

How to Protect Yourself Against Highway Booby Traps

POPULAR MECHANICS

MAY 1968
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The pocketproof 22's.



Pockets, unfortunately, just aren't the cleanest places around.

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That's why we call our high-speed rimfire cartridges the "clean 22's". We don't just *make* them clean; we make

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After all, the action of your rifle is no place for dirt, and lint, and bits of leaves, and old chewing-gum wrappers.

But it's a great place for Remington/Peters 22's. Try a pocketful and see.

Remington  **PETERS**

**One reason to stick
to Remington/Peters "golden" 22's
— dirt doesn't.**

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What you should know about

Driving in the Wilderness

You may want to camp deep in the wilderness but are hesitant. Many people are unsure about driving over rugged mountains, through rushing streams, on wheel-catching beaches. But others, who know the tricks of wilderness driving, find great fun camping away-back-in. So here are tips from experts that will help you take your rig into remote areas—as yet unspoiled.



How to get unstuck

If your trailer bogs down, disconnect and drive car onto firm ground. With 100-foot, 1/2-inch nylon tow rope try pulling trailer straight out. If this doesn't work, run rope through a pulley which you have attached to rock or tree. Tie rope to trailer tongue and to car hitch. Pulley will multiply your pulling effort. If this fails, back car so it's at a 30° to 40° angle to trailer. Tie rope to near side of trailer. Ease forward. The sharp angle should twist one trailer wheel out of bog. Stop, unhitch, repeat on other side.

If stuck with a pickup truck camper, jack up bogged wheel or wheels. Fill hole with any of the following: small stones; floormat from cab; the spare tire; burlap sacks; twigs; dry needles; long-stemmed dry weeds (green weeds or leaves are slip-



pery). Lower truck and ease out.

Remember: Maintain momentum when driving or towing through sand, streams, mud. Stop in the middle for any reason—you're stuck.

How to pass a stalled vehicle on a wilderness road



When passing a stalled vehicle on a narrow road always take the route which circles the high side of the road. When passing on the low side, your tires may bog down coming back up onto the road.

Scrape protectors



As your car enters a short, steep wash or gully, then climbs out, the back of your trailer will drag. To protect undercarriage hardware such as septic holding tanks, it's best to have skid bars welded on before driving in the wilderness. These protective steel bars will take the punishment.

WHEN YOU'RE DRIVING a camper up a steep slope littered with small pebbles, tires may not get good traction. Try to turn rig around and back up. Station a guide whenever you back. Most damage to vehicles occurs when backing.

LOAD-EQUALIZER hitch spring bars should be removed when towing through sand, mud, up and down steep gullies. This lowers full weight of trailer tongue onto car, providing better traction. It also makes tow-joint flexible.

Attach front bumper hitch

A simple bumper hitch mounted on the front bumper of the truck or van will let the driver maneuver his boat trailer or other towed vehicle into tight spots for boat launching, or where a one-lane road precludes turning around. Be sure to mount hitch about 6 inches off center toward the passenger side (curb side) so driver has forward vision along one side of trailer.



Mount front bumper hitch off center so driver can see.



DON'T PARK in dry washes or gullies. Though they break the wind, they are prone to flooding. Flash floods can trap you even when it rains in the mountains many miles away. Choose high ground. Also, don't camp under tall, dead trees. Brisk winds at night can break off heavy limbs and send them crashing through your camper. Many campsites have been wiped out by flash floods or damaged by falling trees.

LETTING AIR OUT of tires trapped in sand is still the best escape method. But make sure you let out *plenty*. If the casings have not deflated to a pear-shaped blob they're still too full! Then drive *slowly* out of the sand. Replace the air before traveling long distances or permanent damage to tire cords is likely. You should carry a *tire pump*.

SUPPOSE YOU MEET someone head-on on a narrow dirt road? Common sense dictates that you talk it over which way to the closest turn-out. The law in some states gives the *uphill* driver the right-of-way. The *downhill* driver must back up to a turn-out. (Backing downhill is dangerous!)

How to turn around on a narrow road

Turning around on a narrow wilderness road is not as difficult as you may think. A careful driver can about-face his trailer in a space as wide as the trailer is long. Here's how.



1 Locate widest spot in road. Now park as far to one side as you can. Watch for soft shoulders. Disconnect trailer.



4 Push the front corner of trailer by hand, turning it so it angles across the road.



2 Turn car around by making short, sharp turns with the steering wheel, jockeying forward and back.



5 Tie rope between trailer tongue and car hitch. Then use car to pull trailer completely around.



3 Squeeze past the trailer and park about 50 feet beyond.



6 Hook up. If trailer tough to push by hand, use pulley attached to nearby tree. Run rope trailer to pulley to car.

Popular Mechanics is published monthly by The Hearst Corporation, 57th St at 8th Ave., New York, N.Y. 10019. U.S.A. Richard E. Berlin, President; George Hearst, V-Pres.; Richard E. Deems, President of Magazines; John R. Miller, Executive V-Pres. of Magazines; Raymond J. Petersen, Senior V-Pres. of Magazines; Albert A. Rachoi, V-Pres. and Director of Circulation; Joseph F. Kern, V-Pres. for Popular Mechanics; Frank Massi, Treasurer; Harvey L. Lipton, Secy. Single copy in the United States and Canada, 50 cents. Subscription prices: United States and Possessions, \$4.00 for one year; \$7.00 for two years; \$10.00 for three years. Canada, add \$0.50 for each year. Pan American Postal Union countries, add \$1.00 for each year. All other countries, add \$2.00 for each year. When changing address, give old address as well as the new, with postal-zone number, if any, and allow six weeks for change to become effective. Second-class postage paid at New York, N.Y. and at additional mailing offices. Authorized as second-class mail by the Post Office Department, Ottawa, and for payment of postage in cash. Registered as second-class matter at the Post Office at Mexico D.F., Mexico, June 20, 1950. © 1968 by The Hearst Corporation. All rights reserved. Printed in U.S.A.

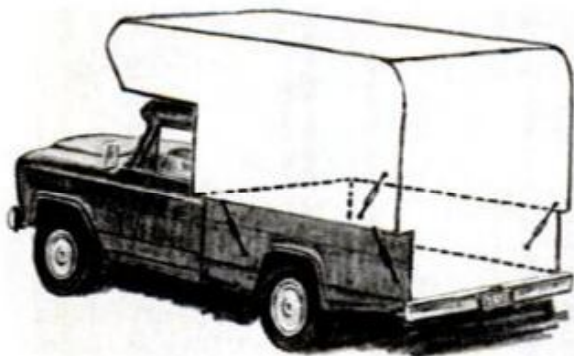
Know your top clearance in brush country

Measure the height of your rig before leaving home. Carry a 10-foot folding rule in your glove compartment. It's easier to measure a low limb from the ground than to climb onto the coach roof to judge clearance nose-to-nose. When driving under trees keep a sharp eye on thick clusters of leaves low enough to dust the roof. Leaves may conceal broken limbs that ram tops.



Tighten camper bolts

If the road is unusually long and rough (like the Alcan Highway) tighten floor bolts daily, or oftener if they keep loosening. If you use turnbuckles, give them a light twist twice a day. Use your hands. Twisting with a screwdriver may only crack, break or weaken them.



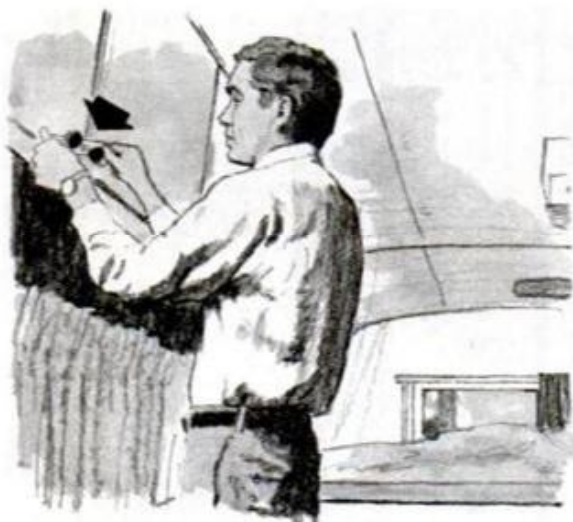
Don't bury emergency equipment

Leave jacks, ax, spade, tire chains, wheel chocks, tow cable, saw, rope where they can be easily reached without major unloading. On long trips into remote areas, carry two spare tires—and a tire repair kit. Don't forget a tire pump, either. Carry extra gas unless you're sure a full tank will get you there and back.



Check for breakage

Stop every few hours and check interior for overturned boxes, spilled drinks, open cabinets. Use heavy rubber bands to secure cabinet doors. Stretch bands between cabinet knobs. Keep windows closed tightly to keep out road dust.



REMEMBER—the best of all advice is to travel in pairs. Having another vehicle along assures drivers that help is always handy. There isn't much excuse for both vehicles getting into trouble.

Pickup campers aren't "square" anymore!



Look what's happened to campers! Camping and traveling with a pickup camper has never been "square", and now campers aren't either!

Gone is the boxy look with flat sides and square corners. The modern - as - tomorrow Goldline has a sculptured look and streamlined styling that is totally new and unique. But looks are only part of the picture. Here is a brand new concept made possible by a space-age material and sandwich-wall construction that has features never before available in a pickup camper. It's lighter in weight, never needs paint, easy to clean, has 30% more storage area, and is virtually indestructible.

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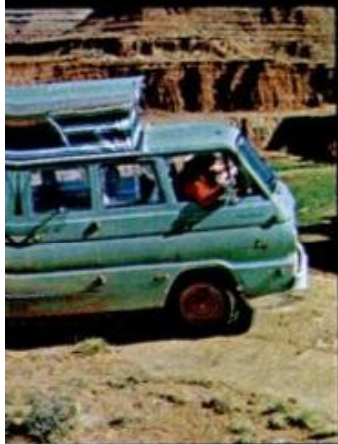
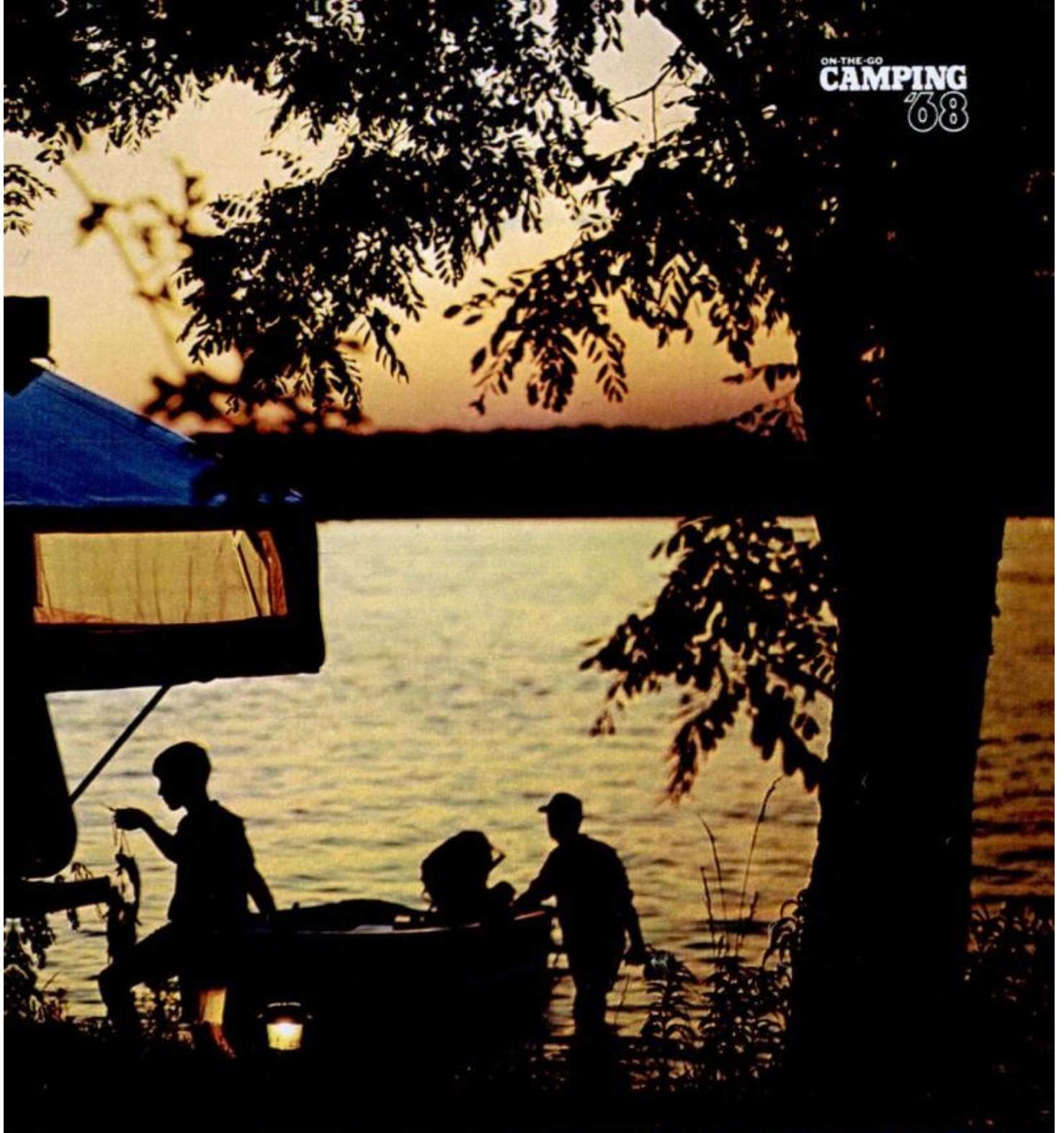


The Right Camp Wheels For You

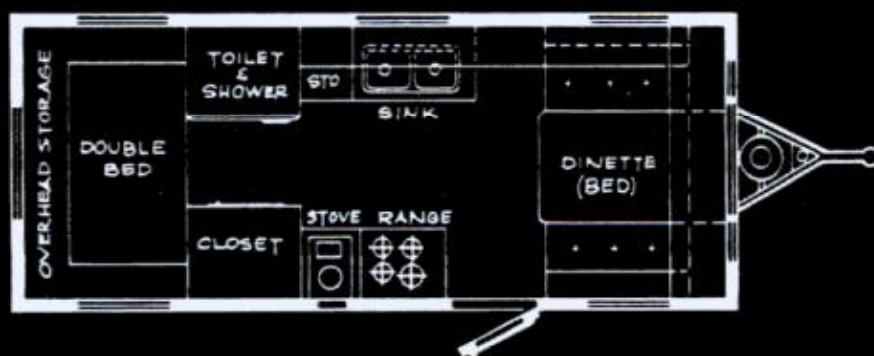
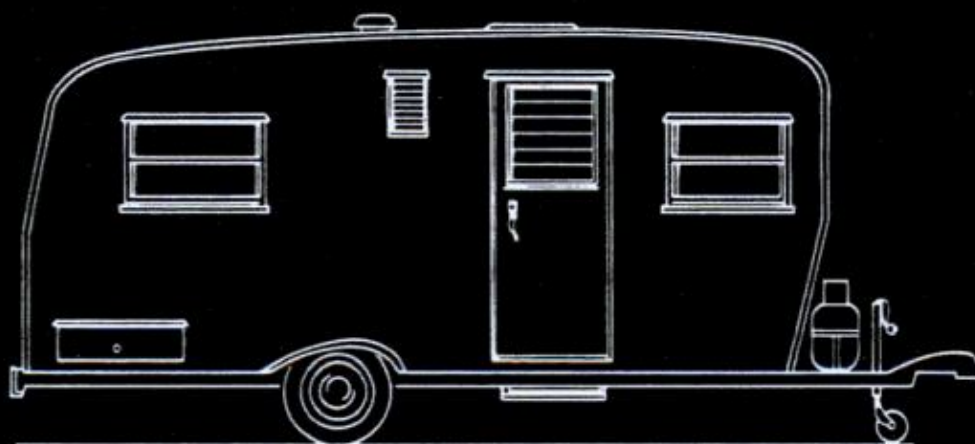
Whether you're a first-time buyer or old-time pro, here are some basic facts you should know

PICTURED HERE are the four most popular types of recreational vehicles—camping trailer, van, travel trailer, truck camper. What's right for you depends on your idea of "roughing it," the size of your family, the heft of your wallet, and whether you plan to use the family car or want an extra truck or van. You can spend from \$300 for a small camping trailer to \$6000 for a luxury, self-contained (shower and toilet) camper or travel trailer. There are over 700 models to choose from. Advantages of each basic vehicle are explained on the next four editorial pages.





Travel Trailers



Travel trailers are the most popular of all vacation vehicles because they are spacious and can be easily towed behind the family car. They range from short 12-foot weekenders priced as low as \$800 to 31-footers that can cost as much as \$8000. Self-containment (which means shower and toilet included) begins with the 16-foot models. (Usually the actual living area in a travel trailer is three feet shorter than advertised length. The A-frame tow bar in front and the rear bumper are included in the measurements.)

An 18 or 20-footer is, truly, a small home on wheels. Such a trailer has full headroom, well-equipped kitchen and dining areas, separate

bedroom and separate bath. Many have heaters and airconditioners for all-season use.

ADVANTAGES: All except the shortest sleep six or more people in comfort. Once camped you have the car free for errands and side trips. Makes a good guest cottage when parked at home. Offers sure, luxury comfort on traveling vacations or weekends.

DISADVANTAGES: May be quite an investment. Calls for special training in turning and backing. May be heavy load for a light car. Passengers may not ride in unit while in motion. Restricted to lower speeds in some states. An outside storage ban is imposed by zoning laws in a few residential areas.

If anyone asks why you pay more for Stren*, just tell 'em you get what you pay for.



You get all the advantages of other lines rolled into one. Because STREN fluorescent monofilament fishing line has the ideal balance of properties.

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You get great impact resistance with low, controlled stretch. STREN absorbs the heaviest strikes with minimum give. No slack to let fish shake the hook loose.

You get outstanding knot strength with high abrasion resistance. This means knots that last as long as the

line itself. Which is pretty long, since STREN resists the wear and tear of sand, rocks and rough surfaces.

That's what you get when you pay a little more for STREN. What you get when you start fishing with it is even better.

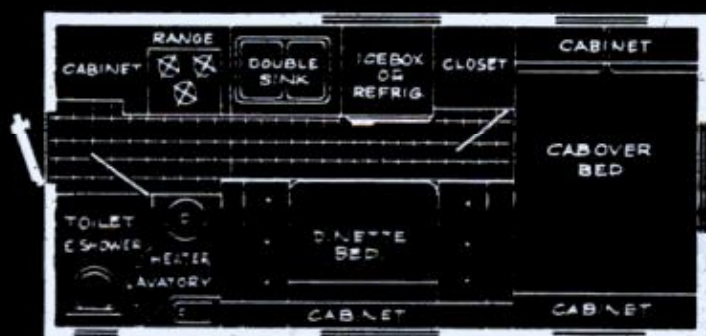
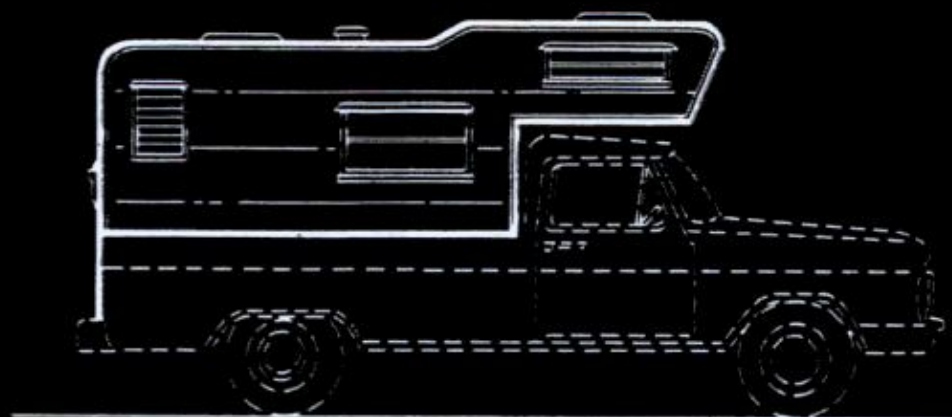
You'll find STREN wherever fine sporting goods are sold. It's ideal for fresh- or salt-water fishing.

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Better things for better living
...through chemistry

Truck Campers



Modern pickups are rugged as trucks and as luxurious as pleasure cars. Lots of families use them as second cars. Next, they buy a camper unit, slide it onto the truck bed, and they have a vacation home on wheels.

A medium-sized camper fits snugly on a half-ton pickup, but heavier ones require a $\frac{3}{4}$ -ton truck. With power steering, power brakes and automatic transmission, a camper special can handle like a car. A truck runs about \$3000, a camper from \$2000 to \$4000.

The big campers are $10\frac{1}{2}$ feet long (up to 13 feet if chassis-mounted) not counting the overcab projection that holds a foam double mattress. Four can sleep in comfort.

The kitchen area contains a dou-

ble sink, cooking top and oven (with overhead exhaust fan), icebox or refrigerator, working space and lots of storage. There's a space heater, water heater, wardrobe, and a combination shower and toilet with tank.

The shrewd buyer selects a model with most of the weights (water tank, refrigerator, stove) as far forward as possible for better balance.

ADVANTAGES: Ready to go at any time. Passengers can ride in the camper. It's highly maneuverable, can tow a boat or another trailer.

DISADVANTAGES: A big camper can be driven around town, but it's more cumbersome than a car. The camping unit can be dismantled with special jacks, freeing the pickup. But some find the chore such a nuisance they leave the camper in place.

A Mercury outboard has 12 fishing features.



1. Mercury's tilted powerhead prevents wet fuel from puddling in the cylinders and intake ports, keeps the engine firing smoothly from slowest idle to top speed.

2. Fixed-jet carburetors provide the precise air-fuel mixture for maximum power and fuel economy — never need resetting.

3. System of Silence. Sound-engineered cowl, sound-sealed remote control and fuel-line fittings, internal reed valves, exhaust relief silencing plus Jet-Prop exhaust.

4. Low-level water intake assures a continuous flow of cooling water to the engine, even when the prop isn't completely submerged. Location of water intake prevents clogging by weeds or debris.

5. Shearproof drive eliminates vulnerable shear or drive pins. Instead, a live-rubber safety clutch "gives" on impact, then resumes running.

6. Jet-Prop buries exhaust sound and fumes deep underwater behind your boat.



7. Twist-grip throttle gives you one-hand control of both speed and direction.

8. Full forward-neutral-reverse gearshift for instant maneuverability in the tightest spot.

9. Remote fuel tank with simple bayonet-mount plug obsoletes motor-mounted tanks. No more messy filling, no spilling—no slippery, reeking, flammable gas in your garage or in your car.

10. Dual clamp brackets are standard on all Mercs, make mounting easier, anchor the motor more securely.

11. Smooth, angled leading edge is designed to glide over submerged obstructions and through weeds safely and easily.

12. Rugged gear case housing has no nose to catch and hold weeds... is cast in one piece to assure permanent alignment of gears and bearings; no gaskets to leak—water stays out, lubricant stays in.

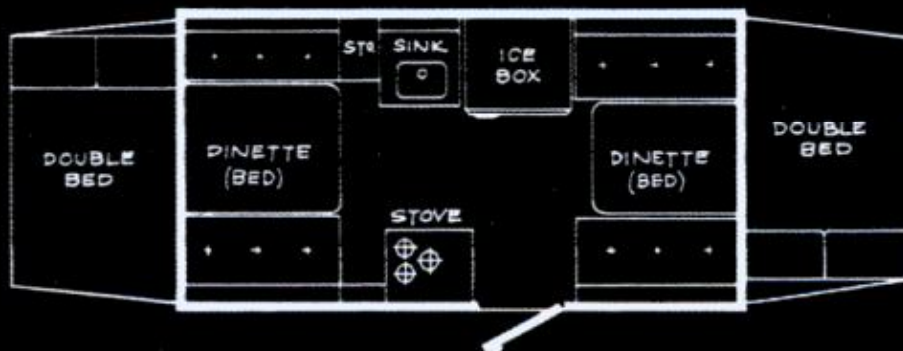
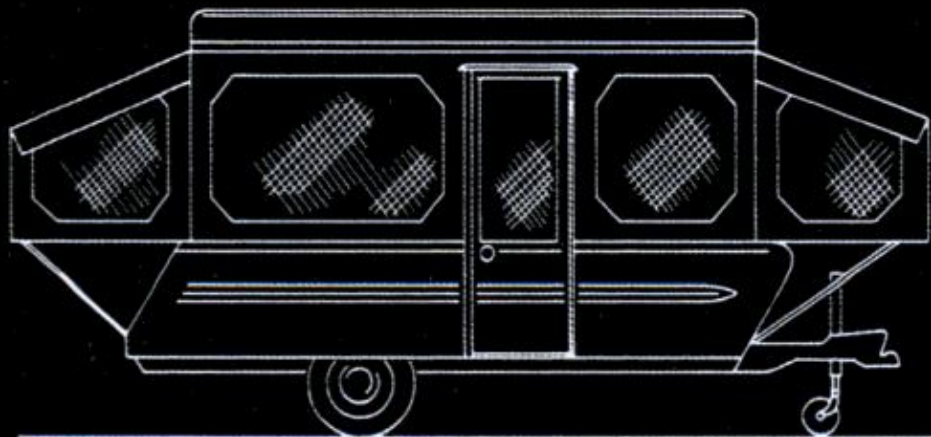
Just try to find another outboard with half as many.



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Camping Trailers



LOW PRICE explains the popularity of camping trailers. You can buy one for under \$300. It's a tent on wheels that folds flat on its trailer for towing. At your campsite you open it into a big, waterproof tent. The most luxurious and spacious models run into the \$2000 bracket.

Many have solid roofs, while some have four solid walls too. Most hand-crank into place. A few operate electrically. All have meshed windows that can be zipped closed.

Depending on the model, you can sleep from four to eight—though eight is crowding it. Typical accommodations include an LP-gas range, icebox, folding table, foam mattresses. With all this, there's still room for stowing food, dishes, cook-

ing gear, fishing tackle and deck chairs.

The camping trailer is excellent for weekending, hunting and fishing trips, once-a-year vacations. It's good if you're just starting in camping on a limited budget.

ADVANTAGES: Aside from low cost, a camping trailer is easy to tow, and puts no strain on the family car. It requires minimum parking space at home. Once at camp, the tow can be unhooked.

DISADVANTAGES: Some require up to half-an-hour setup time when you reach a campsite—more time to fold flat on the trailer bed at the end of your stay. They require public toilet and bathing facilities. Canvas units must be dried before storing.

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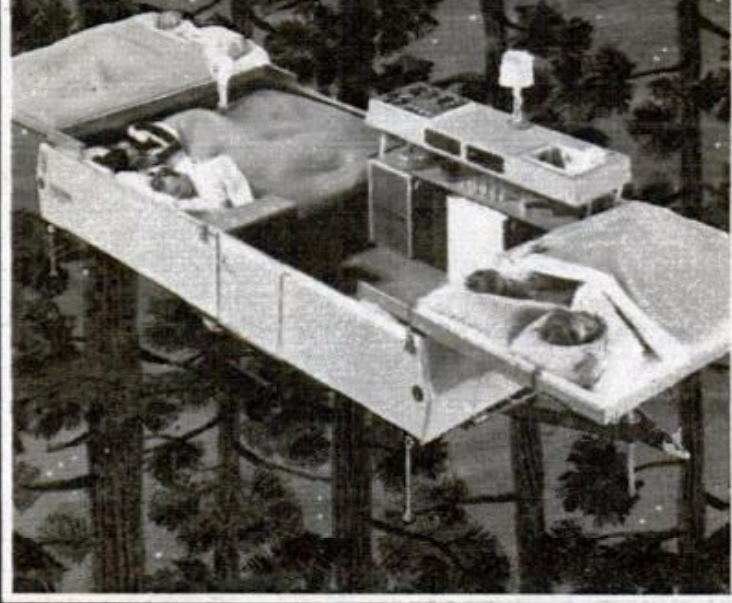
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It's as comfortable as it is light. A full cushion insole softens every step.

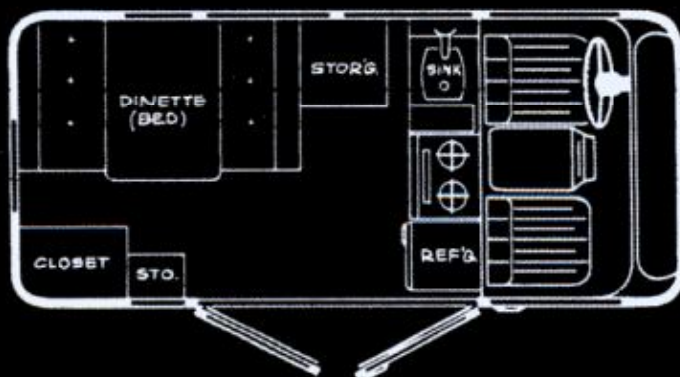
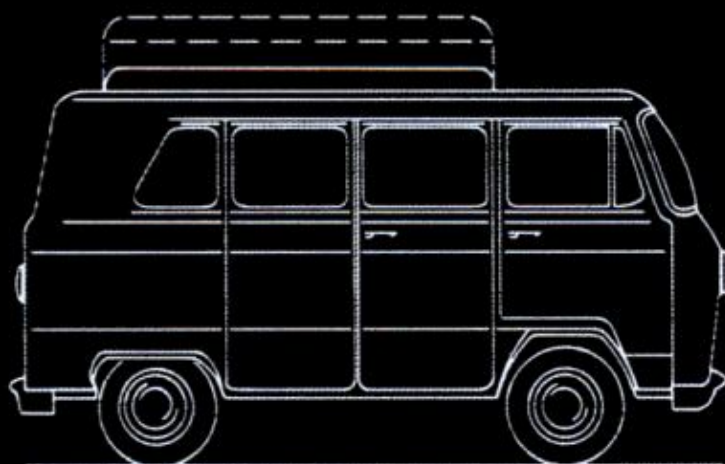
PONDEROSA comes in a full range of sizes. As for styles, there's an oxford, 6 inch, 8 inch, and 8 inch insulated.

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Vans and Buses



Compact vans (90 to 123-in. wheel-base) are the latest to join the recreational vehicle parade. A van can be comfortably equipped with full housekeeping facilities, and sleep two adults and three children. It's especially good for two adults alone.

With good planning it's easy to install a small stove, sink, icebox or refrigerator, table, closet.

Prices range from around \$3000 to as much as \$6000 or more for the luxurious ones. You can also buy the gear necessary to convert a regular van into a camper van for about \$800.

In the simplest conversions the stove may be attached to the inside of one of the side doors. This door is then swung open so that cooking is

done outside, underneath a canopy.

Conversion to full headroom vastly increases convenience. This is best done professionally, either by installing a permanent high roof, or one of the "pop-up" type. Front-engined vans are somewhat nose-heavy, especially with the driver and a passenger in the front seats. Accordingly, all heavy weights should be installed as far aft as possible.

ADVANTAGES: Relatively inexpensive, especially since it may be used as a family's first or second car. Easy to drive in traffic. Requires only one license, one insurance policy.

DISADVANTAGES: Quarters are relatively cramped when the van is fully equipped for living on board. Less storage space is available than in larger recreational vehicles.

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second and
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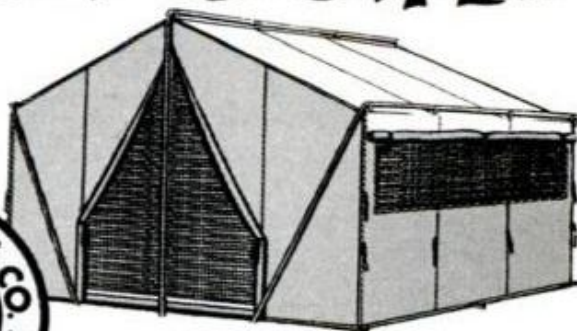


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POWER BOATS, SAILBOATS, CAMPERS AND TRAVEL TRAILERS

Get'em both for 25¢

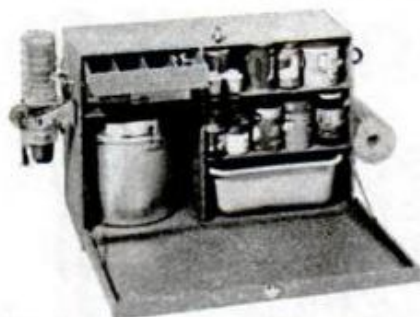


(1) 32-page manual on how to catch fish and (2) this 16-page color catalog that shows the baits to use for bigger catches. From Fred Arbogast—the Bait of Champions. **FRED ARBOGAST COMPANY, INC.** 2000 West North Street Akron, Ohio 44303

1968 Fishing Manual and Catalog



Model #1 shown



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Easily assembled, includes select A-C ext. plywood parts, hardware and glue. Ideal grub box holds utensils, pots and pans, dishpans, foodstuffs etc. Has adjustable shelves and paper towel dispenser. Kit is unpainted. (Can opener, cup dispenser, and internal merchandise not included.) Model #1—27" x 18" x 12½". Model #2—27" x 15" x 14½" (for lower storage height.) Wt. 18 lbs. Satisfaction guaranteed. Please specify model number. Price \$13.95 POSTPAID. Send check or money order (no C.O.D.) to:

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Unit #1—\$13.95 Unit #2—\$13.95 Check

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Get The Workhorse Tire by

before your old worn tires get you.

It's the tire built to take you where the hunting and fishing are good and the roads are bad.

Get stronger sidewalls.

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Get up to 14% thicker tread than most tires used in pickup

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Available in two tread designs. Rib-type for over the road use. Extra traction design for on and off the road use.



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You may encounter a number of handling problems. This quick-reference chart lists probable causes. Note

**TRUCK
CAMPERS**

**TRAVEL AND
CAMPING
TRAILERS**

**VANS AND
COMPACT
BUSES**

	Fishtailing	Bucking and Pitching
TRUCK CAMPERS	Rear suspension too soft Wheelbase too short for load Tires too small Tire pressure low Too much weight in rear of coach	Coach tail-heavy Suspension weak Tire pressure too high Excessive weight on front of truck
TRAVEL AND CAMPING TRAILERS	Inadequate hitch Low tire one side Hitch-ball off center Hitch too high or too low Trailer axle too far forward Excessive weight in rear of trailer	Soft springs on tow car Hitch too low Excessive rear load Loose hitch-ball Wrong size hitch-ball
VANS AND COMPACT BUSES	Too much cargo in rear of van Rear tires soft Weak shock absorbers Second towed vehicle responsible	Shocks worn out Tires too stiff for load Weak front suspension Excessive rear load

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for Rig-Handling Problems

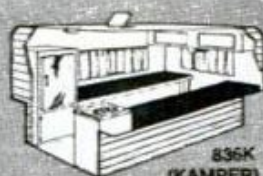
while driving your fully loaded rig. This handy, camping expert Lee Oertle compiled the chart.

Rear-End Sag	Leaning to One Side	Excessive Tongue-Load
Weak springs Coach tail-heavy Rear tires low Excessive load for truck bed Wheelbase too short for load	Coach bolted down off center Water tank located wrong side Cargo loaded unevenly Broken spring Low tire one side	Does not apply
Excessive tongue load on trailer Too much weight in car trunk Soft tires or springs on car Inadequate hitch Trailer too large for car Too much weight in front of coach	Hitch off center Cargo improperly loaded one side Weak spring Low tire on car or trailer	Trailer axle too far to rear Too much weight in front of trailer Water tank in wrong location Excessive weight in car trunk
Rear springs inadequate Too much weight in rear cargo area Second towed vehicle produces excessive hitch-weight	Wind problems Camp kit not correctly installed Low tire Weak or broken spring Water tank on wrong side	Does not apply

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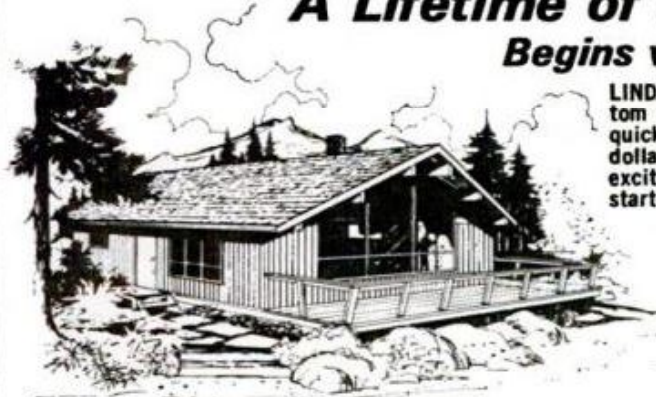
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S26

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CANOE, easy to carry and handle. Good for fisherman. Cost: \$100-\$400

BOAT, easy to tow or haul atop camper. Good for family. Cost: \$100 and up

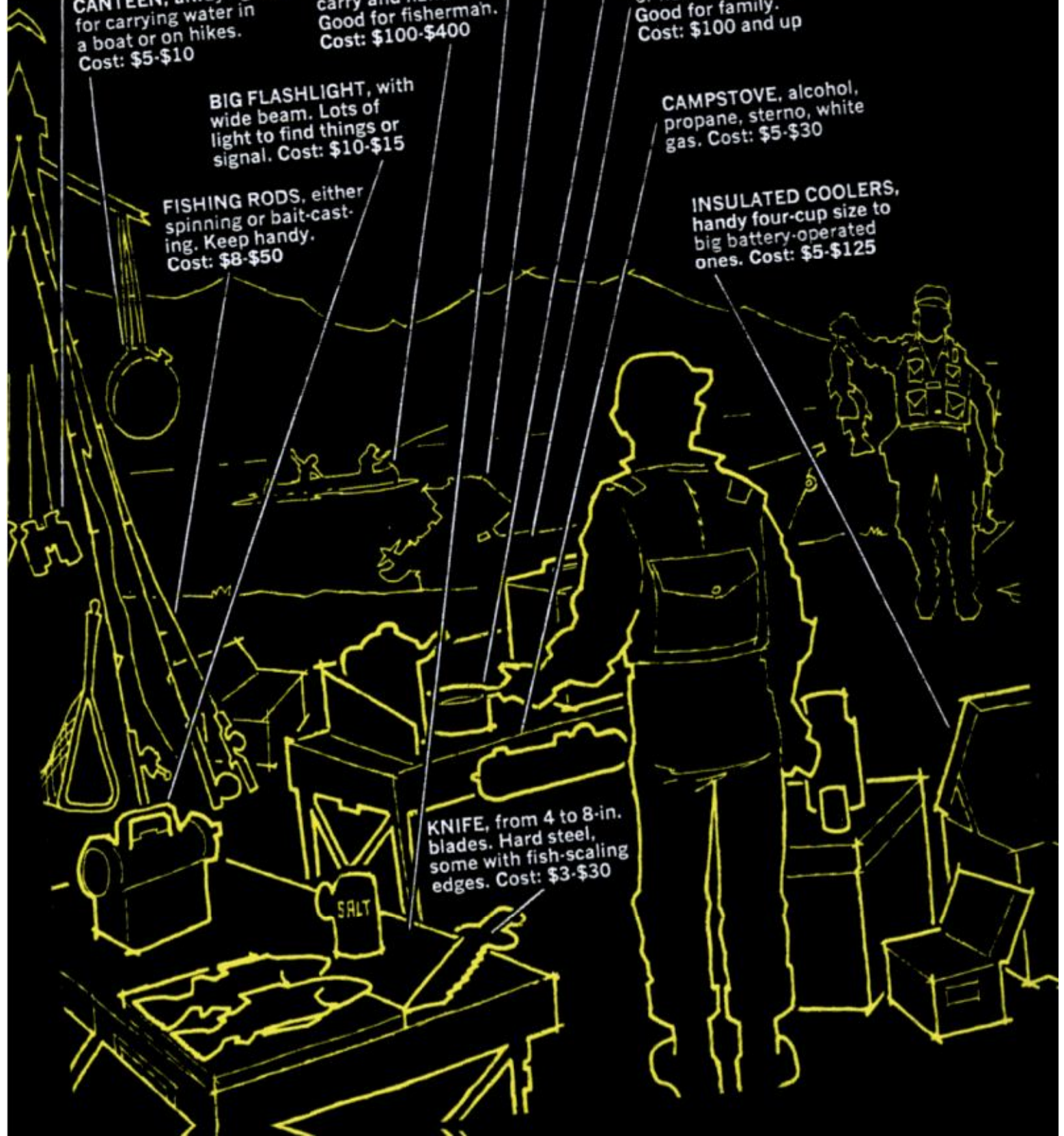
BIG FLASHLIGHT, with wide beam. Lots of light to find things or signal. Cost: \$10-\$15

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In Camp-Fun Extras

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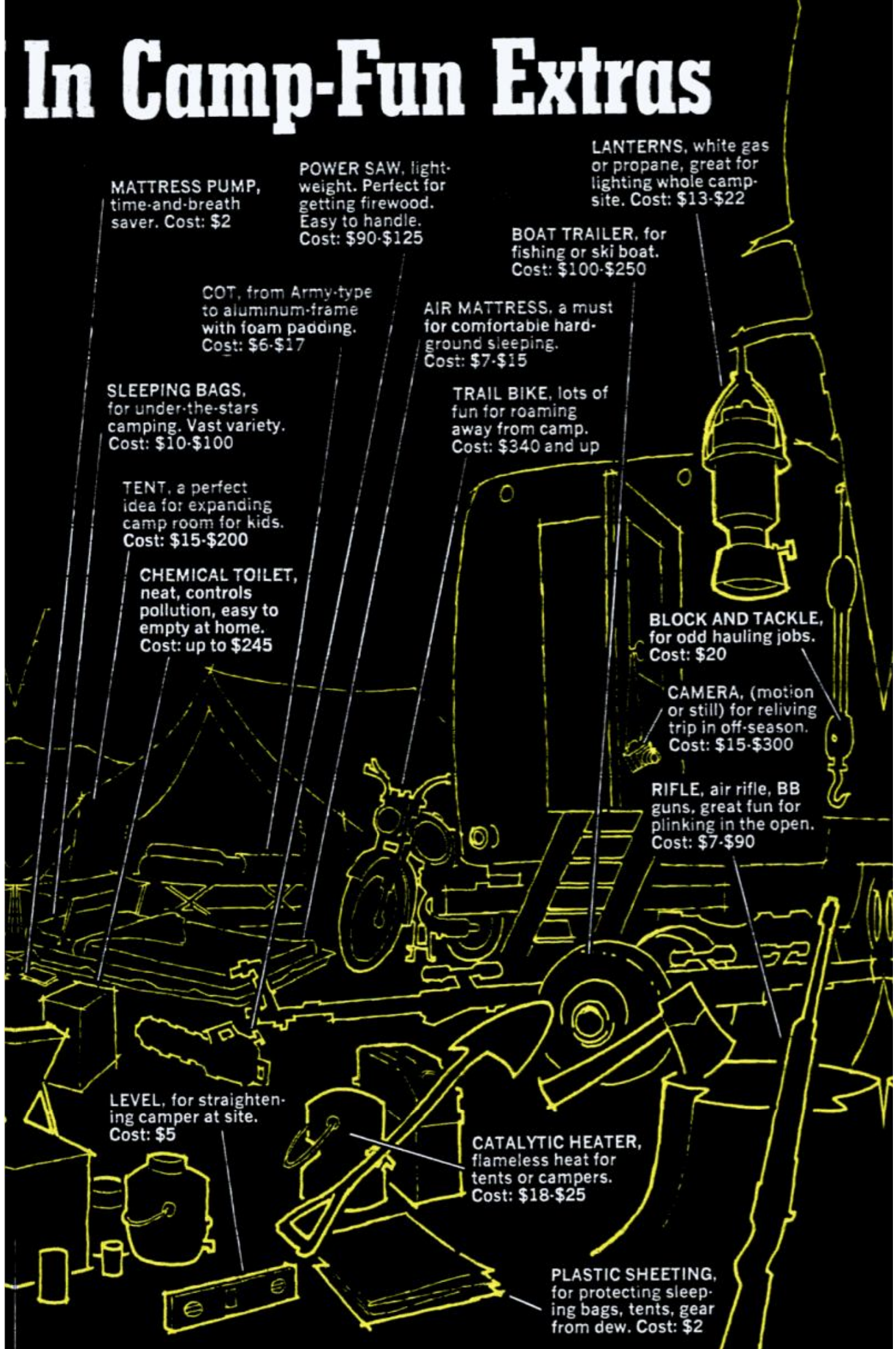
CAMERA, (motion or still) for reliving trip in off-season. Cost: \$15-\$300

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Camping '68 Shopping Guide



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'68



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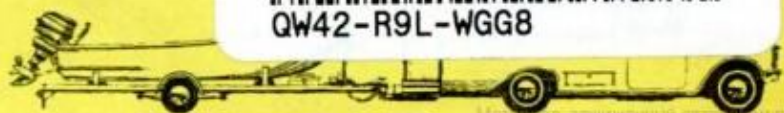
This One



QW42-R9L-WGG8

Dan Fales, Outdoor Editor

◀ **TEAR OUT** along perforated line—keep in glove compartment



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THE SAFE TIRE

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Camping '68 Shopping Guide



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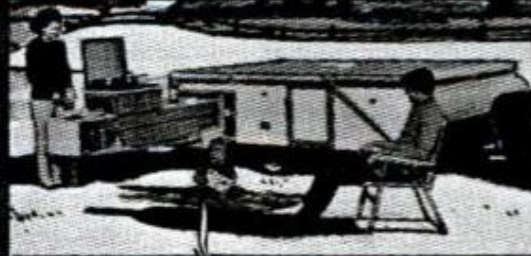


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Cut metals, masonry, concrete

Holiday GTA - with automatic oiling

Pioneer Accessory Kit

To cut wood, clear brush, power a pump or compressor, slice metal or masonry, and many other jobs...

Take it easy...

Take a Holiday by Pioneer

Now! 3 new models plus add-on versatility!!

Now every man who works or plays outdoors can take a Holiday - the easier, safer-to-use lightweight chain saws - and add-on versatility! Now, choose from three work-hungry models - the Holiday, the new Holiday GT, or even better, the Holiday GTA - all with fingertip controls, balanced weight, power to spare. To cut lumber, fence-posts, trees or brush... there's a Holiday just right for you. Add-on versatility with a Power Take-Off

Stand to run a pump, compressor, and many other attachments. Or add a hard-working Brushcutter to your Holiday. Or perhaps a Multi-Purpose Cutter to make short work of metals, masonry, concrete... you name it! Ask your dealer for the right Holiday chain saw and power attachments for your needs. Made by the manufacturers of Johnson and Evinrude outboard motors and Lawn Boy power mowers.

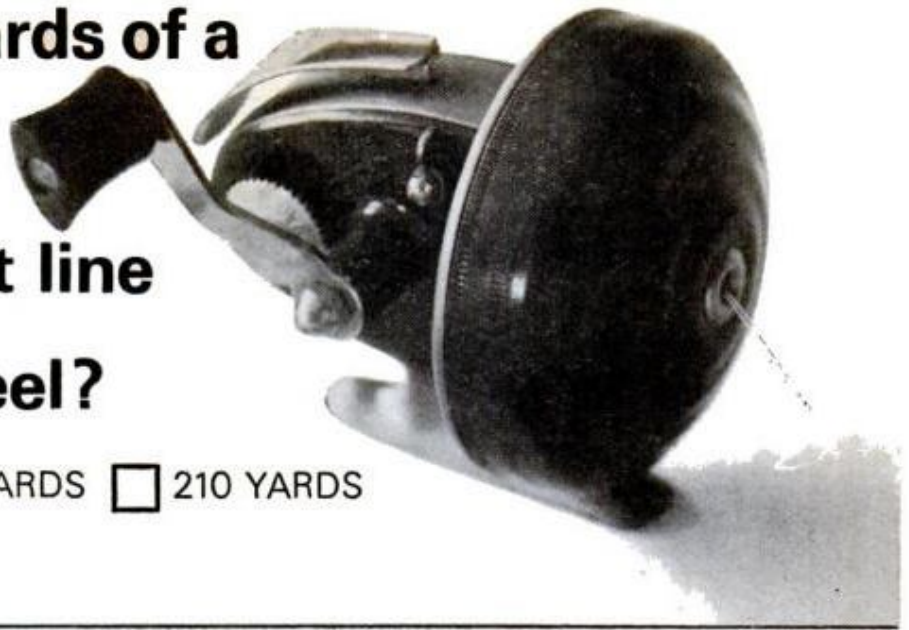


Galesburg, Illinois, U.S.A. / Peterborough, Ontario, Canada

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How many yards of a
6 pound test
monofilament line
will fill this reel?

140 YARDS 180 YARDS 210 YARDS



Eagle Claw **blond** line solves the problem for any reel

Eagle Claw Blond line comes on a single spool which completely fills your fresh water reel — regardless of make or style.

Say you have an open face spinning reel—any brand. You don't have to know its capacity — Eagle Claw already knows. You merely select Eagle Claw Blond *Spinning Reel Line* in the pound test you want. If you pick 6 pound test, the Blond spool has 350 yards—enough to fill your reel. If you want 10 pound test, the spool has 225 yards—enough to fill your reel.

Blond line spools for push button type spin casting reels and ultralight spinning reels also come loaded with the proper quantity.

No more 100 yard spools to run short and make casting difficult. No more double 100-yard

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Eagle Claw Blond is the finest quality nylon monofilament available. Its blond color makes it highly visible in the air—almost invisible in the water.

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Box 20217 EE, Denver, Colorado 80220

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Model Illustrated Eagle Claw 88A Spin Casting Reel. Line capacity—210 yds. of 6 lb. test.



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Cover Photo by Dan Guravich

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PM Owners Reports on the Javelin and Road Runner. The owners sound off after thousands of miles of driving.

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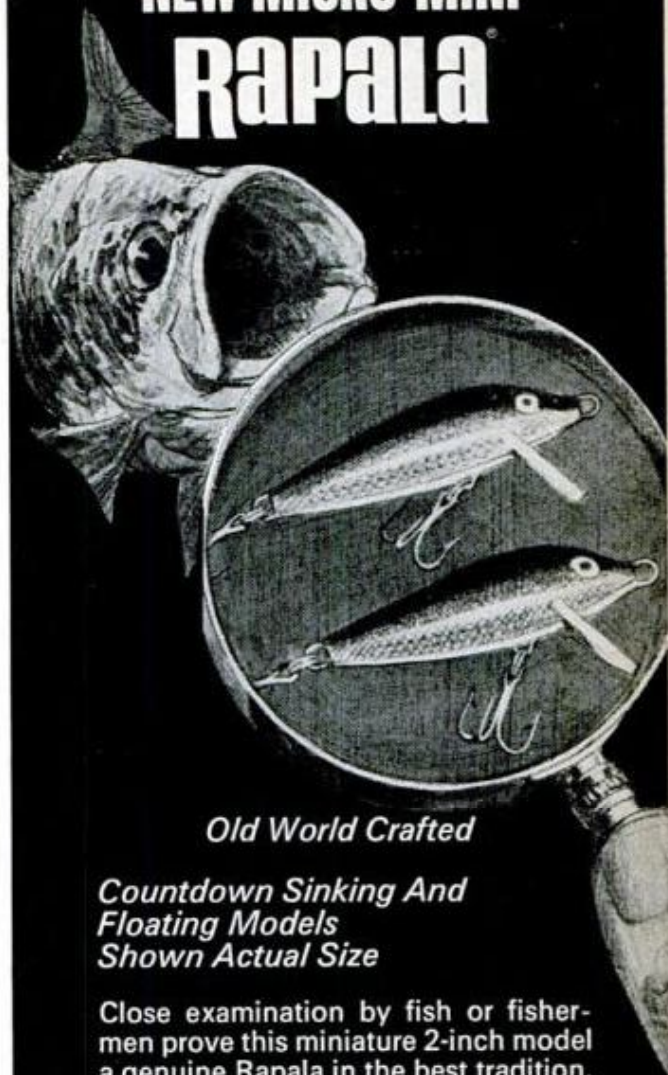
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Popular Mechanics is published monthly by The Hearst Corporation, 57th St. at 8th Ave., New York, N.Y. 10019. U.S.A. Richard E. Berlin, President; George Hearst, V-Pres.; Richard E. Deems, President of Magazines; John R. Miller, Executive V-Pres. of Magazines; Raymond J. Petersen, Senior V-Pres. of Magazines; William S. Campbell, V-Pres. of Magazines; Albert A. Racho, V-Pres. and Director of Circulation; Joseph F. Kern, V-Pres. for Popular Mechanics; Frank Massi, Treasurer; Harvey L. Lipton, Secy. Single copy in the United States and Canada, 35 cents. Subscription prices: United States and Possessions, \$4.00 for one year; \$7.00 for two years; \$10.00 for three years. Canada, add \$0.50 for each year. Pan American Postal Union countries, add \$1.00 for each year. All other countries, add \$2.00 for each year. When changing address, give old address as well as the new, with postal-zone number, if any, and allow six weeks for change to become effective. Second-class postage paid at New York, N.Y., and at additional mailing offices. Authorized as second-class mail by the Post Office Department, Ottawa, and for payment of postage in cash. Registered as second-class matter at the Post Office at Mexico D.F., Mexico, June 20, 1950. © 1968 by The Hearst Corporation. All rights reserved. Printed in U.S.A.

MAY 1968

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Close examination by fish or fishermen prove this miniature 2-inch model a genuine Rapala in the best tradition.

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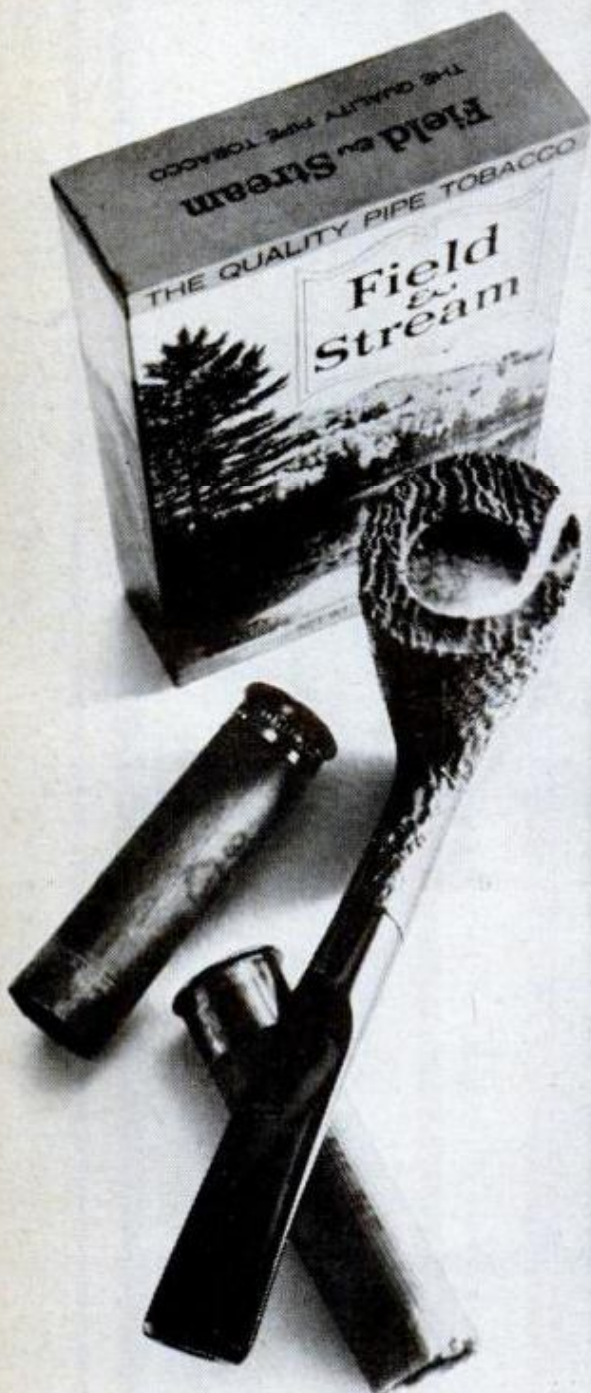
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If the "single" in the next apartment says the autumn-day aroma of Field & Stream turns her giddy,



marry the girl.

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LETTERS

TO THE EDITOR

Pot in the good old days

Being a Seabee, I know that *The Seabees Swarm Again!* (page 82, March PM) was greatly appreciated by all who are in that outfit. Well done!

21st NCR

JAMES A. NESBITT

DAVISVILLE, R.I.

I'll have you know that in 1942 all the Seabees were not "a group of potbellied, middle-aged civilian construction men." My husband's outfit, the 29th Battalion, was at least 50 percent made up of young men in their early 20s. We all enjoyed the article very much, though.

CLEVELAND, OHIO

MRS. FRANK LOUCKA

Guess our author looked at our staff (mostly World War II types) and figured everybody that age must have been potbellied from childhood on.

Deep down, you know we're on top

You had an item about Russia drilling the deepest drill hole ever made (approaching 20,670 feet) in *Science Worldwide* (page 10, March PM).

The United States drilled to 20,521 feet 19 years ago. At present the deepest hole is 25,340 feet.

Please check the U.S. records before claiming someone else can do any job better than we can.

KELLY DRILLING CO. LUTHER H. KELLY JR.
HOUMA, LA. ENGINEER

Great help for inventors

How to Sell Your Invention to Detroit (page 120, March PM) is the best coverage on idea-invention selling I have ever read. The facts are not limited to auto-makers and are typical of all fields.

WEST HAVEN, CONN. THOMAS W. GIBBONS

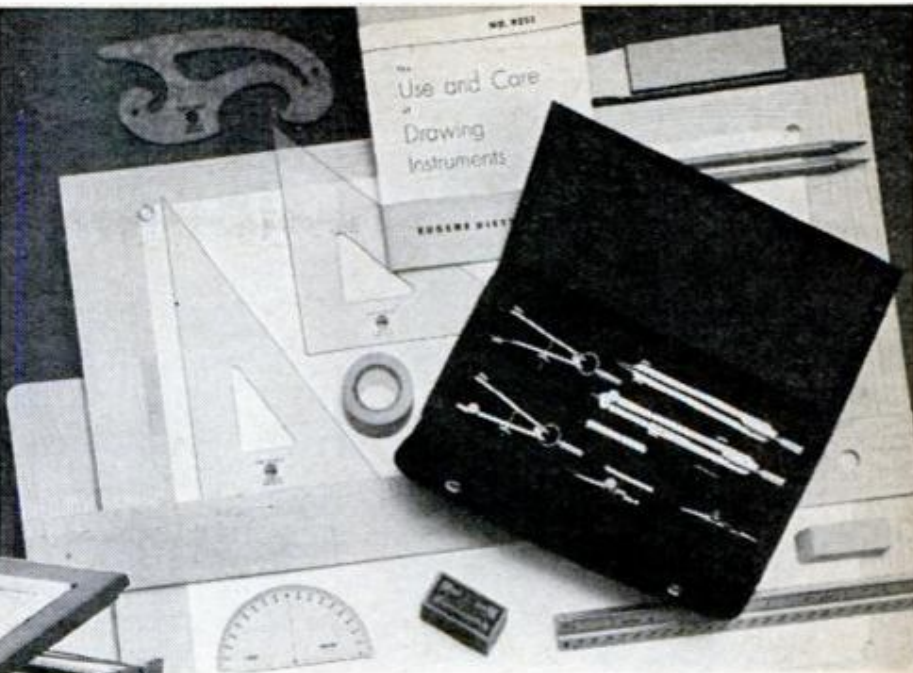
Mark III

What's with Bill Kilpatrick in his article on the Lincoln Continental Mark III (*It's Superbird*, page 20, March PM)?

In the absence of a single complimentary statement for the Mark III, his attack appears to be a deliberate attempt to sabotage the image of this new product to your subscribers. I refer to image because obviously Mr. Kilpatrick has completely missed the point of this newly created

(Please turn to page 8)

This
valuable
draftsman's
equipment
is given
to you...



This drafting table included

when you train with LaSalle for
a big-pay job as a technical
DRAFTSMAN

Learn at home in spare time. No previous skills required!

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door to success in
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- The draftsman is the link between engineering and production. No project, big or small, gets "off the ground" before it comes from the draftsman's board.
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Not a single new production improvement, not a single building or mechanical project, gets under way without the skilled help of the modern draftsman.

Why don't you get started in this busy field and prepare to earn big pay? LaSalle trains you by mail; expert instructors start you at the beginning and give your work personal attention until your course is completed. The cost of instruction is remarkably low.

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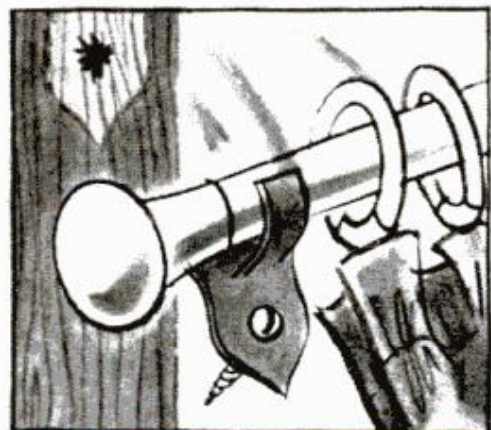
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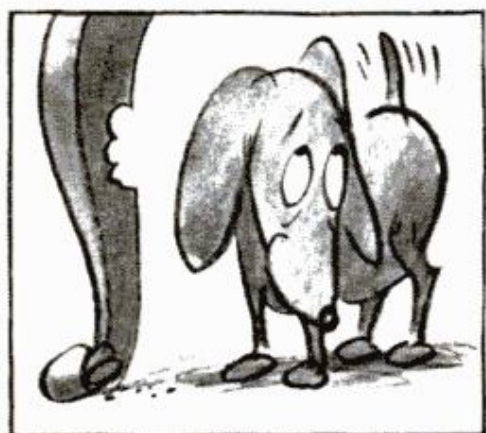
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Your five-year-old banged a hole in the floor?

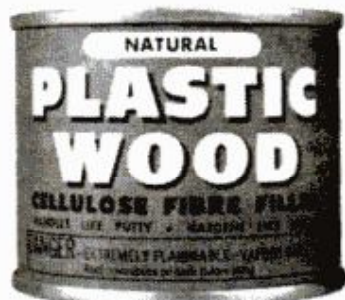


The curtain rod came crashing down?



Pup chewed on the table?

Fix it with the
genuine **PLASTIC WOOD**.[®]
Looks and lasts like real wood.



Handles like putty—comes in 5 colors.

LETTERS

(Continued from page 6)

prestige car. An attempt to qualify the relative value of a car of this type by a "nuts and bolts" comparison is as senseless as an attempt to justify the ownership of a luxury sailing yacht to serve the owner's transportation needs.

This new car is built to provide the few who will own it a symbol of success.
MT. VERNON, ILL. **OBIE O. ATKINSON**

But Bill thinks that even if the rich folks are simply buying symbols of success, they deserve a more advanced car.

Concorde goes to school

May I congratulate your magazine for an extremely clear and concise article on a current and highly technical development (*You, Too, Can Break the Sound Barrier*, page 111, March PM) and a word of praise to the art team of Wolff, Gustafson, Chapin and Schafer.

May I adapt the cutaway of the Concorde for instructional use during the aerodynamics portion of our course?
U.S. MILITARY MAJ. NORMAN KUKLINSKI
ACADEMY ASST. PROFESSOR
WEST POINT, N.Y.

Yes to both questions.

January was the best

I have a life subscription and am now 81. I've always liked PM, but your January issue is particularly good.
SAN DIEGO, CALIF. **V. A. LYMAN**

And he's not even a relative!

I'd like to say how pleased I am with your magazine. I had subscribed to *Mechanix Illustrated* when I was a teen-ager and to *Popular Science* some years ago—and was dissatisfied with both. I guess that's why I never took your magazine until now. I assumed it contained the same mediocre material.

Popular Mechanics has the articles with the "meat," the kind of articles that get right down to details on how to fix my car and how to make this or that. This is the magazine for the guy who keeps his tools warm instead of the chair by the TV.

P.S. I just resubscribed for three years.
RIVERDALE, MD. **ROBERT J. DUNN**

You're the kind of active guy we like—the kind who does our projects, writes us flattering letters and "re-ups" for another three years. ★ ★ ★

POPULAR MECHANICS

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

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

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

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

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

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

FREE BOOK PUT JOE MILLER ON THE ROAD TO BIG INCOME

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

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

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

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

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

FREE PLACEMENT SERVICE

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



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

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

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

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

HE TRAINED WITHOUT RISK, IN HIS SPARE TIME AT HOME

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

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

Joe Miller's income is unusually high and it is not typical of the industry. He's

become a busy specialist in storm loss adjusting. But it does show the huge potential in Accident Investigation—even for men with no college and no experience. For example, here are some reports from recent Universal students:

My income has more than doubled."
—James T. Woodruff of Louisiana.

"An immediate 40% increase in wages."
—Bill Ruhnke of Missouri.

"A raise every three months for the next two years, plus new car and expense account."
—Oscar Singletary of Georgia.

"Approximately 25% increase in wages, plus \$125 a month for car expense."
—J. J. Dubreuil of Maryland.

"My salary has increased by 63%."
—Marcel Roy, Canada.

FIND YOUR OPPORTUNITY NOW! SEND FOR FREE BOOK TODAY

In a matter of days, you can have in your hands the same book that put Joe Miller and so many others on the road to new success. There's no obligation. No salesman will call on you. Simply mail the coupon below or send a card to Universal Schools, 6801 Hillcrest, Dallas, Texas 75205.

Read why Accident Investigation is today's most exciting career... about the many spare time or full time job opportunities open to men everywhere... the stories of successful Universal students, with names and locations... about Universal's respected no-risk training plan and free placement service.

But act quickly! Take that money-making walk to a mailbox. Send your coupon today.

Approved for Veterans' Training

MAIL NOW FOR YOUR BIG, FREE BOOK

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6801 Hillcrest, Dallas, Texas 75205

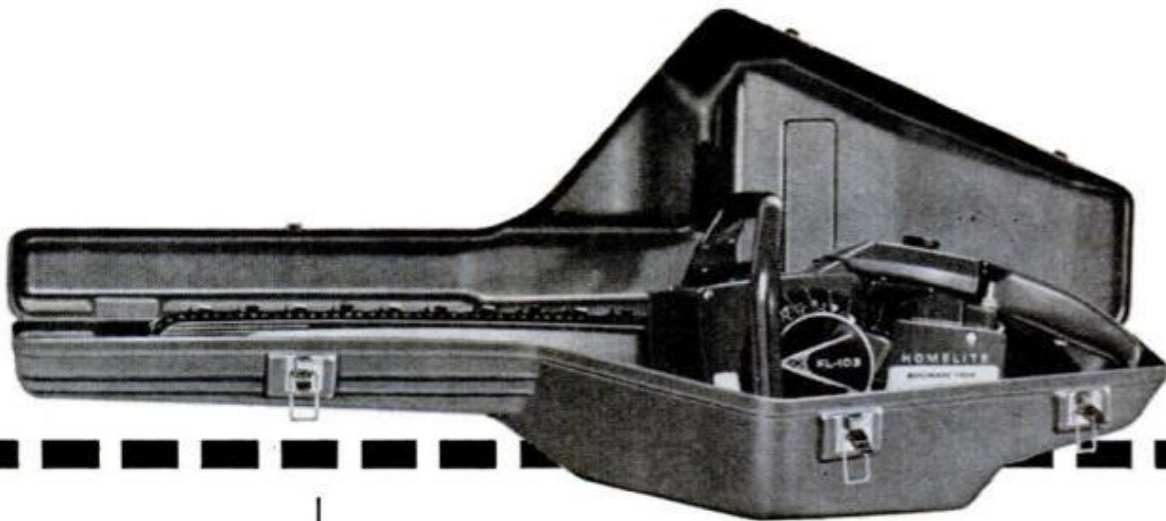
Please rush my free book on earnings and opportunities in Accident Investigation. No obligation. No salesman will call.

Name _____ Age _____

Address _____

City _____ State _____ Zip Code _____





**This coupon
is worth
\$15⁰⁰**

when you buy a new
Homelite XL-101 Series
Chain saw with Carry Case

BUYER'S SIGNATURE

DEALER'S SIGNATURE

CHAIN SAW SERIAL NUMBER

Offer expires June 30, 1968

Here's a \$15 reason why you should buy your new Homelite XL chain saw before June 30th



You'll save \$15 on the new \$19.95 Carry Case, if you buy a new Homelite XL chain saw before June 30th. One demonstration will show you why Homelite XLs are the world's fastest-selling chain saws. They're perfectly balanced for smooth-running power and easy handling. The new Carry Case protects your chain saw, and provides the most convenient way to transport and store your saw. Take this \$15 coupon to your Homelite participating dealer. He's listed in the Yellow Pages.

HOMELITE

10205 RIVERDALE AVE., PORT CHESTER, N.Y.

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DIVISION

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10

POPULAR MECHANICS

Материал, защищенный авторским правом

How would you like to be the guy who bought the last car you traded in?

And yours might have been in pretty good shape compared with a lot of them. Most people don't trade a car in until something serious goes wrong.

Of course, used car dealers usually take care of something like that in one way or another. One way is to fix it. That's what Volkswagen dealers do. And you can be sure they do it very well because they guarantee their used cars.

The Volkswagen used car guarantee covers everything that makes the car tick. Engine. Transmission. Rear axle. Front axle assemblies. Brake system. Electrical equipment. For 30 days or 1,000 miles (whichever comes first), a VW dealer will repair or replace anything that goes wrong in any of these areas. At absolutely no cost to you.

You're covered during the period when anything wrong with the car usually shows up. That gives you

something important that you don't always get with a used car.

Peace of mind.

We hope that's worth something to you, because it's going to cost you a few dollars more. Not much, considering how much money a VW dealer puts into every car he puts a guarantee sticker on.

The car gets inspected and tested. Then everything that needs fixing gets fixed. Very carefully, since every dealer knows that anything that goes out a little wrong will come back very wrong.

If you're thinking "that's all very nice but I don't want to buy a used Volkswagen," don't go away. To sell a Volkswagen, a VW dealer usually has to buy something else.

So he probably has whatever kind of used Something Else you're looking for.

Try him. He might give you a much better buy on a Something Else than a Something Else Dealer.



Look for this sticker and you won't get stuck.

DETROIT

LISTENING POST

BY BOB IRVIN

SHORTER GUARANTEES may be in store for 1969 car buyers. The auto industry is thinking of cutting back those five-year, 50,000-mile warranties on major operating components. Instead, all important items would be covered for two years, or 24,000 miles. The companies complain about rising costs, dealers about red tape and trouble getting reimbursed. Customers have bombarded Washington about the service, and bills are pending that would give the government a voice in the administration of warranties. First tightening of the warranties came last fall with the '68 models. Any more changes will probably be announced late this summer.

"SENSATIONAL STYLING" is the way one auto man describes the 1969 standard-size Ford and Mercury cars, new from the wheels up. Size and packaging concepts are based on current Buicks, which seems to confirm reports the FoMoCo cars will be bigger.

FORD'S 1969 STATION WAGONS will have a new twist on the two-way tailgate. You'll be able to leave the window up like a regular door when opening the tailgate from the side. The window will have to come down, of course, when you use the tailgate in the conventional manner. It should keep Ford one wagon-length ahead of General Motors, which is supposed to have a two-way tailgate in 1969 patterned after the current Ford design.

"FAIL-SAFE" HEADLIGHT may be on some cars in 1969. Designed by Wagner Electric, the new unit has a second filament that stays lit should the main light burn out. It's not very bright, but can be seen by cars approaching from the opposite direction, eliminating the hazard posed by a "one-eyed" car barreling down a highway at night. Detroit and Washington are interested in the unit and it would add only pennies to the cost of a car if made standard equipment.

TWO "REVOLUTIONARY" DEVELOPMENTS are promised by Pontiac for 1969. No one's saying what they are, but one could be the long-rumored overhead-cam V8. Pontiac in recent years has been pretty much an engineering and styling pacesetter for the industry.

PRICE HIKES—the prospect is worrying car importers. They're afraid the U.S. government may raise duties because of the balance of payments problem. But price hikes might deter buyers of domestics, too, because American-built cars face another major price increase in 1969—something more and more auto officials are hinting.

A CAR SHORTAGE could result if there's a steel strike just as Detroit swings into 1969 model production. The companies are stockpiling steel, but the best they can hope for is a two-month supply. Even a strike of less than two months could put a crimp in production.

A \$68 AUTOMATIC TRANSMISSION is being offered by Chevrolet on its Camaro and Chevy II Nova models. It will reduce still further the dwindling number of cars sold with three-speed manual transmissions.

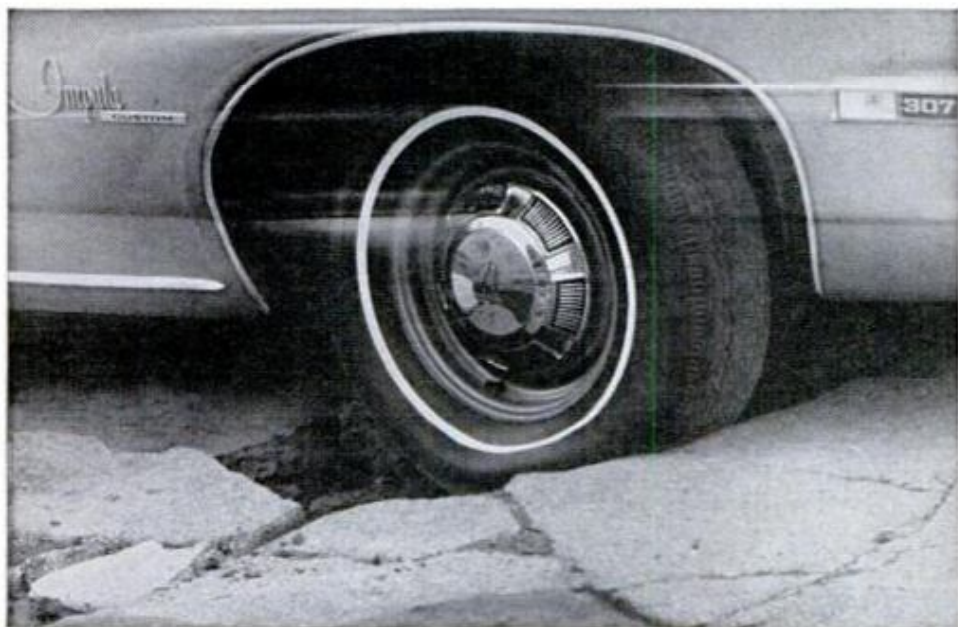
ANTITHEFT DEVICE being offered on the Corvette is a horn that sounds whenever someone breaks into the passenger or engine compartments. Chevy says it's designed to combat the high theft rate involving Corvettes. A new antitheft device being marketed by a New York firm is a combination lock that mounts on the instrument

(Please turn to page 14)



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DETROIT LISTENING POST

(Continued from page 12)

panel: You have to know the right combination in order to start the car. The device sells for about \$20.

