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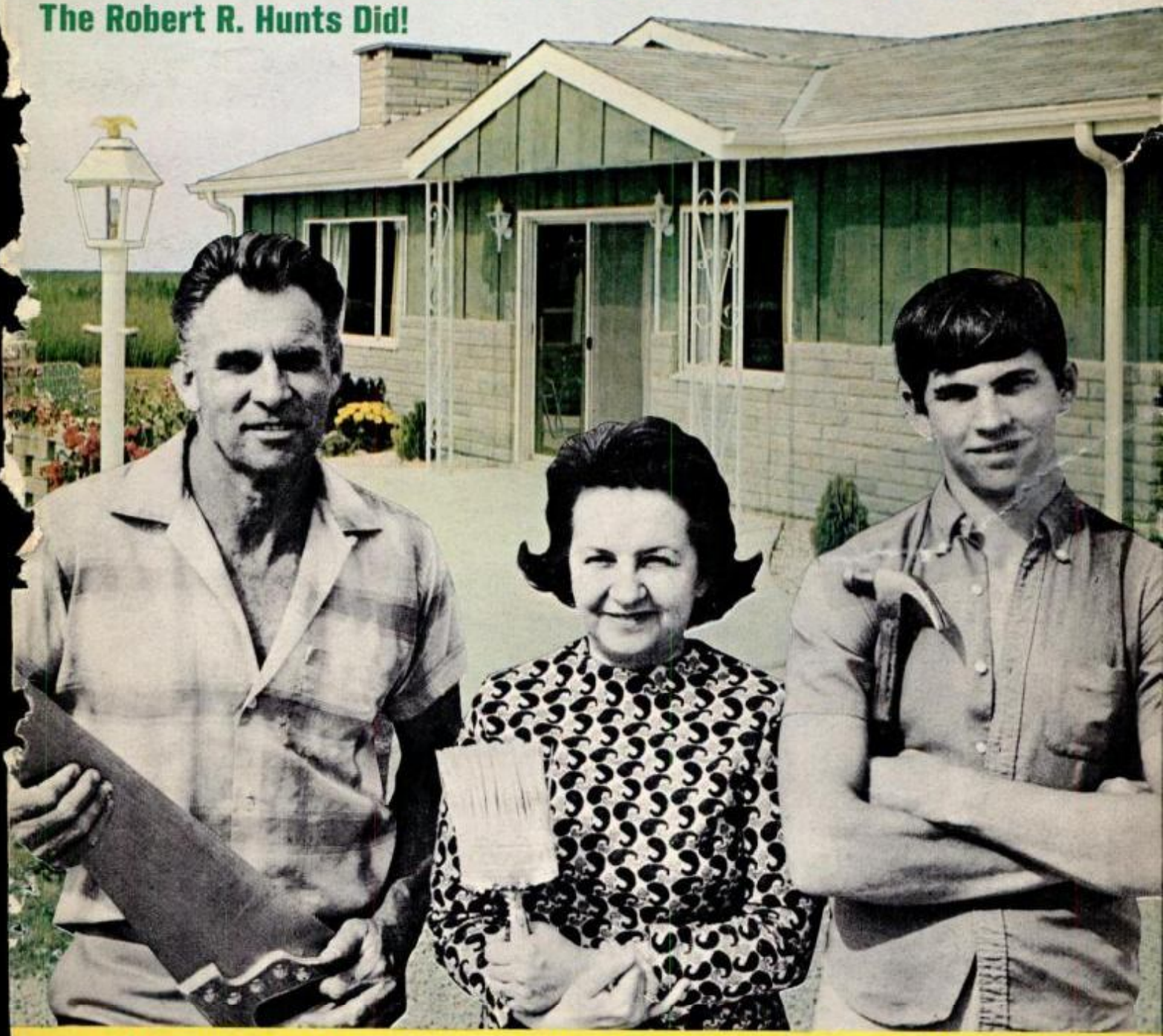
POPULAR MECHANICS

NOV. 1969
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NOVEMBER 1969

1



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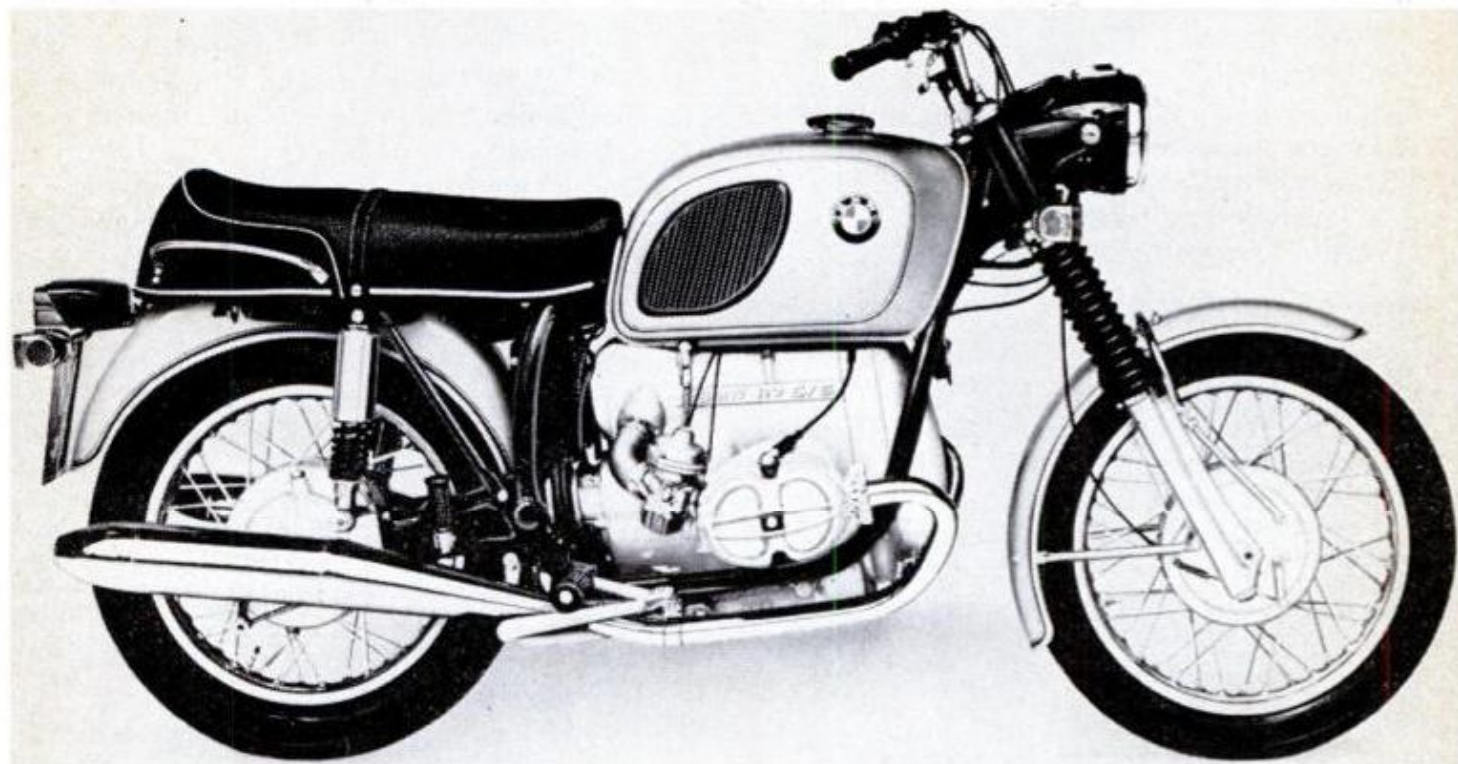
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The Robert R. Hunts and the 3-bedroom, 2-bath airconditioned house they built for \$7500

NEXT MONTH IN POPULAR MECHANICS

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LETTERS TO THE EDITOR

Tributes to Willy Ley

Regarding your editorial, *Send Willy Ley's Ashes to the Moon!* (page 10, Sept. PM), I believe every effort should be made to honor this man in that way.
DEERFIELD, N.H. E. D. HERSEY SR.

I was deeply saddened upon opening the September issue to discover that Willy Ley has missed man's conquest of the moon.

I grew up into America's space age on a solid footing provided by his classic, *Rockets, Missiles and Space Travel*.

I agree with PM that he deserves a final tribute from this nation, to which he has contributed his foresight and vision. Willy Ley's final resting place should be on the moon—which he prodded this country to conquer.

DETROIT, MICH.

DAVID GARIEPY

PM Owners Reports get an 'A'

As both an academic and practicing statistician, I have long frowned upon the evaluation of various consumer goods by magazine staffs or groups organized for such purposes. The difficulty is not the objectivity nor the thoroughness of the investigators; rather, the problem lies in the procedure of drawing conclusions about all units of a model or brand from the study of a single unit. In view of the natural variability of manufacturing processes, without a large enough sample and proper statistical procedures, it is impossible to infer anything meaningful about the entire group.

A refreshing contrast to this pattern are your evaluations of automobile models on the basis of a million or so owner-miles. The mileage per gallon and defect-percentage data based upon your results, although somewhat deficient for several statistical reasons, are nevertheless sufficiently meaningful to provide real guidance for the prospective automobile purchaser. Please continue this form of evaluation—your data on gas mileage and auto defects are the best available.

HUNTER COLLEGE P. S. KIRSHENBAUM, PH.D.
NEW YORK, N.Y.

Trailer insurance in Oregon

Your May issue carried a statement about Oregon's insurance requirements for travel trailers. This appeared on page (Please turn to page 8)



TUNE UP ELECTRONICALLY ANY CAR EVER MADE!

- ✓ COMPACT or LIMOUSINE
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- ✓ 4, 6 or 8 CYLINDER
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With New Improved Model BT-162

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ASSURE - EASY STARTS, OPTIMUM PERFORMANCE and
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**The Model BT-162 will perform the services specified below
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- ✓ Car manufacturers' dwell angle recommendations are included in the manual provided with the Model BT-162 for all cars including the external adjustment type distributors specified above.
- ✓ It is no longer necessary to file points to smoothness when using the Model BT-162. The instrument will automatically make allowance for any existing "pitting" or "wear."
- ✓ To adjust for mathematically correct carburetor adjustment and thus insure maximum gas economy and

quiet engine running, simply use the Tachometer section of the Model BT-162. Read the exact RPM while the engine is in neutral position. Then adjust the carburetor in conformity with the car manufacturer's recommendations as specified in the manual provided with the Model BT-162.

- ✓ To locate a "miss" you need only disconnect or "short" the spark plugs one at a time with the Model BT-162 switched to the Tachometer position. You will be able to instantly identify which particular plug (or frequently its wire lead) is responsible for the malfunction.
- ✓ Cars with automatic transmissions function efficiently only if the fluid pressures are correctly maintained and since manufacturer's instructions always refer to RPM the Model BT-162 (or an equivalent tachometer) is required to properly service automatic transmissions. Incidentally, the 5,000 RPM maximum range of the Model BT-162 is adequate for all car engines without any exceptions.

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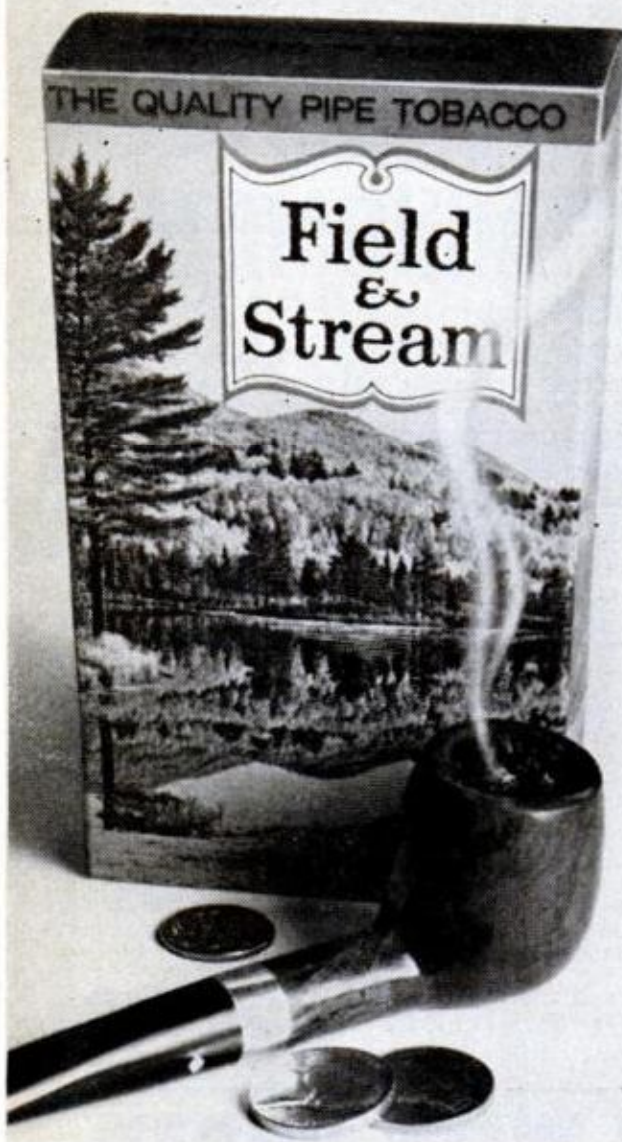
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says that Field &
Stream's aroma reminds
her of a great autumn
day in the woods...



**start
saving up
the dowry.**

A quality product of Philip Morris U.S.A.

LETTERS

(Continued from page 6)

S-10 (*How to Camp Anywhere*). To clarify what is apparently a misconception I thought it best that I write you.

Your article stated that Oregon required \$100,000/\$300,000 minimum liability insurance on *all* travel trailers. To the contrary, Oregon has no minimum liability requirement on *normal* travel trailers. If a trailer exceeds 10 feet in width or 55 feet in length it must be granted a permit by the Permit Section of the Highway Div. of the Department of Transportation. Before such a permit can be issued to a vehicle that is obviously oversized, the owner must provide liability insurance of the limits you indicated.

STATE CAPITOL
SALEM, ORE.

TOM MCCALL
GOVERNOR

Crazy and mixed up

Your statement in *Our Crazy, Mixed-Up Speed Laws* (page 81, Sept. PM) that "You're innocent until proven guilty" is somewhat a myth, for many small-town judges and police receive a percentage of fines—a sad situation in this day and age.

Furthermore, your account of a California traffic officer who admits that he picks on teen-agers clearly demonstrates one of the reasons for general unrest in this country. This man not only does great disservice to the community but also promotes an "outsmart the cop" attitude. He does great harm in citizen-police relations.

The hate and fear of police can only bring disaster to this nation.

EVANSTON, ILL.

IGOR DE LISSOVOY

Regarding the *Speed Quiz*, I gave an answer of 45 mph to the question: "The speed limit as you enter most towns is..."

Most towns, as you enter, post a 50-mph speed limit to allow you to gradually slow down. A little further, this drops to 40, then to 30 (or 25, as the case may be).

DALLAS, TEX.

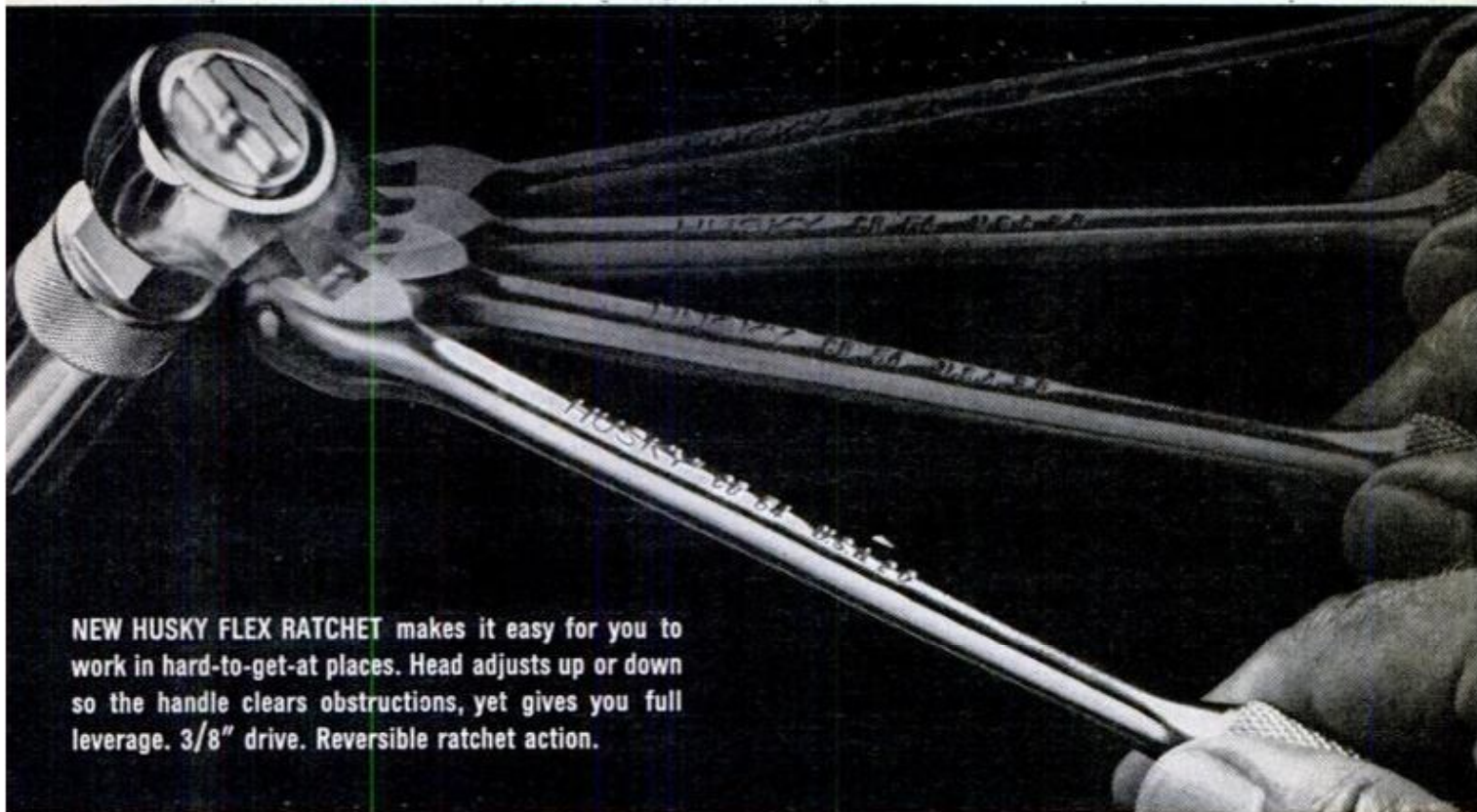
E. P. ALDREDGE

I agree that we have crazy, mixed-up speed laws, but few people, including the authorities who enforce them, realize how many there are that are actually so crazy that it is impossible for anyone to comply with them. It can be proven in any laboratory, just court or congressional investigation that it is impossible for anyone to comply with these laws, therefore it not only is *prima facie* evidence that the laws are crazy and insane but are also unconstitutional, immoral and contrary to almost every physical and just legal law.

BUCHANAN, N.D.

J. M. SZARKOWSKI

Tools you should get your hands on.



NEW HUSKY FLEX RATCHET makes it easy for you to work in hard-to-get-at places. Head adjusts up or down so the handle clears obstructions, yet gives you full leverage. $3/8$ " drive. Reversible ratchet action.

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DETROIT

LISTENING POST

BY BILL KILPATRICK

DON'T BET Ford won't have a new president some time in the coming year. In fact, by the time this appears board chairman Henry Ford II may already have named a new man. This despite his insistence at the time Semon E. "Bunkie" Knudsen was fired that the company would be run by himself, executive vice-president Lee A. Iacocca and a group of divisional executives, each of whom has been dubbed "president." Ford personally is known to feel the company needs a strong hand at the helm (Knudsen was too strong, ruffled too many executive feathers, according to insiders), meaning Ford isn't apt to leave the day-to-day business of running the company to a "committee" of often far-flung, diversified executives. If and when there's a new man, the hunch here is it'll be a face familiar in the industry.

CHRYSLER'S NEW MINI-CAR, due to bow in the late spring of '71, won't be too new and won't be too mini. The car, code-named the "25," will be built on a 91-in. wheelbase and be 166 in. long overall, meaning a good bit of overhang, probably up front. (By comparison, VW's "Beetle" has a 94.5-in. wheelbase, is 158.6 in. long overall.) Where the "25" will shine, however, is in overall width—a proposed 71 in., 10 more than the "Beetle," and three to six inches wider than similar mini-cars due from Detroit. One source told *PM* the new car would look like a "stunted, starved Valiant," somewhat high in the back end, and possibly featuring a cargo door a la the Simca 1204 and the Renault 16. The car, in different versions, will appear under both the Dodge and Plymouth labels, may portend the end of the line for the Dart and Valiant as we now know them.

GROWING CONCERN is being voiced around town these days about the seemingly unavoidable conflict between safety interests and booming car and truck production. One group sees little but gloom, the other roses. Dr. Ross A. McFarland, of Harvard University's School of Public Health, a widely recognized authority on matters of public health and safety, is on record as seeing the automobile contributing in part to "new threats to the well-being of large sections of the population." Dr. McFarland said there was little if any reason to doubt that the regular increases in the number of drivers killed on the world's roadways wouldn't continue as more and more drivers and vehicles hit the streets. On the other hand, John B. Naughton, general manager of the Ford Div. of Ford, recently forecast that annual new-car sales of 14 million "will be nothing extraordinary" within ten years. Naughton said he also could see truck sales expanding by as much as 25 percent over their present level of two million annually. Dr. McFarland, meet Mr. Naughton.

RENAULT has lowered prices \$50 per car in the United States due to the recent devaluation of the French franc. At the same time the company announced the price cut it also wiped out the P.O.E. price differential between east and west coasts. Now the Renault 10 sedan and the Renault 16 sedan-wagon will be \$1725 and \$2395 respectively. As of this writing, other French imports—Citroen, Peugeot, Simca—plan to hold the line on prices despite the franc's devaluation. In view of Detroit's recent boosts, the cut could spur import sales even further.

IF YOU'RE A WOMAN over 45 and you're a good driver, chances are you're a *very* good driver. But if you're bad, you're terrible. However, regardless of your age and whether or not you're good or bad as a driver, you tend to have a better overall driving record than a man and you also have better driving habits. This bit of fuel for the normal fires of domesticity is reported by Pirelli Tire Corp., which each spring at the New York Auto Show administers a driver personality test to thousands of show visitors. This year,

(Please turn to page 14)

**MODEL 521K12
VARIABLE SPEED
JIG SAW KIT**

- 0-2800 1" STROKES-PER-MINUTE
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**MODEL 821K11
DELUXE 3/8\"/>
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DRILL KIT**

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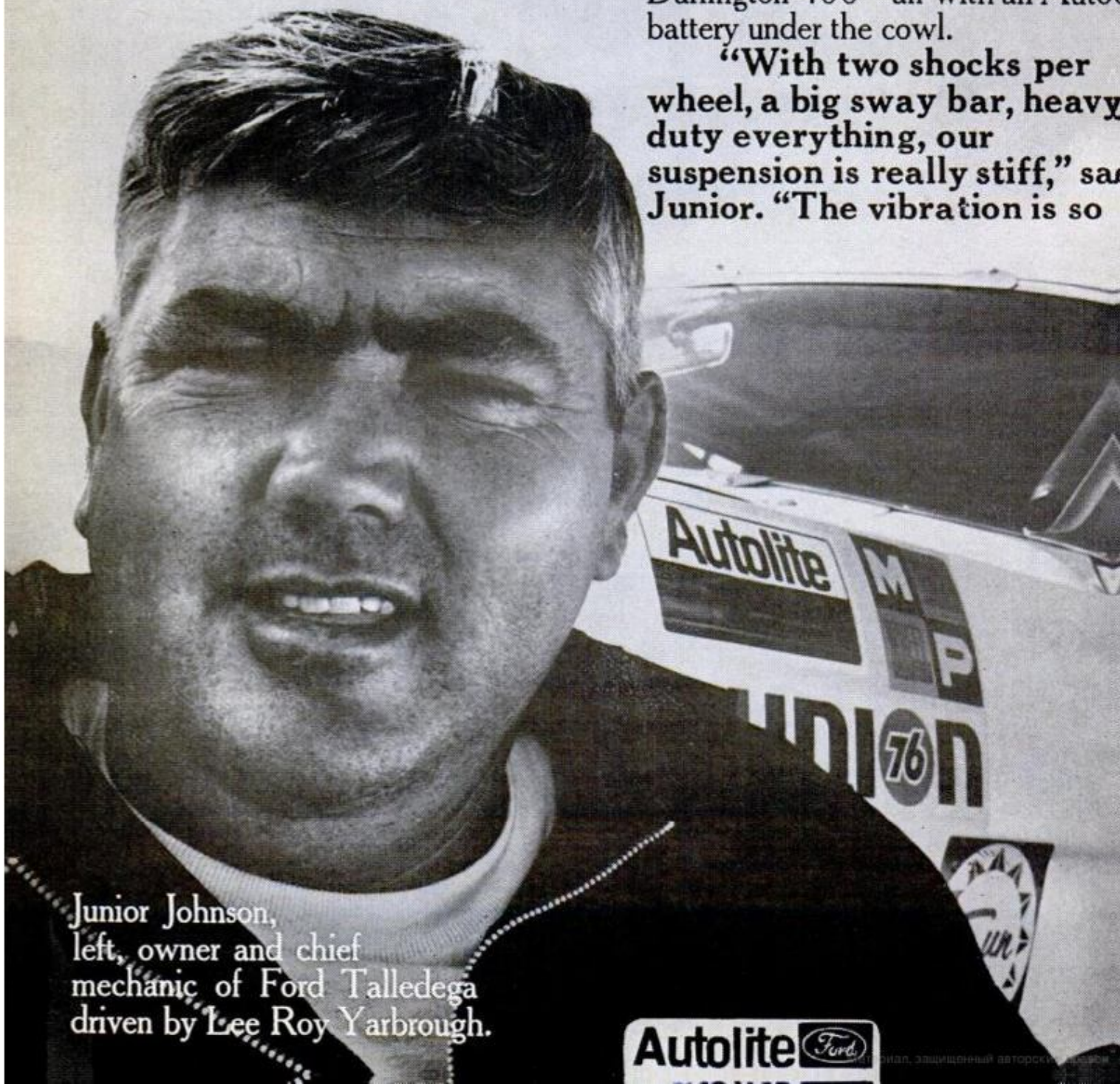
WEN PRODUCTS, INC.

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“We sprung our Firecracker 400 passenger rig. The vibration was really tough. You’re tougher on yours.”—Junior Johnson

Junior Johnson sets up racing cars with the same charging determination that made him a legend as a driver. By mid-1969, his Fords and Mercurys, with Lee Roy Yarbrough driving, had won the Daytona 500, the World 600, the Firecracker 400, and the Darlington 400—all with an Autolite battery under the cowl.

“With two shocks per wheel, a big sway bar, heavy-duty everything, our suspension is really stiff,” says Junior. “The vibration is so



Junior Johnson, left, owner and chief mechanic of Ford Talledega driven by Lee Roy Yarbrough.

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winner about 400% stiffer than a ough on our Autolite battery.

bad, Lee Roy can hardly sit down next day. That Autolite battery takes all that vibration right nicely. The plates in my Autolite have never come loose."

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**"Racing's
tough on bat-
teries. You're
tougher. You
cold-start a lot.
That drains
fluid and**

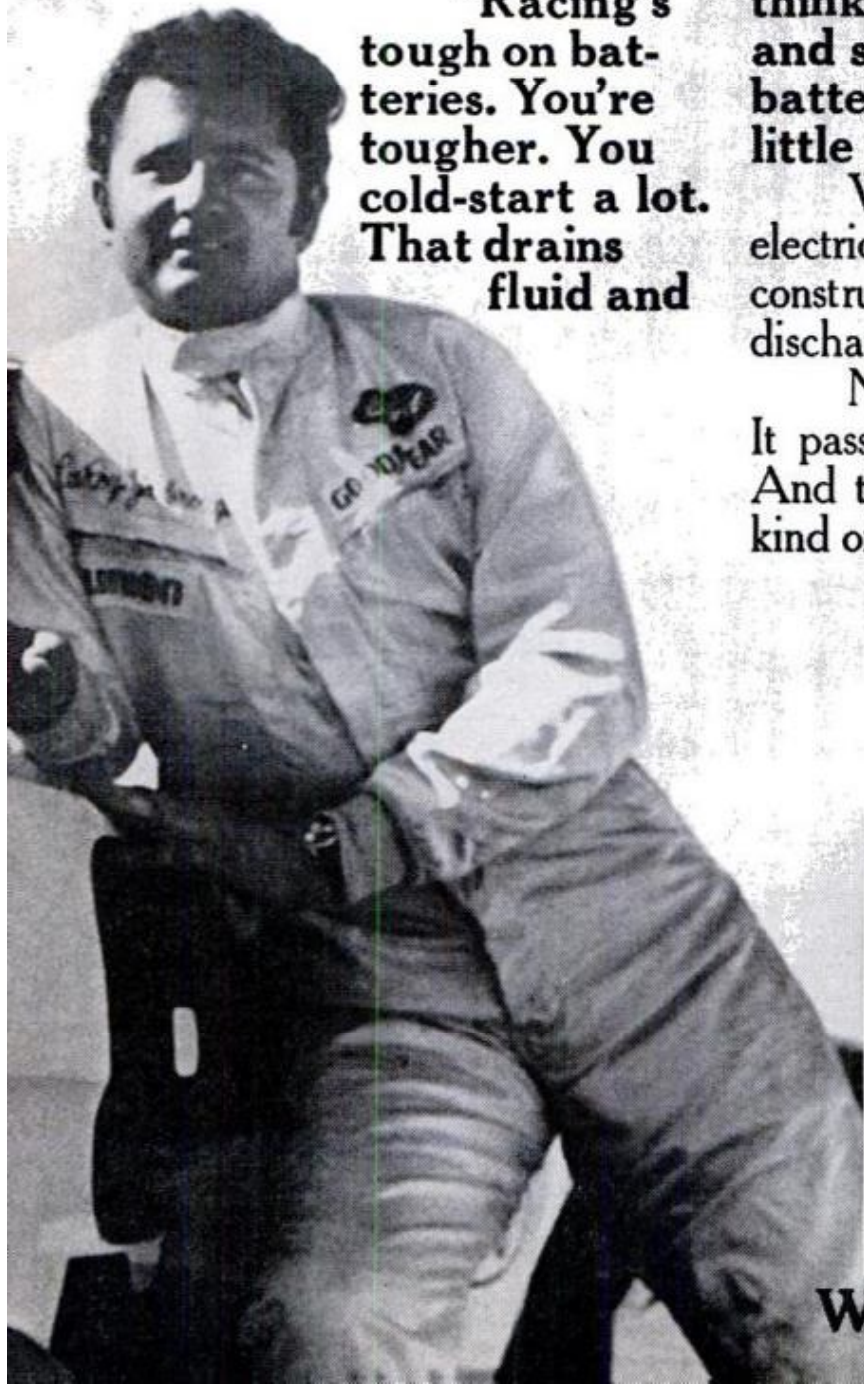
**power. And then you don't let
the gas station fellow take
time to refill your battery."**

That's okay with Autolite. Its Sta-Ful reservoir has up to 3 times more water above the plates. And, in normal use, needs filling only about three times a year.

**"We change batteries like
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and stuff piling up on the
battery, and making a nice
little path for electric leaks."**

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25 KITS SENT TO BUILD THIS
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DETROIT LISTENING POST

(Continued from page 10)

over 7000 men and women drivers were tested. Purpose of the tests, according to Pirelli and industrial clinical psychologist Dr. Harry J. Woehr, is to show that driving records tend to match overall personality traits.

"We feel the results of our tests will prove useful in formulating driver education programs," Dr. Woehr says. "For example, contrary to popular opinion, alertness is not the most important factor in maintaining a safe driving record. On the basis of test information, we can only conclude that alert drivers do not necessarily have the best driving record with regard to violations. In fact, their records were no better than those who scored poorly on alertness. Obviously, alertness is a desirable driving trait. However, test findings indicate that traffic violations are related more significantly to attitude, mood and personal outlook than to the alertness aspect."

Pirelli's survey also brought out disquieting news for the fathers of teenage daughters—women between the ages of 16-25 are apparently the most conscientious drivers on the road, this "safest group" recording fewer violations than any other age or sex grouping.

EMISSION CONTROL SYSTEMS now being utilized on cars sold in the United States came in for kind words recently from a group that ought to know whereof it speaks—the Committee on Chemistry and Public Affairs of the American Chemical Society. The committee, in a special report to Congress, said present systems in cars have resulted in "significant steps in the control of automobile pollution."

The report pointed out, however, that periodic inspection and maintenance of the systems are required to insure their effective performance, adding that available procedures and equipment "are not well suited for this task." The committee urged prompt development of effective procedures and equipment by both government and industry. It also said even stricter federal antipollution standards would be needed in the near future.

A NEW UTILITY VEHICLE designed to compete in the fast-growing four-wheel-drive market may be in dealer showrooms by the time you read this. General Motors' Truck and Coach Div. is reported to have such a unit in the wings, ready to go. If and when it appears, it'll carry the GMC nameplate, be aimed squarely at Ford's Bronco, even the GM-produced Chevy Blazer. ★ ★ ★

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WOMAN SELLS \$1,000.00 JEWELRY
"In one month I sold over one thousand dollars worth of jewelry. Most of it came from Spain and other parts. Also over five hundred dollars in cosmetics and an order for three hundred electric shavers from Switzerland."

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"I just received word from my exporter in France that my shipment of perfume was mailed. This order is for \$40.00 my cost and will give me a gross profit of not less than \$200.00."

These authentic testimonials have been selected from hundreds of successful reports on file at my Headquarters. I do not promise everyone will do as well because success depends on the willingness to work for these fine profits and ability. But the money-making opportunities are there and I will help you go after them right now.

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DOES WORK OF \$75 BENCH SAW as is. Converts easily to equal any \$300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dadoes, makes coves and mouldings.

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FREE CABINET BASE PLANS Use as portable bench saw as received (inset photo) or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing \$300. FREE plans... all you'll need are a sheet of 3/4" plywood and 3-4 hours. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, tool storage compartment.

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Optional faceplate for turning bowls, trays, lamp bases, rosettes, etc. \$2.50.

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f.o.b. factory. Wt. 15 lbs.

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100% precision ground cast iron and steel.

DOES THE WORK OF \$60 UNITS... Professional power planing at a hand tool price. Make faster, more accurate joints, rabbetts, bevels for windows, doors, drawers, square tapered legs—Adjustable precision ground cast iron tables. Patent-pending design holds knife to table clearances at any depth. Rabbett depth 3/8". Fence adjustable 0°-50°. Hardened, ground hi-speed steel knives. Dual cutter guards. Balanced cutter head.

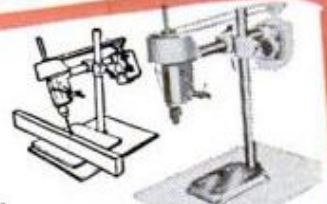
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32" RADIAL DRILL PRESS

All cast iron and steel f.o.b. factory Wt. 30 lbs. 1/2" cap. Jacob's chuck incl.

\$2995

DOES WORK OF \$90 UNITS... and much more. Industrial quality precision unit with all standard features, many extras. Head raises, lowers. Depth of throat up to 16". Pre-set to any angle for on-or-off table drilling, even horizontal drilling. 10-YEAR FULL SERVICE GUARANTEE.*

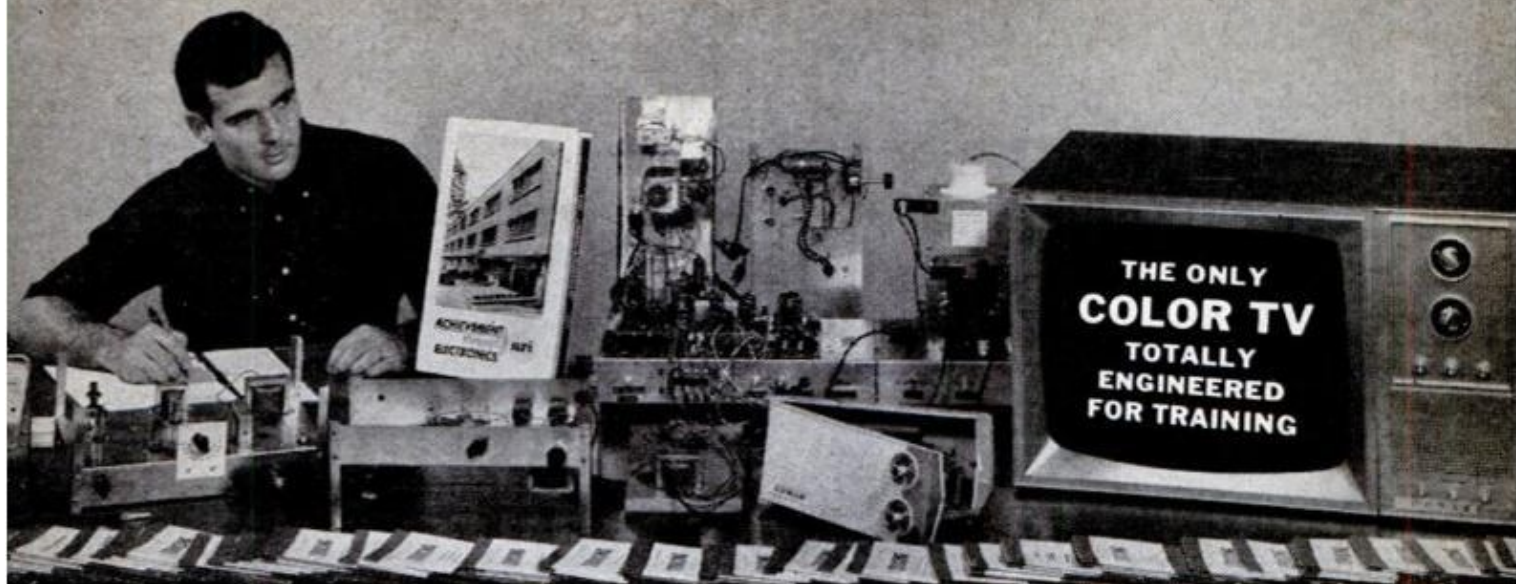


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Science Worldwide

BY JOHN F. PEARSON

Payoff from Apollo 11 laser experiment: a determination that the moon is 131.2 feet farther from Earth than previously thought. The measurement was made by sending a laser beam through the 107-inch telescope at the University of Texas' McDonald Observatory, bouncing it off the reflector placed at Tranquillity Base by astronaut Neil Armstrong, and clocking how long it took for the light rays to make the round trip between Earth and moon. Because of the moon's elliptical orbit, the distance between the two bodies varies; the mean distance has been estimated at 238,857 miles, a calculation that will no doubt now be corrected. The distance between the McDonald Observatory and Tranquillity Base was measured to be 232,271.381 miles—a measurement considered to be the most accurate to date.

Sonar and a big pipeline are combined in an unusual plan for corralling big quantities of fish off Australia's northwest coast. Masses of fish that move into Admiralty Gulf at high tide would be "directed" into nets by means of sonar. The nets then would be dragged to the mouth of a pipeline for pumping to a shore-based processing plant. The plan, developed by an American firm, calls for a pilot plant by 1971.

Attacks by blood-sucking vampire bats pose a serious problem in almost a score of Latin-American countries. Most frequent victims are cattle, which become infected with paralytic rabies, a disease carried by the bats that results in coma and death. Researchers in Mexico are carrying out a broad study into bat behavior, the mechanisms by which the rabies is spread, and how best to protect against the disease.

Computers report to computers when many companies send in quarterly statements of workers' earnings to the Social Security Administration. Computers in company offices record earnings on magnetic tapes, which are sent to Social Security offices where other computers read the reels and transcribe data. The system is more efficient than that involving human bookkeepers, according to Social Security officials, resulting in savings for both employers and the government. The number of companies using the system has grown from 106, four years ago, to 635 today.

A sudden loss of physical strength occurs in Japanese men at age 42 and women at 39, according to a report in *Medical World News*. The condition, uncovered in a survey of 36,000 men and women by the Japanese Ministry of Education, is attributed to the fact that Japanese adults do not participate much in sports. In Western countries loss of strength is gradual for both sexes.

Electronically controlled artificial hands can now be attached immediately after surgery by means of a procedure developed at Northwestern University Medical School. A plaster cast is used during the first few weeks following the operation. It acts as a rigid, post-surgical dressing, protecting the wound from infection, and contains metal foil electrodes that pick up tiny electric signals from the skin. These signals are amplified and processed to operate the hand (prosthesis). When the wound has healed, the cast is removed and the final prosthesis is fitted. Because the patient uses muscles in his stump from the start, circulation is improved, resulting in faster healing.

The importation of the walking catfish may be banned in the near future by the U.S. government. Some of the creatures escaped from a tropical fish dealer's pond in Florida about five years ago, and since then have spread to the point where they threaten the survival of other fish in that state. A native of Southeast Asia, the catfish has accessory breathing organs that allow it to operate on land as well as its natural habitat. When ponds are poisoned, the catfish take off, creeping a quarter-mile or so in search of more salubrious water. The fish can cover about five feet a minute if the ground is wet. If the fish is not stopped in its tracks, warn wildlife officials, it may in time spread all over the Southeast. ★★★



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Drivin' with Dan

Do the McLarens really use a 'stock' Chevrolet engine? Will the trend to 'big boats' at Detroit ever end? What is a good minimum age for driving? Dan Gurney answers these and other automotive questions



AN ELATED Dan celebrates his September victory in USAC championship car road race at Donnybrooke. He finished second in first heat, was first in second

Q. I hear Mercedes-Benz has a new sports car it plans to run at Le Mans, like the Ford GTs. Do you know anything about it?—Bill Nixon, Springfield, Ill.

A. You probably have heard about the new Mercedes C-111, which was featured in last month's issue (*Mercedes Places Triple Rotor Amidships in New Limited-Production Sports Car*, page 72, Oct. PM). It has captured the interest of the entire motoring world, especially those of us in racing. It is styled somewhat similarly to the Le Mans-winning Ford GT-40, but the most interesting aspect is its Wankel rotary piston engine. Experts have

long speculated that the rotary may be the engine that will replace the reciprocating piston engine. The powerplant in the C-111 reportedly produces 330 hp from 220 inches of displacement and everyone will be watching to see what Mercedes-Benz does with it, although it insists it has no plans to race again.

Q. Who won that race between Indianapolis drivers and European drivers at Monza, Italy, in 1958?—Cliff Haffenden, Scarsdale, N.Y.

A. It was run in heats, but the overall winner was Jim Rathmann in the John Zink Leader Card Special. I was in Europe at the time, just beginning my racing over there, and was fortunate enough to watch the race. It was very interesting and thrilling, but the cars took a terrific beating on the high-banked old track and I doubt the race will ever be repeated.

Q. What kind of engine is used in the McLarens which have won so many of the Can-Am races? Is it really a "stock" Chevrolet?—Robert Stewart, Dallas.

A. It is probably a great deal more "stock" than you might think. It's an aluminum alloy version of the 427 engine that appears in many Chevrolet cars. In fact, the 427 alloy engine you might order for Can-Am racing could be installed in its basic form in either a passenger car, or, with additional racing "musts" like fuel injection, dry sump, special headers, pumps, bellhousing, and so on, in a competitive Can-Am car.

Q. A friend of mine says there are more Detroit factories participating in Trans-Am racing than
(Please turn to page 38)



A winter tire that thinks it's a snow plow.

Atlas Weathergard.

The Atlas Weathergard tire clears its own road as it bites in and plows through the snow. Thanks to its deep and unique tread design. And, for safer stopping on slick wet roads, it wipes the road surface like a squeegee.

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For extra safety, your Atlas Weathergard can also be studded. On packed snow and ice, it will give you much better traction

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Get the best all-around tire for winter driving. The rugged Atlas Weathergard.

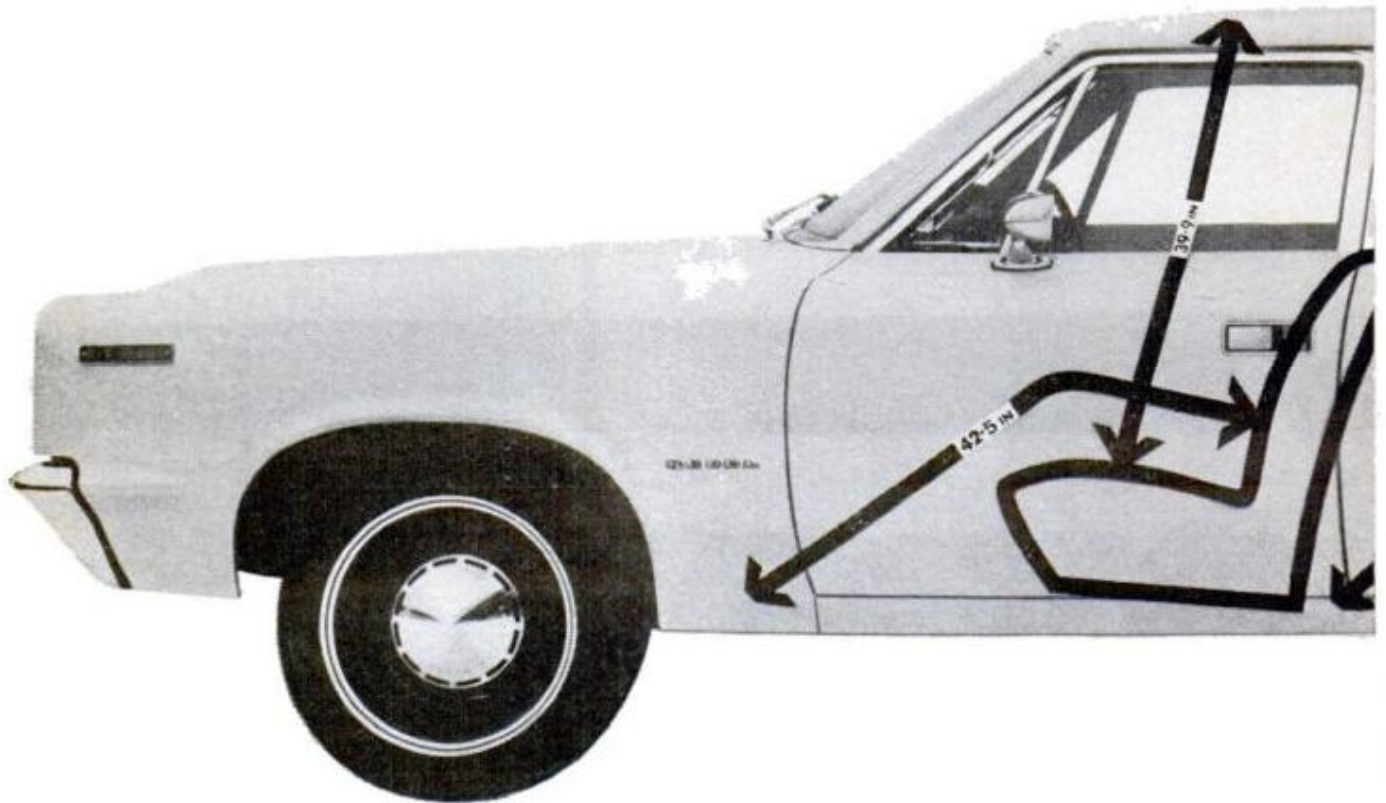
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This may be the first time anybody in our business seriously asked you to check out the competition.

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Our Rebel Wagon has the lowest list price of any wagon made in America.

It also has more room inside than any other wagon in the intermediate class. (More room, for example,

than Plymouth's Belvedere, which lists for \$219 more.)

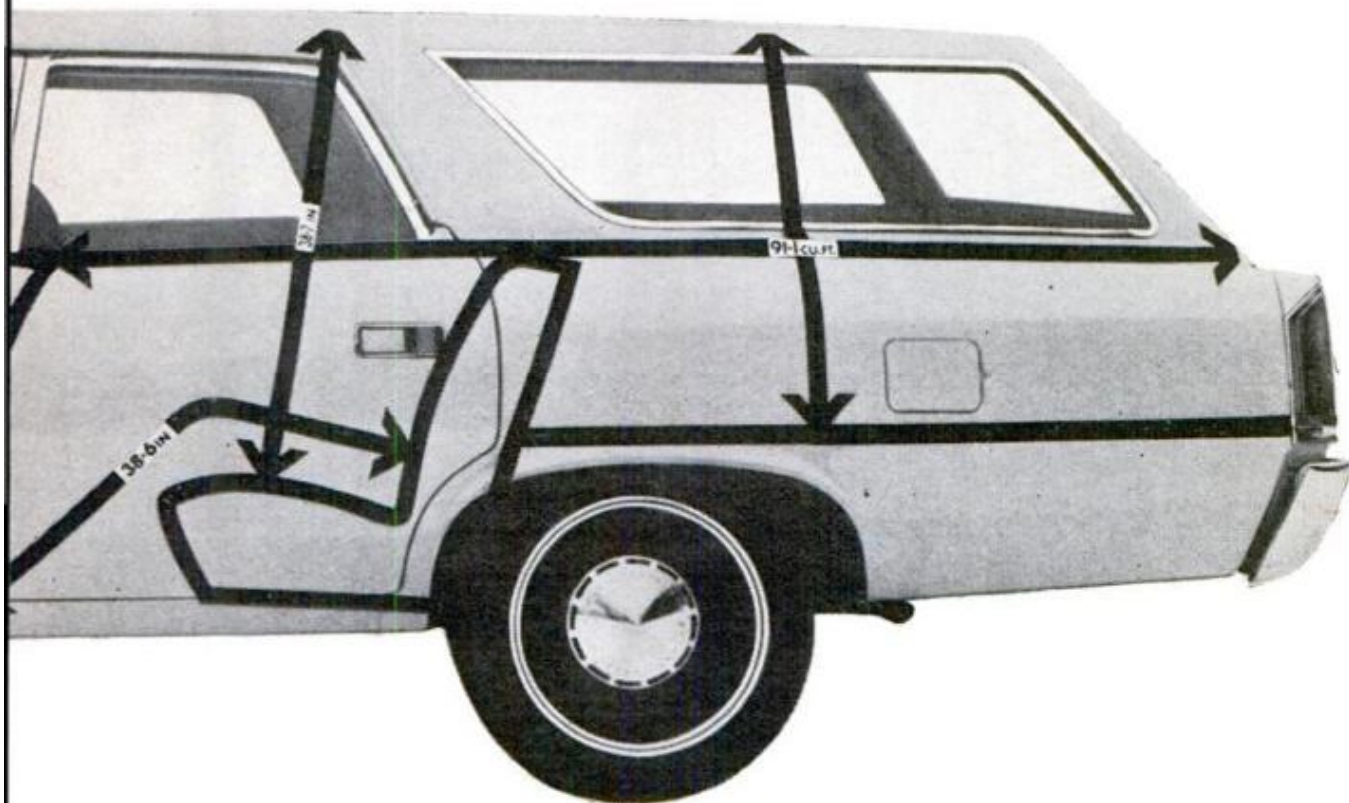
And you don't have to take our word for it.

We're displaying specially-marked Rebel Wagons so that you can see just what you get from us.

And, we're furnishing charts and tape measures so that you can go see just what you get from anybody else.

At the risk of being unfair, here's what you get in cargo space, which is what most people buy a wagon

or Plymouth salesman room priced at \$2,766.*



for in the first place.

According to Automobile Manufacturer's Association figures, the Rebel gives you 91.1 cubic feet of above-the-floor cargo space. Fairlane gives you 87.0; Belvedere, 84.9 and Chevelle, 84.0.

So the Rebel is way ahead there.

Now, about shoulder room, hip-room, legroom and headroom.

Against Fairlane and Chevelle, the Rebel wins in 7 out of 8 AMA interior measurements, (5 out of 8 against Belvedere), and it wins in

all the important places. Which leads us to think that you can't find more room for your money than you get in a Rebel Wagon.

If we thought you could, we wouldn't be handing out charts and tape measures.

American Motors Rebel Wagon

*Manufacturer's suggested retail price for Rebel 4-Door station wagon, federal taxes included. State and local taxes, if any, destination charges, white wall tires and other options extra.

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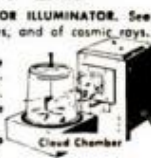
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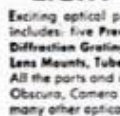
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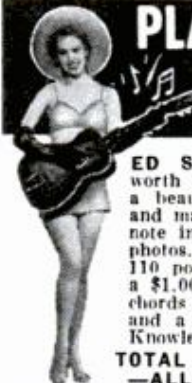


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Let Ronald D. Rider, President of American Unifax, tell you about a growing line of Space Age "break-through" products that are making Direct Selling history . . . products that can help YOU break through to your true profit potential.

I've been concerned with salesmanship all my working life, and I've seen one fact demonstrated over and over again: *to make money, you've got to have products that SELL.*

American Unifax has a whole line of such products. If you're of average intelligence and not afraid of a little hard work, there's no reason why you can't earn \$1,000 or more per week selling our products.

Wide-awake men and women all across the nation report the biggest, easiest profits of their lives with our line. A Florida housewife, who had never before sold a thing, spent "maybe 5 minutes" in her local newspaper office and nailed down a \$785 sale—including \$215 commission for herself. A Connecticut bank manager racks up *spare-time* profits of over \$275 per week merchandising one of our products via mail order. A California businessman writes that his sales volume **QUADRUPLED** two months after he became an American Unifax Distributor.

The "secret" of Successes like these? *Products that sell.*

For example, consider COPYFAX, our patented replacement for old-fashioned carbon paper. Carbon paper represents a \$203,000,000 market. COPYFAX is rapidly taking over that market, because COPYFAX in every way is demonstrably superior to carbon paper.

Carbon paper is a flimsy grade of tissue paper coated with a mixture of carbon particles and grease. COPYFAX is tough, thin DuPont Mylar®, with a microscopic "honey-comb" surface impregnated with a liquid ink similar to that used by printers.

COPYFAX does away forever with all the annoying features of carbon paper. COPYFAX won't curl, crease, or fold. Try to tear a sheet of COPYFAX. You can't; COPYFAX actually has one-third the structural strength of steel. Crumple a sheet of COPYFAX into a ball and smooth it out again—it's still perfect. A piece of carbon paper is ready for the waste basket after about 5 uses. COPYFAX is still giving sharp, crisp, smearproof copies after 100 . . . 150 . . . *even 200 uses.* In terms of cost, COPYFAX outperforms carbon paper by at least 500%.

Next, consider the revolutionary American Unifax Typing Ribbons—made of the same DuPont Mylar and special solvent ink found in COPYFAX. This miracle ribbon converts any typewriter—old or new, manual or electric, standard or portable—into a prestige "Executive" machine that produces a sharp, crisp smearproof image almost impossible to distinguish from fine printing. Until the advent of this ribbon, such results were possible only with a special typewriter costing several hundred dollars and using a so-called "one-shot" ribbon. An American Unifax Typing Ribbon installs instantly, without special spools or adapters. And because the special solvent ink never touches the keys, the messy, time-consuming job of cleaning the typewriter is gone forever!

"Corrections so neat that only your typewriter knows you made a mistake!" Say those 12 words to any typist, any steno, any secretary, and you'll have made another convert to new American Unifax Correction Paper with miracle

M-E-K! Ordinary correction paper employs a powdered-chalk coating, and often requires several strikes to blank out the error, several more to insert the correction. American Unifax Correction Paper employs a snow-white, total-release solvent ink—one strike and the error disappears, one more and the correction appears . . . every time. No eraser crumbs, no chalk dust, no paint spatters. Every typist loves it—and so does her boss, because corrections made with this amazing paper are virtually undetectable.

We've both heard of products that "sell themselves," and we both know that there is no such thing. But American Unifax products come amazingly close to being self-sellers.

