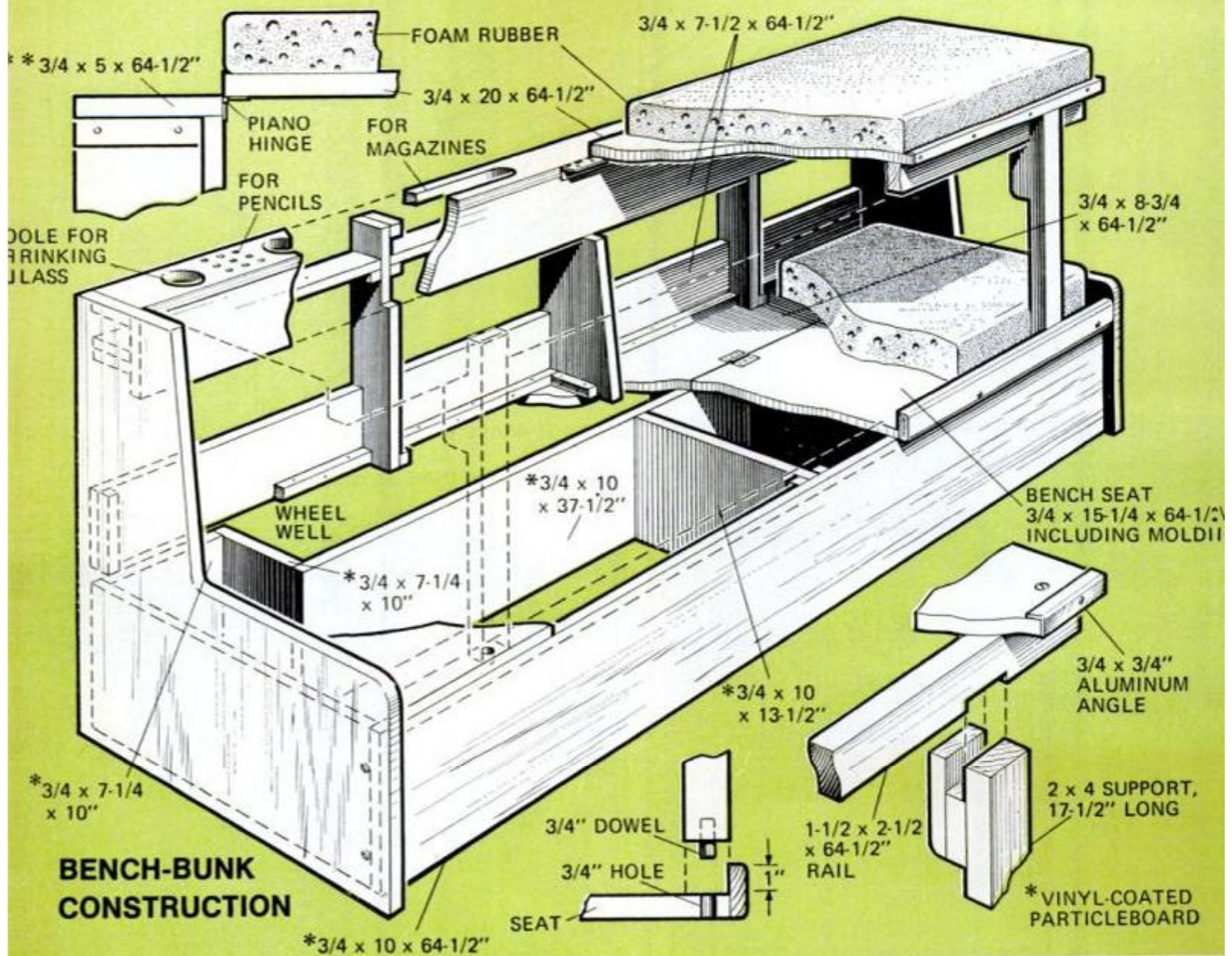


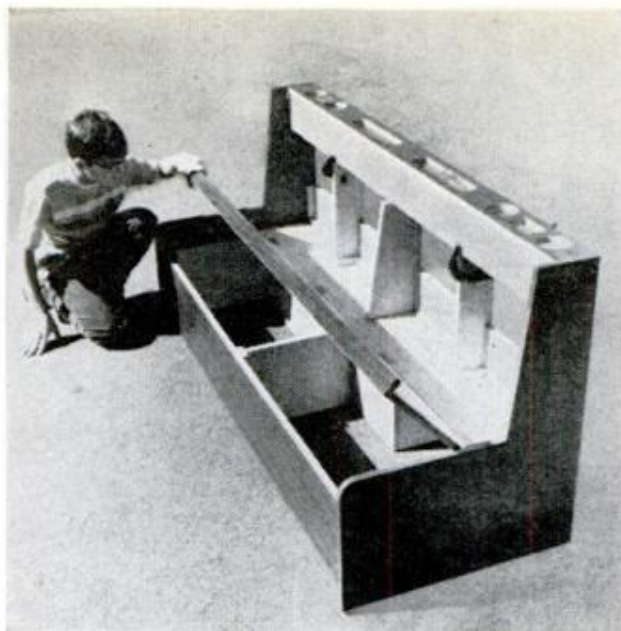
STORAGE SPACE seldom seems sufficient in camping rig, and the addition of these easy-to-build pieces allows numerous items of gear to be stowed easily





DOUBLE-DUTY BENCH-BUNK serves three functions—as daytime seat, as upper and lower berths at night and as a spare storage bin for sleeping bags and gear at any time. Such items as flashlights, pencils, insect repellent and reading materials are stored along back in easy reach

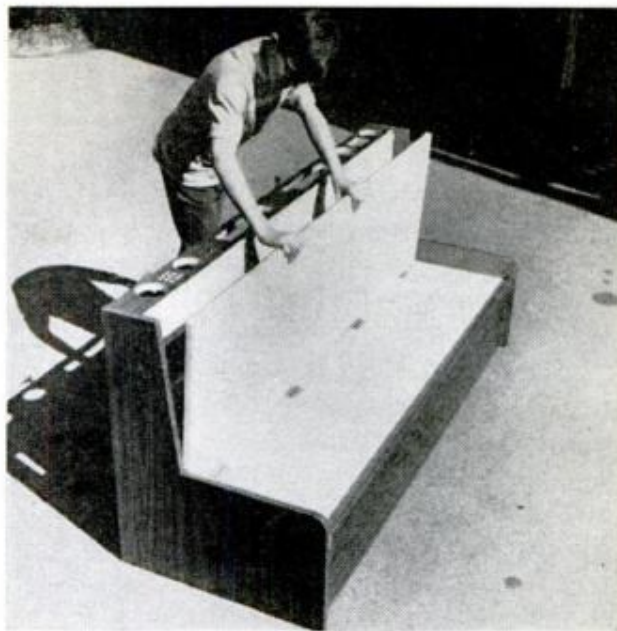




ASSEMBLED BENCH-BUNK (photos above and below) has storage areas plus cutout to fit over wheel well

pup or backpack tent on the roof platform if the pop-up top has not been brought along.

Sleeping five adults is possible if a canvas pipe berth, with rail supports secured to side and windshield pillars, is slung over the forward driver and passenger seats. Two more then sleep on the upper and lower berths of the bunk-bench, and the final two bed down up on the roof pop-up shelter after the roof has been propped up, side and front canvas curtains snapped on, and mosquito netting installed if necessary. Even with fewer campers along, the canvas berth over the

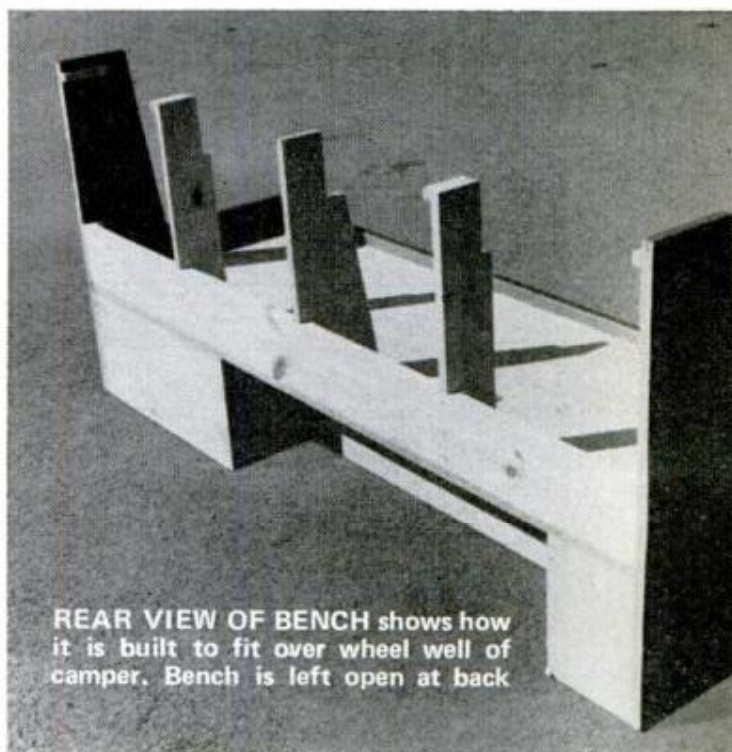
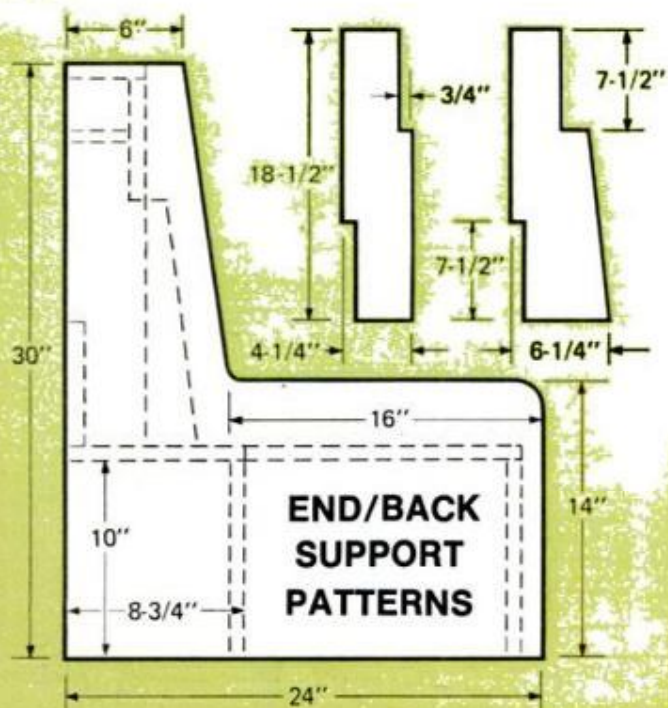


BENCH BACK becomes bottom of upper bunk when lifted out and legs dropped to make double-decker

front seats is worthwhile since it provides an ideal storage spot for gear while you're living inside during wet weather.

Headroom and a place to stretch or dress standing up can be rigged with a canvas dodger or fly stretched out from the erected pop-up top. Inside camp cooking is easy with a gas or LP stove on the drop-leaf table. Cutouts, as indicated, can be made in the back of the bench-bunk for glasses, drink cans and magazines.

Construction of these units can turn any van into a camper. Lifted out, they allow quick return of the vehicle to its former use. ★★★



REAR VIEW OF BENCH shows how it is built to fit over wheel well of camper. Bench is left open at back

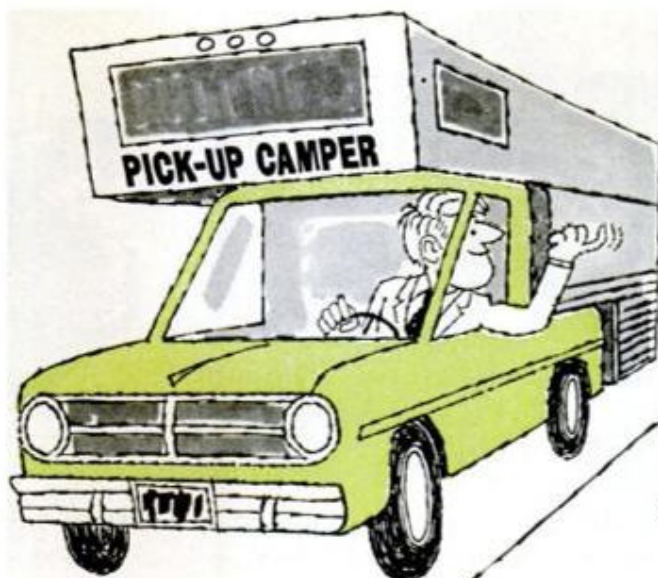
20 questions motor

By V. LEE OERTLE

Illustrations by Alnos Hall

● *What mileage do RVs get? Which is most economical?*

The car pulling a travel trailer may average 8 to 11 mpg. A pickup truck hauling a camper body can do slightly better—8 to 13 mpg. Motor homes up to 10,000 pounds average up to 7½ or as poor as 5 mpg. A car with a light tent trailer or a light van camper does best. But economy isn't everything; don't forget comfort.



● *Are trailers made in the East better for cold weather?*

Thickness and efficiency of insulation depend on builder's standards, no matter where he's located. Check his reputation, inspect units, read the specifications. Remember you can order extra insulation built in.

● *Is wind resistance very important in picking a camper or motor home?*

No. Engine power, driver habits, tire size, tread pattern, axle ratio, highway surface, elevation, gas quality, engine efficiency have more effect on handling safety and operating economy.

● *How big a trailer will my car tow?*

Tow safely is the question. Even a compact can haul 5000 pounds, but not easily. Here's a good rule: For subcom-

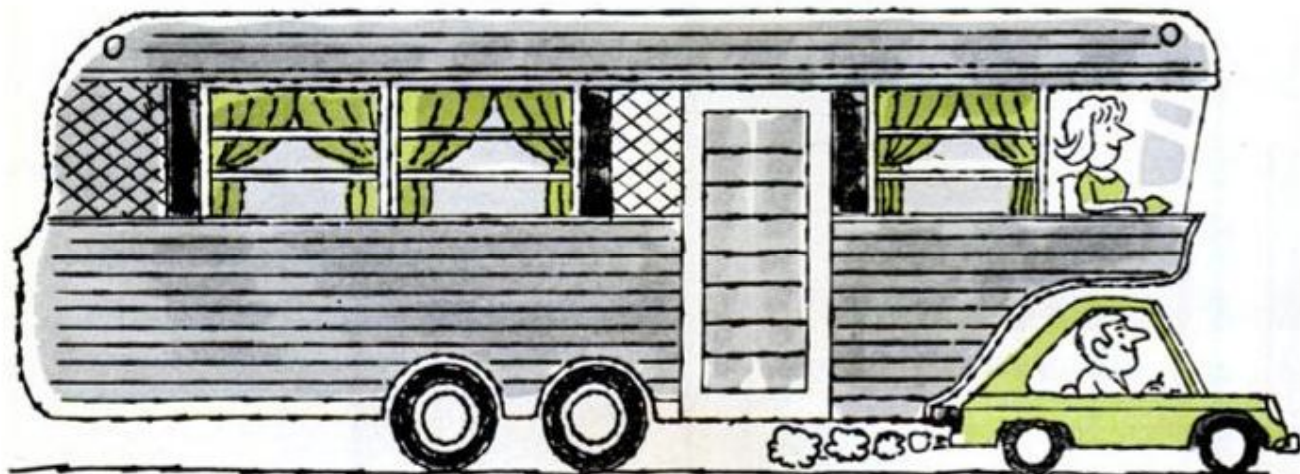
pacts, tow rigs under one-third of car weight. Compacts can tow half their weight. Intermediates tow up to three-quarters of their gross weight. Standard to luxury cars can slightly exceed their own weight. A 5000-pound car should handle a 5000-pound trailer.

● *Tent-trailers look flimsy but they cost less. Are they comfortable? Durable?*

Improved synthetic side materials, metal or fiberglass tops, new lift mechanisms make them durable. Galley and sanitary provisions make them as well equipped as any other RV, and they sleep more—up to 11. Take your pick from \$500 to \$3000, and any car can tow one.

● *Are high-sided pickup campers dangerously top-heavy?*

The cab-over section usually weighs



campers ask most

only 100 pounds. Heavy appliances are low and make the rig stable. Appearances are deceiving.