NEW ANTISMOG RULES proposed by the federal government for 1970 model cars can be met, auto manufacturers agree. But they are dead set against some features, including one requiring all cars to have a device designed to keep gasoline fumes in the fuel tank and carburetor from escaping. Meanwhile, Doughboy Industries in Wisconsin says it has developed a new carburetor that can meet antismog requirements at much less cost than present units.

AUTO RACING is still taboo at General Motors. Top officials at GM are afraid of trouble with Washington's safety crusaders if they re-enter competition on an official basis. Boat racing is another matter. The GMC Truck & Coach Div. has been busily publicizing the fact that one of its diesel engines recently set a world powerboat record.

A SEE-THROUGH BATTERY is being marketed by Sears. The hard rubber cover is replaced by one of plastic, meaning the caps don't have to be removed to check fluid level. Durability is about one-third better, Sears claims. Appropriately, it's called a "Die Hard" battery.

AN ELECTRIC TRUCK is being tested by General Motors. Developed for the Army, it has a unique electric-drive system. Basic power comes from a six-cylinder gasoline engine. It feeds a 100,000-volt alternator which drives two 20-hp motors mounted on each of the truck's six wheels. The motors have stationary windings and are brushless. GM calls them self-synchronous, says the commutation function is performed electronically. One advantage is power—the truck can climb a 60-percent grade carrying two tons of supplies. The truck is very maneuverable in rugged terrain since no fixed axles are needed because of the electric motors.

STRATIFIED CHARGE ENGINES are being developed by Ford and Texaco. The system, which uses fuel injection, allows a much leaner mixture. Result is far better gas mileage and lower carbon monoxide emissions. Right now it's strictly an Army project, but because of cost is unlikely to be used in mass-produced cars. But automakers and oil companies continue their search for a "cleaner" engine. ★★★

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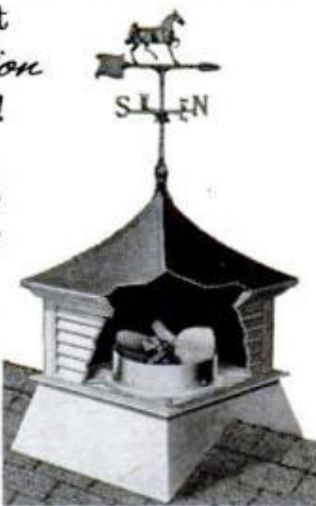


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Science Worldwide BY JOHN F. PEARSON

New world's diving record was posted recently when two Navy aquanauts descended to a simulated open ocean depth of 1025 feet in special high-pressure chambers at the Navy Yard in Washington, D.C. Wearing neoprene wet suits and Navy Mark VIII breathing apparatus, the men remained at the record "depth" for 13 minutes. They were subjected to pressure 31 times that at sea level. The dive was part of the preparation for Sealab III, an underwater living experiment the Navy will conduct next fall off California.

Smog may damage the human genetic apparatus and cause mutations. That possibility was voiced by A. J. Haagen-Smit, a noted Caltech biologist, who explained that oxides of nitrogen in polluted air react readily with amino groups to form alcohols. Amino groups are the building blocks of life and, if altered, will change the hereditary characteristics passed on to an individual's descendants.

Complete penetration of Antarctica's ice cap—a "first"—was recently achieved by U.S. Army engineers who drilled a hole a mile and a half deep at Byrd Station. The drill hit solid rock after removing more than 7000 feet of ice cores. Because Antarctica's snow never melts, the cores hold a continuous record of the earth's precipitation and atmosphere that goes back tens of thousands of years. Core samples will be intensively studied.

Flames can convert electrical signals directly into sound waves. That was recently discovered by scientists at the United Technology Center, Sunnyvale, Calif., who were doing research on underwater sound generation. They were surprised to find that signals fed from a tape recording to an amplifier and then to an acetylene torch were reproduced by the torch's flame. The scientists theorize that a variable electrical current picks up charged particles as it flows through flame. When the particles mix with surrounding air, a sound wave is produced. No immediate applications are seen for the discovery.

New weapon against tooth decay may be an enzyme called dextranase, which breaks up plaque, the tough film that forms on teeth. In experiments at the National Institute for Dental Research and at the labs of Merck, Sharp & Dohme, dextranase was put in the drinking water of hamsters receiving a high sucrose diet. Result: The animals were found to be virtually free of cavities. Researchers now plan to try the method on human subjects.

A custom-made archeological site—a soil mound 80 feet long, 15 feet wide and 5 feet high—will be created this spring by students at Cornell University. As they build, they will bury articles such as bones, pottery, coins and textiles. Then each year, for the next 100 years, a one-hundredth slice of the mound will be dug up and examined to determine the effects of weather, plant growth and burrowing animals.

Iron, magnesium and aluminum in pure form may be found all over the moon. So says a physicist at the Westinghouse Research Laboratories in Pittsburgh, who describes the moon as a giant natural refinery where the solar wind reduces ores to pure metals. Protons in the solar wind could form the refining agent—atomic hydrogen—by picking up electrons from the surroundings. Hydrogen is chemically very reactive and would tend to combine with nonmetallic elements in the ores and free the metals to gather together as pure metallic dust. Magnets on Surveyor 5 disclosed some metallic dust on the moon.

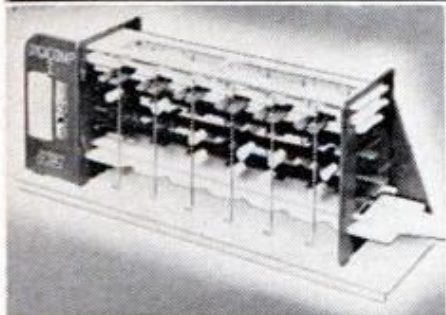
The "garbecue" is the brainchild of a successful Japanese inventor. Essentially a hydraulic press, the machine squeezes garbage to one-tenth its original size and encases it in cement. The resulting blocks, says the inventor, can be used as land fill or dumped in the ocean. Bacteria are said to be destroyed by the high temperatures and low oxygen levels that accompany compression. Garbecues capable of processing 300 tons of refuse every 24 hours will be in operation in three Japanese cities this spring. ★★

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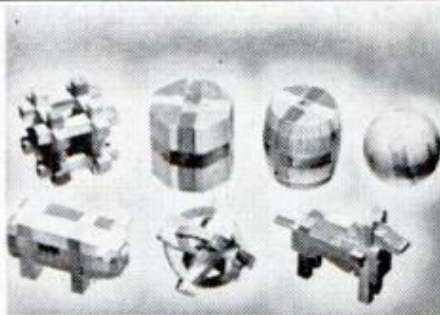
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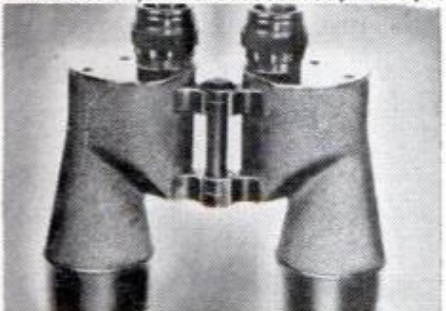
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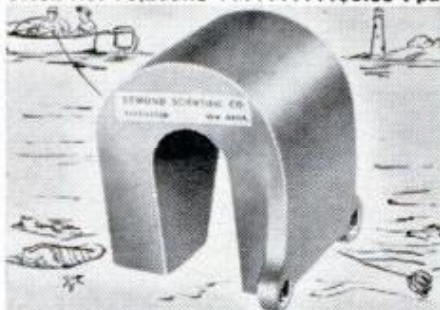
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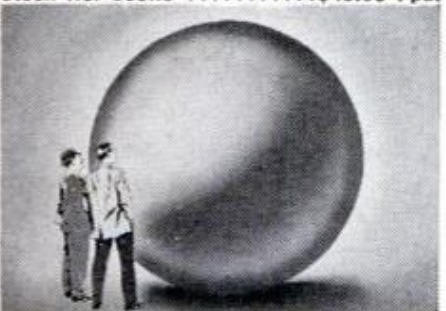
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Drivin' with Dan

Does college help a racing career? Are the larger cars safer on U.S. roads? What sparked the success of McLaren Group 7 cars in last fall's Can-Am series? Dan Gurney answers these and other provocative questions



ROARING INTO Riverside's famed esses, Gurney sets up his '68 Ford stocker to run the tricky turns at top speed. Dan is five-for-six in the 500-mile race

Q. *With your fifth win in six tries at the Riverside 500 this year, I figure it puts you in the top four or five all-time NASCAR 500-mile race winners, even though you run only one race a year. Have you thought about the other NASCAR 500-milers?—David Bowman, Charlotte, N.C.*

A. *Actually, I have driven a couple of the big 500-mile races in the South, although without a great deal of success. I ran the Daytona 500 a couple of times and finished fifth there in 1963. I also entered the Atlanta 500 and recall getting tangled up in an accident with Parnelli Jones. That kind of racing requires practice and experience, just as road racing does. It's not even like the Indy 500, and if and when I am able to return, I want to get in as much practice as possible.*

Q. *I read that you are a college graduate. Do you feel that any of your college courses helped your current career?—George Denoway, Seattle.*

A. *My college education involved liberal arts courses. If I had to do it over, I would probably specialize in areas more related to my present work. However, I do feel my education has been important in my overall career.*

When I started college, I knew I wanted to race, but I wasn't sure exactly how to go about it. Now I know the more a driver or mechanic can educate himself, the better chance he has.

Q. *Generally speaking, the United States has bigger and better roads than any in the world. Since our roads can handle larger cars more easily, isn't it smarter and safer to take advantage of this?—Marty Fritz, Des Moines.*

A. *If the larger cars were nimble enough and had brakes commensurate with their size, it would be a lot tougher question for me to answer. However, I have found the "middle-weight" and slightly smaller cars the most fun to drive on American roads. I believe you have a better chance of avoiding trouble in a responsive automobile.*

Q. *I have read that you are a drag-racing and motorcycle enthusiast. Is this true?—Ed Lewis, Torrance, Calif.*

A. *Yes, it is. When I was a teen-ager I spent a great deal of time working on my own and other people's hot rods. I raced them at drags, even at Bonneville. I still enjoy drag racing very much, but nowadays try to take every chance I get to go cross-country motorcycling, something I find to be a great tonic.*

Q. *Aren't those fireproof driving suits terribly uncomfortable? Also, I hear you wear long underwear underneath them. True?—Barbara Thomas, Fort Lauderdale, Fla.*

A. *Why, Barbara, I didn't realize you'd noticed. Yes, there is a suit of long, flame-resistant underwear that most drivers now wear under their driving suits. And yes, they*

(Please turn to page 29E)

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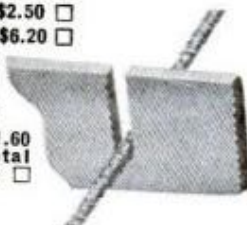
ea. (total \$12)

ppd.

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BRUSH IT ON. Let stand a few minutes or several hours depending upon the depth of the rust. HOSE OFF WITH FRESH WATER. After all of the Naval Jelly and rust is gone, the dry surface will contain a rust inhibitor, a thin, clean film. This will prevent further rusting and may be painted over.



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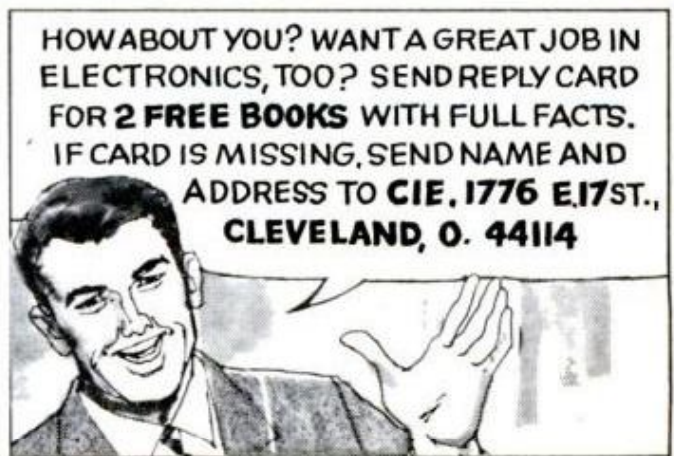
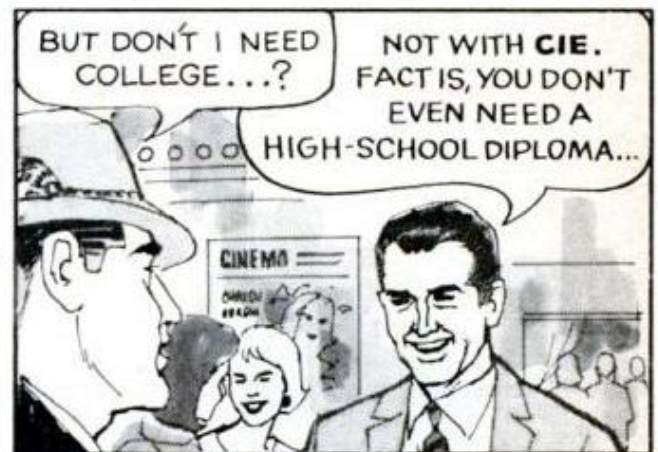
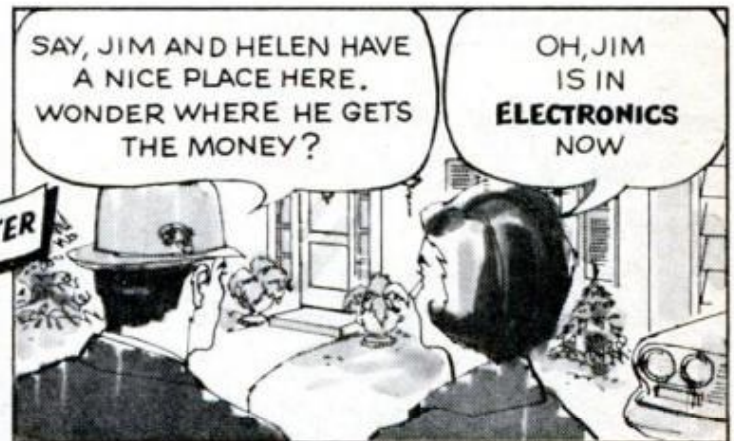
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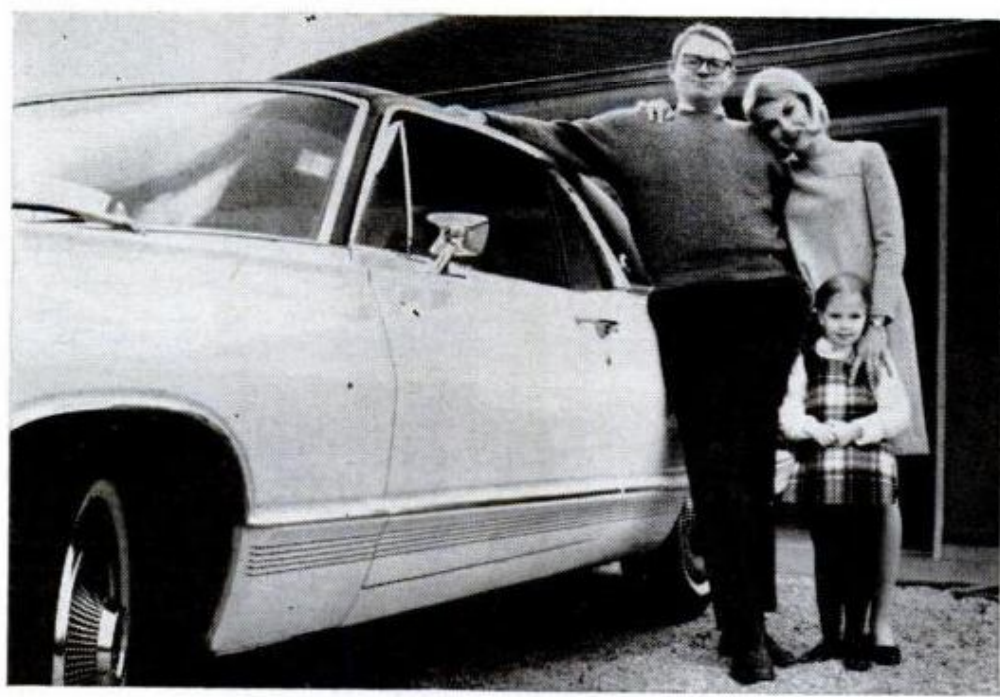
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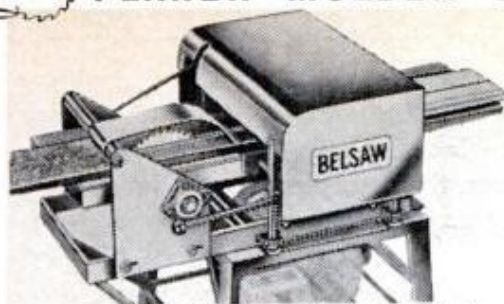
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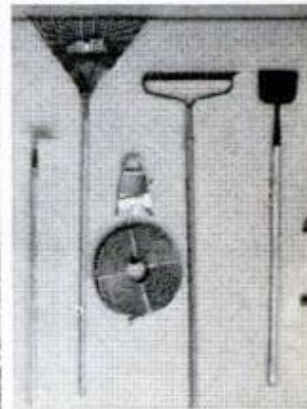
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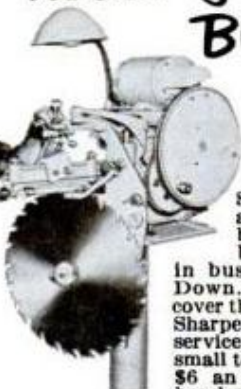
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DRIVIN' WITH DAN

(Continued from page 22)

can be pretty hot on a warm day. However, the Nomex-type suit that I prefer has remarkably good breathing quality and while it's a bit warmer than, say, shirts and slacks, it's not really as bad as you might think.

Q. *If you don't mind saying, what did Ferrari pay you when you started racing for them?—Billy Grady, Philadelphia.*

A. *It was a while ago—1959—so I don't imagine any of my friends at Modena would mind. The offer which I gratefully accepted was \$160 per month plus 50 percent of the prize and starting money.*

Q. *Are NASCAR drivers getting better in such road races as the Riverside 500?—Larry Huffman, New Orleans.*

A. *Although Riverside is the only road course I've had the chance to see stock cars operate on lately, I feel most of the top drivers have done well all along. Besides such top names as David Pearson, Richard Petty, and Cale Yarborough, I remember some impressive performances at Riverside from guys like Curtis Turner, Marvin Panch, Junior Johnson and Fireball Roberts.*

Q. *What will your car number be at Indianapolis this year, and how many cars will be there from AAR?—Nancy Hinton, Boston.*

A. *My car—the Olsonite Eagle—will carry number 48. At this writing, we don't plan to enter cars from AAR for any other driver. We have, however, built several Eagles, including three or four of a new design, for such drivers as Roger McCluskey, Bobby Unser and Jerry Grant.*

Q. *Why were the McLaren Group 7 sports cars almost unbeatable in the Can-Am series last fall? Engine or chassis?—Tommy Olson, Parkersburg, W. Va.*

A. *The overall car itself (less engine) was probably the biggest single advantage the McLarens enjoyed last year. This was a totally designed and tested car and chassis. As is often the case in racing, it wasn't so much any single key feature of the car, but a collection of small improvements in almost every area that made the difference. I don't*

(Please turn to page 34)



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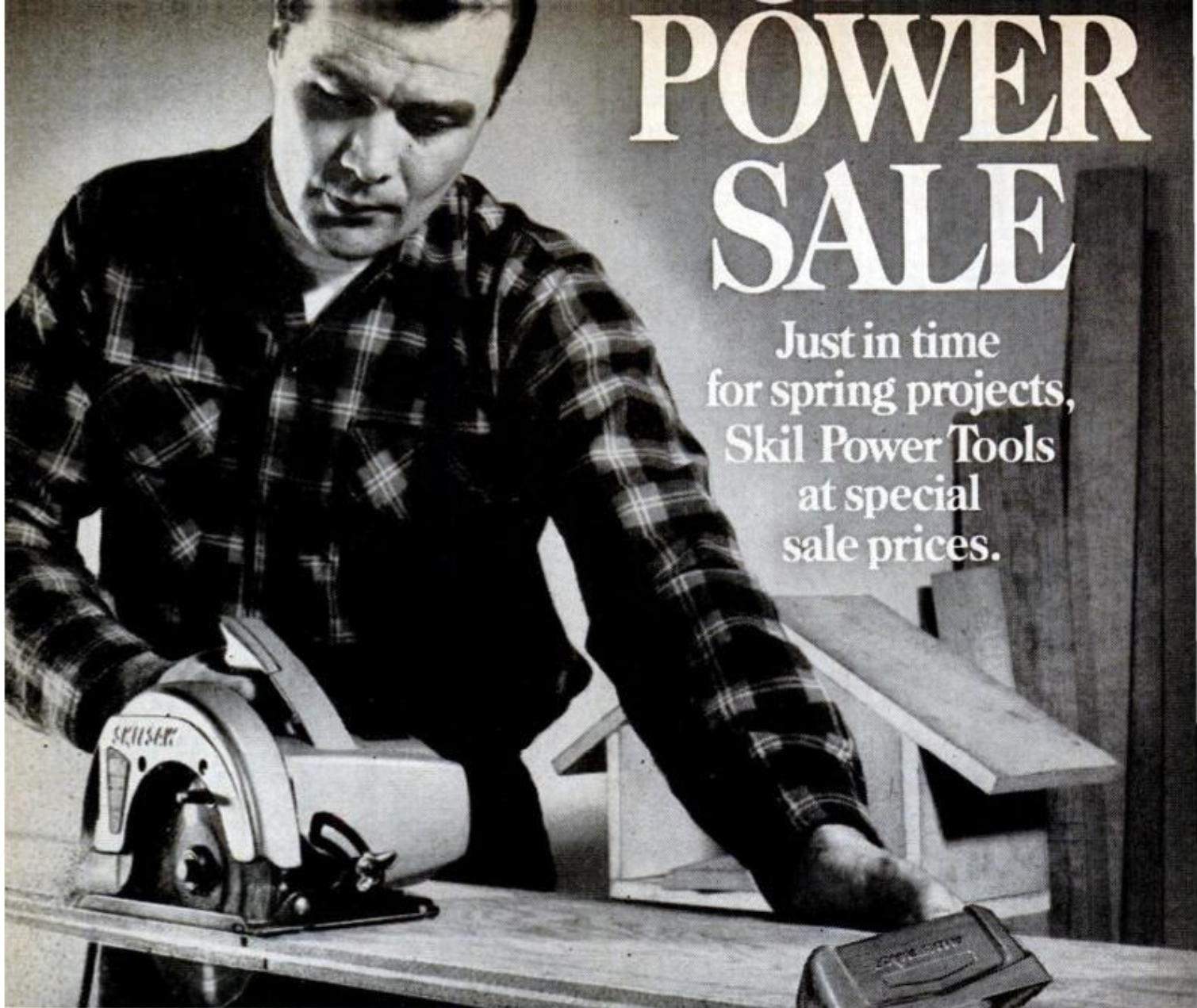
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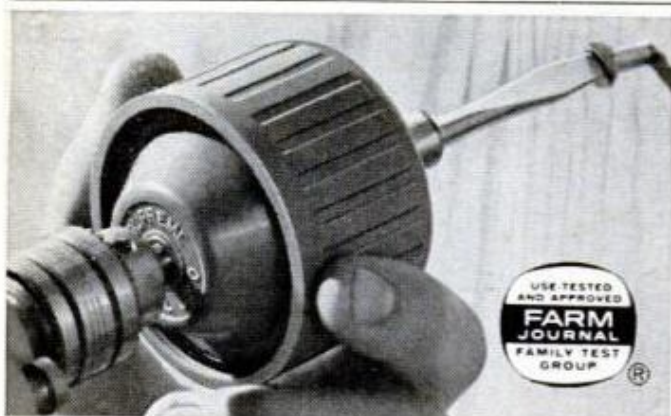


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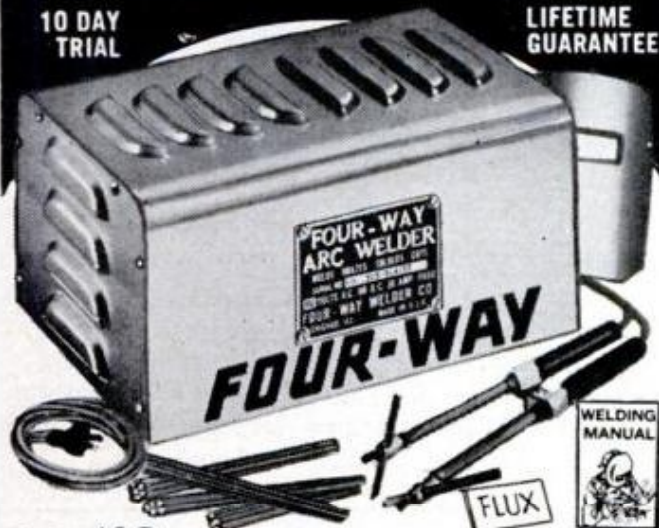
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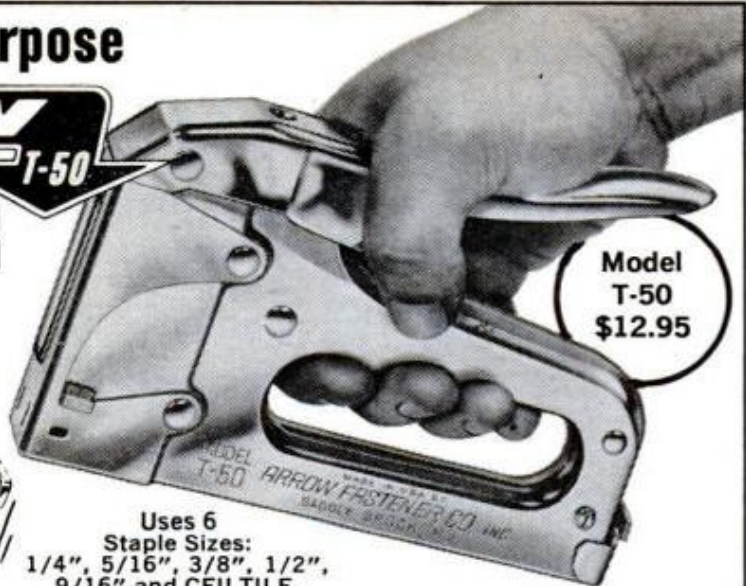
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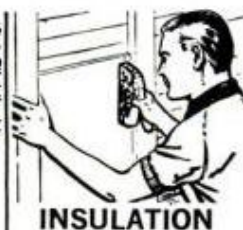
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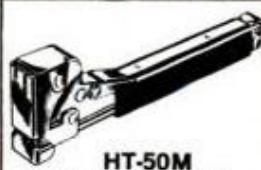
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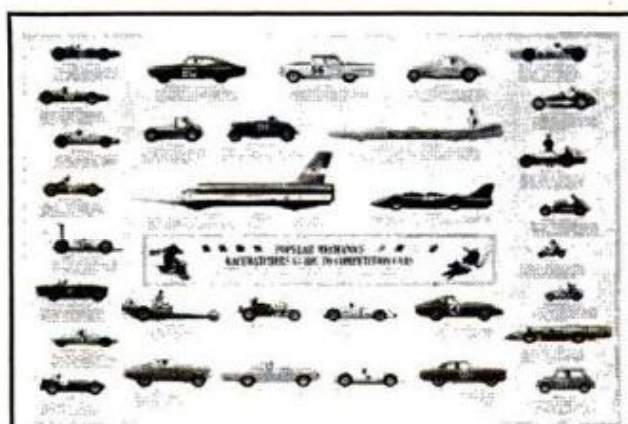
DRIVIN' WITH DAN

(Continued from page 29C)

believe they will enjoy that sort of advantage this fall, however, although they certainly remain the cars to beat. Our Ford engines were probably putting out as much power or more than the Chevys on the McLaren cars.

Q. I saw Swede Savage run a stock-car race or two last year and thought he was a very good-looking prospect. Is it true that he's driving for you now?—Tony Lyndhurst, Norfolk, Va.

A. We agree that Swede is a young driver of great potential. He's working with us at the moment, learning the racing business from a preparation standpoint, and we hope to be able to bring him along in a sports car soon.



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Q. Settle an argument for me. In Indy 500 history, what driver has had more leading laps than any other? I say Wilbur Shaw, my buddy says Bill Vukovich.—Chet Zelonsky, Babylon, N.Y.

A. According to my record books, Chet, you're both wrong. Ralph DePalma led the race more laps than any man in Indy history—613. Wilbur Shaw led in 508 laps, Bill Vukovich, 485. DePalma, however, won only once, in 1915.

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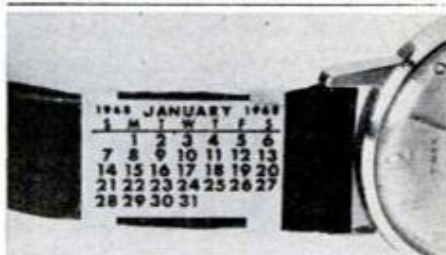


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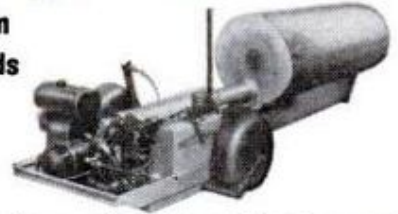


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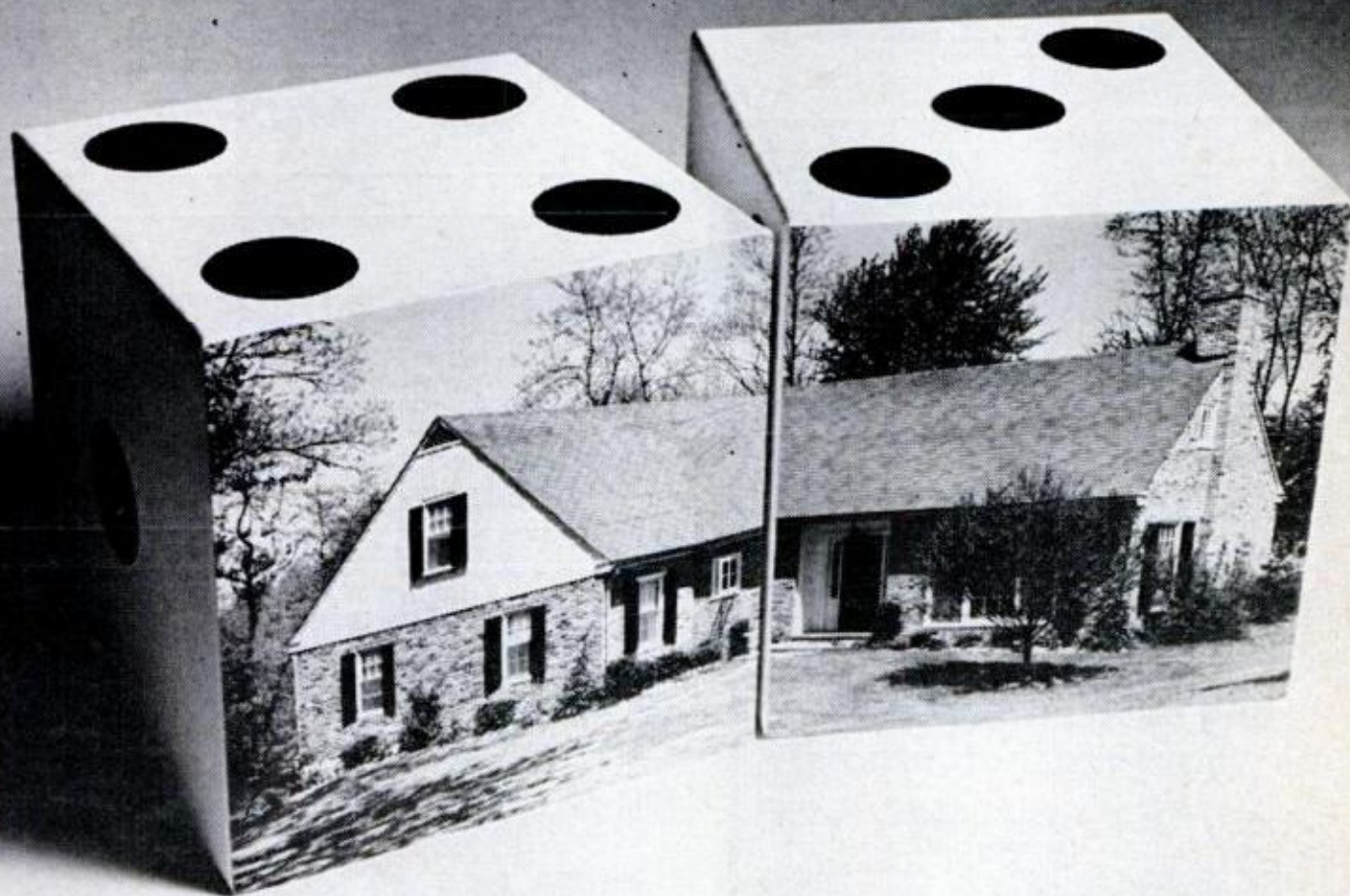
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QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Regluing old ivories

I have an old piano and believe the keys are faced with genuine ivory. All have yellowed noticeably. Some of the facings have come off entirely, others are loose and one is missing. Can these be reglued and can you tell me how to go about it?—R.L., N.H.

Ivories on some old pianos are in two parts: the head (wider part) and the tail, which is the narrower part between the black keys. You do not distinguish between the two so we'll assume that the loose sections are either the heads or the entire facing. If the latter is the case, I suggest you have your local piano tuner do the job. But if the facings are in two parts and only the heads are loose—which usually is the case—you can handle the job yourself if you use extra care.

Pry off the loose facings carefully, then remove the key slip which is the wood member just in front of the keys. This usually is fastened with screws driven up from underneath. Scrape the mating surfaces of the key and the ivory free of all old glue, using a sharp knife blade as a scraper. Then place a few drops of white glue on both surfaces and spread to a uniform film on both faces. Replace the ivory, taking care to position it correctly. Then place a thin wood block over it and use a spring clamp to apply pressure. Remove any oozing glue with a damp cloth immediately. Allow the glue to dry for several hours before removing the clamp.

That missing ivory may have loosened entirely and dropped between the keys onto the key bed. Look for it there before you get a replacement.

Color-matching problem

I'm hanging a couple of hollow-core panel doors faced with Philippine mahogany. After trimming and planing the edges to fit I have the problem of staining the exposed pine framing to match the facing. Red mahogany stain just isn't dark enough. Is there some other way?—W.L., Calif.

I assume the faces of the doors are to be finished in the natural color with a clear finish. If so, a burnt-sienna color in oil

(Please turn to page 60)



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HOMEOWNERS' CLINIC

(Continued from page 58)

may do nicely. Use painter's tinting color or artist's color, the latter is perhaps best.

First, sand the edges smooth, using several grades of sandpaper from medium to very fine. Round the corners slightly. Be sure both doors fit with sufficient clearance. Then apply the color as it comes from the tube, using the tip of your finger or a clean cloth. Apply with the grain, then rub off until the colors match. If after wiping, the color turns too light, apply more color and wipe again until you get a matching tone. Oil colors dry slowly so you have plenty of time. Once you get the desired color-match, allow a week to 10 days drying time before finishing the edges. Be sure to apply a finishing coat to the top and bottom edges as well.

Coloring metal

How can I blue small parts of steel? I don't want to use a paint or lacquer; I want to color the metal a deep blue-black, as uniformly as possible, and without using any coating that will wear off or chip in time like paint or enamels.—S.H., Pa.

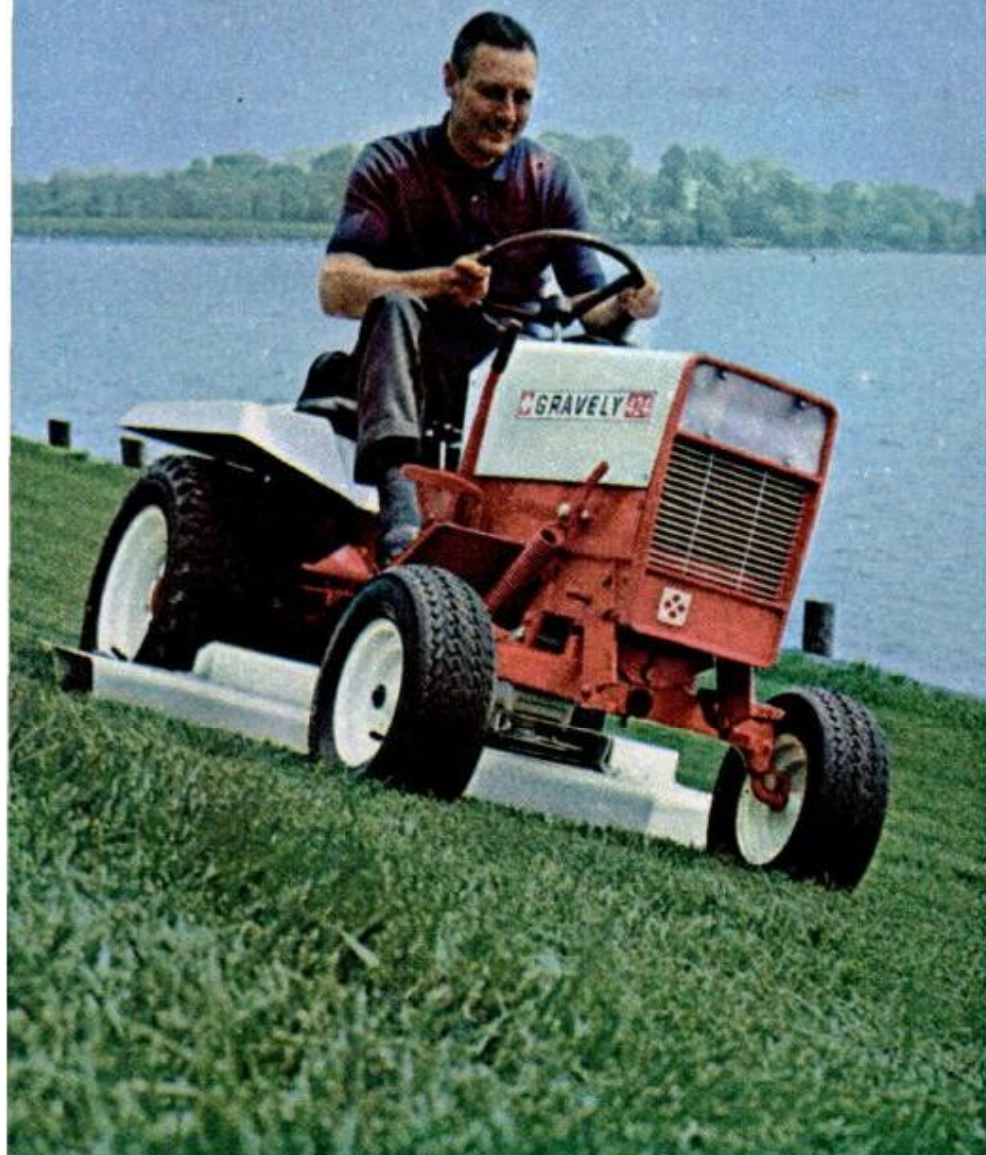
Perhaps the easiest and simplest way of producing a deep, blue-black finish on ordinary steel is to use a gun bluing solution available from dealers handling sporting goods. First of all, the item to be blued *must* be thoroughly clean, which means that all oil, grease, rust and dirt must be removed. Usually this can be done with solvents and wire-brushing, the latter preferably with a power-driven wire wheel. Unless the piece is clean, the bluing solution will not "take" uniformly. After cleaning don't touch the metal surface with your hands or fingertips. Before applying the solution, read the instructions on the container closely and observe all precautions listed. After the bluing process has been completed, it usually is best to coat the item with light oil or, perhaps, with a clear metal lacquer to prevent rusting.

Weeds in compost?

How about composting weeds? I've lots of tall weeds about my country place and I've thought of cutting and composting them for use in my garden soil. Will the seeds survive?—L.W., Mich.

If you cut the weeds before they seed, fine; but if any of the seeds are mature, they'll remain viable for several years and you will be sowing them when you spread the compost on your garden plot. ★★★

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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Frozen assets

I've just spent a good deal of money having the Turbo Hydra-Matic transmission of my 1965 Pontiac overhauled. It wouldn't operate in reverse. The mechanic told me a rear servo piston had broken, probably because of high oil pressure. Is he right or was I taken?—Harold Frazer, Scranton, Pa.

He is probably right. A busted servo piston often occurs when the pressure-regulator valve or modulator valve sticks, or when water freezes in either the vacuum or oil side of the modulator diaphragm. Both cause excessive pressure on the piston.

For example, if the car has been standing outside in freezing temperature, any water collected in the modulator from loose or cracked vacuum lines and fittings will freeze. The excess oil pressure can break the piston. This is especially common if you shove the selector into reverse without giving things time to warm up.

One tip-off to the trouble is delayed upshifting when you drive the car before the transmission's had time to warm up. Don't disregard it, but have modulator and regulator valves checked for free operation, and the modulator assembly inspected for the presence of water.

Cure for a crunch

A crunching sound in the front end of my 1964 Olds F-85 has me worried. It generally occurs on a sharp turn up or down an incline. Can you tell me what to do?—Bernie Myers, Jamaica, N. Y.

Make sure ball joints are in good shape and sufficiently lubricated. If okay, the noise is probably caused by insufficient torque of the lower control-arm bushing bolts. Tighten 'em up to 85 ft.-lb. with the weight of the car resting on the wheels.

Blade buster

On four different occasions, my 1963 Buick Electra has thrown a fan blade. The fan, fan clutch and water pump have been replaced. It keeps happening. Why?—A. W. Richards, Elizabeth, N.J.

As long as the fan clutch is in good

shape, I have a feeling that you've got a simple out-of-balance condition. If the bottom crankshaft pulley has moved, for example, the belt will be pulling sideways. This could be enough to throw the fan. I suggest you have the pulley-belt alignment checked carefully.

Stumbling along

The 1964 Comet V8 I just bought is in good shape except for a stumble on acceleration I haven't been able to correct. Is there something I've overlooked?—Bob Priddy, Modesto, Calif.

A search of my fixit file reveals that acceleration stumble and stall with the Comet can be caused by insufficient fuel being discharged by the accelerator pump. Try this, Bob: Check the pump operating rod to see if it's in the next to the outside hole in the over-travel lever. If not, move it there.

Black tailpipe blues

The tailpipe of my 1965 Buick is coated on the inside with black, sooty deposits. Am I headed for trouble?—Alex Perone, St. Louis.

You sure are unless you correct the condition. Those deposits signify that you're running on an overly rich fuel mixture that could be diluting engine oil, leaving pistons, rings and cylinder walls unprotected.

Usual causes of a rich mixture are a faulty choke, a clogged air cleaner, a carburetor that's not adjusted to specification, a stuck manifold heat control valve, and bad sparkplugs. No great shakes to check and fix.

By the way, an occasional examination of the tailpipe for those deposits can help anyone stop a potential troublemaker before it develops. It's a maintenance check that should be added to your list.

Feeling low

Brake adjustments have failed to increase the brake-pedal height in my 1965 Mercury. Braking is adequate, but I get the whammies until the pedal catches. What's wrong?—Howard Arthur, Syracuse, N.Y.

(Please turn to page 64)



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ups ride like cars with no compromise of big-truck durability. Other better ideas for the asking: front power disc brakes, SelectAire Conditioner, bucket seats, V-8's up to 390 cu. in. Drive one soon!



...has a better idea!

AUTOMOBILE CLINIC

(Continued from page 62)

The only thing I know of that can cause this in a Mercury, other than improper shoe adjustment or air in the system, is the use of incorrectly sized spacers between the brake-pedal support bracket and firewall. It happens that some cars left the factory in this condition. I'd have a Mercury shop check the spacers. The right ones are .88-inch long. If you have to order them, the part number is C5A2-2849-B.

Double cross

When I went to start my 1965 Chrysler the other morning, the starter motor jammed and broke. My mechanic, who is now working on the car, is unable to explain what happened. Do you have any ideas?—Jack Carpenter, Providence, R.I.

An extreme cross-fire can damage the starter motor. The sudden change in direction of flywheel rotation with the starter engaged causes severe stress on the pinion, which could result in a broken pinion or other part. Before installing a new starter, your mechanic should thoroughly clean and inspect the distributor cap, looking for cracks and carbon tracking. Get rid of the cap if it's damaged.

Completing the list

I have a 1966 Buick Special that starts to shimmy and shake between 60 and 65 mph. I have new tires that have been trued and balanced, new shocks, new wheel bearings. The front end has been aligned to spec and the steering system inspected. What's left?—Norm Silver, Miami.

The following, Norm: unbalanced flywheel, loose and/or broken motor mounts, bent driveshaft, worn universal joints.

Two readers write

Here are a couple of helpful tips from two Auto Clinicians:

Gary Veenstra, of Kalamazoo, Mich., writes that if owners of 1965 Comets have trouble locating the cause of an overheating condition, they should check the fins in the radiator core. Gary had the problem and found that the fins had come loose.

Joe Witkin, a driver education instruc-

tor in the Portland, Conn., high school, comments on causes for intermittent power-window operation. He had the trouble with his 1965 Oldsmobile 98. The problem, he found, was a defective relay switch, located behind the upholstered kick panel just forward of the left front door and about even with the parking brake pedal. He checked the relay by turning the ignition key on and off, and putting his ear at the kick panel to listen for the relay clicking in time with ignition key operation.

Thanks for the help, gentlemen.

SERVICE TIPS

● **Ford** reminds us that use of a motor oil in its 1968 cars that doesn't meet engineering specification M2C101-B will invalidate your 5-year, 50,000-mile warranty. Most of the high quality oils of leading oil companies meet this specification, but if you're not sure, check with the dealer for a list of brands. And get it in writing—just in case.

● **Some 1968 Chrysler cars** with airconditioners may be giving their owners stalling troubles when hot starting their cars with the airconditioner turned on. You can rid yourself of the problem by setting the idle speed to 600 rpm with the airconditioner turned on instead of it being turned off. The procedure applies to those cars with 383-cu.-in. engines and Carter BBD-4423S carburetors and also 440-cu.-in. engines with Holley R3918A carbs.

● **Got a chirp in the brake system** of your 1967 Chrysler, Imperial or Plymouth? If so, you can get rid of it by applying a new lubricant to the backing plate platforms. The grease carries part No. 2932524. The way to apply it is laid out for your Chrysler mechanic in service bulletin 67-5-6.

● **Don't tow your Olds Toronado** by throwing a chain or winch around the rear axle. You could ruin it. Instead, if it becomes necessary to tow the car, fasten the chain around the rear spring at the rear shackle, with the chain load on the bottom of the leaf spring.

● **Chevy** tells us that investigation of a number of water pumps returned as noisy revealed there was nothing wrong with the pumps. In most cases, no noise could be reproduced as long as the belt tension was properly adjusted. So, if noise does crop up in the water pump area, check belt condition and tension. ★ ★ ★

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.

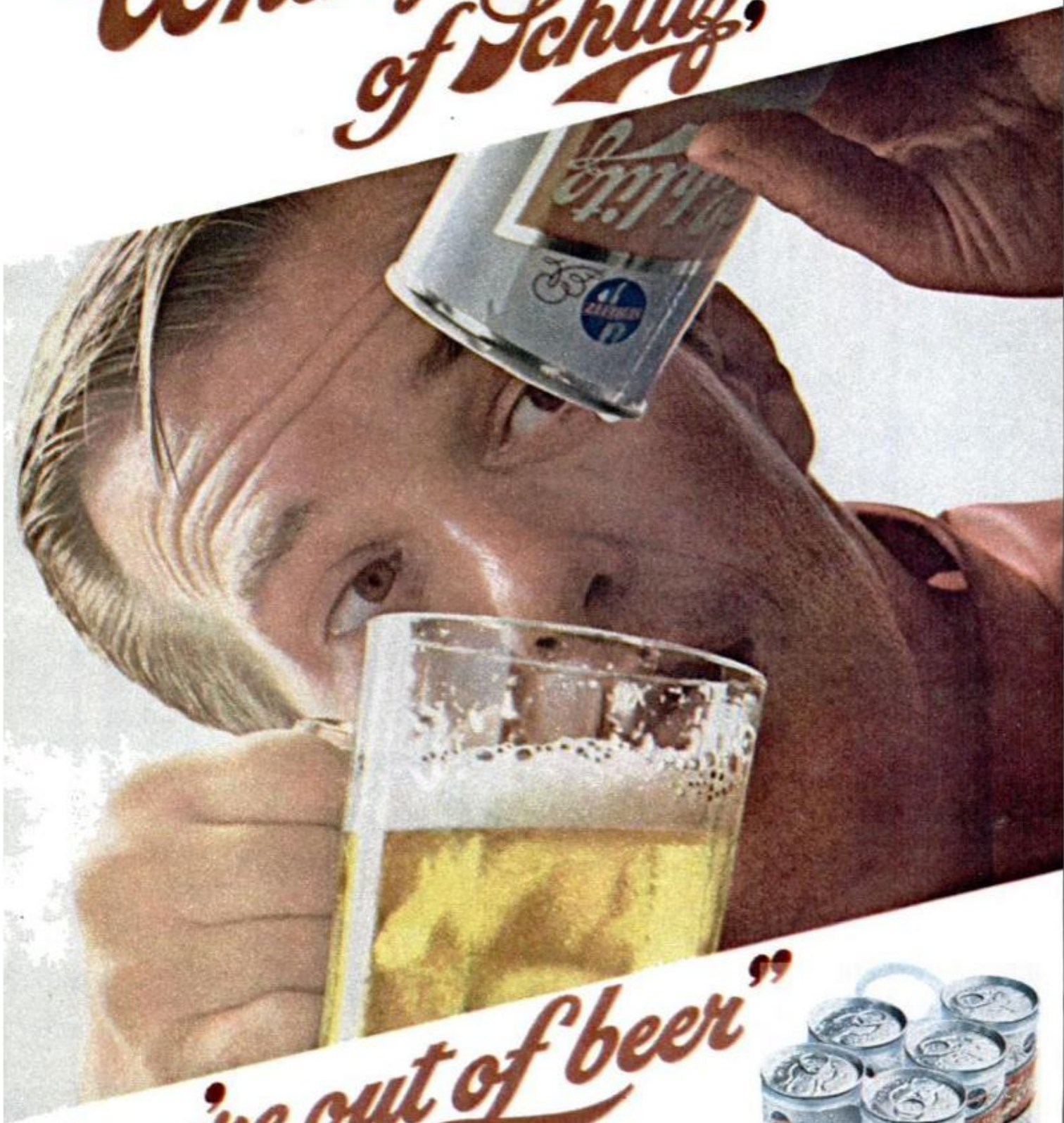
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How to Beat Those Highway Death Traps

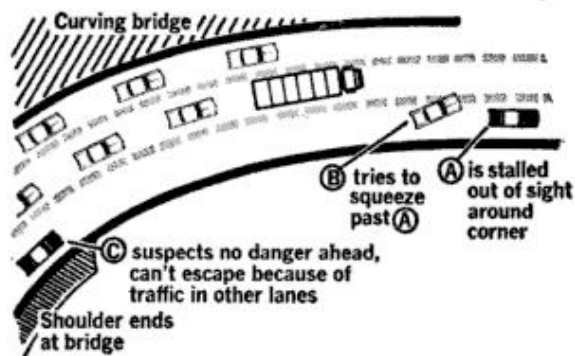
By E. D. FALES JR.



YOU ZOOM around a bend in a six-lane super-highway and suddenly there's the gas station you've been looking for—two lanes over to your right. You have to zigzag through two lanes of roaring traffic or wait another 26 miles. Then there's the exit ramp that immediately follows an access ramp so that cars getting on and off must crisscross. Such engineering blunders are already raising angry cries from legislators. Said a Connecticut representative in February: "I fail to understand how highway engineers could have designed so many death traps." Turn the page for some of the worst traps and how to avoid them.

**THIS CAR IS ABOUT
TO HAVE AN ACCIDENT!**

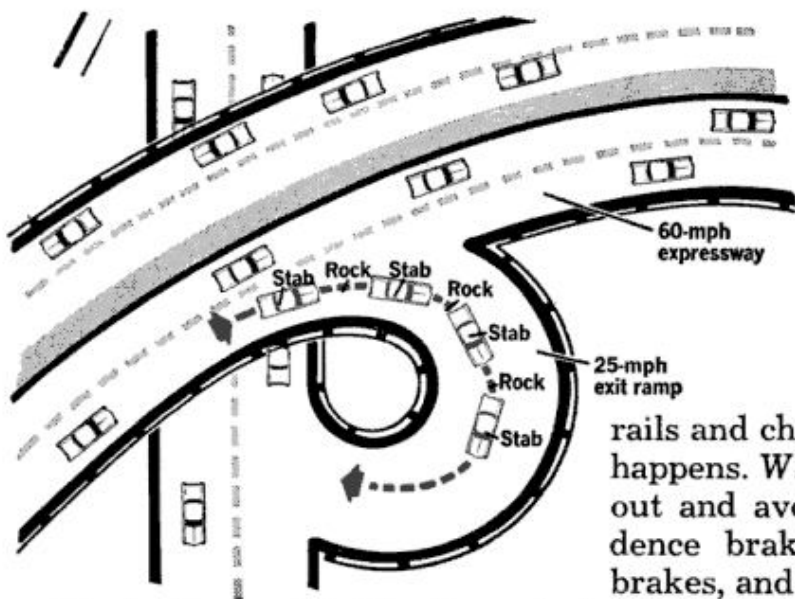
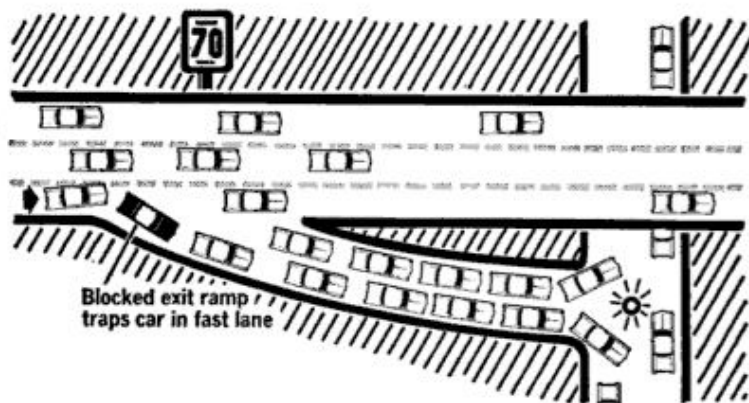
Illustration by Howard Schafer



The Blind-Bridge Trap: Car A has broken down in the right lane on a curving trestle. There's no pull-off shoulder; high railings hide him from following cars. Car B tries to swerve around A, but can't. Car C, suspecting no danger, roars down on both. Result: a multiple-car smashup. This is the situation shown on the preceding page. *What to do:* If you're B, don't pull up close behind A. Slow down and lay back until it's safe to

switch lanes. If you're C, you're wrong in the first place. Never cross a high-speed bridge in the right lane—that's where stalled cars will be stopped.

The Blocked-Exit Trap: Some expressway exits fail to allow for rush-hour traffic or a slow-changing stoplight right at the end of the ramp. Result: The backup of cars catches you still on the highway—a sitting duck. *What to do:* Try to check the exit before you get on top of it. If it looks full (you can tell by brake lights), slow down, get the traffic behind you under control, then proceed at minimum speed, giving the ramp time to clear. If it's still blocked when you reach it, it's better to pass it by completely.

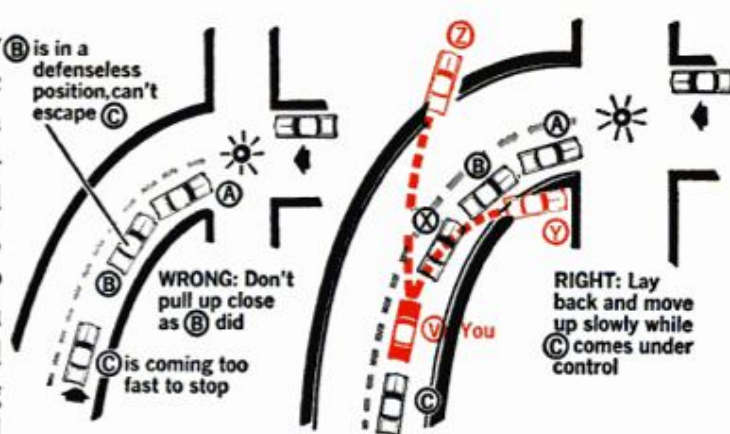


The Corkscrew-Exit Trap: You're doing 60 on a strange expressway and suddenly you spot your exit—a murderously sharp turnoff with the helpful warning that ramp speed is "25 mph." You hit the brakes, discovering too late that you can't steer with locked wheels. The devastation around such exits

—broken poles, smashed guard rails and chewed up grass—clearly shows what happens. *What to do:* If you still can, straighten out and avoid the turn. If you can't, try "cadence braking." This is expert pumping of brakes, and it can hammer down speed incredibly

fast in a crisis. The important thing to remember is to hit the brakes in quick stabs in time with your car's natural rocking rhythm. Stamp down hard—Wham! Wham! Wham! You want to hear the tires screech. As soon as you feel the wheels lock up, release the brakes and let the car rock back. Each stab will cause a powerhouse nose dive that throws weight on the front wheels where you want it. The intermittent braking also maintains steering. If it still looks like you're going into the guard rail, avoid that lethal post at the end of the rail. Release your brakes to free your steering and lay the car up against the side of the rail beyond the first post. If you must go off onto the grass, head straight for it right away. Don't wait until you're halfway around the turn where the car may sideswipe the curb, tripping your wheels and possibly causing you to overturn.

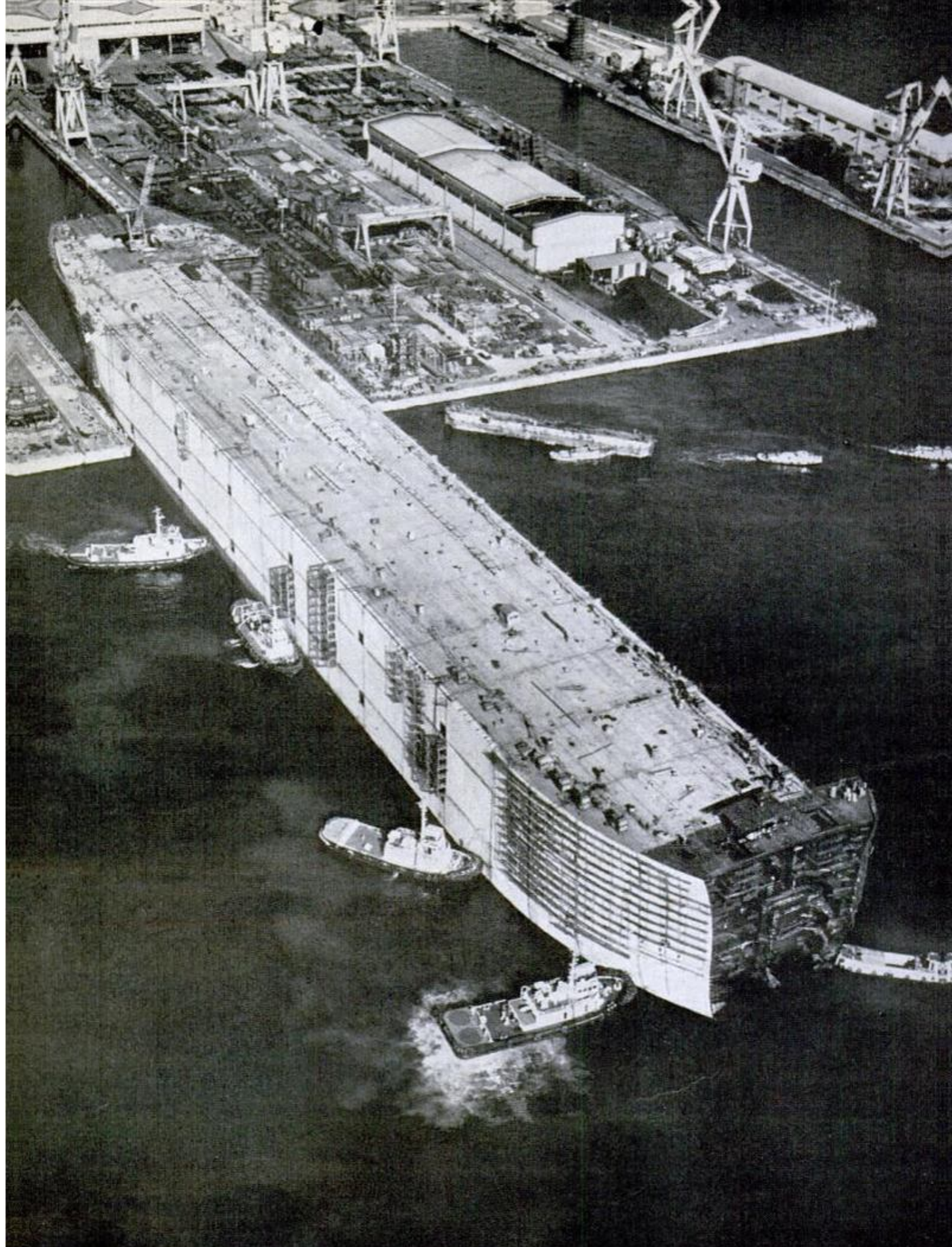
The Sudden-Stoplight Trap: Many high-speed roads still have traffic lights. Such unexpected lights are a perfect setup for a rear-end collision. Car B pulls up close behind car A, waiting for the light. Car C, unaware of the light, plows into them. *What to do:* As soon as you spot a light ahead, slow down and warn following cars by flashing your brake lights. Lay back until cars behind you have also slowed. Creep ahead, leaving yourself a last-minute escape cushion. If another car C is still coming too fast, ease up to position X, giving him room to stop. In an emergency, you (car V) can still escape to Y or Z.



The Wrong-Way Trap: It isn't just drunks who find themselves going the wrong way on a one-way road. Many competent drivers are innocently led into this trap by confusing highway design. Here's how: Before getting on an expressway, you (car B) pull into a corner station for gas. Then you leave by the opposite side. You turn left to go west—into onrushing traffic. Or you (car A) come to an unmarked intersection and make the normal left turn to go west without realizing you must first cross the eastbound track. *What to do:* If you're ever in this predicament, don't try to turn around right away. Flash your headlights on and off rapidly with one hand while steering with the other (in daylight, use high beams). Switch on your four-way flashers. Head for the nearest shoulder and pull off. Cut your headlights so as not to blind oncoming drivers, but leave the flashers on. If the shoulder is too narrow or the traffic too heavy for you to turn around safely, wait there until help arrives.

The Stupid-Sign Trap: A driver speeding along at 65 to 70 is looking for Smithtown. Suddenly his eye catches a sign with the word Smithtown and an arrow to the left appearing to indicate that the exit is farther ahead. Too late, he sees a second arrow indicating the turn to Smithtown is really to the right and that the left-hand arrow refers to East Smithtown. Faced with a 23-mile detour to the next exit, the driver decides to risk backing up. What he doesn't know is that a car backing on a high-speed road actually looks like it's going forward. Anyone who hasn't seen this will find it hard to believe, but it's true. *What to do:* Watch ahead for cars acting uncertainly at exits, especially if you're in the right lane. A car pulled off just behind an exit has probably missed his turn and may back up. Keep an eye out for white backup lights, although these are not too noticeable in daylight. Be wary of a car that has started to take an exit and then stopped. He may change his mind and swing back into your lane. If you are in doubt about an exit yourself, it's wise to take it anyway. It's easier to get back on if it's the wrong one than to miss the right one and have to go 40 or 50 miles out of your way. Never stop near an exit—some other uncertain driver may plow into you.





JUST THREE MONTHS after her keel was laid, world's biggest tanker is floated out of building dock in Yokohama. Bow and port side are now being finished in longer, wider repair dock (upper right)

The Biggest Thing That Ever Moved

In the post-Suez scramble for supertankers no one builds them bigger or quicker than the Japanese

By ROBERT P. CROSSLEY, Editor

WELL, THERE SHE WAS. The largest thing man had ever put together and expected to move.

I had come a long way to see her, and now she stretched nearly a quarter of a mile in the huge building dock of the IHI Shipyard in Yokohama. Towering 164 feet from keel to wheelhouse, she looked like an unfinished skyscraper being delivered in a box. Stand her on end, I thought; her length of 1135 feet would make her the world's second-tallest building.

Up to now the longest ship in the world has been America's nuclear-powered carrier, the USS *Enterprise*, 1123 feet. The longest liner, the *France*, is 1035. The biggest ship in service is the *Idemitsu Maru*, 210,000 deadweight tons, built in this same dock. The monster I'm looking at will weigh in at 312,000! You could put 62 tennis courts on her deck.

I noticed the outside plating was being affixed on the starboard side, but not on the port. I asked why. Like the guy who built a boat in the basement, IHI—Ishikawajima-Harima Heavy Industries Co., Ltd.—had a problem. The 312,000-ton giant, first of three IHI will build for National Bulk Carriers (another Japanese yard, Mitsubishi, will build three more), will be 174 feet, 10 inches wide. The dock is 170 feet, 7 inches. There just wasn't room enough to put the skin on both sides. The dock is also 52 feet *too short*, so her bow couldn't be finished either.

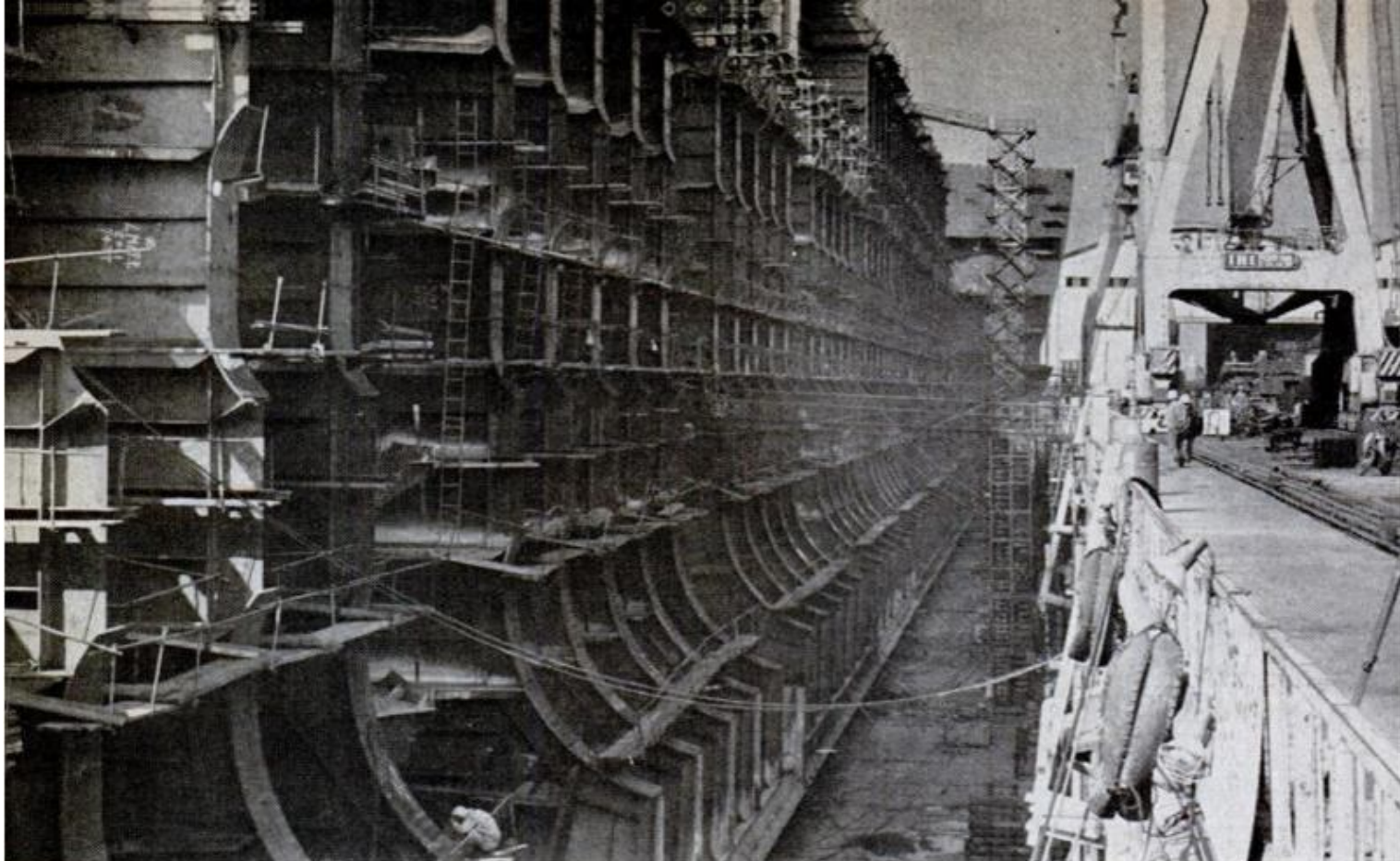
When the main hull was watertight she would be floated out of the build-

ing dock, turned around in deep water, and headed into a larger "repair" dock, occupied when I was there by a nearly finished 207,000-tonner. Dwarfed by its burgeoning neighbor, this one would have been the world's biggest only two years ago.

I was there Nov. 26. The monster's keel had been laid Oct. 7. Already she looked like a ship. They floated her into the repair dock Jan. 9. Her sea trials will be this summer. She'll be delivered in September to start hauling crude oil, 2.2 million gallons a trip—nearly half enough to supply the whole East Coast of the United States for one day. She'll go from Kuwait around the Cape of Good Hope to a deep-water harbor being built for her at Bantry Bay in Southern Ireland. That's the way they build tankers in Japan. In any other country a ship this size would take twice as long.

The closing of the Suez Canal last June spurred the demand for supertankers, although the canal had already become obsolete. When Suez clogged up, only five percent of the world's tanker capacity was in ships of over 100,000 tons. Now over 70 percent of the capacity on order will be in supertankers, a term coined in 1950 to describe a then-awesome 28,000-ton giant. As this is written, more than 150, each over 150,000 tons, are on order throughout the world.

Suez's limit was 60,000 tons. The big new ships can haul oil *around* Africa more cheaply than the smaller ones could by taking the shortcut. Although



VAST SIZE IS APPARENT in port-side view taken by author last November, six weeks after work started

the round trip is 13,000 miles longer, the 312,000-tonners will deliver oil to Europe for half of what it would cost in a 50,000-ton ship using the canal.

The giants cost less to build, too. At \$20 million, the 312,000-tonner costs \$64 a ton in Japan; a 50,000-ton one costs \$110. Add one foot to the length of a 300,000-tonner, and you increase its capacity by 2000 tons.

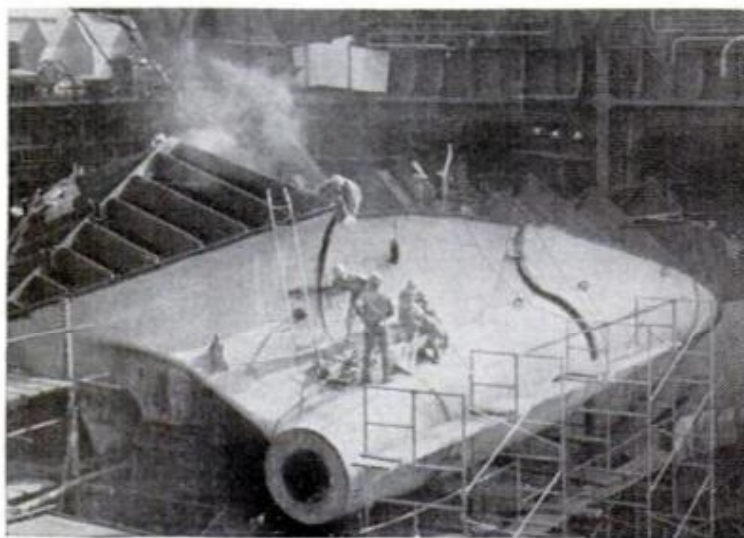
Obviously it requires fewer men to run one 300,000-ton vessel than it does to operate six 50,000-tonners. The 150,000-ton *Tokyo Maru*, another IHI ship, which was also the world's biggest for a while, has a crew of only 29. It is so automated that no one stands watch in the engine room at night. However, automation is tremendously expensive, and the new ships will carry 76 men.

Since its merger last month with Kure Shipbuilding and Engineering Co., Ltd., IHI is the largest shipbuilder in the world. In 1966 it launched more tons than West Germany, the No. 2 shipbuilding nation. IHI also makes iron and steel, steam and hydroelectric generators, jet engines, cement,

papermaking machinery, farm equipment, atomic reactors, bridges, cranes, seawater distillation plants, parking garages—you name it—and is the world's largest diesel-engine builder.

