

How to defend Yourself Against 'Damn-Fool' Drivers

POPULAR MECHANICS

JULY 1968
50 CENTS

Owners
Reports
Pontiac,
Mercury

HOW ENGINEERS
WILL SHUT OFF
NIAGARA FALLS

Hot New
Houseboats

They Don't
Just Float
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The X-24 Wingless Plane That Flies in Space

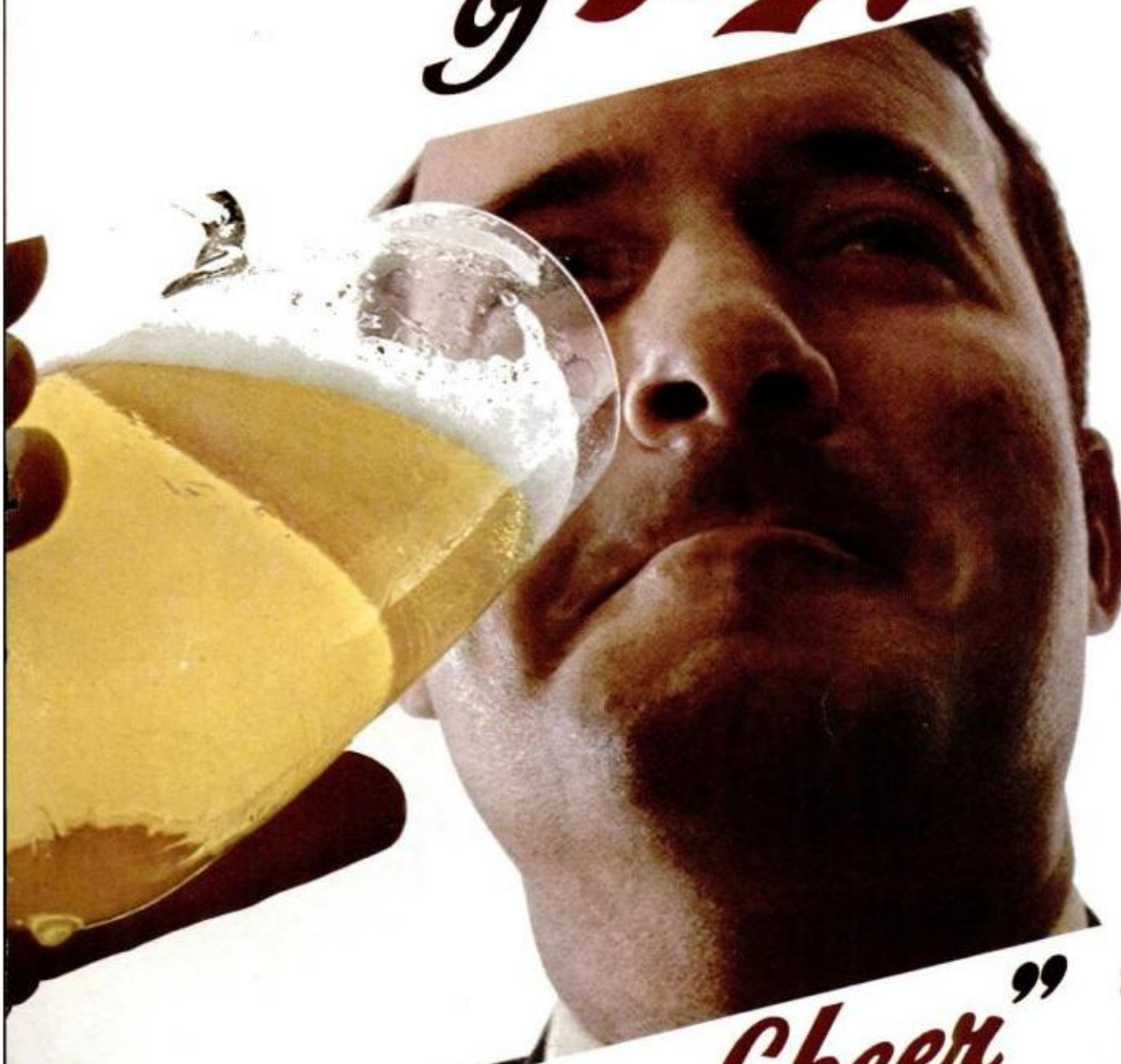
New Tunnel-Hull Inboard,
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— First Test Reports

IDEAS
TIPS
and
PROJECTS

A Soda Fountain for Your Fun Room ■ A Room Divider
That Makes Music ■ More Cooling From Your Airconditioner
Radio-Controlled Airplane Kit ■ A Hi-Lo Camper for
Your Pickup ■ Handsome Jewel Boxes (Weekend Project)
Automated Lawn Sprinkler ■ Bathroom-Darkroom

They Answers the Questions You Ask on Racing and Driving
MECHANIC: Tuning Your Car for Hot Weather • Also Auto Clinic

*"When you're out
of Schlitz,*



you're out of beer"

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

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The Round Tire is

Tread-ier



It gives you at least 3,000 extra miles

What do we mean by "tread-ier"? Just this: The Round Tire—Atlas Plycron*—has a rugged overall construction that's topped by a muscular tread made of tough, long-lasting rubber compounds.

It has a unique tread, designed to put more rubber on the road, where you need it. And this Atlas Plycron tread is backed by all the strength of four full plies.

Road tests against complete sets of tires for new 1968 cars again proved that the Atlas Plycron is "mile-ier," too. It will give you at least 3,000 more miles than tires that come on most new cars. Do we test Atlas Plycron tires for safety? You bet. Fifty-four different ways. You can't buy a more reliable tire. Get Atlas Plycron tires and start thousands of miles ahead!

ATLAS

Tires • Batteries • Accessories

Sold at over 50,000 leading service stations

*TRADE-MARKS "ATLAS" "PLYCRON" REG. U.S. PAT. OFF. © 1968 ATLAS SUPPLY CO.

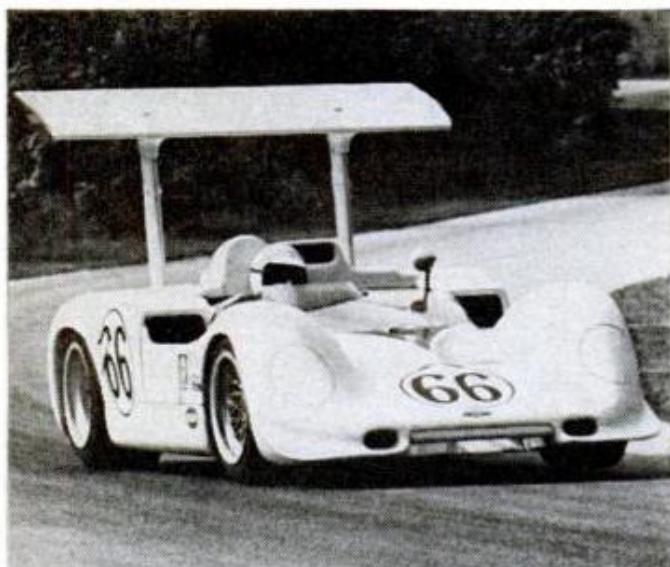


JULY 1968

1

Spark plug advertisers go to great lengths to use race drivers.

Jim Hall went out of his way to use us.



This may surprise you. Spark plug and automotive advertisers induce race drivers to use their products.

This is the reason you find a lot of advertising after a big race that claims several different products were responsible for a single victory.

In a way, Robert Bosch started the whole thing. In 1908, he put his newfangled

spark plugs in a Mercedes and it won the French Grand Prix. Bosch was happy. Mercedes was happy. And they let it go at that.

We haven't changed our philosophy much in 60 years. We still don't make it a project of seeking out race drivers just for the use of their names. This is why Bosch was pleased when Jim Hall, after testing many spark plugs, came to us.

So now he uses Robert Bosch plugs in the famous Chevy-powered Chaparral cars which he builds and drives. Cars that have won in competition from Nürburgring to Sebring to Riverside to Watkins Glen. And he uses them in his wife's Chevrolet—the same plugs that will give you perfect performance in your car, no matter what the make.

Next tune up, insist on Robert Bosch spark plugs. You'll get the same sparkling performance Jim Hall gets.

As for race endorsement ads, this is it. We have to get back to work.

ROBERT BOSCH CORPORATION

New York • Chicago • San Francisco • 2800 South 25th Avenue, Broadview, Illinois

How Renault scrimps on gas without scrimping on car.

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

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

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

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

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

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

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



A PIECE OF PAPER CAN SUPPORT A 4½ lb. BRICK

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



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

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

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

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

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

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

RENAULT 

*P.O.E. EAST COAST.
AUTOMATIC TRANSMISSION
OPTIONAL. FOR INFORMATION
WRITE RENAULT, INC.,
BOX 37, 750 3RD AVE, NYC



The Renault 10

This One



00D4-6Y2-JDRH

JULY 1968

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Cover Illustration by Ed Valigursky

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What Owners Think of Torino and Dart . . . after driving thousands of miles.
New All-Out War on Forest Fires. Fought by jumpers, planes and ground troops.

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JULY 1968

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



portable bar

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*offer valid only where legal

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in the shade
and you get a whiff
of a great
autumn day
in the woods,



someone
must be
smoking
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LETTERS

TO THE EDITOR

How to get unstuck

Your special section, *On-the-Go Camping '68*, in the May issue is very informative and interesting, but I feel you made a mistake in the article, *How to Get Unstuck* (page S4).

You state that a pulley will multiply the pulling effort of a car if you tie a rope to the trailer tongue, run it through a pulley attached to a tree and tie the other end to the car hitch.

I feel in this case the only advantage of the pulley is a change in the direction of pull. To multiply effort, the pulley must be on the trailer tongue, the stationary end of the rope tied to a tree and the other end tied to the car hitch. This gives you a mechanical advantage of two (double the pulling power), disregarding the efficiency lost in the pulley.

WINCHESTER, KY.

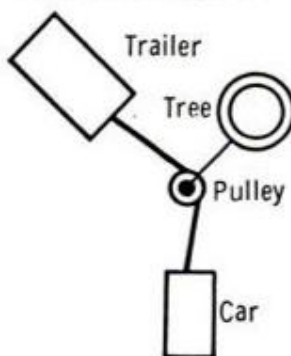
JIM JUDGE

Your special camping section is very interesting and informative. More people should be enjoying the beauty of America in this manner. I did find one misleading statement . . .

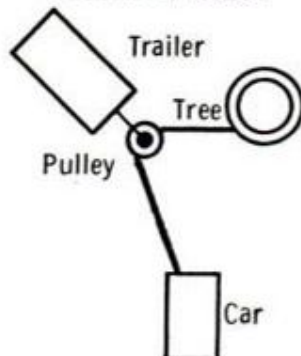
COLLEGE STATION, TEX. EUGENE BUTH, P.E.

. . . and so did lots of other sharp-eyed readers. You're all correct; the pulley set-up shown in May will only change direction. (That's all the writer intended to claim for it, but he got carried away.) To multiply force, the tow rope should go from the tree through the pulley to the car, as shown in the right-hand drawing.

CHANGE DIRECTION



MULTIPLY FORCE



Best one yet

The May issue of *PM* is the best one you have ever published. I realize that you have to put in articles that appeal to everybody, and you couldn't have fabricated a better overall magazine. You just

(Please turn to page 8)

Second chance for high school drop-outs to get a diploma



Now you can Finish High School at home

EARN A DIPLOMA IN YOUR SPARE TIME
WITHOUT LOSING A DAY'S PAY

**QUALIFY FOR A BETTER JOB
HIGHER PAY • GREATER SECURITY**

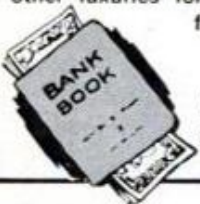
\$75,000 extra income in a lifetime

U.S. Government figures show the average high school graduate earns \$75,000 more than the non-graduate. Here's what you can do with the extra money:



Live in a home of your own in a fine neighborhood.

Drive a new car, provide other luxuries for your family.



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HERE'S A NEW, easier way for anyone over 17 to finish high school at home — with just a few hours a week of spare-time study. You don't have to go back to school — school comes to you.

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964

LETTERS

(Continued from page 6)

cannot make up a better issue than May!
STOCKBRIDGE, GA. O. BRASSFIELD

Four wheels better than two?

I couldn't agree more with Pat Perrett that taking a boat along is the only way to go (*We Took Our Boat Along*, page 124, April PM). However, he made a couple of misleading statements about its being "better to stay with a two-wheel trailer until you're forced to use a tandem" and that it's often impossible to launch and recover without submerging the trailer.

If finances permit, a four-wheel tandem-axle trailer with tilting bed is the most satisfactory type trailer for a boat of 17 feet or more that will be taken long distances. The trailer permits launch and recovery without trailer submergence and is capable of much greater loads with greater safety than single-axle trailers.
CORONADO, CAL. DON ENGLISH

Responds Pat: "I'll agree that the larger the boat, the greater the advantage in having a tilt-bed trailer both for ease of launching operations and keeping the

wheel bearings and brakes dry (especially in saltwater). But I still believe that the average boater (who is interested in cost) should stick to a single axle for 17 to 21-foot craft if load capacity is not violated. Every trailer should be purchased for maximum possible load plus a safety factor for the intended boat and equipment."

Aw, shucks. Do we really?

You wrote about the Chrysler Imperial (*Owners Report*, page 100, April PM). Well, I think you stink. Always knocking Chrysler cars. Corvettes cause accidents, but you say "good cars." Fords fall apart; you say "well built." GM drinks gas; you say "good riding." Chevies whistle on highways, but you say "good trade-ins." How much do the other companies pay you to knock Chrysler cars? You're real good at stepping on smaller companies. Hope someone does it to you some day.
DETROIT (UNSIGNED)

Ordinarily unsigned letters wind up in the wastebasket, but we're printing this one just to remind our anonymous correspondent that Owners Reports are exactly that: They tell what the owners think
(Please turn to page 10)



Not recommended for drivers under 18.

Du Pont Golden "7" is the high-performance motor oil additive. The one made to give your car top power and top performance. We figure it's not kid stuff.



Better things for better living...through chemistry



Bob Jones boosted his salary 300%*.

Could you do the same?

A few years ago, he was just another guy. Putting in long hours in a monotonous job. Barely able to make ends meet. No prestige. And no opportunity to get ahead.

But Bob Jones had determination. He looked around and saw other men being promoted. Men with no more on the ball than he had. Except for one thing. Specialized training that made them worth more to their employers.

So then and there Bob made up his mind to get out of the rut he was in. He read an ad for International Correspondence

Schools, and mailed the coupon. (The same coupon you see at the bottom of this page.) And though he didn't know it, he'd already taken his first step up.

Soon, Bob was busy studying in his spare time. Learning new skills, and applying them in his work. It wasn't long before he was offered a better job, with a fat increase in pay. Then came other promotions—and each time, more money. Bob Jones was starting to go places. The future was bright. Today, his salary has skyrocketed 300%!

Bob Jones' success story isn't unique. It simply proves what determination can do. You can do it, too, if you're even half as interested in making good. Pick the position you want, and I.C.S. will help you prepare for it. Just as it helped Bob Jones, and hundreds of thousands of others.

Clip this coupon now. Mail it at once. You'll receive 3 valuable booklets—free. They'll prove to you that Bob Jones' success story can be yours!

*The true story of Robert E. Jones, Houston, Texas. From the success files of I.C.S.

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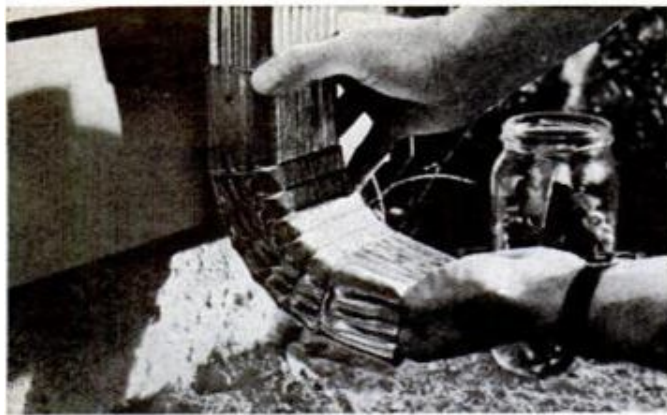
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LETTERS

(Continued from page 8)

about those cars they paid their money for—not what we think. The Big Two don't always do so well, either.

Gold finder

One of the recent projects my son and I worked on was your *Gas-Driven Dry-washer* (page 170, Jan. '66 PM).

It was raining the first time we used the



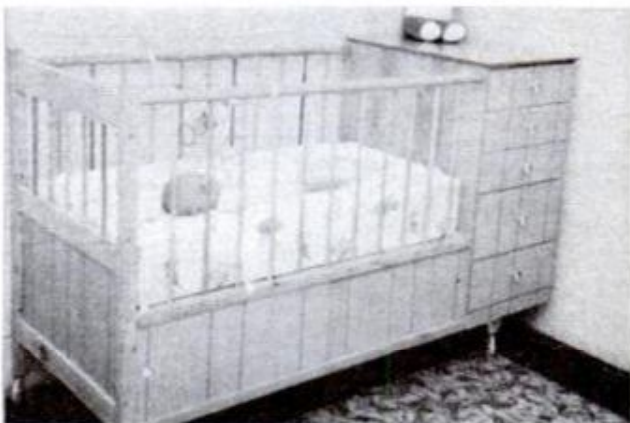
drywasher (we should have built a wet washer!), but we did recover a small amount of gold.

POPE AFB, N.C. COL. GEORGE F. OWEN

Any other would-be prospectors who missed the article can get a Xerox copy for 75 cents from PM's Bureau of Information.

Easy does it

Our baby's bed was made by my husband from plans in *Build This Two-in-*

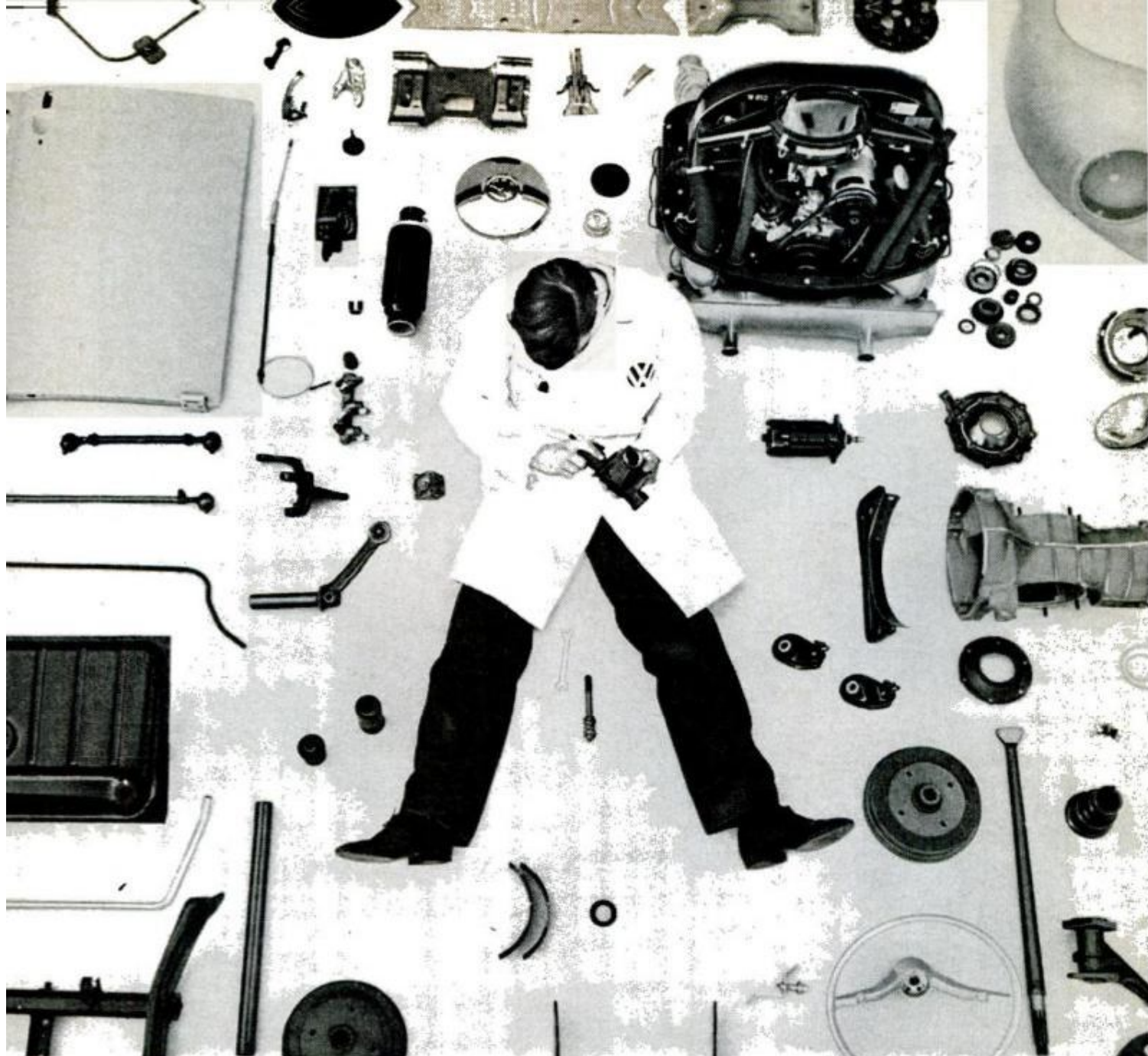


One Chest-Crib (page 172, May '67 PM).

I am very pleased; it is so convenient having everything in one area. Thank you for making things easier for me.

HENDERSON, TENN. MRS. FLOYD C. ARNOLD

POPULAR MECHANICS



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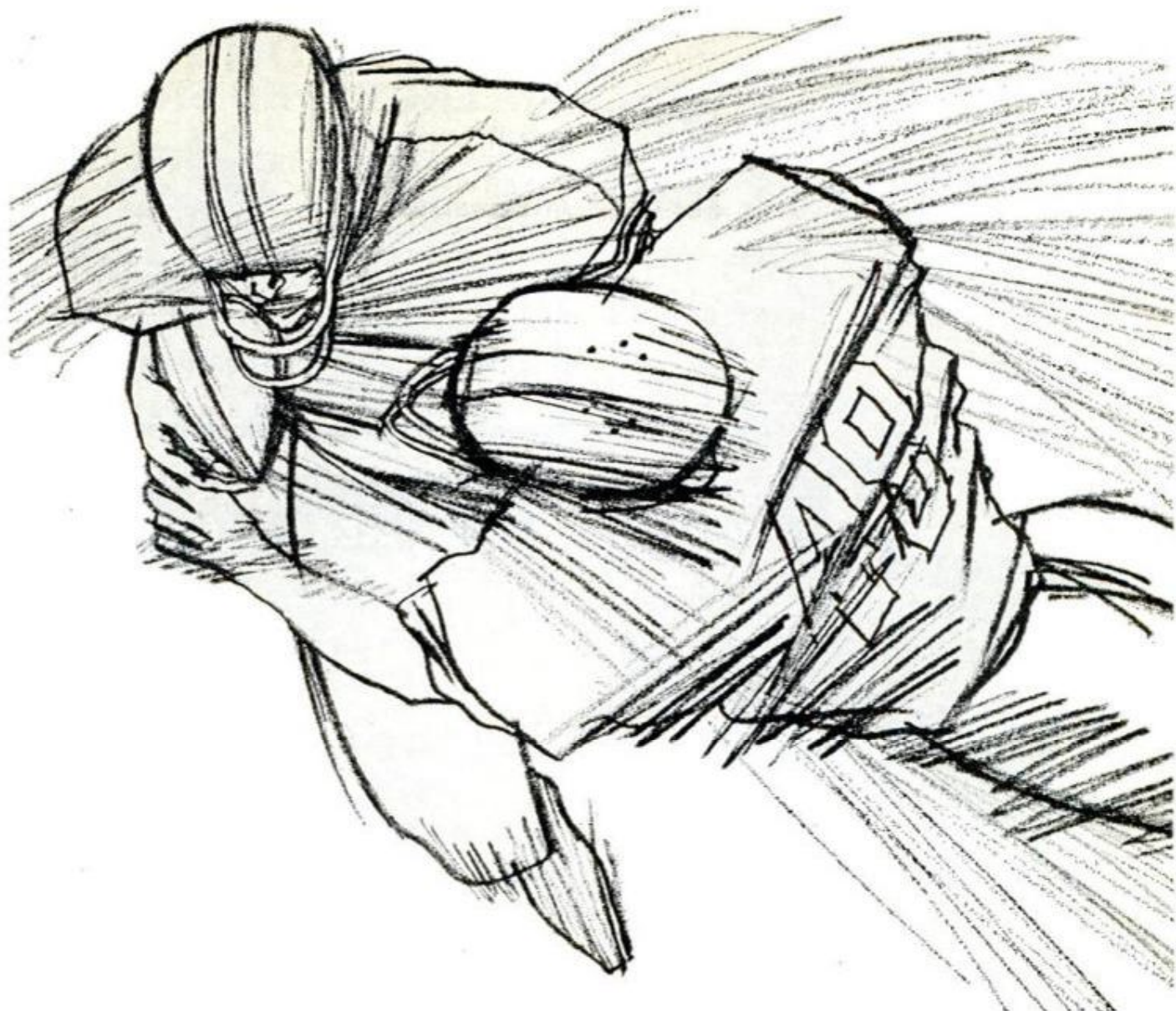
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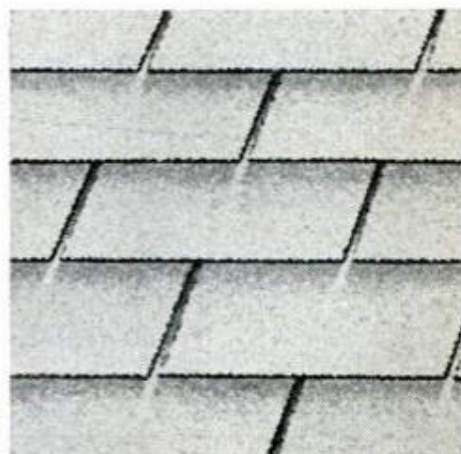


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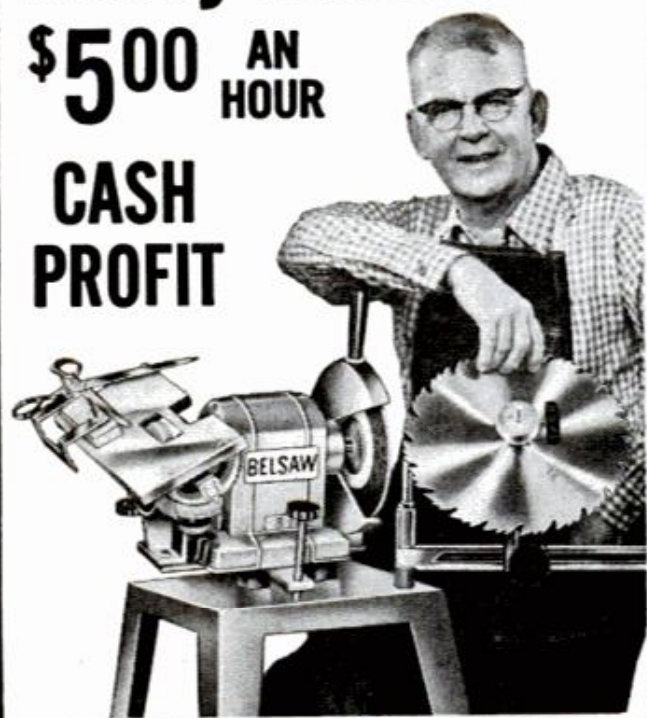
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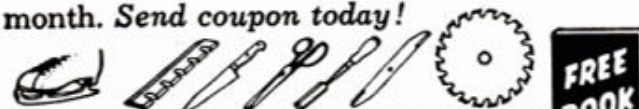
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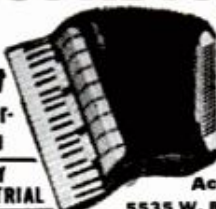
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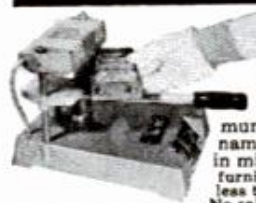
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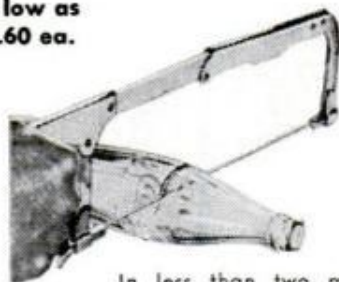
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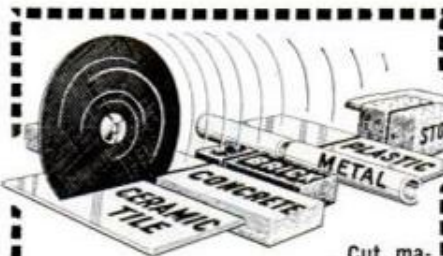


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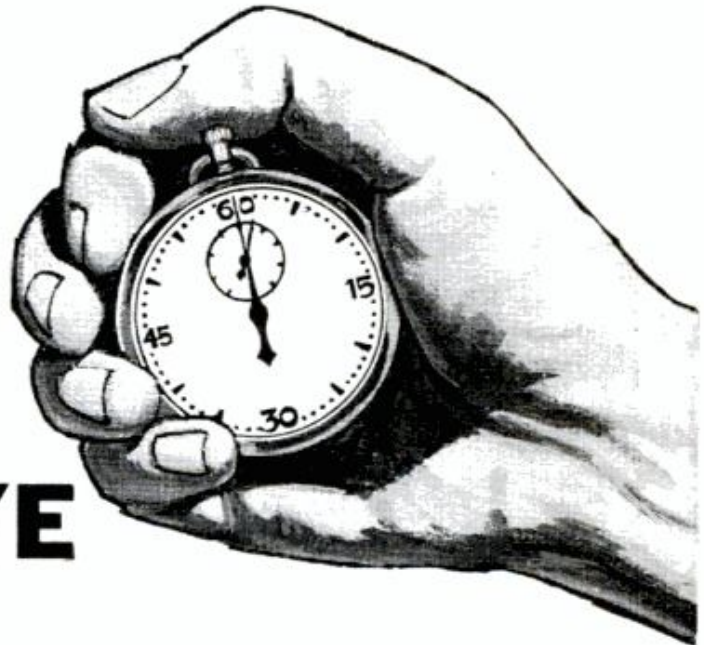
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Milk is not a good food for most nonwhite adults, according to separate studies by researchers at Johns Hopkins Medical School and at the University of New South Wales, Australia. The lack of an enzyme, lactase, apparently makes it impossible for most adult Negroes and Asians to digest milk. Drinking more than a glass of milk causes cramps and diarrhea.

Supercooling is the key to boosting the energy of the Stanford University Linear Accelerator (SLAC), currently the world's most powerful atom-smasher. By surrounding the two-mile-long "gun" with helium chilled to minus 456° F., the power of the accelerator can be increased tenfold from its present level of 20 billion electron volts. At very low temperatures, helium loses its electrical resistance and becomes a nearly perfect transmitter of energy.

Adding charcoal to the diets of cows is an effective way to remove harmful pesticides from the animals' systems. Michigan State University scientists report that charcoal binds itself to pesticide residues and allows them to be carried out of the body instead of being reabsorbed into blood and tissues. The end result is pesticide-free milk.

Fear can be transferred by injection, according to an experiment by a Baylor University researcher. He made rats afraid of the dark (they usually love it) by giving them an electric shock every time they entered a darkened box. Their brains were removed and an extract taken from them. When this was injected into rats known to prefer darkness, they immediately exhibited fear of the dark chamber.

Asthma attacks appear to be psychologically triggered in many cases. Of 40 patients who volunteered for an experiment at Brooklyn's Downstate Medical Center, 19 developed asthma symptoms after breathing the mist of a salt solution said to contain allergens such as pollens and dust. But the symptoms disappeared immediately when the patients took what they thought was an asthma drug. Actually, the "drug" was only more of the salt mist.

Keeping tabs on the moon may be the best way found yet of predicting earthquakes, according to a scientist at the Arctic Institute of North America, Washington, D.C. In 27 passages of the moon through its point of greatest apparent latitude, 33 quakes occurred within a day of the event. If there were no relationship between the two events, says the scientist, a random distribution should have produced only 23 quakes in that period. Using this and similar observations, astronomers predicted a number of earthquakes days or weeks in advance from 1965 to 1967.

A mixture of jet fuel and oxygen, burned in a modified Atlas vernier rocket engine, may be the U.S. Air Force's answer to the problem of throwing light on night combat offensives. The system would make it possible for an aircraft flying at 10,000 feet to illuminate a 4-square-mile area 50 times more brightly than moonlight.

Early cases of breast cancer may soon be detected by means of ultrasonic holograms. Two ultrasonic beams, passed through the breast, create an interference pattern that can be illuminated by a laser to produce a 3D image of the internal tissues. Researchers at Roswell Park Memorial Institute, Buffalo, N.Y., report success in using the method to detect tumors in rats and mice.

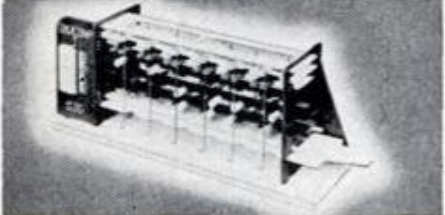
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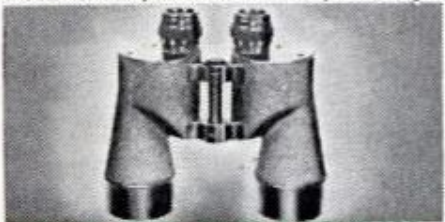
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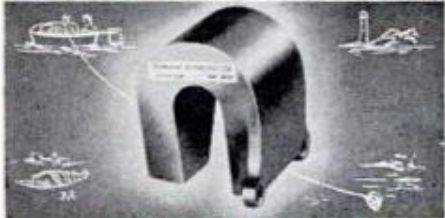


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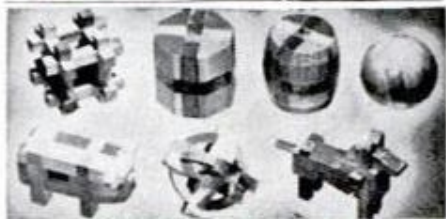
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Sweden sends us something special

In the Driver's Seat of the SAAB SONETT II

By ALEX MARKOVICH

FILMS aren't the only sexy imports from Sweden of late. The sleek, sinuous Saab Sonett II has more curves than Ekberg, more kick than a shot of aquavit.

Compared to its cousin, the Saab sedan, the Sonett isn't a terribly practical street machine. It seats only two. The luggage space, though large, is exposed beneath the large rear window. Bumper protection is practically nil. That's because the Sonett was designed mainly for rallies and other competition use. Yet, people who appreciate fine machinery should be willing to put up with these minor inconveniences.

The competition influence is strong in the design. The low, long hood is studded with racy bulges and scoops; the fastback is chopped off according to the latest aerodynamic theory; and a neat black rollbar provides extra protection in the unlikely event of a rollover, as well as a measure of status.

The styling alone is almost worth the \$3690 admission price. The body, incidentally, is all fiberglass, which means light weight, no corrosion, easier minor repairs and greater impact absorption and passenger safety in an accident.

The doors don't open too wide, and the openings are low; you get lots of good, healthy exercise getting in and out.

But once you're in, it's worth the effort. The bucket seats are contoured and padded in all the right places. Since the Sonett is a couple of inches shy of four

feet in height, seat backs are sharply raked for head clearance.

The driver gets the VIP treatment. Pedals are well spaced for fast, no-tangle operation, and the steering wheel is perfectly positioned at nearly arm's length. Visibility is excellent.

Old-time Saab fans who have become resigned to the rough, three-cylinder engine that pops like a percolator are in for a happy surprise. The old two-cycle has been replaced with a smooth, fast-revving four-cycle V4. Its relatively mild state of

(Please turn to page 24)

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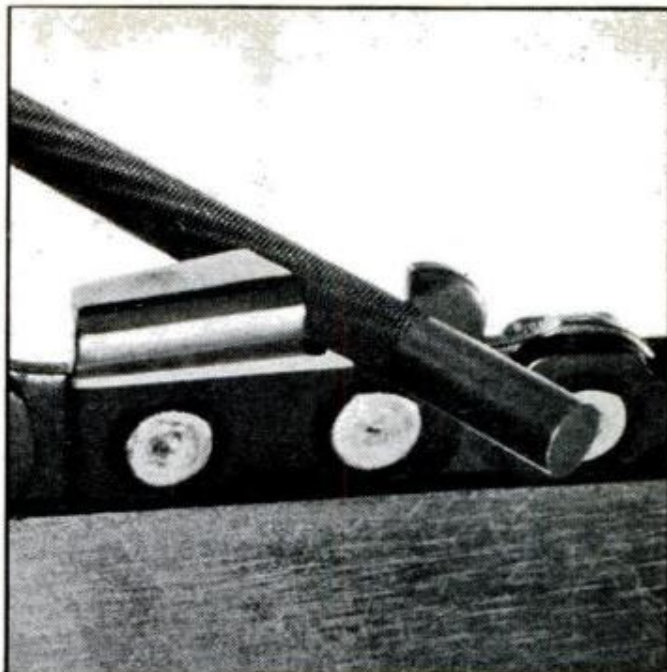
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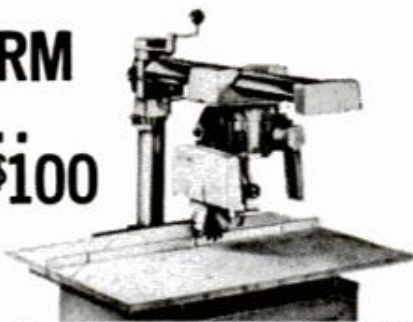
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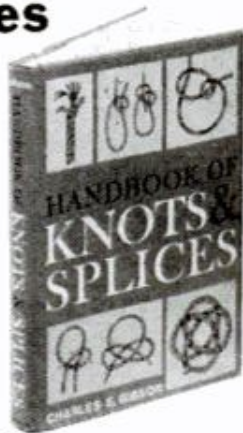
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DRIVING THE SAAB SONETT II

(Continued from page 22)

tune (73 hp from 91.4 cu. in.) makes it completely tractable along Main St. And yet it can reach 60 mph in under 14 seconds, and its top speed is well over 100. The electronic tachometer is redlined at 5200 rpm, but you can push the needle past 6000 without any sounds of distress.

In spite of my acceleration runs and generally hard driving, the Sonett averaged better than 30 mpg. With its 15.8-gallon fuel tank, the car has a cruising range of about 500 miles!

Road-holding is fantastic. The front-wheel-drive design has unusual handling characteristics that are useful if you know how to take advantage of them. Under full throttle on a curve, the car understeers, or takes a wider arc than is dictated by the angle of its front wheels; this is due to a slight sideward slippage of the front wheels. If you find you've gone in too fast and the understeer is becoming excessive, just back off the throttle. This induces the opposite effect, in which the rear wheels slip outward and tighten the turn. You can actually steer with the throttle.

The ride is on the hard side at low speeds, but it smooths out beautifully at 50 or 60. Considering the short, 84-inch wheelbase, pitch is unusually mild.

With disc brakes in front and drums in back, the Sonett stops fast and straight. Half a dozen panic stops from 60 in rapid succession result in practically no fade.

The rack-and-pinion steering is exceptionally precise and, at 2 1/4 turns lock-to-lock, very fast. The turning circle is a tight 31 feet.

An unusual Saab feature is the gas-saving freewheeling device, which automatically disconnects the transmission when you lift off the throttle; an incidental benefit of this is clutchless downshifting. When the freewheel is engaged, it's like coasting in neutral with the engine idling. The lack of engine braking is disconcerting at first, but the brakes are more than up to their job. When driving down a long, steep hill, pull a handle under the dash to cut out the freewheel.

My only real criticism of the Sonett concerns the sloppy, inconvenient column shift. It doesn't really hurt performance noticeably; the four-speed box is well-synchronized and shifts fast. But all that spaghetti between the gears and the driver just doesn't feel good. However, several Swedish speed shops and one domestic Saab dealer are said to be working on a floor-shift conversion kit.

All in all, the Sonett is pretty close to a perfect sports car. ★★★

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WHAT'S NEW OUTDOORS

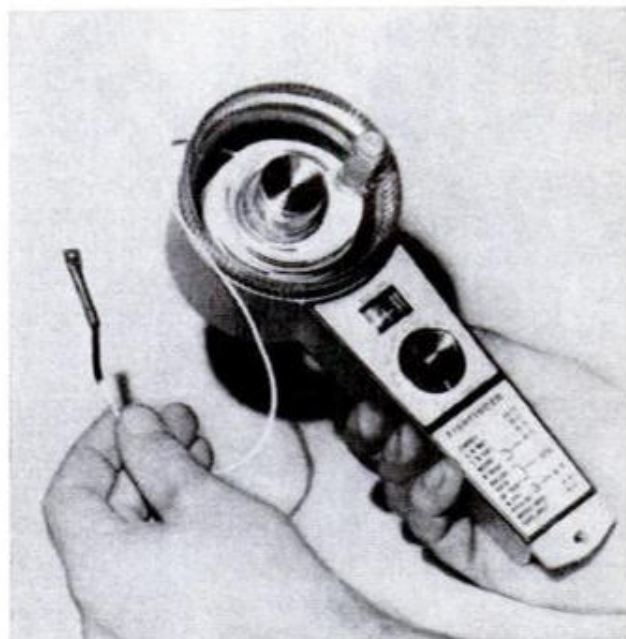
BY DAN FALES

TO HANDLE the most delicate filleting job, Normark Corp. is introducing a new model of its popular Fish 'N Fillet knife. Normark calls it the deluxe presentation model because of a number of extras which have been added to the regular filleting knife. These extras include a six-inch, progressively tapered stainless-steel



blade; hand-ground edge that can be easily resharpened with a hand-hone; molded ebony-colored handle. Also included is a heavy ox-hide sheath that's hand-tooled. This knife retails for \$7.95. You can get more information from Normark at 1710 East 78th Street, Minneapolis, Minn. 55423.

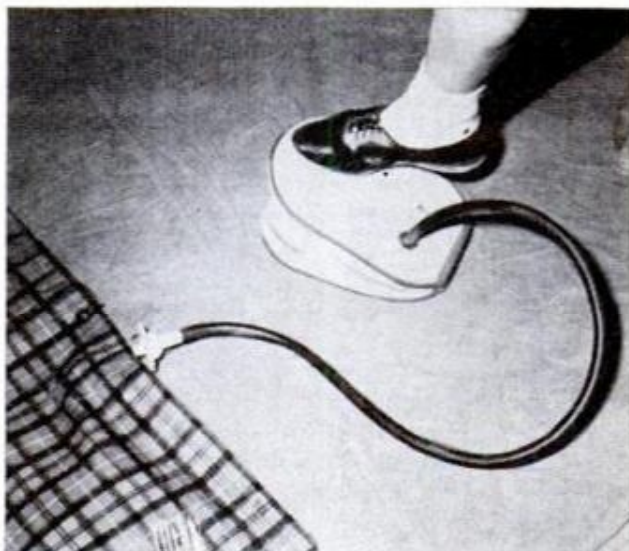
A NEW ELECTRONIC FISHING thermometer lets you dial the desired temperature, then tells you how far down that thermal layer is. The Vexilar Electronic Fishfinder combines a temperature dial, meter, encased hand reel with 60 feet of plastic-coated wire and a battery holder. The sensing element attached to the free end of the wire is extremely sensitive to temperature change. When this element reaches the water temperature that coincides with the temperature dial, there is a reaction visible on the meter. It takes about 30 seconds for the meter to react. The fishfinder is powered by a 1½-volt, C-type battery. Suggested retail price is



\$39.95. For more information, contact Vexilar Engineering, Inc., 1300 South First Street, Minneapolis, Minn. 55404.

BUILT FOR RUGGED OUTDOOR USE is this new step-on Bellows Pump. It's good for inflating air mattresses, air-chambered floats and boats, beach balls and other inflatables.

A 2½-quart chamber permits an air-volume capacity more than triple that of most other foot pumps. It's made with a wooden top and bottom, durable rubber sides, plastic air valve. When not in use, the pump folds to a compact 2 by 7 by 10-inch unit. The Bellows Pump weighs about 2½ pounds and costs \$7.95 from Gloy's Inc., 11 Addison Street, Larchmont, N.Y. 10538.



Most any paint looks good going on. Spred® House Paint goes on looking good.



6 YEARS, CANADA. "Cold winters and strong sun are hard on paint. But our house has come through beautifully. Several neighbors switched to Spred House Paint." S. K. McBirnie.



3 YEARS, COLORADO. "Had to paint four times in two years because of severe blistering. Then tried Spred House Paint in 1965. It stopped the blistering and looks great." D. M. Craig.



6 YEARS, CALIFORNIA. "No switching paints for me. Used it on siding, masonry and metal. No sags, no runs, no lap marks show. We have a basketball backboard that needed painting every six months — until Spred House Paint!" C. Schaffer.



8 YEARS, OHIO. "Spred House Paint solved a terrific blistering problem. I did repaint one side, south, after six years, but other three sides still don't need repainting." T. S. Trippett.



3 YEARS, MINNESOTA. "Still looks like we just put it on — flowed on easier than any house paint I've ever used. No brush drag." H. E. Griffin.



6 YEARS NORTH CAROLINA. "Spred House Paint gets a real test in this mountain area — cold nights, hot days, and fumes from a nearby textile plant. There's no discoloration." J. B. Smith.



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

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People who drive all day, every day, rain or shine.

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

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

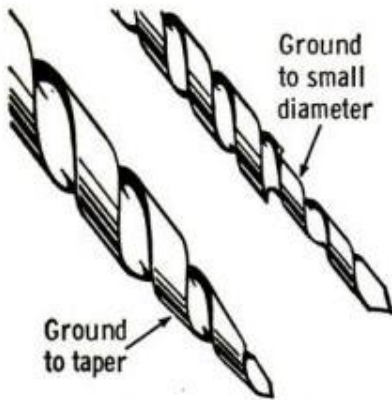
You see, to make a tire that has all the features of The Rain Tire and that's strong enough for trucks takes time.

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

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

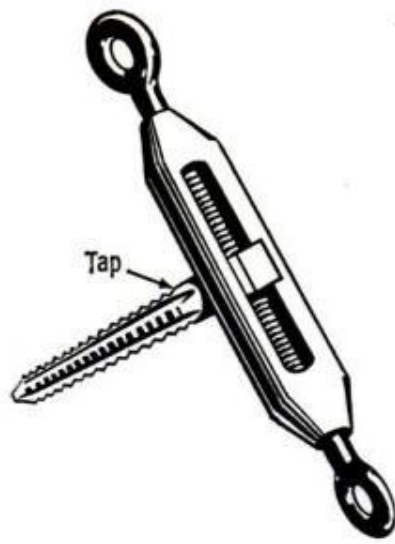
The rain tire® for small trucks 

HINTS FROM READERS



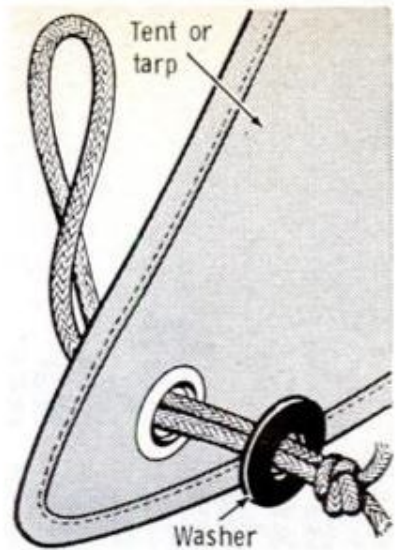
Improvise special bits

By chucking a regular bit in a drill press or lathe you can grind it to a different shape for special jobs. A long taper lets you drill holes of more than one diameter in sheet metal or other thin material. Grind tip to a smaller diameter to make a counterbore.



Simple tap wrench

If your tap wrench isn't handy when you need it, you can easily improvise a good substitute from a turnbuckle. Just slip the head of the tap through the center of the slot and tighten the screws against it. The rounded body of the turnbuckle provides a good grip.



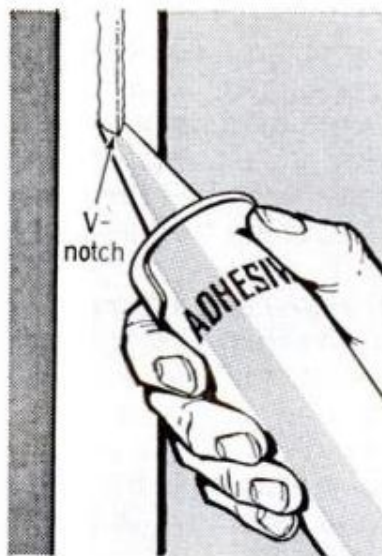
Tough tent loops

When replacing the tie-down loops on a tent or tarp with stronger nylon rope, you may find that a retainer knot in the smaller-diameter nylon is small enough to slip through the grommet. Instead of tying an unsightly oversize knot, install a washer ahead of knot.



Torch handle

You'll find that it's much less tiring to use a propane torch for long periods of time if you attach a handle to it with a pair of hose clamps. Bend the handle from a 1-in.-wide strip of 1/8-in. mild steel and tape the grip. Try this when burning off old paint.



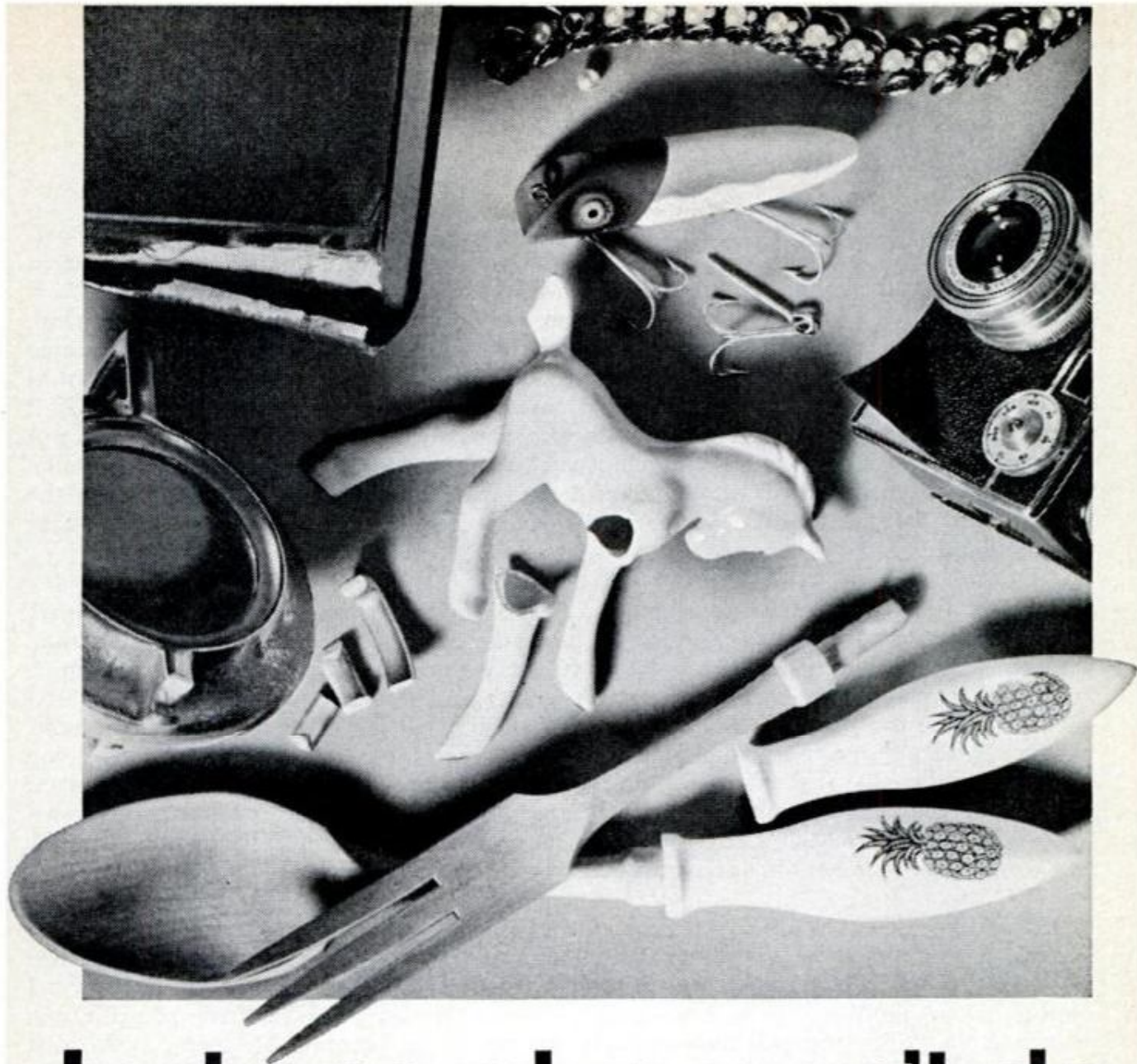
Mounting paneling

The cartridge-type adhesive used to mount paneling on studs will go on a lot more evenly if you cut a small V-notch in the upper edge of the nozzle. This will produce an ideal ridged bead of adhesive on the stud, ensuring even contact with the back of the panel.



Patching screen

To patch fiberglass screening, trim the hole to a rectangular shape and cut a patch to match—about 1/4 in. oversize on all sides. Position patch over hole on a hard, smooth surface, cover with waxed paper, set iron to "cotton" and run tip of iron around lap.



Just one glue won't do

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LISTENING POST

BY BOB IRVIN

ANTISKID BRAKES will be pioneered by Ford next year. The 1969 Thunderbird will offer an electronic antilock system developed by a supplier. In a panic stop, the system actuates the brakes many times each second (see *Coming Soon! "Skidproof" Cars*, page 104, Feb. '68 PM). It's designed to keep the brakes from locking, prevent a skid, a problem with conventional brakes on wet pavement. A test T-Bird with the electronic antiskid system even stopped smoothly in a panic stop on a foam-coated taxiway at Metropolitan Airport near here. Federal safety officials are mighty interested. If it works as well in production cars as it does in tests so far, look for Washington to put the heat on other manufacturers to adopt such systems soon. The only system available up to now has been the Dunlop-Maxaret device—a mechanical one available on the British-built Jensen. The Ford electronic system, while it operates only on the rear wheels, is still said to be superior.

FORD'S NEW SMALL CAR is scheduled to go into production next March. An April, 1969 introduction is expected. The car—a two-door sedan—will be slightly smaller than the present Falcon compact. The Falcon's future is uncertain. Because there's not much difference in size between the Ford small car and the Falcon, the latter could be phased out. Or maybe the new car will be called a Falcon. That might be a mistake, however, because if it's a new car it probably ought to have a different image. The car isn't going to be aimed directly at the best-selling import, Volkswagen, but it still should put Ford in a better position to counter the foreign car boom. The car will probably be priced just slightly under \$2000. This would be around \$300 below the Falcon and Chevy II, but would still leave room for continued importing of the British-built Ford Cortina.

MORE NEW STYLING DETAILS on the 1969 cars are coming to light. Items: The Pontiac Grand Prix will have four rectangular taillights set on each side of the license plate, behind the rear bumper. It will have a hunched-up rear deck and a new, formal roofline. Door handles will be flush with the side of the car . . . The Firebird grille will resemble the G.P.s, but will have an ellipse-shaped, wraparound bumper . . . Word is that the concealed radio antenna on the G.P. will be a thin wire fitted in the front windshield, close to the A-pillar . . . The driver's compartment on the G.P. and the big Ford for 1969 will take on the "cockpit" look of Corvette in recent years . . . The new Tempest will have a grille resembling the current big Pontiac. That is, the snout in the center extends below the bumper. The rear lights are still rectangular but are no longer set completely in the bumper. Instead, the top part of the rear bumper fits around the lower part of the taillights. There are two small side scoops on the front quarter panels . . . The luxury version of the 1969 Mustang may be called the "Grande." The interior will have simulated wood-grain paneling and hopsacking upholstery. Another touch will be bullet-shaped side-view mirrors . . . The performance-minded will find race-type locking pins not only on the hood of the new Mustang Mach 1, but also on the Cougar and the sports models of the Ford Torino and Mercury Cyclone . . . Wider rear-view mirrors are under development by GM and may be on the new cars. Some models seen at the GM proving ground near Milford, Mich., appear to have foot-wide mirrors . . . With luxury versions abounding in all car classes, how do the "old line" luxury cars stay distinctive? With little touches like the fully-carpeted trunk due on the new Lincoln-Continental.

CONSERVATIVE STYLING will be the theme at Chrysler again in 1969. One car which has been and will still be an exception is the Charger. This sporty-looking model—a leading seller in '68—will be touched up a bit for '69. A thin vertical bar

(Please turn to page 38)

The next time some guy tells you a used car is "just like new" ask for the guarantee.



When all the smooth talk is done, a guarantee is about the only thing this kind of guy is guaranteed not to give you.

Which might explain why so many people find it rough going with a used car they got from a smooth-talking salesman.

VW used car dealers aren't smooth talkers. In fact, they aren't talkers at all. Their guarantee says it all.

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The engine, transmission, rear axle, front axle assemblies, brake system, electrical system are all covered.

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But if they do, anything he has to say about them he says in writing.

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GUMOUT DIVISION
 Pennsylvania Refining Co., Cleveland, Ohio 44104

DETROIT LISTENING POST

(Continued from page 36)

will be added to the center of the grille. Taillights will be narrow and concave and nearly full-width, replacing the present twin sets of round lights. The other middle-size Mopars also will have only minor changes, with the Plymouth Satellite grille emphasizing a single horizontal bar and recessed, square taillights.

The Dodge Coronet will have three thin, rectangular taillights. The compact-sized Plymouth Valiant and Dodge Dart will have plain front ends with parking lights set inside the horizontal grillework.

A PLASTIC AUTOMOBILE CHASSIS

is a long way off, even though Mobay Chemical Co. of Pittsburgh is exhibiting just such a vehicle. (See *Even the Chassis Is Made of Plastic*, page 78.) The test car was developed by Farbenfabriken Bayer, of Germany, Mobay's parent firm. It features a chassis engineered out of high-strength plastics and rigid urethane foam. The car also has a plastic body. Company officials say they could build a sports car version today at a price competitive with Porsche. But they don't see any car being built soon with this type of chassis. And they believe it will be "a very long time" before any high-volume car uses an all-plastic chassis.

FRONT-END DESIGNS are still being criticized by Washington, even though hood ornaments have been eliminated. Dr. William Haddon Jr., the federal safety boss, has harsh words for stylists who design more for appearance than safety. He calls them "unreasonable and irresponsible," adding: "I wonder if they would design that way if they knew members of their own family were going to be hit by these cars?" Safety officials obviously want to see things like the Pontiac snout done away with but are finding it difficult to write a suitable standard.

FORD STYLING is undergoing such a big shakeup under the firm's new president—S.E. "Bunkie" Knudsen—that word is he has even opened up his own studio at the Ford design center. Bunkie managed to make some design changes on the 1969s, ordered even more changes on the 1970 and 1971 models. And, according to some industry scuttlebutt, he threw out all the preliminary designs for the 1972 models, rattling some top Ford executives in the process. But it sounds like he's going at his new job with the same gusto he displayed 10 years ago when he rebuilt the Pontiac Div. of General Motors. ★ ★ ★

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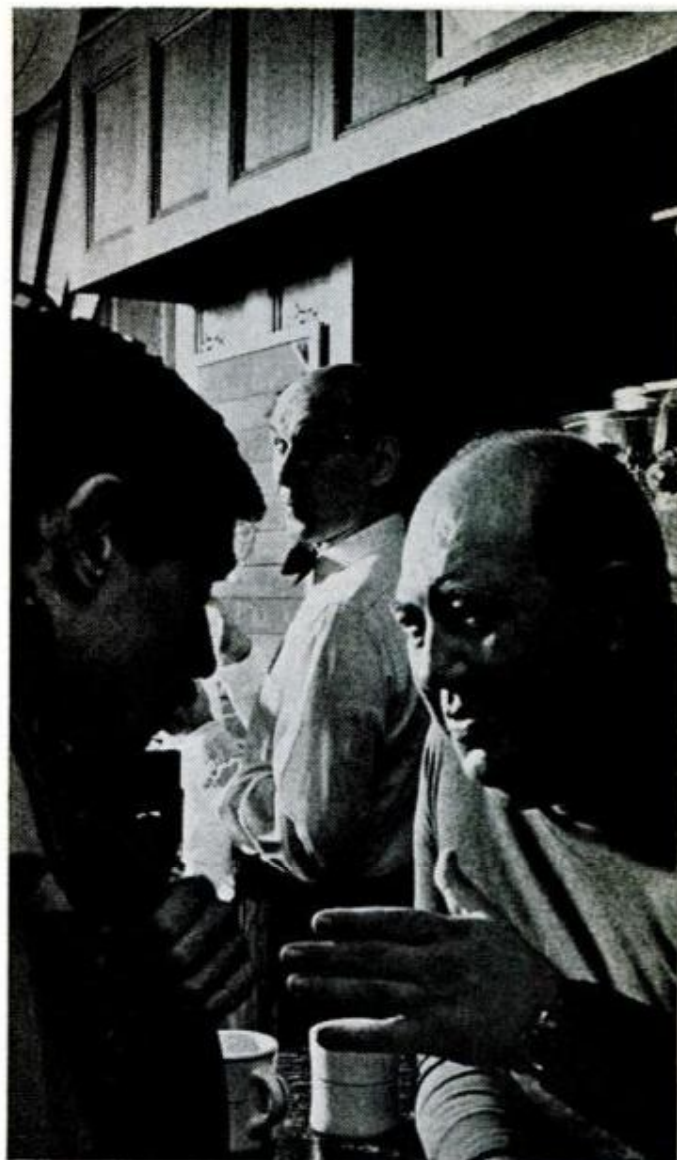
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Not the old fashioned cheap kind of welder or torch you may have read about, but a brand new 1968-69 "Power Package" that produces 4 TIMES the HEAT needed to melt iron, plus extra power boost attachment for industrial users.

3 WELDING HEATS . . . not just one as with other low priced models. "High" for tough jobs, "medium" or "regular" for lighter work. LOWER OPERATING COST! 3-heat feature saves cost of welder in welding rods alone. SAFETY feature to prevent overload of house wiring and burn out.

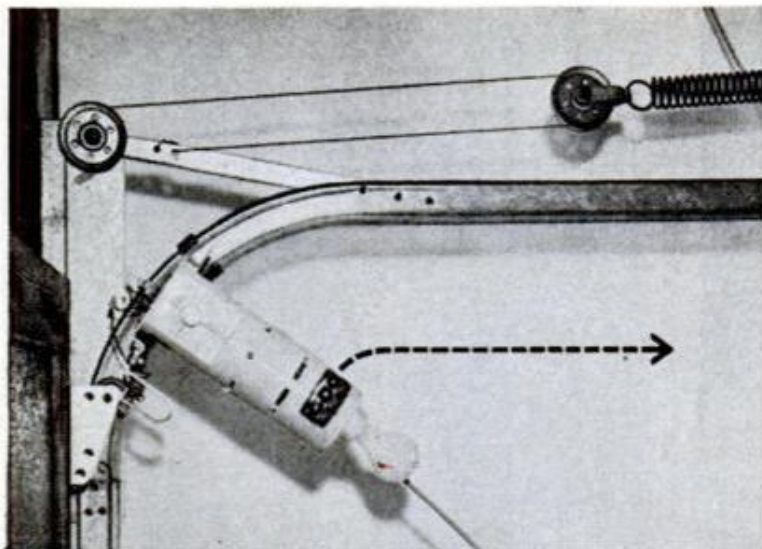
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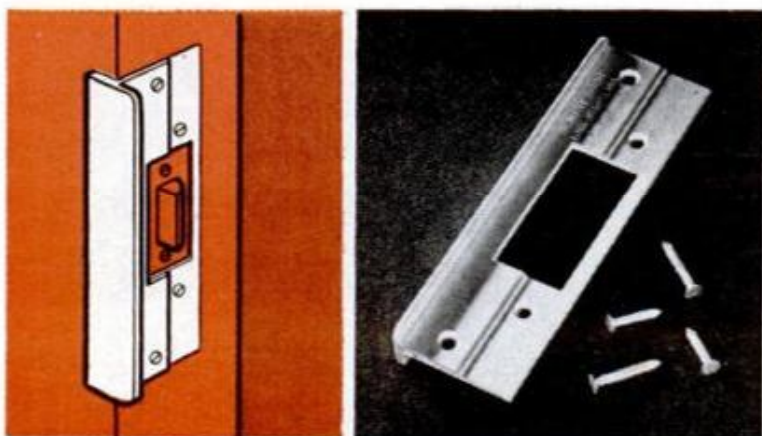
WEL-DEX MFG. CO., Dept. W-10, Box 10776, Houston, Texas 77018

NEW HARDWARE YOU SHOULD KNOW ABOUT



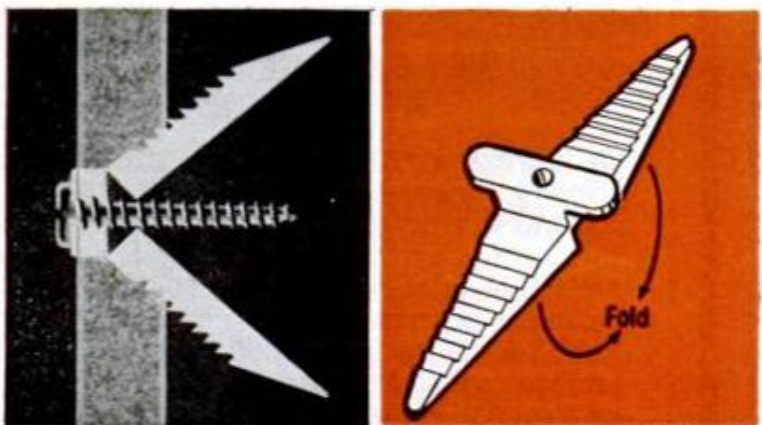
Bargain garage-door opener

Instead of using the standard beam-and-chain arrangement to open and close the door, a new garage door opener cuts manufacturing costs by doing the job with a patented self-adjusting rubber wheel. The $\frac{1}{3}$ -hp motor is operated by a battery-powered transmitter in the car. A safety sensor stops the door instantly on contact. A light goes on when the door opens and off when it closes. Easy to install, it lists for \$135.95 (installation is optional) from GDO Co., Inc., Dept. PM, 248 Broad Ave., Palisades Park, N.J. 07650.



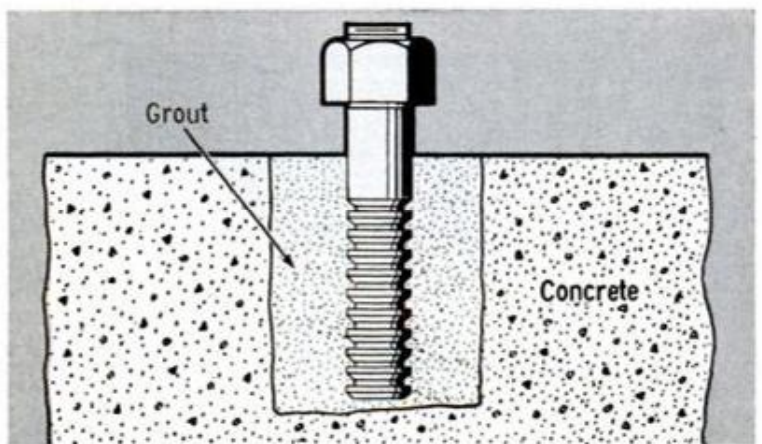
Jimmyproof lock guard

A T-shaped plate designed to be mortised flush in the edge of your door fits over the latch and prevents anything from being slipped between the door and casing to jimmy the lock. The only modification required is cutting off the protruding edge of the striker plate to make it even with the outside of the door frame. The Stop Thief retails for \$1.75 from Engineering Service Co., Box 352, Dania, Fla.



Fastener for plasterboard

A new hollow-wall fastener can be hammered into plasterboard walls without first drilling a hole. It's made of polypropylene and fits both a $\frac{3}{8}$ and $\frac{1}{2}$ -in. plasterboard. Driving sheet-metal screw (Nos. 6 to 14) or ribbed nail into center of the fastener pushes out wings to anchor it securely. To remove it, reverse the procedure. Neetlok fasteners are made by Reddi Car Corp., 174 Greeley Ave., Sayville, N.Y. 11782.



New design for anchor bolt

Recommended for heavy-duty applications, a new anchor bolt features unique perpendicular shoulders. This places their withdrawal potential directly against the withdrawal axis of the bolt cylinder itself. The reverse face of the grooves also facilitates the flow of grout into the grooves. Available in $\frac{1}{2}$ to $1\frac{1}{2}$ -in. diameters, they're made by Dependable Parts Co., 33220 Lakeland Blvd., Eastlake, Ohio 44094.



I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

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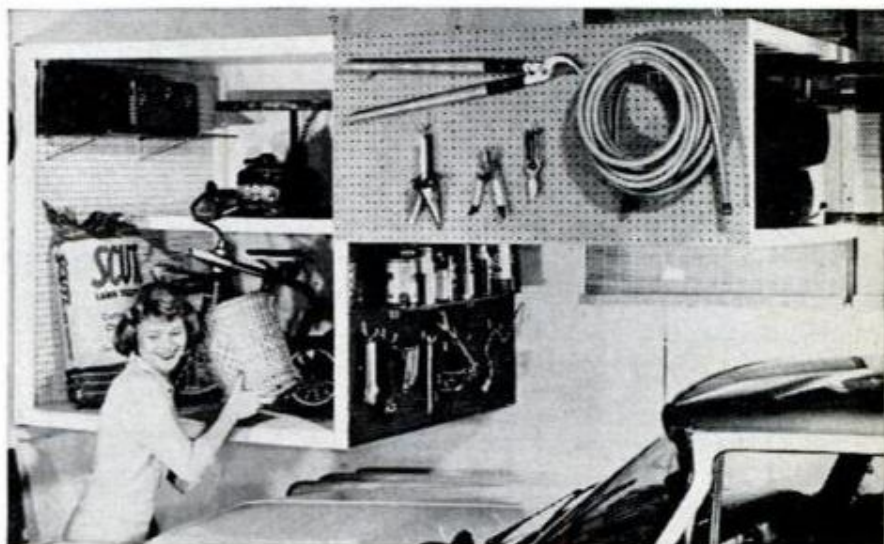


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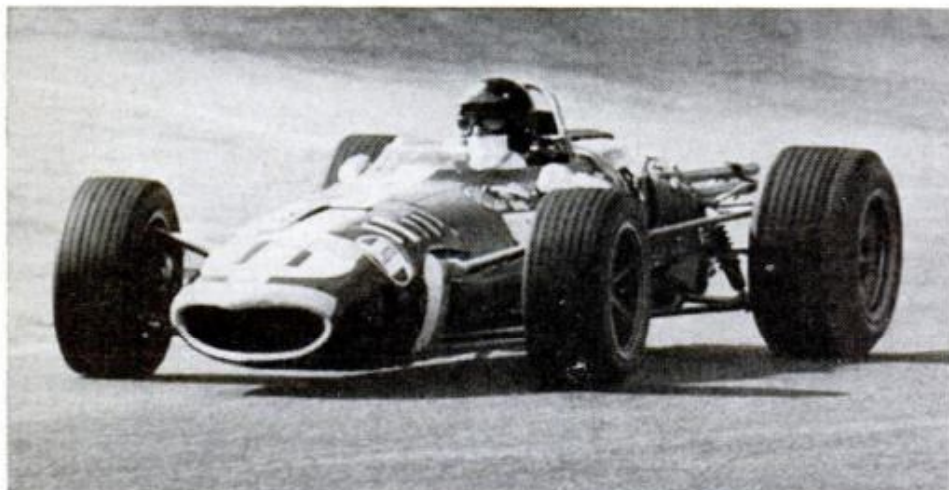
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Drivin' with Dan

Will a dragster ever run a standing quarter in five seconds? What's with hydrolastic suspensions? Where should I jack a Fairlane to check ball joints? Dan Gurney answers these and other provocative questions



GURNEY AT RIVERSIDE, the track he seems to "own," works preseason kinks out of one of the AAR Eagles he's campaigning on this year's Grand Prix circuit

Q. I saw you drive in the Trans-Am 300 at Green Valley Raceway in Smithfield, Tex., last year, and now I hear that Trans-Am refuses to come back to the track because it's "too dangerous." Is this true?—Mike Barreyre, Dallas.