Within a few miles of your home, there are literally thousands of business offices, industrial plants, doctors, dentists, lawyers, accountants, banks, stores, schools, churches, and government agencies. Call on them. Demonstrate our products. Invite them to try them under our no-risk money-back guarantee.

If you make the sales calls, if you do the demonstrations, you WILL make sales—fast, effortless, high-profit sales. No if's, and's, or but's. I guarantee it. Not just small sales, either—even relatively small customers order hundreds of dollars worth of these products at a time. And, of course, the repeat-order profits are tremendous and virtually automatic.

The American Unifax line continues to grow—and YOU can grow with it. These products are not short-lived gimmicks—they are superb, premium-quality necessities with which you can build yourself a secure, prosperous financial future.

No special experience or big cash investment is necessary for you to take advantage of this once-in-a-lifetime opportunity. To get started, all you need do is take a moment to fill out and mail the coupon below. Everything you need to start making money with American Unifax products will be rushed to you by return mail.

In addition, when your inquiry arrives, we will mark it with the date of receipt. This date establishes the priority of your association with our company. We are now developing an Exclusive Distributorship Program, and Distributorships will be awarded on a first-come, first-served basis to qualified applicants. So you see, it's important that you get the coupon into the mail to me as quickly as possible. There's absolutely no obligation on your part, so do it right now. Don't take a chance on getting left out in the cold!

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Rush complete information. FREE and without obligation.

I enclose \$9.00. Send me 1 pack of COPYFAX, 1 Typing Ribbon, and 1 pack of Correction Paper (total retail value \$12.40), plus complete information. (If you wish, specify make and model typewriter:

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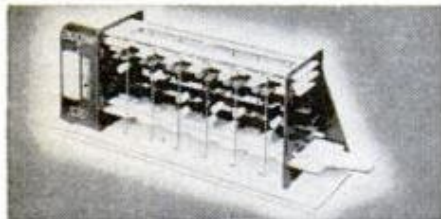
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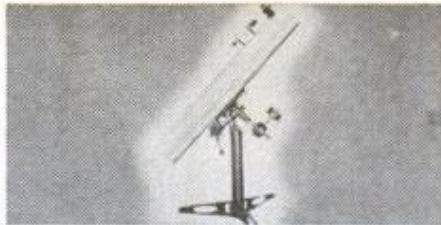
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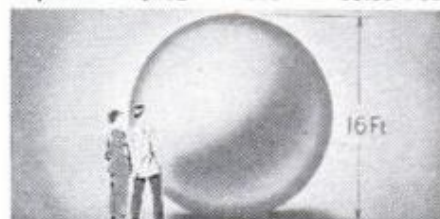
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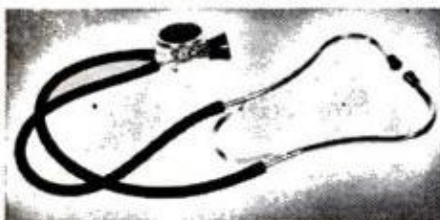
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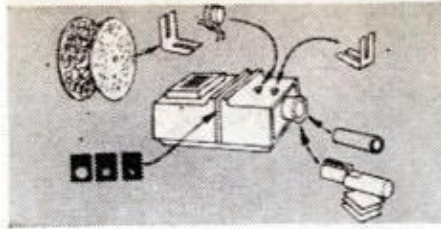
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DRIVIN' WITH DAN

(Continued from page 22)

there are in NASCAR. Although I like to watch Trans-Am "Pony Cars" road-racing, it's hard for me to swallow that. What do you say?—Al Wells, Sacramento, Calif.

A. I say you should open wider. If you consider the parent corporations, you really have only Ford and Chrysler interested in NASCAR. In Trans-Am it isn't hard to see that Ford, General Motors (Chevy Camaro, for example) and American Motors are already very interested, with rumors of Chrysler joining the battle in 1970.

Q. Has Jackie Stewart, who I read clinched this year's Grand Prix World Driving Championship by winning at Monza, ever been World Champion before?—Alvin Junor, Tustin, Calif.

A. Though Jackie has long been held in very high esteem all over the world, this is his first World Championship. I salute him and his fine team for a job well done.

Q. From what I have read it sounds like you prefer smaller road cars for your personal transportation. Do you think the trend to "big boats" at Detroit will ever end?—J. L. McDuffy, Brooklyn.

A. I really don't know what the major manufacturers have in mind for the next few years, but as I read the signs, I believe we may see a more concentrated volume in smaller-sized vehicles than has recently been the case. I would guess one of the most popular cars in the country right now is the "Pony" car, or the Cougar-Mustang-Camaro-Barracuda-Firebird type. Also, I have seen reports from experts in the industry which indicate that the country will soon be facing a serious problem in physically handling the millions of "big boats" already produced, and that size must come down if only for this reason.

Q. I am 16, live in Kentucky, and am about to receive my driving license. But they are talking about raising the age limit to 18. What do you think about the minimum age for driving, and when did you start?—Billy Walton, Talmouth, Ky.

A. I received my license when I was 16, although I started driving sooner than that. In fact, I did so much driving while seated to the right of the driver that for awhile it felt awkward.

(Please turn to page 40)

"Scotch" Brand Cassettes prevent tape hangups

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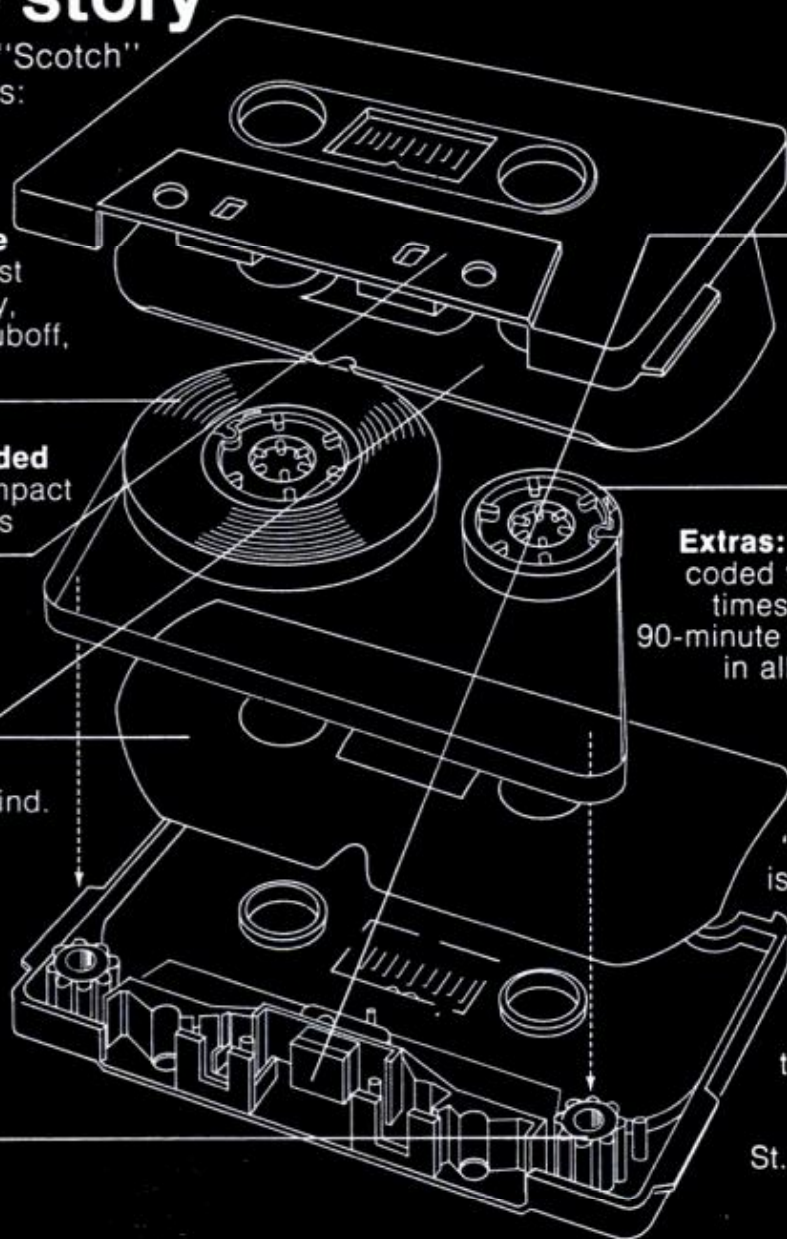
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DRIVIN' WITH DAN

(Continued from page 38)

ward when I got into the real driver's position. I think a beginner's age of 16 is fine. It really depends upon the individual's judgment and training much more than how old he is.

Q. How do you "pop a wheelie"?—Mike Stannard, Bridgewater, N.J.

A. On a motorcycle, you just turn it on in low gear at the same time that you pull back and up on the handle bars. In a car you need a certain amount of power and traction, depending upon the weight distribution of the car. The farther forward and the lower the center of gravity, the more power and traction you need. The clutch is often used if you don't have enough power.

Q. How does the Eagle compare in speed to a Group 7 or Formula 1 car?—Jim Martin, Vandalia, Ohio.

A. At the moment, I would say our Indy Eagle is on a par with a Group 7 car when equipped with F-1-style wings, and faster than an F-1 car. Championship rules do not allow wings as such, however (though we have tested with them), so it ends up being equal to an F-1 car and a bit slower than a Group 7 car.

Q. For drag racing, how wide should the tires be on a Dodge Charger or Mustang?—Brad Arnold, Farmersburg, Ind.

A. The best way to find this out is to go out to a good drag strip and check the cars in your class that are running best. Then measure their tires.

Q. My girl friend says someone told her you were once an opera singer. Why don't they get you to sing the national anthem before the Indy 500?—Jerry Davis, Chicago, Ill.

A. Someone obviously has me confused with my dad, who in his career sang with the Metropolitan Opera. As a singer I might make a half-way decent race driver. ★ ★ ★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 84).

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1 • Associate G. H. Jones made \$1200.00 on one job. Associate R. G. Fullmer says contracts this year will gross about \$18,000.00. And no wonder...this machine washes walls 6 times faster than by hand...with no mess...no drop cloths needed. Washing is so easy...no tiresome scrubbing...special glider wipes walls clean with little effort. You can start part-time and by working week-ends add hundreds of dollars to your income while still employed.

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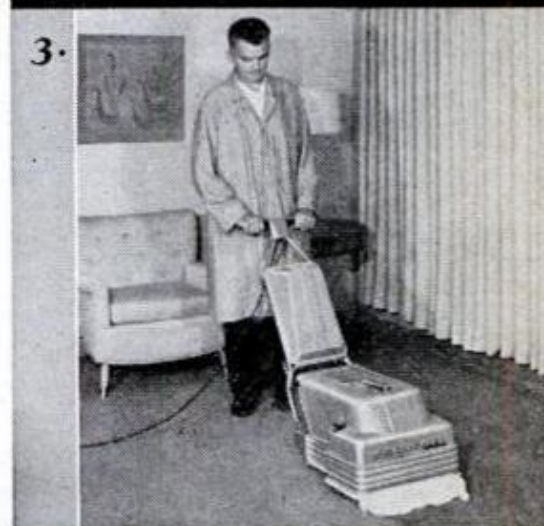
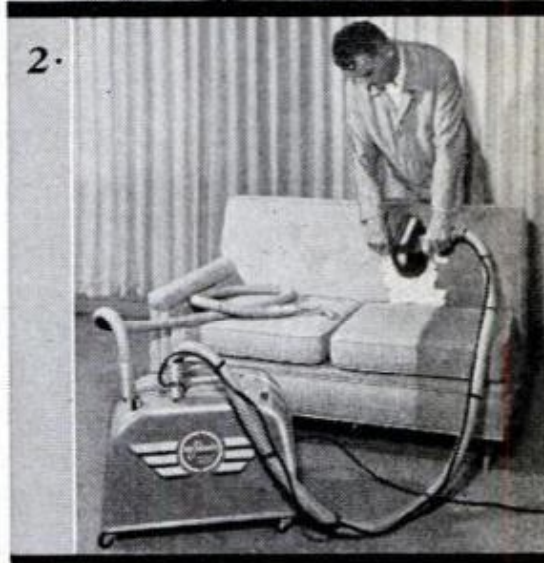
because each service helps to sell the other two

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LOW INTEREST RATES ON TRAVEL TRAILERS. Despite much talk of tight money and a credit crunch, Airstream Trailers report that they are still selling their vehicles with low interest rates. Other companies are doing the same, and it's safe to say that a good credit risk can still get rates fully one-fourth to one-third cheaper than rates charged on new cars or new boats. Buyers should be aware of the leverage they can exert. Fight for better rates! They're available.

HAVING PROBLEMS WITH BAD TASTING WATER? It's a common complaint in well-used recreational vehicles. Water tanks collect dust, salt and unpleasant flavor from gas-station hoses. You can solve this problem with a new filler hose advertised as being "tasteless." Write H&H Engineering Co., Box 242, Battle Creek, Mich. 49016.

DOME-TYPE ANTENNA FOR TELEVISION RECEPTION. Vorta Systems, Inc. (220 S. Main St., Wauconda, Ill. 60084) is selling the first real departure from the standard tree-type television mast. This new dome-type antenna utilizes reflectors and drivers, but the entire signal system is anchored in polyurethane foam inside a protective fiberglass dome 8½ inches high by 18½ inches in diameter. A coaxial cable, permanently attached to dome, is shielded against interference. Price is \$29.95.

MONITORING DEVICES INFORM DRIVER OF REAR LIGHT CONDITIONS. Light-transmitting Lucite wires can be bent around curves, and they carry light that acts as a monitoring beacon. Now the driver towing a trailer can see whether his taillights and turn-signal lamps are working just by glancing at the tiny jewel-like monitors placed on the front of his trailer. A quick glance in the mirror shows condition of rear panel lights. If they go out, Lucite wires cease carrying the light, signaling malfunction.

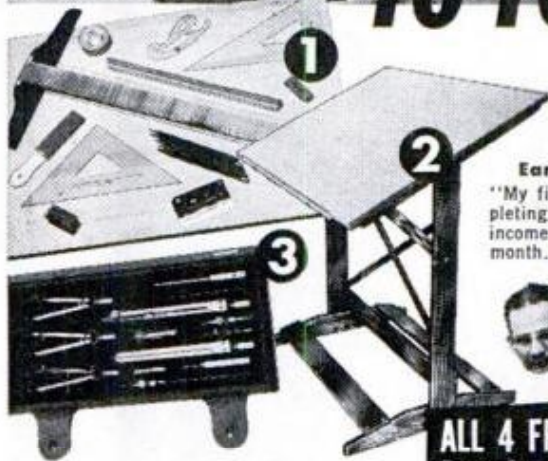
SKYLIGHTS ARE COMING. Barth Trailers has announced the availability of translucent skylights for its coaches; they're constructed of plexiglass in a double-dome design to seal out heat, water and cold. The 43-inch square domes are tinted blue to filter the glare, while interiors are white for maximum enjoyment of the extra light. Skylights eliminate dark pockets and make any coach more cheerful.

DID YOU KNOW that there were an estimated 700,000 snowmobiles in private possession at the start of the 1969 season? By the end of 1970, experts predict an increase of another 350,000 track-type snow machines capable of penetrating wilderness areas. That means a possible *one million snowmobiles* in operation by next year at this time! Roughly 75 percent of all snowmobiles are presently concentrated in just five states: Maine, Michigan, Minnesota, New York and Wisconsin.

DON'T HOLD YOUR BREATH. An all-industry switch to fiberglass coach construction is at least five years away, according to reliable estimates. Despite the obvious and unassailable advantages of nonporous, seamless fiberglass, manufacturers will face major problems during coming change-over: lack of skilled workers familiar with plastics; higher cost of resins and glass cloth; heavier weight of fiberglass versus aluminum; problems with repair of molded panels; and difficulty of joining dissimilar materials to the plastic-reinforced coach bodies. ★★★



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Each T5 Kit includes 3,000 assorted staples and a lightweight, durable plastic carry case with removable tray.

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Weller 8-piece Homecrafter Kit (as illustrated)
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With Weller® Dual Heat Soldering Gun kits you can put other kits together in a jiffy. Models, hi-fi sets, hobbycraft kits are wired with ease . . . and much more fun.

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How to get rich

How can you get rich some day? Make a hit record . . . a killing on the stock market . . . or invent a gadget like the hula hoop?

For most of us, these are just dreams. But have you ever stopped to think that there is a way to get rich—possibly only one sure way? Most fortunes, as you know, are made by people who own their own business.

Perhaps you've thought of starting a small business of your own . . . a franchised drive-in, or maybe a service business. Trouble is, you need \$10,000 to \$15,000 to get started and even then it's a gamble—with slim chances of ever making really big money.

But there is *one* business which could make you rich—almost overnight! And the beauty of it is, you can start on a shoestring during your spare time, even while holding your regular job.

one-man Mail Order enterprises make up to \$50,000!"

Pick up any magazine. Notice how the same mail order ads are repeated . . . month after month? That's concrete proof! You know those ads wouldn't be repeated over and over again—*unless* they were bringing in big cash profits to their owners.

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You can get thousands of dollars worth of advertising in big national magazines—without investing your own money! And you don't have to write a single ad. Tested and proven ads are prepared for you by experts. Reinvest the profits from your first successful ad—to get more, larger ads, and the profits begin to snowball! It's like building a chain of stores . . . each new store puts more money in *your* pocket.

You mail out beautiful catalogs which offer hundreds of dollars worth of fine, quality gifts—yet you don't invest one

Repeat orders alone, just from mailing catalogs, could bring you a steady income for the rest of your life!

Yes, Mail Order is the fastest-growing, most profitable business in America! And now, with more people moving to the suburbs . . . the population explosion . . . and the expanding teenage market . . . we are on the verge of the BIGGEST BOOM in Mail Order history!

Now, with the help and backing of Mail Order Associates, Inc., of Montvale, N.J., you can follow the same proven steps to Mail Order success—using the 'secret' of financial leverage!

Start Now

We supply you with beautiful gift catalogs throughout the year. All products are dropshipped for you, with up to 100% mark-up! You get free samples of top-selling mail order items, plus monthly trade reports on 'hot' new products . . . tested, successful ads are sent to you monthly. You get advertising directories, postal laws, complete courses, expert guidance—**EVERYTHING** you need to practically guarantee **YOUR SUCCESS**. Why? Because *our* business depends upon your success. It's mutually profitable!

A recent feature article in Income Opportunities Magazine stated, "Mail Order Associates Inc. offers the most comprehensive Mail Order program ever offered to beginners." They go on to say, "This could be the opportunity you've been looking for. A chance to get in on the ground floor in a little-known business which we believe is on the verge of a new boom."

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We are now accepting a limited number of charter members in our new Mail Order Program. No previous experience is required but you must be over 21.

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It strikes like a bolt of lightning! Suddenly, you are deluged with cash orders from all over the country . . . MORE MONEY than you could ever make in a lifetime!

Like the Vermont dealer who ran one ad in Sports Afield Magazine. His ad pulled 22,000 orders—over A HALF MILLION DOLLARS IN CASH!

There is no other business where you can make a fortune so quickly!

● A beginner from Newark, N.J., ran his first small ad in House Beautiful—offering an auto clothes rack. Business Week reported that his ad brought in \$5,000 in orders. By the end of his first year in Mail Order, he had grossed over \$100,000!

● Another beginner—a lawyer from the midwest, sold an idea by mail to fishermen. Specialty Salesman Magazine reveals, "he made \$70,000 the first three months!"

Proof

It's a fascinating business! Running ads in newspapers and magazines . . . mailing gift catalogs . . . getting cash orders in your daily mail—steady as clockwork.

There is no other business where you can start on a shoestring and pyramid your profits—*without investing in merchandise!* One husband and wife mail order team took in \$40,000 selling one item. They obtained FREE ads in national magazines . . . didn't invest a cent in merchandise, and even got the supplier to ship all orders for them!

These exceptional cases are absolute proof that *you can get rich* in your own Mail Order business. Very rich. Even a U.S. Gov. Report stated: "A number of

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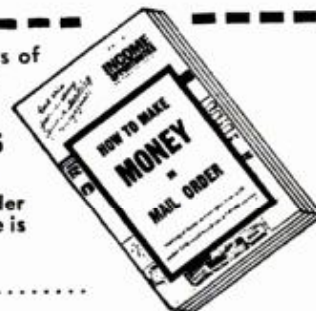
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Montvale, New Jersey 07645

Please rush complete details on your Mail Order Program. I understand everything is free and there is absolutely no obligation. I am over 21.

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Address.....

City..... State..... Zip.....



Everybody's Happy But Esquire

Everybody came out of Apollo 11 smelling like a rose. Everybody, that is, but *Esquire*. The self-styled "Magazine for Men" was worried sick lest our astronauts embarrass us all by failing to say something clever when they reached the moon.

On the eve of man's greatest adventure, *Esquire*, in a fit of adolescent nit-picking, devoted its July cover and six pages to "prove" that the astronauts were a bunch of Mortimer Snerds.

To help Neil Armstrong come up with something to rank with "Dr. Livingstone, I presume?" *Esquire* asked more than sixty eminent Americans what they would say if *they* were first to set foot on the moon. The panel included such heroic types as Tiny Tim, Dr. Timothy Leary, Sal Mineo and the president of the American Sunbathing Assn.

William H. Honan, who detailed *Esquire's* apprehensions, kept calling Armstrong, a civilian, "Commander Armstrong." He demonstrated a fine grasp of history by describing what happened "after Magellan had circumnavigated the globe" (he never made it) and what Vasco da Gama said "when he sighted the New World" (he never did) and displayed his understanding of space technology by recalling "when Captain Schirra throttled up the Apollo Spacecraft's great rocket motor . . . commanding enough power to fling himself to the moon and back" (Schirra never rode the Saturn 5 moon rocket; his Apollo 7 flight used the smaller Saturn 1-B).

Earlier, when Schirra was communicating with Gordon Cooper from the ground, *Esquire* was mortified to hear him tell Cooper he was "right smack dab in the middle of the plot." It makes you wonder if CBS auditioned Schirra before it signed him to back up Walter Cronkite.


When Cooper exclaimed that he had landed "right on the old bazoo!" *Esquire* said he "sounded like Granny on the Beverly Hillbillies." John Glenn "filled the first chapter in the Book of Space with five hours of unrelieved drivel." Rusty Schweickart said, "Hello dere," as he walked in Space. Borman, Lovell and Anders, who read from Genesis on Christmas Eve, "share with the other astronauts a pronounced verbal dysfunction."

The astronauts, warned *Esquire*, "are likely to litter the intergalactic void with gibberish and twaddle and despoil the written record of man's reach for the stars with the sentiments of squares."

Well, *Esquire*, you can quit worrying. When the chips were down—or rather the LM—Neil Armstrong, least talkative of astronauts, but one hell of a pilot, did all right with the words too.

"One small step for a man, one giant leap for Mankind" will look all right in the history books alongside "I regret I have but one life to give for my country." In case you've forgotten, that was attributed to a square named Nathan Hale. Buzz Aldrin and Mike Collins weren't tongue-tied either. According to *Time*, "The eloquence of the Apollo trio provided the finest moments of Richard Nixon's elaborate state dinner in their honor."

Okay, *Esquire*, you fly to the moon with Tiny Tim, Cassius Clay and Truman Capote. We'll go with Armstrong, Collins and Aldrin.



Editor

Important information for people 65 or older
and their children and relatives:

Protect your income and savings against big hospital bills

YOU CAN... NOW... FOR ONLY \$2.90
PER MONTH... WITH AMERICAN LIFE'S



\$10,000 Medicare Supplement Plan

- Pays you **IN ADDITION** to all other insurance.
- **GUARANTEED RENEWABLE** for life or until \$10,000 paid per person.

This message is of special interest to men and women 65 or older who are automatically covered by the U.S. Government Medicare Hospital Plan.

It tells about the wonderful new \$10,000 American Life Medicare Supplement Plan which gives you full protection, in accordance with the benefits described, against big hospital bills.

It pays hospital costs which Medicare does not cover.

U.S. Government Medicare Plan A pays only PART OF THE COSTS after 60 days* and NONE OF THE COSTS after 90 days of hospital confinement. This is why it is important that you have the full, low-cost additional protection of the new American Life Medicare Supplement Plan.

We never know when one of a score of diseases or accidents may strike, requiring a long hospital stay—such as heart attack, stroke, cancer, vascular disorder or a broken hip. Statistics show that people 65 years or older are hospitalized at least twice as long as those under 65.

How about you? Do you have enough income to cover big, unexpected hospital bills? Do you have enough savings to handle such long-term emergencies which could cost you thousands of dollars.

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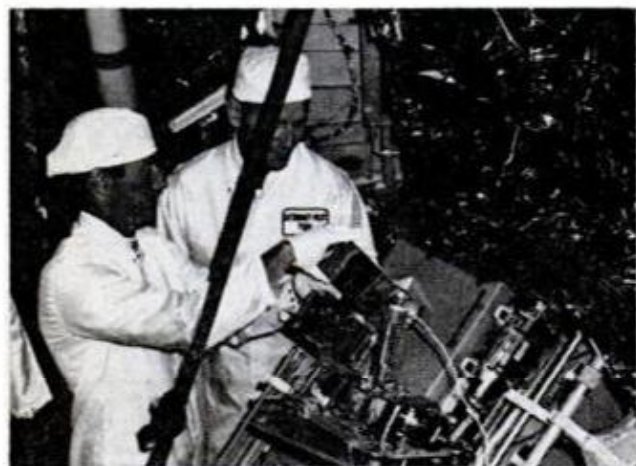
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Apollo 12—Our Second Walk on the Moon

This month Cmdr. Charles Conrad Jr., Cmdr. Richard F. Gordon Jr. and Lt. Cmdr. Alan L. Bean will blast off for Earth's suddenly familiar satellite. While Gordon orbits to bring them home, Conrad and Bean will explore a new "base." How long will they stay? How far will they walk? What will they do that Apollo 11 didn't? To learn the answers to these and other questions, PM Editor Bob Crossley interviewed Col. James A. McDivitt, commander of Apollo 9 and Gemini 4, now NASA's manager of Lunar Landing Operations in the Apollo Spacecraft Program Office.



APOLLO 12 CREW during training. From left: Astronauts Conrad (crew commander), Gordon and Bean



EXPERIMENTS PACKAGE, to be deployed by Conrad (left) and Bean, is more complex than previous one

Crossley: *First I'd like to ask you, Colonel, where will Apollo 12 land in relation to Apollo 11's Tranquillity Base?*

McDivitt: The site—it's called Apollo Site 7—is to the west and a little south of Tranquillity Base. To give you another reference, it's a bit south of the moon's equator and west of the prime meridian.

Crossley: *How close is Site 7 to the remains of Surveyor 3?*

McDivitt: Our target area may be from 1000 to, say, 1500 feet from Surveyor.

Crossley: *What do you hope to learn from the pieces of Surveyor that might be brought back?*

McDivitt: There are so many things that we could learn. For instance, if a piece of insulation were brought back, we could see if it had holes in it, indicating strikes by meteorites. The condition of a television camera would tell us how equipment with electronic components reacts to the moon's environment, to bombardment by cosmic rays, and so forth.

Crossley: *How long has the Surveyor been on the moon?*

McDivitt: About three years. And since we know the condition of the spacecraft when it left Earth, we can determine how it has deteriorated in the three years that it has been sitting on the moon's surface. But before we leave this subject, I want to stress that the primary objective of Apollo 12 is not to bring back pieces of Surveyor 3. That is only a secondary ob-

(Please turn to page 52)

A GRADUATE of the University of Michigan, Col. James A. McDivitt joined the Air Force in 1951 and flew 145 combat missions during the Korean conflict. He was selected as an astronaut by NASA in Sept. 1962



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SECOND WALK ON THE MOON

(Continued from page 50)

jective. We've got to develop a pinpoint landing capability, and picking such a site allows us to see what we can do. We're going to use various techniques to try to hit it. We'll refine our techniques from one flight to the next, until we have a pinpoint landing capability. Incidentally, the objective of Apollo 11 was not to land at a certain spot—but just to land.

Crossley: I understand that you've selected landing sites for each of the next nine missions. Is that correct?

McDivitt: Not exactly. Let me explain. There are a tremendous number of sites where one could land. We obviously cannot target for, say, 2000 landing points. So we have had to eliminate in order to reduce the number to a usable total. About six months ago we had reduced the number to 25 or 30 sets. From them, knowing that we had 10 lunar missions to fly, we selected 10 sites of prime importance. Now, bear in mind that they were selected from the scientific standpoint. And there's a big difference between selecting a site and being able to go there. So now, after we have selected these prime sites, we have to make sure that we have proper photography on them. We have to determine that the terrain is smooth enough and that the approaches are all right.

Crossley: What do you mean by "proper photography"?

McDivitt: Well, we have some very precise photographs of a number of sites. These sites looked good scientifically for our lunar exploration program. So we had as many of them as possible photographed during the Lunar Orbiter program. Both medium and high resolution photography were used—high resolution to cover the precise landing sites and medium to cover the surrounding area, out to maybe 50 or 60 kilometers. We wanted to know what radar would do in the approach to a site.

Crossley: Plans for future Apollo missions call for a series of landings on the Earth-side of the moon. Tell me, Colonel, will we someday land men on the dark side?

McDivitt: Oh yes. In fact there's nothing right now to preclude such a landing. But I don't think we'll be doing it for some time because we like to have communications with the space capsule during descent.

Crossley: Yes, we're familiar with the fact that when a craft is behind the moon you lose radio contact with it. Do you lose telemetry as well as voice contact?

McDivitt: Yes, everything. And that means that the three men in the spacecraft lose the help of the thousands of

guys here on Earth. If you can't talk back and forth, you simply can't help those guys up there.

Crossley: Since we will be making landings on the dark side someday, how do we lick the communications problem?

McDivitt: By means of satellites. If you put three communications satellites in orbit around the moon, each 120° apart, there would always be one that men on the back side of the moon could transmit through.

Crossley: Just the way we bounce signals off communications satellites around the Earth right now?

McDivitt: Exactly.

Crossley: Would it be complicated to get the satellites into orbit?

McDivitt: Not really. It could be done quite easily with today's technology. If we had a larger spacecraft than we have now, we could fly a craft out there and pop the satellites out, one at a time. We have some of this capability in our command and service module right now. It has an empty bay that we're thinking of modifying to carry experiments. One of the things that could be done is to modify it to carry a satellite. As you know, communications satellites don't have to be very big.

Crossley: That's interesting. But now I'd like to get back to Apollo 12. Neil Armstrong's manual landing had a lot to do with the success of Apollo 11. But he almost ran out of fuel on landing. Tell me, are there plans to carry more fuel on Apollo 12's lunar module?

McDivitt: No, it can't carry more fuel. There was as much on Apollo 11 as the spacecraft would hold.

Crossley: So Apollo 12 will have to live with the same limitation?

McDivitt: Right. And we'll fly Apollo 12 exactly the same as we did 11. We have always had a manual landing capability built into the lunar module and it's unlikely that we'll ever take it out. I wouldn't be surprised if every landing in our program is made just that way.

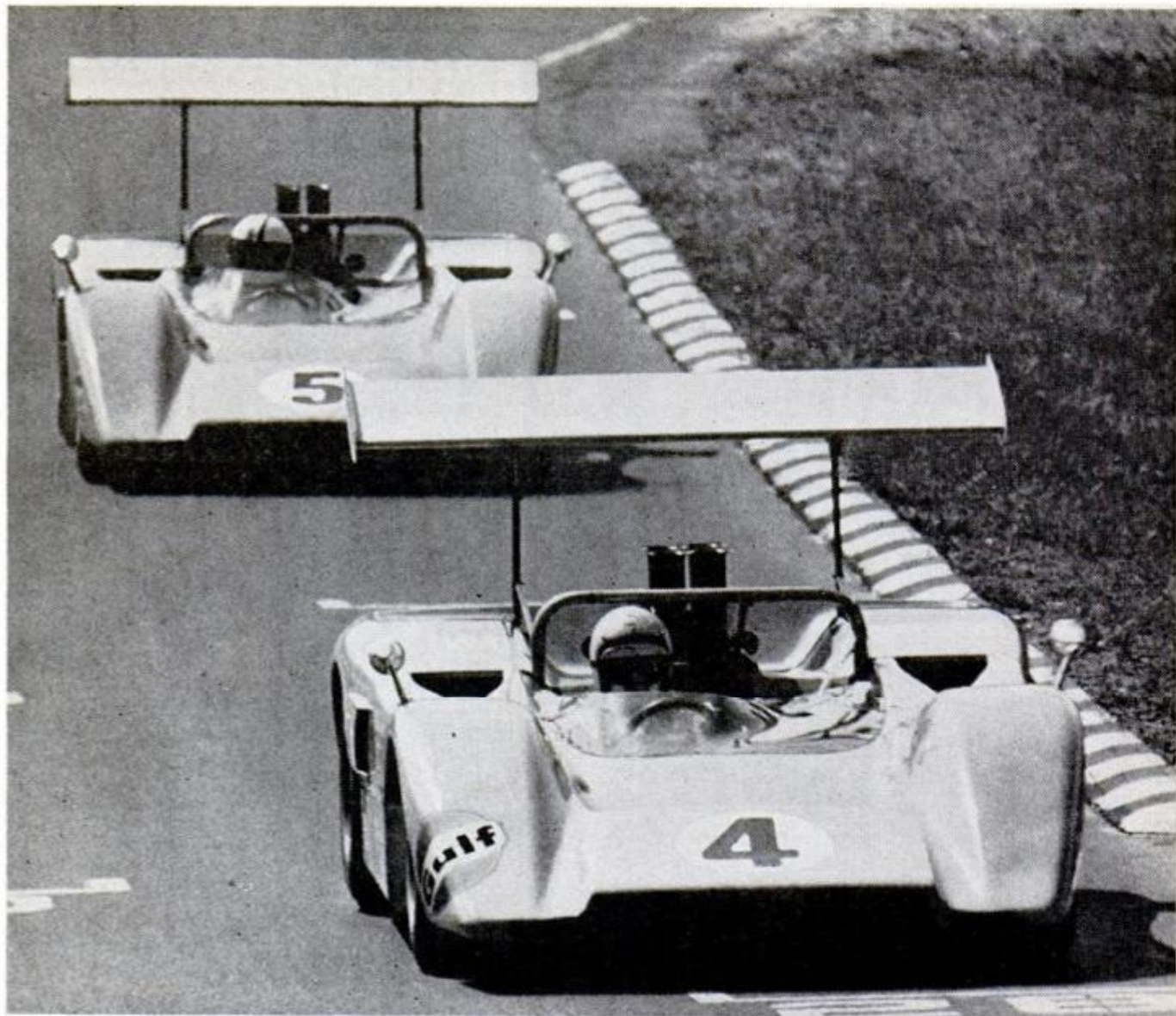
Crossley: You mean a manual landing during the final seconds?

McDivitt: Yes, because our knowledge of the surface simply is not that good. Craters are so numerous. Photos we work with don't show rocks two or three feet in diameter, and you don't want to land on a rock that big. So the pilot has to look for the best place to land and head for it.

Crossley: What about the computer aboard the LM? On Apollo 11 it seemed to get overloaded in the final phase of descent.

McDivitt: What happened was that the computer was looking at two different

(Please turn to page 54)



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SECOND WALK ON THE MOON

(Continued from page 52)

800-cycle signals, one not phase-locked to the other. When that happens, the computer thinks it's seeing a lot of data. But a change has now been made. The computer won't even check those inputs unless the switch is in a particular position. We won't have that problem again.

Crossley: Now let me ask you about the crew for Apollo 12. Pete Conrad, who'll command, flew two Gemini missions, didn't he?

McDivitt: That's right. And Dick Gordon flew one.

Crossley: The third man, Alan Bean, has never flown, right?

McDivitt: Right.

Crossley: Please tell me something about him.

McDivitt: Well, he was on the backup crew for Apollo 9. He's a hard worker and a very fine guy.

Crossley: What generation of astronauts is he from?

McDivitt: I think the third. He came in with fellows like Dave Scott, Rusty Schweickart and Charley Bassett.

Crossley: Do you think it's risky to send a rookie to the moon?

McDivitt: (Laughing) I think it's risky to send anybody to the moon.

Crossley: As I recall, Apollo 11 was on the moon a total of 21½ hours. How long will Apollo 12 stay?

McDivitt: Probably 32 hours. We're looking at times between 28 and 36 hours, but I think it will go 32.

Crossley: Neil Armstrong's extravehicular activity lasted for 2 hours and 20 minutes, as I recall, and Buzz Aldrin's 1 hour and 40 minutes. How long will Conrad and Bean stay outside the LM?

McDivitt: Well, they're going to be outside on two EVAs rather than just one, and each will last about three and a half hours. The general plan is that they will land, do an EVA, rest, do another EVA, and then launch.

Crossley: You say each EVA will last about three and a half hours. But the backpack—the life-support system—only has oxygen for three or four hours, doesn't it? At least that's the way it was on Apollo 11.

McDivitt: No. You see, the system is rechargeable in the spacecraft. The lithium hydroxide canister, which cleanses the oxygen of contaminants, can be changed and the water recharged. The thing to remember is that the portable life-support system is really not time-dependent as much as it is B.T.U. (British Thermal Unit) dependent. If you work very hard continu-

(Please turn to page 56F)

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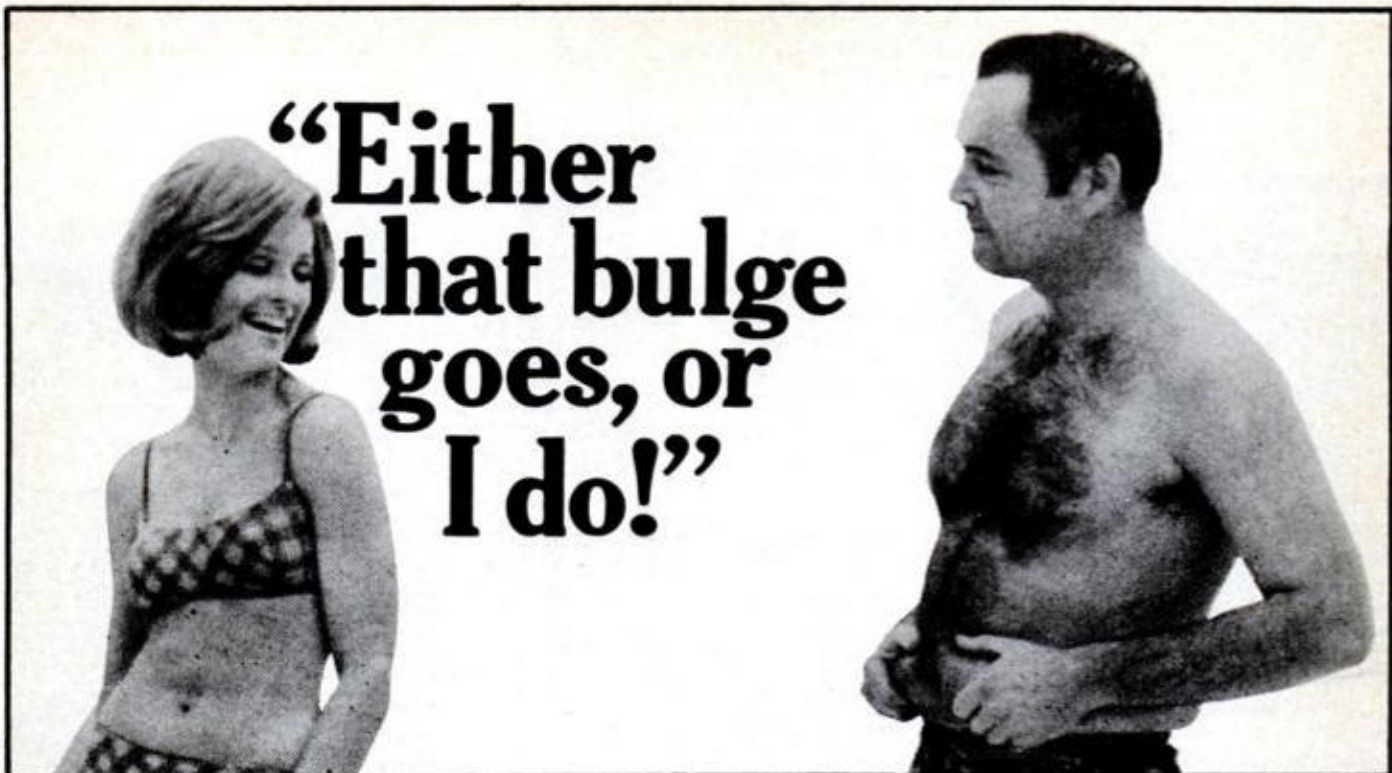
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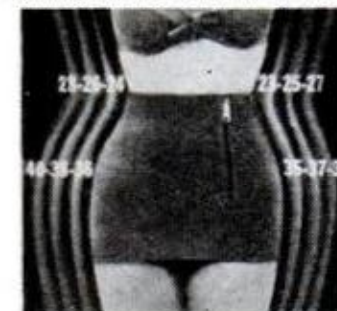
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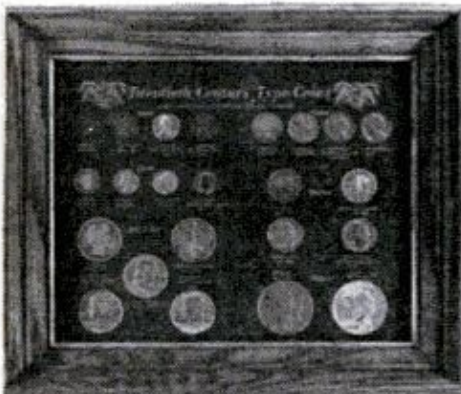


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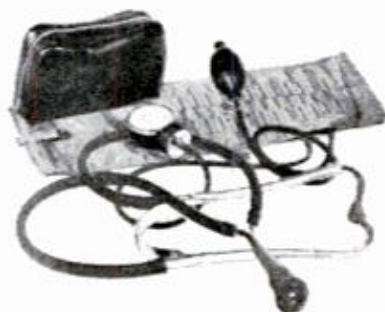
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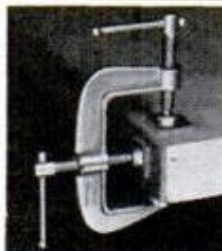
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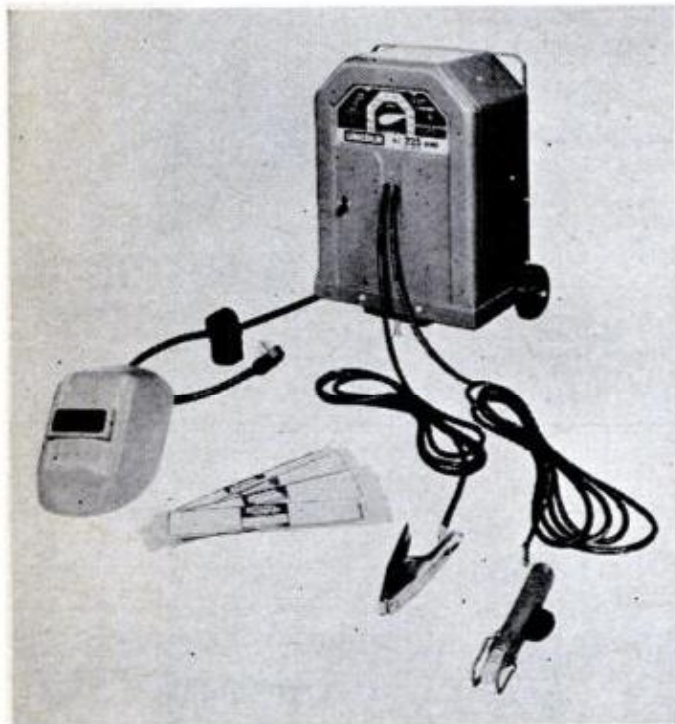
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SECOND WALK ON THE MOON

(Continued from page 54)

ously, the time that the system can supply you with cooling by evaporating water, supply you with oxygen and take out the carbon dioxide might be only about three hours. But if you work very slowly at a steady rate, you might use the same system for five hours. So you see, it's really a rate-dependent thing.

Crossley: How much rest will the men need between the two EVA periods?

McDivitt: We're thinking in terms of periods of about 8 to 11 hours.

Crossley: How far will they walk from the LM this time?

McDivitt: We're limited in how far we can go from the LM by a thing that we call the oxygen-purge system. It's the backup system to the portable life-support system. Since it has 30 or 40 minutes of oxygen in it, and you want to allow 15 minutes of it for clambering up the ladder and getting back in the LM, you can only go 15 or 20 minutes away from the LM.

Crossley: Is there any danger of the guys getting lost if they go fairly far from the spacecraft?

McDivitt: No, I don't think so. I think that you can go a mile from the LM without worrying about getting lost.

Crossley: Will one astronaut remain at the LM or will both go?

McDivitt: They'll go together.

Crossley: Let me ask you about the experiments planned for Apollo 12. On Apollo 11 they deployed a solar wind experiment, a passive seismometer and a laser ranging retro-reflector. What experiments will be deployed next time?

McDivitt: Let's see. It's a much more sophisticated package than we had on Apollo 11 and is designed to provide a great variety of information. It's referred to as ALSEP, standing for Apollo Lunar Surface Experiments Package. I'll read you the titles of the experiments included: Passive Seismic Experiment, Active Seismic Experiment, Lunar Surface Magnetometer Experiment, Solar Wind Experiment, Suprathermal Ion Detector Experiment, Cold Cathode Gauge Experiment, Heat Flow Experiment, Charged Particle Lunar Environment Experiment.

Crossley: That's quite a package. I won't ask you to explain them all. But what's involved in the Active Seismic Experiment?

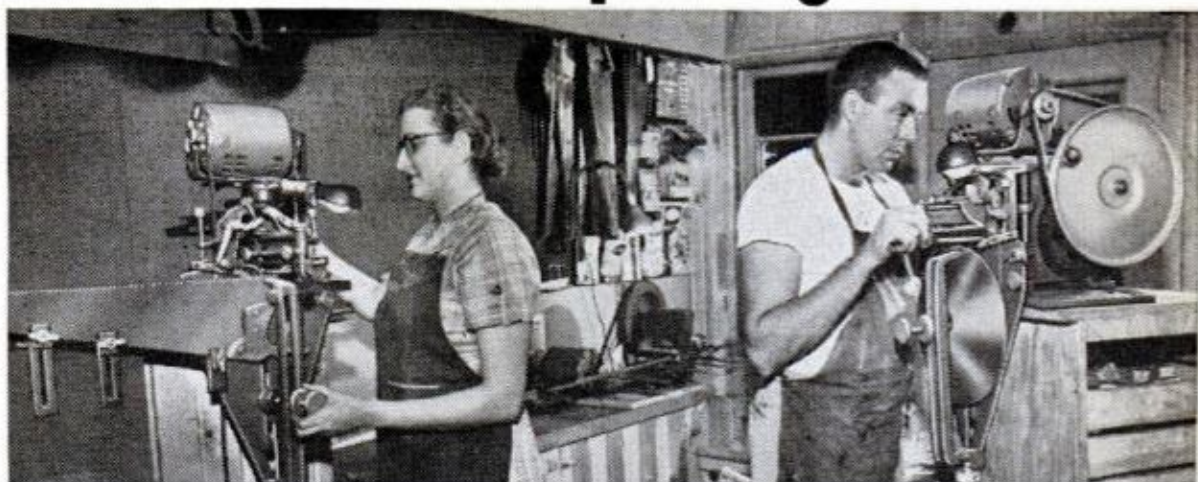
McDivitt: It's designed to create a seismic disturbance. A mortar box assembly holds four grenades that can be launched—on command from Earth—and exploded at various distances. Seismic waves created will be detected by a geophone array. The

(Please turn to page 56H)

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They started in spare time with one

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SECOND WALK ON THE MOON

(Continued from page 56F)

purpose is to measure the elastic properties of the lunar subsurface material to a depth of about 500 feet.

Crossley: *And the Cold Cathode Gauge Experiment?*

McDivitt: It's designed to provide data pertaining to the density of the lunar ambient atmosphere. The scientists are particularly interested in determining any variations of the particle density associated with lunar phase or solar activity.

Crossley: *Please tell me something about the Heat Flow Experiment.*

McDivitt: It measures the lunar temperature profile at depths up to 10 feet and also the value of the moon's thermal conductivity to the same depth. These measurements may tell us what the outward flow of heat is from the moon's interior. The data may indicate whether the melting point may be approached deep inside the moon. But let me say this about all of the experiments: their purpose is to provide scientists with a great amount of data about the lunar environment, especially in the areas of geology, geochemistry, geophysics, particles and fields. Broadly speaking, this is the kind of knowledge that will in time provide us with an understanding of the moon, where it came from, how it was created, and we'll also get insights into the formation of our solar system. Incidentally, scientists were enthralled with the data and specimens provided by Apollo 11.

Crossley: *Collecting rock samples is still part of the scientific program, isn't it?*

McDivitt: Oh yes, we'll get rocks, core samples, contingency samples.

Crossley: *Good. Now I'd like to get onto another topic. Tell me, will there be color TV from the moon this time?*

McDivitt: I don't know. We're working on it. The color TV cameras we have now are not compatible with vacuum operations or extreme thermal environments. They have to be modified. But I don't know if there's enough time remaining to test them adequately before the mission gets underway. We can carry only one TV camera, you know; we want to be sure it works.

Crossley: *Now I'd like to ask a personal question. Colonel, you, Wally Schirra and Frank Borman have all retired or given up flight duty. All of you took that step shortly after serving as commander on a mission. Can you tell me why you veteran astronauts are dropping out, so to speak?*

McDivitt: I can't tell you why the other guys did, but I can tell you my reasons. When I came down I realized that there

(Please turn to page 58)



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Next Month in Popular Mechanics

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Big, Full-Color Foldout of Boeing's Giant New 747

Slated to go into service for Pan Am in December is Boeing's giant new airliner, the 747. *PM* has prepared a painting of the plane that'll be reproduced on a special full-color foldout. Detailed cutaways will graphically illustrate the many unique features of the 747.

Owners Report on the Ford Maverick

After driving their Mavericks some 1,260,821 miles, owners told *PM* that they're getting what they wanted: an economy car that's economical to operate. Three-fourths of the owners we queried have the smallest available engine in their car and three-fourths have manual shift—and they're getting 21 to 25 miles per gallon. Among the few complaints: There are some rattles and there isn't a glove box.

'I'm Not Stuffed—I'm Freeze-Dried!'

The lifelike, frozen-in-action poses of the new wildlife specimens in the Smithsonian Institution are the result of freeze-drying, a process that preserves them perfectly.

Special Save-It Section: 30 Smart Ideas for Putting Space to Work

Looking for more storage room? Today, the answer isn't just another trunk in the attic. In the modern equipment-packed home, you need to hide things away and still have them at your fingertips, ready for use. Here are 12 pages of storage arrangements that make living more efficient and more fun.

New Mini-Strobes: Flashguns You Can Slip in a Pocket

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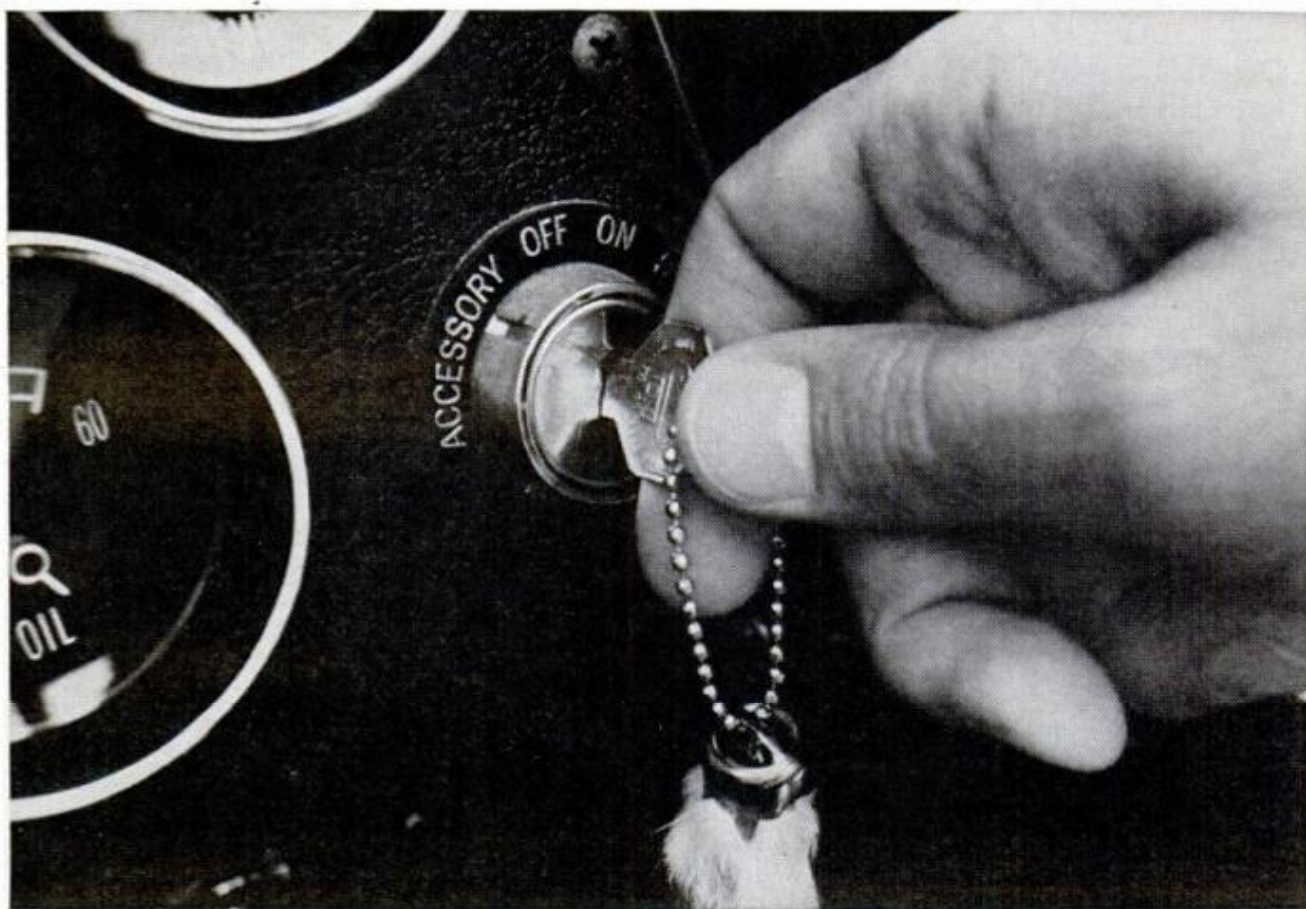
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SECOND WALK ON THE MOON

(Continued from page 56H)

wasn't going to be another Apollo flight for me for some time. I felt then—and I feel now—that I could go on another space flight today or next year. But a longer interval—that would be different.

At any rate, it became apparent that there would be a gap in my flying, and so I decided to step down. You see, I don't think you should be flying if you're too old, if you don't have the desire and drive that's called for. The training requires a heck of a lot of enthusiasm and really hard work. And when you can't put out the way you used to, then you are not going to be properly trained for the mission.

Crossley: *But having been so deeply involved in the program for so long, don't you still feel a burning desire to go to the moon?*

McDivitt: Sure, I want to go and land on the moon. But I don't think I want it so badly that I would jeopardize the entire space program by going off there when I wasn't the best guy to do it. I always felt that if I couldn't be the best astronaut, I shouldn't be one at all. If there is a guy available who is better, then he should be flying, not me. You know, if we have a number of failures in the space program, it will be a lot less popular than it is now. No, I don't think a man should put his pride or ambition above the best interests of the program or of his country.

Crossley: *That's a very good answer. The thought strikes me that the astronauts are so carefully selected and so superbly trained, that they are, in a sense, interchangeable.*

McDivitt: Exactly. There are so many young fellows who can do just as good a job as the older guys. Take Gemini 4 as an example. Ed White and I were on the prime crew, and Jim Lovell and Frank Borman were the backup crew. None of us had hardly even seen a spacecraft till we got here. And we did all right. No, I don't think you need a wealth of experience in space flight to be able to do a good job. But I do think you have to have a great amount of drive and desire.