It is providing twin 18,700-shp steam turbines, built under a license agreement with General Electric, to move each of six big, new tankers, its own and Mitsubishi's, at 14.6 knots. The

TWIN PROPELLER HOUSING: 71-foot draft created tough water-flow problems for usual single screw



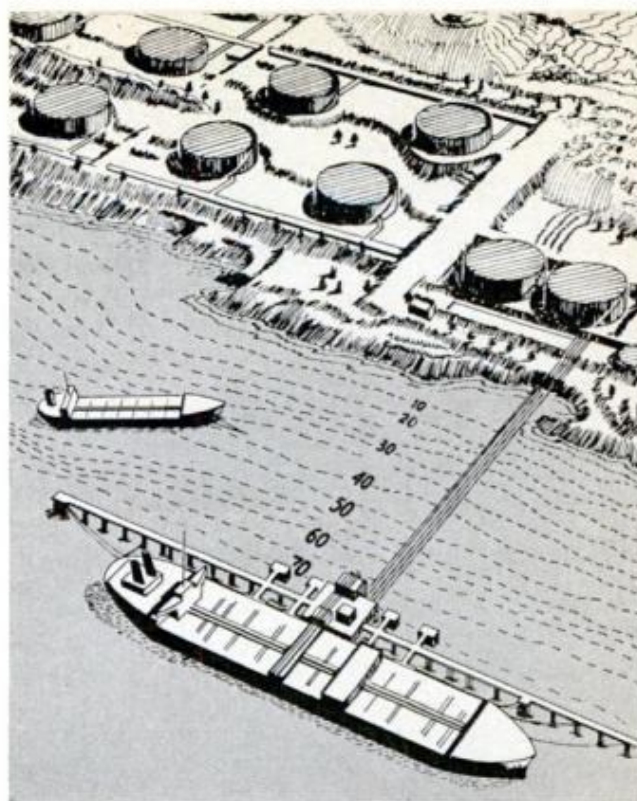
210,000-ton *Idemitsu Maru* has a single 33,000-shp turbine. But because their tremendous draft, 71 feet, created difficult flow problems for a single propeller, the 312,000-tonners were designed with twin screws, the first big tankers powered with two engines.

Japan has topped the world in ship-building every year since 1956. It now builds nearly half of all the tonnage in the world—more than twice as much as the next three nations, Sweden, England and West Germany put together.

Japanese leadership is based on five main factors: low cost, "sure delivery dates," quality, advanced welding techniques, and "block construction" in which sections of 100 tons or more are fabricated in the shop and hoisted into the building dock. Another innovation, "advanced fitting," means fitting is three-fourths done by launching time.

Much of the welding is automated. Mitsubishi has even developed a method of "welding at sea," in which two parts of a hull can be connected after they are in the water. This could permit a 400,000-ton ship to be built in a 200,000-ton dock.

All of the big tankers are built to a new "bulky hull" design, wide, deep and short—if you can call 1135 feet "short." This permits a maximum capacity with the smallest possible investment. On a 100,000-ton tanker, a bulky hull can save one-fourth on steel



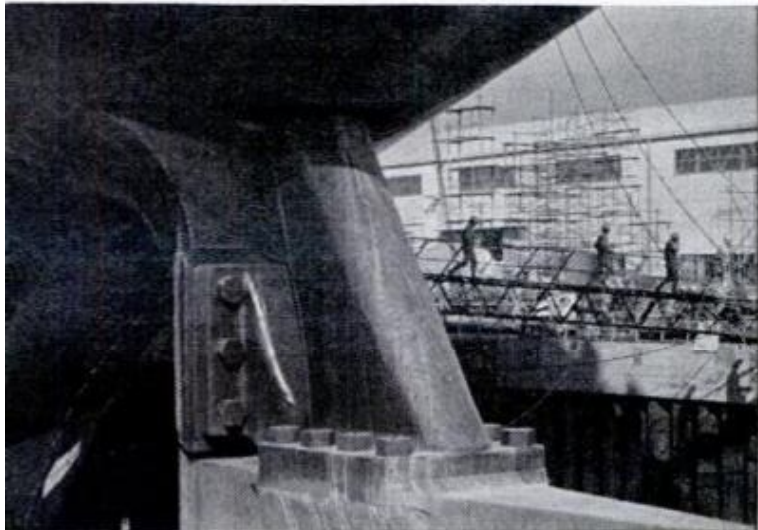
NEW DEEP-WATER PORT at Bantry Bay, Ireland, will be terminal for tankers bringing oil from Kuwait

and reduce power requirements by as much as 15 percent.

Few harbors can handle such giants. They'll load at Kuwait from a stationary barge 10 miles offshore. Oil will reach the barge through a 48-inch pipeline. Gulf Oil, for whom National Bulk Carriers will operate the 312,000-ton ships, is building an unloading facility reaching out into deep water at Bantry Bay on the southern tip of Ireland. Oil

(Please turn to page 182)

MAMMOTH BOLTS holding rudder of "little" 207,000-ton tanker would call for gorilla-size monkey wrench

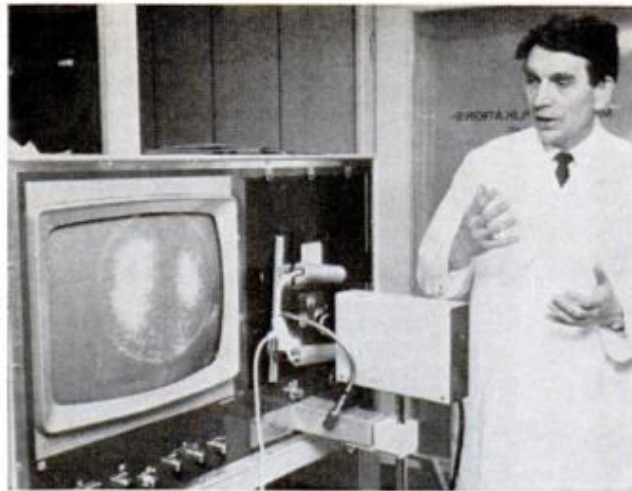


MAY 1968

BULBOUS BOW and heavy anchor chain indicate scale of 207,000-tonner. Depth marks are one foot apart



73



Diagnosis by television

The new Anger-Camera makes it possible to diagnose some human illnesses on a TV screen. Radioactive substances in the body enable the camera to transmit images of organs to the screen. Photos show the camera in use at the Nuclear Medical Institute of Cologne University.



Barrely a boat

Hoping to win a bet that he can cross the English Channel in a barrel, a Briton has out-fitted one with outriggers and a motor.



Still trying

Leslie Smith is another who dreams of man-powered flight. Although he pedaled furiously, his Smith Biplane Special wouldn't take off.

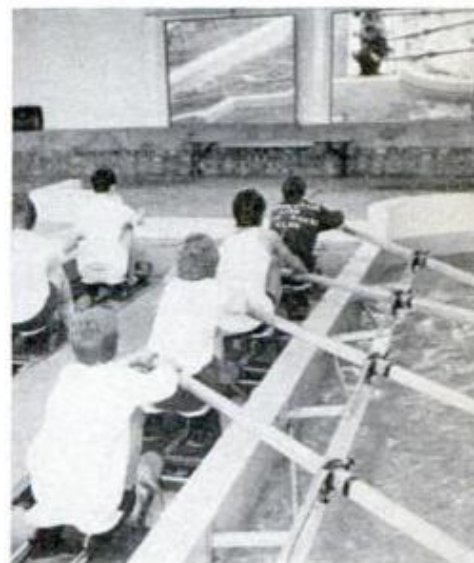
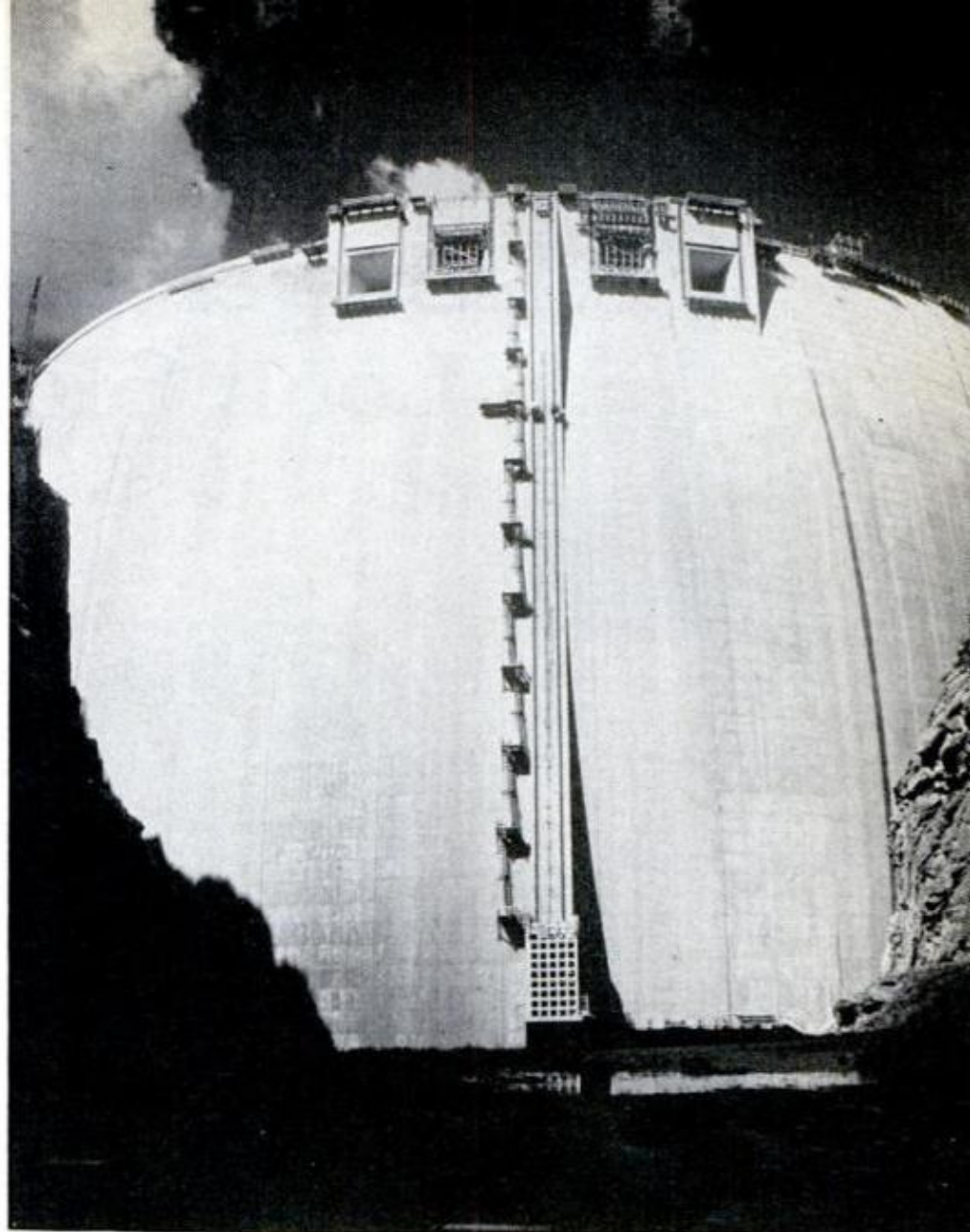


Ski tub

Water skiing becomes an indoor sport with the introduction a simulator that lets you zip over moving water in a 15-foot tank. Water is pumped at high pressure from the front of the tank toward the skier, providing lift. The water spills over a weir behind the skier, returns through the tank's false bottom and comes back through the water jets. Everything comes to a halt if the skier falls. The simulator is a product of R. B. Buswell & Partners, England.

Double curved

Largest double-curvature, thin-arch dam to be built by the Bureau of Reclamation is the new Morrow Point Dam, located 20 miles east of Montrose, Colo., on the Gunnison River. The concrete work was finished late last year, and work continues on the hydroelectric plant; target date for power operation is 1969. The 469-foot-high dam has a length at its crest of 740 feet. Top width is 12 feet and bottom width, 52 feet. Bureau engineers say that they chose the unusual design because of its inherent stability, economy and suitability for the site. ("Double-curvature" means that the dam curves from left to right and from top to bottom.) One of three dams on the Gunnison River, the Morrow Point structure will create a reservoir holding 117,000 acre-feet of water in its 11-mile length. The shoreline will be 24 miles long.



Here's where lots of work gets you nowhere

London youngsters who want to learn competition rowing are given a safe start in a new rowing tank built by the London Education Authority. The oars and the seats are exactly like those in a racing shell, but there's no danger of tipping or being carried away by swift currents. Large mirrors (right) help the students observe their own progress.



The Freight That Makes the Super Chief Look Slow

By E. D. FALES, JR.

AUTHOR Ed Fales boards the Super C to report the record-breaking first run of the new Chicago-Los Angeles freight



AT 1:45 P.M., the world's fastest freight train, the *Super C* stands throbbing in Chicago ready for her first run. Glittering in new paint, she's an 11-car train—perhaps the train of tomorrow. Half passenger, half piggyback, she is the Santa Fe's spectacular bid to recapture transcontinental freight now moving by air and trucks.

In a few minutes we will take off for the West Coast, 2230 miles away, in an attempt to set a new freight speed record—and establish a new daily schedule. The fastest freights to Los Angeles now require 59 hours. But *Super C* (the C stands for cargo) will try to chop off 19 hours. Skeptics say it can't be done. After all, we'll have to stop 17 times to pick up engine and caboose crews. And it takes an ordinary freight as much as an hour to recover speed after a stop. Despite this, we're going to *try* to cross the country in 40 hours. No truck makes that time.

Takeoff is set for 2:00 p.m. Assembled to watch are 200 VIPs of the shipping world. A cloth banner has been stretched across our track.

1:55 p.m. *Super C's* twin horns sound a musical warning. Our two-unit locomotive is humming. Units No. 100 and 104, bright red and yellow, are right out of GM's Electro-Motive Shops.

1:57 p.m. I swing up the side of No. 100, find an empty seat, look around. The cab is roomy and comfortable. The engineer, a big, capable man named Pete Dauma, sits at the console.

In the left window sits the head brakeman (we have no fireman). Also here are the road foreman of engines (RFE) and the supervisor of air brakes (SAB). Today is Wednesday. We've been given an impossible schedule: Hit L.A. at 4:00 a.m. Friday!

1:59 p.m. Great tension in the cab. All eyes watch the tower. "Brace yourself," calls the RFE, tall Joe Elliott.

1:59:50 p.m. The RFE starts a count-down: "Ten . . . nine . . ." A switch engine scurries out of the way. Yard tower is on the radio: "Ready, *Super*



ENGINEER (above) of Santa Fe's *Super C* locomotive has a pair of 20-cylinder, turbocharged diesel engines behind the throttle. Crewman (below) in the caboose reports on condition of train to the engineer



C?" Two red signals (a "red board") bar our way. Suddenly one light changes. "Yellow over red!" shouts the brakeman. "Yellow over red!" confirms the engineer. "Yellow over red!" shouts the RFE, standing behind the engineer. "Start the train, Pete! Go get it!"

Our trumpets whoop twice. Behind us two 20-cylinder turbocharged diesels thunder. Electric power flows into 12 axle-motors. Our 40-inch driving wheels—24 of them—bite the track. Hats wave. We burst through the banner. Riding like silk, *Super C* throbs out through the throat tracks, thunders across another railroad, threads a bridge. "Yellow board!" Our throttle has eight notches. We're still on notch 1, crawling.

"Green board!" cries the brakeman. "Green!" confirms the engineer. He



AT LOS ANGELES YARD, *Super C* is straddled by giant cranes that start to remove the first piggyback trailer one minute after the train came to a halt. The entire 11-car train was unloaded within 30 minutes

pulls to notch 2, lets the ammeter leap to 350. In succession the throttle clicks six more notches. Pete Dauma eyes speedometer and console. He's watching for a warning light. If it flashes, our wheels are in an acceleration spin—and that's trouble. But there's no flash. These big new passenger-freight engines (3600 hp each) have something called IDAC that keeps wheels from slipping. IDAC (instantaneous detector and control) is a tremendous advantage. If wheels slip, it meters off exactly the right amount of electric power. It also drops sand on the track. Pete can "pour it on" without fear of slip-delay or damage to driving wheels.

2:10 p.m. Dauma's up to notch 8. Someone calls, "Man, this baby can roll!" Speed: 35-45-55-75. And suddenly 84. This is a 93-mph engine but you can't run a piggyback that fast because wind tugs at the trailers. So Pete cuts back. It has taken us only three minutes to jump this incredible train from 30 to 84. (An ordinary big freight would need 20 minutes.) We settle to an easy 79—on half throttle.

2:18 p.m. Prairie towns race toward us. There's a highway. We're leaving cars far behind. We lay into a hard

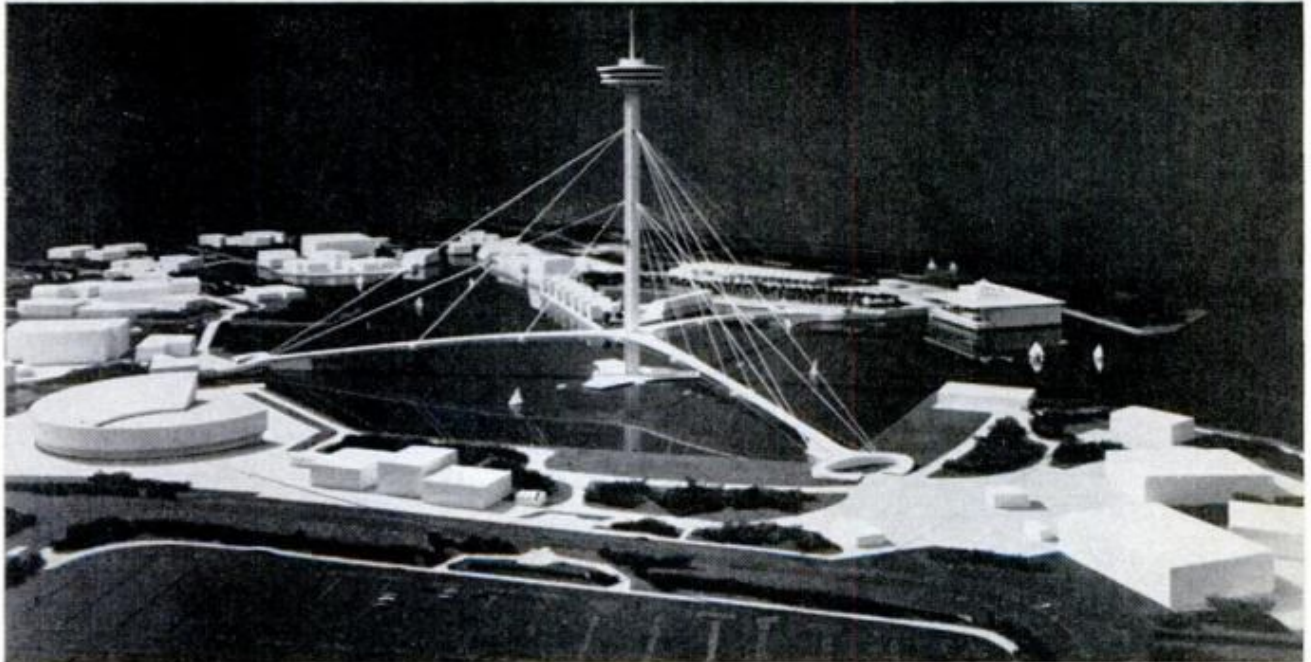
turn. "How are we on the curve?" calls Pete Dauma.

The brakeman tugs at his window, and looks back. "All black. (No sparks or fires.) *They're still following you!*" We're a *short* freight; on its daily runs *Super C* will never exceed 21 cars. Our cars are, first, a test car full of technicians measuring everything we do; then three passenger cars; then seven piggybacks carrying trailers; finally, a red caboose. Most trains pick up and discard *three* cabooses on a transcontinental run. But this huge caboose is specially built. It's big, comfortable, and will go all the way.

Those passenger cars (which shippers predict will some day carry paying passengers) are along to carry our VIPs. With us on this first run are not only the Santa Fe's president, John S. Reed, but two vice-presidents, a small army of experts and several journalists.

Our trailers carry *premium* freight for which shippers pay \$1400 per trailer instead of the usual \$500 to \$1000. One has Ford motors needed on an L.A. assembly line; another, hurry-up Chrysler parts. Others have new color-TV sets, hot for the market; machinery;

(Please turn to page 178)

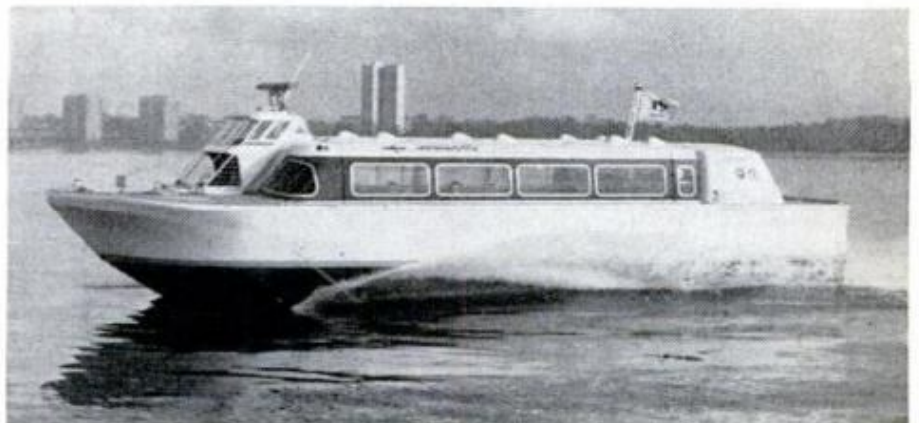


1000-foot tower to rise on the Florida Gold Coast

Soon to be part of the Miami skyline is the 1000-foot Tower of Freedom, which will be the dominant landmark of Interama, a permanent cultural and trade center for all nations of the western hemisphere. The center is scheduled to open in mid-1970. Shown at top is a model of the tower; the lower photo looks south over the 1700-acre Interama site and Miami.

New hovercraft

The HM-2, described by its maker as a "sidewall-type hovercraft," will carry about 65 passengers on regular ferry service between Portsmouth, England, and the Isle of Wight. The 35-knot craft was built by Hovermarine, Ltd., of Southampton. It was photographed during trial runs.

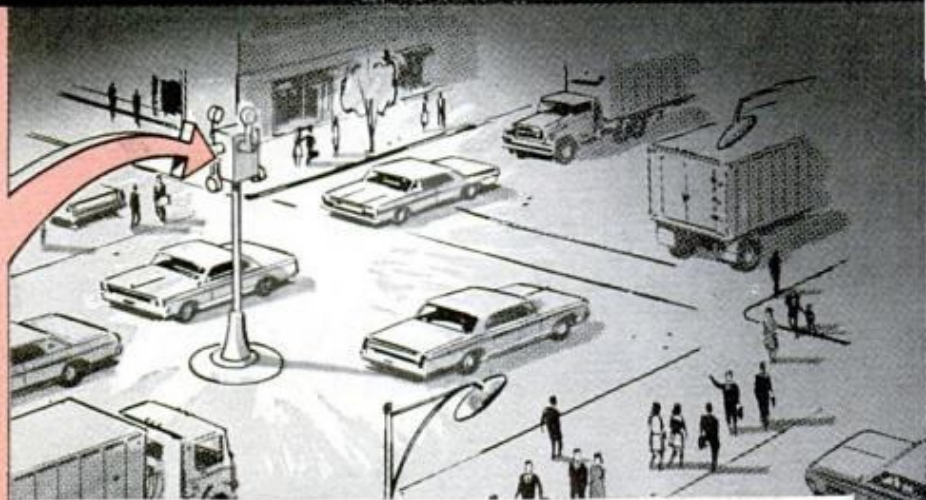
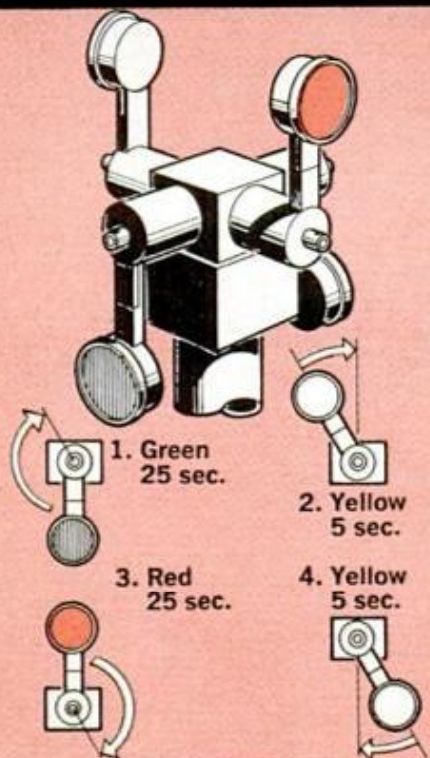


Just patented

PM'S PICK OF THE NEW INVENTIONS

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

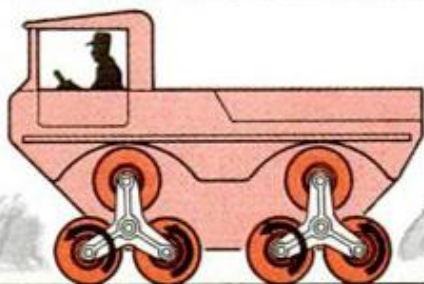
Illustrations by ZIK Associates, Ltd.



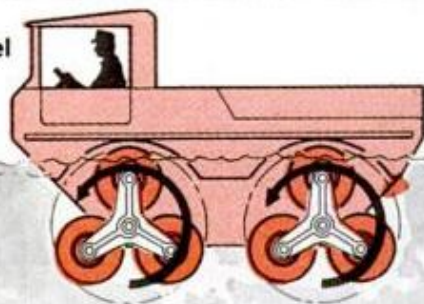
1. **THERE'S NO DANGER** of accidentally going through a stop signal with this ingenious traffic light. Each light rotates slowly on the end of an arm. By watching its position, you can tell exactly how much time you have before the light turns red or changes to green. At the bottom of its swing, it shows green. Near the top a yellow warning flashes on, then switches to red as the arm reaches the upright position. Inside each lamp housing are three different-colored bulbs

2. **TRICK WHEELS** enable this amphibious vehicle to go anywhere. Each "wheel" consists of three fat-tired rollers in a cluster. On smooth roads, the cluster remains stationary and only the two lower rollers turn. In water, swamps and muddy bogs, the entire cluster turns, propelling the vehicle like a paddle wheel. On very rough ground, the cluster and rollers all rotate so the vehicle can climb up and over obstructions. Steering is accomplished by speeding up the wheels on one side and slowing them on the other—like a tank

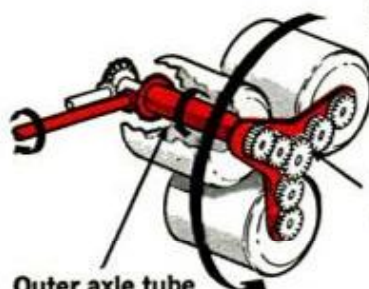
1 On smooth roads, only small wheels turn



2 In water, entire wheel clusters turn like paddle wheels

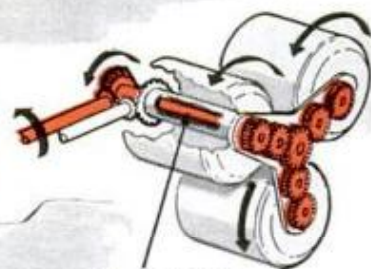
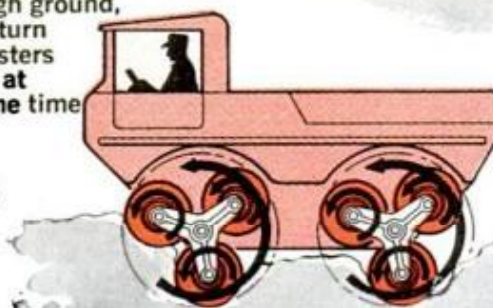


3 On rough ground, wheels turn and clusters revolve at the same time



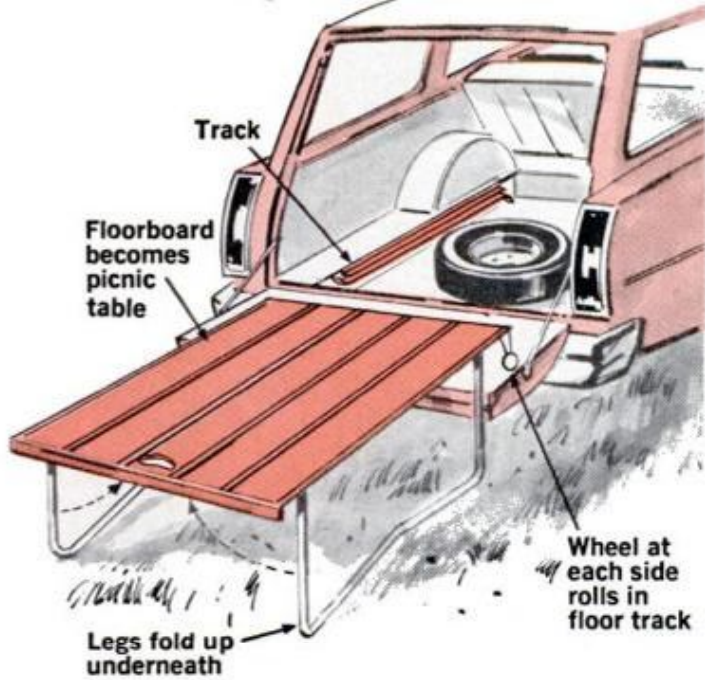
Outer axle tube drives spider, turning entire wheel cluster

Spider assembly



Shaft inside axle tube turns gears to drive individual wheels

Inventors of the items shown on these pages are as follows: 1. Joe B. Worsham, Anniston, Ala. (No. 2,883,646); 2. Robert W. Forsyth and John P. Forsyth, Upland,

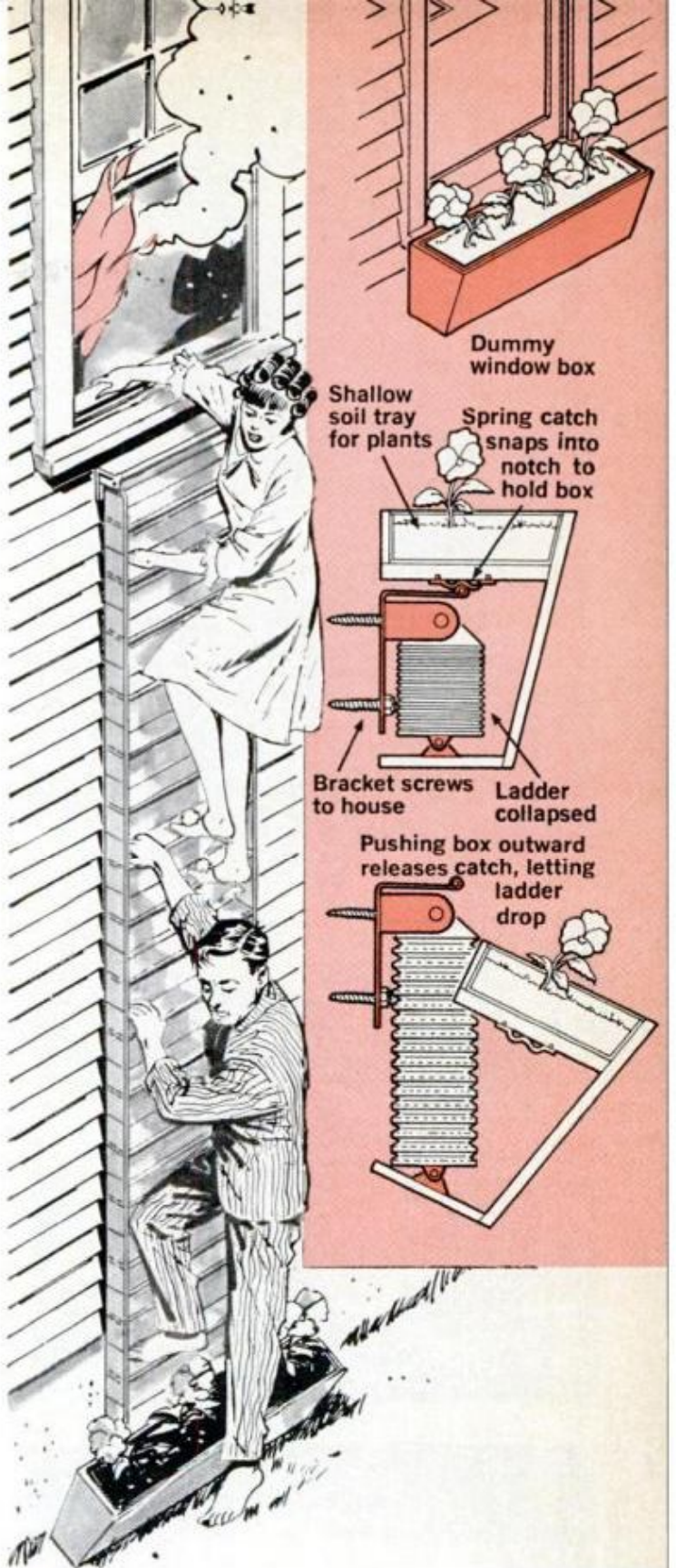


3. SLIDE OUT THE FLOOR of this station wagon, unfold collapsible legs, and you have a roomy table for family picnics by the roadside. Inside the wagon, the table serves as a hatch cover for tools, camping gear and a spare tire stowed in a well underneath the floor. The inner end rides on small wheels in a track, making it easy to roll the table out

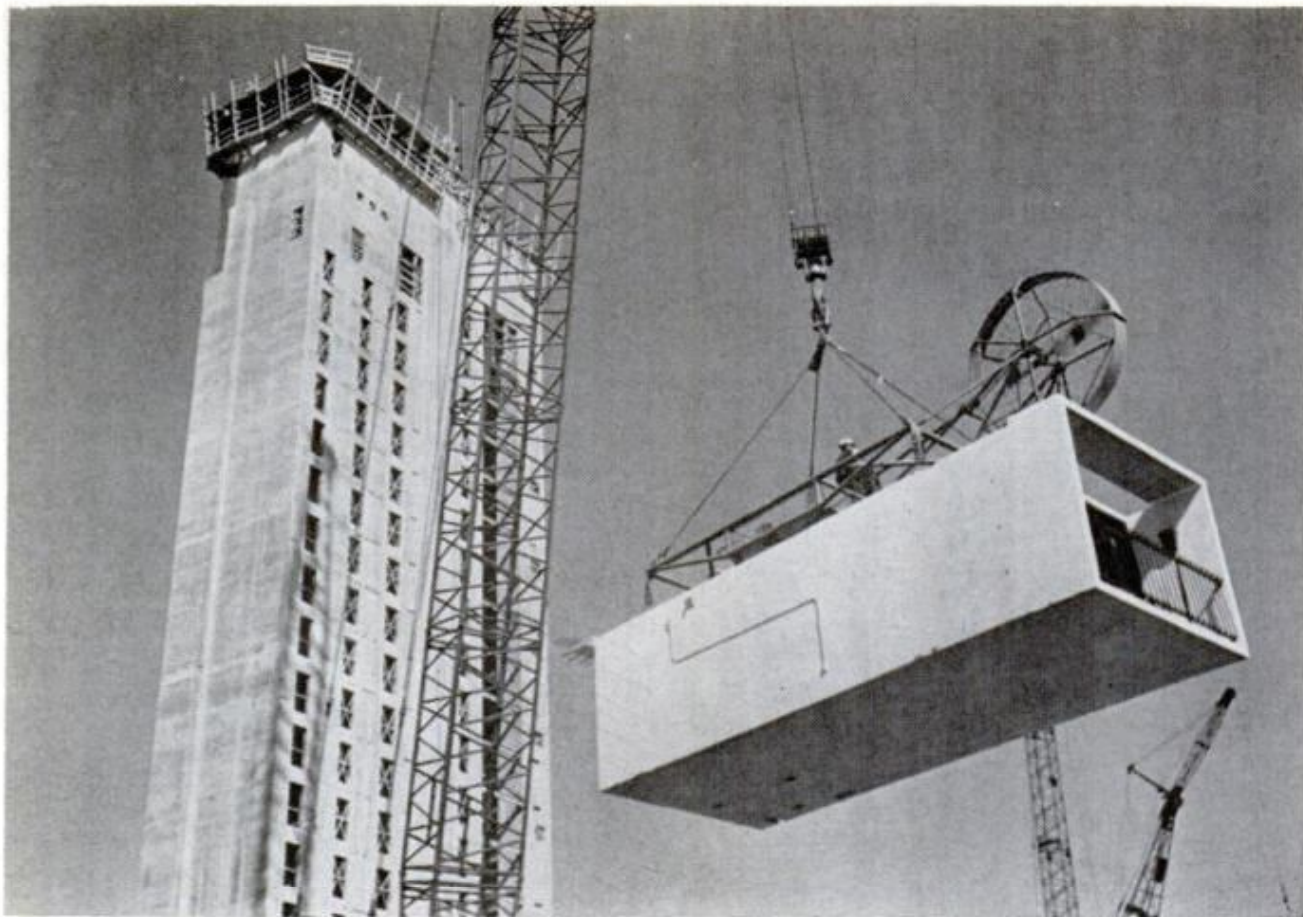
4. THE PORTABLE FIRE ALARM below can be installed anywhere there's a wall outlet—you just plug it in. Its heat-detecting element works on ordinary house current and sounds an alarm if the temperature goes above 135°F. The miniature fire sensor weighs less than two ounces and can be carried in a purse or suitcase for protection away from home



Calif. (No. 3,348,518); 3. André Cauvin, Port-Marly, France (No. 3,338,620); 4. Majima Co., Tokyo, Japan; 5. Joseph Boscarino, Jr., Flushing, N. Y. (No. 3,344,886).



5. IT LOOKS LIKE A FLOWER BOX, but it's actually a collapsible ladder designed to provide a way out in an emergency without the ugly appearance of a permanent fire escape. Pushing the box outward releases spring catches at the ends, allowing the ladder to drop to the ground. The sides of the ladder are made of thin, jointed plates that fold up like an accordion for storage inside the box. A shallow tray on top of the box holds real flowers



Hotel rooms fly into place

Construction of the new Hilton Palacio del Rio Hotel in San Antonio included an unusual touch picked up from aviation. When its precast concrete rooms were lifted into place, a stabilizing rotor like that on a helicopter allowed workmen to keep the giant blocks under control in wind currents (photo, above). The first four floors of the 21-story, 500-room hotel were constructed in a conventional manner. After that, the center core—which houses the elevators—was poured. Then each room was cast of concrete, completely decorated and lifted into place. The hotel, built by the H. B. Zachry Co., overlooks the site of HemisFair '68.



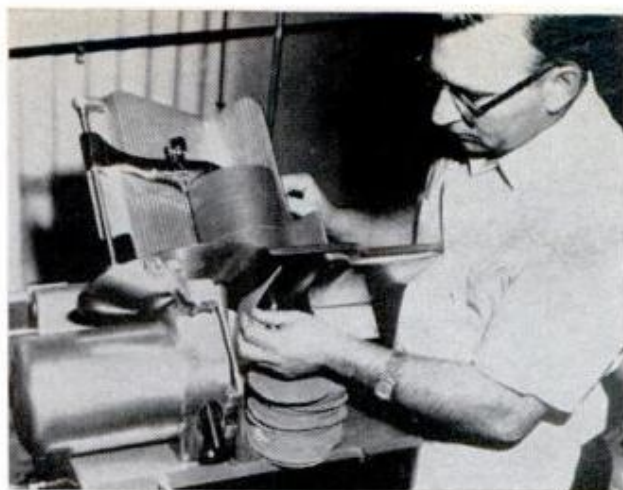
Chess set from car parts

Two British Motor Corp. apprentices made this chess set from a variety of auto parts, including valves, springs and switches.



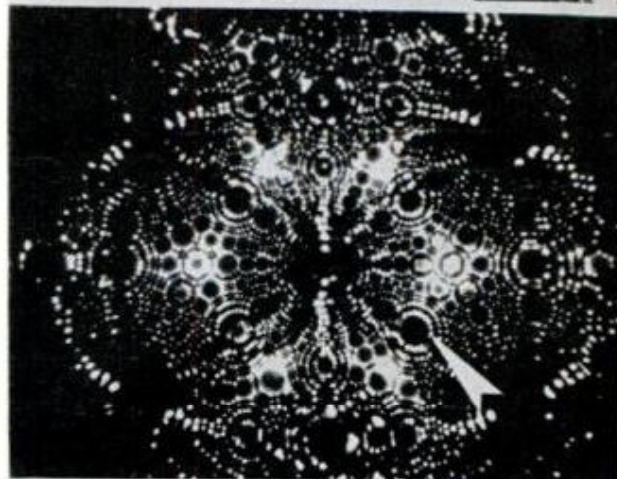
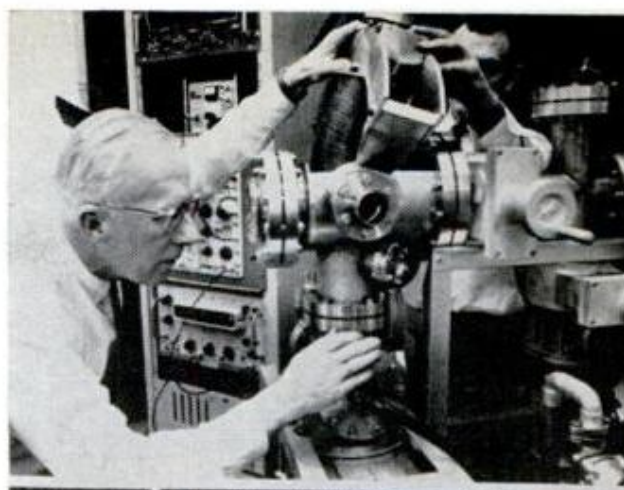
Battlefield alarm

When the thin strand of wire is broken, a buzzer or signal light on the Army's "burglar alarm" warns GI that someone's sneaking up.



Cold cuts

Solid rocket propellant is sliced by machine in much the same manner as balogna. A slice placed in a small rocket motor will get a five-pound rocket going 120 mph in seconds. The method is used by Lockheed Propulsion Co.



Atom watcher

Prof. Edwin Mueller of Pennsylvania State University peers into the viewing port of his newly developed atom-probe field ion microscope (top). With the instrument, he can, for the first time, focus on a single atom of a substance and separate it from the thousands of surrounding atoms. The bottom photo shows the view—a magnification of 2,100,000 times. The arrow singles out one atom from thousands of surrounding tungsten atoms.



Shades of the Wild West

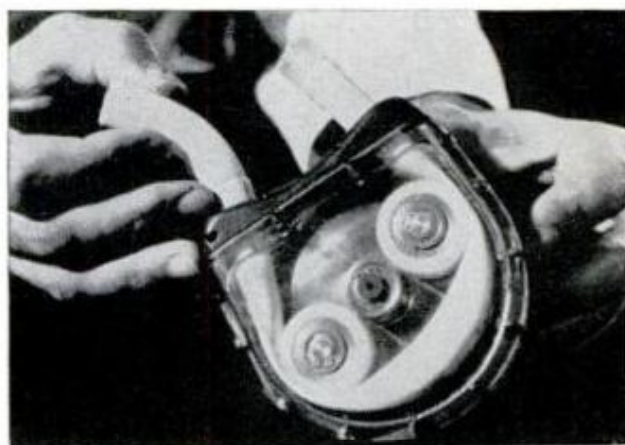
The Navy uses flaming arrows to burn bamboo camouflage off Vietcong bunkers. Regular ordnance simply passes through bamboo.



Pool cleaner

The manager of the Sanno Hotel in Tokyo has found that a large beach ball floating in the swimming pool collects much surface dirt and grime, thus reducing clean-up chores.

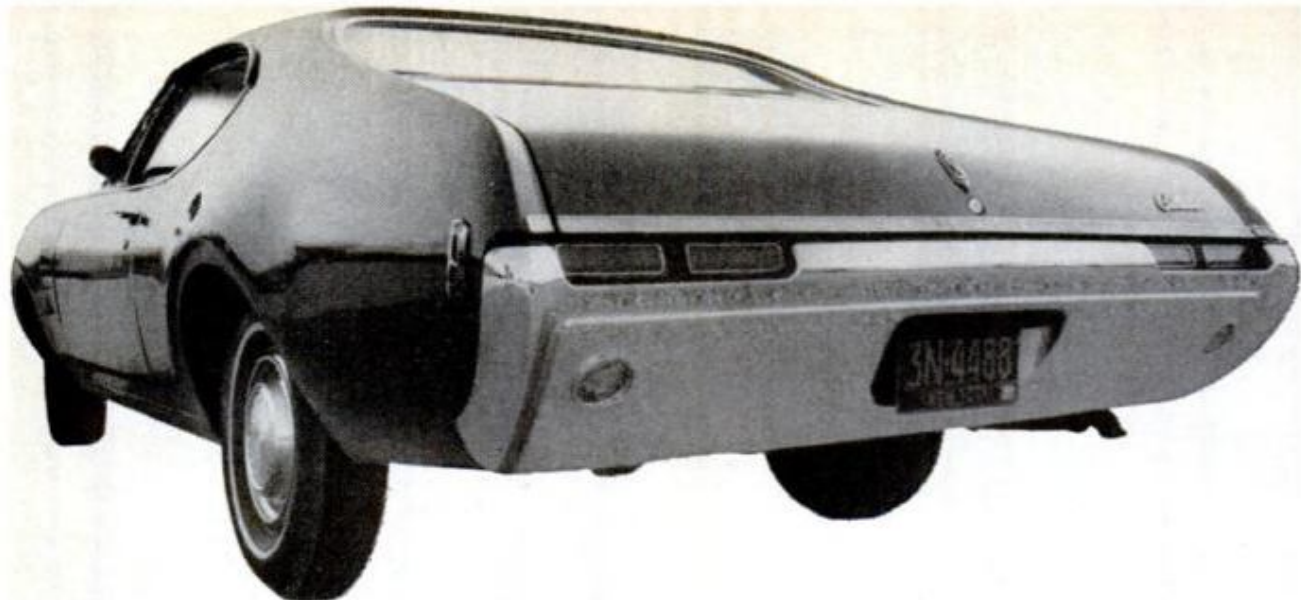
MAY 1968



Help for a heart

This heart-assisting device may soon be implanted in the chest of a patient, according to U.S. Public Health Service. Blood is pushed through the tube by the two wheels.

83



**OLDS
F-85**

Style, a Knockout; Economy, a Wipeout!

The F-85 looks great, but it guzzles a gallon of high-test in a dozen miles of high-powered driving

By **BILL HARTFORD**, Associate Auto Editor

Photos by *Irving Dolin*

ANYONE WHO OWNS a Rolls Royce and a Cadillac Fleetwood and also owns a new F-85 is obligated to explain to all of us why he's got the F-85. For—relatively speaking—slumming?

The owner in this case is a woman, and a most charming one—a widow in Palm Springs, Calif.—of, as she says, “undetermined” age.

Why did she buy her F-85? Simply, uncomplicatedly, emotionally, because

“it was so cute!” Even after getting it home, the car has proven it's just as faithful as cute: Any mechanical trouble? “No, no, no.” Any complaints? “Don't be silly—what complaints? I have *never* loved another car so much.”

► **A refreshing reply.** (And I'm sure Oldsmobile agrees.) When you're east again, please stop by. We can talk cars.

A woman's response to style is emotional all the way. The equivalent re-

GOOD ROAD-HOLDING, exhibited by Cutlass model, is part of overall handling praise from F-85 owners



sponse when we get it from a male owner is, predictably, right from the "gut." Occasionally it's from the head: sort of an intellectual appraisal of style, weighing the balance of line vs. function and things like that. But it's never from the *heart!*

► I wonder if, subconsciously, this negatively affects a man's reaction to the little red heart in the "win-you-over" Plymouth ads?

Instead of a heartfelt "cute" as applied to F-85 style, the men say it's "gutsy, tough, a knockout." And so go the masculine accolades for the car that starts the Oldsmobile line. Whatever the adjectives, *Style*, spelled with a capital "S" is the 1968 F-85's claim to fame. But style *costs*.

► Some owners complain that the car is "overpriced."

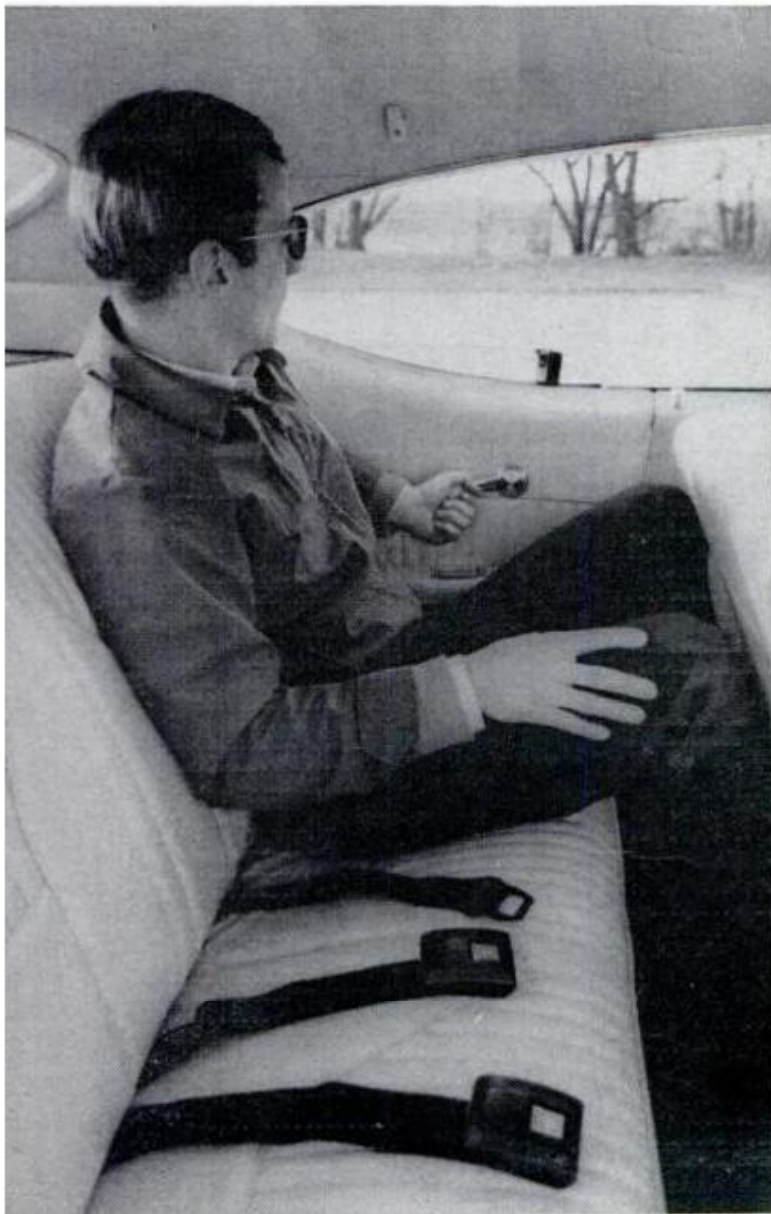
It's bad enough having that gnawing

feeling that the end of the month means sending out another hundred, or whatever the financing payment comes to, but to see that gas-gauge needle bouncing on empty again! That's what really gets to a lot of owners.

Guzzling the gas is Oldsmobile's 350-cu.-in. V8 engine, the powerplant nearly all of the surveyed owners (96.7 percent) have. The 12.4 and 15.4 mpg averages for putt-putting around town and gobbling up throughways, respectively, are disappointing.

"So far, gas mileage" is the biggest complaint of a Pennsylvania traffic manager, who also says, "not enough power out of this size engine for the amount of gas that is dumping into the carburetor."

► He's getting 9 mph around town and 12 mpg on the road.



GIVEN A FREE HAND to help effect some changes in F-85 design, owners would like more room in the rear seat, more headroom and, oddly, more trunk space. Workmanship complaints include interior trim

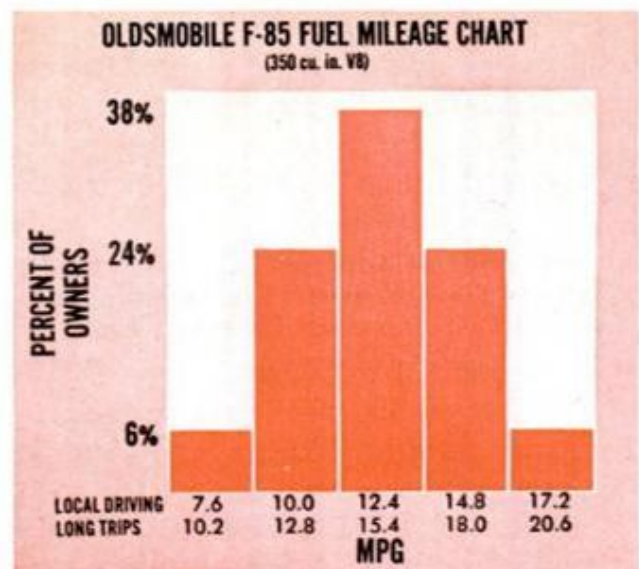


REAR END TREATMENT, while a style success, is controversial for its visibility and snow problems

An Illinois clerk typist doesn't have a harsh word about fuel economy and she, too, is getting 9 mph around town.

► **Does she think that's good?**

"Low, lousy, poor, exorbitant, terrible and excessive gas mileage," remark typical owners. The owner who gets the booby prize with 6 mpg around town is a Pennsylvania woman whose



fiance bought her the F-85 at the same time he bought a half-ton Chevy pickup truck for himself. Combined, they have enough complaints to write a story in itself.

An Ohio technical illustrator whose gas mileage is also below the average doesn't make too much of the fact. Only recently he replaced his 1965 F-85 with a '68, and after the experience that brought about the replacement mileage doesn't seem too important: "I just survived a freeway crash of 60 to 70 mph in early morning workday traf-

Summary of 1968 F-85 Owners Reports*

Total miles driven 538,183
Average miles per gallon:
 350-cu.-in., local driving 12.4
 long trips 15.4

Specific likes:
 Styling 65.3%
 Handling 50.7
 Power 27.8
 Ride 26.4
 Performance 22.2
 Comfort 21.5
 Roadability 9.0
 Economy 9.0
 Size 7.6
 Quiet 6.9

Specific dislikes:
 Gas mileage 30.2%
 Workmanship 15.1
 Rear visibility 11.1
 Roadability 7.9
 Dealer service 6.3
 Carburetor 6.3
 Glove compartment 6.3
 Wind noise 5.6
 Trunk room 5.6

What changes would you like to see?
 More headroom 13.6%
 More trunk room 12.0
 More room in rear 11.2
 Bigger, better glove

compartment and door 9.6%
 Better rear visibility 9.6
 Better dash 8.0
 Better gas mileage 8.0
 Workmanship improved 7.2
 More room 6.4

Model:
 350-cu.-in. 96.1%
 250-cu.-in. 3.9

Transmission:
 Automatic 94.8%
 3-speed manual 2.6
 4-speed manual 2.6

Had any mechanical trouble?
 No 61.2%
 Yes 38.8

What kind of trouble?
 Carburetor 28.1%
 Electrical 18.8
 Transmission 19.9
 Speedometer cable 15.6
 Brakes 6.2

Dealer repair satisfactory?
 Yes 54.0%
 No 23.6

Why the F-85?
 Style 52.1%
 Past experience 33.6
 Size 17.1
 Price 13.0

Reputation 8.9
 Performance 6.8

Is the F-85 your only car?
 No 60.8%
 Yes 39.2

Other cars owned:
 Oldsmobile 31.3%
 Chevrolet 17.7
 Ford 10.4
 Pontiac 8.3
 Cadillac 8.3
 Mustang 6.3
 Dodge 5.2

What options/accessories?
 Power steering 93.1%
 Power brakes 82.3
 Radio 52.3
 Airconditioning 48.3
 Whitewall tires 17.9
 Wheel covers 17.9
 Vinyl roof 17.9
 Tinted windows 17.2
 Courtesy lights 13.2
 Tinted windshield 10.6
 Positraction 9.9

Age distribution of owners:
 15-29 26.4%
 30-49 37.7
 50 plus 34.9

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

fic. Having a hearse hit you head-on at that speed and outweighing my 1965 F-85 by a few tons proves to me that this car can take it. Had it not been for its full-channel frame, sturdy steel construction and protection of passenger and driver areas, I may not have been able to write this."

► **That is certainly a happy testimonial.**

Soliciting testimonials from other owners for good, solid workmanship in their F-85 is, for the most part, a hard job. Most seem to have one or more examples of a lack of factory finesse that detracts from a quality workmanship image. But there are exceptions.

The Pennsylvania traffic manager says, "Why should anyone in this day and age have to start getting the bugs out of a car the day he buys it?" But still, overall, he finds workmanship "fair" and feels "Olds is above average in its class."

► **After only a few hundred miles of driving, "rattles under the dash" is the only real complaint he's got.**

A Ford worker in Ohio has his own unique problem in the under-the-dash area and it has nothing to do with workmanship: "I need a cover for under the dash so the children can't get at the wires."

► **With everything behind the modern dash totally inaccessible, I'd teach those little prying fingers to come up with the right wire when you need it.**

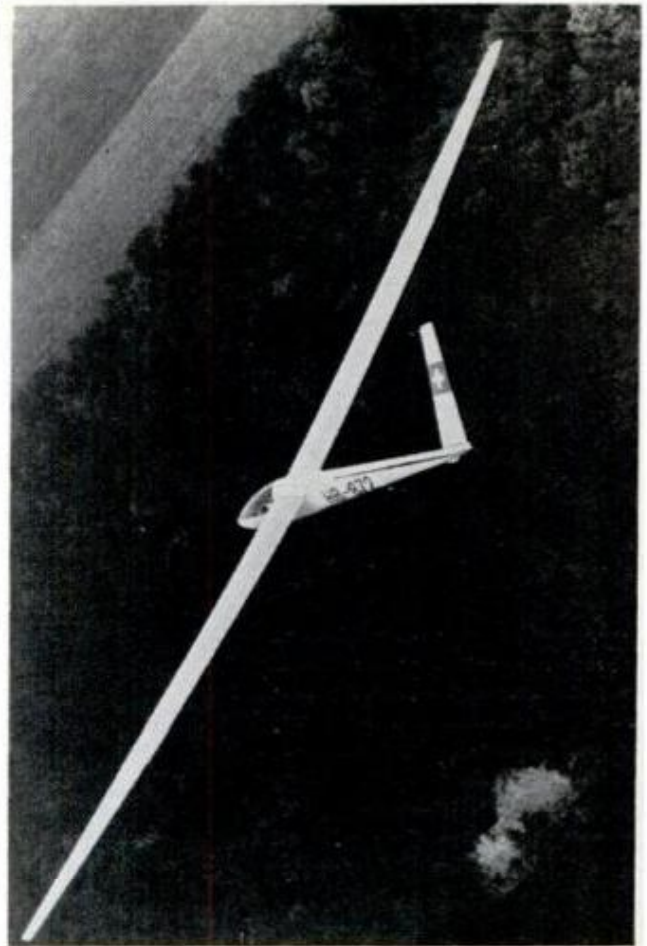
Bringing up the rear in the complaint department, is the F-85's tail end. Sexy it is, but visibility is dismal. "Rear window is so high, rear fenders are not visible for parking," says a Florida accountant. Snow accumulation is another annoyance to many who live in a colder area of the country.

The last word belongs to a sprightly woman, a retired college professor living in California. Seventy years wise, she can really tell you a thing or two about what really counts in designing automobiles:

"Curved rear window holds dust—always is dirty!!"

► **Remember that if you're thinking of buying an F-85.** ★ ★ ★

MAY 1968



Swiss sailplane

The Elfe is a new Swiss sailplane with an unusually wide wingspan of 64 feet. Made of aluminum, plywood and balsa, the 660-pound craft is being produced in a farmhouse "factory" near Zurich.

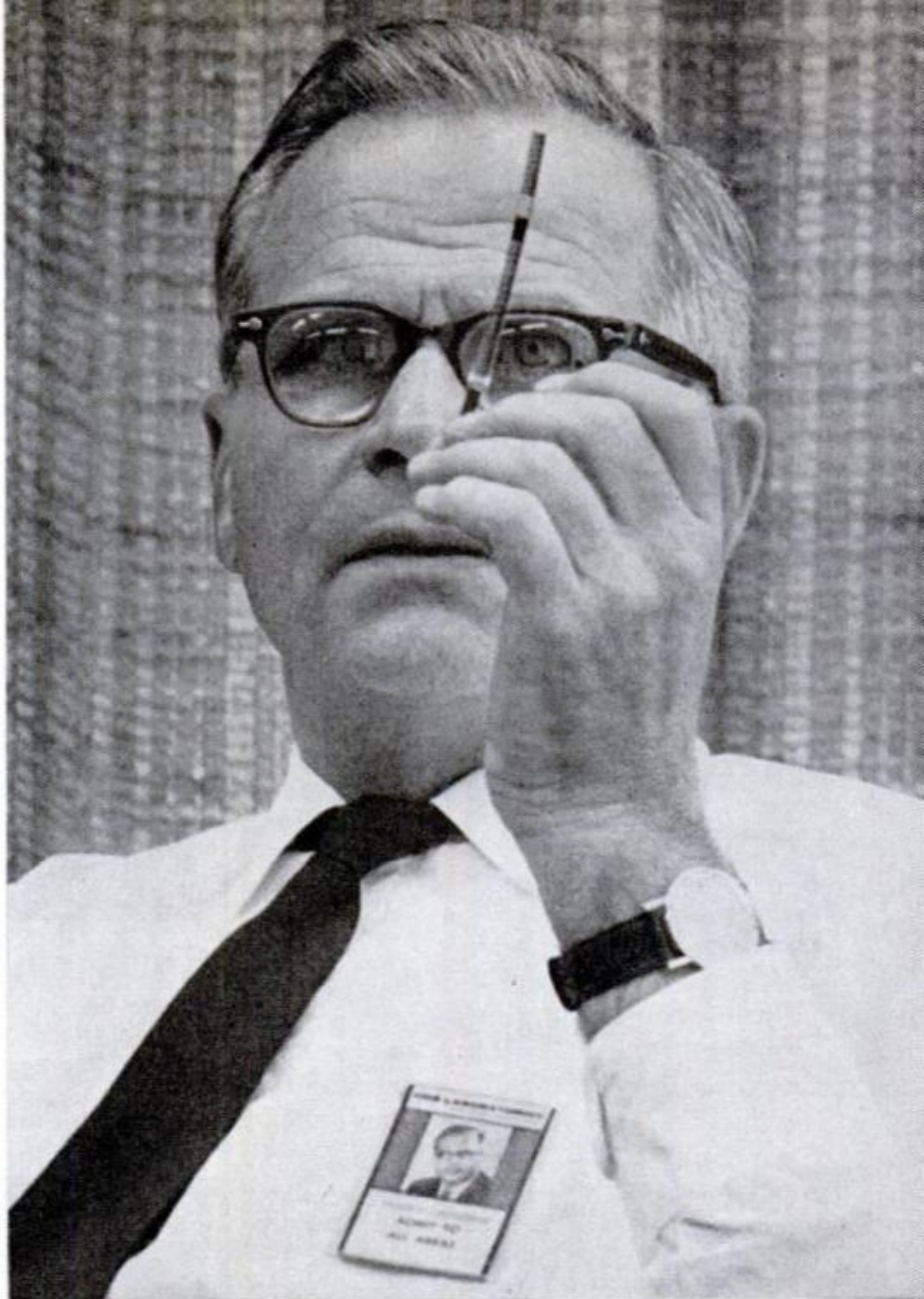


Japan's new fireboat

This is a model of a new fireboat that the Maritime Safety Agency of Japan is building to combat fires on the supertankers being constructed in that country. (See page 70.) The twin-hulled boat can carry 3700 gallons of extinguishing chemicals, delivering them from its 50-foot tower onto the fire.

PETER GOLDMARK studies a strip of Electronic Video film. It looks like movie film, but a single reel can hold the contents of a 24-volume encyclopedia—plus stereophonic sound and signals that convert its black-and-white images back to the original full-color, full-size TV pictures

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CBS LABORATORIES PHOTO

His Invention May Make You Your Own TV Producer

The pioneer of color TV and LP records says his new EVR—Electronic Video Recording—will offer 'easy, low-cost access' to the best of TV

By LEE EDSON

PPETER CARL GOLDMARK, president of CBS Laboratories, was asked on a radio interview whether he thought telepathy would ever replace television. Goldmark hesitated, rubbed his glasses, and said cautiously that there might be some undiscovered

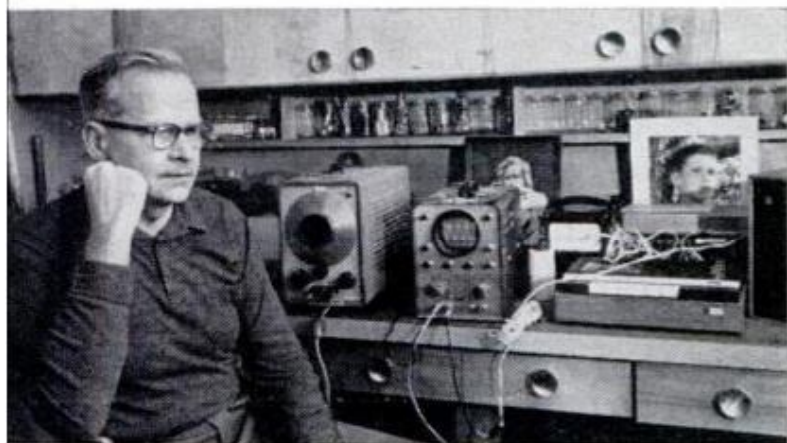
radiation from the brain that could some day provide a new communication channel. "But that's a long way off," he added hastily. After the program he turned to one of his aides and asked rather worriedly: "Do you think I went too far?"

Goldmark is a relatively quiet, unassuming PhD inventor who has a scientist's horror of looking too far beyond the coaxial cable. Few people know that he is one of the 10 top inventors of today. The father of two electronic revolutions, he is working on his third.

In 1940, Goldmark built the first practical color TV system, an invention that turned RCA all colors of the rainbow. In 1948, he produced the world's first long-playing record, which also sent RCA into a tizzy. Now, Goldmark (and his bosses, William Paley and Frank Stanton) have recently announced the development of EVR (Electronic Video Recording), an invention that will enable you to put the visual material you want into your own set. Dr. James Killiam of MIT, calls it one of the most significant developments in television in more than a decade.

Goldmark lives in a large, self-designed house of undefinable category which his wife, Diane, calls Early Goldmarkian. It has no futuristic electronics, such as stove doors opening at a whispered command, but the house fits a man who is both an accomplished musician and a creative physicist.

GOLDMARK'S WORKSHOP is next door to his kitchen. When an idea hits him, he can test it immediately



MAY 1968

Goldmark's fully equipped workshop is next door to the kitchen, so he need waste no time in jumping from the soup to the oscilloscope when the urge is upon him. A jog away in the living room is the piano which Goldmark plays when inspiration falters.

As Goldmark talked to me, his husky frame relaxed into a sofa and he fiddled with some knobs on a barely visible console. "Listen to this," he said.

Suddenly the living room expanded with organ music and grew to the size of a cathedral. I felt myself joining the choir of King's College Chapel, Cambridge, as they marched down the aisle to sounds that seemed to emerge from walls, ceiling and even floor. "No matter where you stand in this room," Goldmark told me, "it sounds as if you

A FORMER CONCERT PIANIST, Goldmark is constantly seeking "the perfect combination of sight and sound"



are right in the church. It's not like stereo, where you have to be glued to one spot or you'll lose the three-dimensional effect. Walk around and see."

In every part of the room the glorious sounds continued to march closer and closer to my ear, until finally they grew to a climax and then passed on. "I'll patent this one of these days," Goldmark said when the record was finished.

A practicing pianist-cellist, who once performed in Vienna concert halls,



DR. DENNIS GABOR, left, inventor of holography, enjoys listening to his friend's excellent LP collection

Goldmark has one of the largest LP libraries around, with some of the rarest sounds ever recorded.

"I've always looked for the perfect combination of sight and sound," Goldmark said in his Continental accent. "A few years ago, I thought how wonderful it would be if not just the music but also the environment of a place like Carnegie Hall could come into the home. This led to an invention of mine, the Reverbatron." (The Reverbatron is a device that simulates the echoes and reverberations of a large hall; it can be used in the recording studio or in the home to create the depth and fullness of the sound.)

"Now I think Electric Video Recording can do more for people in the visual medium. EVR is not just another tool in the audio-visual kit; it's a new medium, a new dimension. For the first time in video history it can free the individual set owner from complete dependence on the programmer and broadcaster. How would you like to turn off *Batman* for a lecture, a play, a concert, an Odetta folk song? Or would you like to replay a favorite show? They all can be transferred to a tiny cartridge of special film and played into the TV set at will. I always thought it was possible to do this, to achieve easy, low-cost access to great viewings, but it took six years to develop the right combination of machine

and materials. Now we're ready to go."

The first public demonstrations of the system are scheduled for late spring, with sales to start later in the year. The first users will be broadcasters; home playback equipment and films for home use will follow. For the start, at least, the home player will cost about \$280; the films, between \$7 and \$14 per reel.

The EVR process begins with an electronic "camera" and associated equipment for transferring a picture and accompanying sound from a live show, film or tape, or even the pages of a book, onto a roll of specially sensitized miniature film. As many copies as desired can be made from this master. However, the processing must be done by the manufacturer; the home user cannot film a TV program off the air the way he can tape a radio show.

The film is wound into a cartridge—the size of a standard tape-recorder reel, 7 inches in diameter—that is made to fit a compact player device attached to a regular TV set. The cartridge has a hole in its center. Drop it into place, like a phonograph record, tune the set to an empty channel (or flip a switch that cuts off all outside reception) and there you are.

The heart of EVR is, of course, this replay, and one of the mysteries that had to be resolved before it could be developed was the film. "The photographic world never needed to produce such a miniature film," Goldmark says, "because they're used to large-scale duplication, so we had to built it from scratch. We had to start a new phototechnology. That's why we had such a long row to hoe."

The film is 8.75 millimeters wide—about the width of a home-movie film. It looks pretty much like movie film, too: frame-after-frame of tiny pictures, in black and white, with magnetic striping to carry the sound track. But this film (the chemical nature of its base and coating are CBS secrets) packs an unprecedented amount of information. It has 90,000 frames per reel

(a 50-foot reel of 8-mm home-movie film has 4000 frames); its sound track is stereophonic, and it carries electronically coded signals that can turn its tiny black-and-white images back into full-color pictures enlarged to the full size of the TV screen. Unwinding at the rate of 5 inches a second, a cartridge will play for half an hour in color; in black and white, it will play for a full hour. Color and black and white can be mixed on a single film, and the cartridges rewind automatically when finished.

The entire content of a 24-volume encyclopedia can be filmed and stored in one such cartridge, and Goldmark adds that he can provide a mechanism for the viewer to pick whatever page he is interested in. "Think of the possibilities, too, of animating parts of the description, so you can actually see how things work," Goldmark says. "This can be done right along with the explanation. A talking book with moving pictures! And the cost to the viewer will be less than a roll of tape."

Boon to educators

Obviously, EVR is not going to change the quality of commercial television programs—only the public taste can do that—but its impact is likely to be considerable. In educational circles, it promises to create a real furor. As a recent Carnegie Commission report on TV put it, "The teacher can select the program, play it at the moment of his own choosing, replay it at will in whole or in part, interrupt it for his own comments—in sum, fit the program to the needs of his own classroom as he understands them."

Public educational television—that is, TV for the general viewer rather than the student—is also likely to have a strong ally in EVR. Until now, educational TV—though primed with millions of dollars from the Government and the Ford Foundation—has been a poor competitor for the minds and hearts of the public. It has failed, says one critic, "to grow flowers in the

wasteland." But with the advantages of EVR—and Congress's recent approval of a public ETV corporation—the educational TV tortoise might yet catch the commercial TV hare.

Manufacturers of color film and magnetic tape, which have dominated television storage for the past 10 years, have a lot to be worried about. Tape is expensive—about \$225 for an hour's recording capacity. EVR is cheap. Whether it will replace tape and film is another matter, since, among other things, tape can be used for instant playback, an advantage not shared by EVR, but that EVR will make a dent in both of these fields and especially in color film, is likely because of its low cost. CBS is already turning color movies into EVR reels for distribution to stations, claiming high quality and lower cost because the color can be "walked" in directly from the master film without the need for making 16-mm copies, the usual practice now.

EVR will affect the economics of small TV stations in other ways. There is the matter of extra income through storing popular programs for resale to home viewers. Even more important, stations that could not afford color before may be able to go into color programming at one-third the cost of present equipment.

The man who is largely responsible for EVR is an intense hard-driving 61-year-old Hungarian who, despite his corporate identity (he is on salary and the company holds his patents), can claim credit for being one of the few survivors of a vanishing breed, the "basement inventor." "Peter is the great lone inventor in the tradition of the classic English inventors of the 19th century," says the distinguished electronics expert, and inventor of the three-dimensional photographic process called holography, Dr. Dennis Gabor of Imperial College, London. (See *Holography: 3-D Magic in Mid-Air*, page 104, March *PM*.) "It is as natural for Peter to invent things as to eat." A

(Please turn to page 196)



Computers and television control 150 miles of London traffic

Now in use in London is the first traffic-control system in the world to combine computer control of fully vehicle-actuated traffic signals with closed-circuit television surveillance at critical points. Run from a central control room at Scotland Yard (first photo), the system is designed to keep traffic flowing over 150 miles of streets in four London boroughs. More than 100 sets of traffic signals are connected to the computer. In addition, some



Chopper in the living room

After building three airplanes in his living room, Fred Brown is now completing a helicopter in the same "shop." He'll have to disassemble it to get it outdoors for flying.