A. I don't want to become involved in a shouting contest, but I would doubt danger is the reason Trans-Am won't race at Green Valley this year. All tracks are dangerous. No, I suspect money—that is, the lack of it—is the real reason.

Q. In a race, should you pour it on at the first, or at the last?—Rusty Theno, Tonganoxie, Kan.

A. It depends. There are no set rules, but in this day and age—if the car stands up—one is pretty much obliged to pour it on from green to checkered flag. Former world champion Juan Fangio used to try to win at the slowest possible speed.

Q. I understand new regulations on prototypes by the Federation Internationale Del'Automobile for the 1968 Le Mans race limit engines to three liters. Can you tell me the reason why they did this and, also, is three liters the same thing as

183 cu. in?—Cory Rasmussen, Salt Lake City.

A. First, yes, 183 cu. in. is three liters. Second, I don't pretend to know all the ins and outs involved, but some say it was done in the interest of safety by limiting speeds. Others say it was done to give France a chance with some of its new three-liter engines. There may be other theories, too. Changes like this always cause protests, but if the type of racing involved is healthy enough, it'll survive.

Q. I'm a Ford man, but I have friends who say Oldsmobiles, Dodges and Chevys have won more Grand Prix and drag races. Is this true?—Curt Harding, Parma, Ohio.

A. Not Grand Prix races, for sure, but probably drags. But hang in there if you're a loyal Ford man; Ford may have a surprise or two up its sleeve for the drag strips.

Q. Regarding the hydrolastic suspension, what factors need be considered in the design of this system that are not present in a coil-spring suspension? To what extent can a hydrolastic suspension be tuned? Do you think it will deliver

(Please turn to page 51)



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DRIVIN' WITH DAN

(Continued from page 44)

better-than-average road-holding?—Richard Lorenz, Whitewater, Wis.

A. Basically, what needs to be considered is the hydraulic link between the front and rear wheels. The ride is definitely different; I'd say better in some cases, not in others. It seems to eliminate some of the pitching—*or front-to-rear rocking—normally found in a car. I've never tried tuning this type of suspension, but it seems to open lots of room for experimentation. As for its road-holding ability, well . . . it hasn't started any revolution as yet.*

Q. *How do you feel about the Mark III "baby" Lincoln? Since it has come out, do you think the price of the Mark I will go up?—Beverly Lehman, Prospect Park, Pa.*

A. The car's looks testify to its being a very elegant and sporty luxury car, but certainly not a "baby." As for your other question, the price of classic cars seems to go up as they get older.

Q. *Do you think a dragster will ever run a standing quarter in five seconds?—Mark Franklin, Wallace, Neb.*

A. I doubt it. Not a wheel-driven dragster, anyway. It's easier to get from 7 to 6 than from 6 to 5. However, I'd hate to say where the limit is; some of the predictions made only a few years ago appear to be ridiculous now.

Q. *I read recently that you are part of a corporation promoting Swede Savage. Why him, and what do you look for in an up-and-coming driver?—Mike Johnson, San Bernardino, Calif.*

A. The corporation doesn't exist as yet. Savage is a personable young man and seems to have all the physical attributes and natural ability necessary to become a top-notch driver. Also, he has strong desire, he works hard, sacrifices and pays attention. He's a dedicated man, and we'll help him all we can.

Q. *What axle ratio do you recommend for economy on a '68 Dodge Coronet station wagon with a 318-cu.-in. engine? Also, will radial tires cause fishtailing?—D. Lowell Nissley, Goshen, Ind.*

A. About 2.90 to 1, to answer the first question, and I doubt it, to answer the second.

Q. *In discussing Grand National stock-car pit stops and the speed with which the crews refuel the cars, some of us were wondering if the fuel cans are pressurized. If not, why do the crews pump the cans up and down while pouring the gas into the cars? Does this create pressure from within the cans?—Airman F.H. Slade Jr., Holloman AFB, N.M.*

A. Well, they're not supposed to be pressurized. This doesn't mean they're not, but I doubt it. Crews pay a lot of attention to such things as smooth flow, low turbulence and good breathing in the cans. Personally, I've never noticed the "pumping" you mention.

Q. *I've heard a lot about a 427-cu.-in. SOHC, OHV Ford engine. Is it used in Grand National stock cars? What engine is used in Ford Trans-Am cars? Were the BRM H-16s entered at Indy last year F1 engines enlarged or supercharged, or were they a completely new design? At Daytona, for example, what engine is used in the GT-40?—Dan Glueck, Wilmington, Del.*

A. The 427 tunnel port V8 with pushrod-operated valves is used in Grand National cars. The 302-cu.-in. tunnel port engine, also with pushrod valves, is used in Trans-Am racing. Ford's only use of a SOHC engine in competition so far has been in drag racing, where it has been quite successful. BRM didn't show its H-16 at Indy last year, or this year either. The GT-40 uses a Ford 289 similar to the Trans-Am engine.

Q. *Where should a Fairlane be jacked up to check for excessive play in the top ball joint? Ford says it shouldn't be jacked up in the middle.—Carl Seydell, Wichita, Kans.*

A. Try the bumper jack, one side at a time. You might not have to jack it up at all if you shake it back and forth hard enough. If that doesn't work, you could always take out the springs. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 52).

SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Pinging problem

Who says the 1964 Rambler American 220, six-cylinder OHV engine should run on regular gas? My baby is tuned properly and yet I can't get it to stop pinging. Does this mean that I will have to use a premium fuel?—Harold Parker, Harrisburg, Ill.

I hope not. Try this cure which was worked out by Rambler service when it was determined that this model did have an inherent pinging problem. Install a thicker head gasket, part No. 3206934, which is available from an American Motors dealer.

Triple reverse

I'm beginning to think I've got a backward car. It's a 1963 Buick Riviera. The "hot" (positive) cable to the battery runs inboard, meaning that the battery has to be positioned with the positive post inside. My brother's 1963 Electra is just the opposite—his hot line runs so you have to position the positive post outboard. Who's reversed?—Ken Mauser, Phoenix, Ariz.

No one. That's just the way things are, Ken. Riviera is the only one with the positive post lying inboard. LeSabre and Invicta as well as Electra have to have their batteries positioned so the positive post is outboard. Just don't let your brother's setup influence you. Always make sure the battery is installed properly (that goes for him, too). If leads are hooked up wrong, you'll burn out the wiring harness and also the diodes of the alternator. The damage can be done in a split second.

Good tips from readers

Our thanks to these readers for their great tips on things automotive:

C.E. Rueffer of Naperville, Ill., says he solved the problem of his fishtailing Chevy station wagon by installing radial tires. "They are really something to write home about," he claims. Maybe C.E. has finally found the solution to the tough problem that has plagued many a wagon owner.

Mrs. June Medsker of Eaton, Ill. (we've got women mechanics, too, you know), says the first thing to do when a whistle

peeps from beneath the hood is to tighten up on the intake manifold bolts. "That's what we did when one of the mail trucks sounded off," she says. Mrs. Medsker works for the post office.

K.L. Birch of Keene, N.H., writes that his 1962 Plymouth wouldn't start when parked uphill despite adjustments and tuneups. Took him 10 minutes to install a fuel pressure relief by-pass kit on his carburetor. He bought it for \$2.29 from J.C. Whitney Co., Chicago. "Presto! No more trouble. It starts at the turn of the switch," he says.

To push or not to push

Settle an argument. My friend has a 1963 Buick Riviera with automatic transmission. He says he's started the car by pushing. I have a 1963 Buick Skylark, also with automatic transmission. I've never been able to start the car by pushing. Who's right?—Meryl Passman, Cincinnati.

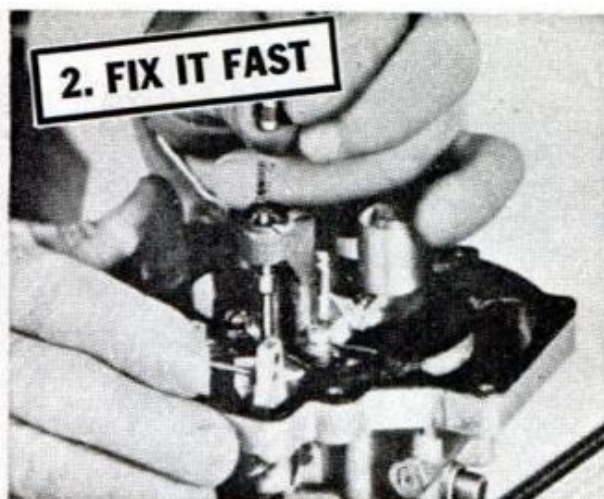
You both are. Your buddy's transmission is a triple turbine; yours is a twin turbine. The difference? For the purpose of the argument, your transmission doesn't have a rear pump, and you can't drive the engine through the transmission. So, when you get stuck with a dead battery, you have to use a jumper or install another battery. When he gets stuck, he places the shift lever into neutral and pushes the car till speed reaches 15 mph. He then shifts into low and continues to increase speed. Because his transmission has a rear pump, the transmission can drive the engine for starting.

A matter of lubrication

I've been getting groans and vibration noise from my 1964 Chevrolet with 327 V8 engine and Powerglide, especially when I back up slowly. U-joints and drive shaft check okay, and I'm ready to start ripping into the part I believe to be the culprit—the transmission. Do you have any tips?—Louis Silka, Portland, Ore.

Yes. Don't do that yet. Complaints like yours with the 327 and 409 V8s have been traced to the rear axle; not the transmission. A sure cure, if this is the cause, is

(Please turn to page 54)



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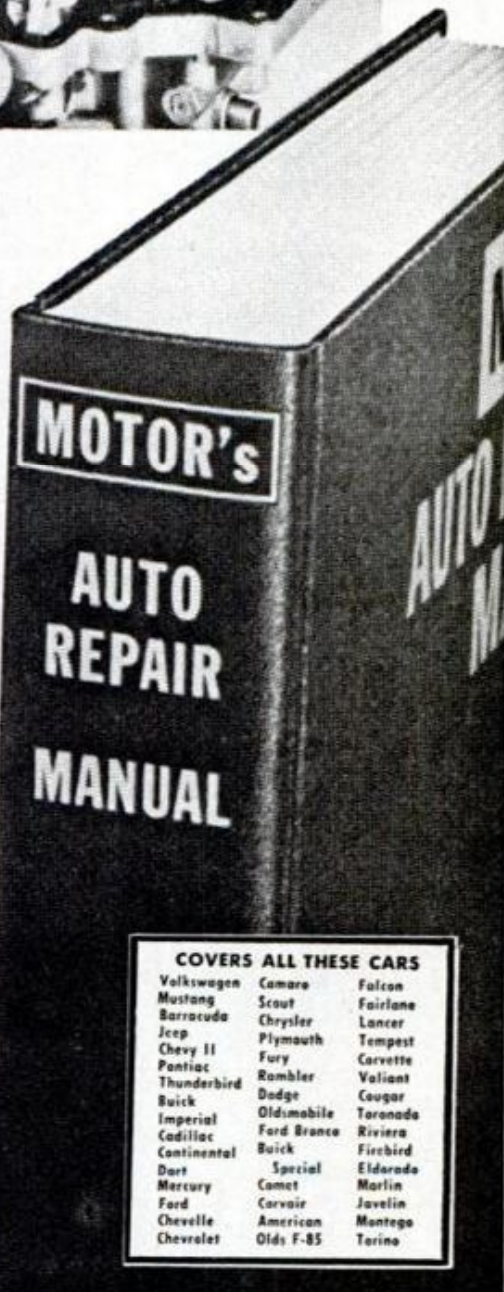
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AUTOMOBILE CLINIC

(Continued from page 52)

to drain the lubricant now in the rear and install positraction lubricant (part No. 3758791). This applies although you may have a standard rear axle. The lubricant compensates for the play that's causing the groaning. You can get it at a Chevy shop.

Checkout by the numbers

I'm getting noise from beneath my 1963 Falcon eight-cylinder which I'm sure is being caused by an exhaust system part banging. I've not been able to trace it. Can you help?—Fred Wolff, Paterson, N.J.

This has been a problem for some time, so let's clear it up once and for all. The following dimensions must be maintained as closely as possible with the exhaust system cold:

The muffler to rear-spring shackle clearance is $1\frac{1}{16}$ in. on all cars with V8s except Sprint. Clearance on the Sprint is $\frac{7}{8}$ in.

Muffler to fuel-tank clearance is $\frac{3}{4}$ in. on all cars except Sprint. On that one, it's $1\frac{1}{16}$ in.

In the area opposite the handbrake lever, there must be a clearance of $1\frac{1}{4}$ in. between the floor pan and muffler inlet pipe.

A clearance of $1\frac{1}{8}$ in. to the floor pan and the engine rear-mount rubber must be maintained at the engine rear mount.

The muffler inlet tube should have a clearance of $\frac{1}{2}$ in. at the bottom rear right-hand corner of the automatic transmission.

There should be a $\frac{1}{2}$ in. clearance between the muffler "Y" pipe and the starter at the point that the pipe curves around the starter.

A clearance of $\frac{1}{2}$ in. must be maintained between the flat on the muffler "Y" pipe and the power steering hoses.

If that doesn't do it, let us know!

Automatic defrosting

I've not been able to stop a refrigerant leak at a connector in the airconditioning system of my 1966 Oldsmobile. I've tried tightening the connector, but this hasn't helped. Can you give me the solution to

this headache?—Charles Concord, Syracuse.

Since O-rings do the sealing, "tightening" the connector won't help the problem. When a leak exists and the connector is tightened to the correct torque, you find and fix the cause of the leak. It's liable to be a damaged O-ring or a defective pipe. You won't know till you get inside.

Service Tips

● **1968 Oldsmobile radiator pressure caps** bear examination. The '68 is different from the cap used in 1961 through 1967 models. The vacuum relief pressure spec of the new cap is $2\frac{1}{2}$ lbs., and not $\frac{1}{2}$ lb. as before. Part No. of the 1968 cap is 6410366; that of the older cap is 3886273. The 1968 cap is colored gold.

● **1968 Ford owners** who are experiencing slow starter cranking can get help. The trouble is probably being caused by high resistance between the battery cable and the cable eyelet. Service bulletin 86 (2/23/68) tells your Ford shop how to go about correcting it.

While on the subject of slow-cranking starter motors, also note that any 1968 Ford, Mercury or Lincoln starting motor may be slow to crank due to insufficient lubrication of the starter drive housing bearing. Remind your dealer that service bulletins have been issued on this problem, too.

● **1968 Chevrolets** equipped with Monojet MV (automatic choke model) carburetors may be flooding during cold engine operation. This is probably due to the fact that the cranking enrichment valve is sticking in the open position. The valve is supposed to allow fuel from the cranking valve channel to supplement that being supplied by the idle circuit and main discharge nozzle during cold starting.

If it sticks open, you'll get too much supplemental fuel. To remedy the problem, simply render the valve inoperative. Use a pair of needle-nose pliers to pull upward on the valve stem, closing the valve. Then, bend the stem back and forth until it breaks off. Now the automatic choke will not activate it. You really don't need the cranking enrichment feature. A closed choke is sufficient for cold-weather starting. You can have the dealer do this job under provision of Chevrolet Service News No. 2, Feb. '68. ★★

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

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"The barrel rib is kind of nice, too," they said. "But it sometimes gets in the way when you go to mount a scope."

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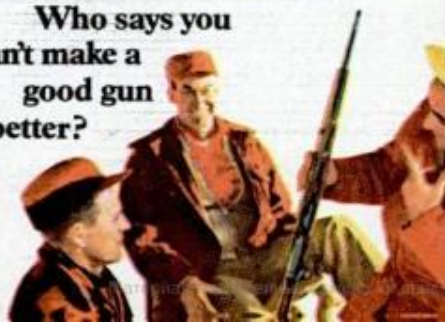
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Tile over wide flooring

I recently bought an old home with flooring of wide pine boards in random widths of about 8 to 12 in. The floor seems firm and quite level, but it's worn in some areas where a few knots actually project an inch or so. How should I prepare this old floor for tiling?—S.D., Pa.

If the floor is firm and fairly level (except for knots around which the softer wood has worn away), all you need do is sand it all over with a floor-sanding machine. Take special pains to cut down the projecting knots, then inspect the entire floor closely and re-nail any boards that may be loose. I don't think it's necessary to apply a sealer to the newly sanded area, though this can do no harm.

You don't say what kind of tile you intend to use, but normally all tiles laid over a wood floor require underlayment.

For this, I suggest you use a $\frac{3}{8}$ -in. plywood or, if you prefer, $\frac{1}{4}$ -in. tempered hardboard. Be sure to follow directions (you get these from your dealer) for nailing and spacing either type of underlayment, and for "breaking" the joints of the separate pieces over the joists.

Smoking fireplace

My fireplace is quite new and looks normal in every way; there's a mantel to put things on and the design makes you think of some old colonial home. But when I build a fire the thing smokes. What can I do about it?—W.H., Calif.

Is the damper fully open? In some fireplaces, the damper handle projects through the masonry above the opening; on others it's concealed inside, just above the top of the opening. Reach up inside with the poker that comes with your fire set, hook the damper and pull or push it. When you're sure it's open, put on some old clothes, sit on the hearth, then slide back into the fire opening and look up. If the flue is clear you'll see daylight or a reflection of it. Then open a window in the room, twist several newspapers into small "logs" and set them burning as you would in kindling a fire. Now, your fireplace should no longer smoke, assuming that it's properly built, the flue is clear and your home is of modern construction.

The modern house is practically airtight. If you use the fireplace only during cool weather when doors and windows are kept closed, the fireplace flue will be cold. The cold flue and lack of air often cause a fireplace to smoke. The burning paper and the added air through a door or window will start a column of warm air up the flue. This done, you can close the window, add kindling and a log, and enjoy your fireside.

Cranky faucet

The hot-water faucet in my bathroom lavatory makes a machine-gun-like clatter when I open it. I put on a new washer but I still hear the staccato racket. I'm about to replace the faucet, but I'd still like to know what's wrong.—I.S., Fla.

Quite likely the threads on the stem are badly worn. This permits a slight up-and-down movement of the stem when the faucet is opened.

Such noise usually can be stopped, at least temporarily, by repacking. To do this, you remove the handle and, just underneath it, the packing nut. Remove the old packing, clean the stem, and put in new packing—either a washer-type graphite material made for the purpose or the cord type, a length of which is wrapped around the stem. Older faucets generally require the latter. After packing, tighten the packing nut until there is noticeable resistance to movement of the handle. This should stop the "hammering" temporarily, but if the threads are badly worn it is almost certain to recur. It's probably best to replace the faucet.

Does glass insulate?

A friend tells me that ordinary window glass has insulating value, that it resists the passage of heat and cold. Is he right?—T.N., Okla.

In a way, perhaps, but one does not ordinarily think of a material with the density of window glass as an insulator. Tests have shown that with 100°F. applied to one side of a pane of glass there is a temperature differential of only 2° or 3° on the other side. Of course, this refers only to a single pane of this glass and not to the dual-pane window. ★★★

You're in the portable age...



**General Electric
Perma-cell
Batteries
and Charger
make it fun**



Nowadays your fun things need batteries. And batteries run down. Radios stop. Flashlights don't flash. Recorders don't record. The fun stops.

But it won't stop for long when you use General Electric Perma-cell batteries. These are the Rechargeables. Rechargeable 1000 times or more.

That means no more missing the ball game. No more ruining a good picture with a flash camera that doesn't flash. No more trudging to the store for another throw-away battery. You might say it's like having an endless battery supply.

Ask for GE Perma-cell Batteries and Charger at your favorite store.

You'll find the Charger priced under \$10† and Perma-cell batteries—sizes AA, C and D—under \$4† a pair.

If your favorite store does not yet stock the Perma-cell Rechargeables, write General Electric Co., Section 453-02A, Schenectady, N. Y. for information on where you can buy the Perma-cell Rechargeables.

†Based on manufacturers suggested retail price.

GENERAL  ELECTRIC



- 1** We're the truck people from General Motors. We just cut apart a brand new GMC pickup so you can get a real good look at the toughest truck engine ever to go under a hood. Our new GMC V6. A lot of experts still haven't figured out how so many of these engines go 150,000 miles (and more!) before major overhaul. Obviously, our competitors haven't either. They still don't offer a V6.
- 2** If you're looking for a truck with real pick up to it, you've come to the right place. We have V8's with horsepower to 310. These engines prove once and for all that a truck doesn't have to perform like a truck.
- 3** We also offer a pair of rugged inline-sixes.
- 4** Sixes that shrink gas and repair costs.
- 5** We can put any one of seven engines in this room. Seven. That's more than any other truck-maker offers. If you can't find what you want at your GMC Truck dealer's, it hasn't been invented yet.
- 6** Of course, we give you a cab-full of safety features. Pushbutton seat belts, dual-speed windshield wipers, padded instrument panel, all standard equipment.
- 6** Another revealing insight into a GMC pickup is its price. It's priced right down with the also rans. Yet you get a lot more pickup for your money. At your GMC Truck dealer's.

GMC breaks open the engine room to show you where our pickup gets its pickup.

The Truck and Coach Division of General Motors

G M C

What a difference a name makes

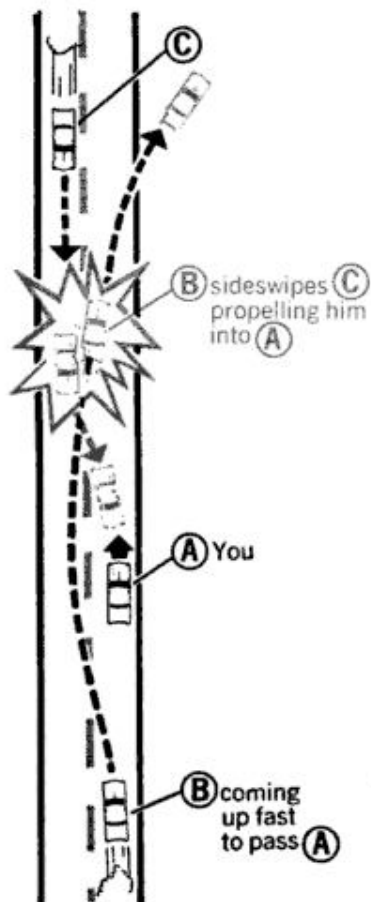
How to Defend Yourself Against Dangerous Drivers

**COLLISION 'PULL'
SPINS THIS CAR INTO
THE OPPOSITE LANE**

By E. D. FALES JR.

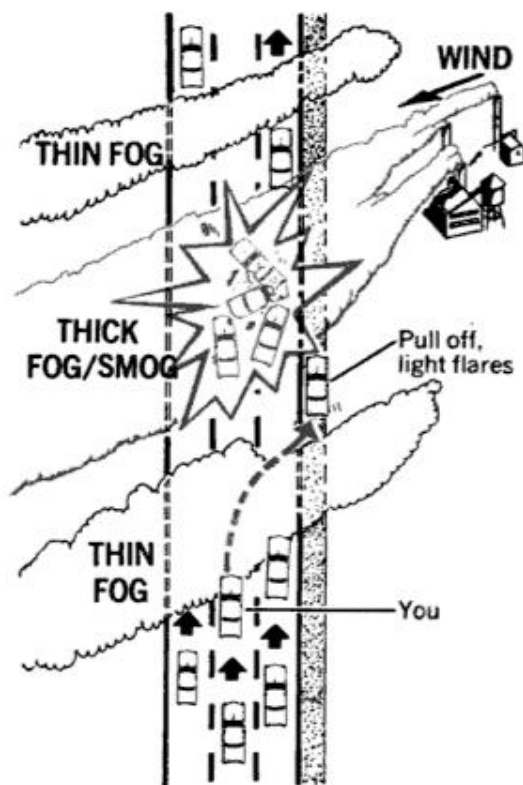
AT turnpike speeds today, the slightest mishap becomes a major catastrophe. The most treacherous hazards seldom give advance warning. They are usually a combination of foolhardy driving and unexpected road conditions. The only way to protect yourself is to be aware of what may happen and why. On the pages that follow are tips on how to avoid highway situations that seem harmless—until you're caught in one.

**THIS UNSUSPECTING
PASSERBY IS ABOUT TO
BECOME AN INNOCENT VICTIM**

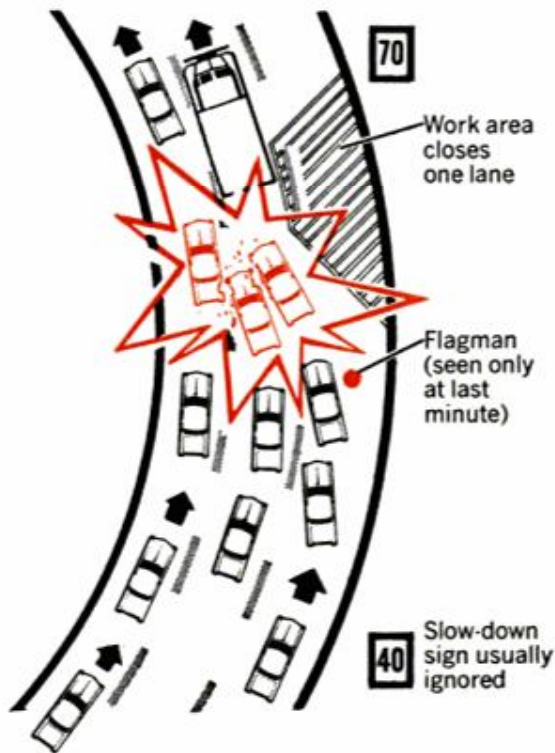
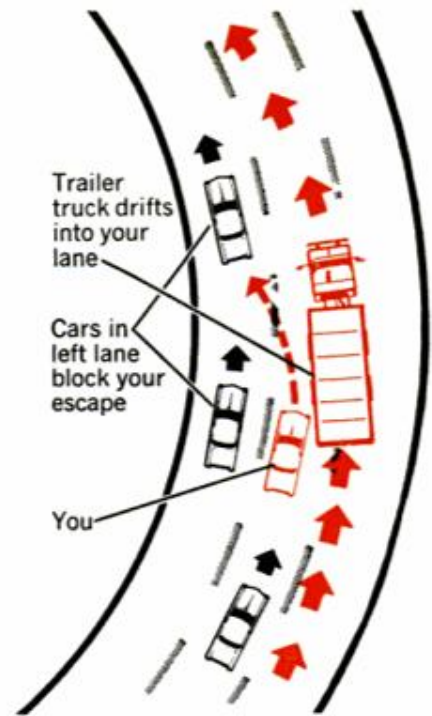


WATCH OUT FOR COLLISION "PULL." Many innocent drivers become a third party to a wreck simply because they fail to allow for the side effects of a collision. One is "pull." You're heading north on a two-way road at 2:00 a.m. Coming up fast behind you is car B, what troopers call a "late night flyer." His speed is 90 to 100 mph. He booms past you like a rocket to the moon, can't get back in in time and slams into the side of southbound car C 100 yards further on. You're appalled but not especially concerned for your own safety—the crash seems far ahead. Suddenly, you're shocked to see car C hurtling straight for your windshield. *What to do:* The only defense against "pull" is to know it's going to happen and be prepared for instant action. When a car is struck on its side, the friction pivots it around and pulls it toward the direction of impact instead of away. This almost always spins the hit car into the opposite lane. If you're alert, you can take evasive action—brake, swerve or perhaps put on a quick burst of speed. One way to handle a foolhardy passer is to run up your own speed. This locks him behind you until it's safe to let him by.

MURDER IN THE FOG PATCH. You're breezing along in a light fog with fair visibility and no particular problems. Other drivers have cut their speed slightly but not much. Without warning, the car ahead suddenly disappears from sight, swallowed up in a patch of dense fog. You can barely see his taillights. Behind you, you know the pack is thundering down on top of you, unaware of the peril. *What to do:* The onset of sudden thick fogs is becoming a major superhighway problem. One trouble is that heavy smoke from nearby factories can turn a thin fog into a pea-soup smog unexpectedly. The patch may not extend for more than a few hundred yards, but it's enough to cause disaster. Many drivers think it's safe to "follow a taillight" in a fog; at turnpike speeds, it isn't. If you keep going, you'll eventually plow into something—a pileup of cars that have already tangled or some driver who's panicked and hit the brakes in front of you. If you slow down, you risk being smashed from behind. There's only one safe thing to do—get off the road. You have only seconds to act, so move fast. Get into the right-hand lane as quickly as possible and look for an exit. If there's no exit handy, pull off onto the *right* shoulder—not the center divider. Put on your flashers and get out of the car. Light one stick flare 10 feet back, another 300 and one 600 feet back. Listen. If you hear a sound like distant gunfire, the collisions are beginning. Get as far away as you can—up high on an embankment or off in a field. Even the densest fog lightens from time to time. Wait for a break, then proceed cautiously to an exit and try to find a slower road.

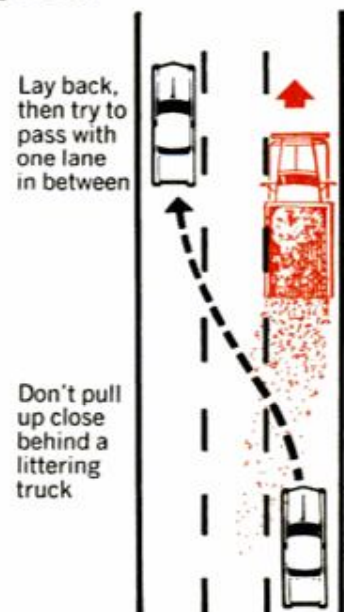


BEWARE OF THE DRIFTER. You're speeding along a fine interstate, just easing into a slightly banked left turn. Suddenly, you're horrified to see a huge trailer truck on your right drifting into your lane. You try to back off or move over, but cars coming up fast behind you and in the adjacent lane block you. You're trapped. *What to do:* If you act fast, you may be able to blast ahead of the truck, but gauge your chances carefully. As a last resort, try to get the driver's attention by blowing your horn and flashing your lights, although this often won't work. The best bet is not to get caught in this situation in the first place. The reason? Even a slight curve slows down a big truck. To maintain speed, some drivers use a trick of cutting the curve short and riding down the banked pavement. To be fully safe, never come abreast of a truck on the *inside* of a curve.



THE WORK-AREA SQUEEZE. You're doing 65 to 70 mph, legally. You begin to pass some road-repair warning signs, but nobody pays any attention to them. You'd like to slow down, but there's a wolfpack pounding down on you from behind. You're caught in the flow and have to keep going. Too late, the pack spots the flagman and the closed lane. Brake lights flash on and cars jockey crazily as three lanes of high-speed traffic try to squeeze into two. Result: A multiple smashup. *What to do:* At the first hint of construction ahead, look for an opening in the right-hand lane and pull over into it as soon as you can. Slow down and let the wolfpack howl past you into the gap. Then adjust your speed so that you'll arrive at the gap by yourself, between packs.

THE LITTER-TRUCK PERIL. An all-too-common sight on today's highways is the overloaded demolition truck bouncing along at near-passenger-car speeds, scattering a trail of rocks, nails, broken glass and tree branches behind it. Such debris can blow a tire, smash a windshield and, if sizable, cause a major wreck. Another increasingly serious danger are the stones lodged between the tires on dual-wheel trucks. At turnpike speeds, these fly off with a bulletlike force capable of killing an occupant in a following car. *What to do:* Never come up close behind a littering truck. As soon as you spot one ahead in your lane, look for an opening in an adjacent lane and move over. On a three-lane road, try to pass with one full lane in between. If it's impossible to pass, cut your speed carefully and lay back until there's an opening.





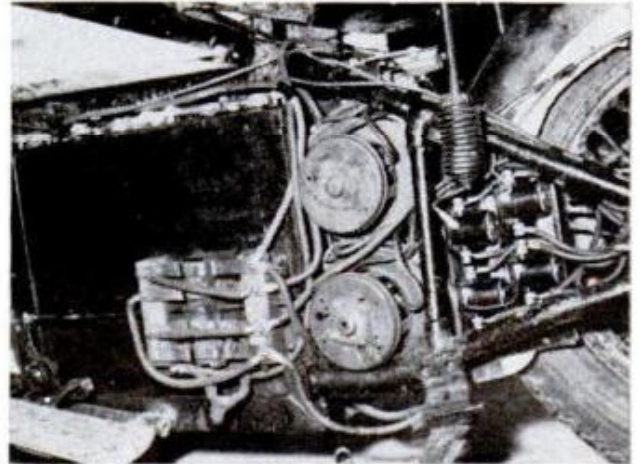
Stands up to hurricanes

Six utility poles set in concrete are the foundation for an unusual six-sided, hurricaneproof vacation home recently completed in the Florida Keys.



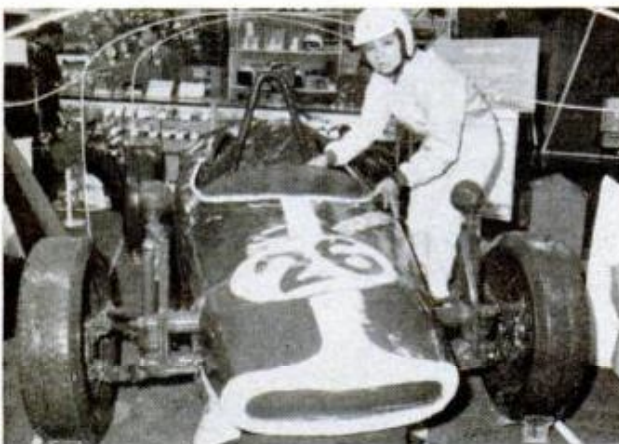
Underwater sled

A new two-man "swimmer sled" will carry scuba divers to depths of 150 feet at speeds up to 2½ knots. The electrically driven sub is a product of North American Rockwell.



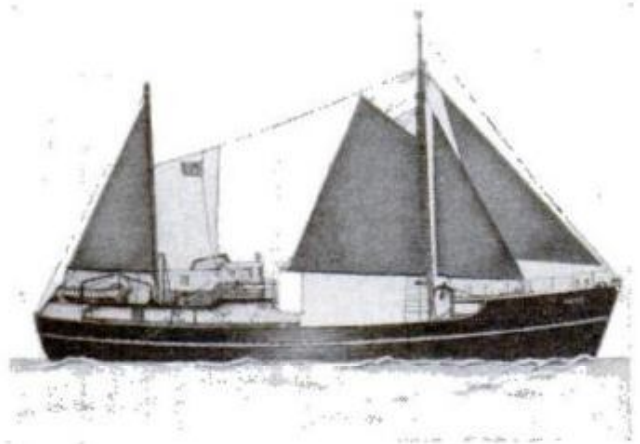
Electric motorcycle ranges 35 miles on one charge

Eight auto batteries power an electric motorcycle developed by Harold Randall of Battle Creek, Mich. The 650-pound machine can range 35 miles on one charge; top speed is 35 mph. The batteries supply power to a pair of 1924 Dodge starter motors (mounted over one another, right) which are connected to the rear wheel by chain and sprockets.



Drive it or eat it?

A full-size model of a Formula V racing car was made entirely of chocolate by a Japanese confectioner. It's on display in Tokyo.



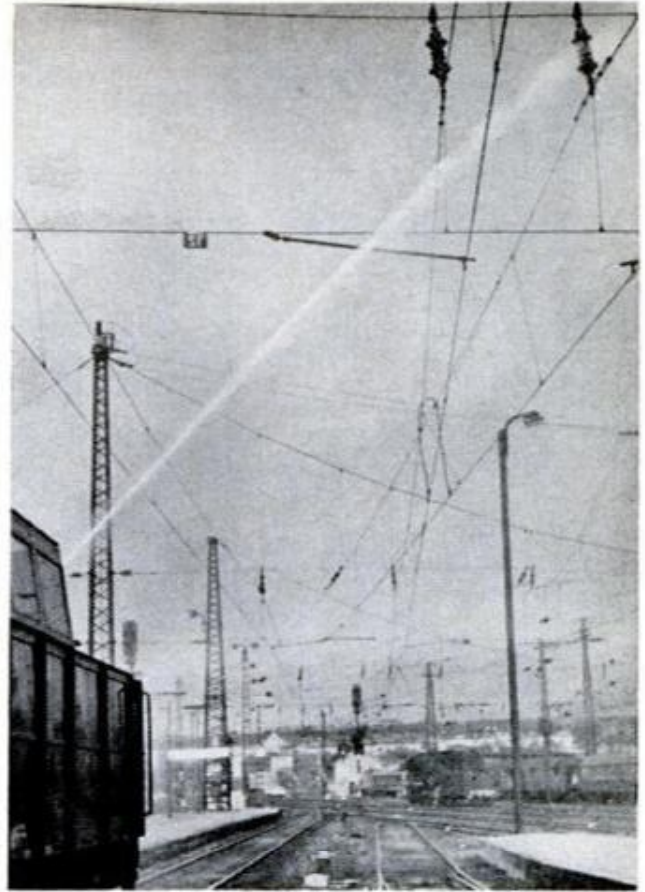
Scientists turn to sails

Hero, a 125-foot research vessel, will go to Antarctica when completed late in '68. Sails steady her during scientific operations.



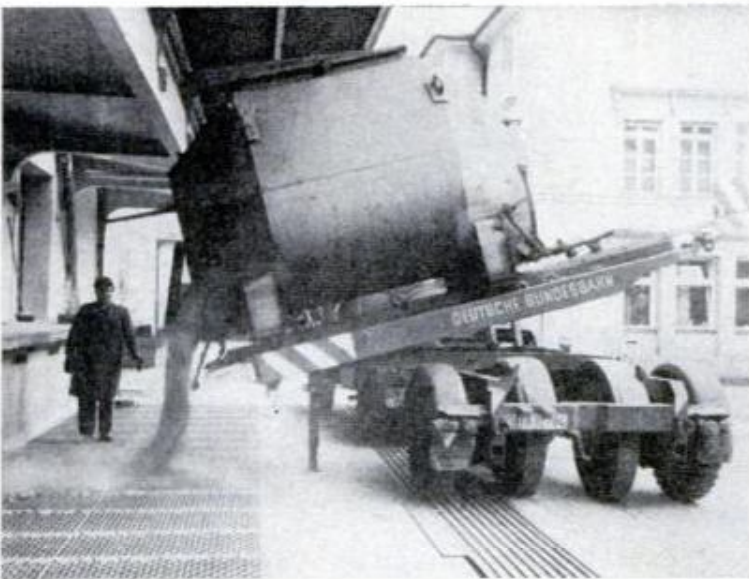
Helps deaf to talk

Speaking into a microphone, a deaf child watches an electronic dot move to a section of the oscilloscope which represents a vowel. Dr. Huseyin Yilmaz (shown) demonstrates this method of teaching the deaf how to speak more clearly through instant visual recognition of their speech sounds.



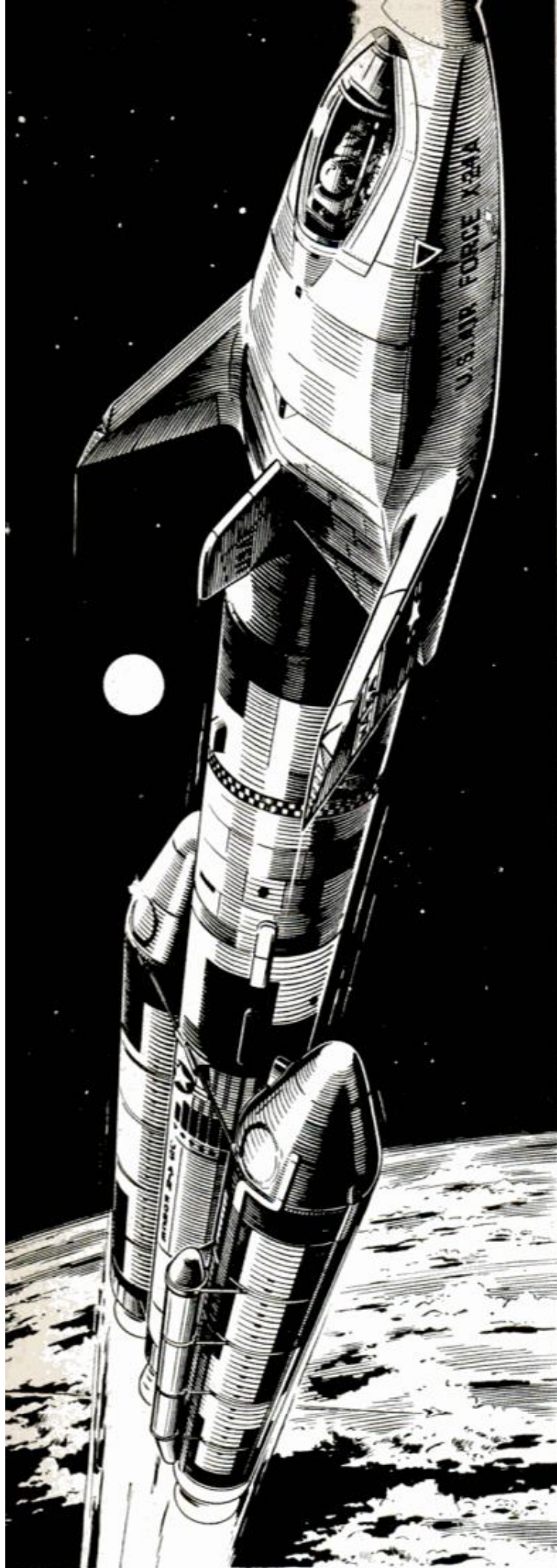
High-powered scrubdown

Normally, washing a 15,000-volt power line with a stream of water is an invitation to disaster. However, a Munich firm has made it safe for railway maintenance crews by developing a technique of breaking the stream into tiny water drops so that the air spaces between drops provide insulation.

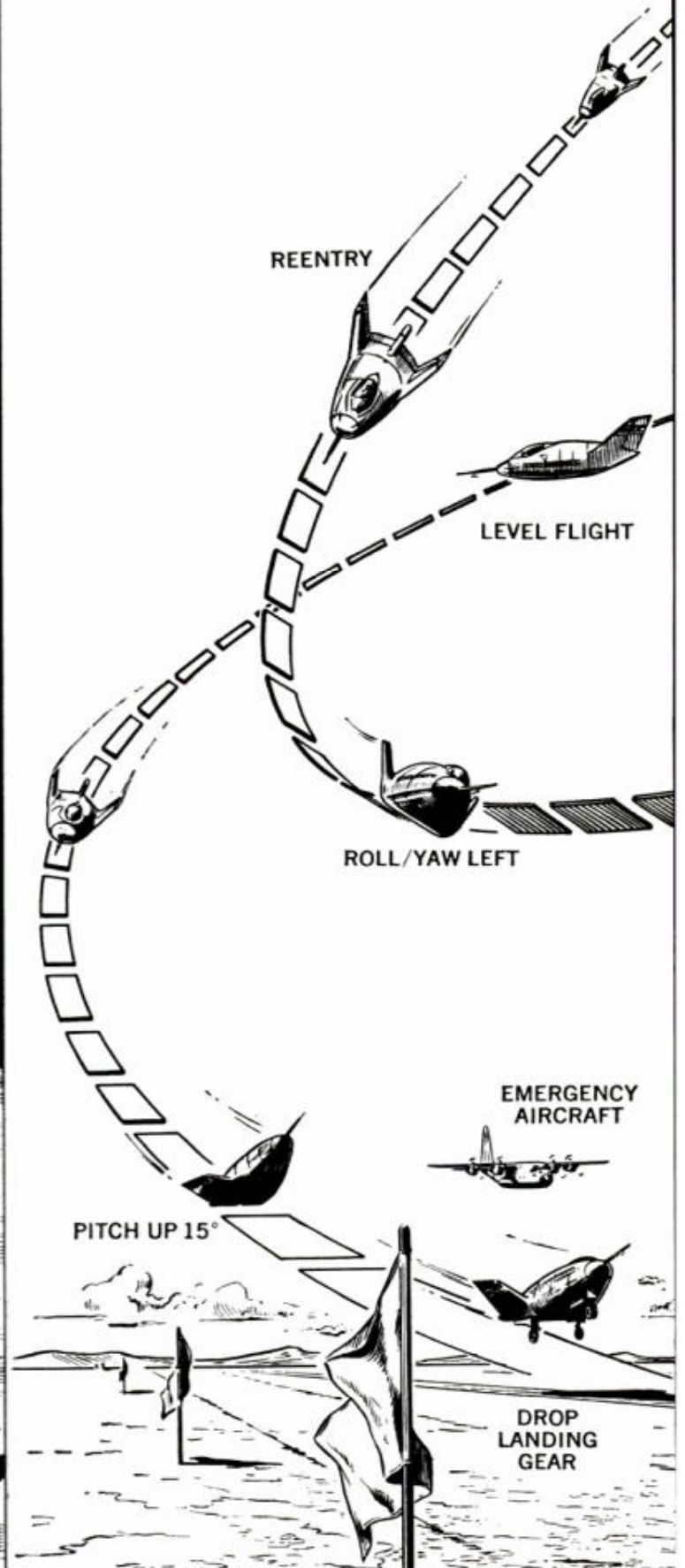


German railway finds tipping speeds service

The German Federal Railway is speeding up its loading and unloading operations by introducing vehicles that tilt to empty their contents. At left is a trucklike multiwheeled vehicle that tips its bed to unload the contents of the container. At right is another type of loader that lifts the carrying vehicle and tilts it to empty its load.



LIFTING BODY, in art concept (left), lifts off on top Titan III booster en route to space, just like spacecraft. Landing, however, is different. It becomes an aircraft, skipping back into atmosphere to slow down to flying speeds, then heading for conventional airport. Such landings eliminate awkward problems of picking spacecraft from ocean

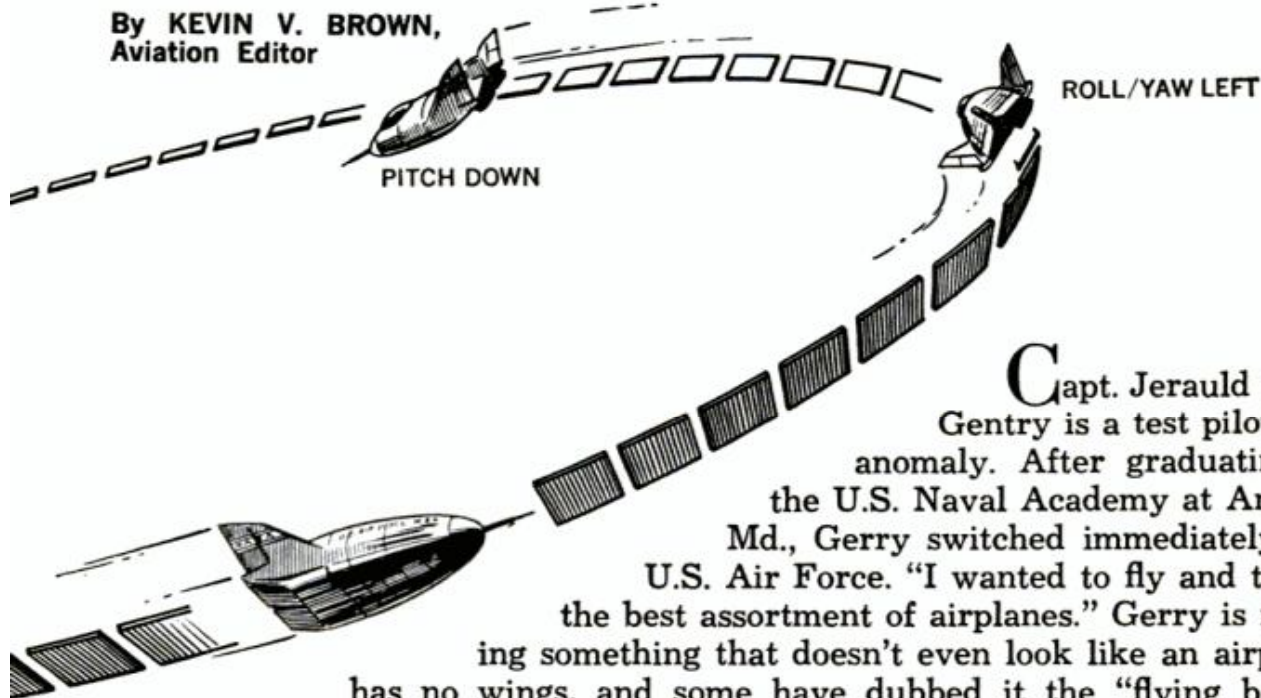


REENTRY

Our Wingless Airplane That Flies in Space

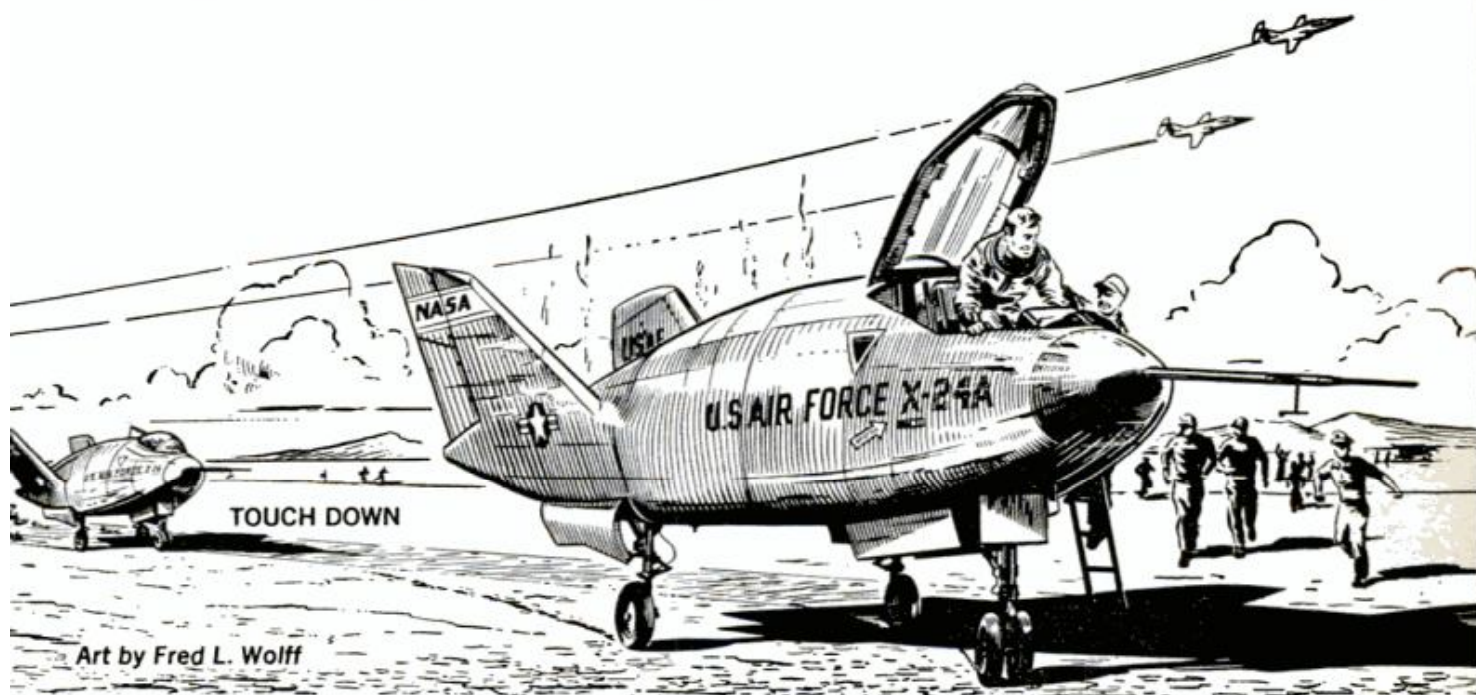
The 'lifting body' may be our next spacecraft, riding into orbit on a rocket but flying back and landing like a plane

By KEVIN V. BROWN,
Aviation Editor

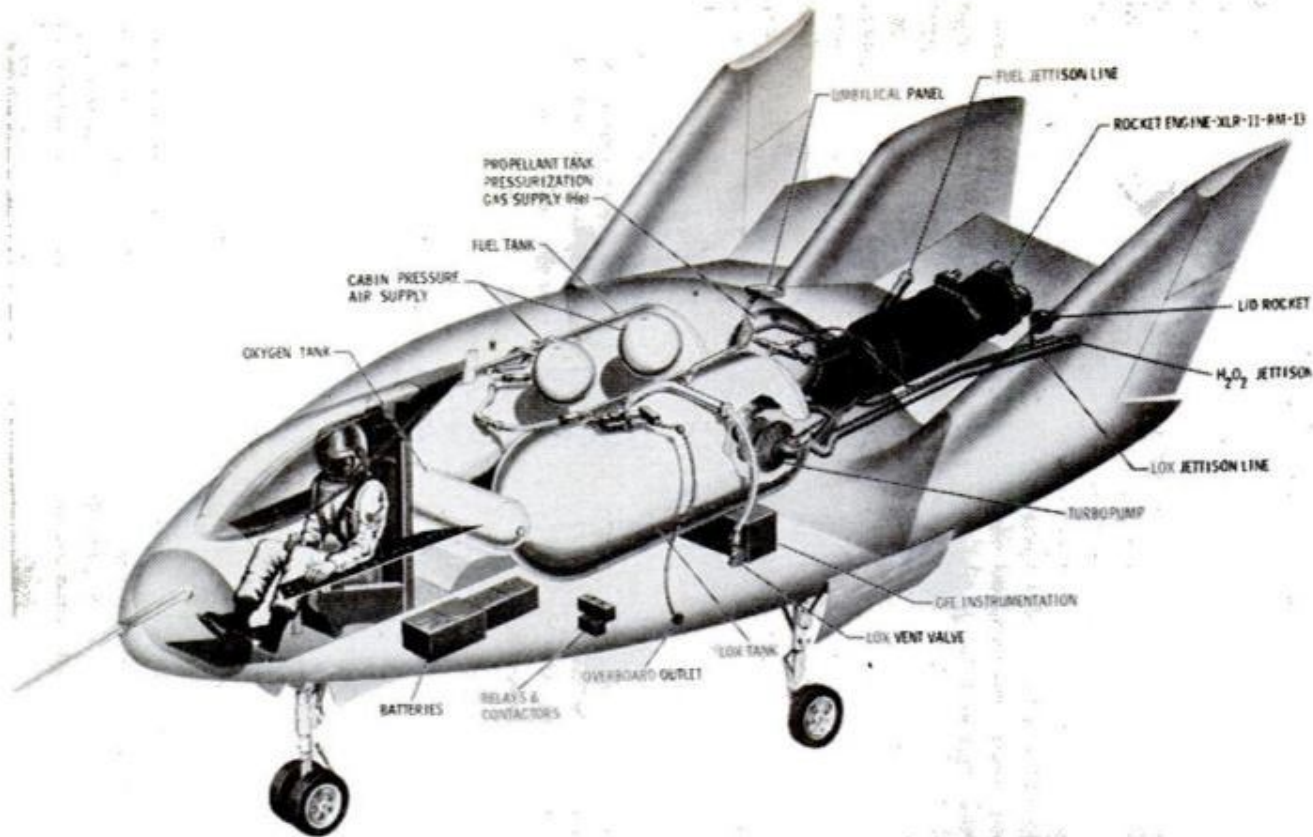


Capt. Jerauld (Gerry) Gentry is a test pilot and an anomaly. After graduating from the U.S. Naval Academy at Annapolis, Md., Gerry switched immediately to the U.S. Air Force. "I wanted to fly and they had the best assortment of airplanes." Gerry is now flying something that doesn't even look like an airplane. It has no wings, and some have dubbed it the "flying bathtub."

Captain Gentry is project pilot on the Air Force X-24, the so-called "lifting body" program. This summer, for the first time, Gerry will fly the bathtub to supersonic speeds. Some day, he or another anomaly may fly it, or one of its descendants, right on out into space, because the lifting body program is



Art by Fred L. Wolff



CUTAWAY VIEW of X-24 shows power unit. Engine is almost identical to those that powered original X-1

intended to find a solution to one of the space program's most vexing problems—the awkward and expensive rescue after each mission of an awkward and

INTREPID AUTHOR flies X-24 simulator. Biggest problem is rapid rate of descent without power

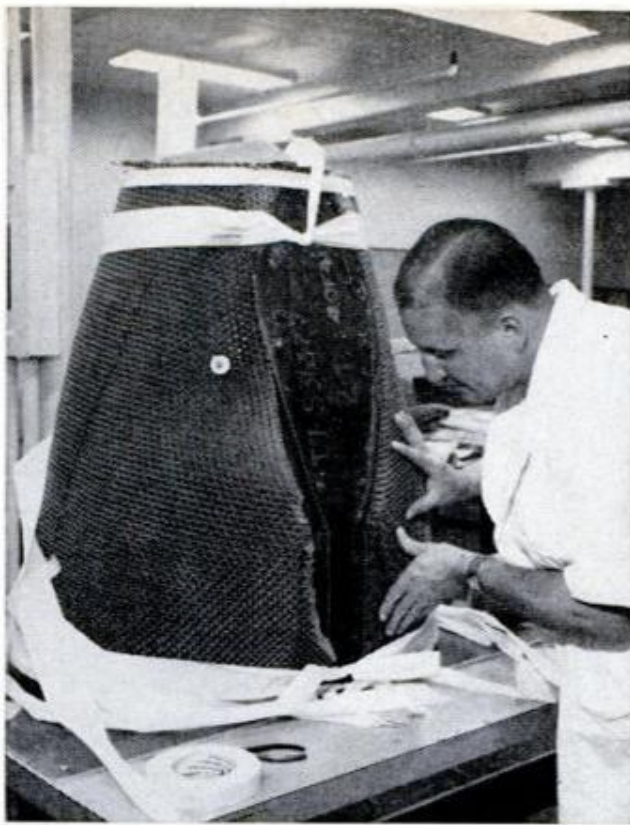


expensive spacecraft that can never be used again anyway.

The X-24, or something like it, instead of landing in the ocean, where the Navy has to go out and retrieve it, can fly itself back into the atmosphere, maneuver like an airplane, then land under its own control at an existing air base.

Such a craft could come down anytime. It would not have to be timed for the moment when seagoing ships were in the right position to lift it from the ocean. In fact, the Navy could get out of the spacecraft-recovery business. More important, the spacecraft itself could be used repeatedly, instead of ending in a museum after one flight.

The lifting-body program goes back several years. It began with the M-2, produced by Northrop Corp. for the National Aeronautics and Space Administration, followed by the HL-10, also by Northrop for NASA. Both of these were dropped from "mother ships," mostly B-52s, then they glided to earth without power but with aerodynamic control like an airplane. Auxiliary rockets in the HL-10 gave it an



ABLATIVE MATERIAL, tested in space on small model, can be stripped off so lifting body can fly again

tain Gentry at the controls, will be the first to use sustained power and will ultimately go supersonic, probably this summer. Its descendants will, in fact, become the first "flying" spacecraft.

I visited Edwards Air Force Base, where the X-24 is based, and talked to Gerry Gentry and some of the others involved in the lifting-body program, and I also flew the lifting-body simulator, neither wisely nor well.

The concept of an aerodynamic-spacecraft, or a ballistic-aircraft, was put to me in simple terms by a Martin man.

"All bodies have aerodynamic qualities, some better than others," he said. "The idea is to find the optimum shape between what you want to put into that body, based on its mission, and what you want that body to do to perform its mission."

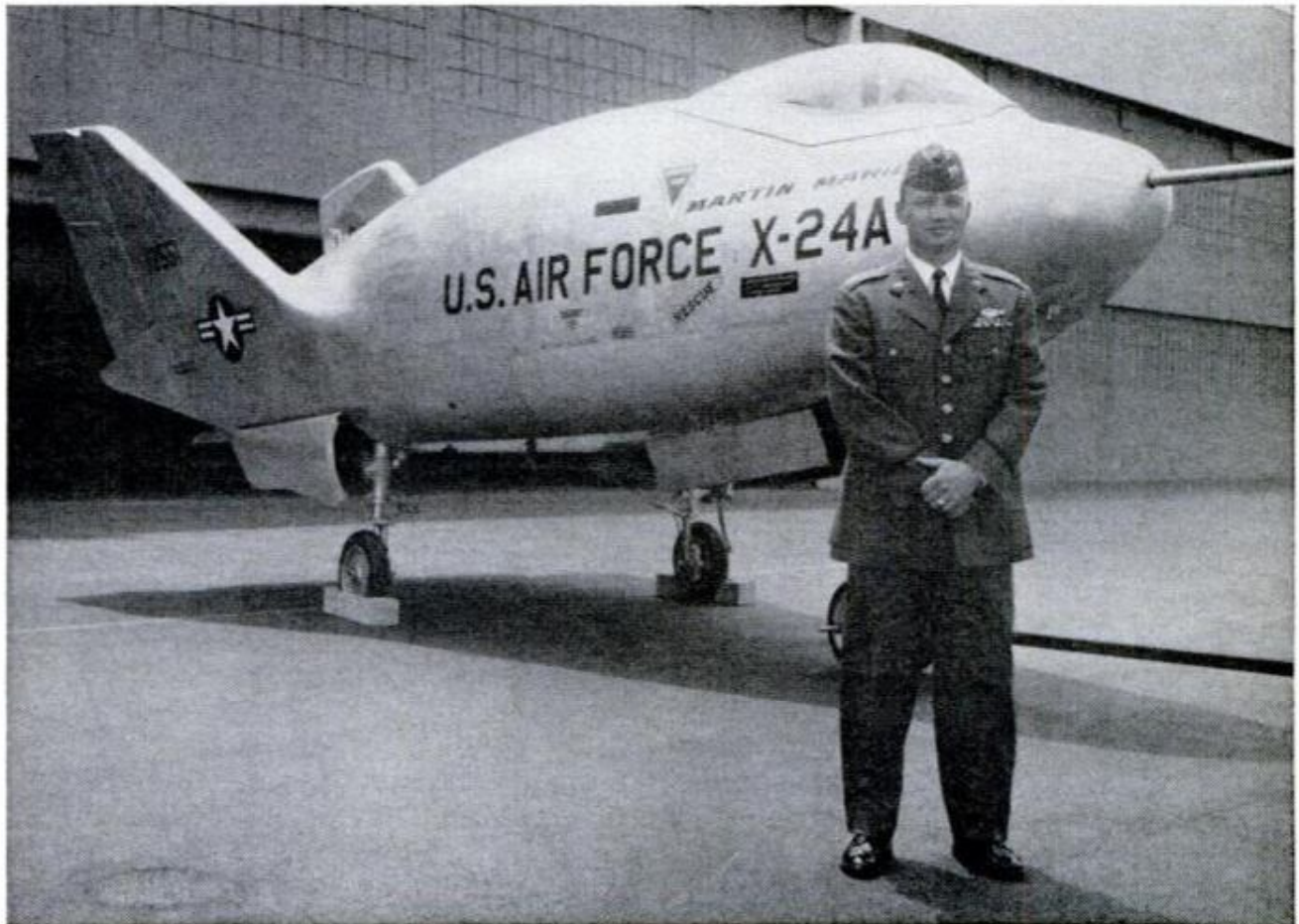
In other words, once you have established what you have to put into the

(Please turn to page 172)

additional boost if needed on landing.

Now the Air Force is getting in on the act with the X-24, produced for it by the Martin Co. The X-24, with Cap-

GERRY GENTRY, project pilot on lifting-body program, will fly X-24 to supersonic speeds this summer



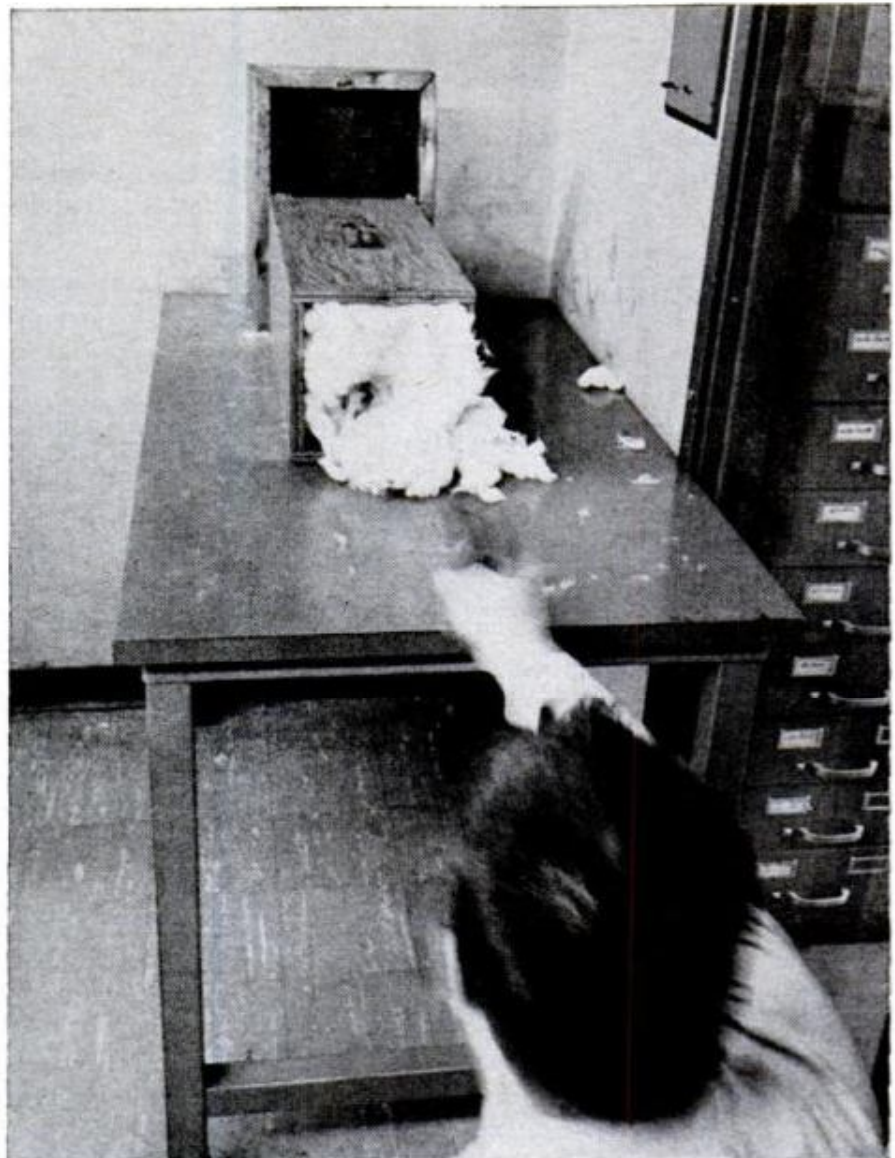
How Scientific Detective Work EVIDENCE

New York City's Police Laboratory fights back against increasing crime and legal restrictions by gathering more evidence that can be examined under a microscope and will stand up in court.

By CREIGHTON PEET

Photos by James Pickerell

SUSPECT GUN is fired into cotton batting to get bullet to compare with one found in body of recent shooting victim



JAMES BOND flashing his sexy smile and reaching for the nearest blonde has it easy. He drives his souped-up Super-Super through a concrete wall, swims across a river full of piranhas and shoots down a covey of spies with thought waves. Never does 007 have to appear in court or convince a jury.

But for real-life cops here in the United States, such as those in New York City's Police Laboratory, things aren't that simple. Nationally, crime is increasing at an appalling rate (up 48 percent in six years). Today the police must not only get their man, but bring in physical proof that will convict him

in court. Take such a basic as fingerprints. Too many bank robbers and jewel thieves have seen the same television shows you and I have. So they wear gloves or wipe all surfaces. Technicians in the New York Police Laboratory say they can find usable prints in only about 10 percent of their cases.

Ballistics is a vital department in the lab. Test-firing a gun into a box of cotton or a long tank of water yields an undamaged bullet that bears distinctive markings made by the barrel of the weapon. Matching such bullets under a comparison microscope with those taken from victims has yielded convictions.

Develops THAT STICKS

Blood, perhaps scraped from a handkerchief or bedsheet, may be helpful, although this work can be frustrating, admitted Detective Cesario Matteace. "As yet we have no means of connecting a blood sample with an individual. Blood does not reveal age, sex or race. All you can say is that a sample belongs to a given type. But blood can be a help. The suspect who said he got blood on his clothes while shaving was stopped cold when we proved it *wasn't his type!* This proved nothing, but then he had to talk pretty fast."

Also useful are dust, mud, sawdust, chemicals, paint, food, bits of vegetation, anything. For instance the man accused of a murder in Central Park seemed to have a good alibi until the men in the lab produced from the cuffs of his pants seeds from an unusual plant growing only in the area where the body was found. He was convicted.

Another jury was convinced by some red smudges found on a handkerchief in the pocket of a man accused of attempted rape. He had tried to gag his victim, and her makeup had come off on his handkerchief. In the lab a chemical analysis showed the red smudges



DETECTIVE DUSTS for fingerprints at entry door of burglary (above) while partner (below) inspects bedroom of ransacked apartment for additional clues



matched the makeup found in the woman's handbag.

Other clues—scrapings from under the victim's fingernails showing hairs, cloth fibers and the like—might point to a suspect who had had a terrific struggle. Tires and sneakers wear unevenly and pick up tiny stones in their treads, so that soon they leave prints as distinctive as fingerprints. And vapor drawn into a vacuum tube after a fire may reveal whether it was of incendiary origin.

As for laundry and dry-cleaners' marks, there were the bank robbers who left a jacket in their car when they jumped out and ran into a crowd. "That one was a cinch," recalled Detective David Solomon in his office full of files of cleaners' marks. "I was able to pick out the cleaner he used in a few minutes," he told me, "and the store gave us the man's name and address. Another easy one was the fellow who murdered his girl friend and wiped his bloody hands on his shirt—which he then threw in the corner. He as good as gave us his name and address."

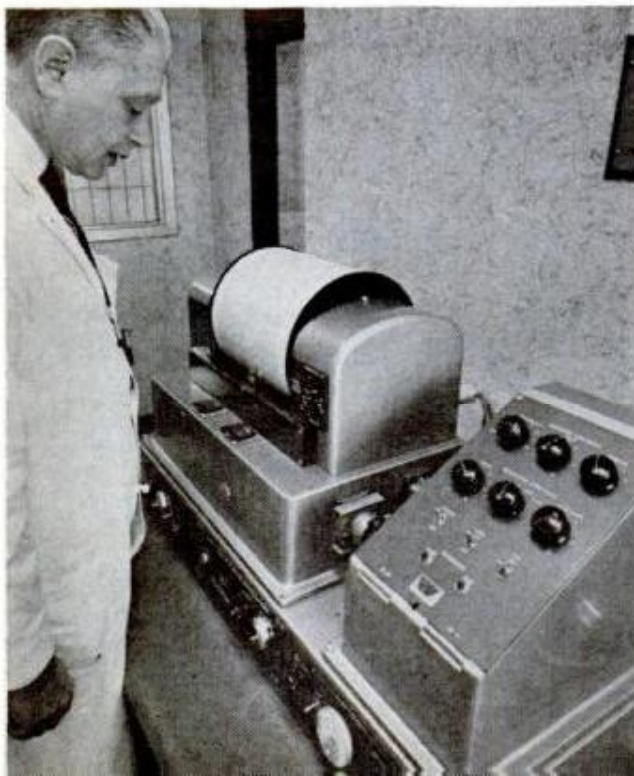
For many thieves who carefully dress up in dirty coveralls, Detective Solomon has only scorn. "When they're done," he told me, "they wipe off all the fingerprints and change into conservative business suits, but they never

notice the extra-large laundry marks on the coveralls—which they leave behind."

Solomon's section also handles all sorts of materials such as eyeglasses. He showed me that the manufacturer's name is usually on the frame's side-piece, which helps in tracing the owner. There was the man who died leaving no clue to his identity but his eyeglasses. "First I got an optician to give me a written prescription for this man's lenses. From the frame maker I got a list of the stores in the area which stocked this type of frame. In a short while I found a store which had a customer who used frames and lenses matching those found with the body—and this was the man."