Crossley: *A final question. I don't know if you're aware of it, but there's a movement afoot to have the ashes of Willy Ley, the late science and space writer, scattered on the moon. In fact, Popular Mechanics had an editorial on it in the September issue. Now, would such a thing be possible?*

McDivitt: I couldn't say. I guess something like that would have to be decided on a very high level.

Crossley: Thank you, Colonel, for an interesting interview. ★★★

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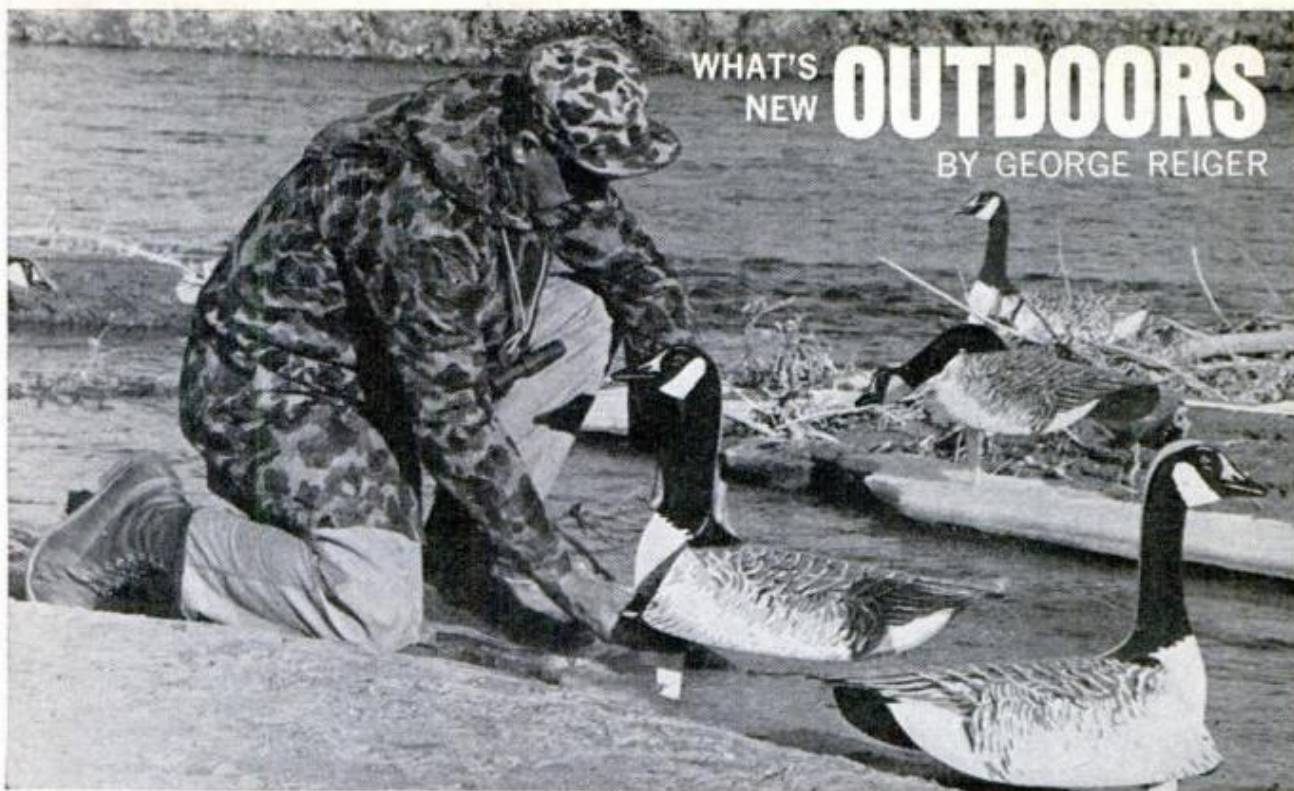
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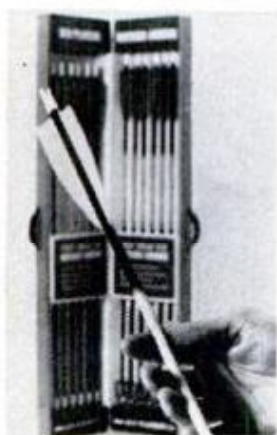
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THE CANADA GOOSE is a tough bird to lure within gun range. The more decoys a hunter uses, the better his chances are of bringing home a wild goose for Thanksgiving dinner. But full-bodied decoys are expensive and heavy, and a gunner may run into off-season storage problems. The answer is stick-up silhouettes. Several companies make these cardboard deceivers which can be waterproofed for several seasons' use by coating the decoy's surface with flat varnish. A wax-based waterproofing—like that used on canvas tents—also works well.

Nebraskan waterfowler Pete Czura points out that the wooden stakes provided by some of the silhouette manufacturers are not strong enough for repeated use and recommends that a gunner substitute sturdier stakes of his own devising. He also suggests that the stakes should be painted a flat black or gun-metal gray to lull the suspicions of wary honkers. The lightweight decoys illustrated are made by Canadian Decoys, Box 66, Rosemont, Minn.

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

By Victor B. Mason

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

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

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

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

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

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

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(Continued from preceding page)

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(Continued from preceding page)

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BUSINESS OPPORTUNITIES

(Continued on next page)

BUSINESS OPPORTUNITIES

(Continued from preceding page)

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(Continued on next page)

MONEYMAKING OPPORTUNITIES

(Continued from preceding page)

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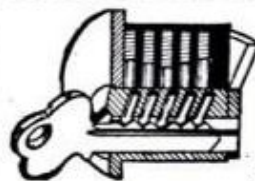
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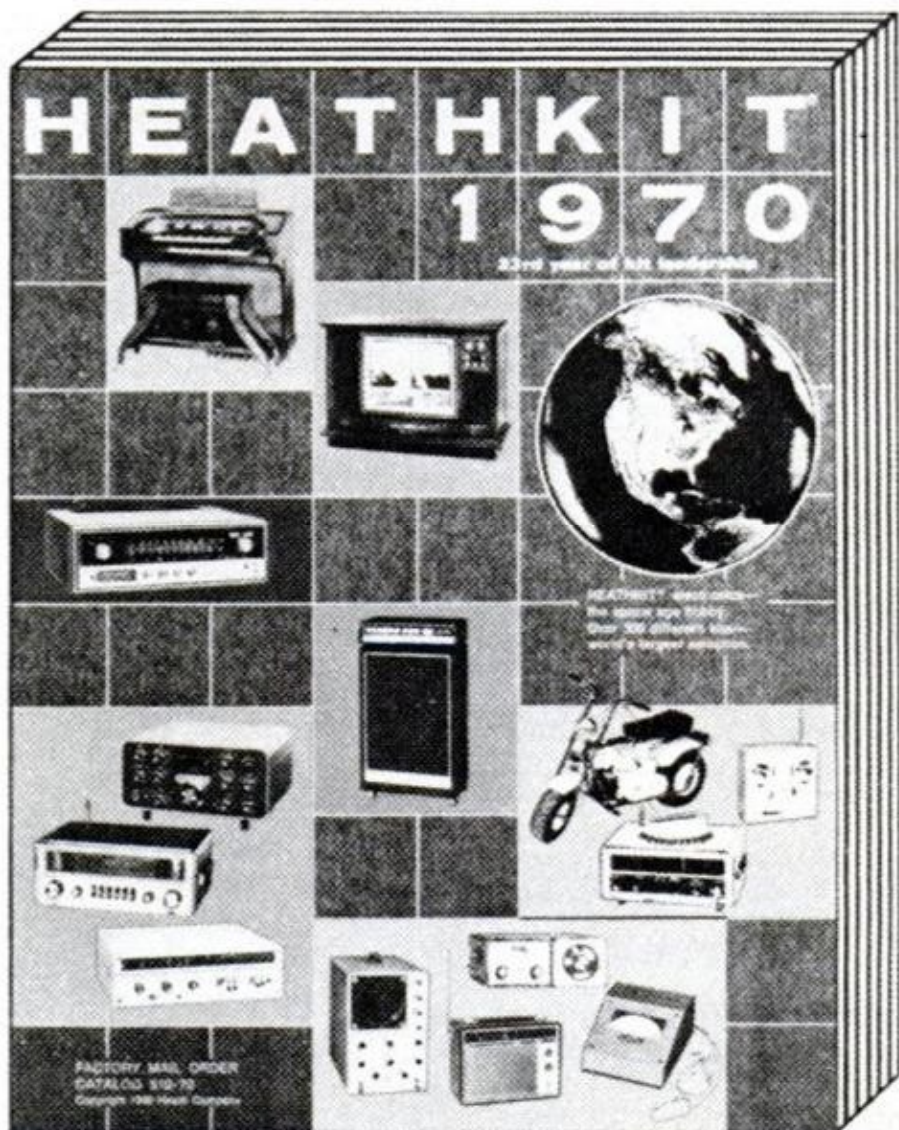
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Snappy spring

Last year, while backing my 1965 Corvette (396-cu.-in. engine) into a parking spot, the No. 6 cylinder intake valve spring snapped. It cost me a small fortune. Now, almost a year to the day later, the same thing happened to the same cylinder. The only difference is that I was traveling about 65 mph in fourth gear. Any ideas?—S/Sgt. William F. Moore Jr., APO New York.

Check the rocker-arm stud for that intake valve for looseness. A loose stud will cause undue stress on the valve spring which, in time, will cause the spring to break. If the stud is loose, replace it with one that's oversize. The stud hole will have to be reamed to accommodate the larger stud.

Hot bug

Recently I saw an advertisement for a "2-bbl. Carburetor Ram Induction Manifold Kit" for Volkswagen that claimed to give a 50 percent increase in horsepower at top speed. Can this be true? Would you recommend the use of such a device?—Robert A. Flanagan, Norfolk, Va.

You won't get anywhere near that much additional power. The smallest part of your car's induction system is the valves. No matter what you do, you can only shove so much fuel past those restricted intakes. My answer to your second question is a question of my own. What will this device buy you? It won't harm your engine, I'm sure, but is it worth the the money? VW of America in Englewood Cliffs, N.J., doesn't think so. The company frowns on you adding anything of this sort to your car.

Transmission leak

The governor plate on the automatic transmission of my 1965 Rambler Ambassador lets fluid drip past. Not a lot, but it's steady. The dealer has tried a new plate and many new gaskets. No luck. Please help.—Ronald S. Price, Westfield, N.J.

I'd have to conclude that the surface of the transmission isn't perfect at this point. In cases like this, applying No. 1 or No. 2

Permatex beneath the gasket should stop the leak. If not, I'm afraid you'll have to have the surface machined, and that's a big job.

Gas trap

Gasoline is constantly getting into the modulator valve of my 1963 Chevy Impala with 327 engine and automatic transmission, resulting in rough shifting. The carburetor has been overhauled twice. Garages cannot explain what causes this. Where do I turn next?—James Willenbring, Cape Girardeau, Mo.

This old problem happens when the carburetor bleeds down a bit or runs on a rich mixture. Enough gas can drip through the straight modulator line to flood the modulator, causing your rough shifting action. The fix is to put a bend in this line to create a trap, much like the elbow pipe on your kitchen drain.

Noise abatement

When my 1967 Falcon Futura (200-cu.-in. engine) is cold, the valves clatter for about 10 minutes before they quiet down. The Ford dealer says all Falcon hydraulic valves are noisy. Are they?—W. C. Dougherty, Butler, N.J.

Not if you've changed oil and oil filter as often as you should. But there's another possibility. A worn valve guide can act like a noisy hydraulic valve. It gives the same type of noise. A good mechanic can tell the difference between a worn, clicking valve guide and a noisy hydraulic lifter by putting pressure against the valve spring while the engine is idling. A sloppy feel indicates a worn valve guide. If the problem is with the valve guide (or guides), rebore the guide to oversize (.003", .015" or .030") and fit the cylinder head with the appropriate oversize valve (or valves). This is the least expensive way of fixing the trouble. Of course, if guide wear is more than .030" you'll have to replace the cylinder head.

Stiff shift

I've just purchased a 1969 Jeep Wagoneer and have one problem. Shifting from four-wheel-drive high to four-wheel-

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drive low is nearly impossible unless I stop. The book says it's supposed to work at 5 mph, but the dealer says this is normal. Who's right?—Chester Pajak, Galway, N.Y.

They both are. Jeep four-wheel-drive gearboxes are stiff as a board when new and tough to manipulate. As you've found out, you often have to stop and then shift. As you use the unit, it will loosen up and will eventually allow shifting at that 5 mph speed. Be patient.

Taking in air

Can you tell me why my '67 Buick Riviera whistles at me? It's a high-pitched whistle that comes from beneath the hood, and it's heard whenever I start out in the morning.—John Domench, Stockton, Calif.

Check for a loose intake manifold which leaks air to produce a whistle. Spread some oil around the manifold and carburetor and start the engine. If the area is leaking, you'll see the oil being drawn in. Just tighten it all down, and the whistle will stop.

Ventless fuel tank

I have a 1968 Pontiac Catalina with 400-cu.-in. engine and 2-bbl. carburetor. Why does this engine stall out when driving along at 45-50 mph? It just dies. No sputter—no falter. It always restarts easily and immediately. The trouble has been occurring about once or twice a month.—C. J. Meloskie, Netcong, N.J.

One good reason is insufficient venting of the gas tank, causing the fuel pump to suck fumes rather than fuel. There may be a crimp in the rubber tube that runs down from the gas filler neck to vent your gas tank. Or, more likely, the tank just isn't vented enough. I'd drill a 1/8-in. hole in the center of the gas cap.

Sloppy shock

It's difficult to diagnose noise problems without driving a car, but maybe you know why I get a terrible rattle in the rear of my 1968 Toronado when I hit a bump. It's tough to live with.—Bill Shane, Miami.

A few of these models have shown up

with loose retainers in the shock tower of the rear vertical shock upper mounting. The shock has to be detached from the top, compressed and a nut installed to the extreme end of the bolt threads. After attaching the shock to the retainer, the lower nut has to be torqued to 100 ft.-lb. to seat the shock in the retainer. Your Olds dealer knows about this.

Service Tips

● **Chrysler Corp.** has issued words of wisdom regarding your engine and the fuel it burns. One and two-barrel carburetor powerplants (170, 225, 273, 318 and 383 cu.-in.) are designed to operate on regular fuel. If a spark knock is experienced, either change to a regular gas of higher octane or retard the ignition timing up to 3° from specification. Four-barrel carburetor engines (340, 383, 426 and 440 cu.-in.) run on premium fuel. If spark knock is encountered, try a fuel with higher octane or retard timing up to 3° from spec. Chrysler says the highest octane gas you can get in your area should be used in its 440 magnum engine.

● **General Motors** has cautioned all dealers to guard against overfilling automatic transmissions prior to delivery of new cars. Overfilling leads to foaming, which can cause erratic shifting and damage transmission components. Be doubly sure and check the transmission yourself. Drive the car for at least 15 minutes and park it level with the transmission lever in Park and the engine idling. Fluid level should be at full to 1/4-in. below full.

● **Some 1969 Lincolns** have gotten into the field with an incorrect steering centerlink. It's not a hazard, but the wrong centerlink will contact a starter motor mounting bolt-head during a full right turn and cause a rattle. The incorrect part is bowed toward the starter motor. The correct one (part No. C8VY-3304-B) is bowed out to clear the starter motor.

● **Chrysler, Plymouth and Dodge** station wagons didn't have a safety relay incorporated into their power tailgate circuitry until later in the 1969 model year. This relay prevents operation of the window unless the ignition switch is in the "on" position. If you want this in your 1968 or early 1969 model, see your dealer. Service bulletin 69-23-19 (4/28/69) explains how to do the job on Chryslers and Plymouths. Service bulletin 69-23-21 details the Dodge procedure. ★★

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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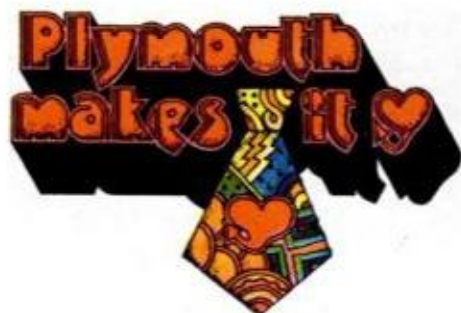
Very possibly this is the fastest production car in the country.

If you had something

gentler, but equally sporty, in mind, we also make Barracuda and the Barracuda Gran Coupe.

So remember the name, new people. Barracuda. It's all yours.

Hello, new people. We have a new car for you.



HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Floor cracks diagonally

My home is a little over two years old and the slab floor is tiled and carpeted. The floor is cracked diagonally nearly all the way across. The crack, running right through the kitchen tiles, is about ¼ in. wide. My contractor is at a loss to explain. What could be the cause and what might be done to repair the damage?—Y.R., Colo.

The most logical reason for the break is inadequate bedding (tamped gravel) over unstable soil. There could be other causes, such as a yet undiscovered leak in the plumbing, earthquake or settling of earth fill. A leak in plumbing will show up somewhere on the outside sooner or later. An earthquake is only a guess and any other unusual features of the location can be judged only by an on-the-spot check of the immediate locality.

The only repair you can carry out without delay is to remove the affected tiles, lift the carpeting and then pour a thin mix of prepared concrete patcher into the crack, troweling or brushing it flush with the surface. There's no way to tell in advance if this will hold. If the settling—or whatever the original cause—continues, then the patch is likely to break, but if the floor has stabilized the chances are good the patch will hold.

Glass top creeps

I have a small lamp table with a plate-glass top. The tabletop seems perfectly true, but the glass will not stay in place. It steadily "creeps" to one side and it's giving me the creeps, too. If I move the table, the glass top still moves to one side or the other. What could cause this and what can be done to make the glass stay put?—O.R., Ga.

After reading your description I can almost "feel" the tabletop move. I'm going to guess that the cause is vibration set up when you walk across the floor or by passing cars and trucks on your street or a nearby highway. If the tabletop (the wood top) is perfectly flat and the floor is level or nearly so, the remedy is to seat the glass top on four or five rubber squares. You can cut them from a wide rubber band or you can obtain rubber discs made for the purpose from office

supply stores. Use four or five discs, depending on the size of the glass top, placing one disc at each corner and one in the center. Corner discs should be placed about 1 to 1½ in. in from the edges. If the top tends to "teeter" on the center disc it should be removed, of course, and you will have to be careful not to weight the top too heavily at the center. The top should be at least ¼ in. thick.

Remover won't remove

I tried to remove the finish from an old blanket chest, one of those things having a lidded box on top and a drawer underneath. The remover took off the paint in a jiffy but it won't touch the reddish finish underneath. An antiquarian has told me that in wanting to take off the reddish finish I'm guilty of a "vandalism." She says this should be preserved. I resent being called names. Is she right?—C.T., W.Va.

I want nothing to do with the quarrel over "vandalism," but in saying that the "reddish" finish should be preserved, she's right. No doubt she's thinking of the added value of the red finish to the piece as an antique. Undoubtedly, this is the original finish and is well worth preserving as is. If this value appeals to you, just wash off the residues of the remover and forget all about wanting to see the pine or poplar under the red. There's no telling for sure what was in the original finish but probably one ingredient was skimmed milk, the casein content of which usually defies the action of many common paint and varnish removers. You can take off the old finish with a cabinetmaker's scraper, but I wouldn't recommend it for the reason your antiquarian has given, also because that procedure will take some doing.

'Rain' lilies

We've just moved to our new home. On a porch we found three small pots with a dry growth that appears to be a kind of grass. I set them out along the garage, it rained, and now new growth is coming. This looks like a very coarse, wide-bladed grass. I took the pots inside and shortly a lily-like flower appeared in one. Can you guess what this might be? H.R., Tenn.

You probably have what are commonly known as "rain" lilies—originally said to be desert plants. It's best to keep them inside during the winter, preferably in a basement. When you water them again in spring, new growth will appear and they should bloom as before. ★★★



We hate to dampen the spirits of other trucks. But scrappage records show Chevy pickups outlast others.

What makes us so tough? For one thing, we use two pieces of sheet metal in our cab. Double-wall it, for strength.

And we build our independent front suspension to expect the worst from a road. Without getting rattled.

Another thing. We just won't leave well enough alone. For instance, you can now order a powerful new additive for regular gas: a 400-cubic-inch V8.

It's not that we're out to make it tough for other trucks. We're out to make it easier for you.

Because putting you first, keeps us first.

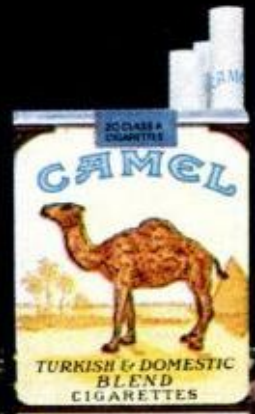


On The Move.

**You'll still be washing it
when other '70's are washed up.**

"I'd walk a mile for a Camel."

This message is strictly for smokers who never tasted a Camel cigarette. Camel smokers, you know what we mean. You other guys, start walking.



New Barriers That Cushion The Crunch In Crashes

Sand-filled plastic barrels, water-filled cells, empty oil drums, a net—one of these may save your life when your car careens toward a deadly highway abutment

By E. D. FALES JR.

IT'S YOUR NECK and they're thinking up surprising new ways to save it when you run off the road and hit an abutment or other fixed object. Half of the traffic deaths in the country are caused by cars leaving the road and hitting concrete piers, parapets and utility poles.

Some of the new devices employ new mechanical principles—one is adapted from the landing gear of the lunar module—but they work. One uses an odd "metal bender" system similar to that used for slowing the plane-arresting cables on aircraft carriers. One of the most effective is a "tennis net" that suddenly drops across the road and snares your car. The net (of nylon or steel) can stop a heavy truck at high speeds.

Among the systems being tested are:

- Sand-filled plastic drums that burst when hit by a car;
- Empty oil drums that fold accordionlike when hit at 50-60 mph;
- "Rolling ring" shock absorbers inside telescoping tubes;
- Water-filled rubber cells that are placed in front of dangerous fixed objects on the roadside.

Some of the new devices are still in the design state, but most are now being installed experimentally. On San Francisco's Golden Gate Bridge recently a driver blacked out while approaching a tollgate at high speed. The toll-taker ducked behind the protective abutment. It was shielded by an array of "Hi-Dro Cushion"



Hole makes barrel easily collapsible



Empty steel drum

TEXAS CRASH CUSHIONS (left), interlocked steel drums anchored by cable, cushion shock when crushed by car

HI-DRO CUSHION CELLS (right), water-filled vinyl plastic cylinders 6 inches in diameter, 3 feet high, are fastened with metal to form cushions. In high-speed impact, water is released; after low-speed impacts, water is retained for continued use. Drivers restrained with lap and shoulder belts are uninjured and vehicles sustain light damage when subjected to a force of 5 to 12 Gs



cells. When the car hit, water rose in a great geyser and fell like a cloudburst. The driver was uninjured and the car could be driven after the impact. "Hi-Dro Cushions"—generally installed at abutments—have already saved 10 lives in several states.

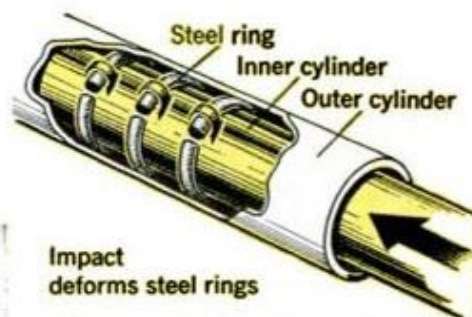
Connecticut will soon install 20 "Fitch Inertial Barriers," a system that

employs sand-filled plastic drums, designed by former racing driver John Fitch. These do a remarkable job of stopping cars up to 70 mph.

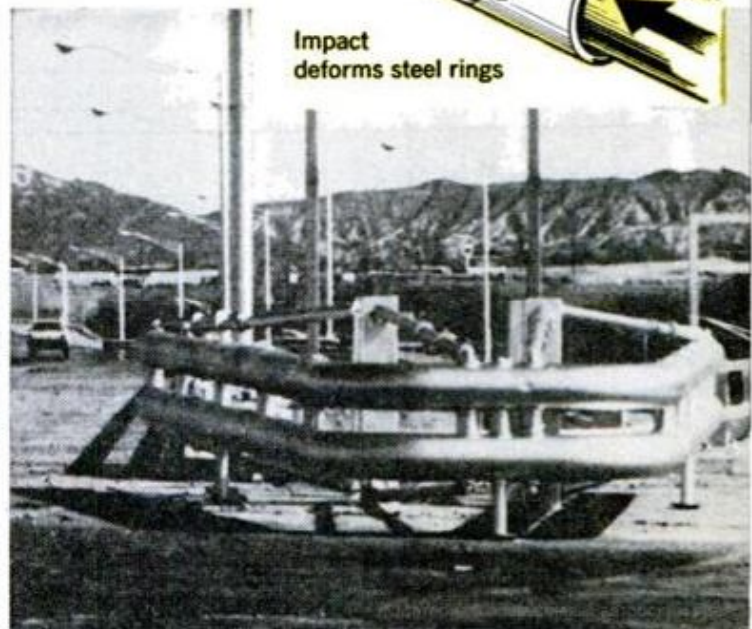
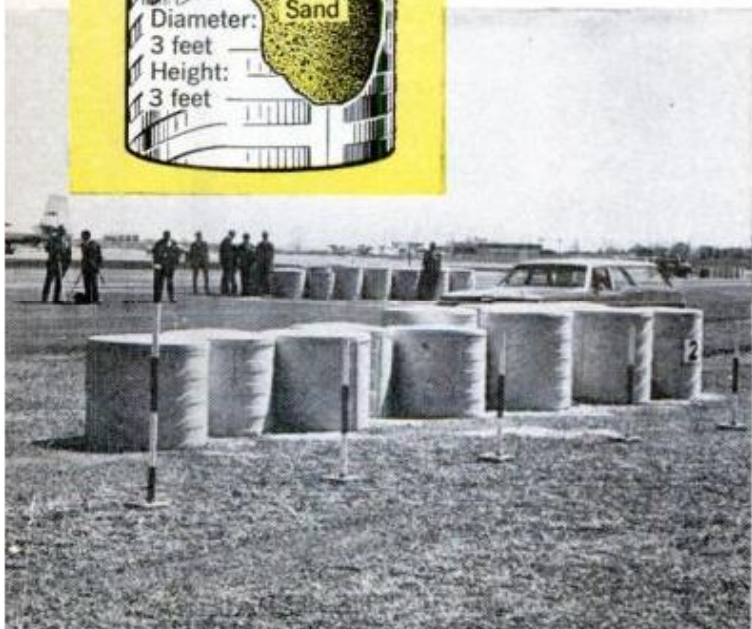
Most exciting of all is the "tennis net," now being marketed commercially under the name "Dagnet." This is a mechanism designed by men who have safely stopped a fully loaded air-

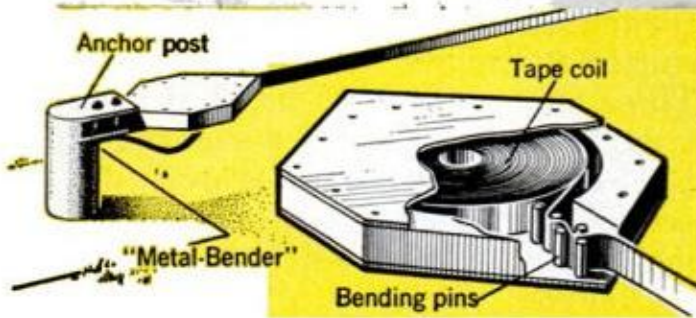
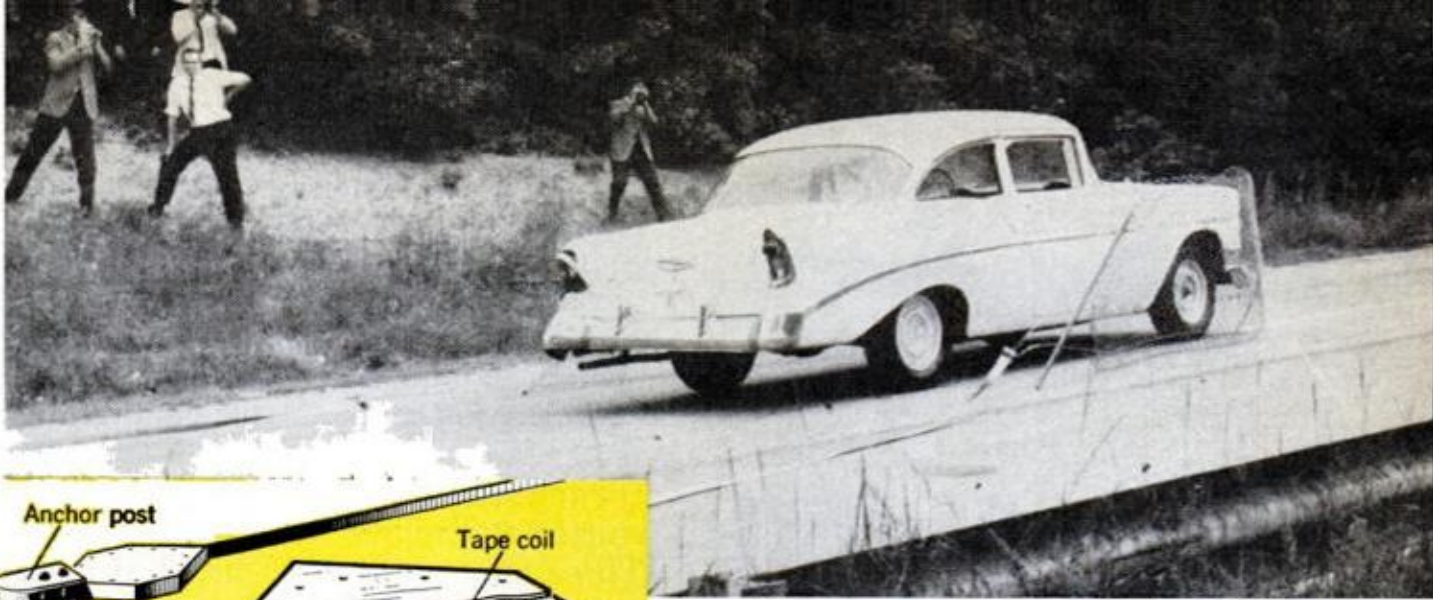
FITCH BARRIERS (left) have safely stopped cars at 70 mph. (See the photo on page 91)

TOR-SHOK SYSTEM (right) uses telescoping aluminum tubes. Steel rings squeezed between cylinders roll inside out under impact



Impact deforms steel rings





DRAGNET uses principle of aircraft arresting gear to bring vehicles traveling over 100 mph to safe, sure stop. Net (of nylon or chain-link fence) is attached by metal tapes to "Metal Bender." When car strikes fence, tapes weave through bender, create 8000-pound braking force. Car is undamaged

liner that aborted takeoff at about 200 mph. The first Dragnet is now protecting drivers at a Houston, Tex., ferry slip where several cars have gone into the water. Others may soon be tested by the federal government to protect railroad grade crossings. High-speed trains—like the Penn Central's new Metroliner between New York and Washington—can clock 120 mph only occasionally because of the danger of hitting a vehicle at a grade crossing. Drivers can't see fast trains approaching. Special crossing nets have been designed for study by the U.S. Department of Transportation. If a car heads for the tracks as a train approaches, the net will snag it and—without damaging it—hold it out of the supertrain's path.

These nets, made by the Van Zelm Co., of Providence, R.I., are so strong and gentle that they can even be strung between police cars to snag fugitives attempting to crash road blocks at speeds up to 100 mph.

The nets can be installed on long, steep grades where the brakes on trucks have been known to fail. In the event of failure, the driver will steer for a marked "escape chute." A net will seize the truck and slow it. Steel rails on both sides of the chute will prevent jackknifing. Then a second net

will drop in front of the truck and snub it to a safe stop.

What's it like to hit a net at 60—or even 80? On a strip near Providence the other day a test driver named Bill Birch tried it. He was driving a '68 Toronado.

"I was coming so fast I couldn't even see the net until the last seconds," he said. He heard a "poof." The nylon had snared his front end, wrapping tight around the bumper and grille. He heard a shrill, anguished screeching. Then he saw steel cables holding him back and he was stopped. The screech had come from the cables which ended in thin steel tapes. These had been pulled and bent at terrific speed in a maze of rollers called a "Metal Bender." Birch examined the car for damage; the paint wasn't even scratched.

Equally amazing in their effect on car and driver are the Fitch Inertial Barriers. A test driver who has hit them at 60 mph says the sensation is "like hitting a deep puddle of water." While the cars suffer front-end damage, many of them can be driven away after 60-mph crashes.

Empty oil drums, set in rows in front of abutments, have already prevented several crash fatalities. The "Texas Crash Cushion" system is being devel-

(Please turn to page 226)



Big Airlift To the North Slope

Supplies and hardware have to be flown to crews working the big oil strike in Alaska. In this exclusive report, a pilot tells what it's like to make the rugged Arctic run.

By **FRANK A. TINKER**

THE NEEDLE on the radio compass swung toward a low-frequency "homer" to our right. We contacted the controller at Anchorage, and his voice came through clearly: "Seven-One-Zulu, you are cleared for an approach."

From that point on, the procedure would have been familiar to pilots old enough to remember how it was before the advent of sophisticated landing systems. We homed in on the beacon, turned to the proper bearing and started a letdown through the murk. Three minutes and 7.5 nautical miles later we broke out of the overcast at 500 feet above the terrain—scarcely discernible from the white haze overhanging it—and strained to sight our target.

"Tallyho!" sang out my co-pilot as he spotted three red trailers squatting in a vast white plain. Beside them, marked by flare pots, stretched a narrow runway scraped from the surface of the frozen lake. A slow, close-in approach, a final wind check and then Dumbo settled onto the ice.

Brakes? Forget them here. Control? As speed decreases and the rudder becomes ineffective, you hope that you've read the wind right. We had. We slid to a stop with a good 100 yards to spare on the 3500 usable feet of runway.

This may not be the approved way to handle a large transport, even in the bush, but this is no ordinary operation. It is one of the most unusual aerial support missions ever mounted. It was



organized almost overnight by private aviation, transforming a remote Arctic plain into a complex of airstrips. The success of the operation, in which I am lucky to play a part, depends to a great degree on the experience and ability of the air crews.

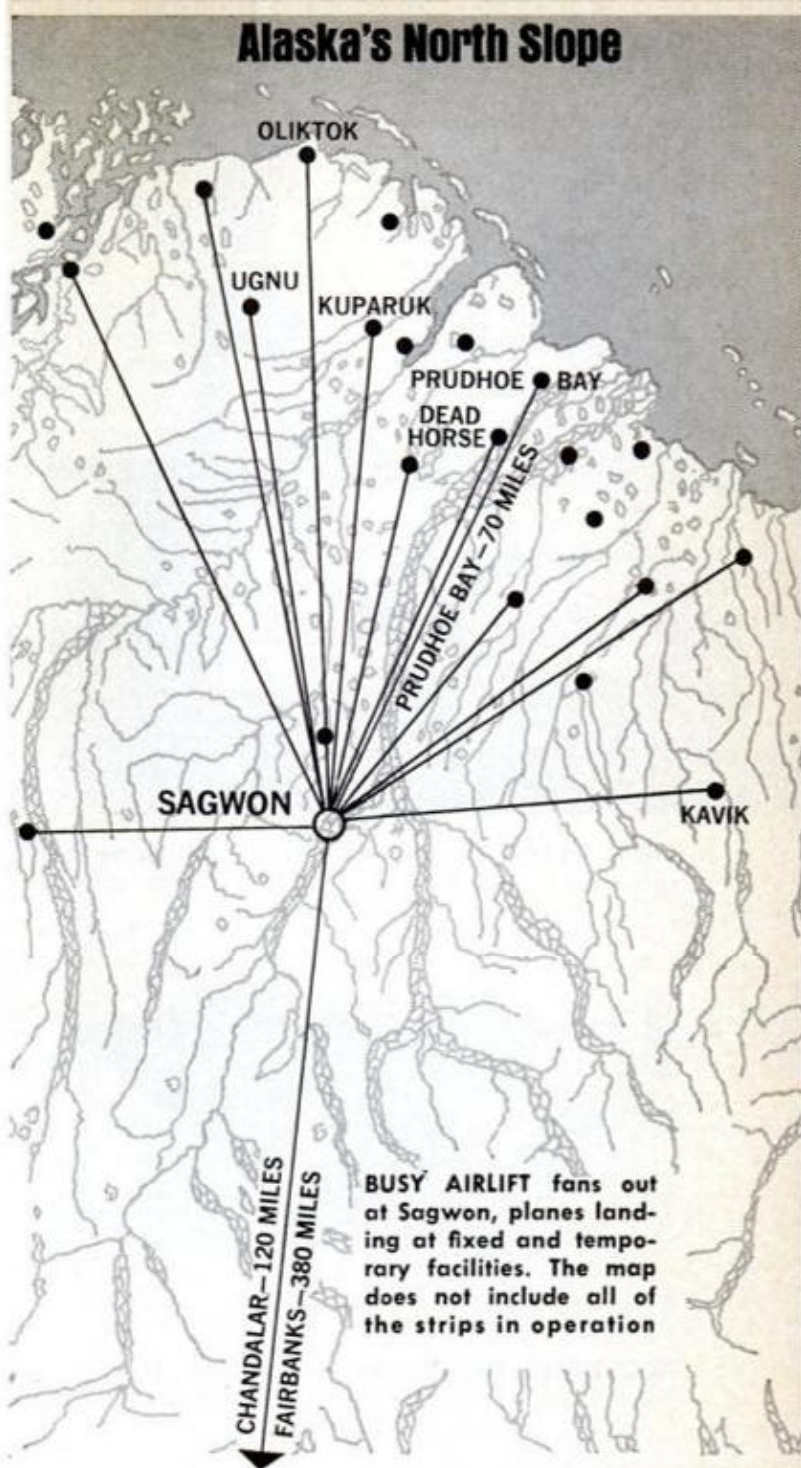
The purpose of the mission is to support the big oil strike on Alaska's North Slope. Even veteran oil men, accustomed to doing things on a grand scale, find it hard to believe that it was only about a year and a half ago that the big news came back from the Atlantic Richfield Co.'s test hole at Prudhoe Bay. There, under the tundra south of the Arctic Ocean, was a reservoir that held between 5 and 10 billion barrels of oil. It's a big one. In the history of the petroleum industry, only 21 fields have ever produced as much as a billion barrels.

The discovery posed a big problem: how to move exploratory parties and drill rigs to the hostile, bleak North Slope, and how to keep them supplied. By sea, it's about 2000 miles from Anchorage up through the Bering Strait and a narrow channel to the landing beaches on the north coast. At best, the channel is open for only three months out of the year. No established roads or railways extend north of Fairbanks, the nearest terminal, which lies 400 miles south of the strike over the barren Brooks Range.

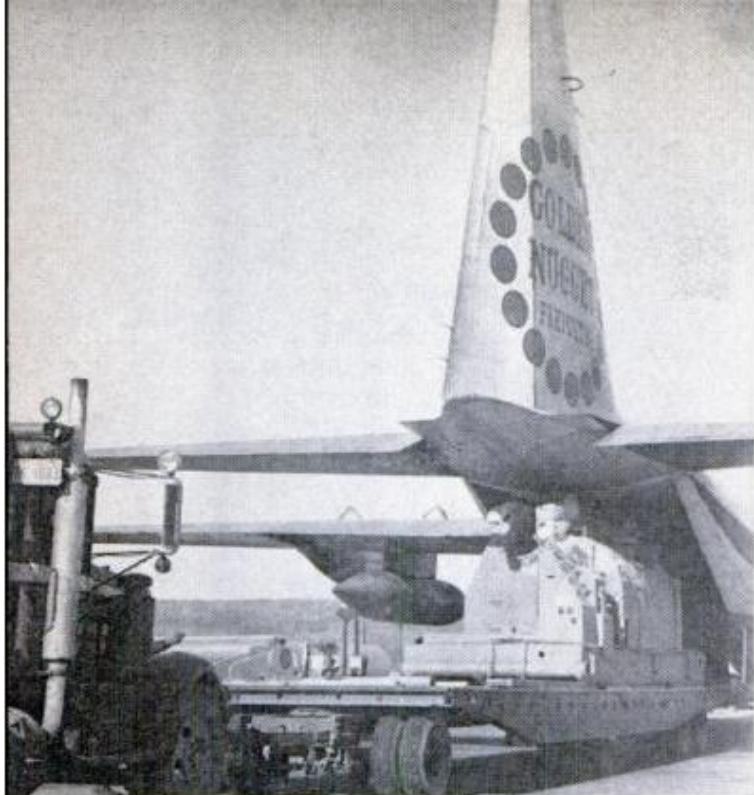
This left an aerial "bridge" as the only year-long alternative. Rising from near sea level at Fairbanks, the bridge climbs northward across the Yukon and over the Brooks Range, where 10,000 feet is listed as a safe instrument altitude.

Once over the Brooks Range, we slant down and terminate at one of the strips scraped in the frozen terrain. At first, most of these were simply level areas on frozen lakes or the tundra. During the past year gravel pads have been laid over the permafrost—the permanently frozen sub-

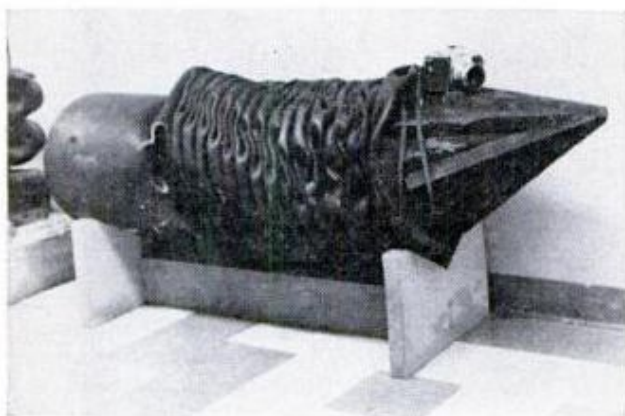
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WORKHORSE OF THE RUN between Fairbanks and the North Slope is the Lockheed Hercules. In a test, a "Herk" hauled over 500,000 pounds of cargo in three-day period



BIG GENERATOR is put on tracks and rolled into the cargo hold of a Hercules at the Fairbanks airport



ACCORDION PLEATS were put in this steel piling point when it was driven into layer of permafrost



surface layer of earth and moisture—and the major strips rest on these pads. Together with the lake strips, these ports constitute a hub of air activity equal in many respects to any major terminal in the “lower 48.” At last report, there were almost 40 low-frequency beacons assigned to the Slope, all within a few minutes’ flying time of one another.

It isn't easy flying. Ice fogs cause whiteouts that erase horizons and make contact flying a tricky combination of instrument and eyeball modes. The strips and their infrequent lights seem suspended in a milky void where there is no horizon, thus no up or down. Vertigo can hit a man just walking in a whiteout. Landing a plane requires considerable faith in instruments that often contradict a pilot's vision and sense of balance.

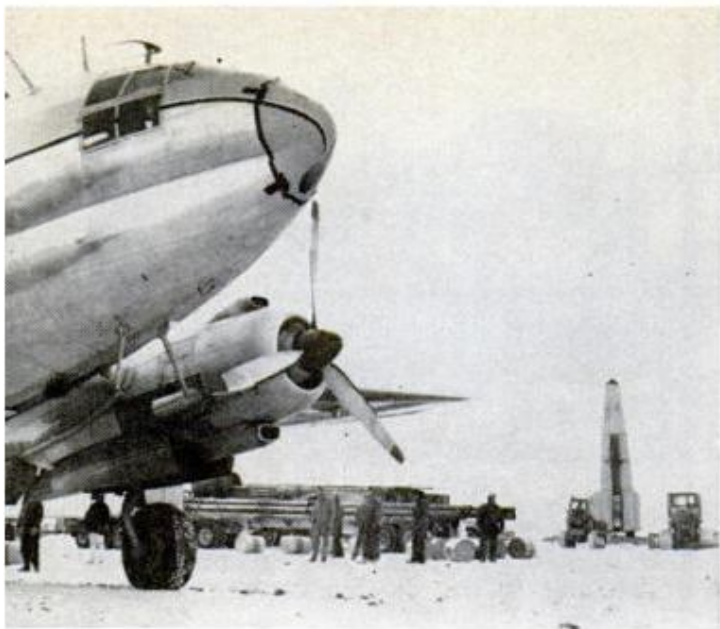
Landing is the critical part of the Slope flights. The only serious accidents last year occurred to incoming aircraft. One huge Lockheed Hercules 130 turboprop landed short of a runway and lost a prop. Another “Herk” actually bounced off a near-vertical cliff during a letdown, then staggered aloft again and was flown back to Fairbanks for repairs.

But such difficulties aloft are almost overshadowed by those facing the mechanics, the real heroes of any Arctic operation.

“In winter,” reported the Atlantic Richfield Co., “the surface is frozen concrete-hard. Steel pilings driven into the permafrost have crumpled like accordions. At temperatures of 65° below zero, ordinary steel implements are likely to shatter like glass on impact, so special care must be taken in the use of heavy equipment.”

If an engine is not kept heated—or running well above idle—oil congeals to the point where a man can hang on the prop of a light plane without turning it. To restart a heavy diesel engine on the Slope, according to companies

RIG RESTS on bed of gravel, protection against thaws. Large bladders hold oil pumped from the well



VENERABLE C-46 doesn't need much room for take-offs and landings, making it ideal for Arctic work

operating there, costs an estimated \$500 in heating and coaxing operations. Large piston engines on planes would be even more expensive; we keep ours turning even during loading and unloading when the thermometer sinks below minus 20° F.

And that is the *mean* temperature in January north of the Brooks; a week of minus 70° temperatures was recorded near Fairbanks last winter. Hydraulic lines cracked like cold licorice, carbon in microphones refused to vibrate. A pilot toggled a cockpit switch in one of our planes and the crystallized metal snapped off in his fingers. Oil riggers and mechanics have learned to respect the "chill factor"—the combined effect of wind and severe cold. At 40° below, a 25-knot wind produces the same effect as a minus 104° temperature in still air!

Despite such handicaps, the aerial bridge had to be stretched northward if oil was to flow from the Slope. Starting with a single drilling rig in early 1968, oil companies planned to have a dozen in place within a year. Word went out to aviation outfits and pilots who specialize in such assignments.

The expansion since can be seen in the statistics: Fairbanks, only one-fifth as large as Anchorage, now boasts the state's busiest airport. FAA services to

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FUEL AND PIPE for North Slope. Crew will unload quickly, then return to Fairbanks for more cargo



COLLAPSED NOSE WHEEL made this plane a casualty on landing at Slope. Landing is risky part of trip

aircraft, including weather briefings and clearances, jumped from 2500 in March, 1968, to 20,000 for the corresponding month a year later. Aviation fuel pumped at Fairbanks totaled 7500 gallons a day in mid-1968; the past few months it has approached 100,000 gallons.

Interior Airways, an old-line bush operator with its own communications setup in north Alaska, started 1968 with barely a dozen pilots; by the summer of 1969 its flight staff had passed 100. Yet planes have had to sit on the Fairbanks ramp for lack of crews.

"You'll get your 100 hours (all that's allowed a pilot in monthly flying time) in less than two weeks," our company representative told me. He was right.

No letup is in sight for this big op-

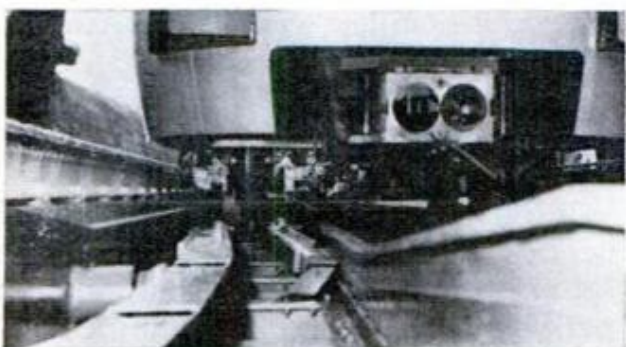
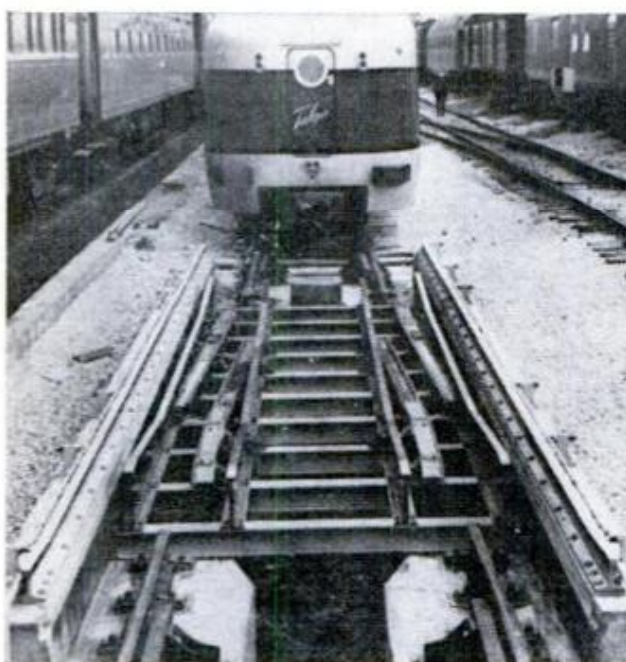
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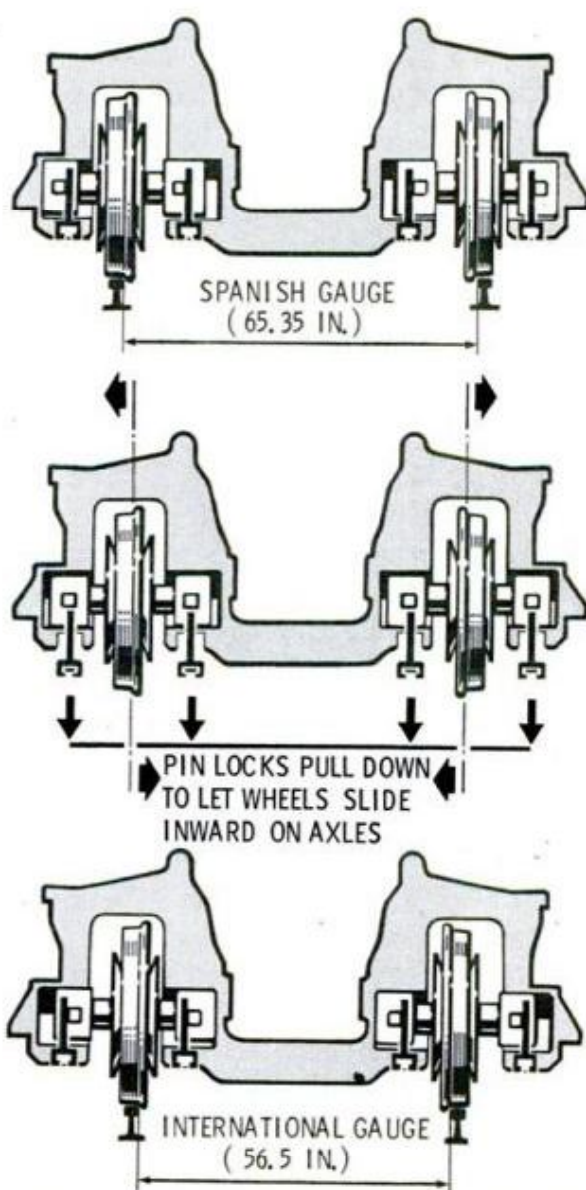
Old-timers have reached the end of the line

"Rust in Peace" is the epitaph scrawled on one of 240 old steam locomotives—once the pride of British Rail—that wait at a dockyard in Wales to be reduced to scrap metal.

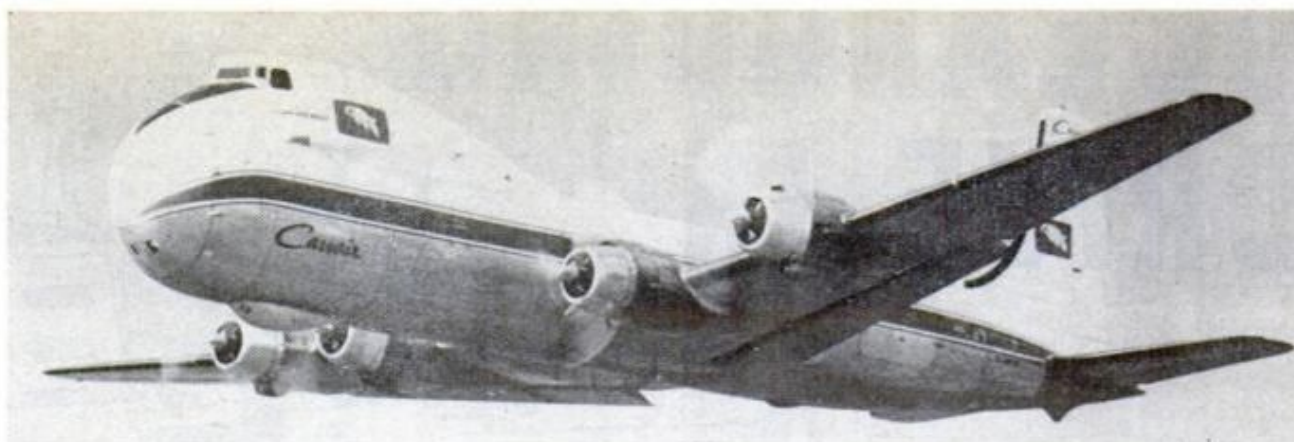


Quick gauge change

Until this summer, rail passengers crossing the French-Spanish border had to leave one train and get in another. The reason: Spanish trains with a rail gauge of 65.35 inches couldn't travel on most other European tracks which are international gauge, or 56.5 inches. Now the Talgo rail firm has a device that shifts wheels from one gauge to another



as the train moves. It takes the weight off the wheels, then pulls down on wheel-locking pins, exerts pressure to move the wheels sideways, and finally locks the pins to fix the wheels at the new gauge.



Flying ferries cross the English Channel

Britons who want to travel on the Continent in their own cars can load themselves and their vehicles in an air ferry and be driving in France, Belgium or Holland a short time later. The planes, operated by British Air Ferries Ltd., are converted DC-4s. After conversion—which includes the addition of a huge nose section and front-loading door (lower right-hand photo)—the planes are called Carvairs. Each can carry five cars and 22 passengers. In 1968, the Air Ferries planes transported 50,000 cars, 25,000 tons of freight and 250,000 passengers to the Continent.



Speedy health checkup

Cavendish Bio-Medical Centre in London offers a two-hour, head-to-toe checkup that ordinarily would take a week of clinic visits. Computers help speed the analysis, so at the end, patients have a profile of their health.