● *What does "self-contained" mean?*

The rig usually has a stove with oven, refrigerator, water heater, space heater, water and light systems, toilet, holding tank, and can camp without outside hook-ups for limited periods.

● *How long can a family travel in a self-contained rig before emptying the tank?*

Two adults and two children can travel about four days before dumping the average holding tank, and a careful family could stretch it to a week.

● *Is it true campsites are almost impossible to find these days?*

No. Avoid the busiest national parks on the busiest holidays; try some of the private campgrounds nearby. There are 10,000 in the country with 600,000 campsites. Many take advance reservations.

● *Is an equalizing hitch a gimmick?*

A load equalizing hitch is very worthwhile for trailers over 2000 pounds, and any rig of any weight with handling problems. Through mechanical leverage, the trailer-tongue weight is distributed between the tow car's front and back wheels.

● *Is stick-shift better than automatic?*

An automatic transmission seems to last much longer than a stick-shift clutch before overhaul, especially for inexperienced or ordinary RV drivers. It gives more efficient control, shifting when necessary and reducing engine wear.

● *Will trailering hurt my tires, brakes, engine?*

Antisway bar, load-equalizing hitch and premium-grade tires will lengthen tire life. Most of the trailers over 1500 pounds now have separate brakes; downshifting should be used on downgrades. Match car weight to trailer weight, use reasonable speeds and you should have no extra engine wear.

● *Are tandem-axle trailers better?*

Tandems are best for the largest trailers. Engineers say "every bump is just half a bump" with four wheels. The trailer body takes less of a beating.

● *What are GVW and payload factor?*

Nearly every car and truck has an identification plate with gross vehicle weight—its legal loaded limit. GVW minus gross weight (empty) is payload factor—weight of passengers and gear you can carry.

● *Do RVs pay for themselves in travel costs?*

Not exactly, but at \$11.50 a day for a family of four (campsite \$3.50, ice 50 cents, propane 50 cents, groceries \$7) plus gasoline, it's a lot less than resort expenses.

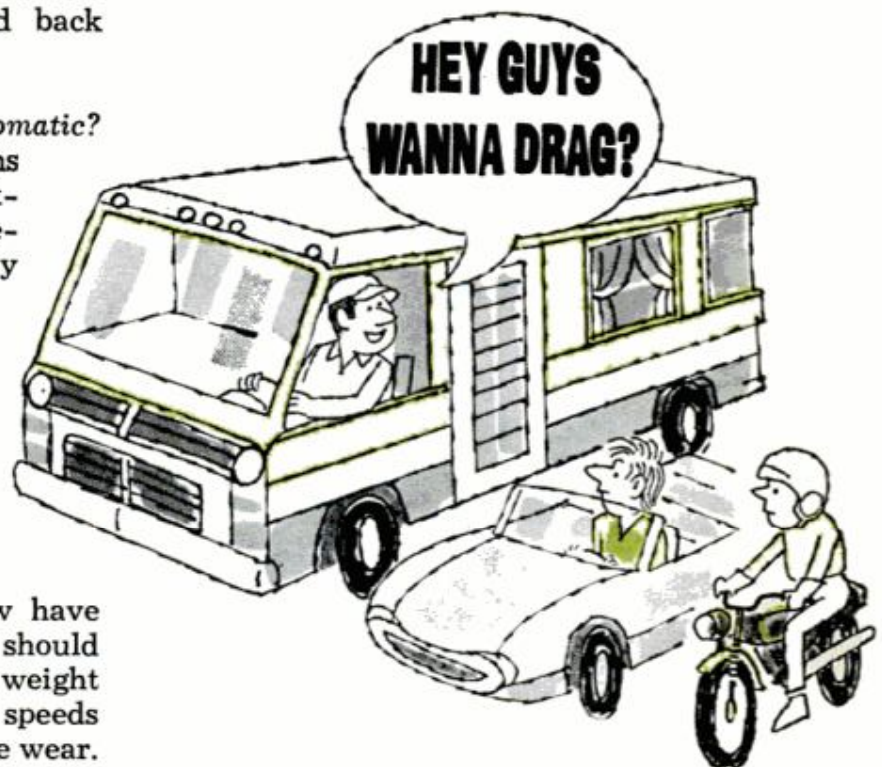
● *Is a pickup better than a trailer?*

Trailers can be towed by various vehicles, parked and left, and have more room. Pickup campers are much shorter overall, can be driven faster. Take your pick.

● *Are electric trailer brakes best?*

Hydraulic and electric are both safe if properly installed, but hydraulic should

(Please turn to page 191)



How to be a savvy RV

Try these special handling tips; they'll help



ANTISWAY CONTROLLER should be installed to keep rig from straddling white line at left, above. Trailer towers should always stay in right lane except to pass. Whipping back and forth and sway are danger signs



SUDDEN STOPS can be part of any vacation, and stopping distance is much longer with a large heavy rig. Brakes and tires must be kept in top shape, all loose gear must be secured and children kept out of aisles



TIE-DOWNS were forgotten by the driver who borrowed this pickup camper. A fierce gust of wind actually blew the camper right out of the truck cargo box. Remember your camper also requires separate insurance

pilot

By V. LEE OERTLE

you prevent most accidents



TRAILER CARGO on flatbed trailer must be secured as well. Without chain binders at all four corners, racer could plunge forward during emergency stop, crash through camper, as has sometimes happened



MIRRORS at left and right are particularly needed by the RV driver as faster cars continually pass him. Use a windshield scraper when mud and snow collect if the mirror is too far out for easy cleaning



MAY 1972

THE DAY OF MY ACCIDENT I should have noticed the clues ahead of time. Summer heat had leached oil through the blacktop pavement and patches of it made purple splotches against the ribbon of highway. Then the Utah sky ripped open with rain and the oil began to drift over the crown of the road. The bus ahead of me slowed down, yet spray from its jumbo tires opaqued my windshield with an oily film.

Then, with no warning, the back end of my pickup camper skated around and I found myself traveling backward! The driver behind me stabbed his brakes, started to skid, and I knew we were all going off the highway. Later I learned my big flotation tires had hydroplaned up onto the layer of water and oil. My truck slid sideways down the sloping shoulder as I tightened my seat belt. Then the rear wheels struck a rock and we rolled until we came to rest upside down in two feet of ditch water. I opened the belt release, fell onto the cab roof, and forced my door open to wade away unhurt in the knee-deep muck. Through my shock I heard the truck engine running wide open though upside down, and I stumbled back to shut it off as other drivers stopped above to offer help. The cab was badly damaged but the camper body holding up the truck was only dented and not crushed. The accident, however, has made me give a lot of thought to factors affecting RV safety:

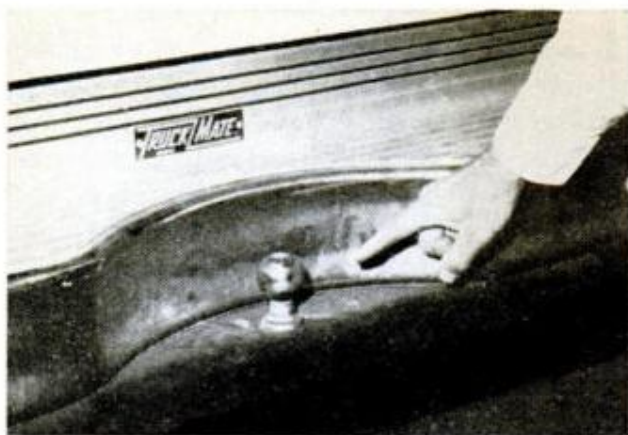
While under way in any kind of recreational vehicle, make a habit of stowing away securely all loose gear in your camper. A sudden stop can throw pots and pans around like clubs. Heavy tools should be stored in a special bin; not in the cab or passenger compartment. Passengers should remain seated and preferably safety belted, away from shelf corners, handles and knobs.

Pickup camper owners should pay more attention to tie-downs. A strong wind can blow the camper out of the cargo box. Vibration can loosen turnbuckles, so they should be regularly tightened. A camper body that pulls out during an accident may then be struck by a following car.

Travel trailer accidents can result when a big trailer towed by too small a car

STABILIZER JACKS should be checked regularly. If your tent-trailer jacks are left in a down position by mistake, they could catch in a chuckhole or on railroad tracks and tear the trailer away from tow car

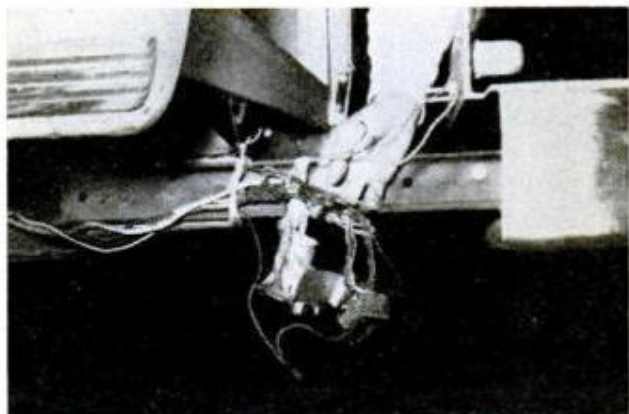
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BUMPERS of cars and trucks flex too much and are not designed to take the stresses of towing unless specially braced as shown. Stiffeners should run back to frame rails if large trailers will be towed



ELECTRIC BRAKES for trailer should be adjusted regularly before any chance of emergency stop. Set them so that they come on just ahead of car brakes to prevent any possibility the trailer might jackknife



ELECTRICIAN'S NIGHTMARE of wires is typical of too many trailer hookups if boat, horse and travel trailers are towed interchangeably. Couplers could drag on pavement, cause fire. Keep connections neat



CARPORT ROOF that this pickup camper hit crumpled corner of cab-over but did not twist or buckle its frame. The accident revealed the basic strength of this somewhat fragile-looking rig. Glass did not break



ROLLED OVER three times by the author, this camper body shows surprising strength from foam-sandwich construction. Truck landed upside down but only the cab was badly damaged by the rainy-day accident



FRONT-BUMPER LOAD, like the trail-bike shown, can cause an accident if it falls in front of RV. Rear bumper mounting is better, but unit should be set in special carrying rack and double-strapped as well

starts to sway. Other causes include too much speed and cheap bumper hitches. Use equalizing hitches and antisway bars.

Motor homes should allow extra stopping distance, avoid tailgating and save brakes by using lower gears.

Tires must be the right size and with

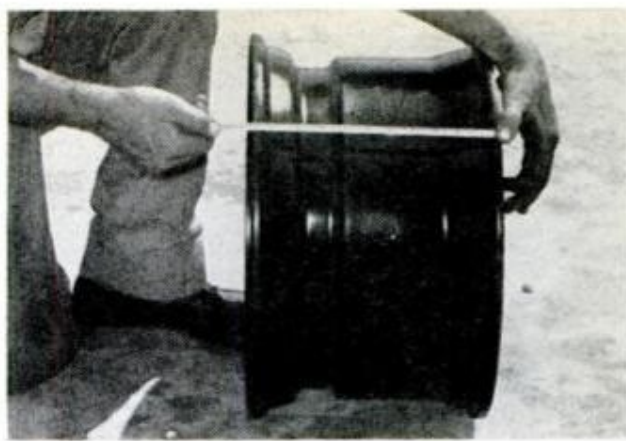
good tread of the same pattern at each end of an axle. Slow down during heavy rains.

Strap down boats carried on camper tops, bicycles and trail bikes on bumpers, and keep yourself belted in.

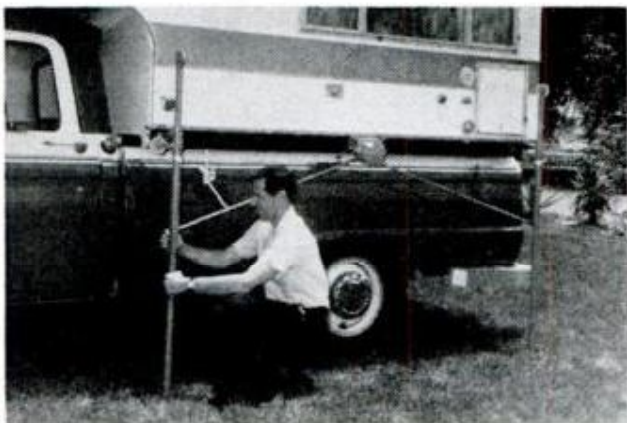
Should an accident happen, make sure



TOWED VEHICLE rates special care in hooking up. Use strong safety chain plus proper brake and light couplers. Hitch should be able to take strains of the load. Extension bumper shown had too much flex



EXTRA-WIDE RIMS must be used when you switch to superwide tires or an accident could result. Rim shown fits 10-16.5 Super-Single that provides truck with the wheel strength to match tire weight capacity



BUILT-IN JACK LEGS must be hinged up and strapped securely in place to prevent dropping and dragging camper off truck body. Sidewall brackets, floor bolts and turnbuckles can be combined to hold camper in



PROPANE SHUTOFF before starting trip is a safety precaution to prevent fire in event of an accident. The LP gas lines might be ruptured. Prechill your LP refrigerator and start it again at the campground

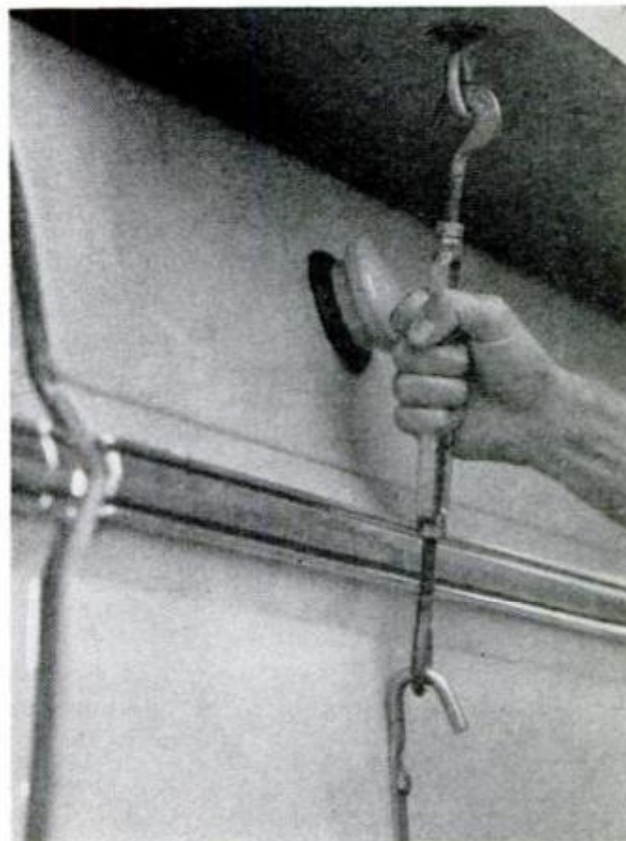


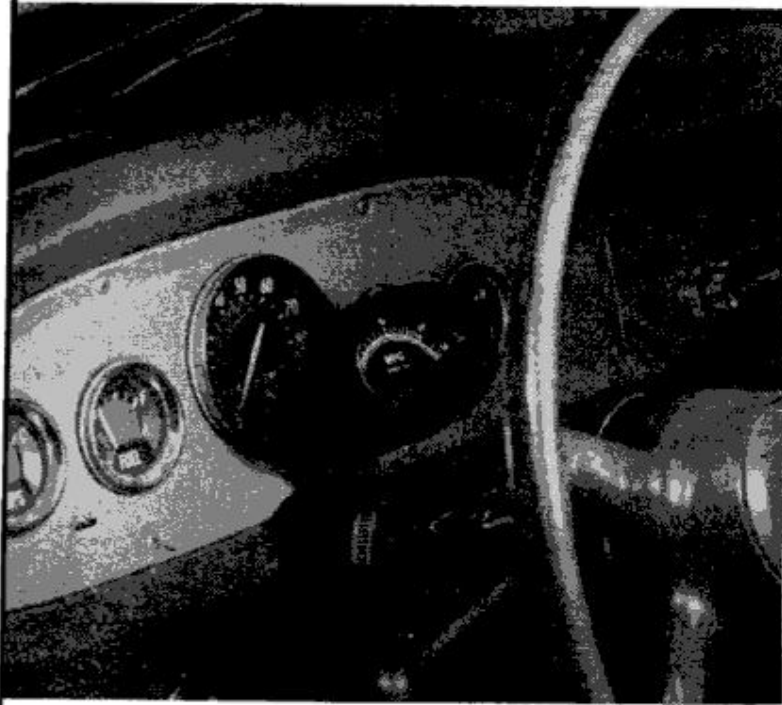
REAR LIGHT CHECK is important in daytime as well as at night. Examine brake stoplights and turn indicators regularly, and carry spare bulbs for them

TURNBUCKLE HOLD-DOWNS (right) can vibrate loose on a rough road, so check them at every gas stop. Don't apply leverage with a long-handled tool as it might break them. Snug turnbuckles only hand-tight

all passengers are out of the RV, shut off motor and propane supply, take pictures, record witnesses and light warning flares away from possible fumes. ★★★

MAY 1972





MPG meter: Constant measure for driving economy

This gadget will give you nonstop lessons on how to drive and can save you money any time that the engine's running

By MERLE E. DOWD

"**S**LOW DOWN NOW for your next gasoline refund," the miles-per-gallon meter seemed to be saying to me. "Try accelerating more slowly this time and I'll show you the difference."