Some of the devices used in the lab cost up to \$25,000 each and require a good deal of training to operate. Detective Kevin O'Brien showed me the emission spectrograph, a 15-foot-long, boxlike gadget in which tiny chips of material are burned by an arc to produce on film pictures of their wavelengths. Not long ago a chip of blue

EMISSION SPECTROGRAPH burns samples of material to produce pictures of their specific wavelengths



paint was left on a black car when it was wrecked by a hit-and-run driver. When a blue car which showed damage was located and a chip of its paint was also burned in the spectrograph, the film it produced matched that found on the victim's car—and the owner of the blue car pleaded guilty.

Another machine, the X-ray diffractometer was used in the case of an elderly woman who was attacked and robbed in her home. When the assailant entered, the woman was polishing silver, and in the struggle a smudge of this polish came off on his clothing. The diffractometer proved that the crystalline structure of the polish she had been using and that of the smudges on a suspect's clothing were identical, and he pleaded guilty.

Other lab technicians test poisons and drugs, getting hundreds of tiny packets ("bags") of heroin a week. Detective Charles Pompa showed me how these tests are made in big batches—but each "bag" must be examined because some are heavily adulterated with

(Please turn to page 176)



EXACT COMPOSITION of substance suspected of being heroin must be found in police chemistry laboratory. Hundreds of packets are tested each week

WEAPONS RACK holds arsenal of almost every type gun known, from homemade to military. Each of them was picked up on an actual case. Among them are zip guns, German Lugers and Walthers and several antique guns as well as the usual modern gun



BLOODY FOOTPRINTS are photographed at scene of shooting (left) and tireprints of suspect car are made on blotting paper (above). Since fingerprints are getting harder to find in criminal cases, detectives seek new methods to find hard evidence that will establish guilt and stand up firmly in the courtroom



Just patented

PM'S PICK OF THE NEW INVENTIONS

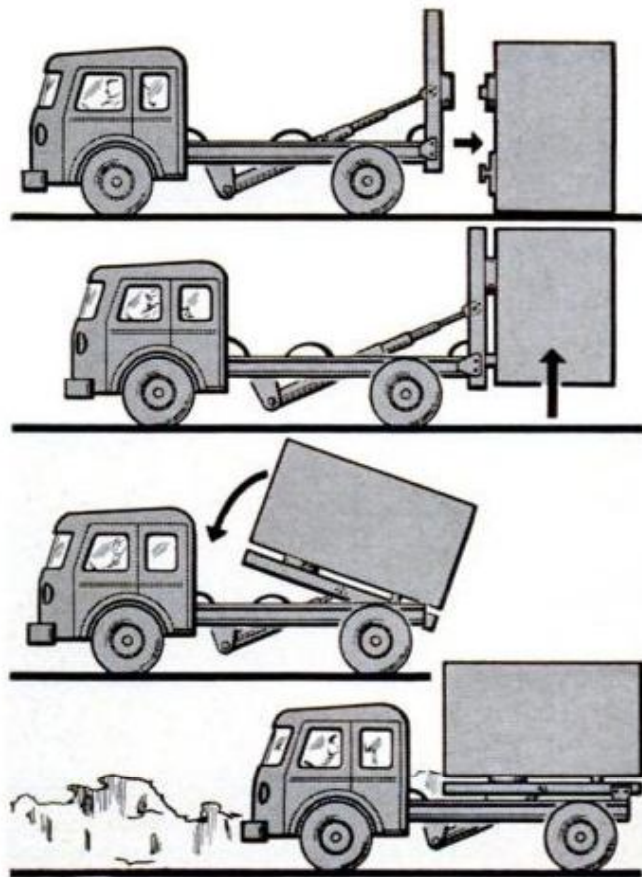
Prepared in cooperation with Roger S. Shashoua,
Director, International Inventors Association, Inc.



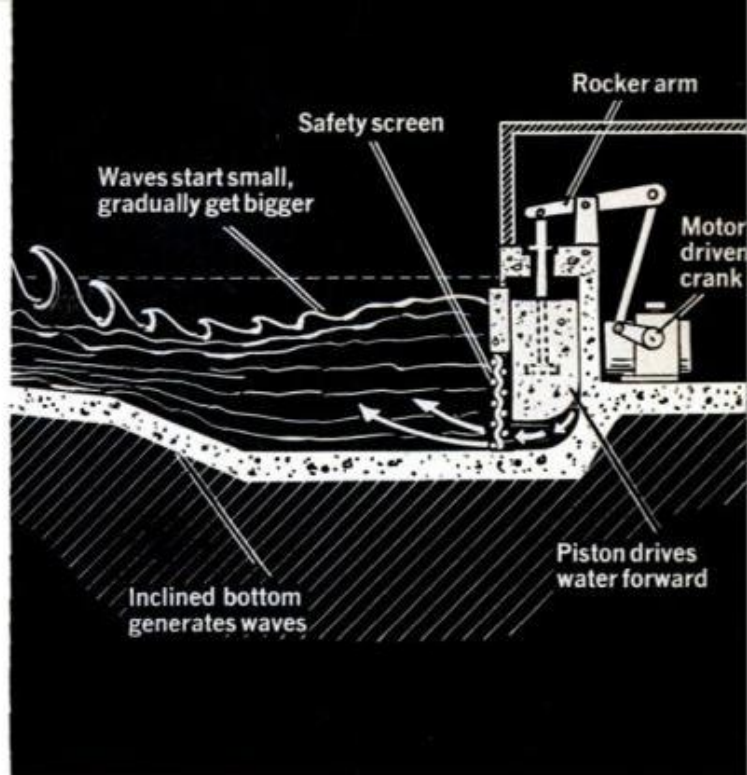
1. MAN-MADE WAVES may make it possible to go surfing in a swimming pool miles from any ocean. The plan is to build a large semicircular pool with a bottom sloping upward to an artificial beach area at one end. A series of giant motor-driven pistons, arranged in a fan shape, would send water rushing up the

2. CARRYING HIS OWN SHOWER BATH, a fireman is shielded from searing heat in the invention below. Water is fed under pressure to a helmet-mounted jet nozzle that whirls around like a lawn sprinkler. A ring surrounding the nozzle breaks the streams into a fine, cooling spray. The nozzle can be fed from a back-slung tank or by hose from a pumper truck

3. INTERCHANGEABLE TRUCK BODIES save valuable loading and unloading time. When the driver gets to his destination, he just drops one cargo container, picks up another and is off again with no delay. To pick up a load, a hydraulically operated track swings up, couples onto the cargo container, then lifts the container up and onto the truck chassis

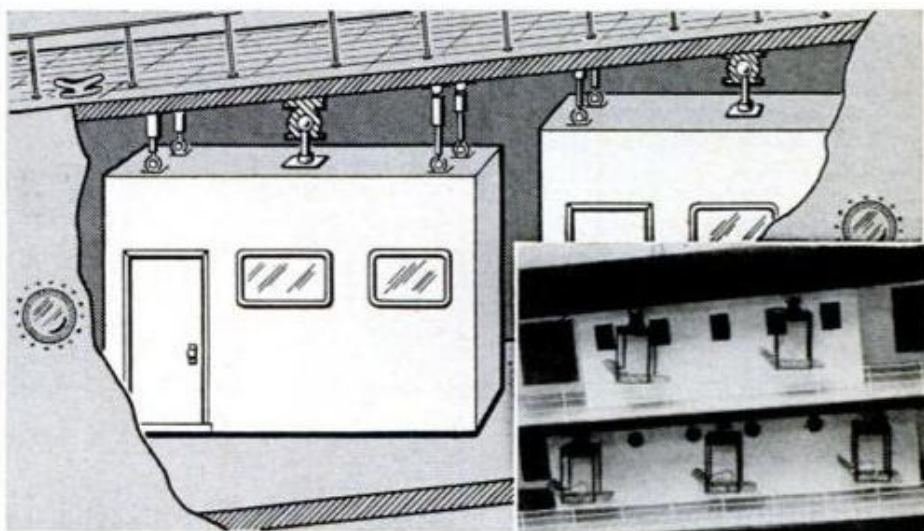


Inventors of the items shown on these pages are as follows: 1. Walter J. Leigh, Glendale, Calif.; 2. Clarence J. De Coste, East



slope where it would tumble over itself, producing a wave action just as on a real beach. Surfers would ride the breakers in, then land on sand at the shallow end. The idea is to develop such installations at amusement parks and community recreation centers so that inland residents can enjoy this popular sport

4. HANGING CABINS for ocean travelers are designed to solve the problem of seasickness. Suspended from a ball-and-socket joint, each stateroom swings freely like a chandelier, remaining level no matter how the ship rolls and pitches. Hydraulic shock absorbers at the corners act as snubbers, keeping the action smooth. The system could also be applied to deck chairs (photo at right). If too costly for an entire ship, it might be used just for special rough-weather lounges and emergency operating rooms



5. MULTIPURPOSE PILLOWS can be arranged to form different pieces of furniture as your needs change. The system consists of two wedge-shaped cushions and one or more straight sections. Laid out in a row, they produce an 8-ft.-long guest bed or a sloping lounge (see photos at near right). Pile them up, add a back section and you have a comfortable modern chair (far right). The pillows are of foam rubber covered with a special rough-pile fabric to keep them from slipping apart



Providence, R.I.; 3. Virgil O. Talbert, Wilmette, Ill.; 4. Jacob Perlberger, Antwerp, Belgium; 5. Mines & West Ltd., London, England.

The Boat With Its



I AM POINTING to the prop shaft where it passes through the hull into tunnel. Note the flat shaft angle

Penn Yan's tunnel drive may threaten both inboards and I-Os. It could revolutionize planing-boat design. PM brings you the first report on this exciting, new propulsion system

By DAN FALES, Boating Editor

IT COULDN'T BE DONE, they said —“You can't recess a propeller in the hull of a planing boat.”

But Penn Yan has proved them wrong.

They call it tunnel drive. It's an old principle that's been tried on large-displacement boats—tugs and the like—but never on speedboats.

The doubters give three reasons why tunnel drive shouldn't work: One, too

much cavitation; two, no speed; three, poor steering.

I tried Penn Yan's new tunnel-drive boat during a rough day on one of New York State's Finger Lakes. At the helm of a 22-foot Penn Yan Barracuda with a deep-vee hull, I ran at something more than 35 mph, maneuvered through quick, tight turns and jumped off small waves.

Penn Yan installed its prototype pro-

Prop in a Pocket

pulsion system into this 22-footer. True, the boat was almost nothing but a bare hull. But with a 210-hp Chrysler winding at 4000 rpm, I could see advantages of tunnel drive over straight inboard drive and inboard-outboard drive. I could also see disadvantages.

Tunnel drive is also called reaction drive by its developer, Bob Stuart, Penn Yan's lanky, soft-spoken president.

"This system, in many phases of recreational boating, could well obsolete not only the traditional inboard propulsion arrangements, but the I-Os, too," Stuart says. It's on this basic philosophy that he's steering his company straight

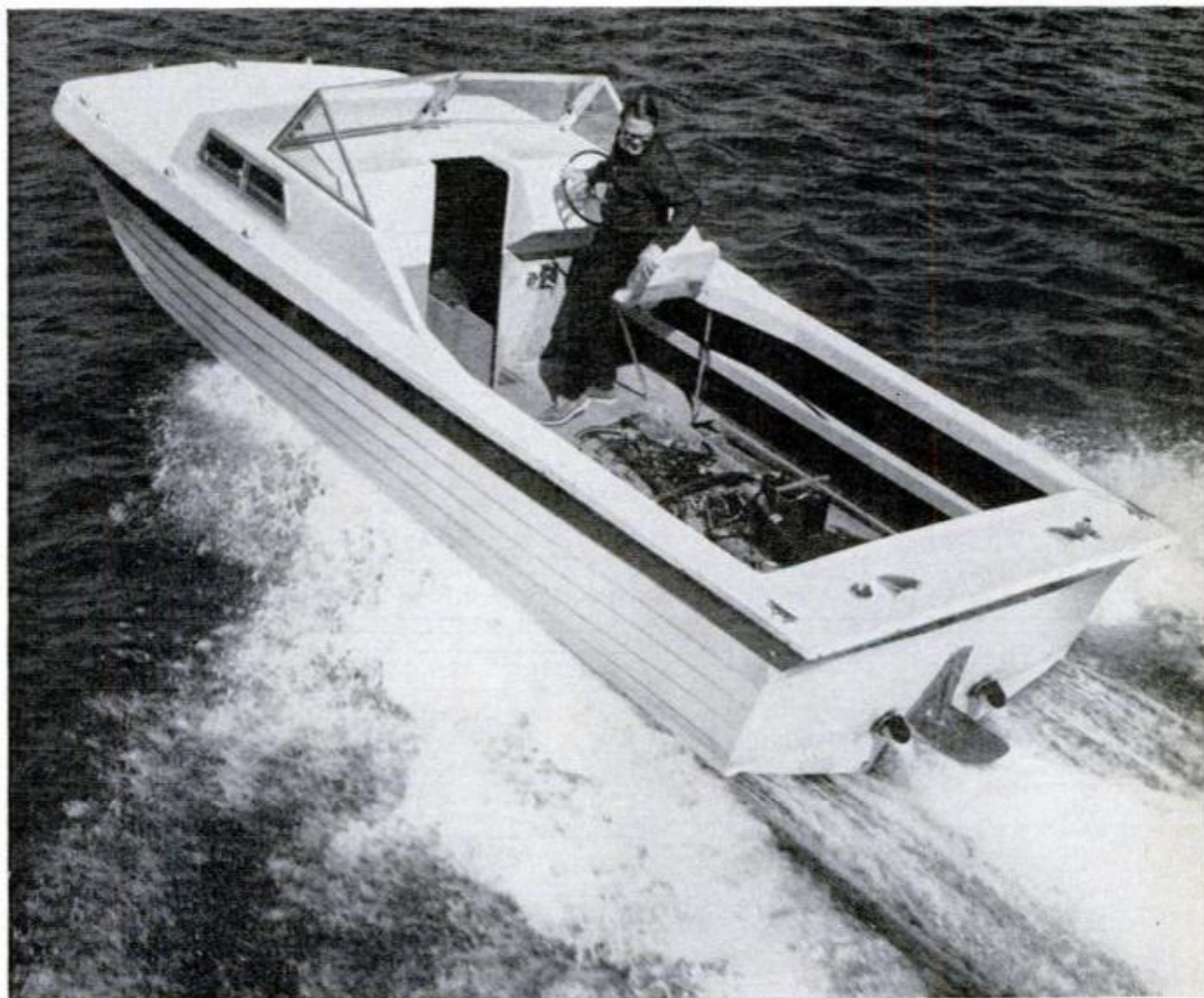
ahead in the tunnel-drive direction.

Basically, tunnel drive operates much like a jet. At high rpm the prop sucks water into the five-foot tunnel and then violently pumps it out the opening. The action of forcing a mass of water out an opening at a certain velocity creates an equal and opposite reaction. It's Newton's principle of the conservation of momentum. This reaction is forced against the prop and driveshaft. It moves the boat.

The tunnel looks like half an ice-cream cone. Penn Yan says it can put a tunnel in most planing hulls, but it's especially effective in vees.

A tunnel means that the prop will

AFTER A LOOK FORWARD, I quickly check the water swirl that's forced by prop into void left by the hull



operate more efficiently than a non-enclosed prop. With an open prop some efficiency is lost because of eddying. Just as water leaves the prop, it curls around the prop and is again sucked into it. If a barrier stops this eddying, prop efficiency is improved. So that's one advantage of tunnel drive.

But some critics of the tunnel principle have maintained that forcing water through a tunnel at high speed creates cavitation. They have said that such a system would pull water so hard that it would vaporize—becoming gas around the prop. This destroys efficiency and cuts speed. They have also claimed that suction would pull air into the flow.

All I know on this point is that I piloted a 3200-pound boat up onto plane, hitting a top speed just over 35 mph. When I threw the throttle forward, the boat was quick to respond with minimum of bow lifting. It took only seconds to hit top speed at 4000 rpm. If there was cavitation, it was not noticeable. Even when we pulled the boat and looked at the prop there was no pitting (its presence is a sure sign of cavitation). So Penn Yan's tunnel

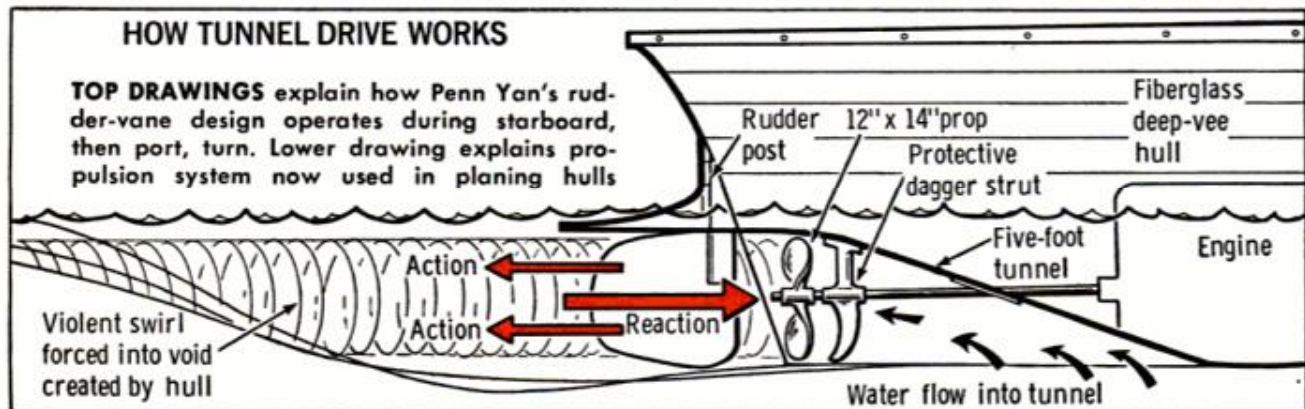
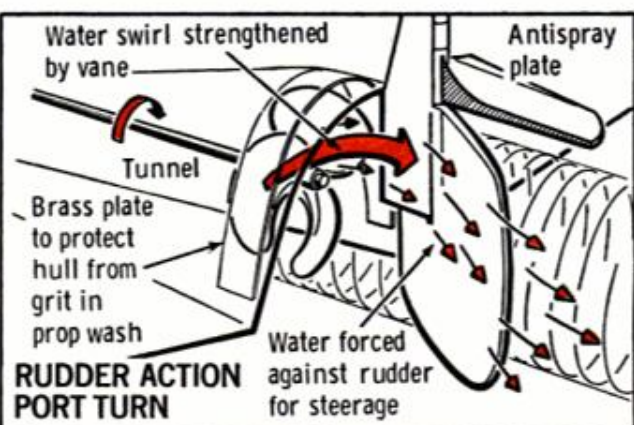
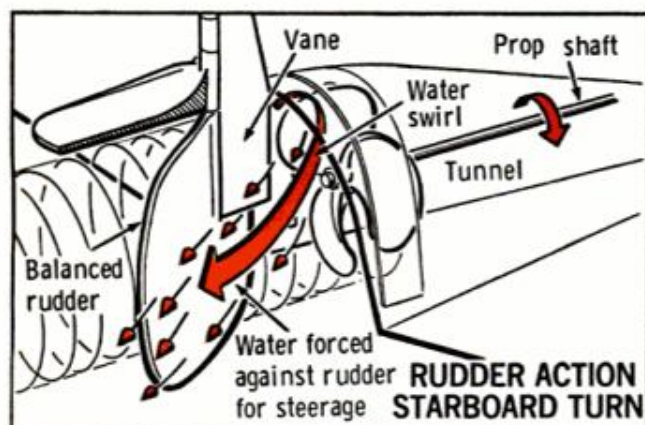
drive, at least at 4000 rpm and below, seems okay on that score.

But what about steering? It has always been claimed that a responsive rudder could not be designed for a planing TD hull.

Here's where Bob Stuart foiled the doubters. It took him two years, but he finally dreamed up a rudder configuration that works. It's a balanced rudder, part of which is a stationary vane or fin. The fin—which is 20 percent of the rudder surface—parts the violent swirl coming off the prop. This straightening of the water is important when turning to port. The vane forces the water along the top part of the rudder for a port turn. In a starboard turn the natural swirl of the water hits the bottom part of the rudder, forcing a turn right. The vane does not come into play for a starboard turn. (See diagram on this page).

Obviously, the positioning of this vane is critical, therefore it's factory tuned. If the vane is off, you'll have sluggish steering.

So, now you have a boat that is propelled by a tunnel-drive system. It can go fast enough to plane and compete



with other propulsion systems. It will maneuver easily.

But what are the main advantages?

First, shallow-draft operation. With the prop up in the hull, you can speed in water that's just a little deeper than your keel. The Barracuda has a nine-inch draft. You don't have the prop vulnerability of an inboard system, and you don't need the draft of an I-O.

Second, lower cost—from \$200 to \$300 less. Penn Yan's 23-foot Avenger with a 210 I-O system costs \$7889. The same boat, with the same equipment and 210-hp engine, but with tunnel drive instead of I-O drive will cost about \$7500. Eliminating the gear which hangs outboard in an I-O system results in a lower cost package.

Third, weight distribution is more even. With a tunnel-drive system, the inboard engine can be placed right over the boat's center of gravity—almost level. With regular inboard operation the engine must be angled so that the prop shaft will run deep enough in the water to swing a propeller without hitting the hull. Though inboards are designed to operate at such an angle, it is always better if they can be as level as possible.

With the engine at the center of gravity, it is easier to balance the boat. This also permits a lower angle of hull attack for planing. If the weight of the engine and outboard gear is in the stern, the angle is affected.

Fourth, tunnel drive should prove more economical with a longer cruising range. Though the top speed of tunnel drive is slightly below that of other propulsion systems, TD can be more efficient at lower rpm. Because you are getting peak prop and engine efficiency from TD at cruising speed, you don't have to turn as many rpm to attain the same speed as other propulsion systems. Penn Yan says it has found that to attain the same cruising speed with TD running at 2500 rpm, the I-O they were testing against required 3000 rpm to keep up.

Fifth, all gear below the water line

is made of similar metal—brass-based—an obvious advantage especially in saltwater operation. Though Penn Yan designers will attach a zinc fitting to the prop shaft, they believe the electrolytic action in this system is weaker than one using dissimilar metals below water.

Sixth, readily available parts. The TD system uses common shaft, strut and propeller (12 by 14 inches). The only items needed from Penn Yan, because of special design, are the spray plate and rudder assembly.

Seventh, less wake. In high-speed operation, Penn Yan says TD has virtually no wake. At slow speed, I found the wake on the prototype minimal.

Eighth, trailer and hoist advantage. TD can use any regular outboard boat trailer and can be hoisted in slings without worry about bending shafts.

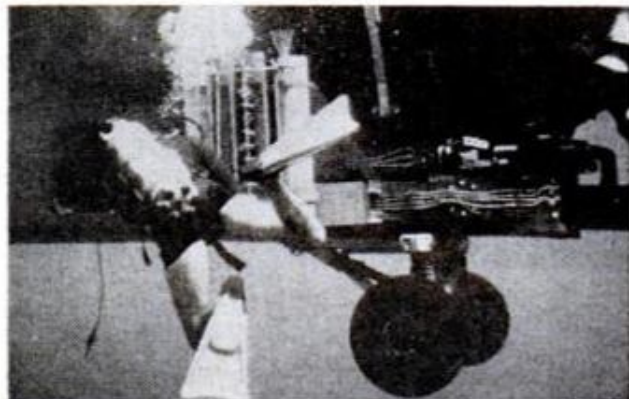
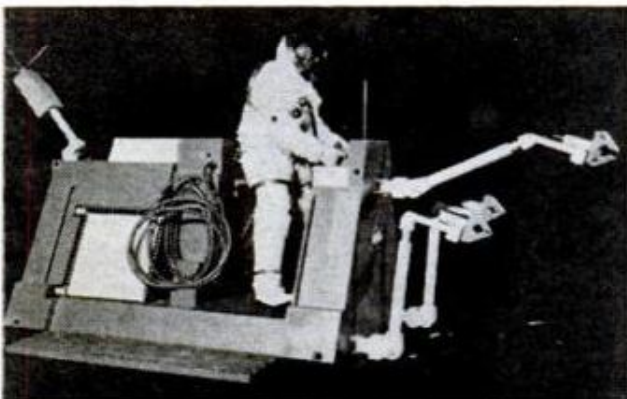
Ninth, relatively safe for swimmers and divers. Because the prop doesn't extend below the hull line, danger to persons in the water near the boat is minimized.

Though this seems like a glowing report, I found some disadvantages. The

(Please turn to page 193)

NOTE the tunnel, which looks like hump over drive-shaft in a car. I am pointing to propeller shaft



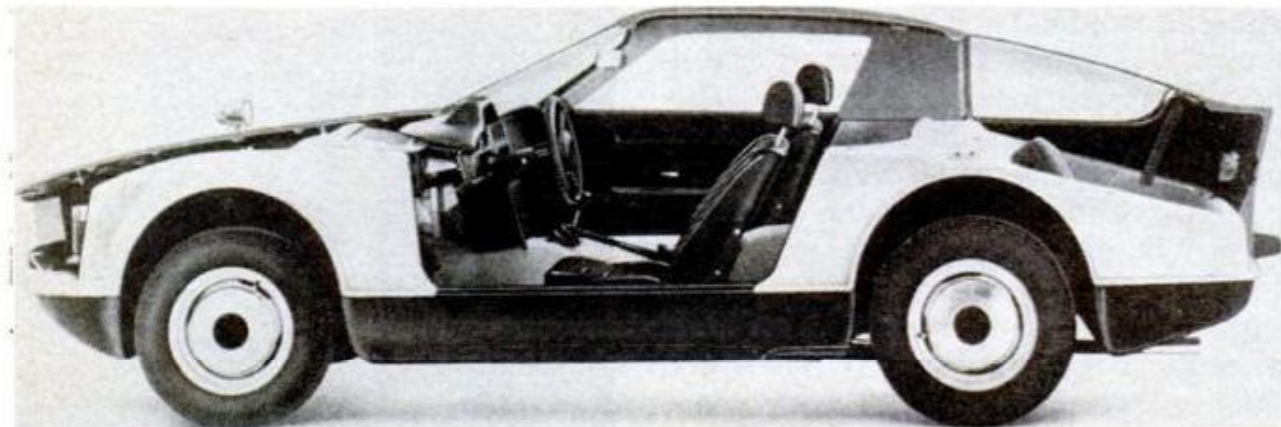


Ride 'im, astronaut

A space-suited crewman would ride this Maneuvering Work Platform to perform construction and maintenance tasks in orbit. The unit is an Aerospace Corp. proposal.

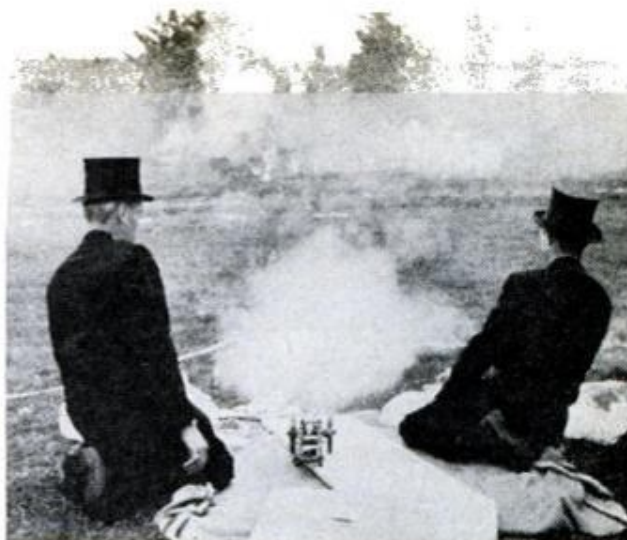
Airplane tires take a dive

Tires designed for the tail wheel of a C-47 transport are being used to carry the *Alumnaut* submarine across the ocean floor. They're filled with water, not air.



Even the chassis is made of plastic

Plastics have completely replaced metal in both the body shell and chassis of this prototype car, developed by Farbenfabriken Bayer AG and shown in this country by Mobay Chemical Co. A fully operational model of this same design has been road-tested in Europe.



These sharpshooters must be agile as well as eagle-eyed

A strange sharpshooting contest is held every year in Tuttlingen, Germany, where a group of formally dressed men assume many informal poses to fire miniature cannons. The whole thing started because of the interest in miniature artillery on the part of Dr. Hanno Monauni, director of a firm that makes surgical instruments. He allows apprentices in his factory to make the cannons in their spare time (top left photo, facing page) for sale. Buyers come to the competition and blast away at conventional targets and toy forts.



Back-yard trolleybus

Fascinated by trolleybuses since childhood, Peter Lepine-Smith of England finally decided he needed one of his own—much to the joy of the neighborhood children. Starting with a milkwagon chassis, he built a one-third scale model of a real trolleybus. The body of his back-yard bus is made of fiberglass and aluminum. It travels five mph under an 800-foot-long power line.



"He looked so honest and he gave me a 10-year written guarantee"

HOW TO OUTFOX THE 'HOME IMPROVEMENT' SWINDLER

This article contains a free offer: What you'll save by knowing the five favorite selling schemes of swindlers may be enough to pay for your next home project

BY MORT SCHULTZ

Illustrations by Joe Farris

YOU'RE FAIR GAME for home-improvement swindlers—if you can't recognize their most commonly used selling schemes.

Any homeowner can be taken by these expert con men.

One Long Island, N.Y., woman of 65, for example, was bilked of \$995 for roof repairs that failed during the first heavy rain.

"He and his young son looked so honest," she explained, "and he did give me a 10-year written guarantee."

Where trust fails to sway a customer, the desire for a bargain often works.

Home-improvement swindlers are masters at tempting you with offers of free gifts and tremendous savings.

Lack of cash in a homeowner's bank account never stands in the way of a sale. Easy credit (at exorbitant interest) is available at payments to fit any budget. Excited at the prospect of a "good deal," however, many homeowners unwittingly sign documents that put expensive second mortgages on their homes.

The home-improvement gyp "discounts the paper," as selling the contract to a finance company is called.

Legally, the finance company can't be held responsible for fraud perpetrated by the salesman. If you refuse to pay, the mortgage is foreclosed and you lose your home. The alternative is to make the monthly payments, small to be sure, but which, like alimony seem to go on forever.

How can you recognize the home-improvement swindler? There are five commonly used selling schemes. They work so well that they are used year after year with slight variations.

The "reco" scheme. "Reco"—that's short for recommendation (also called referral selling)—is one of the most common of home-improvement swindles. The "reco" artist holds out a promise of easy money if you'll act as a company representative. But, of course, you need something to demonstrate. That's where the product comes in, for which you always pay an inflated price and never see a penny in return.

and referring them to the company.

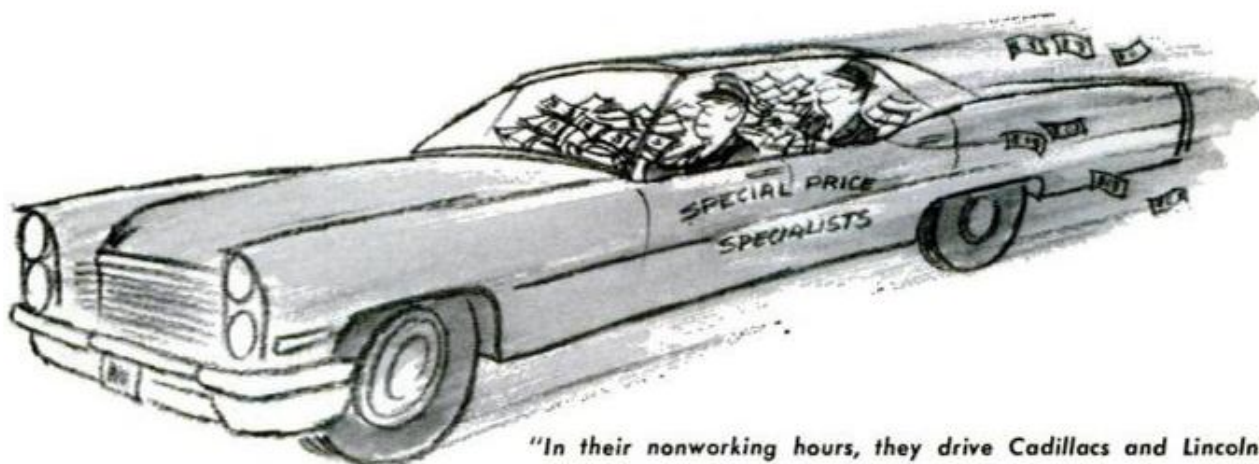
"You'll receive \$100 for each person you recommend," he was told by the salesman of Allied Enterprises, Inc.

The contract was quickly signed. But instead of receiving money for making referrals, the homeowner received a payment notice from a finance company. He had unknowingly signed an agreement which placed a second mortgage on his home. He had to pay.

A complaint to the FTC resulted in an order that Allied could no longer use "reco" selling tactics. That didn't bother the company. It had gone out of business, leaving behind 200 victims and nearly \$300,000 worth of second mortgages.

Despite variations, "reco" selling has characteristics that will help you spot it. They usually occur in the following sequence:

The salesman appears at your door unsolicited, or after a phone call for an



"In their nonworking hours, they drive Cadillacs and Lincolns"

"The first thing people had better realize is that you can't get something for nothing," warns John T. Walker of the Federal Trade Commission.

The experience of a Washington, D.C., homeowner shows how a swindler baits a trap with a "free" carrot. At \$1389, the price of the home intercom system seemed high. (It was. The same system can be purchased for \$600.)

But the offer was one the customer couldn't turn down. He could get the system free of charge—even make a profit—by demonstrating it to friends

appointment. He seldom introduces himself as a salesman. Instead, he's a "survey-taker," or he's been recommended by a neighbor.

He brings up an important but obvious issue for example, that early fire detection is important for your family's safety. This is an introduction to his product—in this case, of course, a fire alarm system.

The company he represents never sells products, he will say, but has been authorized to make *free* installations in a few homes for demonstration purposes. (Watch for his claim that the

product is not on the market. As with everything else, that's a lie.) "However, the law prohibits my company from making an outright gift," is a pitch often used.

He'll then ask that you serve as a company representative, making demonstrations and referring customers. You'll receive commissions and will eventually own the item "free and clear."

The final pitch is to get you to sign papers before you have time to think. According to Kenneth B. Willson, president of the National Better Business Bureau, "Chain referral sales plans are *always* used with intent to mislead and defraud." Avoid anyone who seems to use one.

The model home scheme. This sales pitch is similar to "reco." Again, it lures you with a promise of something for nothing—in this case, something for the exterior of the home ("free" siding, "free" storms and screens, "free" gutters and downspouts). As with "reco," the price you end up paying is much more than what you'd pay for the same product sold legitimately. However, the promise of commissions for allowing the company to use your home as a "model" makes it seem foolish to pass up the deal.

Often within minutes after you've signed the contract, a truck loaded with supplies drives up and work commences. Why so fast? Home improvement gyps know the law. No contract can legally bind you unless some work is done.

Bait and switch. One of the most deceptive of all swindles, bait and switch hides behind a mask of respectability. Bait advertising, which offers products at unbelievably low prices, is found in newspapers, on television and radio, and in national magazines. Millions of people every year fall for it. I decided to, also.

I called the phone number in the ad that offered a complete aluminum siding job for only \$267. If I acted immediately, the ad said, I would get as a



"I read the fine print and caught the hooker"

"free" gift combination aluminum screens and storms for every window in my home.

The salesman reluctantly showed a sample of the aluminum siding. It was as thin as tissue paper.

"What can I do? It's what the company's offering," he explained.

He started to pack his case.

"Hey," he suddenly exclaimed, "I just thought of something. There may be some of last year's siding left in the warehouse. Here's what it looks like."

He showed me a piece—pretty good stuff.

He reached for the phone, dialed a number and asked someone to check bin 675 for "last year's siding."

"You're in luck," he said. "There's enough to do your home, and since it is last year's stock I can give you a great deal."

I'd just been switched. Instead of a complete job for \$267, I could have the better material for \$850. And this would be almost \$400 under last year's price. I'd still get the free storms and screens.

The salesman then showed his company's "phenomenal" guarantee. I read it.

The company, it said, guaranteed the siding against practically everything for 20 years. It appeared that it wouldn't cost me a cent if anything went wrong.

I read the fine print and caught the hooker. Should the company "*at its sole discretion*," it said, "determine

the siding should be repaired or replaced. . ."

As indicated, a definite sequence of events takes place during bait and switch. Here's what to look for:

- The bait—ads offering products at fantastically low prices.
- Belittling of the advertised product by the salesman.
- The switch—demonstration of a better item that you can buy for "far below its original price."
- The ever-present guarantee and fast paper shuffling to try to get your signature quickly.

Fear tactics. These are used by gyps who literally invade your home. One of the more notorious cases involved the now defunct Monarch Construction Co., which operated in the Washington, D.C., area from 1963 to 1967. It sold contracts to hundreds of homeowners and grossed a reported \$2.5 million.

People in rundown neighborhoods were approached by men who said they represented "urban renewal." The homeowners were in danger, they were told, of having their homes condemned if they didn't remodel.

The swindlers then proceeded to recommend a company which supposedly had an agreement with "urban renewal" to do work at discount prices. In other words, the pitch went, "urban renewal" would pay part of the remodeling cost.

Before frightened homeowners realized what they were doing, many signed contracts and deeds of trust. They were stuck for payments they couldn't afford.

The fear tactician preys on those in upper-income brackets as well. The experience of a Dayton, Ohio, couple shows how this works.

The man at the door, flashing a badge that cold winter day, said he was from

the building department. He'd come to inspect the furnace. Ten minutes later, the couple was called to the basement to find furnace parts strewn over the floor.

"This furnace is in terrible shape," the man said. "It could blow up at any time. I should give you a summons, but you have enough trouble. You must get a new furnace immediately."

By this time, the couple was so chilled by fear and lack of heat they would have done anything.

The man suggested a furnace company "who can install new equipment today." The furnace was installed several minutes after the "inspector" made a phone call and the homeowner had signed a contract for \$2000, putting his house up as collateral.

When his fears abated, the homeowner became suspicious and called the town's building inspector to verify the



"I hate to dump that good material left in the truck"

man's credentials. But this simple action, which should have been taken before the man had been allowed into the home, came too late.

The "special price" pitch. The infamous Williamsons, who offer home repairs at amazingly low prices—in fact, pretty much what you want to pay—are masters of door-to-door selling. They'll "repair" roofs and foundations, gutters and downspouts, driveways and

(Please turn to page 178)



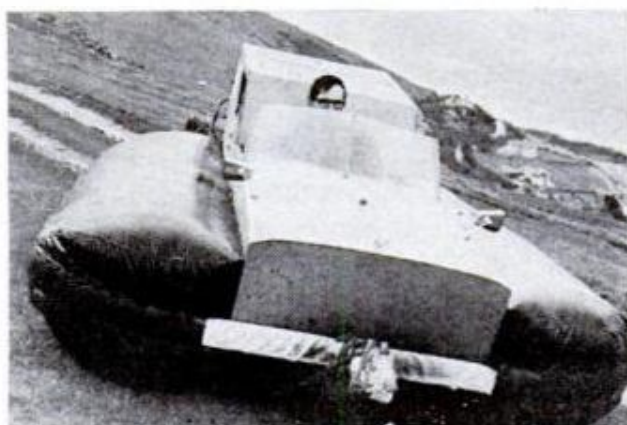
Computerized bartender

It's a little like playing a jukebox. A waitress orders a drink by pushing a button (above). Then the Comp-U-Bar 801 dispenses the drink (any of 1000) in four seconds. In addition, the "computerized bartender" produces a bill and keeps a record of the sale.



Hard hats for catchers

Catchers for the Los Angeles Dodgers are wearing protective headgear this year. The protectors fit under their face masks and shield them from a bat that swings wide. Shown here at the start of the baseball season are Tom Haller (top), new to the Dodgers this year, and Jeff Torborg, regular catcher.



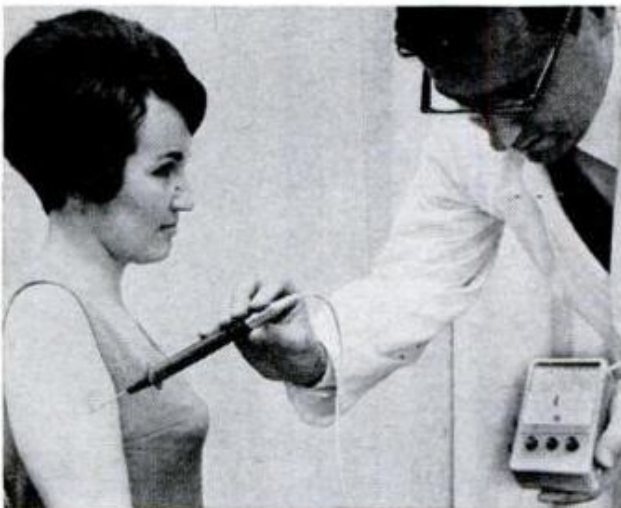
Hill-climbing hovercraft

Spiked wheels mounted on the rear of Geoffrey Harding's hovercraft enable it to climb steep slopes that would otherwise be impossible for an air-cushion vehicle. Harding, a Briton, installed a used 250-cc motorcycle engine to drive his vehicle and a 197-cc engine to supply the lift.



Shoemaker's big feat

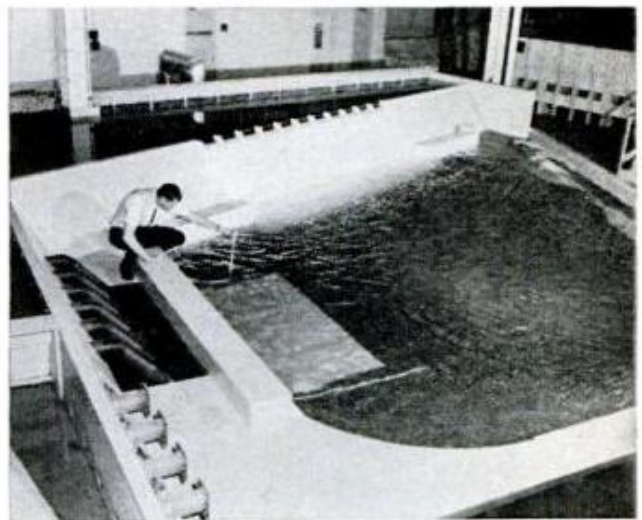
How'd you like to keep an elephant in shoes—at over \$100 per foot? There's an Indian gentleman who thinks it's worthwhile; he ordered 16 boots for ceremonial occasions. The maker, Wilfred Hunter of Doncaster, England, is shown measuring (upper left), making (left) and finally fitting the boots (above).



Tells temperature in a hurry

Simply by touching the feeler tip of a German electronic thermometer to a patient's skin, a doctor can read the person's temperature immediately on the instrument's scale. The unit, which registers Celsius temperatures from minus 50° to plus 110°, is transistorized and powered by batteries.

JULY 1968



More power for Grand Coulee

Giant problems are solved in miniature by the Bureau of Reclamation as engineers design a third powerplant for Grand Coulee Dam. The present dam, with its two powerplants, appears at the rear of this model; the new "forebay dam" is at left. Total power capacity will be 9.2 million kilowatts.

85



PONTIAC CATALINA A Nationwide Survey Based on
1,186,000 Owner-Driven Miles



They're Lifetime Fans, But They Visit the Gas Pump Too Often

For many owners their '68 isn't the first Catalina and won't be the last Catalina they own, even though mileage is only one of several complaints

By **BILL HARTFORD**, Associate Auto Editor

Photos by Irving Dolin

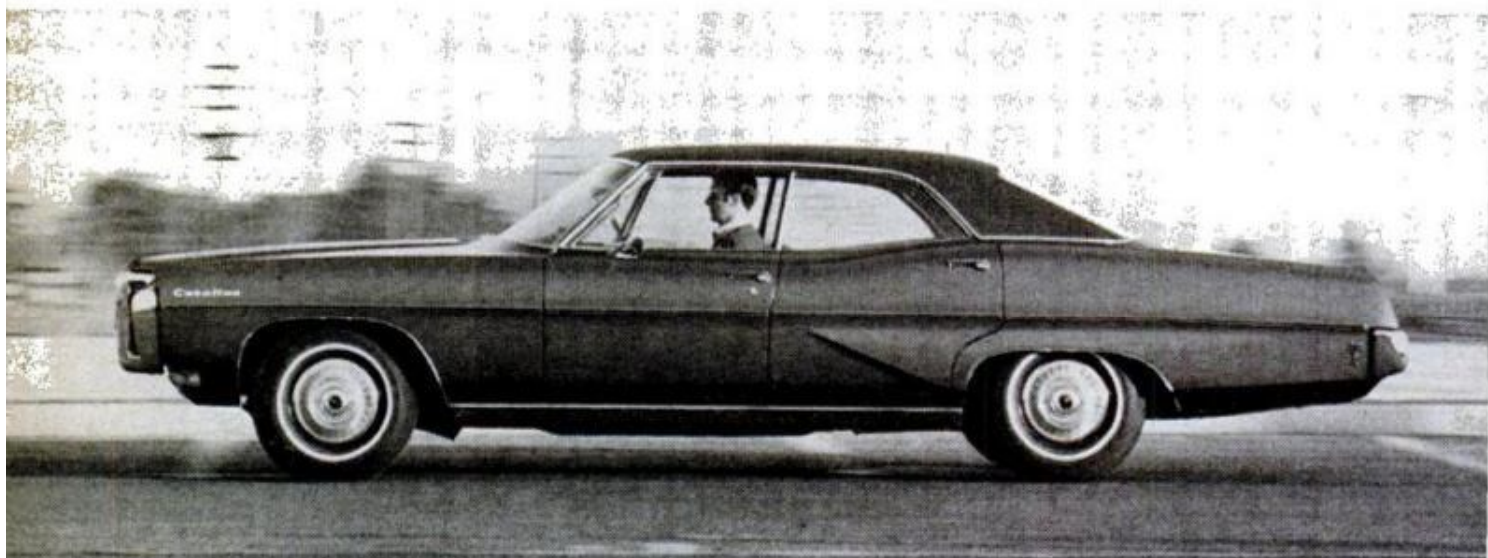
ONCE A CATALINA OWNER, always a Catalina owner is not too far fetched a statement:

"I have owned ten Catalinas—they have all given good service."—Minnesota salesman.

"This is my fifth Catalina. It's a good dependable car. Never had any problems except tires and tune-ups on my other four."—Massachusetts heating and ventilation foreman.

"... my fourth Pontiac; I stick with

"BEST ROAD CAR for the price," says a Minnesota owner who, nevertheless, criticizes protruding nose



a good thing.”—Wisconsin farmer.

Some of these owners who buy one Catalina after another and say they never have any trouble better not have: They trade in every year. Typical are an Indiana banker and Illinois salesman. A second Illinois salesman says, “This is my third Catalina in as many years.” A North Carolina construction foreman says, “No complaints; this is my sixth since 1962.” Some folks do skip a year

An Alabama secretary had only 90,000 miles on her '63 “with practically no upkeep” before she traded in for a '68.

No use talking about all those other typical owners who tell us they keep their car the usual three years, driving it the usual 10,000 miles per year before they, as usual, buy another Catalina. It makes dull reading.

Catalina styling, to many owners—



HANDLING PRAISE refers mostly to ease of turnpike driving, but owners also like the handling in hard turns

here and there: “I’ve been driving a Catalina since 1958. I’ve owned a ’58, ’60, ’62, ’64, ’65, ’66 and ’67,” says a New Jersey salesman.

But, equally satisfied with their Catalinas are owners who don’t nonchalantly dump the old car every time they hang a new calendar. An Illinois farmer says, “We have 105,000 miles on our ’63 Catalina with no repairs on motor other than fuel pump, plugs, points and cleaning the automatic choke.”

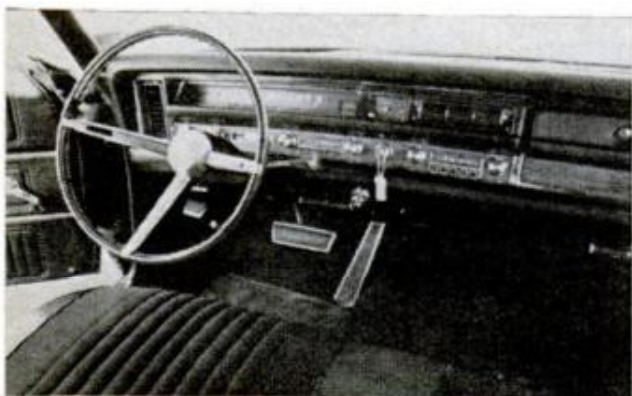
► He’s still got it. It’s one of two other Catalinas in addition to his ’68.

40 percent in fact—is one of the best things about the car. Nevertheless, one aspect of the car’s design is on the most-wanted list—most owners wanted it changed. The Catalina’s “beak,” as a Maryland machinist calls it, is for the birds.

“Strange looking front bumper,” says a Nebraska funeral director. “I think Pontiac has had bulging front ends for too long. The ’68 is, by far, the worst.”—Wisconsin service station owner. “Projection of center front may be stylish, but it’s a hazard to other vehicles

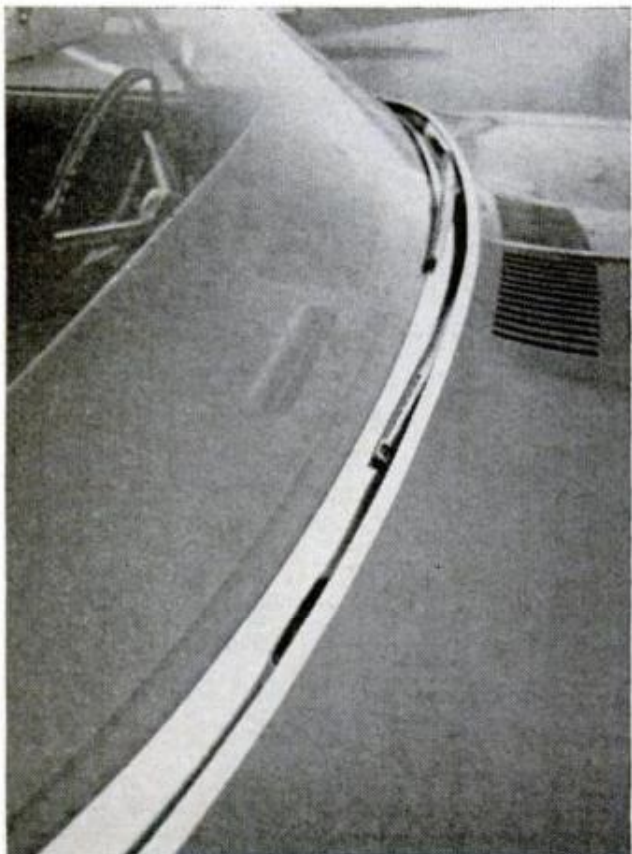


REAR-VIEW MIRROR position is criticized by some owners, but even bigger complaint is rear visibility



SWEEP OF DASH in gently arcing curve well forward of driver contributes to roominess, say owners

RECESSED WINDSHIELD WIPERS look good, but many have frozen in place and otherwise malfunctioned



and pedestrians."—Wisconsin clergyman. And, "It's like leading with your chin."—Ohio construction worker.

A New Jersey salesman, in calling for a change, observes that "protruding nose is a menace. Also, metal underneath grille can be damaged easily. Bent mine on a frozen snowbank." And a Louisiana derrick man finds that the "metal under the bumper scars up if you get too close to a high curb."

► The unprotected sheet metal below the Catalina's front bumper also contains the parking lights. Remarkably, no owners have broken them yet, but it's just a matter of time.

Owners north of the Mason-Dixon line find that it's also just a matter of time before winter rolls around again and their wipers freeze into their cozy, recessed igloos. Furthermore, "Hidden wipers freeze down if shut off even for a minute," says a snow-blind Ohio engineer.

That's not the only problem. Catalina owners mentioned the wipers under the heading of mechanical complaints because "windshield wipers have hit together and caused fuse to blow,"

AQUILINE SCHNOZZLE cuts the air way ahead of car. As gentle owners say, it's not car's best feature



as a Pennsylvania merchant complains. An Indiana bookkeeper had hers "link together and bend the metal strip holding the wiper." A Massachusetts secretary's wipers "were misaligned—damaged windshield within two months and had to have windshield replaced."

► **What!!**

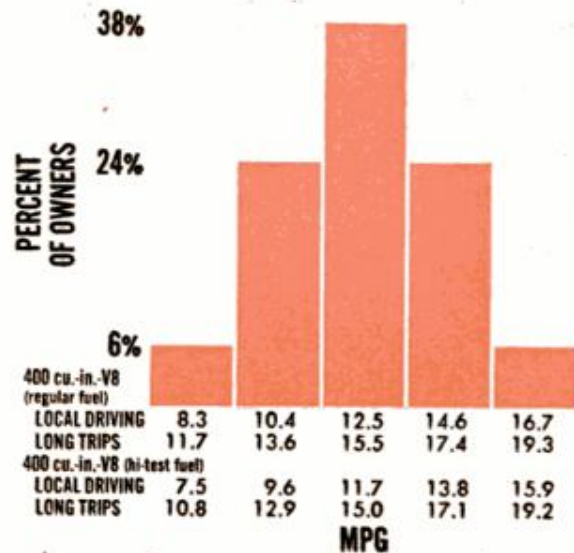
When a timekeeper-clerk in New Jersey bought her Catalina the salesman warned her about fuel mileage. Now, regretfully, she says, "not enough mileage per gallon of gas. I should have listened to the salesman when he told me to buy a Tempest." She gets 10 and 14 mpg around town and on the road, respectively, with her 400 cu.-in. high-test fuel engine.

► **Compression ratio of the engine is 10.5:1. That of the identical displacement regular-fuel V8 is 8.6:1. Only eight percent of owners have 428 cu.-in. V8.**

A Louisiana chemical engineer complains that he would like better mileage, and says that his 8.6:1 "does not run properly on regular gasoline. Needs at least a 50/50 mixture of regular/premium gasoline."

A Maryland plumber says he gets two

PONTIAC CATALINA FUEL MILEAGE CHART



mpg less with his airconditioner turned on. And a Massachusetts sales technician consoles owners with the fact that the timing of our Catalina survey reflects mileage figures for winter driving, which is somewhat less economical than mild weather operation.

A Georgia bank officer isn't counting pennies at the gas pump, but he's still thrifty: "I consider it the best investment short of a Cadillac!" ★★★

Summary of 1968 Pontiac Catalina Owners Reports*

Total miles driven:1,186,691

Average miles per gallon:
 400-cu.-in. V8, regular gas
 local driving .12.5
 long trips .15.5
 400-cu.-in. V8, high-test gas
 local driving .11.7
 long trips .15.0

Specific likes:
 Handling51.9%
 Styling39.5
 Comfort34.0
 Ride24.1
 Performance21.6
 Economy15.4
 Power13.6
 Roadability9.9

Specific dislikes:
 Gas mileage30.3%
 Workmanship12.9
 Rear visibility10.6
 Wind noise9.8
 Rattles8.3
 Rear view mirror position6.1
 Front bumper protector5.3
 Windshield wipers5.3

What changes would you like?
 Rear visibility13.1%
 Gas mileage12.3
 Styling12.3
 Grille shape9.2
 Rear view mirror position6.9

More headroom6.2
 Front bumper5.4
 Higher seats4.6

Model:
 2-door sedan12.0%
 4-door sedan29.1
 4-door hardtop17.1
 Hardtop coupe39.4
 Convertible2.3

Transmission:
 3-speed manual2.3%
 4-speed manual1.1
 Automatic96.6

Had any mechanical troubles?
 No59.7%
 Yes41.3

What kind of trouble?
 Carburetor (includes routine adjustment)20.3%
 Window wipers13.5
 Transmission9.5
 Electrical9.5
 Brakes6.8
 Power steering6.8

Dealer repair satisfactory?
 Yes68.8%
 No23.4

Why the Catalina?
 Past experience48.2%
 Price23.2

Style18.9
 Size8.5
 Reputation6.7

Is the Catalina your only car?
 No53.7%
 Yes46.4

Other cars owned:
 Pontiac37.9%
 Chevrolet25.3
 Ford9.5
 Volkswagen7.4
 Dodge7.4
 Plymouth5.3
 Camaro5.3
 Oldsmobile5.3

What options/accessories?
 Power steering99.4%
 Power brakes93.8
 Radio56.6
 Airconditioning52.6
 Tinted glass22.5
 Whitewall tires19.1
 Vinyl top11.6
 Tinted windshield10.4
 Decor group9.8
 Power seat2.2
 Power windows1.7

Age distribution of owners:
 15-2915.7%
 30-4947.7
 50 plus36.5

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

Is a Houseboat Your Best Buy?

You can have luxury boating and cruiser speed—
at a summer cottage price

By DAN FALES

Boating and Outdoors Editor

IF YOU THINK OF A HOUSEBOAT as a run-down shanty anchored to a mud-filled barge that's so full of dry rot every footstep's an adventure, you're living in the past.

Suddenly the houseboat image has changed—and changed dramatically. Now such boats are sleek, speedy, sunny, airy, roomy and half the cost of a regular powerboat the same size.

For 17 years, one experienced boatman owned traditional cruisers. But early this spring, he jumped from a 30-foot yacht to a 33-foot houseboat.

Why?

"More boat for less money," he says. "During the summer, my wife and kids can live aboard comfortably while I work in the city. Our other boat was great, but too cramped for four people. I'd have bought a larger cruiser, but didn't have the money."

He calls his boat a "floating cottage," adding that his wife likes the extra space, and the kids like gunkholing weekends.

Space, mobility, convenience and low cost are the four ingredients that make houseboats so popular, so popular, in fact, that the two dozen manufacturers had all their boats snapped up before the ice was off many of the

northern lakes. And it's on many of the country's larger lakes and rivers that houseboating is really taking hold.

"It's less expensive than buying waterfront property with a cottage," says another houseboat owner. "I shopped in my area for a decent summer cottage. I couldn't touch any lakefront property for under \$20,000."

His answer—a 34-foot houseboat that sleeps six. Cost: \$13,500.

Now he is, literally, on the lake where he found property too expensive.

So shop in your area. If property is too high for you, a "floating cottage" may be *your* answer.

Of course you may want to be mobile—roam large lakes; poke your nose into quiet coves; be by yourself away from crowded towns, marinas, shorelines. You may like meandering along a gently flowing river down South, or going upstream into Canada.

Then again, you may be a saltwater buff who likes to zip down Long Island Sound, or to anchor in calm Mobile Bay, or to feel the cool breezes of Puget Sound, or to run through open ocean to Catalina Island.

Houseboats are so mobile that for a little extra money you can have yours



CRUISING offshore islands (top) in a 33-foot Nauta-Line can be a thrill. For hot southern climates, a fold-down canvas top over the sun deck is a good idea. Picnicking on an isolated shore (middle) in a 33-foot Chris-Craft is another fun activity available with a houseboat. The dazzling pilot control (right) of a 34-foot Drift-R-Cruz houseboat gives the skipper all the engine and navigational information he needs. Big windshields and side windows provide great visibility on all houseboats



HOUSEBOAT INTERIORS are designed for luxury living afloat. This 33-foot Chris-Craft has a spacious galley (forward), plenty of living space, and paneling to boot. The airiness of big windows avoids a cramped feeling

RIVER QUEEN'S 35-footer has a hull constructed of heavy-gauge steel. This houseboat is 12 feet wide with raised bow. It's powered by a single stern drive, though twin drives are available in a variety of power options

trailed each year to a different body of water. (For this purpose, it's a good idea to get the boat cradle when you buy the houseboat.)

But before you spring open your checkbook, there are things you need know.

Houseboats come in a flood of sizes from 17 feet overall for about \$5500 to 60-footers for \$50,000 and up. Of course, the living area is less than overall length. On a typical 33-footer you get a "cabin" that's about 20 feet long by 10 feet wide. Because of over-the-road hauling rules in many states, most houseboats are just under 12 feet in width.

Regardless of size, houseboats are generally designed for inland waters. Though several of the bigger 50 to 60-footers do run the oceans, the smaller 20 to 40-footers are almost exclusively for protected areas. In fact, some warranties do not hold for offshore running.

It's in wide open waters that the regular cruisers have the advantage. Their sturdy hulls with high freeboard make them sure and dry in blue-water cruising.

Though cruiser design is great for heavy weather in open water, there are space limitations that don't trouble houseboats. Houseboats give you wide, straight-back space below, plus minimum draft. This means plenty of room for the family and the advantage of shallow-water boating. Depending on

size, houseboats need only a foot or so of water.

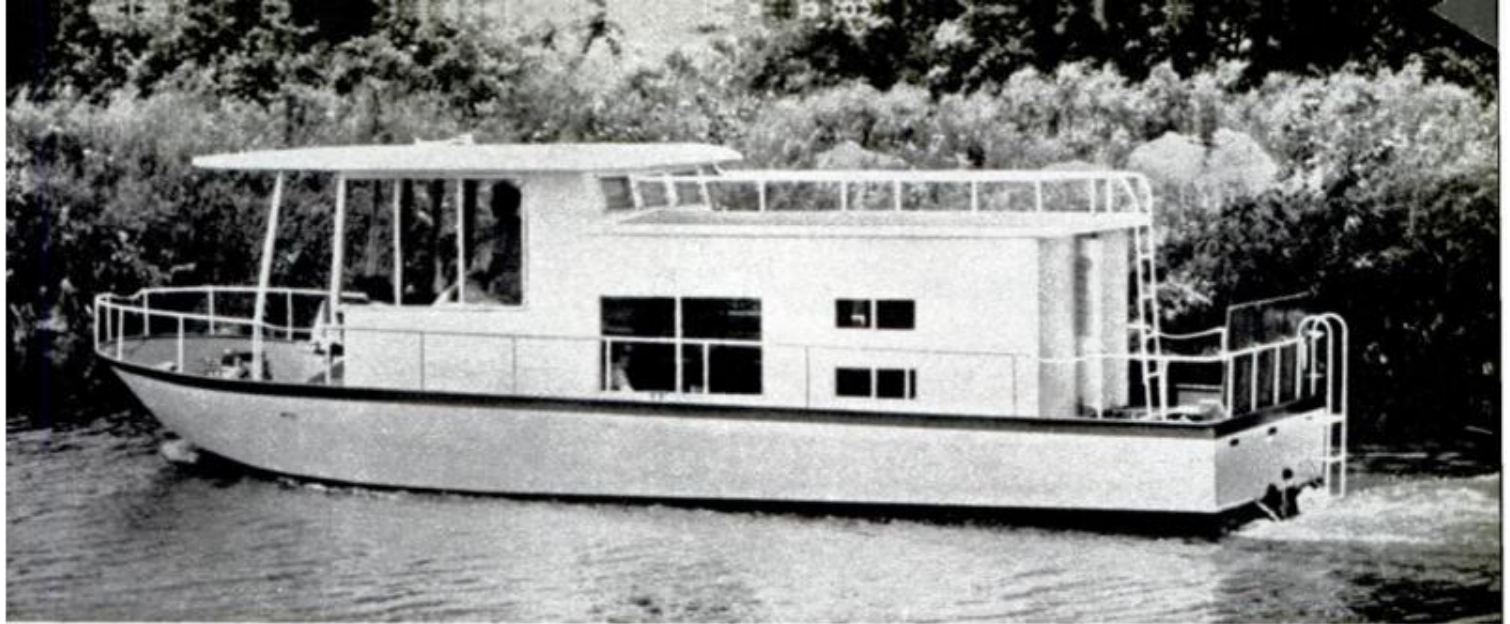
This shallow draft capability results from hull design. The typical hull has a V-entry at the bow that rounds out to a flat stern. This design is good for planing and relatively high speeds—up to 35 mph. However, catamaran hulls are available. Though they are more stable, you may find less interior space.

Hull design also governs wetness. Some high-bow houseboats are dryer than those with decks flush with rub rails. Again, your decision depends on your particular boating area. Rivers and smaller lakes don't kick up as much as ocean waters or the Great Lakes. Remember—smooth water, little wetness; rough water, much wetness.

Hull material is the next important decision. You can get hulls in steel,

KENNER'S 47-foot Suwanee is a good combination of traditional cruiser bow design with houseboat space





aluminum and fiberglass. Your choice depends on both where you plan to cruise and size of boat. Most popular for inland cruising is fiberglass. For offshore running, aluminum or steel provides that extra sturdiness needed for the open sea. However, many fiberglass models are popular with the salt-water set.

Married to your hull is the power supply. When talking power, there are two factors to consider—size of houseboat and your finances. Your choice of power systems is varied. Some smaller houseboats use one outboard motor; little bigger boats use two. In the 30 to 40-foot class you can get single or twin inboard-outboards (stern drives) from 120 hp to 210 hp and up. On larger boats, regular inboards prevail.

Most power sources are gas operated, though diesel is available. Diesel

PLANING HULLS, like that of this 32-foot Nauta-Line, free houseboats for pleasure cruising and pulling skiers



is by far the safest and most economical in the long run. But it is the most expensive at the point of initial purchase.

And talking about prices, be wary of the advertised price of houseboats—of all new boats for that matter.

When a houseboat is quoted at \$7000 or \$9000—that's not the total price you'll pay.

Though the standard equipment on houseboats is ample, there are items you'll want that cost extra.

Among standard items, you'll get hull, power, interior decoration, toilet, icebox, propane stove, 110-volt hook-up.

But you might want a shower, water heater, airconditioner/heater, holding tank for head, compass, extra fuel tank, automatic bilge pump, batteries, pressure water system, electric refrigerator, electric range, drapes, fume detector. For these extras, plus charges for shipping your boat from factory to marina, add \$3000 to \$4000.

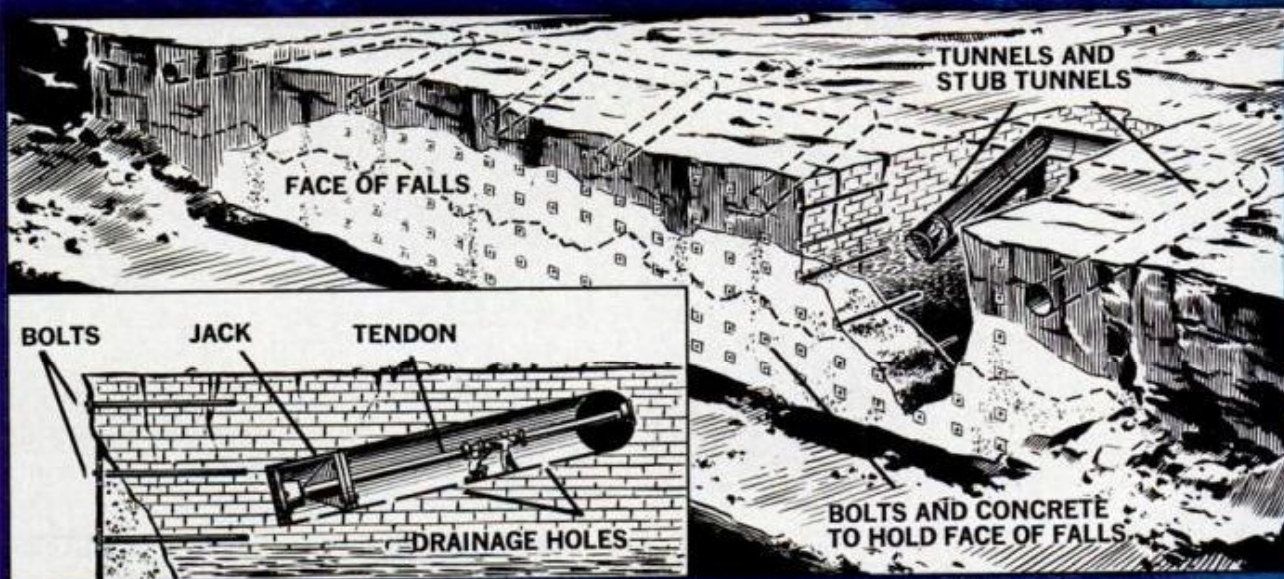
For a good 33 or 34-foot houseboat—nicely equipped—you can figure on \$13,000 to \$14,000. But that's less than half the cost of a cruiser the same size equipped the same way.

Though you shell out extra bucks for some first class accessories, you'll really please the females in your family.

One of the toughest jobs in a

(Please turn to page 182)

HOW ENGINEERS WILL



SAVE NIAGARA FALLS



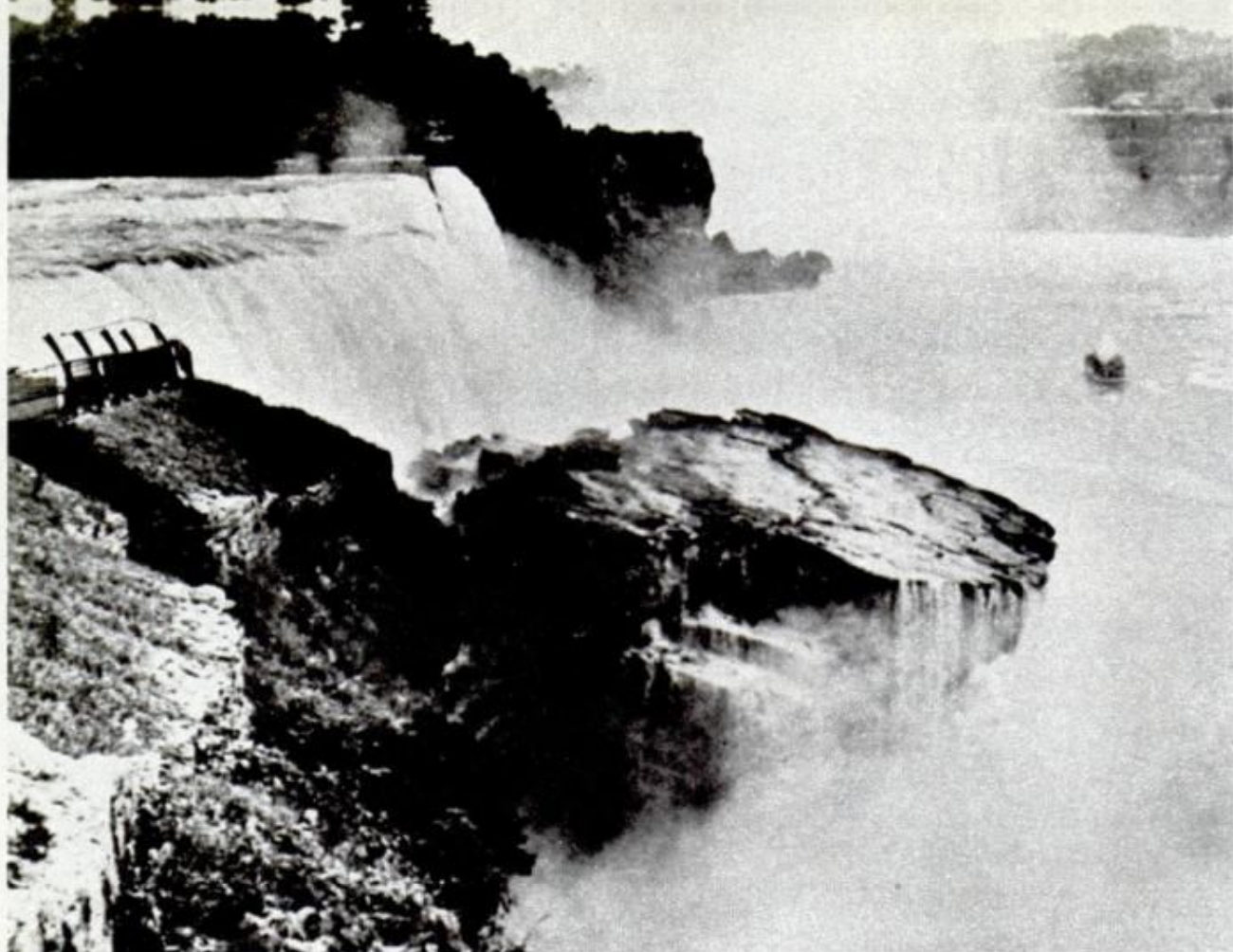
Huge cave-ins threaten America's most famous scenic attraction. Now there's a bold plan to stop the ravages of a mighty river

By **ROBERT G. DYMENT**

YOU HEAR A LOT about man ruining Nature's wonders. For once it will be the other way around. Man is about to save Niagara Falls from Nature. The Falls, one of the scenic wonders of the world and a favorite of tourists and honeymooners for generations, is in trouble.