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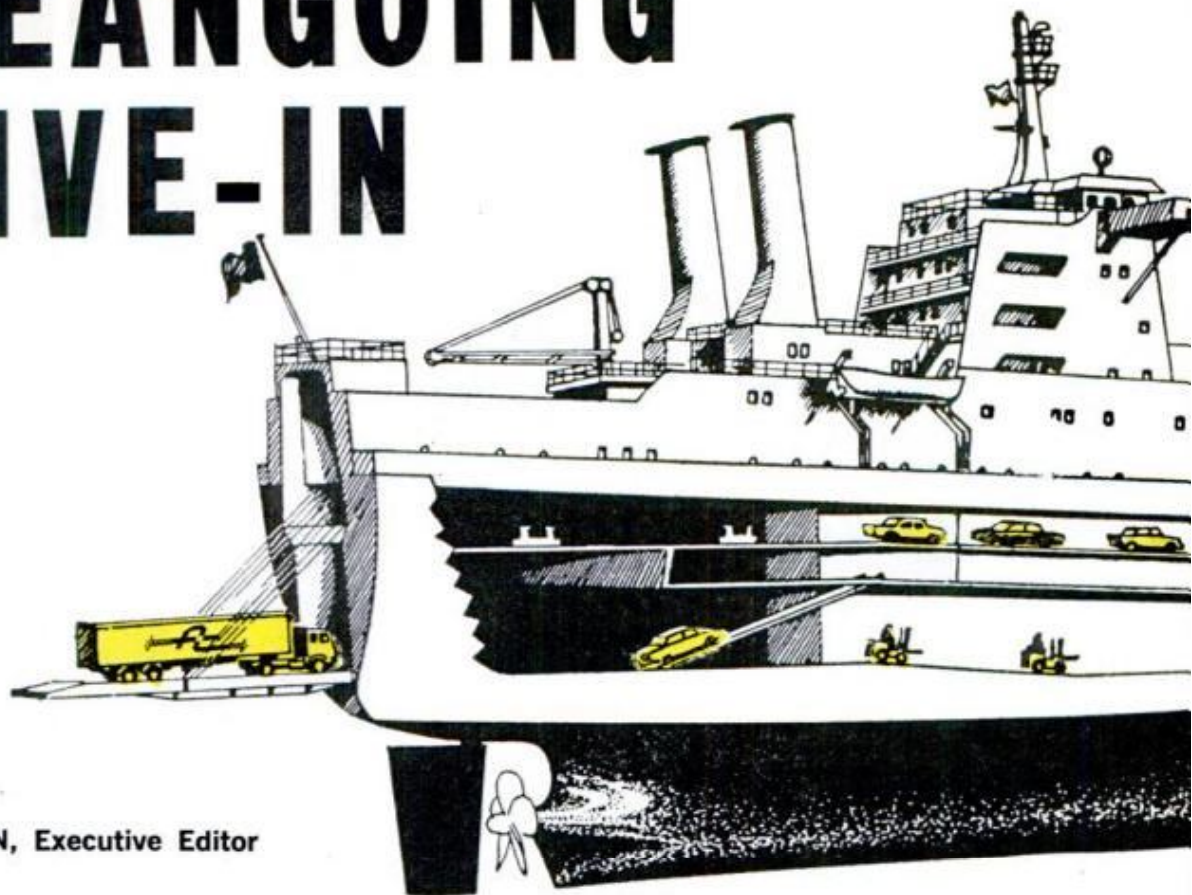


Niagara Falls in Austria

Before being shipped to Seaside Heights, N.J., this huge Swiss-made chute—called the "Niagara Falls"—was set up at Graz, Austria, where local thrill-seekers made use of the 185-foot-long slide.

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OCEANGOING DRIVE-IN



By JIM LISTON, Executive Editor

CONTAINER SHIPS—vessels whose cargo is carried in standardized shipping containers to speed loading and unloading—are fast making general cargo ships obsolete. The result has been that shippers of odd-shaped and oversized cargo—autos, tractors, buses, bulldozers, farm machinery, steam shovels—have found themselves boxed out. Their products don't fit into standard containers.

The answer is a new type of cargo vessel, known as a roll on/roll off (RO/RO) container ship, that handles almost anything that can be pushed, pulled or driven aboard. The cargo is wheeled into the vessel over a stern ramp that is lowered to a floating platform attached to the dock. While containers are being lifted aboard by overhead cranes, RO/RO cargo rolls in over the ramp.

The new concept in cargo transportation was introduced by Atlantic Container Line, Ltd., a consortium of six major steamship lines: Cunard, The French Line, Holland-American, Swed-

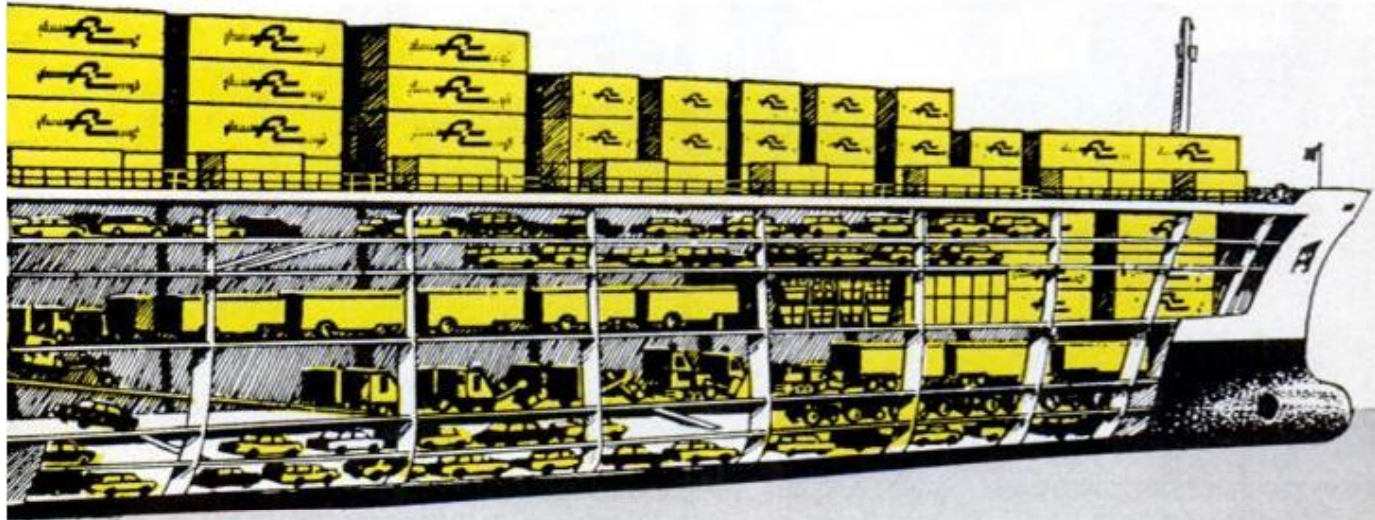
ish American, Swedish Transatlantic and Wallenius Line.

Four of the new ships, *Atlanta Star*, *Atlantic Saga*, *Atlantic Song* and *Atlantic Span* each carry 485 20-foot containers or 227 40-foot containers, or a mixture of both sizes. Containers are carried on the upper deck or in the forward part of the hold. In addition, each ship can carry 1150 automobiles plus a mixed cargo of rolling stock. The six internal decks provide a cargo space of nearly two million cubic feet. The ships are 646 feet long, 86 feet wide, carry a crew of 27 and are powered by 20,700-hp diesels producing an operating speed of 21 knots.

The ACL ships are equipped with an advanced electronic system that provides full directional control from the bridge. Exceptional maneuverability in port is made possible by a 1000-hp bowthruster that precisely steers the bow of the ship.

Six larger and faster "second generation" ACL ships will be in service early next year. The first of these, *At-*

Spanning the North Atlantic like a giant, floating conveyor belt, new fleets of fast cargo ships carry heavy trailer trucks, farm machines and road-building equipment—all rolled on and off as easily as cars on a ferryboat



STRANGE-LOOKING STRADDLE CARRIERS wheel cargo containers up to the ship's side, ready for loading. Standing 27 feet high, the long-legged, motor-driven vehicles can stack containers three high

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TOWERING DOCKSIDE CRANE picks up a 32-ton container as if it were an orange crate and sets it

gently on the ship's deck. One of two in use, it rolls on rails so it can reach any cargo location

Atlantic Crown, will be able to carry 600 20-foot containers. The ship will have two four-bladed screws driven by steam turbines, giving her a speed of

24½ knots. When the six new ships join the four now in operation, ACL will have a fleet of 10 vessels providing three sailings per week from New York. Each ship will call at two or three separate ports in England, France, Germany, Scandinavia and the Benelux countries. In the United States, they will call at Baltimore and Portsmouth in addition to New York.



A MAMMOTH BULLDOZER awaits its turn to board the *Atlantic Star*, one of four new ACL container ships

For handling RO/RO cargo, the new stern-loading ships were designed without bulkheads or partitions so that rolling stock can be driven to and from any of the six lower decks on an internal "highway" system equipped with 20 traffic lights. A closed-circuit TV system provides additional traffic control and surveillance throughout the ship.

All traffic is handled from an electronic traffic-control center. The center uses the TV and traffic light systems to control the rapid and orderly flow to and from the ship and within the vessel.

RO/RO shipping eliminates costly crane loading and crating and makes it possible to ship fully assembled heavy

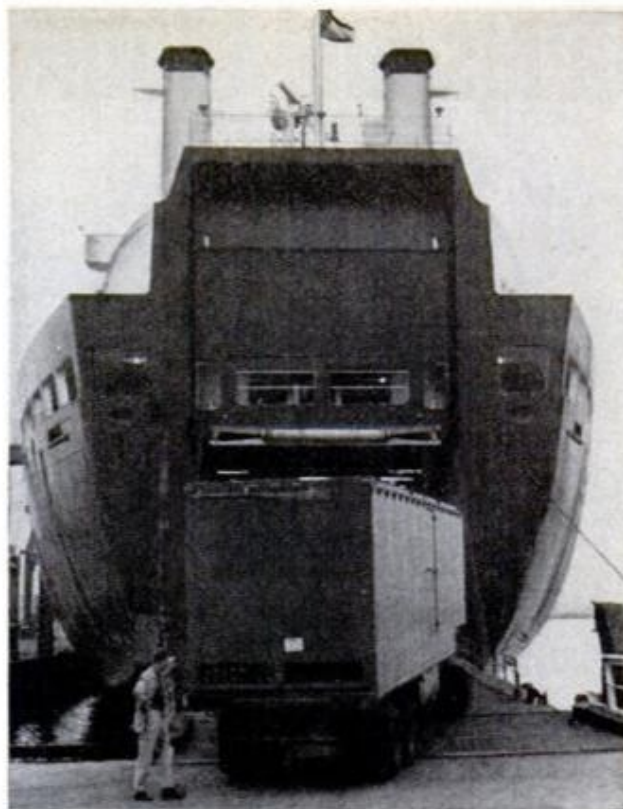
equipment, motors and other uncontainerized cargo below decks. On a conventional ship, a large unit, like a helicopter, is carried on the weather deck where it must be protected from salt spray by an expensive cocoon of plastic strips. The wrap requires four men working three days. Recently a Sikorsky helicopter destined for Holland was flown directly from the plant to the ACL terminal at Port Elizabeth, N.J. At dockside, the rotors were removed, the fuel drained, and the copter rolled below decks. When the *Atlantic Song* arrived in Rotterdam, the copter rolled off the ship, was fitted with rotors, fueled and flown to Amsterdam.

In New York, where the RO/RO ships dock at the Elizabeth-Port Authority Marine Terminal, the old method of pier construction was abandoned in favor of a dockside that resembles an airfield. On the 54-acre site there are 20 acres—ablaze with light at night—where up to 1200 containers can be stored. There are 23 paved acres just for the storage of 3500 automobiles for import and export. An airfield-type control tower commands a view of the storage area and two berths, and controllers are in short-wave radio contact with eight straddle carriers.

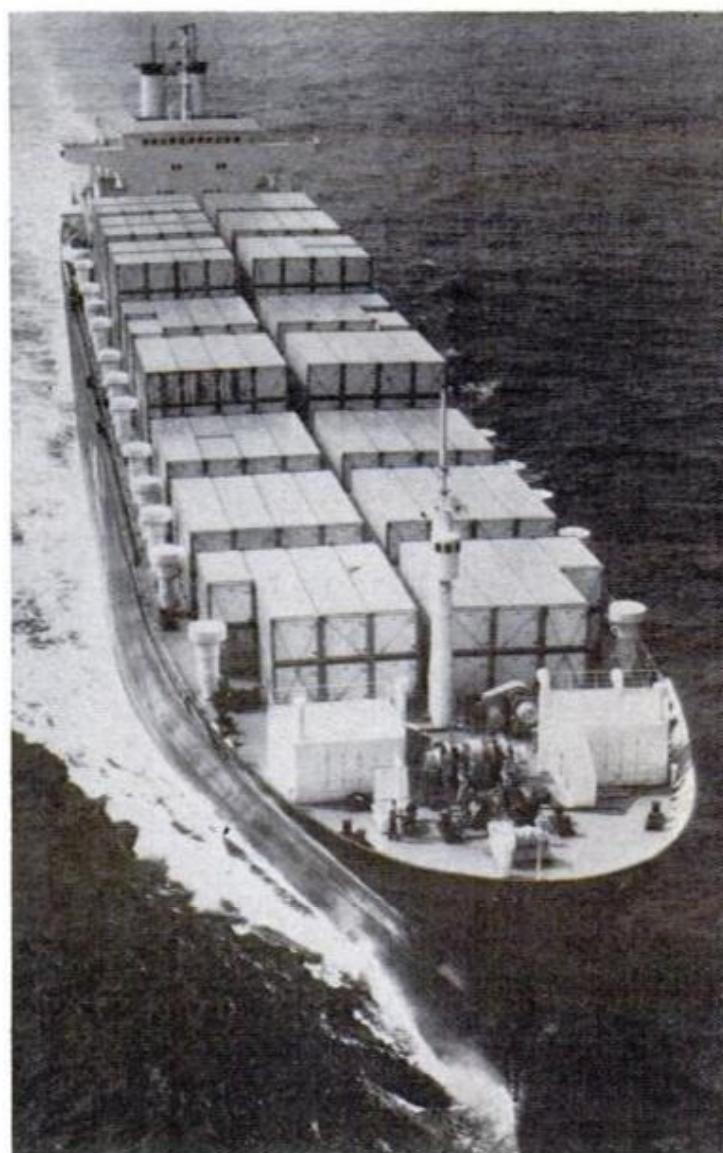
These huge vehicles (27 feet high) move 32-ton containers between storage, customers' trucks and shipside cranes. They can stack 20-foot containers three high. Two wheeled cranes, equipped with spreaders that telescope electrically to handle 20 or 40-foot containers, ride the length of the berths.

Behind the scenes is a computer that keeps tabs on all the complex operations involved in the scheduling, routing and billing of shipments, coordinating the activities of port agents, inland offices and marine terminals. The system, linking all points in the network, provides instantaneous information on the location of cargo in any part of the country and the availability of space in any ACL ship. ★ ★ ★

PILED HIGH WITH CARGO, an ACL container ship heads for European ports at a brisk 21-knot clip
NOVEMBER 1969



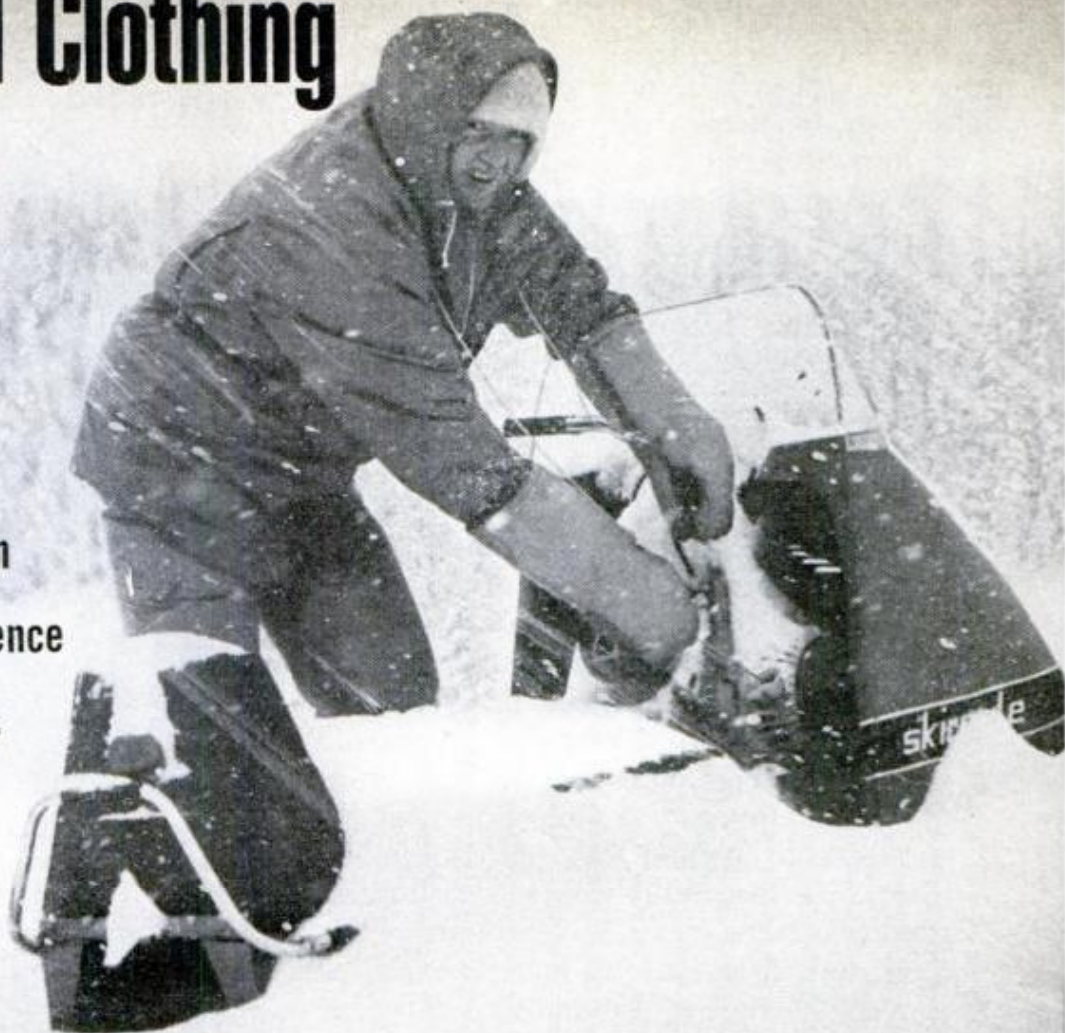
ABOUT TO BE SWALLOWED UP, a loaded trailer truck rolls up a ramp into the huge, gaping cargo hold. Cargo door in the stern lifts like a drawbridge



Clues and Clothing For Snow Survival

A blizzard turns
an experiment into an
unforgettable experience
for PM's field testers

By E. P. HADDON



A WINTER WONDERLAND observed from a swiftly moving snowmobile can turn into a nightmare when viewed from a machine that has split its motor mounts. In half an hour you have traveled farther into the wilderness by snowmobile than you can hike in a day—if you can hike it at all.

What to do? Abandon the machine and start out on your own? Risky—perhaps suicidal. As in boating mishaps, survival lies in staying with your equipment.

In really serious situations where warm clothing is lacking and night fast approaching, the polyurethane padding in some snowmobile upholstery can be ripped out to improvise mittens or clothing. In barren lands, the snowmobile itself can be used

as a windbreak and its fuel to start a fire. But even a minimum of preparedness can save a snowmobiler a great deal of discomfort—not to say his life.

First, *always* leave information with friends as to your travel plans. That hastily conceived ride into the outback



SNOWMOBILES MAKE IT EASY to carry an emergency tool kit, sleeping bag, and enough plastic for a temporary shelter



BRIGHTLY-COLORED COVER staked out on the snow will serve to attract an aircraft search party

country could well be the death of you.

Second, going into a winter wilderness is comparable to swimming in deep water. Be sure to travel in pairs.

Third, a 12 by 12-foot brightly-colored tarp or plastic sheet costs little and weighs less. It can be used to make an improvised tent or serve as a protective wrapping for a sleeping bag. Even a small bit of plastic stretched across a snowmobile will provide an emergency shelter.

Finally, in addition to a routine motor repair kit, a snowmobiler should carry matches, flashlight and a knife—even for short little hops over the hill.

But beyond these basic precautions, what can a snowmobiler do to protect himself from prolonged exposure? *PM* asked me to field-test some of the latest arctic clothing and to make suggestions for winter shelter.

I enlarged *PM*'s basic toolkit to include a carpenter's handsaw, a snow shovel (a smaller shovel for backpackers), and snowshoes. Then I traveled to the Colorado Rockies with Gil Phillips, who has taught thousands of Boy Scouts to live comfortably in frigid weather. On the way, we experimented with emergency snow caves, a quick-



POLY-FOAM FACE SHIELD and mittens serve to keep Gil Phillips warm even in the coldest weather

to-make shelter often used by the Eskimos. For the site, we selected an exposed mountain pass at an elevation of more than 10,000 feet.

After first shoveling off powdery surface snow, we found it easy to saw blocks of firm snow to form a wind-break around the working and sleeping area. After making two vertical cuts 6 to 8 inches deep the full length of the saw and 36 inches apart, the blade was used horizontally at floor level between the two vertical cuts to give the block a smooth base. Next, the blade was run across the backside of the block between the two vertical cuts. To break the block away after cutting, the blade was used to tilt it forward on a hand and arm. Then, with both arms around the block, one man carefully lifted it out of place. This process of quarrying was continued until a trench 8 to 10 feet long was attained.

Working from within the excavation, we placed one block on edge at the rear of the trench. Butting against this, two more blocks were stood on edge at each side of the trench, then leaned inward to form a gable. For an improved gable, the top edges of the blocks were easily shaped with the saw. This simple



SNOW CAVE 8 to 10 feet deep built with 36-inch-long blocks is the simplest survival shelter to make



FIRST STEPS in making an igloo are to scribe a large circle and move powder snow inside to its edge



OUTSIDE IGLOO'S PERIMETER, snow blocks are taken from a "quarry" which will later become entrance



EACH LAYER OF BLOCKS leans increasingly inward. Saw is used to shape and fit blocks together

process soon provided a surprisingly comfortable place in which to sleep, with adequate length for a sleeping bag and height for sitting headroom.

Just as the snow cave was finished, a blizzard struck and the *PM* field test took on the dimensions of a real emergency. Phillips and I decided to build an igloo—the best shelter ever devised for survival in a frigid environment.

Using a ski pole as a scribe, Phillips made a perfect 9 to 10-foot circle for the igloo's perimeter; then scooped off surface snow to provide firm footing for the heavy blocks. About five feet in front of this foundation, snow blocks were sawed from the "quarry." Blocks 36 by 24 by 6 inches were lifted into place. These blocks were angled in to form the start of a spiral wall and dome.

A temporary entrance was cut at the base of the wall for constructional pur-

poses. It was also used for throwing out snow during the finishing of the interior. The man outside lifted successive blocks into place while the man inside used a saw to shape and fit them properly. Each successive layer leaned inward a little more. The key or last block to be fitted topside locked the dome into a firm unit which could support a man's weight. Outside seams were then chocked with snow.

When snow is shallow, a crawl-in doorway may be necessary, but our snow base of more than 13 feet permitted us to dig a 6-foot passage down from the quarry and up into the side of the finished igloo. With cold drafts eliminated, the igloo became even more secure as a haven during the storm.

A standing area for the cook was dug just inside the igloo wall so that he could have his own kitchen space;



AUTHOR ENTERS IGLOO through passage 6 feet below floor level. This corridor keeps wind out; warmth in

GIL PHILLIPS readies the dome for all-important "king" or key block that will make the top complete

small ventilation holes were cut above the stove, and for safety's sake, another small hole was cut higher in the dome. A single Coleman lantern cast a cozy light that reflected off the entire dome, and small pieces of wood were stuck into the wall to provide handy shelving.

While working on the igloo I wore a pair of costly down mittens that quickly became saturated with moisture. When my hands became quite cold, I switched to a pair of poly-foam mittens. Sheathed in a tough nylon outer covering, these mittens kept my hands warm even after snow was dumped in-

side them! Though bulkier than down, the poly-foam pair weighed little and retained body warmth despite wetness.

New poly-foam versions of the Eskimo mukluk keep inactive feet unbelievably warm in cold weather. While bulky like the mittens, the muklucs are lightweight and comfortable, even while using snowshoes. Drawstrings at the boot tops keep snow from entering but can be loosened to let dampness escape. Fine for snowmobiling, or even for snow survival, the poly-foam mukluk makes an ideal after-ski boot as

(Please turn to page 211)

DRIFTING SNOW from the storm has obscured the igloo's design, but the author emerges ready for the hike out

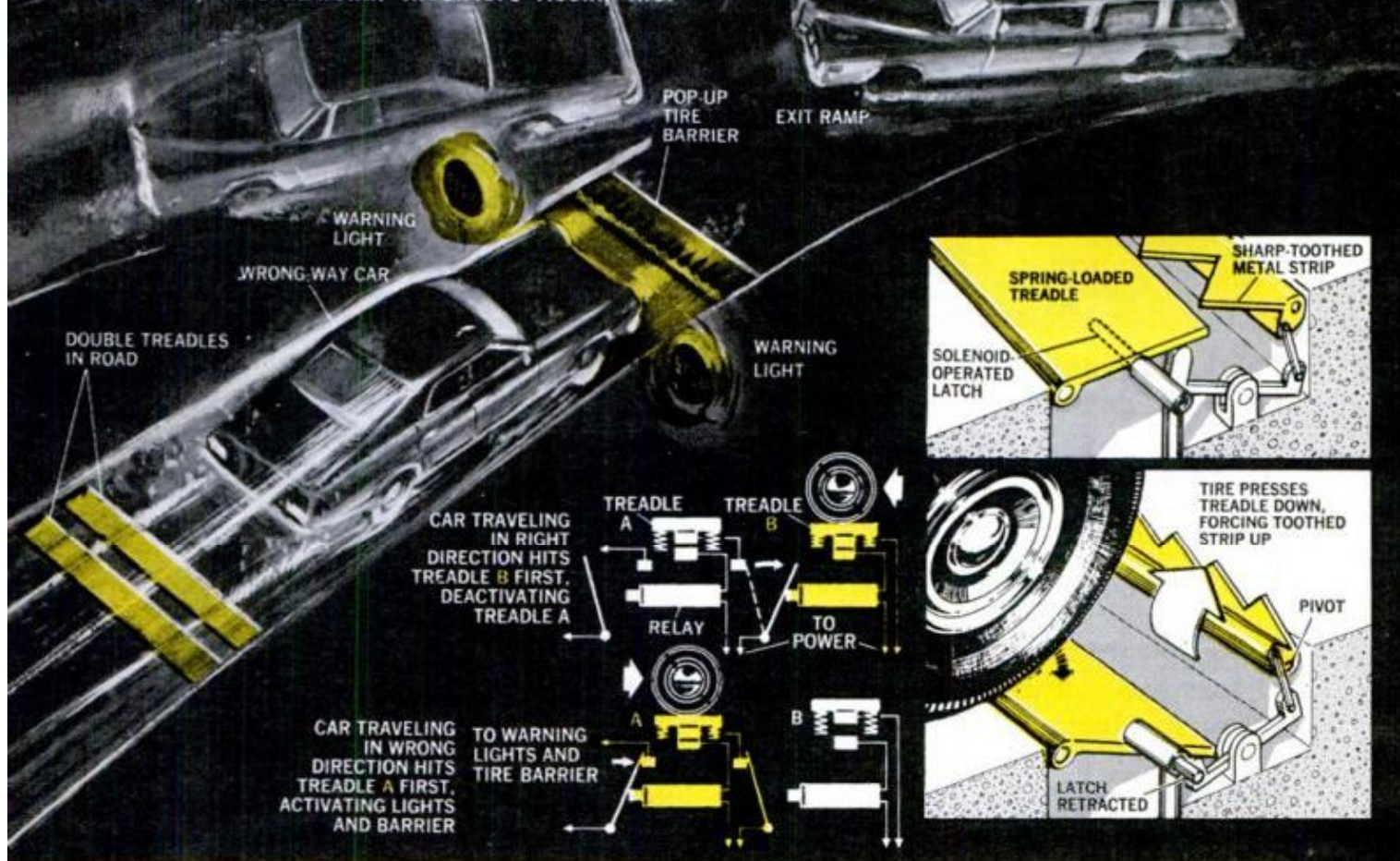
AUTHOR MELTS SNOW for drinking water over small portable stove while standing on ledge inside igloo's entrance



Just patented

PM'S PICK OF THE NEW INVENTIONS

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



1. WRONG-WAY CARS couldn't accidentally enter a high-speed turnpike with this clever barrier built into each exit ramp. A car turning onto the exit in the wrong direction runs over a treadle in the road that activates flashing stop signs. If the car refuses to stop, such as in the case of a drunk driver, it hits another treadle farther on. This causes a

sharp-toothed barrier strip to fly up, tearing the tires to shreds and bringing the car to a halt. Cars exiting in the right direction trip a safety treadle that deactivates the first treadle so the barrier will not operate. The treadle actuating the toothed strip is kept in the locked position by a solenoid latch until a wrong-way car shows up in the exit ramp



2. ADD-YOUR-OWN rumble seat brings back the good old days of jouncing along in the open air while hanging on for dear life. It also lets you carry extra passengers in a pinch. The seat fits into a standard car trunk and is complete with handholds for safety. The regular trunk lid is removed, and a clip-on lid covers the seat in bad weather. When the trunk is needed for luggage, the seat can be quickly taken out

Inventors of the items shown on these pages are as follows: 1. H. St. Laurent, 166 Wendell Rd., Warwick, R.I.; 2. Ross J. Gafvert and Charles L. Chaney, Yellow Springs, Ohio (No. 3,413,031); 3. Robert C. Le Sueur, River Forest, Ill., and Vincent A. Martens, Racine, Wis. (No. 3,413,742);

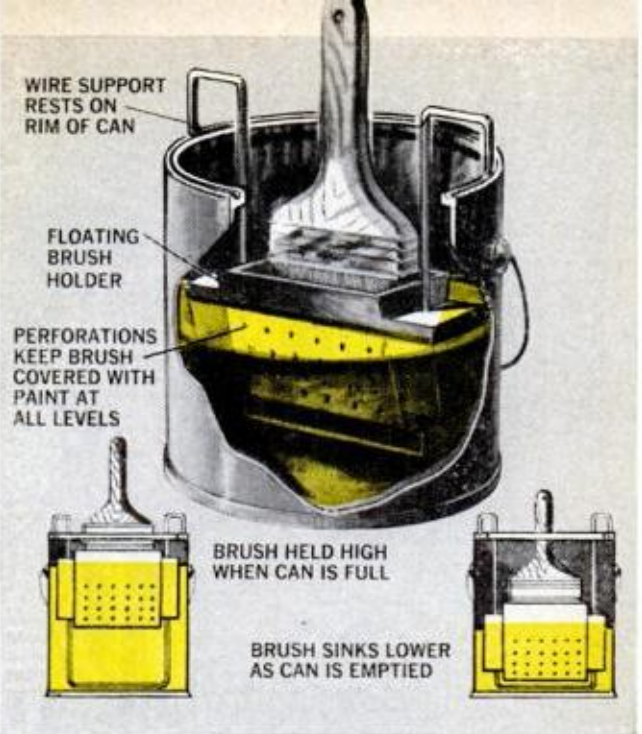
4. Roland Moore, Jr., 13427 Coleen St., Warren, Mich. (No. 3,436,784); 5. William P. Zabel, Jr., 2060 Hanover Dr., Cleveland Heights, Ohio (No. 3,358,858). Roger Shashoua can be reached at the International Inventors Assn., Inc., 680 Fifth Ave., New York, N.Y. 10019.

**IRON TRAILS
NO POWER CORD
WHILE IN USE**

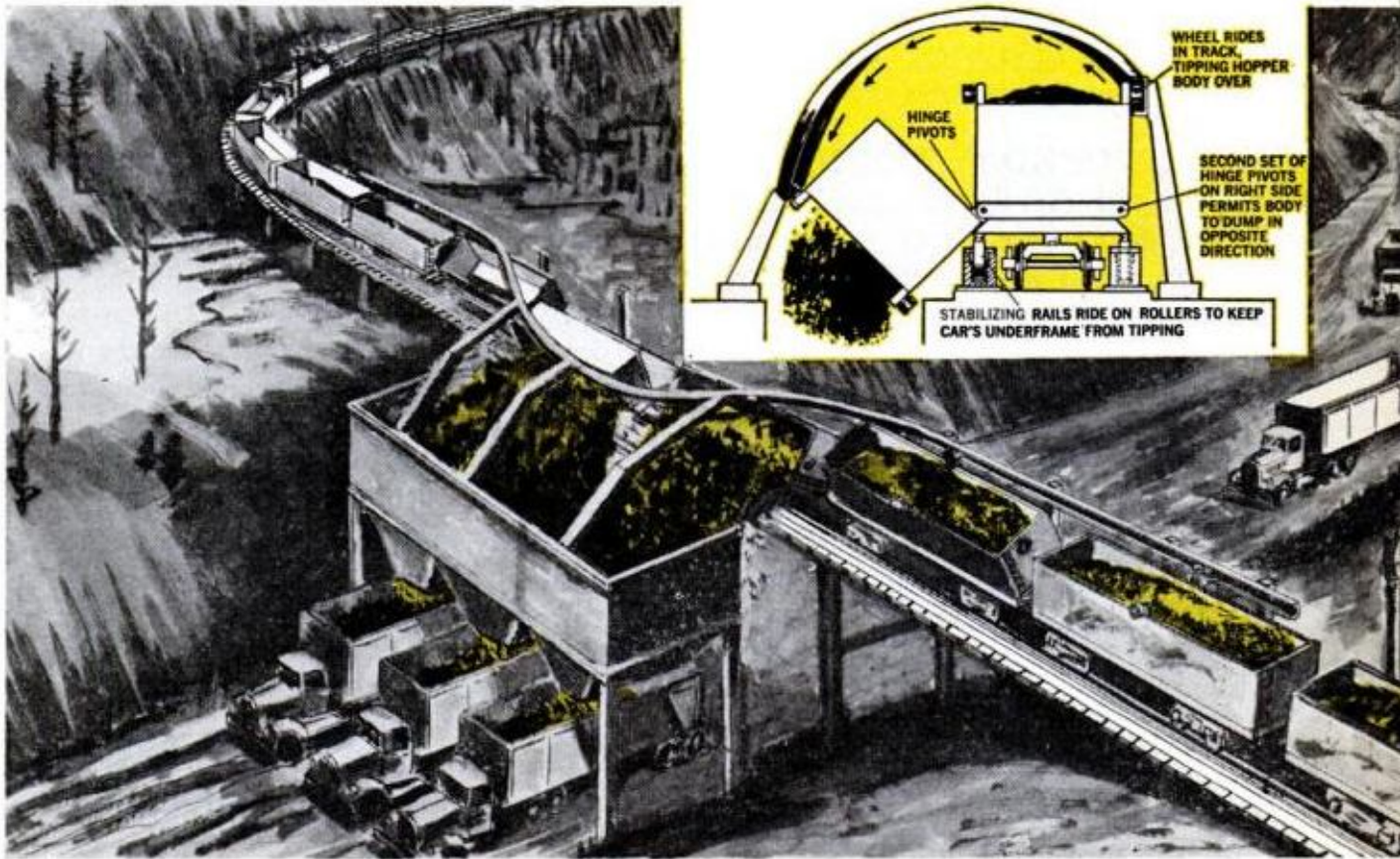


3. THERE'S NO POWER CORD to trail behind the clothes iron above. The iron is kept hot between pressings by standing it upright on an electrically powered base clamped to the ironing board. Matching circular contacts in the base and in the back end of the iron slip together to carry power to the heating element while the iron is at rest. The base is equipped with a circular lip that automatically guides the iron onto the contacts from any direction

**WIRE SUPPORT
RESTS ON
RIM OF CAN**



4. PARK YOUR PAINTBRUSH in this floating holder and it will always stay at the same level in the paint no matter how full the can is. The perforated plastic cup slides down a wire frame as the paint is used up, keeping the brush immersed. It lets you dip your brush to the same depth each time and prevents the bristles from drying out when you put the brush aside temporarily between jobs. The frame hooks into the groove in the can's rim



5. FAST, ON-THE-RUN DUMPING of railroad hopper cars is possible with this ingenious flip-over system. As each car passes over the dump pit, a wheel mounted on the side engages an overhead track. The track curves out over the pit, forcing the hinged hopper body to swing upside down and empty its

contents. The track then curves back to bring the hopper upright again while the following car is dumping. The hopper has hinge pivots on each side so it can tilt in either direction. The self-dumping cars can be used for transporting coal, crushed rock, sand, dry chemicals and similar materials



THINGS GO BETTER for Coca-Cola because only two men know secret formula and mix batches of essence

By **VICTOR BLOCK**
Cartoons by Bob Bugg

EACH WORKDAY MORNING, 80-year-old Avedis Zildjian and one or both of his sons drive up to a tiny red-brick plant at the end of a cinder road in Quincy, Mass. Once inside the building, they glance around to make sure no one is watching, then walk up to a heavy steel door marked "Positively No Admittance."

Unlocked, the door swings open to reveal a 30-by-30-foot room filled with piles of tin and copper ingots, and sheets of silver. Using two small furnaces, the Zildjians combine these ingredients to produce, on an average day, 400 of what musicians generally consider to be the most melodious cymbals in the world.

The secrecy surrounding the manufacture of such a relatively innocuous product is to protect the method used. It traces back to 1623, the year in which an Armenian alchemist discovered a means of treating certain alloys that

produced cymbals of outstanding quality. Since then, the secret has been handed down through generations to the oldest living male member of the family. In 1929 it came to Avedis Zildjian, who was running a candy store in Quincy, when he received a message from an aged uncle in Rumania: "The secret of the cymbals is yours."

The hush-hush nature of the Zildjian operation is by no means unique. A number of successful businesses, including some of the world's largest commercial empires, are based on secret formulas or processes. The men who run these enterprises believe that, when it comes to protecting a trade secret, a padlock can be better than a patent. That is, it's sometimes better to *keep* a secret than to patent it.

Did you know, for example, that the fishhook you tie onto a line was made under security regulations rivaling those of many defense plants? The rea-

When a Secret

Giant Coca-Cola and the tiny cymbal maker have the same outlook: Competitors can study and copy patents, but secrets they have to steal.

Is Better Than a Patent

son is that, like the Zildjians' cymbals, fishhooks are unprotected by patents. Instead, they're safeguarded by the difficult procedures necessary to correctly carry out such seemingly simple tasks as applying the barb, forming the point and shaping the eye of the hook.

Companies such as Eagle Claw Fishing Tackle and the Pflueger Corp. design and manufacture their own production machinery. The plans for the machines are kept locked, and no unauthorized personnel are permitted to get a close look at the equipment itself.

The assembly line at Avery Products Corp. in Los Angeles also is strictly off limits to prying eyes. The company manufactures a variety of self-adhesive labels and products ranging from price tags and address stickers to clock dials and adhesives used on "pasties" worn

by burlesque strippers. Afraid to patent the adhesive formulas upon which this \$52-million-a-year business has been built—lest competitors find some way of duplicating them without infringing on a patent—R. Stanton Avery instead permits the carefully guarded company secrets to be revealed to only a few key employees.

With an eye toward security, Avery Products Corp. even refused to reveal for this article information *not* about the formulas themselves but about the methods used to safeguard them. So, too, did Crane and Co. of Dalton, Mass., which makes much of the paper used in bank note production. The company uses a secret process for getting the



STRICTLY HUSH-HUSH is a cymbal-making process used in a small New England plant. The method, dating back to 1623, produces cymbals of outstanding quality

colored threads embedded into the paper.

Probably the best-known efforts to safeguard company secrets—as well as to spy on competitors—occur in Detroit. With \$1-billion or so invested each year in tooling and design changes on new car models, the automakers understandably run tight shops. Guards armed with binoculars, two-way radios and whistles patrol the rooftops of auto plants to watch for intruders. Some guards carry saws, which they use to threaten photographers discovered in trees overlooking test tracks.

To confuse spies, companies prepare elaborate decoy models that are driven endlessly around tracks. Actual proto-

. . . knowing what the other guy is doing is part of the game.

types are often painted ink-black to limit depth perception in photography.

Inside, wastebaskets in the styling section are equipped with electric paper shredders, and their contents are dumped in chutes that lead directly to furnaces. At some General Motors buildings the locks can be switched within an hour if a key is lost or stolen, and the company's technical center has a listening device that automatically draws all the curtains at the sound of an approaching helicopter or airplane.

If Detroit is sincere in its efforts to safeguard styling secrets, it also recognizes that, in a sense, knowing what the other guy is doing is part of the game. As retired Ford styling chief George Walker put it, "You need this kind of information so you know what *not* to do." Only in this way, he explains, may companies avoid the embarrassment of too close duplication.

Outside Detroit, some firms not only recognize efforts to steal their trade secrets as a way of life, but turn secrecy into a valuable advertising asset. Several leading manufacturers of liqueurs and other beverages, for example, don't hide the fact that their products are

derived from secret formulas. The secret for Drambuie liqueur is kept in the head of Mrs. Gena MacKinnon, the company owner-manager, and under lock and key in a bank in Edinburgh, Scotland. Mrs. MacKinnon learned the herbal formula from her late husband on their honeymoon, but her daughter and son—the latter is president of the firm—won't learn it until after their mother's death.

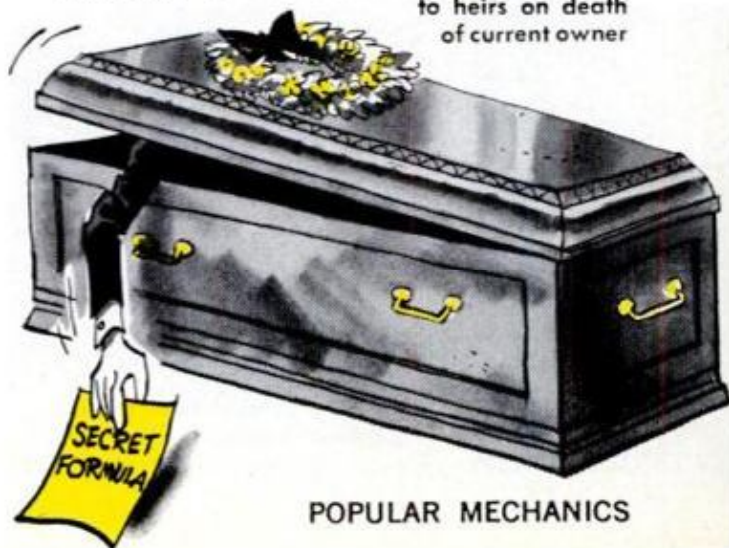
Advertisements for another liqueur, Chartreuse, and for Tribuno vermouth also make much of the fact that their recipes are known to only one person. In the case of Chartreuse, it's a monk in the Carthusian order near Grenoble, France. The monks have guarded the formula for more than 400 years. Tribuno ads picture John L. Tribuno himself and proclaim: "Only one man knows Tribuno's secret—and he keeps it under his hat."

The formula for Angostura Aromatic Bitters, first made 45 years ago as an herbal remedy for stomach pains, is known to only three persons, including the great-grandson of the inventor. They take turns whipping up batches of the concoction to check on one another and ensure the accuracy of the preparation. They also take pains never to travel together, to minimize the risk of simultaneous death. As an added precaution the company keeps a copy of the formula in a bank vault.

The Coca-Cola Co. has built its enor-

(Please turn to page 208)

SOME FORMULAS are known to but one person. Recipe for famous scotch liqueur will pass to heirs on death of current owner



POPULAR MECHANICS

Материал, защищенный авторским правом



Meteorites sell like hot cakes

Chunks of "rock"—not art or antiques—recently were sold to the highest bidders at Sotheby's, London's famous firm of auctioneers. Major item to go under the gavel was a 30-pound lump (upper right) of the Canyon Diablo meteorite that fell in Arizona 20,000 years ago, digging a hole half a mile wide and 600 feet deep. The specimen, which went for \$1200, is composed of nickel, cobalt, phosphorous, sulphur, carbon, copper and traces of diamond. A piece of iron meteorite (right) sold for \$96.



Real drag in wind tunnel

Coach Don Henderson keeps an eye on instrument that registers amount of drag as he talks to skier inside the wind tunnel at the Lockheed-California plant at Burbank. Facing air speeds of up to 70 mph, skiers tried "tucks" and other racing positions in an effort to minimize air drag. Coach Henderson termed the tests a success, saying they would help the team to win top ski prizes next year.

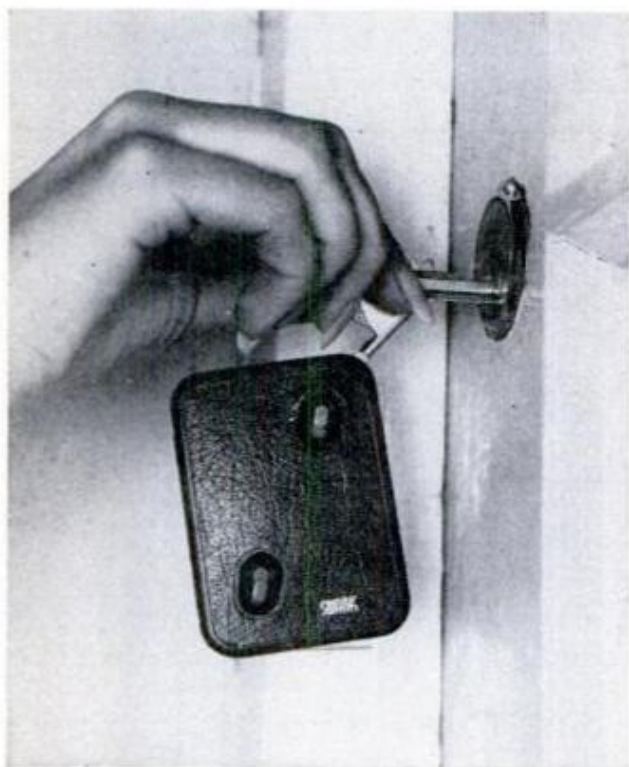
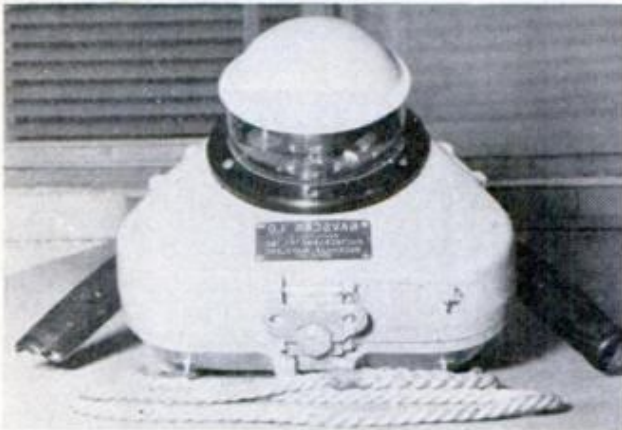
NOVEMBER 1969



Contoured relaxation

A contoured bathtub is what you need if you hanker for the relaxation that soaking in a warm tub provides. That's the view of Stanford University engineering student Stephen Hobson, who happens to have created a contoured fiberglass tub in a course in product design. Located over the pretty bather's head is slot from which water gushes to create waterfall effect when control button is pushed.

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Instant keys

Ever fumble around for your house key while juggling an armload of heavy packages? This pushbutton holder ends the fuss of trying to pick a particular key out of a mass of different types. You just press a release and out pops the right key, ready for use. There are two buttons in each side, controlling four spring-loaded keys. Each button is a different color so you can tell at a glance the right one for the key you want. Swank, Inc., of Attleboro, Mass., came up with the idea.

Breath test for car exhaust

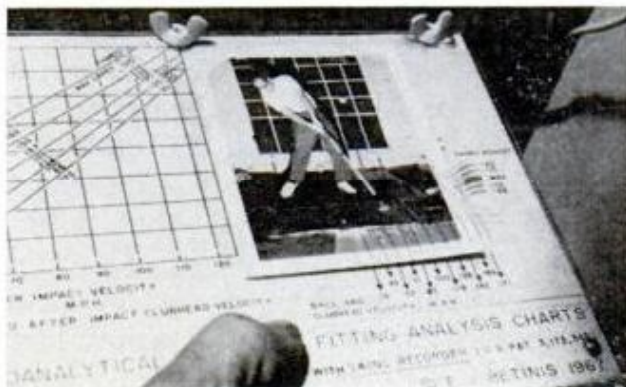
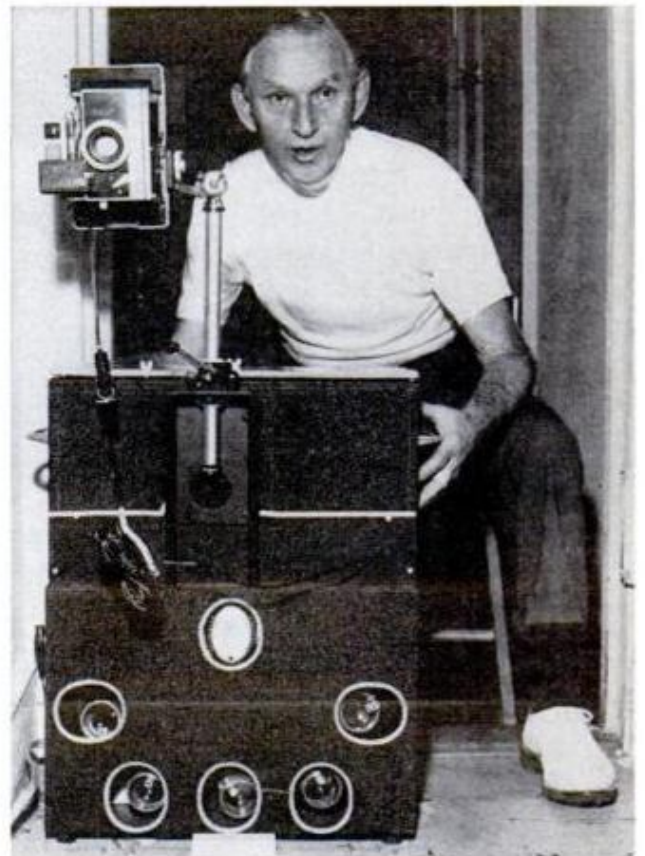
British motorists may soon have to have their cars' exhaust checked for excessive carbon monoxide just as suspected drunk drivers must submit to a breath test for alcohol. The device gulps in exhaust samples, analyses the CO content and indicates whether the amount exceeds safe limits. The firm of J & S Sieger in Poole developed the "breathalyser" for use at government car inspection stations.



Marine photos by the yard

The photo stretching across the pages above is a six-foot-long underwater panoramic view made at one time by a new camera developed for use by U. S. Naval Oceanographic divers. The picture represents a 350° sweep—almost a complete circle—of surrounding marine terrain. By knowing the center point from which the panorama was made, oceanographers can plot the size, distance and direction of each feature shown.

The technique is expected to speed mapping of unknown areas of the ocean floor. The Navscan camera makes 75 circular exposures on a 100-foot strip of 35-mm Tri-X film.



Electronic golf analyzer

This electronic golf-club selector photographs a golfer's swing and records the speed and impact as the club trips photocells. By studying a photo chart (left) golf expert Frank Malera can calculate the ideal weight, length and stiffness of club for each golfer. Mathematician E. J. Betinis invented the device, now in Malera's New York sports shop.

The Right Way To Winterize Your Camper

Torturous winter months can ruin your rig in no time. Here's what you can do to protect your investment.

By V. LEE OERTLE

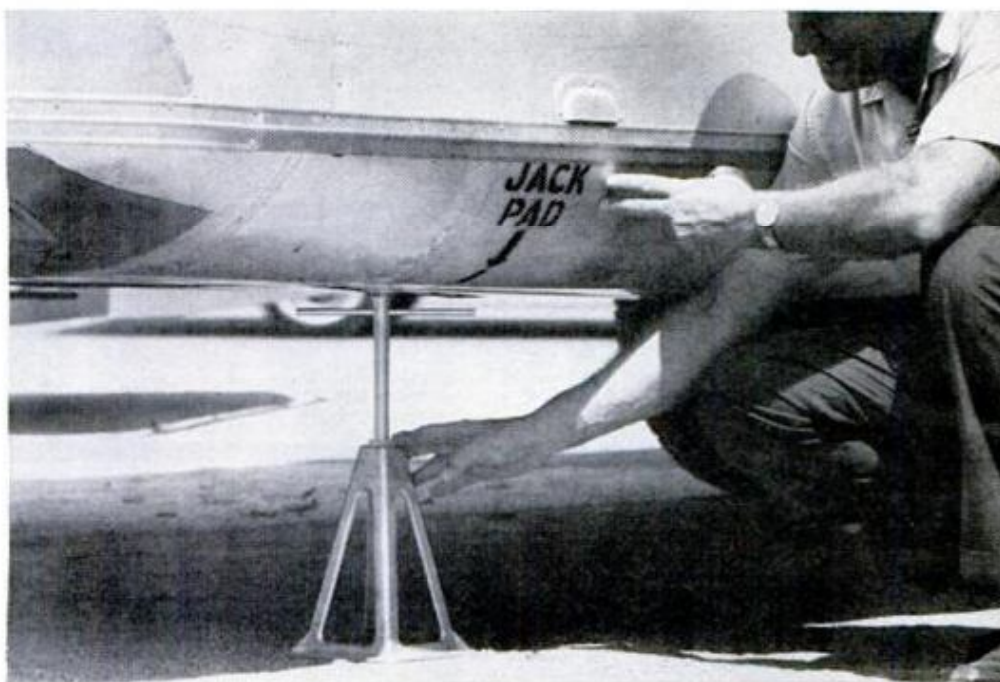
IN ONE WINTER your recreation vehicle can be ruined if you're not careful. That's right—improper winter storage can give your RV a down-at-the-heels look before spring.

The first important decision you must make is where to store your rig. This can make all the difference.

Above all, don't park it under a tree. Falling limbs can puncture the roof. Bird droppings can stain the exterior. Tree sap can be the devil to remove.

Avoid locations with heavy pedestrian or vehicle traffic, such as gateways, pathways, busy parking lots. The less the traffic, the less the damage to your RV. Also, watch out for spots where gates can swing open and strike the coach. In a storm, a wildly-swinging gate can severely damage the aluminum skin. It's easily punctured but hard to repair.

The best parking-storage locations are in wind-protected spots, or under a carport or roof of some kind. Many owners prefer to cover their coaches with a tarpaulin. Aluminum does not



ON MANY TRAVEL TRAILERS utilizing a full underbelly, the only place stabilizer jacks should be set is under the words "Jack Pad," stenciled on the coach. These words indicate the location of the frame channels

rust but eventually it begins to pit and corrode. Once the finish is dulled by weather, it takes a cleaning with acid to bring back the gloss.

Next, stabilize your RV properly. If the coach can be parked on a paved surface, that's best. Otherwise, set wood blocks underneath the stabilizer jacks. All four corners of the coach should be stabilized so that wind-action won't rock it about. *Caution!* Some travel trailers have locations plainly labeled jack pads. Use stabilizer jacks *only* at those points. On any trail-

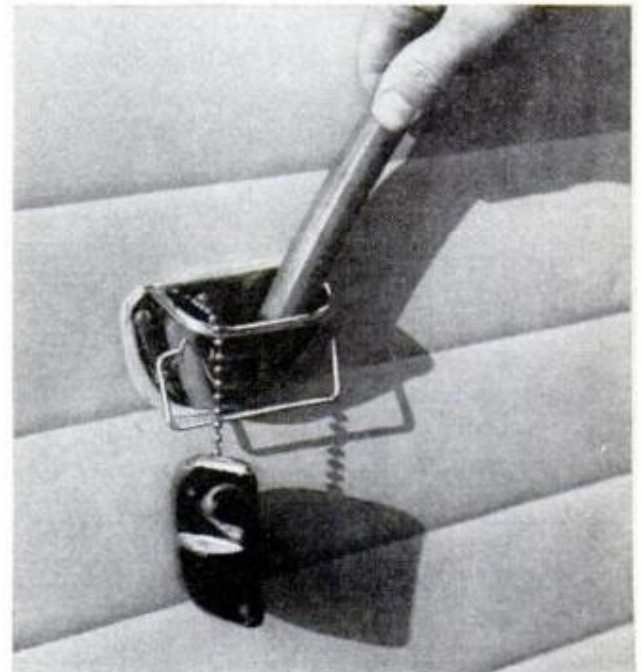
er, place stabilizer jacks under main frame members. *Never* place jacks under outboard struts or wooden channels.