I had just mounted it on the steering post of my International Travelall and was testing it out alone and while towing a trailer. Some of the featherfoot facts it has taught me include:

- Don't attempt to accelerate uphill. Of all gas-wasting habits, this is the worst.
- Maintain a constant speed while coasting downhill.
- Keep your engine tuned and timed precisely.
- Keep tires inflated to recommended pressure or slightly higher.
- Shift down to a lower gear when climbing hills with a trailer or camper.
- Change speeds gradually and learn to read the road ahead in order to avoid starts and stops.

By following these tactics, owners of pickups with campers, motor-home drivers, and trailer towers report up to 30 percent better gasoline mileage, with most of the drivers reaching a 20-percent improvement easily.

MILES-PER-GALLON METER combines readings from fuel flow into carburetor and speedometer reading

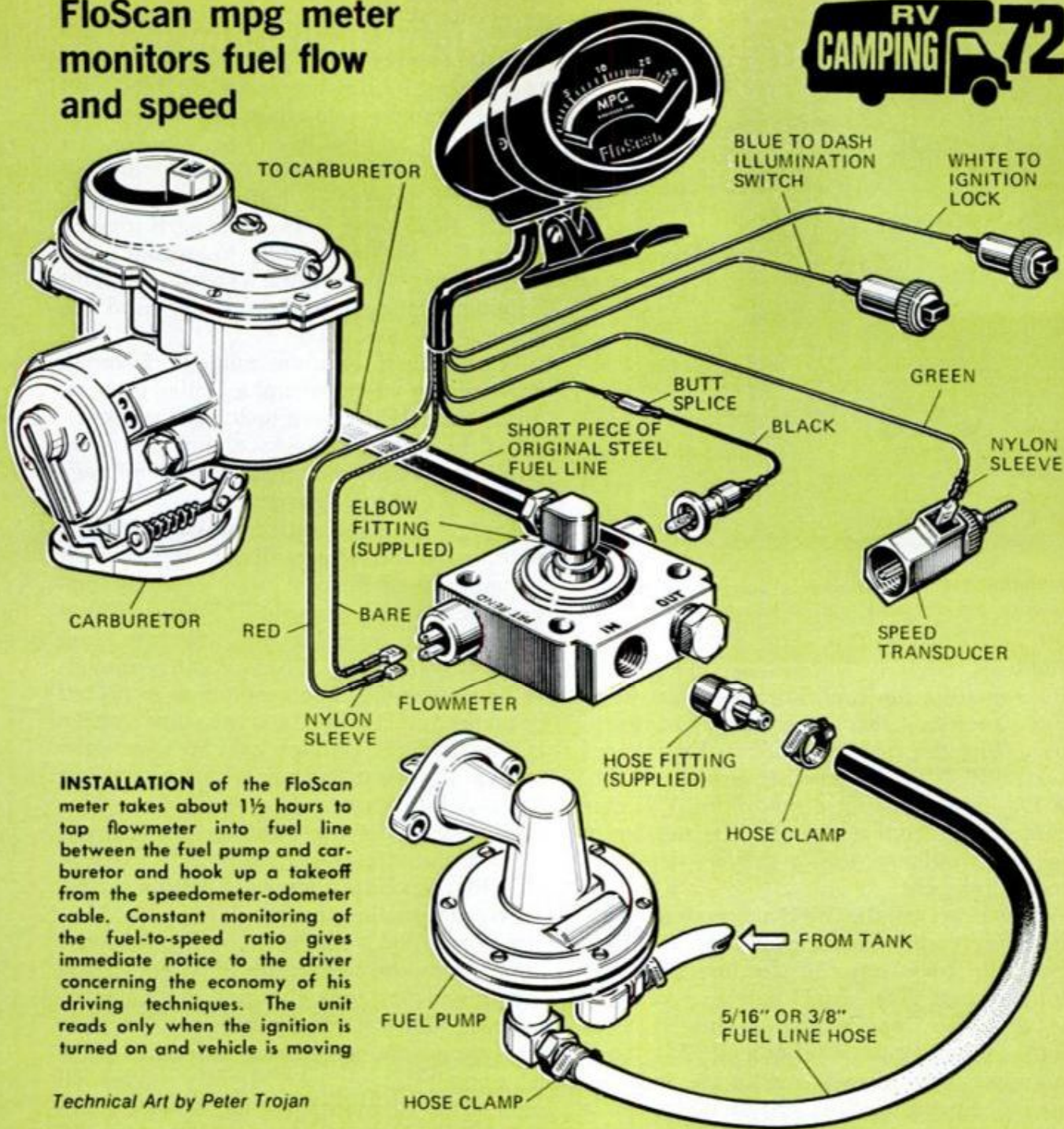
"Can you imagine how a 20-percent cut in burned gasoline could reduce air pollution?" one camper remarked recently. If a 12,000-mile-per-year driver cuts his gasoline bill by 20 percent, that's a saving of \$80 to \$90—more than enough to pay for the miles-per-gallon meter.

Cars and trucks with automatic transmission stand to benefit as much or more than cars with stick shifts. Trucks with four or more speeds can tailor their driving according to mpg meter indications even more precisely.

To get my gas-saving facts I mounted

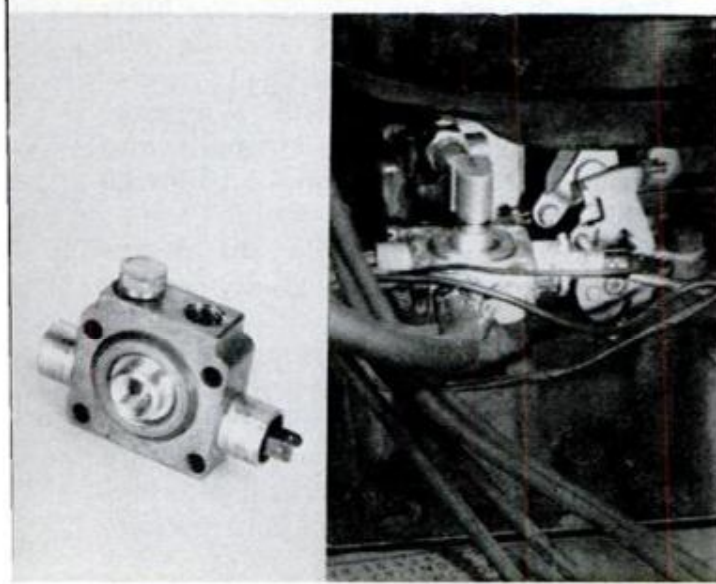


FloScan mpg meter monitors fuel flow and speed



INSTALLATION of the FloScan meter takes about 1½ hours to tap flowmeter into fuel line between the fuel pump and carburetor and hook up a takeoff from the speedometer-odometer cable. Constant monitoring of the fuel-to-speed ratio gives immediate notice to the driver concerning the economy of his driving techniques. The unit reads only when the ignition is turned on and vehicle is moving

Technical Art by Peter Trojan



a FloScan Model 10A mpg meter, hooked the fuel-flow meter into the fuel line, and connected the speed sensor to the transmission. Total installation time was about 1½ hours. The FloScan meter operates on a simple concept—convert fuel flow and vehicle speed into electric signals, send them through a solid-state circuit, and present the constantly changing ratio as a single miles-per-gallon indication.

Such meters are not new, but until FloScan devised a low-cost transducer

FLEXIBLE HOSE in fuel line helps keep heat from vaporizing gas to cause bubbles and distort flow



AIRCRAFT-TYPE wind recording gauges showed that velocity can influence gas consumption of RV rigs

FloScan devised a low-cost transducer for signaling the fuel flow, the units were too expensive for the average driver to use. Now the maker, FloScan Instrument Co., 3016 N.E. Blakely St., Seattle, Wash. 98105, is developing a model for VW-size cars where high engine rpm is necessary for good mileage, and a gallons-per-hour meter for boats.

The heart of the FloScan system is its fuel-flow transducer which is installed near the carburetor in the line from the fuel pump. The fuel flow activates a three-blade impeller which interrupts a light signal into a photocell. Photocell impulses vary directly with the impeller speed. Speed signals originate from a switching device inserted between the transmission takeoff and the speedometer cable. The speed sensor fits General Motors, Chrysler and most truck units. An adapter is needed for most Ford and American Motors cars.

Inside the speed sensor is a molded triangular nylon cam that makes and breaks an electrical circuit in direct proportion to the speed. The signals feed directly into the circuitry of the display unit. At idle, there is no speed signal and the mpg reading is 0. When you are coasting with the accelerator pedal at idle, the reading may go the full scale to 50 or 80 miles per gallon, depending on the model.

As I learned from driving tests with the

meter, I found that an increase in gas mileage comes with a slight increase in travel time. Allowing speed to bleed off when climbing a hill cost me in average speed but I learned to compensate for this by approaching the bottom of the hill faster. On one steep hill while towing a trailer at 25 mph I was getting 6 mpg in high. By shifting down to second and maintaining the same speed without lugging, I discovered I had increased the gas mileage to 7 mpg.

Wind affects gasoline mileage, I found, particularly when towing a trailer because of its bulk. No driving technique compensated for wind resistance, but the mpg readings indicated speed for best mileage with and against the wind.

Testing for comparative gas consumption with or without the muffler in the exhaust system, the difference was scarcely noticeable on the Travelall. Neither did a switch from regular to premium fuel change the amount of consumption enough to be noticeable. The result was expected because the Travelall's truck-type engine is designed for regular gas. So save your money if your engine burns regular without knocking.

How does driving strategy affect a car with automatic transmission? I tested a 1970 Plymouth station wagon with a three-speed automatic transmission and a FloScan installed. The main difference apparent was the higher speed at which the maximum mpg was obtained during level running. Engine efficiency was shown to increase as the speed was increased until it topped out at just slightly under 60 mph. The Plymouth owner reported increasing his average gas mileage from 17 to 21 mpg on trips by following the hints we have mentioned. When climbing hills without a trailer, he found that the transmission stayed in high with a mileage drop of 5 mpg. By shifting manually into second when the speed dropped below 20 mph, his gasoline savings doubled.

Average fuel consumption can always be figured as miles traveled divided by gallons consumed after a trip. But these figures do not provide the clues for better RV driving. By seeing the results on your mpg meter, however, while they are happening, you can experiment as I have to bring about immediate and continuous benefits for your driving and your pocket-book.

★★★

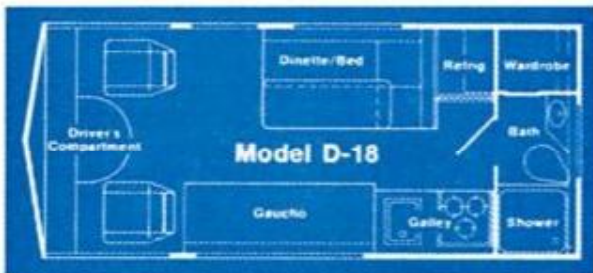
\$6,700*

Feature for feature and dollar for dollar, it's your best buy in a low-cost motor home.

Maybe you'll find a motor home with a lower sticker price than Winnebago's new D-18 Brave. But if you do, compare the standard equipment. Then start adding up all the extra money you'd have to spend to bring the other unit up to Winnebago quality.

The new D-18 is compact and easy to drive—at 18'3", it's no longer than a family station wagon. It has a big 318 cu. in. Dodge V-8 engine with power brakes, power steering, automatic transmission and dual rear wheels. It's built with exclusive Thermo-Panel® construction. Yet it's priced at just \$6,700.* And it includes dozens of standard equipment features that are either not available or optional at extra cost on most other low-cost motor homes. Features like water heater and shower, pressurized water system, forced-air furnace, 3-burner stove with oven, 4 cu. ft. gas/electric refrigerator, dual 70 amp. batteries, twin 20-lb. gas bottles and 15 amp. converter.

See the D-18 Brave and 13 other 1972 Winnebago motor home models at your dealer's now. Or write to Winnebago Industries, Inc., P. O. Box 152, Forest City, Iowa 50436. This is the year to find out how much fun you can have when you go the Winnebago route.



Go the Winnebago route



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P. O. Box 152
Forest City, Iowa 50436

PX

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I'm interested in () buying () renting.

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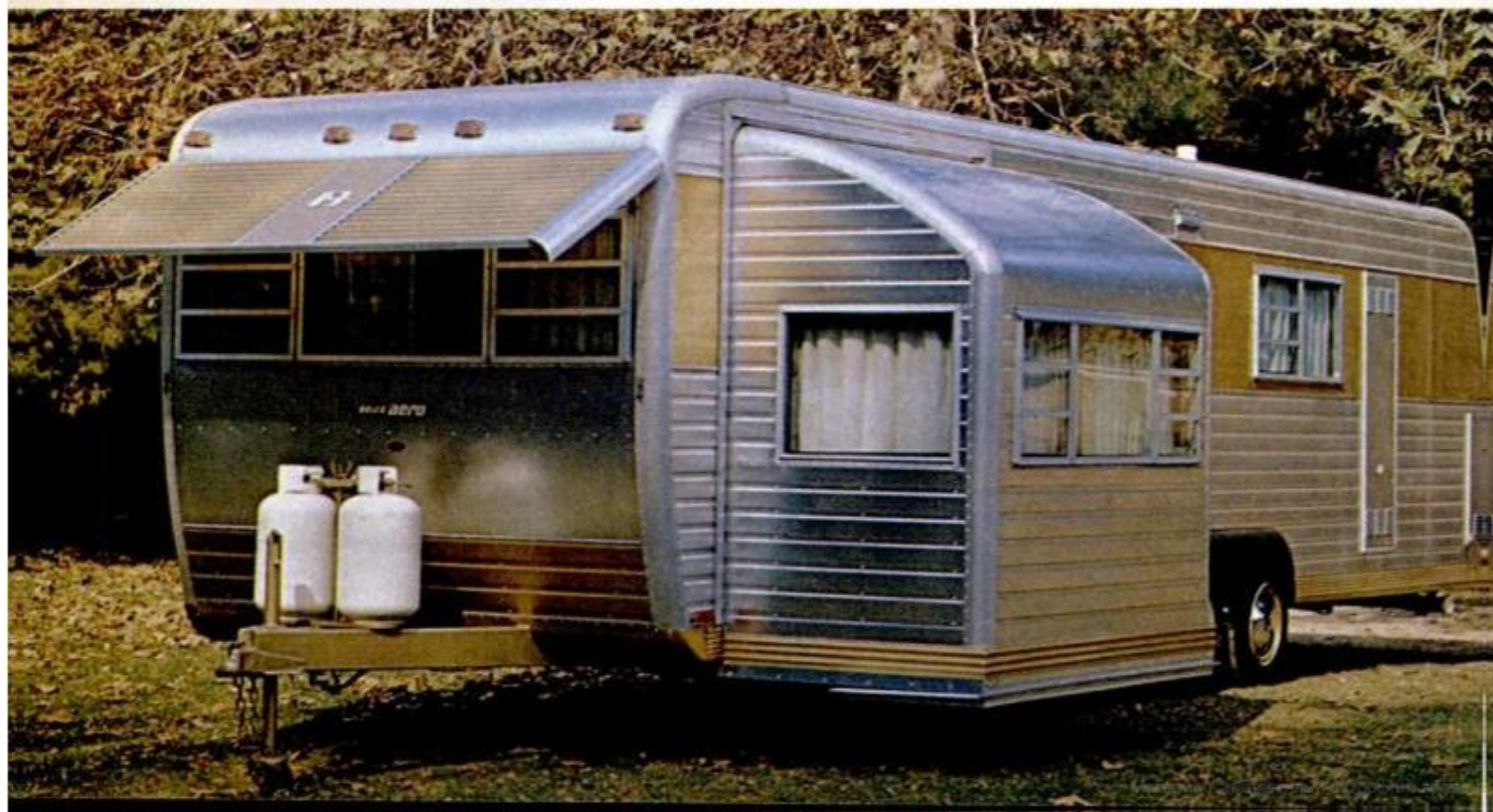
You have a lot to choose from



RV
CAMPING 72

WINNEBAGO'S new 18-foot Brave motor home at \$6795 matches rigs with fewer standard features

BOLES AERO widens living area with new Tilt-Out room for 34 and 35-footers, plus sliding glass doors



in rolling rigs this summer



SMALLER MINIS, bigger maxis and more for your money in nearly every RV are the trends for the better looking rigs for 1972. Styling outside, planned space inside, plus convenience and carefree performance, are characteristics the shopping buyer or renter can expect to get for his RV vacation.