Tons of rocks, breaking from the crest of the American Falls, have accumulated at its base. As they piled up in unsightly heaps they reduced the height of the water drop and now threaten to turn the Falls into a rapids. Soon, however, the unsightly debris may be cleared away and the erosion halted permanently. In a joint project that includes the U.S. and Canadian governments as well as local groups, engineers have already

Art concept created specially for Popular Mechanics



MOST SPECTACULAR rock fall occurred July 28, 1954, when 185,000 tons of rock broke loose from crest and plunged to foot of Falls. Each such fall gave crest jagged, saw-toothed appearance, piled up debris at base

taken the first steps to restore the giant cataract. Preliminary drilling operations have been completed and partial dewatering (for seven hours) was accomplished, both for geological studies.

Next year, from June through November, if agreed to by the United States and Canada, the American Falls will be shut off completely for final studies to determine exactly what can be done.

The problem is this. At the American Falls, water flows over a resistant cap rock (Lockport Dolomite) about 80 feet thick. Beneath it is a softer shale formation (Rochester Shale) about 61 feet thick. The falling water and wind-driven spray erode by abrasion and cavitation, and by alternate freezing and thawing, the softer, less-durable Rochester Shale, gradually removing it and undermining the stronger Lockport Dolomite above it.

Fractures, or partings of the rock, in the Lockport cap-rock layer begin to open up as tension in the overhanging

blocks increases. Water flows along the joints, building up hydrostatic pressure. Finally, the cap rock collapses, giving the lip of the Falls an unsightly sawtooth pattern in plain view.

To compound the problem, the flow of water over the American Falls is relatively smaller than it is over the more-famous Canadian Horseshoe Falls. As a result, the American flow is not enough to cut through the rock strata at its base, so the fallen rock accumulates in another unsightly formation known as a talus. Further, as the talus grows, it protects the shale beneath it and any recession there is retarded.

On the Canadian side, however, the much-greater flow cuts through the lower strata and scours out a basin at the base of the Falls. As the fallen blocks and fragments are worn down in the turbulent water in this basin, no significant talus accumulates and the rate of recession is greater.

So the problem is peculiar to the American Falls alone, and the solution,

by current thinking, may take one of two forms, or perhaps a combination of both. The rock can be stabilized from the inside or from the outside.

The preliminary explorations indicate that both the dolomite and shale are in relatively good condition and that the preservation of the American Falls is feasible from geological and engineering viewpoints. More detailed studies will be made if the Falls are dewatered. This operation will involve constructing a cofferdam, probably from the head of Goat Island extending eastward to the mainland. Water which normally flows over the American Falls would be diverted over the Horseshoe Falls.

Then, in the dry channel, engineers will make subsurface explorations in areas previously unreachable, both on the riverbed and in the face of the Falls.

Among other things, the engineers will try to determine the condition of the rock strata and the nature and extent of seepage through the strata and the talus accumulation.

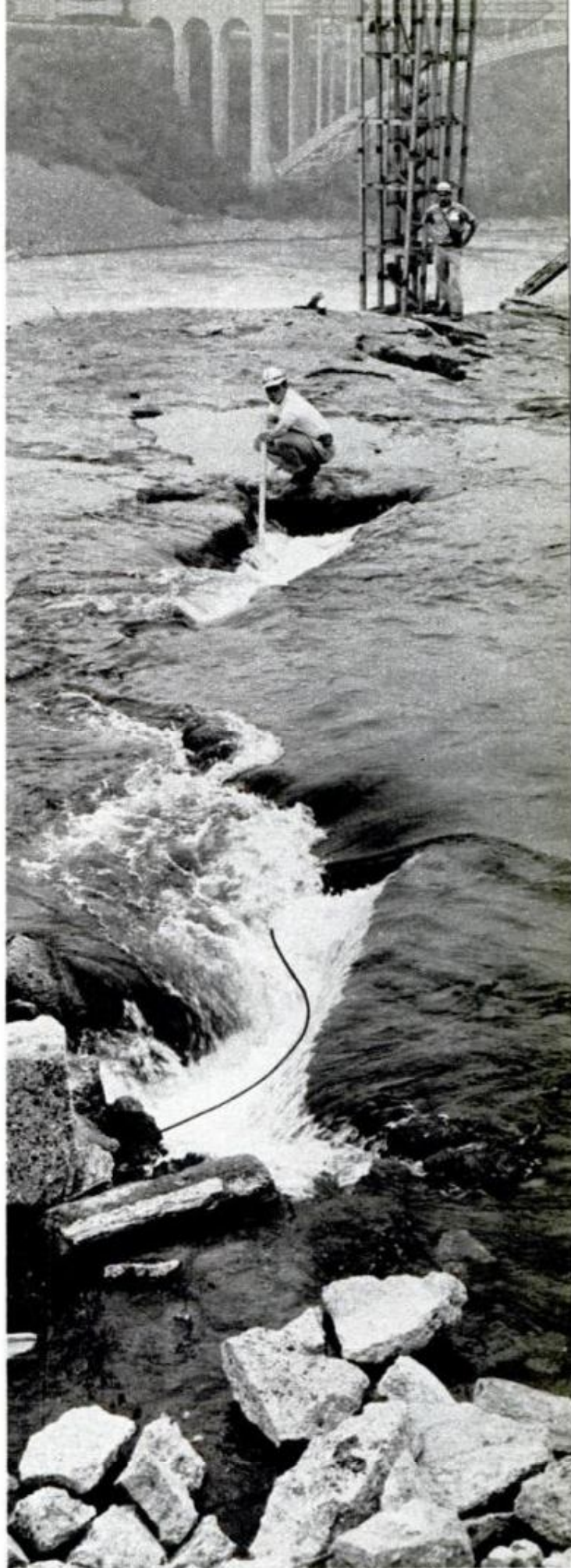
The evaluation of this data will help decide what action is taken. The goal, of course, is to restore the scenic beauty of an unbroken waterfall, so the solution will include cleaning up the debris and preventing any more from accumulating.

The removal of the rock, while no great engineering feat, would be expensive because of the quantity of the rock involved and its inaccessible nature. There are no roads to the base of the Falls, and to build some would damage their scenic beauty. Moreover, the removal trucks would have to be routed, discreetly, through a park. A vertical-lift device seems necessary.

Even so, this is the simpler task. The more difficult engineering feat will be shoring up the rock strata to prevent further erosion, and it probably will be done in one, or both, of these two ways. (See diagram on page 94).

The face of the Falls will be covered,

(Please turn to page 184)

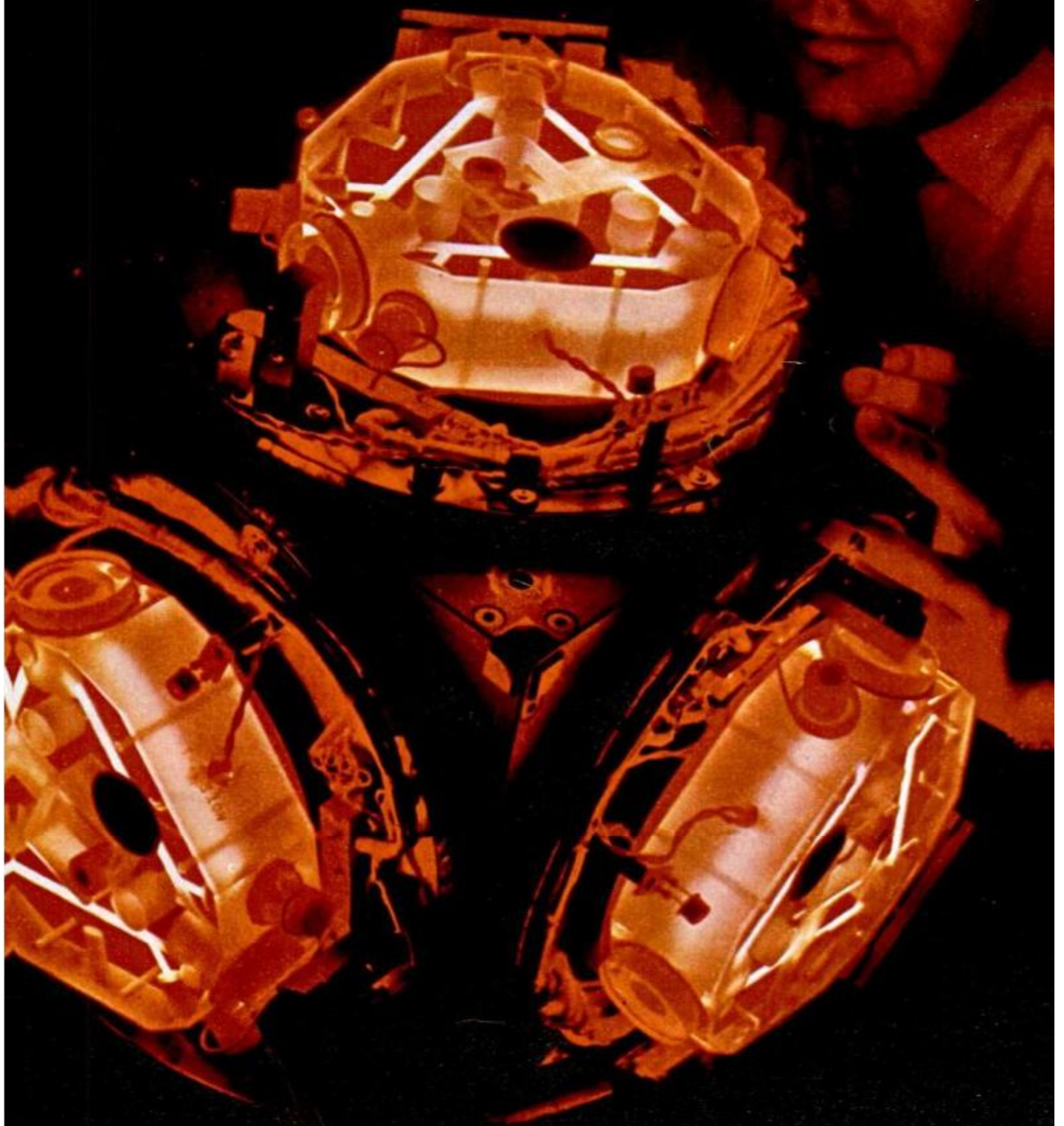


PARTIAL SHUTDOWN of channel leading to American Falls several years ago gave engineers chance to examine fractures in cap rock and plot future action

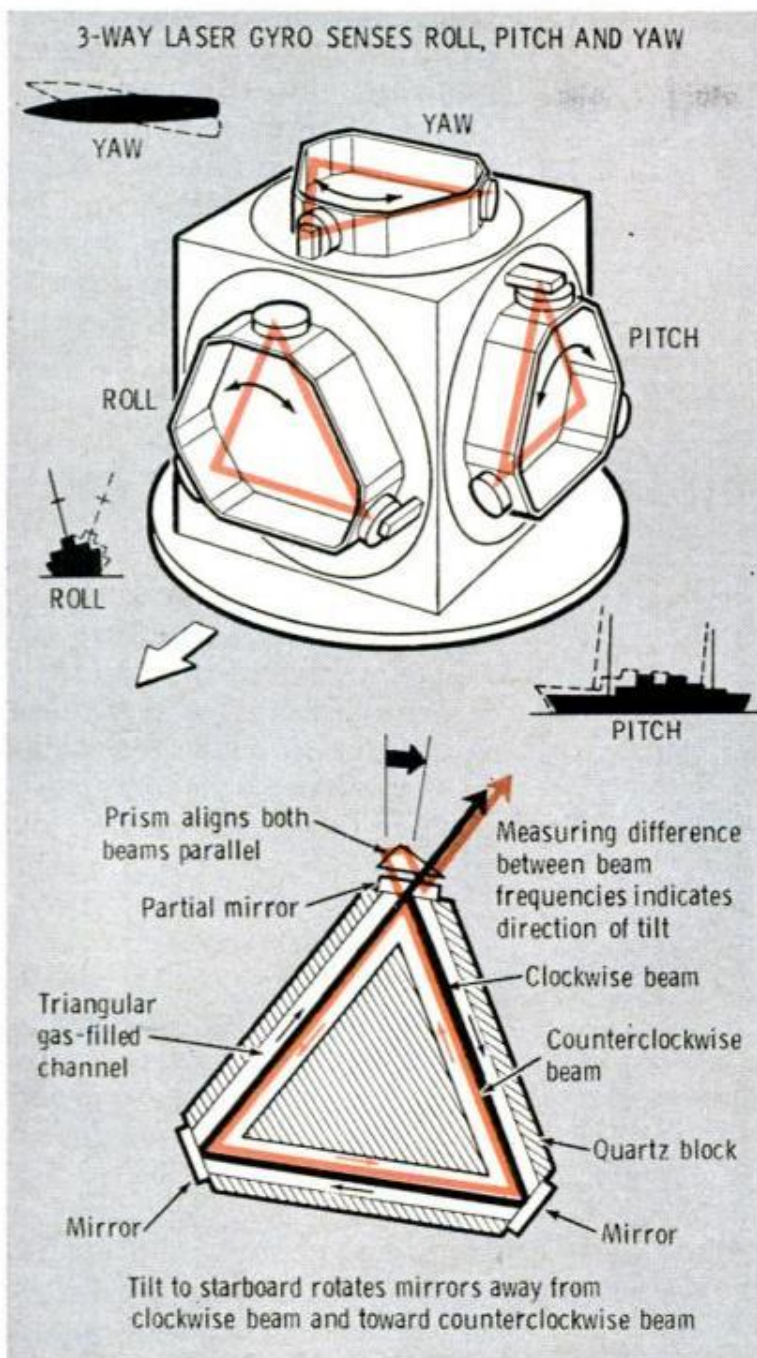
SCIENCE

Look What They're Doing With Lasers Now

By ARTHUR S. FREESE



**They used to be called "a solution in search of a problem."
Now these fascinating beams of light are doing everything from performing delicate surgery to carrying messages through outer space**



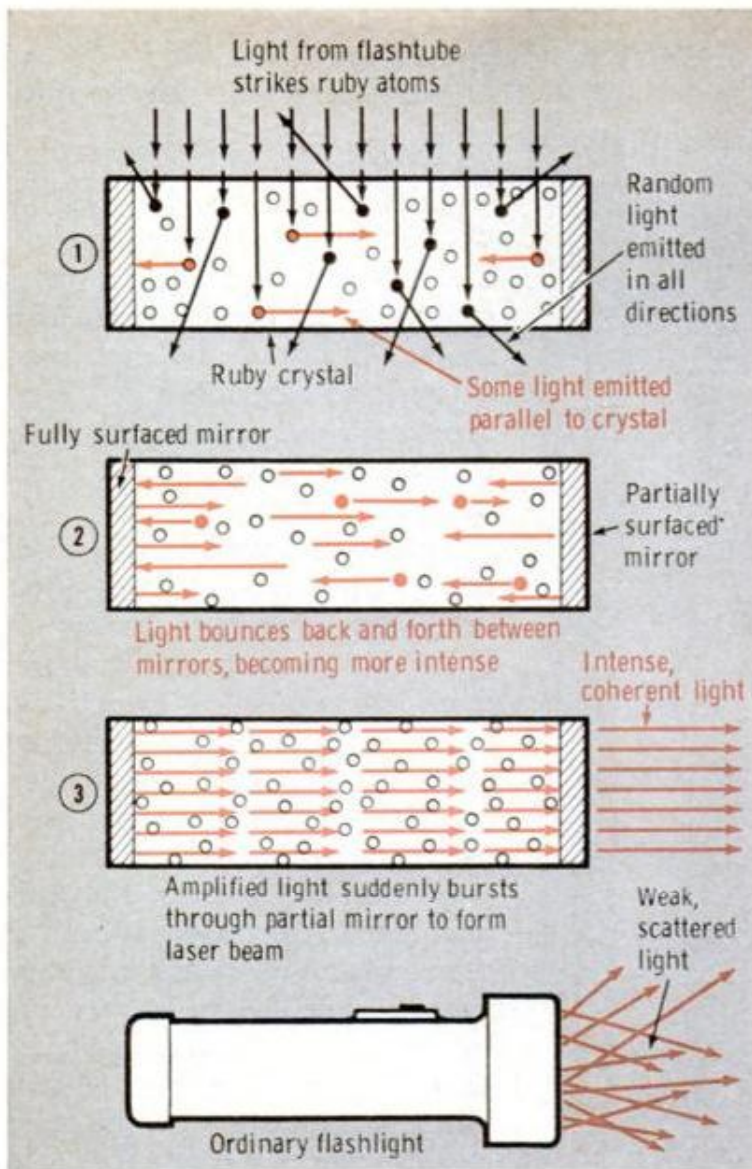
GLOWING WEIRDLY IN THE DARK, the ingenious laser gyroscope at left is readied for a Navy warship. Each of the three luminous quartz blocks contains two laser beams whirling around a triangular path in opposite directions. The frequencies at which the beams oscillate are determined by the length of the path they travel. As long as the ship is stationary, the beams travel the same length path and oscillate at the same frequency. When the ship tips, it rotates the block slightly toward one beam and away from the other, as shown above. This, in effect, shortens the path for the beam coming toward the rotation because the block is moving to meet it. At the same time, it lengthens the path for the beam moving away from the rotation. The beams thus oscillate at different frequencies. Measuring this difference indicates the direction and degree of tilt. Each block senses motion in a different plane—one for roll (side-to-side tilt), one for pitch (lengthwise rocking) and one flat on its side for yaw (veering off course)

THEY BLAST HOLES in rock, beam messages to the moon and tell pilots when to drop their bombs. Soon they may drill cavities in teeth, cure dread diseases, serve as "eyes" for the blind and bring back television pictures from interplanetary space.

These remarkable Jacks-of-many-jobs are lasers—those brilliant, piercing beams of light that concentrate tremendous energy in a pencil-thin point. When the first successful laser was created eight years ago, it was a laboratory curiosity. Scientists joked that it was "a solution in search of a problem" because it didn't seem to have many practical uses. Today, lasers have found hundreds of ingenious applications in industry, medicine, military technology and space exploration.

At Massachusetts Institute of Technology, engineers are experimenting with a rock-pulverizing laser to bore underground tunnels for highways and railroads. Fantastic? That's only the beginning. At Stanford University, scientists recently made a picture of a man smoking a pipe eight miles away at night, using a laser beam to produce a holographic image. Holograms are three-dimensional images created by the interference patterns of reflected laser light (see *Holography: 3-D Magic in Mid-Air*, page 104, March '68 PM). The Stanford researchers hope to use this technique to view high-soaring satellites orbiting the earth 100 miles or more away.

If this isn't exotic enough,



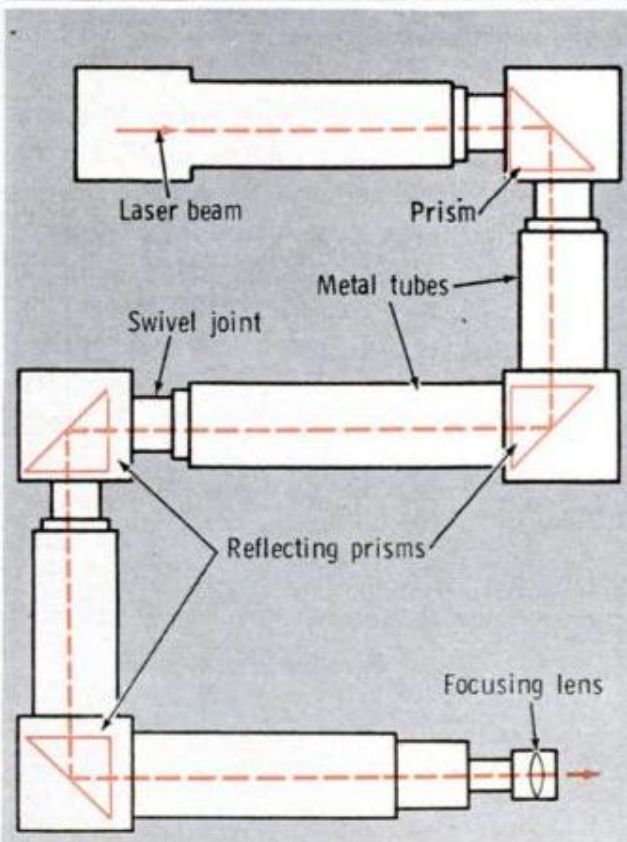
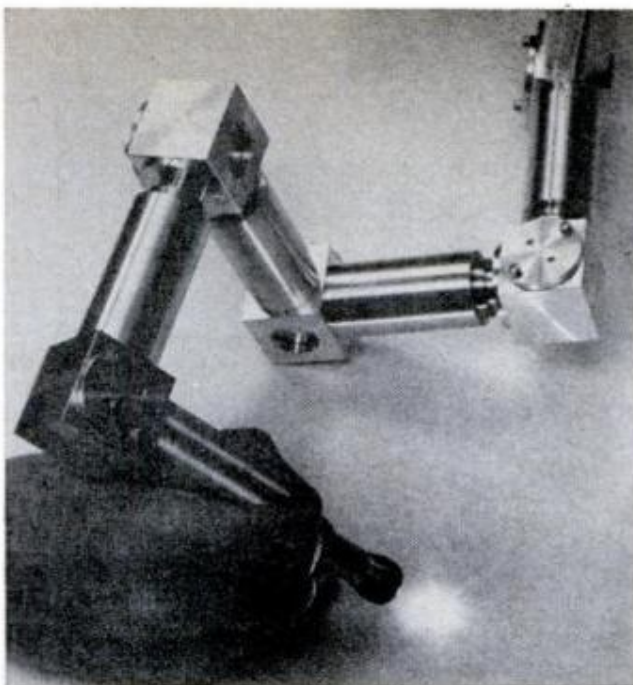
HOW A LASER WORKS: In the common ruby laser, the crystal is fitted with a mirror at each end and bombarded with bright light from a flashtube. As the light strikes the ruby atoms, the atoms absorb energy, become "excited" and, in turn, emit their own light in all directions. Some of this light happens to be parallel to the sides of the crystal and is reflected between the mirrors at the ends. As it bounces back and forth, it strikes other excited atoms, causing them to release their excess energy in the same direction. As more and more atoms are struck and release their energy, the bouncing light builds up tremendous intensity. One of the end mirrors is only partially surfaced, permitting light to pass through it when it is strong enough. Suddenly, the rapidly multiplying light energy bursts through this partial mirror in a quick, brilliant flash—a laser beam. This beam, though brief, is many times more powerful than ordinary light, and its rays are concentrated in a straight line with little spread. All of the light is of the same color or wavelength because excited atoms release only energy of the same wavelength as that of the energy they originally absorbed. By contrast, light from a flashlight is a mixture of all wavelengths scattered in all directions. Gas lasers work like crystal lasers except that the gas atoms are excited by electricity instead of light. This causes the gas to glow something like a neon sign. While the light is not as powerful, it produces a continuous beam instead of merely a short flash. The newest lasers to come along, called semiconductor or injection type, make use of a semiconductor material, triggered by electricity, as the light-amplifying medium

consider the strange-looking contraption shown on page 98. It's a laser gyroscope. Three pairs of contrarotating laser beams whirling around inside quartz blocks sense roll, pitch and yaw—the first gyro to detect all three motions simultaneously. The slightest movement causes a shift in the frequency of the beams, indicating both direction and rate of tilt. Developed by Honeywell, the new gyro will soon be tested by the Navy on warships. NASA is also at work on a laser guidance system for spacecraft.

Your telephone was one of the first to benefit from the use of commercial lasers. Recently, Western Electric brought in lasers to drill holes in 4000 diamonds. The diamonds, arranged in rows with progressively smaller holes, are used as dies to draw copper rod into fine wire. The rod is run through these dies at speeds of up to 10,000 feet a minute to produce 160 billion feet of wire a year. The laser beam pierces a diamond in two minutes, a process that used to take three days by older drilling methods.

In 1962, a laser beam one foot in diameter was shot to the moon. After traveling 240,000 miles, it lit an area on the moon's surface only two miles in diameter. By contrast, a radar beam would have spread to 200 miles, and a conventional searchlight, if it could reach the moon at all, would cover some 25,000 miles.

Making use of this pinpoint accuracy, Hughes Aircraft Co. has developed a laser bomb-sight whose beam is so narrow that from 100 feet it lights up a spot only one inch in diameter. More sensitive than radar, the

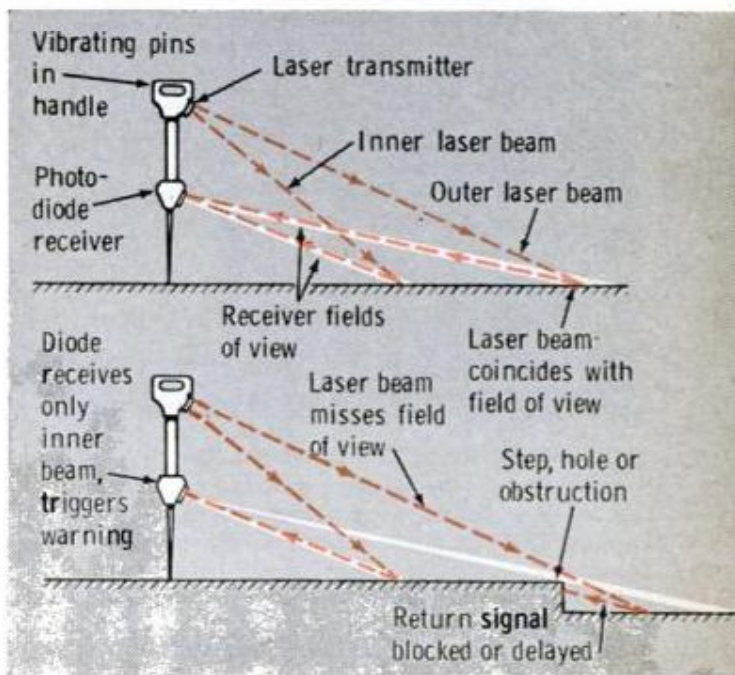
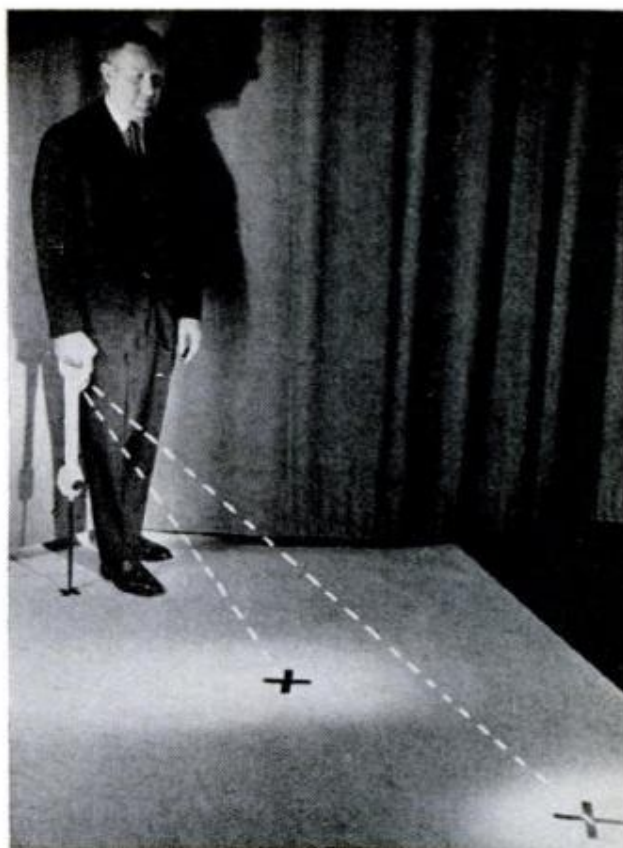


LOOKING LIKE A DENTIST'S DRILL, this swivel-jointed laser "knife" is used in surgery as if it were a scalpel. Beam is bent around corners by prisms so the arm can be moved in any direction. At the tip, it's focused to a needle-sharp point for cutting tissue (beam shown unfocused in photo above)

beam is bounced off a target, and the time it takes its reflected waves to return indicates the distance away.

Combined with a ballistics computer, the Hughes bombsight tells a pilot exactly when to start his run, when to let his bombs go and when to pull up. It

JULY 1968



"SEEING-EYE" CANE spots obstructions for the blind. It sends out two laser beams three and six feet ahead. If beams bounce back unhindered, pins in the handle vibrate, indicating that path ahead is clear. If one or both beams are interrupted by an obstacle, the pins stop vibrating as a warning

also regulates the aiming and firing of the aircraft's machine guns and rockets. Lockheed's awesome AH-56 fighter helicopter, being readied for action in Vietnam, is equipped with a similar laser rangefinder system.

Air pollution, too, may yield to the

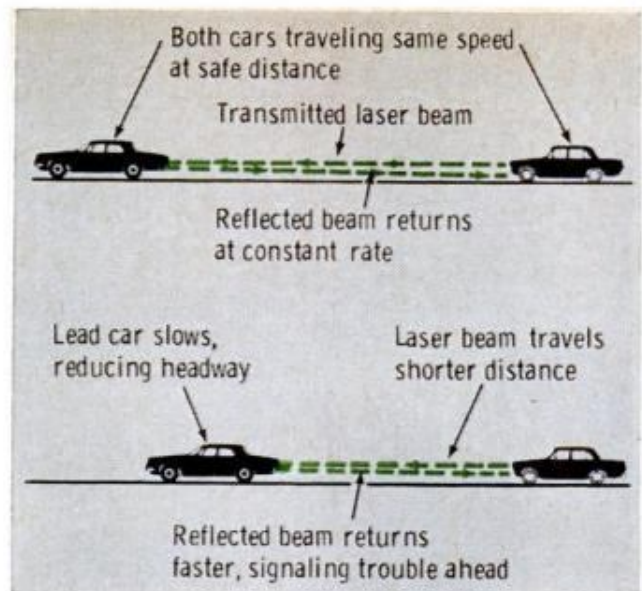
101



MAGNIFIED HUNDREDS OF TIMES, the circle you see at the top of the page is actually a hair-size hole drilled in a diamond by a laser beam. The diamond die is used to draw rod into fine wire. In lower photo, a continuous-wave argon laser is split into different wavelengths by use of a grating and prisms.

magic of light. A fan-shaped laser beam shot into the sky can light up clouds of tracer materials, making it possible to measure wind speed, turbulence and inversion—important keys to what causes our deadly smogs.

One of the latests tricks lasers have pulled off is to balance a gyro rotor while still in motion. Conventionally, the rotor is stopped, one or more holes are drilled to even the weight, then it is restarted. Since this may have to be done many times, there is a severe load on the bearings during the process.



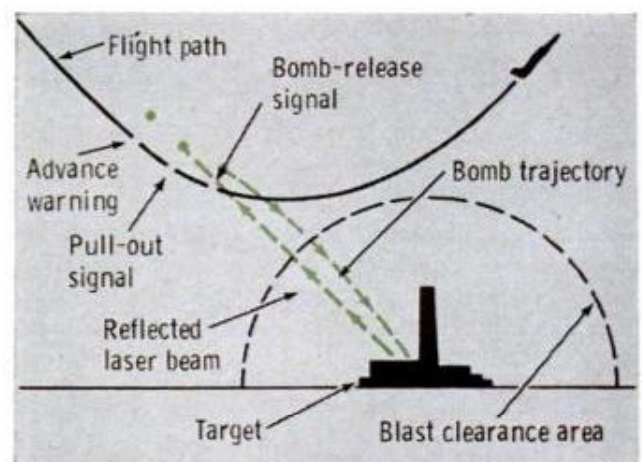
LIKE AN INVISIBLE HEADLIGHT, a laser sweeps the road ahead in new collision-warning system by RCA. A change in the beam's return rate signals trouble, might even apply the brakes automatically

Now, however, while the rotor is spinning merrily along at some 30,000 rpm, the heavy spot is located and when it comes alongside the laser . . . Wham! The beam knocks off the excess material with no need to stop the rotor.

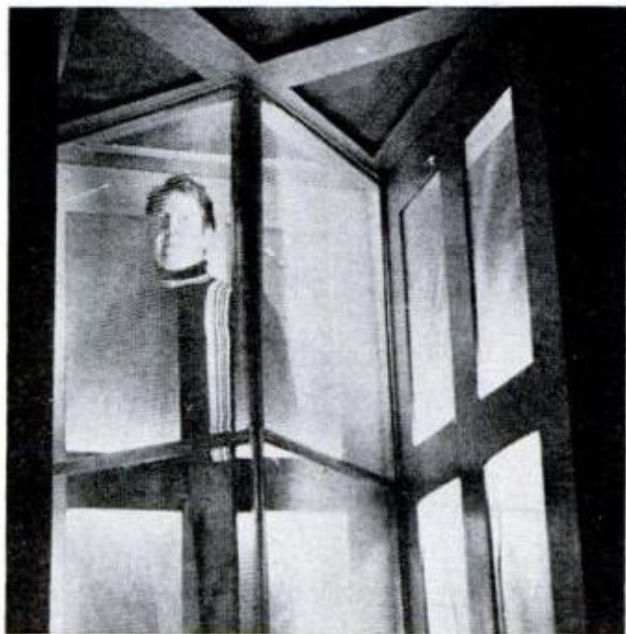
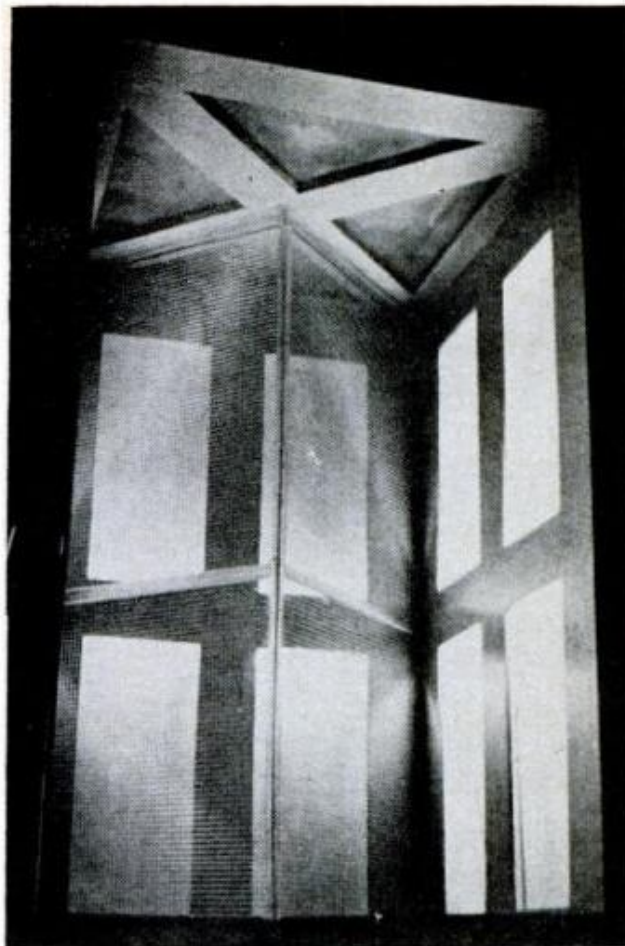
Lasers' intense heat welds together incompatible metals that cannot be joined any other way. The U.S. Bureau of Mines reports that lasers have vaporized coal into gaseous chemicals and may reduce the cost of producing such chemicals industrially.

Fast long-distance communication is

(Please turn to page 186)



LASER BOMBSIGHT developed by Hughes pinpoints a target more accurately than radar, tells a pilot when to let bombs go. In this drive-toss approach, the pilot actually starts his pullout before releasing bombs. This "tosses" the bombs ahead, giving the plane time to get safely away from the blast area



Going . . . going . . . gone

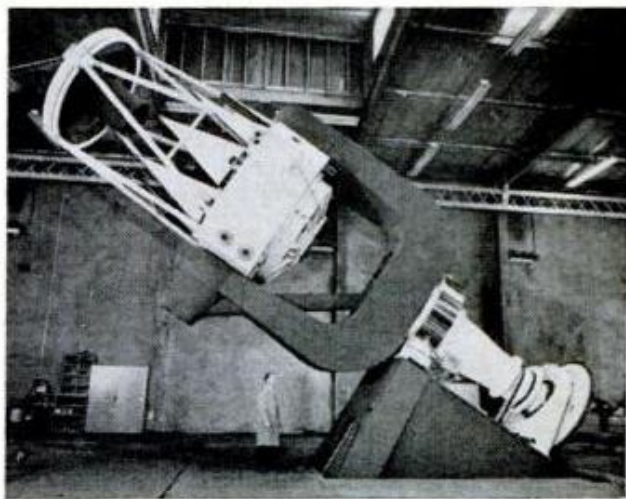
He disappears before your eyes—and it's all a matter of manipulating lights, say the developers of this European variety-show act. Shown at upper left is Comedian Danny Ross, who steps inside a wire mesh enclosure. He begins to disappear (left), then totally vanishes (above) during the stunt.



Navy has hydrofoil gunboat

Boeing's hydrofoil gunboat *Tucumcari* has been delivered to the Navy. It cruises at more than 40 knots, using a water-jet propulsion system. Water, drawn through the rear struts, jets out the stern.

JULY 1968



New eye for Kitt Peak

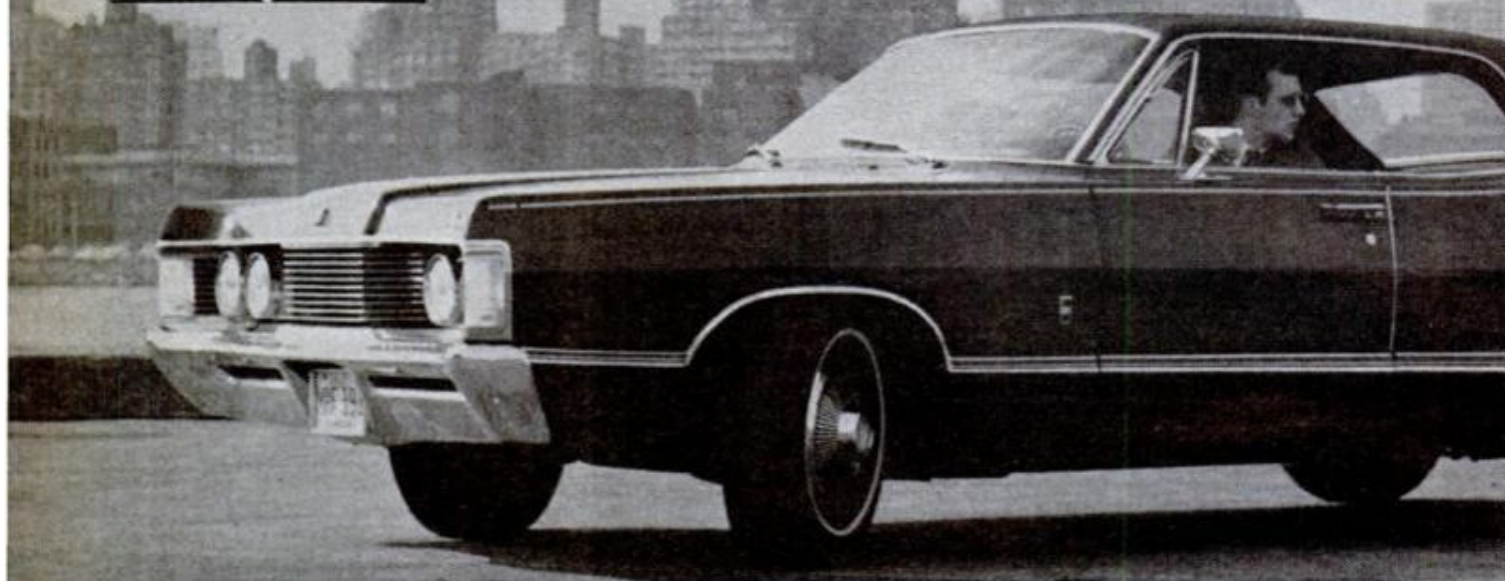
Soon to be installed in the University of Arizona observatory on Kitt Peak is this 100-ton telescope with a 90-inch aperture. Fourth largest in the United States, it was built by Boller & Chivens Div. of Perkin-Elmer.

103



MERCURY MONTEREY

A Nationwide Survey Based on
1,250,000 Owner-Driven Miles



It Rides Like a Dream—Once You Find the Ignition Switch!

Owners of Mercury Montereys praise handling, ride, style and comfort, but apply a critical eye to workmanship and fuel mileage, and cast a real fine eye to design and layout of dashboard controls and switches

By **BILL HARTFORD**, Associate Auto Editor

Photos by Irving Dolin

THE REAR WINDOW FELL OUT of our station wagon. It landed on the grass; luckily, it didn't break. Needless to say, the salesman was embarrassed."—Massachusetts housewife.

"Car has left me stranded twice since I got it."—Ohio supervisor.

"Light switch on dash panel had to be replaced. After driving two or three hours the headlights would go out."—New Mexico personnel director.

"At 76 miles the dealer replaced rods and main bearings. Noise started again at 300 miles. Got new engine at 800 miles. Five-week wait for repair."—West Virginia heavy equipment operator.

You name it. It's happened to a Monterey owner. But, on the other hand,

think of the best things you could want in a car. Chances are there's a Monterey owner who's got them:

"A good heavy car, not a gingerbread or strawberry box type"—Wisconsin real estate promoter.

"Smooth as silk, solid, strong, super quiet. The 'Big M' is superior in ride, room and comfort."—New Jersey hand liner of fine China.

"I haven't a single complaint."—California teacher.

"I'll never have any complaints if Mercury keeps building the quality car they've put out this year."—Minnesota railroad engineer.

"Ford has a better idea: Mercury!"—Pennsylvania finance corporation director.



MONTEREY HANDLES AND RIDES easily and smoothly, say owners, all of whom have power-steering option

That's the way it is. There are as many praises and complaints as there are owners. But some things that owners boast and complain about show up often and consistently enough to pigeon-hole the Monterey for its faults and for its outstanding qualities.

For one thing, there's nary an owner who feels pigeonholed for room. Comfort and size are tops with owners who have been sticking with Mercury for many years, for owners who have moved up, and even for those who've told us they're glad they chose Mercury over more expensive luxury cars.

Handling and ride, too, are great attributes of the car. The Monterey is a turnpike cruiser and it's on the turnpikes where owners find the car a joy to drive.

A Michigan metalsmith likes the way it handles with his house trailer, and finds the design of the rear chassis is perfect for easy installation of his hitch. "Wonderful ride, quiet, excellent handling ease," says a West Virginia photographer. He does, however, add a note of discord: "I find that when hitting a road bump or railroad crossing the rear end has a tendency to dance."

His problem may be similar to that of a California machine shop owner whose car does the "freeway hop." As he says, "the car vibrates in a dangerous fashion at speeds from 60 to 70 mph. Tires have been changed at least six times. Shock absorbers, springs, rear axle have been changed. Still vibrates. Factory representative calls the problem 'freeway hop.' Twenty years of driving California freeways and I've never heard of this problem."

► **Freeway hop? Sounds more like you're getting the mystery-problem shuffle.**

A scapegoat for many other unexplained problems, unfortunately, is anything that's on the car—and this goes for any make of car—for reasons of safety or smog control. We've heard from lots of owners who have been given the run-around from service managers who use antipollution systems as scapegoats for everything from poopy acceleration to popping after-fire. We suspect that all too often it's the catch-all reason given for repair time and bills that are longer and higher than estimated and many other customer inconveniences.

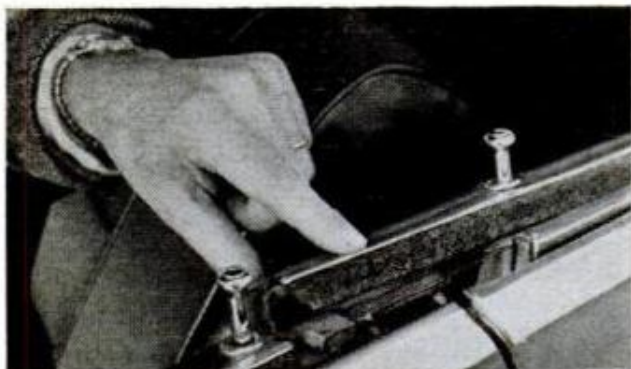
The last straw for one whose safety



LONG REACH down to vent control is annoying, but big complaint is about ignition-switch location



THUMBSTRETCHER horn ring, on all Ford cars, is consistently complained about. So is bulky crossbar



WORKMANSHIP COMPLAINTS include such things as poorly fitted panels as on this four-door hardtop



TRUNK ROOM like this can't be complained about. Only few owners have remote-control deck lid release

or smog equipment has been falsely accused would be this reply an Illinois teacher got from his dealer in response to his complaint of a rattly steering column: "The dealer said that it's 'normal' because of the energy-absorbing steering column!"

► **C'mon, let's cut it out, guys.**

If there's one thing Monterey owners would like a hand in, it's redesigning certain parts of their car—the dashboard most specifically. It seems too fantastic to believe that the team that engineered the incredible meshing of hardware called the Monterey placed the ignition switch where one-quarter of all owners would have trouble finding and using it, but it's true.

No, it's not in the glove box or under the seat, but its location close to the steering column, under the lip of the main instrument cluster, makes it hard to see, find and use.

Incidentally, the second and third lower tiers, moving toward the firewall, are where owners with very long arms can reach such things as the cigaret lighter and vent controls, which also received their share of complaints.

Of the ignition switch and other controls owners railed that they're "hard to get to," and "in the most ridiculous places." A telephone company man in Minnesota suggests, "Put the lighter and ashtray where you don't have to be a contortionist to use them. It's hard to find the ignition switch in the dark, too." And a Nebraskan's "only real complaint" is the "positioning of ashtray, lighter and ignition."

► **The ashtray is in the top tier to the right of the ignition switch.**

A Pennsylvania secretary observes, "The warning light for the emergency brake should be located on the same side as the brake. But they've located it on the right-hand side near the center of the car and it doesn't attract attention when it should."

There is, however, one design feature of the Monterey that is especially well-liked. It's the Breezeway rear window on sedan models. It retracts, giving the

effect of a convertible top with its rear window zipped down.

The Breezeway, standard on Park Lane and Brougham models, is optional on Montclair and Monterey sedans. Some owners apparently are not aware that the Breezeway is still available.

"Bring back the rear Breezeway design."—New York truck driver.

"The slanted-in back window was wonderful for fresh air, no wind noise when open. Like to have it again."—Texas rancher.

"Would like the tilted-inward, full opening Breezeway I had on my '64."—New York engineer.

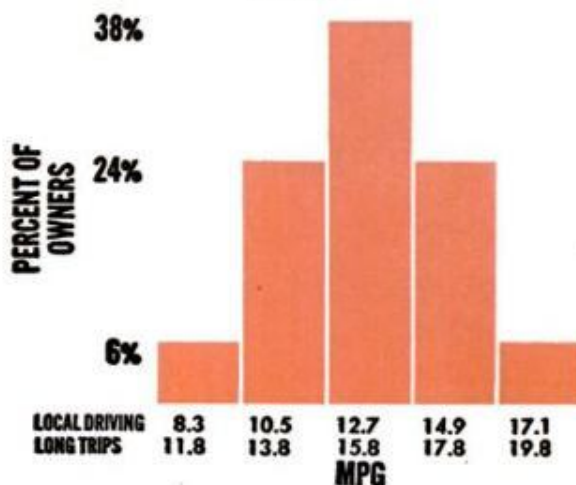
There's one owner, a Colorado teacher, who had a strange reason for buying a Monterey: "I never buy the same kind of car twice in a row." He is certainly in the minority among owners who decided on a Monterey because of good past experience with Mercury. A Maryland engineer, however, bought his because of good past experience with his dealer: "Cars are cars—I buy by the dealer, not the brand."

Still, it's the car that counts. A col-



MERCURY MONTEREY FUEL MILEAGE CHART

390 cu.-in. V8



lege dean in West Virginia finds "the body, like most Ford products, rattles," but it's his third Mercury and, typical of us car buyers who need to place our faith in one make of car and stick with it, he exclaims, "I'm a Mercury man!" ★★★

Summary of 1968 Mercury Monterey Owners Reports*

Total miles driven 1,255,441

Average miles per gallon:

390-cu.-in. V8, local driving 12.7

long trips 15.8

428-cu.-in. V8, insufficient data

Specific likes:

Handling 47.0%

Ride 44.9

Style 37.9

Comfort 31.3

Power 20.2

Economy 18.2

Quiet 12.6

Performance 8.6

Roadability 8.6

Durability 7.6

Room 7.1

Specific dislikes:

Gas mileage 17.7%

Workmanship 17.0

Ignition switch location 14.2

Two-ply tires 8.5

Wind noise 7.1

Location/size of ashtray 6.4

Rear visibility 6.4

Rattles 5.7

What changes would you like?

Ignition-switch location 23.0%

Breezeway window as in past 9.2

Ashtray location (front) 9.2

Cigaret-lighter location 9.2

Better rear visibility 5.9

Better workmanship 5.9

Gauges, not idiot lights 4.6

Bigger glove compartment. 3.9

Model:

2-door hardtop 27.9%

4-door sedan 51.1

4-door hardtop 19.2

Convertible 1.8

Engine:

390-cu.-in. V8 98.6%

428-cu.-in. V8 1.4

Transmission:

3-speed manual 0.0%

Automatic 100.0

Had any mechanical trouble?

No 57.4%

Yes 42.6

What kind of trouble?

Carburetor 15.4%

Power steering 14.3

Electrical 14.3

Ignition shift interlock 12.1

Transmission 11.0

Automatic choke 6.6

Dealer repair satisfactory?

Yes 72.1%

No 26.7

Why the Monterey?

Past experience 54.0%

Style 24.3

Price 20.8

Availability (during strike) 5.9

Size 5.9

Weight 5.9

Ride 5.4

Is the Monterey your only car?

Yes 55.1%

No 44.9

Other cars owned:

Ford 32.0%

Mercury 18.6

Chevrolet 12.4

Comet 10.3

Mustang 9.3

Plymouth 6.2

Oldsmobile 6.2

Falcon 6.2

What options/accessories?

Power steering 100.0%

Radio 100.0

Power brakes 51.6

Airconditioning 32.8

Whitewall tires 21.7

Remote side-view mirror 12.8

Disc brakes 12.8

Wheel covers 11.7

Tinted glass 10.6

Rear speaker 9.4

Clock 9.4

Vinyl top 8.3

Power rear window 2.7

Power seats 1.4

Power antenna 0.9

Age distribution of owners:

15-29 6.6%

30-49 51.0

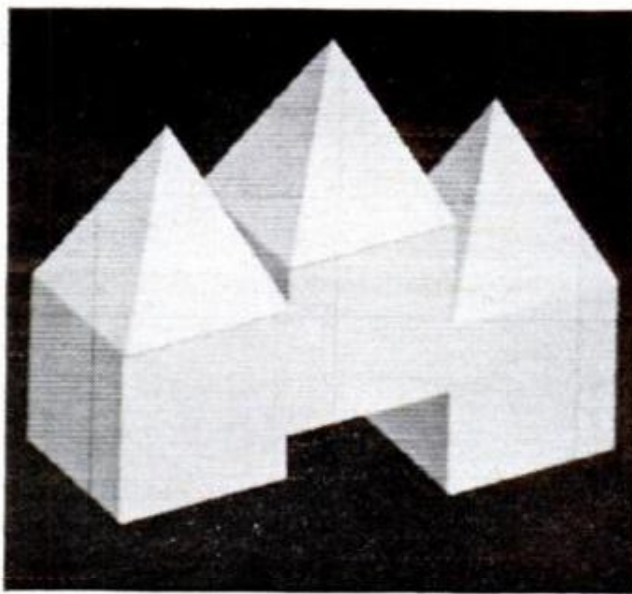
50 plus 42.4

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



Archeologists hope to round up a solid gold calf

In their search for a legendary solid-gold calf that is hidden—so the story goes—in the ruins of historic Basing House, British archeologists are resorting to such equipment as scuba gear and a "Revealer." The scuba suits were used for exploring a deep well (left) and the Revealer (center), a sort of steel divining rod, has been employed to check possible burial sites. At right are some of the articles found so far—plus a model of the gold calf the explorers hope to find. It is believed that the treasure was buried when Basing House was besieged by Oliver Cromwell, who finally burned it down.



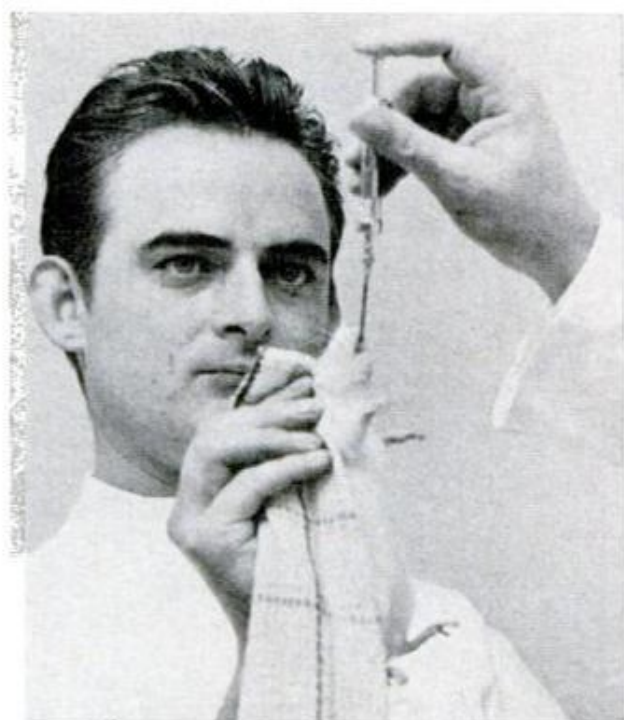
They can photograph ideas

University of Utah researchers use a specially programmed computer to create three-dimensional halftone "photographs" (right) of a man's ideas. A man at the console (photo, left) calls up and manipulates the "building blocks" on a cathode-ray tube. On command, a halftone photo of the image created can be taken by a camera on a nearby oscilloscope.



Paddlewheeler fights the weeds in British waterways

Capable of cutting through heavy weed growths at the rate of 14 to 20 miles per day, a new aquatic mower is now being produced in Britain to clear canals and rivers. The fiberglass-hulled craft is driven by paddlewheels powered by a nine-hp gasoline engine.



Drink-and-drive is okay for some rats

Two Munich doctors are using white rats to test the value of an "antidrank" compound they've developed. When the substance, Diathanolamin-Rutinat, is taken by a person who must drive a car later on, it neutralizes most of the effect of any alcohol that's consumed. Tests on the white rats show that those which are given the compound plus alcohol are able to perform significantly better at such physical feats as hanging onto a thin iron rod (right) than are the rats that get alcohol alone. In addition they don't become as sleepy.

BUILD THIS ROLL-AWAY BATHROOM

A mobile enlarger stand and folding work table give you a photo-processing setup you can store away in minutes

By RAYMOND D. JOHNSON

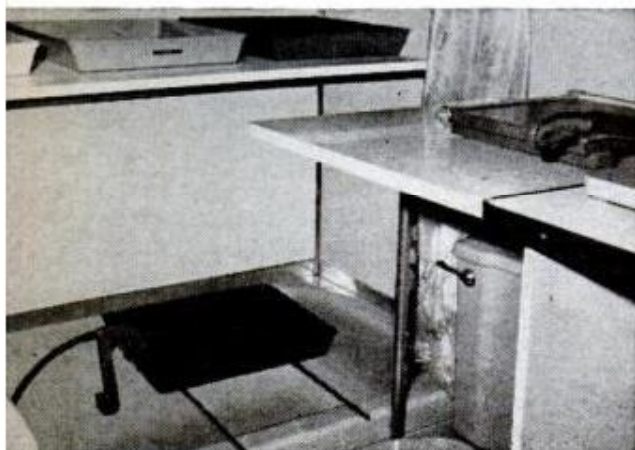


MOBILE CABINET stores enlarger, dryer, and other items in cleverly shaped compartments



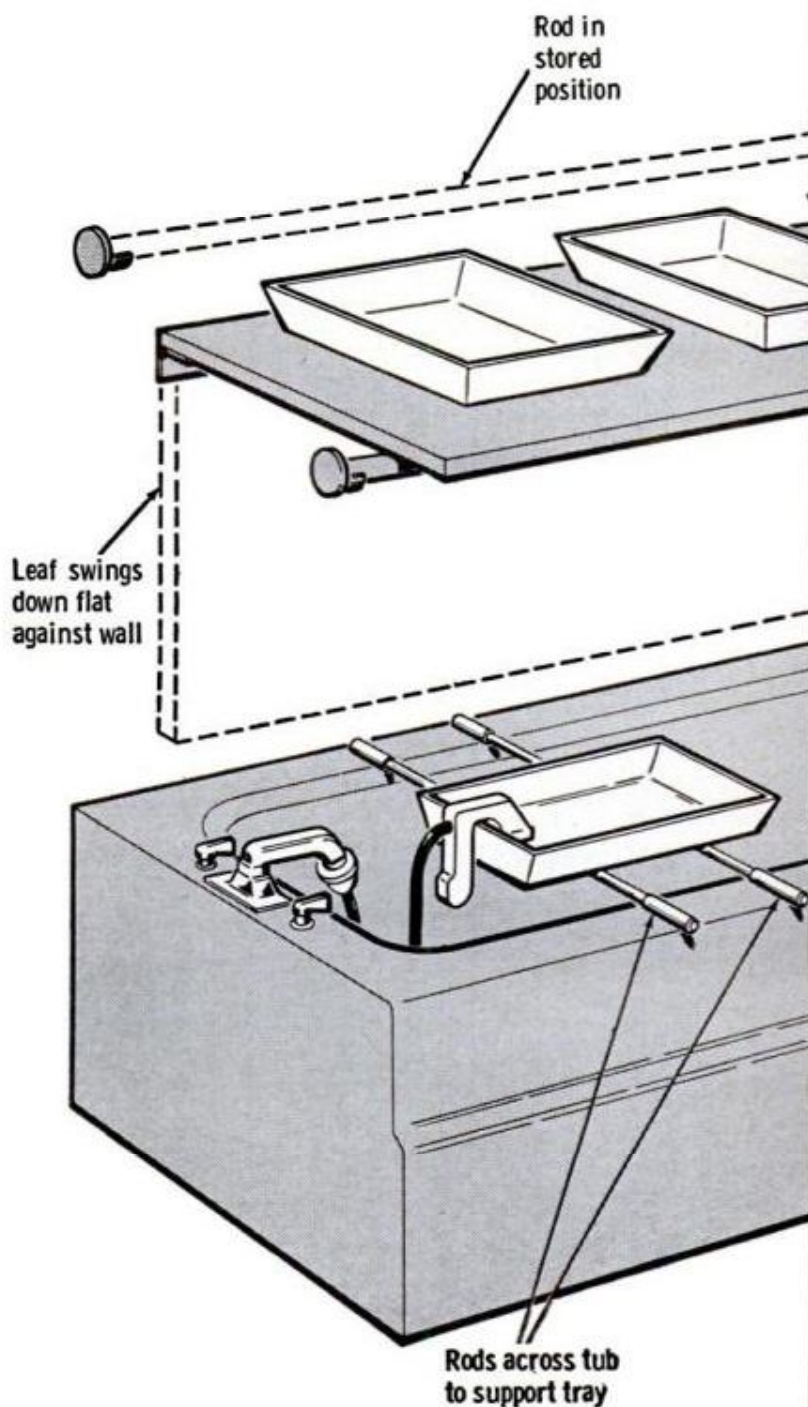
WHEN NOT IN USE, cabinet parks in kitchen where it doubles as extra counter space

SWUNG UP OVER TUB, hinged table holds processing trays with washer handy under it



THIS QUICK-CHANGE SETUP turns a 5x8 bathroom into a handy darkroom in less than five minutes. If someone wants a fast shower, you can have the whole works knocked down and stored away in the same short time.

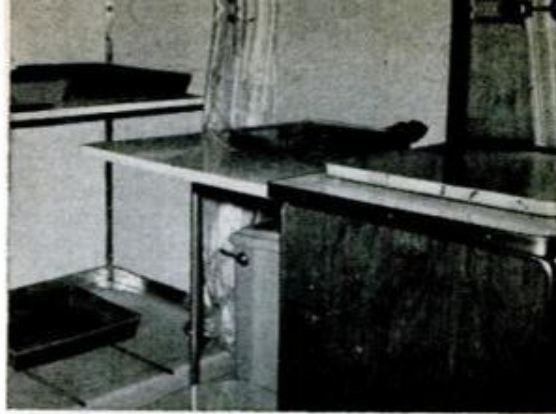
Heart of the system is a roll-around unit that houses enlarger, print dryer, processing trays, paper, paper cutter and chemicals—all in a compact, counter-height cabinet only 20 in. wide by 24 in. deep. Ball glides on the bottom make it easy to move. Rolled into the bathroom, it becomes a stand for the enlarger, and a



DARKROOM

single-legged table hooks onto the side for added work space. The cabinet can be stored in a closet or parked in the kitchen.

Completing the setup is a drop-down counter hinged to the wall above the tub. This swings up and rests on a shower-curtain rod slipped into holders on the side walls. When not in use, the rod stores in a duplicate set of holders mounted near the back wall out of the way. The counter is purposely made slightly shallower than the tub so spills run off into the tub instead of on the floor. ★★★



Hinged leaf supported on shower-curtain rod

IN THE BATHROOM, the rolling cabinet becomes an enlarger stand. A hook-on table supports a paper cutter, print dryer or other bulky equipment. Print washer rests on bars across the bathtub where its overflow runs neatly down drain



Hook-on table

Single supporting leg

Mobile supply cabinet

Now... R/C Plane Kits

An entirely new generation of radio-control equipment now makes flying a practical reality for the novice. Just combine any of the R/C rigs with one of the new kit planes and you're on the way to Dutch rolls and Cuban 8s.

By WALTER SCHRODER



You Fly in 15 Hours

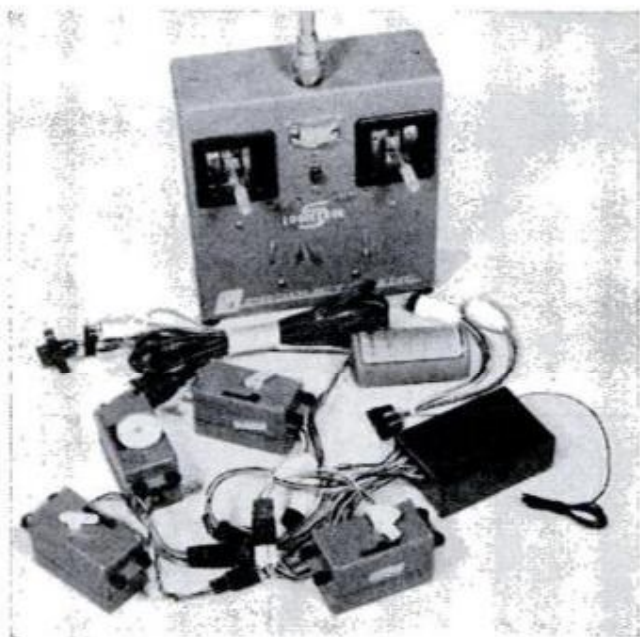
IF YOU'VE EVER SEEN one of these babies perform, there's no need to convince you that you should fly.

If you haven't, however, a Saturday afternoon spent watching the members of your local flying club will leave you yearning to try flying via radio control.

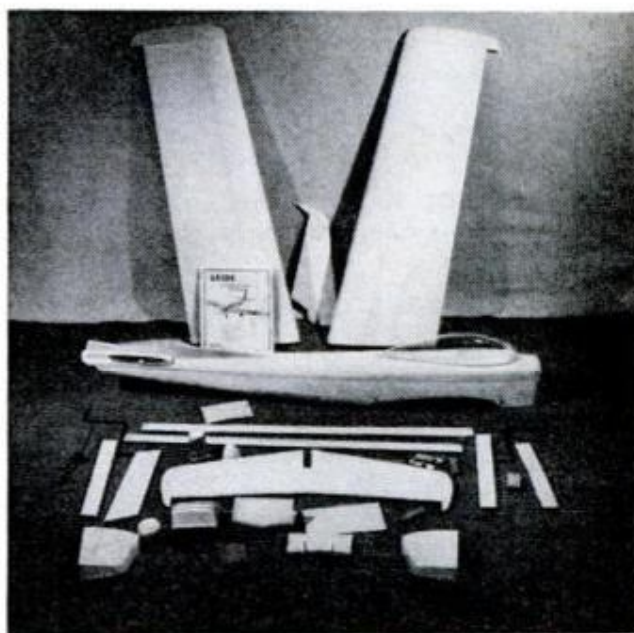
Once bitten by the bug, your problem becomes one of wading through hundreds

of possibilities. Should you scratch-build, buy a ready-made, build a kit, or purchase an older used plane from an experienced flyer? What brand of R/C equipment should you use—what engine? In short, you ask, "Exactly how do I get started?"