Now, pay attention to your tires. Much misinformation surrounds the proper storage of tires. Latest research indicates that wherever industrial air pollution (smog) is a problem, tires should be elevated off the ground and deflated to 10 p.s.i. *Reason:* Deflating tires allows outer pores to close up. Inflating tires stretches the rubber and makes it more susceptible to damage. But remember, don't deflate tires that are carrying a heavy load. The best protection is to block up the axles with

With the RV anchored, you can tackle the interior. Coach interiors collect stale odors during idle storage. Causes can be traced to such things as leftover fish bait, a forgotten cheese sandwich in a hunting jacket, or a spilled puddle of gasoline under a leaking portable generator. These items are quite common, and just a tiny sampling of actual occurrences that bring a loud "Whew!" come spring. Look throughout the coach for leftover foods and beverages, opening all drawers, cabinets, storage bins, closets, and appliances. Something innocent as a cabbage leaf is potent when trapped in the



VACUUM ALL INTERIOR SCREENS before storage. Dust on screens collects moisture which encourages rust. Also vacuum the cabinets, closets and drawers



DRAIN, FLUSH AND CLEANSE WATER TANK so that all stale water tastes are removed. Keep the tank lid tightly closed during storage to keep out dust

wood or concrete piers, deflate tires to 10 p.s.i., and cover tires with plywood or metal panels as protection against sunlight. This last step is extremely important in desert and Gulf Coast states, less critical in northern regions. Strong sunlight deteriorates tires rapidly.

Surest protection for tires during the winter is indoor storage. If you don't plan to use your vehicle during the winter months, jack up the chassis and remove the tires, deflate them and store them in a shaded, well-ventilated area.

airtight interior. With meticulous care remove soiled handkerchiefs, hunting boots and all dirty clothing. This will eliminate the source of many stale or sour odors.

Get those stains, too. Don't leave that streak of tomato juice on the dinette seat. Remove that tar stain from the floor tiles by the front door. Food stains on the table, cushions or bedding will be three times harder to remove after winter storage.

Remember not to leave metal objects in the sink or lying on the drainboard;

even stainless steel can leave trace stains due to condensation of moisture inside a tightly closed coach. Vacuum all screens and the interior of all cabinets, closets and bins. Clean and wax the floor and all appliances. When you're sure that the interior is clean and fresh-smelling, then—and only then—start buttoning it up.

Now, shut off the LP-gas supply *at the tank*. On the trailer that will be on the front frame. Twist the shutoff handle *clockwise* until it has seated firmly.

Enter the coach and be sure all appliance controls are set to the off position. Remove range burners and vacuum dust from the orifices. Replace burners and close the range cover to block dust. If the range lacks a cover, wrap burners in aluminum foil to prevent rusting.

Next, work on the plumbing. Because it can freeze, the plumbing system is particularly vulnerable. To prevent ice damage or bad taste next spring, follow these instructions:

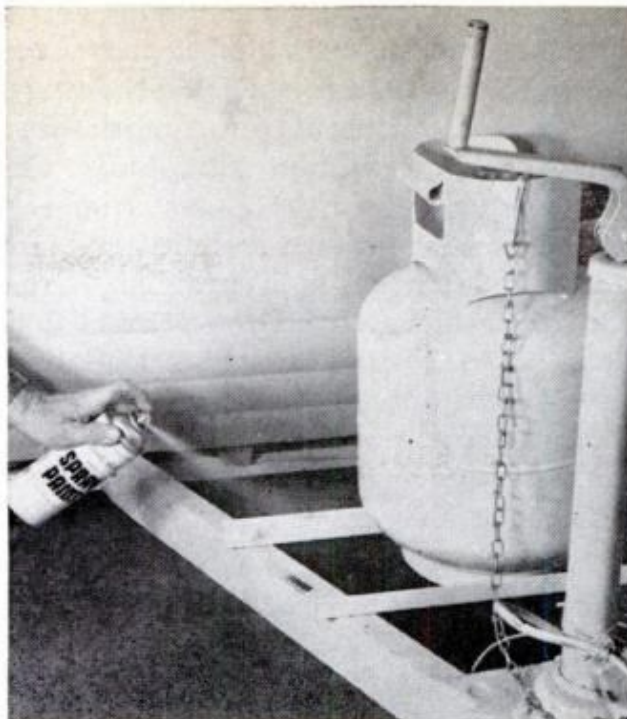
1. Drain the water heater.

2. Drain the water tank and flush it for at least 20 minutes with clean water. Close the drain valve. Add half a box of baking soda and five gallons of water and let it stand overnight. Then drain the tank and flush it one last time. This action neutralizes unpleasant odors or bad taste.

3. Drain the sanitary holding tank, preferably at a service station outlet. Flush it thoroughly. Tighten the valve, and add a small amount of deodorant chemical to tank. Where necessary, use air pressure to rid the sink trap, shower trap and internal plumbing lines of water. If overlooked, as frequently happens, these areas may freeze and break. Flush the toilet several times to rid lines of water.

4. Use a cup and sponge to drain the last bit out of the toilet commode. One coach manufacturer reports this item tops the list of frost-damaged hardware.

5. Place a cupful of antifreeze in



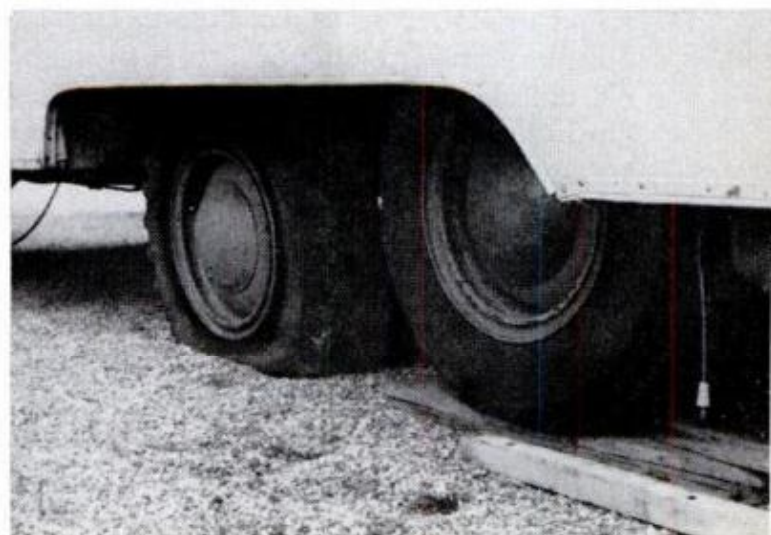
SIMPLE TOUCH-UP with spray paint over rust spots on frame will prevent worse damage during storage

each of the drain traps: shower, sink, tub, toilet and commode.

Just to make *sure* that all the water is out of the lines, raise the lift jack on the front of the trailer all the way, then lower it all the way down. This tilts the frame enough to drain stubborn pockets of water. On truck mounts and motor homes, you can accomplish the same thing by parking on a severe angle for a few minutes with all drains open.

Place aluminum foil between glass and screens to keep the sun from fading.

SEVERE FLAT-SPOTTING and rusted hub caps may result when you leave tires on trailer during winter



WINTERIZING SPECIAL GEAR

Some recreational vehicles are equipped with air compressor-type water-pressure systems. Turn the air compressor switch to OFF. Disconnect inlet and outlet hoses from pump and rotate the pump manually to expel water trapped inside.

Remove the 12-volt storage battery from the coach. Get it recharged to peak strength, then replace it. Do not reconnect battery cables to terminals. Spray a little anticorrosion coating onto the terminals and cable-heads. In extremely cold climates store the storage battery where it cannot freeze.

Don't forget the water purifier! They're popular these days. Remove the cover plate and make sure all water is out of it. (In the spring, replace the inexpensive filter cartridge with a new unit.)

Load-equalizer hitches should be removed and stored inside the storage bin or in your garage. The spring bars should get a light coat of spray paint. Bearing-ends of hitch-spring bars should be lightly coated with bearing-grease and wrapped in foil.

Clamp-on side-view mirrors on the towing vehicle can be removed and stored for the winter.

If you have a portable electric power generator, it should be winterized. Drain the fuel tank. Drain and change the oil. Clean and replace the air-filter. If the unit is bolted inside the coach, just keep it covered. Otherwise, remove the generator and store it inside your garage. Set it on wood blocks, not on the bare floor. Wrap the generator with a plastic bag but do it loosely to provide for ventilation.

ing interior fabrics on cushions, gaucho beds and mattress covers. It's best to remove all bedding and blankets from the coach and store them in your home. But if you must leave bedding in the coach, cover it with plastic *loosely* laid over the fabric. This precaution will prevent wet spots and mildew stains in the event of a leak or draft which may let rain enter the coach.

One common mistake beginners make is to cork up the coach like a wine bottle. Don't do it! Proper *ventilation* is necessary even in the coldest

climates. Condensation will become a problem in a closed, cold coach. Roof vents should be tightly closed, but one window or sidevent can be left open about one-half inch on the wind-protected side of the coach. Take the extra precaution of taping a plastic cover underneath the vent window inside the coach. In a severe climate where prolonged subfreezing temperatures are the rule it may be necessary to close vents and windows securely. In this case, the coach should be opened

(Please turn to page 228)

DEFLATE THE TIRES and store them indoors. Locate the jack under frame rail, not an outboard strut

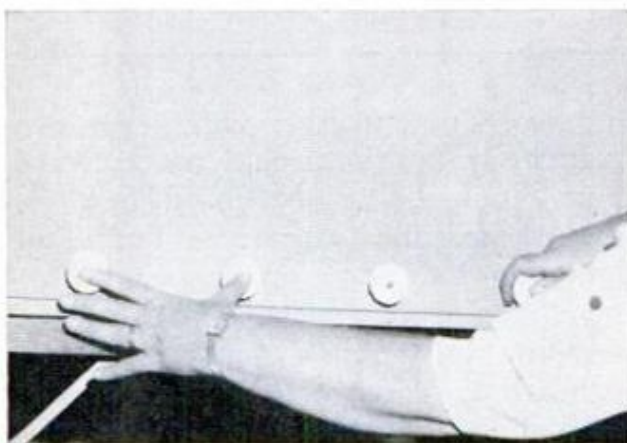
REMOVE GENERATOR and service gas engine to avoid leaks which may cause unpleasant odors and stains





Modern astronomy display in building of ancient design

Shaped like an ancient Babylonian ziggurat, the large chamber of the new Buehler Planetarium at Broward Junior College, Fort Lauderdale, Fla., provides 100 seats for college classes and features—among its many pieces of equipment—a Spitz A-3-P that projects 2000 stars on the dome. Another smaller chamber (not shown) is for instructing schoolchildren.



Childproof medicine cabinet

Three of the widely spaced knobs on this medicine-cabinet door must be held down simultaneously to open it. Thus, children cannot open the door and get at the contents. It's an Australian invention.



Plastic grave marker

Designed for his wife's grave by a British plastics expert, this molded plastic marker has become the prototype of a new line of plastic "gravestones" being made by Imperial Chemical Industries in London.



Fearless firefighter

The Fire Cat, a small, remote-controlled firefighter, can be carried to a fire on the front of a tender (top photo), then lowered to the ground and directed by radio to the blaze, where it sprays a chemical foam (bottom photo). Controlled from the cab of the tender, the Fire Cat can approach flames that would be dangerous for human firemen. It's built by Flextrac-Nodwell, Calgary, Alberta.

Jetting Down Montana's Mighty Missouri



By DAN FALES

Photos by Ed Christopherson

Shallows, rapids and steamboats were all part of PM's test of Glastron's new 17-foot Berkeley jet

IT'S THE ONLY PLACE I know of in this country where the push of civilization not only has been stopped, but has been literally thrown back.

You can drift the upper section of the Missouri River and find the country wilder now than it was 100 years ago. In those days steamboats struggled upstream every summer bringing supplies and people to outlying trading posts. A grounded steamboat was fair game for raiding Sioux, and boat captains were threatened, not only by Indians, but by their own crews and passengers. And just 66 years earlier, Lewis and Clark, traveling the same river, mapped and opened this expansive country.

But now we are taking a modern, jet-powered pleasure boat down 200 miles of river. The reasons we picked the Missouri for a test run are: lots of shallow water for proving the jet, a route taking us through beautiful and historic country, and above all, a river any sensible boatman can run when the water's right.

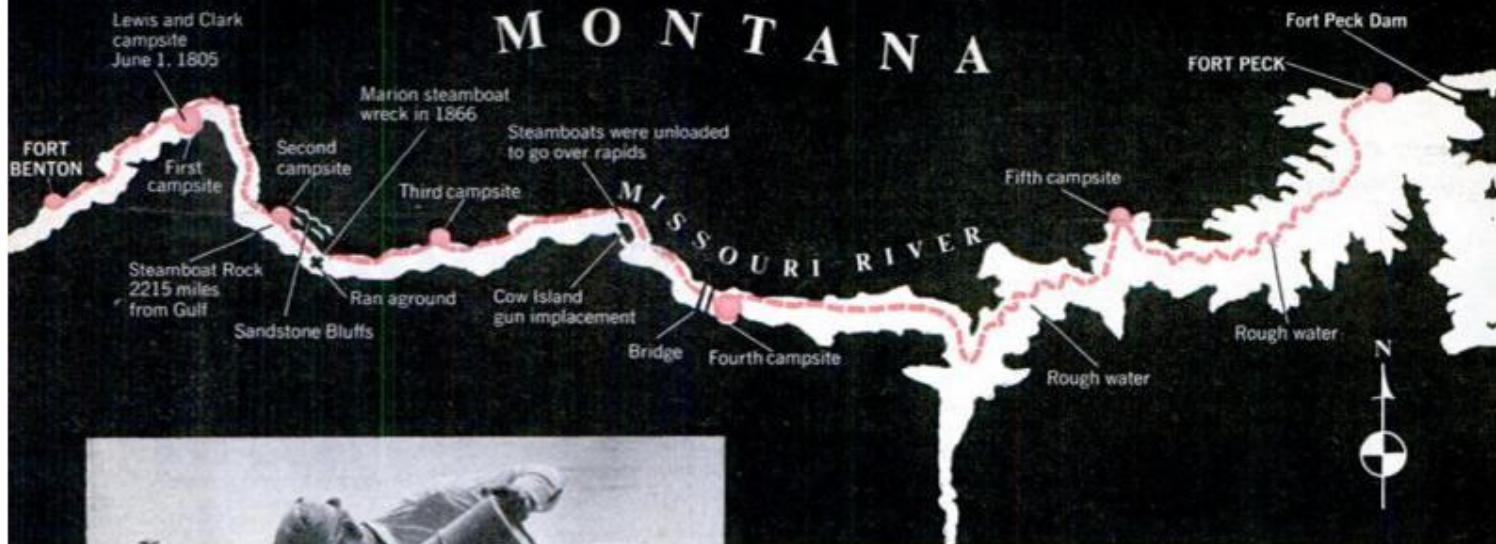
We're traveling with a group of boating enthusiasts from Fort Benton and Glasgow, Mont., who take this trip every year. But we're not the only greenhorns. Some have trailered boats from the Midwest, others from Southern California. The Glasgow Chamber of Commerce sponsors the run along with the Fort Benton Chamber.

The boat we're using is a new 17-foot Glastron V-174 V-hull rigged with a 210-hp Aeromarine engine which drives a Berkeley jet power package. It's a red-hot boat, a great toy if you can afford about \$5500 for a 17-footer.

We leave Fort Benton at 1:00 p.m. on a Sunday, heading east toward the Fort Peck Reservoir, not far south of Glasgow. I soon realize what we're in for.

Three of the 35 boats start banging outboard motor propellers before we're a half mile from the start. With my boat loaded to the gunwales with camping gear, plus a photographer and his son, I feel as though one wrong move will swamp

MONTANA



FILLING from reserve gas cans aboard is quite easy. The bow tank holds 18 gallons, which last for a day



HOMEMADE BOATS are not uncommon on Missouri. But this paddle-driven craft grabbed our attention



us. But after we cross the first "shallows" without incident, I calm down.

The first night's camp is set up at Virgelle Ferry—an old-time cable and float arrangement that runs people and vehicles across the Missouri.

After a great steak cooked on an open fire, a few cups of coffee at dusk and a few jokes, I make up the bunk aboard the V-174. All through the trip I find the bunks (lounge seats stretched out) are okay for sleeping.

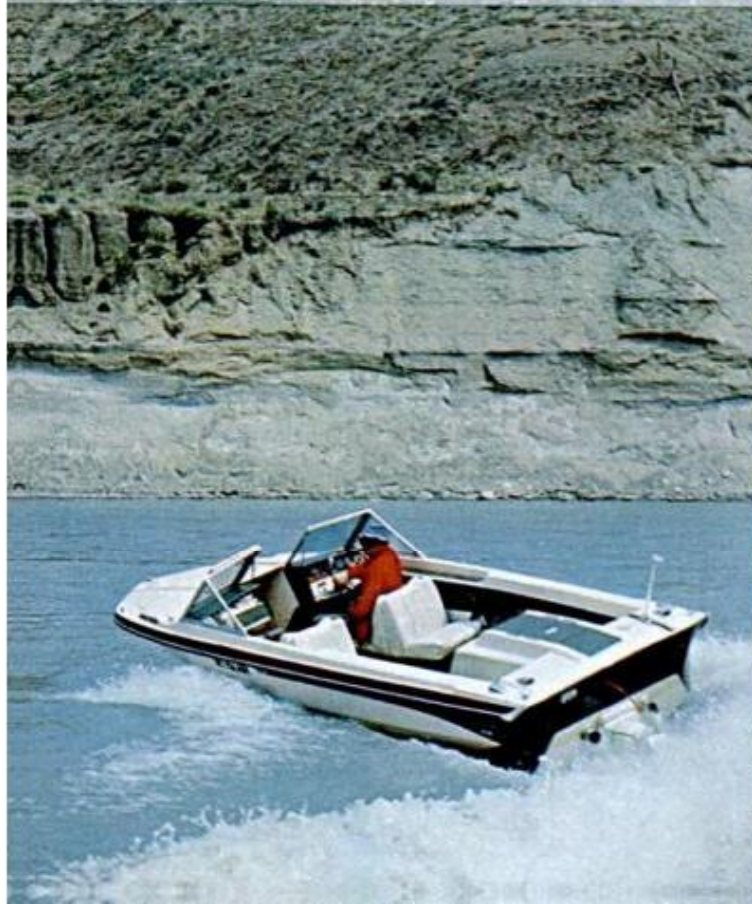
For the next few days we pass some of the most awesome territory you can imagine. True, it's not like running the Colorado or smashing upstream on the Snake. But taking it easy down the Missouri is my idea of a true vacation.

The jet boat gives freedom from worry in rapids and near the shore. There are only two problems with the jet operation. One—you'll find yourself getting too close to shore and shallows because you don't really worry about water depth. Suddenly you're aground. It's then that you discover the other problem. The power of a water jet is amazing. But to call on that power in shallow water means that the pump will suck up every rock and piece of debris on the bottom. Result—damaged impellers and loss of power. You can get the power back by cleaning out the jet chamber. With all power off, you can uncap the jet unit, poke your hand down into the impellers and clean out

DRIFTING DOWN the river is another popular sport. These are the four rafts that were followed by geese



WIDE OPEN and fully loaded, our 17-foot jet-powered boat charges down the Missouri River. We camp along the shore (lower right) every night. The boat's maneuverability (lower left) is amazing when it is empty and used as runabout or ski boat



debris that's been sucked through the protective "screen." Slip the cap back on and you have power again. The operation takes two minutes. It happens three times on the whole trip.

The five days are unbelievable. Great blue heron pick up ahead of us and lumber into the sky. Bald eagles fly high about the great river. Fish break the surface at twilight.

The trip is so planned that you can drift all day for several days without jeopardizing the timetable. And it's drifting that makes any river trip. If you get tired of the scenery or become too hot, you can kick in your power and travel downstream for a few miles.

At the end of one of these power stints we run across a party drifting downriver on rafts. There are a dozen people in four rafts. Floating right with them are two Canada geese—strange because these are wild geese and they have been with the group for two days.

Farther downstream we pass good campsites that look as though they have never been used. There are several Bureau of Land Management sites, too. Any detailed geodetic survey map can give you tips on good campsites.

Ahead are the rapids. At low water I imagine they can be tough on propeller boats, but now the water's high and only a few deeper draft boats bang a prop. All the boats find a prop change necessary at least once during the trip.

All who travel the river carry a lot of supplies. Gas of course, is all important. Although it's possible to get gas from a rancher along the river if there's an emergency, it's better to carry your own. We have 35 gallons extra in our boat. Loaded down and going slower than her planing level of about 2200 rpm, the V-174 uses a lot of gas. But when the boat is empty and on plane, gas consumption is cut drastically, though water jets are not the most economical method of propulsion known to man. Many of the outboard boats did much, much better in the gas department, though they were not running a V8 210-hp monster. When the jet boat



CLEANING OUT THE IMPELLER is easy once you know how—even when pieces of vine wrap around shaft

is on plane, it handles like a dream. It's hot and sure and very maneuverable. It's even possible to spin out if you're not careful. This is a fun boat to handle, but as with a sporty, supercharged car, you should know what you're doing.

Off plane, the boat doesn't handle nearly as well. The jet of water streaming out the stern acts as a stabilizer when the pump is operating at high rpm. But when that force is not there, you tend to weave all over the water.

Those who plan to travel the upper Missouri should contact the Glasgow Chamber of Commerce for charts and additional information. The U.S. Army Corps of Engineers administers the river, as it is still classed as a navigable water. Someday, it is hoped Congress will make this 200 miles of water a national river or national park. ★★★

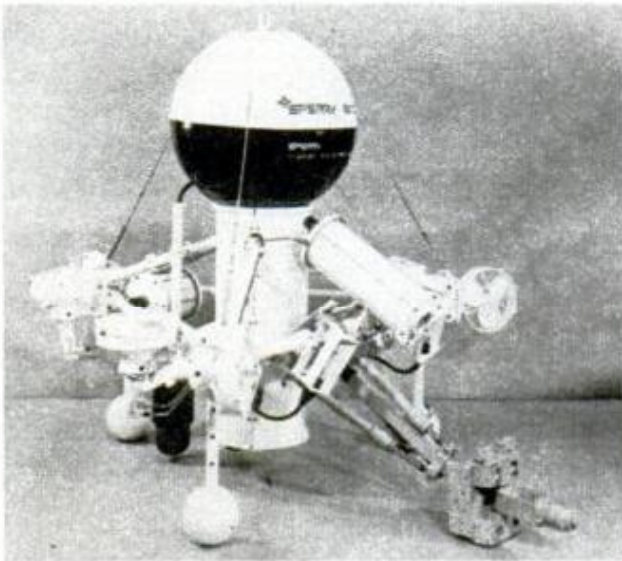
OPERATOR of the Virgelle Ferry stands and watches as the 17-foot Glastron V-174 passes on downstream





Giant trailer is going to work for the TVA

Loads of up to 800,000 pounds can be carried on this giant trailer, constructed for the TVA by Peerless Trailer and Truck Service of Tualatin, Ore. The tractor-trailer combination is 133 feet long, has 74 tires and has hydraulic steering for the rear wheels.



Deep-diving worker

A prototype of the Worksub, which will operate as deep as 2000 feet by remote control, was shown recently by Sperry Systems Management Div. of Sperry Rand Corp. The vehicle is propelled and maneuvered by six hydraulically powered thrusters. A closed-circuit TV system allows operators to observe underwater objects while they control the sub's manipulator arm in a variety of tasks.

NOVEMBER 1969



Tree to logs in 60 seconds

In about 60 seconds, Omark's new C-10 tree harvester can clamp onto a tree, saw it off at the base with a chain-saw system (top photo), swing the tree to a horizontal position while removing limbs—and finally stack the logs (lower photo). One operator, with four hand controls and four foot controls, does it.

125

WE BUILT THIS

By ROBERT REX HUNT



Photos by Kranzten Studios
Interiors by Hartley Furniture, Arcadia, Ind.

A 29-foot living room with fireplace and glass doors to a patio, three bedrooms, two full baths, 90 square feet of closet space and airconditioning—how do you get that today for \$7500? We did, and have the receipts to prove it

WITH THE HELP of my wife and our 15-year-old son, Kris, I built this 1457-square-foot home in 1969 for \$7500. That may not seem possible, but we have our sales slips and cancelled checks as proof. We took advantage of a few discounts, but about 90 percent of the material was purchased at retail prices.

We spent a lot of time shopping and looked for sales, but we did not buy as cheap as we could have. Neither did we trade at the top of the line. For example, a 4x8 sheet of plasterboard, taped and painted, costs about \$2. The same size panel in walnut or cherry plywood may cost \$14 or \$15. Since there are 43 panels on just the outside walls, those areas could have been done for either \$86 or \$645. Though it meant spending considerably more, we chose the plywood.

There are many alternatives. We used hand-hewn beams in the living room that

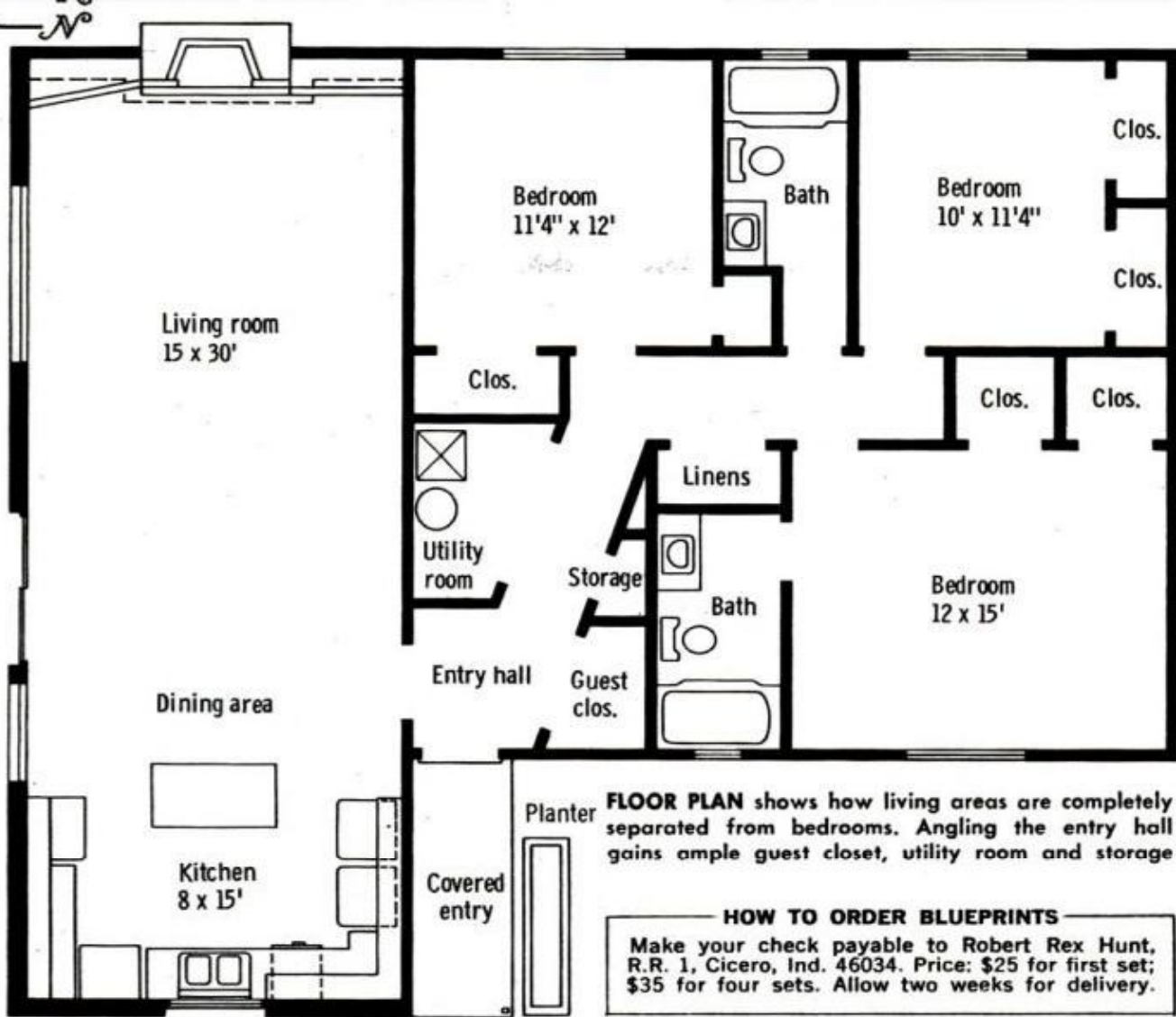
HOUSE FOR \$7500



HOUSE FOR CASUAL LIVING has stained, rough-sawn cedar siding. Entry is sheltered by roof overhang and masonry planter. Redwood extends a warm welcome

FAMILY-LIVING ROOM has masculine charm that comes with paneling, hand-hewn beams and fireplace wall. Room lends its spaciousness to kitchen





cost \$145. They improve the house, but could have been omitted. We spent an extra \$100 for special windows in the living area; \$25 more for the front door and \$400 for airconditioning. In the bedrooms and kitchen we used acoustical ceilings which cost more than plasterboard. We used bi-fold louvered rather than less expensive flush doors on all of the closets.

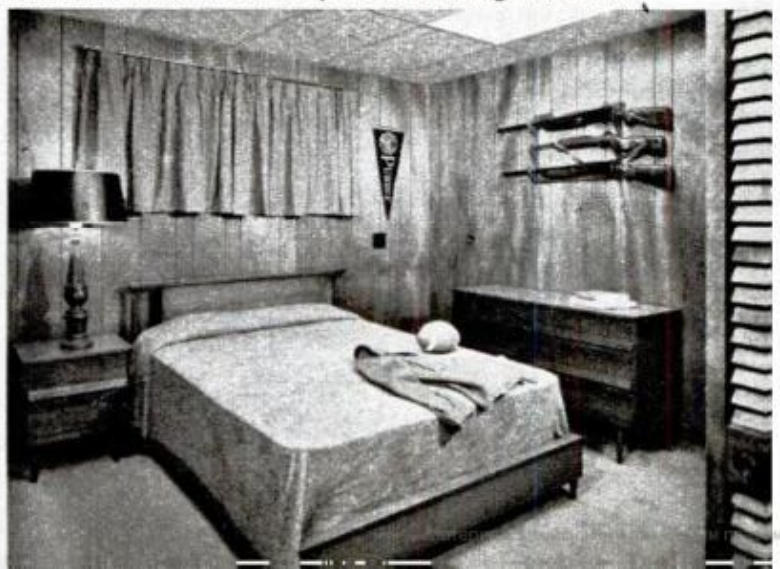
This house is a product of 30 years' experience, incorporating all the good ideas and advice I've absorbed along the way. It will fit almost any location. If the alternate plan for the kitchen is used (see page 129), the house will fit comfortably on a 50-foot lot.

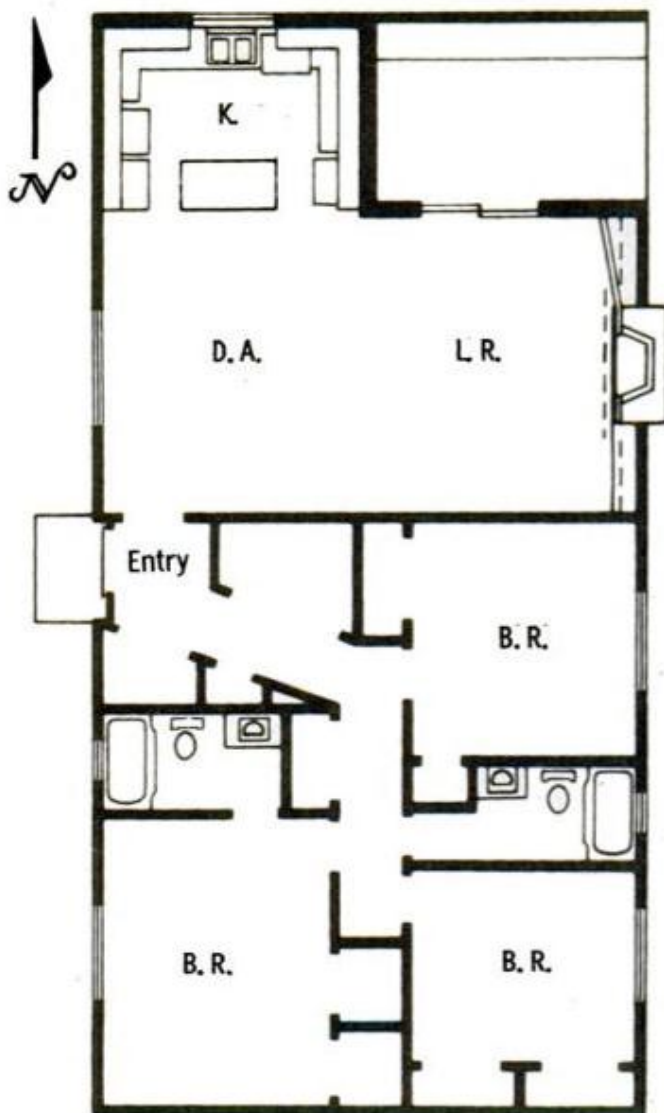
Designed for easy, casual living, the living area is completely separated from the bedroom area. The kitchen is

SOUTHEAST BEDROOM, furnished as office and den, has full wall of storage behind louvered bifolds



DROPPED CEILING with recessed lighting in Kris's room was reward for his part in building the house





ALTERNATE FLOOR PLAN offsets kitchen from living-dining area, still retains sliders to patio

free from traffic entering the house. And, the house has about 90 square feet of closet space, plus access to the attic for additional crawlspace storage.

Since the difference between cost and actual market value of the house is approximately \$14,500, your wages are worth \$22.50 per hour (based on my calculation that a skilled craftsman can erect it in 600 on-the-job hours).

We spent an additional 200 hours hauling material in a ½-ton pickup truck (not included in my estimate). Doing it required many 28-mile round trips but saved trucking costs. And by going into the lumberyard frequently, we were able to save possibly another \$100 by picking up unadvertised items that were on sale.

EXTRA HELP. Depending upon your skills as mason, carpenter, plumber and electrician, it is wise to borrow enough



CENTRAL AIRCONDITIONING compressor was installed outdoors. Evaporator is in furnace plenum



UTILITY ROOM DOORS open full width of wall for easy access when servicing furnace and water heater

money when you get your mortgage so you can hire help when you need it.

It is my opinion that almost any mechanically-minded man can build a house with the materials available today. Plastic pipe, truss roofs, prehung doors, interior paneling and acoustical tiles—all are quite within the grasp of most men who have seen someone do it or can follow packaged instructions.

Though I did most of the work myself, I spent \$106 for plumbing and electrical help. A local contractor asked me if he could bid the work and I told him I intended to try it myself. He then offered to help for \$4 an hour. Actually, I put in all the plastic plumbing drains below the concrete floor and nailed my outlet boxes to the ceiling and walls. I helped him pull wires and he made up the junction boxes and tied the ends off so I could hang my fixtures. His total



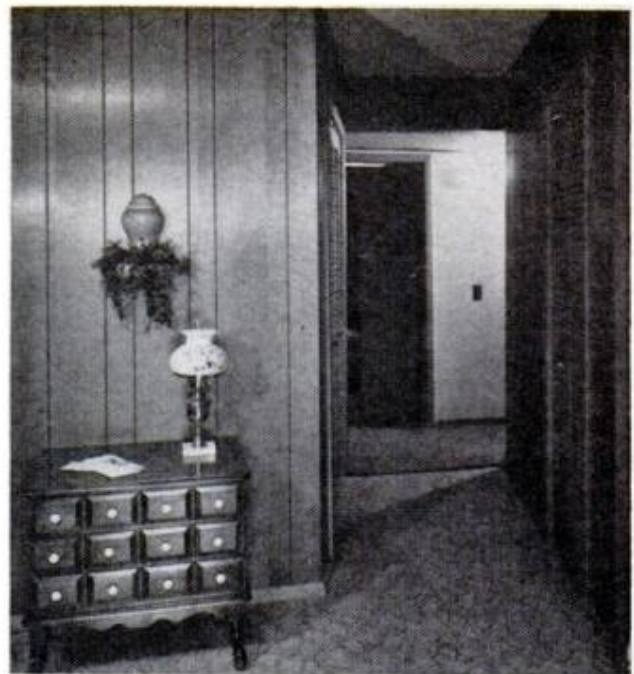
KITCHEN IS SEPARATED from dining area by dropped ceiling (acoustical with recessed lighting) and island counter that can also double as a breakfast bar

MASTER BEDROOM (12 ft. by 15 ft.) with high, slider window allows flexibility in arranging furniture. It has an attached bath and 24 sq. ft. of closet space





BATHROOM has ample vanity, sink, tub-shower. Bath adjacent to master bedroom is a duplicate of this one



ENTRANCE HALL has open feeling that results from angling the walls of the utility and storage areas

hours: 26½. But, you will find that the cost of help depends on the area of the country, season and trade.

By all means get qualified help on concrete and electrical installations. You can rip out just about anything else and do it over if you make an error. But concrete must be right the first time, and incorrect wiring can be dangerous.

I emphasize that the \$7500 price tag on this house covers only materials. Any labor will up your cash outlay.

FRAMING. House framing is not too difficult for anyone with a little carpentry or do-it-yourself experience.

All framing in this house is laid out on 16-inch centers which means there are 14¾-inch spaces between studs. If the job is not within the scope of your experience, get professional help. Common practice in my area is to frame for 80 cents to \$1 per square foot in labor. This means a carpenter crew would erect this house completely closed in, windows and front door and patio door installed, siding on, and roof shingled for less than \$1450.

We used ½-inch plywood sheathing (Plyscord) throughout the house—walls and roof. We needed it on the walls to hold the 1x12 cedar. While we were building, the cost of a 4x8 sheet jumped from \$3.43 to \$5.29 and later

dropped back to \$3.99. There are 116 sheets in the house. We paid top dollar.

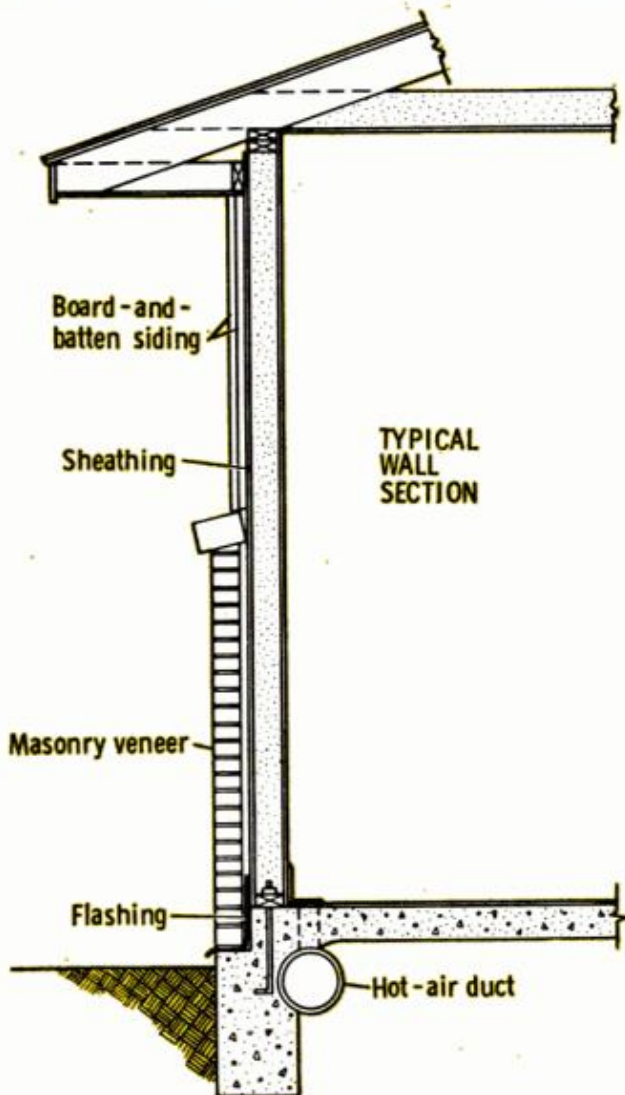
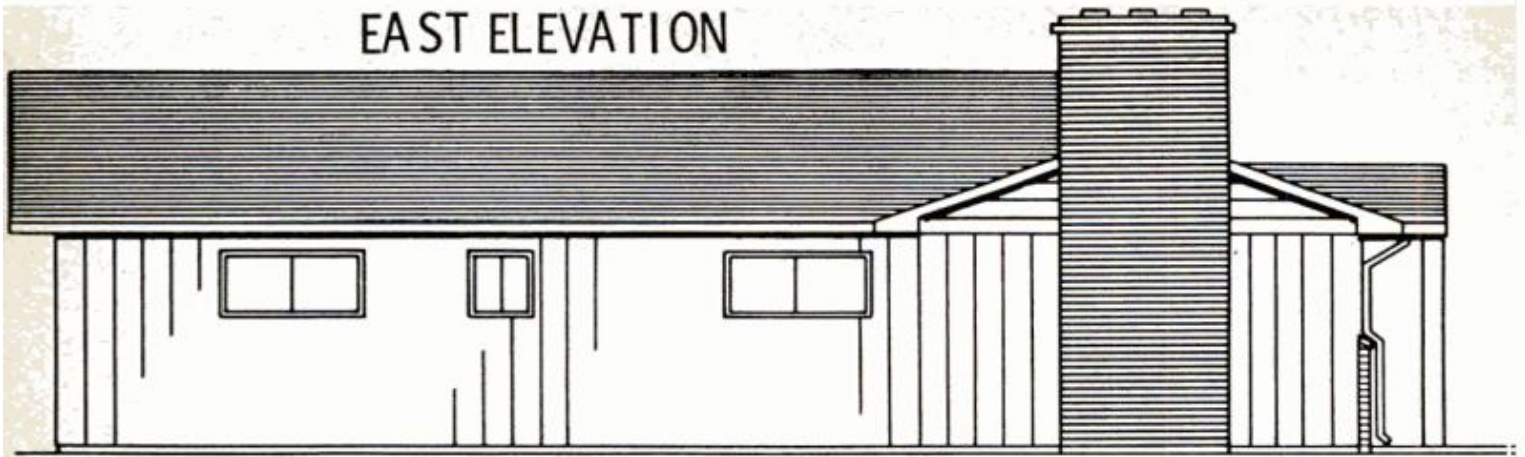
INSULATION. For economy over the long pull, we installed 3½-inch foil-face insulation in the walls. For this house, a heating and airconditioning expert suggested 6-inch fiberglass in the ceiling; it does an excellent job. The house remains comfortably cool when the outside temperature is 85°.

CEILING. In the living-family area we used plasterboard and taped the joints with one coat of drywall cement. All nails were well set and covered with two coats. Finally, redwood beams covered the joints. We used a texture paint—a powder product mixed with water. After painting an area about 10 or 12 square feet with a course white-wash brush, we went back over it with swirling strokes, going far enough each time to cover the center of the last swirl.

In the master bedroom, den and bathrooms we used acoustical ceiling tile, following directions in the package. In the other bedroom and kitchen we used a suspended ceiling with recessed lighting, which cost about twice as much as acoustical tile but is a center of attraction and adds a touch of luxury.

MASONRY VENEER. We laid stone veneer 4 feet high along the south

EAST ELEVATION



TYPICAL
WALL
SECTION

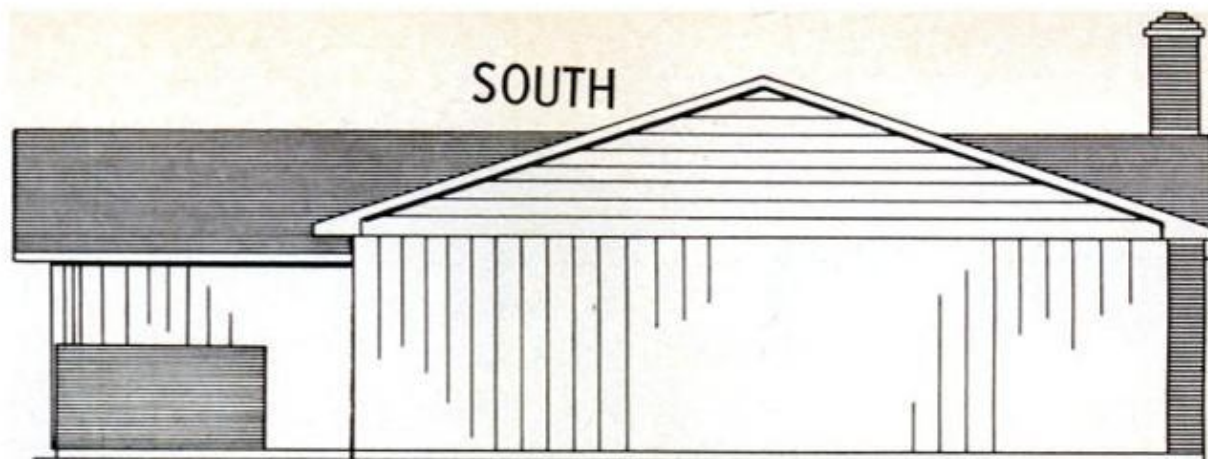
and west walls. Actually, this is an imitation stone called "splits." It is a colored concrete block made with fine aggregate. Cast 4 inches high and 8 inches wide, a block is either 16 or 24 inches long. It is cast one day and split in a press after it has set for a few hours. This gives a finished block 4x4x16 (or 4x4x24) inches long.

These "splits" are made with that or other names all over the United States. Some manufacturers sell them out during the winter for half price because when they resume manufacturing such blocks again the following spring, the colors may not match those of the older blocks. We happened to catch the sale and saved here.

ROUGH SAWN CEDAR. Nowadays, siding is quite popular for both interior and exterior applications. By rough-sawn board we mean a 1-inch plank planed on one side only, leaving the saw marks on the other side. Or it may be a 2-inch plank that has been planed two sides, then split on a band-saw to get a somewhat smoother sur-

WEST





face. There are also redwood and cedar plywood panels on the market with which you can get a board-and-batten effect.

We debated between the two, then chose the boards at about half the cost—22 cents per square feet against 40 cents for plywood. But since boards must be lapped, we allowed 15 percent waste against a possible 5 percent on the plywood.

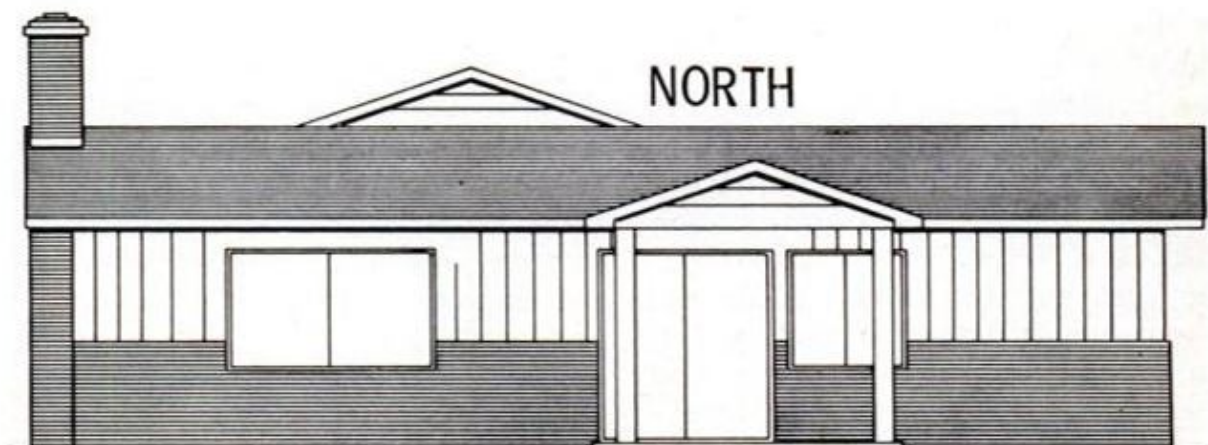
Since we could not afford a “way-out” house, but still wanted our home different from those on the rest of the block, we decided to try 1x12 boards, 12 in and 12 out, or in other words, a 12-inch board (actually 11½ inch) nailed on the wall, then five 10½-inch-long cleats nailed horizontally for spacers and support, then another 1x12 nailed to the sheathing. A 1x12 is then nailed over the space between the two. The spacers and fillers held the top board rigid. We achieved a nice effect but made a serious error. The cedar, which shrinks and expands more than most woods, drew water like a blotter.

Our 1x12s shrank from 11½ to 10½ inches—a full inch. This left a crack alongside the outside board which meant we had to pull off several boards, glue and nail ¾-in. strips on the underboards, then replace the outside boards. Also the 1x12s had a tendency to expand between the galvanized 8d nails which held them to the spacers and plywood wall sheathing.

I would now recommend smaller dimension boards: 1x8 or 1x10. With these your waste must be figured at 25 to 30 percent, so your savings are less. Also remember that cedar erected vertically will expand and shrink in the weather, jamming windows in the wet season and pulling open during dry weather. Caulking does not help much and it also does not absorb stain. Be sure your cedar is dry and then stain or paint the siding at once.

Borrowing money is by far the biggest and most important cost in building or buying a home. I would place borrowed money in two classes: First,

(Please turn to page 227)



How to Read an Oil Can

All the information you need to know to make the right choice of oil for your car can be found printed right on the container.

By MORT SCHULTZ

IF YOU DRIVE an oil-burning old klunker, you don't ask silly questions like:

"Is the oil I'm using the one best suited for my car?"

"Am I wasting money by using the highest-priced oil?"

"Which of the several different types of oil sold by my local gas station should I use?"

You just buy the most oil for the least money and keep pouring it in.

But if you own a new car or a good used one, you want an answer to the important question: Which oil? And

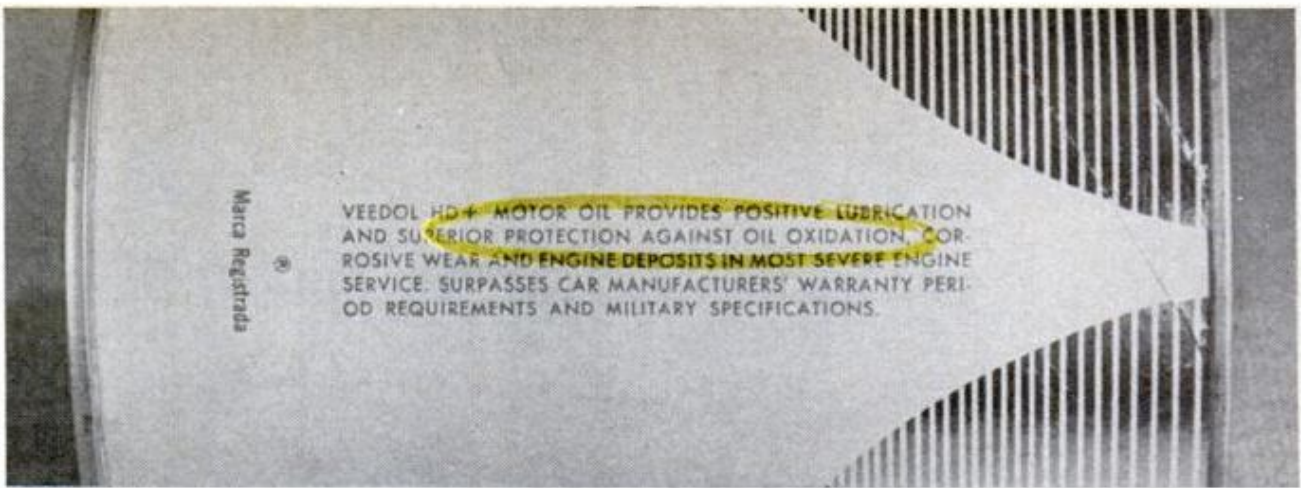


BACK OF THE CAN is usually where the important information about the characteristics of an oil is printed. "Surpasses All New Car Warranty Requirements" is the key phrase for owners of cars still under warranty. American Petroleum Institute (API) classification MS is highest rating meaning motor service severe; MM, moderate service, ML, light (see text)

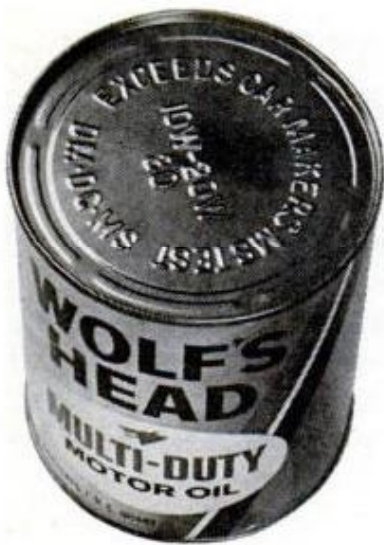
the answer is right on the can. All you have to do is know how to interpret the information for your individual requirements.

The first question the information on the can should answer is: Does the oil meet the auto manufacturer's warranty requirements? The power-train warranty on a new car specifies that if an internal engine failure occurs during the warranty period it will be repaired at no cost to you if you've provided the engine with maintenance required by the manufacturer.

If your engine is under warranty,



NEW-CAR WARRANTY on power-train components is only good as long as the car is serviced as specified by the manufacturer. Every auto company establishes its own MS oil requirement, not necessarily the same as the API rating or military specifications. To be safe, always go by the statement that refers to the fact that the oil has characteristics that meet or surpass car manufacturers' warranty requirements



TOP OF CAN is stamped with information to the effect that oil exceeds manufacturers' MS test and with viscosity index. Multiviscosity oil, in this case, ranges from SAE (Society of Automotive Engineers) 10W (winter) to 30



IN ADDITION to standard motor, (M) ratings are "D" ratings that refer to all diesel engines—passenger car, truck or marine. DG means diesel service general, or light, and DM specifies oil characteristics for moderate service



SINGLE-VISCOSITY OIL costs a bit less than a multiviscosity type but is not as versatile. Multiviscosity oil is an increasingly popular all-year-round lubricant that doesn't need changing when the ambient temperature changes

you can be sure that an oil is suitable for your car if the can states that the product meets (or exceeds) *carmakers'* warranty requirements or is of *carmaker* MS quality (MS is an industry classification referring to oils that meet severe operational service standards).

The statement means that the oil meets automobile manufacturer specifications and can remain in the engine for the recommended period between oil changes. If the container bears no such statement, the oil does not meet stringent standards and should not be used.

Following are several ways in which the statement is presented on oil cans:

"Exceeds all car manufacturers' standards for MS service" (Citgo Extra Range).

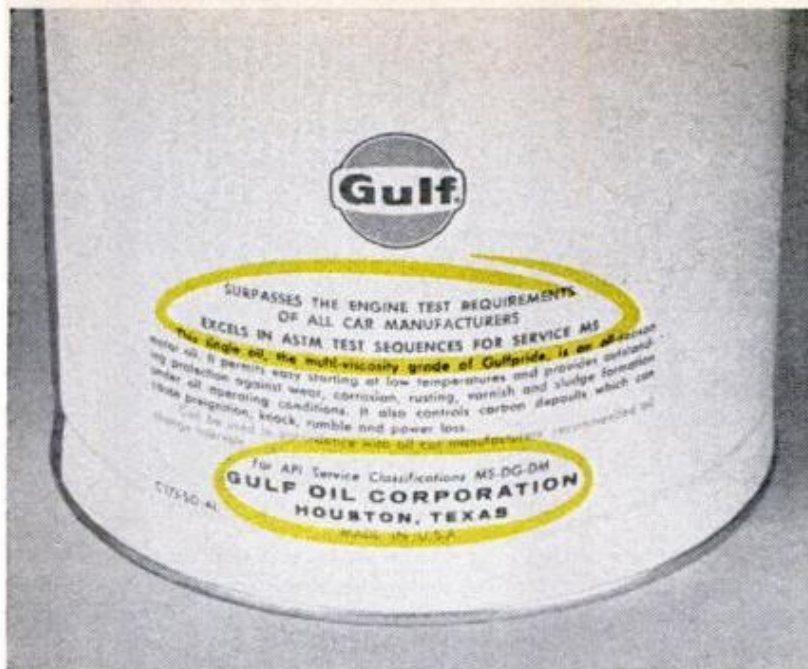
"Exceeds all automotive manufacturers' requirements" (Super Shell).

"Meets all manufacturers' requirements for new car warranties" (Sunoco Special).