COACHMAN camper mounted on Dodge pickup (top) offers new styling with option for choice of eight colors

DISCOVERER 25-foot six-sleeper motor home by Rectrans (center, above) rents for about \$300 a week from Avis

SMALL WORLD 16-foot mini-trailer from Apeco (below) sleeps six—or more on an enclosed hinge-down porch



RV
CAMPING 72



Mini-trailers

Compact rigs for compact cars and families are another new trailer trend for budgeteers



SMALL WORLD, from Apeco, is 16-foot space capsule with panoramic window, drop-leaf back porch (above)



TRAILERS STARTED SMALL, grew big, and are available again this year back down in midget models any car can tow. Tiny rigs like the \$975 Serro Scotty 13-footer have new competition. Starcraft, Kayot, Winnebago, Sprite, Blazon, Swinger, Compact Jr., Wheelcamper, and Midas and Boise Cascade divisions are among larger companies turning out trailers 18 feet overall or less. Some are low enough to fit your garage. Others telescope or fold for easy towing and stowing. Units like the new solid-state Apaches and Retractable-Wall Rolites offer tent-camper tow dimensions and travel-trailer walls. ★★

AMERIGO FG-16 packs into 16 feet bunks for four, enclosed toilet, refrigerator, two-burner stove, furnace

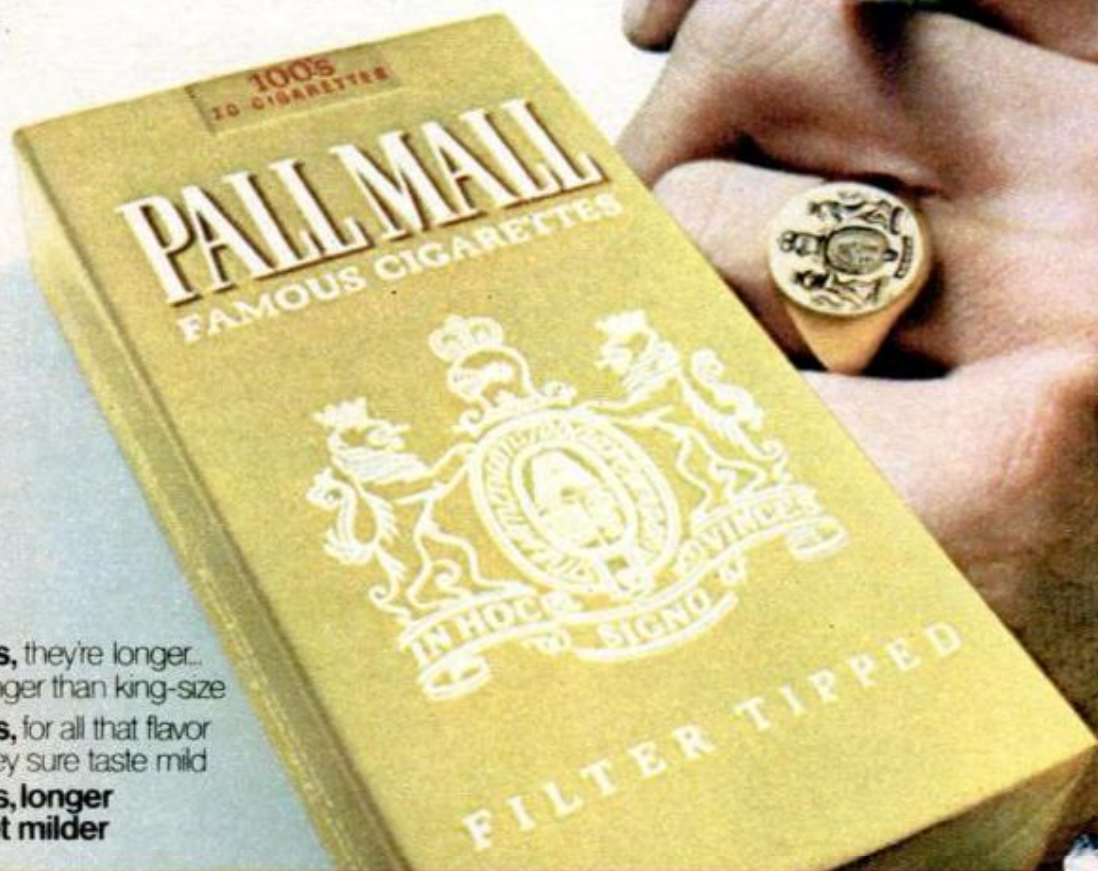


BOLER AMERICAN sleeps four in only 13 feet overall, with room left for table, icebox, stove, dinette, clothes closet

ROLITE, by Larson, opens by pushbutton from tent-camper profile to solid-wall trailer through use of Retractable-Walls

POPULAR MECHANICS

PALL MALL GOLD 100's Yes, longer yet milder.



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longer than king-size

Yes, for all that flavor
they sure taste mild

Yes, longer
yet milder

Also first class flavor in a filter king
New Pall Mall Filter King



Gold 100's.
19 mg. "tar", 1.3 mg. nicotine av. per cigarette. FTC Report AUG. '71.

20 mg. "tar", 1.4 mg. nicotine av. per cigarette by FTC method.

Mini-motor homes



Chopped vans put it all together for budget motor-homers

SHASTA is typical of new trend: has beds for six in 17-foot length



VAN-A-HOME from Harvest Coach stretches 20-foot, \$8495 unit to provide rear door, four separate beds

RV BUILDERS used to take vans and panel trucks, torch or sheer off the body behind the cab and permanently mount a pickup-type camper body. Now cab-equipped chassis are supplied by major carmakers ready for camper companies to bolt on a chassis-mounted body. "Mini-motor home" is the popular name for this new RV favorite. Such units, an outgrowth of camper vans, cost thousands less than the bigger \$10,000 to \$30,000 motor homes, still must vie with inexpensive models like Winnebago's \$6,795 18-foot Brave. Minis range from under \$5000, through pop-top and fiberglass expansions like Minihome, to the rolling homes shown here. ★★★



MINIHOME, a raised-roof van conversion from Motor Homes, Lora-in, Ohio, adds chopped-van model on Ford chassis for more room on same wheelbase

DIAMOND MINI-HOME, new unit from Coons Co., Oswego, Kans., is 19 feet long, has enclosed shower



MONITOR MINI-MOTOR HOME 19-footer, smallest in a line of seven, has luxury styling, fixtures



POPULAR MECHANICS



A better idea for
safety: Buckle up.

Works like a truck.

Ford pickups ride like no other pickup because no other pickup has Twin-I-Beam suspension. Each front wheel has a forged steel I-beam axle that works independently to step over bumps. Steering is responsive. Cornering is flat. And there is practically no nosedive when braking. In the rear, a unique leafspring suspension is offered that automatically adjusts spring stiffness to load conditions.

Rides like a car.

And loads are what Fords thrive on—92 out of every 100 Ford trucks sold in the past 12 years are still on the job. Get a fully detailed catalog as well as a revealing test drive at your Ford Dealer's.



FORD PICKUPS



Fifth-wheel trailers

Are five wheels better than two?



COBRA'S FIFTH WHEEL, the latest addition to their extensive line, is \$7500, has a 6½-foot headroom and includes a four-burner stove, bathtub and shower and many accessories as part of standard equipment

TWENTY-FOUR companies now build fifth-wheel rigs—a year ago there were four—indicating the popularity of the trailer that hooks up to the cargo bed of a pickup truck. A hitch like the connection used by tractor-trailer trucks is mounted in the truck bed. Heavier tongue weights, towing ease and stability and two-minute hookups are some advantages. Passengers can ride legally in this trailer in most states. Units are 19 to 35 feet long;

special low-profile designs are produced for Ranchero and El Camino pickups. One major builder, Wheelcamper, makes Truk Traveler trailers in 27 models. Most units have luxury camp accommodations in side, split-level layouts, stairway to a balcony bedroom. ★★



KAYOT Royal Traveler is also a two-bedroom luxury unit offering uncrowded living in a 24-foot length

SHADOW, with hitch on car roof, allows vehicle towing to completely reverse and push-park rig



POPULAR MECHANICS

Take this \$3.49 book FREE!

Let these 257 experts show you how to attain the skills of a real pro!

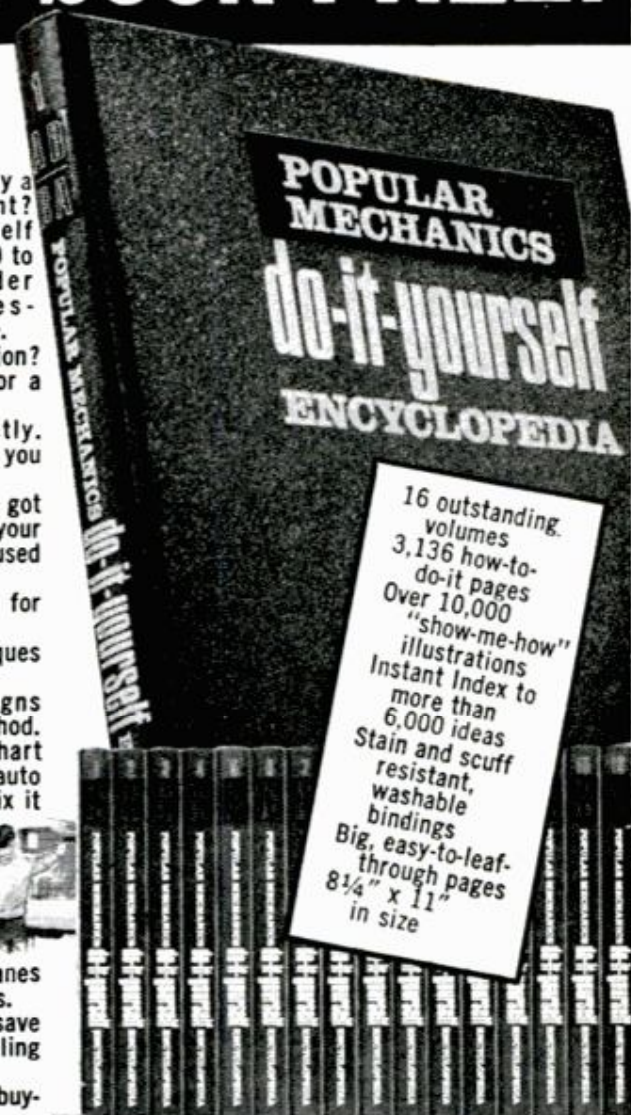
You get this giant 8¼" x 11" illustrated volume of exciting "how-to" projects for your family, home, garden, car, boat, vacation—as an outright gift—nothing to buy. It is crammed with reliable shop-tested, do-it-yourself techniques and practical show-how pictures. Use these hundreds of do-it-yourself plans, projects, tips and hints to polish your own shopwork and hobby skills! Here is a brief glimpse of all your FREE Volume brings:

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- Do your own auto body repair expertly with simple tools and methods.
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- Need better burglar protection? Build effective power alarm for a safer home.
- Refinish furniture perfectly. Hands-at-work pictures show you how.
- You'll wonder how you ever got along without an air supply in your shop once you've built and used the "foot-bellows" system.
- Build a gas-fired barbecue for more back-yard fun.
- New soundproofing techniques enable you to relax in quiet.
- Anyone can hand-letter signs with the "Project-A-Plan" method.
- Special trouble-shooting chart pin points malfunctions in an auto electrical system so you can fix it quickly.
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REAR SPEAKERS are mounted in the underside of overhead cupboards running across back end of vehicle. Though facing downward, they radiate sound in all directions to give rich, room-filling music that seems to come from everywhere. At top of the page is Craig installation kit consisting of a quadraphonic cartridge player, four speakers and connecting cables for \$154.95

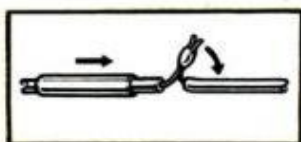
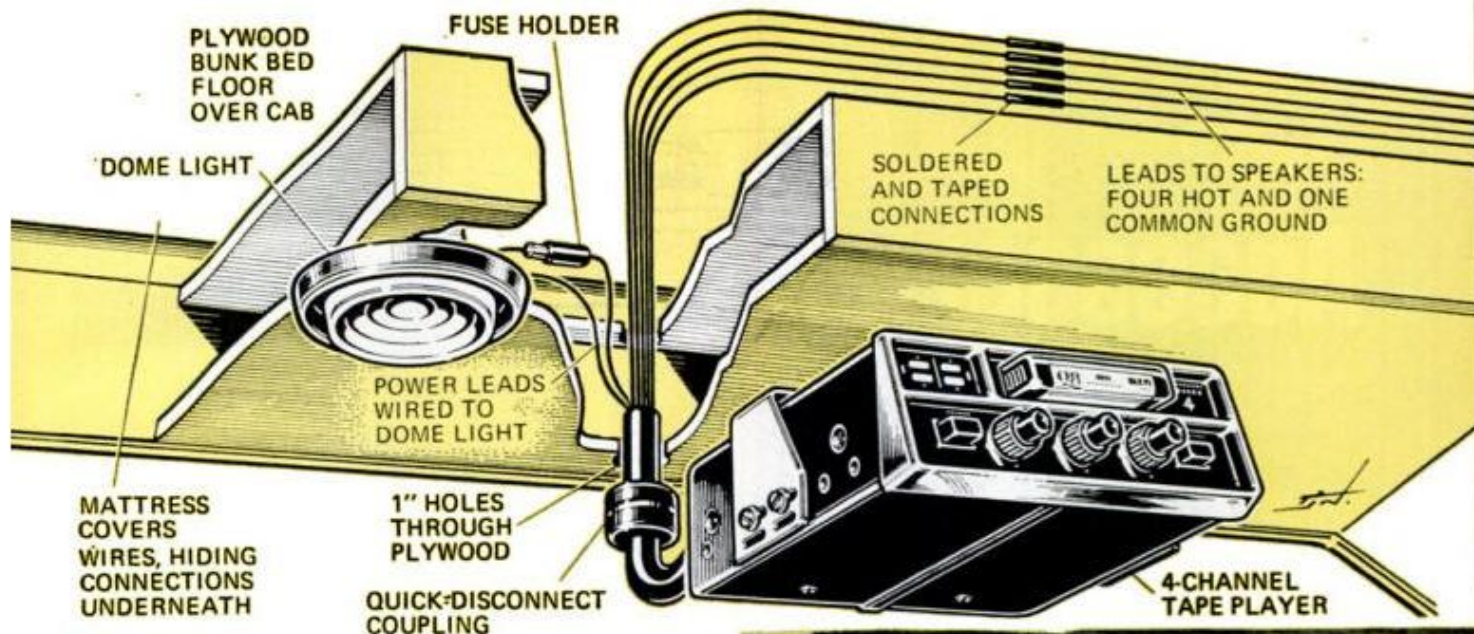
You can have music

New quadraphonic tape players provide glorious four-dimensional sound for a small motor home

By **SHELDON M. GALLAGER**

THERE'S NO REASON a home-on-wheels can't sound just as good inside as a home without wheels. If you enjoy on-the-road hi-fi, you'll enjoy it even more with a four-speaker setup that creates an uncanny illusion of living-room spaciousness in the small interior of a motor home, pickup camper or camper van. While any car tape player can be hooked up to four speakers, the ideal answer is one of the new quadraphonic units that provide four separate channels of sound. These four channels, each feeding its own speaker, surround you with music from all sides so you feel like you're sitting in the middle of a rolling concert hall.