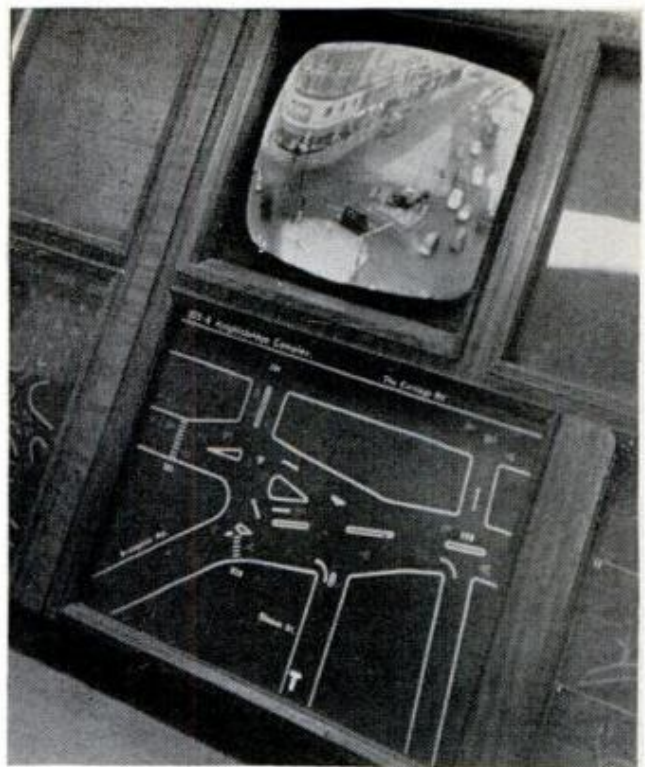
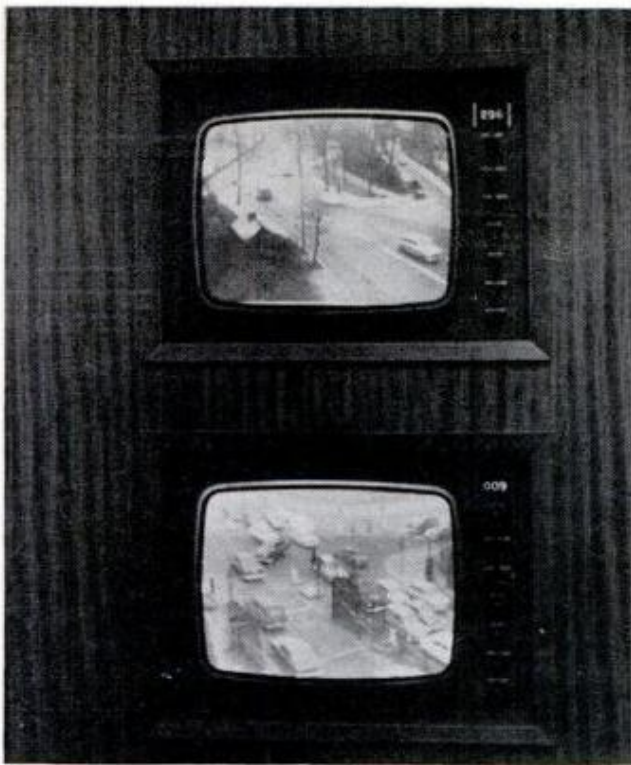
Jet silencer

To cut down the noise from jet engines during warmup, Swissair is using this silencer at the international airport at Zurich.

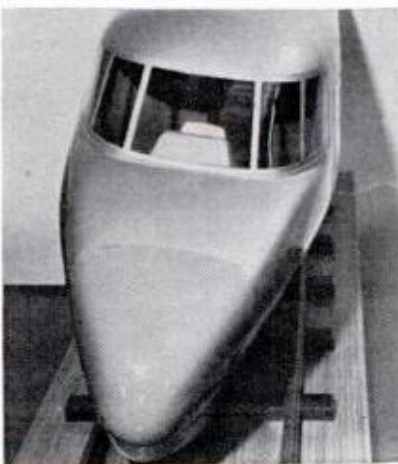
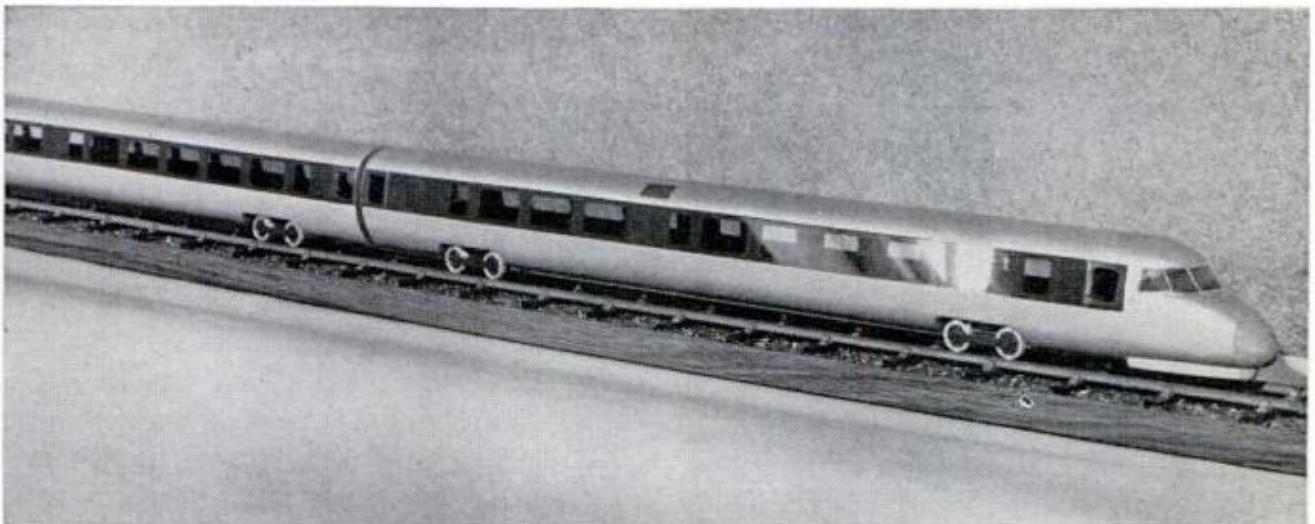


Like the good old days

Improvised sails added speed to the Royal Navy's *Dampier* when her prop was damaged.



500 detectors connected to the computer provide counts of traffic approaching the signals. Eight closed-circuit television cameras have been placed at six strategic points. (One camera appears in the second photo atop a 40-foot pole.) By observing the television pictures (third photo), operators can take charge of situations that are not covered by the computer program. Maps of the intersections (fourth photo) help in this task.

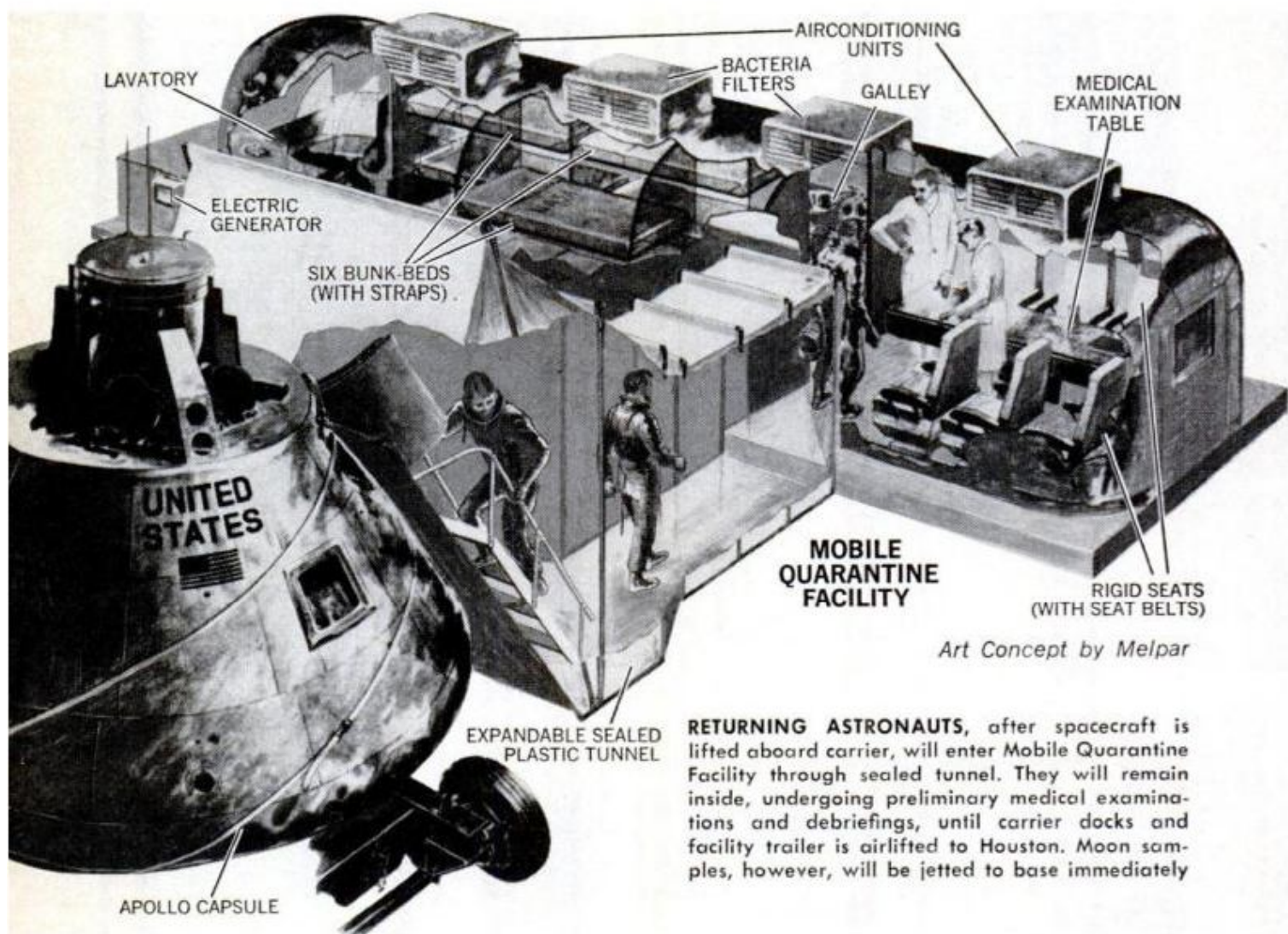


British jet train aims for 150 mph

A streamlined jet train, capable of 150 mph on standard railroad track, is being readied by British Rail for tests this fall. A model of the new train (above and left) shows its configuration, including an aircraft-type nose. The vehicle will be powered by two gas-turbine engines—probably the Rolls-Royce Darts that are used in Viscount airplanes. They'll be placed below floor level. Bodies of the trains will be of stressed-skin construction; use of a light alloy will keep weight down to about 600 pounds per passenger. Coaches are to be 85 feet long. Engineers are also working on a hydraulic system to tilt the coaches individually on curves so that turns can be made comfortably at a high rate of speed.

AFTER THE

By HAROLD WILLIAMS



RETURNING ASTRONAUTS, after spacecraft is lifted aboard carrier, will enter Mobile Quarantine Facility through sealed tunnel. They will remain inside, undergoing preliminary medical examinations and debriefings, until carrier docks and facility trailer is airlifted to Houston. Moon samples, however, will be jettied to base immediately

SINCE MAN first looked up at the moon, he's wondered, "What's it made of?" He may soon find out.

Apollo astronauts will bring back 50 to 80 pounds of the lunar surface for history's most thorough scientific examination. But it raises problems.

Scientists say they are reasonably sure that no organisms will be found in the samples. This small doubt, however, caused the National Aeronautics and Space Administration to build a \$12-million Lunar Receiving Laboratory in Houston.

The reason is that organisms brought to Earth could be dangerous pathogens unknown to our science.

Even if no organisms are found, the samples might behave erratically in

our atmosphere, give off poisonous gases or react unpredictably with other elements.

If either be true, then the samples and the moon-tramping astronauts themselves might be unwitting carriers. So the astronauts, their spacecraft, all their clothing and equipment, plus the samples, will be placed under a strict quarantine in the LRL for at least 30 days. In the lab, a thorough examination of astronauts and the material they bring back will be made.

The concept is unique: To place within one building all necessary equipment, along with scientists—from medicine to geology, from chemistry to ichthyology—to try to unlock secrets from another planet.

LONG VOYAGE HOME

No one knows what strange organisms astronauts may bring back from the moon, so they'll spend a month in a new \$12-million 'quarantine cottage'

The laboratory has three roles:

- To detect extraterrestrial life.
- To study the origin of the universe.
- To study the moon and its relationship to Earth.

Of the three, the most exciting is detection of life outside the Earth.

The story will begin on the moon when astronauts collect samples outside a contamination radius made by exhaust fumes and water ejected from landing rockets. A small coring device will aid them to drill below the surface for truly uncontaminated material.

Each sample will be wrapped individually, then placed in two miniature pressure chambers. The carriers, along with the tools, will be sterilized before the flight and be made of materials with easily recognizable spectrographic signatures to distinguish them from the moon samples.

Containers will close over crushed indium, a rare chemical element, and be clamped airtight. They won't be opened until placed in a vacuum chamber back at the lab, so no trace of the earth environment can spoil them.

The quarantine starts the moment the spacecraft is hoisted onto the recovery ship's deck. A sterile plastic tunnel is connected to the spacecraft's hatch and to the Mobile Quarantine Facility, an instrument-loaded, \$57,000 house trailer.

The astronauts, with two or three attendants—probably a doctor and another standby astronaut—will stay in the trailer until it, too, is brought back to the lab, perhaps a week later.

At the laboratory—a three-story complex covering 83,000 square feet and divided into three sections—the astronauts will go to the crew-reception section and the samples to the sample-operations section. These two

areas are sealed off from each other and from the third section—support and administration—by an elaborate shield, the biological-barrier system.

For the astronauts' living accommodations, the living area has bedrooms, a living room, a snack counter, office space, medical-examination rooms and a debriefing room. The spacecraft has a quarantine space of its own.

For the samples, there is even more space. The sample-operations division occupies three floors. Other laboratories include the vacuum chambers, magnetic testing, gas analysis, biological test and biological containment.

In the vacuum laboratory, sample containers will be opened and repackaged for storage or shipment while inside vacuum chambers. Technicians opening the containers will work with remote manipulators or gas-tight gloves. The chambers look like department-store display cases, except the glass is much thicker.

The biological-test labs contain the entire spectrum of life from the lowly one-cell amoeba to sharks, from algae to pine trees; all kinds of vegetables and plant life; several varieties of birds; hundreds of bugs, lizards, alligators, snakes, dogs, pigs and cows.

To test these living things with materials from another world, the lunar particles will be ground into a fine dust. First, the animals will be exposed to the dust, then made to inhale any of the gases, then an ointment containing the dust will be dabbed onto their skin, and finally they will be inoculated with it. Dabbings from the astronauts' skins will also be analyzed.

From these tests, the scientists can tell if it's safe to allow the astronauts or samples out of quarantine.

In the physical-chemical test lab,

small chips of the samples will be cataloged and classified. Then they will be sent to scientists in the United States and overseas for experiments in mineralogy and petrology, chemical and isotope analysis, and organic analysis.

In the underground radiation-counting lab, the gamma count may begin as soon as 24 hours after splashdown.

The building's third major division, the support and administrative com-

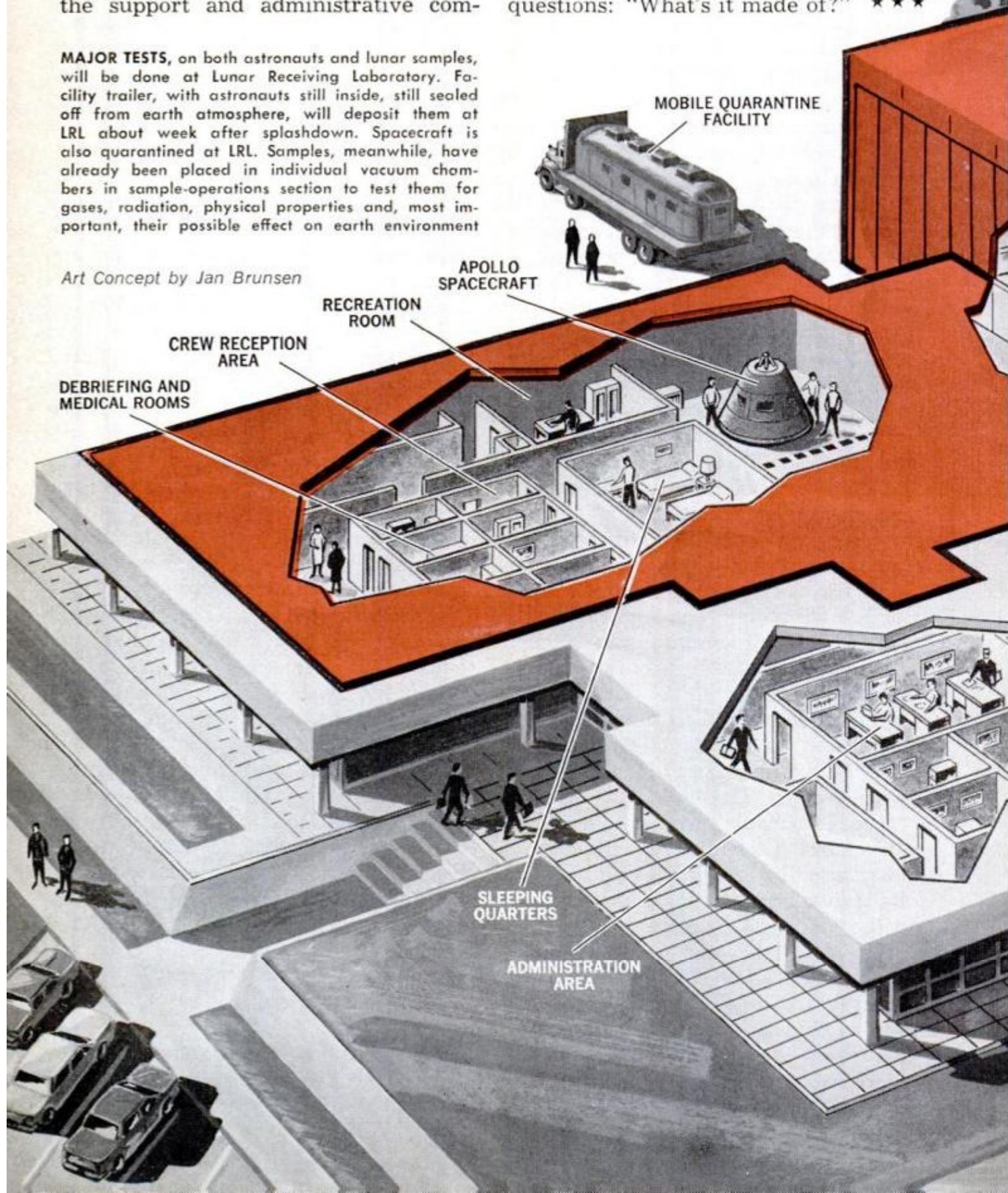
plex, maintains many spare animals and plants, as well as auxiliary laboratories and testing equipment, plus the communications system, closed-circuit television, observation areas and offices.

Getting to the moon and back safely is the Apollo program's goal. It will be one of the greatest achievements in history—and costliest (\$22 billion).

But it will answer one of the oldest questions: "What's it made of?" ★★★

MAJOR TESTS, on both astronauts and lunar samples, will be done at Lunar Receiving Laboratory. Facility trailer, with astronauts still inside, still sealed off from earth atmosphere, will deposit them at LRL about week after splashdown. Spacecraft is also quarantined at LRL. Samples, meanwhile, have already been placed in individual vacuum chambers in sample-operations section to test them for gases, radiation, physical properties and, most important, their possible effect on earth environment

Art Concept by Jan Brunsen



MOBILE QUARANTINE FACILITY

APOLLO SPACECRAFT

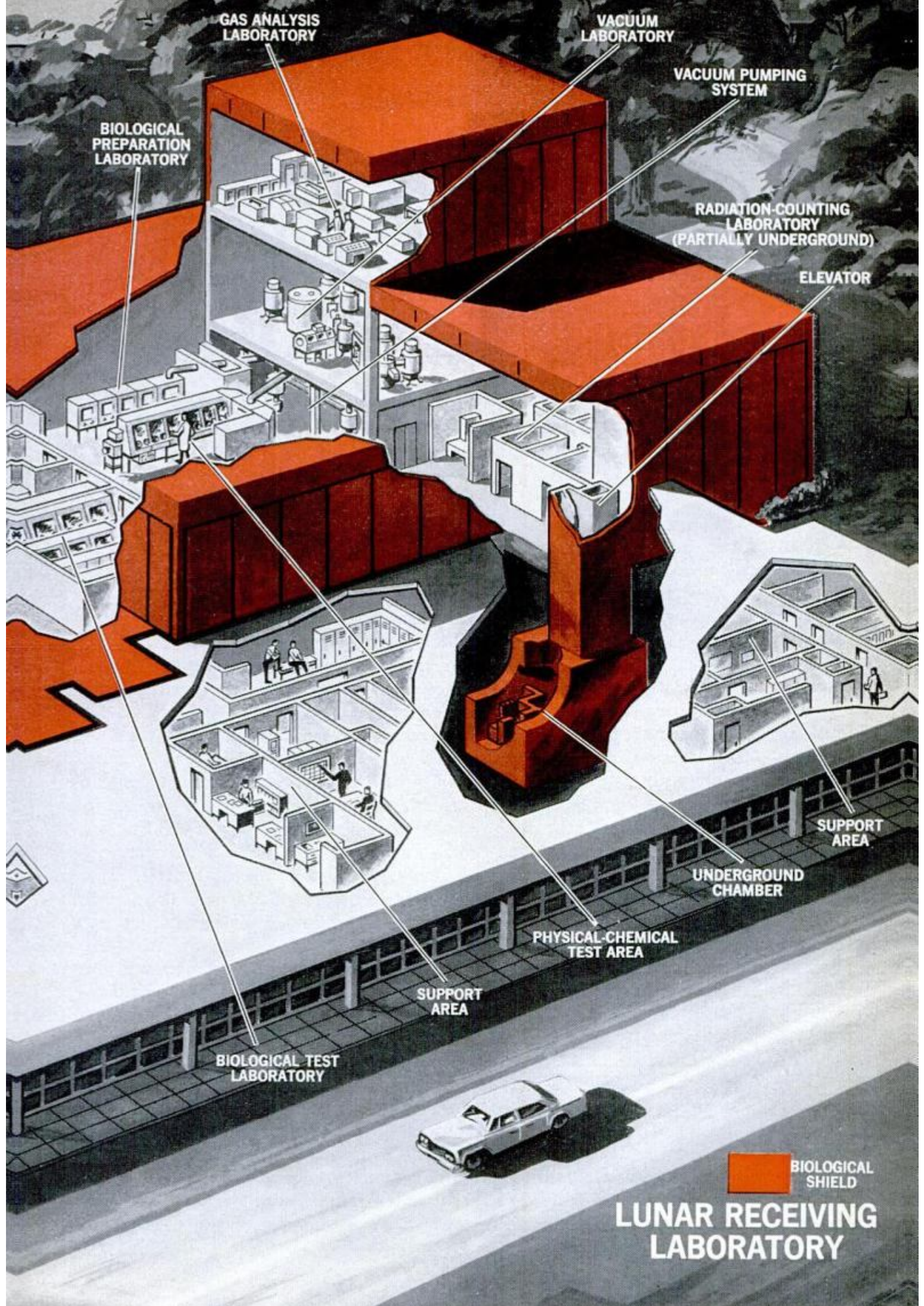
RECREATION ROOM

CREW RECEPTION AREA

DEBRIEFING AND MEDICAL ROOMS

SLEEPING QUARTERS

ADMINISTRATION AREA



GAS ANALYSIS LABORATORY

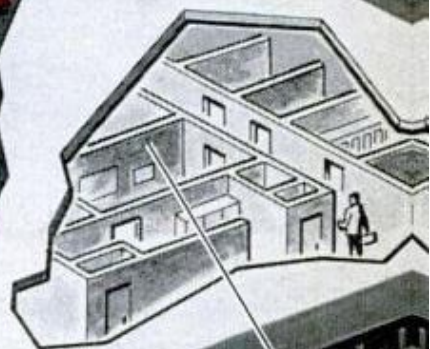
VACUUM LABORATORY

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ELEVATOR



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RODGER WARD'S INDY '500' PREVIEW:



Will the Turbines Take Over?

How well the new turbine-powered cars do this pivotal year will determine the immediate future of the world's foremost auto race, maybe even the future of your family automobile

By RODGER WARD

ANY KID with an ounce of gasoline in his blood can tell you rear-view mirrors were unheard of until 1911, when the late Ray Harroun rigged one on his winning Marmon for the first running of the Indianapolis "500."

That mirror was just one of many automotive innovations developed through racing, so there's a lot of precedent for suggesting that certain things on today's race cars will probably show up on your family car tomorrow.

All of which leads to an interesting question: With turbines seemingly becoming "the way to go" at Indy, are they the car engines of the future?

Before trying to answer that one, let's take a look at both past and present of turbines at Indy.

The idea, of course, isn't new. As a rookie in '62, Dan Gurney tried hard but failed to qualify a turbine car entered by John Zink. In '65, Norm Demler entered a turbine-powered roadster that the stewards ruled off as being unsafe in the corners. (The car, however, was pretty quick down the straights, giving a powerful hint of things to come.) And then last year, Parnelli Jones in Andy Granatelli's

Winner of Indianapolis "500" in 1959 and 1962

STP Turbocar ran away from the field, only to have a \$6 bearing fail just three laps from what would have been a sensational win.

You can bet the impact of what Jones almost pulled off wasn't lost on the racing fraternity; at least 12 turbine-powered cars are entered in this year's race.

Granatelli says he'll have six turbine cars ready to go by the start of time trials May 18—five all-new, the sixth the '67 car. The five new cars are being built in a joint venture by STP-Paxton in California and Colin Chapman's Lotus Cars, Ltd. in Great Britain. The four fastest cars of the six (two will serve as backups) will be driven by Jones, Jim Clark, Graham Hill—all former Indy winners—and a driver yet to be named. The new cars are said to be somewhat radical in design, their main characteristic being a boxy monococque body featuring an elongated snout and a "chopped-off" rear end.

Granatelli says all his cars will be powered by the Pratt & Whitney ST6B-62 turbine he used last year. If this is true, it means he plans to show up with engines having a 23.999-sq.-in. inlet area, a defiance of the U.S. Auto



ALMOST-WINNER in '67 was Parnelli Jones's STP Turbocar that started turbine revolution at Indianapolis
LAST YEAR'S piston cars of Jim McElreath (left), Roger McCluskey typify Indy design that may be obsolete



Club's (USAC) 1968 rules limiting inlet area to 15.999 sq. in. But (as this is being written) Granatelli has sued to force USAC to revise its rules, claiming the restriction of inlet area is a move to hobble his cars.

Late last November, Jim Clark tested Jones's '67 turbine car at Indy. He held applied power down to what would be legally permissible under USAC's new rules. The best lap the car could crank out was 161 mph, not enough to have even qualified for the race it almost won. This probably explains Granatelli's suit; his car ap-

the required 15.999 sq. in., but, even so, Wallis says he expects lap speeds of 170 mph and more. A feature of the cars, which look like the STP car, is a four-wheel-drive setup Wallis calls a "hybrid mechanical hydraulic system," a rig he says delivers power to each individual wheel as required. Australia's Dennis Hulme and New Zealand's Bruce McLaren will drive two of the cars, the third being a backup.

A car powered by an Allison 250 turbine is being built by Mississippi State University aerophysics professor Glenn Bryant for sponsor Jack Adams. The engine, weighing about 140 pounds, probably will be the smallest turbine at Indy this year, but designer Bryant says he hopes to compensate for what the car may lack in brute power by using a smooth, highly aerodynamic configuration. The car is a narrow (only 24 in. wide) center-line roadster made of steel-reinforced fiberglass covered with sheet steel. No driver has as yet been announced.

Norm Demler hopes to be back with a new turbine car, but says he'll hold off making an engine selection decision pending the outcome of the Granatelli vs. USAC suit. No driver as yet here, either.

Veteran chassis-builder Fred Gerhardt is also in the turbine-car business, his design being powered by the Allison 250. Gerhardt's car is very light and—unlike the other turbine cars—features two-wheel drive. In all likelihood, either Art Pollard or Mel Kenyon will do the driving. Gerhardt is also putting the finishing touches to four "regular" cars for either Ford or turbocharged Offy power. Two of these cars are for Gordon Johncock, both powered by Fords.

It's just possible that between now and race day, a few more turbine-powered cars may be on the scene. But whether or not more come out of the woodwork, it's a good bet that turbines will be a much-discussed topic along Indy's famed Gasoline Alley. If the turbines manage to qualify, they're go-



A. J. FOYT, driving a heady, steady race, won last year, his third victory in the Memorial Day classic

parently isn't competitive under the new rules and he feels he has too much money and principle at stake to stand still and do nothing. How he'll make out in court is anybody's guess, but personally, knowing Andy, I'm sure he has an alternate plan up his sleeve, possibly involving British turbines.

Three cars powered by General Electric T-58 turbines have been entered by Carroll Shelby. Sponsored by Goodyear, the cars are being built by Ken Wallis, the man who played a big part in the design and construction of the '67 STP Turbocar. Inlet areas of the T-58s have been reduced from 41 to

ing to be hard to beat—they can run with a lighter fuel load and there's less to go wrong mechanically, to mention just two attributes in their favor. But even if it works out that turbines dominate the race, you can bet the "regulars" won't go down without a fight.

Not about to give up easily are such stars as three-time winner A. J. Foyt, Dan Gurney, Mario Andretti, Lloyd Ruby, Jackie Stewart, Roger McCluskey, Jim Hurtubise, Jim McElreath, Joe Leonard, Al and Bobby Unser, Cale Yarborough, Jochen Rindt, Lee Roy Yarborough, plus many others, all of whom will be on hand with piston-engine cars.

Most will be powered by Ford's DOHC 255.3-cu.-in. engine, a proven racing plant. Sleeved down, its stroke shortened, this much-modified engine is based on the old Ford 289. Others will be powered by turbocharged Offys, an engine that in the past has had power output and a bit of reliability trouble, but now is reportedly more competitive than ever.

An engine that might show up on a couple of cars is a new turbocharged Ford. Nobody's doing much talking about it, but it's known that the engine developed a few bugs during recent tests. I understand the engine cranks out more power than has ever been seen at Indy, which would put it up in the 700-800-hp class. Personally, I

think the engine is about a year away, but look for a couple of them, anyway.

Trying to anticipate qualifying speeds at this stage of the game is as risky as trying to pick a winner. However, Fearless Ward here looks for something a little over 170 mph to win the pole position, the increase over Andretti's 168.982 pole-grabber of last year being due primarily to improved aerodynamics and better tires. My bet, incidentally, is that a piston-engine car will win the pole.

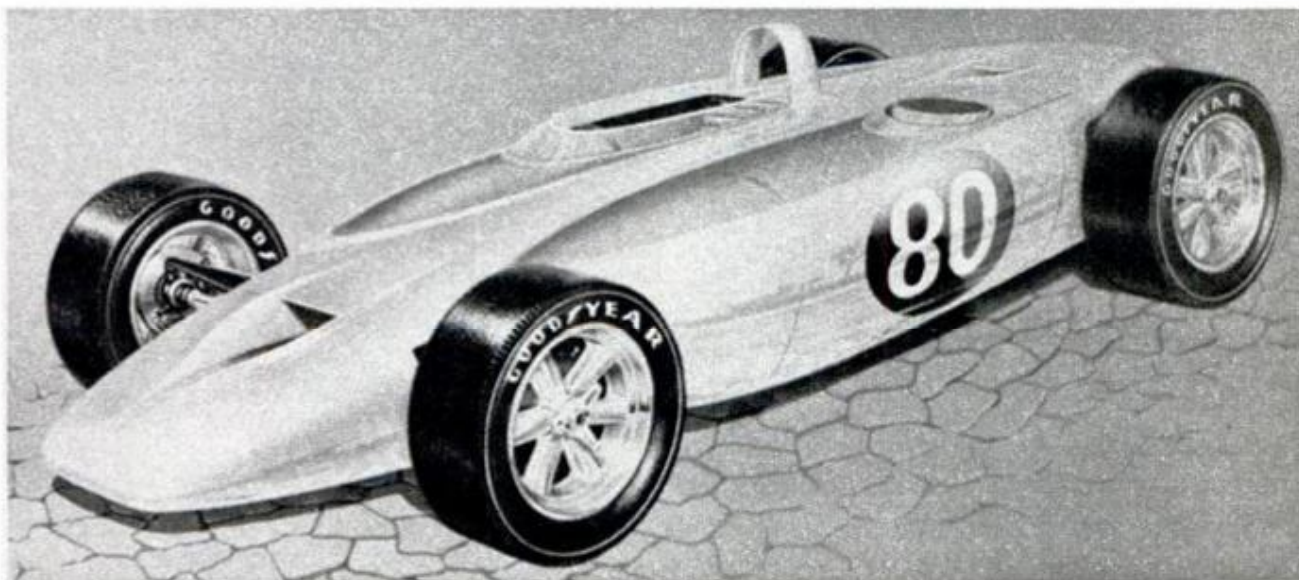
And this, I guess, brings us back to that double-edged question we asked earlier: Will turbines take over Indy, and are they the passenger car engines of the future?

I'd have to answer "No" all-round.

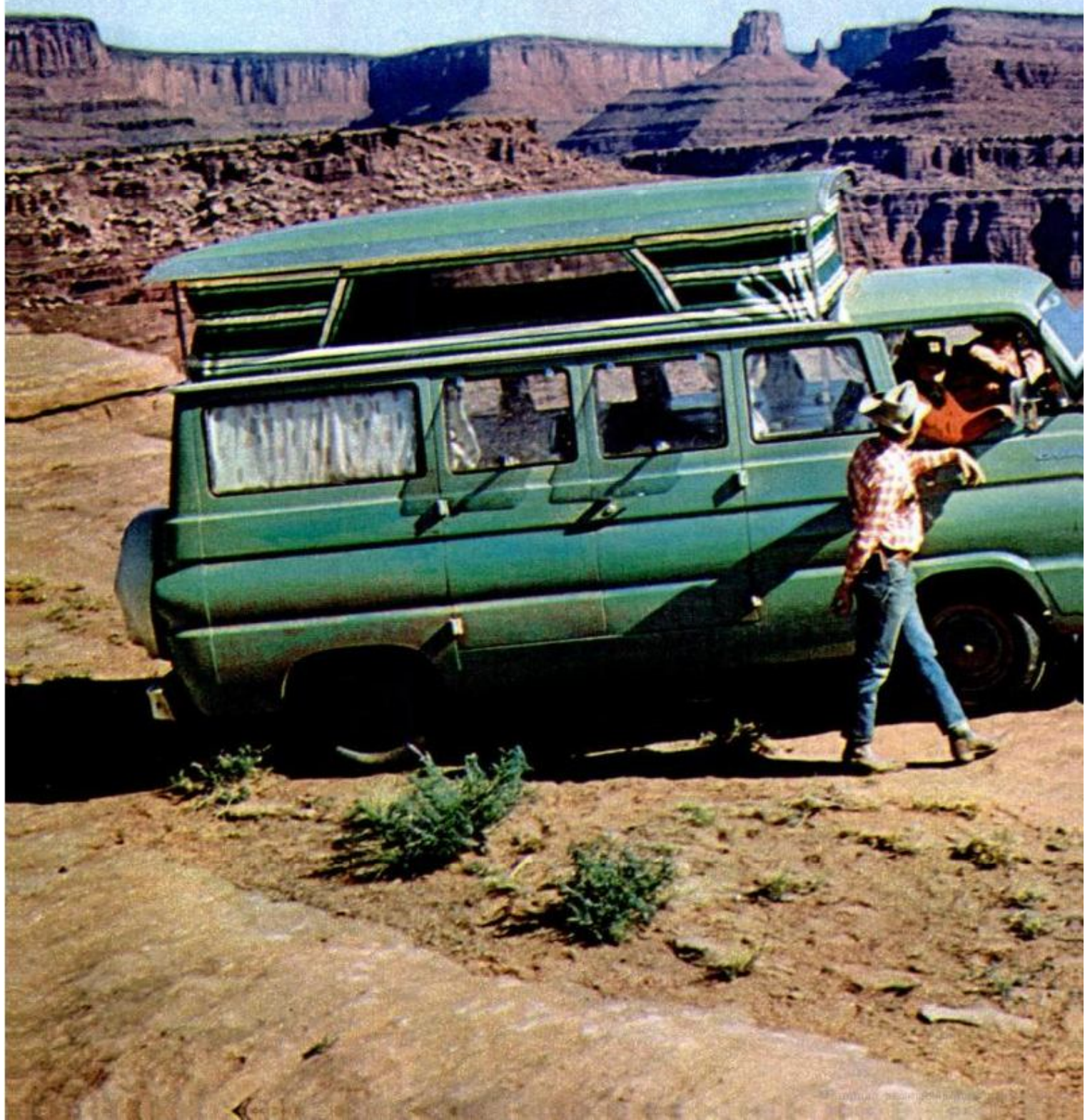
As to the race, unless there's some radical development of new and more powerful turbines in the near future, current USAC rules will keep things competitive for power plants of all types. Besides, there's still a lot that can be done with so-called "conventional" engines, and I think they'll dominate the race for several years to come. As for powering the family bus, turbines—even in mass production—are just plain too expensive, period. Also, as we know them, they could never hope to meet current antipollution regulations.

Now watch a turbine make a bum out of me and win the race. ★★★

TURBINE CAR (one of three) being entered by Carroll Shelby is powered by General Electric T-58 engine



Challenging the Canyonlands



in a Camper

By DANIEL C. FALES, Boating and Outdoors Editor Photos by John Flannery

HOW FAR CAN YOU GO in a two-wheel-drive camping van on trails marked "For Jeeps Only"? To find out, *PM* Editor Bob Crossley and I are tackling tough jeep roads in



SETTING UP CAMP on White Rim overlooking the Colorado River are *PM* staffers and veteran Canyonlands guides. Deadhorse Point is at upper right



one of America's newest and wildest national parks. For three days, we'll slip, slide and burn rubber in the beautiful, craggy Canyonlands of Southeast Utah. And we'll find danger in the most unexpected places.

Our trip starts in a gas station. We planned to leave home base at Moab, Utah, on the Colorado River, about 7:00 a.m., but a leaky gas tank on our new Dodge Sportsman van forces a two-hour delay. A pinhole at the tank's intake throat is the trouble. So Bob Crossley decides to hop off in a Ford Bronco for Angel Arch with Joe Lemon—one of Moab's famed "canyonlads." An ex-marine who came here to cowboy 20 years ago, Joe's been guiding and driving in this back country for years. He'll take you anywhere

BOB CROSSLEY checks note I wrote when slick mud forced us to abandon van on pass. Note wheel blocks



ROCKDRAGGER PASS is so named because we tied a boulder to Tex McClatchy's van to get down the slick trail. Using a heavy chain (far left) we tied it around the rock and anchored it to the van. You can see the mud and ruts (above) as Tex prepares to descend the dangerous road. The mud is only a half-inch thick, but enough to cause real trouble. On the way down (far right) Tex felt his van swinging toward the edge. The rock dug into the road, stabilizing van rest of the way

and tell you all about it. Angel Arch is tucked back in the farthest corner of the southern Canyonlands, below the confluence of the Green and Colorado Rivers. It was discovered only a few years ago. Joe had herded cattle within a couple of miles of it and never knew it existed. It's worth the trip. Bob and Joe will meet us tomorrow at Mineral Canyon on the Green.

This leaves me, John Flannery, our photographer, and Tex McClatchy, our guide. Tex runs jet sightseeing boats on the Colorado, as well as trips by four-wheel drive.

Today Tex is driving a 1954 Chevy Suburban which looks like a beat-up chuck wagon. Atop, he's strapped two canoes so we can sample a short cruise down the Green River.

With the gas tank fixed, we buzz along a paved road at 60 mph, paralleling the west bank of the Colorado. The van, with its 108-inch wheelbase, handles like a dream.

Up ahead, I see Tex take a quick right turn onto a dirt road. He stops at a sign—*For Jeeps Only*. "Here goes," he says.

From nowhere, there's a blast of wind,



and cold rain pelts the windshield. "Trouble ahead," I think. A green sedan carrying a vacationing couple backs down the dirt road toward us.

"Back on out," Tex tells them. "It's too much for a car."

I wonder about the van. The clearance is okay, and the 210-hp, eight-cylinder engine (318 cu. in.) seems to give all the needed power.

"Follow me," Tex says. "If I can make it in my '54, you shouldn't have any trouble."

But he's experienced. He's run these roads for years, learned every trick.

It's raining in fits and starts, now. But the road's fairly dry, and traction's good.

"This is a great spring test," I tell John as we bounce over a dry stream bed.

We're climbing now. The wheels slip and spin in gravel-dirt. Tex is moving well, but he has more weight in the stern than I.

Suddenly, my speedometer's showing 30 and the van's standing still—wheels spinning.

"Handbrake," yells Tex running back. "Back up a little. Hold the brake, rev her a bit, then let her go."

It works. It's a good tip. I've never done much handbrake driving, but it sure helps in rugged country. If you're off for any tough-road driving, have a mechanic check your handbrake.

We drive out onto a bleak, flat mesa. A sign at roadside tells us we've just come up Pucker Pass. Aptly named.

With rain washing our van, we lunch on the mesa at Deadhorse Point. Tex says it's named that because horses stuck on the mesa in dry seasons would jump off the cliffs to get to the Colorado River—2000 feet below.

Rain or no rain, the view from Deadhorse rivals Grand Canyon.

"There's parts of this country that's never been explored," Tex says.

FLOATING DOWN the Green River in canoes is an unforgettable trip. We bumped over sandbars, passed claim markers, spotted white egrets and Indian markings, were awed by huge red monoliths lining both banks





NATURAL BRIDGE, called Musselman's Arch, above, is one of the many dramatic scenes found in Canyonlands country. *PM* editor Bob Crossley checks the "bridge" while expert guide Tex McClatchy approaches in our camper van. A large crack in the middle of the rock formation stops Tex from driving farther

DRIVING UP ROCKDRAGGER PASS out of Spring Canyon, left, is a lot easier now than it was the day before when rain turned the road into a giant skid strip. It was while going down this rugged road that we almost met disaster. The canyons and cuts in Canyonlands are among the most awesome in the country

UP AND AT 'EM, below, is the cook's call as the morning sun ricochets off the bluffs at 5:43 a.m. Photographer John Flannery eases out of his sleeping bag after a night under the stars. This is our campsite the second night. From this high plateau we can look across to the scene pictured on pages 102 and 103



The rain eases while we retrace our trail for a few miles, then cut west. The road's damp. A red brake light bangs on as Tex skids to a stop ahead.

"We've got to get down into Spring Canyon from here," Tex says. "Watch it—it's slick."

I don't know how slick. The rain has done its damage.

On we go right around the face of a cliff. On the right, sheer walls; on the left, a 1500-foot drop.

Suddenly, the road angles down. Tex stops several hundred yards ahead. The rain has mixed the clay and shale road into a trail of goose grease. My hands shake as I grip the wheel.

I swear. The front end slides right. I'm in a ditch. Thank God I didn't slide the other way.

"Straighten your wheels," Tex commands. "It's like driving in snow."

With Tex pushing at the right front wheel, I ease her out. The brakes lock. I slide 10 feet to a stop. I'm right in the middle of the road.

"You got to get her down to that small turnout," Tex says, "just to the left of my truck."

I'm scared. I'm thinking how to jettison if the van starts over the edge. It's no good. My door opens on the bad side. "Pump your brakes," Tex says, "keep her rolling—but slowly." A yard at a time, I sneak to the turnout.

I step out and my boots clog with mud—gumbo they call it.

Ahead, the road drops off more—every bit of a 22 percent grade. "It's too slick for your van," Tex says. "Have to leave it here."

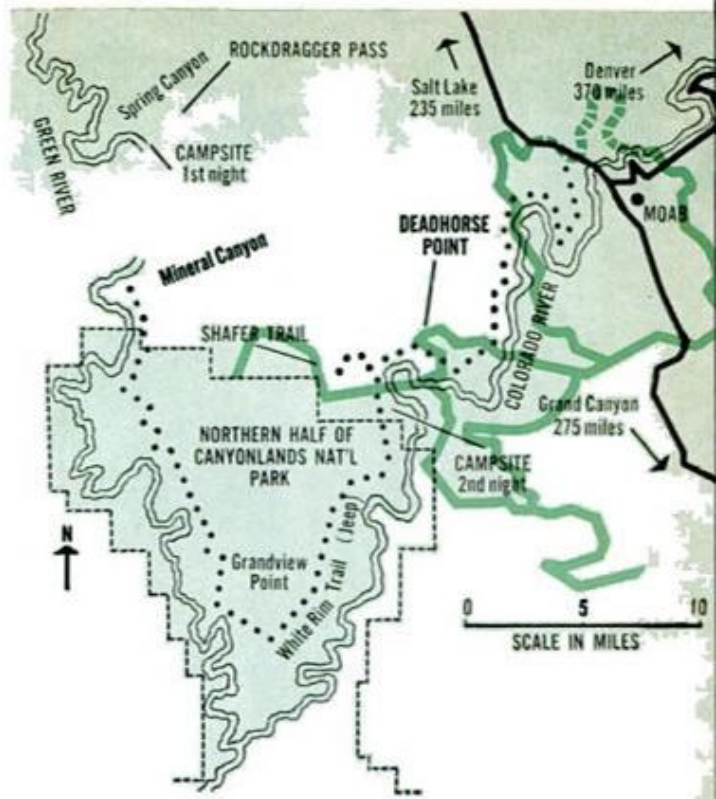
But what about his rig?

Tex rummages around in the back of his truck and pulls out a $\frac{5}{8}$ -inch chain.

"Never go into the wilderness without a chain," he says. "Look for a big boulder." We find one. It must weigh 350 pounds. Quickly we wrap the rock with the chain and attach it to Tex's rig.

"It's an old trick I learned while driving for loggers," Tex says.

He climbs aboard and starts down-



MAP OF three-day trip through the Canyonlands area of Southern Utah. Dark line indicates our route in a van

hill. His old Chevy fishtails toward the edge. The rock catches and starts to plow. The Chevy straightens. Tex has made it. I leave a note in my van for Bob and Joe who'll be by tomorrow.

At the bottom of Spring Canyon, we set up camp for the night. With a good meal under our belt and a little bourbon in our coffee, we review the day.

"Let's name the mud road," I say.

"Okay," says Tex. "How about Rockdragger Pass?" And so it is.

Naming things becomes a habit. The next day we launch the canoes at our camp on the Green River. With a small 3.5-hp outboard, Tex, John and I head downstream, one canoe towing the other. As we putt, we name points and canyons—Serpent's Head, Cancan Girl, Amphitheater, Canyon of Many Faces.

We glide by small piles of four or five stones—one atop the other. These are claim stakes of uranium prospectors. We pass geological formations that look like layer cakes—each layer taking 10 million years to "bake." Dark streaks, called desert varnish, trail down red cliffs of giant monoliths. It's iron manganese mixed with rainwater

(Please turn to page 194)

MUSTANG**Easy Handling on the Road;
Tight Sitting in the Rear!**

"OUCH!" From both ends, the fastback rear seat is hard on adults

I DIDN'T WANT A BACK SEAT anyway," says a Massachusetts actuary referring to his Mustang fastback. This being the case, he doesn't complain about it. But owners who did want a rear seat, and figured that Ford's "2+2" fastback formula meant accommodations for a total of four adults, feel they've been taken for a ride. They've found out that "2+2" means driver and a passenger up front and "two bags of groceries in the rear," as a Maryland chemist puts it. Some people substitute kids or dogs for the groceries. They squeeze grown-ups into the back only after warning them to expect head bumping and rump thumping.

We can't print some of the anguished cries from the rear. As a secretary-treasurer from Kansas says, "Front seat is delightful. Back seat, you wouldn't like the comments." Of her hardtop back seat, a Maryland nurse says, "Impossible."

Over a million miles of driving convince Mustang owners that their sporty "personal" car has a lot more than just personality. A happy housewife in Minnesota simply likes "the spirit of the thing." But some more discerning owners report gasoline mileage is better than expected, handling is tops and power is plentiful. At the same time, they're objective enough to voice complaints, big and little.

By **BILL HARTFORD**
Associate Auto Editor

Photos by Irving Dolin



BEHIND THE WHEEL, Mustang owners are impressed with car's handling and fuel economy. Some criticize light rear end which can get away on hard turns

"The rear is hell on your knees," complains a Kentucky salesman. And so it goes.

Some owners seem to realize that long-hood, short rear-deck styling limits the available room in the back, and fastback roof lines limit it further. So they accept the fact, as a Florida fire-fighter puts it, that "the back seat isn't intended to be comfortable." Others, usually those with particular family situations, actually have found that the small, "uncomfortable" back seat is tailored to their needs: "My two hound dogs ride in the back and seem satisfied," says a retired Air Force man. And, "my children like it," says a South Carolina metallurgist.

A few critical owners who have taken a *hard* look at their back seat have a good point to make. Roomy it's not, they say, but more comfortable it could be. "Back area is not padded enough," says an Iowa schoolteacher. And a Maryland Navy man calls for "more padding in the seats—they become uncomfortable on long trips."

The message to Ford seems clear: Include a back seat. Small as it may have to be, make it comfortable. Size and comfort are two different things. The uptight "jump" seat, as some Mustang owners call it, is better than nothing, but a little extra padding would be appreciated.

Handling, although it means different things to different people, is the best thing about the Mustang to lots of owners. Interestingly, a housewife and mother in Indiana says, "very easy to drive. A child could learn." Interesting because the average age of owners is pretty low as it is. The largest owner age group is the 20- to 24-year-olds. One owner's daughter, sounding like a social activist, would lower it further: "Every teen-ager should have one!"

Handling may be easy enough for a child, a pleasure for the many young women who've told us about their Mustangs, and just plain "Zow!" for the fast-cornering crowd. But there is one handling characteristic that makes Mustang owners who have experienced it a



TRUNK ROOM of hardtop and fastback should be increased, say owners, but none had solution as to how

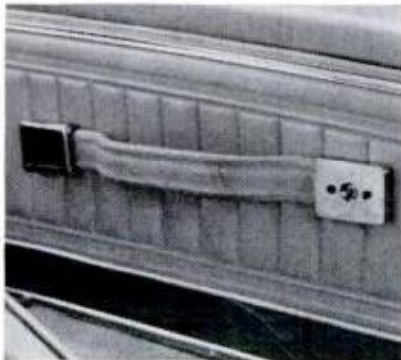


FASTBACK ROOF LINE, well-liked style element among enthusiastic owners, gets hardly any visibility beefs

HORN RING is set too far below wheel for quick reach with thumb



CHROME TRIM should pry off, not pop off as some owners complain



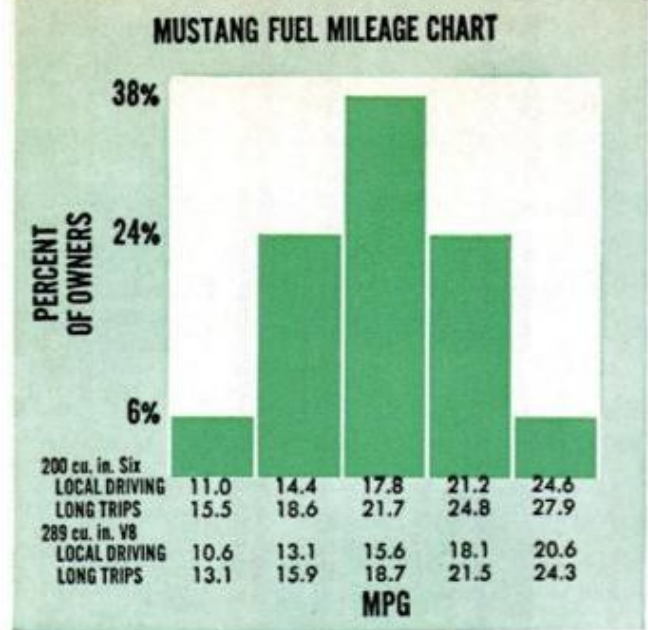
KNUCKLE-KNOCKER chrome strip skins you when lowering window



little nervous. A student from Nebraska who has experienced the problem minimizes it: "Surprisingly good traction in spite of the light rear end."

Comparatively speaking, the Mustang does not have a "light rear end." In fact, all of the half-dozen, so-called "sporty" cars have very nearly the same front-rear weight distribution—the average being roughly 57 percent of the car's weight up front and 43 percent on the rear wheels. Nevertheless, some owners consider it light because sometimes it gets away from them. A Maryland civil servant says, "lack of weight in rear end; tends to break away easily." A Minnesota ironworker complains

(Please turn to page 200)



ON THE ROAD for long stretches, owners with most popular 289 V8 are happy about 18.7-mph average



Summary of Ford Mustang Owners Reports*

Total miles driven1,096,616	More weight in rear 7.2	Size 21.8
Average miles per gallon:	Rear ashtrays added 6.6	Past experience 20.9
200-cu.-in., local driving ... 17.8	More headroom 6.0	Economy 20.9
long trips 21.7	Slimmer steering wheel ... 5.4	Price 11.7
289-cu.-in., local driving ... 15.6	Workmanship improved ... 5.4	Performance 11.7
long trips 18.7	Bigger glove compartment. 5.4	
302-cu.-in., local driving ... 14.3	Easier to get in and out ... 3.6	Is the Mustang your only car?
long trips 17.1		No 53.7%
Specific likes:	Model:	Yes 46.3
Handling 58.4%	Fastback 14.2%	Other cars owned:
Style 52.3	Hardtop 81.0	Ford 36.9%
Economy/gas mileage 31.3	Convertible 4.7	Chevrolet 19.7
Power 22.4	Transmission:	Volkswagen 9.0
Comfort 18.7	Cruise-O-Matic 63.8%	Buick 7.4
Performance 16.8	3-speed manual 31.4	Mercury 6.6
Ride 11.2	4-speed manual 4.8	Oldsmobile 6.6
Size 8.4	Had any mechanical trouble?	Pontiac 5.7
Roadability 7.5	Yes 51.1%	Mustang 4.9
Bucket seats 6.5	No 48.9	What options/accessories?
Specific dislikes:	What kind of trouble?	Radio 56.7%
Room in rear/rear seat 17.9%	Carburetor (includes routine adjustments) 29.3%	Power steering 34.4
Weight/roadability 15.5	Electrical 8.6	Whitewall tires 19.0
Workmanship 14.9	Brakes 7.8	Wheel covers 14.8
Dealer service 7.7	Smog control 6.9	Airconditioning 13.8
Gas mileage 7.7	Transmission 6.0	Tinted glass 11.4
Trunk room 6.5	Dealer repair satisfactory?	Power brakes 8.3
Glove compartment 6.0	Yes 55.0%	Console 6.7
What changes would you like?	No 37.6	Age distribution of owners:
More room in rear seat/more legroom 21.7%	Why the Mustang?	15-29 47.1%
Bigger trunk 10.2	Style 57.8%	30-49 37.6
		50 plus 15.3

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



Gas and grocery store

Customers at Atlanta's Bread Basket store select groceries by pushbutton (top) and have them packaged (bottom) and delivered to the car—all while the gas tank is being filled.



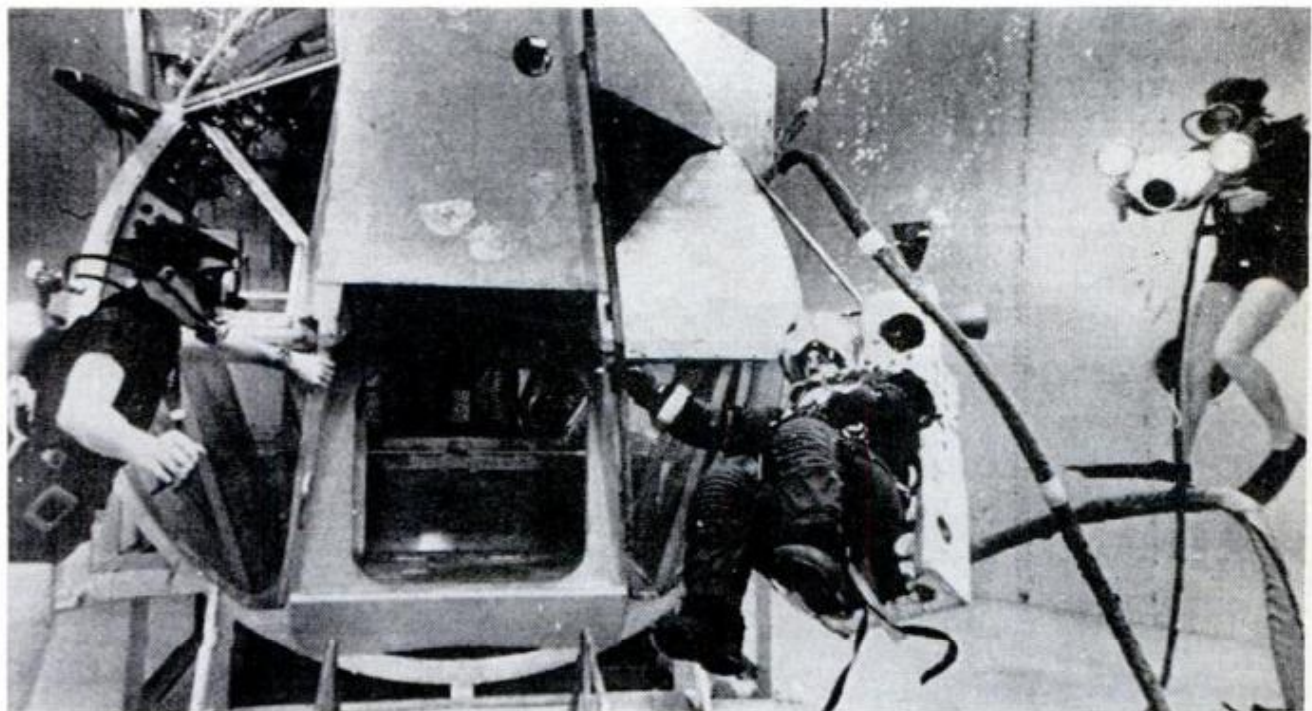
World's smallest rocket

This seven-pound Resistojet engine can propel a 1000-pound spacecraft once both are free of gravity. It uses ammonia fuel.



Pillow protection

A pillow that inflates in 4/10ths of a second to protect motorists in a crash has been shown by Ford and Eaton Yale and Towne.



Underwater tests will help astronauts get to the moon

Engineers at the Houston Space Center go underwater to simulate weightlessness in determining the best way for astronauts to work outside the lunar module on their moon trip.

New Tabletop Radios: How Hi the Fi?

PM listened to some FM sets bang out highs and lows with enough tinkle and boom to make the music from typical garden-variety radios sound like mud

By LEN BUCKWALTER

THE NEXT TIME you amble into the showroom at your local hi-fi dealer's, you may do a double take. You just won't believe your ears that those high and low notes filling the room are pulsing from a piddling little tabletop radio. Utterly impossible!

But the truth is that table radios like the Fisher 100 and the KLH 21 shown below actually can push out low bass notes with authority and slither up to shimmering treble tones with clarity. Happily, these sets fill that big gap between low-fi, mass-market sets and complete hi-fi systems with all their controls, switches and cables.

What's the secret weapon that gives these hi-fi tabletops their disarming sound? Part of it is "acoustic suspension." This term refers to a speaker-design technique that was first applied in slashing down giant speakers to bookshelf size without slashing sound. The Lilliputian hi-fi tabletops borrow

this idea and scale it down further.

Acoustic suspension is used in both the Fisher and KLH sets. As is to be expected, prices—\$90 for the KLH and \$100 for the Fisher—are higher than those for run-of-the-mill FM table models. The price of conventional sets usually falls in the \$50 to \$80 range and often includes AM and a clock. But these sets sound thin when compared to the new hi-fi tabletops, and a close look will reveal why.

Conventional table radios use the familiar cone loudspeaker to pump air. The heart of this type of speaker is a coil and permanent magnet. When the coil is energized electrically (by the program signal) a magnetic field expands out of the coil. The field interacts with the speaker's permanent magnet and the result is mechanical motion of the speaker cone.

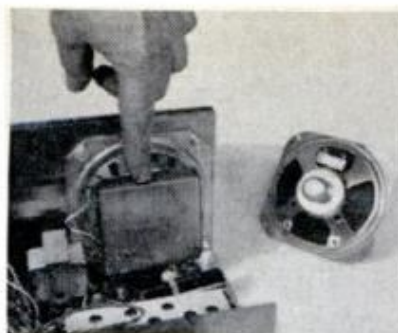
The big bugaboo in this familiar loudspeaker is the firm mounting of



HI-FI TABLETOPS such as the KLH 21 (right) and Fisher 100 have better engineered tuner, amplifier and speaker design than the typical FM set



SPEAKER CONE of acoustic suspension design has flexible mounting for good bass, plastic-coated center area for tweeter action



SPEAKER MAGNET comparison shows huge magnet in hi-fi table set dwarfing tiny, round magnet on conventional speaker at right



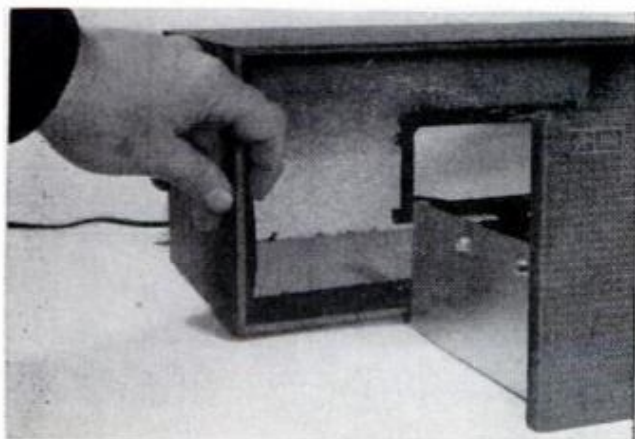
SOUND DAMPENING action in KLH tabletop is provided by fiberglass pillow. No hot tubes will burn it with solid-state design

the cone in its frame. This mounting is necessary to return the cone to a rest position between sound waves. When a strong bass note comes along, the cone tries to take a big bite of air, but it can't move far enough. That's why a regular table radio is feeble on bass notes, which often come out sounding like a toneless thump.

The hi-fi tabletops solve this problem with acoustic suspension. First, the firm mounting of the cone is eliminated. This permits the cone to move as much as 1/4-inch—an enormous excursion for a small speaker.

The problem of returning the cone to rest position is solved neatly by the air inside the cabinet. As the speaker cone moves toward the back of the enclosure, it compresses air trapped within the cabinet. Between sound waves, the air pushes the cone back to the rest point. The net result: a speaker that overcomes small size by extra-

FRONT AND REAR GASKETS around Fisher's rigid, heavy enclosure help trap the air. This is necessary for proper operation of acoustic suspension speaker



MAY 1968

ordinary thrusts of a compliant cone. Now it's possible to pump the volume of air demanded by powerful bass notes and do it with precious few inches of cone area.

But to make acoustic suspension work, other refinements not found in ordinary sets are needed. These refinements push up the price tag, but they also push up the fidelity.

Sealed cabinet. Since the speakers compress air, the radio cabinets must be completely sealed. (Both the KLH and Fisher sets use gaskets on all removable panels.) Thanks to cool-running transistor circuits, ventilation holes are not necessary. To prevent annoying vibration, Fisher uses a heavy cabinet structure; KLH kills motion with a fiberglass "pillow" and wood-dowel stiffeners in the cabinet.

Speaker cone. Both speakers have specially fabricated cones. Fisher uses one with an approximate 5-in. diameter and treats it with a hard plastic for good "tweeter" action on high tones. KLH manufactures its own cone material and coats speaker edges with butyl rubber to seal against outside air. The KLH speaker is about 3 in. in diameter.

Massive speaker magnets

Magnets. There's a dramatic difference in these components compared to regular radios. The speaker magnets are massive. They weigh about a pound apiece; regular speaker magnets weigh mere ounces. The monster magnets provide precise control of the

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speaker throughout a wide range of frequencies.

Amplifier. Typical table radios produce an output power of about one-half watt. Fisher and KLH beef up power to about three watts to push the speakers during heavy bass tones. Further, both sets use a "push-pull" output, a circuit that improves fidelity and helps cancel distortion. Regular sets use a less costly "single ended" output. Both manufacturers eliminate the speaker output transformer, another stumbling block to good low-frequency reproduction.

Tone control. Regular sets have no tone control, or merely a single knob that cuts treble. The new sets have separate bass and treble controls. The sophisticated circuits behind them offer a wide span of boost and attenuation in tone control.

'Contouring' boosts the bass

Contouring. This electronic juggling of the circuit closely matches amplifier to the speaker. By "contouring" the amplifier it's possible, for example, to produce consistently strong levels of bass power. It helps overcome the small size of the speakers. Independent of tone controls, contouring introduces appropriate bass boost at all settings of the volume control.

The novel speaker and audio sections in the hi-fi tabletops steal the spotlight, but there are other important features.

SPEAKER JACK on the rear of Fisher and KLH radios is convenient for use of remote or external speaker

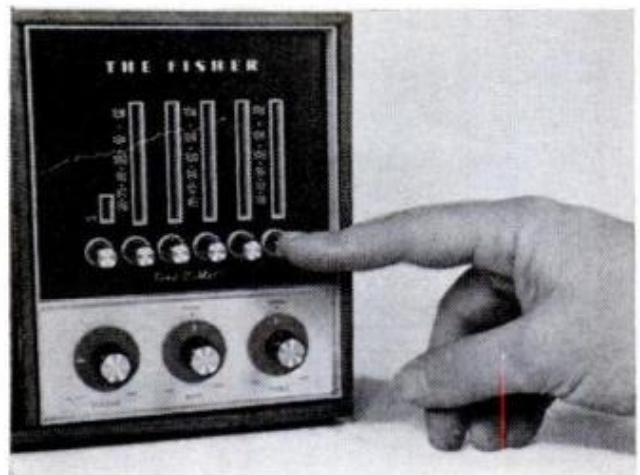


The FM tuners operate at high sensitivity and have good resistance to interference. Usually, the built-in antenna, which is conveniently designed right into the line cord on these sets, is sufficient to pull in most stations. The sets can be hooked to an outdoor antenna to improve fringe-area reception, however.

Fisher's hi-fi tabletop has a very desirable innovation. Its "Tune-O-Matic" system abandons the usual tuning dial in favor of pushbuttons. Up to five stations can be selected in an arrangement like that used in car radios. KLH has a single tuning knob, but it's geared down so selecting a station can be done with precision. Both radios can be played through an optional remote speaker available for about \$30.

Both the Fisher and KLH sets are monophonic and automatically convert a stereo broadcast to mono. A query to both manufacturers brought the same reply as to why there are no firm plans for a stereo version: The hi-fi tabletops have a special niche in the marketplace. These radios fill a big gap. They'll easily outperform any conventional FM table set. And their appeal seems to be for people who want better sound in a handy package. The sets can operate anywhere in the home and they afford a good second music source for owners of a large hi-fi rig. By trying to offer stereo, too, the manufacturers of the little sets would probably

"TUNE-O-MATIC," Fisher's solid-state pushbutton tuning system, allows the presetting of five stations



price themselves out of this market.

With KLH and Fisher already off and running, chances are that other hi-fi manufacturers will soon be making some noise with hi-fi tabletops of their own. It'll take sharp ears to choose among them.

Helpful listening tests

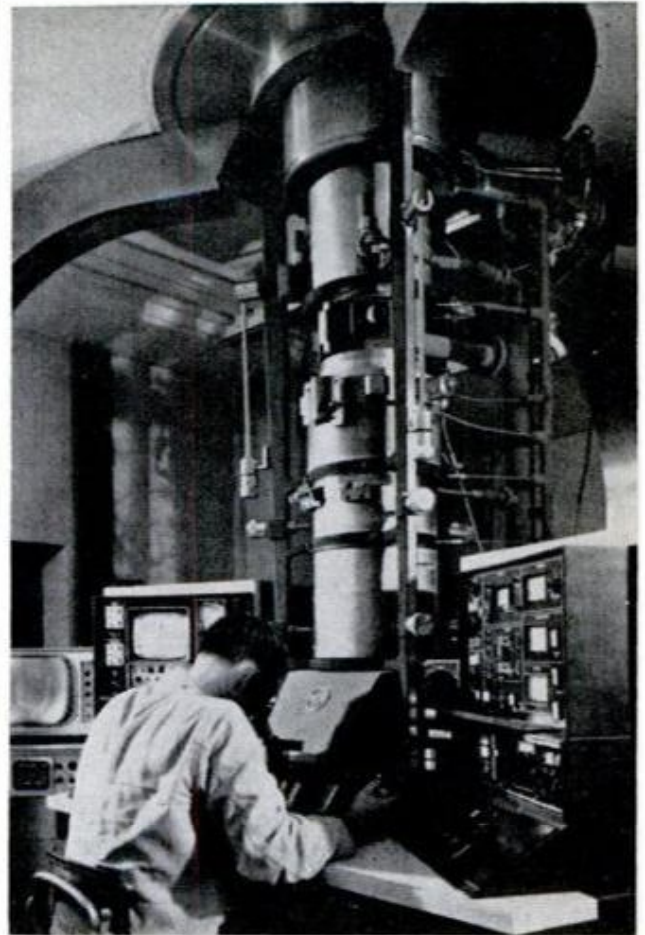
There are simple listening tests, though, that can prove helpful. Most important is judging bass performance. With tone controls (there should be both bass and treble knobs) set to normal listening level, tune in orchestral music. Do drums, cello, and other low-tone instruments retain their characteristic sound? A poor set will tend to confuse them.

On the high end, the "s" or sibilant sounds of a speaker should come through with sharpness and clarity. And the radio should have "presence." This is checked by listening to the mid-range tones; these should not be swamped by exaggerated bass and treble. Turn up the volume and set the bass slightly above normal level. Low tones shouldn't start distorting or lose identity.

If there's a costly hi-fi system in the same showroom, compare it with the little set. Biggest difference should be in low range. The expensive system can reach significantly further down the musical scale. The table model should perform with reasonable smoothness on all but the lowest range.

Will the hi-fi tabletops get even smaller? Probably not in the near future. The purely electronic part of the package can be made smaller still, but the speaker systems are another story. Remarkable sound can be charmed from tiny cone diameters with the clever acoustic suspension principle. But the basic loudspeaker is a durable item that's resisted change for nearly a half-century. Until some skinny, solid-state device replaces the coil-and-magnet design, these tabletops will remain, as the engineers say, the "state of the art." ★★★

MAY 1968



It's a microscope

A scientist studies the viewing screen of a million-volt electron microscope (the most powerful built for commercial use) at a U.S. Steel Corp. research center in Pittsburgh.

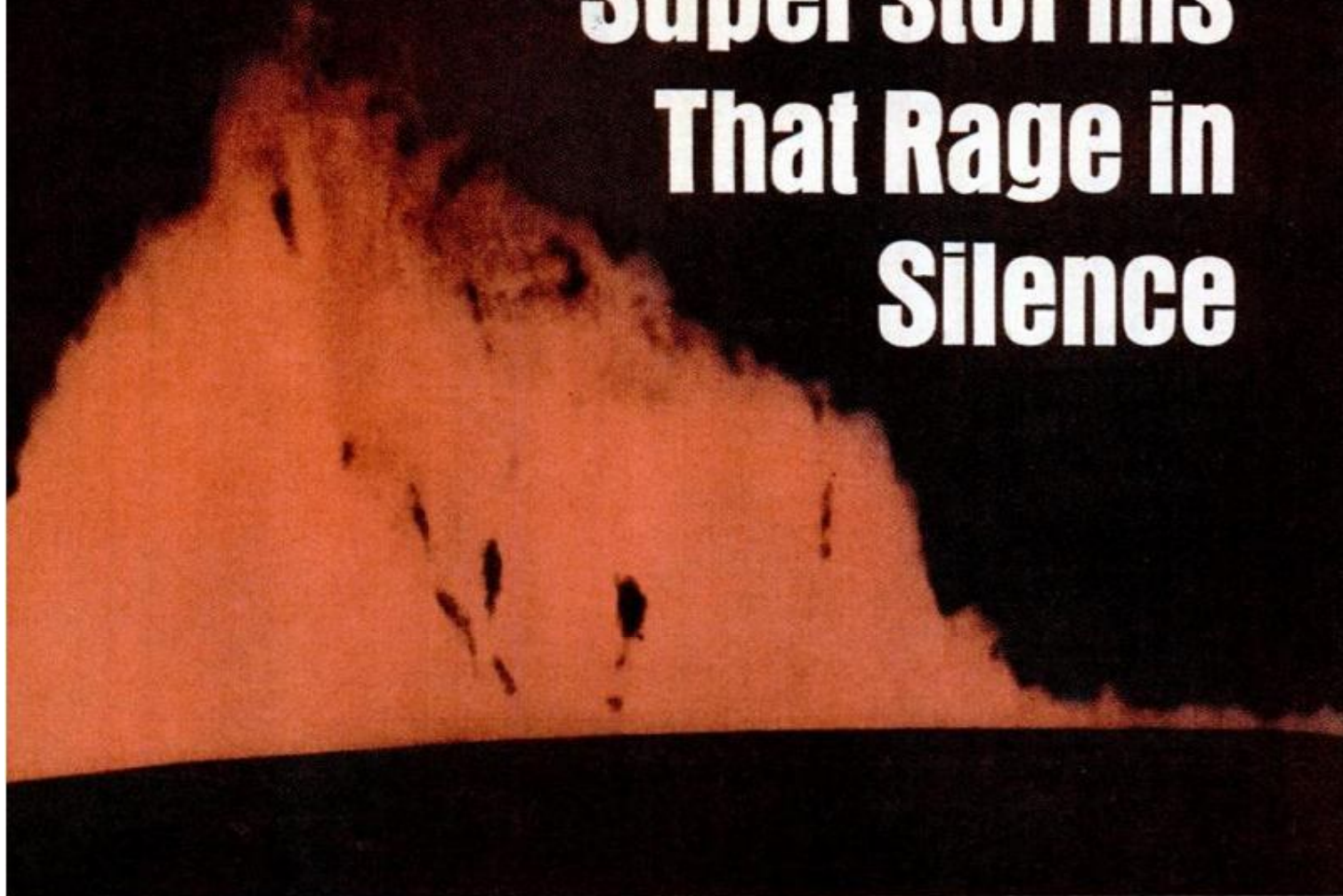


Ride 'im, prof!