"Meets warranty requirements of U.S. car makers" (Esso Extra).

"Exceeds car makers' MS tests" (Wolf's Head Multi-Duty).

"Surpasses the engine test require-



MANUFACTURERS' MS RATINGS are based on what are usually referred to as "best sequence" or "sequence performance tests" on most oil cans. The tests set up standards for judging an oil and its additives and correlating with oil change intervals



PROMINENT STAMP on the front of few brands calls attention to the only statement that is really of interest to owner of a car that's under warranty

ments of all car manufacturers" (Gulfpride Single-G).

There is one thing to be cautious of if the statement makes reference to MS service requirements or tests. There are two kinds: automakers' MS and API (American Petroleum Institute) MS. They differ.

Oil tested in accordance with API MS standards does not have to meet automaker MS requirements, which are designed to assure suitability of the product under the warranty. Thus, an oil container which bears reference to API MS service requirements without referring to carmaker tests or requirements means that the product should be drained and changed every 60 days as recommended by the API. Only that oil which has carmaker approval should be used in engines covered by warranty.

In all likelihood you'll come across two different cans of the same brand of oil that will differ in price by about 15 cents per quart; yet both of them will carry the statement that the product meets automakers' requirements. What's the difference?

In some cases, one will have a multi-grade viscosity rating, such as SAE

10W-40, while the other will have a single grade rating, such as SAE 20W/20. (The higher the SAE (Society of Automotive Engineers) number, the greater the viscosity or resistance of the oil to flow.) You're paying the extra money for the variability afforded by the multigrade oil.

In other cases, the SAE ratings of both will be the same, but one container will state that the oil *exceeds* carmaker requirements while the other will say that the oil *meets* carmaker requirements. That's the difference which accounts for the price differential.

Both oils are suitable for use in your 5/50,000 warranty-covered car, but the one that exceeds carmakers' standards possesses additional detergents and dispersants that afford your engine extra protection, especially desirable if you should exceed the recommended drain period.

Detergents are chemical additives that keep the engine clean by preventing deposit buildup. Dispersants are chemicals that keep sludge and carbon suspended in the oil in the form of small particles.

If the oil can states that the product



GALLON CANS are most economical way of buying oil for the do-it-yourselfer. Some outlets sell gallons of top-grade oil by the case (12 cans) for fantastic savings. Always cover any open, unused cans

is for Service MS, the oil contains detergents.

You may discover what appears to be contradicting statements on some cans of oil. The can will state that the oil meets (or exceeds) car manufacturers' warranty requirements. Yet there will be another statement someplace else that says something like, "To help your car run better and last longer, drain and refill with (such and such oil) at least every 60 days."

What the oil company is telling you is that the oil can safely be used as recommended by your car's manufacturer. However, for even greater protection, change the oil more frequently.

You should also examine the oil can for the type of operational service the oil is designed to meet—severe (MS) or moderate (MM). MS and MM (ML, too) are classifications formulated by the American Petroleum Institute. M stands for Motor. The second letter stands for the type of service—S for severe, M for moderate and L for light.

MS-designated oil contains the inhibitors, detergents and dispersants needed to protect today's engines against the severe service they're subjected to, specifically stop-go driving,

short trips and long periods of idling.

If a can carries the designation *For Service MM*, the oil is designed for moderate service which is defined as service that involves no stop-and-go, short-trip or long-idling operation. MM-designated oil contains little or no detergents and is less expensive than MS-designated oil.

Since the early 1960s, automakers have recommended that only MS-designated oil be used in engines. However, if your engine is no longer covered by warranty and is burning oil, you might as well save money by using the less expensive MM oil until you decide whether to fix the engine or sell the car.

As for oil designated ML, most places no longer sell it. It's just straight mineral motor oil.

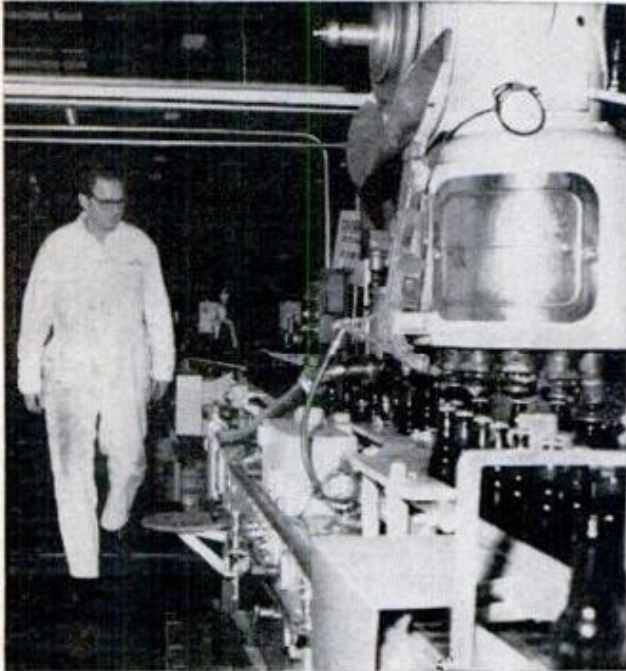
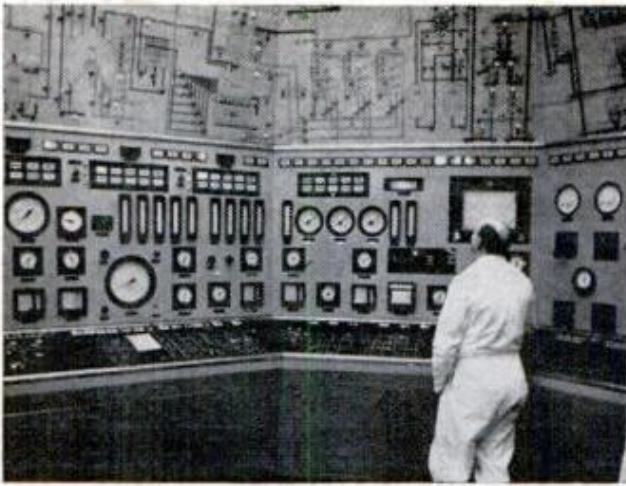
Along with the designation MS, you're likely to see the designations DS, DM and DG. These refer to the suitability of the oil to meet operational service requirements of diesel engines. DS stands for Diesel Service Severe, DM is for Diesel Service Moderate, and DG is for Diesel Service General (light service).

You may wonder what happened to the designations "regular," "premium" and "heavy duty." They formed the classification system adopted by the oil industry after World War II, but were superseded by the MS and MM system early in the 1950s.

As mentioned, multiviscosity oil is more expensive than an equivalent single viscosity oil but is worth it. Suppose that the temperature in your area is now above freezing (32° F.) and you're using an SAE 20W/20 oil. Suddenly there's a change and the temperature dips to below freezing and stays there. To assure that the oil flows properly inside your engine to provide maximum protection, you should drain the SAE 20W/20 oil and replace it with an SAE 10W oil.

However, if the oil you use is an SAE 10W-30 or an SAE 10W-40, you don't

(Please turn to page 227)



Computer can really make the suds flow

Bad news for human brewmasters comes from a new British brewery where the production of suds is handled from start to finish by computer. All machinery is controlled from a single dial-studded room. Technicians take strolls to keep an eye on things and to examine faulty bottles culled from conveyor belt by an infrared inspecting device (top right). The big plant is designed to produce more than a million barrels annually.



Powered glider spies on enemy in Vietnam

Night missions in Vietnam are reported to be the specialty of quiet-operating motorized gliders. A small engine, mounted behind cockpit, drives wooden prop. Crew consists of pilot and observer, who uses Starlight Scope (See *How the Army Learned to See in the Dark*, page 79, Jan. PM) to spot enemy in darkness below.



1. **STICKS ARE BOILED**, then soaked in preservative



2. **STRAIGHTENING** on notched plank follows heating



3. **OVERNIGHT CLAMPING** around disc shapes handle



4. **SOME STICKS** are scorched to darken their color



5. **STOCK FOR SHILLELAGHS** comes from blackthorn bush. Cudgels are finished with stain and varnish

Sticks for walking and other vigorous pursuits

Some 360,000 walking sticks and shillelaghs—those traditional Irish skull crackers—are turned out annually at an English factory where cutting and rough shaping are the only operations entrusted to machines. Most of the sticks are made from ash and chestnut that come from farms in Surrey, and range in price from \$3 to about \$15. The lethal-looking shillelaghs, which may go for as little as \$5, reportedly are sold mainly to U.S. and Canadian tourists.

How to Check Out Your

If you know how, you can repair blown head gaskets or reed-valve failure with a minor teardown. For a ring job, the teardown will be total. Here's how it's done

By HENRY B. NOTROM

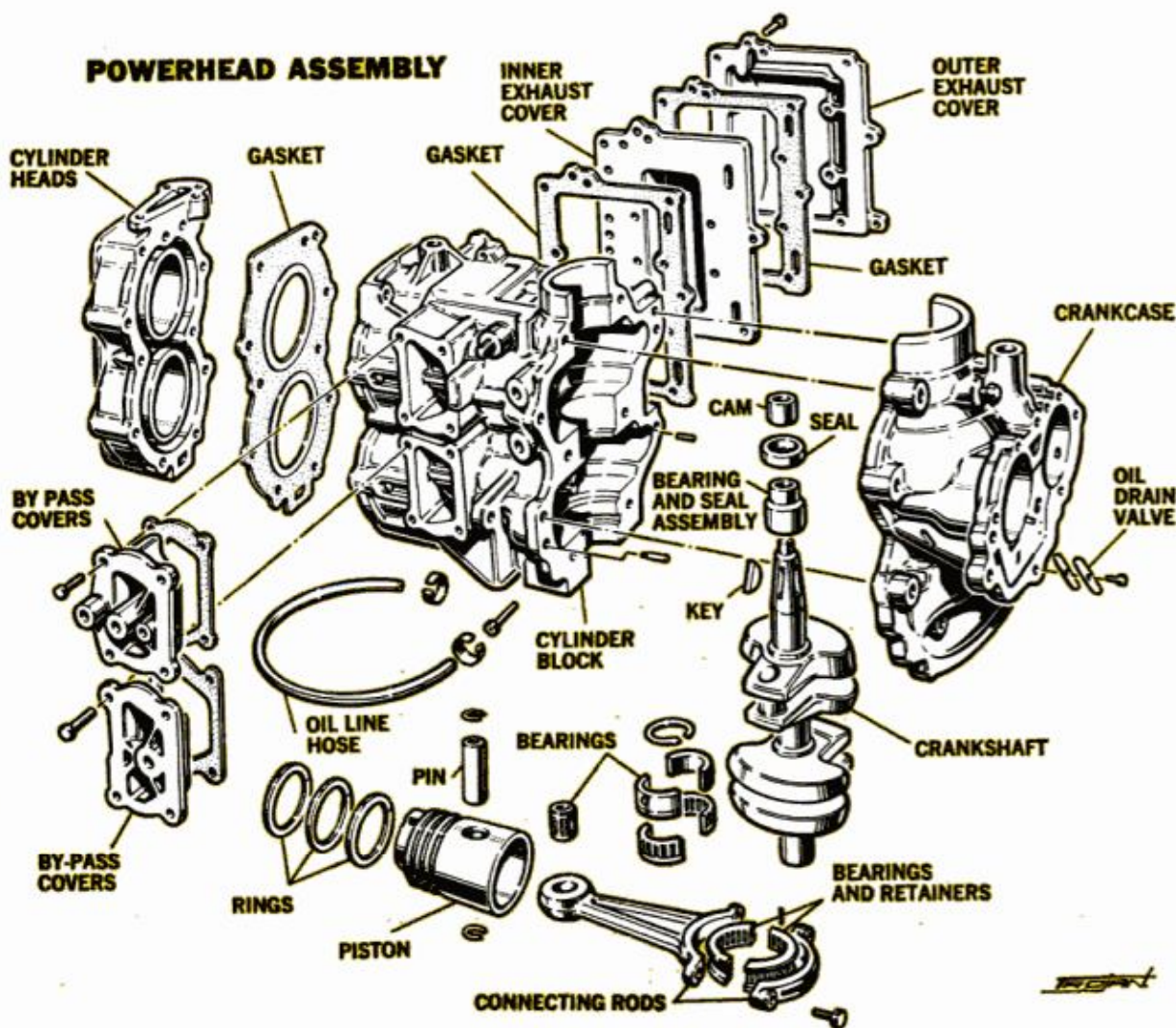
THERE ARE TWO WAYS to tear down a powerhead: minor and major. A minor disassembly allows you to repair such damage as a blown head gasket, a reed valve failure and carbon buildup in exhaust ports and around cylinder heads. It also lets you look inside the motor to see if a major tear-down is necessary.

If there's an indication of damage that you can't observe directly—such as worn main bearings or a bent connecting rod—you'll have to commit yourself to a major disassembly.

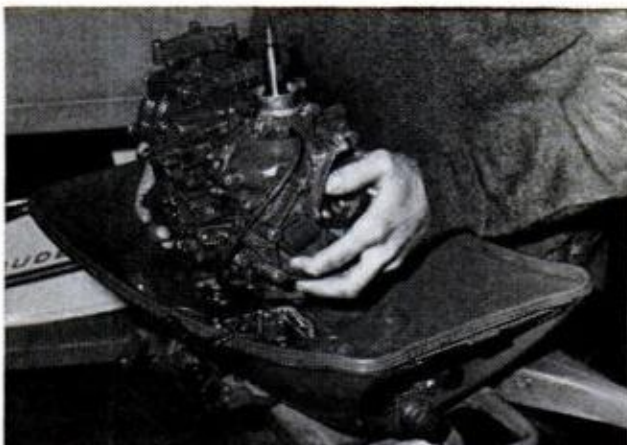
A list of powerhead troubles and how

they usually make themselves known is provided on page 143. However, a word of caution: Be sure that all other causes of a problem are investigated before you tear into the powerhead. Wouldn't you be red in the face to find out that the cause of an engine knock was advanced ignition timing and not the pistons you're holding in your hand?

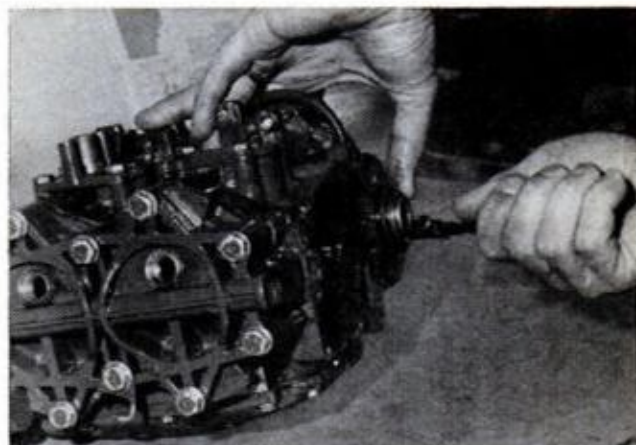
An important question you will have to answer is whether to do a major disassembly yourself or to let a professional shop do it for you. There's no doubt that any competent reader can tear the engine



Powerhead



1. LIFT POWERHEAD from exhaust housing after all external engine parts and screws have been removed



2. IF YOU DECIDE to rip powerhead down completely, the carbon seal has to be removed. Pull retainer

apart. But then what are you going to do afterwards?

Suppose, for example, that the cylinder walls show wear, requiring reboring to accommodate oversize pistons. Do you have the reboring tools necessary for this job? If not, would it be less expensive for you to let an outboard repair shop do the whole disassembly and repair job?

Even if reboring isn't necessary, the cylinder walls should be honed and new rings installed while the engine is stripped down. Do you have a cylinder wall honing tool? Do you have a ring expander? Would it be worthwhile to buy them?

All two-cylinder outboard motors are disassembled in pretty much the same way. As you work, be sure to follow these basic guidelines:

- Place parts with their respective fas-

teners in order of disassembly. This will facilitate reassembly.

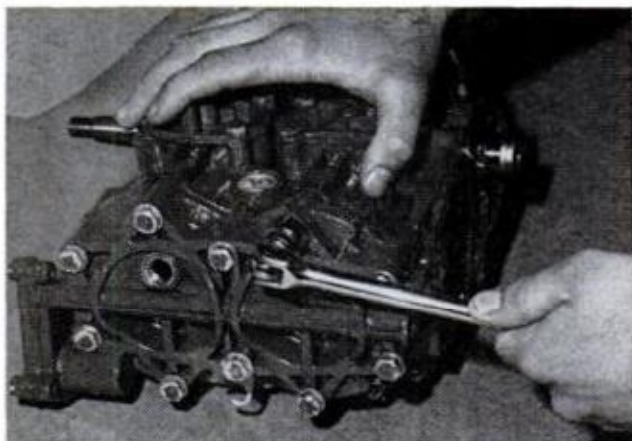
- As you perform disassembly, make notes and diagrams of the procedure so that reassembly will be simplified.

- Be observant. Examine everything before you take it off so you'll know how it goes back on. For example, a piston has to be put back into the cylinder with the concave (intake) side of the deflector toward the intake port.

- Keep things clean. Replace worn parts, also all old gaskets and seals.

To disassemble the powerhead you have to start by removing the powerhead from the rest of the outboard. Remove all external engine parts: carburetor, flywheel, fuel pump, starter, magneto and so on.

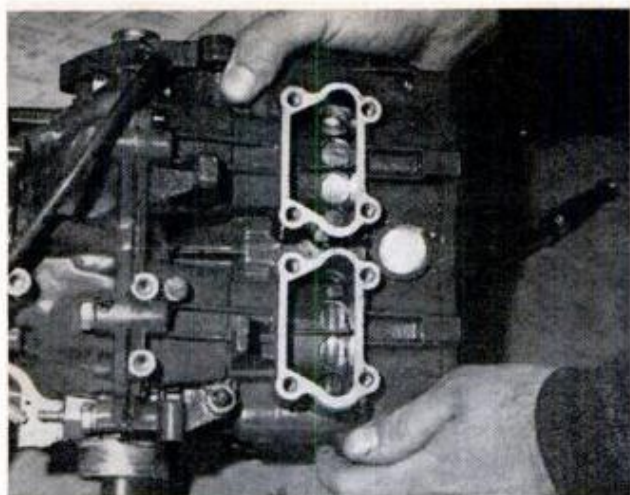
Now, remove the screws that attach the powerhead to the exhaust housing, and



3. CYLINDER HEAD often experiences carbon build-up. Remove it and clean it thoroughly in a solvent



4. TAKE OFF the bypass covers. Once they are removed, you can get an idea of block's condition



5. PART OF THE PISTON RINGS and some of piston surface are exposed when bypass cover's removed



6. WITH CYLINDER HEAD removed, examine tops of pistons, part of cylinder wall and all of cylinder head

lift the powerhead carefully to disengage the crankshaft from the driveshaft (Photo 1). Place the powerhead on the bench.

Remove the carbon seal from lower end of the crankshaft (Photo 2). This seal sits atop the crankshaft lower main bearing. (However, you need not remove it if you are not doing a major disassembly.)

Remove the cylinder head, bypass (cylinder block) covers and the exhaust covers (Photos 3 and 4). You can now peer inside the block and partially check for cylinder wall damage, carbon accumulation, piston wear and scoring, and piston ring wear.

The final task in performing a minor disassembly is to remove the intake-manifold cover, which reveals the reed valves (Photo 8). These components do the same job as intake valves on a car—they allow fuel to enter the combustion chambers in measured amounts.

Remove the reed valve assembly and inspect the leaves to be sure that they're

free of varnish and gum, that they lie flat and aren't distorted, and that none are broken (Photo 9). If one is damaged, replace all the leaves by simply unscrewing the leaf assembly from the leaf plate.

If this is as far as you're going, carefully clean all parts and castings, especially the cylinder head. Replace all gaskets.

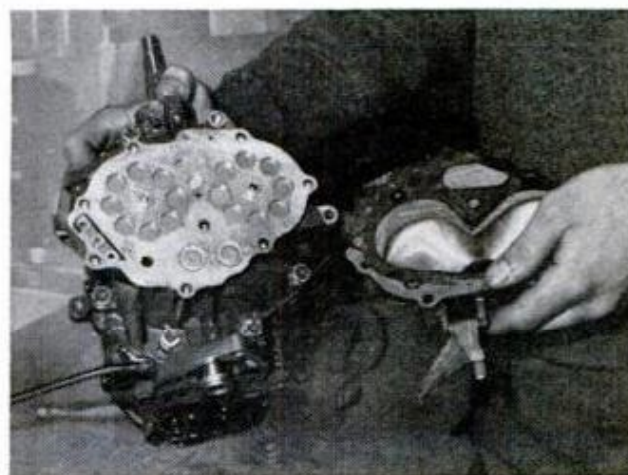
Now, if you determine that the rest of the engine has to come apart, detach the crankcase from the cylinder block to uncover the crankshaft. Disconnect the connecting rod retainers from around the crankshaft and carefully remove the connecting rod bearings.

Next lift the crankshaft from the cylinder block (Photo 10). Remove the crankshaft main bearings for cleaning and inspection. Lift the pistons and connecting rods from the cylinders (Photo 11). You are now ready for overall inspection.

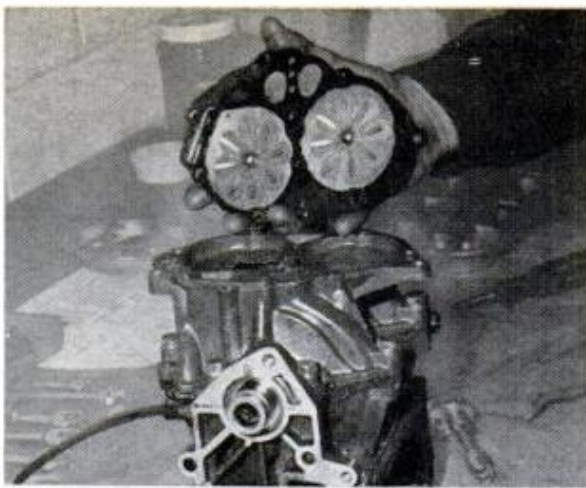
Start with the crankshaft. Check all bearing surfaces for any rust and pit marks. Clean rust off with a very fine



7. WITH EXHAUST COVERS removed, you'll see side pistons opposite from view through bypass cover area



8. REMOVE INTAKE MANIFOLD COVER to reach reed valves. Reed valve plate is held by single screw



9. BE SURE TO EXAMINE reeds carefully for gum deposits, varnish, distortion and any broken pieces

emery cloth. If the shaft is pitted badly enough so that your fingernail catches as it scrapes over the surface, replace the shaft.

Each journal and each throw of the crankshaft should be checked for alignment with a dial indicator.

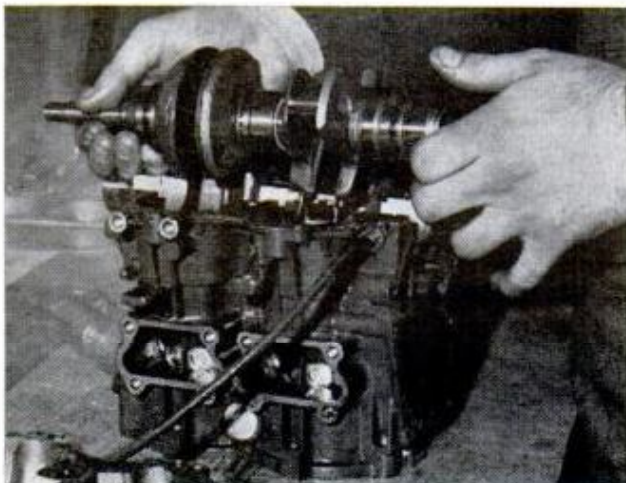
Check connecting rods for rust and alignment. If a rod shows the least sign of being bent, discard it.

To check connecting rods, they should be disconnected from the piston. Make sure the piston pin that holds the rod to the piston provides a sound fit when you reassemble them. The piston should not feel loose.

Replace needle bearings. Ball bearings, if undamaged, can be cleaned and reused.

Check pistons for scoring and cracks. If a piston has been scored or the metal is damaged, replace it. Clean off all carbon. Replace piston rings.

Check cylinders for wear and accuracy with inside telescopic gauge and



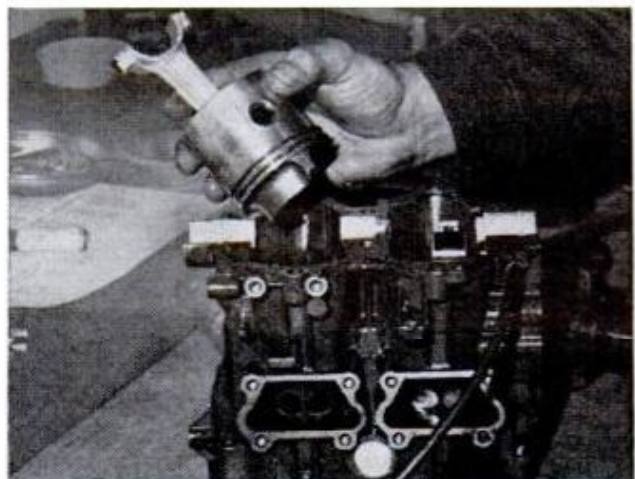
10. REMOVE CRANKSHAFT after connecting rod retainer and bearings are disconnected and removed

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POWERHEAD TROUBLESHOOTING CHART	
PROBLEM	POSSIBLE TROUBLE
Hard to start or won't start	Reed valve failure
Low-speed miss (rough idle)	Leaky or blown head gasket Leaky or blown reed plate gasket Leaky crankcase seal Bad carbon seal
High-speed miss	Leaky head gasket Leaky exhaust case gasket Carbon in combustion chambers
Coughs and spits	Reed valve failure
Runs, then slows and stops	Fouled combustion chambers
Won't start, backfires	Reed valve failure
No acceleration, low top rpm	Reed valve failure Blown head gasket Blown exhaust cover gasket Scored cylinders or stuck rings Carbon buildup on piston head
No power under heavy load	Scored cylinders or stuck rings Carbon buildup on piston head
Engine won't crank over	Broken connecting rod
Motor overheats	Obstructed water passages Bad seals and gaskets Cracked cylinder housing
Motor knocks	Worn or loose bearings, pistons, rods or wrist pins Carbon in combustion chambers and exhaust ports
Motor stops suddenly (freezes up)	Rusted cylinder or crankshaft Bent or broken connecting rod, crankshaft Stuck piston

micrometer. If the cylinder is out of round, you can either rebores it so that it will accept oversize pistons, or replace the block.

Inspect the block thoroughly for cracks. Hone the cylinders to remove glaze and to provide a slightly roughened surface for seating the new rings properly. ★★★



11. ONCE THE CRANKSHAFT has been taken from the engine, you can lift pistons out for inspection

143



OUTDOOR PHOTOGRAPHER E. P. Haddon displays some of his many eye-catching montages of animals.

How to bring to life those forgotten snapshots: **MAKE A MONTAGE**

Mounting a whole collection of prints on a background panel is a handsome way to display photos that usually get stored away in a bureau drawer

By E. P. HADDON

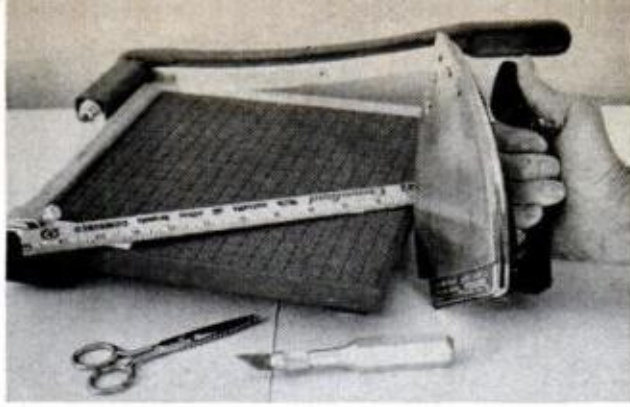
S MALL PICTURES often don't look like much by themselves so there's a tendency to file them away. But put a whole collection of pictures together and you suddenly have an interesting, story-telling display that can make an attractive wall decoration. Montages are an ideal way of capturing events that require a variety of photos instead of just one big picture—scenes from a vacation trip, animals at the zoo, the humorous antics of a baby learning to walk.

Making a montage requires just enough artistic skill to be fun and a challenge. You can arrange your pictures in many ways. Sometimes a montage is built around one central, dominant photo. Sometimes the repetition of a single subject shown in different poses or wearing

different facial expressions can be effective. Generally, the most interesting arrangements are a combination of both vertical and horizontal views. Group your subjects so they're looking in toward the center rather than off the edges.

A montage can be any size, but 16x20 inches is a good choice. This is a standard mounting-board size, readily available at photo and artists' shops. Use a white pebble board and leave a border of 1 to 1½ inches around the edges.

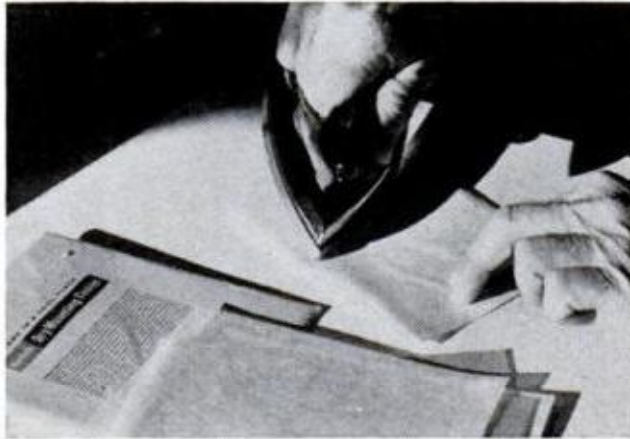
The prints are held to the board with dry-mounting tissue, also available at photo and artists' shops. This is an adhesive sheet that's slipped between the print and the board and then melted with an electric clothes iron to bond the two firmly together. First, tack the tissue tem-



ONLY TOOLS NEEDED are scissors, a ruler and an electric iron. Paper cutter, though not essential, speeds trimming of photo prints, and a sharp mat knife is useful for cutting out intricate shapes



LAY OUT YOUR PICTURES to get an idea of how many you'll need and which look best. Mix verticals with horizontals for variety. Remember untrimmed prints take much more space than final montage



TACK DRY-MOUNTING TISSUE to back of each print with tip of iron to hold it in place temporarily. Cover the tissue with paper and run iron down the center for about an inch. Set iron on medium heat

temporarily to the back of each print with the tip of the iron. This way, print and tissue are trimmed together to the final shape. You then cover the prints with a protective sheet of typing paper and iron over the top to bond the pictures to the mounting board. Never use rubber cement to mount photos as it will bleed through and discolor the surface.

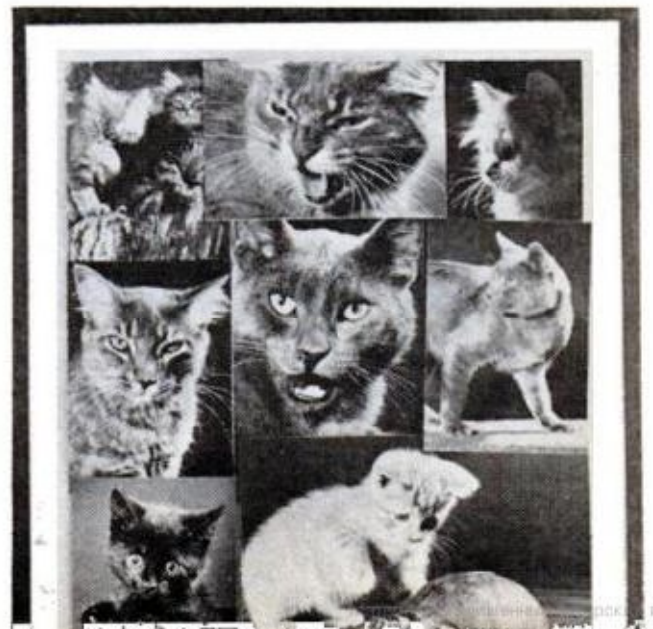
In fitting your pictures together, make the lines between them deliberately irregular to create a natural, random look. To get neat seams between prints, cut the edge on one first, then use this as a template and trace its outline onto the edge of the adjacent picture. Do not, however, butt the edges tightly together. Leave a small gap—about $\frac{1}{8}$ th of an inch—between them. This outlines the prints in white and adds a dramatic effect.

Don't attempt to mount all of the prints at once or they may shift out of place. Mount one or two at a time, working from the borders toward the center. The photos on this page show the preliminary mounting steps. The final steps are shown on the following page. ★★★



ROUGH-TRIM EACH PRINT to remove the borders and excess background area. Cut as close to the image as possible without actually slicing into it. Cut right through the dry-mounting tissue on the back

MAKE TRIAL ARRANGEMENT of rough-trimmed prints to find the most pleasing order. Group should have one or two dominant pictures, with others filling in



PHOTO



OVERLAPPING EDGES are now trimmed off freehand to create interesting pattern of irregular shapes. For neat seams between prints, trace cut edge of one picture onto edge of adjacent picture, as here



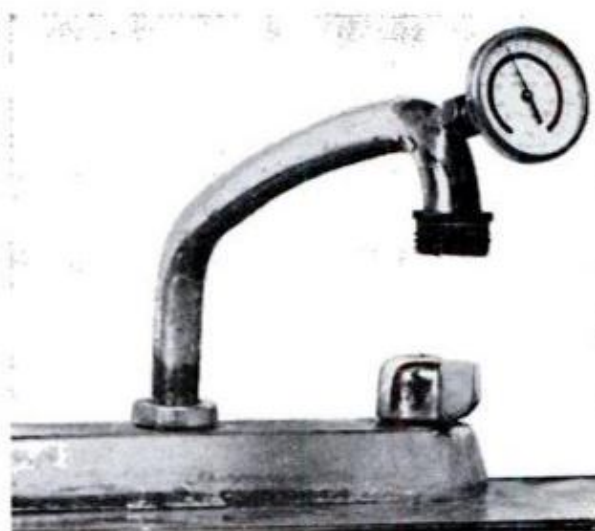
CAREFULLY FIT the pieces in place, leaving narrow gaps between them. Cover the prints with paper and iron over the top to bond pictures firmly to the mounting board. Do one or two prints at a time



FINISHED MONTAGE shows the random shapes and white outlining that give the grouping an attractive free-form appearance. Note how the contour cutting around the cat's head in the center photo breaks up the square lines of the other pictures and establishes a strong focal point of interest



MARKING YOUR TRIPOD LEGS with lines spaced an inch apart will speed the job of setting all three legs to the same length. Felt-pen markings work for a while, but eventually wear off. For longer-lasting markings, make light grooves with a three-cornered file, then rub in colored crayon—it won't come off.—Arthur L. Ramos



SIMPLE TEMPERATURE CONTROL for photo processing can be made from an ordinary darkroom thermometer. The faucet arm is drilled just above the spigot and a short pipe nipple soldered into the hole. A standard compression fitting—the kind used on copper tubing—is threaded onto the nipple with a rubber or nylon bushing to grip the thermometer stem snugly. By watching the dial, you can easily adjust the water to the desired temperature.—R. K. Pedersen

POPULAR MECHANICS

HINTS

YOU CAN DRY FILM FASTER with this simple rig made from a one-pound coffee can and your wife's hair dryer. Drill or punch a series of holes in the metal can bottom and also in the plastic lid. Take a second lid from another can and cut a hole in it to take the end of the dryer hose. Make the hole a snug fit so the hose will snap in and stay by itself, as in lower photo at far right. Pressed onto the bottom of the can, this lid will hold the hose firmly against the holes so warm air flows through the can. Slip your reels into the can, press on the other plastic lid with the vent holes and you're ready to dry. Run the dryer on its low-heat setting so the air won't get too hot. The can will hold three 35-mm reels or two of the No. 120 size. For convenience, you can fashion a little cradle for the can from some scrap wood, as shown in the photos.—Bob Corley



WASHING PRINTS in a bathroom sink is handy if you don't have a darkroom, but it's hard to keep the faucet stream from striking the prints directly. Partially fill a 35-mm film can and turn it upside down under the stream. The dimple in the bottom makes a perfect water deflector and centers the can under the flow. A kitchen-sink cup strainer placed upside down over the drain keeps prints from being sucked down against it.—Art Emerson



AN ORDINARY WHITE UMBRELLA and this tilting bracket can give you a bounce-lighting setup similar to costly commercial units for only a few dollars. Hack-saw the handle off the umbrella and insert the shaft into a blind hole drilled in a small block of wood. Drill another blind hole in a second block of wood to slip over the top of a light stand. Fasten the two blocks together with a bolt and wingnut. A bracket to support light source can be made from a flat corner angle screwed to the upper block and bent as shown. Any light source—strobe, flashbulb or photoflood—will work well with the setup.—R. S. Hedin

Hottest Line In the World

735,000 volts make Hydro-Quebec's power complex the highest voltage transmission system in the world

By ROBERT DYMENT

HYDRO-QUEBEC'S 735,000-volt alternating-current transmission system is the highest-voltage commercial transmission system (either a.c. or d.c.) now operating anywhere in the world.

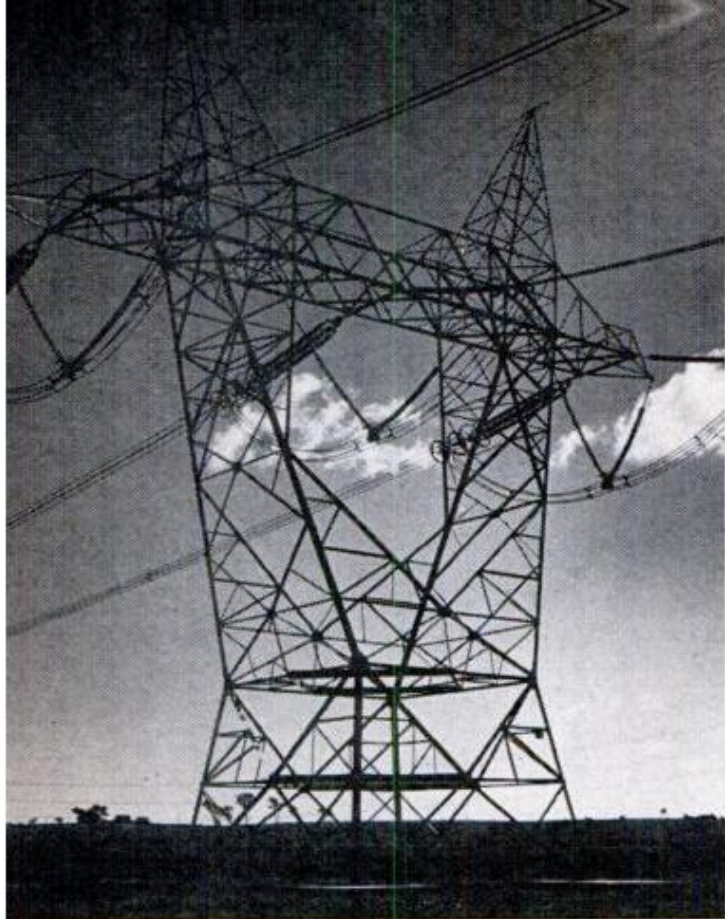
Hydro-Quebec developed this system to transmit power from its remote Manic-Outardes hydroelectric complex to the load centers in Quebec City and Montreal. The same voltage level will be used in the future to transmit power from the huge Churchill Falls hydroelectric station being built in Labrador.

The \$1.2 billion Manic-Outardes complex will ultimately consist of seven new power stations with a combined generating capacity of 5.5 million kilowatts on the parallel Manicouagan and Outardes Rivers. Construction of this complex reached an important stage in 1968 with the completion of Manic 5 dam (since renamed the Daniel Johnson Dam) which is the largest multiple-arch dam in the world and has created an 800-square-mile reservoir with twice the storage capacity of the next largest man-made reservoir on the North American continent.

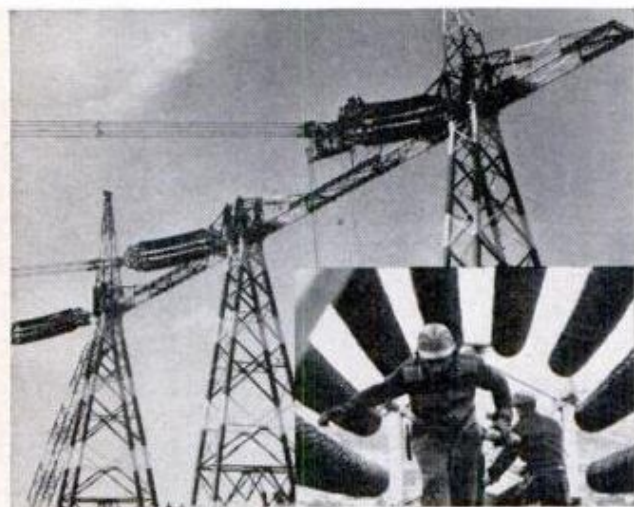
During the three years from the decision to proceed with the 735-kv system to the actual placing-in-service, entirely new equipment had to be designed, fabricated and tested, the route had to be surveyed and cleared from Manic-Outardes to Montreal, and the line had to be erected, much of it through rugged country, far from civilization and transportation.

Natural obstacles included four river crossings requiring the longest spans of

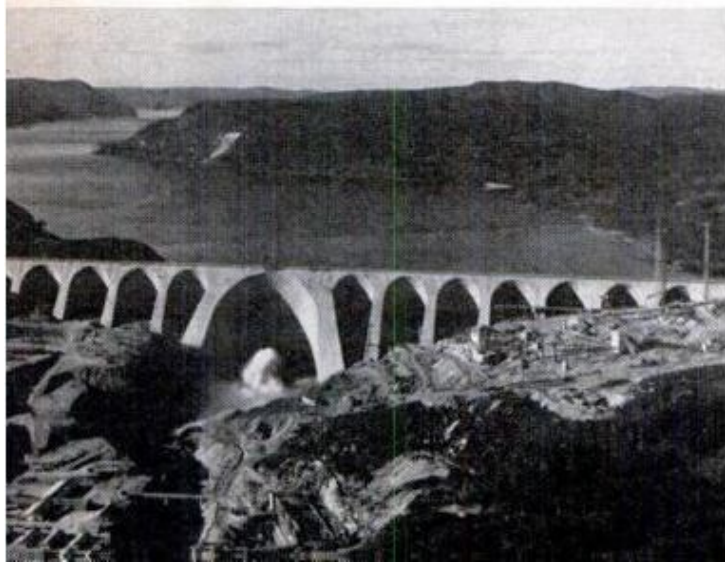
DANIEL JOHNSON DAM, the world's largest multiple-arch dam, is system's main generator of electricity



HEIGHT OF TOWERS varies from 132 to 212 feet. The spans generally range from 900 to 3000 feet long

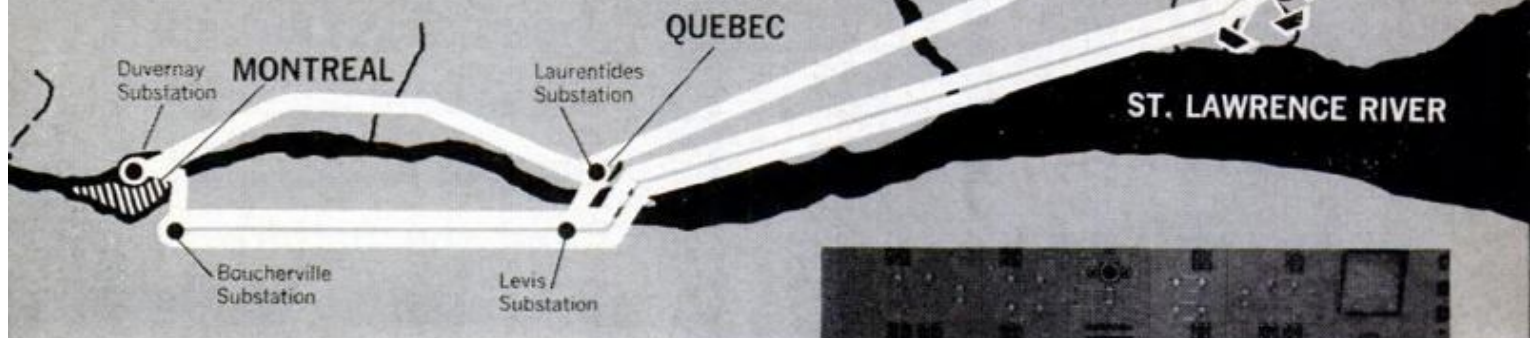


ANCHOR TOWER atop cliff 796 feet above Saguenay River supports a record span of 5875 feet. Each insulator assembly is 43 feet long (see inset), has 12 chains with 33 insulators and weighs 8 tons



735-kv Substation
Generating Station

POWER FROM CANADIAN WILDS flows to Quebec and Montreal from seven generating stations on the Manicouagan and Outardes Rivers. As new stations are added, another line will be built to Montreal



bundled conductor in the world. In the longest of these crossings, the line spans 5875 feet between anchor towers on opposite banks of the Saguenay River near Tadoussac, where the cliffs rise 608 feet high on one side and 796 feet on the other.

Hydro-Quebec emerged as a world leader in transmission technology, with an economical and highly successful transmission system that has inspired new impetus in extra-voltage research and development around the world.

When the 5,225,000-kilowatt Churchill Falls power station goes into operation, its power will not only be transmitted over 735-kv lines, but these lines will be integrated with Hydro-Quebec's existing 735-kv system. Hydro-Quebec, which has a financial interest in Churchill Falls, will buy virtually all of the power produced.

Churchill Falls will be larger than any hydroelectric station in the world, and is the largest civil engineering project under construction in the Western Hemisphere. It lies 700 miles northeast of Montreal in a direct line. The first generating units at Churchill Falls will be commissioned in 1971. When the station is completed, three new 735-kv lines will be built between it and the Manic-Outardes substations, and additional lines will be built to expand capacity of the existing 735-kv system between Manic-Outardes, Quebec City and Montreal.

When the Churchill Falls lines are completed, they will approximately triple the length of lines originally planned for the Manic-Outardes complex. ★★★

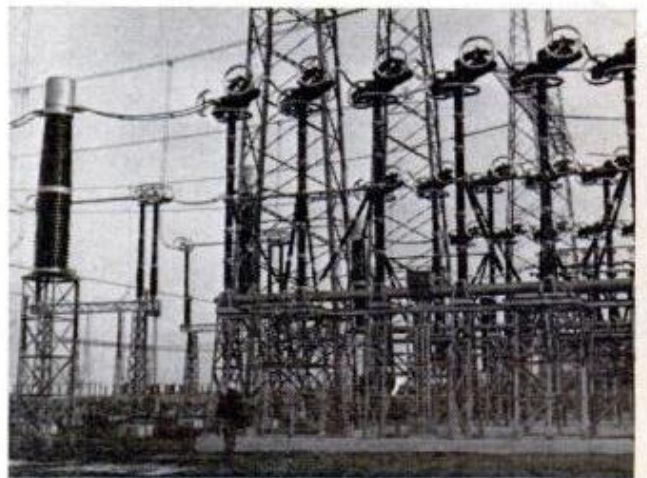
SPECTACULAR ELECTRIC ARCS are caused by the opening of a disconnecting switch at Levis substation

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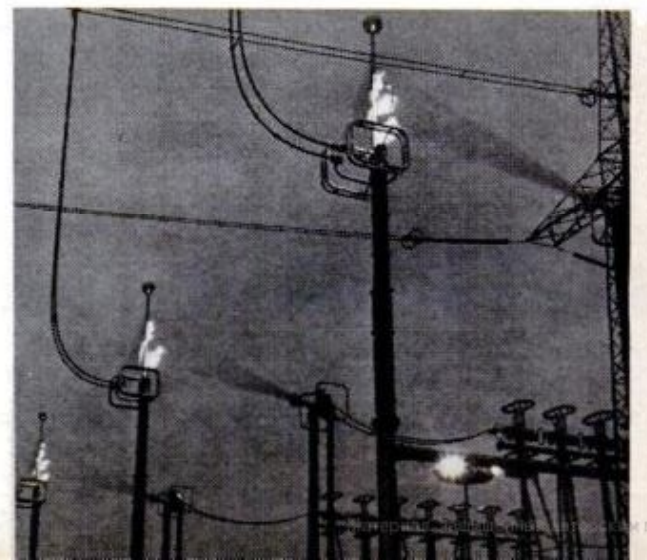
149



CONTROL ROOM at Levis substation. Lines also serve as a telecommunication system between substations



THREE-POLE CIRCUIT BREAKER at the Levis substation has 12 chambers per pole; longest on line is 53 feet



How to Read Your Tires For Front End Troubles

Don't just check your tires for obvious damage or the amount of tread left. Read the pattern of tread wear for a sure indication of exactly what may be amiss in your auto's front end

By MORT SCHULTZ

PREMATURE and irregular wear of tire tread is the surest clue to trouble in your steering or suspension system. The wear pattern will even tell you if the trouble is a simple misalignment condition or a worn or loose part.

Most of us know an underinflated tire shows maximum wear on the outside edges of the tread and little wear in the center, while overinflation causes heavy wear in the center of the tire as shown in Figs. 1 and 2, respectively. More complex wear patterns are also easily "read" and interpreted: toe wear, for example.

Toe-in and toe-out refer to the difference in measurements between the front of the front wheels and the rear of the front wheels. Correct toe alignment allows the front wheels to roll freely without any detrimental force acting upon the tires. If toe is not in alignment, front wheels work against each other to scuff tires and produce wear.

There are two kinds of toe wear: constant and intermittent. Constant toe wear is caused by an improper toe-alignment setting and is corrected when alignment is readjusted to specification.

Intermittent toe wear occurs when a front-end part is damaged and causes toe adjustment to bounce alternately out of and into proper setting. Putting the car on a front-end alignment machine won't tell you if an intermittent toe-wear problem exists, because the vehicle is at a standstill and under a fixed load. Intermittent wear occurs when the car is being driven and the load varies.

Thus, the only sure way to know if you have an intermittent toe-wear problem is to read the tire. Look for scuffing of several of the tread ribs in the center of the tire. The outside edges of the tire will show little or no wear (Fig. 3).

By comparison, if you have a constant toe-in or toe-out problem, *all* tread ribs (not just some) will show wear (Fig. 4). If the condition is toe-in, the outside edges of the ribs will show wear while the inside edges will have a sharp, ragged pattern. If the condition is toe-out, the same pattern will be formed, but in reverse.

Steering and suspension problems that create an intermittent toe-wear condition are sagged springs, worn or loose ball



FIG. 1. Excessive wear on the outside edges of any of your four tires indicates they've been running with insufficient air pressure. Check the pressure every week



FIG. 2. Excessive wear of the center tread indicates running with tires overinflated. Always check and inflate your tires before driving, while they're cold



FIG. 3. Center tread scuffed, as opposed to evenly worn as with overinflation, is a sure indication of intermittent toe wear. Cause is damaged front-end part



FIG. 4. Scuffing over the entire width of the tire indicates incorrect toe alignment—a constant toe-wear condition. Tread pattern gets a ragged appearance



FIG. 5. Excessive tread wear on the inside edge of a front tire indicates constant excessive negative-camber condition; on outside, excessive positive camber



FIG. 6. Tread wear, on the inside or outside edge, that is spotty indicates intermittent camber wear. The characteristic "knotty" wear pattern is very noticeable

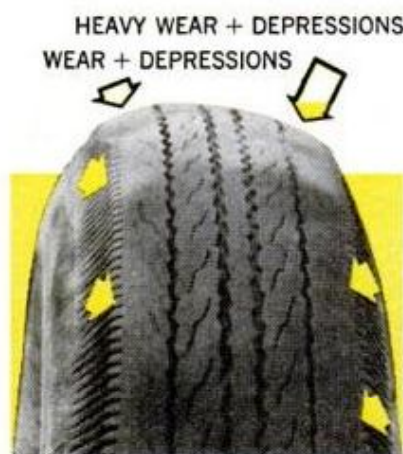


FIG. 7. Tread worn more on one side than other and numerous depressions worn into tread means multiple problem—in this case, worn ball joint, wrong camber



FIG. 8. Erratic wear on one side and sharp, feather edges worn on the other indicate loose suspension part (here, a control arm) and excessive toe-out condition



FIG. 9. This tire was ruined in 3000 miles of driving. A combination of worn upper control-arm bushings, loose ball joints and a loose idler arm caused the wear



CHECK FOR SAGGING SPRINGS by measuring height to fender well on both sides of car. Check for equal tire pressure first



TIE RODS should be checked for play and replaced if any is present. Tie rods are usually split for easier replacement



STEERING IDLER ARM (arrow) can be tested for play by twisting it and adjacent rods

joints, worn or loose tie-rod ends, loose idler-arm bushings, loose bushings on the upper and lower control arms, and bent spindle supports or steering arms.

Camber wear is another problem that can be read on your tires. Camber refers to the inward or outward tilt of a wheel, and is the angle made by the center line of the wheel and true vertical. The inward tilt of a wheel is called negative camber, and the outward tilt is known as positive camber.

As with toe wear, there are two types of camber wear: constant and intermittent. Constant camber wear (Fig. 5), as with constant toe wear, results from improper alignment and is alleviated when camber is set to manufacturer's specifications. You'll know when too much constant positive camber is a problem if the outside edge of the tire tread shows accelerated wear. Excessive negative camber is demonstrated by excessive wear to the inside edge.

Intermittent camber wear results from a bad part in the front end. Keep in mind that almost every steering or suspension part that is sufficiently damaged to cause intermittent camber wear will also produce some degree of intermittent toe wear.

If the wear on the tire is caused predominately by a change in camber, then tire wear will be uneven or spotty and the worn spots will be "knotty" in appearance and show up more toward the side (Fig. 6). Those conditions which cause intermittent changes in camber are worn ball joints, worn bushings on the upper and lower control arms, a bent spindle support, and sagged springs.

The shorter radius followed by your inside wheel than the outside wheel in a turn is obtained by introducing a toe-change that varies in proportion to the degree of the turn. Were it not for this deliberately calculated toe change, the front wheels would scuff badly.

Wear produced by incorrect turning radius usually appears as normal tread wear except that the tires wear more than normal for the distance traveled. Wear is often heavier at the tread edges, and the tires will squeal on turns—even at slow speed.

The two problems which affect turning radius most often are worn tie-rod ends and loose idler-arm bushings. Other problems that can lead to the condition are worn ball joints, worn control-arm bushings and a bent steering arm.

The tire-wear pattern becomes complicated when a combination of the aforementioned front-end problems occurs. When tire wear of the types illustrated in Fig. 7 to 9 appear, you must look for damaged parts in the suspension and steering,



FRONT-END ALIGNMENT is a must after replacing a steering or suspension component. A good auto shop is best equipped to do a quick, accurate alignment

align the front end to specification, and balance the wheels.

Checking for ball-joint looseness is a story in itself and will be discussed in detail in next month's *Saturday Mechanic* feature. Upper and lower control arms are usually spoken of in the same breath as ball joints. When they're worn they'll demonstrate some play. Even more of an indication of a damaged control arm, though, is one which appears twisted.

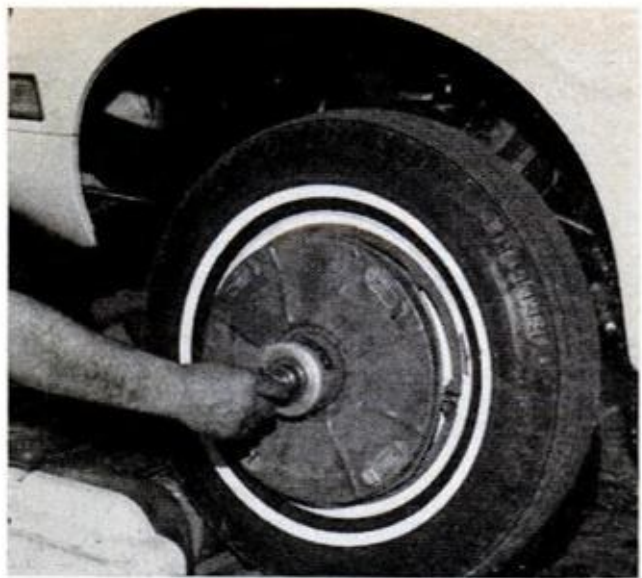
To check for sagged springs, make height measurements from the rocker panels or fender wells to the ground.