The arrangement shown here is based on Craig's Model 3129 quadraphonic player, one of the first of its kind on the market. It not only plays the new four-channel Quad-8 cartridge tapes, but will also handle standard two-channel 8-track stereo tapes. Installing quad sound in a motor home is simple because there's usually a bunk bed extending out over the cab. The hollow bunk floor makes it easy to hide wires and make connections. Since most motor homes have a switched

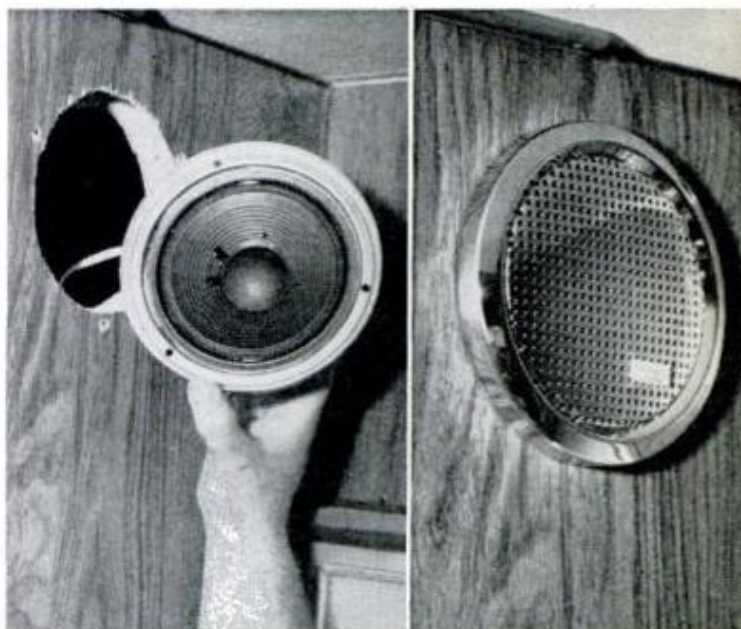
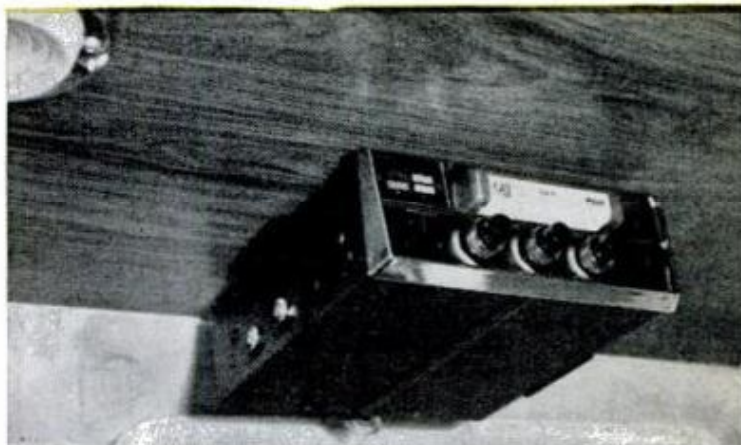


CONNECTION DETAIL:
TWIST WIRES, SOLDER
AND WRAP WITH TAPE

wherever you go

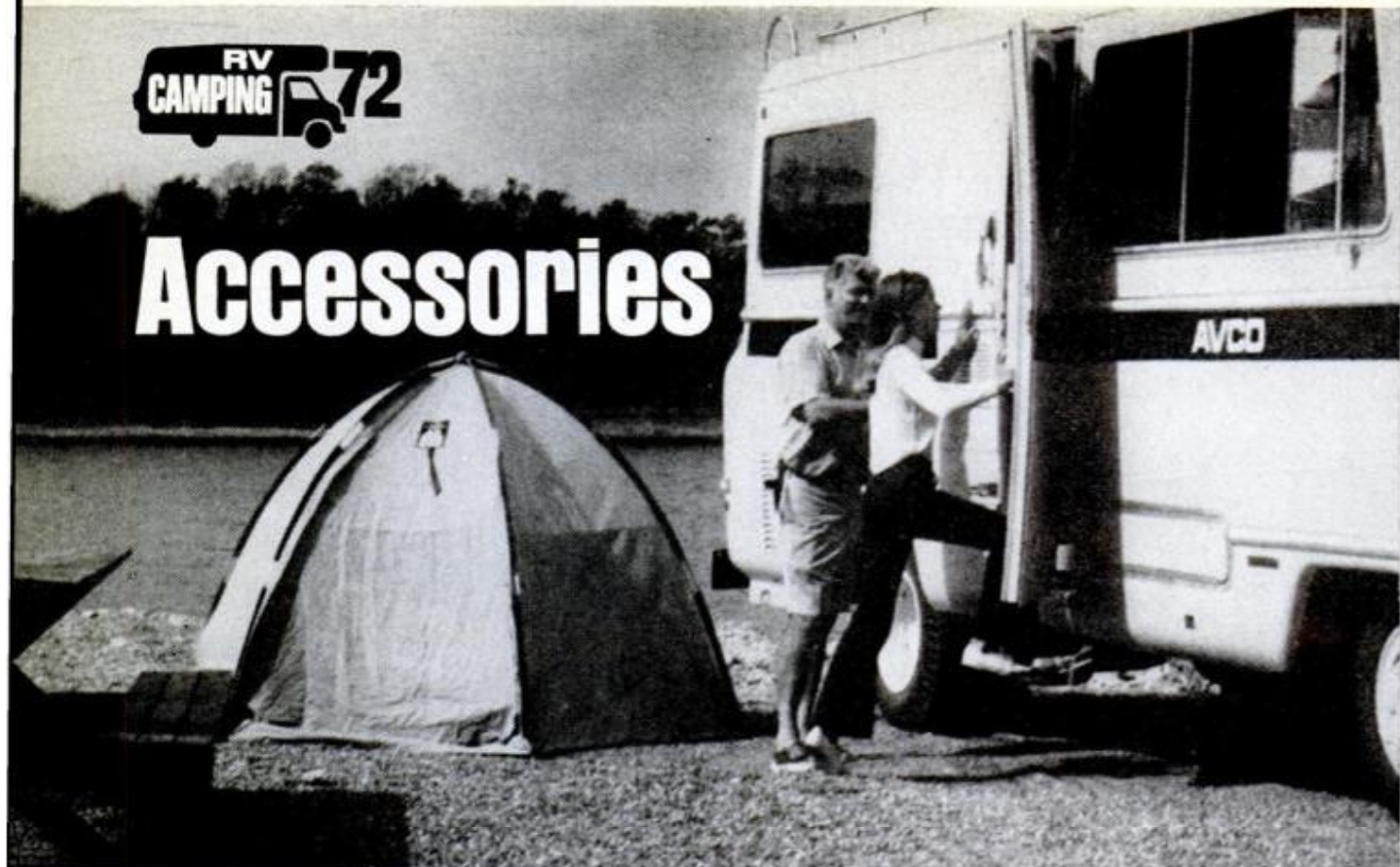
dome light in the cab roof, you can wire your power leads directly to this without affecting the operation of the light itself, as shown in the drawing above. If there's no dome light or if the light is switched from the dash, then it's necessary to run your power leads down to the fuse block or ignition terminals to tap into the vehicle's 12-volt system.

A handy location for the player itself is up under the cab roof. This puts it waist-high for easy operation from the living area in the rear and at the same time makes it readily accessible to riders up front. The bulkheads that typically separate cab from living quarters are ideal for mounting the two left and right front speakers so they face rearward. The two left and right rear speakers can be recessed into cupboards or other enclosures at the back of the vehicle. The Craig player sells for \$154.95, including four trim-looking speakers and a color-coded wiring harness that simplifies hookup. Further information can be obtained from Craig Corp., 921 West Artesia Blvd., Compton, Calif. 90220. ★★★

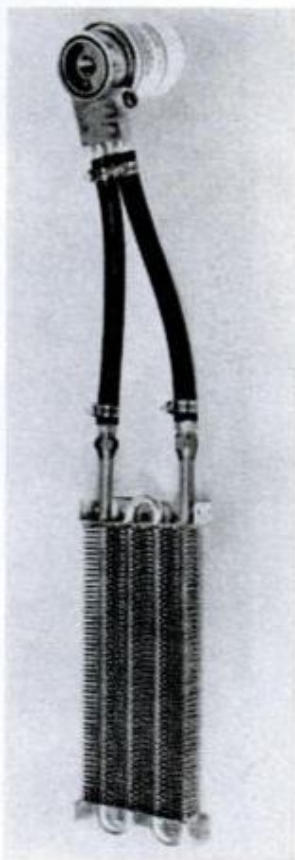


SPEAKERS ARE EASILY INSTALLED in partitions or other surfaces because they require only rough-cut circular opening made with a keyhole or sabre saw (left, above). Flange of speaker conceals opening and is held in place by three screws. A snap-on chrome grille completes the job (right, above) to give a neat, professional look. Player mounts under cab roof, as shown in photo and drawing at top. You'll find seven wires coming from player—five for speaker connections, two for hookup to power

Accessories

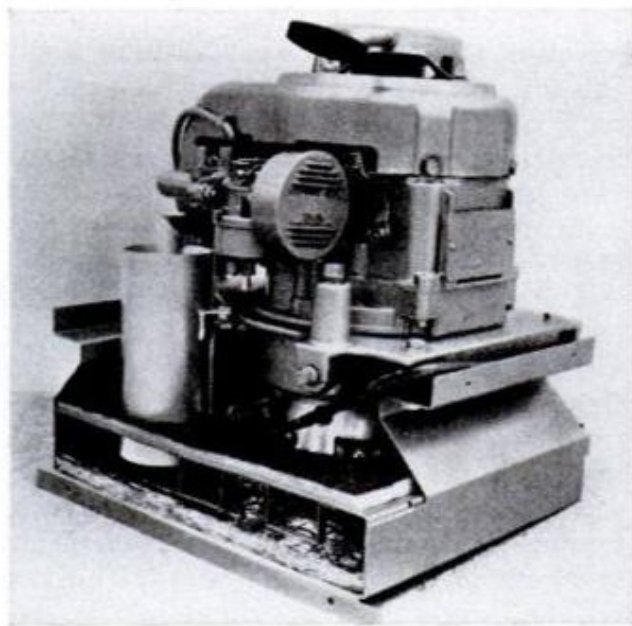


CLOTHESLINE for the camper pulls out of spring-wound reel to dry 15 feet of swim suits or laundry, or can support awning. Rig is \$10. Martin Reel, Mohawk, N.Y.



OIL COOLER unit that RV owner can install for under \$100 is by Thermo-Chem, Tulsa, Okla. 74135. Model 500 has bypass valve for cold starts, installs at oil filter.

THERMOS POP-TENTS, old camping favorites, have RV uses as campsite savers and spare rooms for juniors. Seven or 9-foot model sets up in two minutes, can hold a parking spot while storing gear when motor homer is away



NEW ONAN BATTERY CHARGER runs on LP gas, is 300-watt d.c. unit said to charge RV battery in one to three hours at 15-20 amps. It has remote electric start (plus rope-recoil starter if battery is low), can run 22 hours on 20-pound propane bottle, weighs 90 pounds and fits in 15x16x13-inch space. Made by Onan, 1400 73rd Ave. N.E., Minneapolis, Minn.



Fabulous *Folbot* Holidays

Pictures show our home assembled Super Folbot.

Now, we marvel at her beautiful shape, the slim and trim lines, the accurate symmetry of this perfectly harmonious design, further enhanced by its colorful and tastily textured hull and deck of ELASTIC FIBER-PLASTIC. Our good neighbors and friends all shared in admiration.

The assembly was easy indeed. Quite an assortment of pre-fabricated sections, parts and frames arrived in cartons with numerous containers, and a multitude of fasteners, fittings, metal shapes, special cement, compounds, undercoating and valuable resin varnish; in fact everything from the first brass screw to the name plate, as the last. We fastened the instruction sheet on our garage wall for easy follow-through. Every step is described and pictured, which made it a cinch to proceed. In spite of expected 'bugs', there were none. With eager helpers, my wife and her visiting little brother, we had the framework up in four hours. Then we allowed a break to extoll about shape and lines of our handiwork.

We installed the double hull fabrics and decking, and ended up with a smoothly fitting job. Of course, all outside surfaces are already supplied with a substantial and beautiful VINYL coating, which provides this excellent and elegant Folbot



WORLD RECORD FISHING

Champion reports: "Caught more Tarpon because my Folbot skims over water Fast & QUIET, easily tows Tarpon and Shark for hours and SAFELY ashore, which revolutionizes fishing entirely."



WALLY TABER of High Adventure

"Folbated hundreds of miles between Ocean & Mountains. From Folbot took snook, porgo, pompano etc. Shot doves, pheasants, ducks and my Folbot performed PERFECTLY, really magnificent"

Indispensable for CAREFREE Nature Study, observation of fascinating Wildlife and EXCELLENT photography. Essential to ecology minded and educated folks, who prefer the natural glory of primeval surroundings. Efficient Folbots, featherweight paddles, dacron sailrigs, without mechanical upkeep are INEXPENSIVE to maintain. From 1 to 4 seaters in desired colors or camouflage, either FOLDING type or PORTABLE cartop are SENSIBLY priced from \$65 up with terms to suit, in PREFAB Kits for Fun at Home assembly or Factory Finished ready to go. IMPORTANT literature with colorful plates, action catalog, startling facts and figures mailed FREE without sales agents to rush you.

Most educational hobby saves bulk of labor cost and half your money

Counting everybody's time, a most enjoyable and relaxing pastime it was, it took from the prefab cartons to the BEAUTY on the lawn some 53 hours. If we value our leisure time at two dollars per hour, we SAVED over a hundred dollars this way, and would not want to miss this fun even without a saving. It all started a few months ago, when I was tired of repairing and attending to our motor boat, which took most of my free time. We also desired a more rewarding and sensible recreation, rather than constant noise and vibration of a motorised boat. We love to explore new environments and learned that folboting offers inexpensive, independent cruising on charming waterways at a reasonable pace. We have dozens of clean rivers for exploration, a moderate surf and sea, as well as lovely lakes and connecting canals. All of these we will cruise, explore and absorb over many years in our new Folbot. Only a few times out, we already realized the difference and many advantages. In the motorboat, we could never converse quietly and had to raise voices under strain; the motorboat hopped over waves and wakes, which hardly was restful. In our Folbot we relax in deepseated, cushion supported seats with swivel backs, equal to bucket seats or easy chairs. Alternating from gentle paddling to just floating and observing the scenery glide by, we are in love with our new-found way of boating. My wife and I can readily load this Folbot on our sport car with cartop rack. Every free day off, shows us a different surrounding. We bring home unusual photos, and capture nature's best

You missed it long enough .. get your Folbot now!

FREE third class mail takes 2 to 4 weeks. For INSTANT first class mail include \$1, for Airmail \$1.50. Mail coupon or address to: Folbot Corp. Stark Industrial Park, PM 572, Charleston, S. C. 29405.

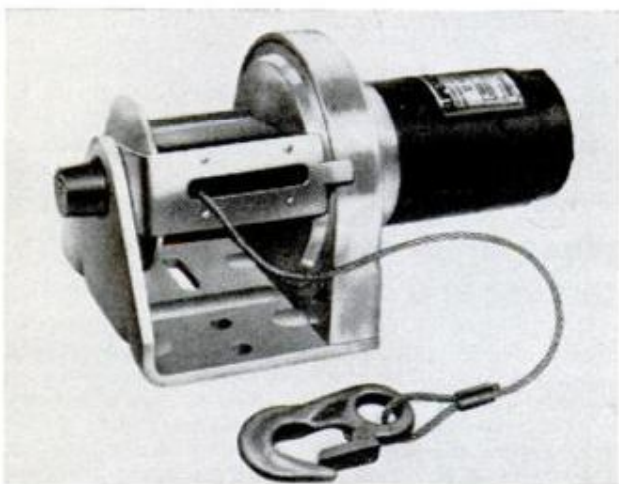
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RV ACCESSORIES

(Continued from page 182)



RV WINDOWS said to take a do-it-yourselfer armed with a screwdriver and sabre saw just 20 minutes each to install are available from Meksol Co., 865 17th St., Costa Mesa, Calif. 92627. They come with locks; clear, tinted or bronze safety glass and removable screens.