Five professors at a Stanford University workshop built this motorized hoop. Here one of them test drives it around a field.

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Superstorms That Rage in Silence



AN ERUPTIVE ARCH PROMINENCE, a hydrogen gas cloud, rises more than 60,000 miles above surface of sun

Photos by Sacramento Peak Observatory, U.S. Air Force Office of Aerospace Research

Magnetic storms black out cities, raise havoc with radio and television, ground communication. Solar flares are the cause—and new disturbances lie

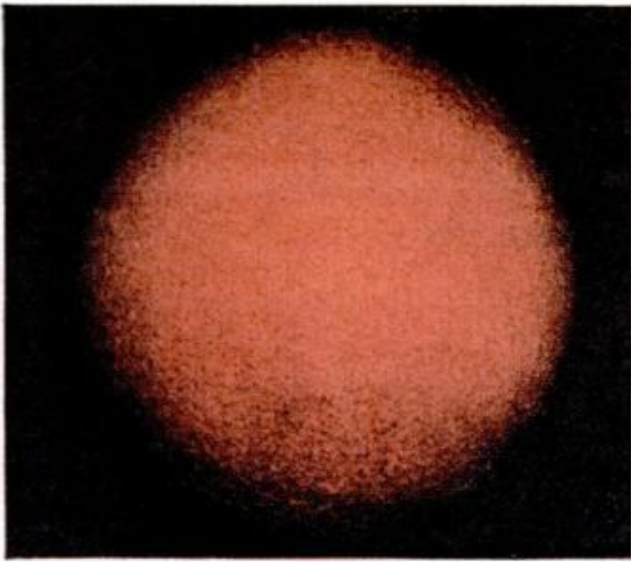
SHORTLY BEFORE 8:30 on the crisp Monday evening of Feb. 10, 1958, a storm of savage intensity struck New York City and within a minute engulfed the entire earth. Transatlantic radio was wiped out. Ships lost contact with shore stations and with each other. Airplanes aloft were limited to line-of-sight communications only. Teletype and Western Union messages were so garbled translation was often impossible. Low-altitude radiation tripled, while tremendous electric currents surging beneath the sea turned oceans into huge storage batteries.

The storm was the worst of its kind

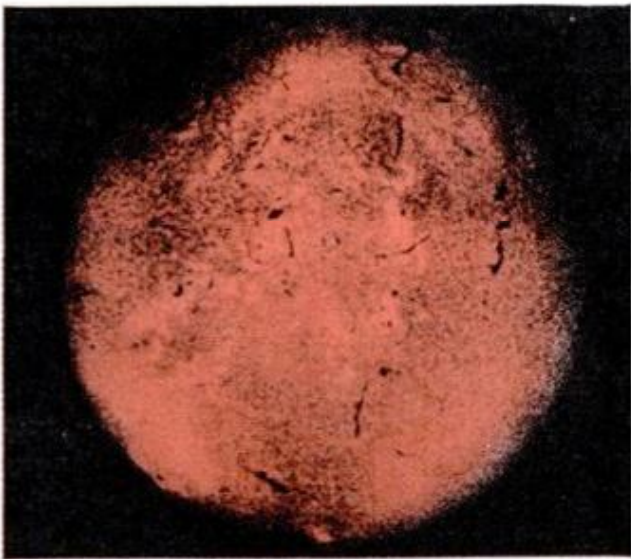
ever recorded, yet few people knew about it until they read their morning paper. Visible evidence of its fury was limited to wild scratchings on magnetograph charts, wavering compass needles and a magnificent auroral display stretching from polar regions almost to the equator.

No doubt such storms wracked the Earth long before the first life struggled from the primordial sea. Their existence, however, went virtually unnoticed until about a century ago, when the equipment they affect came into common use.

Since then magnetic storms, as they



SUN AT SOLAR MINIMUM: Few sunspots (flares) are seen. In 11-year cycle, sun returns to solar maximum



SOLAR MAXIMUM: Bright areas (flares) emit Gamma and X-rays, disturb ionosphere, cause radio blackouts

and cut off airline pilots from their ahead.

By **LYMAN M. NASH**

are called, have become a growing nuisance, periodically interrupting the smooth conduct of our electrically oriented lives. They cancel long distance phone calls, scramble telegrams and silence the best radios. They build up power overloads to plunge whole cities into darkness. Nor is the situation likely to get better. As we become more electromagnetically sophisticated, we will be increasingly at their mercy.

Each second the sun blows a million tons of matter into space. These charged particles spread out in all directions to form the "solar wind." When this nears the Earth, the latter's

magnetic field deflects the particles into the Van Allen belts. Save for a few high-energy particles that leak through, our magnetic field shields us from cosmic radiation.

What, then, causes magnetic storms? The only thing generally agreed is that they stem from solar flares—explosions releasing energy millions of times greater than the most powerful hydrogen bomb. This energy, in the shape of a gigantic cloud of charged particles, hurtles through space at 1000 miles per second. If on a collision course with earth, it deals the planet such a magnetic jolt that magnetic pull might vary more than 10 per cent, compass needles will swing seven or eight degrees, and the ionosphere will go haywire.

Magnetic storms occur most frequently and are most violent when sunspot activity is at a peak. Sunspots wax, wane, and wax again over a period that averages out at 11 years, though as many as 17 years have elapsed between peak periods. At the start of a cycle, spots appear only in the sun's upper latitudes. As activity increases they show up ever closer to the equator. After building to a peak, which may see the sun literally speckled with spots, they gradually subside. Midway through a cycle there may be no sunspots at all.

Sunspots were first observed in the early 1600s, shortly after invention of the telescope. Beyond the discovery that they have a magnetic field thousands of times stronger than the sun itself, we don't know much more about them today. They appear dark simply because they are 2000° cooler than the rest of the sun's surface, or "photosphere," where the temperature is 6000° C. (about 10,000° F.) Seen alone, a sunspot would glow far brighter than the brightest arc lamp.

When seen through a helioscope, which permits telescopic viewing of the sun without injury to the eye, a sunspot looks like a vortex with stuff falling into it. Some are so large they cover billions of square miles of the

photosphere. A particular spot might last less than a day, or be visible for months. Some emit flares, some do not, but apparently only flaring sunspots cause magnetic storms.

The strange effects of sunspots and magnetic storms first came under international study during the Second Polar Year, a 13-month period from Aug. 1, 1932, to Aug. 31, 1933. (The Polar Year, a half-century before, had confined itself mainly to terrestrial matters.) But a worldwide depression put a financial crimp on the project, and solar activity was at a minimum, so there weren't many sunspots to study. Despite this, the knowledge acquired when applied to radio alone was worth many millions of dollars.

A quarter-century later the International Geophysical Year began. Timed to coincide with maximum solar activity, it started June 30, 1957, and ended Dec. 31, 1958. And it kicked off, magnetically speaking, with a bang.

At 4:00 a.m. on the first day a magnetic storm severely disrupted radio communication between America and Europe. At 5:00 a.m. a brilliant aurora, thousands of miles long, swept across the northern United States. Unfortunately, the storm came too soon for many of the IGY's more elaborate programs.

Which is why, in Feb. 1958, eager scientists around the world had their eyes and ears trained on the sun. Early that month a group of sunspots covering three billion square miles began developing near the sun's central merid-

ian. Then, at five minutes past 1:00 EST, on Sunday afternoon, Feb. 9, the Harvard Radio Astronomy Station at Fort Davis, Tex., picked up a loud crackling sound on 458 megacycles, a frequency favored by the sun. Three minutes later visual observers, scattered over the daylight half of the earth, saw a solar flare of dazzling brilliance erupt near those sunspots, one of the largest groups ever seen.

As the flare developed the radio noise grew to a steady roar and was soon heard on other frequencies, as well. After almost two hours, the flare died and the solar radio quit broadcasting. For the sun, at least, the show was over.

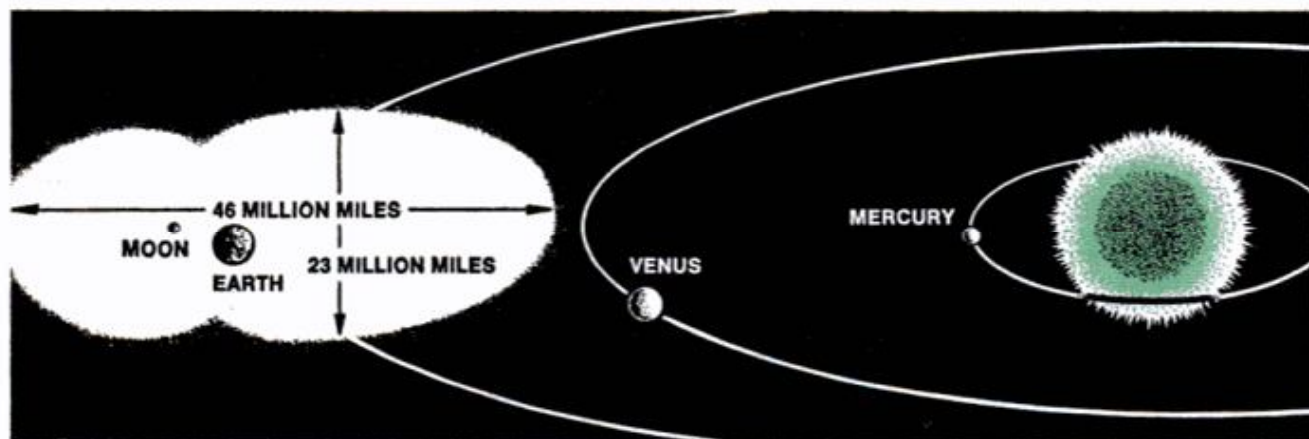
According to the most widely accepted theory, some solar flares emit only radio noise while others also eject what geophysicists call "corpuscles," submicroscopic charged particles. If this flare had ejected such a cloud—aimed at Earth—a magnetic storm could be expected in about a day.

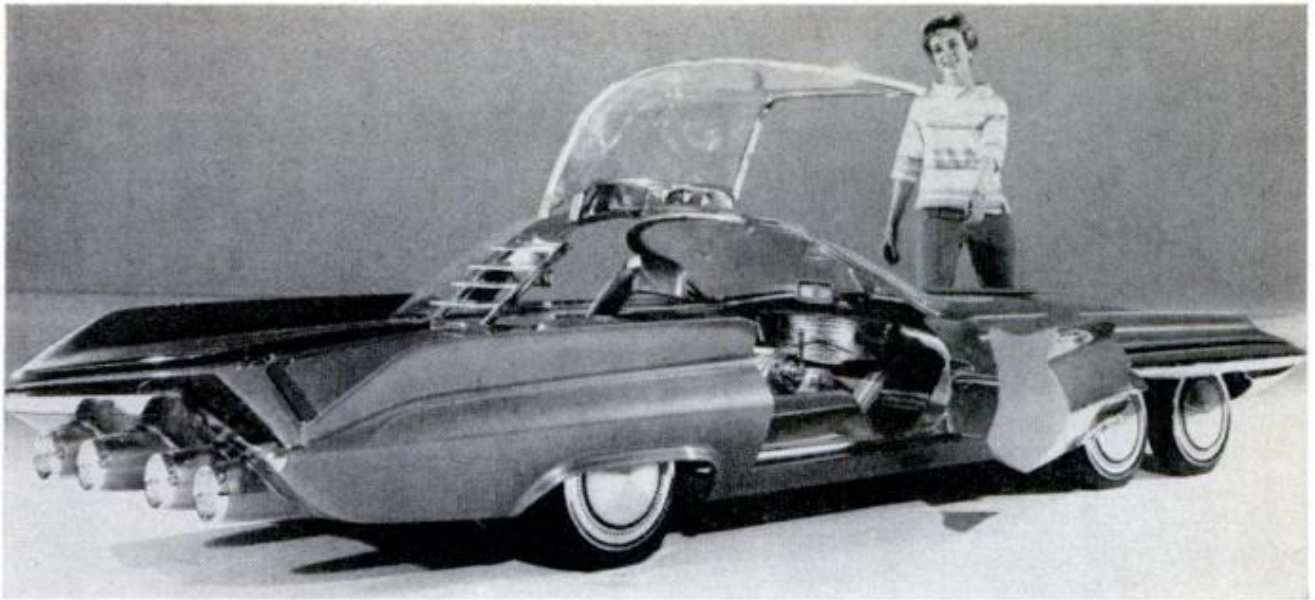
At the IGY World Warning Agency, Fort Belvoir, Va., an alert was sent to scientists of the 66 nations taking part advising them to look for anything out of the geophysical norm. But it was decided not to call a Special World Interval, which automatically would put into operation costly and highly complex experiments. Forty larger flares already had been seen during the IGY, and there had been seven SWIs.

As it turned out, this was a mistake. The flare had indeed ejected a cloud

(Please turn to page 186)

CLOUD OF CHARGED PARTICLES, striking Earth in 1958, caused violent magnetic storm and radio blackouts





Six wheels—count 'em—six

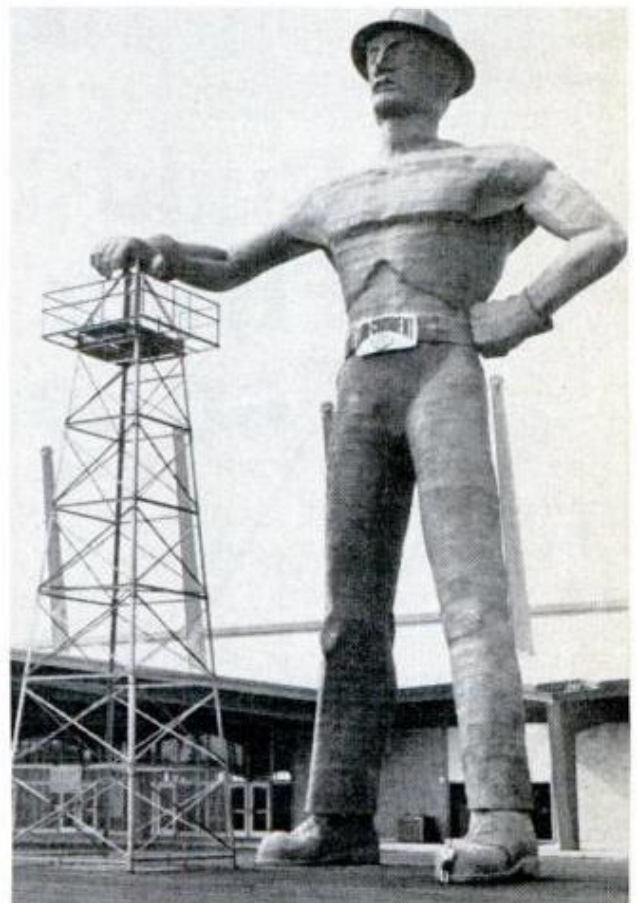
One of the unique features of Ford's new dream car, the Seattleite XXI, is the tandem arrangement of four front-drive wheels. The $\frac{3}{8}$ -scale model also envisions use of a travel programming computer, variable-density glass, jalousie windows and fingertip steering. Designers feel the four front-drive wheels would enhance tracking, traction and braking.



Spire for carillon tower

It took just 12 minutes for a helicopter to lift an 1800-pound spire 300 feet to the top of the carillon tower of the First Presbyterian Church in Stamford, Conn., recently. The pilot, John Roatch, was given radio directions by men on the scaffold.

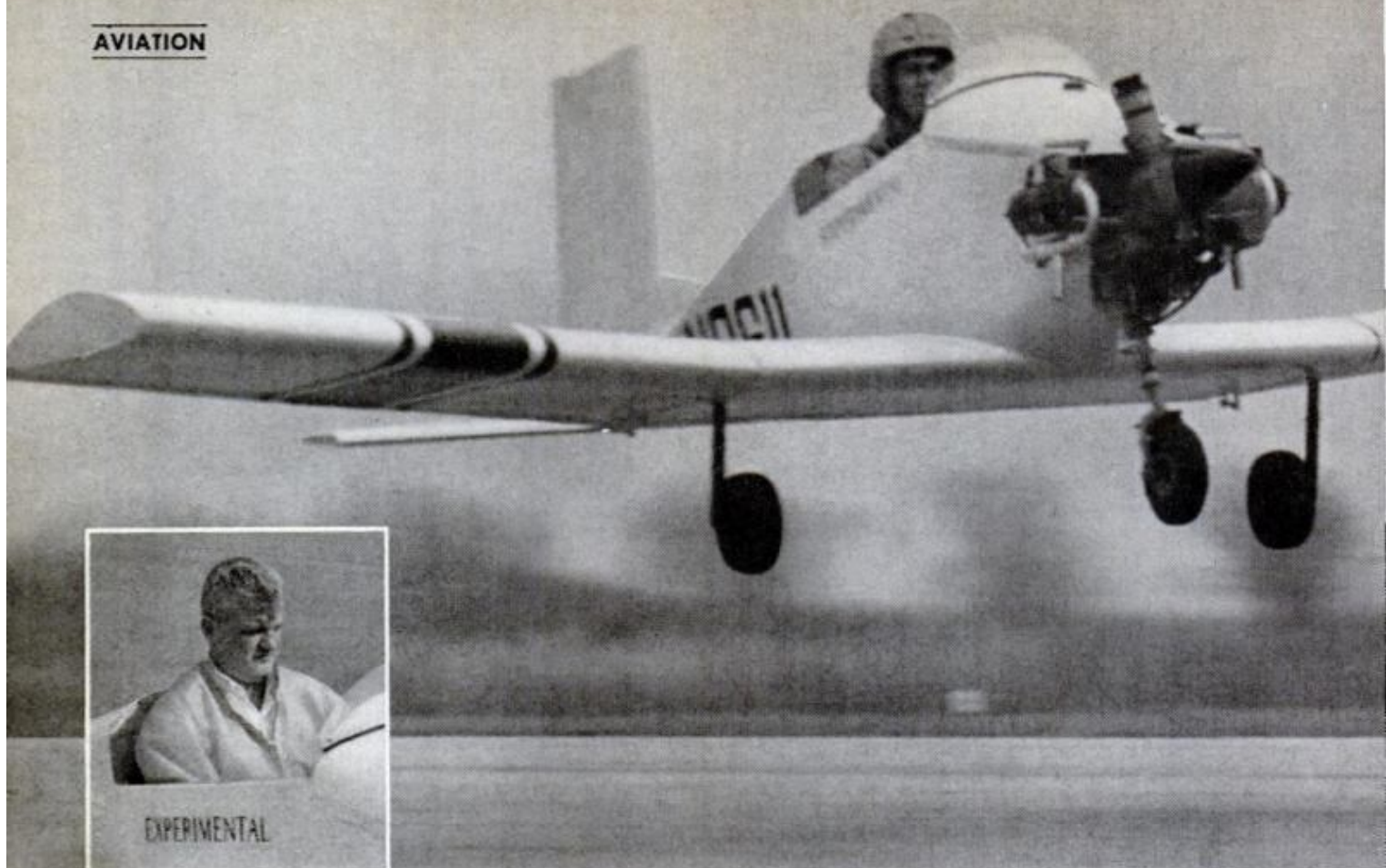
MAY 1968



Big man in oil

Standing 102 feet tall, the "golden driller"—as he's called in Tulsa—is easily the biggest oilman in the country. The giant figure, made to decorate the Oklahoma State Fairgrounds, is constructed of fiberglass placed over a wire framework.

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PM'S AVIATION EDITOR pre-flights *Jeanie's Teenie* before test

Build This 'Flying Volkswagen' For Less Than \$600!

By KEVIN V. BROWN

JUST WHEN THE LAST breakthrough seems to be broken through someone else comes along and does it again.

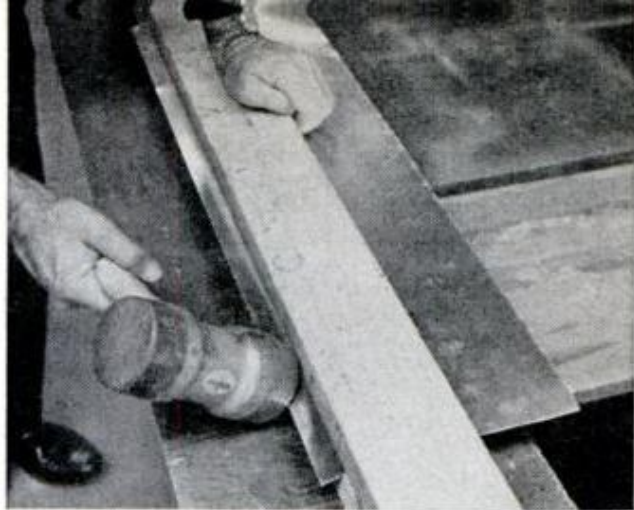
It's just happened in the field of amateur-built airplanes. A good general-average minimum for homebuilts has been about \$1000, and this for basically wood-and-fabric aircraft. Now a new design, from the unlikely place of Daphne, Ala., boasts a maximum cost of \$600, and this for an all-metal airplane that a rank beginner can build. Its major features are:

- A Volkswagen engine, the paragon of dependability and low cost.
- All-metal construction, and with over-the-counter parts and tools.
- Easy-to-build design, a one-man operation with no complicated equipment or techniques.

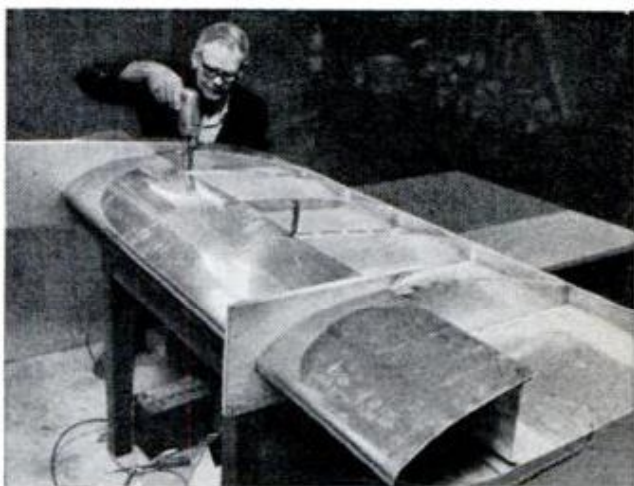
- Easy-to-fly, not swift, but sporty.

All of this grew from the efforts and imagination of Calvin Parker, chief engineer for a Mobile radio station. He lives near the station's tower at Daphne, and some of the early construction and taxi tests were done around the tower.

Parker, who learned to fly in 1946, built a few airplanes from other men's designs, but always felt there ought to be a simpler way to do it. While working for a large West Coast aircraft manufacturer, he enlisted the aid—after working hours—of office friends who were good with figures. He wanted to know what were the lightest metals it was possible to use and still build a safe aircraft. When they'd run through the figures and produced answers, he doubled everything



SIMPLE CONSTRUCTION technique uses plastic hammer to bend metal, eliminating jigs and brakes



CALVIN PARKER drills rivet holes in leading edge of wing, which is held in place by plywood template

Here's a remarkably easy-to-make, all-metal airplane you can put together with simple tools and a minimum of experience. Full plans available

Technical Art by Fred Wolff

and then began the design of *Jeanie's Teenie* (for Jeanie, his daughter, who helped him with preliminary construction, and Teenie for what it sounds like).

I visited Parker at his radio tower, and he told me how *Jeanie's Teenie* came to be. Later I flew the first model.

"I designed it around the Volkswagen engine," he said, while showing me home movies of the *Teenie* in action, "and I believe this is the first time it's ever been done in metal. A few homebuilts have been adapted to the VW, but I started with the VW in mind. It's light, it's dependable and it's relatively inexpensive.

"Also, several conversion kits make it easily adaptable to airplane use."

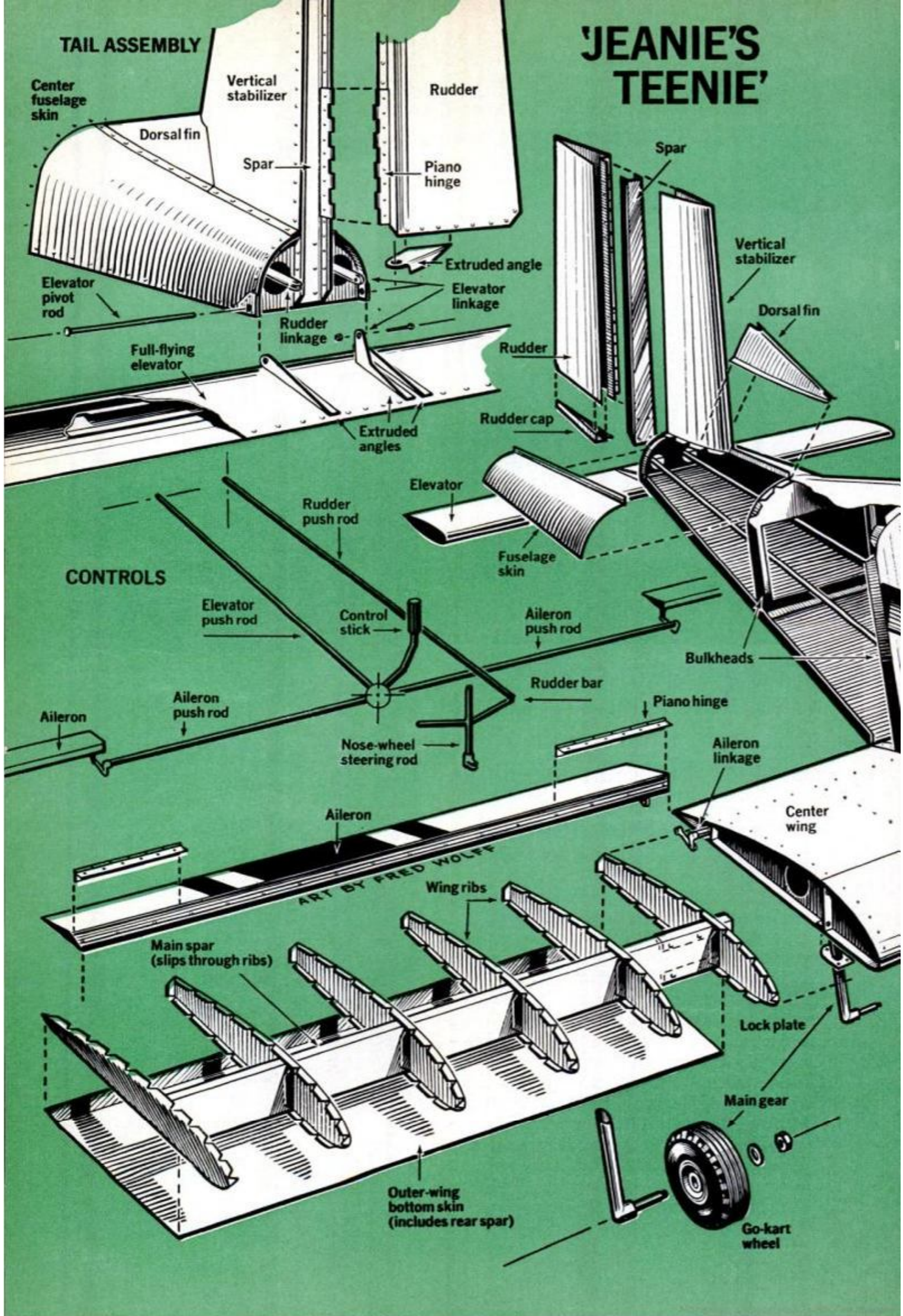
The metal, as any amateur builder

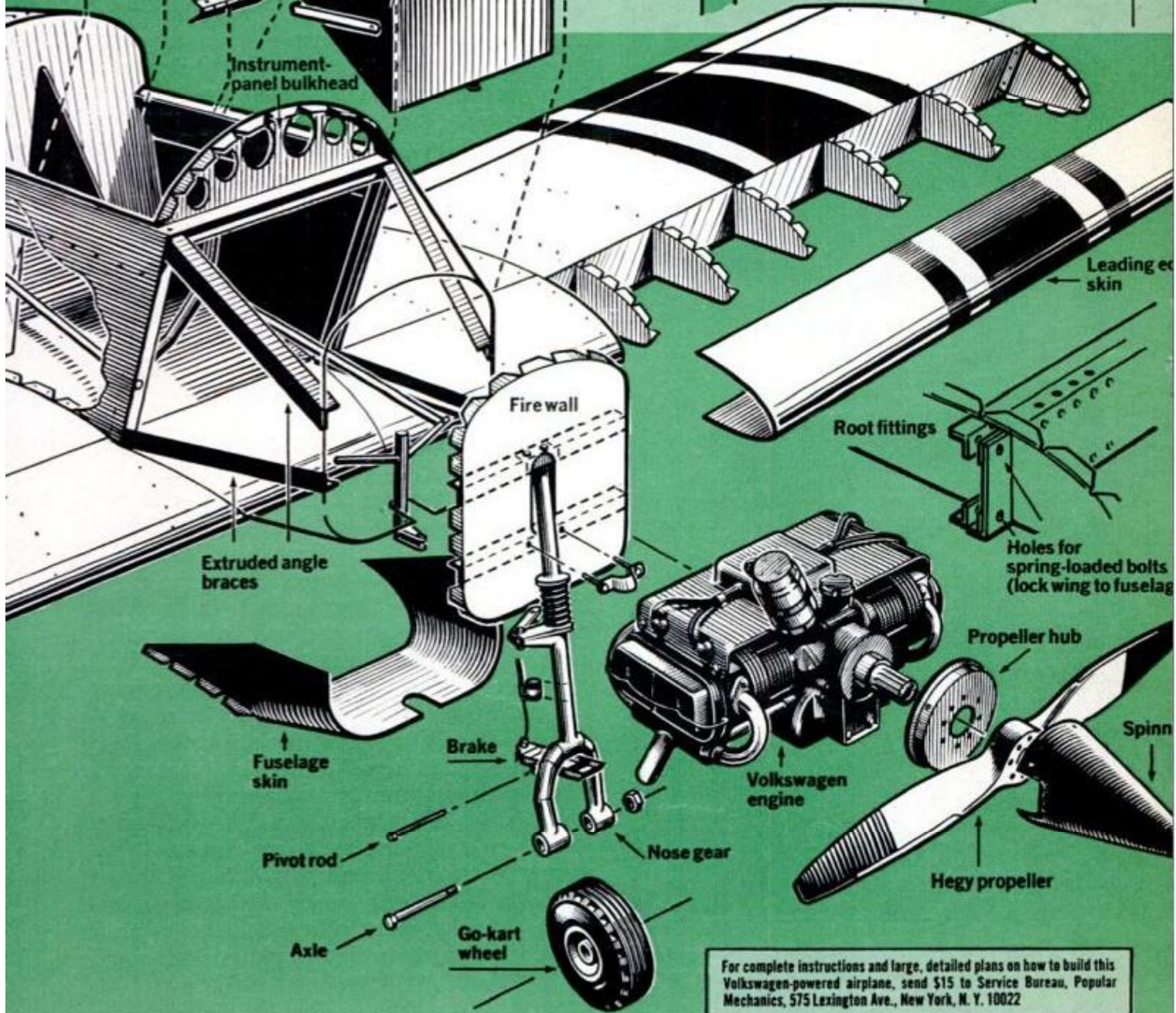
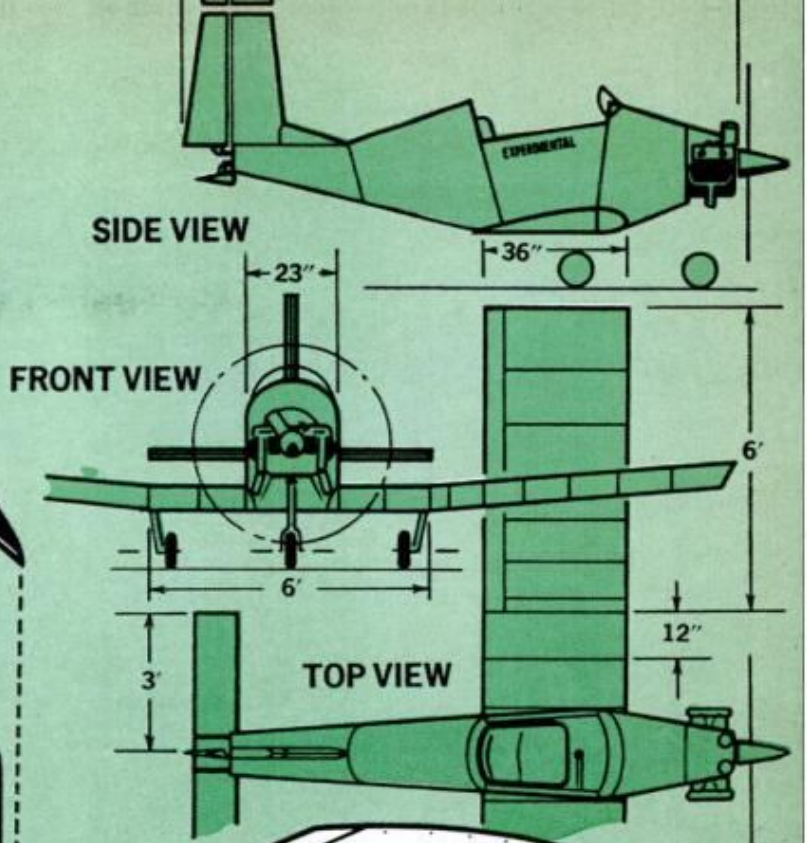
(Text continues on page 124)



VOLKSWAGEN ENGINE was key around which plane was designed. Tricycle gear uses three go-kart wheels

'JEANIE'S TEENIE'





For complete instructions and large, detailed plans on how to build this Volkswagen-powered airplane, send \$15 to Service Bureau, Popular Mechanics, 575 Lexington Ave., New York, N. Y. 10022



JEANIE'S TEENIE has removable wings which can be stowed in station wagon while the plane is towed



SIMPLE COCKPIT layout has basic instruments, off-set stick, rudder bar and push rods to controls



LEWIS LONG, original test pilot, tilts Teenie up with one hand in a demonstration of its light weight

knows, can be both a blessing and a curse. An all-metal airplane, theoretically, should last forever, while a wood-and-fabric job has a limited lifespan unless it receives exceptional care. However, metalworking is not everyone's cup of tea. Complicated equipment and expensive tools are usually necessary, plus some experience in learning to live with the idiosyncrasies of metal. Parker solved most of these problems by designing his plane around metals that can be easily purchased as stock items in any metal-products shop, and also can be cut and shaped with tools as simple as a plastic-headed hammer and tin snips.

Most of the fuselage and wings, including the spars and bulkheads, for instance, are built from standard 2024-T3 aluminum sheets, .020 and .040 inches thick. (The thicknesses, incidentally, are double what Parker and his friends figured out years ago as the minimum safe strengths for an airplane.) The one-piece push rods for the control surfaces—one of Parker's major innovations, eliminating pulleys and cables—and various extrusions for strengthening and mating some of the parts are also stock items.

A minimum amount of advanced workmanship is required. The landing gear and rudder bar, for instance, need some welding, and the propeller hub needs machining, but these, Parker says, can be farmed out at minimum expense to a local metalworking shop. For the rest, Parker demonstrated how most of the parts were formed.

"You don't need a jig or brake," he said, sliding a sheet of aluminum between 2 by 4s and tightening them with C-clamps.

About an inch-wide strip protruded, and he began hitting it softly with a plastic hammer. "I just start at one end and go down the line. If you hit it too hard, it will crack or rip, so you have to go over it easy about three times to bend it safely."

Larger bends, such as the leading edges of the wings or tail-assembly pieces, are made simply by laying the pieces on the floor, clamping wood boards to the center, bending them over and standing on them. The wing ribs take special treatment. Cuts are made in the edges because the bends will be made around a curve. A template is made from plywood to form the ribs; then the remainder of the plywood, which mates with the template exactly, is

(Please turn to page 176)



Tower on wheels directs Australian Navy fliers

Described by the Royal Australian Navy as a "runway control van," this Volkswagen station wagon has a plastic bubble top and swivel seats to give air traffic control officers a clear view in all directions. Here the mobile "tower" is operating at Nowra Naval Air Station.



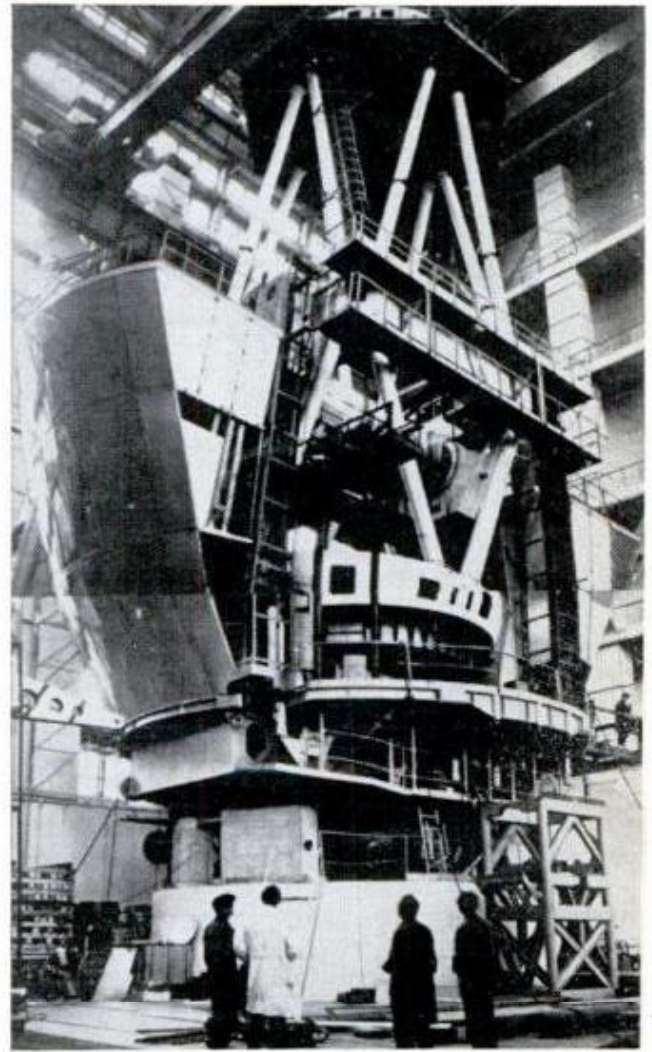
Soviet students' 'dream car'

Sliding doors are featured on the 75-mph "dream car" developed by students at an institute of technical esthetics in Moscow.



Antarctic prowler

Four scientists can live in comfort in this giant snow car, developed by Komatsu Co. for the Japanese Antarctic Investigating Team.

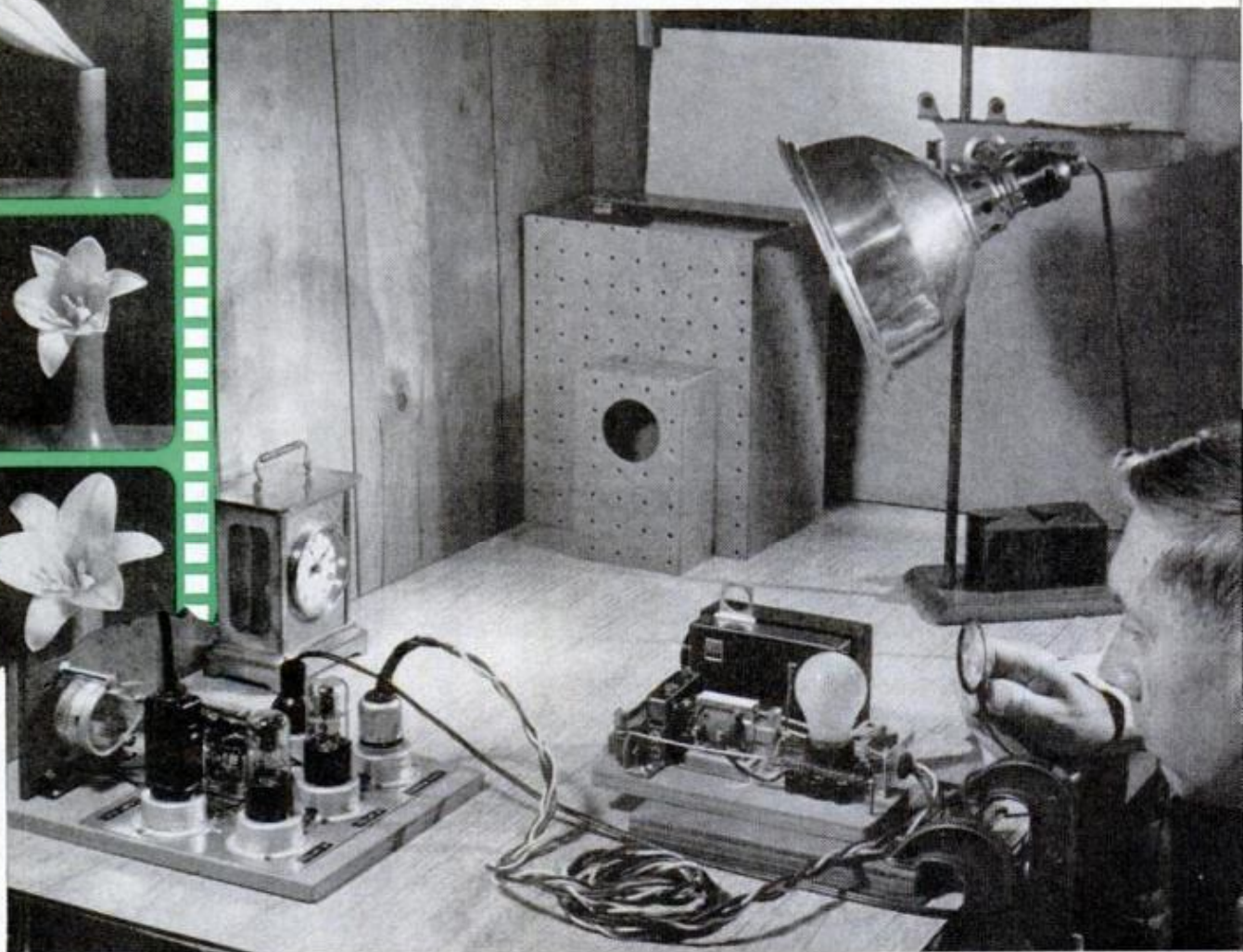
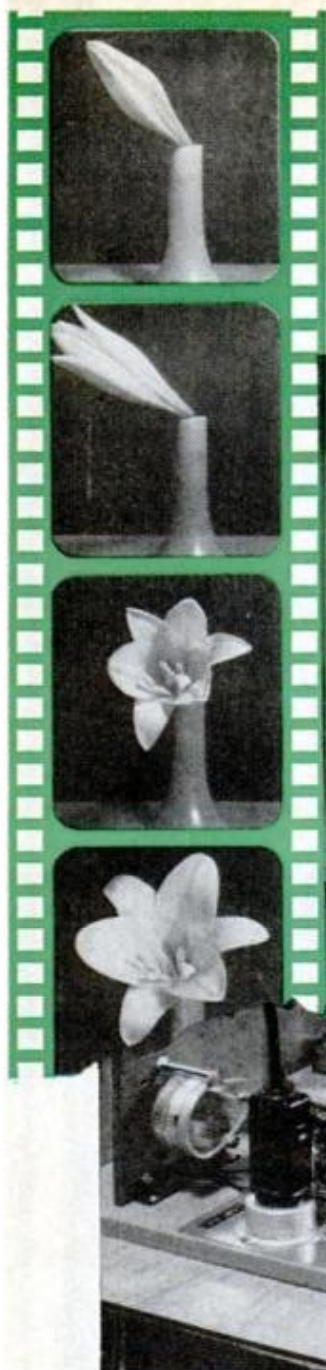


World's largest telescope

Russian astronomers will soon peer into space through the world's largest telescope. Its mirror is almost 20 feet in diameter.

BUILD THIS TIME-LAPSE

This automatic timer trips your hours or days into exciting action



SIMPLE TEST SETUP shows timing unit at left and camera tripper at right. Camera photographs hands of clock every few minutes, making it easy to check accuracy of exposure intervals. Here, a magnifier is used to inspect footage counter to see how fast film is moving through the camera. In background are protective covers made of perforated hardboard, removed to show the parts clearly

By **WALTER E. BURTON** and **JAMES R. OSWALD**

A FLOWER BUD bursts into full bloom right before your eyes. A bunch of cherries turns from unripe green to a luscious red in the space of a few seconds. A snowman melts humorously into the ground and is gone. The sun races madly across the sky and disappears over the horizon, turning day into night in the wink of an eye. These are some of the magic effects you can get with time-lapse movies.

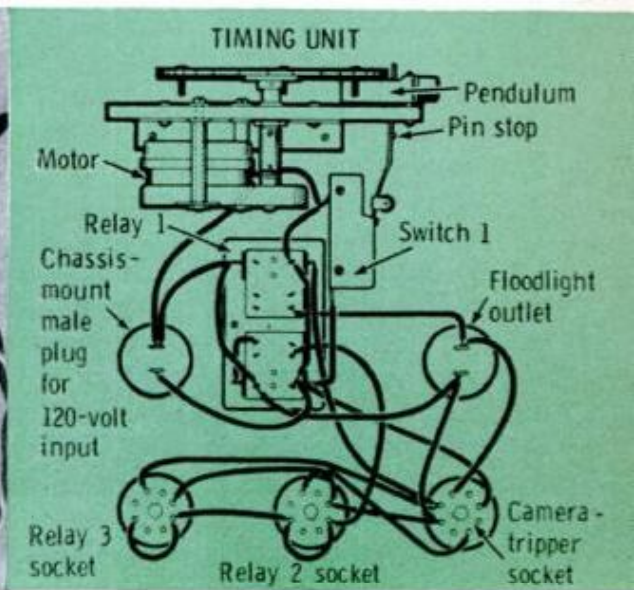
The technique is the opposite of slow-motion movies. What you do is make short exposures at predetermined inter-

vals of an action that takes place over several hours, days or even weeks. Each exposure, usually only a single frame at a time, records the action at a slightly different stage. When the film is developed and run through a projector, the action is speeded up so the entire sequence appears to take place in a minute or two.

Most time-lapse controls are designed for use only with expensive movie cameras that have provision for exposing one frame at a time. The control described here, however, can be used with any movie camera. It's shown in use with Ko-

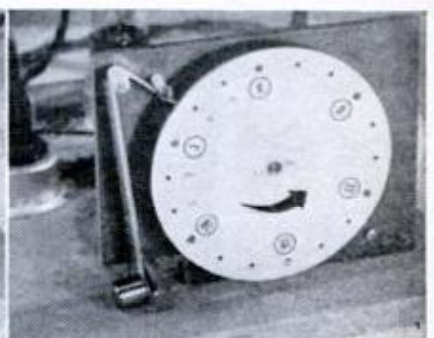
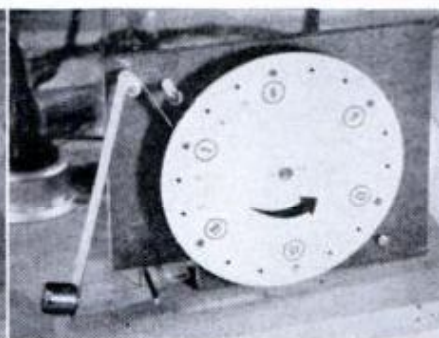
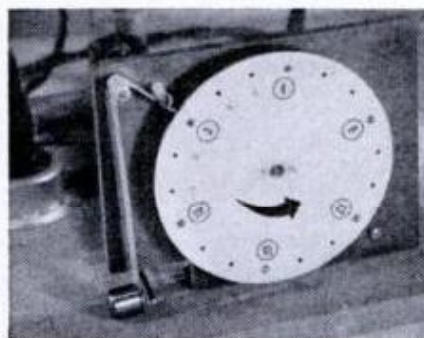
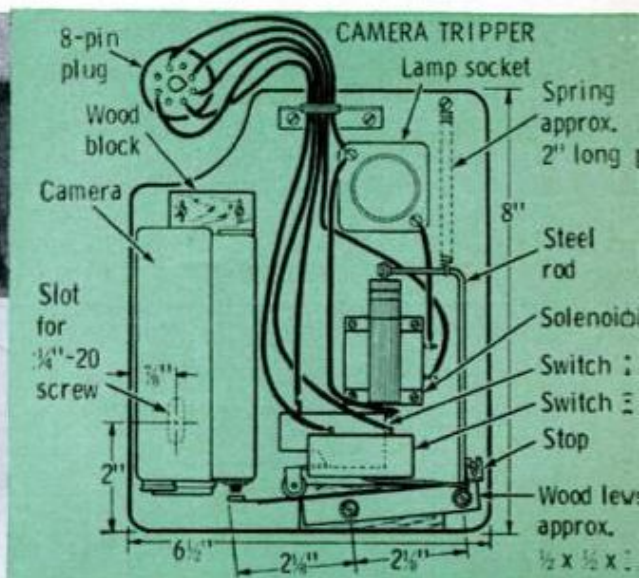
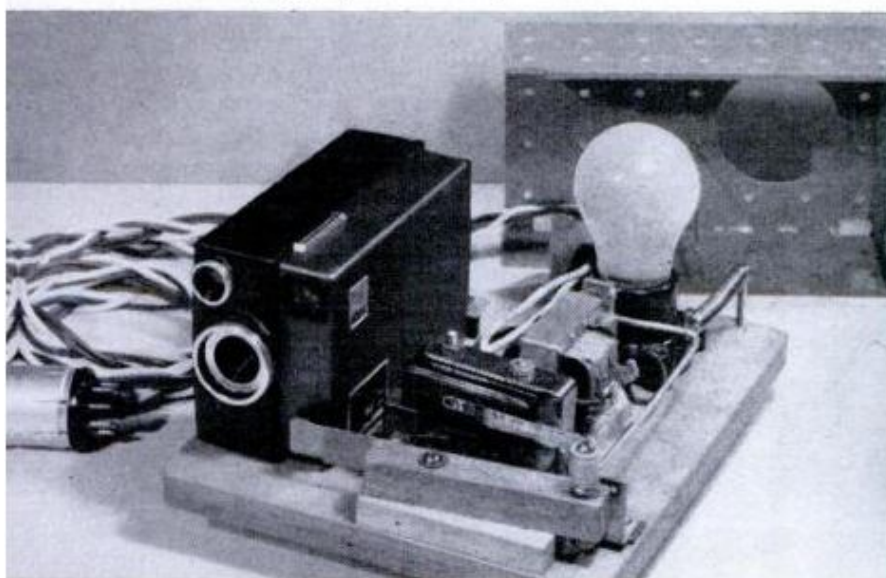
CONTROL FOR YOUR MOVIE CAMERA

camera shutter every few seconds to compress sequences—and you don't even have to be there



TWO BASIC PARTS of the control are the timing unit above and the camera tripper unit below. Timing unit contains timing disc, motor, relays and a receptacle for plugging in a floodlight. Devices at left that

look like radio tubes are thermal-delay relays. Tripper unit houses the camera and the solenoid that actuates the shutter release. Light bulb is used as a resistance to adjust the solenoid's force



AS TIMING DISC TURNS, each pin flips the pendulum outward (center), then lets it fall (right). This trips a switch to make the exposure. Circled numbers indicate 6 pins spaced around rim 2 1/2 minutes apart

dak's inexpensive Instamatic M-14 Super-8 camera, but can be easily adapted to your particular model. It can also be used with a still camera to provide dramatic stop-action shots of things in motion. There's even an automatic floodlight switch so you can take pictures indoors and at night as well as in daylight.

Basically, the control consists of a timing disc turned by a slow-speed motor and a solenoid to trip the shutter for you at the right instant. Pins around the rim of the timing disc determine how often the exposures are made. As each pin passes a certain point, it trips a tiny pendulum that in turn closes a snap-action switch to start the cycle. The floodlight comes on, then a few seconds later the solenoid fires, tripping the shutter to make the exposure. A fraction of a second after that the floodlight goes out and the control turns itself off. The cycle is repeated every time a pin on the timing disc strikes the pendulum.

For convenience, the control is divided into two units. One, the timing unit, houses the motor, timing disc and several relays. The other unit, the camera tripper, holds the camera and the solenoid that triggers the shutter release. The two units are connected by a five-wire cable;

(Please turn to page 190)

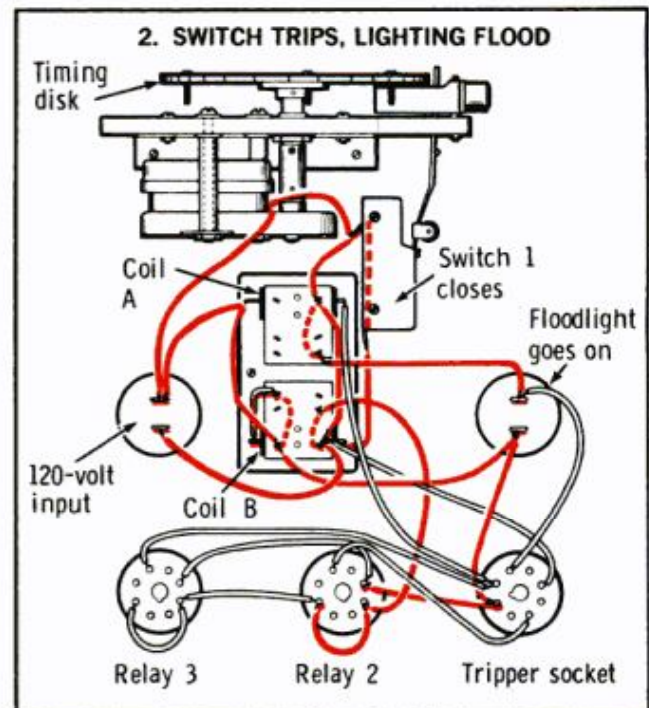
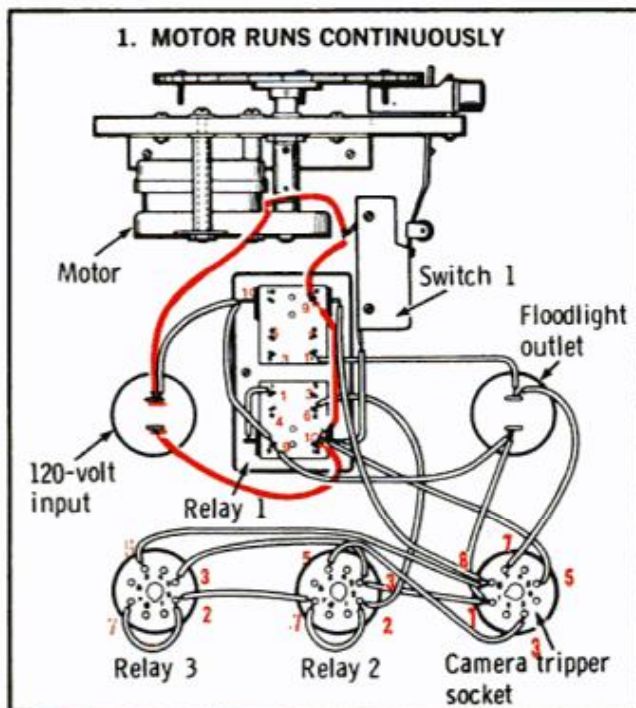
HOW THE CONTROL WORKS: Colored lines in the diagrams below show which parts of the circuit are actuated at different times during the sequence. Stage 1 indicates the basic motor circuit, which functions continuously to keep the timing disc turning. When the disc trips the pendulum, Switch 1

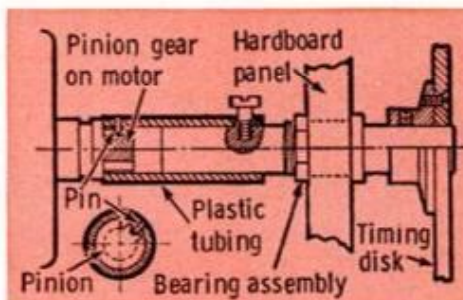
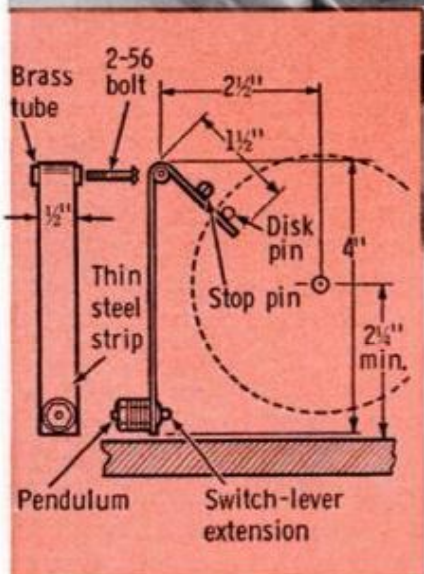
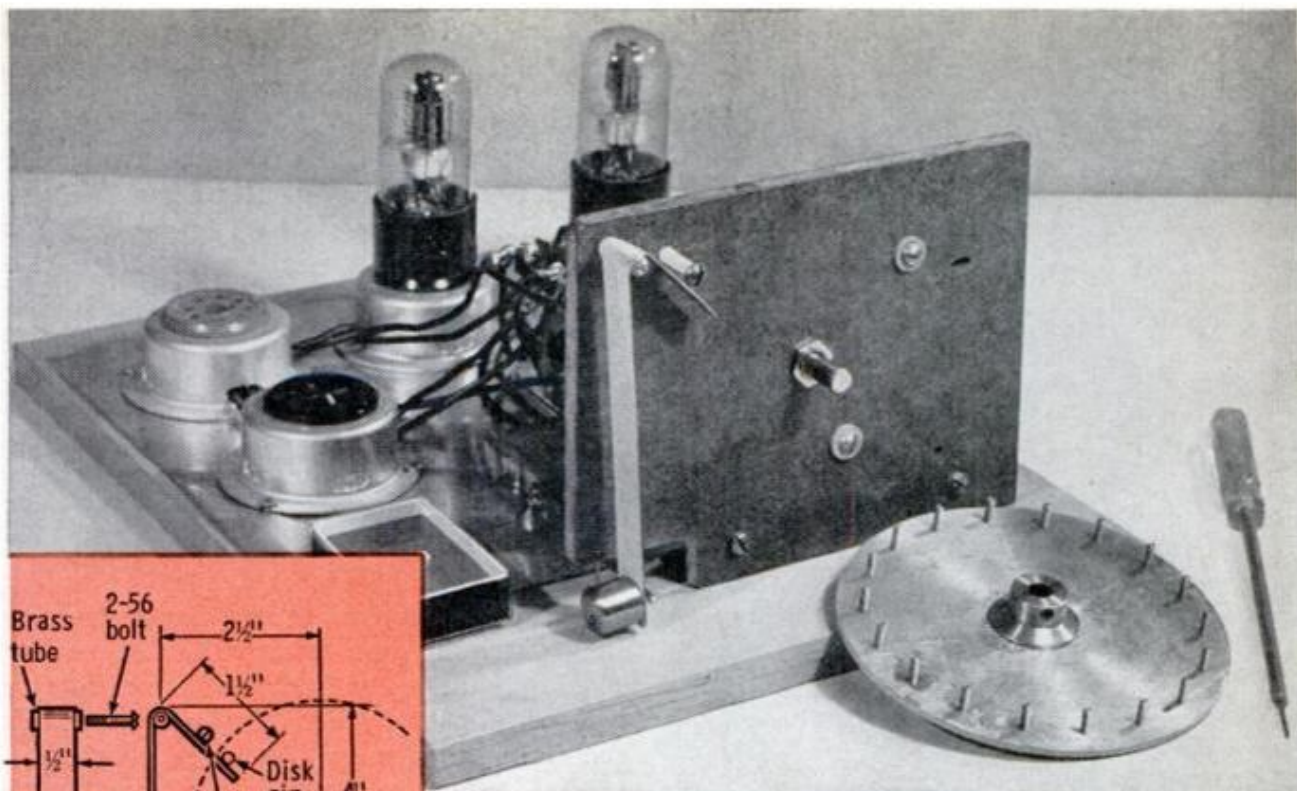
PARTS LIST

- Relay 1**—Potter & Brumfield 115-v. latching relay type KB17AG (Lafayette 30C8649)
- Relay 2**—Amperite 5-second thermal-delay relay type 115N05 (Lafayette 30C1301C)
- Relay 3**—Amperite 10-second thermal-delay relay type 115N010 (Lafayette 30C1301C)
- Motor**—Intermatic 1/15-rpm timing motor type W160 (Lafayette 13C2724)
- Solenoid**—115-v. Olson SW-336
- Switches 1 and 2**—Unimax snap-action type 2HBA82-1-Y, 20 amps. at 125 v., normally open (Olson SW-370)
- Switch 3**—Same as switches 1 and 2 but normally closed (Olson SW-370)
- Octal sockets** (for relays and camera-tripper plug)—Amphenol tube sockets type 78S8 (Allied 47A0058)
- 8-pin plug**—Type 8PB (Allied 47A0846); metal shield for plug type 16-F (Allied 47A0848)
- Chassis-mount power plug**—Amphenol 2-prong a.c. plug type 61-M (Allied 47A0675)
- Floodlight outlet**—Amphenol a.c. receptacle type 61-F (Allied 47A0677)
- Socket shells**—Type 23-IS (Allied 47A0127)
- Panel bearing**—Smith panel bearing assembly (Allied 47A4094)

(Addresses for mail-order supply houses mentioned above are as follows: Allied Radio, 100 N. Western Ave., Chicago, Ill. 60680; Lafayette Radio, 111 Jericho Turnpike, Syosset, L.I., N.Y. 11791; Olsen Electronics, 260 S. Forge St., Akron, Ohio 44308.)

closes, energizing Coil B of Relay 1. This turns on the floodlight and at the same time sends current to five-second thermal-delay Relay 2 (Stage 2). After a few seconds, Relay 2 closes, sending current to the camera-tripper solenoid. In Stage 3, the solenoid fires, actuating the shutter release

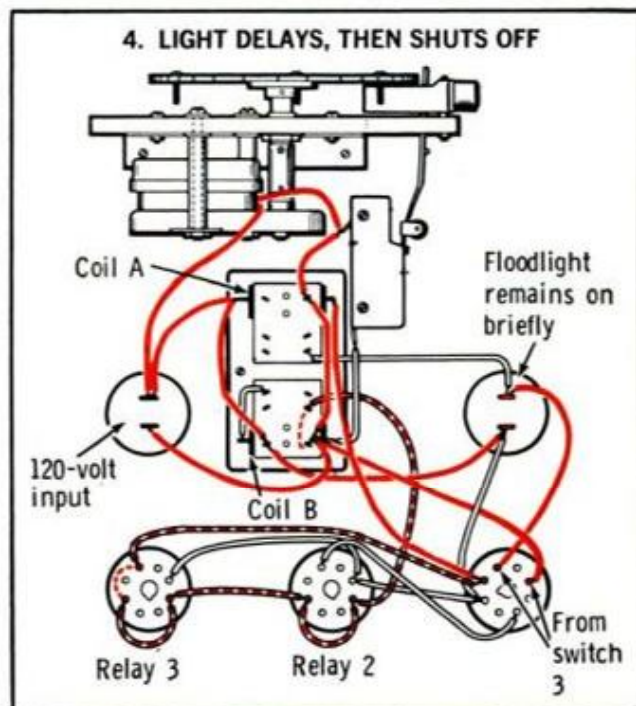
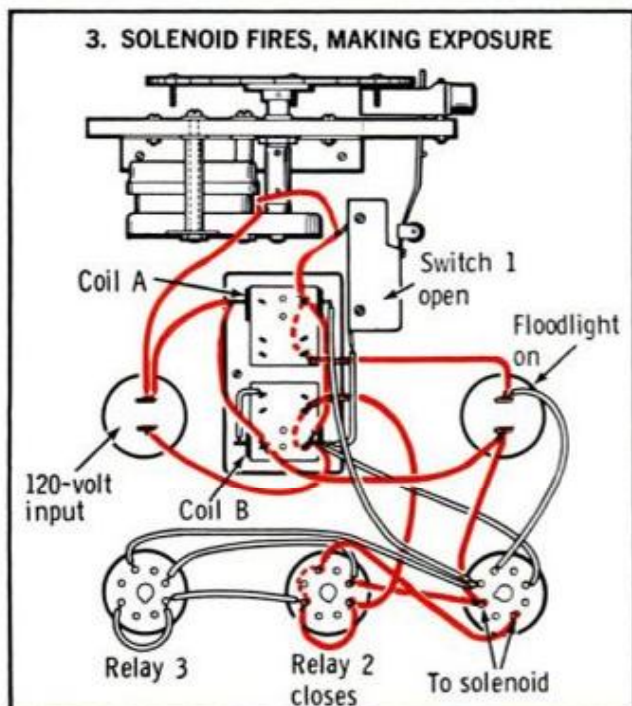




TIMING UNIT with disc removed shows arrangement of pendulum. Stop bolt at top keeps pendulum from striking switch too hard. Back side of disc shows how pins protrude to trip pendulum as disc rotates. Drawing at near left suggests one way to connect motor to the disc

to make the exposure. As the shutter button is pressed, Switch 2 is closed by the shutter-release lever, actuating Coil A of Relay 1. This cuts off power and returns the relay to its original state. The floodlight continues to burn for a fraction of a second, however, being fed current through Switch 3

on the tripper unit until the shutter-release lever returns to its full at-rest position (Stage 4). Relay 3 functions as a safety feature. Should Switch 2 fail to actuate Coil A, this 10-second thermal-delay relay will do so after a short wait, thus insuring the return of the main relay to the off position



WISHING-WELL BARBECUE



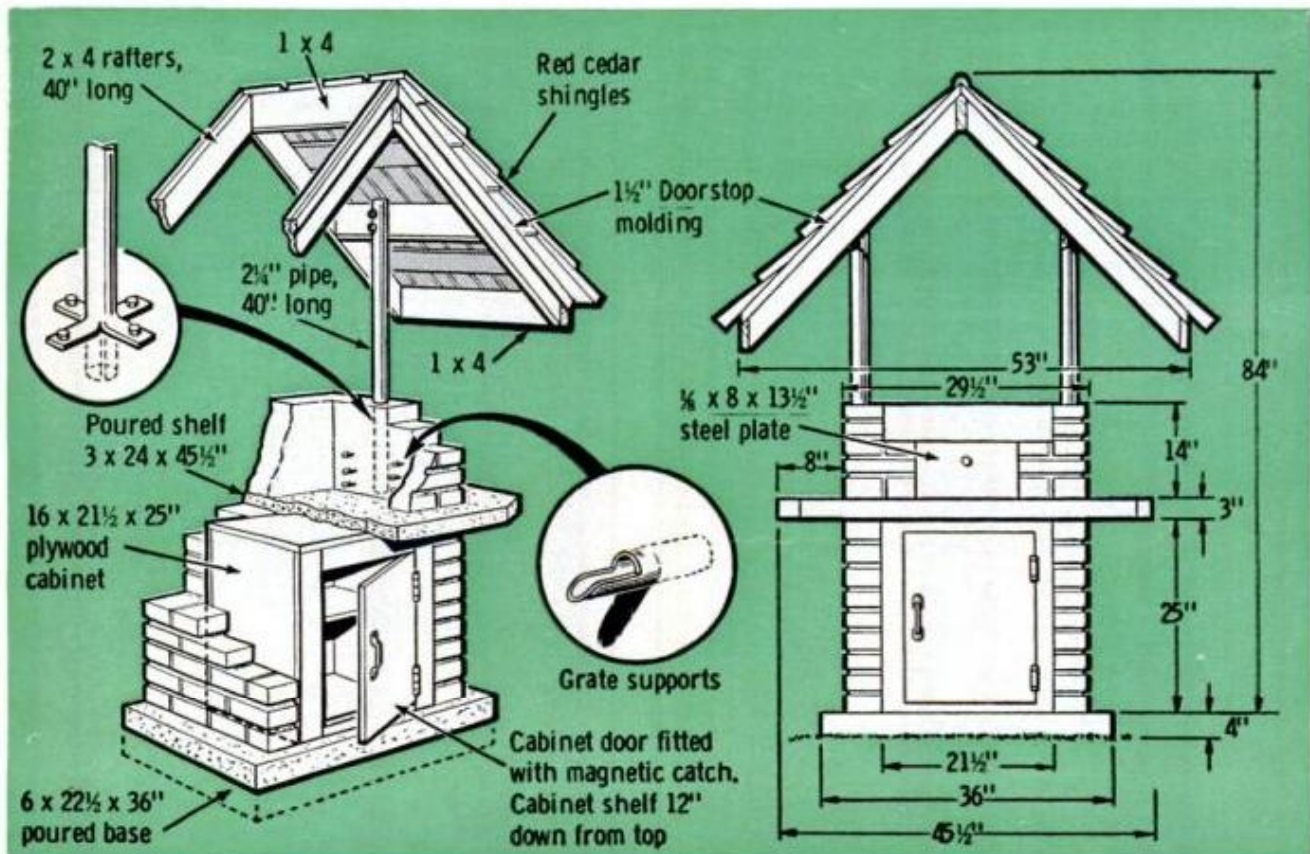
AN ATTRACTIVE ADDITION to any patio, this quaint brick barbecue features high sides for shelter from the wind and a wide, shingled roof to protect your fire from sudden summer showers. The spacious counter will hold all your chef's gear. That roomy cabinet below is perfect for storing charcoal and hickory chips.

The cabinet acts as a male form for the bottom part of the barbecue. Position it on the slab with plenty of weight on top to keep it from moving, then begin laying bricks around it. Use strips of wire mesh to tie the brick sides to the box by bending the strips 90° so they can be set in the mortar and screwed to the cabinet.

You'll have to build a form for the poured counter and firebox base. Use coathanger wire to reinforce the slab.

To build the firebox, first anchor the two roof-supporting pipes to the slab. These must be located in the middle of the side walls. Once you've laid the brick, fill spaces around the pipes with mortar and face the exposed seam with pieces of brick. The 1-in. concrete liner for the firebox is cast by building a wood form to fit inside and drilling holes in it for the grate supports, then pouring the concrete.

—John A. McKee



How to Build A Picnic Table

Technical Art by Don Evans

PLENTY OF ELBOW ROOM and attached benches are two of the most obvious advantages offered by the two king-sized redwood tables shown here and detailed on the following pages.

The hexagon design can be framed with 1½-in. tubing, 1-in. standard pipe or 1¼-in. square tubing. If you don't have access to bending equipment, use square tubing and cut V-notches at the bending points, then bend and weld each joint.

The octagon model is a simple, straightforward carpentry project with no metalworking involved.



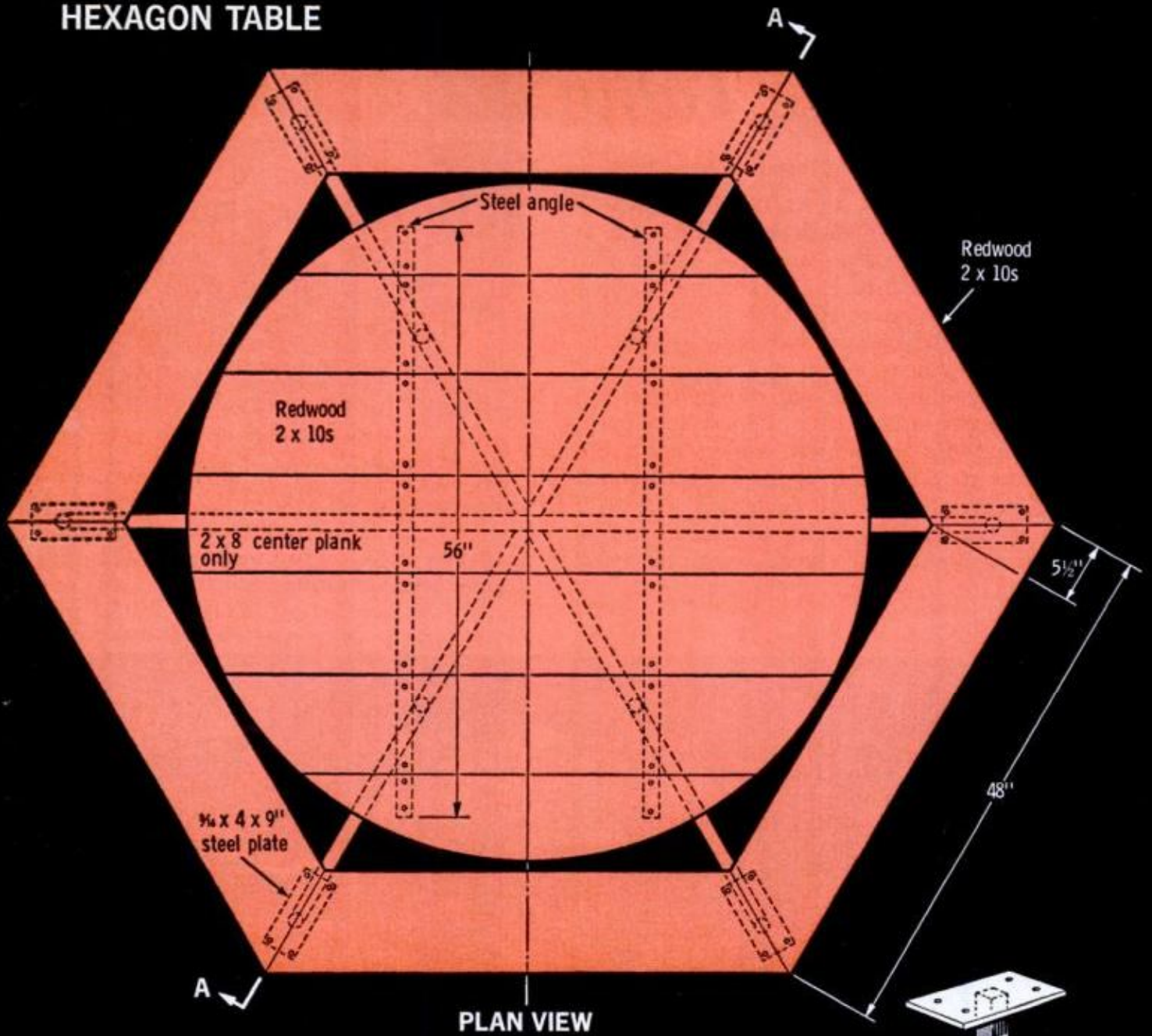
OCTAGON TABLE BY JOHN R. IAMONACO

Since redwood has its own natural preservative, the only finishing required is a thorough sanding and a coat of redwood stain to ensure uniform color. Finish other woods with exterior enamel.