Improper wheel balance can ruin tires as quickly as any of the conditions we've discussed so far. There are two kinds of wheel imbalance: static and dynamic. Static imbalance causes a car to vibrate vertically. One or more areas of the tire are forced heavily against the pavement with each revolution of the wheel. Dynamic imbalance causes horizontal vibration. The wheel oscillates, and a scuffing condition is created that soon produces flat spots in the tire.

With static balancing, a weight equal to the heavy spot on the wheel is placed opposite that spot. In the case of dynamic balance, a weight equal in mass to that on the outside of the wheel is placed at the same point on the inside of the wheel.

Other forces that contribute to poor front-end characteristics are bad shock absorbers, loose front-wheel bearings and dragging or unequally acting brakes. To assure perfect stability and long tire life, check these, too. ★ ★ ★

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WHEEL BALANCE should be part of front-end alignment. Tire scuffing, flat spots and vibration and shimmy in your steering wheel indicate imbalance



COUNTERBALANCE WEIGHTS are placed on wheel rims at points determined by spinning wheel at high speed with professional wheel-balancing equipment



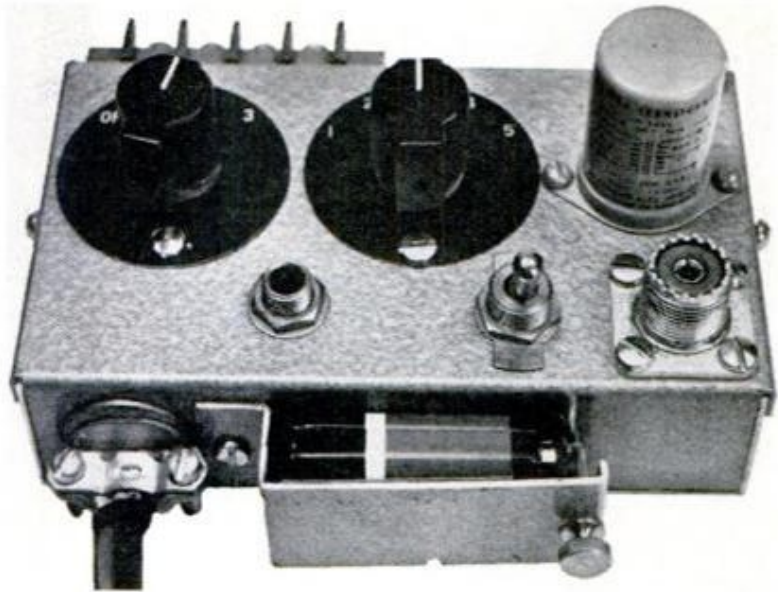
SHOCK ABSORBERS are among suspension components that affect front-end characteristics and tire wear

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Tune in Shortwave

On That Transistor Portable

By NORMAN FALLON



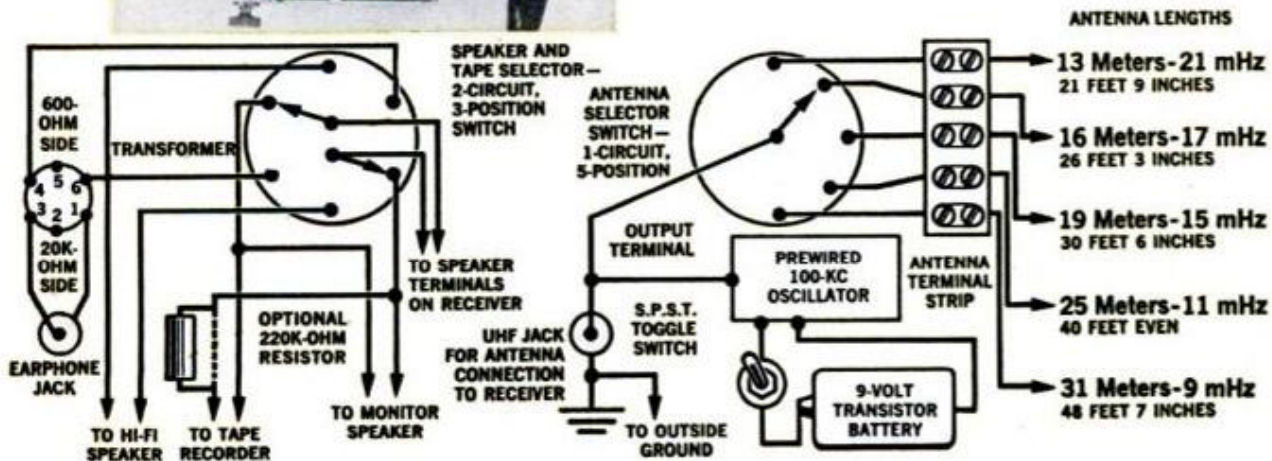
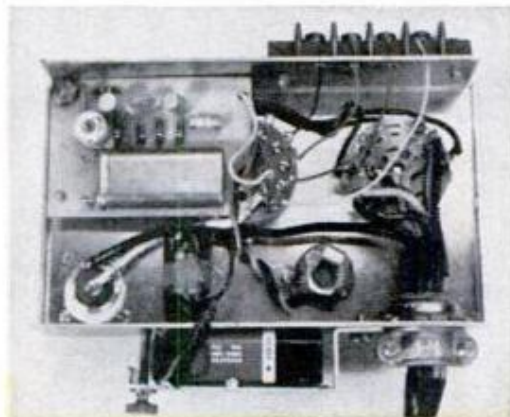
This handy, home-built antenna selector can pull in shortwave on a small transistor portable as well as improve reception on expensive multiband receivers. It also lets you control a tape recorder and external speaker

MOST SMALL RADIOS have more in them than you'd guess. Many are capable of receiving one or more of the international shortwave bands commonly in use, but you'd never know it because the tiny antenna built into such sets isn't

powerful enough to pull in distant stations. Even multiband sets designed for shortwave reception need an external antenna for best results. The question is what antenna? Which type for what broadcasts? An antenna that's right for one shortwave band is wrong for all the others.

The handy antenna selector shown here can solve the problem. It gives you a choice of up to five different external antennas, each tailored to a particular shortwave band. The antennas are ended Hertz half-waves cut for the 13, 16, 19, 25 and 31-meter bands. The table below gives the exact length each should be.

The antennas are selected by a rotary



switch wired to the antenna connection on your radio. Most of the better transistor portables and multiband shortwave receivers have jacks for an external antenna, but some may not. If necessary, you can have one installed at a radio shop.

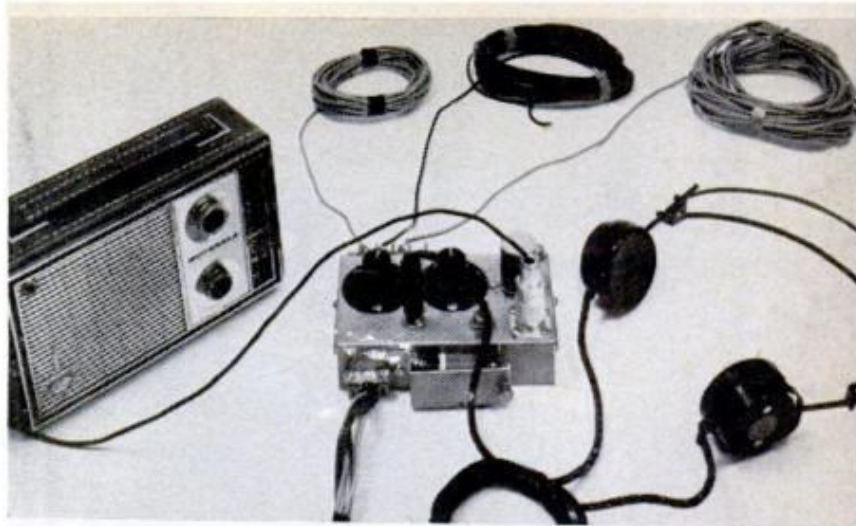
Use stranded 18-gauge copper wire for the half-waves. Wires can be strung around a room, hung out a window or attached to a tree for temporary use. The control is designed mainly for portable operation, not permanent installation. A battery-powered 100-kc oscillator (Peterson Crystals, Model PR-100) is included in the circuit for listening to code with sets that have a BFO (beat frequency oscillator). This can be omitted if you're not a code enthusiast.

A second rotary switch makes the antenna selector an even more versatile control center for shortwave listening. This is connected to the radio's remote-speaker jack and lets you feed the sound to a tape recorder, earphone jack or hi-fi speaker. For taping shortwave broadcasts off the air, a monitor speaker is wired in parallel with the recorder. This way, you can hear what you're recording over the monitor.

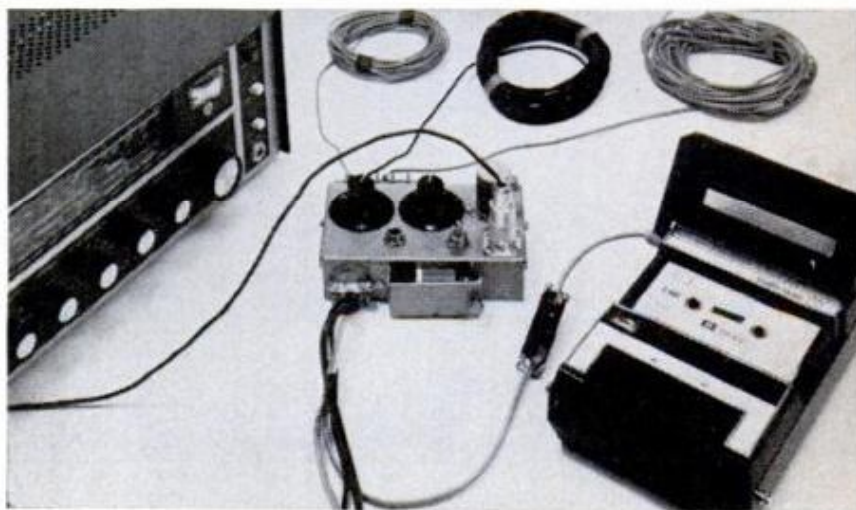
The optional 220K resistor is needed only if you feed the signal into your tape recorder's mike input. If your recorder has a high-level input in addition to the mike jack, you can use it and omit the resistor. For earphone listening, there's a separate switch position that incorporates a transformer for proper impedance match. This is a 20K/600-ohm plate-to-line transformer used in reverse. For minimum signal loss, a coaxial UHF plug and jack are used for the connection from the control box to the radio's antenna terminal, but these are not a must.

The parts all fit in a small chassis box measuring about 4x5 inches. The transformer can be mounted on the outside, as shown in the photos.

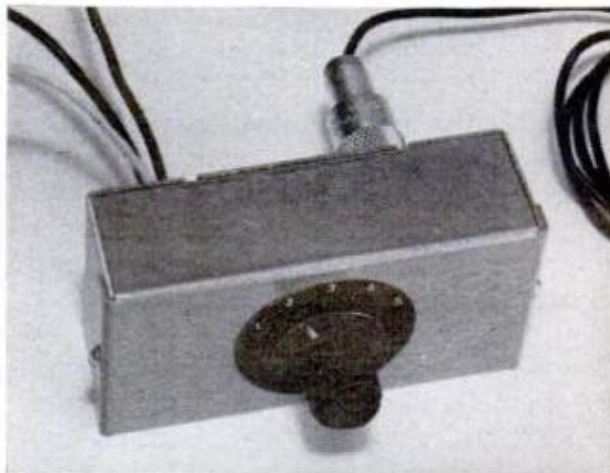
If you want just the antenna selector and don't need the other features, you can build a simpler version of the control shown in the photo at right. ★★★



AT THE TWIST OF A KNOB, you can switch in up to five external half-wave antennas for best reception on the five international shortwave bands. Control also has provision for plugging in earphones for precise tuning of distant stations



TAPING SHORTWAVE BROADCASTS is easy with a recorder connected to the control. You can listen in on a monitor speaker at the same time you record so you can tell what you're getting. Cassette recorder, like one shown here, works fine



SIMPLIFIED VERSION has rotary switch for selecting up to five external antennas, but omits the speaker and tape control. Wires shown at the left run from a terminal strip on the back to the antennas. Connector at the right is UHF type with a wire running to the antenna connection on the receiver



What You Should Know About Home Burglar Alarms

Any home is a potential target for the break-in artist. But you can do something to protect your family and property. Here's how

By **STEVEN J. HOWARD**

Illustration by Herb Mott

HIGH, low and middle-income families have one thing in common: They're all fair game for burglars. FBI statistics show that in 1968 almost 2 million American homes were illegally broken into. Police tell us that the rate will be even higher this year.

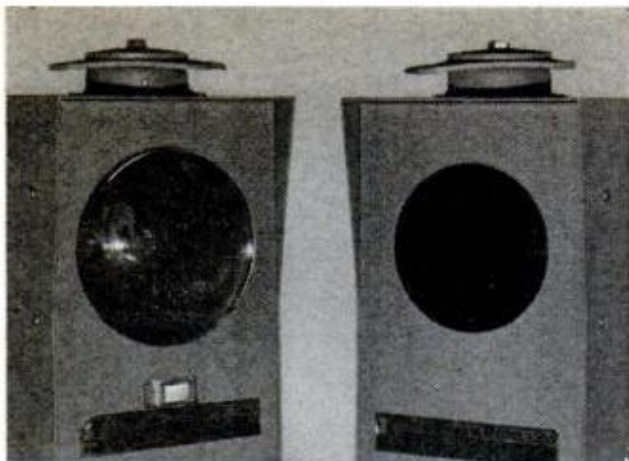
Happily, you can do something to protect your family and property. Properly installed, a burglar-alarm system will warn you of a break-in, and, in many cases, scare off the burglar.

What kind? Since intrusion devices cost from around \$1 to several thousand dollars, the answer to that question depends on what—and from whom—you want to

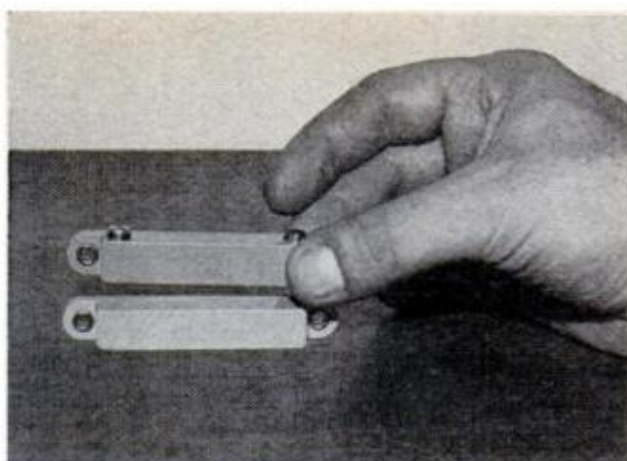
guard. A wealthy man, for example, may keep art treasures, multicarat diamonds and sterling silver in his home. His adversary is the slick professional thief who spends days or weeks "casing the job" before making his move. An alarm system that will stop this pro has to be sophisticated and expensive.

A proximity device would be the best bet for our rich friend. It sounds off when someone approaches to within 2 feet of an object such as a safe. Closed-circuit TV is another solution. Whatever the device, an expensive system is usually connected directly to police headquarters or to a central control station where a private investigator or guard is on duty.

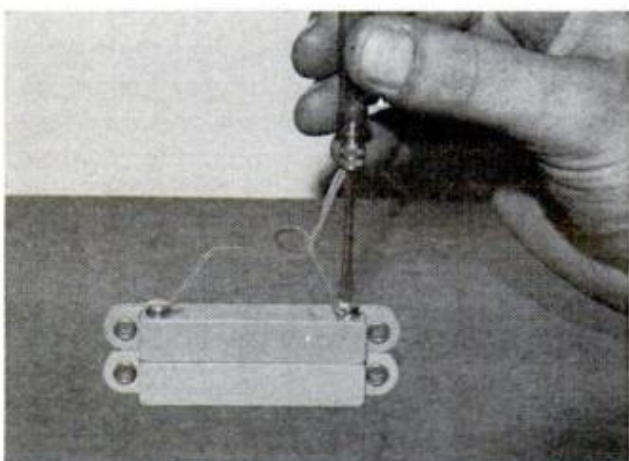
But, most of us don't have to worry about the professional burglar. Our enemy is the vandal and penny-ante thief—amateurs who operate in hit-and-run fashion. In his haste to enter, this type burglar is more apt to blunder upon an alarm, so a less expensive system should



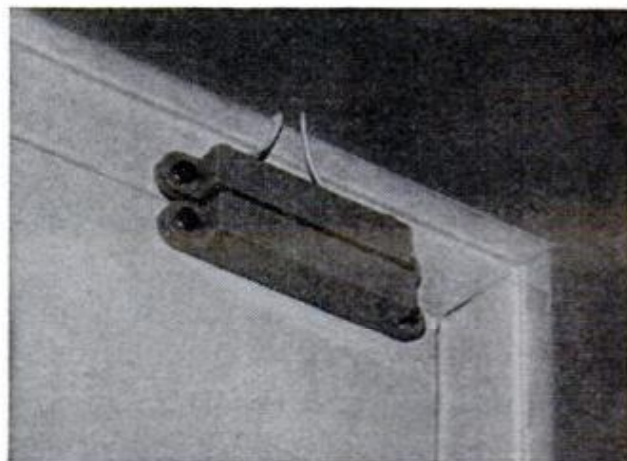
THIEF (left) sets off alarm when he interrupts infrared beam between lamp and receiver (shown above)



PERIMETER DEFENSE is installed by aligning and screw-fastening two contacts on door or window



WIRE IS CONNECTED to the primary contact and run along moldings or baseboard to other contacts



CONTACT SWITCH installed on door is magnetic type. All switches in system tie into one control box

be adequate for the job you have in mind.

Even a homemade system is often effective since the one thing a prowler does not want is attention. Bells attached to doors and windows, which clang loudly when disturbed, will make him quickly leave the scene.

Commercial alarms

One of the most effective systems to guard against a break-in through doors and windows is the perimeter alarm. Literally, the house is encircled with an electric barrier. Contact (magnetic) switches attached to doors and windows are wired in series and connected into a control box that has a switch which turns the system on and off. When a window or door is forced, contact is broken, resulting in a resounding wail.

Once a perimeter alarm is tripped and contact is broken, it cannot be turned off by closing the door or window. It has to be done at the locked control box. This

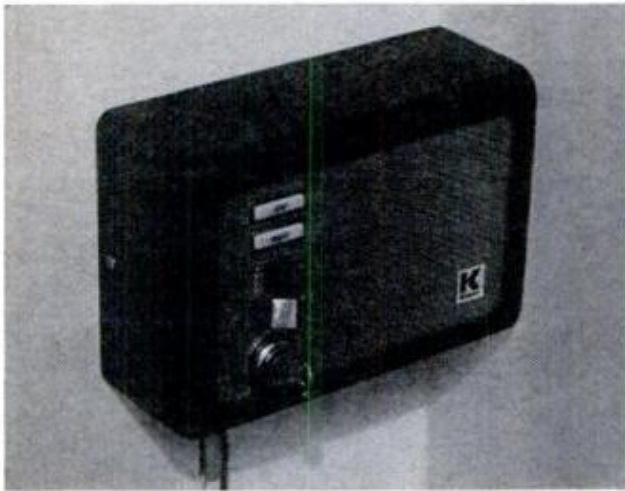
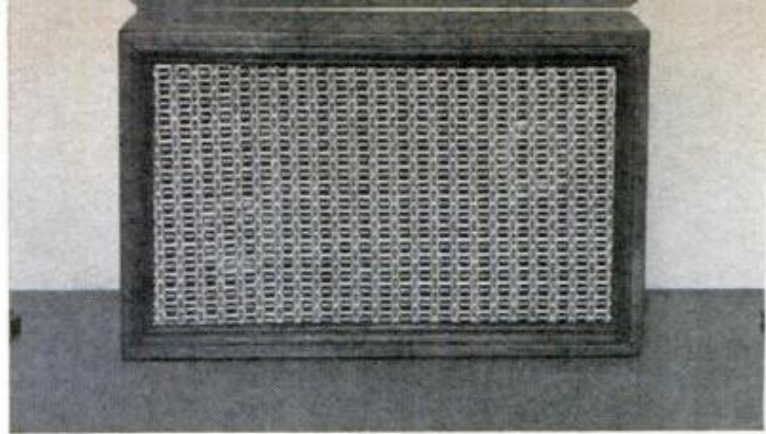
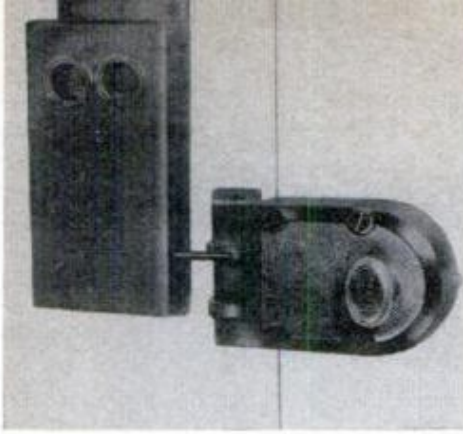
feature applies to all commercial alarms.

In selecting a system, look for one that operates on both a.c. and battery pack. The batteries automatically take over the function if house current fails or is *intentionally* disrupted.

If you install it yourself, a perimeter-alarm system will cost about \$100 for the control box and \$4 for each contact set. One contact set is needed per window and door. Double-hung windows, however, require two, one for the lower sash and one for the upper.

Since every opening in the house does not have to be fitted with a contact, you can cut costs by prudently planning your installation. For example, in an upper-story apartment the entrance door(s) only would require them. Or, in a several-story house, the only installations upstairs would be on doors and windows that lead to a deck or balcony.

Another type of intrusion alarm is the ultrasonic motion detector. One version is



SINGLE-STATION ALARM (top left) attached to door gives signal if there is any door movement. Control box (left) contains signal and battery; it features a three-way switch—off, exit and night. The "speaker" above is actually a motion detector alarm

a box that contains several transducers, a receiver and an alarm signal. It's a low-voltage device that is plugged into a wall outlet that also has a battery backup.

Motion detectors are excellent for guarding one room or a specific area. For example, some people use them to overlap the protection provided by a perimeter system. Thieves who are alarm conscious disregard windows and doors and look for another entrance—like cutting a hole in the roof to enter the attic. A motion detector in the attic will sound the alarm.

The transducers flood a room or area with ultrasonic sound waves in the frequency of 19.2 kc, which is just outside the audible range of the human ear. Any motion in the room interferes with the sound wave pattern, upsets the balance in the receiver and sets off the alarm.

A motion detector, capable of guarding an area that is 10 x 15 x 15 ft. costs about \$200. One drawback with this type detector is that false alarms can be a problem. To illustrate, a detector set up to protect a room at night will let go a blast if disturbed by someone getting up for a drink of water.

A third type of intrusion device is a photoelectric receiver and sender. Like a motion detector, its value is in protecting

a single room or specific area. Outfitting an entire house with photoelectric or motion detection devices is far more expensive than installing a perimeter system but no more effective.

The lamp of a photoelectric system projects an invisible infrared beam of light to the receiver. When an intruder interrupts the beam, the circuit is broken and the alarm sounds. Photoelectric burglar alarms cost from \$130 to \$230, depending upon their range of coverage.

Finally, there's the family of single-station intrusion alarms that are mechanical or electromechanical in function. They are designed to guard a specific door or window. They incorporate in one box the means of activating the alarm, and the alarm signal itself.

Single-station alarms are priced from as little as \$1.50 to about \$25. But, it's not economical to outfit every door and window with them. Single-station alarms are intended to protect one or two openings. Some in the lower price ranges have signals which are too soft to awaken a sound sleeper. Before you buy one of these, test its signal. Since single-station alarms are usually battery-operated, remember to check batteries regularly.

Unlike fire-alarm systems, home burglar alarms are not tested by the Underwriter's Laboratories or any other independent testing agency. However, systems made for industry are. And, you can often buy components for your home system which are made by the manufacturers of these commercial systems. You can get a list of these manufacturers by writing to the National Burglar and Fire Alarm Assn., East Orange, N.J. ★★★



TAKE-APART ICE RINK

HERE'S AN ICE-SKATING RINK that keeps its cool even when the temperature climbs above freezing. The secret is the thickness of the block of ice.

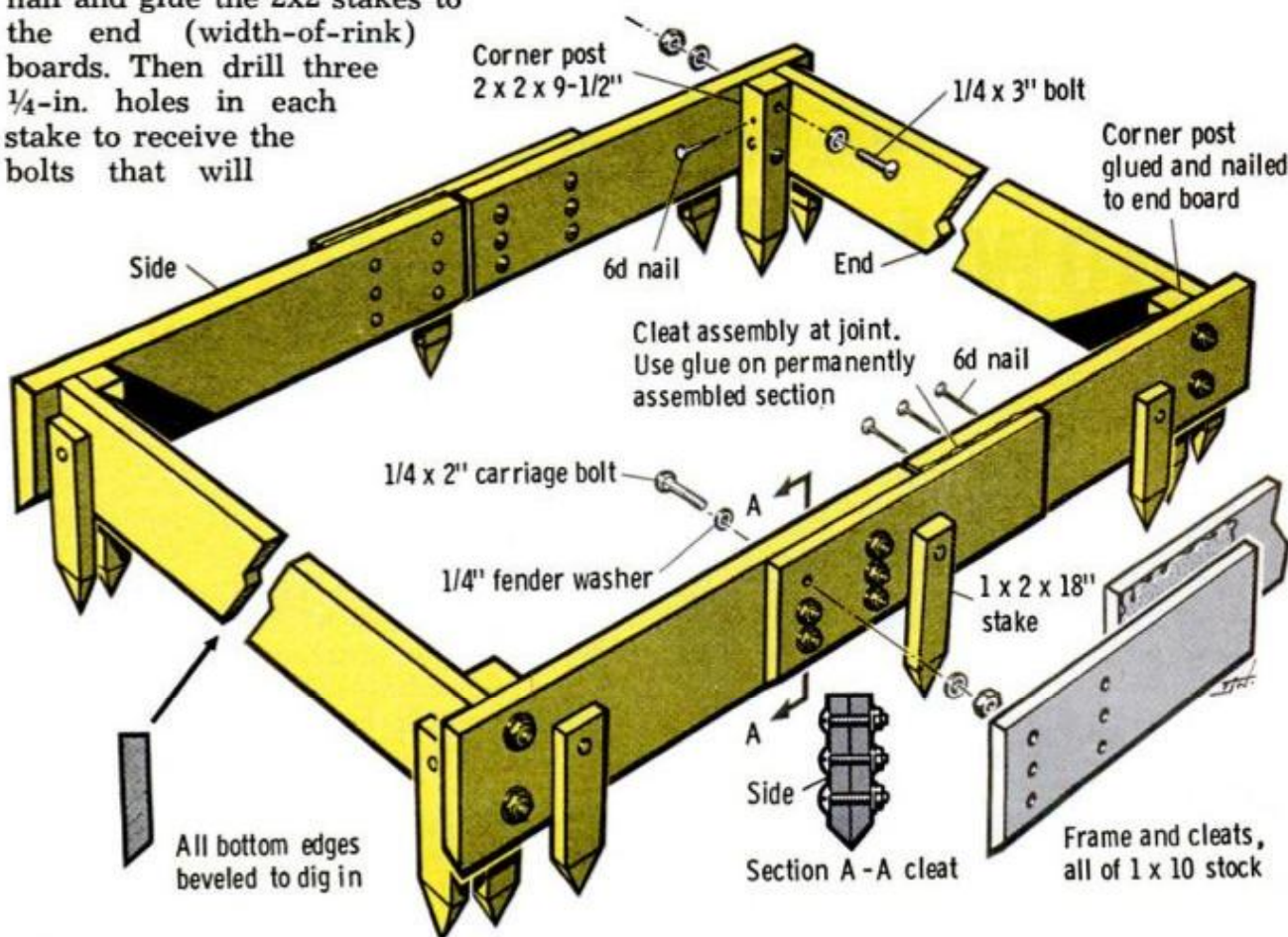
Made of spruce, the rink is assembled with bolts; thus, it can be disassembled, stored away and reused for years. For long sides where boards are butted end-to-end, battens are used to overlap joints on the outside of the rink. To retain the take-apart feature, the battens are nailed and glued to one board only. Bolts, nuts and washers are used on the other board.

After determining the size of your rink, nail and glue the 2x2 stakes to the end (width-of-rink) boards. Then drill three 1/4-in. holes in each stake to receive the bolts that will

hold the sides. After the rink is bolted together, drive the 1x2 stakes spaced about 8 ft. apart. Nail the boards to the stakes and then tap the stakes down slightly to pull the boards tight to the ground.

The flooding operations can be started after the temperature drops below freezing. By using an oscillating sprinkler rather than a garden hose, water is distributed over a large area. Using this method the water freezes quickly and saves buying polyethylene, as is the usual practice for backyard ice-skating rinks.

—Walter E. Runkel





How to Tile a Ceiling

ARE YOU THINKING of tiling your basement ceiling? Fine, but if it's your first tiling job, there's a right way to begin to assure a first-class job.

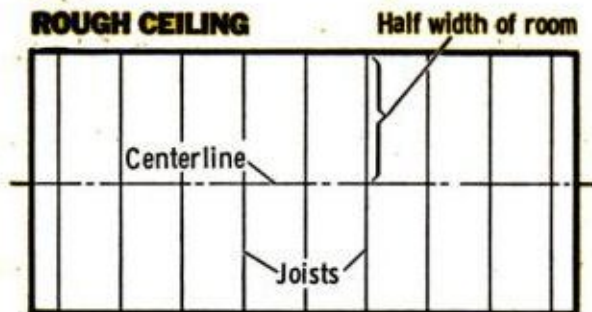
Before applying the tile it is important, as pointed out by Boise-Cascade, to make a layout of the ceiling. This is done by drawing the ceiling to scale, showing the locations of light fixtures, heat registers, ducts, pipes and any other features that should be considered. The widths of the border rows of tile should then be determined and the tile joint locations shown on the drawing. It is generally good practice to make the layout so that the border rows come out a half-tile or wider as this

contributes to both good appearance and economy of material.

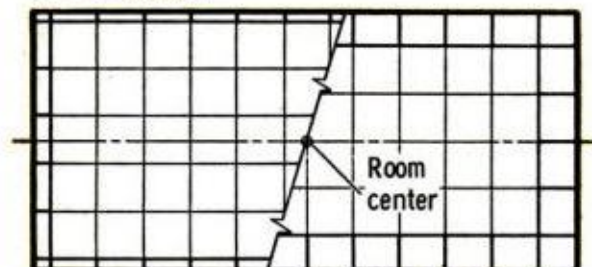
The tile can be applied directly to a continuous nailing base such as an existing drywall ceiling. For open joists, or to cover old plaster ceilings, install 1x3 softwood furring strips at right angles to the joists. Fasten the strips by nailing into the joists. Place the furring on 12 or 16-in. centers at ceiling-tile joint locations to suit the size tile being used.

Begin application of the tile in a corner and work along the wall on a line parallel to the center line of the room. It is essential that this first row of tile be laid along a chalkline or straightedge as this will

ROUGH CEILING



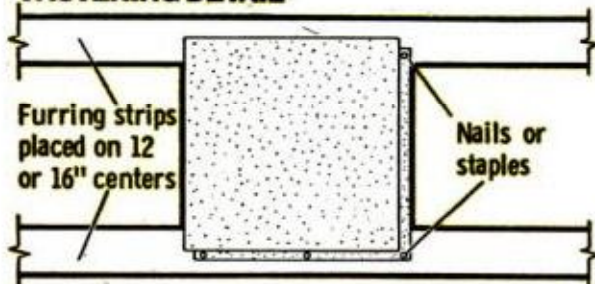
TILE LAYOUT



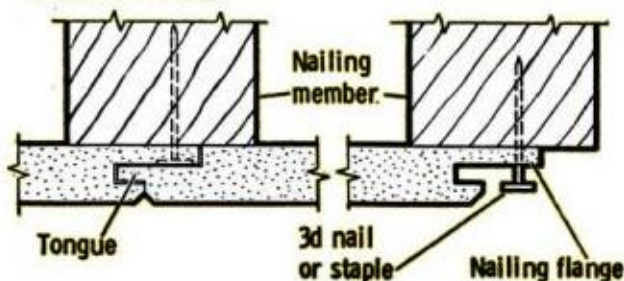
Avoid border rows less than one-half tile width

Preferred border rows greater than one-half width of tile

FASTENING DETAIL



JOINT DETAIL



affect the appearance of the entire job.

Place the starting tile, either a full-sized or a cut one, as the case may be, so that the two flanged edges point toward the area to be covered. To cut the tile use a sharp knife, power saw or a fine-tooth handsaw. Saw with a minimum of pressure. To fasten use 3d (1 $\frac{1}{4}$ in.) box nails or staples with $\frac{1}{2}$ -in. (minimum) legs.

If the outside edges of the tiles are to be covered with a molding, face-nail them with large headed nails. Otherwise, use brads or finishing nails driven at an angle (in crisscross fashion for better holding) with heads countersunk slightly below the surface. ★ ★ ★

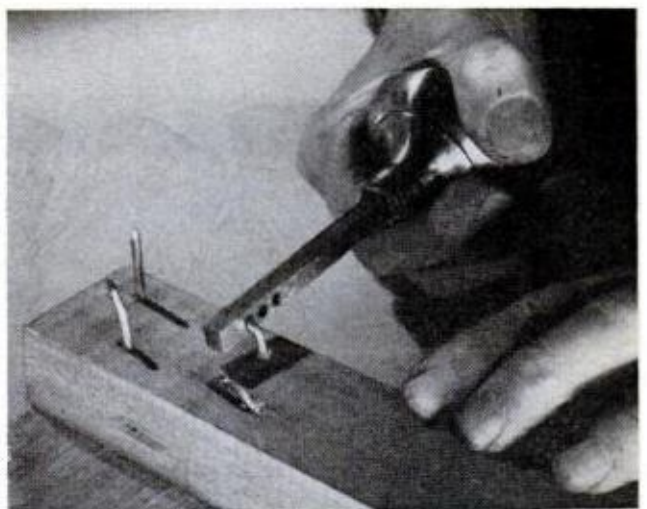
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HINTS FROM READERS



Auto mechanic's toolholder

A clean paint-roller tray makes an ideal tool and small-parts holder when you make repairs on vehicles or farm machinery. In use, the holder saves searching in the grass for dropped parts. It also avoids the possibility of inadvertently putting a heavy tool on the fender and scratching the paint. Be sure the tray is reasonably level and solidly placed before throwing in the parts. And, if the parts are greasy, line the tray with aluminum foil or plastic wrap.—*John Krill*



Clinch nails in a jiffy

The proper way to clinch a nail is to bend the spiked end 180° (U-shaped), then drive the point into the wood. A doorknob with a square shaft makes a handy tool for this chore. Simply insert the nail point into one of the holes, twist the nail over and finish the bending with a hammer. Be sure the setscrew is well tightened in the knob to avoid stripping the threads on the spindle.—*Daniel Bousha*

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Make This Handsome Chess

Here's a chess set you can build that is fit for a king, queen, even a pawn. It easily copped first prize at the Michigan Industrial Education State Fair

THOUGH its exact origin is unknown, a generally accepted theory is that chess was imported to Europe from the Orient more than 1500 years ago. The game as we know it today, except for minor changes, is at least 600 years old.

While the shapes and sizes of the chessmen may vary, the checkered playing board is standardized around the world and consists of 64 squares—32 light colored and 32 dark. In our version, the board is of 1/2-in. plywood and the squares are made by tilting the table saw blade to 45° and running shallow V-grooves at right angles.

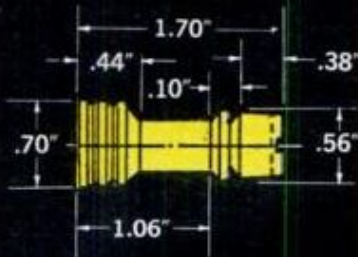
The contemporary chessman are machined on a metal lathe. One set is of brass while the other is of aluminum. Other combinations of metal could be used or, both sets could be aluminum with one set being anodized. To protect them when not in use, they are snugly stored in rattleproof drawers lined with Styrofoam.

Making the chessmen: Start by cutting the stock to length—allowing two chessmen to each length—except for the kings and queens. Cut a chessman out on one end of the stock, then reverse the stock end for end and turn the second chessman. Dimensions for all the chessmen are given below; use standard metal-lathe practice to cut them. The stylized king's crown is made using a jeweler's file. Carefully file the notches about 1/16 in. wide and 1/16 in. deep.

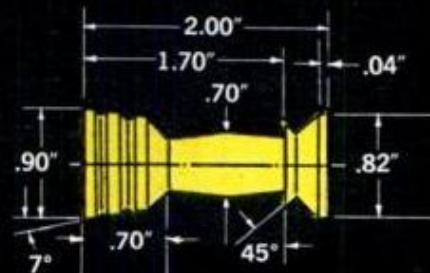
Finishing the chessmen: After each piece has been turned, leave it mounted and polish it dry with 240-grit emery cloth, then with oil. Next use 320 grit, also dry and then with oil. Use lacquer thinner and tissue paper to clean the piece while it is still on the lathe. Once each of the pieces has been cleaned make certain that they are not touched with the fingers.

Heat the piece with a torch until just warm—don't overheat. Then apply three

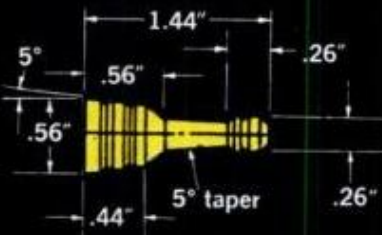
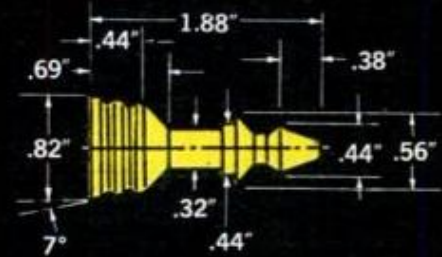
ROOK (make 4)



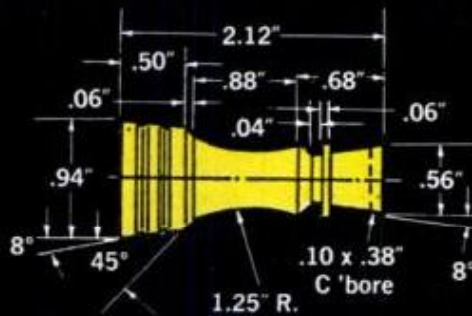
KING (make 2)



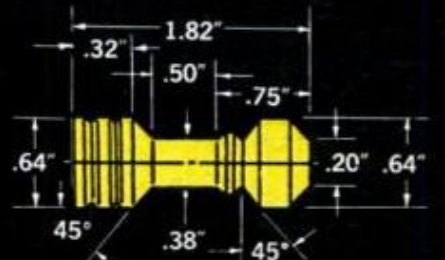
BISHOP (make 4)



PAWN (make 16)



QUEEN (make 2)



KNIGHT (make 2)

Set for Christmas

By BILL FIFER
and WALTER LANGE

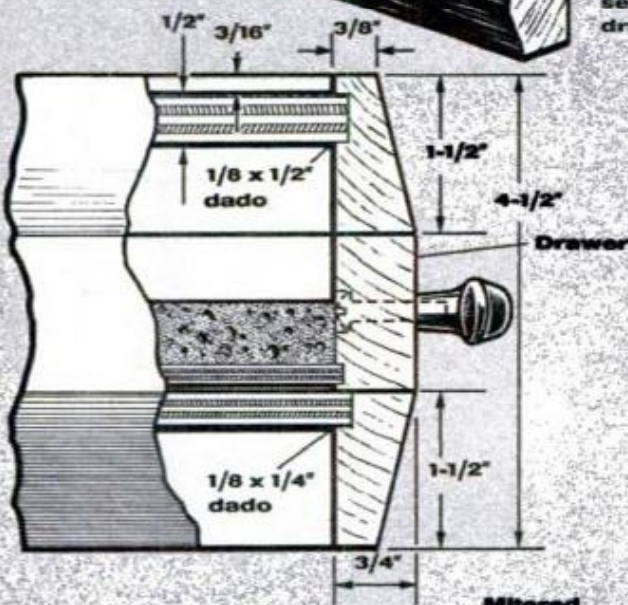
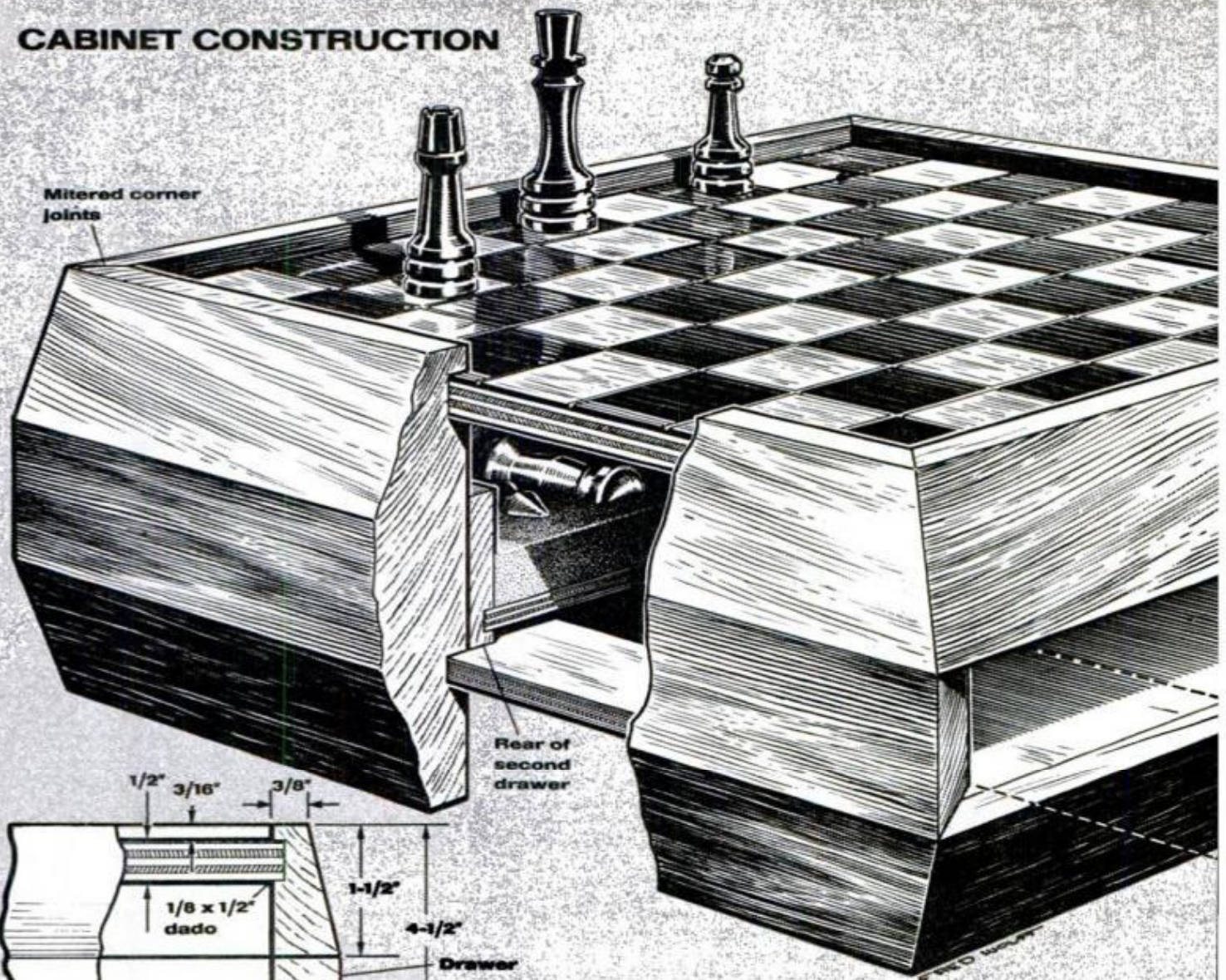


LATHE-TURNED MEN in gleaming brass and aluminum, used and stored in a rich walnut case, make this handsome chess set a unique conversation piece that's worthy of your finest craftsmanship. Each set stores in a drawer of its own and is cradled in a bed of Styrofoam. The chess playing surface is scored and squares are stained contrasting light and dark colors



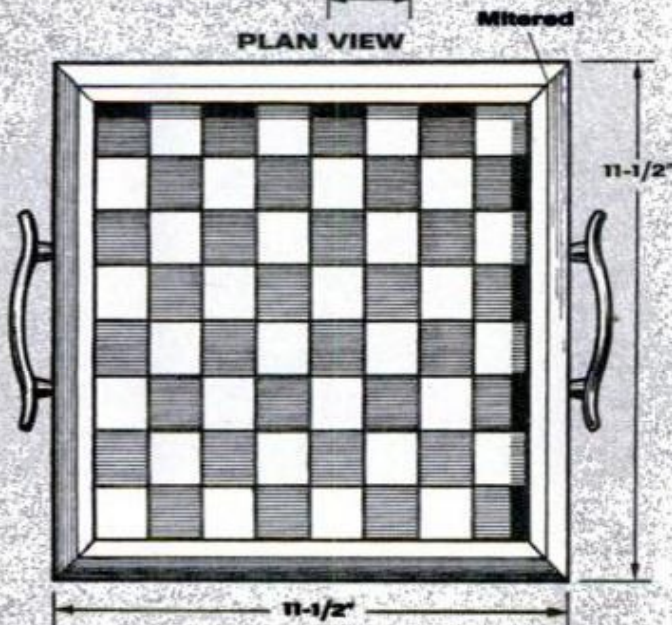
Photos by the Authors

CABINET CONSTRUCTION



GLEAMING BRONZE HANDLES accent walnut used for cabinet and drawer fronts, were purchased at a local hardware store. Drawers do not require backs, but Styrofoam should be cut oversize to insure a press-fit. Drawer bottoms can be of plywood as shown or, if preferred, of $\frac{1}{4}$ -in. tempered hardboard

Technical Art by Fred L. Wolff

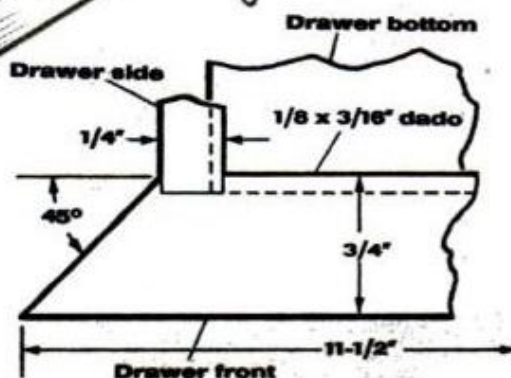
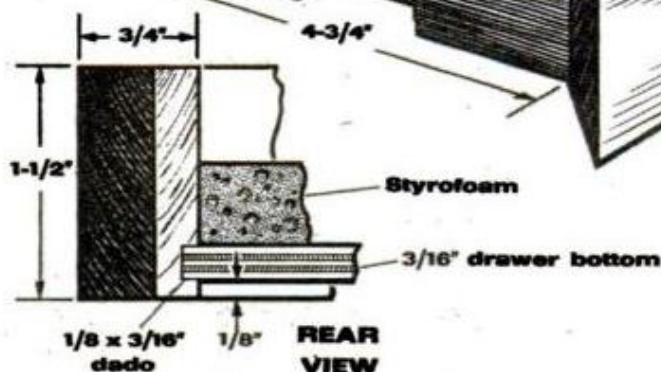
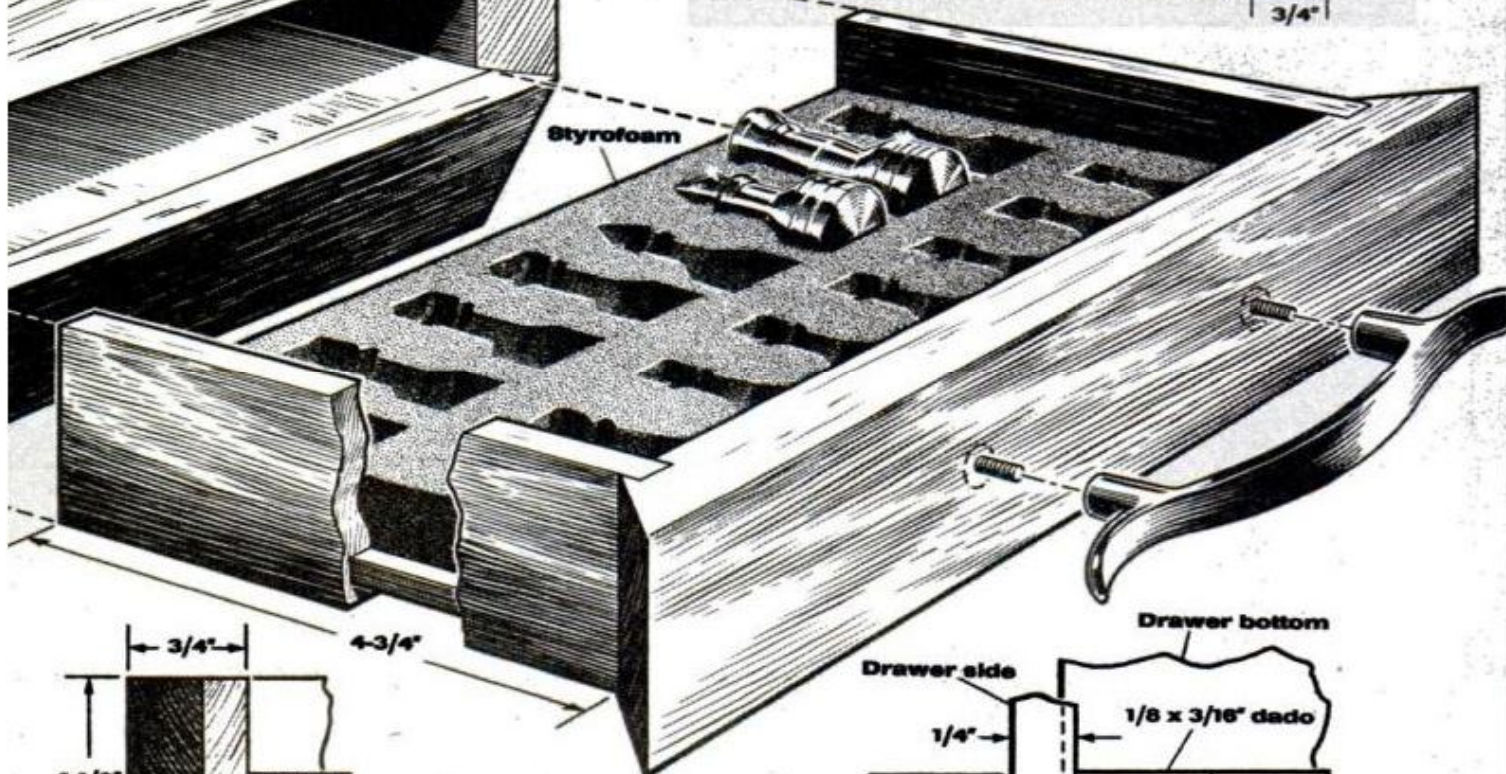
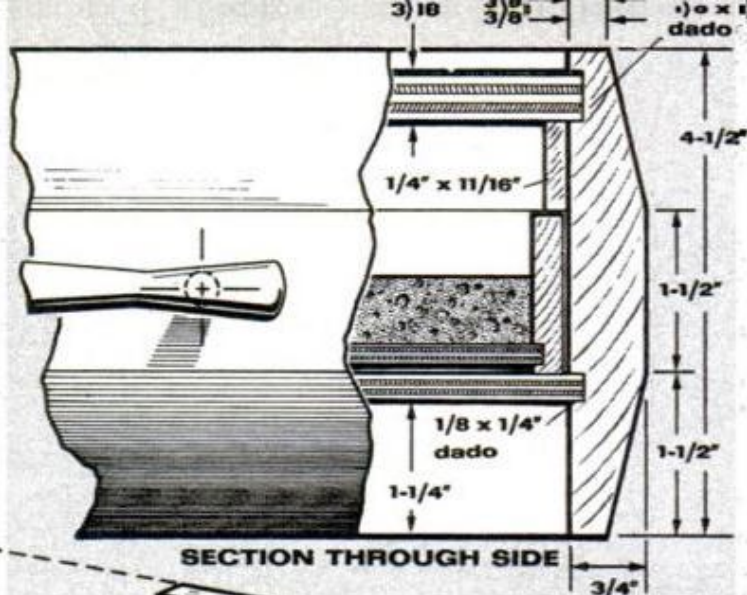
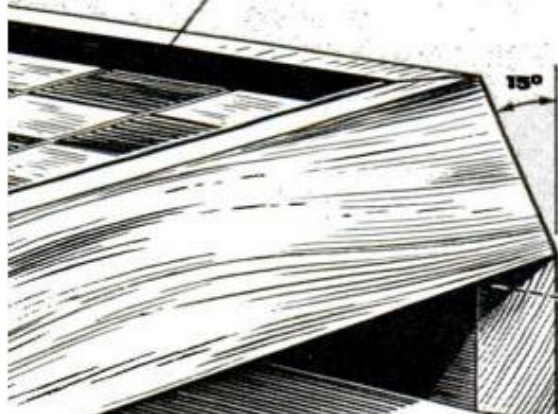


coats of spray-can lacquer. Finally, cut the piece off with a parting tool, making sure the bottom is flat. If there are any burrs, knock them off with a single-cut file.

Notice that the aluminum pieces were flocked (on the bottoms) with a royal blue flock and that the brass pieces received a light green flock. (Flocking is the process of applying powdered felt to paint while it is still wet. Here, of course, it is applied to lacquer.) The felt on the bases is optional but it does save the playing board from scratches.

Making the cabinet: Start by cutting

Sixty-four 1-1/4" squares ruled and scored in veneer-faced plywood. Every other square stained a contrasting color



the playing board to size. Be sure you allow an extra 1/8 in. on all four sides for inserting the plywood into dados in the cabinet sides. After grooving the squares, sand the board thoroughly, and stain alternate squares, using an artist brush and walnut stain.

Next make the box. There are no tricky or unusual cabinetmaking techniques called for, but work carefully so that the finished product will have the look of elegance it deserves. The sides are cut to shape on the table saw. Notice that the corners are mitered as are the mating ends of the drawer fronts. To insure a

minimum of saw marks on the bevels on the cabinet sides, use a hollow-ground cabinet blade to make the cuts.

With box and drawers assembled, cut both Styrofoam drawer liners to size. Next, arrange the chessmen in two rows as they appear on the board. Then, gently press each piece down into the Styrofoam so that it will clear the drawer opening. Remove the pieces, paint the Styrofoam top and front and then flock with the color of your choice. Allow ample time for the setup to dry before going on to the next step. *Caution:* Since certain paints will

(Please turn to page 216)

Build PM's Revolving



MERRY
CHRISTMAS

Photo by Bill Aller

Christmas Card

By HARRY WICKS
Workshop Editor

Three Disney characters rotate 'round and 'round to take turns wishing all your friends and neighbors a very Merry Christmas

Last spring the staff at PM decided that for Christmas 1969 we wanted yet another unusual yuletide decoration that readers could build. All agreed that whatever the finished product, it had to reflect the good cheer of the season. So we commissioned designer Gary Gerber to come up with something new. He did. Then ace workshopper John Capotosto went to work and put the project into the realm of a do-it-yourselfer: He figured out how to build it. Finally, to give the display the happy mood of the season, the Walt Disney Studio created three of their characters especially for PM. The handsome result of all this effort is our way of saying Merry Christmas to our readers.

—The Editors

CREATING an outdoor Christmas display that is unlike any that has been done before is a tall order. But the top-talent team that accepted this challenge from PM's editors delivered. The result is a finished product that's sure to draw raves from all who see it, and one that just might knock off first prize for best outdoor decoration in your neighborhood.