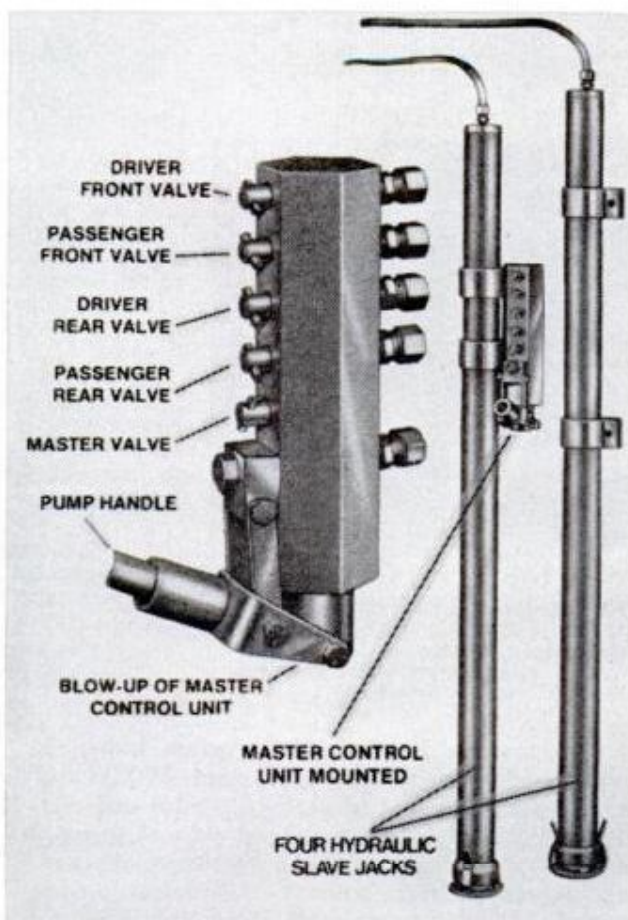
RV WINCH with useful camp accessories is offered by Superwinch, Inc., Pomfret, Conn. 06258. The 12-volt \$80 model mounts permanently or bolts to bracket fitting trailer-hitch ball. Switch can be lanyard-controlled or mounted on dash with accessory bracket.



LEVELING TRAILER without leaving driver's seat is possible with \$13 level from Tamarack Engineering, 9050 S.E. 137th Ave., Portland, Ore. 97236. Mounted in front, level is easy to see in mirror. Second unit gives correct position while tongue jack is cranked.



MOBILINK is a pickup camper intercom the RV owner can build and install himself. One unit mounted in pickup cab lets driver and front passengers talk with camper occupants or monitor youngsters riding in rear. Heathkit, Benton Harbor, Mich., makes \$26 kit.

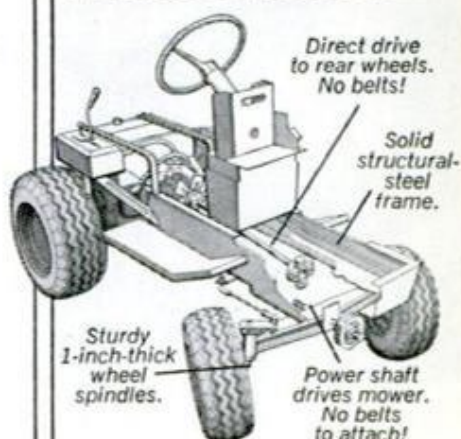


HYDRA-STAR MASTER CONTROL uses four jacks, one at each corner, to level, raise, lower or even lift off camper from pickup. All adjustments made from one position. Hellstar Corp., 1600 North Chestnut, Wahoo, Neb. 68066, makes \$220 system owner can install.

"How can a garden tractor that looks so good be so tough?"



Here's how:



The heavy-duty frame isn't afraid of hard work. Old-fashioned belts have gone the way of rumble seats; a direct-drive power train brings power to rear wheels. A power-take-off shaft replaces belt connections for attachments—makes hookup surprisingly simple. A favorite feature of the mower: you drive the tractor up and over it to position it underneath for installation—no more struggling to shove the mower under!

Want more? The tilt-away steering wheel lets you step aboard without acrobatics . . . the hydrostatic transmission makes you an instant expert (one handle controls forward, reverse, stopping) . . . swing-up hood and rear deck expose major service areas.

A word from the sponsor. New Holland is a Division of Sperry Rand Corporation. In addition, farmers have made us the country's leading manufacturer of specialized agricultural equipment. Both good references!

For the name of the New Holland dealer nearest you, phone toll free 800/631-1972. (In New Jersey, 800/962-2803.)



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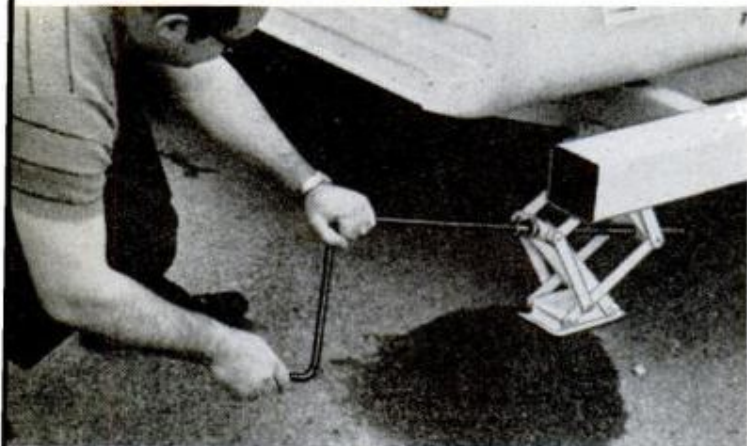
NEW HOLLAND

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14-hp. (shown) and 12-hp. models available with wide range of attachments: 48-inch mower, snow-thrower, tiller, 2-wheel dump trailer, dozer blade and more. New 8-hp. compact garden tractor also available.

RV ACCESSORIES

(Continued from page 184)

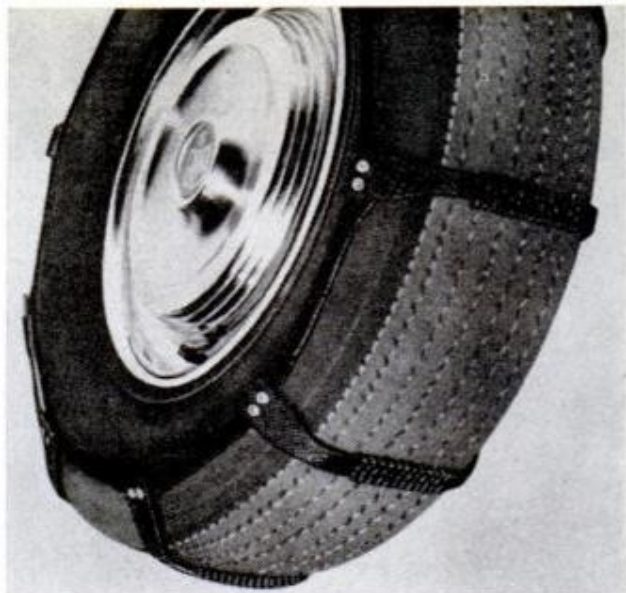


STABILIZERS for permanent mounting by bolting or welding to corners of RV are four for \$56 or two for \$30 from Trail-Line Products, 2479 Second St., Cuyahoga Falls, Ohio 44221.



MOTOR CAMPERS having no inside shower can carry this \$65 Suitcase Shower. Battery-powered 15-pound unit comes with curtain; water drains in disposable plastic bag. Mahar, 241 S.W. 21st Terrace, Fort Lauderdale, Fla.

OFF-THE-ROAD vehicles like this Bronco can benefit from front and rear-mounted winches. Rig can lift itself for servicing, winch out of ditch, haul a vehicle in trouble back on the trail. Superwinch units of graduated capacities cost up to \$160 for 12-volt models. Blocks and twin mounts boost strength.



BETTER TRACTION than snow tires is claim of Detwiler Corp., 36 New York Ave., Westbury, N.Y. 11590, for Snow-Treds. Bands reported easier to mount than chains can be driven on clear pavement. Two-tire set is \$24.



PANASONIC Model CX 601 offers four-channel sound for RVs and can be converted to home use. One of the new players for automotive mountings, unit can use speakers shown in a motor home for new high in highway luxury.



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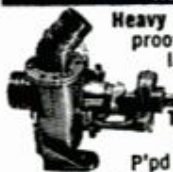
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SATELLITES

(Continued from page 50C)

to Spain had to be radioed over the Andes and Caribbean to Florida, then traveled via land line to New York, across the Atlantic by cable, and over telephone wires through Europe to Madrid. Provided the Atlantic cable was not broken by undersea stresses or cut by fishing trawlers, or the radio signals were not disrupted by electrical storms, ionospheric disturbances or sun spots, the Chilean caller could expect to carry on a shouted, garbled conversation with Spain three days later.

Today, however, a Santiagan can pick up his telephone, give the operator the Madrid number, and speak to his party within two or three minutes, through space, in normal conversational tones. A few years hence, satellite communicators tell us, he may not need to bother the operator. He will simply dial the number and be talking to Spain—or Senegal or Turkey, for that matter—within seconds. Every telephone will be automatically connected to every other telephone on Earth.

Matching the increase in speed and quality of communication has been the dramatic reduction in rates. So much cheaper, per circuit, are satellites to build and maintain than cables and land lines, that international telephone charges have plummeted 80 percent in six years—and when the system is fully developed you may be able to call any city in the world for the price of the change in your pocket.

Distance has no effect

Distance is of no consequence to the satellite, and its super-high-frequency transmissions are unaffected by natural cosmic or terrestrial disturbances. Whether a message from San Francisco goes halfway across the Pacific to Hawaii, or across the globe to Singapore, the operating cost and power expended are exactly the same.

Nor does it actually make the slightest difference to the bird what it is asked to bleep out. It can send telephone, television, telegraph, computer data, facsimile and any other kind of electronic message—simultaneously—to a thousand different spots on earth.

To find out how satellite communication works, I visited the world's busiest Earth station, situated in a "radio quiet" mountain valley near Etam, W. Va. Through the mazes of electronic equipment in its control room, passes more than half of all the communications

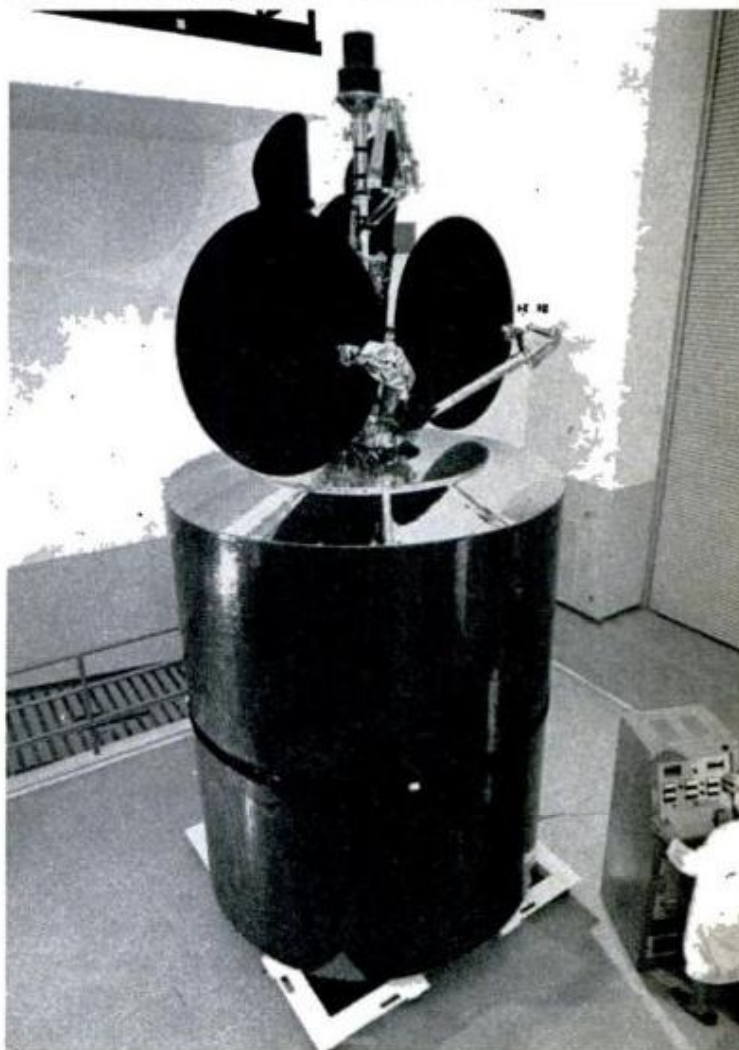
traffic between the United States, Latin America, Africa, Europe, and the Midwest as far as Iran. A staff of 30 engineers and technicians man the nerve center around the clock, constantly testing and monitoring the equipment, rerouting channels when traffic gets heavy, and coordinating operations with other stations of the Atlantic network.

Looming over the station, 10 stories high, stands the antenna, a concave metal eye 97 feet (30 meters) in diameter, with its gaze locked hypnotically on a satellite floating over the South Atlantic. Although the 470-ton dish appears to be immobile, it is actually in constant motion, readjusting its position in movements too minuscule for the eye to detect, for radio signals do not bend, and if it loses sight of the microscopic dot in space, communication is instantly broken off.

Despite the enormous distance the signals must travel, the amount of electrical energy needed is unbelievably small. It takes only 100 watts (the power of an average reading lamp) to send 240

(Please turn to page 186D)

INTELSAT IV SATELLITE is checked out at Hughes plant prior to launch last January. It was placed in circular orbit, 22,300 miles above the Pacific Ocean



SATELLITES

(Continued from page 186C)



CONTROL CENTER in New York served as key distribution point for telecasts of China trip. Day and night, engineers maintained constant quality check

voice messages to the satellite, while the incoming signals from the satellite (whose total generating capacity would just suffice to operate a kitchen toaster) return at considerably less than one-trillionth of a watt. To make the whispers from space intelligible, they are amplified billions of times by supersensitive devices.

Simply described, the satellite is a tightly packed assembly of antennas, which both receive and transmit, telemetry equipment that measures the bird's state of health, and small tanks of hydrazine gas that are used to adjust its position or move it to a new location, when necessary. Its power is generated by thousands of solar cells which convert the raw, undiluted sunlight of space into electrical energy. To keep the satellite in permanent communication with the area it is meant to serve, it is propelled into circular orbit 22,300 miles above the equator, with its speed synchronized to keep exact pace with the Earth's rotation. Thus it remains relatively stationary over a designated spot on the globe. Each Earth antenna can look at and talk to only one satellite. However, the satellite, from its great height, can see and talk to every Earth station over one-third of the globe, either singly or all together—which is what makes simultaneous global broadcasts possible and their costs so low.

Three spacecraft, strategically stationed over the Atlantic, Pacific and Indian

Oceans, are sufficient to provide a worldwide communications network. However, the volume of traffic is such that there are now five Intelsats in orbit, with more on their way. The vehicles have also grown in size and versatility over the years. "Early Bird," the first launched in 1965, was a little drum, about 2 feet across, weighing 85 pounds, with a capacity of 240 voice circuits or 1 black-and-white TV broadcast. Intelsat IV, latest in the series, is a monster by comparison: over 17 feet high and almost 8 feet wide, weighing 1587 pounds, capable of transmitting 6000 telephone calls simultaneously, up to 12 color telecasts, or various combinations of the two.

Satellites must stay on course

Satellites must be closely watched, for they are constantly being tugged at by gravitational attractions of the sun, moon and Earth. If pulled too far off course, their hydrazine jets must be again activated to bring them back to proper position. A satellite "dies" when its booster jets run out of fuel and it can no longer be prevented from drifting. Although its communications may still be functioning, it must be abandoned and a new one put in its place.