HEXAGON TABLE BY ALBERT KONDAK



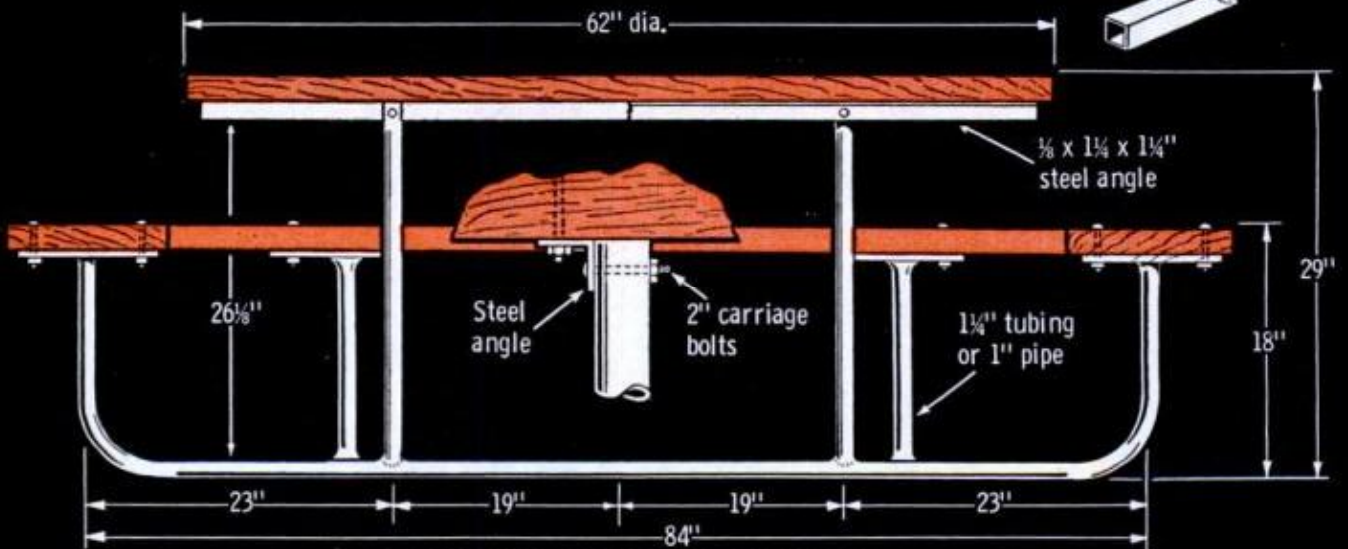
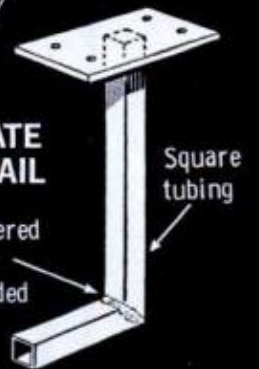
HEXAGON TABLE



CUT FOLD TAPE

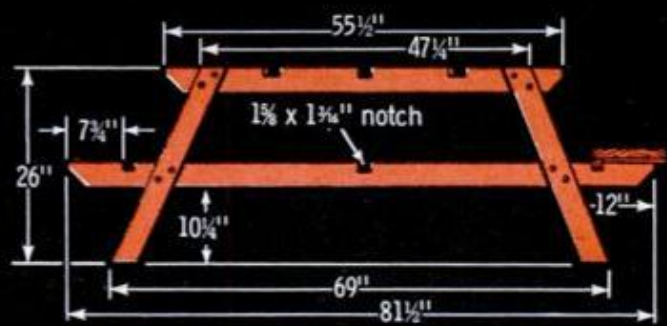
PICNIC TABLES

ALTERNATE LEG DETAIL



SECTIONAL VIEW THROUGH A-A

OCTAGON TABLE



$\frac{3}{8}$ x 5 1/2" carriage bolts, washers and nuts, 4 reqd.

2 x 8 table top 54" long

2 x 3 top cleat 48" long, 2 reqd.

$\frac{3}{8}$ x 4 1/2" carriage bolts, washers and nuts, 16 reqd.

3" - # 16 R. H. wood screws 28 reqd.

2 x 10 seat planks 32" long, 8 reqd.

$\frac{1}{2}$ x 8 x 8" plywood, 4 reqd.

2 x 3 seat support 40" long, 4 reqd.

2 x 4 seat rail 81 1/2" long, 4 reqd.

2 x 4 top rail 55 1/2" long, 2 reqd.

1 1/2" - # 14 R. H. wood screws, 80 reqd.

$\frac{3}{8}$ x 4 1/2" carriage bolts, 4 reqd.

$\frac{1}{2}$ x 6 1/2 x 8" plywood 4 reqd.

2 x 4 legs 30" long, 4 reqd.

$\frac{3}{8}$ x 4" bolts, washers and nuts, 16 reqd.

LEG ANGLE

22 1/2°



SATURDAY MECHANIC

HOW TO SERVICE Front Wheel Bearings

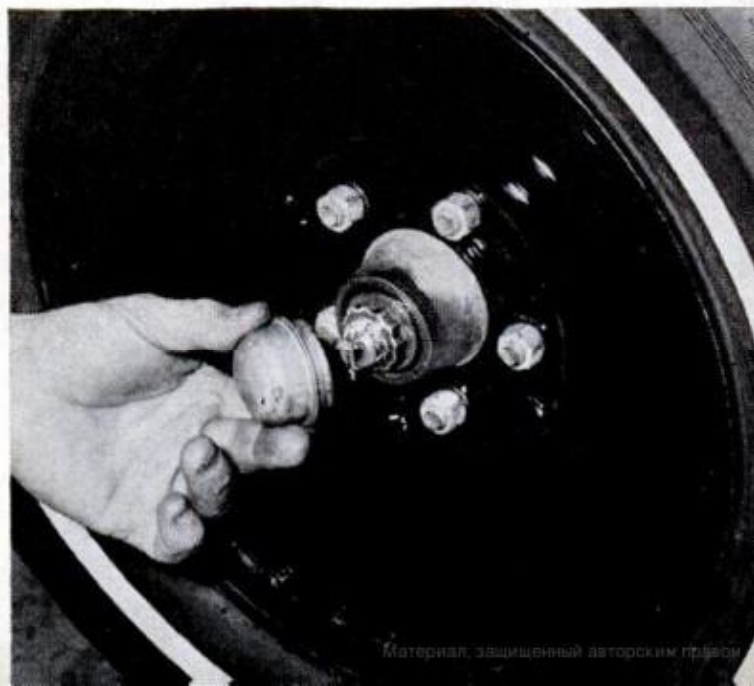
By MORT SCHULTZ

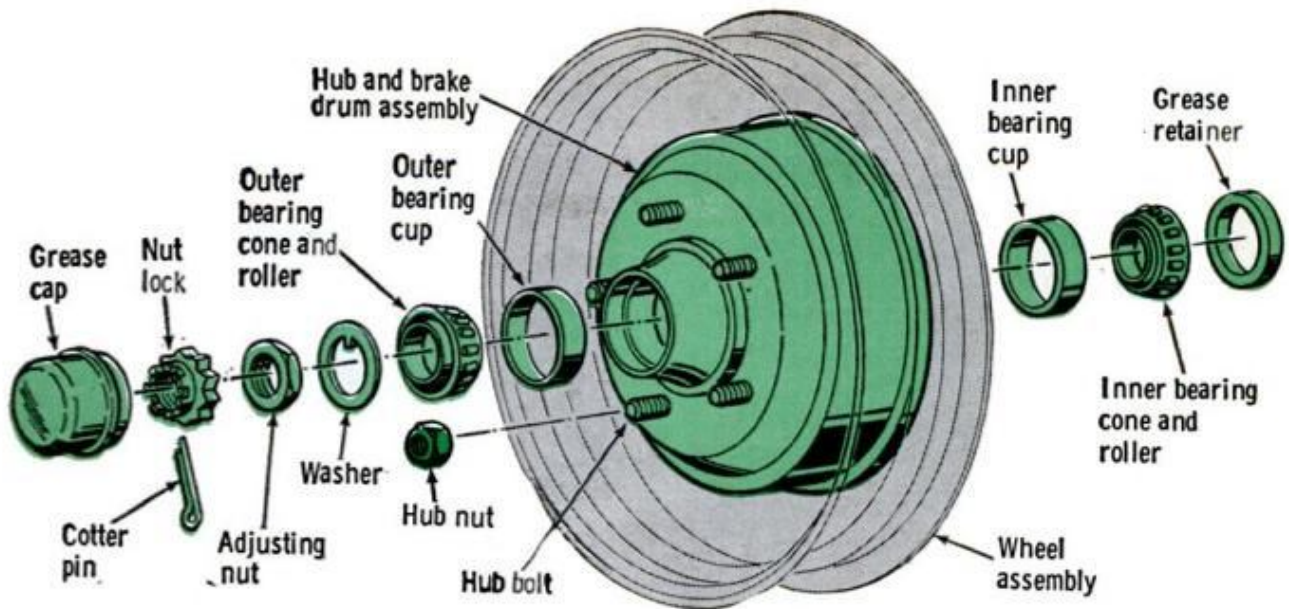
IN WASHINGTON, D.C., an automotive industry official outlines new crash safety proposals for a panel of senators. At the same time, in Detroit, a group of engineers studies the effects of a 40-mph barrier crash on man-size mannequins.

Meanwhile, somewhere in the United States a Saturday Mechanic is pulling the front wheels off his car to lubricate and adjust the wheel bearings.

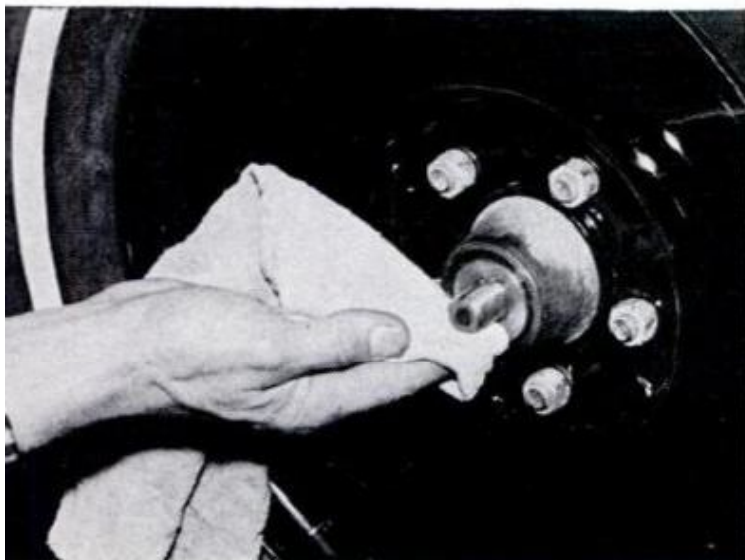
How did *he* get into the act? By trying to *prevent* an accident instead of betting his life on safety equipment that may or may not save it—that's how. He knows that if wheel bearings go bad his car can dart from side to side, steering could have

REASSEMBLING FRONT-WHEEL ASSEMBLY (above) requires torquing lock-adjust nut to spec while spinning wheel by hand. Proper torquing prevents too loose or overstressed bearings. With wheel cover off (below), grease cap can be removed to start the job





WHEEL BEARING ASSEMBLY, removed from spindle, is shown in exploded view at top. Photo above shows lock-adjust nut being removed, revealing thrust washer which guards outer bearing. Clean the spindle thoroughly, as shown below, before popping bearing



too much play or be jerky, the car could pull to one side, or even lose a wheel.

A comparison of 1964 and 1965 service manuals with those prepared for 1967 and 1968 models shows most manufacturers now give major emphasis to wheel-bearing service. In 1965, for instance, Chrysler recommended lubrication and adjustment of bearings every 20,000 miles. That interval was reduced to 12,000 miles in 1967.

General Motors follows a similar pattern in emphasizing more frequent service: "The proper adjustment of front-wheel bearings is one of the important service operations that have a definite bearing on safety."

The job is really a snap. I do it every 12,000 miles. If you don't have time, let a mechanic do it. The charge is about \$5.

If you want to tackle this simple maintenance service yourself, a torque wrench will be needed. Many Saturday Mechanics own one anyway. About the only out-of-the-ordinary tool required is a grease retainer seater of the proper diameter for your car, which costs approximately \$6.

Each front wheel has two bearings—an outer and inner. Each rotates inside a cup that is pressed into the hub. If a bearing or its respective cup is damaged, replace *both* parts. Bearings, cups and whatever else you need can be purchased in the parts department of a dealer selling your make of car or from an automotive-parts store. Make sure to get the parts for your year and model vehicle.

To start wheel-bearing service, jack up the front of the car. Be sure to block the

back wheels. Pry off the wheel cover. Now loosen the grease cap by tapping it with a hammer and pry it off by hand or with a screwdriver. This reveals a castellated nut, which is locked to the spindle by a cotter pin.

Remove the cotter pin and throw it away. *Always* replace the cotter pin after you tamper with it. The castellated nut will come off by hand. Beneath it is a lock-adjust nut which is removed next. Now, with a *clean* lint-free rag, carefully wipe all dirt and grease from the spindle.

Grasp the wheel assembly, pull it toward you an inch or so, then push it back. A thrust washer and the outer wheel bearing will fall onto the spindle. Take the bearing off and place it on a clean sheet of paper or a clean cloth.

Remove the wheel and lay it on a clean cloth face up. Set a brass drift, or other flat-faced driving tool, on the inner race of the inner bearing and gently tap around the circumference until the bearing drops out. The grease retainer will fall out, too. Discard it.

Aim a light inside the hub and inspect the cups. If either is pitted, nicked or scarred, knock it out with a drift. To install a new cup, tap it into place with a drift. Remember to replace its bearing with a new one, too.

Inspect each bearing by smelling the grease. If it has an acrid odor or looks black, the bearing's been running hot and is probably damaged. You'll be able to tell better after it is cleaned.

Cleaning and inspection

Fill a clean container with kerosene or bearing-cleaning solvent. Wash each bearing thoroughly, working solvent between needles with a soft, clean brush. After washing each part, lay it on a clean sheet of paper or on a clean lint-free rag.

There's a right and a wrong way to handle a bearing. Don't wrap your hand around the needles. Dirt and perspiration can attack machined surfaces. Handle the bearing by its race only.

If compressed air is available, dry each bearing with short spurts. If no air is around, leave parts on the paper to dry by themselves.

When bearings have dried, dip them into a bucket of clean, lightweight motor oil to give them protection during the meticulous inspection phase.

Carefully examine each bearing. Look



OUTER BEARING can be popped from its seat by pulling the wheel toward you and then pushing it back

for cracks, pits or other physical damage. If any are found, discard the part. Make sure the bearings aren't rusted or blackened. Blackening indicates that they've been running hot. A slight blue or straw color is nothing to worry about. That's often due to chemical reaction to grease.

Slowly spin the bearing. If it binds or feels scratchy, grit has worked between the needles. Replace the bearing.

Greasing procedure

You're now ready for the lubrication. Even brand-new bearings need an application of grease, although they are coated at the factory. Use high-temperature wheel-bearing grease. Place a glob in your hand and work the bearing into it, making sure grease gets between the needles. Place the greased bearing back on clean paper and lubricate the other one.

Clean the inside of the hub with solvent, let it dry and apply a light coat of grease. Then place the inner bearing into the hub with finger pressure.

Take your new grease retainer and lay it over the inner bearing face. Put the grease retainer tool over it and give it a whack with a hammer. To make sure of a good fit, tap the grease retainer's edge with a brass drift.

Check the brake drum for grease that may have dropped on it accidentally. Be sure to clean grease off with a gasoline-dampened rag. Grease on drums will be transferred to brake linings and make brakes grab.

Clean the wheel spindle thoroughly. No need to use solvent unless grease is caked



INNER BEARING can be popped from the wheel hub by tapping it with a drift. Remove cups the same way



ALWAYS HANDLE BEARING by its race and don't skimp in working grease between bearing's needles



MAY 1968

on. Place the wheel assembly back on the spindle, making sure not to bang one against the other.

Slip the outer bearing into its cup in the wheel hub. Install the thrust washer and run up the lock-adjust nut. You now have to adjust the bearings. You'll need the wheel bearing adjustment specification for your particular car, which can be found in the manufacturer's service manual or in a book like *Motor's Auto Repair Manual*.

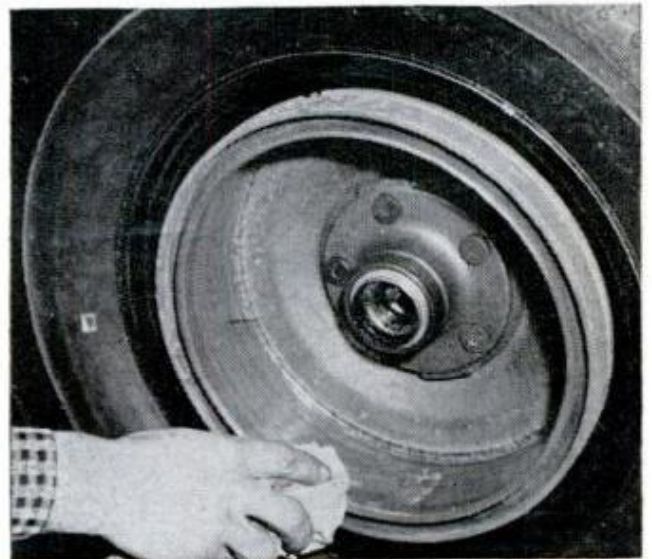
Adjustment is important, so do it right. If bearings remain loose, they can rattle themselves to death against the cups. If too tight, they will fail from excess stress.

Torque the lock-adjust nut to specification while spinning the wheel assembly by hand. After tightening, spin the wheel to make sure it revolves freely. If not, back the nut off and adjust again.

Put the castellated nut on the spindle. Now install a new cotter pin. Make sure the pin's legs are spread wide and are wrapped around. If legs are too long, snip them to make them smaller. Clean the inside of the grease cap and reinstall it to complete the job.

Your rear-wheel bearings need not be serviced, incidentally. They are constantly being lubricated by the rear end. Should a problem arise, though, a mechanic is needed unless you have special tools, such as pullers. Most Saturday Mechanics wouldn't want to buy them on the slim chance that rear bearings will fail. Experience shows they seldom do. ★ ★ ★

GREASE RETAINER SEATING TOOL (left) makes reassembly of front-wheel bearing assembly easy. One whack does it. Below: Always check brake drums for grease. If you clean them, use gasoline-dampened rag



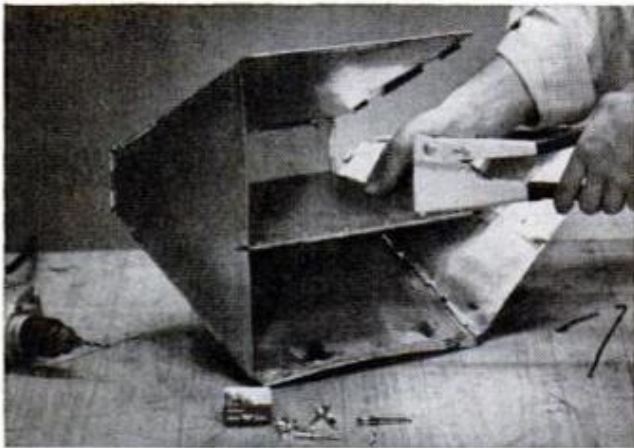
Four Weekend



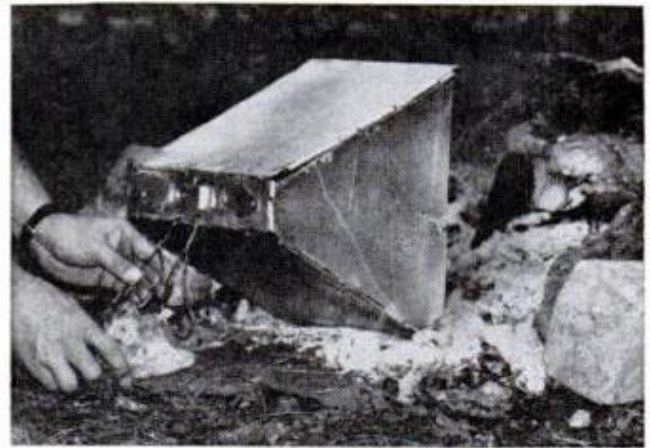
1. Aluminum reflector oven

Designed by the director of training for Philadelphia area Boy Scouts, this compact camp oven is easily disassembled for flat packing. The only materials required are two sheets of aluminum and some coathanger wire.

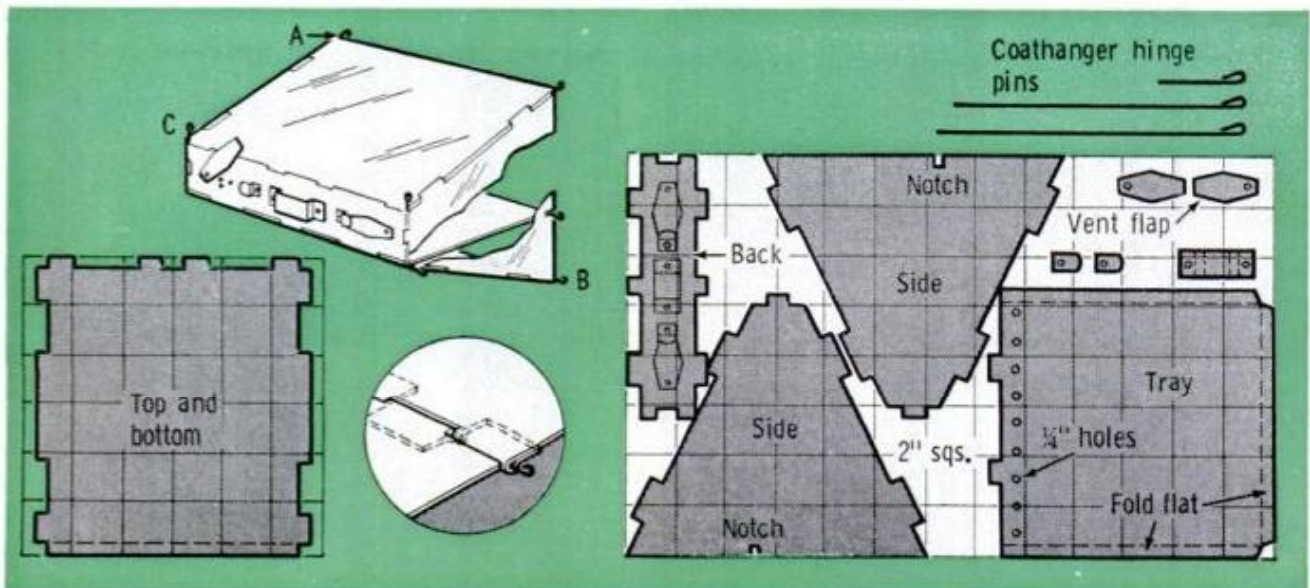
The oven is disassembled by pulling out the coathanger hinge pins labeled A, B and C in the drawing below. To form the channels for these pins, bend each flap around a 6d nail. Use Pop Rivets to fasten the flap over the stiffening wire at the front of the tray. The handle, vent flaps and flap brackets are also attached with rivets. The flaps can be swung up to uncover holes drilled in the back, thus allowing you to control heat distribution. When closed, they pivot under the brackets to prevent leaks.



AFTER BENDING flanges over a nail to shape them properly, use a Pop Rivet Tool to fasten them securely



REAR SUPPORT bent from coathanger wire and riveted to oven can be adjusted by propping it on a rock

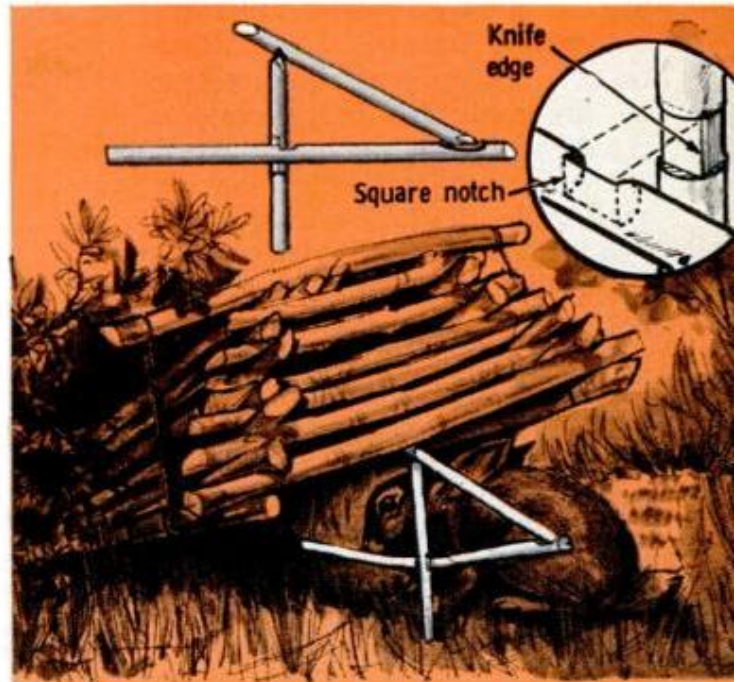


Projects for Campers

2. Small game trap

The only survival equipment you need to build this simple trap is a knife and a couple of pieces of cord—in a pinch, you could even use your boot laces. It's triggered by a "figure-four" series of levers with the horizontal arm extending back into the trap and the upright located just beyond the edge of the cage. Any movement on the trigger lever will cause the supporting arm to collapse and the trap to drop.

Cut green sticks and stack them in a pyramid, log-cabin style. Notch them where necessary to achieve a tight fit. To hold the trap together, bow a green branch across the top and use cord to tie the ends to bottom sticks on each side. Notch trigger sticks squarely and the trap is ready to set.—*Cloyd Sorensen Jr.*



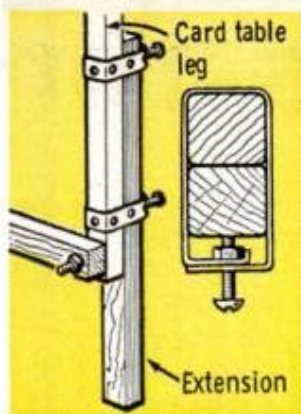
3. Leg extension for camp table

Most campsites are equipped with large picnic tables which provide plenty of space for serving meals, but there is seldom room to set up your cooking gear on the same table. It's easy to remedy this situation, though. All you need to do is an old card table.

Adding retractable leg extensions the same size as existing legs will make it possible to adjust the leg lengths so the table will sit level on uneven ground. Attach each extension with two loops of plumber's pipe strap, using a 1/4-in. roundhead bolt and nut to tighten each loop.

Incidentally, the cross brace shown at right was necessary only because this particular table had one leg which tended to collapse. However, it's a good tip to keep in mind in case you should run into a similar problem. The brace is removed for folding.

—Gene Handsaker



4. Auxiliary dome light for camp trailer

Powered by a 6-v. lantern battery, this extra lighting system for your camp trailer is particularly handy for brief road stops and during setup time before you've connected the regular gas or 110-v. system. Mount the battery in an overhead cabinet as close as practical to the place where you plan to install the lighting fixture. This will simplify routing the wiring.

Fasten a small cleat to the cabinet shelf to hold the battery in place. Next, cut a 2-in.-dia. hole in the ceiling, being careful not to penetrate the camper roof. Then connect the fixture to the battery with two strands of 18-ga. wire, using a stiff wire to feed them through the space between the ceiling and camper roof. Solder the connections to prevent shorts developing from road vibration.—Jack R. Peretti



PHOTO HINTS



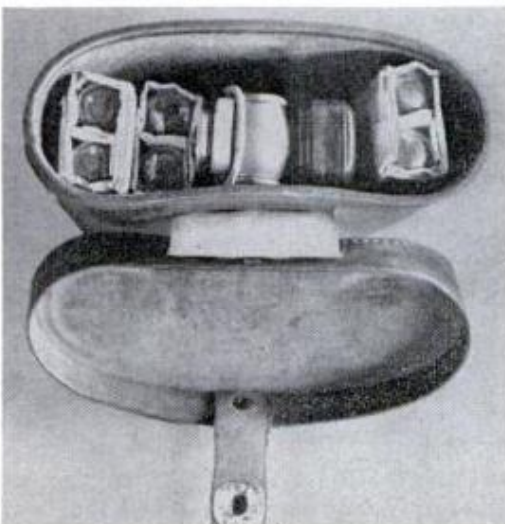
A DIME-STORE KEY CHAIN of the type that winds up can be a helpful photo aid. Clipped to your belt, it will hold a light meter where you can reach it easily (left and center). It will also keep a neck-slung camera from banging around as you lean over (right). To attach the chain, screw a $\frac{1}{4}$ -20 eyebolt into the camera's tripod socket and clip the key ring to it with an S-hook or snap fastener.—Don Anderson.

YOU'LL GET CLEANER PRINTS if you use this trick for removing small particles of dirt, rust and other debris that sneak into your washing water past the strainer. Using white plastic trays instead of the traditional black ones makes it easy to see specks of dirt swirling around in the water. The specks can be quickly sucked into a rubber bulb-type syringe (right). A battery-filler syringe is ideal for this and costs only about 60 cents at an auto-parts store.—Harry A. Tucker



A BINOCULAR CASE is just the right size to make a miniature gadget bag for a subminiature camera. It will hold a flashgun, a dozen midget flashbulbs and other extras—yet it is still small itself

WEAR YOUR LIGHT METER on your wrist and it will be as handy to use as a wristwatch. Most small meters are made to fit a standard accessory shoe, available at photo shops. Bend a strip of springy metal to suit your wrist and fasten the shoe to it. Glue padding on the inside for comfort.—Rod Moon



Wipe-on Plastic Coating



REGULAR BRASS POLISH won't stop tarnish for very long, but a coat of liquid plastic will



PLASTIC COATING SEALS pores in marble and other porous surfaces so stains can't enter



WHEN APPLIED TO FURNITURE, coating adds glass-hard seal which resists alcohol stains

POPULAR MECHANICS

Protects Finish for Months

Liquid-plastic polish hardens like glass to seal surface against stains, oxidation and corrosion

By WAYNE C. LECKEY, Home and Shop Editor

IF YOU'VE HAD YOUR FILL of scouring, waxing and polishing, there's a new product on the market that can keep stains, oxidation or corrosion from leaving their ugly mark on countless items in and around your home.

It's a liquid coating called Plexi-66 which cleans as it polishes and seals, and I found it does a great job.

While it's almost water-thin and goes on like any ordinary wipe-on liquid polish, it's not just another liquid wax. Actually it's more like liquid glass in that it consists of clear Lucite acrylic plastic reduced to liquid form. Once it's applied with a cloth and rubbed to a high gloss, it dries glass hard and literally seals the surface. Stains, tarnish and corrosion cannot reach and attack the finish.

Since it's not a wax or silicone and thus can't wash off through use or exposure to the weather, tests have shown that the coating provides protection up to a full year. It won't crack, peel or yellow, and all that's required to renew its original high luster is an occasional wipe with a damp cloth.

The polish comes in a three-can pack, each designed for different surface pro-

tection. One is formulated for furniture and wall paneling, another for porcelain, marble and tile and a third for brass, aluminum and stainless steel.

On what can it be used? Just about anything. Take aluminum storms for example. Oxidation soon pits the metal and dulls the finish. If you clean it up with steel wool and coat it with liquid plastic, it will stay bright and clean for months.

The abrasive action of scouring powder can destroy a porcelain finish in time. However, when it's sealed with liquid plastic, stains can't become embedded in the pores of porcelain or marble so there's no longer any need to use such a harsh cleaner.

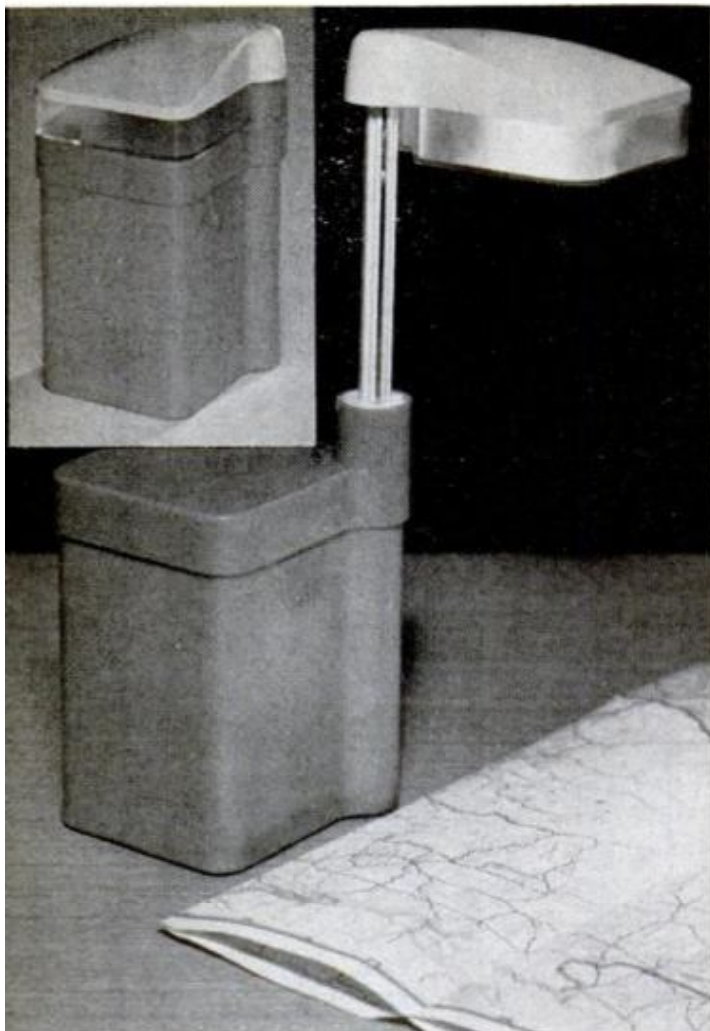
It's great for stopping tarnish on anything made of brass. It also keeps stainless steel free of finger marks and discolorations, and does a fine job of resisting water and alcohol stains on furniture. The painted finish on your mower and other yard equipment plus the kids' bikes and wagons, will be safe from oxidation, rust and corrosion if sealed with this plastic. A three-can pack, enough for 600 sq-ft., costs \$10 from Plasticon Chemicals, 47-38 Fifth St., Long Island City, N. Y. ★★

SEALING PORCELAIN sinks and tubs with the liquid plastic alleviates a need for harsh abrasive powders

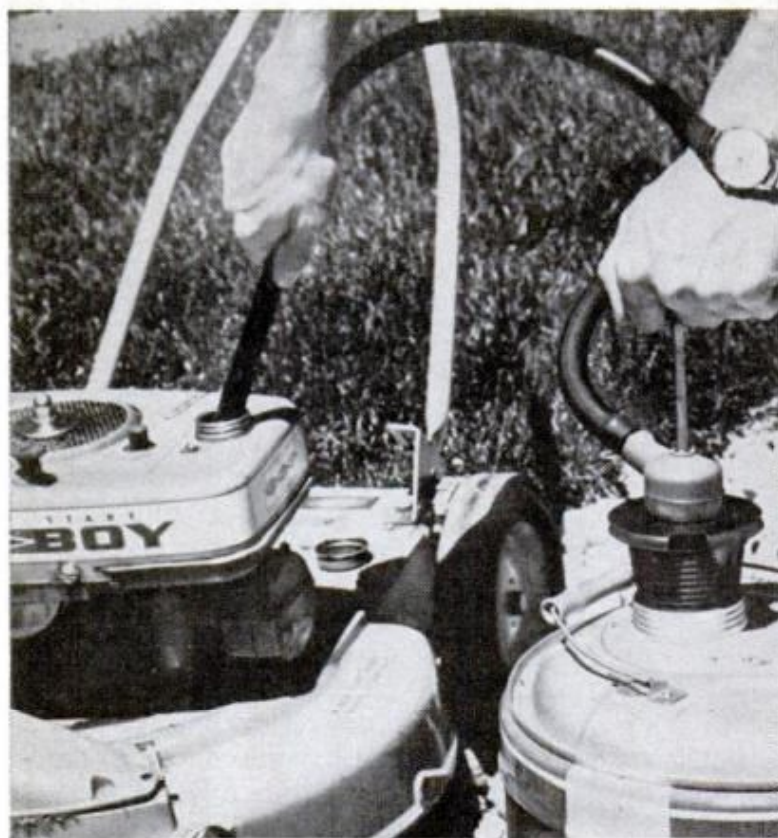


EXCITING NEW PRODUCTS

By CAROL SCHULTZ



CORDLESS LAMP by Eveready is turned on by lifting the shade, which can be rotated a full 360°. Ideal for the patio, while camping and as an emergency light. Sells for \$3.98. Union Carbide Corp., 270 Park Ave., New York.



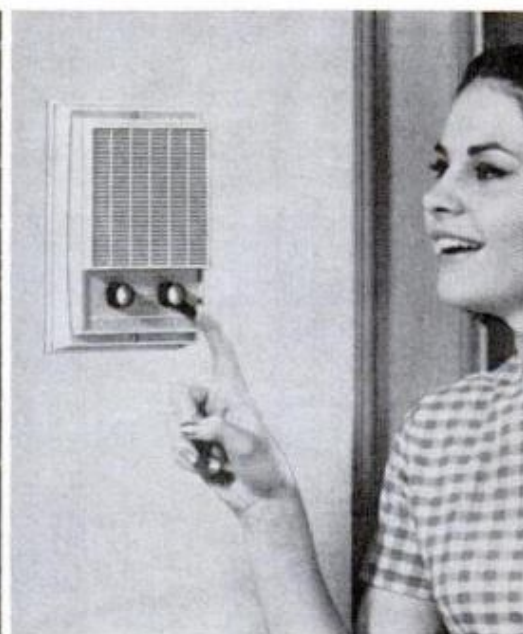
TRANSFER PUMP for fueling lawnmowers and other gas-powered yard equipment eliminates lifting heavy fuel cans, prevents dripping. "Supar Fuel-er" sells for \$9.50. Peters & Russell, Inc., 550 W. Liberty St., Springfield, Ohio.



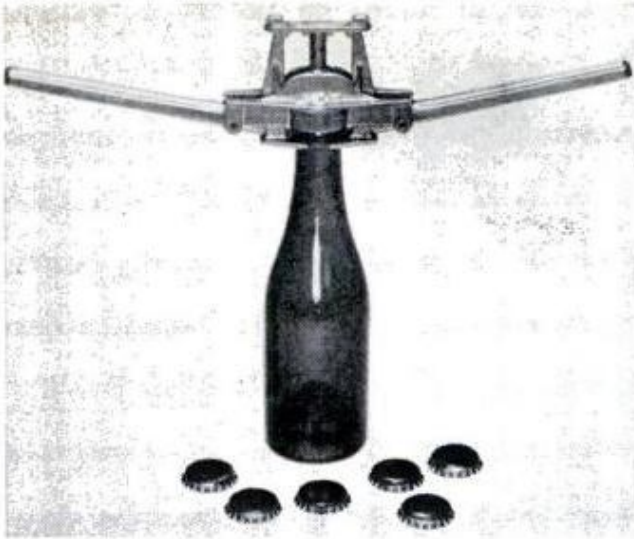
ELECTRIC WATER HEATER attaches to faucet to provide hot water normally unavailable. \$34.95 postpaid from Aqua-Hot, 565 Fifth Ave., New York.



TWO-STATION "OUTERCOM" replaces the door chime, allows you to answer the door from the kitchen or any other indoor location; it lets you know who's there before you open the door. Priced about \$31 (for existing homes), it's made by the Emerson Electric Co., 8100 Florissant, St. Louis, Mo.



POPULAR MECHANICS



BOTTLE CAPPER quickly seals a bottle with one easy stroke. Unit is lightweight, rust-proof, and will cap any height bottle without adjustment. Can be purchased for \$5.95 from Milan Laboratory, 57 Spring St., New York.



AUTOMOBILE EMERGENCY KIT contains a puncture sealer that inflates tube or tubeless tires for 100 miles of travel, fusee flares, flashlight, first-aid kit and highway flag. \$11.40. Bernzomatic Corp., Rochester, N.Y.

THREE-MANUAL ORGAN KIT uses transistor circuitry to obtain the full tonal variety of a theater pipe organ. Easily assembled with hand tools, kit is sold in one-octave modules. Further information can be obtained from Artisan Organs, 1372 E. Walnut St., Pasadena, Calif. 91106.



Build This Plywood Kayak

You'll like the simple construction of this tough little lightweight. Fun to paddle or sail, it's designed to be steered by a novel kick-up rudder you control with foot pedals

By GEORGE EMORY

Technical Art by Fred Wolff



UNLIKE MOST KAYAKS, this easy-to-build plywood design has a generous beam and a perfectly flat bottom from stem to stern, both of which increase the stability. Even more novel, though, is the way it's put together.

There's no tricky toolwork involved. The sides and bottom are $\frac{1}{4}$ -in. plywood with uncomplicated 90° chines and simple fore-and-aft curves. To keep the weight down, $\frac{1}{4}$ -in. plywood is also used for the frames, making it necessary to add stiffening cleats to the edges to give them more rigidity and provide the required surface area for mounting the planking.

From the sheer down, it's an ultrasimple plywood hull. For the deck, however, you switch to fiberglass, stretching $7\frac{1}{2}$ -oz. glass cloth over the tops of the frames and saturating it with resin, then feathering the joint where the cloth laps the side planking.

You'll need four 4x8 panels of $\frac{1}{4}$ -in. exterior plywood. To save work, have the lumberyard rip a 1-ft. strip lengthwise from two panels. These can be cut to length to make all but one of the frame blanks. The two 3-ft.-wide pieces left are butt-joined to make the bottom. Four full 8-in. strips can be ripped from the third

panel to make the butt-joined side planking. Complete plans for construction start on page 148.

Begin with the bottom. Temporarily join the two yard-wide pieces of plywood with an 8x36-in. butt strip. Center a $34\frac{1}{2}$ -in. length of 2x2 over the joint. Nail it temporarily in place, with heads protruding so you can pull them out later. Pencil a center line lengthwise down the middle of the two joined panels.

Next, cut the $\frac{3}{4} \times \frac{3}{4}$ -in. chines. These are 15-ft. 10-in. lengths of clear pine. Center the midpoints on the ends of the 2x2 crosspiece and bend the ends in toward the center line. Two scraps of lumber can be nailed temporarily over the center line to serve as the stems. Mark the ends of the chines for angle cutting so they will fit flush to the stems. After cutting the ends, nail them temporarily to the plywood.

Pencil in the frame positions at right angles to the center line and check width measurements at each location against those in the plans. If necessary, spring the chines in or out to get the proper curvature. Temporarily nail the chines to the plywood at each frame location, then pencil the outline of each one on the plywood



CUTTING PATTERN for the bottom panel is arrived at by bending the chines around beam-width crosspiece

bottom. Be sure to carry the inner lines across the butt strip since this must be cut to fit between the chines rather than under them.

Now pull the temporary chine nails far enough out to remove the chines from the plywood. (Leave the nails in the chines for alignment later.) Use a sabre saw to cut the plywood bottom. This done, you can remove the butt strip and trim it along the inner chine lines.

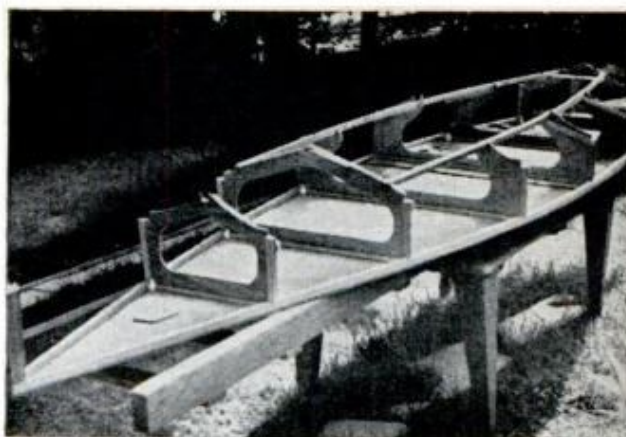
Use a resorcinol resin glue, such as Weldwood, when assembling the boat. Begin by replacing the butt strip joining the two pieces of bottom planking. Coat all mating surfaces with glue and retighten all screws in their original holes.

Next, mount the chines on the bottom. Glue-coat all mating surfaces and push the temporary nails back into their original holes to re-align the chines. Then drive 1-in. copper nails through the plywood into the chines, spacing them roughly 6 in. apart.

Now you can cut and assemble the frames. On the cockpit frames (3, 4 and 5), leave a cross brace between the cockpit stringer notches. These will provide the necessary rigidity to hold the frames in proper alignment until the stringers have been installed, after which you can cut them out to form the cockpit.

While not shown this way in the frame drawing, frames 4 through 7 should have the stiffening cleats mounted on the rear surface, while frames 1 through 3 should have them on the forward surface. Thus, the stemward edge of each vertical cleat will protrude slightly beyond the chine and gunnel stringers. When this edge is planed flush the cleats will provide ample gluing surface for side planking.

Position each frame on the bottom and

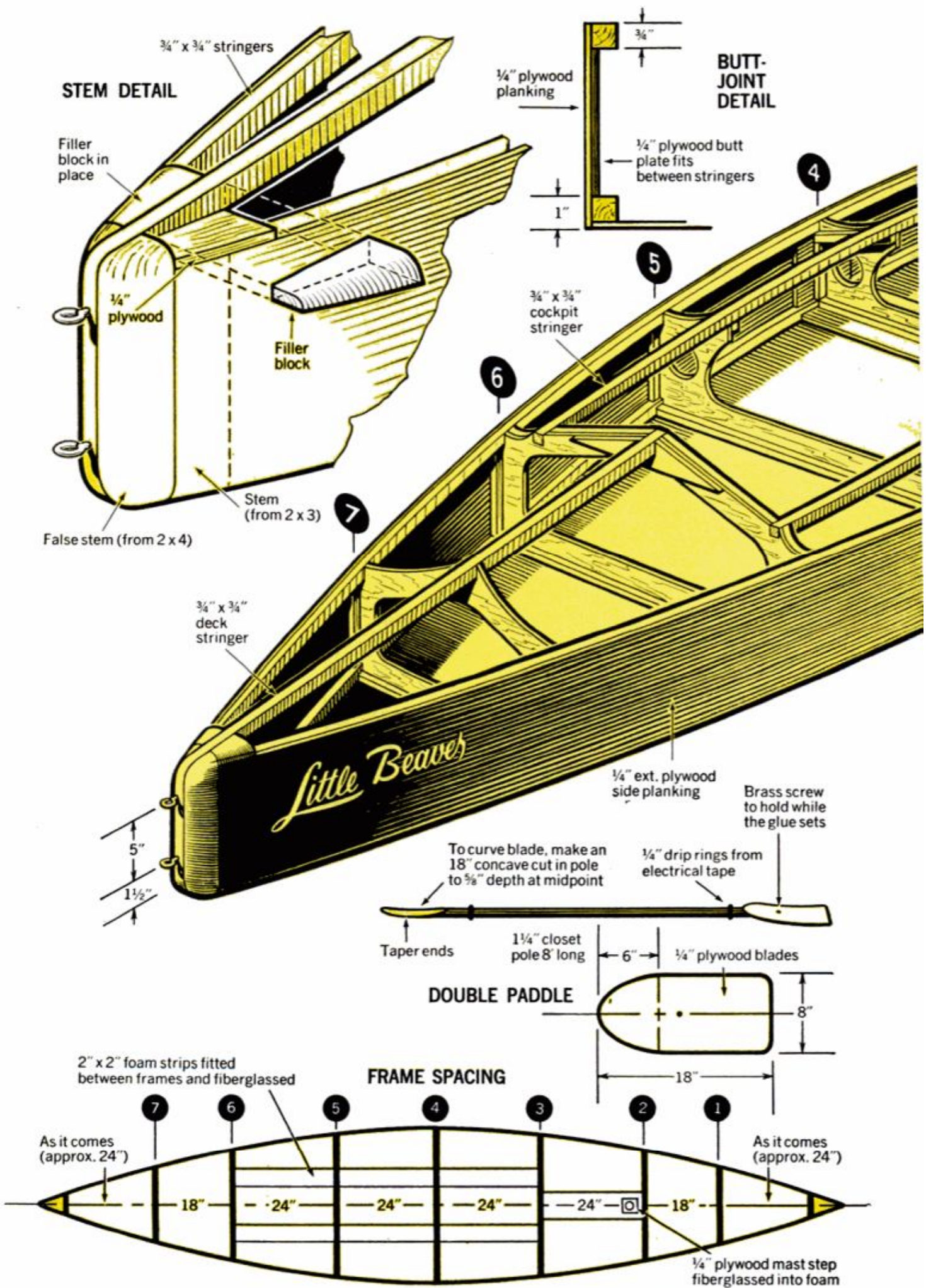


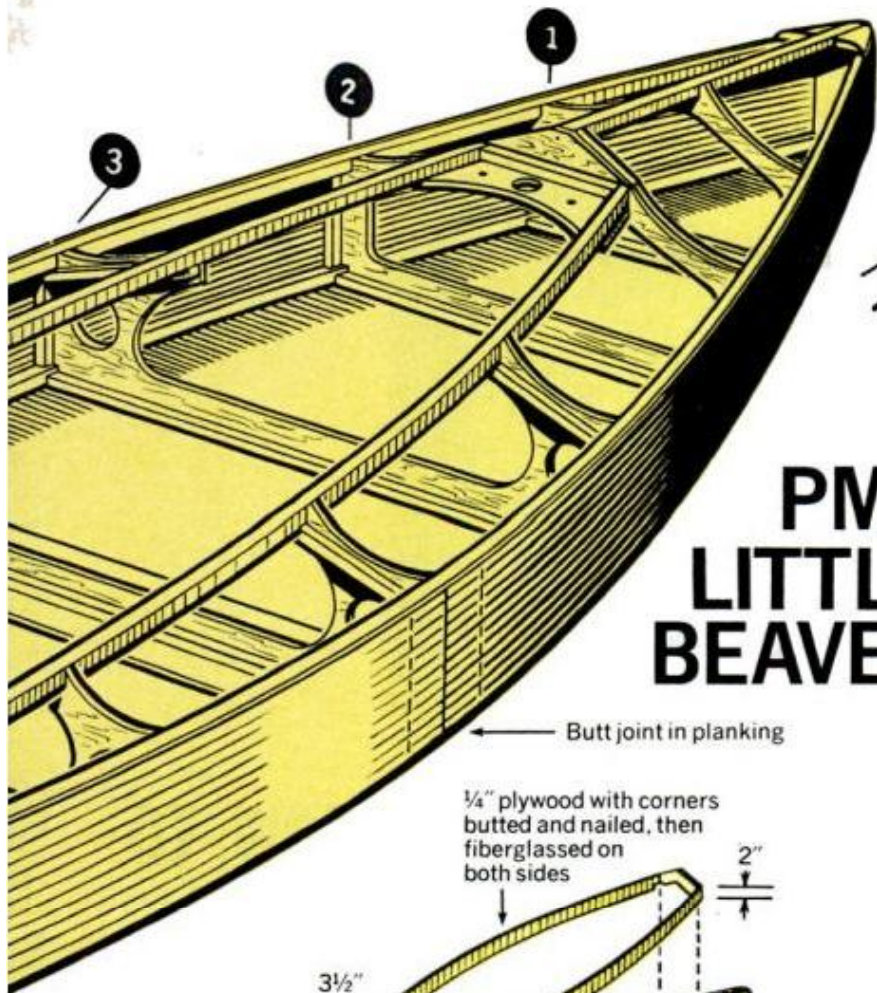
COCKPIT STRINGERS are installed after frames have been mounted on bottom. Use both glue and screws

drive a 1 $\frac{1}{4}$ -in. fine wire nail down through the stiffener strip and bottom near each end, leaving the heads protruding so you can pull them out later. Now, turn the hull over and draw a straight line between the two nail points. Drive a $\frac{5}{8}$ -in. No. 4 flathead brass screw through the bottom into the cleat at the midpoint of this line. Then pull out one nail at a

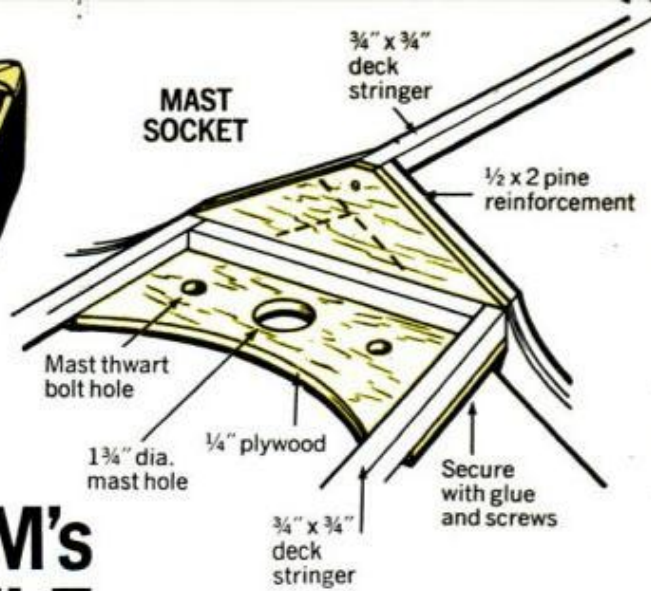
LEEBOARDS PIVOT to permit beaching boat. Wing nuts and carriage bolts lock them in "up" position



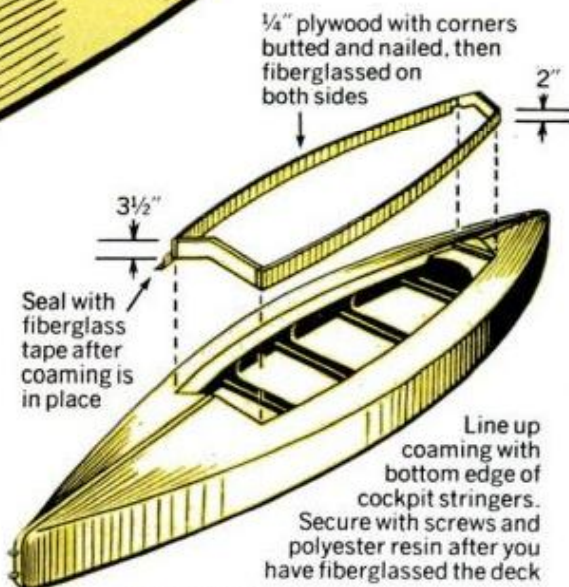




PM's LITTLE BEAVER

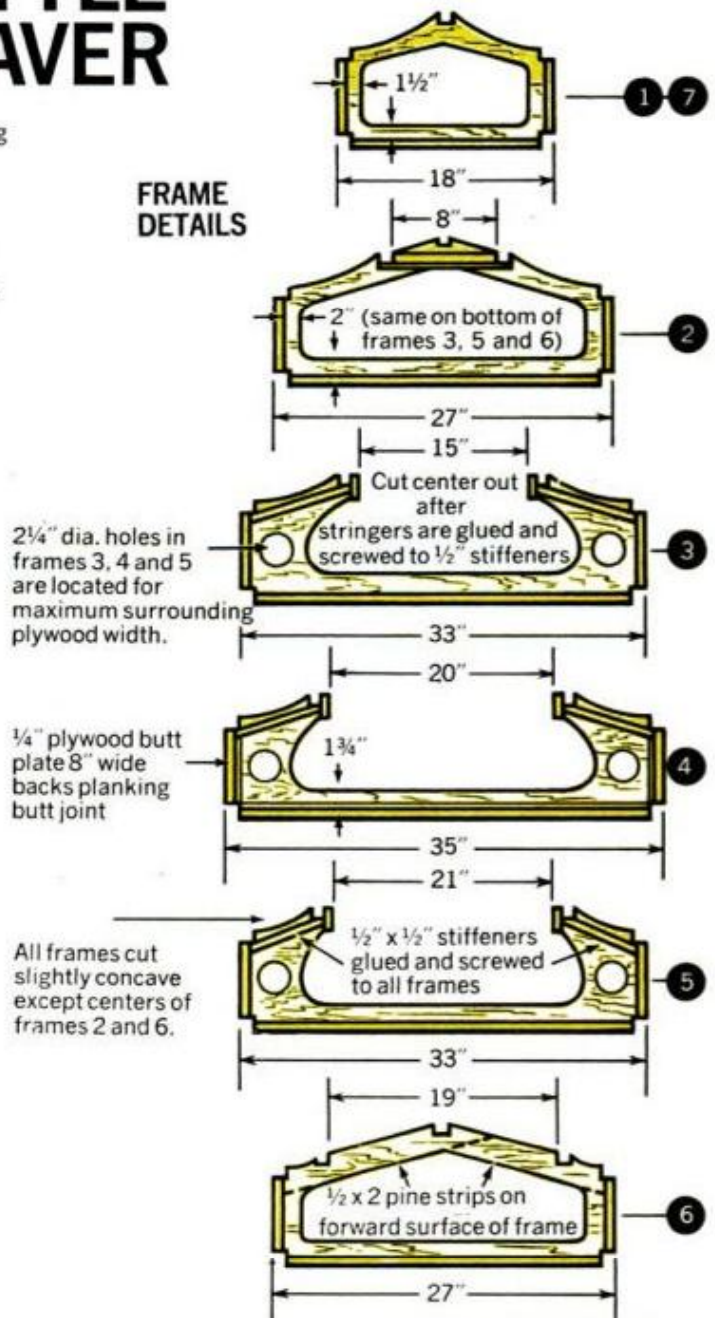


Butt joint in planking



COCKPIT COAMING

FRAME DETAILS



NOTE: All frames cut from 1/4" plywood blanks having vertical dimensions shown. Only the width varies.

time and replace it with a similar screw. As in all other joints, coat mating surfaces with glue. If additional screws are needed to draw the bottom snug against the frame, drive them along the penciled line.

The stems are also mounted at this time. Drive a 1 1/2-in. No. 8 flat-head brass screw up through the plywood into the end of the 2x3. The false stem is actually a nose-piece shaped from a 2x4 to continue the hull line and provide a sharper bow. You can mount this along with the various filler pieces which complete the stem assembly after the side planking and deck stringers

(Please turn to page 202)



HOW TO

Periodic doses of preventive maintenance will help you keep that precision-built laborsaver in fine tune all year long

By JOHN BURROUGHS

GETTING THE MOST from your chain saw is easy if you remember that all the popular models are simply small two-cycle gas engines with centrifugal-clutch-governed sprockets on their crankshafts. When the engine revs up, the sprocket snakes a toothed endless chain around a track.

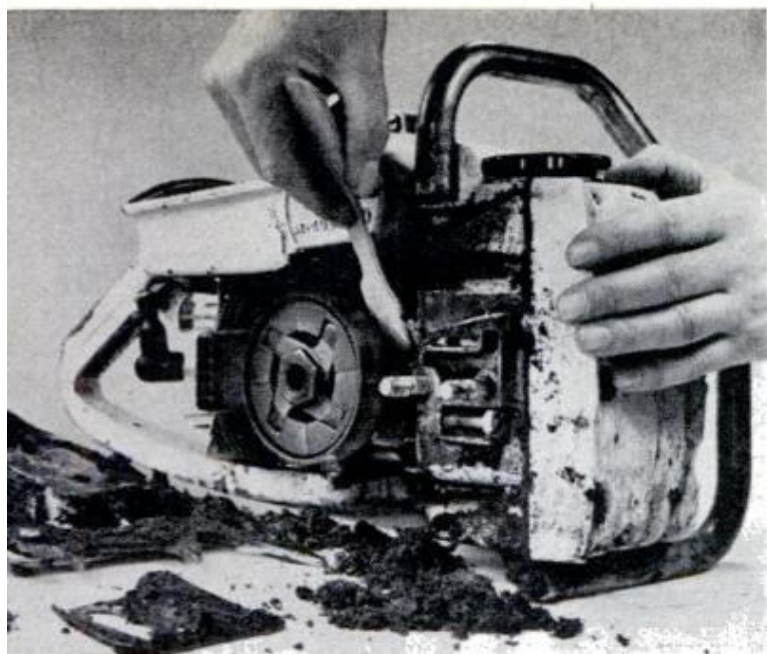
There's the only rub. The chain slides metal against metal at some 35 mph. Obviously, if chain and bar are to give reasonable wear, lots of lubrication is needed—not merely an occasional drop, but oil in quantity. This is supplied by the saw's chain-oiling system, either squirt by squirt (manual) or in a flow (automatic).

While continual oiling keeps the chain sliding smoothly, the oil picks up dirt.

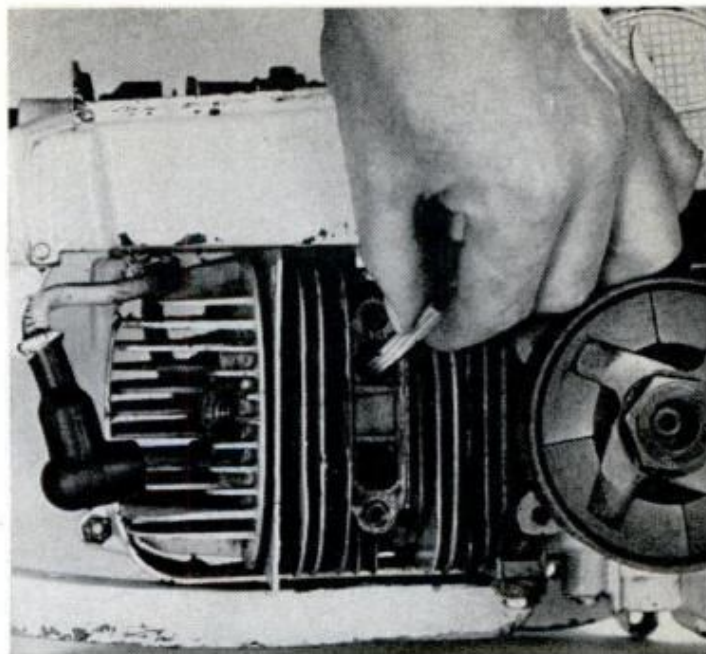
Consequently, a chain saw soon gets pretty grimy. If dirt deposits plug the flow of oil or interfere with engine cooling, serious damage results.

Unscrewing the clutch and flywheel covers from time to time and washing up the tool with solvent (not lacquer thinner, which might take off the paint) is the only way to keep a chain saw clean. Dirt collected on the cylinder's cooling fins should be scraped out. Occasionally the cylinder exhaust port, and the muffler, should be scraped free of carbon.

To clean the chain, slosh it thoroughly in solvent. Saturate it with oil before replacing; also clean and oil the bar's groove. Wobbling the chain sideways in the groove with your fingers will show



CLEAN DRIVE SPROCKET regularly. Scrape gunk with wooden paddle, then wipe with solvent and rags



CARBON DEPOSITS in exhaust ports are power robbers. Carefully scrape out carbon with wooden stick

Keep Your Chain Saw Cutting

how much the groove has worn. Worn grooves usually can be reconditioned.

While many owners take their saws to service shops for resharpening, it's easy to file the chain's cutters yourself. Use a sharp file of the right size in a special holder (shown on following page), re-edging each cutter with a single firm file stroke at a 35° angle. After repeated filings, the cutter's depth gauges (projections ahead of the cutting edges that limit depth of cut) should be checked and, when necessary, filed down uniformly.

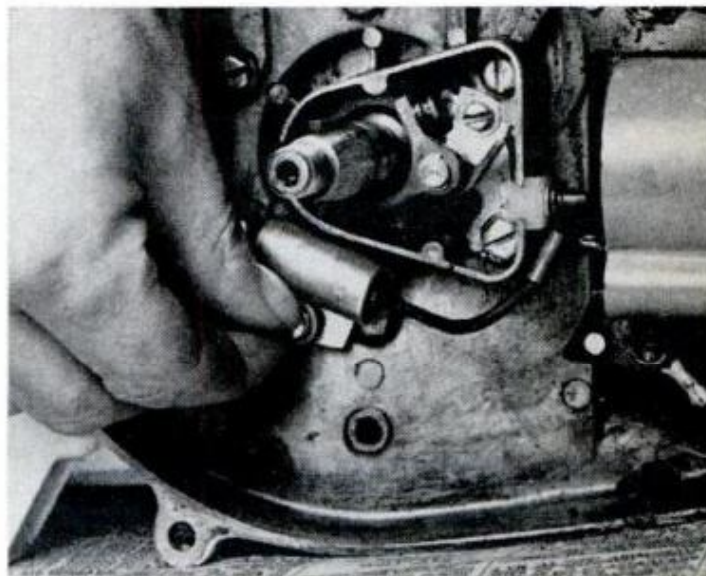
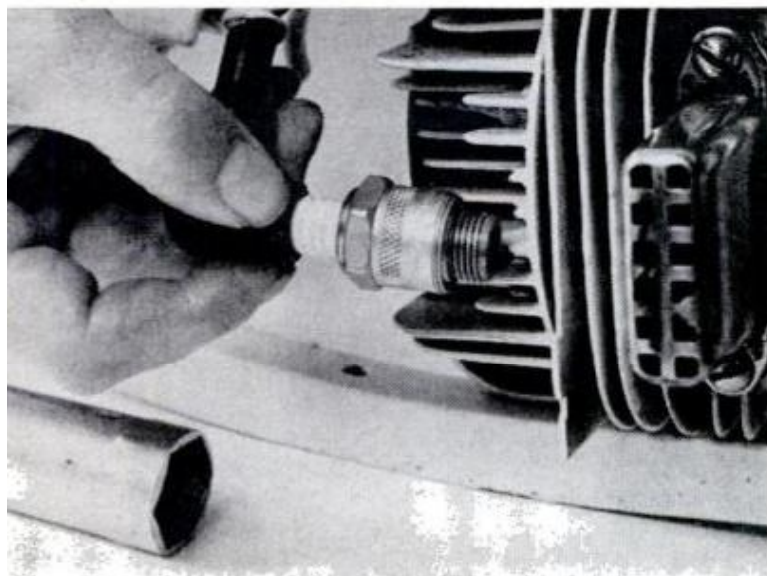
IF ENGINE WON'T START, examine plug. It should be wet with fuel. Then ground plug, crank engine

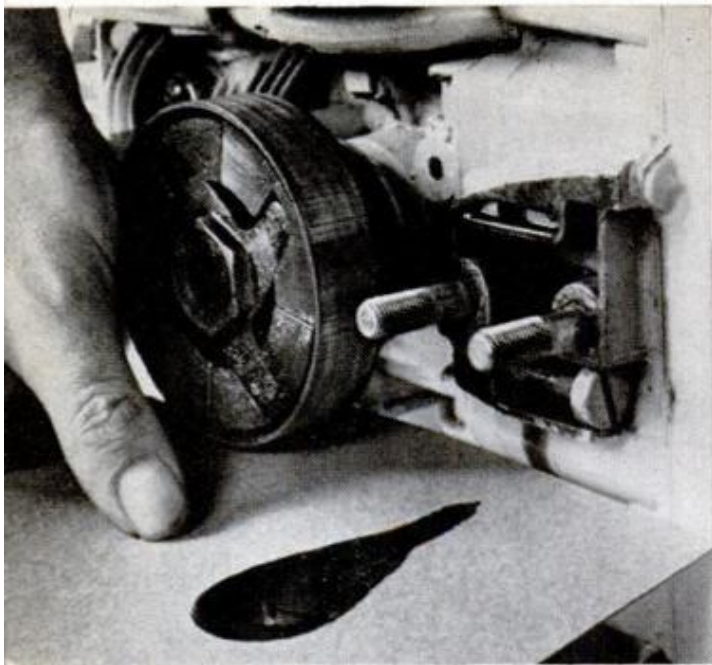
It's vital to keep chain tension adjusted as specified in the saw's instruction manual. New chains stretch after just a few hours of use.

If your saw is an older model with a spur-type drive sprocket, watch for sprocket wear. Severe wear reduces the sprocket's pitch slightly, which in turn wears the chain. A worn sprocket should be replaced; the newer rim types outwear the spur type.

When you use a correctly proportioned fuel mixture and keep the air and fuel

IGNITION FAILURE is most common cause of trouble. Check breaker points and condenser (under flywheel)





CHECK OIL DELIVERY SYSTEM by removing bar, placing cardboard under oil outlet hole. Oil should appear

filters clean, two-cycle saw engines—despite their 5000 to 6000 rpm speeds—are remarkably troublefree. In time, however, you'll encounter starting difficulty. The cause probably will be ignition or carburetion failure, rather than lack of compression. Remove the sparkplug, then reattach the lead and ground the plug. Replace the engine's ignition points and condenser if the sparkplug won't fire when the engine is cranked. The breaker point assembly, actuated by a cam on the crankshaft, is located under the flywheel. If you have a flywheel puller, it's a simple matter to install the points and condenser yourself. If not, go to a service shop.

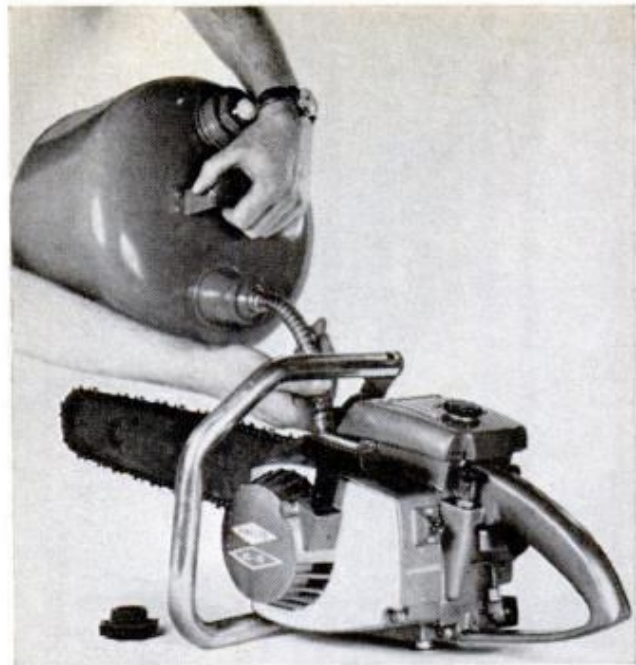
If the plug does fire quickly, the engine

**CUT
FOLD
TAPE**

CHAIN SAW TUNE-UP

CORRECT TENSION is important. If chain is lifted at bar's center, one tang should clear the groove

SHARPEN CUTTERS as needed with round file. Special holder rides on cutters, maintains proper filing angle



SUREFIRE WAY TO PREVENT TROUBLE is to use the exact oil-to-fuel ratio specified by the manufacturer

probably isn't gulping a sufficiently rich fuel vapor. If so try readjusting the carburetor needle valve(s); then check the carburetor's diaphragms and check-valve seat (easy to replace). Finally, look for air leakage (loose manifold gasket or worn crankshaft oil seals).

Since the oil needed to lubricate the two-cycle engine's internal parts is mixed with the gas, avoid an excessively lean carburetor needle valve adjustment.

Some of the older-model saw engines equipped with low-ratio, rewind-starter assemblies and carburetors with large throats can be chronically hard-starting. Easiest cure: install a carburetor that has a smaller venturi. ★★★

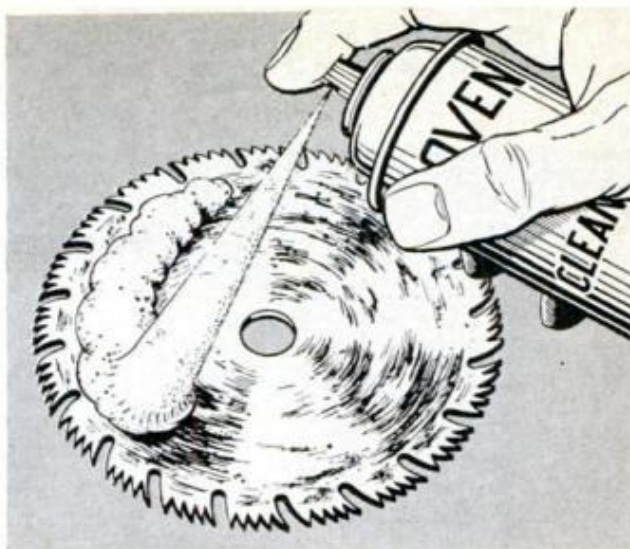


HINTS FROM READERS

Cleaning circular saw blades

The easiest way to remove pitch or gum deposits from your circular saw blades is to use your wife's oven cleaner. Just apply a light coat of Easy Off, or a similar product, and let it stand for a few minutes. Deposits can then be wiped off with a cloth. Turn the blade over and repeat the procedure to clean the other side.

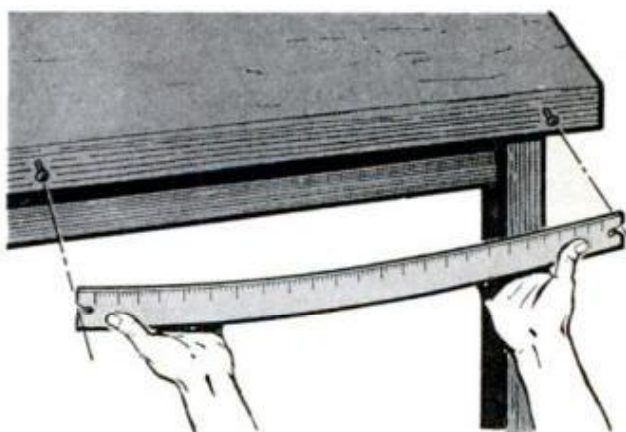
—Robert S. Tupper



Removable bench yardstick

A yardstick mounted on the edge of your workbench is a practical and time-saving addition. However, you can make it even more useful if you mount it so that it can be removed for use anywhere in the shop. Just cut keyhole slots in the ends and drive roundhead screws into the bench to engage the slots. To remove the yardstick, bend the ends inward to clear the screws.