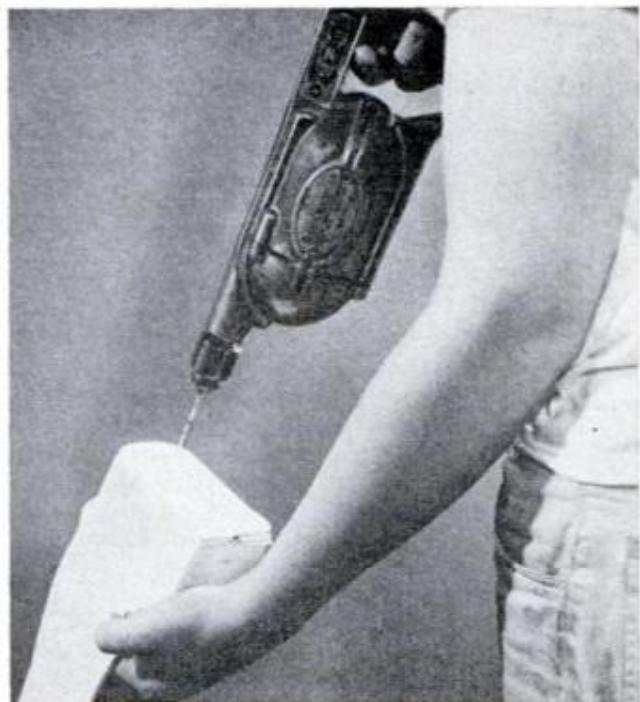
One of the best routes a novice can follow is shown on these pages. It's called the A.R.F. (Almost Ready to Fly) plane and



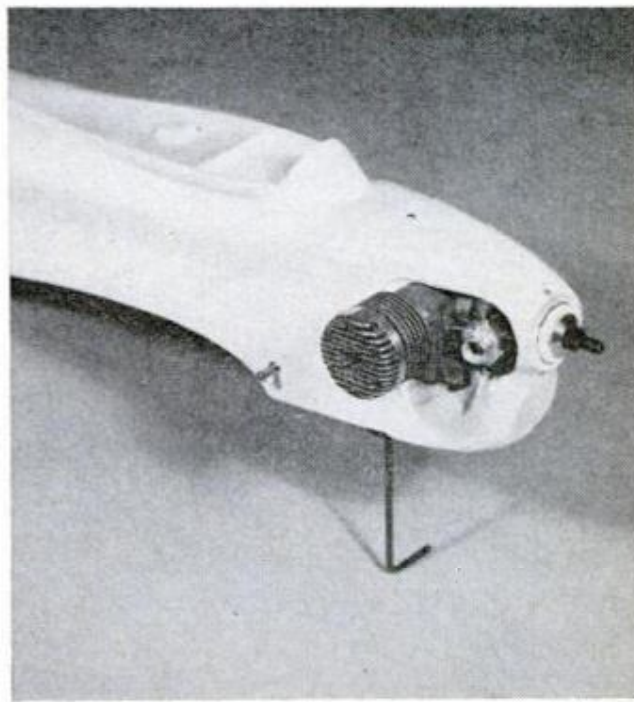
RADIO-CONTROL EQUIPMENT consists of four control servos, receiver, transmitter and batteries



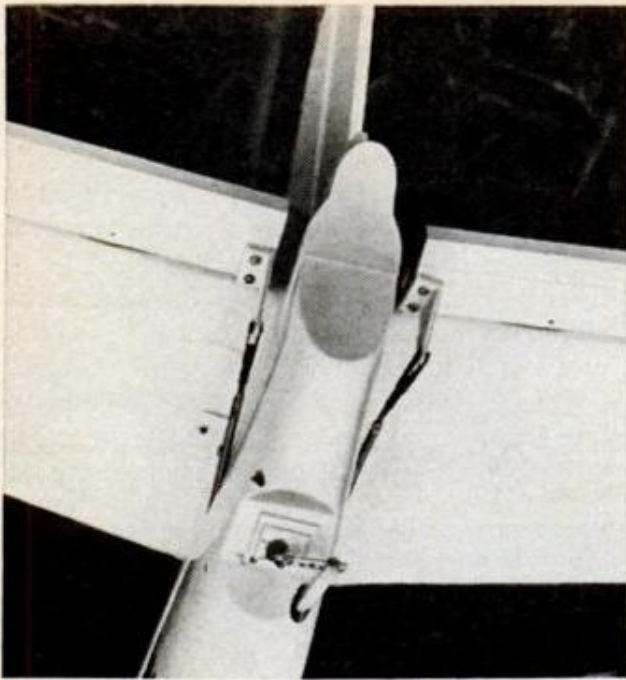
SABRE KIT includes preassembled fuselage and pre-covered wing, fin, stabilizer and control surfaces



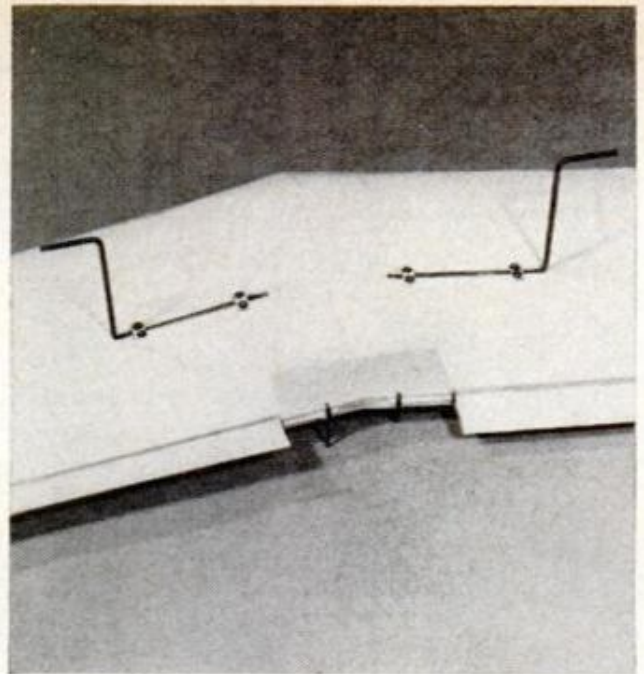
USE THE TEMPLATE furnished with plane kit to locate and drill holes for engine mount, fuel lines



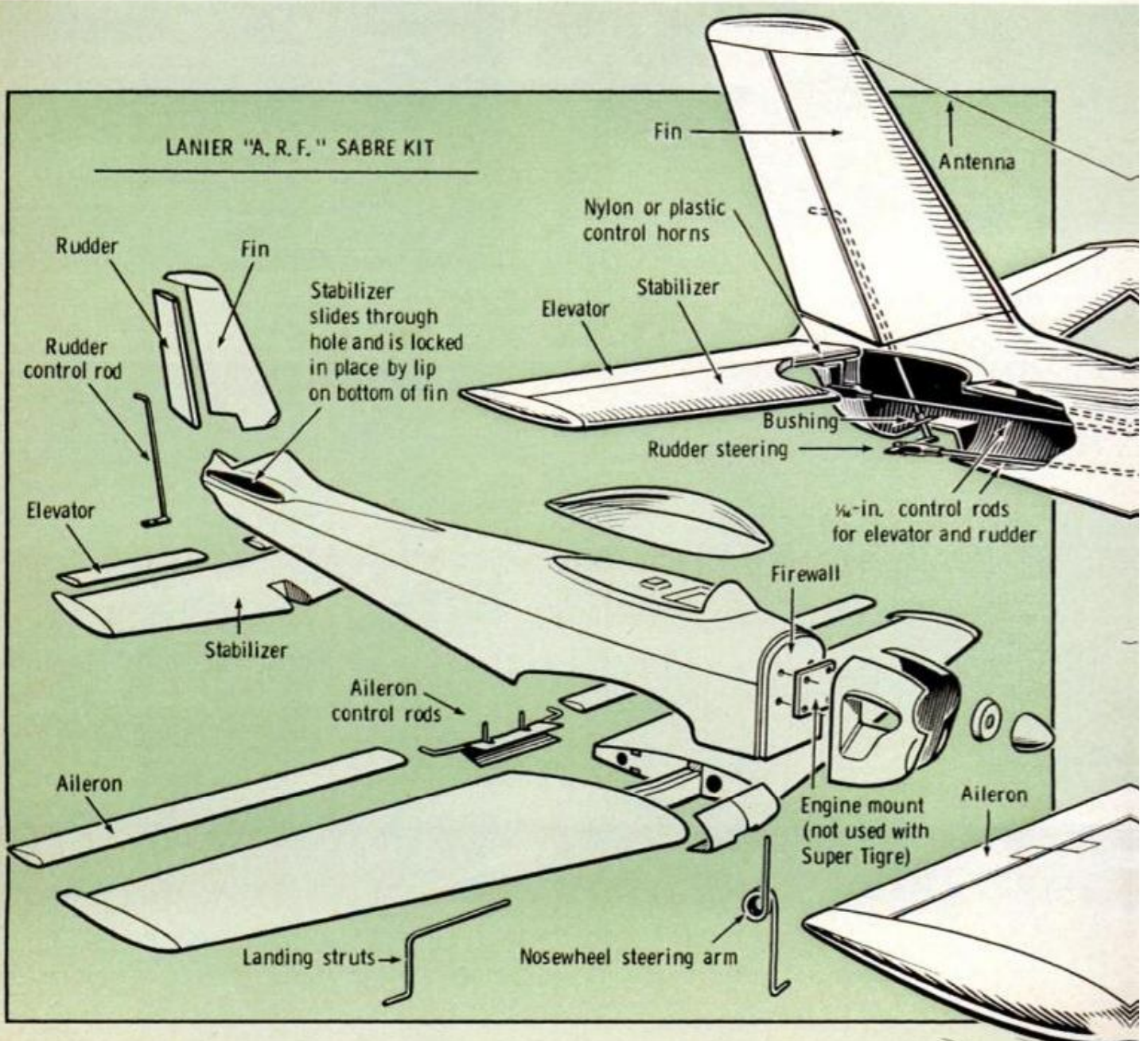
ONE HALF OF COWLING must be cut and trimmed to clear cylinder head of radially mounted engine

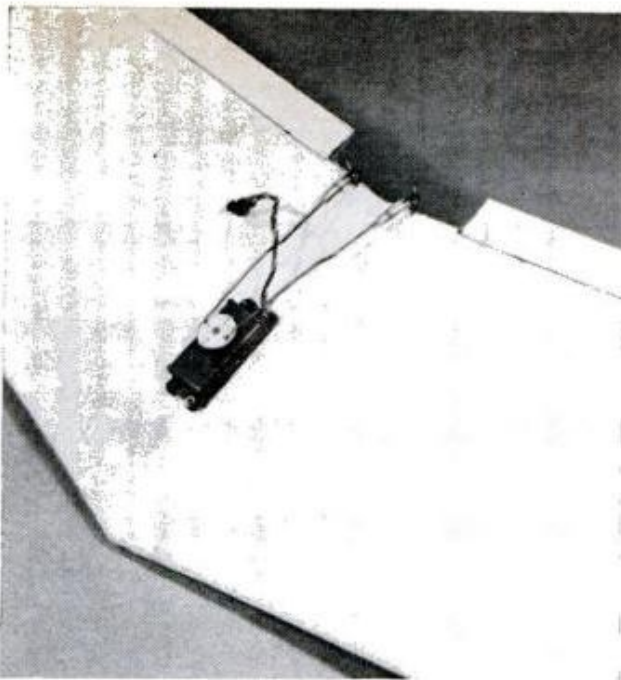


REAR CONTROL SURFACES (rudder, elevators) are connected by pushrods to their controlling servos



MAIN LANDING STRUTS are secured to wing with thick plastic straps, No. 4 wood screws and washers

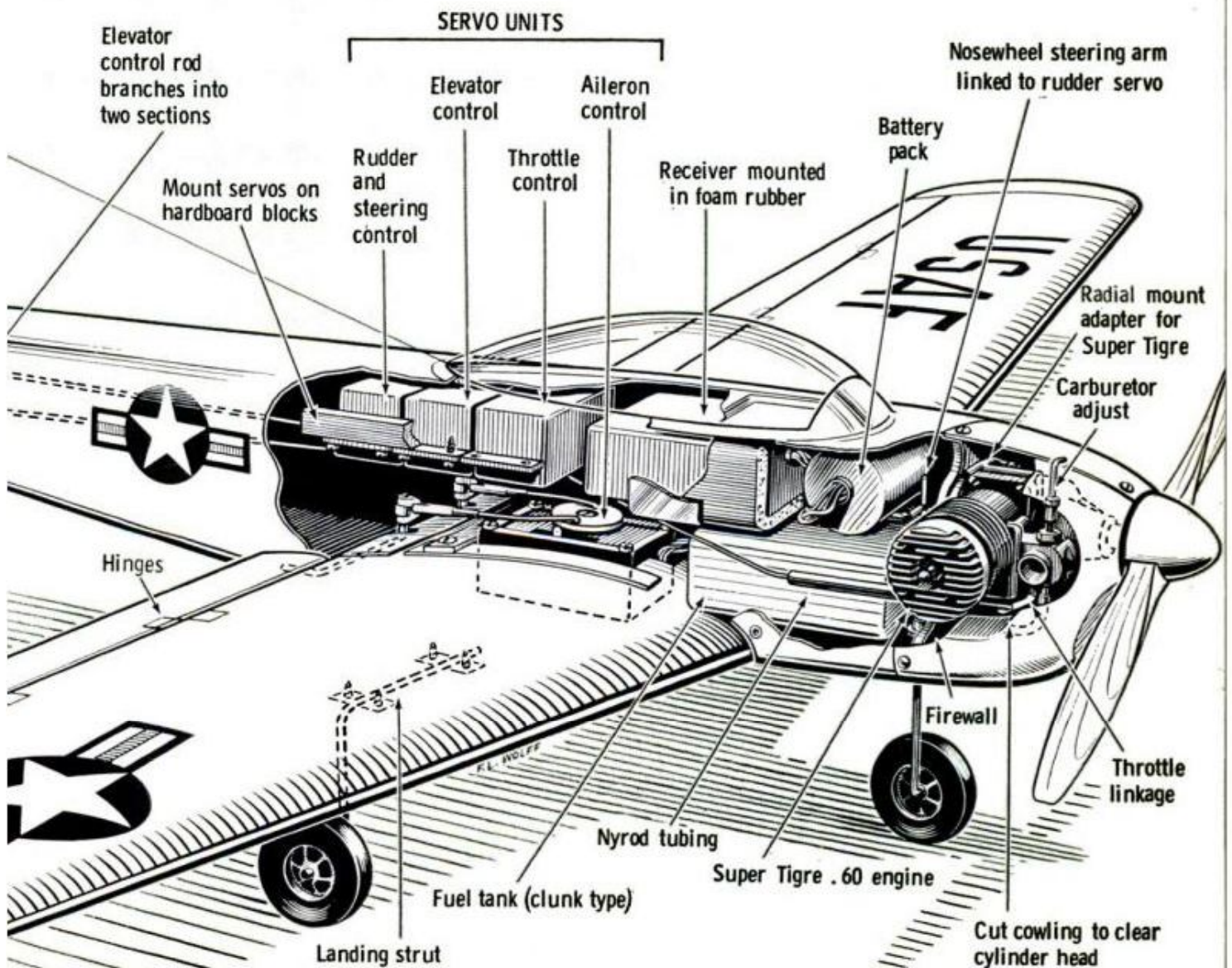


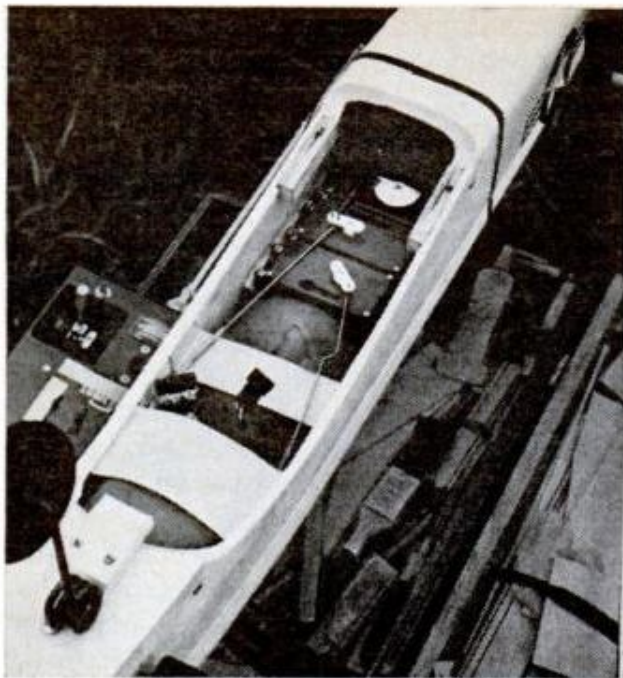


AILERON CONTROL SERVO is recessed in underside of wing, then ringed with wood strips for strength

consists of a vacuum-formed fuselage; precovered wing and stabilizers of molded foam cores; precovered elevator, rudder and ailerons made of balsa, and preformed nose and main landing gear. As shown in the photos, assembly of the Sabre kit (one of seven offered by Lanier Industries, Oakwood, Ga. 30566) is relatively uncomplicated and fairly well detailed in their instructions.

Next comes the all-important decision of what control equipment to install in the aircraft. Here's where it really pays to have spent a day or two watching and questioning members of a flying club. Their knowledge of radio-control equipment and the type of aircraft you're building can prove invaluable. My choice for the Sabre was the EK Logictrol 5, a digital-proportional system from EK Products, 3233 W. Eules Blvd., Hurst, Tex.

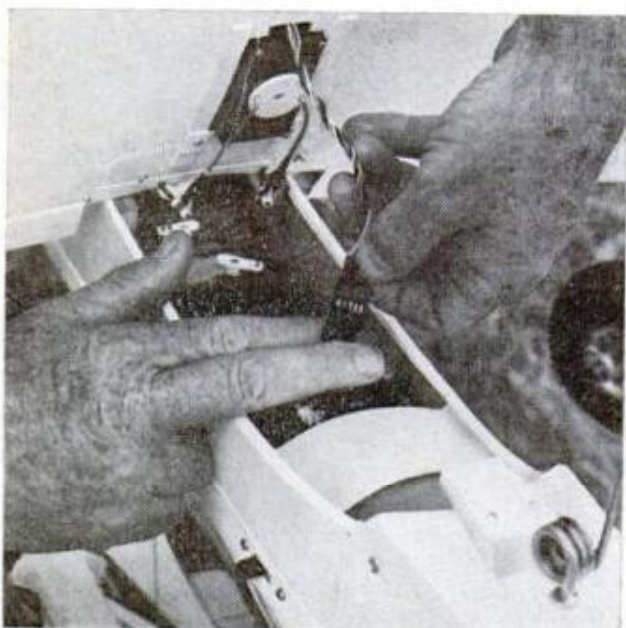




STIFF PLASTIC STRAP holds foam-wrapped receiver snug in fuselage. Small wood block helps lock wing

Install the servos as shown in the drawing on page 115, then hook up the various linkages to the rudder and steering gear, ailerons, elevators and engine throttle. Standard R/C fittings, linkages, rods and clevis connectors make the job much easier than may appear at first glance.

Turn on the R/C equipment now and make certain that all control surfaces are responding correctly in relation to the control sticks on the transmitter. Down on the elevator stick should produce "up" elevator. Next restrain the aircraft and prime and fire the engine. Run the engine



PREWIRED CONNECTORS between servos, receiver and batteries are keyed to prevent wrong connections

116

through its various speeds while varying all the control sticks. The control surfaces should respond smoothly and without jitter. Any erratic movement of the servos usually can be traced to metal-to-metal contact somewhere in the linkages. Make a final vibration check by having two friends raise and hold the plane by its wingtips. Again, no jitter should be encountered when the control servos are actuated.

Before you fly the plane

In every flying club, there is *always* one member known as the "first flier." This unsung hero will take an untested plane and proficiently put it through its paces—and then he will happily proceed to indoctrinate the novice to some of the finer points of radio-control flying. There is nothing so damaging to an aircraft as the wrong elevator stick movement during a full-throttle takeoff.

So find—and join—the nearest flying club. You'll not only avoid disaster, you'll also have someone to fly *with*. For the name of the club nearest you, write to the Academy of Model Aeronautics, 1239 Vermont Ave., Washington, D.C. The AMA is the recognized agency for model flying.

For a comprehensive 150-page catalog of R/C equipment, planes, engines, fittings and hardware, send 75 cents to World Engines, 8960 Rossash, Cincinnati. Polk's Hobbies, 314 Fifth Ave., New York, will also supply free catalog sheets for these radio-control items. ★★★



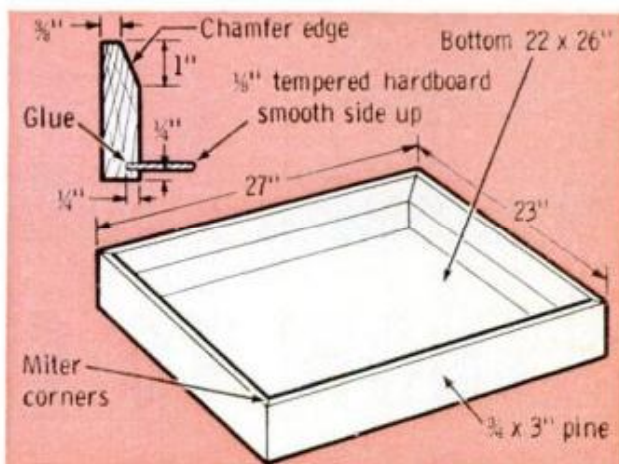
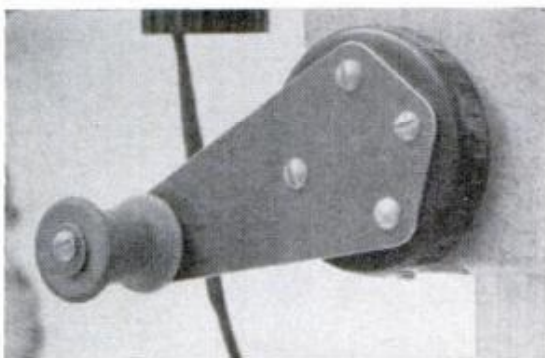
WING CAN BE HELD by thick rubber bands over posts in fuselage or by wood block and sheet metal screws

POPULAR MECHANICS

PHOTO HINTS

JUMBO BLOWUPS are fun to make once in a while, but you may not do it often enough to warrant the expense of the large processing trays. You can solve this problem by making your own giant trays like those shown at right. All you need are some $\frac{1}{8}$ -in. tempered hardboard for the bottoms and 1x3 pine strips for the sides. The dimensions shown in the drawing will take enlargements as large as 20x24 in. Coat the trays with epoxy enamel to give a water-tight, chemical-resistant finish.—*R. S. Hedin*

OLDER ENLARGERS that don't have crank-type adjustment handles can be updated by adding your own crank like the one shown below. A tapering arm cut from steel or aluminum plate with a thread cut from steel or aluminum plate with a thread spool for a knob will increase the leverage and make the enlarger much easier to operate. Bolt the handle to the face of the enlarger's original knob, taking care not to drill through the knob's reinforcing ribs.—*Herman R. Bininda*

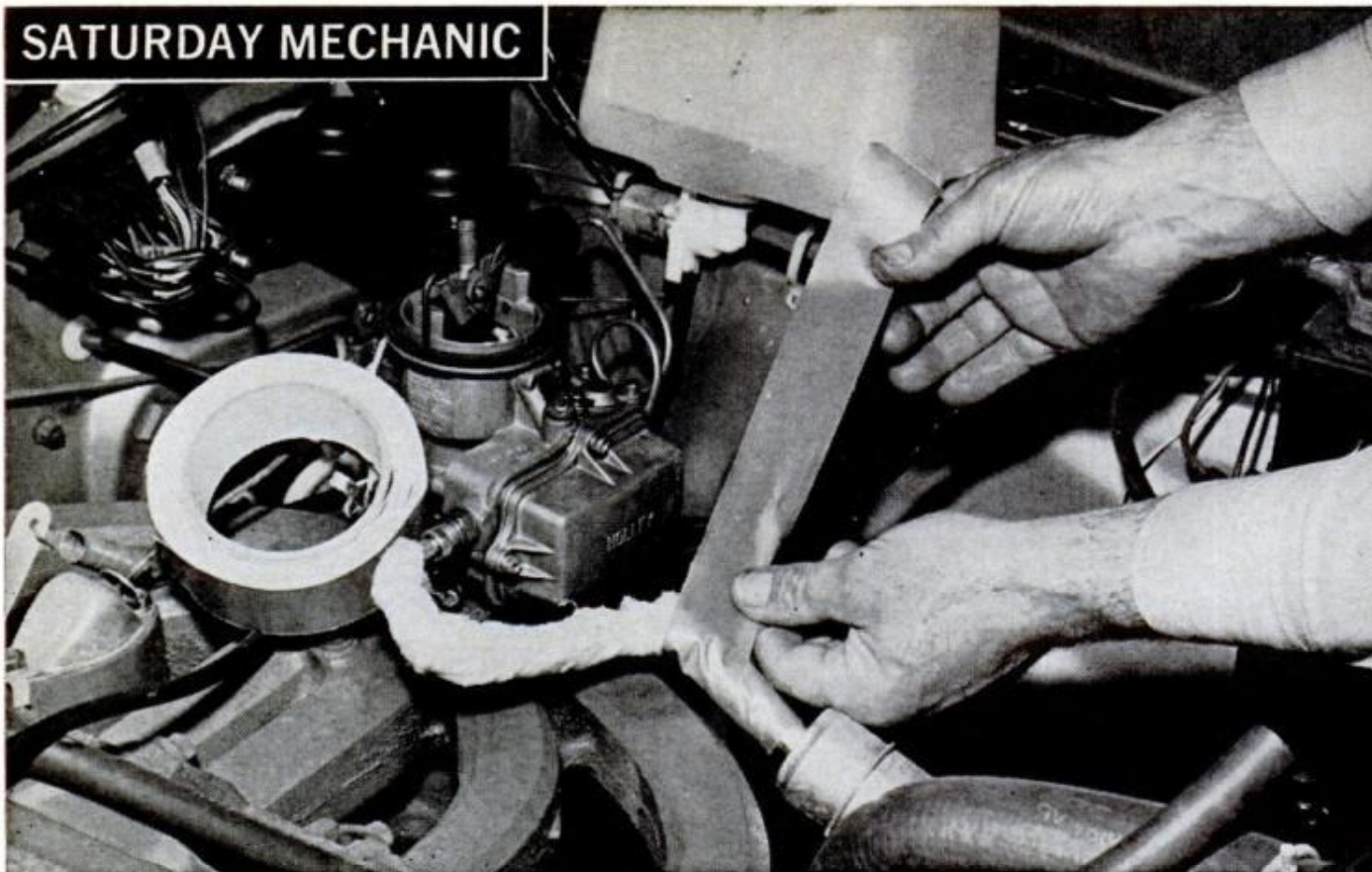


INEXPENSIVE GADGET BAGS usually don't come with pockets inside the lid to hold small articles. You can add your own holders with $\frac{3}{4}$ -in.-wide dress-maker's elastic. Fasten the tape with tiny rivets so that it forms a series of flexible loops. Remove the lining, attach the elastic, then replace the lining so the rivets won't show.—*D. E. Anderson*

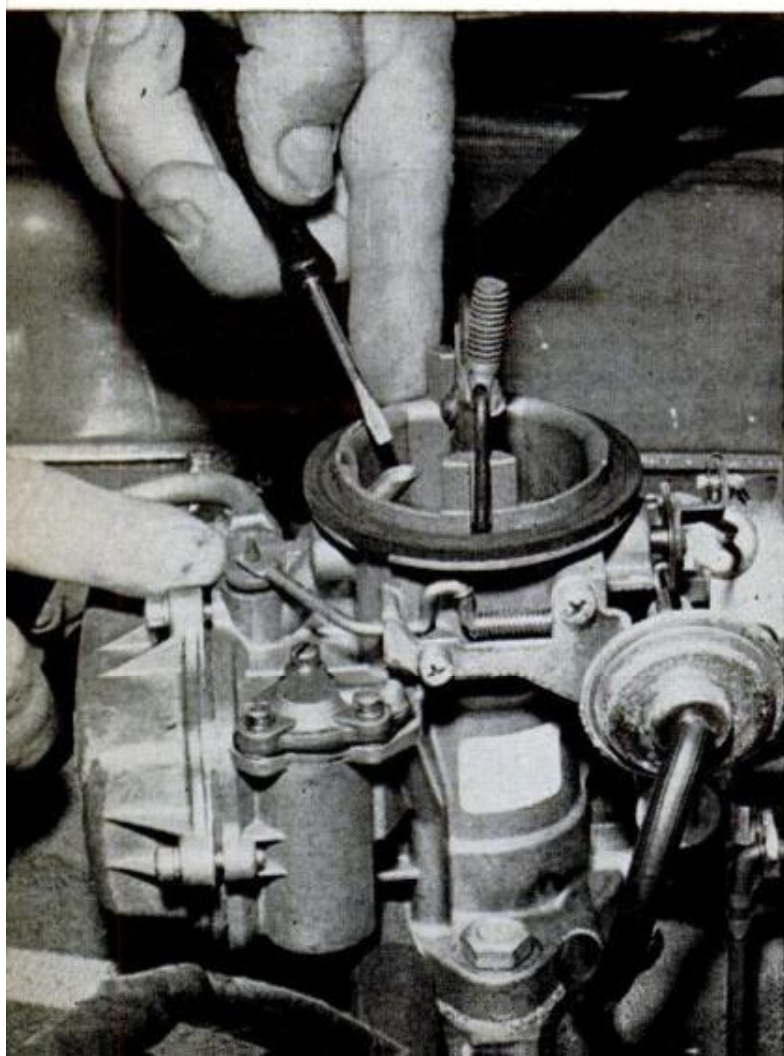


TALL TANKS for processing several reels of film at a time can be improvised from plastic fruit-juice shakers. Bend coat-hanger wire into a T shape and string the reels on it. The operation must be done in darkness, but is quick and easy.—*Rod Moon*





HOW TO SAVE YOUR CAR



The diagnosis and cure of summer's two insidious causes of engine heatstroke—vapor lock in fuel pump and lines and percolation in carburetor—are easy if you know what to look for

By MORT SCHULTZ

VAPOR LOCK and percolation are still current events. Despite mechanical improvements and more careful blending of gasoline, just like your favorite 90-proof, you can find yourself stalled by the roadside when vapor forms in your fuel system or percolation starts in your carburetor.

The two problems are insidious. They usually occur when you're zip-ping down the highway. Suddenly your

INSULATING FUEL LINES (top) minimizes chances of vapor lock from engine heat. At left, finger points to antipercolation vent valve; screwdriver points to high-speed vent

car quivers and loses power. It recovers, goes a few more miles, loses power again and finally stalls. It won't restart. After 20 or 30 minutes, you find you're able to start and are back on the road. But several miles later, you're in the same fix again.

The point is, give the vapor lock or percolating condition a chance to cool down, and it disappears with the heat.

Without heat, there would be no vapor lock or percolation. That's why today's cars are as ripe for the condition as the cars of yesteryear, despite safeguards by automotive and fuel industries. Lower hood lines, more clutter in the engine compartment that cuts down on breathing room, and more heat-generating gadgets (like airconditioners) all conspire with warm weather to cause fuel to vaporize and boil.

It doesn't take much heat to make this happen. Winter grades of gasoline can start to vaporize at a temperature of 74° F. Naturally, vapor lock and percolation

when the carburetor gets hot enough to vaporize and boil fuel in the bowl. As gas gets hotter and hotter, fumes and bubbles of raw gas move up the bowl nozzle like boiling water in a coffee percolator. The gas flows into the carburetor throat and past the throttle valve into the intake manifold.

What happens, then, is just the opposite of the fuel starvation condition you get with vapor lock. With percolation, the engine floods.

How can you tell whether you have a percolation or vapor lock problem? Percolation usually occurs when you stop and idle the engine after a drive. It stalls and won't restart. Or you turn off the ignition after a drive and go to start it several minutes later. It refuses to start.

What happened? When you slow down or stop an engine after a drive, the temperature beneath the hood soars. This heat concentrates itself on the carburetor and gas starts to percolate, flooding the engine.

You can verify percolation by lifting

FROM HEAT EXHAUSTION

during winter are not common because of the rush of cold air going through the engine compartment.

Summer grades of gasoline can begin to vaporize at about 94°. A man who happens to have a load of winter-grade gas in his tank when a warm spell strikes stands the best chance of having his car develop vapor lock or percolation. However, with a summer blend, either problem can occur any time the weather is hot enough and conditions beneath the hood are right.

The first step in heatproofing your car is a diagnosis of the heat problem. Vapor lock is the vaporization of fuel by heat anywhere in a car's fuel system other than in the carburetor. It usually occurs in a fuel line, especially at a bend, but can take place in the fuel pump, too, if the pump is located near an engine hot spot.

When it happens, the flow of fuel to the carburetor is impeded or stopped entirely. Technically, your engine runs out of gas although you may have a full tank.

Percolation, on the other hand, occurs

the hood and sniffing. You'll get a strong odor of gasoline and the carburetor housing will be extremely hot when you touch it. In today's cars, percolation is more of a problem than vapor lock.

Vapor lock can occur when you're driving fast or slow, or when you stop and idle. It can stall you out at 60 mph or hit you in the midst of a jammed city street. Usual symptoms are a sudden loss of power, backfire and engine cutout—in other words, the same symptoms you'd get if a fuel pump went bad, a fuel filter clogged or you ran out of gas.

There's no easy way to verify a vapor lock condition other than to get a jug of water and pour it over the gas lines and fuel pump. If the condition is vapor lock, the water will cool it and the engine will start. Some drivers, knowing their cars are vapor-lock prone, often carry a vacuum jug of cold water with them. Pouring cold water over the carburetor will also alleviate percolation.

Another way to verify the presence of a heat problem, as we indicated, is to let



FIBERGLASS INSULATION is very compressible for use around fuel lines near block or other parts

the engine cool off for about half an hour. If vapor lock or percolation prevented the engine from starting, the engine will start after a cooling-off period. No other condition with the same symptoms as vapor lock and percolation will suddenly disappear with rest.

What can you do about vapor lock? Reduce the amount of heat on gas lines and fuel pump. One inexpensive way is with fiberglass insulation and duct tape, which are products you can buy in a hardware store or plumbing-supply house.

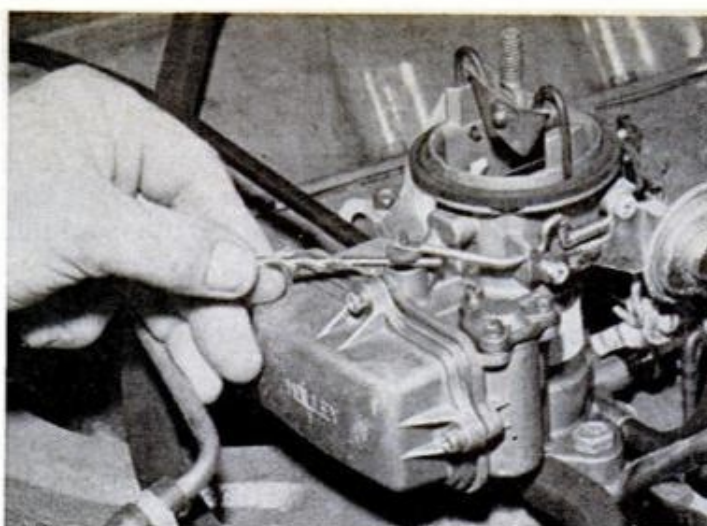
Wrap the fiberglass insulation around fuel lines. Hold it in place by tightly wrapping duct tape around it. This tape is used for sealing heat ducts and will withstand temperatures up to 450°F. before the adhesive lets loose.

As a substitute for fiberglass, you can use asbestos paper, which is as thick as cardboard. Hold it in place with duct tape. This paper is also a plumbing product.

Modern car design has set the fuel pump in a spot where it's usually not affected by engine heat. However, if wrapping fuel lines fails to cure an apparent vapor lock condition, then suspect the pump. You can do one of two things.

Fuel-pump modifications

The inexpensive method is to fabricate a shield around the fuel pump with fiberglass insulation and duct tape. If you want to get fancy, you can modify your fuel-supply system by removing your present fuel pump and fuel lines and buying an electric in-line pump from an auto supply house. Companies making this part include Bendix and Stewart-Warner.



BOWL VENT VALVE of this carb is checked by sliding a 3/32-in. drill bit under it with engine at idle

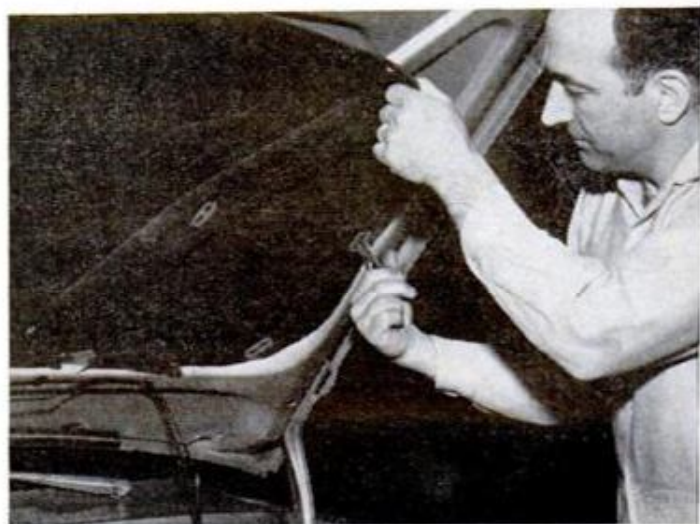
Position the new pump near the gas tank and run a high-pressure fuel line to the carburetor. This, by the way, is something racing car designers do to combat vapor lock.

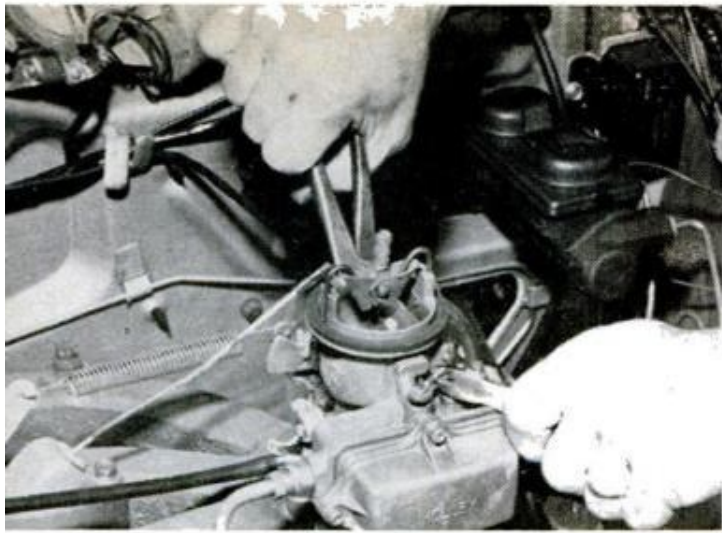
There are several things you can try to clear up a percolation problem. First, however, be aware that most carburetors have a bowl vent valve, or antipercolation device, which allows vapors that form in the fuel bowl to dissipate into the atmosphere.

Most of these devices are adjustable, although some, like the one on the Carter YF 1-V carburetor used in some Fords, are not. Also, each is adjusted to varying specifications, depending on the carburetor. You'll have to check your service manual.

The vent valve in the accompanying photographs should be set to provide a

UNDERHOOD AIR CIRCULATION may be increased enough to prevent carb percolation by removing pad





TO ADJUST BOWL VENT VALVE hold the rod secure while bending rod near the valve (foreground)

$\frac{3}{8}$ -in. opening at idle. The adjustment is done by holding the vent valve rod at one end and bending it up or down on the other. Again, adjustment procedure differs with the carburetor, as outlined in the service manual.

The vent valve is in the open position only at idle and at very low-speed operation. During normal and high-speed operation, activating the throttle linkage by stepping on the gas pedal automatically closes the vent valve.

If percolation occurs and the vent valve is adjusted properly keep in mind that the more you cut down on heat in the engine compartment, the less chance there will be of percolation. Here are several things to do.

First, if you have a fiberglass pad beneath the hood, remove it to allow better air circulation.

MANIFOLD HEAT-CONTROL VALVE should be checked periodically and kept free with a squirt of solvent



Second, make sure the manifold heat control valve is free. If the valve is stuck in the closed position, too much heat will be concentrated on the fuel after it passes through the carburetor. This excess heat can cause gasoline to vaporize.

It will pay to buy a can of manifold heat-control valve solvent at your auto parts supply store. A shot every couple of months will keep the manifold valve working properly. The solvent will also help free the valve should it get stuck. Squirt on the solvent and give the valve a tap with a hammer to free it.

The amount of heat on the carburetor can also be reduced by further insulating the carburetor from the intake manifold. Just add another carburetor gasket or two beneath the carburetor.

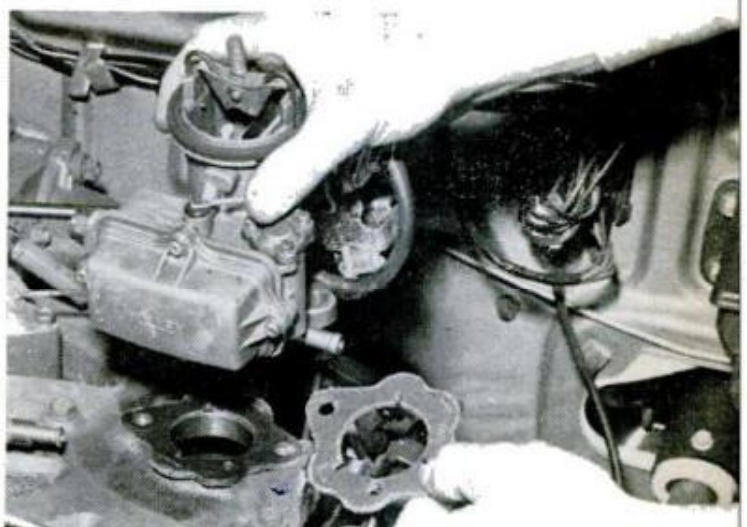
Check for clogged air filter

Incidentally, make sure your carburetor air cleaner is clean. A clogged filter acts like a clogged choke butterfly, resulting in flooding that's similar to that caused by percolation.

Other general things that will cut down on heat beneath the hood and, hopefully, on vapor lock and percolation are as follows: Keep the cooling system in tip-top shape so it doesn't allow engine temperature to rise higher than normal. Make sure the fan belt is in good condition and properly adjusted. Switch to a lower-temperature thermostat for summer use.

A more drastic, last-ditch attempt to lower temperature in the engine compartment is to remove a four-bladed fan and replace it with a multibladed fan that'll pull more air. ★★★

ADDITIONAL GASKETS between carburetor and hot intake manifold can help to eliminate percolation





Outboards from Yamaha?

This summer, the famous motorcycle and piano-maker is hitting the American market for the first time with three outboard boat engines. Here's how they performed for PM.

By V. LEE OERTLE

A NEW AND DISTINCTIVE sound will be heard on the water this summer. It will be that of Yamaha's new outboard motors.

In a sneak preview, I tried the first motors. Yamaha is entering the market with three models—the 3.5 hp, the 5 hp, the 7.5 hp. By fall it plans to add a 15-hp model. And by fall, too, all models, even the 3.5 hp, will have Yamaha's automatic lubrication system—metered oil. Within the next year or two, higher horsepower models will become available.

Heart of the first three models is a water-air cooling and loop-scavenging system. In American makes, the efficient piston shape (see cutaway on page 124) made possible by loop-scavenging, is found only in Evinrude's and Johnson's 55-hp models.

Yamaha says it has been using it for years in its motorcycle engines, and for the past decade in outboards for the Japanese market. But unlike the American

55 hps, Yamaha uses a regular space gap sparkplug and normal ignition system.

Water for these outboards is sucked up a small intake tube. Water mixes with the exhaust and is forced down and out underwater. This cools the exhaust lines and makes operations quieter.

In all three motors, the power heads are forcibly air-cooled by flywheel fans.

I sped around California's Newport Bay for six hours trying to foil each of the three motors. First I found Yamaha uses large-diameter pulleys in the recoil starter. Yamaha advertises one-pull starting. In six hours of steady stop and go, all three units *did* start on the first pull when the throttle was *slightly* advanced. There is a curious difference between the Yamaha and some American outboards. On American brands, I usually advance the throttle about halfway for starting. However, the Yamahas are designed to start best at very low throttle settings—I'd estimate a one-sixth ad-



EXCEPTIONAL POWER for such a small unit is key feature of 3.5 hp. Note stop button on front



SHIFT LEVER (forward and neutral) is easy to reach on 5-hp motor's right side. Clean design is typical



MANUAL CARBURETOR DRAIN is on side of 7.5-hp model so that fuel is never left in the system

vance. I tried a halfway throttle setting and just couldn't get it going at all. But when set at the proper low-speed location, every start was a quick one. It compares with the Yamaha trail bikes. Most Yamaha cycles start quickly and easily at idle speed.

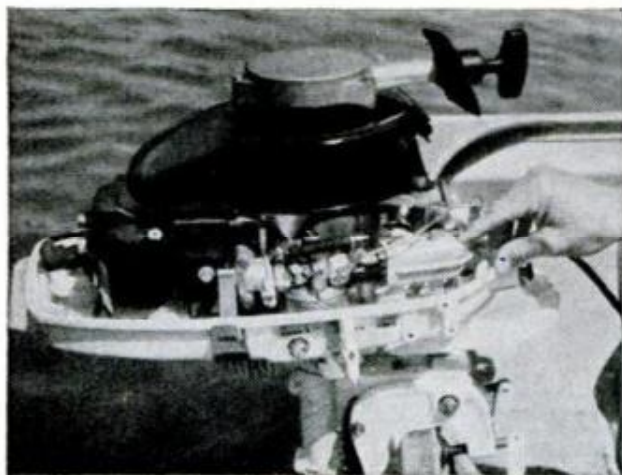
Starting the outboards takes very little physical effort. I began by starting each engine from a standing position. From a sitting position, the motors are still easy, though the long cord may be a problem for some. A short-armed female might have difficulty starting one while sitting.

The shroud on the 7.5 hp is heavily insulated with foam, and is the quietest of the three, judged from a distance. In all honesty, I must admit that it's quieter than the little 3.5-horse kicker.

The 5 hp was the noisiest of the three. (With an integral fuel tank it isn't possible to insulate the housing.) I'd rate it noisier than American outboards of the same power. However, I would not classify it as objectionable, nor even bothersome. It's merely a *little* noisier.

The 3.5 hp seems to have a shriller

FLAME ARRESTER (backfire trap) is only one of many interesting features on 7.5 hp. Note accessibility of all component parts, plus neat wiring arrangement



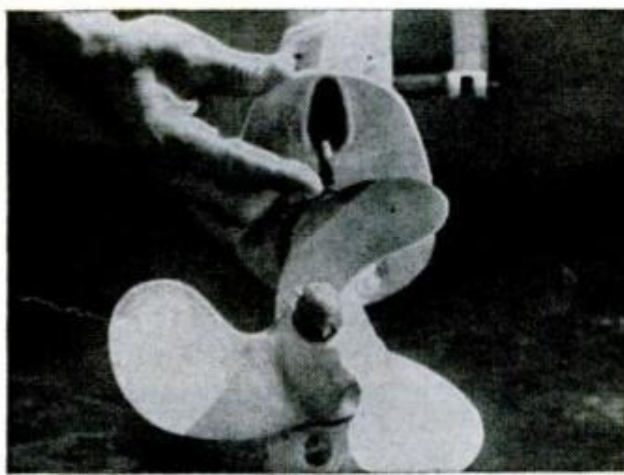
sound, and it seems to reach a higher rpm than the other two models. But the 3.5 hp is still quieter than the 5-horse model.

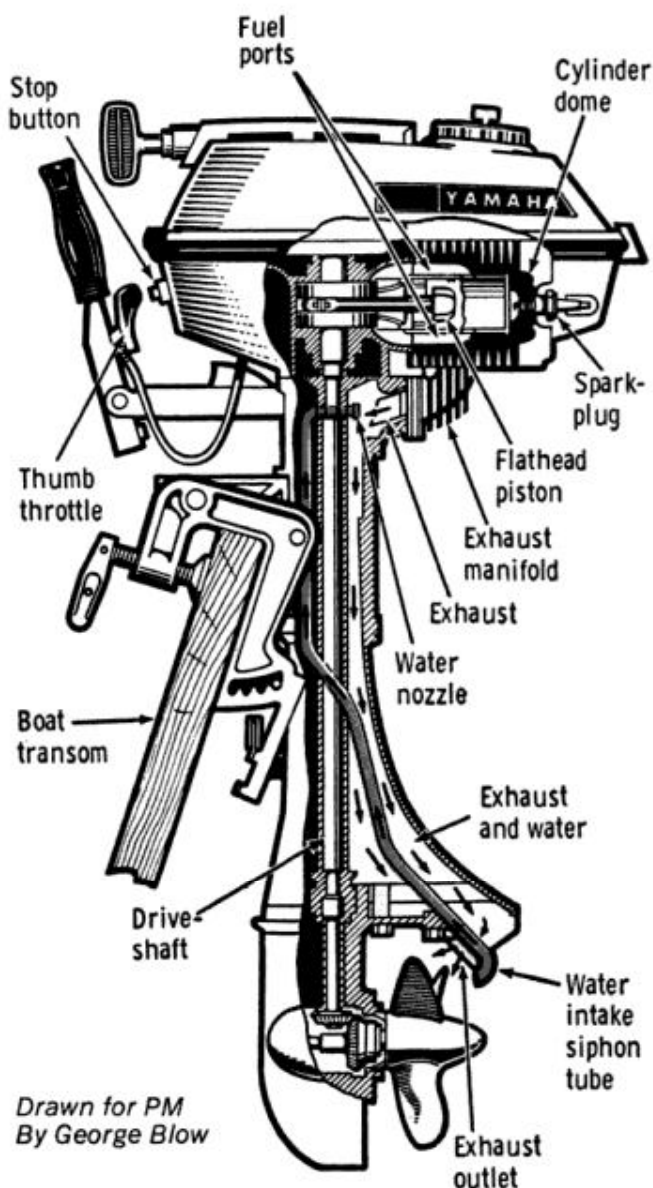
There is a definite difference in the *sound* of Yamaha outboard motors, as well as in the actual audible noise levels. Just as there are perceptible differences to the ear between motorcycles, so it is with outboards. No experienced outboarder would confuse a Mercury with an Evinrude, for example, even if the audible output was exactly the same. There is that highly personal response familiar to anyone in the business. The Yamaha, too, creates a new sound entirely.

Just as there's a difference in sound, so there's a difference in "feel" to each model.

The 3.5 hp (model P-35) is a compact little brute that lifted our 150-pound boat and two-man crew easily and sent us running across the bay without a whimper or hesitation. Power thrust is smooth all the way from no-load to full-load. Time after time, I rammed the throttle

SIPHON TUBE picks up water above the prop. The water combines with the exhaust, cools the lower unit and empties underwater through the larger hole





Drawn for PM
By George Blow

CUTAWAY DIAGRAM of Yamaha 5-hp outboard shows loop-scavenging and water-cooling systems

from idle to full-throttle with one quick motion. The unvarying response was a quick burst of rpm that never faltered. It has 360° reverse ability for all-direction navigation without shifting. The factory rates it from slow troll to over nine mph, which is completely believable. At one point, the motor failed to run at dead idle. One of the Yamaha mechanics did a little tinkering and it trolled a bit smoother, but occasionally it died and had to be restarted. In fairness, I should point out that the surface of Upper Newport Bay carried a moderate chop. (Small motors seem to troll best on quiet surfaces.) I'm confident that this is a matter of tune-up. The 3.5 was fresh out of a shipping carton, as were the other motors. Only the briefest preliminary tune-up had been possible.

The 5-hp (P-95) model certainly more than matches the factory claim for "slow troll to over 11 mph." With two and four persons in the 150-pound boat the 5-horse took us across the bay effortlessly. It features forward and neutral gear positions, plus 360° reversibility. As previously stated, the 5 hp is a bit noisier than the other two units. But in the power department, I'd rate it excellent. However, I had one complaint. While it starts easily, there is an immediate fall-off in rpm before it starts the power thrust upward. Hesitation was apparent in every trial run from dead idle to full throttle. Once

(Please turn to page 174)

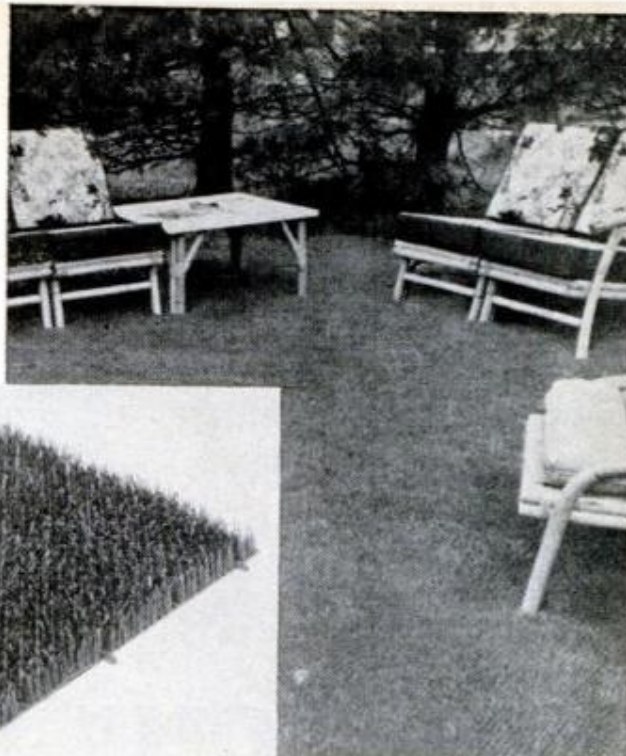
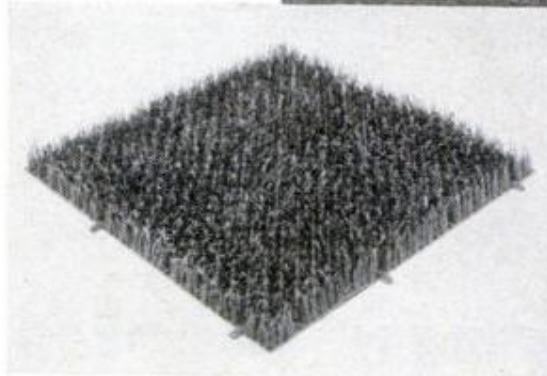
SPECIFICATIONS CHART FOR YAMAHA OUTBOARD MOTORS

	3.5 HP	5 HP	7.5 HP
Engine	2 cycle, single cylinder	2 cycle, single cylinder	2 cycle, single cylinder
Bhp	3.5 @ 4500 rpm	5.0 @ 4500 rpm	7.5 @ 4500 rpm
Bore and stroke	1.77 x 1.57"	1.97 x 1.85"	2.13 x 2.13"
Displacement	3.84 cu. in.	5.6 cu. in.	7.5 cu. in.
Ignition system	Flywheel magneto	Flywheel magneto	Flywheel magneto
Fuel	Gasoline & oil, 24:1 ratio	Gasoline & oil, 24:1 ratio	Gasoline & oil, 24:1 ratio
Capacity	0.66 gal. (integral)	0.66 gal. (integral)	4.5 gal. (separate tank)
Starting	Auto. rewind	Auto. rewind	Auto. rewind
Cooling	Water & air	Water & air	Water & air
Transom height	Standard 15" Long 20"	Standard 15" Long 20"	Standard 15" Long 20"
Pivot range	Full pivot	Full pivot	Full pivot
Controls	Thumb-controlled throttle	Forward and neutral thumb-controlled throttle	Forward-neutral-reverse thumb-controlled throttle
Gear ratio	17:28	17:28	14:34
Propeller	2-blade—7.5 x 5"	3-blade—7.5 x 4.75"	3-blade—9 x 8"
Stern adjustment	4-position	4-position	4-position
Weight	35 lbs.	49 lbs.	59 lbs.
Speed range	Slow troll to 9 mph	Slow troll to 11 mph	Slow troll to over 16 mph
Gear oil	_____	_____	Hypoid gear oil 90W
Prices f.o.b. West Coast	\$146.95	\$213.95	\$274.95

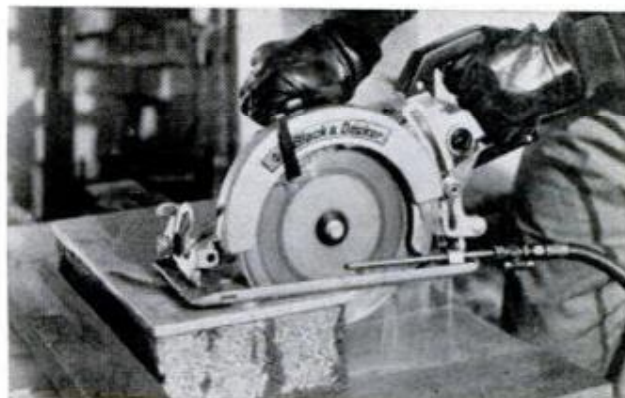
EXCITING NEW PRODUCTS

By CAROL SCHULTZ

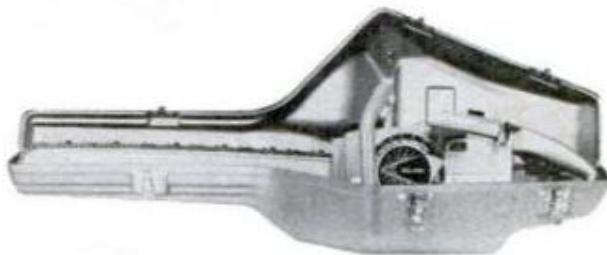
IMITATION GRASS molded of a specially blended formula of colored polyethylene plastic has the look and feel of the real thing underfoot. Perma-Grass is resistant to moisture, oil, gasoline, acid and, therefore, stain-resistant and color-fast. Perma-Grass is molded in 12 by 12-inch squares, and amply perforated to permit drainage and cleaning. Squares lock together with built-in tabs or cement in place. \$1 a square foot. Made by Grass Design Corp., 71 W. 23 St., New York.



WORM-DRIVE SAW with a waterfeed attachment will perform continuously even when cutting tough material like stone, cement or tile. Powered by a rugged 13-amp. superduty motor, the saw is equipped with a high-capacity switch that eliminates burnouts and special brush springs that insure longer motor life by applying a constant even pressure that reduces commutator wear. This 8½-inch Worm-Drive Saw sells for about \$160. The waterfeed attachment is \$15 more. By Black & Decker Mfg. Co., Towson, Md.



CHAIN-SAW CARRYING CASE offers the chain-saw owner a safe convenient way to carry, transport and store his saw. These cases will fit any of Homelite's new XL-101 series of lightweight saws, fitted with bars and chain up to 20 inches long. There's also room in the case for small tools and a few cans of oil. The carrying case can be bought separately for \$19.95 or with the purchase of any saw in the XL-101 line for an additional \$5. Made by Homelite, a division of Textron Inc., Riverdale Ave., Port Chester, N.Y.



TEFLON THREAD SEALANT in tape form is ideal for sealing threaded joints on pipes made of metal, plastic, glass or other materials; it is also perfect for use on bolts, valves and gauges. It's made to withstand temperatures from minus 450° to plus 500° F. The sealant is self-lubricating, will not harden, and releases easily for disassembly. A dispenser holding about 22 feet of ½-inch-wide tape sells for under \$1.70. Many other widths are also available. American Tape, a division of Armour & Co., 430 Michigan Ave., Chicago.



This simple box cover bolts over your truck bed and turns it into a snug shelter cabin. If you want more headroom, just add the high-rise sides

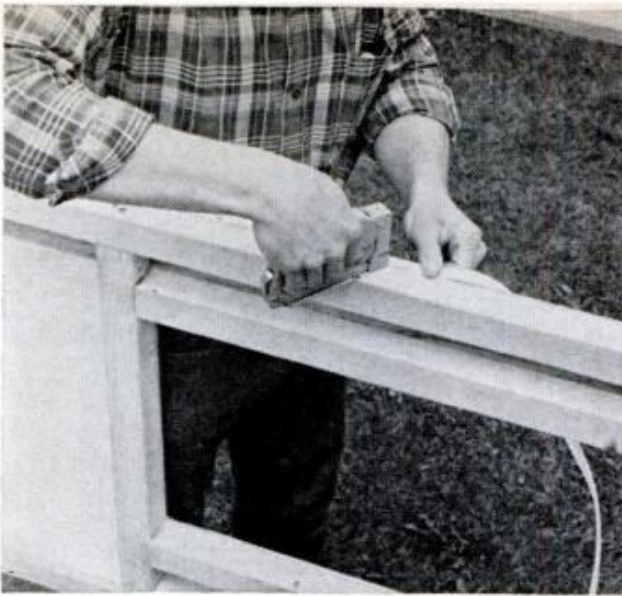


Hi-Lo Camper Shell For Your Pickup

By RAY SHOBERG

Technical Art by Fred Wolff





PLASTIC WALT called "gyp" is stapled along the inside edges of the panels before they are assembled, above. Like quarter round, this covers the joint once pieces are assembled. Plywood gussets on side panels, right, give curve to the roofline and anchor the brackets which support a pair of carrier bars



DON'T CONFUSE a camper shell with a standard pickup camper. The shell bolts directly to the top flange of your pickup box, and unlike a camper, it has no lower sidewalls or floor. Ultralight, it can usually be lifted on or off the truck without the aid of winches or jacks.

The two-part shell detailed here has several advantages over commercial shells. When you buy a shell, you have to choose between a low-profile model roughly the same height as your truck cab and a high-rise style which offers standup headroom.

The higher shells are more comfortable to live in, but they are also bulkier and offer greater wind resistance. Low shells are considerably more cramped. However, they're more compact, lighter and generally handier for year-round utility shelter for your pickup box.

With this two-part shell, you can choose the height to suit the job. The shell itself is a standard low-ceiling design. However, sandwich in the extender between the shell and truck box and you have a stand-up shell. You can also use the extender alone to increase the height of your pickup box for hauling bulky loads. Temporary hooks screwed into the top plate will provide anchorage to lash down the load or secure a tarp.

Before starting construction, it's a good idea to have all the materials and fittings

on hand so they can be measured exactly. Window openings, for example, shouldn't be cut until you have the windows available to use as a cutting pattern. This way you'll be assured of a perfect fit.

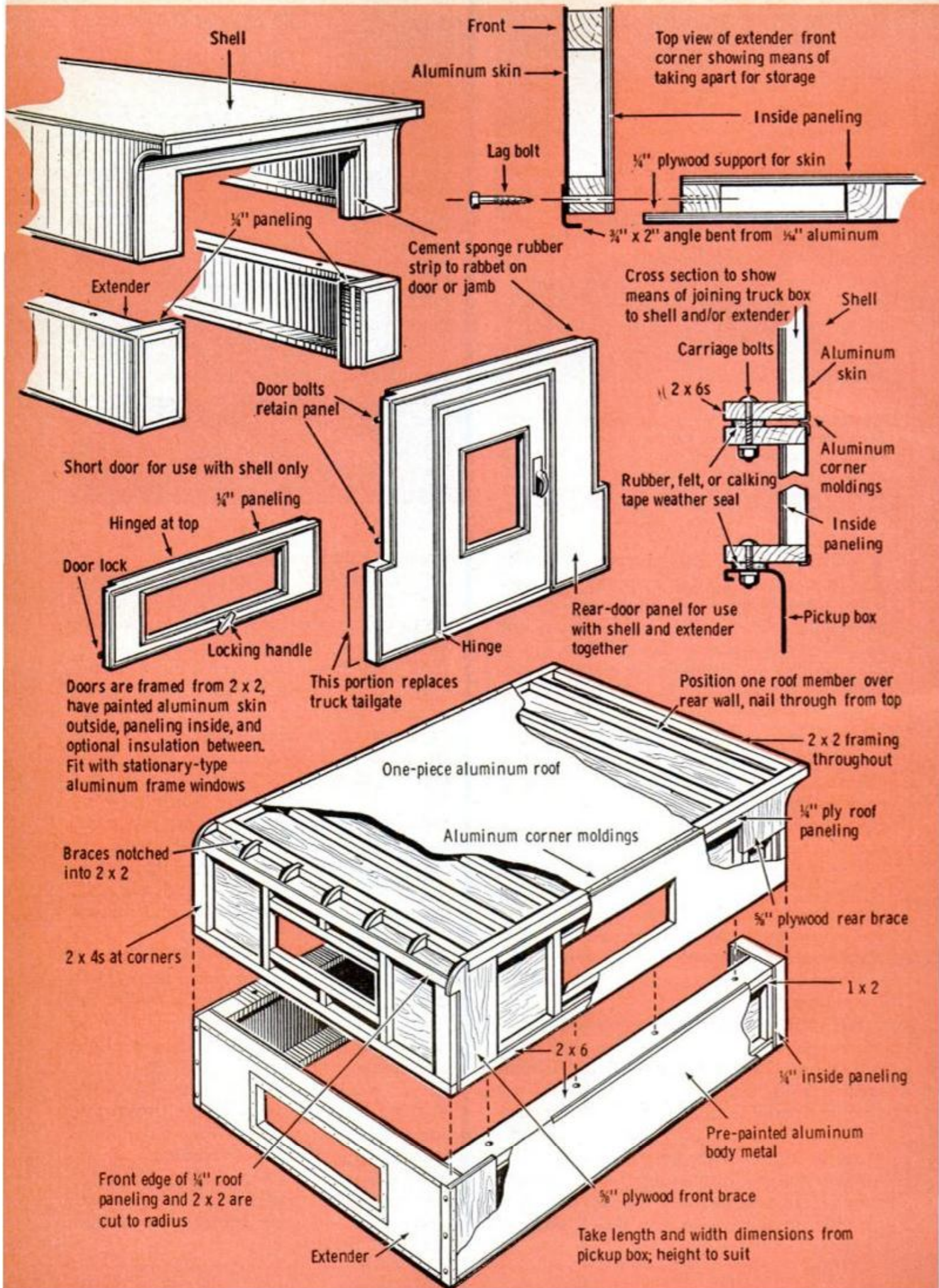
You may have a problem finding some of these parts through local sources. If so, you can order the windows, aluminum skin, metal roof and moldings from Viking Camper Supply, 94 Glenwood Ave., Minneapolis, Minn. 55403.

From the drawings, you should have no trouble visualizing the general construction of the shell and extender. Both are framed with 2x2s and faced with aluminum skin on the outside and plywood paneling on the inside. Naturally, dimensions must be tailored to suit your pickup.

While you can leave the walls hollow, it costs very little to insulate them with batts of fiberglass. This will make the shell cooler in summer and warmer in cold weather. It's well worth the slight extra cost.

If you want to work indoors, the sides, front and back can be partially finished in your workshop and then assembled later outdoors. Construct the framing and attach the inside paneling. Before doing the roof, however, check the dimensions against those of your shop door to make sure you'll be able to get it out.

Take all length and width measurements from the pickup box itself. Height



is a matter of taste, but remember that the roof should protrude slightly above the cab if you plan to haul loads on top with carriers. Use both glue and nails when assembling the framing.

The plywood gussets at the front and rear of the sidewalls serve two purposes. They not only give the correct curvature to the roof line, but also provide solid anchorage for top carriers.

Once you've completed the framing and installed the inside paneling, the front, rear and sides are ready to be nailed together at the corners. A cement driveway or garage floor is the ideal place for assembling the unit, but you can also put it together right on the truck. Just clamp the 2x6 sills a couple of feet back from their final position in order to allow room behind the cab to work on the front of the shell. Staple felt or rubber weatherstrip to the underside of the sills to seal out dust. To finish off the inside corners where the paneling meets, staple plastic welt (called "gyp") to the framing before you begin assembling the walls.

When framing the roof, be sure that you locate a 2x2 under each joint in the plywood inner paneling. Also, include the framing for a ventilator/skylight in your original plan, even though you may not be sure that you need a vent.

Drill small locator holes in the plywood paneling at the corners of this vent frame. This will allow you to try the shell out without a vent. Then, if you decide one is needed, it's a relatively simple job to cut the square out of the plywood paneling, drill the roof metal and make the necessary cutout there. Finally, the roof is nailed on the assembled four sides, with gyp stapled to the tops of the four sides to seal panel joints.

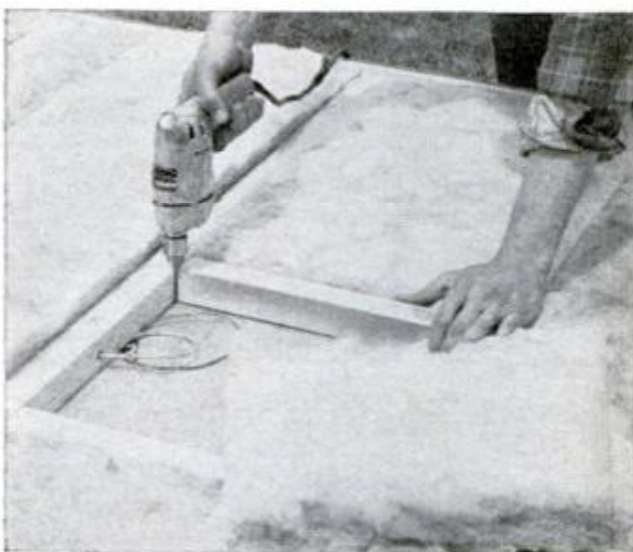
Wiring circuits

Once you've assembled the pieces of paneled framing, the next step is to install the electrical wiring. Inside, you'll want at least a dome light. You may also wish to put clearance lights outside on the four upper corners, and if a roof vent is planned, run wires to the framed opening for a fan. Run both ground and supply wires to each fixture, rather than depend on grounding through the aluminum skin of the shell.

The clearance lights should be on one
[\(Please turn to page 188\)](#)



FIBERGLASS INSULATION is well worth the slight added expense. Note that the front 2x2 has been rounded off to conform to shape of plywood gusset

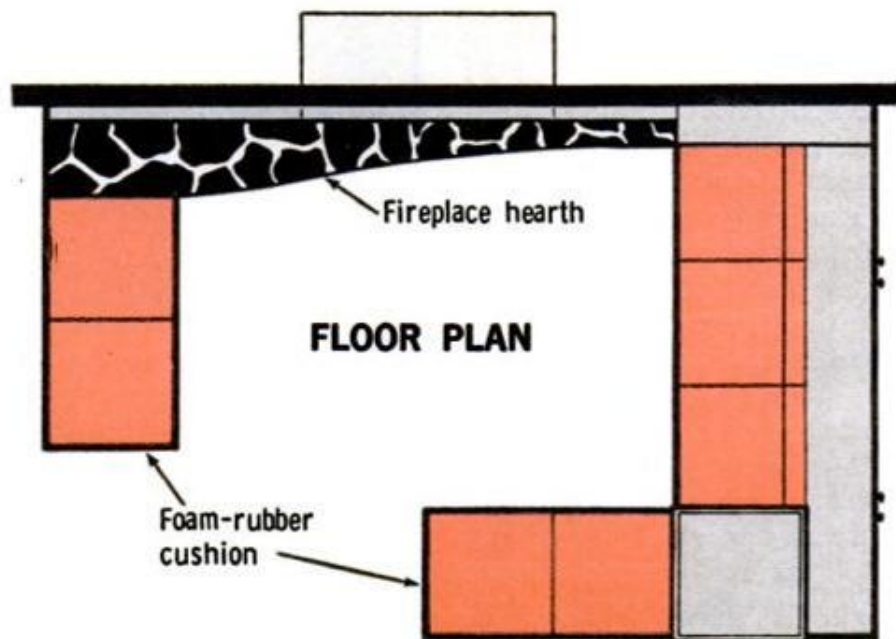


ROOF VENT FRAMING should be installed now, even though you may not put one in immediately. Drill tiny locator holes in corners for cutting opening later



WEATHER SEAL between the shell and the truck box is just weatherstripping stapled in place. The extender should have same seal, both top and bottom

BUILD THIS



All-in-One Divider

Hi-fi, storage and seating are all combined in this handsome home entertainment center

IT DOESN'T MATTER whether you have a fireplace wall to go with this handsome multifunctional room divider. Any wall will be fine. A fireplace just happens to add to the overall coziness.

As a room divider this one has everything. Not only does it create a freestanding floor-to-ceiling partition, but it makes the most of every inch of space it takes.

First, it offers storage galore, both front and back. There are three roomy bookshelves across the back, with deep king-size cupboards below. Across the front there's another handy shelf, a niche for a stereo turntable, record storage under a lift-up lid and a separate speaker enclosure which will make your recordings sound twice as thrilling.

To top it off, built-in benches fitted with comfortable foam-rubber cushions transform the area into a delightful spot by the fire where one can enjoy a relaxing eve-

ning with Mantovani or a hair-raising mystery. A dimmer control added to the built-in fluorescent fixture will let you dim the light to suit your listening mood.

You don't have to be too particular in building the skeleton framework since the prefinished hardboard paneling used to cover it will hide a multitude of sins. And there are any number of finishes from which to choose (Royalcote teak, a product of Masonite, was used to cover the divider shown at the right).

Start with the L-shape plywood base which supports the 2x2 posts. This consists of two separate panels which are joined with a cleat placed on the underside. The plywood base in turn is supported by a 1x6 kickboard, set in 2 in. from the edge.

Four full length 2x2s establish the depth of the divider itself. These are nailed to the base and to a 12-in.-wide



plywood panel placed across the top. The two other 12-in. shelves go in next.

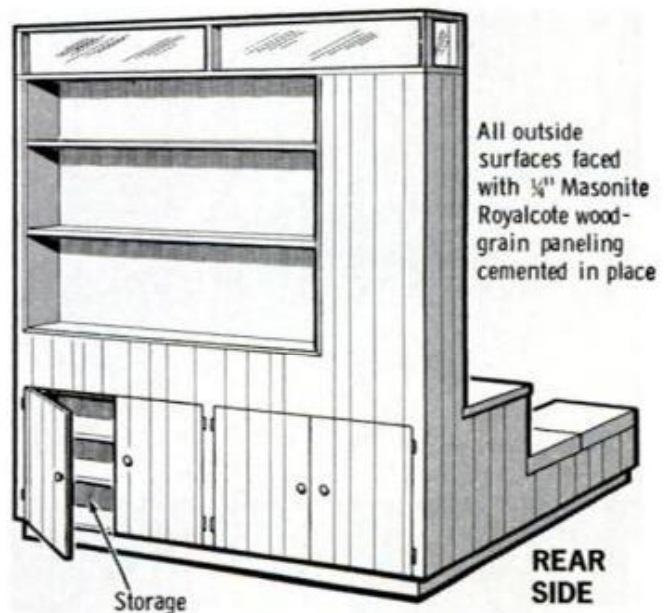
The speaker compartment is framed by installing a vertical divider between the shelves, while the posts across the front are positioned by driving the nails up from the bottom and down from the top.

The posts which support the seats and their backs, as well as those which form the record-storage compartment, are installed next. Note that a bottom, plus a back board, also must be added to the compartment.

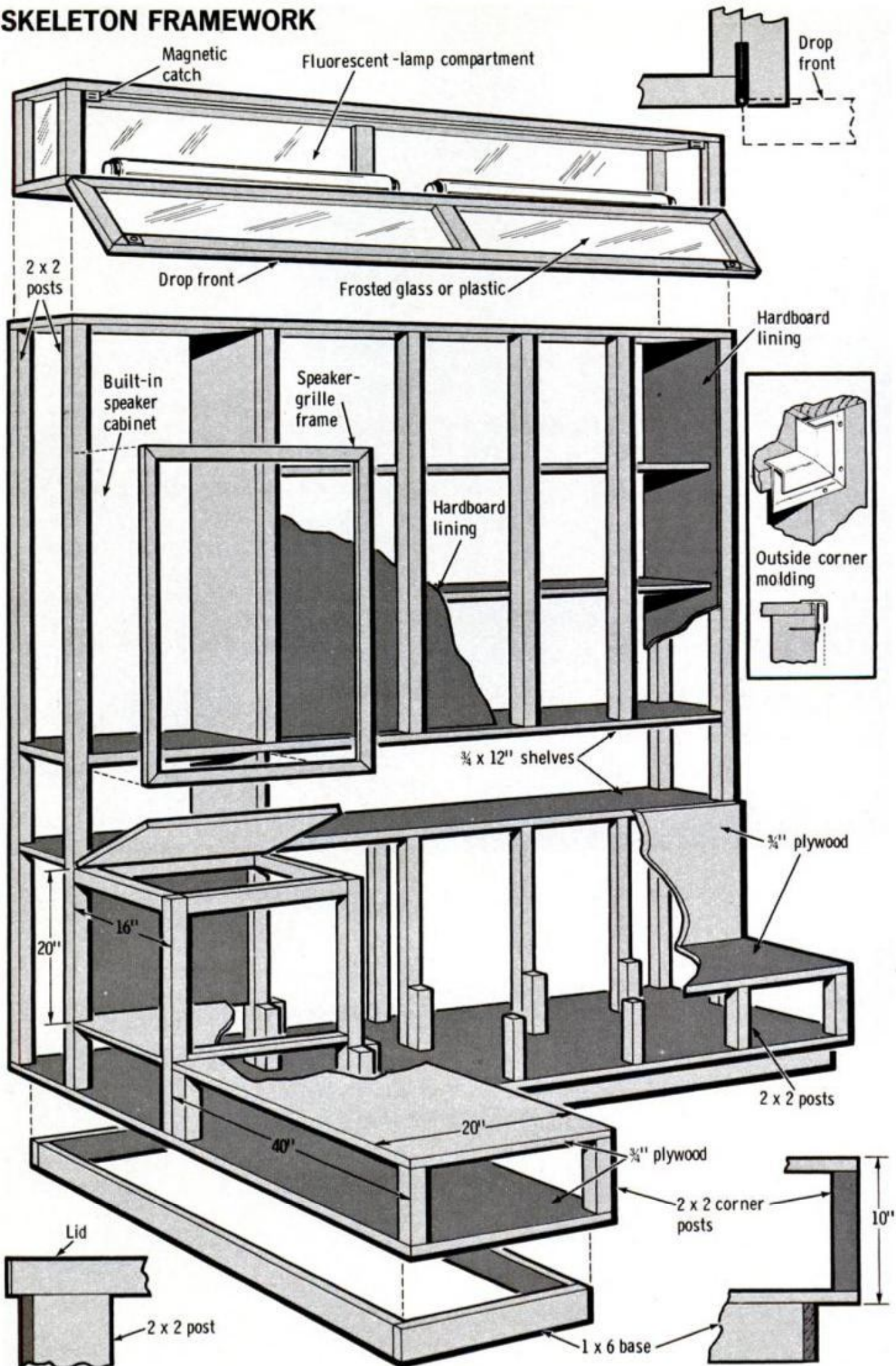
The separate fluorescent light box across the top is made a bit shorter than the space allowed so it can be slipped in place. A small cove molding, mitered at the corners, is later used to cover any gap between the light box and the ceiling.

There's no trick to covering the outside with hardboard. Regular panel adhesive is used to glue it in place. Your

*Concept Courtesy of Masonite Design Center
Technical Art by Don Evans*



SKELETON FRAMEWORK



first step is to line the interior of the bookcase. Then the opening is framed with a matching metal molding to conceal the hardboard edges.

As shown in the detail, the lengths of molding are mitered at the corners and held in place with short nails driven through the tapered flanges. The paneling will later hide the nails. This same molding is used at all outside corners of the framework to provide the same neat edge. It's applied as you come to each corner in working around from back to front.