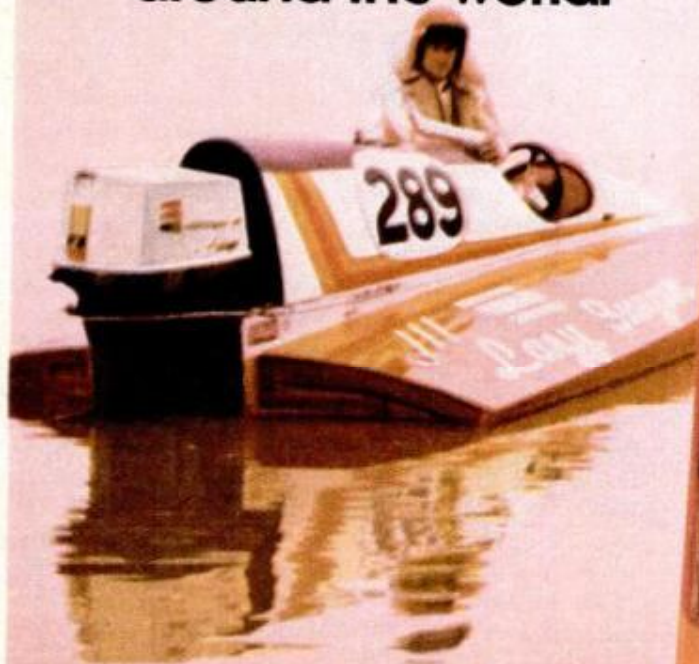
Almost as impressive as the new mode of communications is the way in which it is administered and operated. Since the United States almost single-handedly pioneered satellite technology and, until recently, possessed the free world's only launching capability, the system might easily have become an American monopoly. That it did not is due to an act of statesmanship by President John F. Kennedy and the U.S. Congress. In 1962, they made it possible for the nations of the world to share in the benefits of space communication, with no strings attached. The unprecedented offer led to the formation of the International Telecommunications Satellite Consortium (INTELSAT), a unique commercial venture that serves as a model of what international cooperation can, and should, be.

Intelsat makes the rules for the global network and allocates the circuits, but it owns and operates only the satellites and the equipment that controls them from the ground. The Earth stations are built, owned and operated by designated government agencies or independent firms in the countries where they are located. The partnership's American member, for instance, is the Communications Satellite Corp. (COMSAT), a federally created private enterprise that leases its circuits to the major U.S. telephone, telegraph,

(Please turn to page 186F)

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Division Outboard Marine Corporation — makers of OMC Stern Drives

SATELLITES

(Continued from page 186D)

and broadcasting companies, and also serves as manager of the Consortium.

The investment each Intelsat member makes and the weight of its vote are determined by the volume of business it contributes. Thus, Comsat—by far the largest user, operating seven Earth stations scattered from Puerto Rico to Hawaii—presently holds a 53-percent interest in the network, while some tiny nations own fractions of 1 percent. After paying its share of the costs, each member receives an annual 14-percent return on its investment, plus the revenues from its own Earth stations, which are so high that some stations have repaid their entire \$5-million construction cost in a single year. As a predictable result, the partnership that started out with 14 members and four Earth stations, now boasts 83 members and 53 Earth stations. By 1973 it will have 70 Earth stations and be serving every heavily populated area of the free world. (Any nation is privileged to join Intelsat. But, save for Yugoslavia, none of the communist countries has yet chosen to do so—perhaps because of the expected formation of a rival Soviet-led consortium, to be called Intersputnik.)

"Within this decade" predicts Comsat president Joseph V. Charyk, "electronic libraries in one country could be instantly available to scholars in another. Newspapers, magazines and books, sent by facsimile from central editorial offices, could be published in a dozen distant cities simultaneously. Schoolchildren in developing nations will have available, on command, the most advanced educational materials and techniques."

Already, doctors sitting in an amphitheater in Switzerland have watched famed specialist Dr. Michael DeBakey perform open-heart surgery in Houston, Tex., asking him questions and receiving answers as the operation proceeded. For example, cardiograms and encephalograms have been transmitted from one continent to specialists on another, and the diagnoses returned before the patients involved had finished dressing. Argentine engineers, facing a complicated bridgebuilding problem, have punched data into a keyboard in Buenos Aires and received solutions three minutes later from a computer in Massachusetts. Comsat has proposed a new set of satellites for the exclusive use of aircraft—to control air traffic, warn pilots of weather disturbances and perhaps enable passengers in flight to make telephone calls from their seats. (A space antenna recently installed aboard the

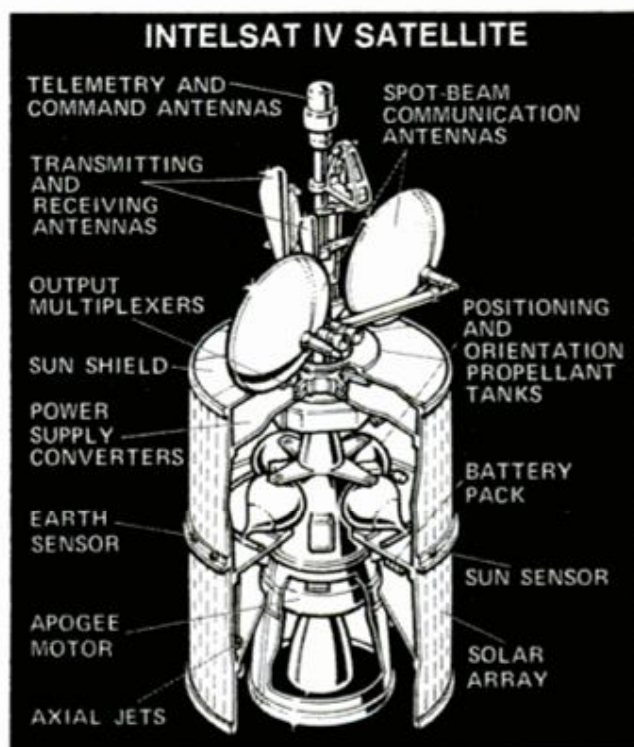
186F

liner *Queen Elizabeth II* could be the forerunner of still another electronic constellation to serve world shipping.)

And this is only a foretaste of the things to come, say the experts. When new satellites are launched to relay messages domestically as well as internationally, new forms of communication will be available to you in your home or office. Bills may be sent and letters exchanged without going through the post office. Housewives may do their banking and shopping by television. By dialing the right number, you may be able to select a play, opera, golf lesson or lecture in physics, from a pretaped library in a remote city, for showing on your home screen—and the pictures may be three-dimensional. These are not figments of a fevered imagination. They are actually under development, or have already been demonstrated, in communications laboratories in the United States and elsewhere.

Undeniably, this incredible communications system has, or shortly will, become the new nervous system of our global society. As science writer Arthur C. Clark—whose fertile brain envisioned using communications satellites long before any man-made object was propelled into space—informed the signatories of the Intelsat agreement in 1971: "Whether or not you intend or wish it, you have just signed a first draft of the Articles of Federation of the United States of Earth." ★★

WEIGHING IN at some 3000 pounds, the Intelsat IV satellite is 8 feet in diameter and nearly 18 feet high. Its solar array absorbs energy from the sun



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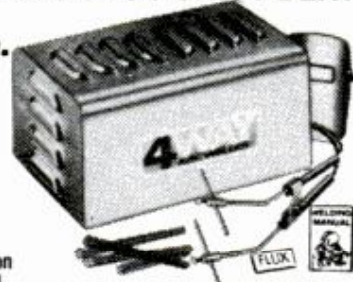
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186H

POPULAR MECHANICS

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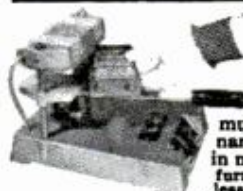
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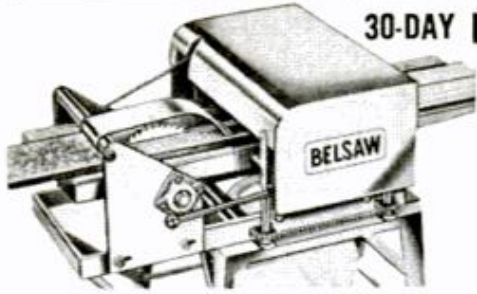
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TAMBOUR-DOOR TABLE FOR \$41

(Continued from page 142)

need to sand the backs of the slats; they're not seen because of the canvas backing. Lay all slats for one door face down on a flat piece of plywood and, using a pipe clamp, clamp them together reasonably tight. Make certain the slats are aligned and square, and clamp the ends down with C-clamps and strips of thick wood.

Cut two 2-in. widths of heavy canvas slightly shorter than the overall length of the clamped-up doors, apply two coats of contact cement to each slat and the canvas strip. When the cement sets, place the canvas strips in contact with the slats and smooth all wrinkles. Keep the assembly in clamps for at least 20 minutes. **Caution:** When you apply the contact cement to the backs of the slats, do not let any glue run onto the exposed sides (the cement will bleed through the lacquer finish).

When the doors are completed, insert each one in the routed groove or track. Apply a coat of paraffin wax to the bottoms of the slats to ensure sliding ease. It's best to make a dry run of the doors with the top temporarily secured. If necessary, sand slat ends for smooth operation.

It is a good idea to stain the parts before assembly. The original tables were given a coat of sealer and three coats of satin lacquer. However, an antique-white finish with the tambour doors in mauve, makes a handsome piece. ★★★

STEAM MINIBIKE

(Continued from page 24)

world know that this is no ordinary minibike.

Smith is primarily in the business of building to order, but sells plans of his steam system that list sources for all parts and specifications for materials. The plans are only for the steam system itself, which you can adapt to a minibike or other type of vehicle. You can write to Richard Smith at 8591 Pyle Way, Midway City, Calif. 92655. The \$20 price of the plans for the steam system includes, in addition, plans for conversion of the Ohlsson & Rice engine, plans for boilers of various sizes, feedpump plans and plans for a rotary valve for use with engines of more than one cylinder. ★★★

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WOODPECKER DOOR KNOCKER

(Continued from page 130)

taken from a discarded clock. The location of the hole in the gear-shaft bearing post will be determined by the diameter of the large gear, which should not exceed 1 in.

When assembling the actuating arm, drill the brass tubing (D) so that its pointed nail shaft will fit tightly, then solder the shaft to the tubing. Note that the shaft is placed offcenter in the tubing to allow for the adjusting screw that holds the shaft in place. Clamp the slotted ends of the brass tubing (D) to the clock spring and to the spiral spring plate (B) and solder them in place. Soldered nail-heads hold in place the spiral spring which needs to be only strong enough to keep spring plate (B) in contact with the fiber cam (C). The spring may be obtained from Edmund Scientific Co., Edscorp Building, Barrington, N.J. 08007, if it's not available at your local hobby shop. Place the operating mechanism inside the bird's body to locate the mounting holes and drill the holes from the inside.

Secure the woodpecker to a shallow plywood box with the two machine screws attached to its removable breast cover, then drive two wood screws into the tail section from inside the box. Locate the hole for the beak bolt by holding the head of the bird against the box. Add or remove washers for the best response from the knocker. A screw in each corner of the box is used to attach the bird to the door. Either a size C or D cell will operate the knocker since its current consumption is very low.—Walter B. Ford, El Cajon, Calif.

MOTOR CAMPERS' QUESTIONS

(Continued from page 161)

not be tapped into tow-car lines. Electric offer completely separate control.

● How fast can RVs be safely driven?

Depending on conditions, vans and motor homes, 65; smaller trailers, 60; pickups, 75, and larger cars with tent-trailers, to 60 mph.

● How long will an RV last?

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● Are RVs safe enough?

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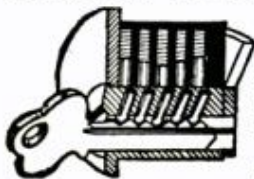
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RIDING MOWERS FOR '72

(Continued from page 105)

woman of the house, \$75 to \$100 brings you this added convenience.

Remember when changing of the cutting height on any mower was a real task? It's never been easier than on this year's riders. On most, it is a one-lever operation and can generally be accomplished while the machine is in motion. This means you can readily cut your lawn to its proper height for the type of grass, the time of the year and the use the area of lawn is put to.

A few years back, "no-scalp mowing" was somewhat of a novelty. Now almost all the makes can lay claim to it and back it up with their machines' performance.

Ariens, for one, has improved its own Flex-N-Float cutting action—which always was quite good—by a design change. The pan now moves with the front axle rather than the rear, for neater results.

Most riding mowers have rear-mounted engines. This gives better traction and better forward visibility. Even those makers who cover the frame with fiberglass—International Harvester's new riders, for example—have designed their units for good visibility. Forward visibility is important; it enables you to see foreign objects in the lawn and mow safely close to fences.

While most speed shifting is still accomplished with a shift lever, Jacobsen has gone to a foot-pedal control. When the pressure is applied the machine moves forward at speeds up to 4 mph. When heel pressure is applied the machine reverses. With no gears to shift, the operator's hands remain safely on the steering wheel. As an additional safety feature, the foot control automatically returns to a neutral-brake position when the foot is removed.

Roof Manufacturing, whose specialty has been mowers for over 25 years, has an intriguing front-axle design on its Deluxe Lariat 30. This unit has unusually large-diameter front wheels for a riding mower. It also incorporates a design which locates the spindle directly over the center of the wheel hub and axle. This eliminates the transfer of wheel shock to the steering wheel.

John Deere has come up with a rider that is an environmentalist's dream. Its new Electric 90 utilizes three 12-volt batteries, a traction motor to propel the unit and two electric motors to power the twin-bladed mower. This unit can honestly lay claim to quiet operation and the elimination of fumes and heat common to gasoline engines. ★★★

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AMBASSADOR OWNERS REPORT

(Continued from page 98)

and also the fact that this car comes with drum power brakes instead of discs." (Discs are optional.) A Denver housewife: "The reclining seats." "It handles and drives so well that you never get tired behind the wheel," states a Nebraska farmer. And a Tennessee corporation vice-president opines, "Handsome car—good but not radical lines."

How about dislikes? Here are notes from those who had gripes: "Engine noise." "Workmanship isn't inspected closely enough before leaving the assembly line, otherwise body panels would line up properly and windows wouldn't leak." "Plastic in interior groans and creaks when cold." "Hood release under dash is too near emergency brake release." "Poor gas mileage." "Gas pedal uncomfortable."

What about quality and workmanship? "Very good overall." "Better than its competitors." "Body sections don't join properly." "About average." "Good, but they don't check over the car as they tell you on TV." "Excellent." "Satisfactory." "Poor—bumpers misaligned, spots had to be repainted, strap to gas tank fell off." "Upholstery is this car's weakest link—unfinished where it can't be obviously seen." "The 1972 Ambassador is by far the best car yet—have owned AMC cars since 1960."

Given a chance, what would Ambassador owners change in their cars? "Move ashtray nearer driver." "Parking-brake pedal is too high, and I catch my foot under it getting in and out." "Design an easier way to adjust headrest height." "I think all Ambassadors should have at least G78 tires. The standard F78s are too small." "A little more interior room, especially rear legroom." "Lower hood an inch or so so right front fender is visible." "I think the air-vent sliding parts should be controlled by the driver and not individually from each side."

Most owners agree their cars are very comfortable to drive and ride in. "This year's ride is hard to beat," says a New Jersey baker. "Ambassador is large, roomy, good upholstery."—Chicago salesman. "Some of my passengers have commented on my car's good headroom. Seats are very comfortable."

The overall summary shows that Ambassador owners are pleased with their cars (a very high, 92 percent would buy one again) and with AMC's Buyer Protection Plan. Many felt that, being smaller, AMC dealers had more time to be courteous and to pay personal attention to customers. ★★★

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THERE'S ALWAYS SOMETHING NEW AT POPULAR MECHANICS

MAY 1972

195

HOME MOVIES CAN SOUND GOOD

(Continued from page 113)

tional playback machine. It sells for \$199.50. Neither package includes the necessary sound projector, which you must purchase separately. The Synchronex model sells for about \$200.

Optasound is somewhat more flexible in that it does not require you to buy a special camera. Virtually any electrically driven Super-8 silent camera can be modified to provide the necessary syncing signals to work with the Optasound system. Modifications made by Optasound technicians cost about \$40 to \$70.

While Optasound has its own matching cassette recorder, it also offers an inexpensive adapter, called Optasync, that can be used to convert an existing reel-to-reel recorder to the Optasound system—again to save having to duplicate equipment you may already own. The Optasync accessory sells for \$69.95, while the cassette machine with built-in sync is about \$140. Optasound does not at the moment offer its own sound projector, but its system, like Synchronex's, can be used with any conventional sound projector having 18-frame image-to-sound separation.

All lip-sync sound systems have one

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drawback—since you have to record “live” with your camera grinding away, any goof you or your actors make is permanently recorded on the sound track. You either live with it or reshoot the scene.