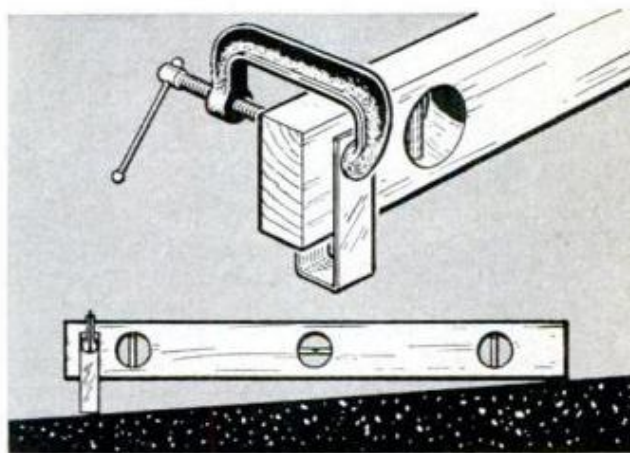
—Wilfred Beaver



Adjustable level reads slope

Here's a simple accessory for your level which will allow you to use it to check the drop when laying a sloping walk or driveway. Just bend a strip of sheet metal to form a U-shaped leg, making the slot wide enough for you to slip the level down between the two arms. Then set the level to the proper angle and secure the leg to the level with a C-clamp. This locks the angle, making the slope read "level."

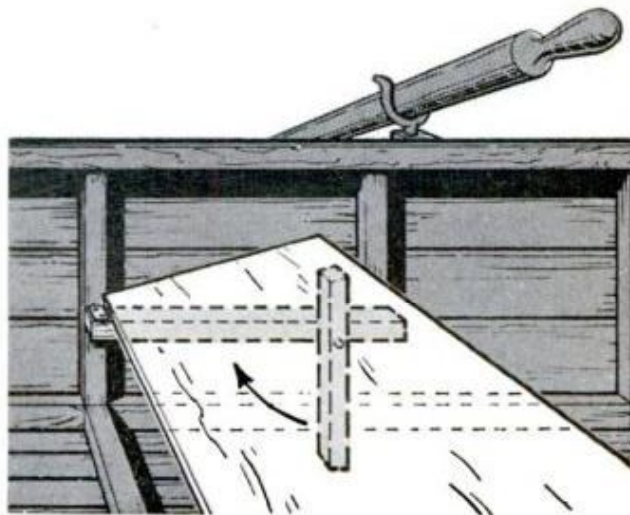
—Wilfred Beaver



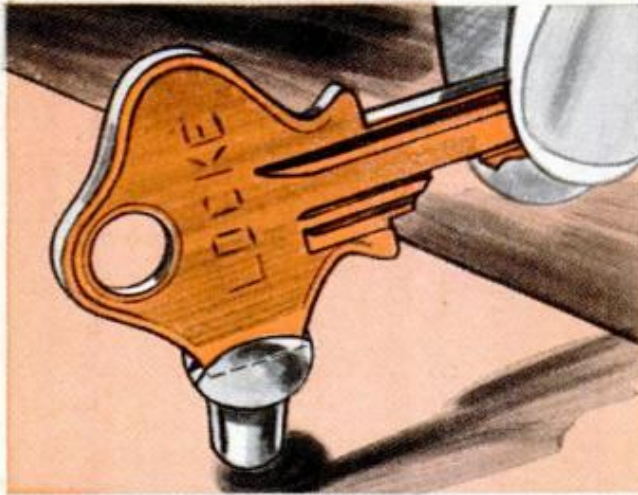
Hinged seat for easier rowing

When you're out in a rowboat and pulling hard against a strong current or wind, it's difficult to get much leverage because you are continually slipping forward on the seat. An easy way to get more pull per stroke is to elevate the forward edge of the seat. To do this, hinge the rear edge of the seat to the supporting cleats and install turnbutton supports beneath the forward edge. When not needed, these supports can be swung back to the horizontal position, allowing the seat to rest on the cleats.

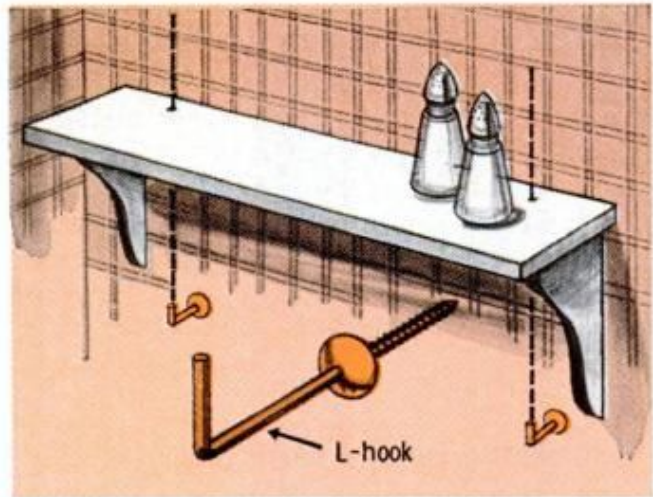
—G. E. Hendrickson



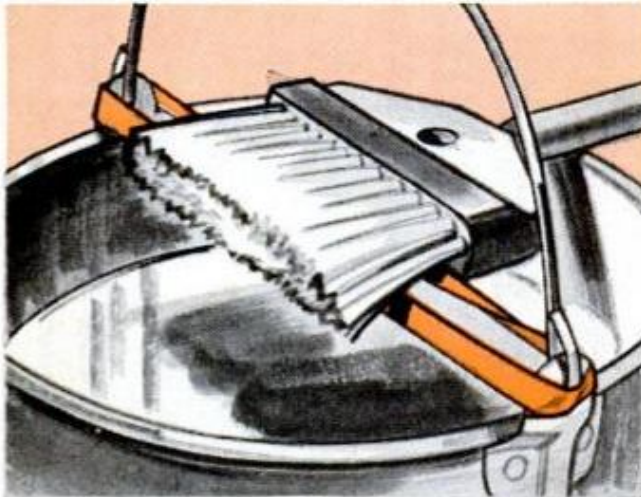
Solving Home Problems



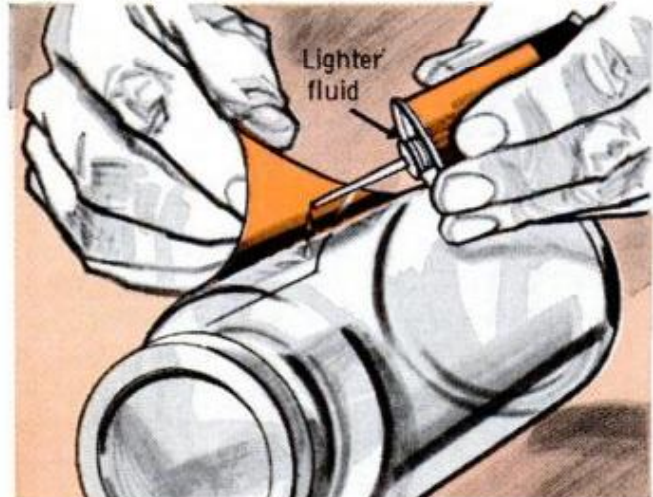
POCKET SCREWDRIVER that's always handy when you need it can be made by cutting the side of one of your keys to shape of screwdriver blade and filing edges smooth. You'll be surprised how often you use it



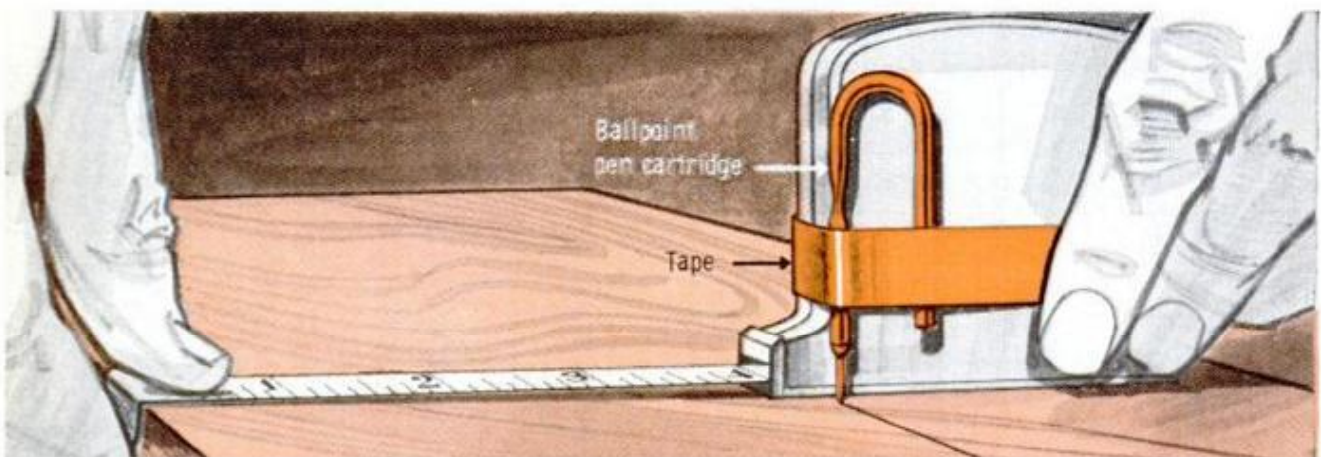
LIFT-OFF SHELF is suspended from a pair of L-hooks driven into the studs. They fit two holes drilled in the underside of the shelf, permitting you to remove the shelf easily when cleaning or redecorating



THERE'S NEVER A PLACE to lay the wallpaper paste brush when you're not using it. However, you can improvise one by slipping a heavy rubber band over the bail ears. This will also support the bail upright



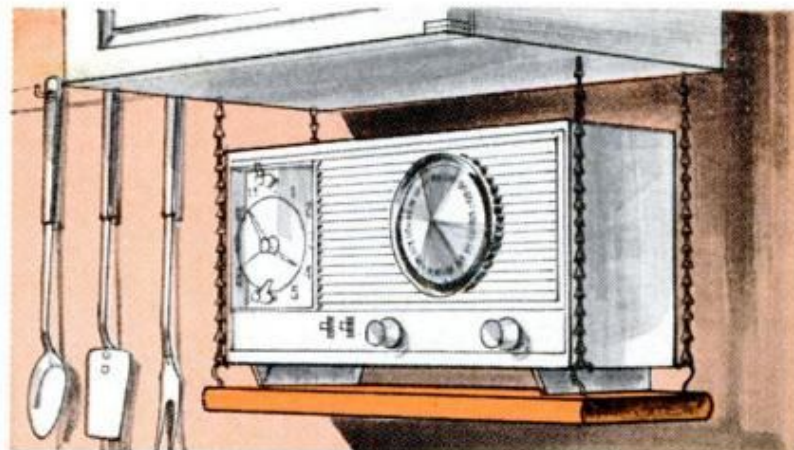
ITS ALWAYS HARD to scrub away the sticky residue left after removing labels or price tags. If you soften the adhesive with lighter fluid when pulling off the label, however, it can be rubbed off easily



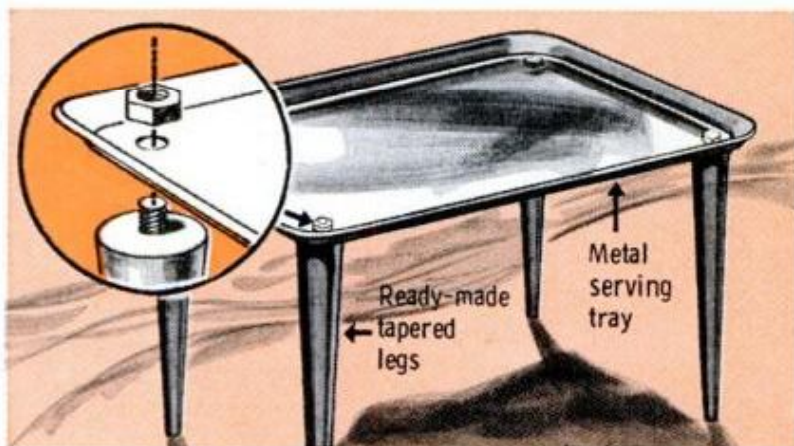
MARKING RULE lets you measure a board and mark it off in one easy operation without fumbling for a pencil. It's made by bending a standard ballpoint refill so you can tape it to side of a regular steel tape



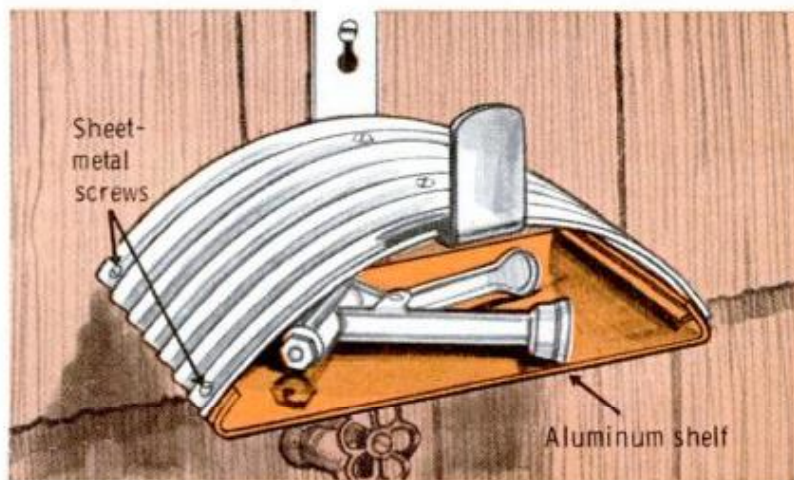
SLIM DISPENSER for toilet tissue is designed to be hung in a closet near the bathroom, shows at a glance when the tissue supply is running low. You can make this out of anything in your scrap box that's thick enough to hold a nail in the edge grain. Use both nails and glue to assemble the dispenser, then sand it smooth and give it a couple of coats of enamel. To dress it up even more, decorate the sides with bright decals in contrasting colors



SHELF FOR RADIO hung from the underside of a kitchen wall cabinet is a good way to save counter space. Cotter pins bent over on the inside of cabinet anchor lengths of window chain which are hooked to corners of shelf. For more space, make the shelf oversize



TAKE-APART BEACH TABLE holds food or drinks safely above the sand, yet packs away in a compact flat package. It's just a plastic serving tray with a hole drilled in each corner so you can bolt on a set of DIY furniture legs. You can even use it inside



HANDY PLACE for your hose nozzle when you're using the sprinkler is an easy-to-make shelf mounted under your hose rack. Bend DIY aluminum sheet as shown above and fasten it to the rack with sheet-metal screws or Pop rivets. It costs practically nothing



One-Man

LOADING AND UNLOADING our 14-ft. aluminum cartopper used to be such a nuisance that it hardly seemed worthwhile taking it along on camping trips. This simple boat loader solved all our problems for only \$15 and turned out to be better suited to our needs than any of the commercial loaders we have seen.

We wanted something that would allow us to load and unload the boat without having to unhitch our camping trailer. This automatically ruled out all rear-loading designs. It also had to be compact and "self-storing," not some special device we would have to erect each time we wanted to use it and which would take up precious storage space in car or trailer.

The design we finally came up with is basically just a plywood platform equipped with a 2x4 loading bar. The bar has a pivot at one end and a caster on the other. A simple latch locks it parallel to the side of the platform during the first part of the loading process.

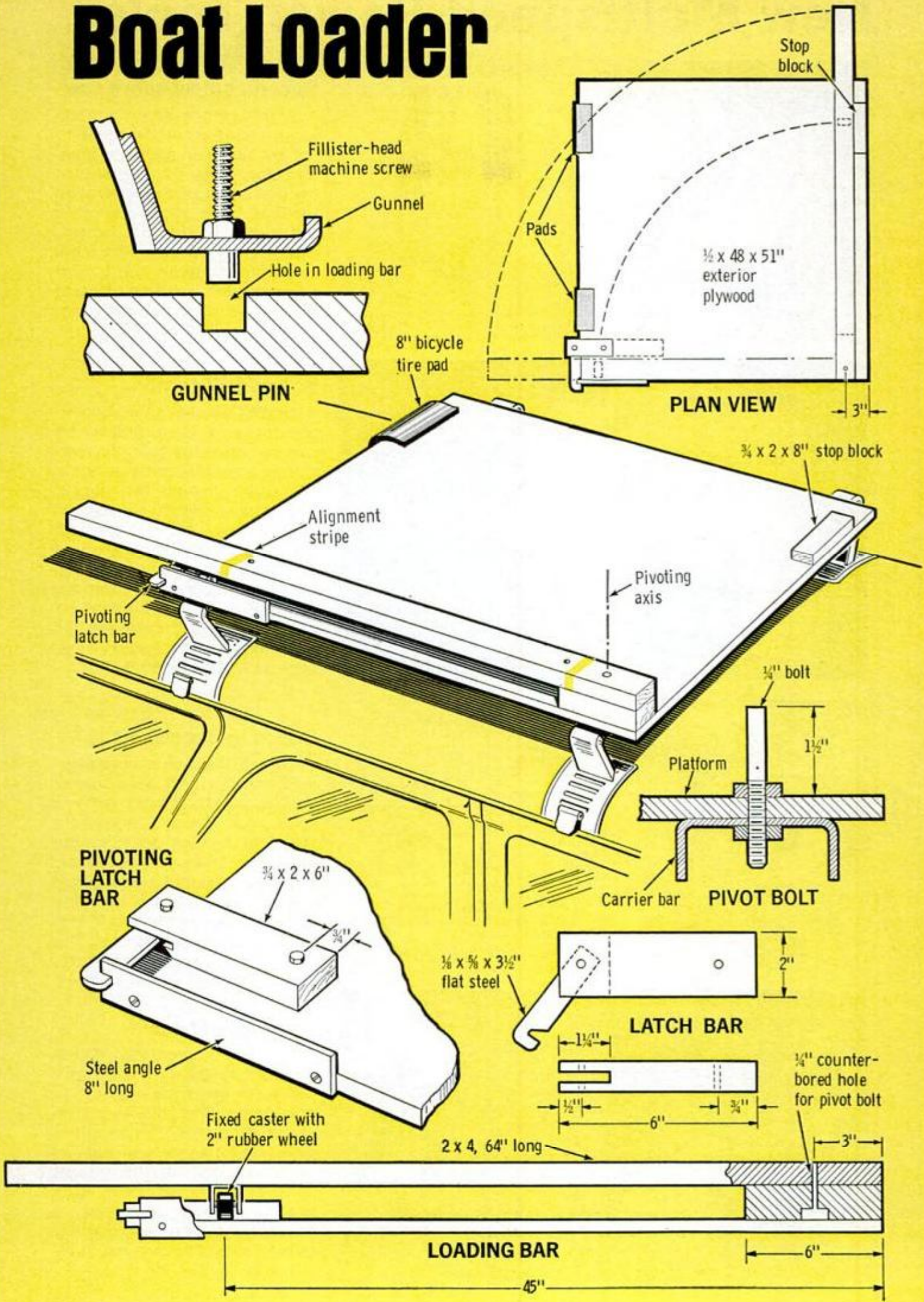
The loading sequence is shown in the series of photos at left. We simply lean the boat against the bar, lining up the gunnels with two alignment stripes painted on the bar. This automatically lines up the heads of two Allen-headed machine screws in the gunnels with a pair of socket holes drilled in the bar. Lifting the stern seats the heads of the machine screws in the holes.

With our boat, the bar falls near the center of gravity, so very little strength is required to support the hull once it has been elevated. Thus, one man can perform the next step by supporting the boat with one hand while unlatching the bar with the other. Once the latch is released, it's easy to walk the stern of the boat around to the rear until the caster hits its stop block.

On short trips at relatively low speeds, the boat can be secured by lashing it to the loading bars with a couple of ropes and running a third rope from the bow to the front bumper. For turnpike driving, however, it's best to lower the bow by removing the loading bar (just support the bow and lift the bar off the pivot). Use pads cut from old tires to cushion the hull.

—Lloyd M. Polentz

Boat Loader

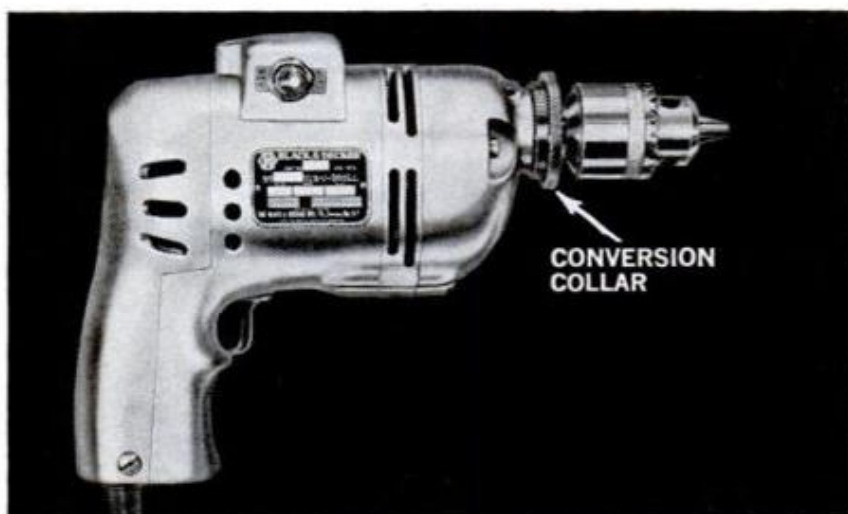


New Multispeed Power Tools



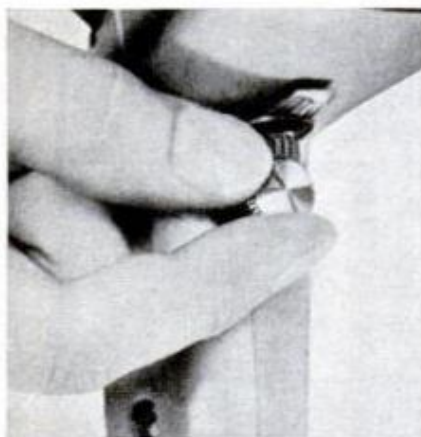
Speed-control sabre saw

A new sabre saw that lets you match the cutting speed to the job has been added to Stanley's Job/Master line. Just turn the dial and a silicon-controlled rectifier feeds more power to the motor to increase speed. Offering any speed up to 3000 strokes per minute, the 1/5-hp saw has a two-position tilt base and a 2-3/8-in. cutting capacity. It's priced at \$47.50.



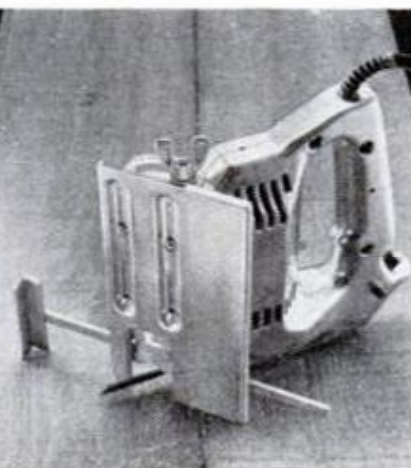
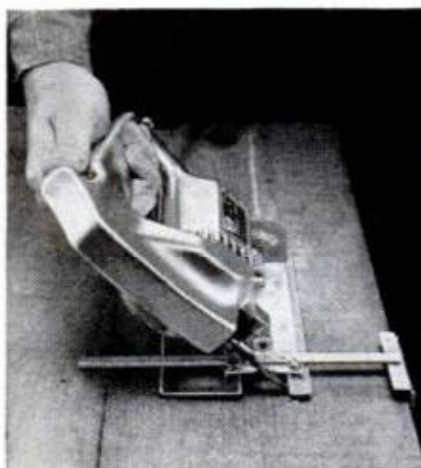
Screw-drill combo

Black & Decker's new two-in-one tool is a 3/8-in. drill which can be converted to a positive-clutch screwdriver by rotating the collar behind the chuck. The trigger switch allows you to accelerate from 0 through 1000 rpm. Flip the toggle-type reversing switch and you can back out screws or remove nuts. The Scru-Drill can be used with 1/4-in., hex-shank bits and associated finders and sockets. It retails for \$69.



Speed limit preset

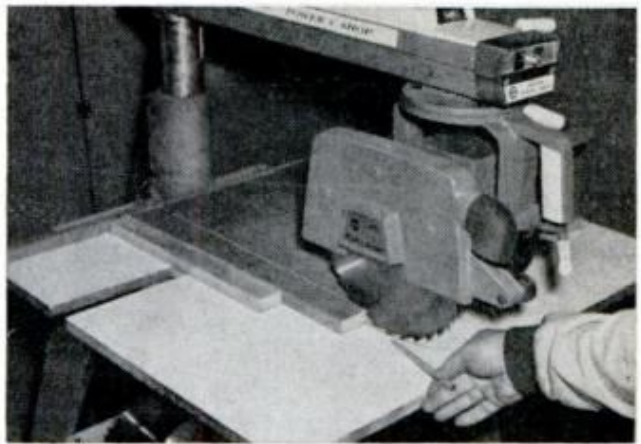
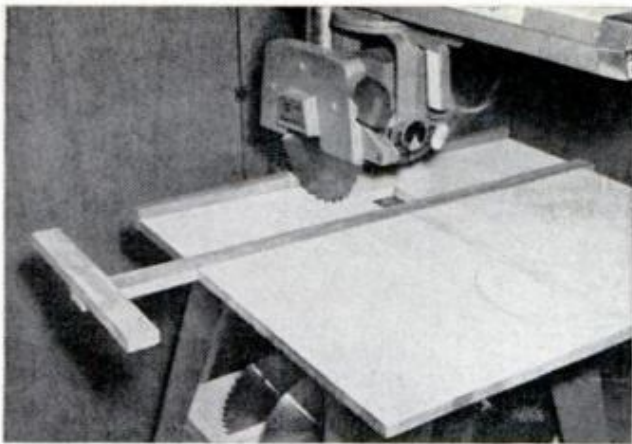
With Skil's new screwdriver-drill, you not only have trigger control over the speed, but you can also preset maximum speed by turning an adjusting knob built into the trigger. Thus, you needn't worry about overaccelerating and spoiling the job if you should pull the Drive-R-Drill trigger too far. The 1/4-in. model sells for \$34.95.



Mind-reader saw

A thumb-operated "Mind-Reader" switch on Wen's new sabre saw gives you any cutting speed from 0 to 2800 rpm. The offset shoe tilts 45° in either direction for angle cuts and can be moved forward for plunge cuts or back for flush cuts against a wall. A calibrated rip guide, right, assures accuracy of long cuts. The suggested retail price is \$34.95.

T-Fence Increases Capacity of Radial-Arm Saw

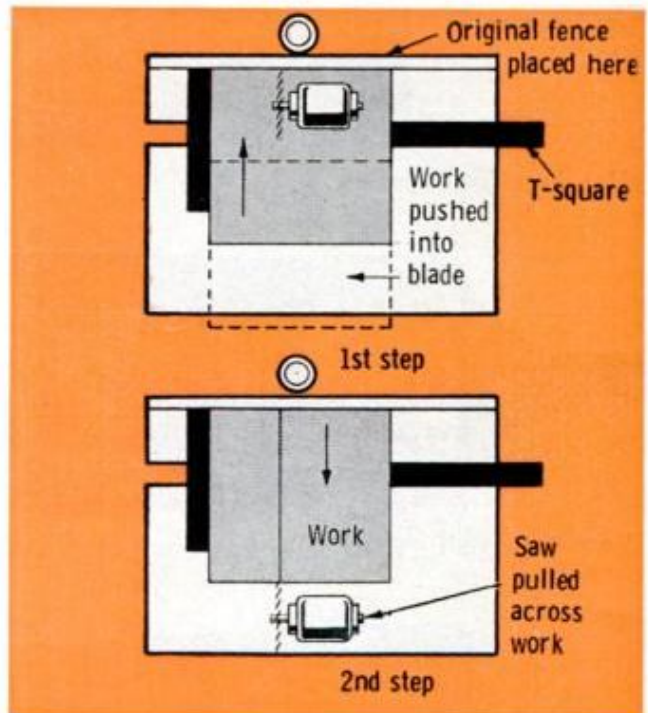


Operating at right angles to the regular fence, this simple T-fence will boost the cutoff capacity of your radial-arm saw by about 7 in. On many jobs, this means that you can make one smooth, continuous cut instead of making a partial cut and then having to turn the material over to complete the cut. It not only saves time but results in a much neater job.

The long arm of the T-fence fits into the table flush with the surface. Make the crossbar just short enough to clear the regular fence when it's mounted at the rear of the table.

To use the T-fence, lock the saw in the back position and feed the material into it, using the T-fence as a guide. Then release the saw and pull it through the material in the regular manner. It's a breeze.

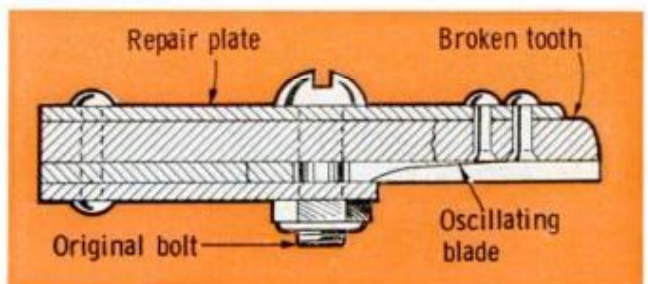
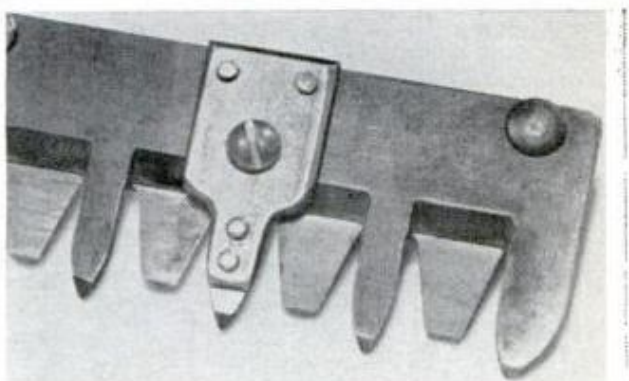
—William G. Waggoner



Like-New Repair for Hedge-Trimmer Tooth

A missing tooth in your hedge trimmer will cause dragging and lower cutting efficiency. However, if it's broken off the fixed part of the cutter assembly, you can reattach it (or install a tool-steel replica) with a repair plate and rivets. The job is easy if you've done metal-working.

The $\frac{3}{32}$ -in. steel repair plate must be shaped to extend over the broken tooth and conform to its contour. Rivet the tooth to the plate, then secure the plate to the bar either with rivets alone or with a bolt located near the broken tooth. If you use the bolt, add a couple of rivets to prevent the plate from pivoting. The rivets shown in the photo at right were made from drill rod for maximum shear resistance. Be sure to install all rivets so that they won't interfere with the oscillating cutter blade of the hedge trimmer.—Walter E. Burton




ALL ABOUT

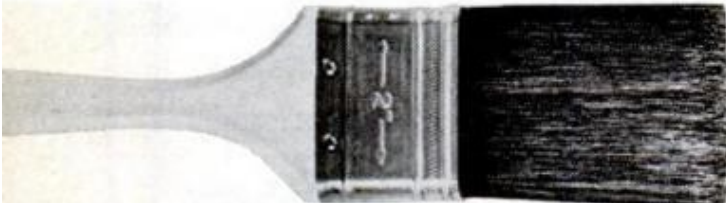
Perceptive



No. 4 oval sash-and-trim




No. 8 oval sash-and-trim



Flat sash-and-trim



Varnish brush



Wall brush



Calcimine brush

THE ONLY WAY to get a topnotch paint job is to use a good quality paint—and the best paintbrush you can buy. If you realize that a good brush will often cost as much as a gallon of expensive paint, you have crossed the first hurdle. The rest is easy—a matter of selecting the right brush for the job. How do you go about it? That and other questions most often asked are answered here.

Must I always buy an expensive brush?

No. Some materials attack and destroy organic bristling or synthetic fibers of a brush. They include muriatic acid for cleaning masonry, epoxy resin paint and liquid compounds used with fiberglass. Once a brush is dipped in these, it's had it. For such uses, buy the cheapest one.

Why is a good brush so important?

It spreads paint evenly, leaving no glaring brush marks or loosened bristles in freshly applied paint. It's easy to handle, doesn't pull, and you can keep cleaning and reusing it for years.

How can I tell a good quality brush?

Look for:

- Full-bodied bristles or filaments of different lengths. The brush should feel full—not skimpy. Over half the bristles or filaments should be full length. The rest should have varying lengths to allow the brush to carry a full load of paint and release it gradually, rather than in a glob. Inexpensive brushes have most elements the same length.
- Tipped or flagged bristles or filaments. Half of the bristles should be split at the tip, but this applies only to synthetic filament brushes.
- Cleanliness. Dust and dirt shouldn't fly from the brush as you strike it across your hand.

PAINTBRUSHES

By STEVEN J. HOWARD

answers to some common questions

● Good handle and ferrule construction. Handles of quality brushes are made of beech, birch, hard maple or plastic, and are balanced and comfortable. A good ferrule (the metal band that holds elements) is of corrosion-resistant steel or copper.

Does it matter whether I pick a synthetic filament or organic bristle brush?

Yes. Bristle brushes (the best have hog hair) are recommended for applying paint, varnish, shellac and other oil-base materials. Synthetic filament brushes (the best are made of nylon) are recommended for water-emulsion paints, such as acrylic latex and polyvinyl acetate. While you can use a synthetic filament brush to apply an oil-base material, *never* use a bristle brush to apply water-emulsion paint. The bristling will act like a blotter to absorb water.

What are the common brush styles?

Wall brushes come in 3½, 4 and 5-in. sizes and are designed to hold a great deal of paint per dip. One such wall brush is the *calcimine (block)* brush that comes in 6 and 7-in. sizes. *Varnish brushes* are made in 2, 2½ and 3-in. sizes and are given a chisel trim. *Flat sash-and-trim* brushes are designed for narrow sash and for trim at window corners. They are of 1, 1½ and 2-in. sizes and also should have a chisel trim. *Oval sash-and-trim* brushes are used on irregular and curved surfaces. Their denser elements can cover ridges and rounds which would cause a flat brush to separate.

Okay, now that I've picked the right brush and I'm ready to paint, what . . .

Hold it. You're overlooking a big step. Before you use a new organic bristling

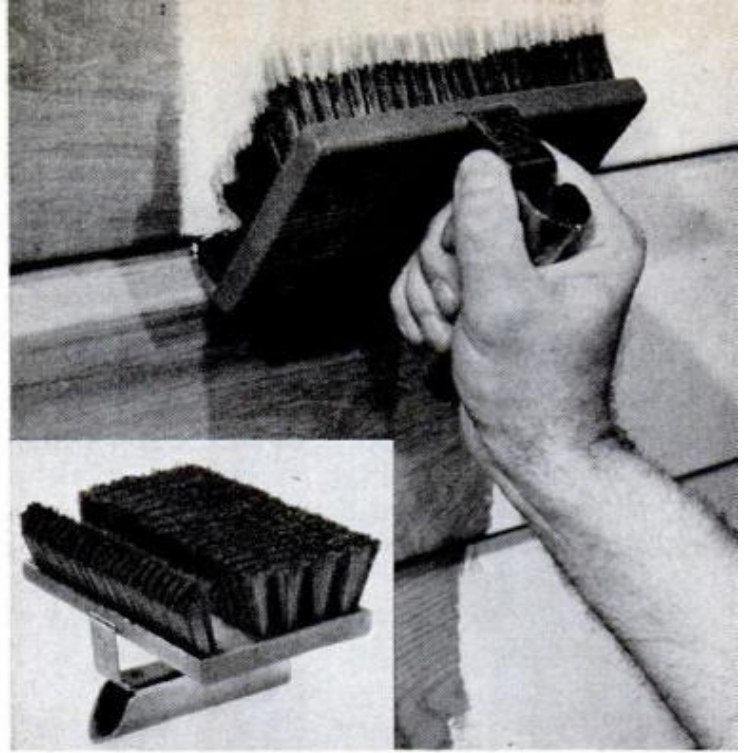
SURFACE OR OBJECT TO BE PAINTED			BRUSH TO USE
Large interior and exterior surfaces—			Wall brush— or a calcimine brush if you can handle it. Calcimine brushes are particularly useful for exterior surfaces such as the side of a house.
Asbestos walls	Clapboard	Roofs	
Boats	Concrete walls	Shingles	
Ceilings	Decks	Stone	
Cinder or cement block	Floors	Stucco	
	Interior walls	Swimming pools	
Medium size areas—			Large varnish or flat sash-and-trim brushes for flat surfaces. Use a No. 8, 10 or 12 oval sash-and-trim brush for irregular surfaces to be painted.
Baseboards	Gutters	Rainspouts	
Cabinets	Large pipes	Shutters	
Cupboards	Large windows	Small boats	
Doors	Moldings	Steps	
Eaves	Picket fences	Tabletops	
Small, narrow or corner areas—			Small varnish or flat sash-and-trim brushes for flat surfaces. Use No. 2, 4 or 6 oval sash-and-trim brush if surface to be painted is irregular.
Chairs	Radiators	Trellises	
Garden tools	Screens	Window frames	
Ladders	Scrollwork		
Metal furniture	Small pipes		

CUT
FOLD
TAPE

PAINT-
BRUSHES

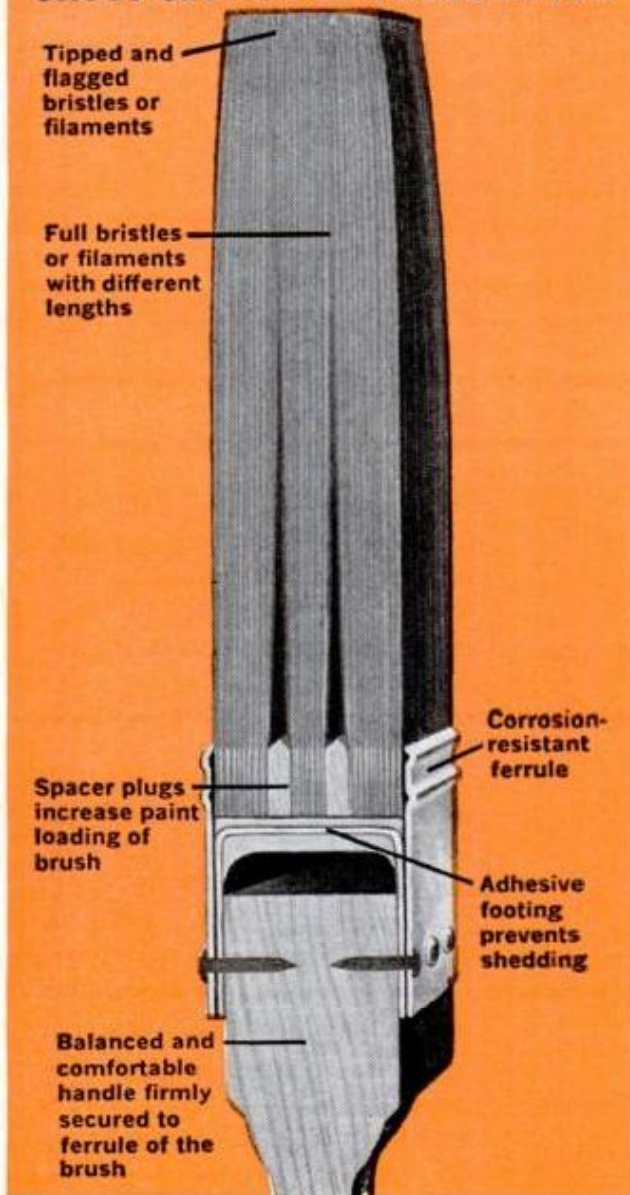


SNAP-APART brush (U.S. Plywood) has foam element



SPECIAL SIDING BRUSH called Ruff-Rider gets edges

CROSS SECTION OF A GOOD BRUSH



brush, suspend it in linseed oil overnight, making sure the bristling doesn't touch the can. To remove excess oil after cleaning, stroke the bristling from ferrule to tip with a straight stick or metal comb. (Do not precondition a brush in linseed oil if it's to be used in lacquer or shellac.)

Before using a synthetic filament brush, wash it in soap and water, then comb it out. When clean, dip it into the paint halfway to the ferrule. Then tap it lightly five or six times against the top of the can. Now you're ready to paint.

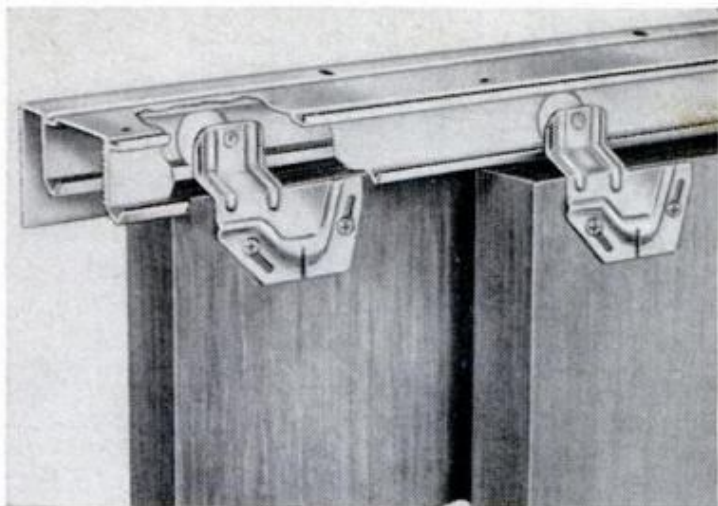
I'm confused about how to clean a brush after use. What's the best way?

Use the right cleaner—the same solvent used to thin the paint. Use turpentine or mineral spirits for oil-base paint, enamel and varnish; soap and water for water-emulsion paints, and alcohol for shellac.

Let the brush soak for a few minutes. Then work the elements against the side of the container to loosen paint. Squeeze the elements by hand from heel to brush tip to work the paint out. If paint's caked on the outside of the brush, scrape it away with a putty knife. Repeat until the brush is clean.

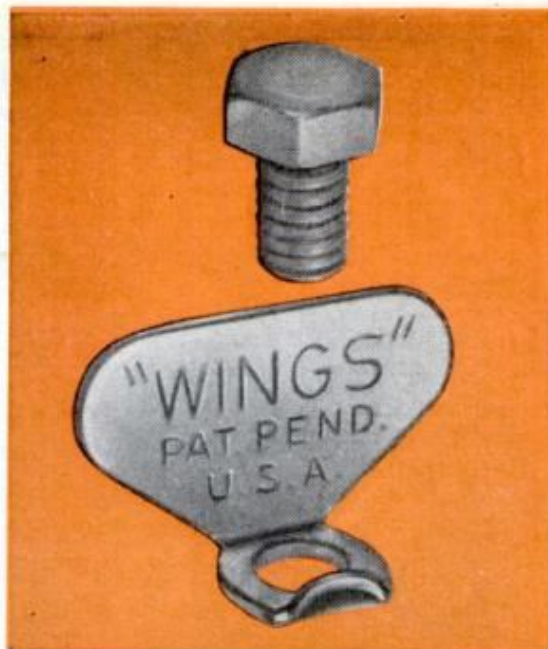
If the brush is to be stored, wash it with a mild soap and warm water after cleaning. Shake out excess water and comb the bristles straight. Wrap the brush in paper to retain its shape in drying. To dry, suspend the brush by the handle. ★★★

NEW HARDWARE



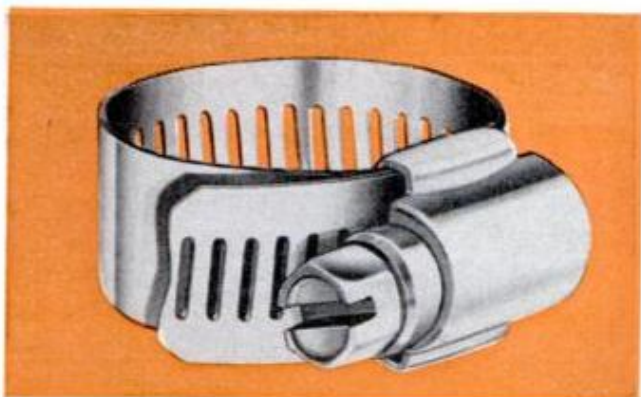
Adjustable sliding-door hardware

A new set of hardware from Stanley features simple adjustment hangers for $\frac{3}{4}$ -in. or $1\frac{3}{8}$ -in. bypassing doors. The hangers have geometrically designed mounting slots to hold the door in the new position while the hanger screws are tightened. Available are 4, 5, 6 and 8-ft. lengths for two doors weighing up to 60 lbs. each. A $\frac{5}{16}$ -in. adjustment to hang the door plumb to a jamb can be made with a screwdriver. Stanley Works, New Britain, Conn. 06050.



'Wings' for bolts

Ordinary bolts and nuts that are frequently removed or adjusted can be converted in seconds to wingnuts and wingbolts by using "Wings." Available in $\frac{1}{4}$, $\frac{5}{16}$ and $\frac{3}{8}$ -in. diameters, they are reusable or can be locked to the bolt with epoxy. Made of nickel-plated steel, they're available from Sorrell Mfg. Co., 870 S East St., Anaheim, Calif. 92805.

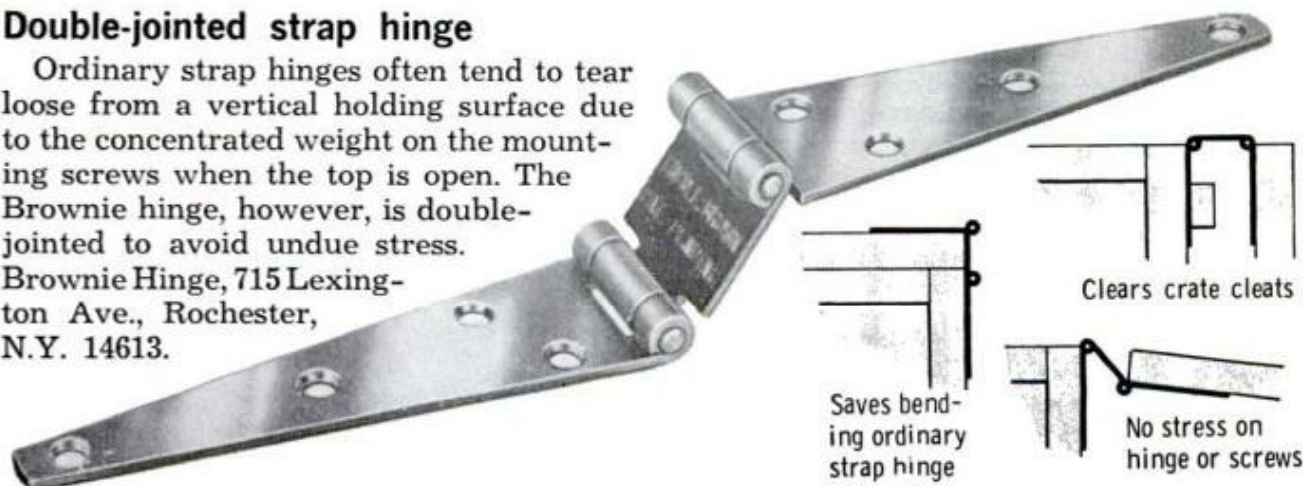


Stainless-steel, worm-drive clamps

The 63 series of stainless-steel clamp is primarily intended for use in highly corrosive environments or in high-pressure areas. Width of the band is $\frac{9}{16}$ in., shouldered $\frac{5}{16}$ -in. hex-head screw is also of stainless steel, and stock sizes range from $\frac{1}{4}$ to 7 in. Additional feature is one-piece band-to-housing interlock which is free of welds. Ideal Corp., 435 Liberty Ave., Brooklyn, N.Y. 11207.

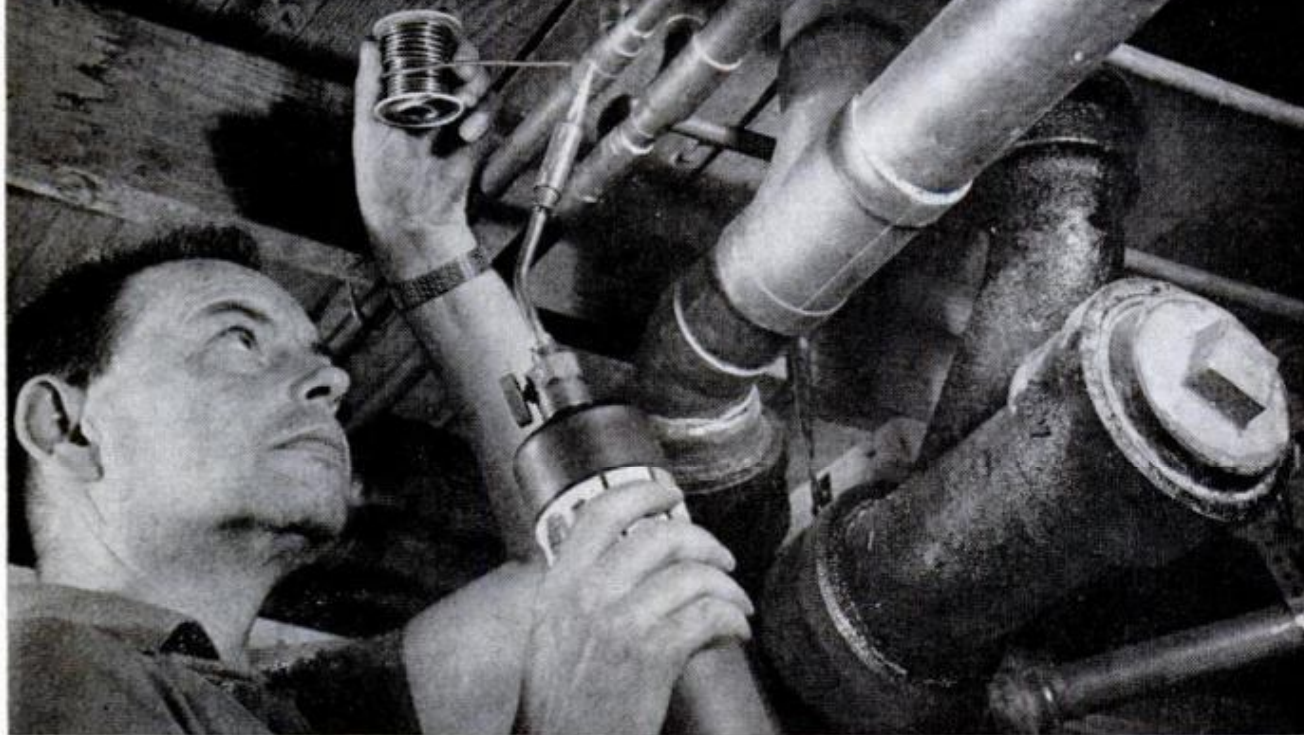
Double-jointed strap hinge

Ordinary strap hinges often tend to tear loose from a vertical holding surface due to the concentrated weight on the mounting screws when the top is open. The Brownie hinge, however, is double-jointed to avoid undue stress. Brownie Hinge, 715 Lexington Ave., Rochester, N.Y. 14613.



Pipefitting Tricks With Copper Tubing

By JOHN BURROUGHS



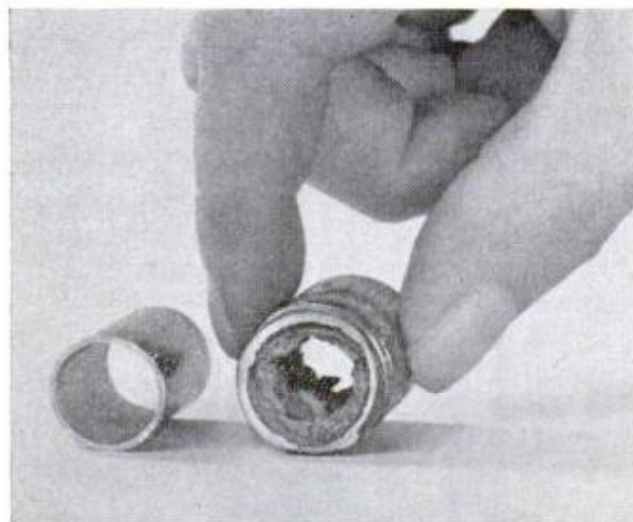
COPPER TUBING has two very important advantages over steel pipe. Since copper doesn't rust, you can expect an installation of it to last a lifetime. And, because the tubing is assembled with slip-on, sweat-soldered fittings rather than threaded, it's much easier to install.

When you use copper tubing, any home plumbing improvement that involves the extension of an existing water-supply system (adding an outdoor faucet, for example, or a new water-consuming appliance) is an easy cut-and-solder job. Copper-tube pipefitting is so simple you can even tackle large projects with confidence (plumbing in a new bathroom, say) if you first consult a plumber's standard-practice handbook and your local plumbing code.

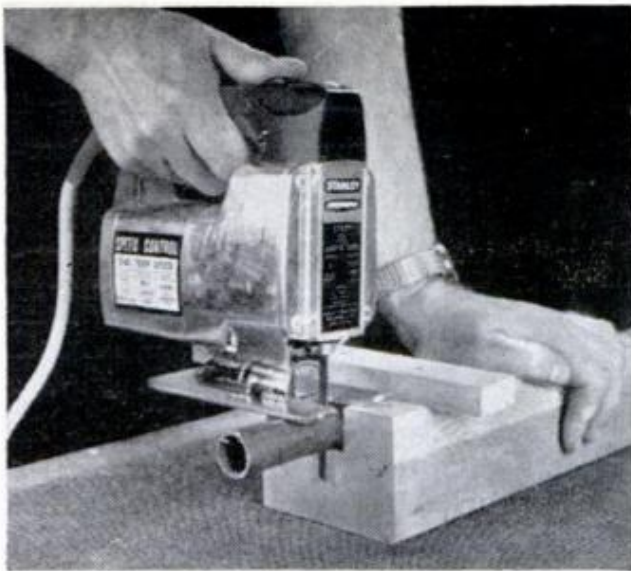
Both the tubing and fittings used for water-supply lines (to 1-in. i.d.) and larger-diameter copper pipe and fittings used for drainage systems (1½ and 3-in. sizes) are soldered and assembled the same way. Making permanent solder-

seals is just a matter of cleaning and fluxing the tube ends and the sockets of the fittings carefully, then bringing the joint *evenly* to soldering heat with a torch.

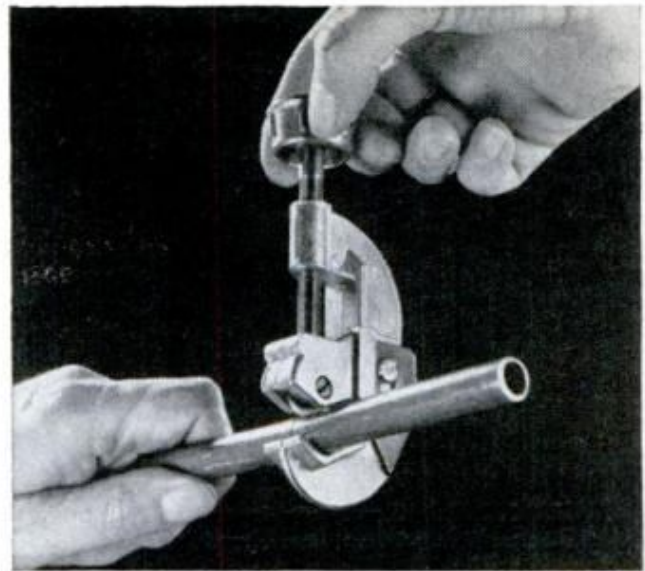
Use a noncorrosive flux and ⅛-in.-dia. 50/50 solid wire solder. While a propane



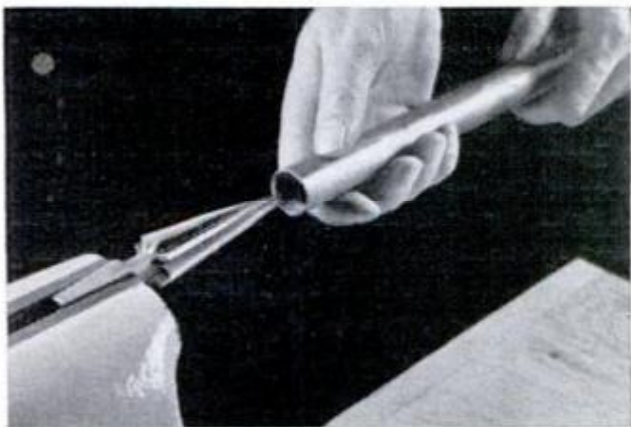
COMPARISON OF COPPER TUBING and galvanized pipe shows how rust can eventually clog an iron pipe



LARGE-DIAMETER TUBES are easily cut with a fine-tooth hacksaw or sabre saw and simple wooden jig



SMALL-DIAMETER TUBING is quickly cut using a wheel-type tube cutter. Then remove the inside burr



BURRS ON LARGE-DIAMETER TUBES can be removed by turning tube over a reamer securely held in vise

torch is satisfactory for soldering small-size tubing, a plumber's blowtorch is preferable for sweating large drainage pipe. When the copper is hot enough to flow the solder, solder-fill the joint, wipe off the



CLEAN THE OXIDE from the tube and the sockets with fine abrasive paper. Then wipe on rosin paste flux

MAY 1968



TEE



ELBOW



45-DEGREE ELBOW



COUPLING



CAP



UNION



**MALE
COPPER-TO-STEEL
ADAPTER**

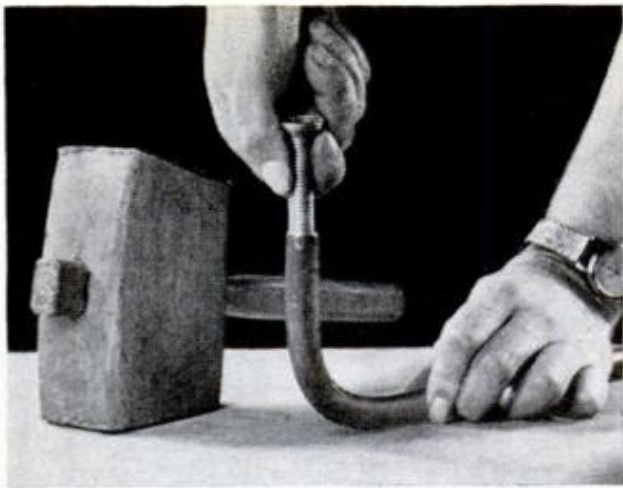


**FEMALE
COPPER-TO-STEEL
ADAPTER**



STOP VALVE

WIDE CHOICE OF STANDARD FITTINGS will enable you to tackle complex plumbing jobs with confidence. Especially handy are copper-to-steel fittings



BENDING SPRING allows you to shape soft tubing to a 3-in. radius without causing tube to collapse

surplus solder with a rag and let the work air-cool undisturbed.

Don't hesitate to connect new copper water or drainage lines to existing steel and cast-iron systems with adapter fittings. Electrolytic corrosion very seldom becomes a problem. If it should, you can easily install an anti-electrolysis bushing.

Medium-weight Type L copper tubing is most commonly used for indoor water-service lines. A heavy-weight tubing, Type K, is also available. Both come in hard temper, sold in 10 and 20-ft. lengths, or soft temper, in 15, 30 and 60-ft. coils.

Plumbers ordinarily use the rigid tubing for exposed horizontal pipework—it

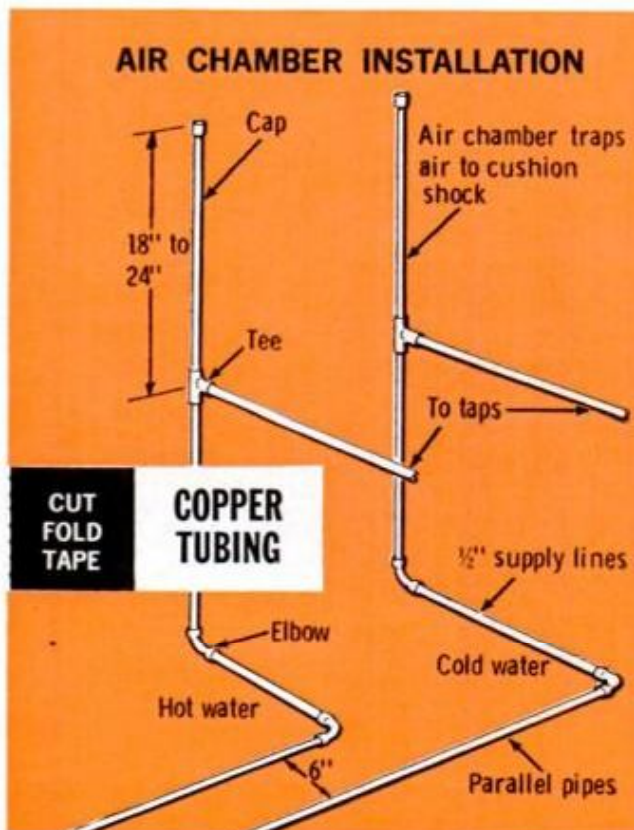
makes a neater-looking installation—and the bendable, soft tubing for concealed vertical runs. Because soft temper tubing can be snaked through partitions readily, it's widely used in remodeling. Soft-temper, Type K tubing, however, is generally required for underground water lines.

Use $\frac{3}{4}$ -in.-dia. tubing for a new water-system branch that will serve more than one fixture. Lines to water heaters or softeners also should be $\frac{3}{4}$ -in. For a run to a single tap, $\frac{1}{2}$ -in.-dia. tubing is okay.

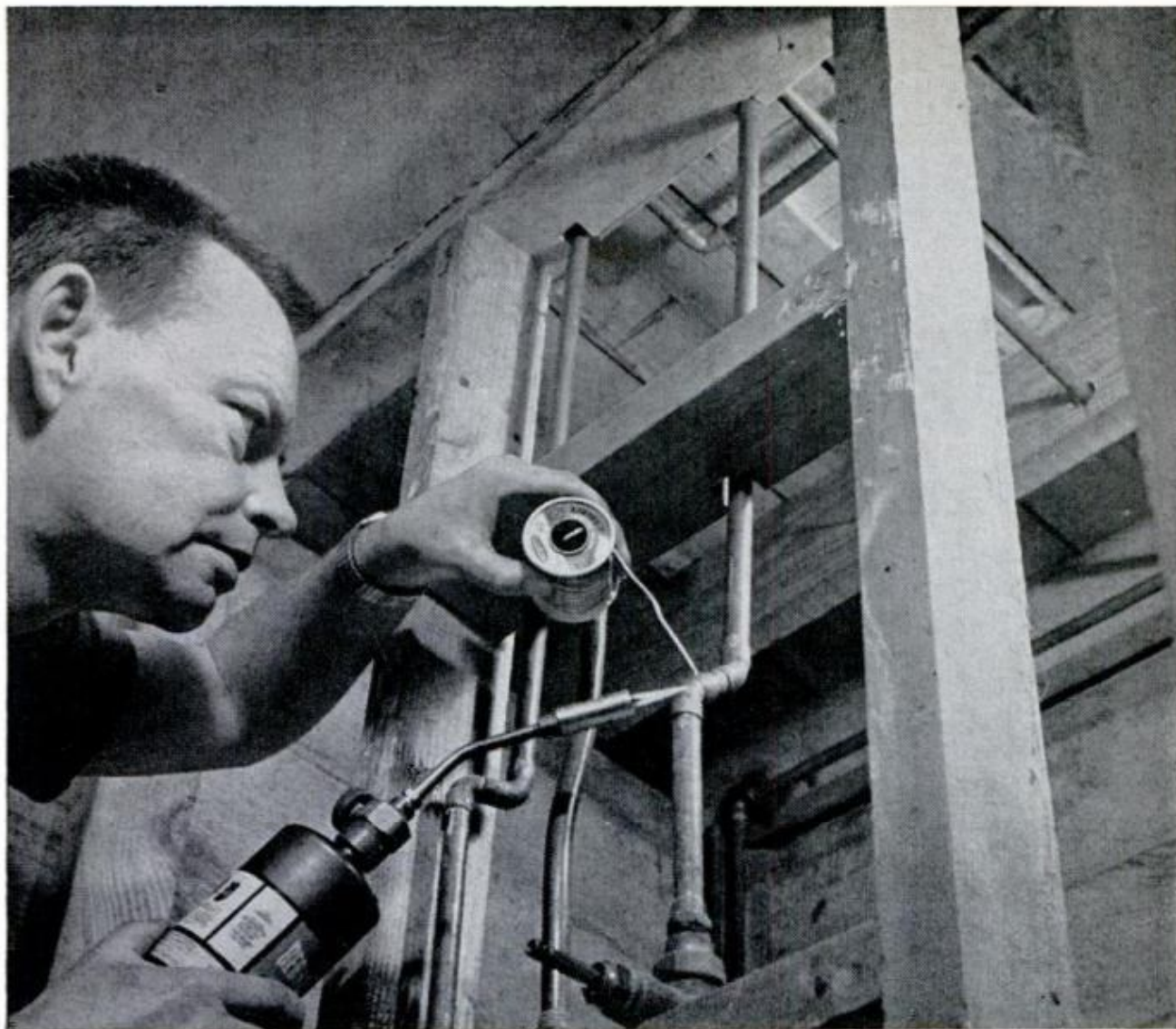
It's usually no problem to tap into the existing pipework. You simply replace a coupling or elbow with a tee fitting.

Horizontal runs of pipe should be graded sufficiently—at least $\frac{1}{4}$ -in. slope per foot—to permit complete drainage. Ordinarily, hot and cold-water lines are installed in parallel runs at least 6-in. apart to prevent sweating. All rigid-tube water lines should be securely strapped to prevent vibration that might strain the solder joints.

Inserting a stop-and-waste valve at an accessible point will permit draining the portion of the system beyond the valve without shutting off the main water supply. Be sure to install a stop-and-waste valve with the drain plug on the unpressurized side of the line. It will also pay to provide unions in water lines leading to a water heater, softener or other appliance



AIR CHAMBERS TO CUSHION SHOCK can be installed as shown at the left, or added as shown above



WHEN RUNNING SUPPLY LINES to a shower, lavatory or sink, remember that cold water enters on right, hot on left. Usually it's easiest to prefabricate sections on bench, then install them using standard fittings

that might require removal for repairs.

Adding a new drainage connection is a more involved plumbing job than the extension of water-supply lines. Remember that sewage gases are a hazard. Provide ventilation before opening any part of your home's waste-disposal system.

If your local code permits, it's sometimes possible to connect a new waste line or soil stack (required for a toilet) at the cleanout fitting on the existing soil stack. Most local codes now permit using 3-in. copper pipe (which can be concealed in a 4-in.-thick partition) for auxiliary stacks.

When this isn't practicable, you're faced with inserting a new connection fitting in the main soil stack. If your stack is 3-in. copper pipe, chances are you can insert a sanitary tee with slip couplings. If it is cast-iron pipe, a portion of the stack can be jacked up and a new section incorporating the connection fitting inserted. But check the local code first. ★★★



WHEN NOTCHING TUBING INTO STUDS, nail short lengths of strap iron over tubes and flush with studs to keep from puncturing tubes when paneling room

BOOST THE BLINK TRAILER'S TURN



A CHANGE IN THE FREQUENCY or flashing rate is a problem frequently encountered when a trailer's turn signals are connected to your car's. The additional electrical load placed on the flasher unit by the trailer lights is the cause.

One cure is to install a simple, two-transistor amplifier in the circuit between the car and trailer. The current needed to trigger the transistors is too low to affect the flashing rate appreciably. As shown in the schematic diagram, the car's turn-signal circuit needs to supply only the base current of the transistors.

The pictorial diagram shows how the amplifier is packaged. A terminal strip with eight contacts is centered in a plastic case. Using the mounting holes of the terminal strip as pilots, drill four $\frac{5}{16}$ -in. holes through the bottom of the plastic

case. Two of the holes, one at each end, should be countersunk on the bottom side for 8-32 flathead screws used to fasten the terminal strip in the case. The remaining two holes are used to fasten the amplifier to your car. Also drill two holes in the end of the plastic case for the wires to the car and trailer.

Part of the barrier webs on both sides of the third connection from the top of the terminal strip must be removed as shown in the pictorial drawing. This allows the flanges of the transistor cases to seat firmly against the metal tab of the terminal strip. Cut through the barrier webs with a hacksaw and then use diagonal cutters and a file to remove the unwanted plastic. Enlarge the holes in the flanges of the transistors with a $\frac{5}{16}$ -in. drill so they fit the 8-32 screws of the

IN YOUR SIGNAL

This small transistor amplifier will take the load off your car's flasher unit and keep car and trailer turn signals flashing at a steady rate.

By GORDON E. GOULD

Illustration by Dale Gustafson

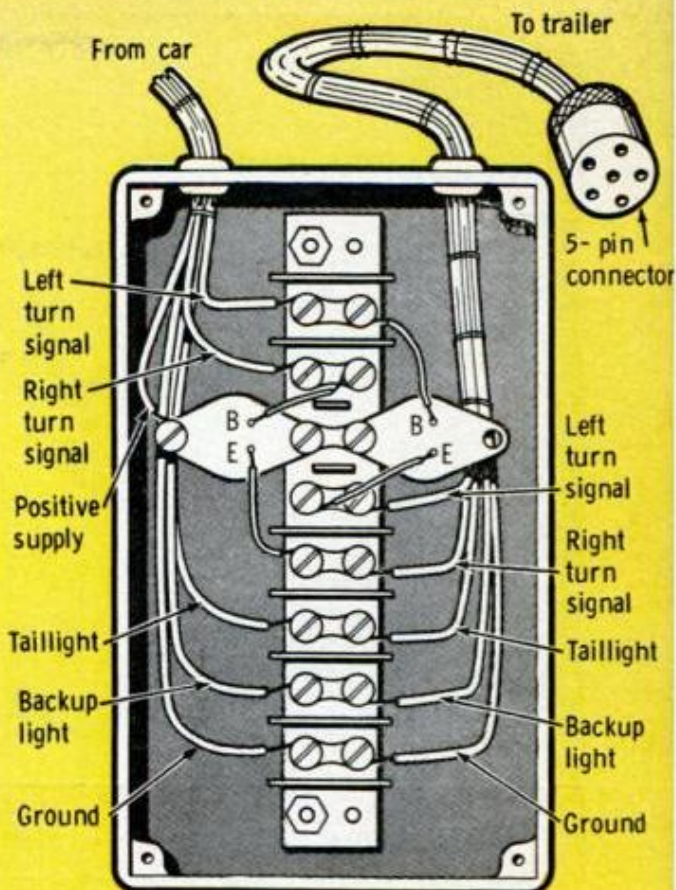
terminal block. In mounting the transistors, be careful to position the base (B) and emitter (E) junctions as shown.

Many cars have a hot wire that runs to the rear of the car to supply the trunk light. This is a convenient place to obtain the 6 or 12-volt positive supply. The amplifier can be used with either 6 or 12-volt negative ground systems or, by substituting p-n-p transistors and reversing polarity, it can be used with a positive ground system. The p-n-p transistors should be a silicon power type with at least a 3-ampere current rating. ★★★

Parts List

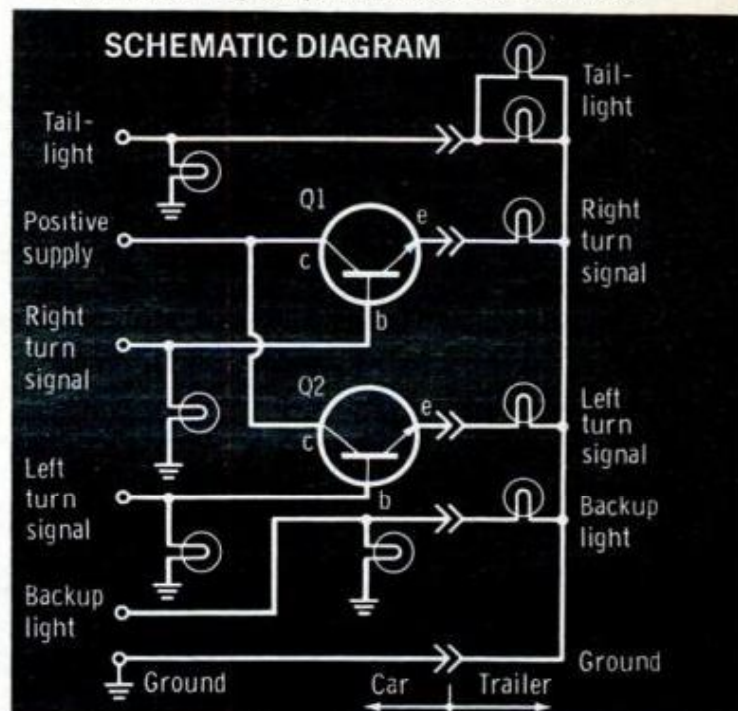
Q1, Q2—40324 silicon n-p-n transistors (Allied Radio 49E140324RCA)
 1—Terminal strip, Cinch-Jones type 8-142 (Allied 47B1676)
 1—Plastic case, approx. 6x4x2-in., and cover (Allied 42B7885 and 42B7887, or equiv.)
 Misc.—Connectors, wire, grommets, solder

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PLASTIC CASE serves as a chassis for the amplifier. All wiring connections are made to the terminal block, which also secures both transistors and connects together their cases (the transistors' collectors)

Technical Art by Graphic Presentation Services



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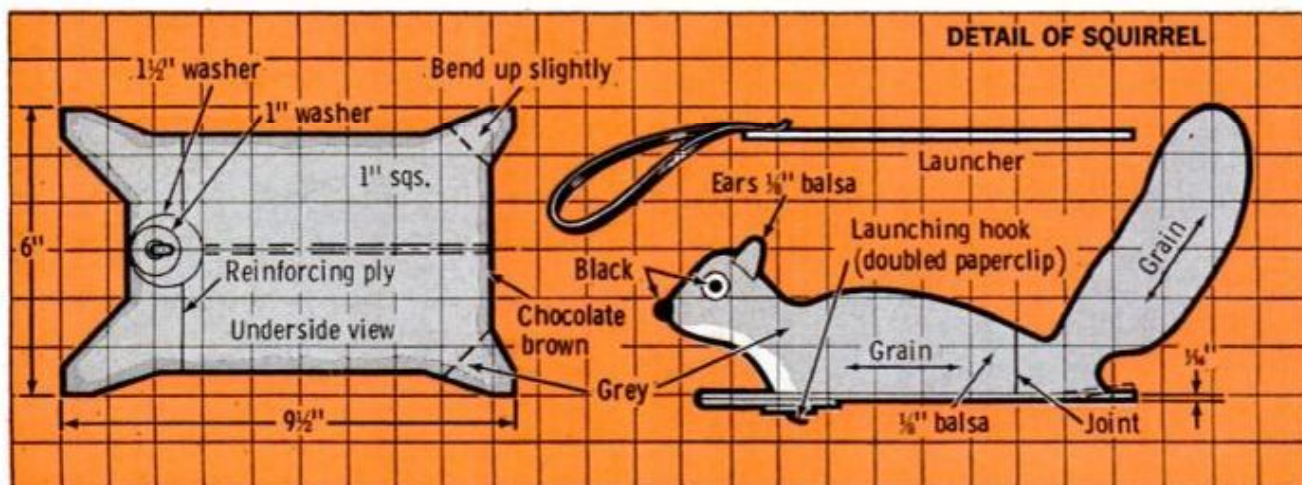
Make This Flying Squirrel

YOUR SMALL FRY will squeal with delight when you demonstrate this zippy little glider. It leaps as high as 100 ft. into the air and will soar 150 ft. or more.