No molding is needed to hide the top edges of the hardboard. The hinged cover, for example, will hide those around the top of the record cabinet, while the cushions will cover those at the top of the seat platforms.

The grille opening for the speaker compartment is made the full width of the compartment, but it's covered with paneling across the top. A mitered, rabbeted frame is made to cover the opening and then a filigree panel of decorative hardboard is cut to fit the frame.

Filigree is a $\frac{1}{8}$ -in.-thick panel which is available in four different patterns. The one used in the original is called Camelot, but there are others you might like better. Stock filigree panels measure 2x4, 2x6 and 4x8 ft. You can also get these panels 16 in. wide and 6 ft. long. Regular

grille cloth is applied to the back of the filigree before attaching the frame in place with a screw in each corner.

Doors for the cupboards at the rear are made by facing $\frac{1}{2}$ -in. plywood with the $\frac{1}{4}$ -in. hardboard paneling. Magnetic catches can be used to hold the doors shut. The two adjustable bookshelves rest on regular shelf brackets which are designed to be inserted in rows of holes.

Slabs of 4-in.-thick, cored latex foam are used for the cushions. If you're not too experienced at making tailored slip-on covers, a local upholstery shop can take over. You may find suitable ready-made cushions to save you from making them.

Strips of 1-in.-sq. solid wood are used to make the sides of the light box, including the drop-front door. Top and bottom are plywood. Front, back and end are lined on the inside with panels of frosted glass or plastic. Two 48-in. fluorescent fixtures are mounted to the bottom of the box and wired to plug into a nearby outlet and switch.

Colorful contrast can be added to the paneling by the cushion covers, and by painting the interior of the book shelves. The kickboards can be made to match or contrast with the hardboard covering. Of course, the whole divider has more of a built-in look when the adjoining wall is done in the same paneling. ★★★

From steel shelving to typing desk

Steel shelving need not be used just for storage. As you see here, you can take some of the parts of metal shelving and make the neatest typing desk you ever saw. This one was made from a five-shelf unit in which two of the shelves were used for the double-thick top, plus one for the back and one for the ends. One shelf cut in half made the two ends.

Two original legs cut in half made the four 30-in. legs which are joined to the double-thick top in the same manner as used in assembling the parts as shelving. New holes must be drilled through legs and shelves to join the back and side members. Here Pop rivets are the handiest things to blind-fasten the legs. Original shelf braces were placed across the bottom of side members.—*Bob Joselyn*



JEWEL BOXES YOU CAN MAKE

By EVERETT JOHNSON

RUMMAGING AROUND in a large dresser drawer for a tiny cuff link is silly, but we all do it. How much smarter it would be to have one of these handsome man-size jewel boxes handy to keep such elusive items from going astray.

The miniature version of a full-size chest shown below appears to have nine individual drawers. Actually it's a fooler, it has only three. But they're long ones which make them all the more perfect for handkerchiefs, checkbooks and passport cases.

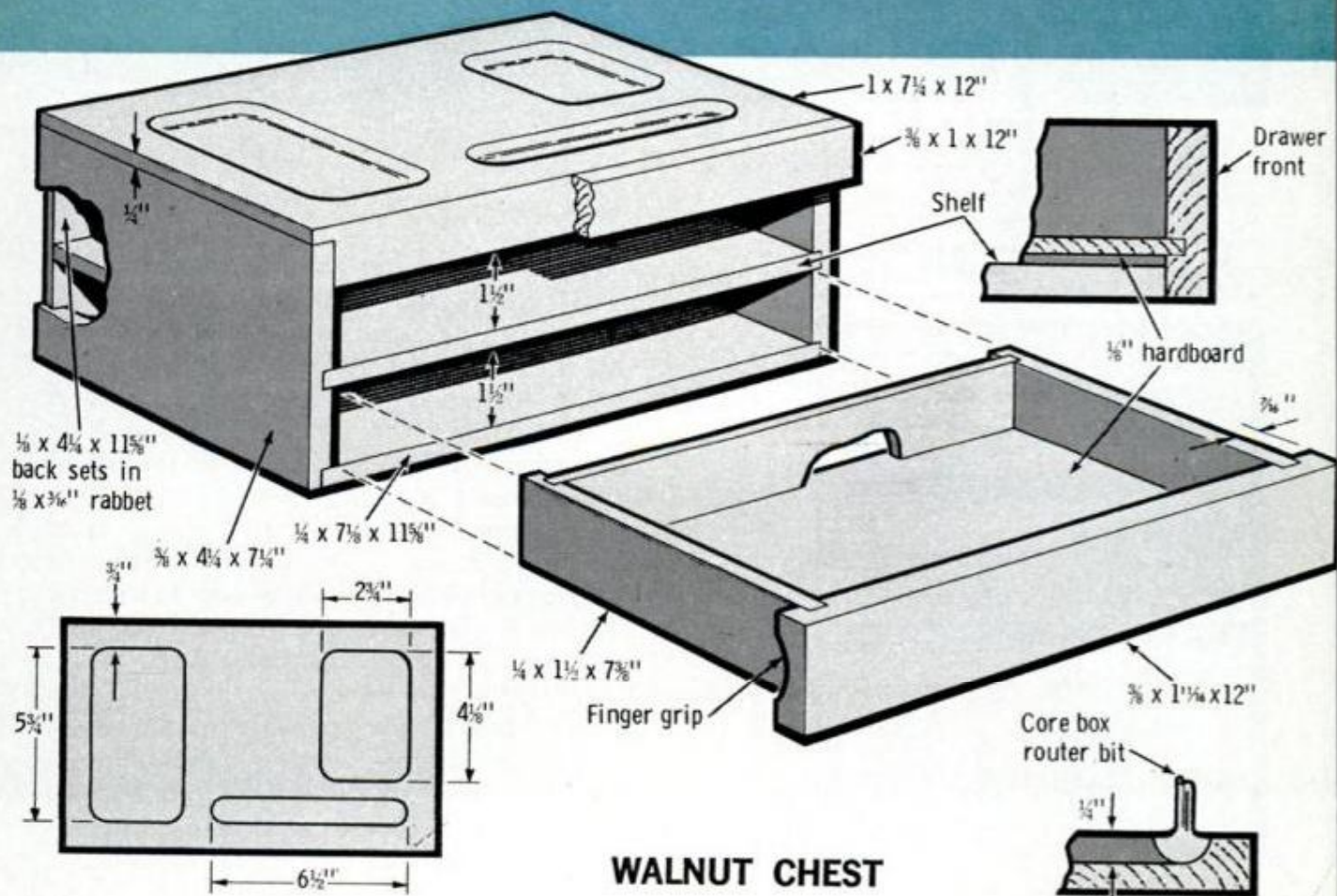
While having only two drawers, the jewel box at the right also serves as an overnight caddy for holding the contents of one's pockets. Recesses in the top provide shallow trays for parking such things as a lighter and comb, a watch and wallet, loose change, money clip—you name it.

Only choice cabinet woods should be used for such elegant boxes and nothing but your best craftsmanship. The box shown below was made of cherry; the other, of walnut. Both were hand-rubbed to a beautiful semiluster finish. The drawers are lined with plush velveteen. Tiny brass knobs give the box a touch of elegance.

Color Photos by Robert Borst

Technical Art by Don Evans

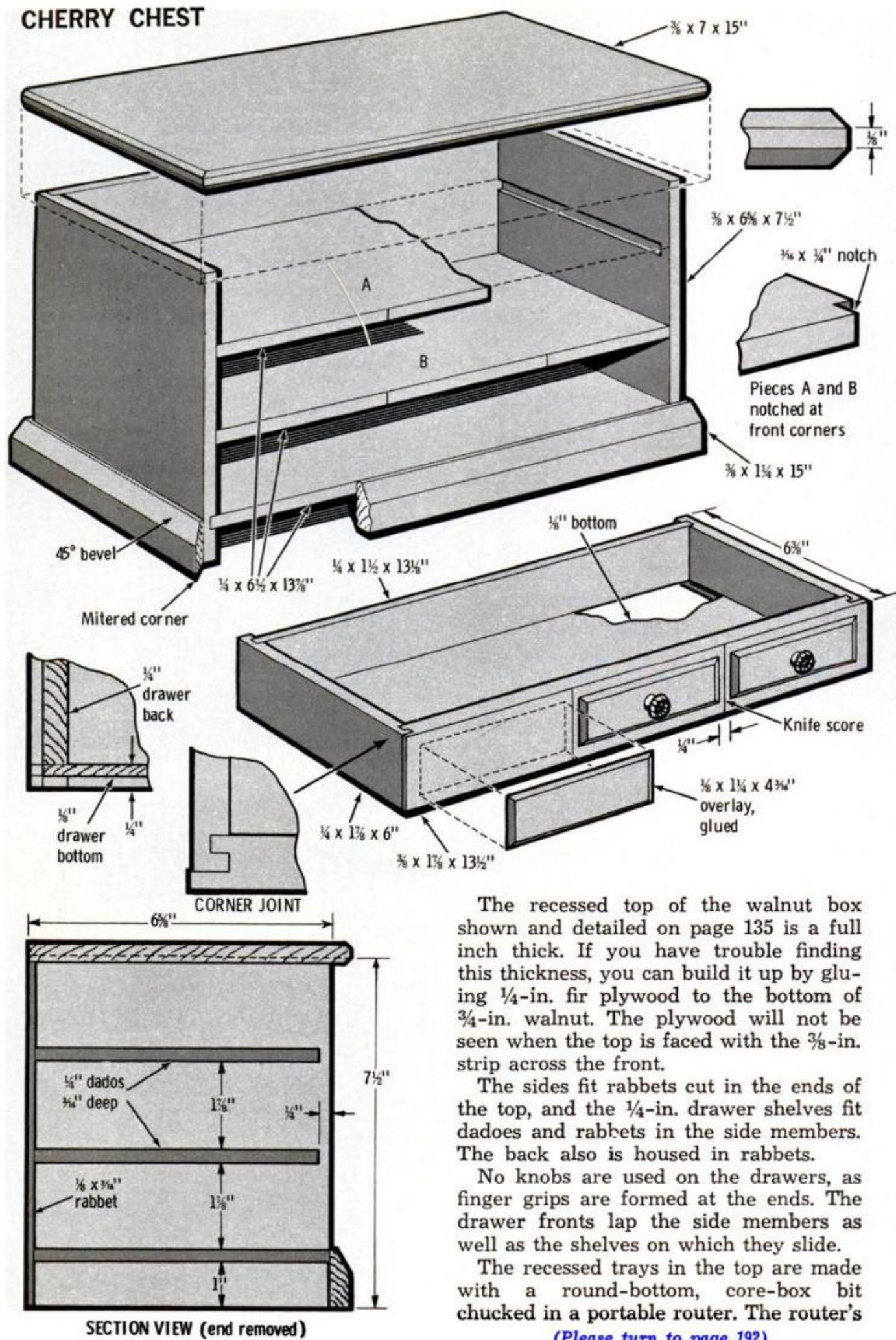




WALNUT CHEST

JULY 1968

CHERRY CHEST



The recessed top of the walnut box shown and detailed on page 135 is a full inch thick. If you have trouble finding this thickness, you can build it up by gluing $\frac{1}{4}$ -in. fir plywood to the bottom of $\frac{3}{4}$ -in. walnut. The plywood will not be seen when the top is faced with the $\frac{3}{8}$ -in. strip across the front.

The sides fit rabbets cut in the ends of the top, and the $\frac{1}{4}$ -in. drawer shelves fit dados and rabbets in the side members. The back also is housed in rabbets.

No knobs are used on the drawers, as finger grips are formed at the ends. The drawer fronts lap the side members as well as the shelves on which they slide.

The recessed trays in the top are made with a round-bottom, core-box bit chucked in a portable router. The router's

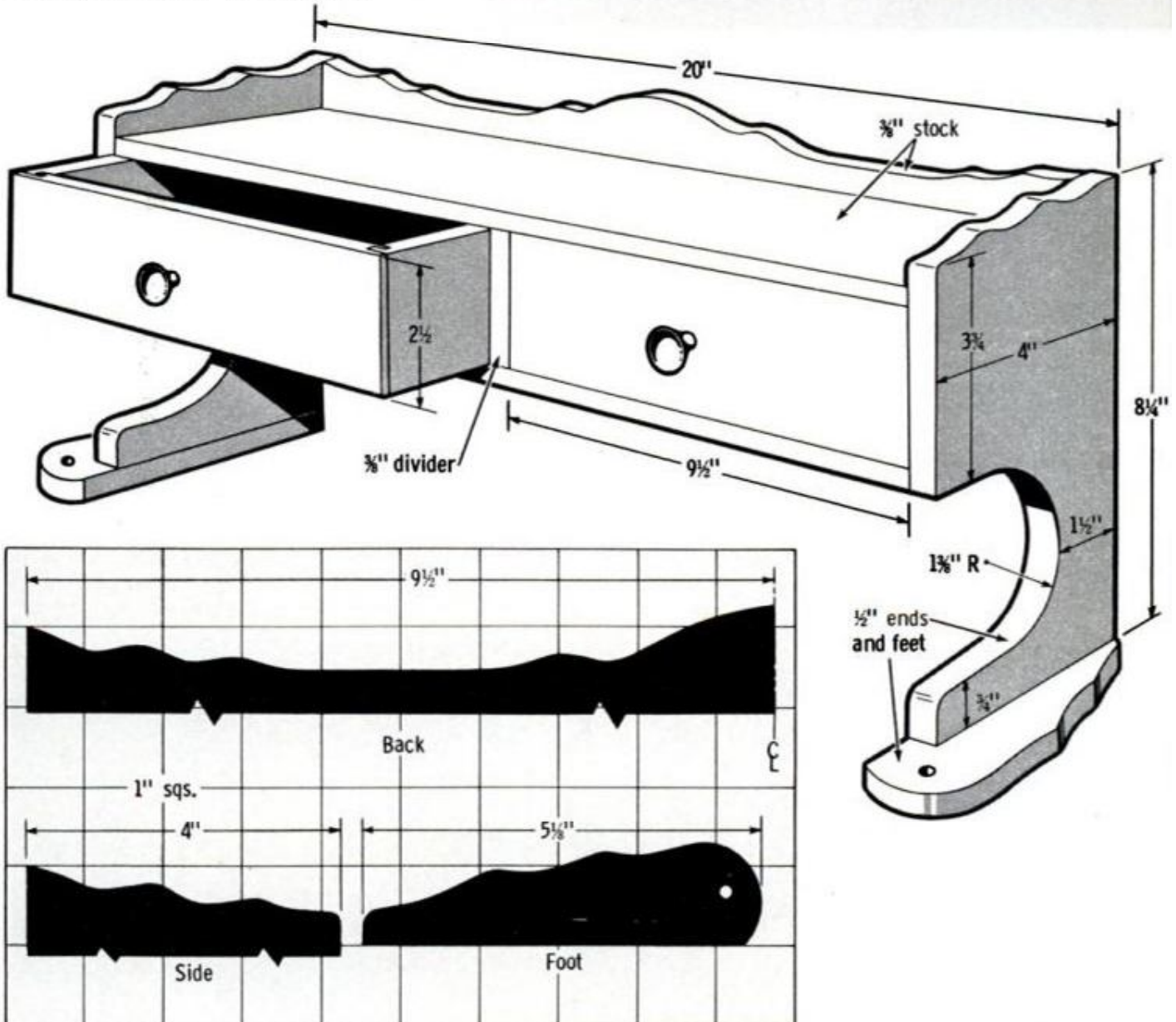
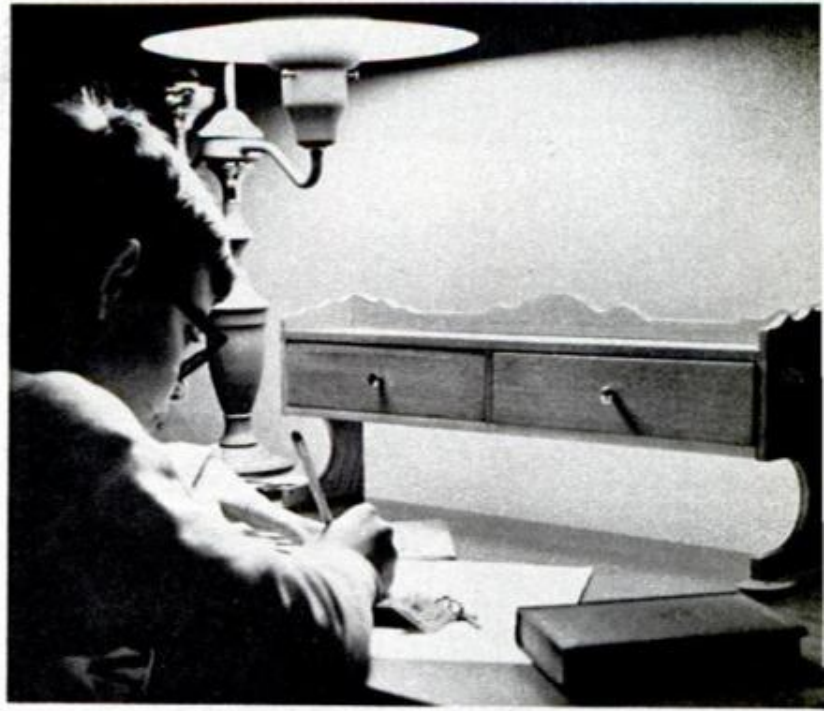
(Please turn to page 192)

Make This Piggyback Drawer Shelf

THIS GOOD-LOOKING SHELF unit can turn any table or counter-top into a desk. It offers enough drawer space to hold pencils, stamps and unanswered correspondence, plus all the other home office materials which would otherwise end up in a kitchen drawer.

The shelf shown here was made from mahogany, using pieces so small they were almost scrap size. However, any other solid wood would be just as satisfactory.

Cut the side panels first. Then glue the top and bottom pieces to these to form the drawer opening. Make the drawers to fit the openings, add the ornamental backboard behind the top shelf and finish to suit your taste.—*Don Shiner*





ICE-CUBE BIN under lift-out tray holds a goodly supply. Bin is stocked from the kitchen refrigerator



BUILD YOURSELF A SODA FOUNTAIN

It's fun to make your own carbonated beverages at home—a lot cheaper, too

By WAYNE C. LECKEY, Home and Shop Editor

Photos by Robert Borst

OVER A PERIOD OF TIME three drinks for the price of one add up to a sizable saving for the average soda-drinking family.

If you're plunking down \$7.20 every week for two cases of soda (48 12-oz. cans), you stand to save up to \$4.89 when you whip up your own carbonated beverages.

At \$3 a gallon for standard fountain syrups, an ounce costs 2½ cents. One ounce of syrup when mixed with five ounces of carbonated water, makes a standard 6-ounce drink which will cost as much as 15 cents at a store.

Figuring everything, the cost of the syrup, the carbonated water and the electricity to run your fountain, home sodas can be made for as little as three-fifths of a cent per ounce. This means that the 576 ounces of soda which cost you \$7.20, can be made for \$3.46.

At this rate a home soda fountain soon pays for itself and makes what might be considered a sheer luxury, an item that's as economical to own and operate as a kitchen refrigerator.

The convenience of a home soda fountain cannot be overlooked. For one thing it's extra handy and even fun to use, and

the fact that you can forget about the return of bottles and the disposal of cans, as well as the chore of lugging them home from the store, makes for a lot less bother.

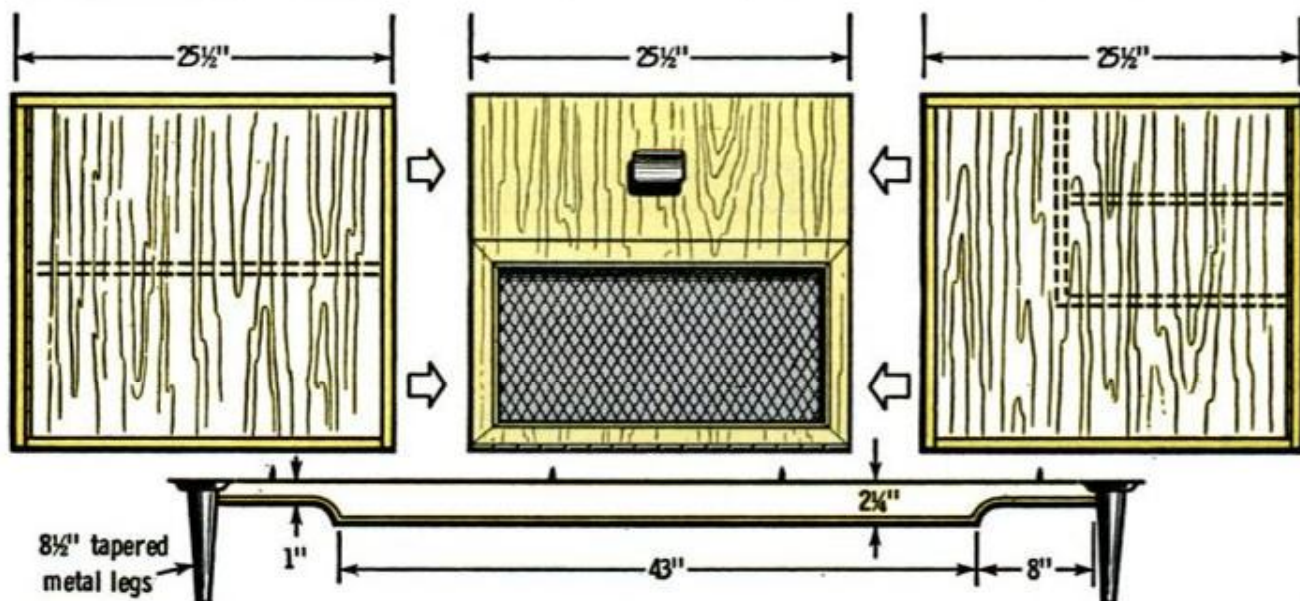
To make yourself a drink you first place a couple of ice cubes in a glass and add a couple of squirts of the desired syrup. Then you fill the glass with carbonated water and stir. It's as simple as that.

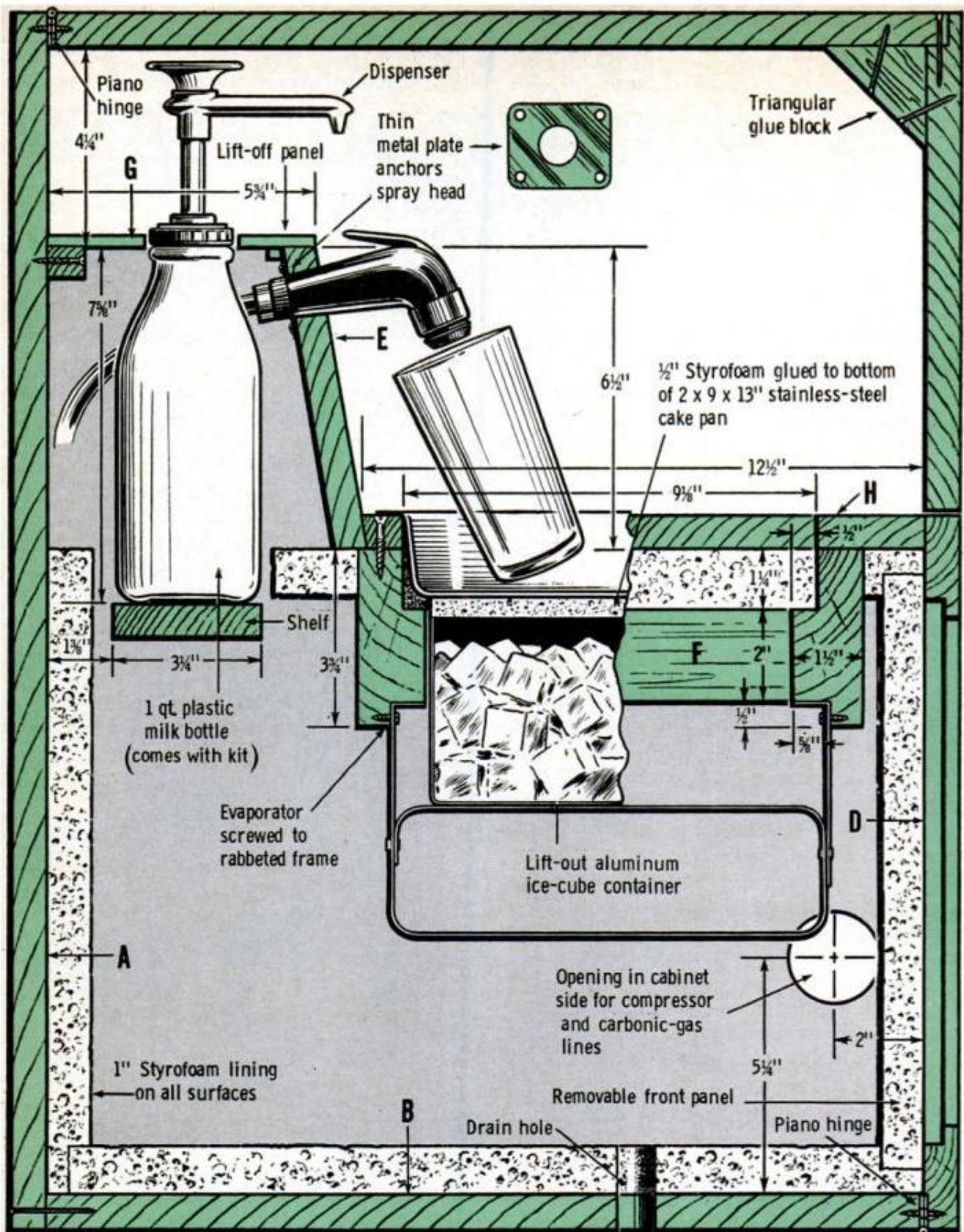
Components of the kit I used include:

- A refrigeration system consisting of a



LEFT-HAND CABINET with adjustable shelf provides handy storage for bulk syrup stock, glasses, napkins, other items. Rod on door keeps towel handy. Roomy cabinet will also serve as liquor cellarette





Technical Art by Fred Wolff

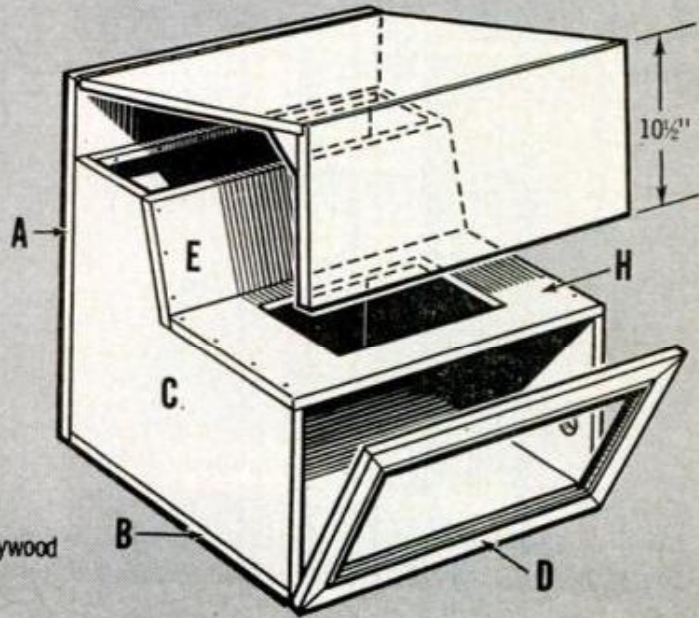
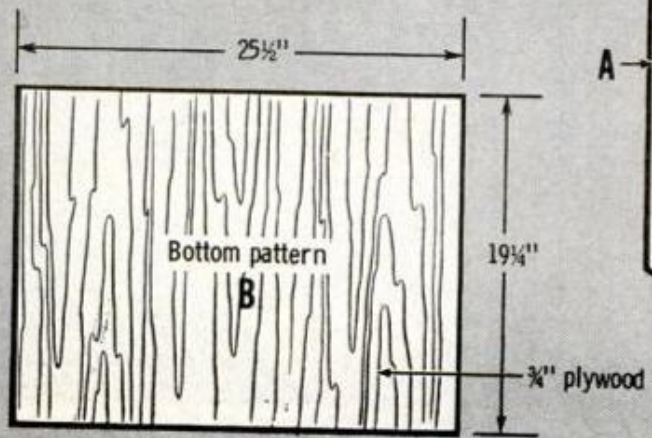
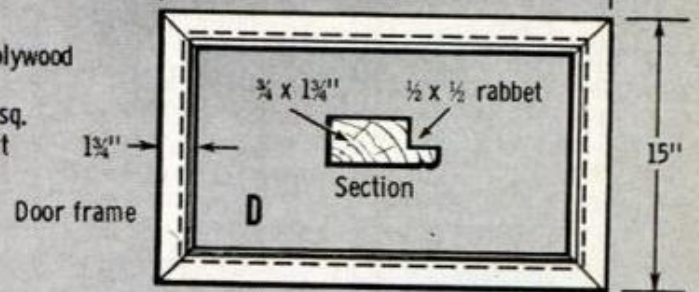
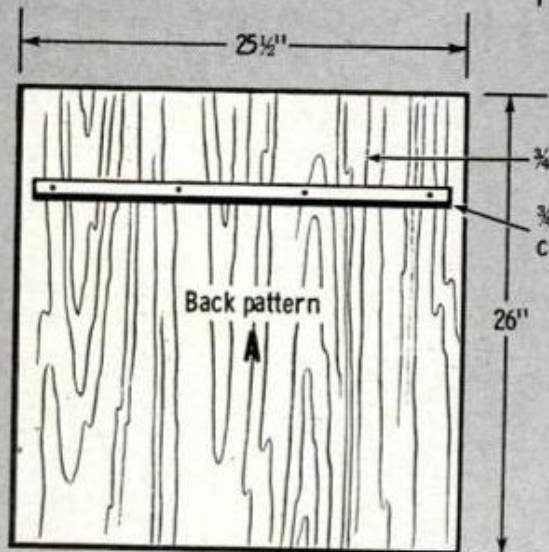
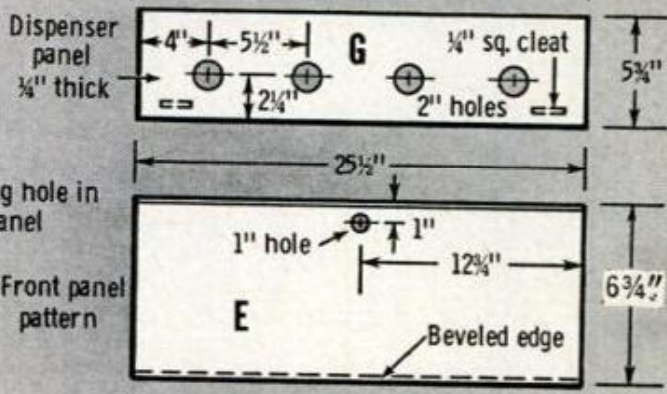
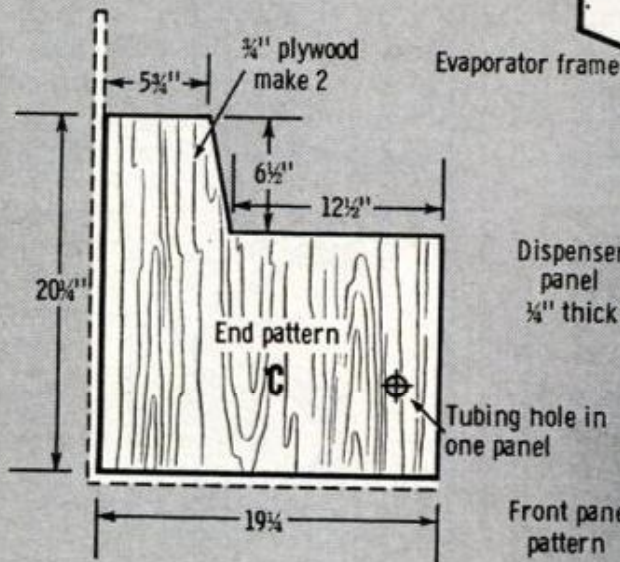
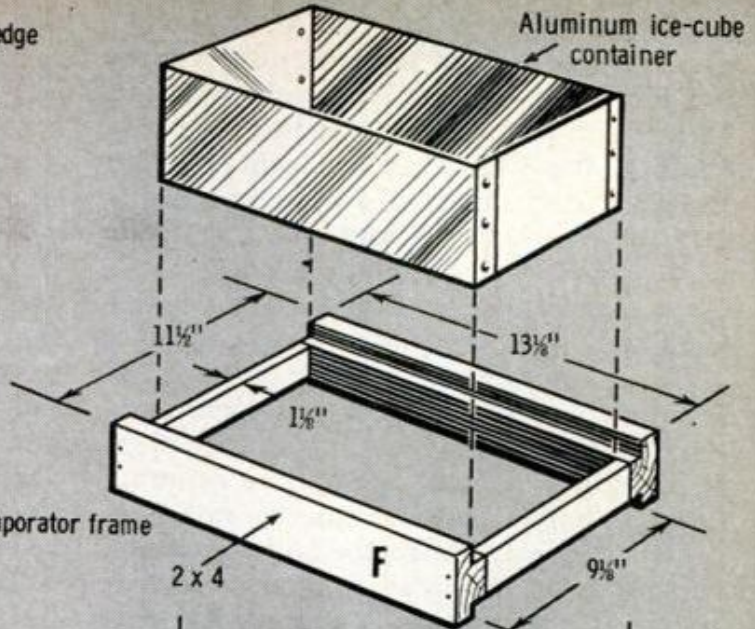
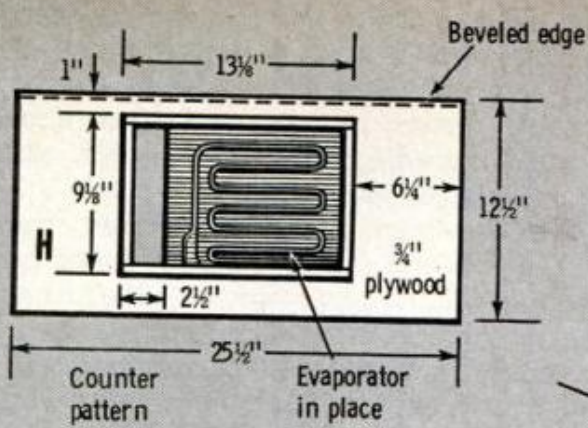
$\frac{1}{12}$ -hp fan-cooled compressor and condenser with a precharged evaporator and temperature control.

- A carbonating circuit consisting of a $\frac{1}{4}$ -hp carbonator and pump, stainless-steel carbonating tank, cold bank, faucet, four 1-qt. syrup dispensers, CO_2 valve and gauge, hoses and necessary connectors.

A common stainless-steel cake pan (Sears) serves as a tray to catch the drips,

and the 10-lb. tank of liquid CO_2 which is required to carbonate the water, is obtained locally from any welding-equipment firm. A 10-lb. tank will make about 2400 drinks before it needs recharging. A refill costs about 40 cents per pound.

You don't have to stick to any one cabinet design for your soda fountain, and it can be as simple or fancy as you wish. In fact, if you already have a bar in your



basement recreation room, the components can be installed in it. Your cabinet also can be designed to house all the components in a single compact unit, or it can be made in such a way that the compressor and the CO₂ tank are remote from the soda fountain itself. I brought a separate water line to the fountain, but if this poses a problem, the fountain will work with a hose leading to a separate water container, such as a plastic jerry can.

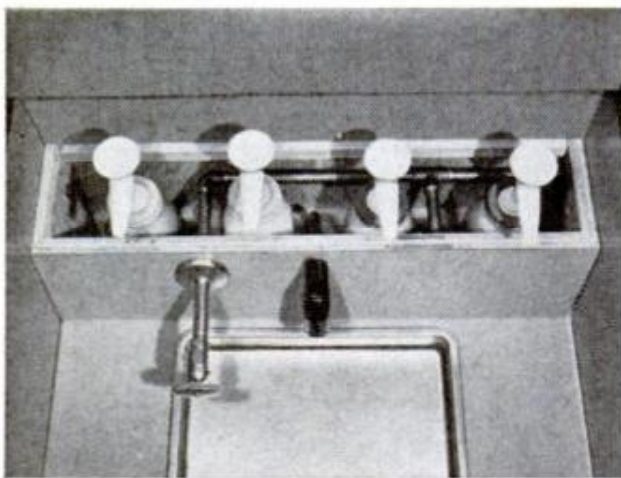
The cabinet shown in color on page 138 is a good example of how your soda fountain can be made to look like a fancy piece of furniture. It consists of three separate cabinets bolted together side by side. The center one is actually the soda fountain, which has an insulated compartment that houses the evaporator, cold bank, carbon-

ator unit and syrup dispensers. The flanking right-hand cabinet houses the compressor and the CO₂ tank, while the left-hand cabinet provides storage for bulk syrups, glasses, napkins and other items. Your flavored syrups can be cola, wild cherry, ginger ale or others.

A 4-in.-deep container formed from DIY aluminum sits in the evaporator and holds a goodly supply of ice cubes under the lift-out drip tray. It's kept filled with ice cubes from the kitchen refrigerator.

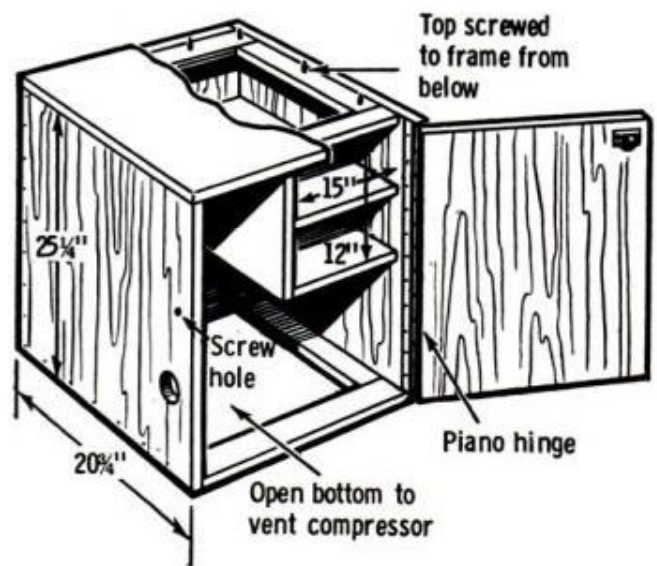
The carbonator pump runs only when you are dispensing sodas. You can draw about three drinks from the tank before the pump turns on. It takes less than 10 seconds to refill; then the pump shuts off.

The four syrup dispensers are refilled by lifting cover G up over the tops and

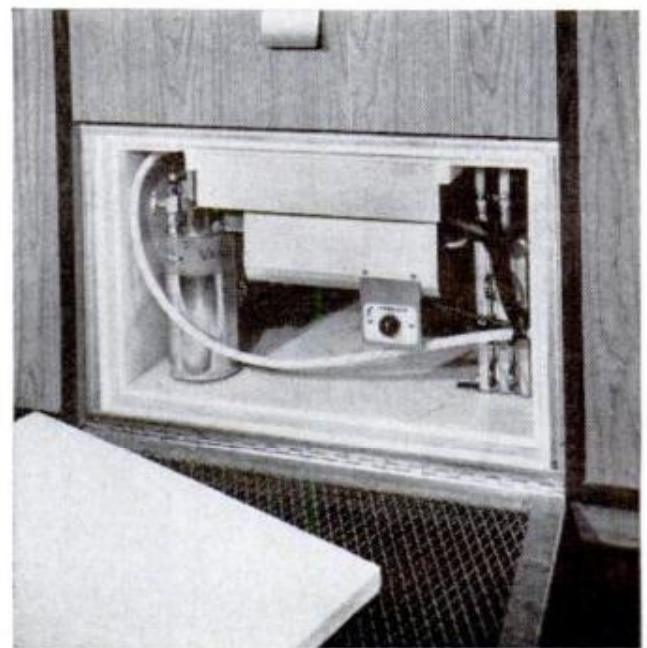


SYRUP DISPENSERS are removed for refilling by lifting off the cover and then lifting out bottles. The extra faucet for plain water is an optional feature

RIGHT-HAND CABINET houses compressor and CO₂ tank. Tank gauge should read 120 lbs. pressure. Shelves over compressor provide more glass storage



INTERIOR VIEW of refrigerator compartment shows placement of carbonator unit, evaporator, temperature control and cold bank. Note Styrofoam panel



lifting out the plastic bottles which sit in a row on a narrow shelf.

The kind of wood for your cabinet is up to you. I used fir plywood and covered the front and ends with 1/4-in. prefinished paneling because I wanted the cabinet to match the wall. I faced the top and inside with a slick plastic laminate. You may prefer to cover the whole thing with plastic laminate. Then again you may prefer to use nothing but hardwood-faced plywood for the exposed parts and tape the edges. Whatever wood you choose, the area around the dispensers and tray should be covered with plastic laminate.

If you decide to copy the very cabinet I made, start with the center unit. Cut the parts from 3/4-in. plywood, following the dimensions given. The two sides, parts C, are identical except for the 2-in. hole which is made only in the right-hand member. Cut the opening for the cake pan in part H, and bore the hole in part E for the special faucet. Now, nail and glue the six parts together.

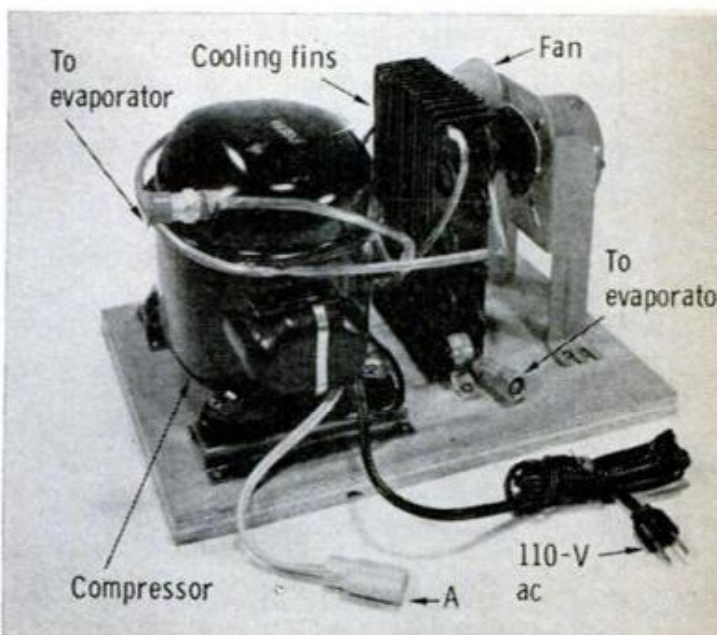
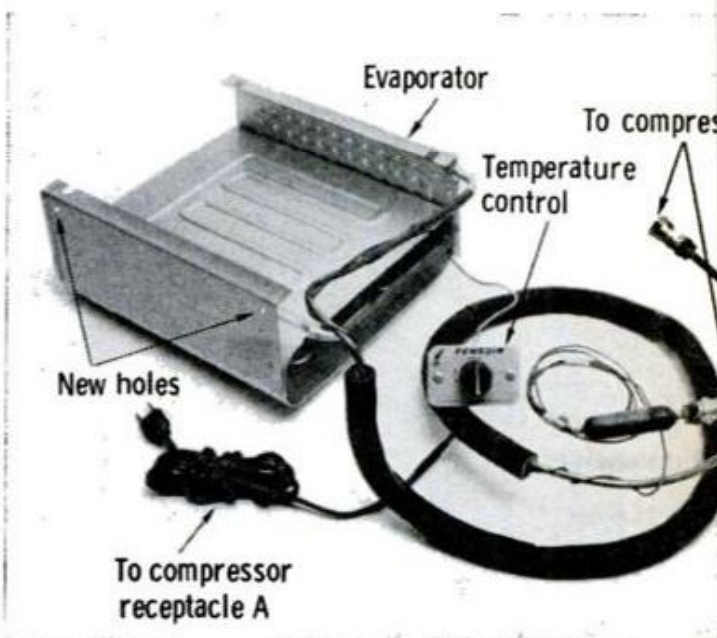
The two pieces which form the lid are joined at the front in a rabbet and then reinforced on the inside with a husky triangular cleat. You'll do best to wait until the three cabinets are bolted together before making and fitting the lid since it must have 1/16-in. clearance along each side so it will open without rubbing. The lid projects 3/4 in. at the front and rests on the edge of the tip-out access door to the refrigerator compartment. A long desk-lid support holds the lid open.

The door, part D, is mitered like a picture frame, hinged along the bottom and fitted with a decorative cloth-backed wire grille. It's kept closed by a screw inserted through a hole in each adjoining cabinet and turned into the door's edge. It's best to wait until later to add the door.

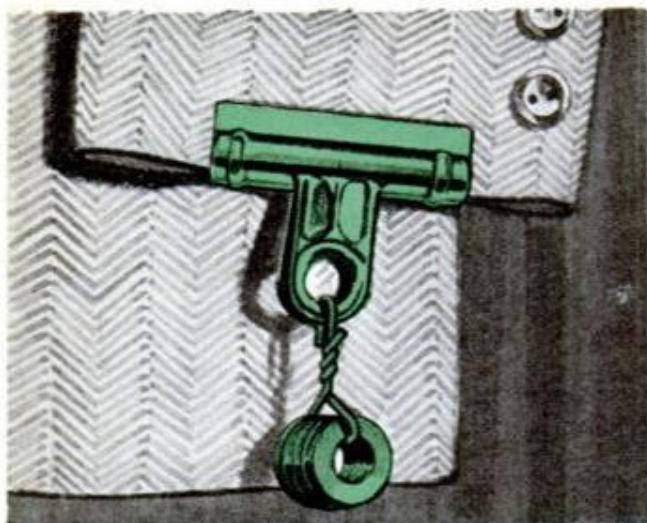
Both right and left-hand flanking cabinets are simple boxlike assemblies, made alike except for the bottom of the right-hand one. This is merely an open frame to provide adequate ventilation for the compressor. The other cabinet has a solid bottom. A 2-in. hole is also made in the side of this cabinet to align with the hole made previously in the center cabinet. The doors are made to swing right and left on piano hinges. If you face the doors with plastic laminate, remember that both sides must be covered to equalize stress

(Please turn to page 190)

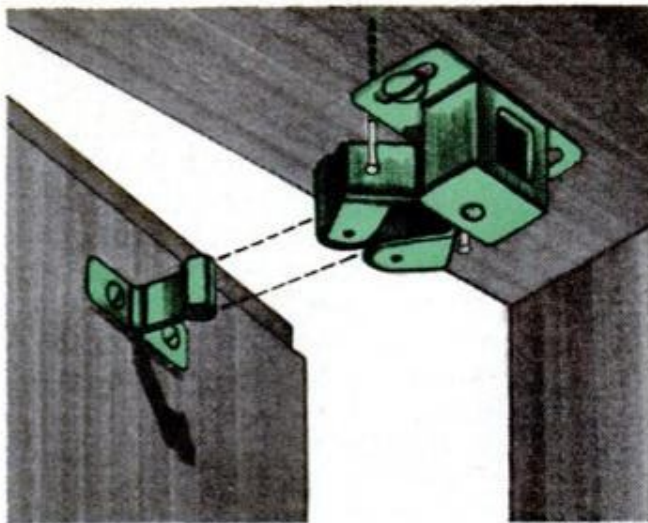
Refrigeration System of Kit



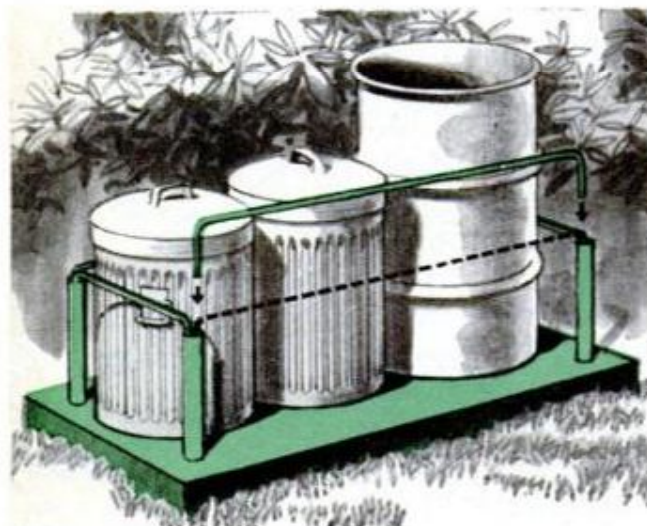
Solving home problems



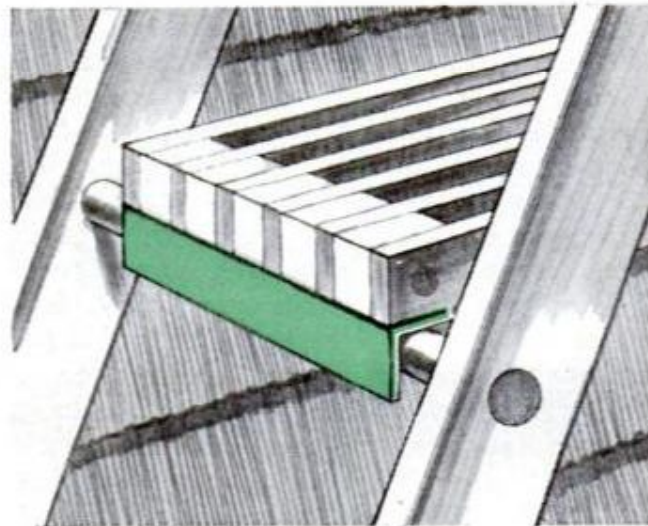
CUFF CLAMPS with suspended weights will keep your coat sleeves hanging straight and wrinklefree. Wire a few washers to one side of a large paper clamp and it's ready to use. Make a pair for each of your jackets



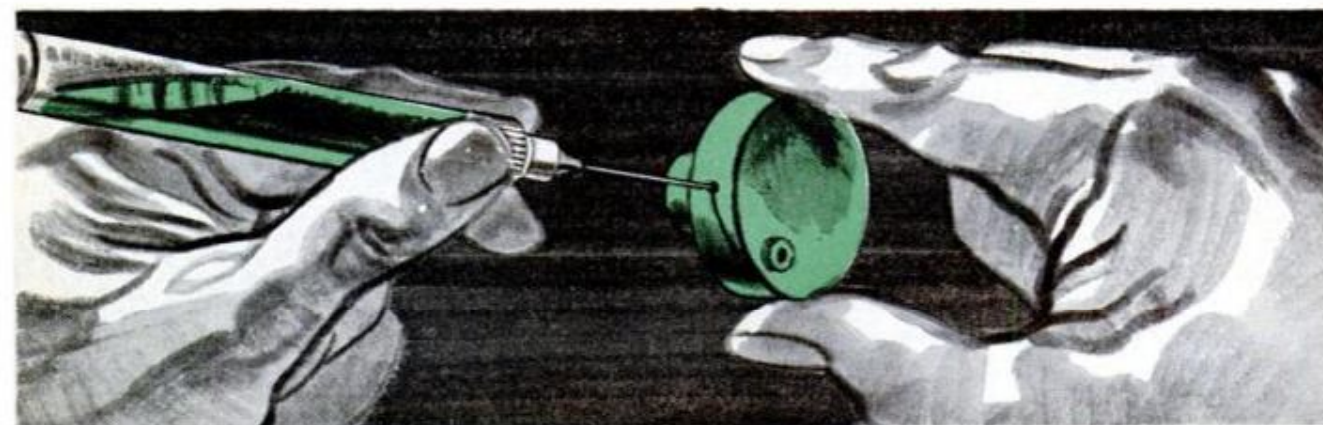
BACKUP POWER for a double-roller cabinet catch will hold the door closed even though it is warped. Drive a pair of 4d finishing nails where the rollers have to dig into them slightly to release the catch



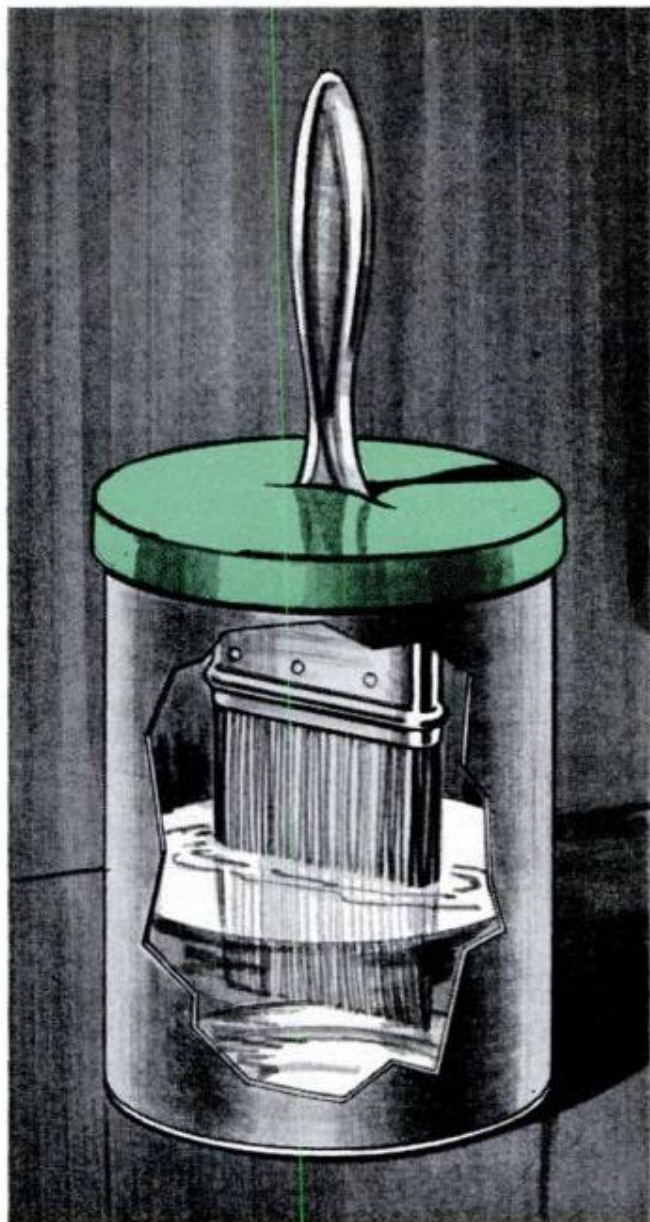
ONE SURE WAY to prevent stray dogs from tipping over your garbage cans is to pour a slab base with lengths of 1½-in. pipe set near the corners, then bend lift-out steel rods to fit into the pipes



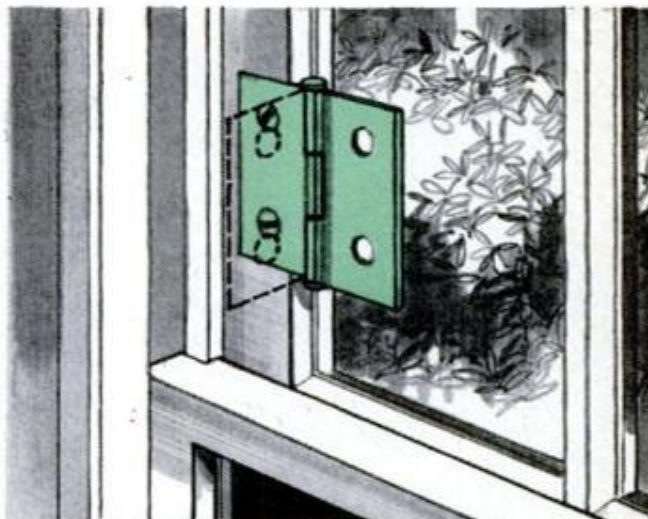
SAFETY BRACKET to prevent your scaffold from slipping off the rungs of a ladder is just a piece of angle iron mounted on the bottom edge of the scaffold. Install one under each end of the scaffold



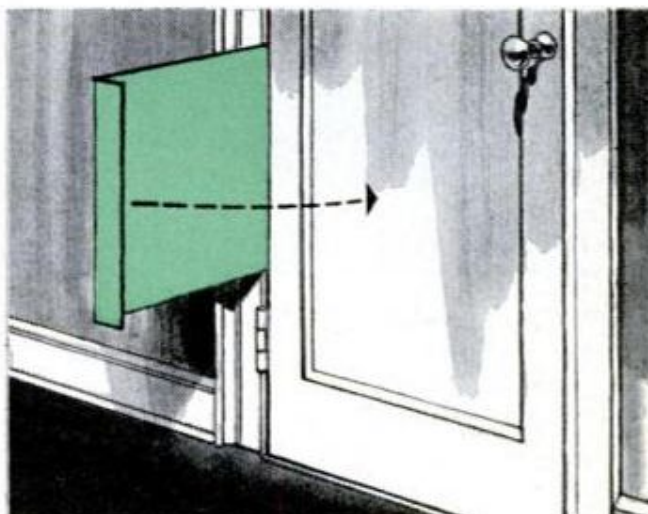
ELECTRIC CLOCK MOTORS which are permanently sealed can often be restarted when they have stopped if you drill a ¼-in. hole in the position indicated above and squirt in a little light oil with a syringe



SIMPLE BRUSH KEEPER can be made by cutting a slit in the plastic lid from a 2-lb. coffee can and pushing the brush handle up through the slit so that the bristle portion will be suspended in the solvent



WINDOW STOP makes it impossible to raise the lower sash beyond a certain height. Determine the desired limit and mount a butt hinge on the upper sash, as shown. Swing the hinge leaf out 90° to lock window



WHEN YOU HAVE TO BEND a piece of light sheet metal and don't have access to a sheet-metal brake, try using the door jamb on a basement or garage door. This will produce a neat right-angle bend every time



IF YOU HAVE a goldfish pond, you can easily make a floating fish house to provide shade protection by cutting a lightweight plastic wastebasket in half lengthwise and attaching the halves at the flanges

A Triple-Screen

By CARL FISCHER



ONE BIG ADVANTAGE of this low-cost sorter is that it lets you dig and screen large amounts of promising material instead of just scratching the surface

KEEPERS GATHER at the lower ends of screens along with the debris. Once you've picked them out, slide screen back into place and shovel on more material



WHETHER YOU'RE AN OLD HAND or an enthusiastic beginner, this easy-to-make sorter is bound to make your rock-hunting field trips more rewarding. Using gravity alone, it separates the gemstones from their overburden and grades them according to size. The whole thing weighs only 30 lbs. and disassembles easily for transportation to your collecting area.

To keep the weight down, use white pine for the 2x2 corner posts. Nail the 1x2 screen runners on the inside of each pair of posts, locating them according to the dimensions given in the detail at right. Add a 1/4 x 1-in. batten to the outside of each runner, elevating it about 1/2 in. above the upper edge of the 1x2 to form a guard rail for the screen.

The screen frames are made of 1x2 white pine and assembled with two 1 1/2-in. No. 8 wood screws at each corner. Mesh sizes listed on the plan are suitable for most gem collecting areas. Tack the screens to the bottoms of the frames. To keep the screens from sagging, it's a good idea to reinforce them with lengths of galvanized wire. Just stretch three evenly spaced strands lengthwise under each screen and three strands crosswise. Tack these to the bottom of the frame, then nail battens over all these screen fastenings so the screens will slide smoothly.

The 1/4-in. marine plywood back should be mounted flush with the tops of the rear corner posts. This will allow a little ground clearance, making it easier to use the sorter on an uneven surface.

To assemble the unit, you'll need ten 1/4-in. carriage bolts, six 2 1/2 in. long for the rear and four 3 in. long for the front. Use washers and wingnuts with all these assembly bolts. Cut the 1x2 front crossbars and mount the pivoting screen locks on them, then drill holes for the assembly bolts and the sorter is completed. If you plan on using it in water, such as working a stream bed, it's advisable to give the unit a couple of coats of paint.

There are no special tricks involved in using the sorter. The inclined screens feed one into the other, classifying the gravels almost as fast as you can shovel them.

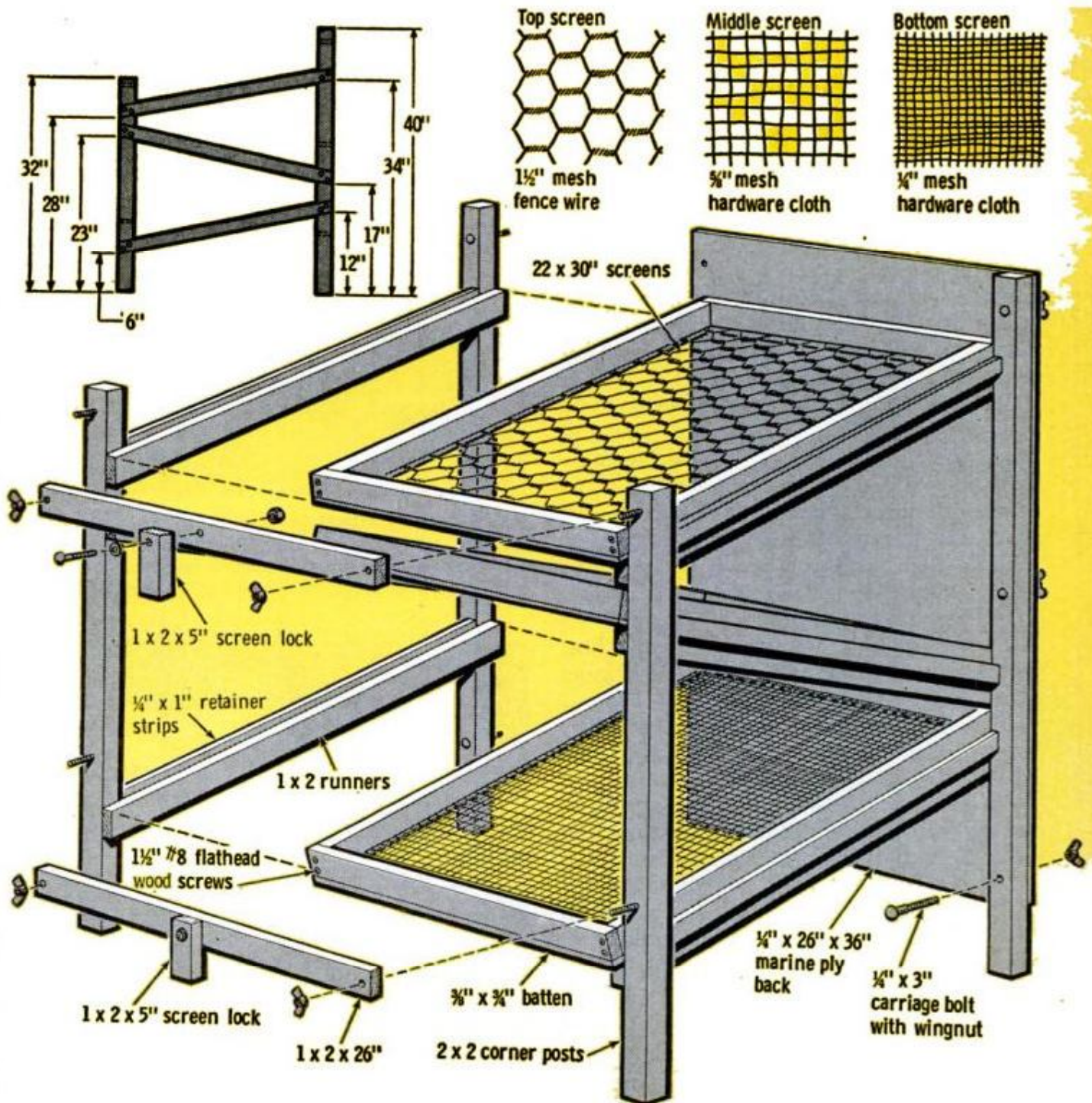
Sorter for Rockhounds

Stones will gather at the lower ends of the screens where you can inspect them at a glance, lifting out the "keepers" and discarding the debris.

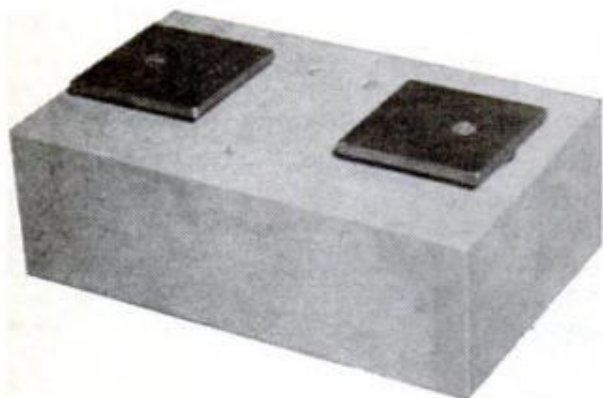
The screens slide out easily and may be shuttled back and forth rapidly to dislodge stubborn sand and clay from your specimens. The sorter has no trouble handling wet material from stream bottoms, but it's wise to add an occasional

pail of water to accelerate the separation.

The biggest advantage of this sorter is that it lets you screen large masses of material, digging down instead of just searching the surface. The more material you can inspect from a likely area, the more stones of gem quality you are likely to find. And as any rockhound will tell you, that's what the whole thing is all about. ★★★



Magnetic Vise For Your Drill Press



WHEN WORKING WITH a drill press, you'll often find it necessary to drill holes in irregular-shaped pieces of iron or steel which are almost impossible to hold in the drill-press vise. Here's where a magnetic workholder comes in handy.

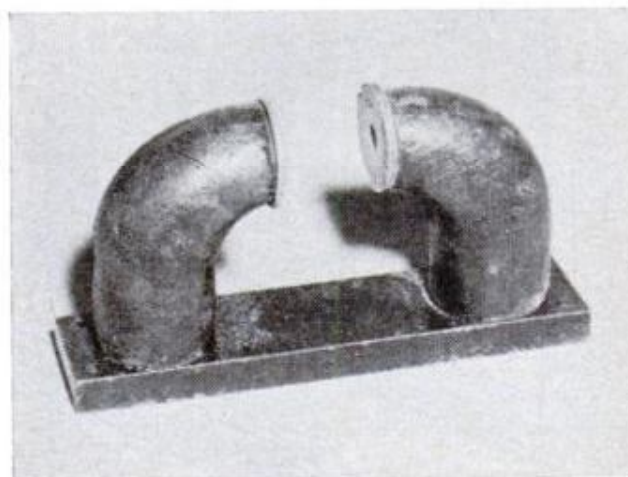
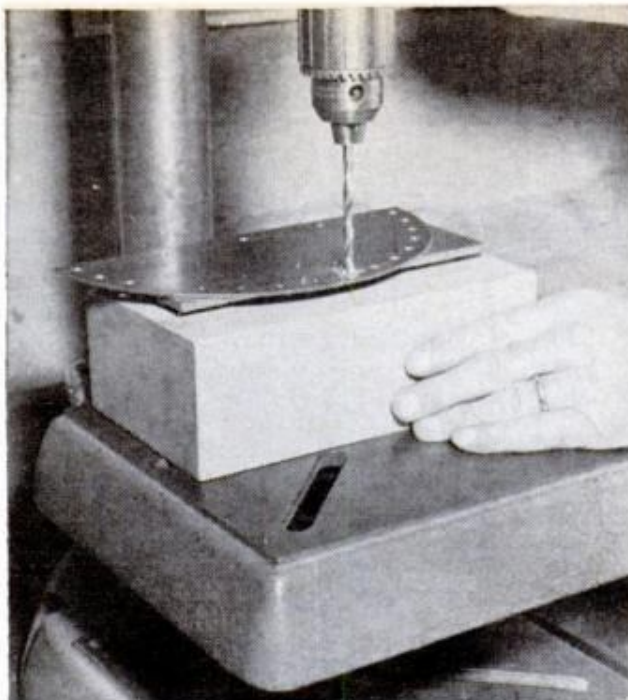
The magnetic holding device detailed here makes use of a magnetron permanent magnet. Originally used with vacuum tubes in radar circuits, these magnets are now available from dealers in surplus electronic equipment.

In its original form, the magnet has two sections attached to a steel bar. The first thing to do is to separate these three components by digging out the sealing compound in the underside of the base and removing the two setscrews thus revealed. The two sections of magnet can now be attached to each other with a 1-in. length of $\frac{1}{4}$ -20 threaded rod. A piece cut from a cap or machine screw will work fine, but make sure that the two poles are level with each other.

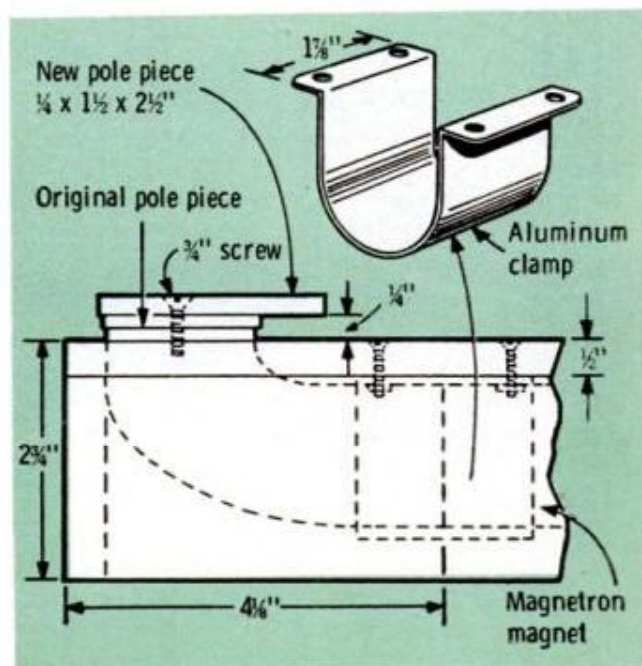
The next step is to make a box base from $\frac{1}{2}$ -in. plywood, following the plan at right. Paint the box to protect the wood from cutting oil, then install the magnet inside with an aluminum U-clamp and four 6-32 flathead screws and nuts.

To increase the pole area, remove the flathead screws in the poles and mount two $2\frac{1}{2}$ -in.-sq. pieces of $\frac{3}{16}$ -in. mild steel on top of the original poles, using longer screws as required.

When using this device, exert only moderate pressure on the drill and make sure the work is in full contact with the poles. Remove the work by sliding it off the poles.—Harold P. Strand



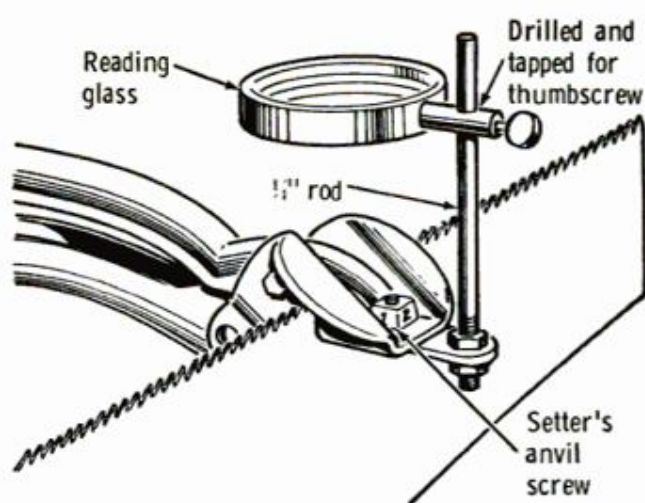
MAGNETRON MAGNET in its original form, above, has two poles mounted on a bar base. In order to make the hold-down, poles must be removed and attached to each other, then installed in plywood box



HINTS FROM READERS

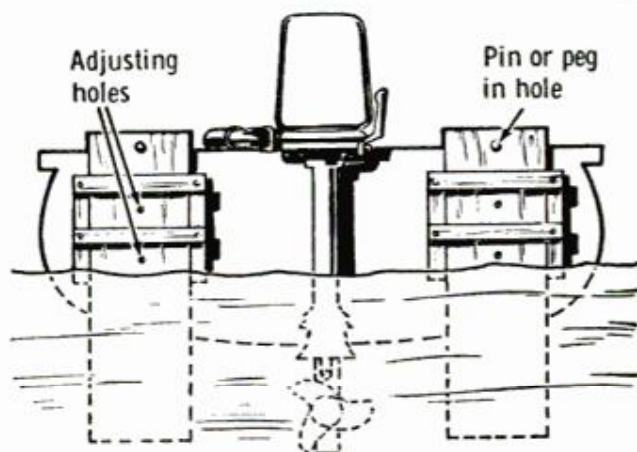
Magnifying glass for saw setter

Attaching a magnifying glass to your handsaw setter will make it much easier to set a fine-tooth saw after sharpening. Use a threaded rod, a pair of nuts and a bicycle-chain link to mount the glass on the setter. Cut, drill and tap the handle of the glass so that it will be centered over the teeth when adjusted on the rod.