Editing is possible, though with some minor difficulties. With magnetically striped film, there's an 18-frame separation between your sound track and the corresponding image. When you snip out a length of unwanted film, you also remove a bit of sound track belonging to other scenes you want to save. This gap lasts about three-quarters of a second, producing a slightly noticeable but not too serious “blip” as the film skips by the missing bit of sound track.

Editing Filmosound would seem simpler since you're working with a separate sound track. It must be done carefully, however, as you have to cut both film and accompanying tape at exactly the same points to maintain sync. As an aid, Bell & Howell offers a detailed booklet on proper editing techniques. Further information on all three systems can be obtained from: Bell & Howell Photo Products, 7100 McCormick Rd., Chicago, Ill.; Optasound Corp., 116 John St., New York, N.Y.; and Synchronex Corp., 635 Madison Ave., New York, N.Y. ★★★

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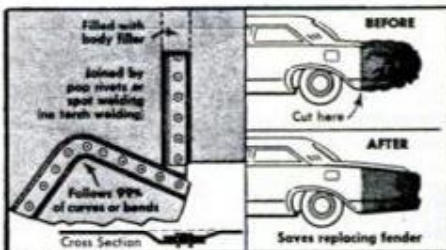
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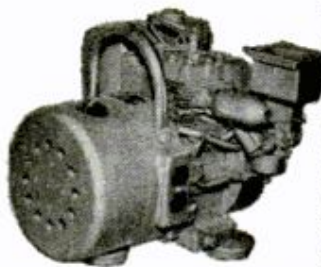
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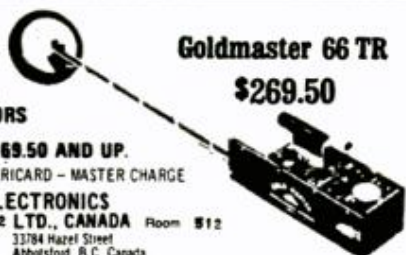
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HINGED TRACTOR WITH FWD*(Continued from page 107)*

hours of use without major maintenance problems. At that point—a year ago—Hesston engineers tore down the tractor and evaluated wear. Some minor weak points were discovered and corrected on this year's production models. The Kansas City contractor's Front Runner now has had over 800 hours of use without breakdown. This compares to 16 years of use by the average owner who runs his tractor about 50 hours a year.

The GMT's rear section, or carrier, serves as a handy carryall for ferrying tools, fertilizer and the like to the job site without the need to tow a cart—which would have to be unhitched when mowing in tight quarters. The carryall plus a top speed of 11 mph (most compacts have a top of 8 mph) give the Front

FRONT RUNNER SPECIFICATIONS

Engine: 14-hp, 4-cycle, Briggs & Stratton
Starter: 12-volt, ignition key, solenoid
Transmission: Hydrostatic, hand control
Brakes: Hydrostatic-dynamic with transmission
parking brake
Turning radius: 46 inches on center line
Wheelbase: 38 1/2 inches
Overall length: 84 1/4 inches
Overall height: 45 inches
Overall width: 40 inches
Ground clearance: 6 1/2 inches
Tire size: 23 x 8.50 x 12
Speed range: 0-11 mph forward and reverse
Power take-off clutch: Electric
Accessory lift control: Hydraulic foot control
Weight: Approximately 800 pounds
For further information write: Hesston Corp.,
Hesston, Kans. 67062.

Runner the versatility of a small mini-pickup truck; it really scats when an operator wants to hustle widely separated chores on an acreage.

Three-blade mowers for the Front Runner are made by Wood Brothers, Oregon, Ill., an old-line manufacturer of quality mowing equipment for many tractor makers. The 48-inch mower lists at \$265; the 60-inch at \$325. An 80-inch bat-wing mower listed at \$615 is available for the 18-hp model. With its mower front-mounted, the GMT mows grass before running over it to insure a clean mowing job. The mower is raised and lowered hydraulically with a foot control.

The Front Runner isn't everybody's tractor. It's a 14-hp hydrostatic-drive tractor weighing 800 pounds; its lightest steel is 11-gauge; it's solid, unitized, welded and it lists at \$1785. (The model 180—18 hp with two-cylinder Kohler engine—lists at \$2325.) But it is a unit many a tractor owner with big grounds maintenance chores will do well to consider when he's ready to trade up. ★★★

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MAY 1972

MORE HI-FI FOR YOUR DOLLAR

(Continued from page 101)

Fidelity recently established standards for measuring output, and most manufacturers abide by them. A power rating followed by the designation "IHF" or "Music Power" indicates that the maker is complying with the Institute's standards. Equally reliable are the even more stringent ratings given in "RMS" or "Continuous Power."

Watch out, though, for terms like "Peak Power" and "Peak Music Power." These are inflated ratings based on an amplifier's top output during only brief bursts of thundering sound. A peak rating will appear to be about twice that of an equivalent IHF rating.

Be sure, too, that the rating is for each channel separately—not the total for the two. Look for ratings in "watts per channel." Unless this is clearly specified, you can assume the figure given is for both channels together. Another point to check

Watch out for terms like 'Peak Power' and 'Peak Music Power' . . . inflated ratings

on is the load under which output power is measured. Since most speakers have an impedance of 8 ohms, the power rating should be given for an 8-ohm load. Some makers rate power output at a 4-ohm load. This yields a much higher wattage figure that looks good on paper, but is meaningless.

Just at or slightly above minimum specifications, you'll find a surprising number of dollar-stretchers with amazingly good performance. Among amplifiers, for instance, Lafayette's Stereo 25 costs only \$41.40 and pumps out 10 watts per channel. Realistic (Allied Radio Shack) offers a neat, compact stereo amplifier, its Model SA-175B, that delivers 12 watts per channel for a modest \$59.95. A companion FM stereo tuner (Model TM 175) is an exact match in style, size and price.

Moving up the power ladder a step, Lafayette has a 20-watt-per-channel stereo amplifier (Model LA-324A) for \$72.25. Realistic's slightly heftier SA-500 boasts 22½ watts per channel for \$99.95. For the kitbuilder, Heath offers a 15-watt-per-channel stereo amplifier (Model AA-14) for \$67.95 and a companion FM stereo tuner (Model AJM-14) for \$57.95.

If you're sure you're going to want radio as well as records and tape, an all-in-one receiver is a good money-sav-

ing choice over buying a separate amplifier and tuner. The reason is that the amplifier and tuner sections in a receiver share some of the same parts, such as the power supply, helping to cut the cost.

Among moderate-priced receivers, Realistic's STA-36 gives you both AM and FM stereo reception, a respectable 18 watts per channel and walnut cabinetry—all for \$119.95. Slightly less powerful, but well designed, is Sansui's Model 210, an AM/FM stereo receiver with 11 watts per channel for \$129.95. Craig's new Model 1506 is a dandy little mini-stereo system offering AM/FM reception, input jacks for accessory equipment and sleek styling for a surprising \$84.95. Though it's modestly powered, its price, which includes two matching speakers, makes it a real catch for the bargain hunter.

Again, stepping up in power, are Allied's 435 stereo receiver with 23 watts per channel for \$179.95 and Electro-Voice's EV-1181 with 25 watts per channel for \$189. In the just under \$200 bracket (\$199.95) are Panasonic's SA-5500, Sansui's 350A, Kenwood's KR-4130 and Realistic's STA-65C—all with good power for their price. Above \$200, you're out of the economy class.

In kits, Heath again offers several fine models to choose from. Its AD-27 compact, shown at the beginning of this article, combines a 15-watts-per-channel FM/FM stereo receiver with a record player in a novel rolltop walnut cabinet for \$169.95. A similar version without rolltop styling is \$119.95. Two other economy receiver kits are the AR-17 with 7 watts per channel for \$72.95 and the AR-14 with 15 watts per channel for \$119.95. Allied's line of Knight Kits includes an amplifier with 25 watts per channel and an AM/FM receiver with a hefty 50 watts per channel for \$199.95.

When it comes to speakers, it pays not to overeconomize. Here's where a few extra dollars really count. Speakers are your system's voice, and a pair of cheapie models will just compound the limitations of moderate-quality components. Reasonably good speakers can be had for under \$30 apiece, such as Allied's 3001 for \$24.95 or Lafayette's Criterion 50A for \$29.95. For a few more bucks, you can move up to air-suspension types like KLH's 32 at \$47.50, Electro-Voice's 8-A at \$49.95 and Acoustic Research's AR-4X at \$57. Any kind you choose should have at least a tweeter and woofer for good reproduction of highs and lows, and some may have a mid-range as well. A woofer that's under six inches in diameter is just too skimpy to provide good, deep, rich bass reproduction. ★★ ★

How far can a rim fire hunter shoot accurately?

Remington research says, "150 yards."

Impossible? Not with the powerful, new 5mm Remington Rim Fire Magnum in the rifles we built to handle it. Here's the story behind our Models 591 and 592...straight from Remington designers and ballistics experts.

In experienced hands, a 22 rim fire rifle is an efficient small-game and varmint getter. But the effective range of a 22 rim fire cartridge is just about 100 yards. Beyond that, bullet drop is so severe that long-range hits are more a matter of luck than skill. (A 22 long rifle cartridge, for example, zeroed in at 100 yards, can drop 10.7 inches at 150 yards!)

Remember, a varmint's range of vision is greater than 100 yards, especially in open or flat country. So, unless you want to stay with short-range situations, you have to pack more power into the field.

Traditionally, varmint hunters looking for greater accuracy have turned to specialized center fire rifles and cartridges. But not everyone wants or can afford to give up the low noise and economies of rim fire shooting. So Remington-Peters developed a completely new rim fire cartridge—the 5mm Remington Rim Fire Magnum—and built the Models 591 and 592 to handle it.

The 5mm Remington ballistics are impressive. In fact, it's the fastest rim fire cartridge made. (For more details, check the ballistics chart above.) And its speed gives it the flat trajectory needed for long-range accuracy. (Sighted in with iron sights at 100 yards, the 5mm drops only 4.3 inches at 150 yards.) And it's the only rim fire cartridge made with the super-accurate "Power-Lokt" hollow point bullet...a perfectly balanced and concentric varmint bullet that can mushroom up to 35 caliber when it hits as a result of an inseparable bond between bullet core and jacket. The pictures give you an idea just how effective the 5mm is in the field.



Unfired 5mm—5mm recovered bullet (150yds.).

RIM FIRE BALLISTICS			
	Muzzle	100 Yds.	150 Yds.
22 Long Rifle 40 GR. "Hi-Speed"			
Velocity (fps)	1285	1025	960
Energy (Ft/lbs)	147	93	82
Trajectory* Iron Sights (.7" AB)	—	0	—11.1"
Scope Sights (1.5" AB)	—	0	—10.7"
5mm Rem. Mag. 38 GR.			
Velocity (fps)	2100	1605	1400
Energy (Ft/lbs)	372	217	165
Trajectory* Iron Sights (.7" AB)	—	0	—4.3"
Scope Sights (1.5" AB)	—	0	—3.9"

*All Rifles Sighted in at 100 yds.

(Incidentally, the full-color, 48-page 1972 Remington-Peters catalog gives the ballistics for all Remington-Peters cartridges. A copy is yours for the writing.)

The 5mm Remington Rim Fire Magnum cartridge is so powerful we had to engineer a new bolt-action rifle to handle it. Six extra-heavy rotary lugs on the bolt engage grooves in the one-piece steel receiver and lock up tight. It's the same kind of multiple-lug lockup used in some of the most powerful Remington center fire rifles. And for added accuracy, the receiver is round for more precise bedding. Speaking of accuracy...

The Models 591 and 592 have the fastest lock time of any rim fire rifles made today. That means there's hardly any chance for you to stray off target after you've squeezed the trigger. To make the most of that incredibly fast lock time, and the inherent accuracy of the "Power-Lokt" bullet, the precision-bored barrel is mated to a steady, crisp match-type trigger.

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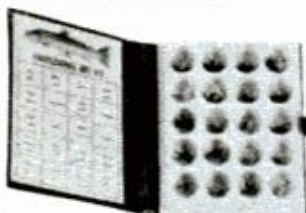


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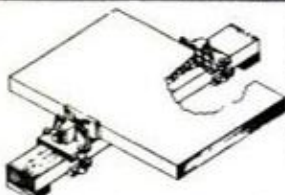


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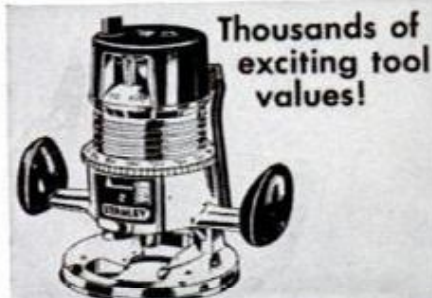
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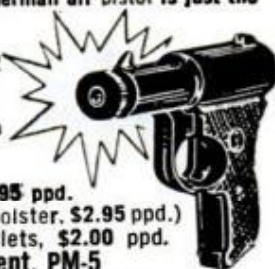
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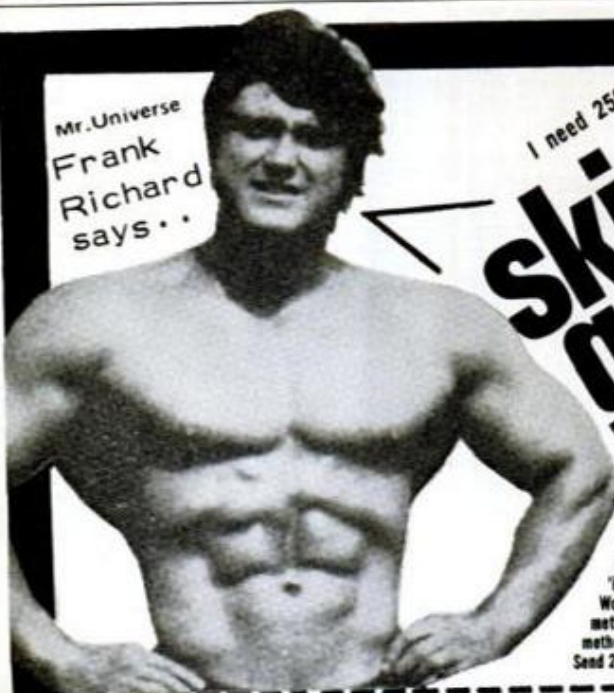
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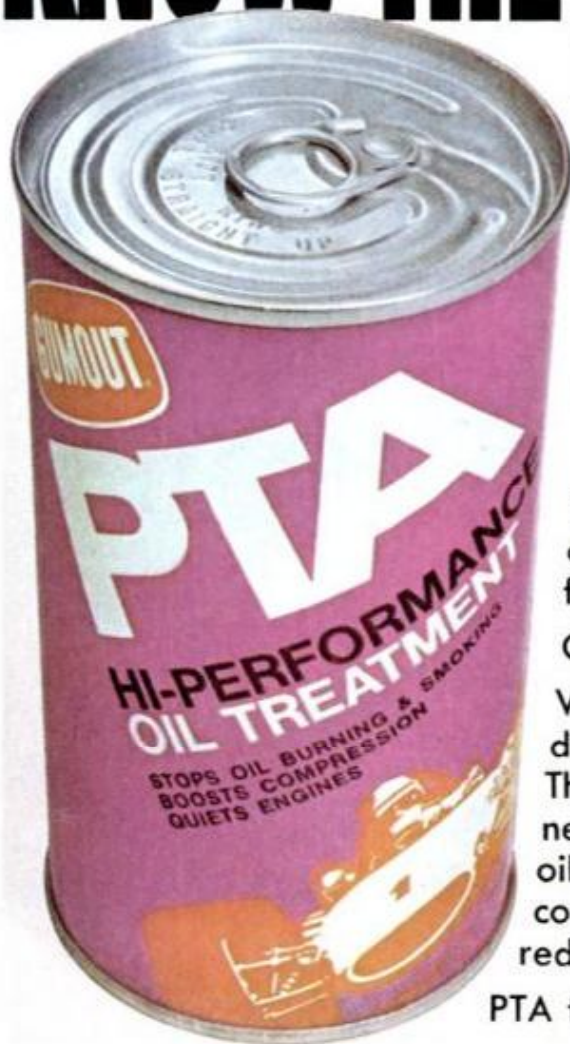
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