Cut and assemble the squirrel as shown in the drawing below, making sure that the gliding surfaces aren't warped and that the "toes" turn up slightly. Give the completed glider a coat of clear dope to harden the surface, then sand off the fuzz and finish with regular model dope.

The eyes are reinforcing grommets sold to beef up notebook pages. Use a drop of black dope for each pupil.

Launching power is a 2-ft. length of $\frac{3}{16}$ -in. model airplane rubber doubled and looped over the hook. Just point it up about 30° and let go.—Roy L. Clough Jr.



NEXT MONTH IN SHOP AND CRAFTS

BUILD THIS COOKOUT BAR FOR A SUMMER OF FUN. Sure to prove a family center for outdoor living and entertainment, this combination patio and barbecue brings all the conveniences of your kitchen outdoors. Complete with running water, electricity, telephone and cooking facilities, the cookout bar will be presented in full color and with complete plans.

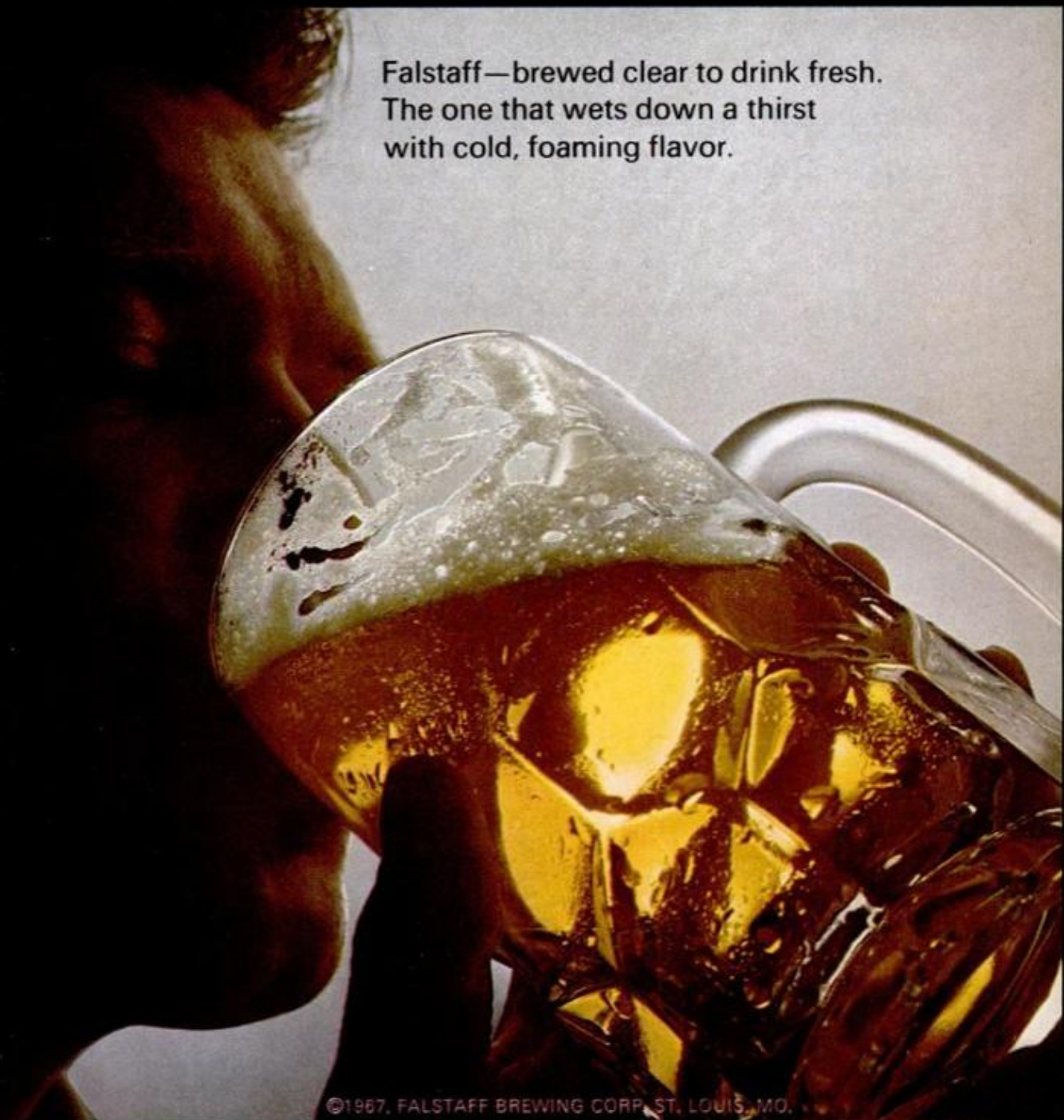
CHAISE BOAT YOU CAN BUILD. This little "loung-about" is strictly for fun and relaxation. Basically, it's just an aluminum lawn chair mounted between two foam pontoons with a tiny $1\frac{1}{2}$ -hp outboard hung on the stern. Twin levers control steering and throttle. You'll find detailed plans for this eye-catching miniboat in the June issue.

WHAT MAKES A GOOD NAIL GOOD? When you realize that about 67,000 nails go into an average-size house, you begin to understand the importance of using the right nail. To help you select the best nail for the job, the June issue will include a comprehensive chart showing the size, shape and special uses of some two dozen nails.

HOW TO KNURL ON A LATHE. Aside from improving the appearance of tool handles, knobs and screwheads, knurling also increases your grip on such items. Difficult as it may seem, the knack of knurling can be mastered easily. Learn how you can get started, and what tools you'll need or need to make, in your June PM.

the thirst slaker

Falstaff—brewed clear to drink fresh.
The one that wets down a thirst
with cold, foaming flavor.



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Illustrated is top-of-line Chateau series. Club Wagon prices start below most conventional wagons.

A better idea! New 12-man wagon changes floor plans to fit your plans.



Wide variety of floor plans, with seat arrangements for 5, 8 or a record 12 passengers. Even a rear table is available for on-the-road work or relaxation.



Color-keyed interiors are richly finished. Driver can step into the rear passenger area.

Got big plans for a wagon? Then here's the wagon to match 'em—the roomiest wagon ever built! Room for as many as 12 passengers . . . room for over twice the cargo you can get into regular station wagons. And you can choose the floor plan that fits your plan. But whatever the model, the ride is smooth, quiet, solid. Big reason is Ford's Twin-I-Beam independent front suspension. Plus a new wide stance and long wheelbase. Power choices include two Sixes and a big 302 cu. in. V-8; 3-speed manual or Cruise-O-Matic transmissions. Shape your plans around the all-new Club Wagon . . . another better idea from Ford!



...has a better idea.

ALL-NEW FORD CLUB WAGON



Customizing the Camaro.

Take a Camaro, any Camaro. Add sport striping that straddles the nose and leaps down both flanks. A spoiler on the deck. White-stripe tires, mag-spoke wheel covers. Pick a bold color borrowed from Corvette: Bronze, British Green, LeMans Blue; or new Rallye Green. Now order 325 hp under a stacked hood, the 4-speed, houndstooth-checked upholstery, AM-FM multiplex stereo radio and/or tape. If that's still not enough customizing, see your Chevy dealer. He's got the book.



Camaro SS Coupe with customizing sport trim.

Until this house was painted with Dutch Boy Latex seven years ago, it needed re-painting almost every year.



We've been watching this house in Roxbury, Connecticut ever since it was painted with our Dutch Boy Latex House Paint in 1962.

It's now nearly seven years—and we're still waiting for our first blister.

(For twenty years before, the house blistered so badly it needed re-painting almost every year.)

Obviously, neither rain, nor sleet, nor snow—even years and years of the tough New England kind—can put a dent in the exclusive resins we put in our Dutch Boy Latex.

But then, everything about Dutch Boy Latex makes it the ideal house paint.

Colors don't fade, there's little or no chalking. And, both tools and hands clean up easily with soap and water.

Paint your house with Dutch Boy Latex House Paint—and watch what doesn't happen.

Dutch Boy Latex House Paint

DUTCH BOY PAINTS
National Lead
Paint Division



If there's quality on the inside... there's a Dutch Boy on the outside.

new Surfer is quality in depth ...19 feet in length!*



We could have screwed our 3-position bucket seats to the floor instead of using bolts plus special gripper nuts. But we didn't.

We could have offered our convertible top and front tonneau cover as optional instead of standard equipment, neatly stowed to protect against dirt and damage. But we didn't.

We could have supplied plated, screwed-on deck hardware as optional equipment, instead of including all deck hardware of non-corrosive alloy, through-bolted, as standard equipment. But we didn't.



We could have scraped by with less than Johnson-dependable power—210 hp strong in a V-8, 4-cycle stern drive—with easy access cover, electric power tilt, full 90° steering arc and one-hand Electramatic throttle and shift control. But we didn't.

We could have saved by eliminating all that storage space in bow, side and glove compartments, or by not padding side and glove compartments for your valuables. But we didn't.



We could have designed a conventional pointed-nosed hull instead of our Sea-Foil hull with its twin-arch contours that put water to work for our soft, smooth, level, dry ride. But we didn't.

We could have settled for a plastic windshield instead of specifying tempered, tinted safety glass in heavy die-cast aluminum brackets bolted to the deck support, with hinged center section for access to bow. But we didn't.



We could have offered instrumentation as an accessory instead of making it standard: tach, speedometer, ammeter, fuel gauge, heat and oil warning lights—plus control switches, a cigarette lighter and electric horn. Plus a new indicator that shows drive direction before you take off. But we didn't.

We could have devised a conventional floor plan for a conventional hull, instead of our square, open bow that creates 96 sq. ft. of space for 9 passengers to spread out in. But we didn't.

We could have skimmed on flotation, instead of pressure-packing every cranny below deck with more than enough to keep a boat full of water and people afloat. But we didn't.



*Actually, 19'-1" center line.

We could have put a lot less built-in value into our Johnson Boats—especially since many of those built-in values don't even show. **But we didn't!**

See all four new Johnson Boats—14'-9" to 19'-1"—at your dealer's now, or write for free catalog. Johnson Motors, Waukegan, Ill. 60085, Dept. PM-B38.

Johnson Boats

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1 We're the truck people from General Motors. And we just ripped up the cab of our new GMC pickup to prove a point about comfort. The point is simple. A truck doesn't have to look or ride like a buckboard. Especially when that truck is a new GMC pickup.

2 The colors on the inside are keyed to the colors on the outside. Fourteen different selections. This is a touch you'd expect only on passenger cars. But GMC refused to build a dull looking truck. Bucket seats, full carpeting, a center console, all available.

3 Every GMC pickup cab has two roofs and two cab walls. Better to keep out noise, vibration and weather. Better for making

the cab last longer. You're probably thinking all pickups are built this way. But ours is one of the few that is.

4 Pushbutton seat belts, padded dash, dual master cylinder brake system, a thick laminated windshield, plenty of safety items.

5 We put coil springs in front and leaf springs in back. Not many trucks can boast a combination like ours. Or a comfortable and stable ride like ours.

6 Something you can't see here—the price. It's in the same ball park with other pickups. Your GMC Truck dealer will let you in on this comforting bit of news.

We'll rip up our new GMC cab to show you where the comfort is.

The Truck and Coach Division of General Motors

G M C

What a difference a name makes

'FLYING VOLKSWAGEN'

(Continued from page 124)

used to lock the leading edge of the wing in place while riveted to ribs and spar. "Pop" rivets, used throughout, eliminated more complicated conventional riveting.

I went through an estimated cost list with Parker. Like most homebuilts, costs vary with the individual's ability to scrounge parts, but here's an average:

Volkswagen engine	\$250
Aluminum sheets and rods	200
Instruments, basic group	50
Go-kart wheels	40
Special propeller	40

The biggest variance will be in the engine. Standard catalogs list rebuilt VW engines of up to 40 hp from \$160 to \$400.

As for specifications, at the time of my visit, the *Teenie* had only 12 hours on it, and a complete list was not available. But an estimated spec/performance chart goes something like this:

Engine	'57 Volkswagen
Horsepower	36
Maximum rpm	3100
Propeller	Hegy special
Wingspan	18 ft.
Length	11 ft., 11 in.
Wing area	3 x 18 ft.
Crew	1
Gross weight	550 lbs.
Empty weight	285 lbs.
Useful load	265 lbs.
Fuel capacity	7 gal.
Takeoff	40 mph
Takeoff distance	300 ft.
Rate of climb	1000 fpm
Maximum speed	85 mph
Range	3 hrs.
Landing distance	500 ft.

Parker claims the plane won't stall. He says it will sink fast, but with full control. I never got a chance to find out. On the day of my test flight, conditions were anything but ideal. Tornados had just passed through the area, and we had a stiff crosswind with gusts and a 1000-foot ceiling.

Even so, I learned enough to spot the two major problems that *Teenie* builders will encounter in the early flights. The VW engine, at best, is 40 hp, roughly half what the smallest standard aircraft engine produces, although it's well mated with the tiny *Teenie*. Even so there's not much margin for error. Also, because the plane is so light, unless you're used to it—and I wasn't—it's extremely sensitive on the controls. But most amateur builders would confirm this as characteristic of all homebuilts.

On takeoff, to compound the problem, I didn't get the throttle all the way to the firewall. It's a lock throttle—I'm used to friction throttles—and it locked about an inch from full power. Then, after I'd used about a third of the runway, I tried to pull it off the ground and it leaped 10 feet in the air. I pushed the nose down again, and porpoised violently a couple of times,

before I got smart and eased up on the controls. I passed the end of the runway before I noticed the throttle gap. Once corrected, the plane climbed smoothly and the rest of the flight was routine.

I stayed within sight of the field to make my turns, and whatever climbs and descents I could manage below 1000 feet, and found nothing unusual about any of the *Teenie's* flight characteristics. It responds immediately, and with commendably equal force, to all the controls, although Parker admits there was some trouble adjusting the aileron linkage in the early flights to match them up. This suggests each *Teenie* builder may have some small adjustments to make, too.

The open cockpit—my first—bothered me not at all, and I wasn't even wearing goggles. Parker thinks the plane could pick up 20 mph with a canopy, but, even so, it will never be a speedster, and some builders will prefer the sporty open-air atmosphere. Helmet, goggles, silk scarf and all that!

So the only real advice *Teenie* builders need in building is to take special care. Since the plane is almost entirely hand-made, you won't have special equipment to compensate for sloppy work. A real premium will be placed on workmanship.

And the only real advice *Teenie* pilots need for the early flights is to use full power on takeoff and ride easy on the controls. We estimated I was trying to struggle into the air on 20 hp and making up the difference with muscle power.

Lewis Long, an Alabama school teacher, who helped build the first model, was its first test pilot and now owns it, certainly had no trouble with it. He flew it while I shot pictures (that's Long on the cover) and was rock steady on the controls throughout, on takeoff, in the air and on landing. It just takes some getting used to. And, if you're like me, you'll learn in a hurry.

In fact, if you're a low-time pilot, you might want to enlist the aid of a more experienced pilot for the first flights to pick up any of your plane's individual characteristics. Most amateur pilots are happy to oblige. It's an adventure.

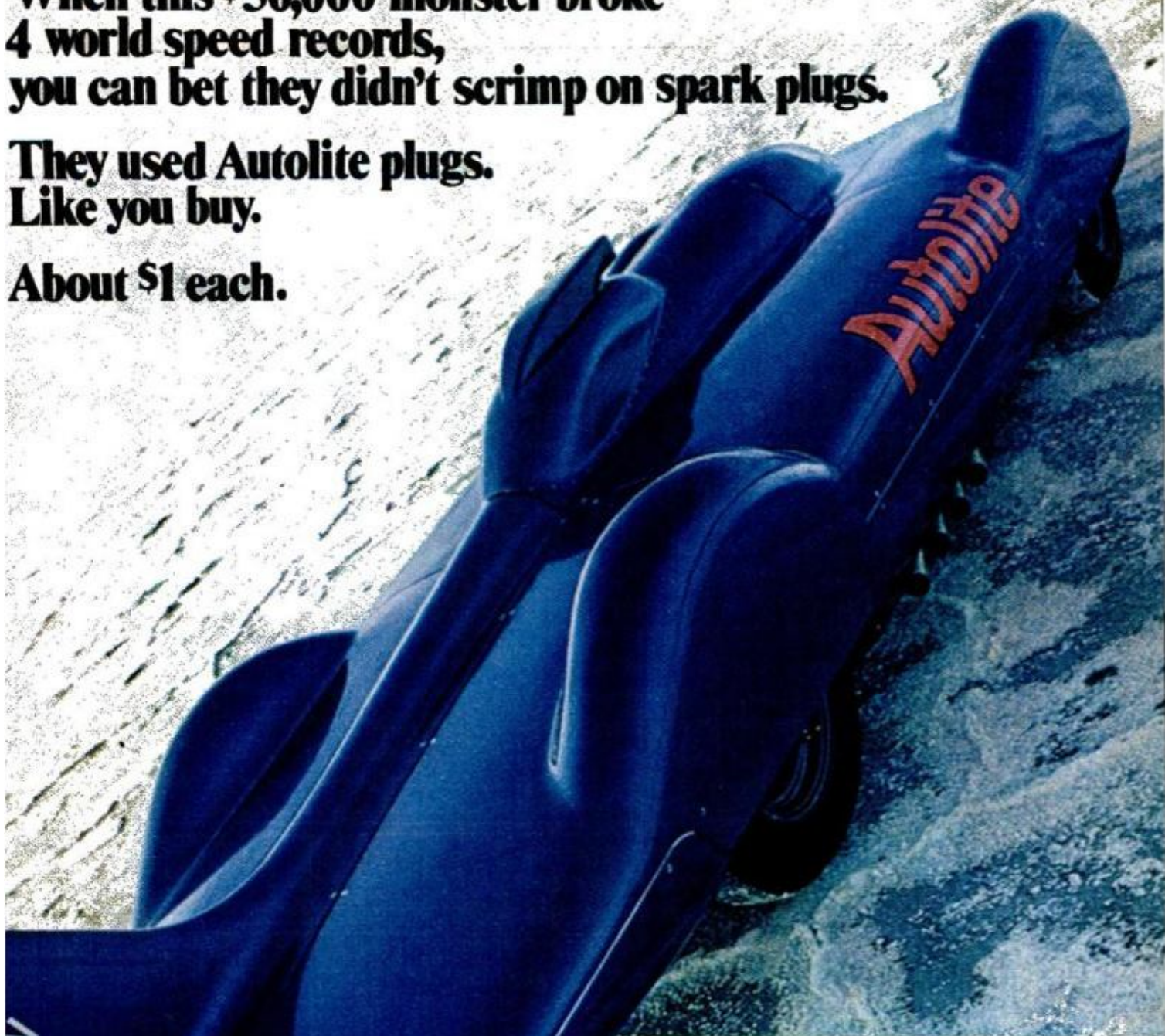
A word here about the Federal Aviation Administration. An FAA inspector must examine your plane before you can fly it. It's advisable to contact him early before you get too far down the road. The first *Teenie* passed the FAA exam easily.

All in all, *Jeanie's Teenie* is a remarkable breakthrough in amateur construction. It's not a Bonanza, nor even a \$2000 homebuilt. But, at \$600, if you build it conscientiously and fly it intelligently, you'll get your money's worth. ★★

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SANTA FE'S FAST FREIGHT

(Continued from page 78)

wire that's urgently needed and—of all things—Quaker Oats cookies right out of New Jersey ovens.

2:30 p.m. We're now on ATC (automatic train control). In our cab a letter H lights up. "High speed," says the RFE. "If they want us to cut back, an M will appear—for medium—or S for slow."

3 p.m. The RFE consults his watch. "Gentlemen," he says, "for the first hour, 64 miles!" We've doubled the distance covered by an ordinary freight.

3:50 p.m. Dauma suddenly shuts down, valves off air. We crawl into a small town. "Trouble?" The RFE grins, "Nope. This is Chillicothe, Ill.—25 minutes too soon." We roll slowly but don't stop. Our old crew scramble down one side. New crewmen slither up the other. At 3:51 we're roaring out of town. In the *Super C* these men know the excitement of railroading. There's pride in the precision it demands.

4:17 p.m. Speed 68. The brakeman draws a drink from a water cooler. Suddenly there's a red light in the cab. Then a warning beeper. Our alerter has gone off. The alerter is a new gadget which, like the old "dead man's pedal," is supposed to stop a train if the engineer is disabled. The brakeman looks up sharply. Our new engineer is very much alive and on the ball. But with everything running smoothly he simply hasn't had to move for 20 seconds—and that sends an alerter into paroxysms of anxiety. If he fails to move in the next 20 seconds, the alerter will set the air and stop the train. Then will come a long routine for "recapturing the air."

The brakeman offers a cup of water. "Thanks," says the engineer. He reaches for the cup. That does it: the alerter stops beeping. Any normal movement cancels the alerter. His stool is wired into a special circuit; body induction does the rest.

5:20 p.m. We cross the Mississippi an hour ahead of regular freights, 40 minutes ahead of our "impossible" schedule.

And so we go all night. I take a catwalk back through the diesels, cross from engine to engine and enter the test car. Here men sit over a moving chart that shows sway, speed, drawbar pull, braking. The new engines are pulling this train with amazingly little effort. And so to bed.

When I awaken we're in Indian country: ponies grazing, yellow mountains. We're far west in New Mexico!

At breakfast the word comes: We're not only outrunning the *Super Chief*—the Santa Fe's crack passenger express—we've also *overhauled and passed* the *Chief*, second only to the *Super Chief* in

speed. We started four hours behind it!

11:09 a.m. Over the Continental Divide in a blur; 7248 feet.

1:16 p.m. Winslow, Ariz. The 10th crew scramble aboard. "Pop it!" calls the RFE. We roll. Now we're working up a tremendous grade. Yet it's so easy that a great silence settles in the cab. The new engineer says: "We can't be doing 79. This speedometer is all wrong." So watches come out. An official check is run. Speedometer is right on the nose.

Up mountains. Down mountains. The engineer says: "This thing is running like a snake's back." Antelope country. Purple peaks. We hear Kingman, Ariz., telling a small freight to tuck itself into a siding. "The *Super C* is coming."

A series of skilled "mountain engineers" are running the train this afternoon. We take curves that would leave any motorist jittery. On sharp turns our "cowcatcher" hangs out over empty sky. The brakeman keeps looking back. A single hot box would spoil everything. But there are no hot boxes. He keeps watching the automatic detectors every few miles. These measure each axle temperature as we pass. If one end of an axle gets warmer than the other, a whirling white light far ahead will start turning to warn the engineer. He will stop the train, thrust his arm into a box alongside the track and get a readout. It will tell him exactly where the hot box is.

But no whirling lights appear.

A two-hour climb ahead. We make it in 34 minutes. At 70 mph we "tip over the top" at Arizona Divide (7313 feet). And now comes a huge drop: a mile descent to California.

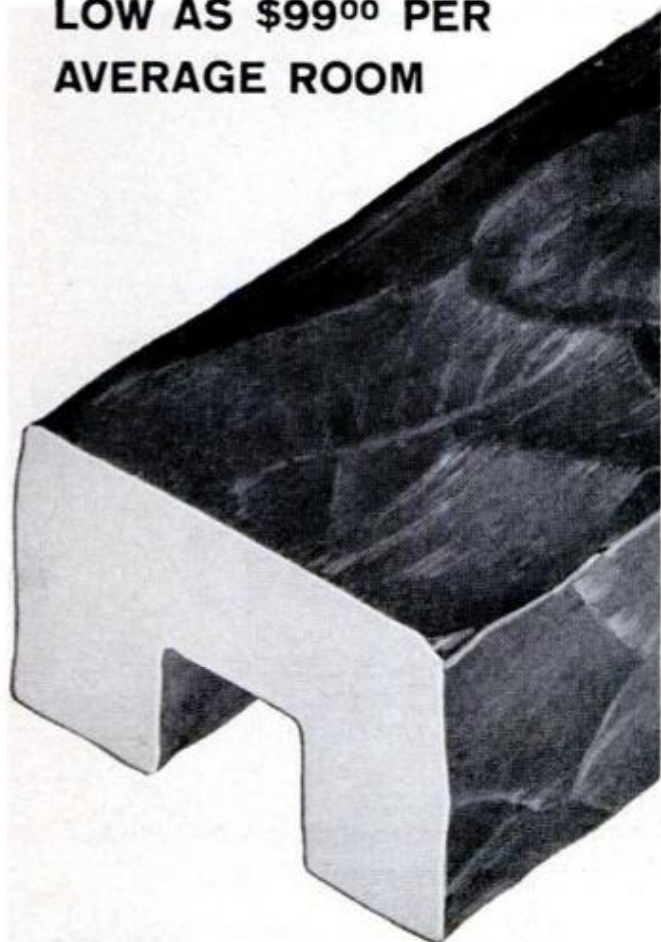
As we go over, the engineer cuts back to notch 1. Now he throws another lever and his throttle becomes a brake. And so we go into dynamic braking. It takes 15 seconds for all our motors to drop out. They now become generators and *they'll* do our braking. We'll be on "dynamic" for 100 miles downhill. When we need max braking we'll go to notch 8.

3:27 p.m. Seligman, Ariz. Crew No. 11 shouts good-by. Crew 12 gets a hand-up. By 3:39 we're far out of town. What a ride! We roar toward curves but somehow they melt away. *Super C* doesn't even lurch. On the steep descents, the test car reports, our motors are holding back 50,000 pounds of draw-bar *push*.

All this energy now turns electricity into a volcano of heat. The electricity heats huge "waffle iron" grids in the roofs, as house current heats a toaster. Then fans blast the heat into the sky; otherwise, the grids would melt. For 100 miles we go

(Please turn to page 184)

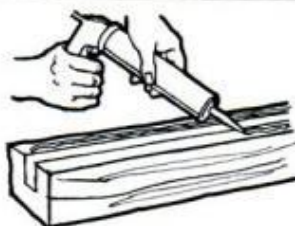
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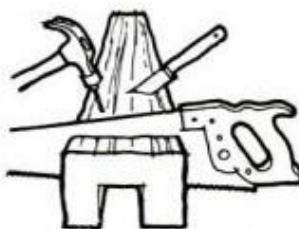
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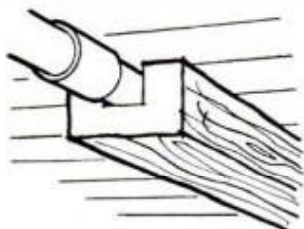
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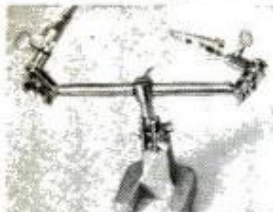
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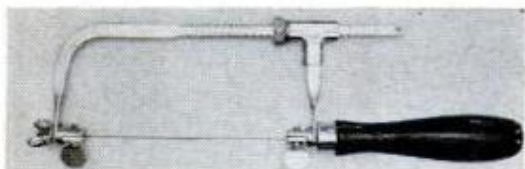


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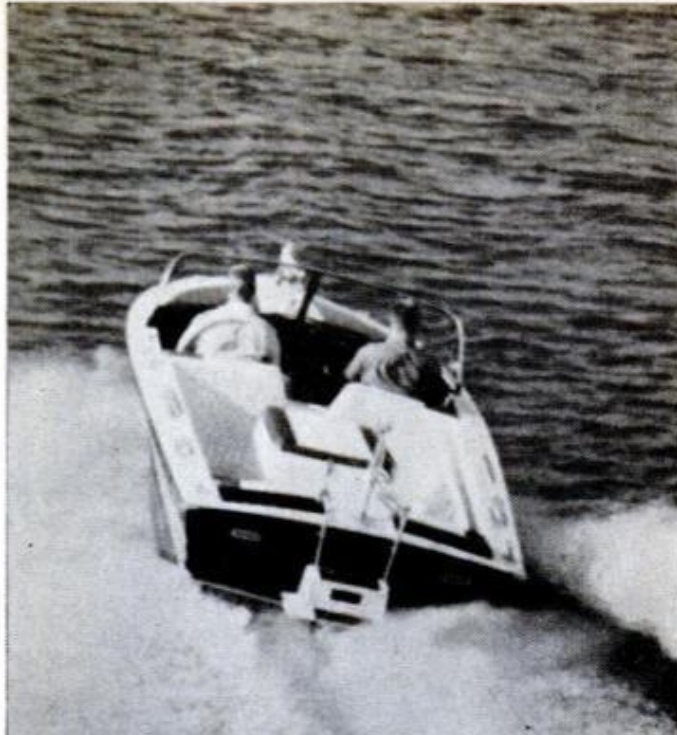
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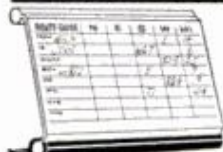


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BIGGEST SUPERTANKER

(Continued from page 73)

will be pumped from the big ships to tanks on land or directly to smaller tankers.

On Japan's southernmost island, Kyushu, the Nippon Oil Co. is building two deep-water berths. When it is finished in 1976, one will accommodate tankers up to half-a-million tons. Ready this month to receive 200,000-tonners is Mitsubishi's new SBM Berthing Buoy, a rubber-fendered doughnut anchored off Daikyo.

With Japanese yards loaded to capacity, European shipbuilders are getting the post-Suez overflow. Esso has ordered twelve 240,000-ton tankers in England, Holland, Denmark and West Germany. The British are also building a 225,000-tonner for Texaco. Sweden has orders for four 228,000-tonners and one of 230,000 tons. The Dutch are planning a pair of docks to build 600,000-tonners. So far the Japanese have had great success with this type of construction, though recently two 190,000-ton tankers, West Germany's *Esso Malaysia* and the *Myrina*, biggest ship ever built in Britain (see page 139, Feb. PM), suffered internal buckling on sea trials.

Japan's 27 major yards have five docks capable of building ships of over 200,000 tons. IHI-Kure is now enlarging a dock to 400,000 tons. Mitsui and Nippon Kokan are building new docks to handle tankers as large as 500,000 tons. Lloyd's Register of Shipping has declared a 500,000-tonner entirely feasible. So far, no yard has announced a contract to build a ship that size, but they aren't building those big docks for rowboats. ★★★



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SANTA FE'S FAST FREIGHT

(Continued from page 178)

downhill. Our regular brakes are taking hold again. We cross the Colorado River. We're at Needles. This is California. The last 300-mile lap is beginning.

Darkness, desert. Our over-and-under headlights bore ahead. Our third headlight, an oscillating searchlight, flicks nervously side to side, and into the heavens, revolving each second, warning for miles.

Up and down on "dynamic" again, letting the push from one mountain hurl us over the next, but always going downward. By radio, all along, we hear the other trains tucking their tails out of the way.

6:24 p.m. The engineer says we're doing 79 on level desert at one-third power.

6:48 p.m. Rising from the desert against a wall of mountains is something that looks like a luminous pole strung with glittering lights. What's this? "Those," says the road foreman, "are our signals for the next 20 miles." The "pole" is our own arrow-straight track reflecting the lights.

"And they're all green!" exults the engineer. "All green!"

We overtake train after train. The radio crackles. Barstow, Calif., shops are calling. Here's where all trains stop for repairs. We could lose an hour, two hours. "What maintenance will you need?" demands Barstow. The RFE grabs the phone.

"Super C to Barstow," he calls, "we won't be stopping. We need nothing, thanks. We're going on through!"

We roll through Barstow. More hours, mountains, towns. Finally a tremendous blaze of lights. We clatter into Los Angeles in a cloud of dust, roll under a huge "straddle crane" and stop. Sudden silence. 4:00 a.m. Friday? Have we made it? I consult my watch. *It is exactly 10:36 p.m.—Thursday!*

We've not only knocked 19 hours off the freight run; we've slashed it *one full day*. The officials announce our exact time: 34 hours 36 minutes, or 2 hours 15 minutes better than the fastest passenger run ever made. We've smashed the *Super Chief's* own record.

At 10:37, exactly one minute after we stop, the crane picks up the cookie trailer. A road tractor rushes up. The connection is made, and at 10:39, three minutes after our arrival—the cookies are on their way. Meanwhile the crane has already lifted the Ford trailer.

In 30 minutes flat the whole train is empty, ready to load for Chicago. A Ford man, summoned hours earlier than expected, whistles his disbelief. "Hell," someone says, "*by 4 a.m. we'll have those new engines on the assembly line!*" ★★★

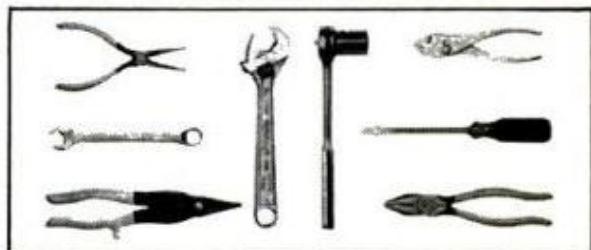


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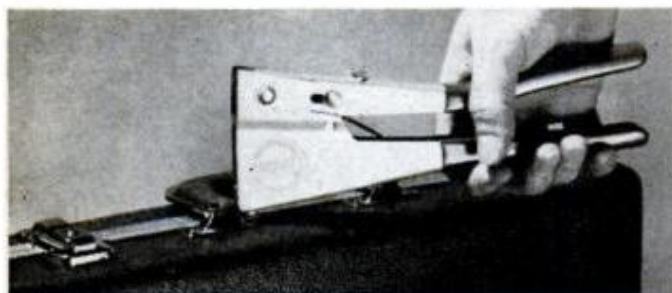
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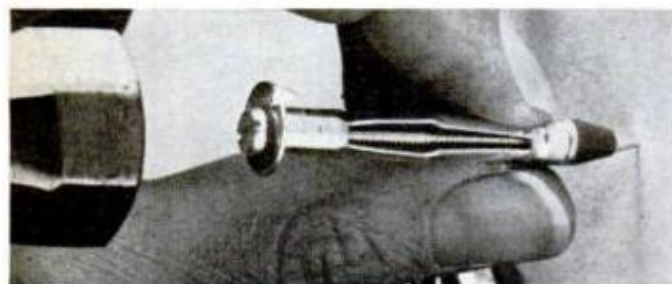
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SUPERSTORMS RAGING IN SILENCE

(Continued from page 118)

of corpuscles—headed straight for Earth.

Twenty-eight hours later, at precisely 8:26 p.m. New York time, Feb. 10, the cloud and the Earth arrived at the same point in space, causing a slight jiggle on the recording charts of magnetic instruments. The jiggles increased rapidly, and by 8:49 were sweeping right off the page. A bright aurora appeared over Minneapolis, and all magnetic hell broke loose.

Normally auroras are confined to two narrow bands encircling the globe about 1700 miles from either pole. Aurora borealis, in the northern hemisphere, passes through central Alaska, Hudson Bay, southern Greenland, upper Scandinavia and Siberia. In the southern hemisphere aurora australis skirts Antarctica.

During a magnetic storm, though, the auroras spread into the temperate zones. If the storm is particularly fierce, auroras can even be seen flickering briefly yet brightly deep into the tropics.

Although auroras have been well studied, they are a long way from being understood, and there is no foolproof theory to explain them. About all that is known for sure is that the presence of an aurora indicates a state of turbulence in the ionosphere, a region above the stratosphere containing tiny particles of electrically charged air.

Within the ionosphere are the Kennelly-Heaviside and Appleton layers which act as mirrors, reflecting radio waves of certain frequencies back to earth. But for them, a series of relay stations would be needed to broadcast long distances, since radio waves travel in a straight line and do not follow the curvature of the Earth. During a magnetic storm, however, the layers seem to go to pieces. Radio waves are gobbled up by the ionosphere and distant radio communication ceases.

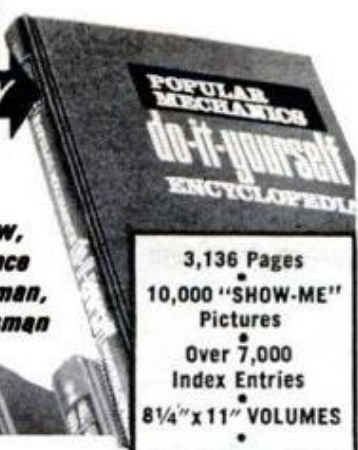
So at 8:50 p.m., with the aurora spreading, transatlantic radio contact abruptly faded. Radio companies tried to keep in touch with Paris by routing messages to South America and over to Tangiers, thus avoiding the turbulent ionosphere above the North Atlantic. Sporadic contact was maintained in this manner until 11:00, then for the next hour and a half there was no contact at all.

Meanwhile, the breathtaking aurora continued growing and at 9:00 p.m. was seen as a faint pinkish glow as far south as Georgia. As sheets of electricity tormenting the ionosphere were duplicated within the Earth, submarine cables began being affected. At 9:01 the Bell System's

(Please turn to page 188)

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SUPERSTORMS RAGING IN SILENCE

(Continued from page 186)

cables between Newfoundland and Scotland packed a potential of 2650 volts. American voices heard in Europe varied from whispers to ear-shattering squawks.

Still the storm's fury increased. Power overloads started tripping circuit breakers and lights began blinking out on both sides of the Atlantic.

At 1:45 on the morning of Feb. 11, a faint aurora was seen near Mexico City. At 2:00 a.m. the junior third officer aboard the *President Taylor*, steaming off the Mexican coast on the same latitude, recorded that the northern sky was aglow in red.

By then feeble radio contact had been regained with Paris, via South America-Tangiers. But the countless ships plying the North Atlantic and the 100 or so airplanes flying above it were still groping in radio blindness. Luckily, there was no marine disaster necessitating an SOS, and pilots managed to keep pretty well on course and out of danger by relaying messages from plane to plane.

At dawn on Feb. 11 the ionosphere reconstituted itself and the layers resumed reflecting normally. However, that night radio communication was once more erratic over the North Atlantic, and auroras were seen in several places. Not until 10:00 a.m. on the 12th was the great magnetic storm of 1958 declared over.

To produce all the phenomena observed it was estimated the cloud of charged particles encountered by the Earth must have been 46 million miles long and 23 million miles wide. The aurora it caused was calculated as being 5800 miles long in an east-west direction, 400 miles wide, 360 miles thick, and starting at an altitude of 120 miles.

While the storm threw some new light on the nature of the ionosphere and the Earth's magnetic field, it left most old questions unanswered. We still don't know what makes auroras shine, or what causes the ionosphere to go haywire during a magnetic storm. Sunspots remain as mysterious as ever, though it is now thought that a sudden breakdown of a spot's magnetic field permits the flare's energy to escape into space. Some scientists feel that if we ever get to the bottom of these mysteries we may be well on the way to solving the secret of the universe. One thing is certain. When solar activity again reaches a peak and the sun is dotted with spots, there will be more magnetic storms, perhaps even greater than 1958. If the sun holds to schedule, that should happen around 1969. ★★

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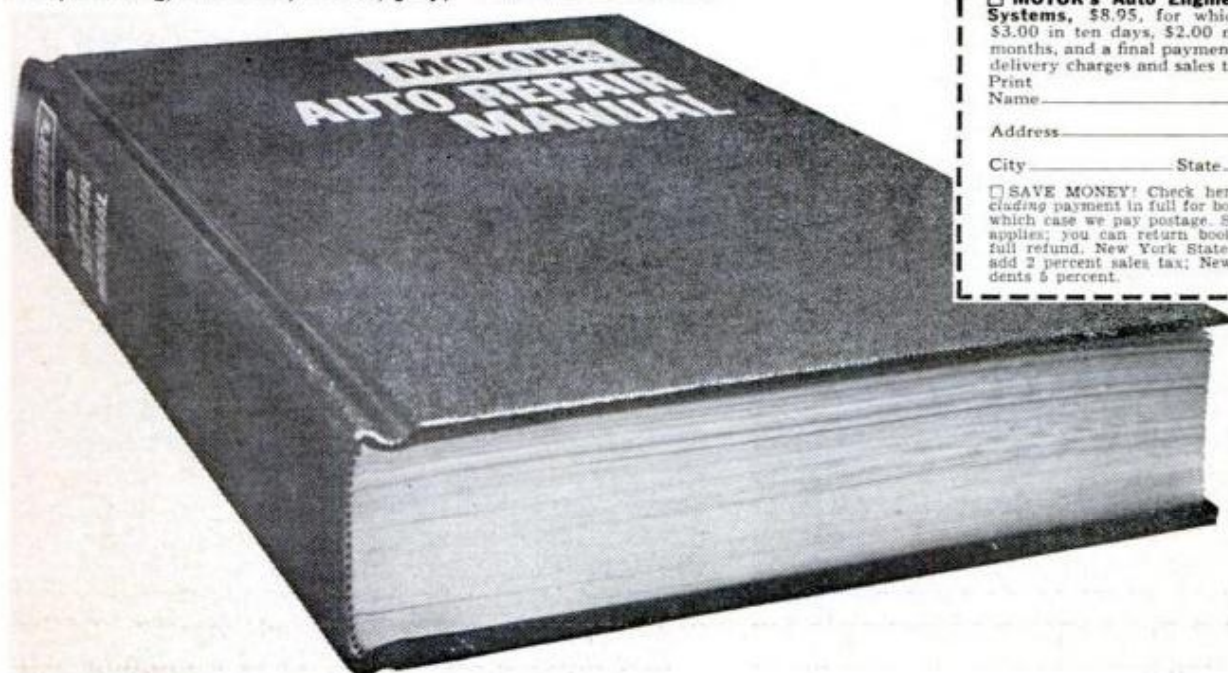
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TIME-LAPSE MOVIE CONTROL

(Continued from page 128)

the accompanying diagrams show how the control works during each step in the cycle. A five-second thermal-delay relay (Relay 2) on the timing unit gives the floodlight a chance to come on a few seconds before the solenoid fires.

The tripper lever is arranged so that it gives the shutter-release button on the camera only a quick jab, exposing no more than one or two frames at a time. A snap-action switch (Switch 2) is closed as the lever swings forward to strike the button. This sends current to the main relay (Relay 1), cutting off power to the solenoid. With the power off, a spring snaps the lever back to its at-rest position. The tripper thus acts as its own cutoff, insuring a brief exposure even on cameras not equipped for single-frame operation.

Another snap-action switch (Switch 3) is arranged so that it stays on until the tripper lever has fully returned to its at-rest position. This keeps the floodlight burning for a fraction of a second after the exposure has been made, even though the rest of the power has been shut off. This switch must be of the normally-on type, while the others are normally off.

A 10-second thermal-delay relay (Relay 3) is added as a backstop. If the tripper lever should fail to shut off power after making the exposure, this delay relay will do so a few seconds later. It thus makes sure that the control is returned to its original "off" state, ready for the next cycle to begin.

Simplified version

If your camera has provision for single-frame exposure, you can omit the cutoff switch on the tripper lever and also the floodlight-delay switch. In this case, the 10-second thermal-delay relay takes over the job of switching off both the light and the solenoid after the exposure has been made. You can eliminate the five-wire cable and simply run two wires between the timing unit and the tripper unit—those for firing the solenoid. Connect Pin 5 on the 10-second relay directly to Coil A of Relay 1.

The interval between exposures is determined by the speed of the motor you select and the spacing of the pins around the timing disc. The motor is a synchronous type used in clocks and other timing devices. A $\frac{1}{15}$ th-rpm speed—one revolution every 15 minutes or four per hour—provides a good choice of intervals for actions lasting from an hour or two up to several days. With an 18-pin disc, this

speed gives uniform exposure intervals of 50 seconds (using all 18 pins), 100 seconds (with a pin in every other hole or 9 pins), $2\frac{1}{2}$ minutes (with 6 pins), 59 minutes (with 3 pins), $7\frac{1}{2}$ minutes (with 2 pins), and 15 minutes (with only 1 pin).

For one minute of action on the screen, you need to expose about 1000 frames of film (960 for regular 8 and 16-mm film at 16 frames per second and 1080 frames for Super-8 at 18 frames per second). To compress into one minute an action extending over 15 hours, you would thus have to make about 70 exposures per hour. The 50-second interval would be just about right for this, giving 72 exposures per hour.

Action determines intervals

In most cases, the type of action will determine the best exposure rate. A slow-blooming flower can be shot at longer intervals than a fast-fading sunset. As a general rule, the shorter the interval, the smoother the action and the more realistic the effect. However, because the two thermal-delay relays need time to cool between cycles, the shortest practical interval is about 20 seconds. At shorter intervals, the relays may not open in time.

The timing disc can be made from hardboard or other thin material. Its bearing assembly is a stock item and can be purchased. The hub can be a simple block of wood drilled and cemented to the back of the disc or it can be machined from metal. The pins are small machine screws bolted to the disc so their shanks protrude toward the rear. A pendulum is used to trip the switch instead of the pins themselves because the pins would hold the switch closed too long and the control might attempt to recycle.

The pendulum is a $\frac{1}{2}$ -oz. weight on a strip of stiff sheet metal about $\frac{1}{2}$ in. wide. The weight can be a stack of washers or any other handy piece of metal. The arm of the snap-action switch (Switch 1) must be extended so the pendulum will trip it easily. The extension is a length of stiff wire flattened at one end and soldered or bolted to the original arm. (This and other snap-action switches shown in the diagrams are of the type commonly known by the trade name Micro-Switch.)

The two thermal-delay relays and the 8-prong plug from the tripper unit fit into radio-type octal sockets. The numbers shown in the diagrams follow the standard order for such sockets, as seen from the top. These and other receptacles are mounted in aluminum socket shells for a neat appearance on the wood base.

The main relay (Relay 1) is a latching

(Please turn to page 192)



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TIME-LAPSE MOVIE CONTROL

(Continued from page 190)

type with two coils. Each coil controls two single-pole, double-throw switches. Note that Coil B is wired through its own contacts in such a way that it shuts off power to itself the instant it's actuated.

The arrangement of parts on the tripper unit will have to be adjusted to suit the particular camera used. The light bulb in series with the solenoid acts as a resistance to vary the force of the solenoid plunger. Without it, the plunger may whack the tripper lever too hard. The bulb tames the action so it's more gentle. For the M-14 shutter release, a 40-watt bulb was found to be just right. Other bulbs can be tried depending on the stiffness of your shutter release. If your camera takes a cable release, you can clamp the end of the cable between two wood blocks on the base so the tripper lever strikes the plunger.

The tripper lever is made of maple or other hardwood with an arm of springy metal to give it a resilient cushion. The two switches actuated by the lever are mounted one above the other on wood or metal brackets. Arrange these so they can be shifted slightly as the switches must be carefully positioned through experimentation.

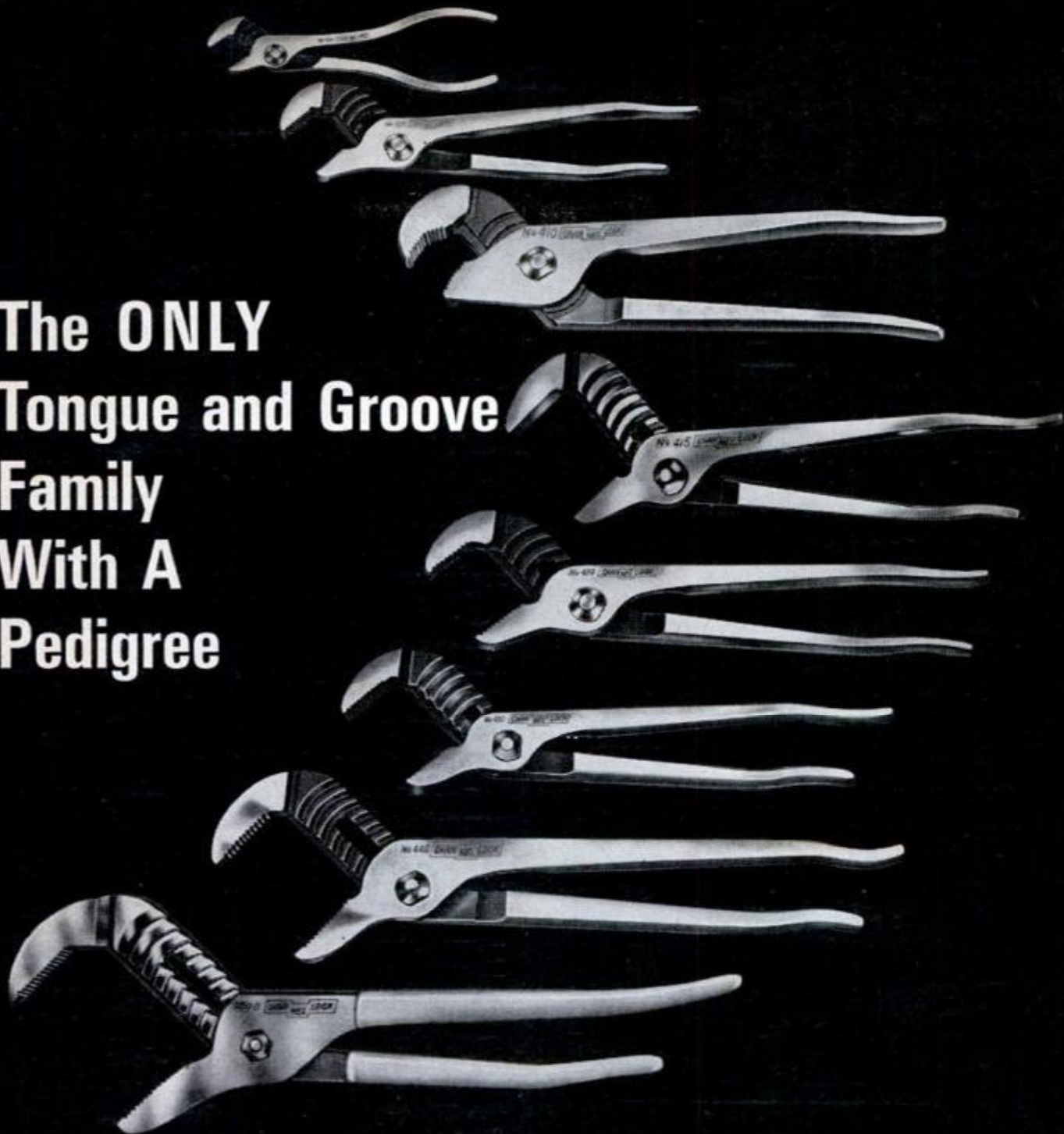
Avoid partial exposures

If the cutoff switch (Switch 2) doesn't cause the tripper lever to snap back fast enough after an exposure has been made, it's possible to get a partially exposed second frame. If it proves difficult to adjust the tripper to expose only one frame, a short "burst" of two or three frames is usually just as good, but be sure that all frames are fully exposed. It may be necessary to run a test roll of film through the camera with the switches set in various positions to see which is the best arrangement.

The tripper unit should be solidly supported or the jerk of the solenoid may cause some blurring of the film. A conventional tripod was found to be too wiggly. It's best to clamp the unit firmly to a table, bench or other stable support. While not a must, a camera having built-in exposure control is helpful on outdoor shots since it will adjust automatically to changing light conditions without your having to be present.

Be careful of exposed connections on the switches and other parts. Protective covers for the units can be made of perforated hardboard or other light material but have been omitted in the photos here to make the parts visible. ★★

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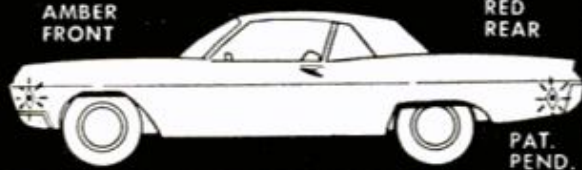
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CANYONLANDS IN A CAMPER

(Continued from page 107)

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Bob and Joe meet us at Mineral Canyon. We load the canoes on Tex's rig, go back for my van, and head for our second night's camp on the White Rim Trail.

But to get there we have to descend Shafer Trail—a "Jeeps only" road that has 20 switchbacks running down the face of a mammoth cliff.

Jeep trails in this country are not for drivers who have had little rough-road experience. I consider myself a terror on modern turnpikes, but quite frankly, these high wilderness trails intimidate me. Even in dry weather some of the turns and cliff-edge roads would scare the pants off someone not used to them. Though our two-wheel-drive Dodge does extremely well on dry roads, I wouldn't want to get caught on a wet trail. These roads are rightfully marked "Jeeps Only."

There are some good roads in this country for the average driver, but if you do want to get into the real Canyonlands, you need a four-wheel drive and/or a guide. Get hold of Tex or Joe in Moab. They'll take you places you've never dreamed of.

Deadhorse Point is a highlight

One place might be our second-night campsite. It's just opposite Deadhorse Point.

Bob, John and Tex sleep out under the bright stars while I try the van.

One thing I do find extremely valuable—my three-layer Coleman sleeping bag. I start the night between the first and second layers. But with the coldness of midnight, I drop a layer and sleep between the second and third layers.

By 8:00 a.m., we're heading deeper into Canyonlands National Park. We travel the White Rim Trail to Lathrop Canyon, then drop down to the river, then back to Moab.

The campwagon conversion unit, installed by Travel Equipment Corp., is great, though there are some rough edges where the roof is cut away to put in the pop-up top. This top, by the way, lets you stand erect inside—a tremendous advantage. TEC provides good hanging lockers, icebox, stove, sink.

Don't take a two-wheel-drive vehicle on Jeep roads. However, if you are an experienced rough-road driver in a four-wheel-drive vehicle you can have a thrilling tour through Canyonlands. If you plan it, don't go alone. Make sure there's another vehicle along. If you're in a car, use roads approved by the Park Service and state park maps. ★★★

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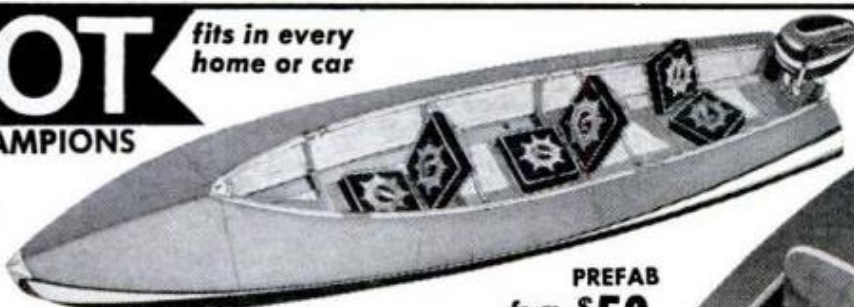
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MAY 1968

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(Continued from page 91)

less flattering audio-visual expert, who worked with Goldmark on a scheme that failed in takeoff, says: "Goldmark is a dreamer. He's at least 50 years out."

Actually this is unfair. Most of his inventions—and there are a couple of hundred of them—are in the here and now. Take the long-playing record, for instance. "I was at a party listening to Brahms being played by Horowitz," he recalls. "Suddenly there was a click. The most horrible sound man ever invented, right in the middle of the music. Somebody rushed to change records. The mood was broken. I knew right there and then I had to stop that sort of thing."

Goldmark who believes irritation is the mother of invention and tenacity its father, took three years to give birth to the 33 $\frac{1}{3}$ -rpm record, and there were the usual detractors along the way who said it couldn't be done. But when it emerged in 1948 it became an instant smash.

Goldmark has a burning desire to make as many things as possible work. "His mind scans a course at maximum speed," says Dr. Gabor, "and he is never happier than when he is beset with an idea and tinkers with circuits until 3:00 a.m." On one occasion, Goldmark's secretary, Sheila Knott, arrived late at his home and blamed it on a faulty electrical system in her car. Goldmark promptly spread newspapers on the concrete garage floor and drove the car in. Then, like any passionate Saturday mechanic, the president of CBS Laboratories crawled under the car, and corrected the trouble. "You now have no cause to be late any more," he said.

Goldmark's own car—a shiny Mercedes-Benz—gets treatment normally reserved for a Ming vase. At a service station, he checks the oil himself and takes off the battery caps. He will suffer the attendant to fill the gas tank, but he personally sees to it that every last drip is wiped off.

When observers have trouble explaining Goldmark's unpredictability they blame it on his Hungarian background. He was born in Budapest in 1906, which makes him a member of talented Hungarian scientists including von Karman, von Neumann, Teller, Szilard and Wigner who made much of 20th-century technology possible.

Goldmark began to fool around with mechanical things when he was still in short pants. Among his earliest recollections is putting together a monstrous motion-picture projector between bouts with a piano master. Goldmark studied engineering at the Berliner Technische Hoch-

schule and took his advanced degree at the University of Vienna.

His professors encouraged the young man to make a career in physics, but by the time he got his PhD in 1931 Goldmark was already entranced with television. The source of this joy was a Scottish stocking salesman named John Logie Baird who wrote in a magazine about a mechanical system of TV he had just invented. Baird had first demonstrated his device before the Royal Society in 1926 and then persuaded the BBC to transmit his pictures. He also started a company which sold do-it-yourself receiving kits.

First color TV—all red

Goldmark got hold of a Baird kit and put together the first TV receiver in Vienna. He was able to pick up the BBC. "The picture came through in postage-stamp size," he recalls. "You could hardly make it out. It flickered so. It was also in color, all red," he adds with a grin. "But it was the most exciting thing in my life."

Several weeks later, young Goldmark found a job with Pye Radio, Ltd., in Cambridge, England, where he set up a TV engineering department and built a mechanical television set based on a revolving disc. He stayed two years in England before concluding sadly that the British were not going to do much in advancing the cause of television. So, bundling up his cello and with \$250 in his pocket, he sailed to America and proceeded to hammer on the door of RCA, where Vladimir Zworykin had just announced his invention of the iconoscope, the basic tube of black-and-white television. "RCA turned me down," Goldmark recalls, and then adds with an impish look: "This proved to be Sarnoff's biggest mistake."

But a vice-president of CBS said he had read one of Goldmark's technical papers. Would Goldmark look into the possibilities of TV for CBS? Goldmark was soon directing the construction of a TV station atop the Chrysler Building.

Goldmark's relationship with color TV began one day in 1940 when he dropped in to see *Gone With the Wind*. It was the first color movie he had seen. The gestation of color television was quick; in March he made a proposal to the CBS management, and three months later TV's first practical color system was a reality. It was based on a rotating disc with a set of filters. Unfortunately, World War II came along and color was curtailed.

After the war, CBS again pushed color. Goldmark built the first color set using the undeveloped UHF part of the broadcast spectrum and demonstrated it in

(Please turn to page 198)

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(Continued from page 196)

New York. The public streamed in, but the FCC ruled that color broadcasts in UHF would take up too much of the spectrum and turned down Goldmark's system. Not one to stay idle, Goldmark took time off from TV to invent the long-playing record.

By 1949 Goldmark, still dreaming color, found he could fit a color system into the lower frequencies. He went back to the FCC, which ordered a special demonstration. The contest was CBS vs. RCA.

What it came down to was that Goldmark's system produced beautiful color—but nothing that could be received by existing black-and-white sets. RCA proposed a "compatible" system that would permit both black-and-white and color sets to receive the same program. By then, though, the Korean War had broken out and when the smoke died down it appeared that RCA had a compatible system that worked—the one we have today.

Ironically, it also means that RCA pays royalties to CBS—a fact not made public until 1965—for the system is based upon a device known as the shadow-mask tube, a form of which Goldmark and his CBS Laboratories crew had been quietly inventing and patenting all the while.

During the fracas Goldmark made a move to Stamford, Conn., where CBS had decided to set up a research wing.

Designed portable hi-fi for blind

A catalog of the electronic wonders which have come from this lab would be pretty dull reading to a modern day audience, but two or three items from Goldmark's pet store will provide some idea. Goldmark, for instance, showed me a portable high-fidelity record player designed for the blind. The device has a clever mechanism that causes the needle to retract when there is too much pressure on the tone arm, thus preventing the needle from scratching the record.

Goldmark can pull out invention after invention, depending on the hat he is wearing. One of his hats is that of professor of medical electronics at the University of Pennsylvania and his most triumphant invention in medicine is a miniature television camera that is used to provide instant pictures in color of the inside of the stomach. Goldmark is also a contractor to NASA, and he points with pride to a scanning camera (based on an invention of his that goes back to the 1930s) which was used recently in the Lunar Orbiter to take the first high-resolution pictures. ★ ★ ★

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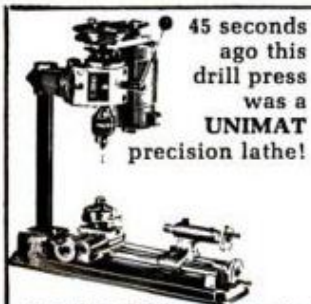
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MUSTANG OWNERS REPORT

(Continued from page 110)

about his car's "rear wheel hop." And "the rear end is far too light on wet roads and driving in snow," says an unemployed Massachusetts lad. And our Indiana housewife and mother has no complaints other than "the back end seems too light. Mine has wide-track tires so it holds the road pretty well, but without them, there could be problems 'cause the back tends to sway on bad roads and in wet weather."

Rear suspension on the Mustang and, again, on all the sporty cars is the same: rigid axle and semi-elliptic rear springs. What's the solution? Countersteer and watch your step.

When it comes to Mustang styling, almost nothing remains to be said. The car hasn't changed appreciably since its introduction in 1964, and neither has the enthusiasm owners feel for its lines. As revealed in our original Mustang Owners Report (Sept. 1964 PM), the decision to buy the car then was most influenced by styling—a whopping 61.8 percent of owners. In 1968 the figure is 57.8 percent. No difference worth speaking about. Four years later and almost the same sheet metal—and the Mustang is still catching eyes and buyers—a phenomenon doubtless surprising nobody more than the designers themselves.

Among specific styling features of the 1968 Mustang, most often mentioned as being well liked are the directional turn signal monitors recessed on each side of the hood (similar to those on front fender tips of many other cars). To a secretary in Maryland, the "signal lights in the hood are the best, most exciting thing."

If the basic style of the Mustang continues, and each year sees only such minor "identification" changes, the car's enthusiasts will start to sound like Volkswagen followers who know just where all the 629 hidden improvements are.

In 1964 only 14.9 percent of owners felt economy of operation to be their favorite feature. Today it's 31.3 percent. An actual mileage breakdown by engine displacement was not done in 1964, but for the '68s the figures are shown in the chart on page 110. While not fantastic, average mileage is good and more than most owners figured. It can even be interpreted to reveal something about Mustang drivers. They're not lead-footed hot rodders. Their sporty car is just that: sporty. It has, as they tell us, fostered a greater pride of ownership, joy of handling and concern with precision driving. A good thing for American motoring. ★★★

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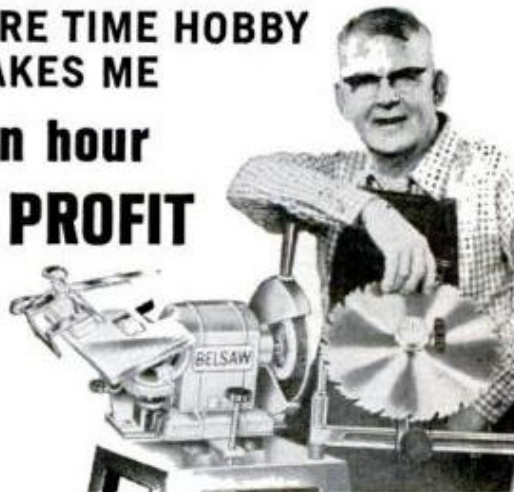
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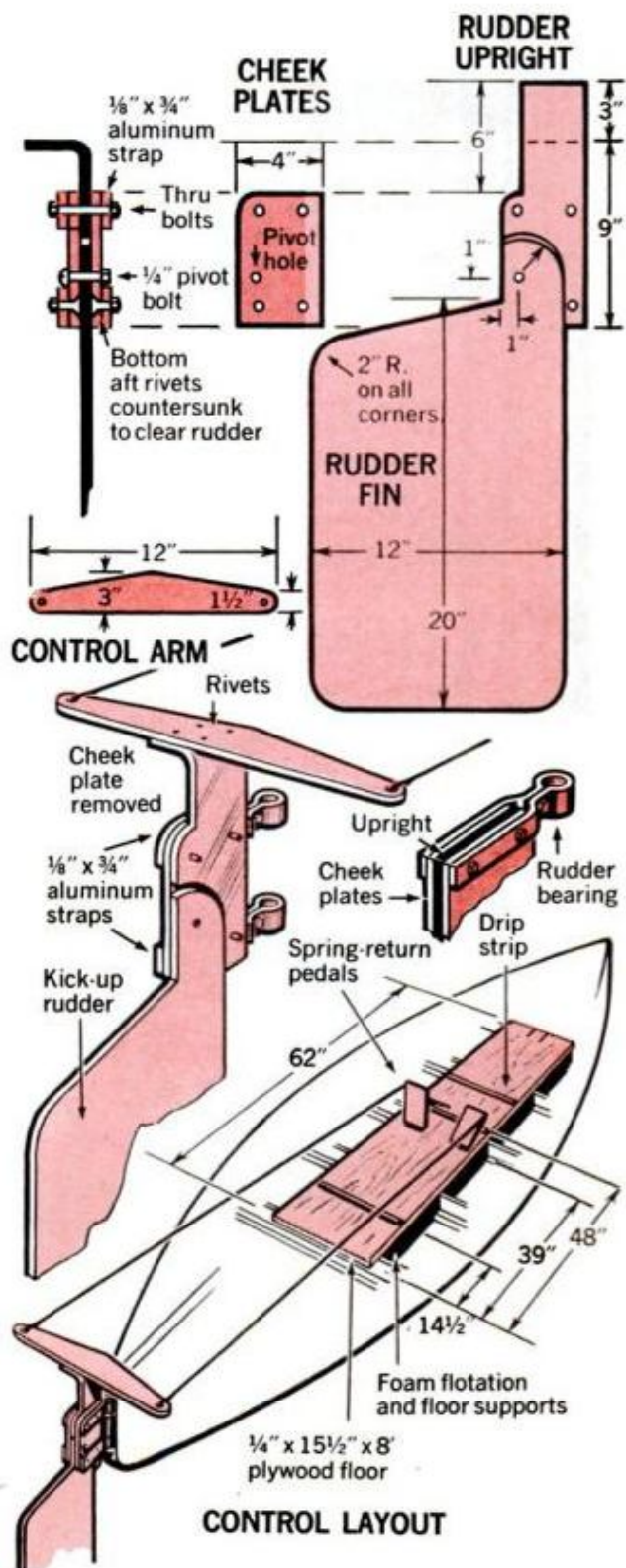
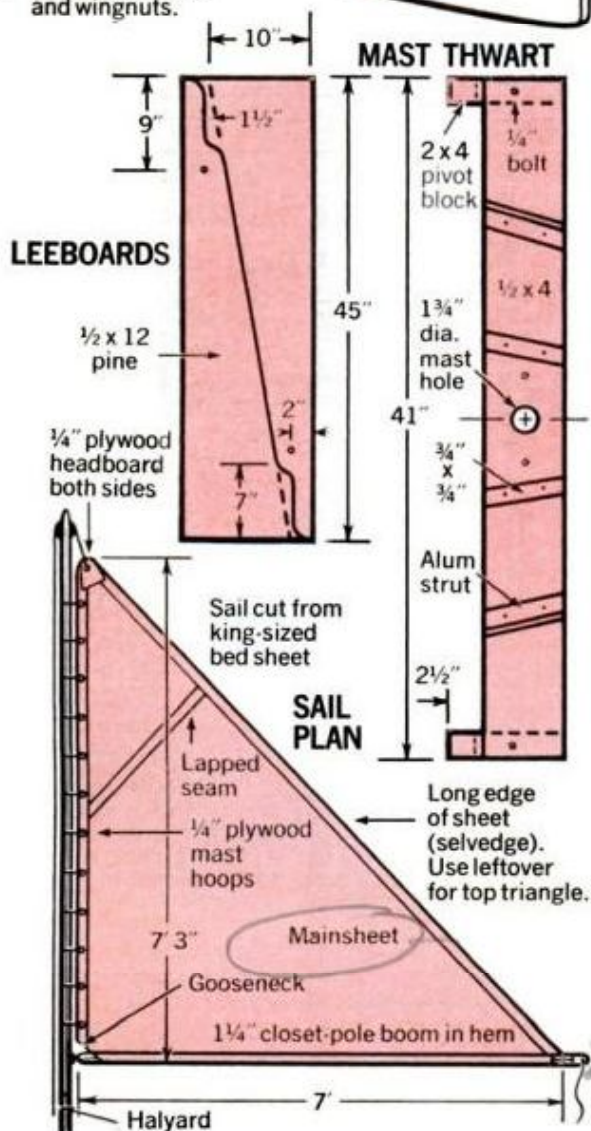
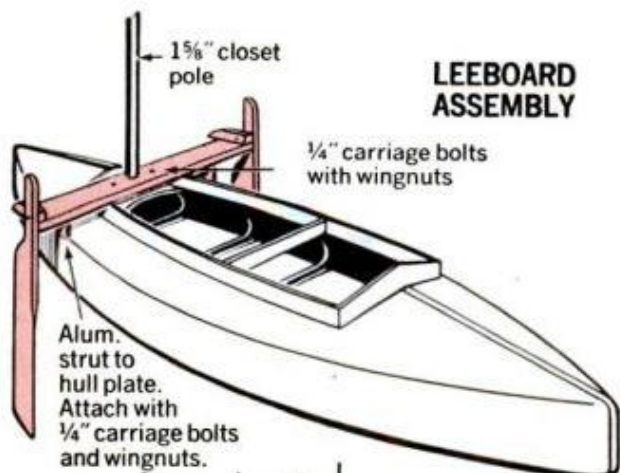
(Continued from page 149)

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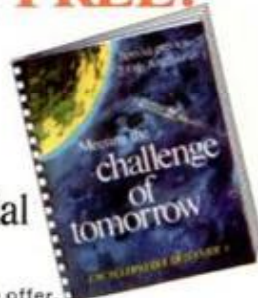
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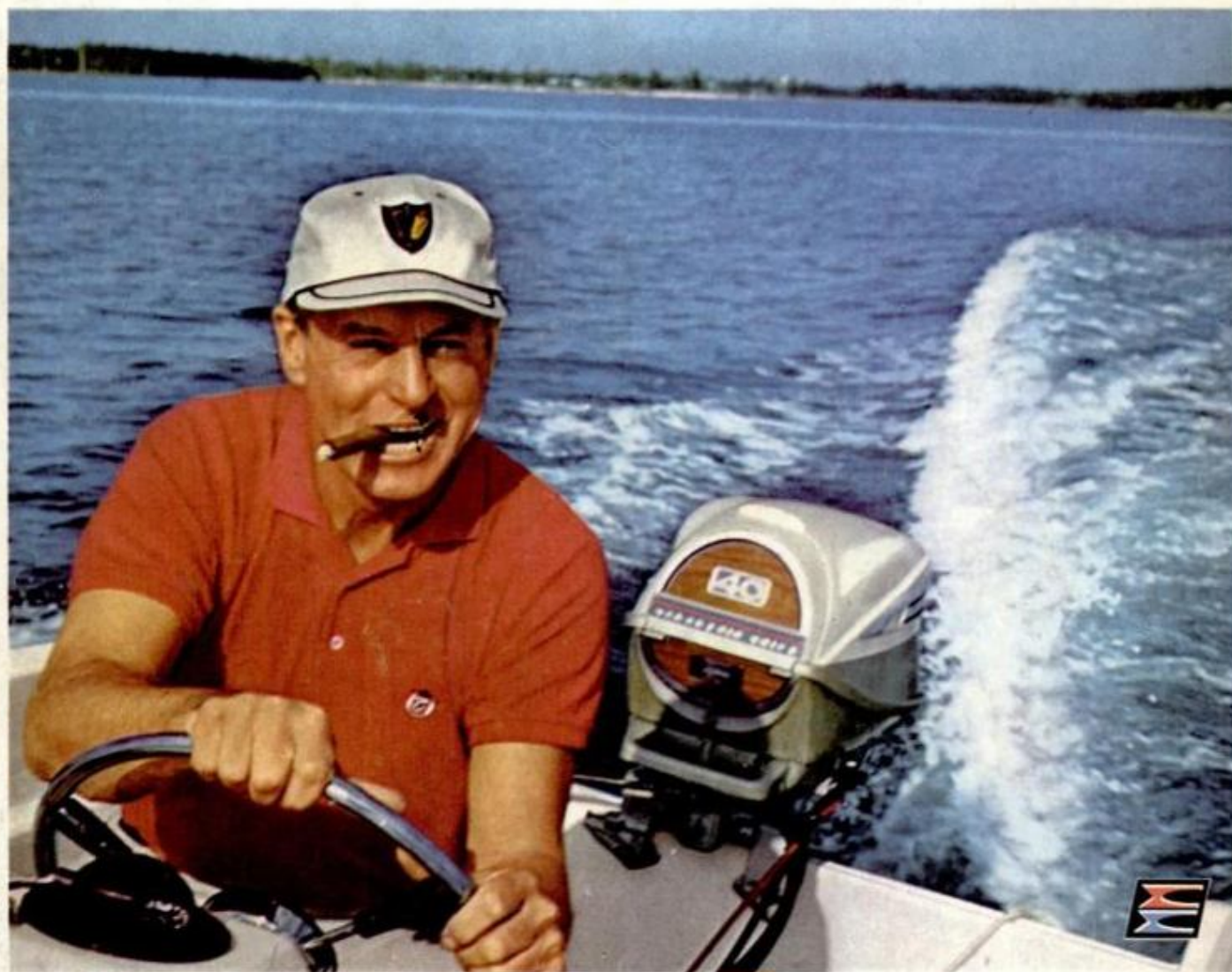
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