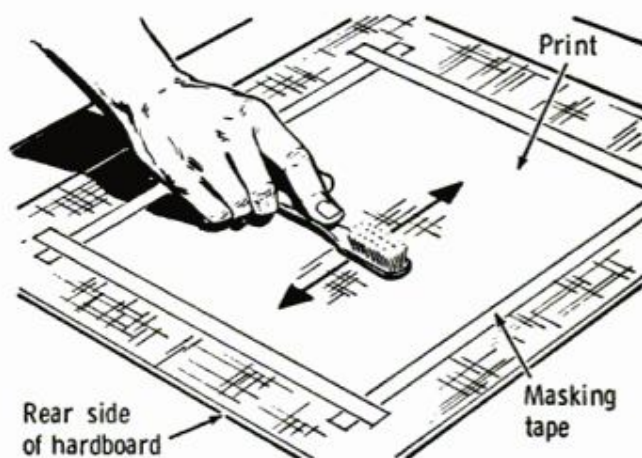
Spoiler boards permit slow trolling

A pair of sliding boards mounted in brackets on the transom of your fishing boat will let you run the motor at a higher rpm without increasing boat speed. Pegs which fit into holes in the boards permit you to set the depth and drag. Higher rpm helps to eliminate plug fouling, but the spoilers can also be used for ultra-slow trolling with a motor that throttles down efficiently.—*Harvey Shepardson*



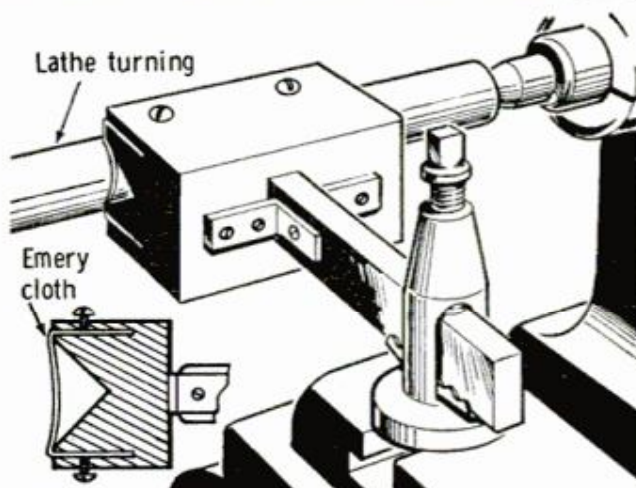
Make color prints look like paintings

It's easy to give a color print the canvaslike texture of a painting. Simply tape the print face down on the back of a piece of tempered hardboard, being careful to stretch it smooth. Then use the rounded back of a toothbrush to rub over the entire surface of the print. This will emboss the texture of the hardboard on the paper, making it look surprisingly like an oil painting.—*Alexander Valentine*



Polishing accessory for your lathe

By making use of your lathe's carriage and a simple emery-cloth holder, you can guarantee a smooth, even polish on long finished turnings. The holder is just a grooved hardwood block with a mounting bar designed to fit in the tool post. The emery cloth fits into slots cut on either side of the V-groove and is clamped in place with four screws, two on each side. Set the block so that the emery cloth is in contact with the turning and you're ready to go.—*Peter Legon*



Ten Tips on Getting More

Outdoor temperature

Make sure your equipment is large enough to do the job. An air conditioner should have sufficient capacity to maintain the space to be cooled at a temperature of 75° and 50 percent relative humidity during the hottest days of the summer. Give or take a few degrees or percentage points, that's the level at which most people are most comfortable.

This means that you would need a larger unit in Phoenix than you would for the same space in Chicago, since the hotter climate would require an additional 10° or so of cooling capacity. Many people make the mistake of buying a unit which will cool the air by about 20°, forgetting that indoor cooling is directly related to the temperature outdoors. For real comfort, the climate has to be considered.

That 'clammy' feeling

Make sure that your equipment isn't too large for the job. An oversized unit is often responsible for the feeling of "clamminess" found in some air-conditioned houses. The problem, of course, is excess humidity. A unit having too large a capacity will lower the temperature of the air quickly. Since the thermostat reads only temperature, it then turns the unit off. While the unit is off, the humidity climbs along with the temperature. Another quick cooling cycle will drop the temperature, but fail to remove enough of accumulated moisture from the air. With each cycle, this condition becomes worse, until the air inside becomes muggy. You may actually be perspiring, though the air temperature is reasonably low.

A unit of the proper capacity will remain on long enough to lower the humidity to the desired level. During a heat wave, it may have to run almost constantly in order to control both temperature and humidity. But don't worry about the operating cost, since this relates more to the total heat removed than to the compressor operating time.

Storm windows

Leave your storm windows on throughout the summer. They can reduce the amount of heat entry through window glass in the same way they reduce heat loss in winter. This will mean less heat load for the air conditioner and result in lower operating cost. Sometimes, in fact, this little trick may make it possible to use a smaller air conditioner. One man we know saved nearly 15 percent on the cost of a central system by having his contractor refigure the cooling requirements based on the use of storm windows in summer.

Hands off that thermostat

Don't be a thermostat fiddler. This is especially important if you have central air conditioning. When you leave the house, don't turn the air conditioning off, figuring you'll turn it back on when you return. When you do this, the unit must work overtime to cool down the house once you turn it back on again. Leave it at the same setting and you'll not only save money but have a cool, comfortable house waiting for you.

It's even worse to turn off the air conditioner and fling open the windows when the first mild spell hits. Remember that when you turn on your air conditioner for the first time in early summer, the unit cools down the entire house and everything in it—furniture, appliances and rugs, plus 15 or 20 tons of building materials. If you turn the system off at the first sign of a cool spell, the temperature of the whole house will gradually rise again. Then, when the next heat wave hits, the air conditioner has to work overtime to cool everything down again, and this results in increased operating costs.

You'll find that it's efficient—and usually cheaper—to let the thermostat take over the whole job. During a cool spell, it will turn the compressor on just often enough to keep the house temperature under control. When hot weather returns, it will be better able to keep you comfortable.

Out of Your Airconditioner

By A. M. WATKINS

Stored cooling

During a heat wave, lower your thermostat setting two or three degrees before going to bed. This is the only exception to the no-fiddling-with-your-thermostat rule. The purpose is to store extra cooling potential in the furnishings and the building itself. This stored cooling will help to fight off the high tide of heat that arrives the next day, especially during a really bad heat wave. Often, this can mean the difference between a cool house and the discomfort that results when your equipment doesn't have quite the capacity to fight off the soaring heat.

Use the same principle to prepare for a party. Extra people will put an extra load on your cooling system, so turn down the thermostat a few hours before your guests are scheduled to arrive. This head start will help your airconditioner cope with the increased load.

Insulation aids

Reduce heat buildup inside your house. Obviously, the more you can cut down on heat inside the house, the lighter the airconditioning load. The roof is usually the biggest single source of heat entry because of the sun boiling down on it all day. Thus, six inches of insulation in the attic floor will probably pay for itself by the heat it keeps out of the living quarters below. Large air vents at each end of the attic (or in the soffit) will allow natural breezes to wash out much of the hot attic air. If this fails to cool it down, try installing an exhaust fan.

Shades good, awnings better

Keep window shades or blinds drawn over the windows directly exposed to the hot sun. This is one of the simplest ways of keeping out heat. However, outside shading devices, such as awning and trees, are about 50 percent better than interior shades in keeping heat out of a house. Remember this when landscaping.

Kitchen vent

Use a kitchen exhaust fan. Turn it on at times when the stove is being used. This will prevent the heat from spreading throughout the house and loading down your airconditioning system unnecessarily. The best location for a kitchen exhaust fan is in the ceiling directly over the range, and the next best is in the wall above the range. Any other location will usually cut down on the fan's efficiency in getting rid of cooking heat.

Spring warm-up

With central airconditioning, turn on the electricity one or two days before you start up the equipment in the spring. Today, nearly all central units have electric coils to warm the compressor. Switching on the electricity early will give the unit a chance to warm up before you use it. This not only avoids excessive wear, but assures you of top operating efficiency right from the start.

Room conditioners

Know how you can "stretch" a room airconditioner. You can't turn it into a central system, but you can take advantage of its full capacity. Be sure to adjust the air outlet vanes so that cool air isn't being short-circuited back to the intake. If you have a warm-air heating system, close off all hot-air registers and cool-air return ducts in the room where you're using the airconditioner. Otherwise you'll lose cool air through the heating system ducts. Since most room airconditioners have a relatively small capacity, such leaks may make it impossible for the unit to cool even one large room during a hot spell. Finally, it's often possible to cool a whole section of the house with one such unit, particularly if the weather isn't hot enough to require full capacity to cool one room. Use a ventilating fan to help distribute the cool air from one room to another. ★★★



You Can Afford Automatic Lawn Sprinkling

The secret is a building-block approach. Start with a small manual system, then add more pipe, sprinkler heads and automatic controls as you can afford them

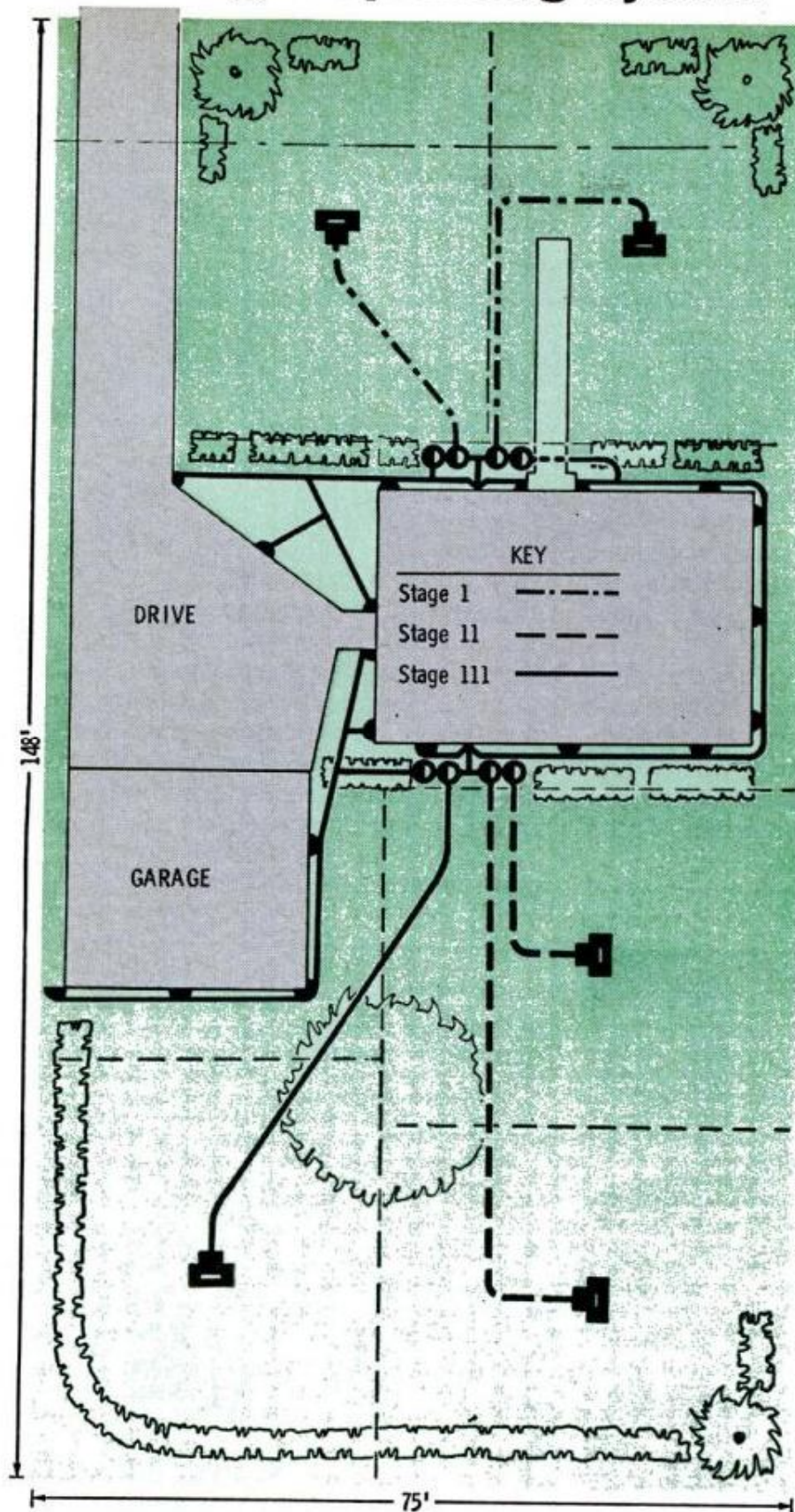
By ARTHUR MIKESELL

NOBODY CAN DENY that automatic sprinkling is a "luxury" for the average homeowner. This simply means that there are less expensive ways of doing the same job. But in an age of color television and 200-hp family cars, just

how much of a luxury is an automatic sprinkling system?

There's a good practical case to be made for automating your lawn sprinkling. For one thing, it protects your landscaping investment. Whether you're at home or

Building a Sprinkling System



STAGE 1. We asked the engineers at Toro to give an example of how a typical sprinkling system could be installed in stages, and here is the result. The first stage covers approximately 2700 sq. ft. and requires two starter kits, each of which sells for \$29.95. This starter kit contains:

- 1—Wave sprinkler
- 1—Combination valve
- 1—Hose faucet adapter
- 40'— $\frac{3}{8}$ " polyethylene pipe
- 25'— $\frac{1}{4}$ " polyethylene control tubing (allowing valve to be opened or closed from remote location)
- 1—Wave adapter fitting (to attach sprinkler to hose and test coverage)

The total cost per square foot is just over 2 cents. If the budget is extremely tight, the second kit could be installed later without disturbing the first installation.

STAGE 2. This addition takes care of most of the rear lawn with coverage of approximately 2800 sq. ft. It was decided to introduce automatic control at the second stage, since the control itself is included in an "automatic" starter kit at a slightly reduced package price. The kit sells for \$99.95 and includes:

- 2—Wave sprinklers
- 2—Combination valves
- 1—4-station controller
- 1—Hose faucet adapter
- 100'— $\frac{3}{8}$ " polyethylene pipe
- 50'— $\frac{1}{4}$ " control tubing

The cost of this back-yard system is approximately the same as that for the front, or about 2 cents per square foot. Adding the automatic control to operate this two-stage system brings the cost of sprinkling both areas up to about 3 cents per square foot.

STAGE 3. Completing the system involves extending coverage to peripheral areas and adding another controller. To do this you'll need another \$29.95 starter kit, an extra 200 ft. of pipe (\$25) and a \$159.95 automatic starter kit. This latter kit is for

larger lawn areas and includes:

- 1—4-station controller
- 4—Combination valves
- 20—Pop-up sprinklers
- 200'— $\frac{3}{8}$ " polyethylene pipe
- 150'— $\frac{1}{4}$ " control tubing

Since the area covered is only

2000 sq. ft. or so, the cost per sq. ft. is quite high—11 cents, to be exact. Total cost for the whole lawn comes to \$375, or 5 cents per square foot. To cut down on this expense, however, much of this third stage could be eliminated and sprinkled with ordinary hose

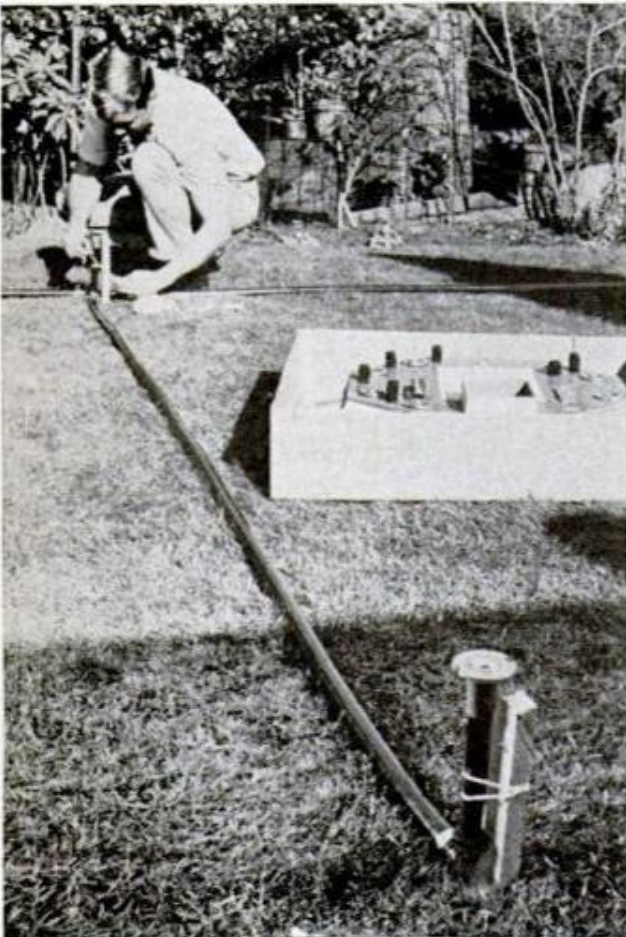


FIRST STEP in installing manual system is to put in a valve ahead of the hose bib and connect it to pipe

away on vacation, the right amount of water is distributed at preset intervals to keep your lawn green and your trees and shrubs healthy.

Also, an automatic system is more efficient. Once adjusted, it always delivers exactly the right amount of water and does this at a gentle rainlike rate which allows for maximum soil absorption. Furthermore, it operates at night when water

TEST SYSTEM by staking risers upright and turning on water. This also softens soil for easier digging

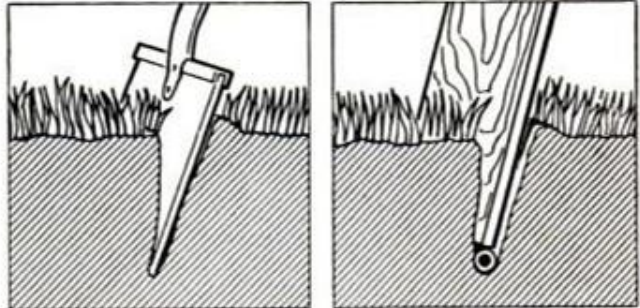


STAKE OUT the position of each sprinkler head, determining the locations from your scale lawn plan

pressures are highest and loss through evaporation is minimal.

The most important reason, of course, is that an automatic sprinkling system takes the work out of watering your lawn. No more keeping track of watering times, wrestling with wet hoses and dragging sprinklers from one spot to another. Instead, you can spend those long hours loafing or working on other more produc-

TORO SUGGESTS opening a slit in ground and pushing pipe down into it with end of wide 1-in. plank



BUCKNER RECOMMENDS digging a wedge-shaped trench, maintaining this makes job easier in long run





LATERAL LINES are attached by means of a T-joint spliced into main line. System shown here is Buckner's

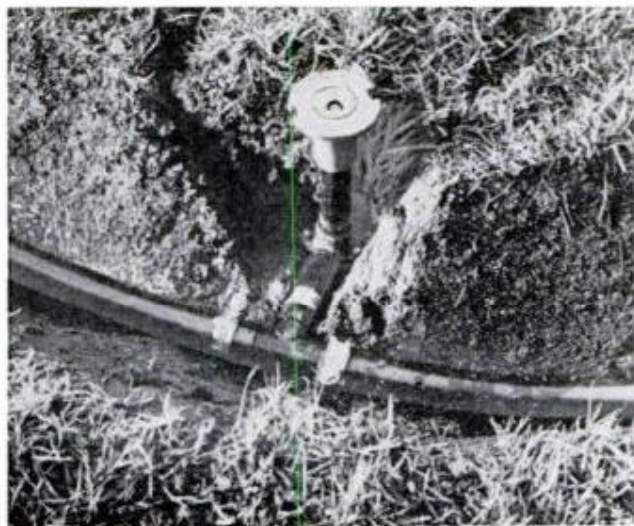
tive lawn-care jobs that can't be automated.

So an automatic underground sprinkling system is a very practical piece of lawn-care equipment. The key question is still, "How much will it cost?"

You can get some idea by going over the system detailed on page 153. The cost of materials for this typical layout is listed next to the plan. A figure not mentioned, however, is the estimated \$240 installation charge you avoid by putting in the system yourself. This "do-it-yourself discount" is the biggest factor in bringing automatic sprinkling within the reach of the average home handyman.

Don't be frightened off if the cost of materials still seems a bit steep for your budget. The most common mistake homeowners make when considering automatic sprinkling is taking an all-or-nothing attitude. They forget that it's possible to

TO BURY SYSTEM, simply slide the pipe into trench then replace wedges of sod and tamp them down



JULY 1968



SPECIAL TOOL cuts hole in pipe at sprinkler head location. Riser is then attached with a saddle clamp

"build" a system over a period of two or three years, an approach that is easy on both the pocketbook and work schedule.

The first stage is a manual underground sprinkling system covering only large lawn areas. This is basically a "bury the hose" idea which gives maximum coverage for minimum money since it requires less plastic pipe and fewer sprinkler heads than the more complicated peripheral runs. For the time being, you can take care of the rest of the lawn by hand watering.

Before you begin the job of installing the first stage, however, you should plan the entire system. This involves plotting the dimensions of your property on graph paper and marking in the outlines of your house, garage, trees, shrubbery, sidewalks, driveways, patio and any other special features which should be taken into consideration. Be sure to indicate the

ONE FINAL TEST after the system has been buried and you're finished. Next step? Automation, of course



155

Sprinkler for Every Problem



and one-quarter circle. Fine for edges, they may be bothered by thick deep grass if set out in the lawn

WAVE SPRINKLERS, exclusive in Toro's Moist O'Matic line, apply water uniformly at two tenths of an inch per hour to rectangular or square areas. With sufficient pressure and flow, they can cover an area up to 50 ft. square. Pattern can be adjusted by either shortening the arc or narrowing the width



POP-UP SPRINKLERS are also designed to be mounted flush with the ground surface, but their nozzles pop up an inch or so whenever the water is turned on and retract when the water is shut off. Patterns are same as those of the stationary sprays

HIGH POP-UP SPRINKLERS are basically the same as regular pop-ups, except that they pop up about twice as high, a desirable difference if you don't like to cut your lawn particularly short. Coverage patterns are same as those named above



ROTARY POP-UP SPRINKLERS distribute the water by swinging a nozzle in a circle. With either gear or cam drive, they're comparatively bulky, but on the other hand, offer the largest coverage (circles up to 100 ft.). Fine for commercial or estate-size lawns

STRIP SPRAYS by Buckner come in single and double-slot models which can sprinkle strips as narrow as 3 ft. Such heads are perfect for narrow areas of lawn adjoining your driveway and the sidewalks if you wish to keep the walk or drive dry while sprinkling lawn. They mount flush with surface



SHRUBBERY SPRAY HEADS designed for more efficient sprinkling of foliage or ground cover are installed on risers in order to bring them up above the level of the surrounding growth. A special flat spray head is also available for use where wind conditions might otherwise be troublesome. Patterns are the same as for stationary sprays

BUBBLER HEADS don't really spray the water so much as they dribble it out. They're special-purpose heads made for the "flooding" of flower beds and other areas where the vegetation to be watered can't withstand a direct spray. Like almost all other sprinkler heads, they have provisions for adjustment of both pressure and flow



locations of outside faucets on this plan.

In order to complete the second planning step—positioning the sprinkler heads on the diagram—you'll need information on your water supply and pressure. This is absolutely necessary, because the coverage of any sprinkler head depends on these facts. High flow pressure means maximum area coverage, low means smaller coverage and thus the necessity for more heads to sprinkle a given area.

The simplest approach is to call your water department and ask about the water pressure and gallons per minute available at your house. Also, find out what size supply line and what size meter you have.

Armed with this information, you're ready to pick out the components for your system. Since it's not recommended that you intermix components from different manufacturers, you'll have to choose one company. Your choice may depend on the type of automatic control, pipe or sprinkler head design. For instance, Toro has a unique wave-type head which sprinkles a rectangular pattern rather than the customary circle. On the other hand, Buckner and Rain Bird offer not only timer-type controls but moisture-sensing controls which turn on the system only when the moisture level of the soil falls below a certain level. While considerably more expensive, this type of control is the ultimate in efficiency.

Once you've decided on a manufacturer, you can begin locating sprinkler heads on your plan. Bear in mind that there are many ways to cut costs in laying out your system. A simple plan in which sprinklers overlap walks and driveways will be much cheaper than a more complex layout designed to keep these dry.

Another possibility is eliminating coverage of odd corners and narrow strips. The cost of including such areas in the system is proportionately much higher than that for large open sections of lawn, and it won't add a great deal of work to water them with a hose.

On the other hand, shrubbery and ornamental plantings can often be included in general lawn coverage, rather than having a separate run with its own special sprinkling heads. This depends on the plantings, so check with your nurseryman before making any decisions.

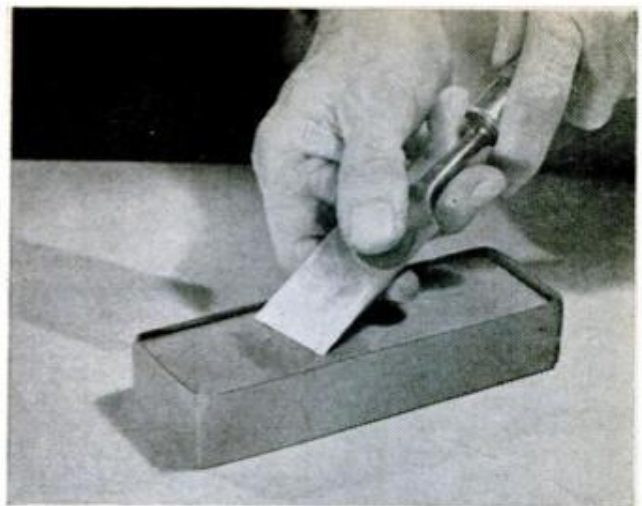
The installation itself turns out to be

(Please turn to page 192)

HINTS FROM READERS

Rubber bumper protects oilstone

An oilstone rattling around loose in your toolbox can easily become chipped or broken. To cushion it, cut a rubber band from an old inner tube, making it slightly wider than the thickness of the stone. When snapped around the stone, this will not only protect it against breakage but also serve as a lip to retain oil or water used in honing tools.



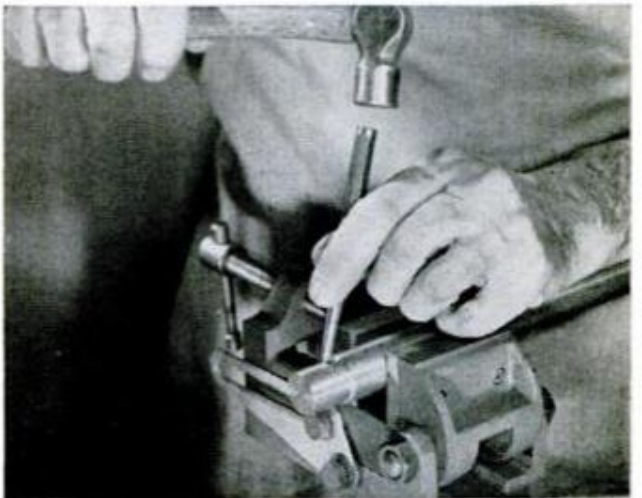
Store small parts in muffin tin

Since a muffin tin is really a series of miniature bins, it's an ideal shop accessory. Keep one handy when dismantling small mechanisms and you can separate the parts as they are removed instead of jumbling them together. Such a tin is also perfect for sorting small nails and screws. You can even turn one into a storage drawer by nailing cleats to the underside of your workbench, spacing them to act as drawer slides for the rolled edges of the tin. Make as many as you need.



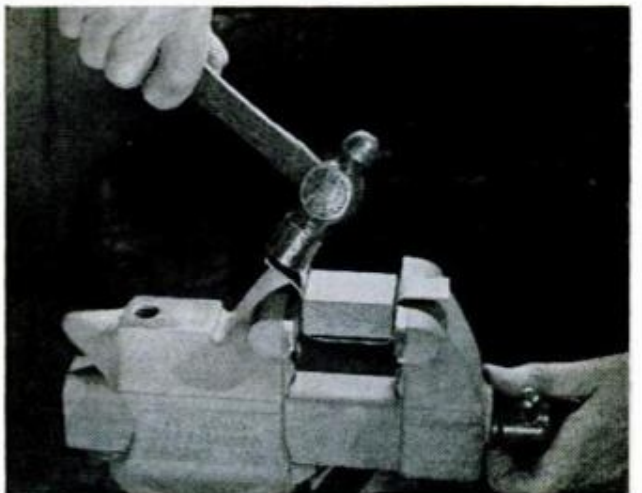
Shaft size increased by peening

When the inner race of a ball or roller bearing wears the shaft down so much that it no longer fits tightly, here's a simple method of increasing the diameter of the shaft. Using a center punch,peen the shaft at closely spaced intervals all the way around. Each tap on the punch causes a bit of metal to protrude out of true round, so repeating the procedure all the way around the shaft has the effect of increasing its diameter. Now you can tap the bearing on tightly.



Making sheet-metal shoulder bends

The simplest way to produce neat, sharp shoulder bends in sheet metal is to clamp the work in a vise around a hardwood spacer block. The block should be set flush with the top of the vise jaws with metal the width of the shoulder protruding above the jaws. Once this is set up, it's easy to tap the shoulder over 90° and produce a clean bend. If the shoulder is longer than the width of the vise jaws, just feed the work through and clamp a new section over the block.



Staple Guns Make a Job Go Thrice As Fast

By JOHN BURROUGHS

ALTHOUGH MANUFACTURERS tag them "spring-type gun tackers," over seven million users call them staple guns.

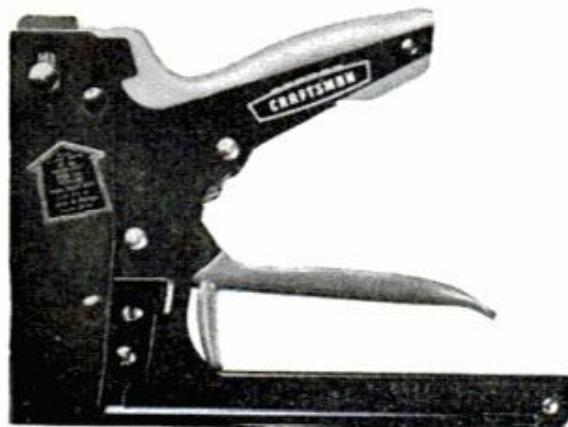
Builders, farmers, upholsterers, cabinetmakers, boat builders and telephone and TV servicemen all use staple guns for fast fastening jobs peculiar to their trade. But the largest group of staple-gun owners is formed by crafty homeowners. A heavy-duty stapler—one using large flat-wire staples—is so handy for so many miscellaneous tacking jobs that the tool is a near-must in a home workshop. There's no easier-to-use, more practical and automatic fastening tool.

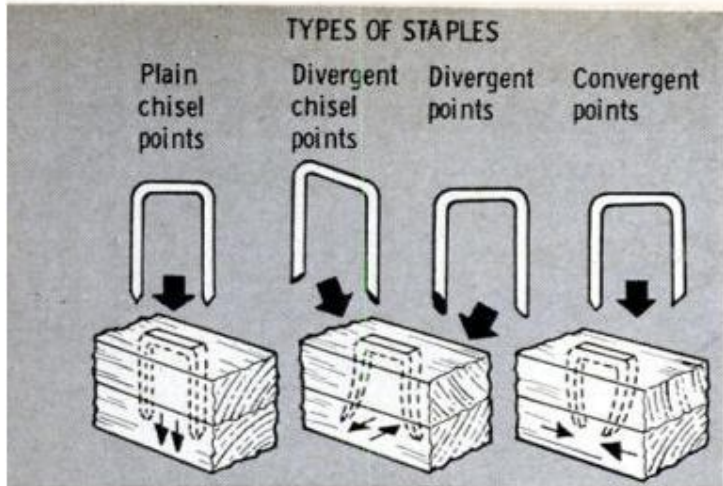
All leading makes of gun have similar mechanisms. Working a handle-lever lifts and then trips a heavily spring-loaded ram that slams down on a staple in the gun's magazine with some 200 lbs. of force. That's more than enough power to force a staple through $\frac{1}{4}$ -in. plywood, sheet aluminum or even through tempered hardboard.

Staples for heavy-duty guns are made of .050-in. steel wire and measure approximately $\frac{1}{2}$ -in. across the flat crown. Since the crown width for some leading makes may vary slightly, it's best to stick with the same brand of staples as the gun.

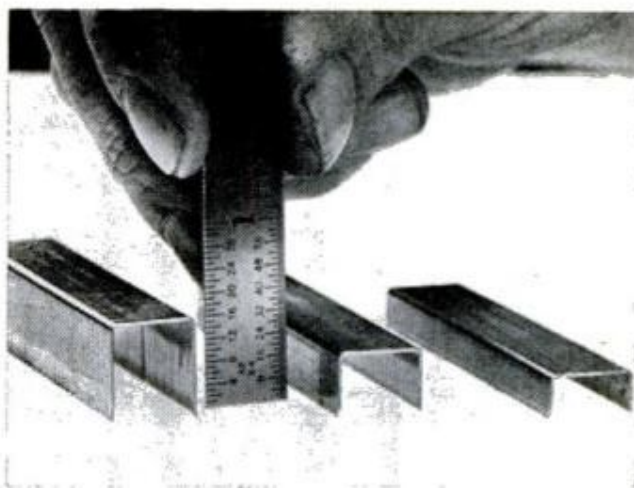
You can buy staples in lengths varying from very short (used for stapling fabric coverings to car-door panels) to $\frac{3}{16}$ -in. long. The right staple for the job should be the largest size your gun can drive flush with the work surface. A heavy-duty gun has sufficient power to drive $\frac{3}{16}$ -in. staples into soft pine. The same gun, however, will not drive that long a staple into hardwoods such as oak or maple. Accordingly, shorter staples must be used with any of the harder wood species.

Using a short staple in hardwood, however, does not decrease the available





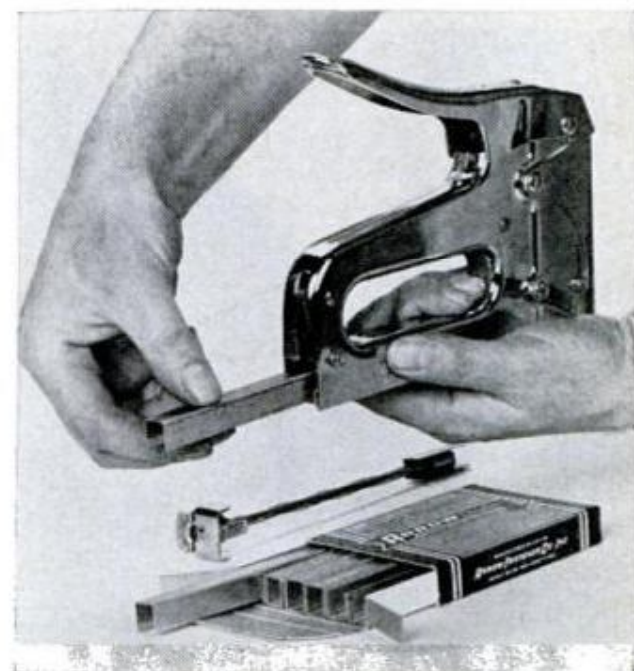
COMMON STAPLES have plain points and shear their way straight into wood. Other points increase grip by separating legs or by forcing them together



HEAVY-DUTY STAPLES are available with leg lengths of $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{1}{2}$ and $\frac{9}{16}$ in. All of them are lightly cemented together to form long, easy-to-load sticks



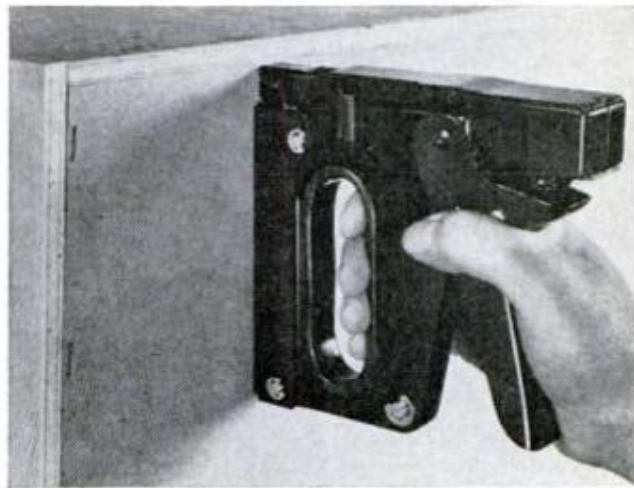
TO INSTALL foil-backed, glass-fiber insulation, staple the batt's side tabs to studs with $\frac{3}{8}$ -in. staples spaced every 2 in. Avoid compressing batts between the studs



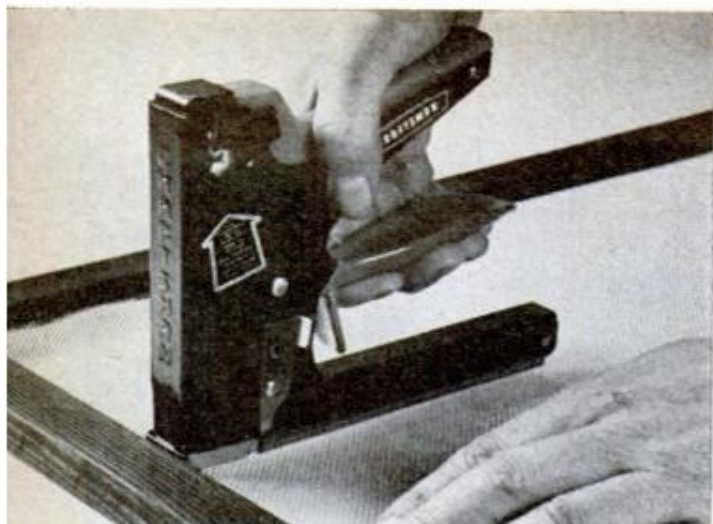
ALTHOUGH LEG LENGTHS may be standardized among various makes of staples, width of crown can vary from make to make. Always match staple to gun



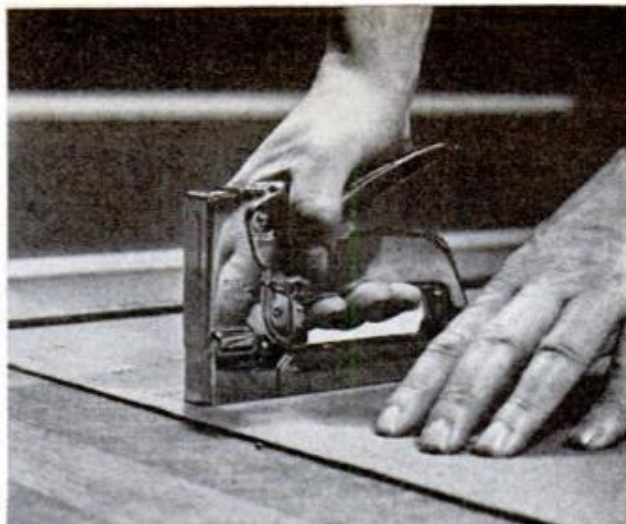
STAPLING IS THE EASY WAY to install ceiling tile. Nail furring strips across joists, then attach tiles to furring strips using special cement-coated staples



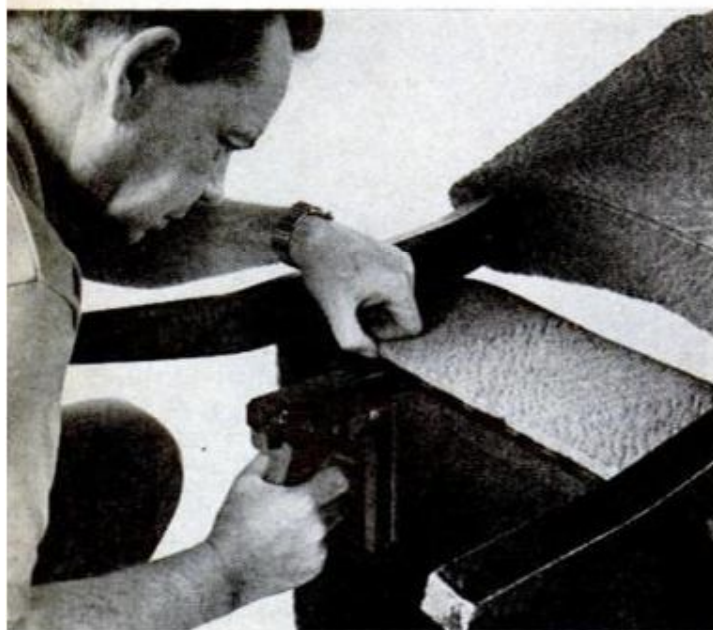
USE LONG STAPLES AND GLUE for permanent joints. Hardboard fitted in rabbeted cabinet backs or in drawer sides calls for use of glue-and-staple method



MAKE WINDOW SCREENS by half-lapping rabbeted 1x2s to form a frame. Staple screening in rabbets. Attaching handy gun accessory stretches screen taut



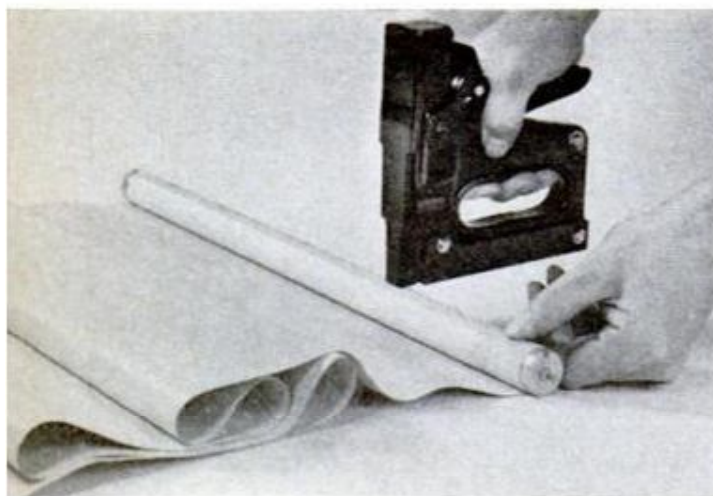
STAPLING DOWN CARPET PADS anchors them safely and prevents bunching. When taking up the pad, all you'll need is a screwdriver to pry out the staples



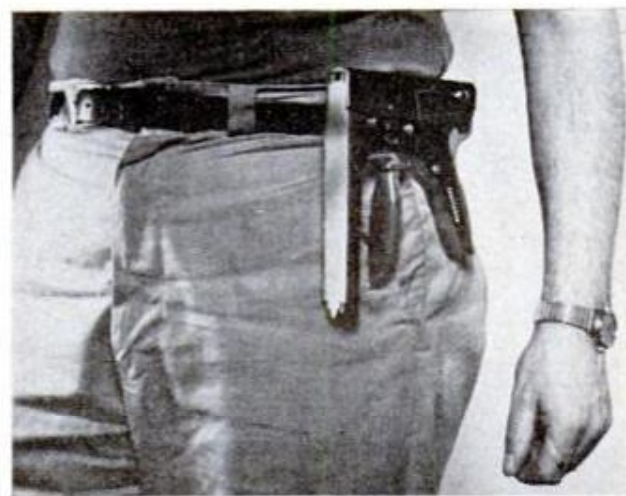
WHEN STAPLING UPHOLSTERY to wooden furniture frames, use the longest staples your gun will drive flush. Staples hold stretched fabric better than tacks

gripping power, since the grip of a short staple in hardwood is comparable to that of a long staple in softwood. Ordinarily, a staple will hold adequately if it penetrates at least $\frac{1}{4}$ in. of the substrate—the material into which the staple is driven. In some materials, a staple will withstand a 100-lb. pulling force. Should extra holding power be required, you can switch to a cement-coated staple, or you can use staples with special points that either twist the legs away from each other, or force them towards each other. Such staples are shown at the top of page 159.

The popular makes of gun all are built of heavy-gauge steel and are practically indestructible. Manufacturers warn, however, against snapping the gun's action with an unloaded magazine, as this can considerably wear the ram stop and shorten the tool's life. ★★★



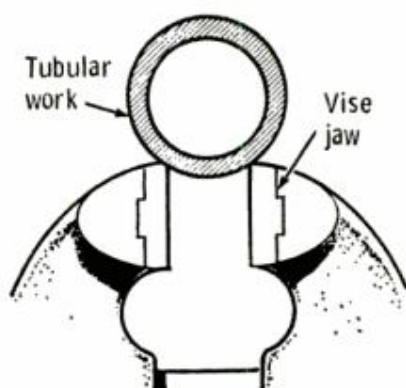
USE SHORT STAPLES for such jobs as securing shades to rollers, tacking shelf coverings, lining drawers. Short staples are a bit cheaper than long ones



A BELT CLIP to hang your gun is an accessory item for some models. It's especially handy when stapling materials that require the use of both hands

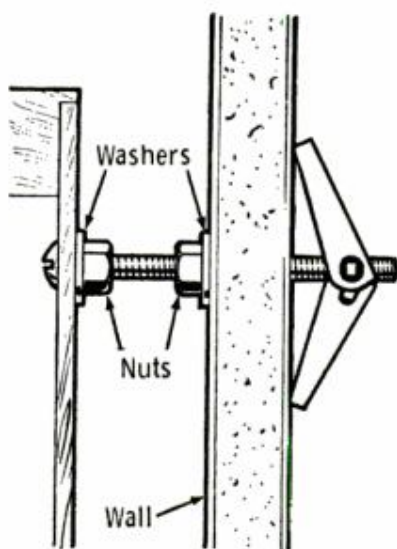
HINTS

FROM READERS



Cutting tubing

When hacksawing metal tubing, don't risk crushing it out of round by clamping it in a vise. Instead, open the vise just enough so that the jaws act as a V-block. Then you can hold the tubing in the slot and rotate it slowly as the saw cuts through it.



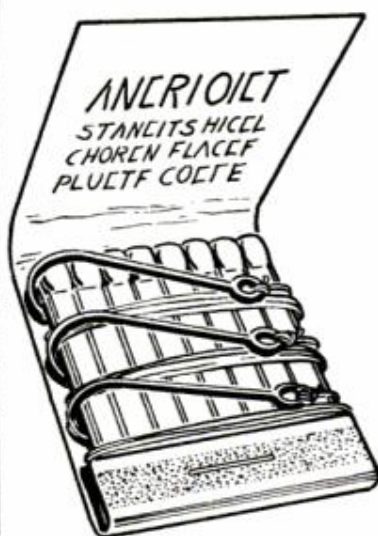
Cabinet anchors

Tall cabinets or book-cases have a tendency to wobble in cases where the baseboard prevents their being set flush against the wall. If the wall is hollow, you can easily anchor them with toggle bolts through the back panels.



Brush storage

One simple way to keep a paintbrush soft overnight without cleaning it is to stand it in a jar containing a small amount of thinner. Slip a polyethylene freezer bag over the top and secure it with a rubber band to seal in all of the fumes from the thinner.



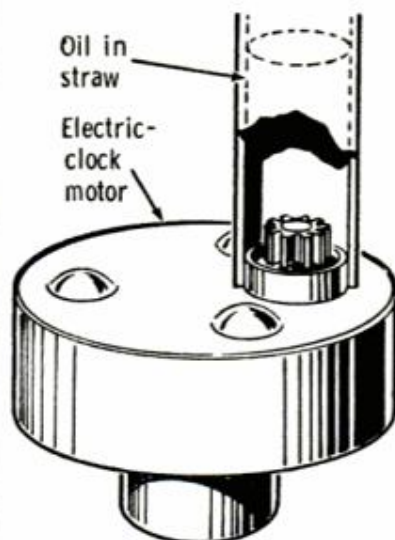
Hook holder

Normally, it's foolhardy to carry fishhooks loose in your pocket. A book of matches will solve the problem, though. Just slip the points under the matches and wrap the leaders around to hold them in place, then close the matchbook cover.



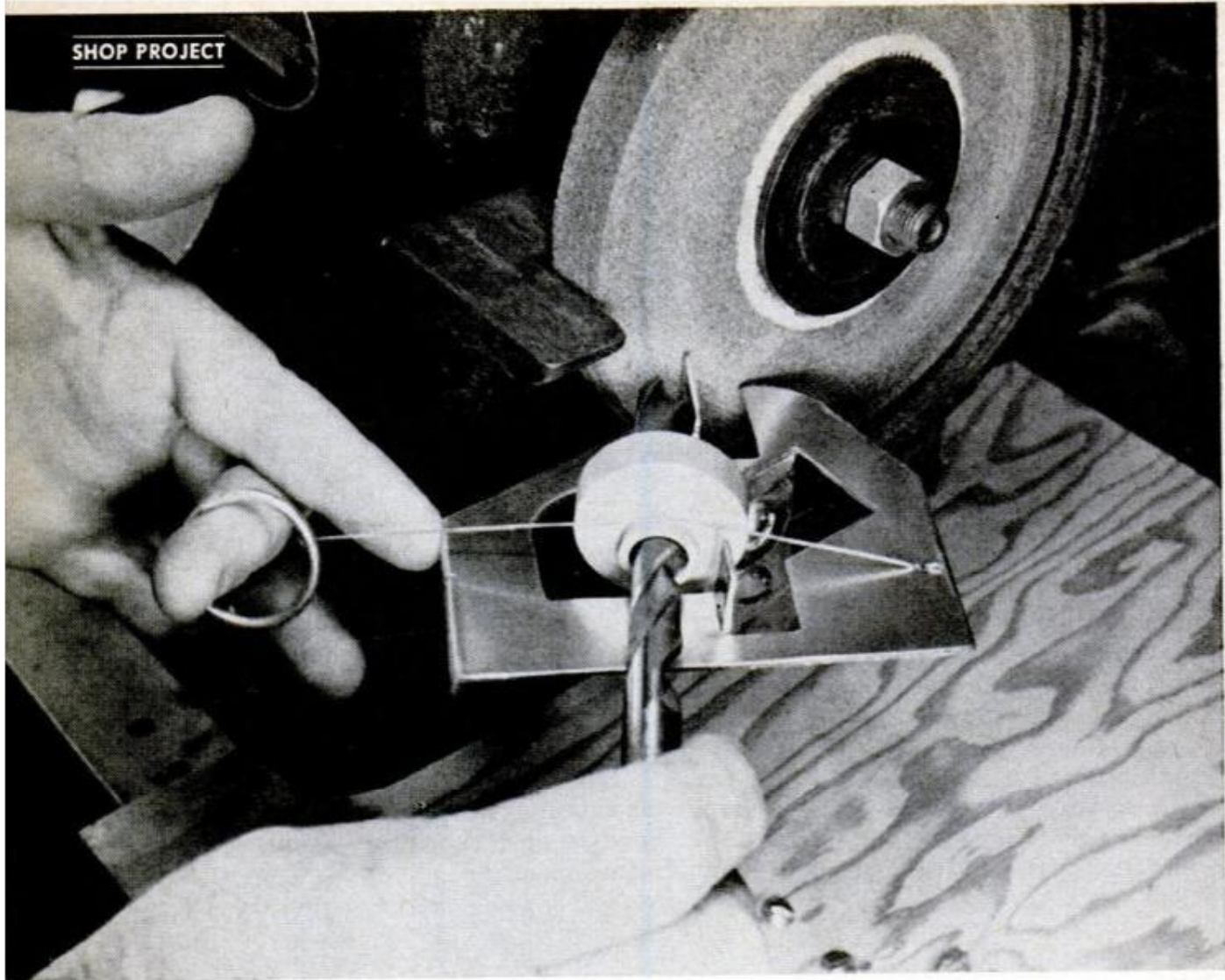
Finding gas leaks

Most plumbers still use a bubbly soap solution to test connections in a home gas system. However, a much more modern material for the job is shaving cream packaged in aerosol cans. It's dense, long-lasting and excellent for use in hard-to-reach spots.



Oiling clock motor

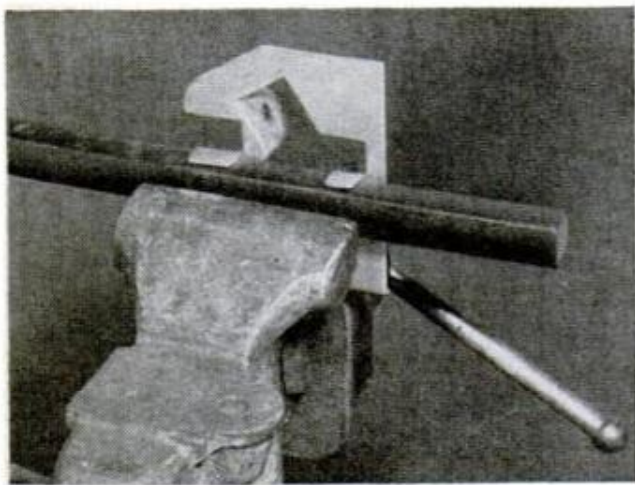
If the motor in your electric clock becomes noisy, here's an easy way to oil it. Slip a straw over the gear shaft, pour a little light oil into it, then heat the motor enough so that air bubbles escape. Let it cool and oil will enter around the shaft.



NYLON LEADER ACTS AS CLUTCH to prevent slipping of bit, yet allows anticlockwise positioning of bit by hand

Make This Drill Sharpening Guide

By WILLIAM G. WAGGONER



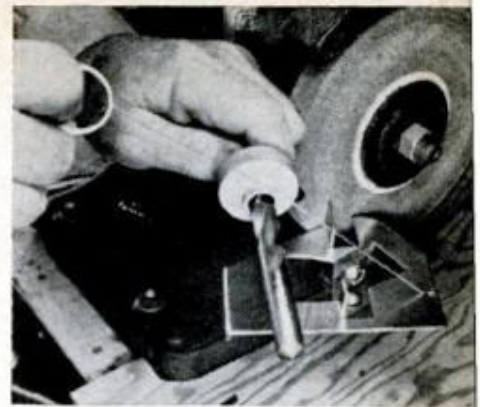
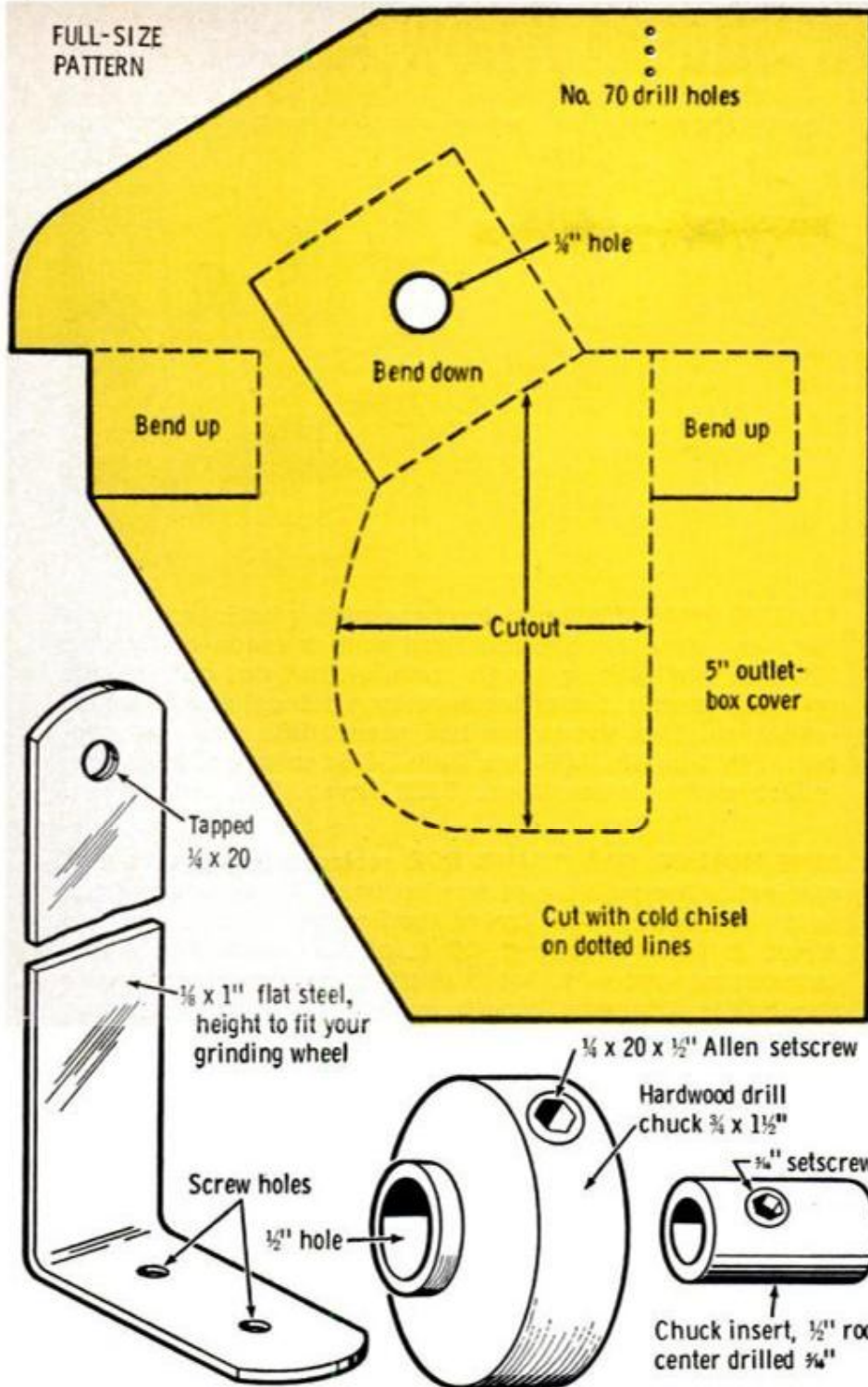
CUT THE METAL PLATFORM to the outline shown and drill the single mounting hole. Then bend one flap down and the other two flaps up by using a square steel rod mounted in vise for exact 90° bends

EXPERT MACHINISTS may be able to sharpen a twist drill with a few flicks of the wrist, but for the home craftsman, a sharpening jig such as this is a basic necessity.

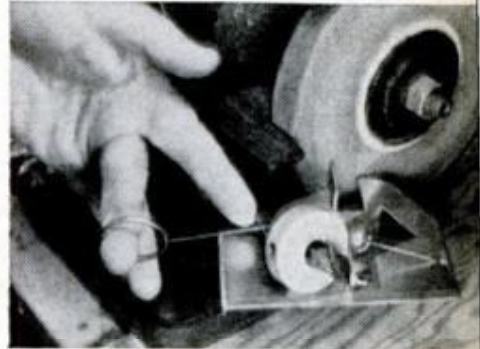
The main advantage of this particular sharpening guide is its simple, almost fool-proof action. There are no intricate adjustments to make; no locking of the bit in a stationary holder, and no blind grinding as with many commercial guides.

The chuck insert shown in the drawing at right is used with drills with a shank of $\frac{3}{16}$ in. or less, while drills of $1\frac{1}{2}$ in. through $\frac{1}{2}$ in. are secured directly to the

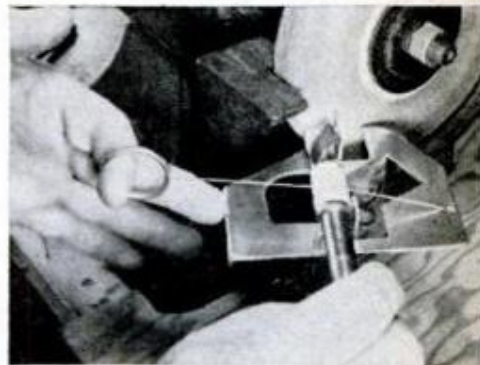
FULL-SIZE
PATTERN



HOLD DRILL AS SHOWN and wrap nylon leader around the chuck only once, beginning at the top



KEEPING THE LINE TAUT, you can remove the bit for inspection and then return it to the exact position



WITH DRILLS over 1/2-in. o.d., you can do without chuck. Wrap bit in tape and grind as with chuck

hardwood chuck or pulley. As an alternative to this, you can turn two of the chucks; one with an i.d. of 1/2 in., and the other with an i.d. of 5/16 in.

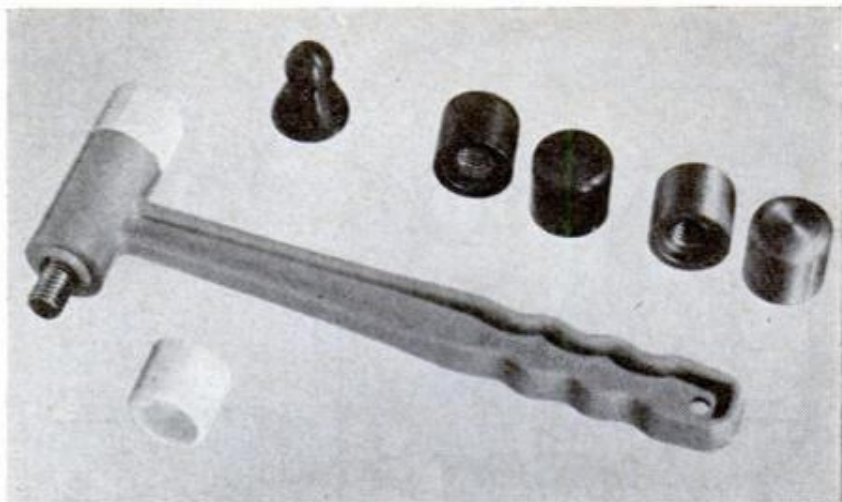
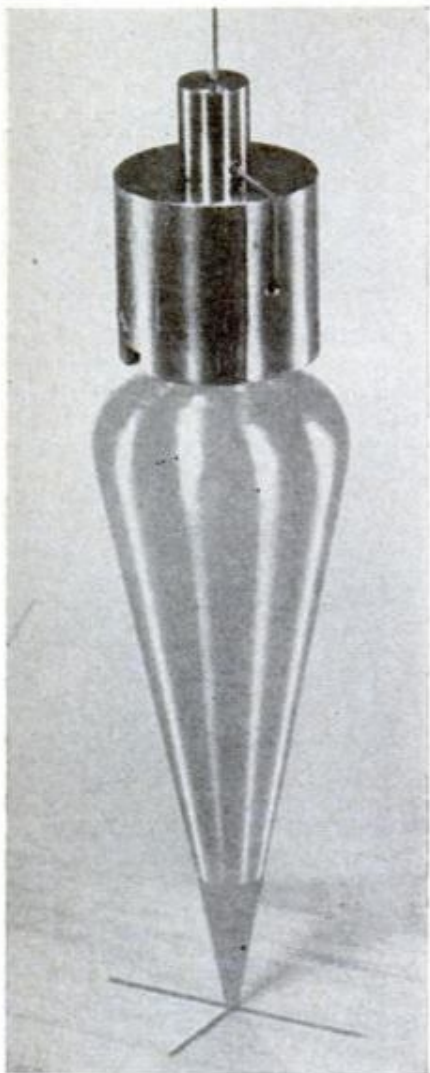
To use the sharpening guide, thread a 7-in. length of 30-lb.-test nylon leader through the three No. 70 holes in the platform, feed the other end through a No. 70 hole in a 1-in. curtain ring, and knot both ends. Wrap the nylon around the chuck pulley, keep tension on the curtain ring, and lay the chuck in the cutout so it rests against the guide's stop tabs. Be sure to wrap the nylon around the chuck in the manner shown so that the

applied tension, plus the rotation of the grinding wheel will keep the bit against the inside step of the platform.

The drill bit should be secured in the chuck at a point that will permit a bit of play when the chuck and bit are placed in the cutout of the platform. This play then allows you to move the bit in and out against the emery wheel.

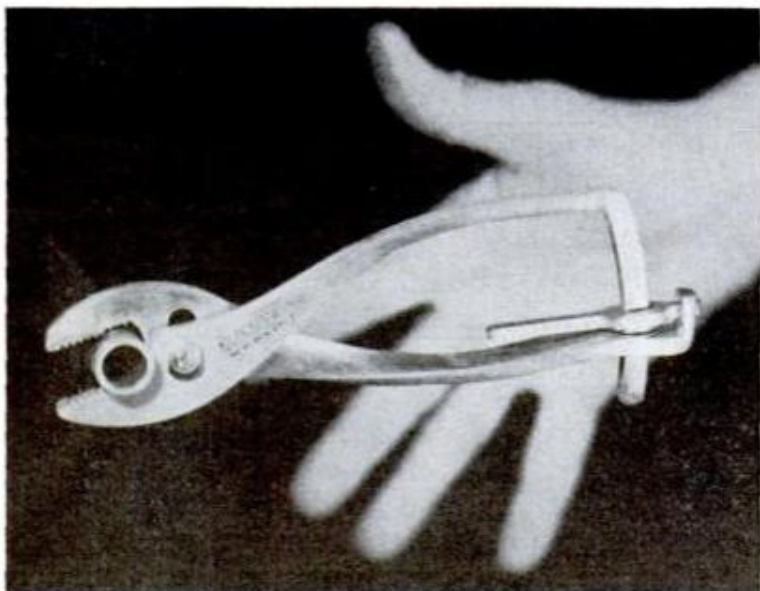
To align the flute being ground so it lies parallel to the grinding platform, loosen the tension on the curtain ring, then turn pulley and bit anticlockwise. Using the jig this way guarantees twist drills sharpened to a standard 59° angle. ★★★

New Tools You Should Know About

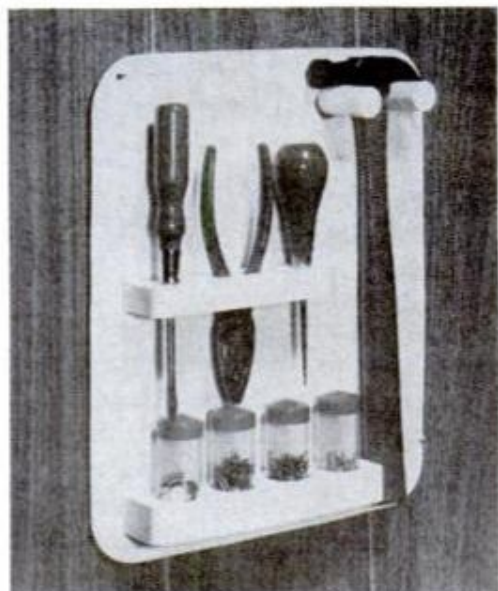


PLASTIC HAMMER has interchangeable plastic and metal tips. One-piece handle and head unit is made of Cycloc ABS thermoplastic, a tough material that not only stands up under shocks but offers superior electrical and chemical resistance. Tips shown are ball peen, ABS, steel and copper. With 1-in.-dia. ABS tips, Safe-T-Grip sells for \$2.55 from Industrial Specialties Corp., 3132 Bryan, Fort Worth, Tex.

LINE HOLDER FOR PLUMB BOB replaces the regular cap, eliminates the problem of snarled line. The capacity of the spool depends on the size of the line you use. It will hold about 30 ft. of 18-lb. test, 10 ft. of 40-lb. test. The manufacturer recommends that braided nylon line be used with this holder. Changing lines is a relatively simple procedure involving removal of the spool and rubber dust plug from the case so that it can be rethreaded. It's priced at \$5 from Adjust-A-Bob, Box 1771-A, Oroville, Calif. 95965.

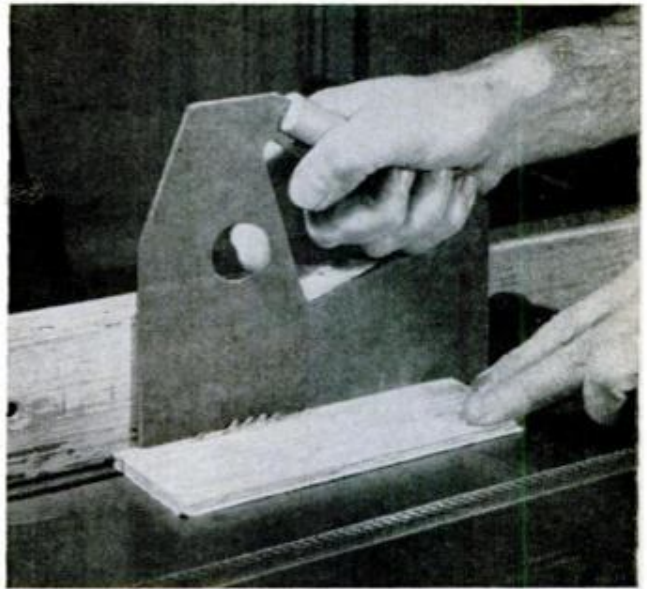
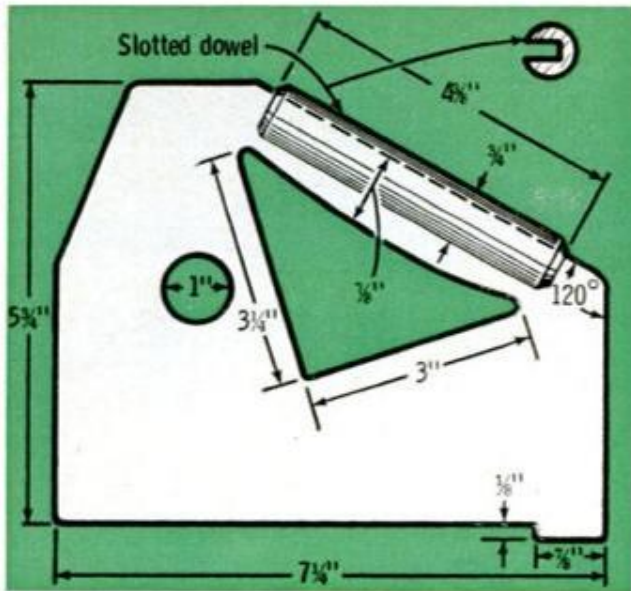


AUTOMATIC PLIER-WRENCH requires no adjusting. Designed for easy one-hand operation, it releases grip instantly when you trip the spring-loaded trigger. A slip joint provides two wide ranges of grip. The tool is made of forged tool steel and sells for \$2.95 from Lockmatic Tool Co., Highway 12, Maple Plain, Minn.



KITCHEN TOOLKIT for your wife will stop her from borrowing your tools. The Handy-Anne, in red, yellow, green or tangerine, costs \$7.50 from Sunset Farm, 223 Montauk Hwy., Westhampton Beach, N.Y. 11978.

Take Time to Make Yourself a Safety Push Stick



ANYONE WHO OWNS a circular saw should have a push stick to steer narrow strips safely between the blade and the fence. The one shown above was made of thin plastic-surfaced hardboard, a material offering the advantage of a hard surface that slides easily along the saw fence.

Cut the material to the shape shown and locate a 1-in. hole where it will be a comfortable reach for your index finger. The grip is a piece of 3/4-in. dowel slotted lengthwise to slip over the hardboard edge. Since most glues won't adhere to the plastic side, use both glue and small nails to fasten it.

While you're at it, you might make a heavier push stick for use with larger work. Cut it to the same shape, but use any 3/4-in. material (tempered hardboard would be a good choice). Since the material itself is thick enough to provide a good grip, the separate dowel grip may be omitted. However, you might round the edges of the grip section.

Never use a push stick as a substitute for a saw guard, but only with a guard that permits the stick to move between it and the fence; or when the work can be cut safely without the guard in position.—Walter E. Burton

NEXT MONTH IN SHOP AND CRAFTS

PM'S MINI-MOVER. Tired of pushing a wheelbarrow? *PM* will show you how to build a miniature flat-bed lawn truck to take the work out of hauling. Powered by a 4-hp engine, it features a unique front-wheel drive and steering system. Part 1 is in August.

HOW TO MAKE AND USE LATHE BORING TOOLS. You can't use a lathe very long without getting involved in boring. Thus, all you metalworking enthusiasts are sure to be interested in next month's A-to-Z article on the special tools and techniques required for successful boring. You'll find plenty of solid how-to information on things like measuring, mounting, speed, feed and even internal threading. It's all in the August *PM*.

TWO HANDSOME WALL SHAVING BARS. Here's something for the man being squeezed out of the family medicine chest by hair spray, cold cream and other feminine necessities. These two masculine wall cabinets have built-in mirrors and provide lots of storage space for your shaving gear and toiletries. You'll find plans for both in the August issue.

BOOKSHELVES FOR PM'S NEW ENCYCLOPEDIA. The first project to build after you've purchased this big 16-volume set of books is a shelf to hold them. *PM* suggests two designs, a utility shop version and a deluxe model for the den. Check the August issue.



FM Stereo For a Song... If You Build It

Getting tuned in to FM stereo is as easy and inexpensive as wiring a \$73 kit. The five-watt do-it-yourself receiver is Heath's AR-17

By **BILL HARTFORD**, Electronics Editor

"A HI-FI SHOWROOM is a nice place to visit but I wouldn't want to live there." If this sums up your stereo sentiments, chances are a 150-watt demonstration of the *Soldiers' Chorus* bombed the eardrums out of your head, or the high dollars-per-decibel price of bringing all those troops into your 12x14 living room drove you over the hill and back to your humble clock radio.

Still, stereophonic reception of FM radio's exciting fare is extremely rewarding for anyone who likes to treat his ears to the best in sound. The Heathkit AR-17 is an inexpensive way to pull in that stereo treat—if you don't count watts as status symbols. The amplifier section of the receiver pushes out a modest five watts per channel, hardly enough to drive a pair of acoustic suspension speakers, but plenty to fill a good-size room with

clean sound using a pair of conventional hi-fi speakers.

With no pretense of being a fringe-area superset or having specs that wealthy audiophiles gloat over, the AR-17 does an excellent job. Its five-microvolt sensitivity, taking a signal from a simple dipole antenna fashioned from flat TV lead-in, proved sufficient for noise-free stereo reception with good separation 25 miles east of New York City's FM transmitters.

After wiring the receiver, the only adjustment necessary was tuning the stereo circuit for minimum distortion and maximum left and right channel separation. This is done by ear and by watching the brightness of the stereo indicator lamp as you turn the slugs of a single coil and transformer.

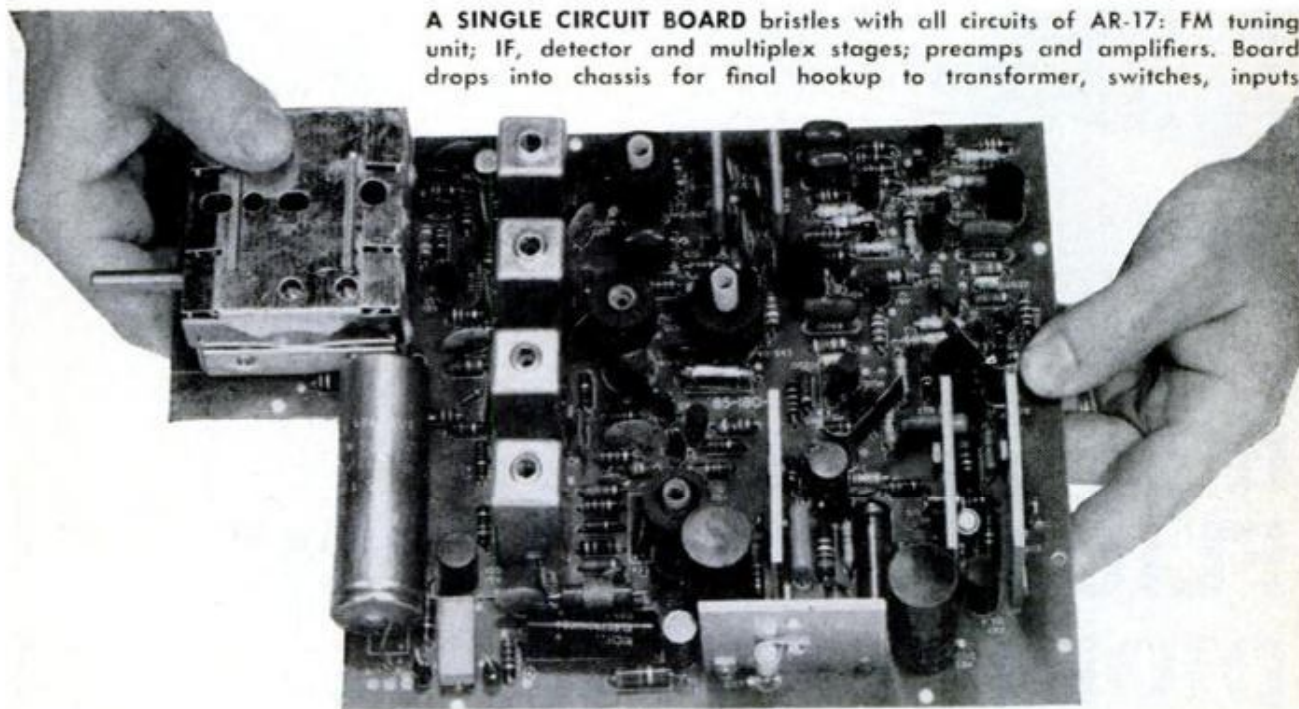
Instructions are given for basic FM tuning, but weren't necessary since the

prealigned IF transformers, ratio detector transformer and FM front end of our kit were right on the nose. If you wish, you can override the judgment of your ear and eye and follow Heath's instrument alignment instructions—if you happen to have a vacuum-tube voltmeter and RF generator accurate at 10.7 megahertz.

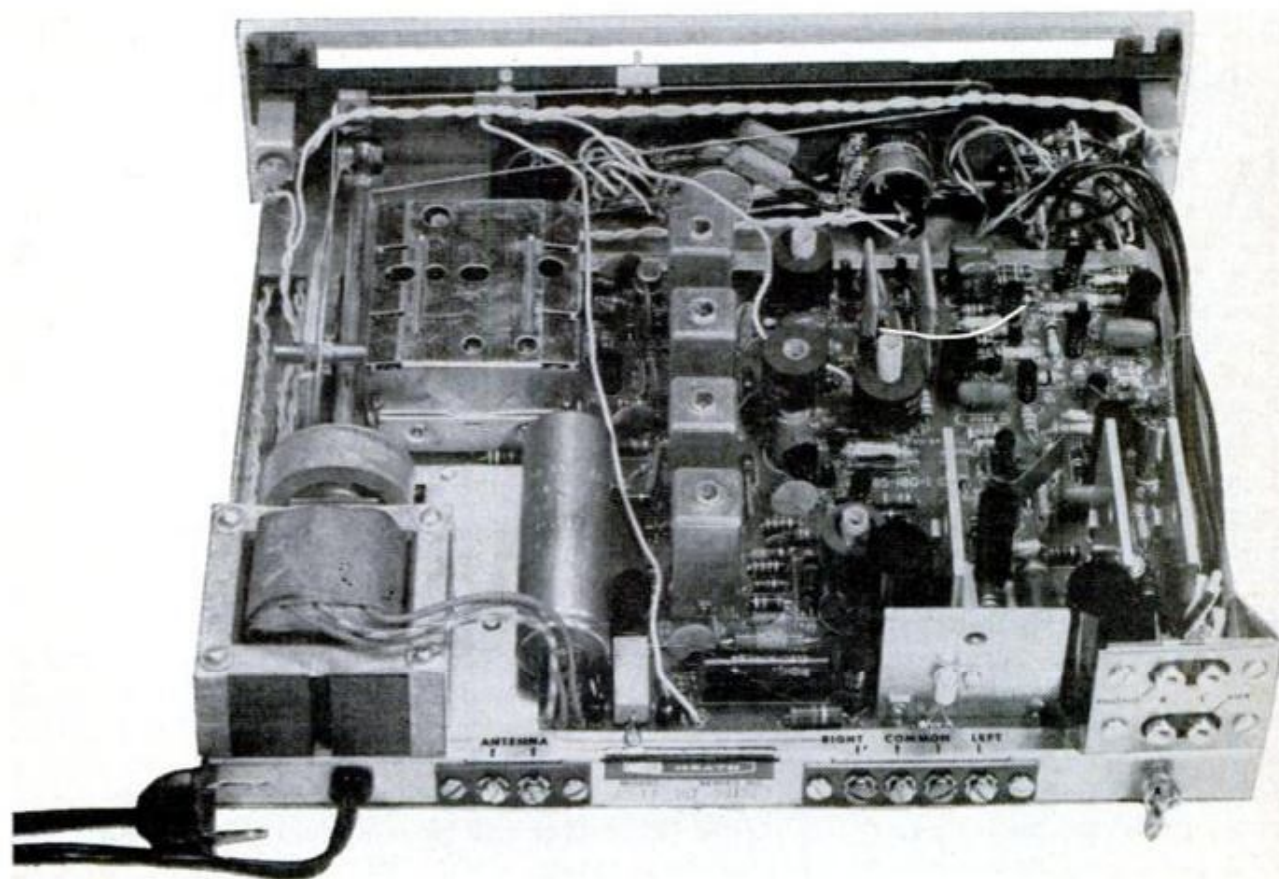
As evident in the photos below, building the AR-17 is not at all difficult. After

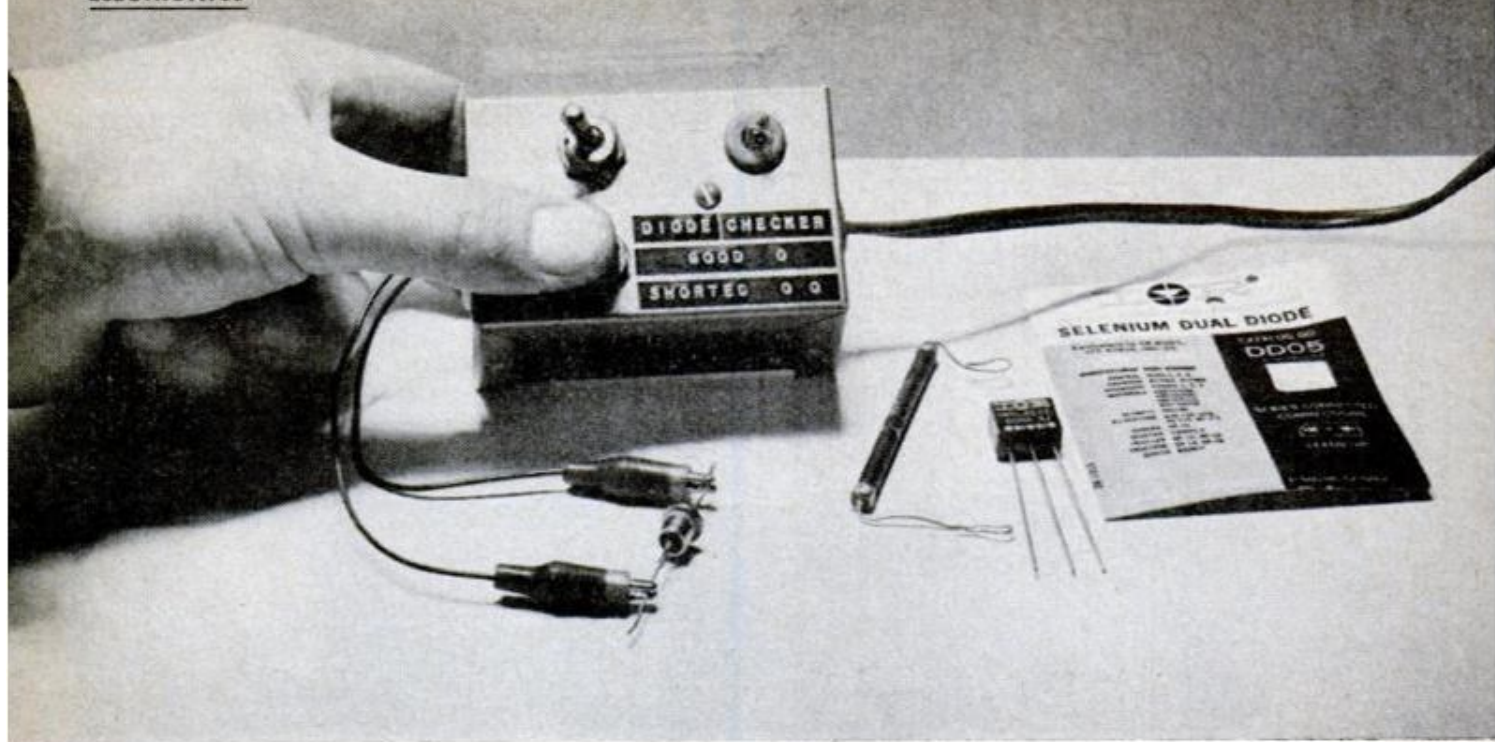
the longest part of the job of wiring the circuit board and checking it closely for solder splash and/or other goofs, you simply mount it in the chassis and complete the wiring, mostly with prepared, cut-to-length cables.

Installation of flywheel tuning, front panel and knobs completes the job. For looks, add a walnut cabinet for \$8 or a beige metal one for \$3.50. ★★★



A SINGLE CIRCUIT BOARD bristles with all circuits of AR-17: FM tuning unit; IF, detector and multiplex stages; preamps and amplifiers. Board drops into chassis for final hookup to transformer, switches, inputs





It's a snap to build this FLICK-OF-A-SWITCH DIODE CHECKER

By HOMER L. DAVIDSON

Just clip the test leads on the diode, press the push-button and throw the toggle switch for a quick reading

WITH THIS SMALL CHECKER, you'll be able to determine the condition of crystal, silicon and focus diodes in a jiffy. Use it for trouble-shooting immediate problems or sorting out an inventory of diodes of unknown condition. Check them all, discard the defective ones and put the good ones back in service.

The diode checker is simple to operate. Just clip the test leads to the leads of the suspected diode. Close pushbutton switch S1. If the neon indicator lamp, I1, lights up brightly when you're testing a crystal diode, throw the polarity-reversing toggle switch, S2, to its other position. The diode is shorted if the neon lamp lights brightly in this position, too. When a good crystal diode is tested, the lamp will glow very brightly in one position of the switch and very dimly in the other.

To check a silicon diode, proceed in the

same manner. A good silicon diode, however, will light in only one position of the toggle switch. When a silicon diode causes the indicator lamp to light in both positions of the toggle switch, discard it—it's shorted. If the indicator lamp does not light in either position, the diode is open.

Check dual-diode rectifiers with the same test procedure. A good dual-diode will produce a very bright and very dim indication. A leaky or shorted dual-diode will give a bright indication in both switch positions. Remember, the dual-diode has two separate diodes tied to a common terminal. Clip one test lead to the common center and the other to the separate outside terminal leads, one at a time, to test both diode functions.

The focus diode of a color television receiver will produce only a very dim indication, even with a good diode. No illu-

mination in both switch positions indicates an open condition. Most focus diodes fail by opening; they seldom short out.

In operation, power is applied to the test leads when S1 is depressed. Rectifier diode D1 and resistor R1 are in one leg of the power line, while resistor R2 and lamp I1 are in series with the other. D.p.d.t. toggle switch S2 reverses polarity of the two test leads to check the diode under test in both directions.

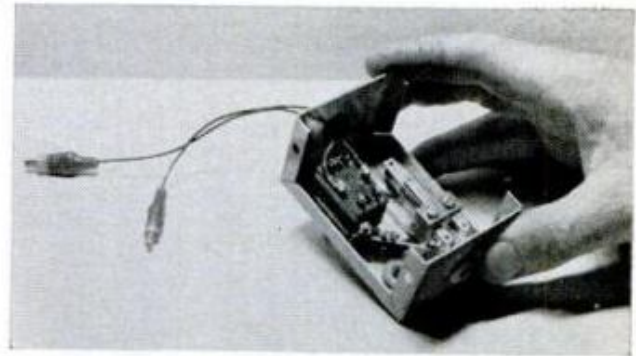
A small chassis box makes an inexpensive self-contained housing for the checker. The one shown is 3¼ x 2½ x 1⅝ in. Prepare it by drilling a hole in each end for the a.c. power cord and test leads. Use an appropriate size grommet for each hole. Drill two ⅞-in. holes in the top of the chassis box to mount pushbutton switch S1 and the toggle switch S2.

Short test leads with insulated alligator clips are used to clip the diode under test into the circuit. Run them through the grommet and tie a strain-relief knot near the ends. The ends are soldered to the center terminals of switch S2 as shown

DIODE TEST CHART

DIODE TYPE	Neon Indicator Lamp		DIODE CONDITION
	S2 1st pos.	S2 2nd pos.	
Crystal 1N34, 1N60, etc.	Very bright Very bright No illum.	Very dim Very bright No illum.	Good Shorted Open
Silicon diode, top hat, etc.	Very bright Very bright No illum. Very bright	No illum. Very bright No illum. Dim	Good Shorted Open Leaky
Dual-diode (check both diodes)	Very bright Very bright No illum.	Very dim Very bright No illum.	Good Leaky Open
Focus diode	Dim No illum.	No illum. No illum.	Good Open

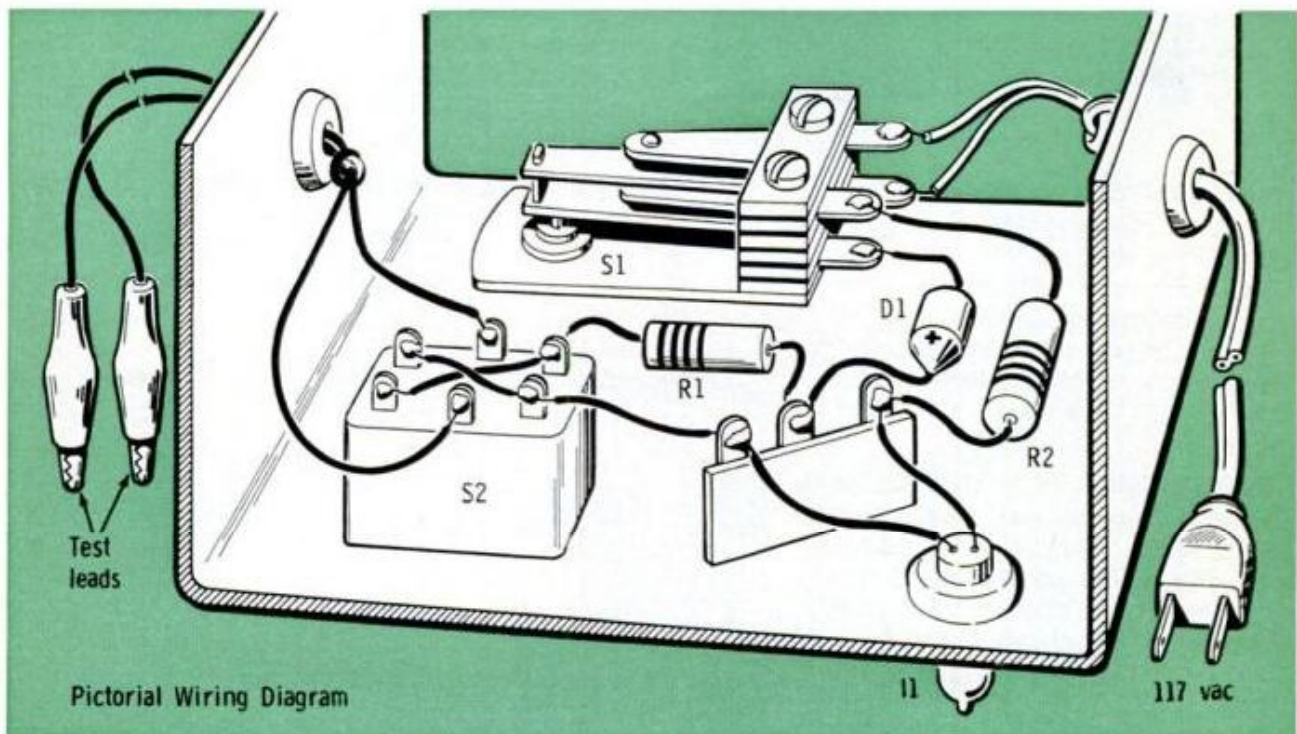
in the pictorial drawing. Solder the leads of the power cord to the terminals of S1 and solder diode D1 in the circuit, observing the polarity shown. Use a terminal strip to facilitate mounting and soldering the circuit components. ★★★



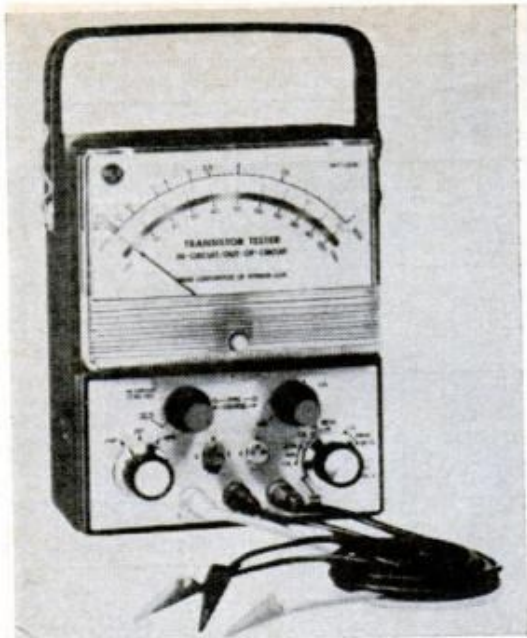
CONNECT COMPONENTS following wiring in drawing

PARTS LIST

- D1—Silicon diode rectifier, 200 PIV (Allied Radio 24B9692 or equiv.)
- I1—NE-2 neon lamp (Allied 60B8518)
- R1—100,000-ohm, 1-watt fixed resistor
- R2—47,000-ohm, 1-watt fixed resistor
- S1—D.p.s.t. normally open pushbutton switch (Allied 56B4997)
- S2—D.p.d.t. toggle switch (Allied 56B4530)
- 1—Chassis box (Allied 42B7617)
- Misc.—Test leads, alligator clips, red and black insulators, a.c. power cord, terminal strip, hookup wire, spaghetti, grommets, solder

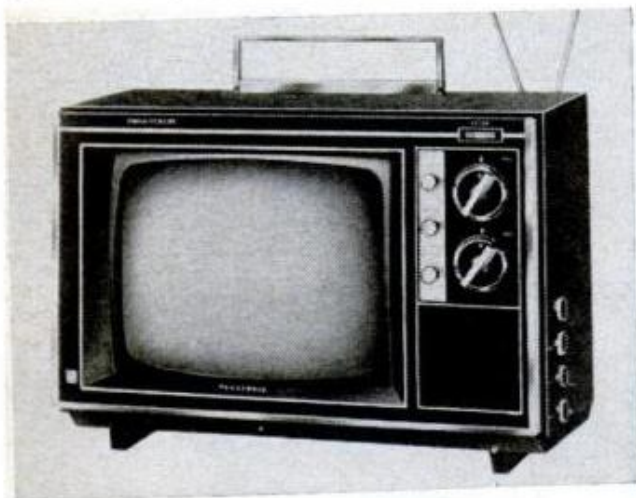


NEW in ELECTRONICS



TRANSISTOR TESTER checks diodes and transistors in or out of circuit. RCA WT-501A has sockets to match npn or pnp types. \$67; RCA Electronic Components, Harrison, N.J.

TELEPHONE MONITOR lets you hear both sides of conversation. Place \$8 battery-power T-1110 next to phone and use an earplug. Kalimar-Tronics, 2644 Michigan Ave., St. Louis.

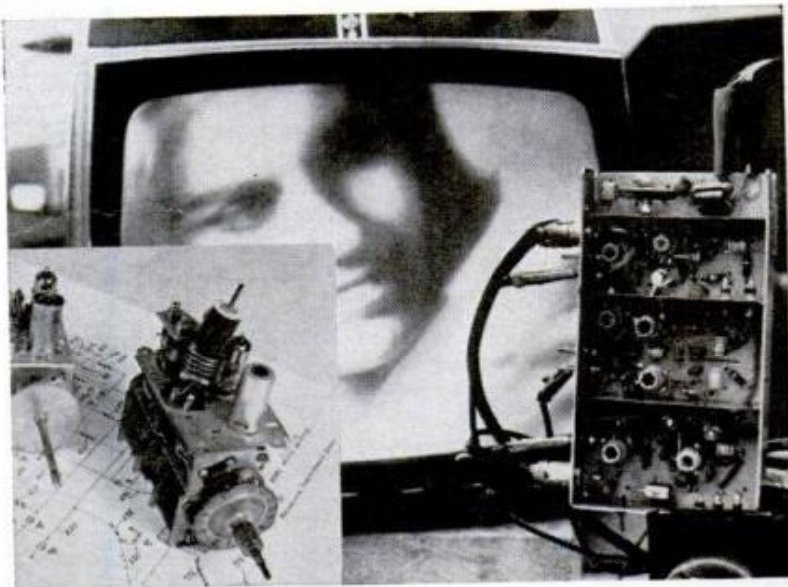


PORTABLE COLOR TV has 12-in., 75-sq.-in. screen size. Panasonic CT-21P solid-state TV weighs 38 lbs., has color reception indicator, automatic degaussing, instant picture and sound, set-and-forget tuning. Matsushita Electric Corp., 200 Park Ave., New York.

ELECTRONIC TV TUNING replaces mechanical switching. Solid-state varactor (voltage-variable diode capacitance) tuning circuit, which can be located anywhere in chassis, is being bench tested. Larger, less reliable mechanical types in inset. Standard-Kollsman, Syosset, N.Y.

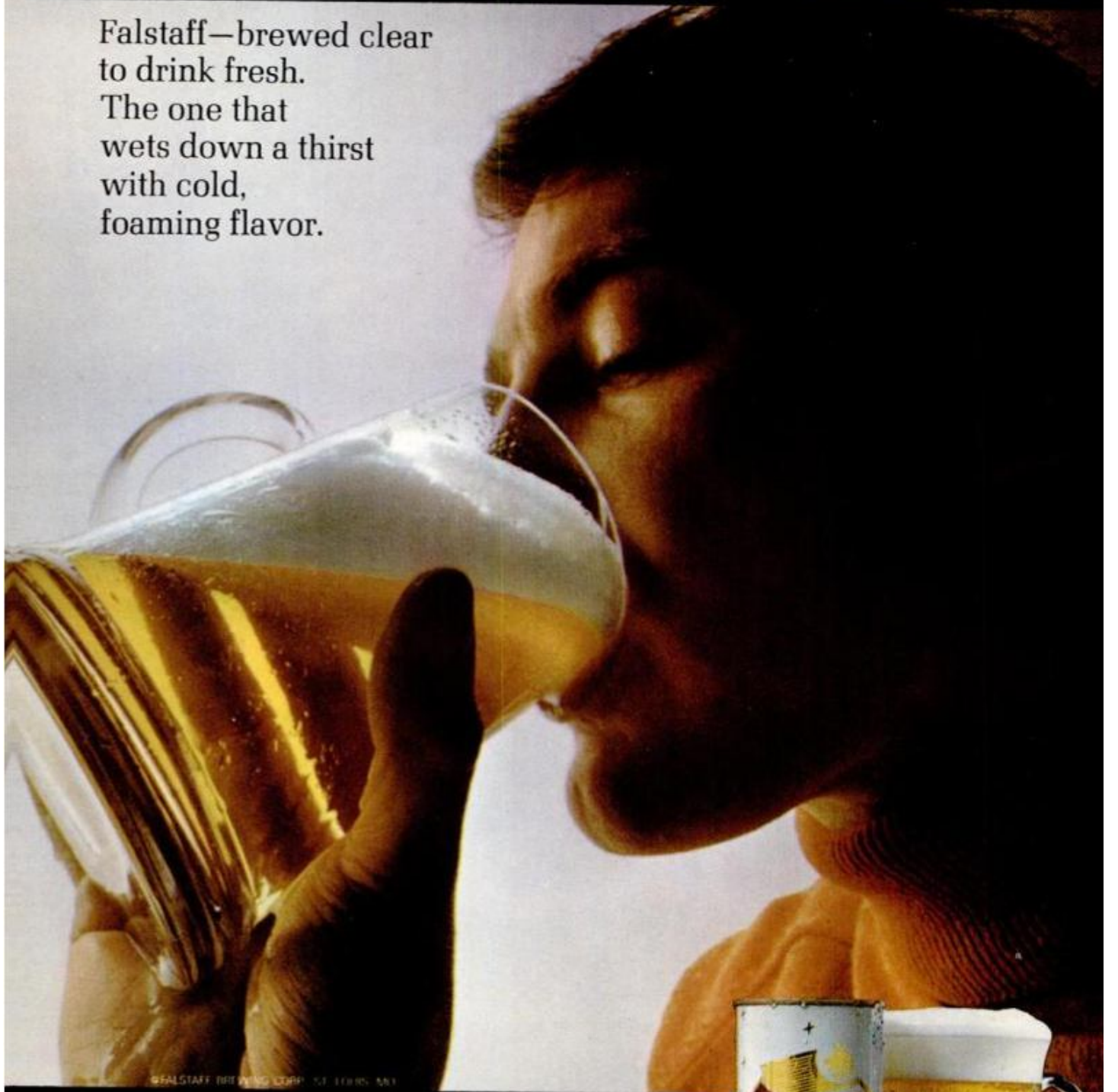


SOLDERING GUN has squeeze trigger for automatic feed of solder from spool. Model 340 is \$13. By Skil Corp., 5033 Elston Ave., Chicago.



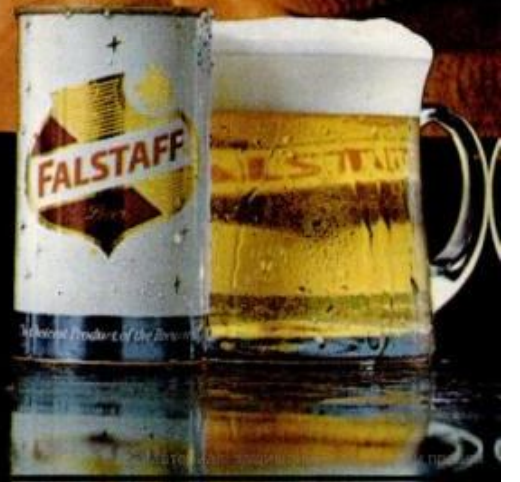
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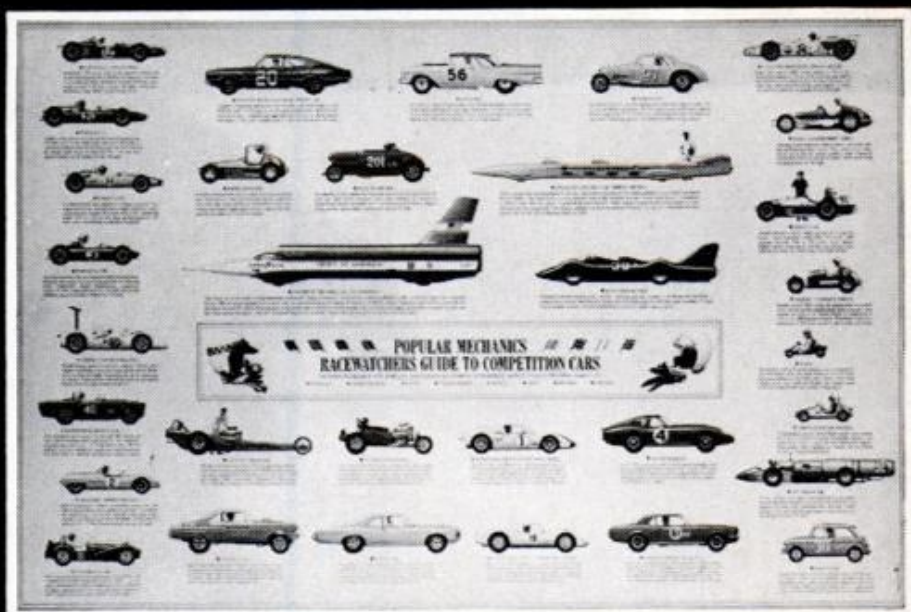
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WINGLESS AIRPLANE

(Continued from page 67)

body—its crew and equipment—the rest is dictated by where that body is going; into space or through the air. A spacecraft is ideal for putting things into every possible corner. It basically falls, not flies, through the air, so it doesn't need much aerodynamic garbage. An aircraft wastes much of its shape on wings and control surfaces for lift and stability.

Part spacecraft, part aircraft

A lifting body is a compromise between the two, trying to squeeze as much equipment for its mission into the most compact shape, yet still retaining the minimum shape that will give it adequate aerodynamic qualities when it re-enters the atmosphere. In fact, its name gives you the first clue; it gets most of its lift from its body.

The ultimate lifting-body shape will be determined by such men as Gerry Gentry. It has already evolved from a negative camber (flat top) shape on the M-2 and HL-10 to a positive camber on the X-24, and from two vertical control surfaces on the M-2 to three on the HL-10 and X-24.

Now, this summer, tests will determine how it behaves under power and at supersonic speeds.

Gerry outlined what a supersonic mission might be like.

"I'll be dropped from a B-52 at about 45,000 feet. We'll be then doing about Mach .6 to .8. I'll then ignite the rocket engine, one chamber at a time, and rotate to a high angle of attack. I'll accelerate to Mach 2, about 1350 mph, while climbing to about 100,000 feet.

"After burnout, I'll pitch over and start coming down. When I'm lined up with the landing strip, I'll flare out at 1000 feet, drop the wheels and bring her on in."

He describes it as if he were talking about a Sunday drive. But it's really not that easy. What are the basic differences between flying a lifting body and an airplane?

Roll poses problems

"Pitch control is great on the lifting body, but we've had some problems with roll. No wings, you know. We're working on it, though."

How fast does the body drop when you start losing speed?

"We try to keep the rate of descent to 10,000 feet per minute."

Like, wow!

I flew the simulator to get a better idea of what he was talking about. After the

simulated launch, the instructor had me light just two chambers to keep me below Mach 1, then rotate to a 15° angle of attack, and check the rate-of-climb indicator.

My eyes were all over the panel. It's not like flying an airplane.

"Now," he said, "fly your altitude and angle of attack to maintain the right Mach number."

I knew what he meant. The rocket power is constant, while it burns, so you adjust speed with the attitude of the craft.

"Turn north and fly east of the field, and maintain a northerly heading until burnout."

Sacre bleu! Now I had to watch direction, too. I had a screen in front of me, simulating the horizon as well as perspective for altitude and direction.

I banked left with rudder and stick, until the compass came around to zero, then leveled out. I missed zero, of course, and turned right again, and by then my nose was down and I was gaining speed and losing altitude.

"Get the nose up and turn left again!"

And then the bottom fell out

But just then came burnout, and the bottom really fell out. I was way off course and dropping like a rock.

"Keep the nose up and watch your speed."

I was now in a glider without wings, and still off course.

Moments later, "Retract your flaps!"

Another problem. The X-24 has twin pairs of flaps in the rear. The bottom pair help with control at supersonic speed, the top pair at subsonic speeds.

But I was dropping so fast, the instructions were coming a shade late.

"Okay, now, lift your nose way up and drop your wheels."

Clunk! And the flight was over.

"Congratulations!" the instructor said. "You just landed in downtown Lancaster." Lancaster is the nearest town to Edwards, and not really that near.

I was glad to give it back to Gentry.

Flying a bathtub isn't easy. A professional pilot just makes it look that way. Even so, more complicated flights are ahead, because the ultimate goal of the program is to place a lifting body on top of a rocket booster at Cape Kennedy, and blast it into orbit just like any other spacecraft, then fly it back to Earth.

As John McTigue, NASA's program manager for the lifting-body program, told me, "If we expect to get into space on a regular basis, we're going to have to

(Please turn to page 178)

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OUTBOARDS FROM YAMAHA?

(Continued from page 124)

the motor caught hold there was an unbroken surge of acceleration up to maximum throttle. This could also result from lack of tune-up.

The 7.5-hp (P-125-A) model is the largest of the Yamaha introduction fleet. It proved to be the quietest, smoothest running, and of course, the strongest of the three.

The 7.5-horse outboard has full gear-shift controls, with forward, neutral and reverse. Operation is by the conventional American method of a short shifting handle on the starboard side. (Facing the engine, the shift lever is on the left.)

Planing ability

The factory claims "slow troll to over 16 mph." With one person aboard the test boat, there was no trouble planing. Two persons in the boat produced no trouble, but three and four persons brought speed down to a point where the motor would not plane the hull. The estimated load at that stage was 800 pounds. The extreme smoothness of the 7.5 Yamaha can't help but impress you. Starting is effortless. Noise control is excellent. I'd have to give it high marks.

Two drawbacks

On all the motors, there are two features I didn't like. First: The thumb-lever throttle is rather awkward to control with one hand. Holding the steering lever operating the thumb-throttle produces difficulty no matter which side you sit on. It's necessary to use two hands for control in many situations. Inasmuch as Yamaha manufactures a twist-grip motorcycle, the decision to go thumb-throttle doesn't seem logical. The test crew agreed that this feature should be changed. I was assured by Mel Callaway, West regional manager, that more conventional throttle arrangements will be produced if buyers object to the thumb-lever.

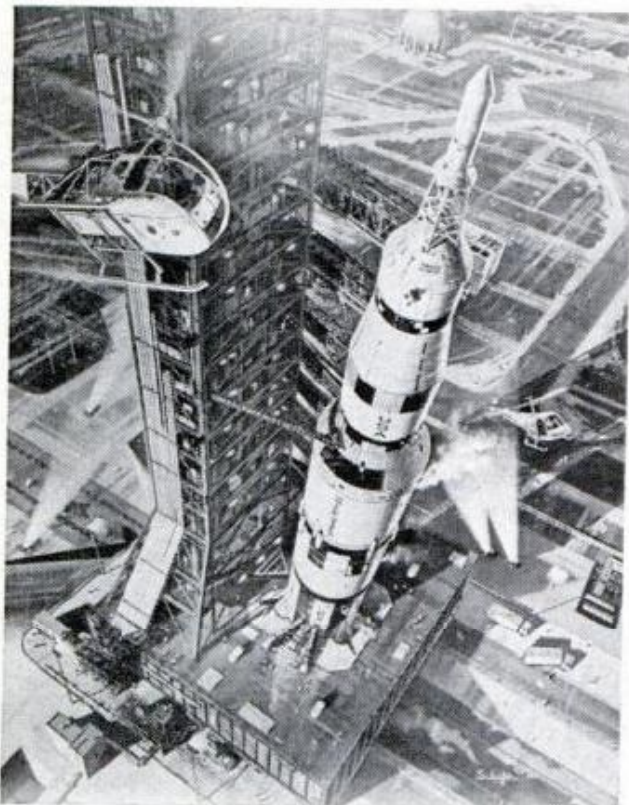
Second: The old shear-pin propeller hub is an unhappy feature on the 3.5 hp. The other models have the good slip-hub prop arrangement.

But these two criticisms should not reflect against a mighty impressive piece of equipment. The Yamaha name is recognized worldwide, and the product is backed by a two-year warranty on parts, one on labor. It's a solid product with a bright future. Distribution is already underway through Yamaha motorcycle dealers and independent marine dealers nationwide.

★★★

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EVIDENCE THAT STICKS

(Continued from page 71)

quinine or milk sugar such as that used in babies' formulas. There was the case of an ignorant pusher who sold a high school boy "heroin" which killed him in a few minutes. The lab proved it was strychnine. LSD, a new worry, appears as a damp spot on a sugar cube or on blotting paper.

Often clever defense lawyers can harass lab experts in court. The bottle of booze found in the drunken driver's car must be chemically tested to verify its alcoholic content, no matter what the label says. Even an unopened can of beer must be tested. The contents of a Molotov cocktail the rioter was about to throw through a street window must also be laboratory tested, no matter how much it smells like gasoline, or the defense will ask, "Officer, are you an authority on combustibles?" and the case may collapse.

Sometimes lab tests protect the innocent. Detective David Innella, who heads the drunkometer testing unit, recalled the driver who sideswiped three cars as he wove his way down a street and crashed to a stop. His passenger escaped before the police pulled up, but the driver was obviously in terrible shape, and an open bottle made the car reek of liquor. He agreed to breathe into the balloon for the drunkometer test—which proved he was absolutely sober! He had suffered a stroke. It was his passenger who had been drinking.

Then in the case of rape accusations by young girls, older men are sometimes cleared after a physician has examined the girl and the laboratory has examined her clothing microscopically for traces of semen. Imaginative, hysterical or vengeful girls (such as the one who was afraid her teacher was going to flunk her) have been known to claim they were attacked when they were not. Such a charge can ruin the career of an innocent man.

The lab's documentation section handles forgeries, threatening letters, phony checks and the like. In one file are threats addressed to such public figures as the President of the United States and the Mayor. Most are from harmless characters seeking attention, others from dangerous psychos.

"Why do they write warning letters?" I asked. "Well," said Detective James Horan, "these people are asking for help. They know they're in trouble. They don't really want to commit this crime. They hope somebody will stop them." This section even keeps the holdup notes passed to bank tellers. And on one occasion one of the field teams brought in a piece of

plasterboard they had sawed from the wall of a room on which a murderer had left an obscene "letter." His handwriting was recognized.

Then there is the Bomb Squad, which gets more than 1000 calls a year, about 400 of which involve real explosives. When a nervous cop calls and says, "We got a bomb," it's their job to do something about it. Detective Wes Somerville, who heads the squad (made up of volunteers from the police department), worked in a bomb-disposal unit in Europe for years.

But the amateur chemist-mechanics working in their basements don't follow any rules. Some are smart and produce murderously efficient devices which have killed members of the squad. Others are astonishingly dumb. There was the man who built a deadly pipe bomb, fitted it in a cigar box and set a fuse to be lighted by a candle when it burned down. Then he closed the lid on his box—and his candle went out!

Due chiefly to the Supreme Court ruling throwing out confessions obtained without the presence of a defense lawyer, police labs are increasingly important. Today many suspects plead innocent no matter how hopeless their cases seem, so that confessions, which can speed a case, are dropping at a rapid rate (down 50 percent in Chicago in recent months). Very often this means the police must produce physical evidence processed in a lab.

Aside from the FBI's big 300-man lab in Washington, primarily concerned with its own work, the largest police lab in the country is that in New York City. Here 107 specialists examine materials brought in by field teams. The first thing a police lab man must keep in mind is the necessity of developing evidence which will hold up in court. Each man who takes the stand to testify must be accepted as an authority in his field.

However, in smaller cities a police lab may have only a couple of men, or just one—or a department may send its fingerprints, guns, bullets and specimens to the FBI in Washington and many do. But sometimes a case can't wait that long, and many police departments are reluctant to admit they don't have the skill needed.

Few schools offer training in this work. Of those that do, the largest is the John Jay College of Criminal Justice in New York. Twenty percent of its four-year academic course is taken up with criminalistics, or to use a newer term, "Forensic Science." This year some 2000 law-enforcement officers, many from New York, are enrolled. It is expected that in coming years lab men will all be civilians, and not recruited from the police. ★★

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'HOME IMPROVEMENT' SWINDLER

(Continued from page 83)

masonry, or spray-paint your house for "half price."

Although their "products" vary year to year, the Williamson clan fits a pattern. They are itinerants, approaching you in your home. The vehicles they drive bear license plates of your state. The name on their invoices or truck door may not be Williamson. The business is for family members only; outsiders become members only through marriage. Therefore, names may be Stewart, McDonald, McMillan, Gregg, Johnstone—or whatever they choose.

When they give a phone number, it's usually an answer service. After working an area a few days, they leave town fast.

Youngsters often accompany the men as helpers to give them an air of respectability. And watch for the distaff members. They're out hustling with hubby and the kids, and will offer fantastically low-priced "Oriental" rugs, antique "Irish" lace and "British" woolens.

The Williamsons are charming, never use overbearing selling tactics and usually speak with a slight Irish or Scotch brogue.

They appear in a neighborhood in pick-up trucks and beat-up station wagons. In their nonworking hours, they drive Cadillacs and Lincolns, and live in luxury. That "special price" you pay grosses them over \$1 million a year.

In May 1965, Dan Williamson appeared at a Hicksville, Long Island, N.Y. home. He told the housewife he was returning to his shop and noticed that her roof needed repair. (It did.) He could do it at a bargain price since it was his last job of the day, "and I hate to dump that good material left in the truck."

That last line is always given as the reason for a special price "if you let me do it now."

The woman paid \$140. Shortly afterwards, the "silicone sealer" Williamson had put on the roof washed away.

"I felt I'd been swindled," the woman said. That, as she was soon to discover, was an understatement.

In June 1966, Williamson again knocked on her front door. Deeply hurt by her complaint, he said, "But I told you it was a first coating. I'm back to apply the second and final one, and I guarantee it will last at least five years and more like 10."

He put *that* in writing. On went the second coat. Away went Williamson—with another \$125. The second coat, of course, was as "stable" as the first.

Along with defensive measures already

noted, there are several other ways to protect yourself against the home improvement swindler:

● Your safest bet is to say "no thanks" to a salesman appearing unsolicited at your door. If his pitch is interesting, however, tell him you want to meet him at his company's office. If there's anything legitimate about the operation, he'll have an office and you can verify his reputation with the local Better Business Bureau or Chamber of Commerce.

● Don't fall for phony credentials. If the man says he's an "official," let him wait outside while you call the police or a responsible town agency to have his claim checked out.

● Never sign anything immediately, no matter how attractive the deal seems. Give yourself plenty of time to think it over.

● If you sign a contract, but realize afterwards you've been swindled, don't let workmen do any work. Once work is done, even partially, you're legally obligated to pay.

● If you're prepared to sign a contract, make sure it stipulates that succeeding parties to whom the contract is sold will be legally responsible for all guarantees and other liabilities.

● Read everything thoroughly before signing. If you don't understand something, don't sign. If a job is going to cost hundreds of dollars, let a lawyer examine the paper work. Don't wait until you're in trouble.

Finally, never fall for the line that you can't afford to be without something. Many times, perhaps, you can't afford to own it. ★ ★ ★

WINGLESS AIRPLANE

(Continued from page 172)

get away from this concept of dropping the spacecraft in the ocean and sending half the Navy out to pick it up. We're going to have to build spacecraft like aircraft."

A new ablative material, also developed by Martin, may help. Tested on models in space, it protects the crew and spacecraft inside it; the charred layers can then be peeled off and the spacecraft is ready to go again.

We may yet see the day when spacecraft, sent out on cargo runs to space stations, satellite inspection or repair work, will return to earth, have their outer coats peeled off and new ones put on, be refueled, then have the crew chief turn to a group of waiting space pilots and passengers and say, "Next!" ★ ★ ★

Doctors Find Way To Shrink Hemorrhoids



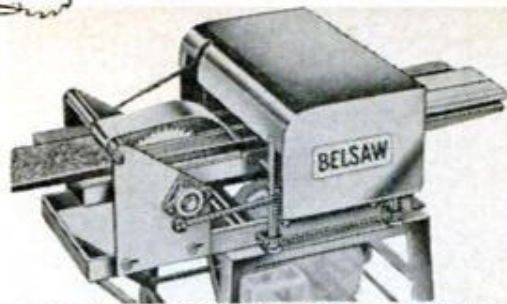
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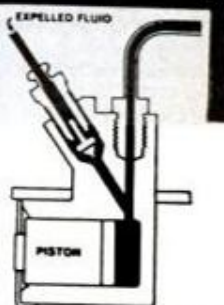
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HOUSEBOAT—YOUR BEST BUY?

(Continued from page 93)

skipper's life is selling the wife on boating. More and more regular boating lines are starting to design cruisers with the woman in mind.

But a houseboat is a boating wife's dream. The layout of such a boat lets the woman have a bit of home-away-from-home. With plenty of headroom, galley arranged like an efficiency apartment, bunks easy to make up, privacy in the head and ample storage space, a woman hasn't a complaint about boating.

Skipper's duties

But the homelike atmosphere of a houseboat doesn't subvert the skipper's duties. He still has to baby the engines, add navigational gear, man the radiotelephone, check the weather, give the orders, handle the craft.

And a skipper of a houseboat soon learns that it doesn't really handle like a cruiser of comparable size. The one big disadvantage of a houseboat is handling in wind. This relatively light boat with shallow draft may skid across the water like an oil slick in a brisk breeze. It may take a few tries, before you learn to master this condition, especially if you have a single engine.

Learning to handle houseboats takes some practice. But many houseboat-rental agencies will let you take a boat for a week's cruise after several hours of checkout. However, you *must* know the rules of the road, and you should know about weather. A fast moving squall line can raise havoc with *any* boat.

Try a houseboat

Many people like to try houseboats before buying. You can do this too by chartering during the summer. This renting practice has become so popular, though, that many rental agencies are now booked up for this season. Rentals go from \$200 to \$300 a week.

A final hint on buying a houseboat: Check the warranty. It's best to have one warranty that covers hull, engines and everything else that's listed as standard equipment. A number of manufacturers have their own warranties for products they make, but pass on to you warranties from makers of equipment they buy to install in the boat, such as engines. ★★

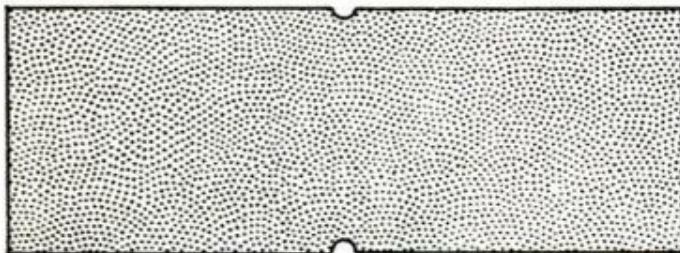
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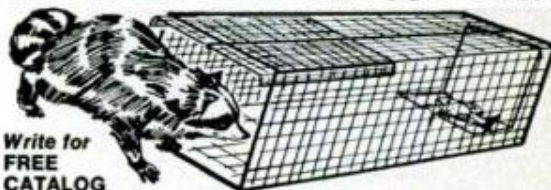
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SAVING NIAGARA FALLS

(Continued from page 97)

where necessary, with a false front of concrete, then huge bolts, 30 to 40 feet long, will be run into the rock layers to anchor the concrete and rock in place. Once the Falls are turned on, of course, the false front of concrete will be covered by the waterfall.

The second method is more complicated. A tunnel will be driven in near river level on the mainland edge of the Falls to a distance of 200 to 300 feet. It will then turn into the riverbed, extending to the edge of Goat Island, from where it will again head for the face of the cliff. Then from the cross tunnel, extending under the river bed, stub tunnels would be directed toward the face of the cliff, toward the weakest parts of the cliff and sloped to provide gravity drainage.

The tunnels will be man-size, six to eight feet in diameter, so periodic maintenance within them can be carried out. Inside them, high-strength beams of steel or reinforced concrete will be installed as anchoring positions. At the open ends of the stubs, fingers called tendons would be drilled into the rock and sealed in place permanently to "grip" the rock. The tendons would then be attached to the anchor beams with cables or adjustable rods, and the cables or rods would be pulled taut to hold the face of the cliff in place. Part of the periodic maintenance would be to adjust the tension on the cables or rods.

Where to place the stub tunnels and the tendons will be part of the preliminary studies, if the Falls are dewatered.

Saving Niagara Falls for its scenic beauty alone is a justifiable project, and has received the blessings of both the United States and Canadian governments. As recently as last spring, a group of 40 European travel editors, en route to the United States, were asked what they wanted most to see. They voted Niagara Falls as No. 1 on their list.

Next year engineers will begin the study of restoring the beauty of the Falls so that it will remain No. 1 for generations yet to come. ★★ ★

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Australian oil drillers have found huge supplies of good-quality water under the desert near Alice Springs, Northern Territory, which could change the so-called "dead heart" into one of the country's biggest irrigation areas. Hydrologists believe the water could irrigate 105 million acres for 100 years.

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WHAT LASERS ARE DOING NOW

(Continued from page 102)

one of the most hopeful of new uses for lasers. Laser beams flashing almost instantaneously across the vast reaches of outer space may bring us TV pictures from space probes like *Mariner* in seconds compared to the eight hours presently needed by radio. RCA is currently working on a sun-powered laser device for 50-million-mile communication with spacecraft traveling to Mars and beyond.

The reason for these exciting possibilities is that a light wave, because of its ultra, ultra high frequency, has a capacity for transmitting messages that's as much as 100,000 times greater than that of a microwave. Theoretically, all the telephone conversations going on simultaneously in the United States at any given moment could be carried by a single laser beam.

3456 voices on one beam

Bell Telephone Laboratories has already succeeded in transmitting two TV programs simultaneously over the same laser beam. A single beam has also carried 3456 separate voice channels. Laser beams carrying messages in Morse code have been bounced off an orbiting satellite and picked up again on earth.

While rain, fog and snow hamper laser transmission on earth, these problems do not exist in space. Lasers could beam messages throughout the solar system at the speed of light unhindered by atmospheric conditions. On earth, laser beams could be shielded from the weather through the use of airtight "pipelines." By bouncing a beam back and forth repeatedly between mirrors, it can be made to travel many miles in a small space, forming an optical "delay" line on which information can be stored. In time, Bell hopes to use such a system for storing telephone numbers and billing information.

Coming: 3-D movies

Three-dimensional holographic movies, an impossibility until now, may be on the way. The problem has been that a hologram cannot be made of anything that moves because the slightest motion upsets the delicate interference pattern produced by the reflected laser light. Now researchers at Bell Labs are using a stroboscopic device to "freeze" motion into a series of separate images that appear to stand still. Holograms of these apparently stationary images are then strung together—like the frames of conventional movie film—to produce the effect of a 3-D motion picture.

Equally intriguing is the use of laser

holography to spot structural failures before they happen. A hologram is made of a part without any load on it. Then the piece is deliberately bent or twisted and another hologram is made. When the two holograms are superimposed, they produce an interference pattern that is, in effect, a map showing lines of deformation and strain. From this, experts can tell how a part is likely to stand up in actual use. Such research, carried on by the American Society for Nondestructive Testing, is expected to improve the safety of airplanes and spacecraft.

In medicine, too, lasers are finding dramatic new uses. British scientists have developed techniques of sending laser beams through glass fibers to treat internal cancers that are inoperable and untreatable otherwise. The use of a laser to "weld" detached retinas back in place has become almost standard practice. Even laser drills for dentists are a future possibility.

A new "light knife" has been built at Bell Labs so that a surgeon can use a laser beam as he would a scalpel. The beam is carried by prisms around 90° corners of a hollow-jointed arm to a small probe the size of a fountain pen. This could make possible "bloodless surgery" because the light from certain lasers, such as the argon-ion type, cauterizes as it cuts.

"Seeing-eye" cane

RCA is working on a cane to make the blind "see" again. Two tiny infrared semiconductor lasers are placed in a "seeing-eye" cane. Their pulses are reflected from points three and six feet in front of the cane and picked up by built-in photoelectric cells. Anything that gets in the path breaks the beam, warning the holder.

Bendix Corp. is working to out-Sherlock Sherlock Holmes. It uses lasers to illuminate transparencies of fingerprints so that "look-alike" prints can be clearly differentiated by the characteristic light patterns they produce. An RCA semiconductor laser opens the way to an automobile collision-warning system that might even apply the brakes if one car closes too rapidly on another car in front.

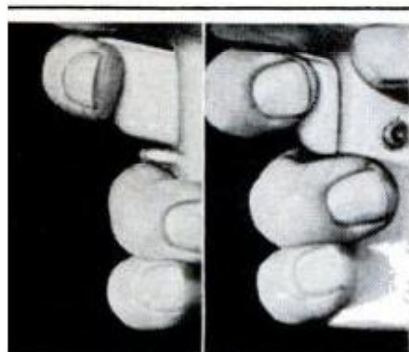
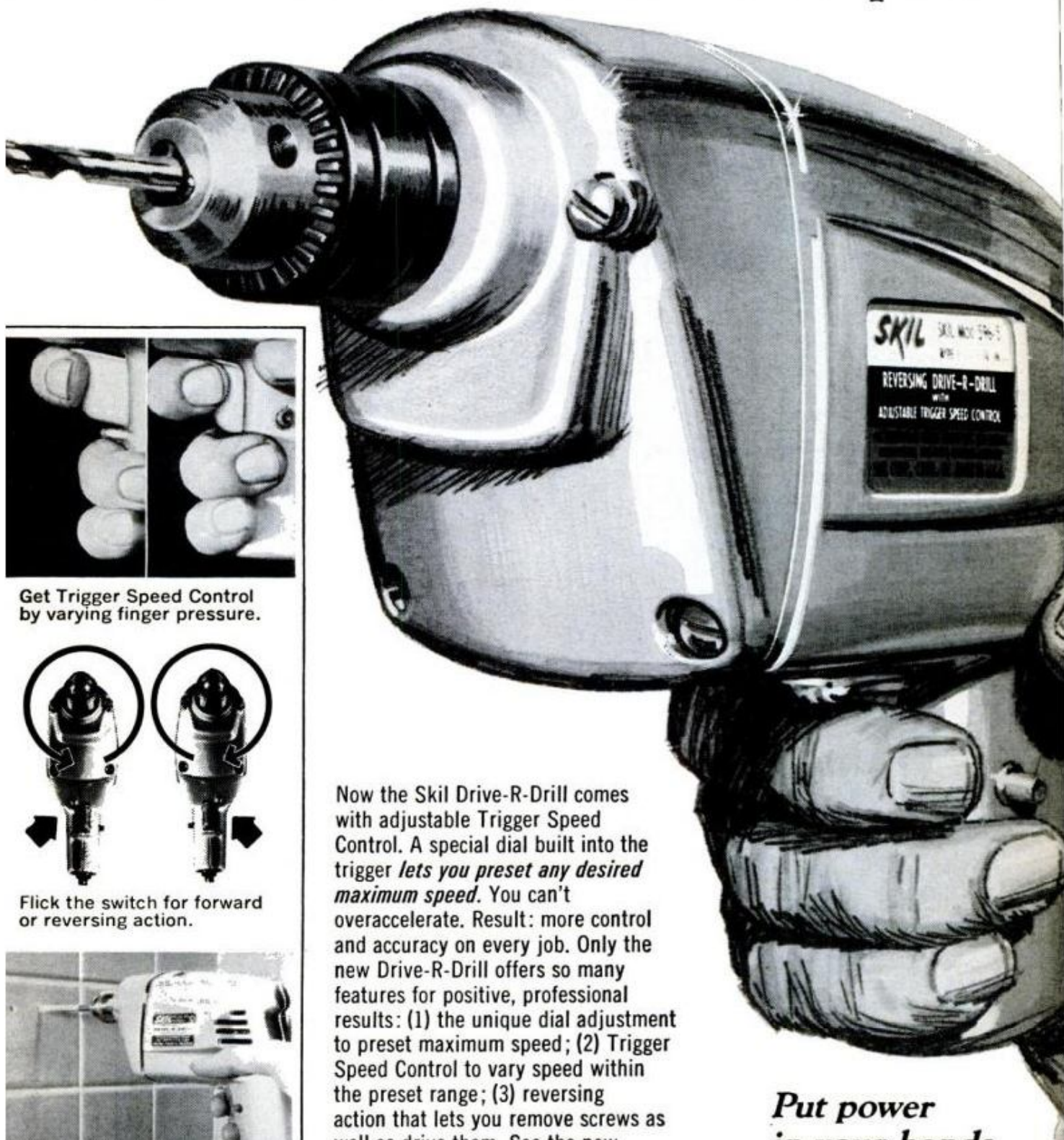
RCA has also just developed the first gas laser to produce intense ultraviolet light for up to 1000 hours continuously. It may lead the way to new chemicals because ultraviolet light is often used to speed up, or even initiate, many reactions. It might even decipher the "code of life," the DNA molecule. The highly precise beam might be capable of acting as a scalpel to cut off one or two atoms for studying how the molecule is put together. ★★

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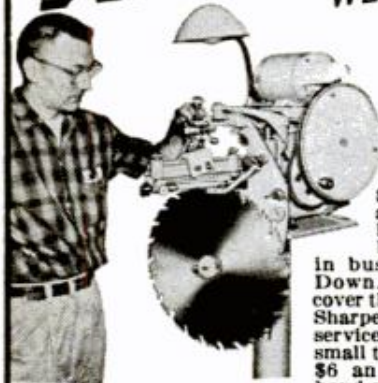
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HI-LO CAMPER SHELL

(Continued from page 129)

circuit, as you'll want them to go on and off with the headlights. The wiring to the dome light and vent fan should be hot all the time, since these will be operated independently. Be sure to use in-line fuse holders where the camper wiring ties into the truck's electrical system.

With the wiring in place, batts of fiberglass insulation can now be cut to fit between the framing pieces. Wedge these batts in place and you're ready to put on the aluminum skin.

Use small aluminum nails to attach the skin to the framing. Nail only at the very edge, and be sure to cut the aluminum large enough so that the corner moldings will conceal the nails. Permagum caulking tape should be used under all exterior moldings and window frames to seal out water. Where it's necessary to curve the corner molding, cut a piece of plywood to the proper radius and use this as a form to bend the molding.

Build the extender exactly as you did the shell. Locate the front window so it lines up with the rear window of the truck cab. This window is primarily for those times when the extender is being used by itself to increase the height of box sides. However, it's also possible to see out the rear window when the shell is in place.

Plan offers choice of doors

Note that there are two doors detailed in the plan. The small swing-up door for use with the shell alone has weather stripping along the bottom edge and is designed to fit against the top of the tailgate. It fits in the rear cutout of the shell and can be taken out when you want to put in the extender.

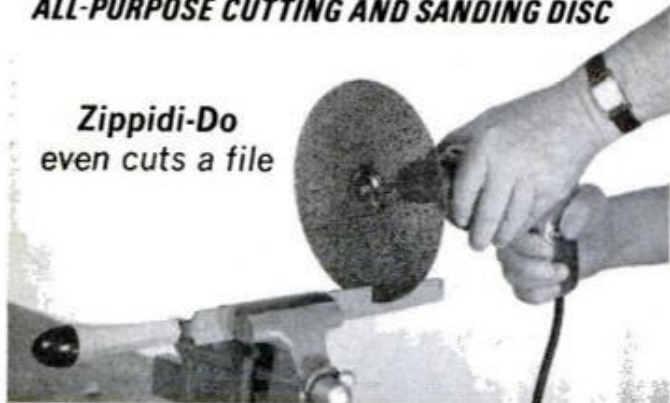
With the extender, it's far more practical to remove the tailgate and close up the rear opening with a second panel featuring a full-height walk-in door. Door bolts inside are used in both cases to secure the rear panel to the shell or the shell and extender.

Interior options are almost limitless. Plywood floor panels with carpet remnants tacked over them help to insulate the floor and give it a finished look, yet can easily be removed when you want to use the pickup for hauling. Likewise, a pair of removable bunks bolted to brackets on the floor and sides will turn the shell into a snug hunting cabin. Make it as simple or elaborate as you like. Either way, your camper shell will probably pay for itself in a couple of season, just in savings on motel bills. ★★★

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BUILD A SODA FOUNTAIN

(Continued from page 143)

and avoid bowing. I used touch latches on the doors, but regular knobs and magnetic catches will do.

The three cabinets are ganged together side by side and holes are drilled through the butting sides for 1/4-in. carriage bolts, placed below the tray level.

The evaporator hangs from a rabbeted wooden frame, part F, below the tray opening. This is made as a separate unit and then glued and screwed to the underside of the opening. Study the section drawing on page 140. Four small screw holes are drilled through the side of the evaporator for attaching it to the rabbets. Note in counter pattern H, page 141, that the evaporator is located off center of the opening so that the refrigerant lines across one end of it won't interfere with placement of the liftout ice-cube container.

The lower compartment of the center cabinet is lined (back, sides, bottom, top and front) with rabbeted panels of 1-in. Styrofoam. Install the back lining first then the bottom, followed by the side panels. Separate pieces are cut to fit around the evaporator frame when lining the underside of the top. These are stuck in place with white glue. The front panel is a mere press fit in the rabbets since it must be left removable.

Aside from screwing ready-made tapered legs to the bottom and bridging between them at the front with a decorative apron, you are ready to install the components. After its refrigerant lines are passed through the 2-in. hole into the adjoining cabinet, the evaporator is screwed in place. Then the cold bank is placed along one side of the evaporator and the carbonator unit on the other.

The hookup of the components is simple. First the water-line hose is connected to one flare fitting on the cold bank. Then a second hose is attached to the other fitting on the cold bank and connected to the water intake fitting on the carbonator pump. A third hose runs from the CO₂ fitting on the carbonator tank to the pressure gauge on the CO₂ tank. Finally, the hose from the soda faucet is attached to the "soda out" fitting on the carbonator tank. The CO₂ and water hoses, plus the carbonator motor cord and the temperature-control cord, all pass through the 2-in. hole. Poke a hole through the Styrofoam lining just big enough to pass the hoses and cords.

The soda faucet is held in place by a thin metal plate screwed to the rear side of the hole in panel E. The knurled nut on the end of the faucet is backed off and the

hose inserted through the hole in the plate. When the nut is tightened, it locks the faucet in place. I added still a second faucet to make plain water available, but this is purely optional.

The compressor, mounted on a board base, rests across the frame of the open-bottom cabinet. Pieces of foam-rubber kneeling pad are used to cushion it. The CO₂ tank stands on a small shelf installed at the front corner. Connecting the two evaporator lines to the compressor fittings completes the hookup.

Once the compressor hookup is made you should not disconnect it for any reason. The compressor lines come charged with refrigerant and, once the seal is broken by tightening the connections, the latter must remain intact. Otherwise, you will lose the refrigerant.

To use your soda fountain, plug the 1/4-hp motor into one side of a 110-v. double wall receptacle. Then plug the temperature control cord into plug A and plug the compressor cord into the other side of your wall outlet. Now turn on the water to fill the carbonator tank and open the valve on the CO₂ tank so the gauge reads 120 lbs. pressure. Purge the air from the carbonator by opening its safety valve momentarily and you are ready for your first refreshing drink.

The complete kit of components, less CO₂ tank, is available from Home Soda Fountains, Inc., 19-41 46th St., Long Island City, N. Y. 11105, for \$269 f.o.b. Ready-made fountains are also available. ★★

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JEWEL BOXES YOU CAN MAKE

(Continued from page 136)

fence attachment is used to keep the recesses parallel to the edges of the top. Work carefully, taking light cuts as you go until you reach a depth of $\frac{3}{8}$ -in. Then sand the recesses smooth. The drawers are made to slide freely in the openings, and a $\frac{1}{16}$ -in. clearance is left between the drawer fronts.

Don't be surprised if your wife twists your arm to make the stunning cherry chest for her. It's actually the simpler of the two. The dados for the two notched shelves are stopped $\frac{1}{4}$ -in. from the front, while the bottom dado runs through. The $\frac{1}{8}$ -in. back joins the sides in rabbets. The flush-fitting drawers differ from the others in the way the sides join the fronts.

Beveled glued-on overlays create the look of individual drawers. Knife cuts scored across the faces of the drawers, as well as the dividing rails, make the illusion even greater. Actually, the drawers are set in $\frac{1}{8}$ in. to make the overlays even with the front.

The top can be pinned to the sides with short dowels or glued in $\frac{1}{4}$ -in. dados cut on the underside. In the latter case, the height of the end members is made $\frac{1}{4}$ in. greater than that dimensioned. The back is likewise made $\frac{1}{4}$ in. higher to fit a stopped rabbet cut along the rear edge.

When you have the chest completed, sand the surfaces glass-smooth, using progressively finer grades of garnet paper. You'll do a better job if you sand the drawers before adding the overlays. Finally, stain and finish as desired, then drill the holes in the center of the overlays for tiny knobs. ★★

AUTOMATIC LAWN SPRINKLING

(Continued from page 156)

very little work. Today's typical residential sprinkling system uses plastic pipe (see *The New Plastic Pipes*, page 162, Feb. '68 PM), which is both lightweight and easy to assemble. Only a minimum of shallow trenching is required.

Fittings and sprinkler-head connections differ from one brand to the next, but the manufacturer's literature covers all questions you might have concerning installation procedure. If your dealer doesn't have this literature, write to the manufacturer.

When buying the materials, don't forget that at least two companies offer "starter kits" which might give you an opportunity to save money. Both Buckner and Toro sell such kits at prices somewhat

lower than what you would pay if you purchased the components individually.

Types of automatic controls

What type of control you use will depend at least partially on what make of system you choose (or vice versa). The simplest possible automatic control is an electric timer that works a lot like a clock radio. Every manufacturer sells this type, and naturally, it's the most economical.

More sophisticated, and considerably more expensive, are moisture-sensing controls available from Buckner and Rain Bird. These provide the ultimate in automation since they turn the system on only when the soil needs water, and not a minute before.

Buckner's control uses two stainless steel low-voltage electric impulse probes set in a special sand-filled "probe bed" located under 4 in. of sod. These read the moisture level in the sand, and if it's sufficiently high to indicate that the soil doesn't require watering, it over-rides the timer to prevent the system from being turned on at the preset time. When water is needed, a light on the control panel will glow, to let the owner know that the system will be activated at the programmed time.

Rain Bird's "irrometer moisture sensor" works on the same general principle, but is a separate unit which can be added to other Rain Bird timer-type controls.

Conversion is simple

Converting a manual system to automatic control is a relatively simple operation involving only the installation of the control unit and the replacement of manual valves with automatic valves. You can do this at any time the budget permits. However, the sooner you begin building your system, the sooner you will be able to enjoy fully automatic sprinkling. ★★

Hottest runner is winner

It is possible to tell accurately the outcome of a marathon race using only a thermometer.

Dr. O. G. Edholm, head of the division of human physiology at the National Institute for Medical Research in London, reports that athletes' body temperatures just after a race tell how they finished in the race.

The first runner to finish has the highest temperature, and the last has the lowest—with the others strung out between in proper order.

One winner has been recorded with a temperature of 106° , near the point at which a human is in serious trouble.

BOAT WITH PROP IN A POCKET

(Continued from page 77)

biggest problem with tunnel drive—the company readily admits this—is reverse. Like any inboard propulsion system, it cannot easily maneuver in reverse. You have little, if any, control. This affects your docking ability, a problem on smaller, single-prop boats. However, Penn Yan is designing a 26-footer with twin TDs. In this boat, at least, you will be able to maneuver in reverse.

Another disadvantage is noise. In any inboard system you find the exhaust in the transom at the water line. The same is true with TD. Though the twin exhausts of a 210 are muffled, your sound level is still higher than that of the underwater exhaust system in I-O.

Finally, I-O can go faster at the red line on the tachometer—several miles per hour faster. But the faster you suck water through a tunnel, the more you are likely to raise the problem of cavitation.

Today, TD design is not at all practical for racing boats. Someday, it may be improved. But Penn Yan isn't selling racing boats, so it's not worried about designing for this sport.

Bob Stuart has designed a system that works for pleasure boats. It operates before plane like the inboard drive on a displacement hull, and at high planing rpm, like a jet.

Some TDs are available now on Penn Yan's 23-foot Avenger series. By fall and early next year, Penn Yan plans to add TDs to the 20-foot Explorer series and the 22-foot Barracuda. The Chrysler 210 will be standard on all models with the 150-hp engine optional on some. ★★

Force field protects fruit trees

High-voltage electricity may help the nation's citrus growers protect fruit against freezing, according to George Yelensky and George Horanic, researchers with the United States Department of Agriculture.

Six-month-old lemon seedlings were exposed to subfreezing temperatures down to 13° F. for 40 minutes. Unprotected seedlings were killed, whereas those planted in a two-million-volt electrostatic force field survived with no apparent damage.

Captive copter sprays fields

A captive helicopter that may be used to spray fields with fertilizers or weed killers has been patented by Nickolaus Laing of Aldingen, Germany.

Laing's helicopter is attached by a hose and control cable to a tank truck.



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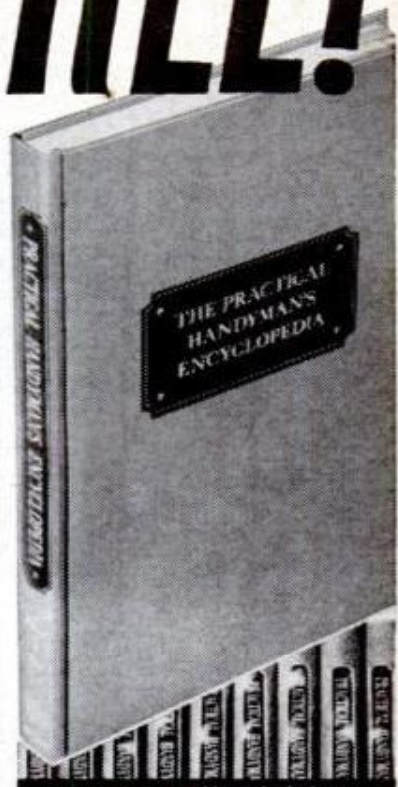
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