Standing about 4 ft. high, the display is motorized and features Mickey Mouse and two "stars" in a recently released Disney movie.

The bottom box sits on a platform while the middle and top boxes revolve slowly in opposite directions. As they turn, the characters change body parts and as each head and upraised arm pass the greeting, the arm waves a Merry Christmas.

To assemble, the middle box is placed on top of the bottom box. The motor is then lowered through the middle box and rests on the bottom box. Two wingnuts from below hold it securely in place. The top box is then placed so that the dowel on top of the motor housing rides in the

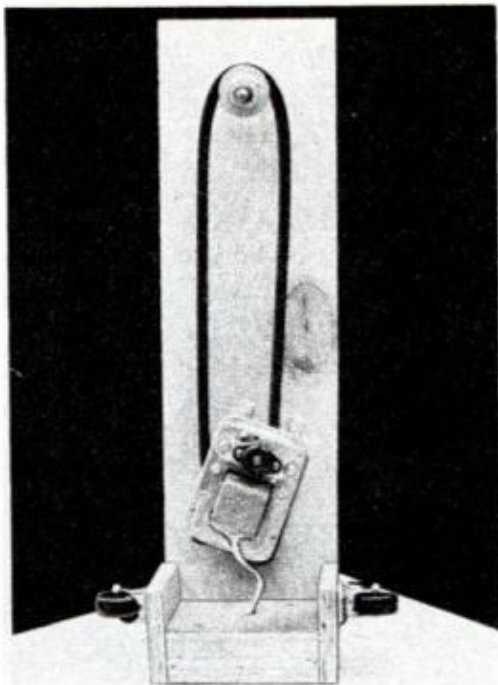


SANTA NEEDS NO INTRODUCTION: He's Mickey, of course. Characters on the other two sides are Leprechaun (above) and King of the Leprechauns (below), who are newcomers to the Disney fold. You'll see both in Walt Disney's latest film, *Darby O'Gill and the Little People*, released nationally in October

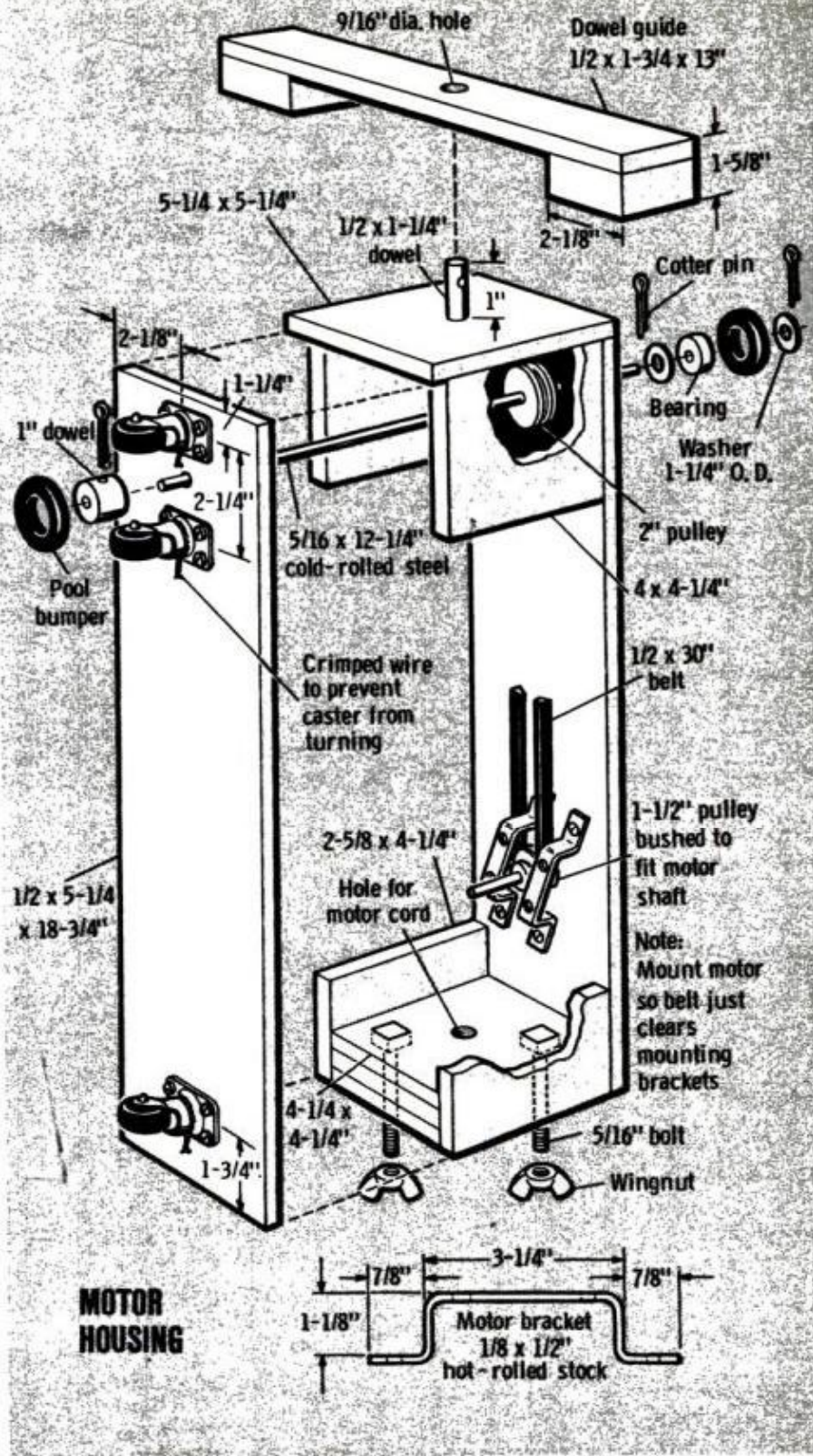
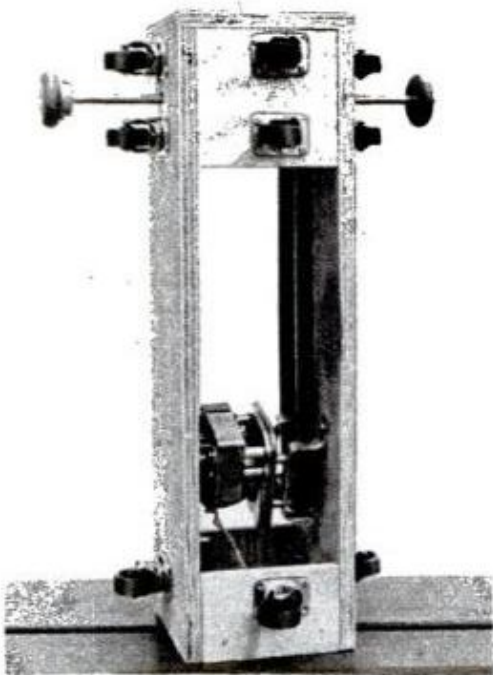


THE REVOLVING DISPLAY is actually three boxes stacked one atop the other. Powered by a tiny motor, the top box revolves in one direction while the middle box goes in the other. To make it a snap for you to copy the artwork, we've included PM's Project-a-Plan slides below. How to use them is explained on page 212, the photos on these pages show you the colors that the characters should be painted





MOTOR is canted to permit V-belt to clear mounting brackets. Drive pulley (behind motor) is bushed to fit motor shaft; axle bearing is shimmed to get 1-in. diameter to fit rubber pool bumper



MOTOR HOUSING

MOTOR HOUSING, shown here ready for installation in display, is constructed entirely of 1/2-in. plywood

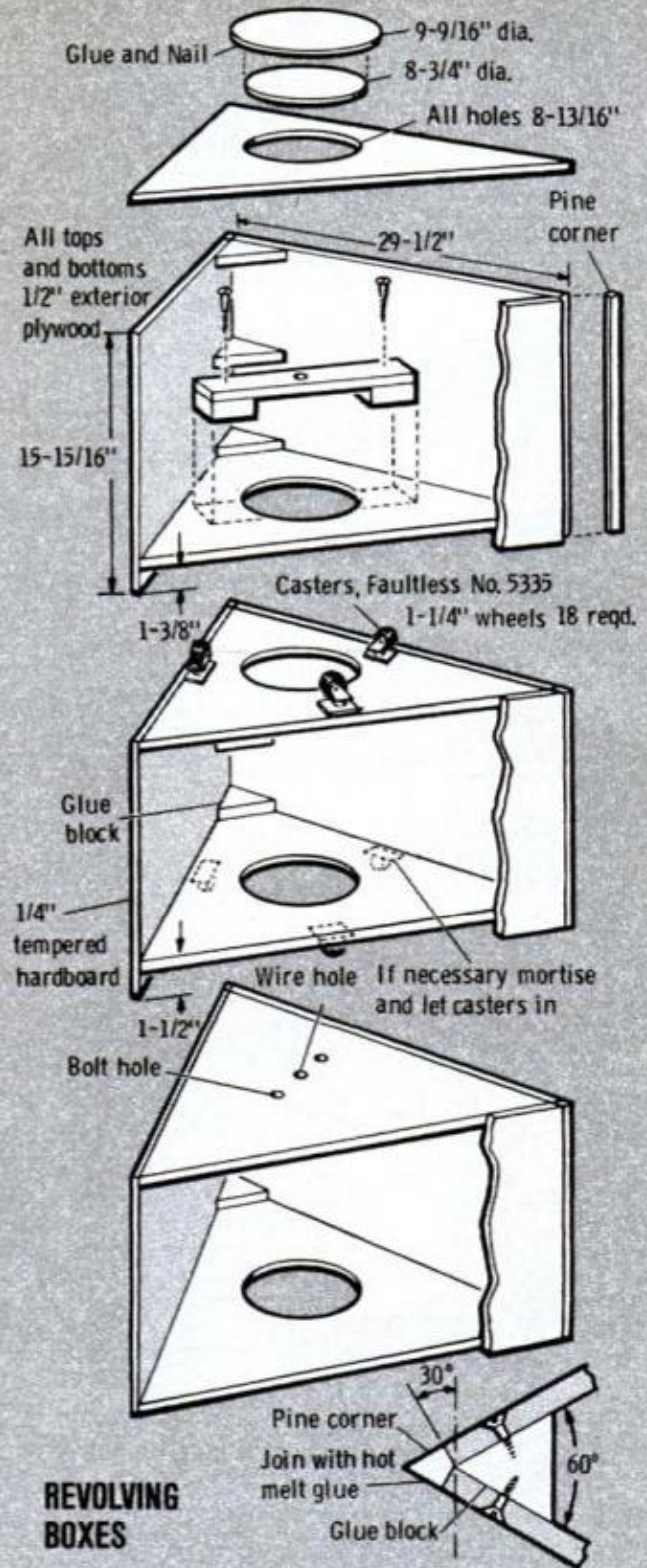
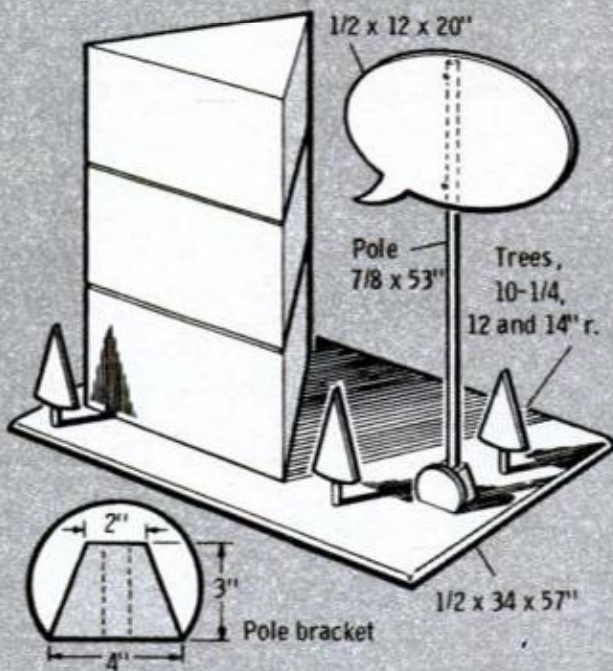
dowel guide. When the season is over, disassembly is equally easy and the display requires but a minimum of storage space.

There are no tricky, or new, construction techniques that you have to master in order to build it. But, though construction is basically simple, you must be sure that parts are cut and assembled so that where it is needed (on the drive wheel), adequate friction is insured.

After all parts have been cut, it's best to make a trial, nonglue assembly to check for accuracy. In this way, dimensional changes can be made if necessary without creating waste. Once you are satisfied that all joints are tight, and that the boxes line up neatly, they can be permanently assembled with glue.

Notice that the corners of the boxes are not bevel-joined. For strength, they are butted and fitted with at least three glue blocks inside and a solid pine filler strip

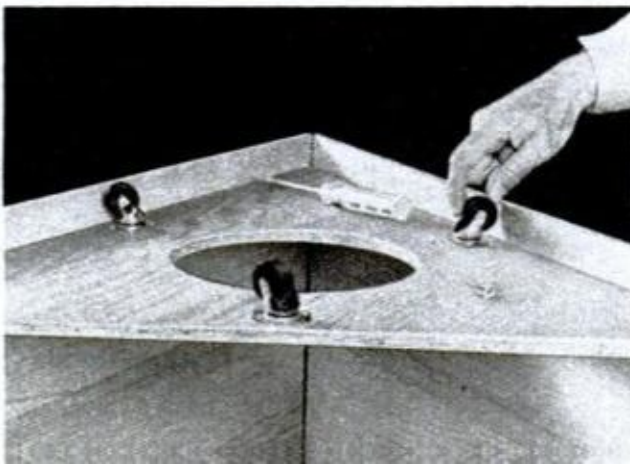
(Please turn to page 212)



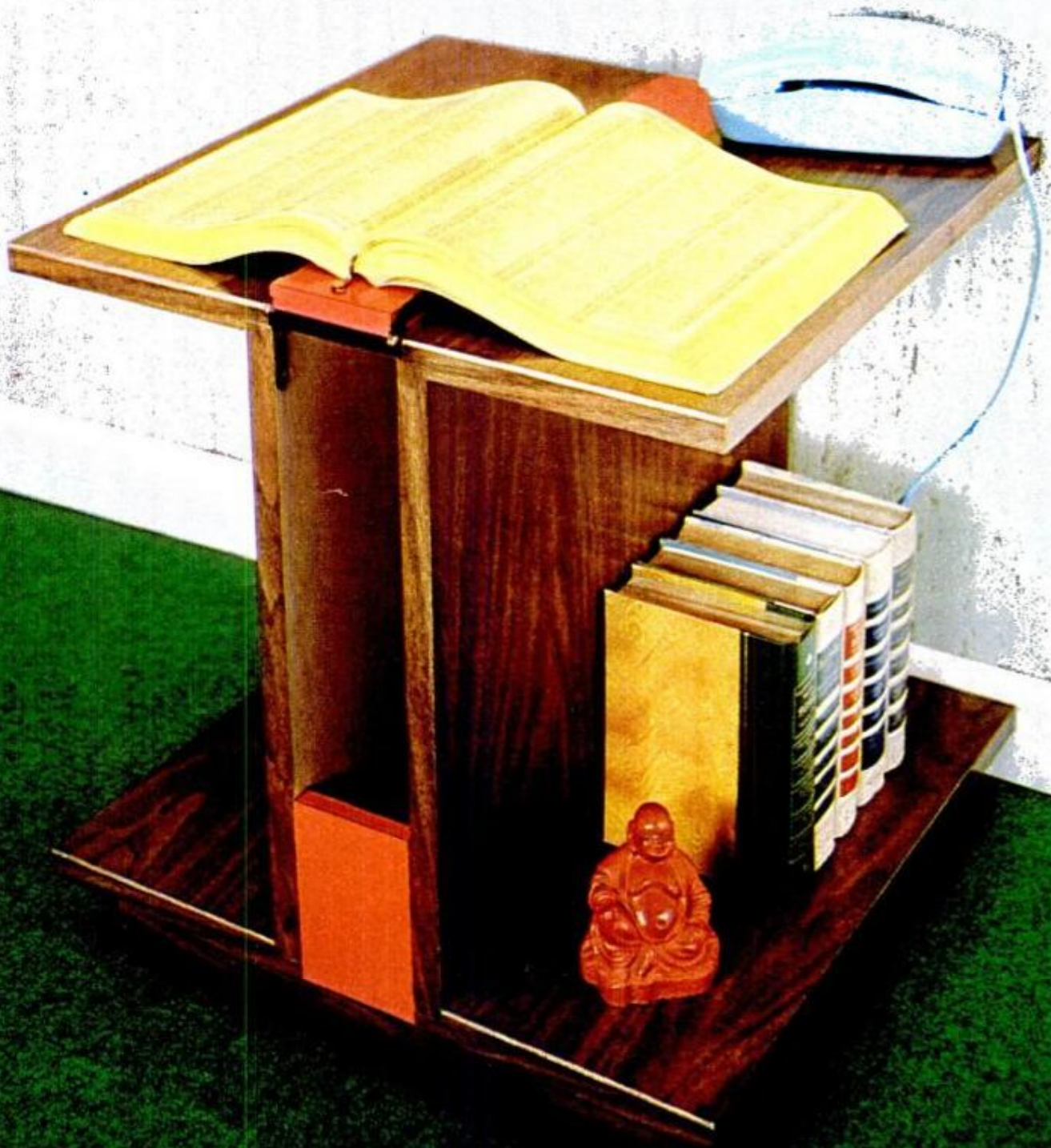
REVOLVING BOXES

SIX CASTERS on bottom and top of middle box must be free to rotate without striking the edge of the box. If necessary, mortise the caster plates

HOT GLUE applied to corner joint with USM's Thermo-grip gun takes weather in stride. Glue sets rapidly, so all parts should be test-assembled without glue



Telephone End



Tables With Built-In Directories

Where to "hide" a fat, dog-eared phone book is no longer a problem. There's an out-of-sight compartment for it right under the telephone.

By WAYNE C. LECKEY, Home and Shop Editor

SHOPPING THE YELLOW PAGES becomes a regular habit when the book is kept handy, but because of its size and beat-up appearance, it is usually chucked away out of sight and not always handy to the phone. Tracking it down becomes a chore every time you want to use it. Consequently, it's not your fingers that do the walking.

That's the way it used to be. Now, thanks to Gary Gerber, noted New York industrial designer, both the Yellow Pages and the white pages of big-city directories have been made as handy to the home phone as the ones in a phone booth. His two clever tables shown here have built-in wells where the directories can be parked within easy reach, yet out of sight.

In the table shown at the left, which is designed for one book, the directory swings up from a center well. In the table shown below, which is designed for two

books, the directories lift out of wells along one side. In each case, the books are attached to wood backs in a manner which permits them to open flat for use on top of the tables.

Plans for building the two-directory table shown below are given on page 172. Of the two, this one is the simplest to build. In each case plywood is used throughout and the kind you use depends on the finish you want and what you want to spend. You can pick hardwood-faced plywood and cover the edges with wood tape, or you can do as we did and use fir plywood and cover it (edges and all) with decorative plastic laminate. Of the two, it may be somewhat more expensive (although hardwood-faced plywood isn't cheap) but you can't match it for wear and there's no staining or varnishing. Once the table is covered, it's finished and ready.

Except for the opening in the front, both

Photos by Robert Borst



OUT OF SIGHT but instantly available, here both directories hang in wells along one side of the table



DIRECTORIES ARE ATTACHED to lift-out panels which permit the books to be opened flat on the tabletop

front and back panels of the table are twins. Likewise the two sides and inner panels are identical. The flush-fitting top and lift-out panels rest on 1/4-in.-sq. cleats. Front and back dadoes are plugged at the top before edge-banding with laminate.

To build the single-directory table detailed on the opposite page you start with a 21 1/2-in.-sq. base (E) and run two dadoes in it, front to back, 3 1/2 in. apart. Parts (D) which are identical, sit in these dadoes. Part (F) fits rear rabbets and closes the center well at the back. A 3 1/2-in.-sq. piece fits between at the front. It will be easier to cut the mortises in parts (D) for the knife hinges if it's done before the panels are glued in the dadoes. Notice that the small upturned stop, which is on each hinge when you get it, is filed off.

The rabbeted edges of parts (B) are glued and nailed to the top edges of parts

(D) and then part (A), which is cut 5/8 in. shorter to accommodate part (C), is glued between parts (D) level with parts (B).

Allowing for the thickness of the laminate (1/16 in.), part (C) is cut to fit the center well and mortises are made for the hinges after the board is covered. A magnetic catch may be added to hold the panel shut. If you like the table as well without the 2-in. base, you can leave it off but add the 2 in. to the length of parts D.

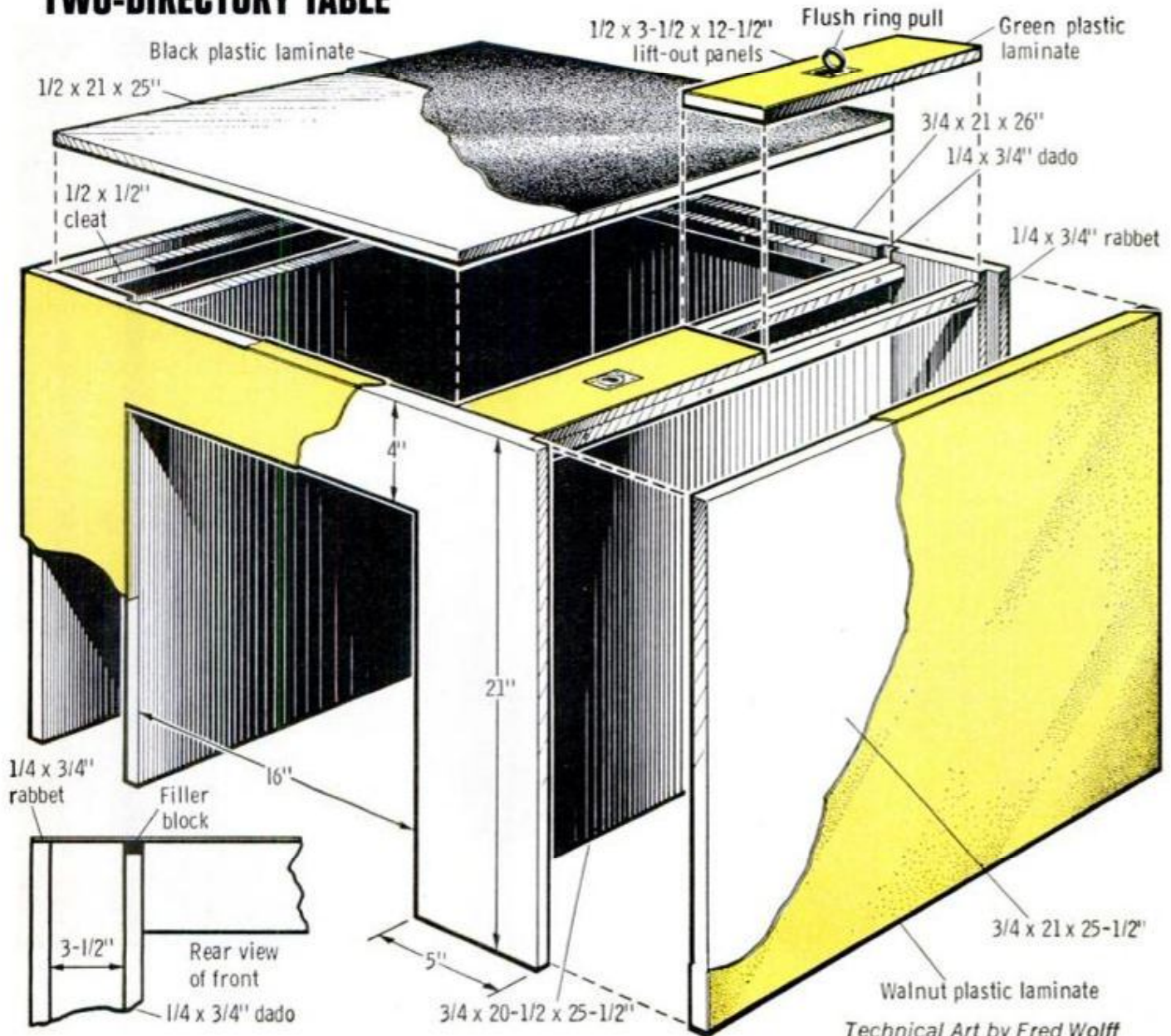
How to apply laminate

If you are new at working with decorative laminate, the one thing to remember is that once the cement-coated material is placed on the cement-coated surface, you can't shift it. You must have it just where you want it the first time.

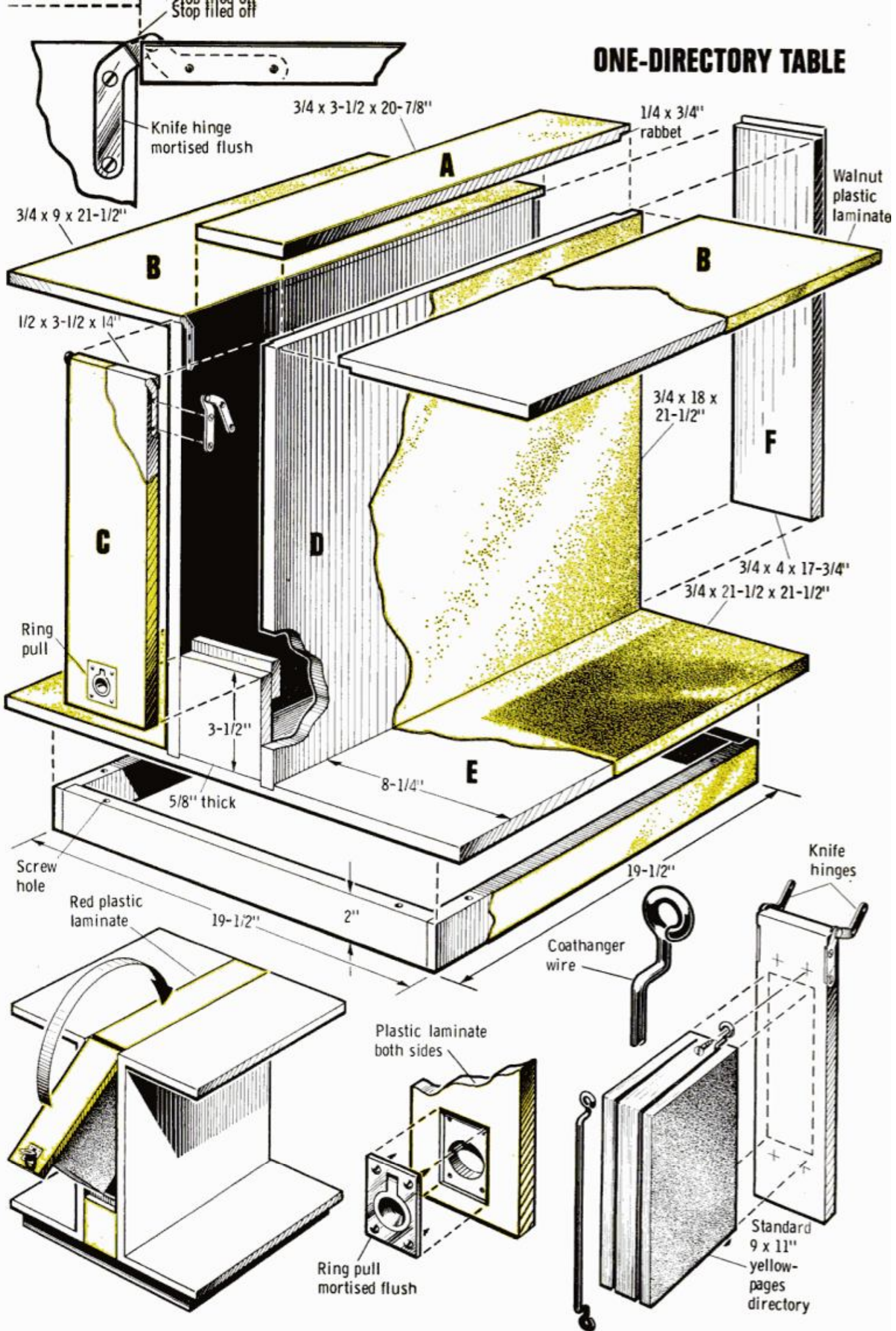
Contact cement is used to bond the lam-

(Please turn to page 216)

TWO-DIRECTORY TABLE



ONE-DIRECTORY TABLE



Build This Christmas Rocking Horse

By WILLARD and ELMA WALTNER

ANY SMALL FRY in the creeping-to-walking stage will rock up a storm when he (or she) finds this rocking horse under the Christmas tree. The streamlined toy appeals to youngsters because it lets them keep their feet securely on the floor while they rock back and forth. It's built of $\frac{3}{4}$ -in. plywood and all parts are thoroughly sanded to insure splinter-free rocking.

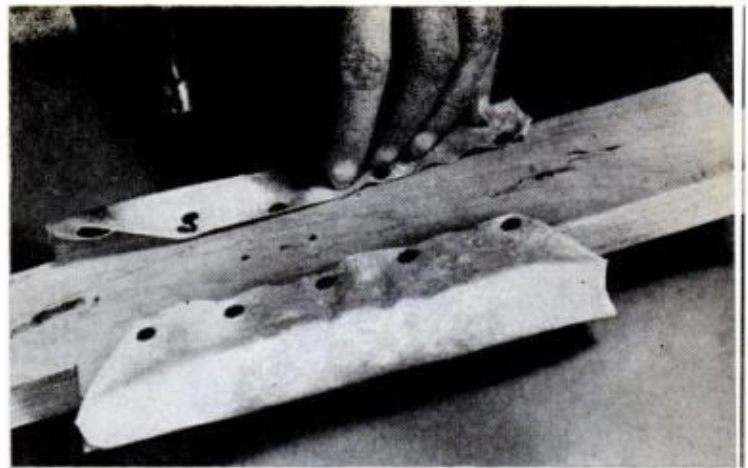
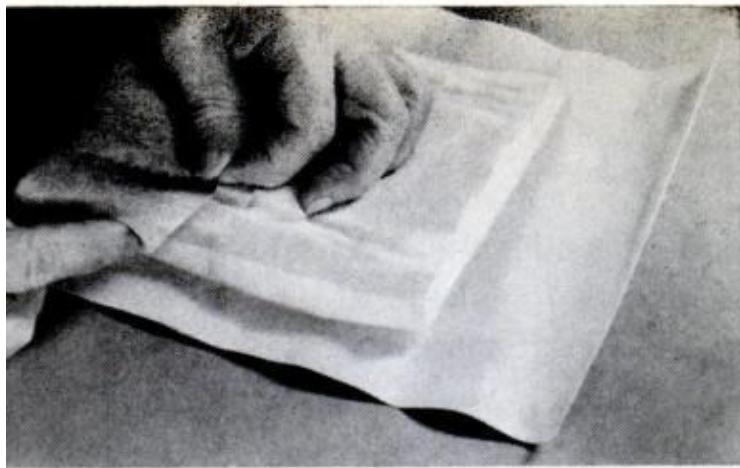
For comfort, the seat is padded with foam rubber and covered with plastic upholstery fabric. After cutting the fabric, lay it upside down on a flat surface. Center the rubber padding and fold up the front and back edges. Place the seat board on the saddle and bring the raw edges of the cover up and around the edges of the board. Next, pull the cover taut and tack-fasten the fabric.

To assemble the rocker, fasten one side to the front and back pieces with $1\frac{1}{4}$ -in. fh screws. Set the seat board in place and screw-fasten the second side. The board is securely sandwiched between the angled top edges of the sides.

To finish, paint the wood parts with nontoxic lead-free paint. ★★★

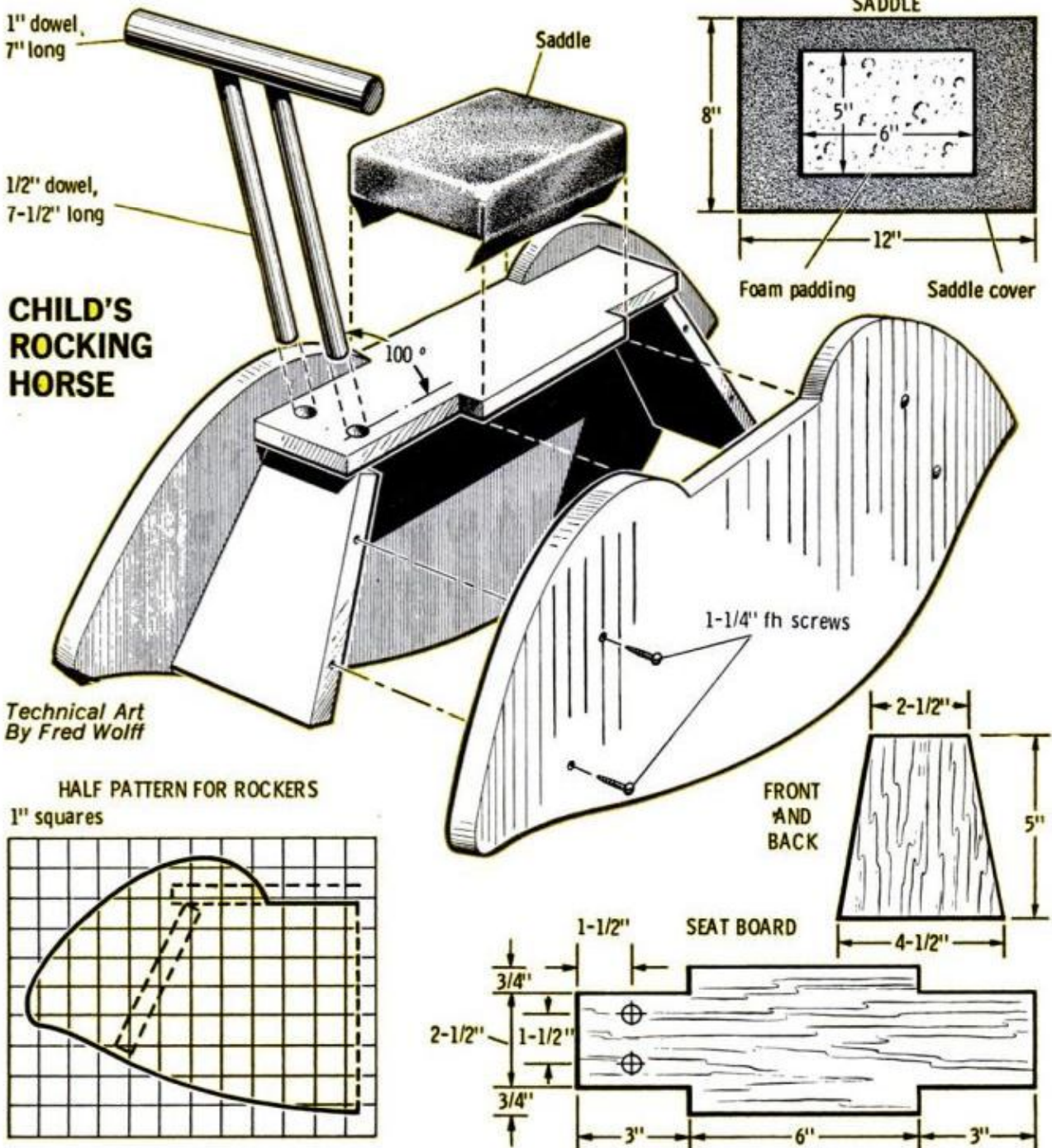
DOWEL HANDLE UPRIGHTS are glued into angled holes in seat board. Tilted slightly forward, the handlebars give the rider a better grip when rocking, let him enjoy a fast ride without fear of a spill





SADDLE-COVER ENDS are folded up around foam padding and tucked in at the corners. Foam and plastic upholstery fabrics are available at local upholstery shops or by mail order from Sears, Roebuck

SEAT BOARD is placed on the saddle, the other two edges are pulled up around board and fastened with upholstery tacks. Make certain that all wrinkles are removed before permanently fastening fabric



PM's Handsome Hall Clock

PART II

Last month you built the basic housing. Now you can try your hand at some fine Old World craftsmanship.

By W. CLYDE LAMMEY

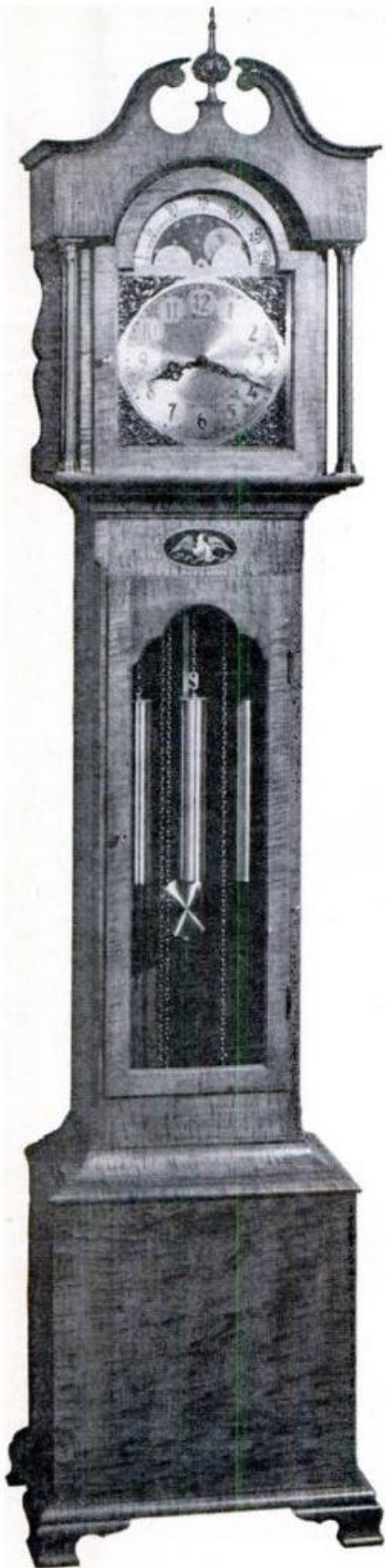
WITH THE BASIC HOUSING built, you are now ready to start on the decorative ornamentation. Happily, construction is a lot easier than appearance indicates.

Since there are several checks you should make before you cut the parts for the hood, you should have the dial and clock movement on hand.

First make a test stand. Cut a piece of $\frac{1}{2}$ -in. plywood about 16 in. wide and 48 in. long. Fasten two pieces of plywood about 46 in. long and 6 in. wide to it at right angles. (Space the strips the same distance apart as the sides of the waist you have made.) Add a base so that the assembly will stand firmly when upright. Next, make the movement seat and chime-rod support. After assembling the two parts, screw the movement and chime assembly in place. Position it on the improvised test stand and add pendulum weights and dial.

With the movement in place, note the position and dimensions of parts A, B and C. Here, reference is made especially to the radii which determine the arch of these parts. Arched dials are generally held to close limits, but there *could* be some slight variations. **CAUTION:** *Don't take the dimensions given on the drawings literally. Don't cut stock until you've made sure parts cut to these dimensions will accept your dial correctly. Check the radius of your dial arch to make doubly sure. This applies not only to the radii of parts A, B and C (the pediment has the same arch as part C) but also determines the radius of the arched door.*

With all dimensions carefully checked, you can start making the hood parts. Begin with the top waist frame. Again, all miter joints are splined. The sides of the hood drop into the dadoes in the frame and are fastened with screws driven from the underside. It's a good idea to omit cutting the grooves for the closure strips at this stage. It's far more accurate if done when the pediment is assembled; you can check location and width of the strips at one time. When cutting the curved parts, allow a little extra so you can sand-finish the rough-sawn edges. Chances are, you will also have to sand the outer edges of the dial stop (part A)



so it will slip easily into its mating grooves.

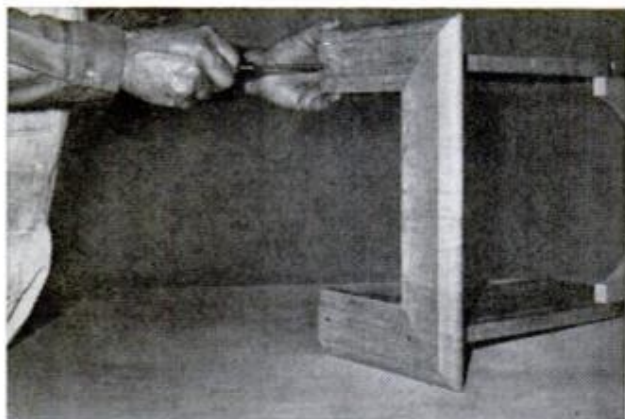
The location of the movement support strips will normally be about 2½ in., measured from the top of the frame to the bottom face of the movement seat. Elongate the screw holes to provide an up-and-down adjustment of about ⅜ in.

Select your best stock for the pediment front. Miter and join it to the pediment sides with special care. Notice that the pediment half pattern shows a center-ornament seat of ½-in. thickness. If you use an ornament with a 2-in. ball and

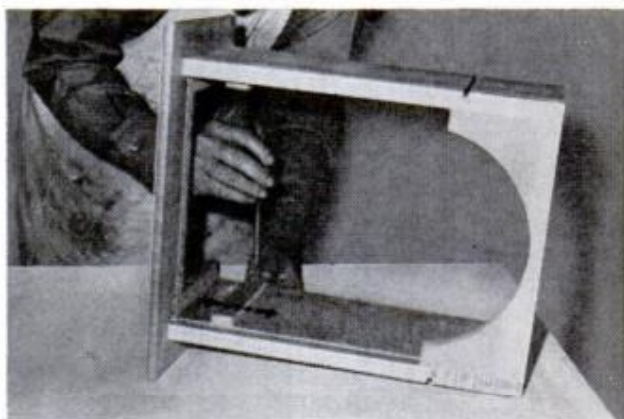
spire as pictured, you should reduce this thickness to ⅜ in. or less.

Fasten the pediment over the hood temporarily, then locate and mark position of the grooves in the hood sides for the closure strips. Disassemble, cut the grooves and reassemble with glue in all joints. (Note: No glue is used in the grooves taking the closure strips or the dial stop.)

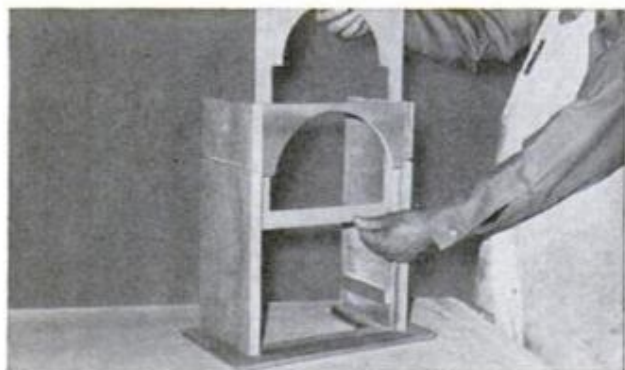
Next, stand the case on a level surface and slide the movement into place. Check the position of the dial in relation to the stop. Raise or lower the movement by ad-



HOOD BASE FRAME is attached to partially assembled hood to check for—and insure—a precise, neat fit



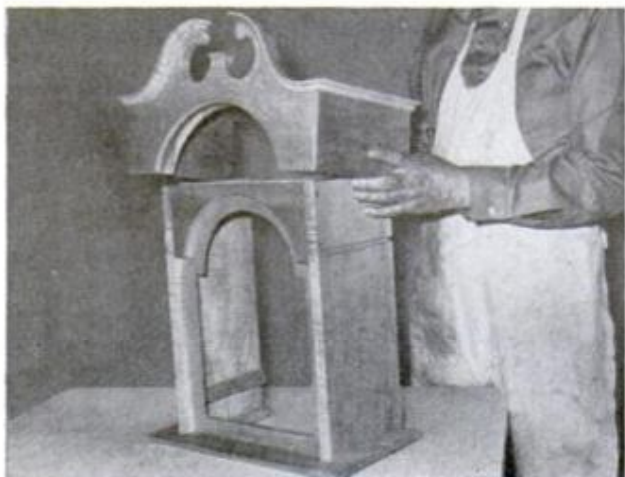
SCREW HOLES in movement-support strips are elongated, provide adjustment to locate the clock properly



DIAL STOP (part A) must slide easily into position behind part B. Check the arch radius carefully



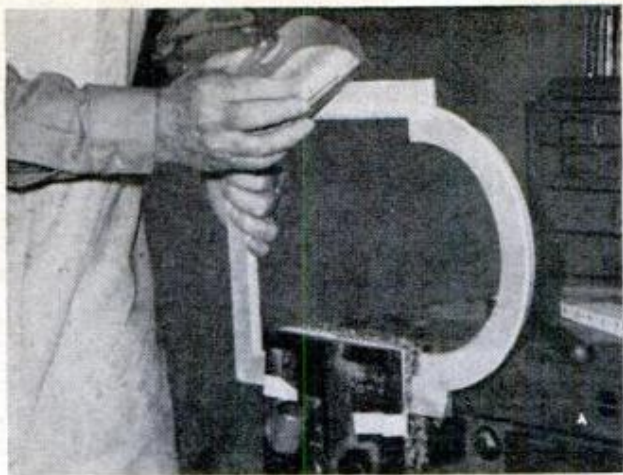
USE SCREWS to fasten top. Moldings along sides are mitered to mate with curved moldings at front



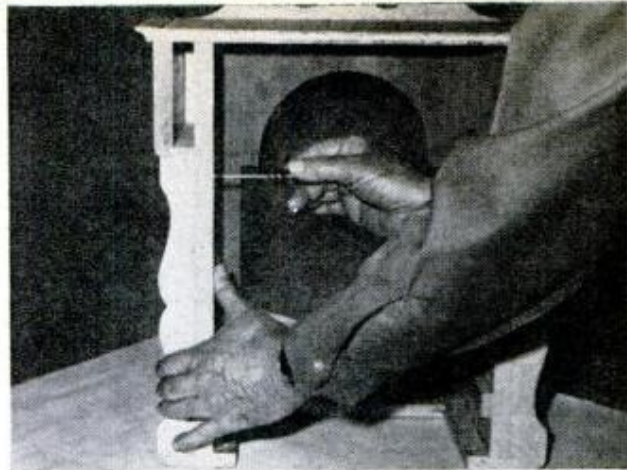
FULLY ASSEMBLED PEDIMENT is slipped over hood, fastened with screws through the top into sides



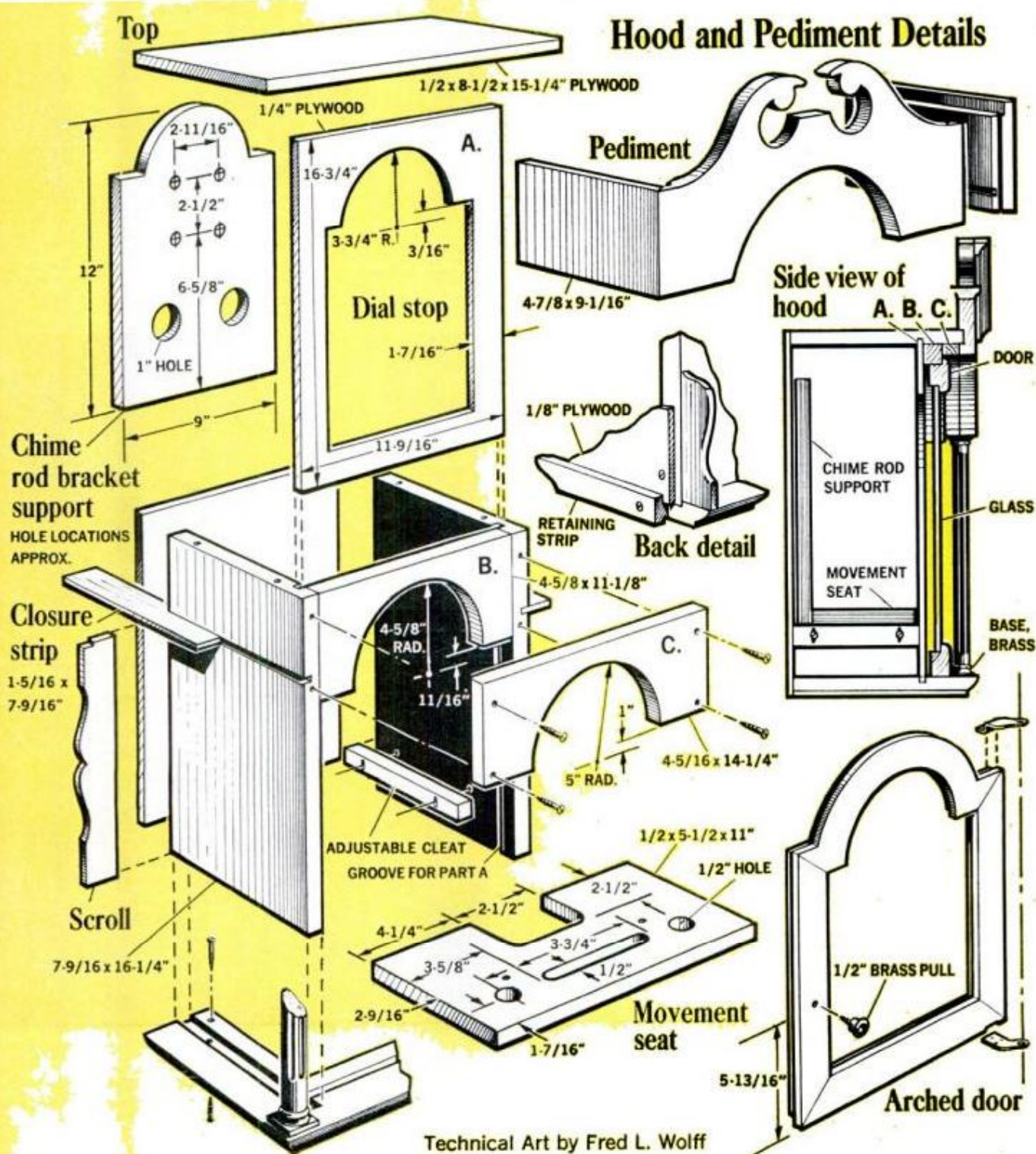
CLOSURE STRIPS slide in and close openings between pediment and hood. Hood is now fixed in place



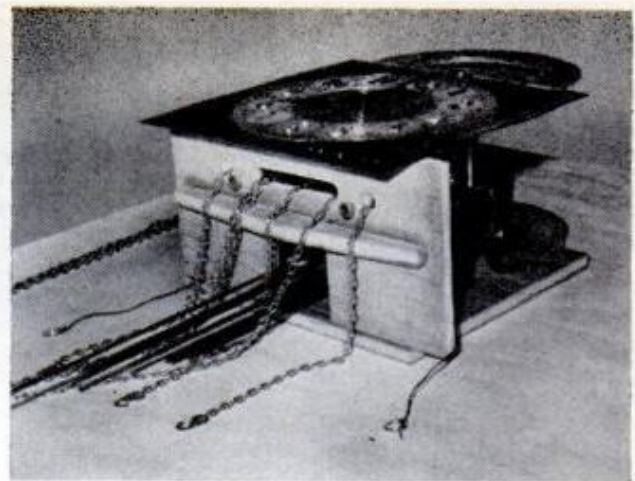
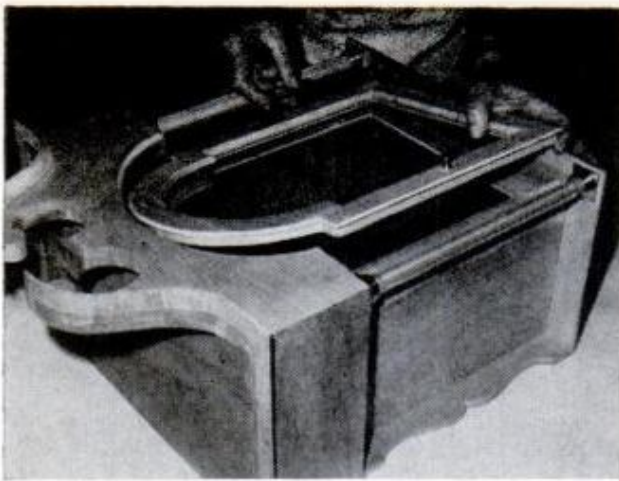
OUTSIDE CORNERS of arched door are slightly rounded. Bottom edge is neither rabbeted or rounded



SCROLLED ORNAMENTS are attached with screws through hood sides, notched to butt on closure strips

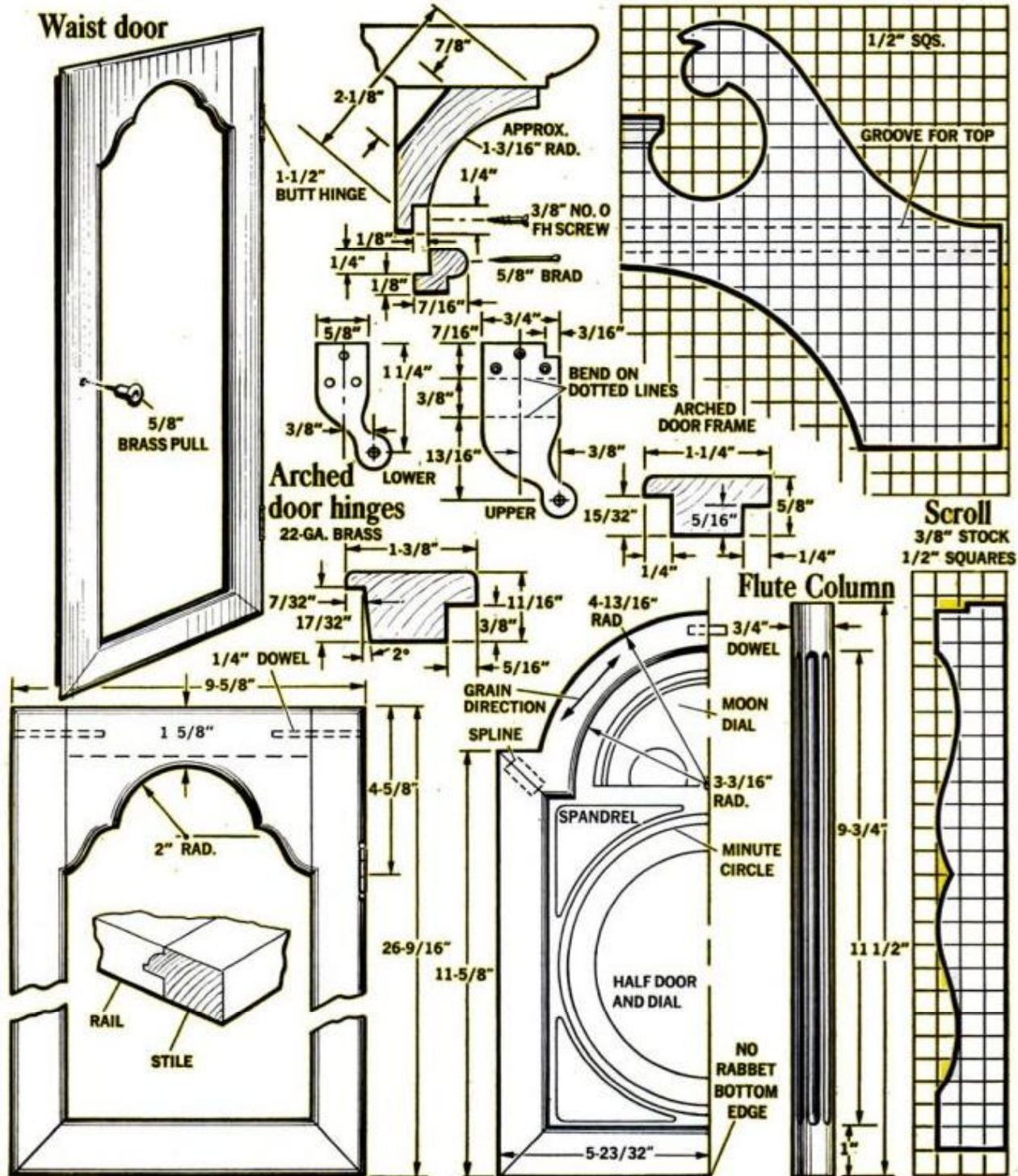


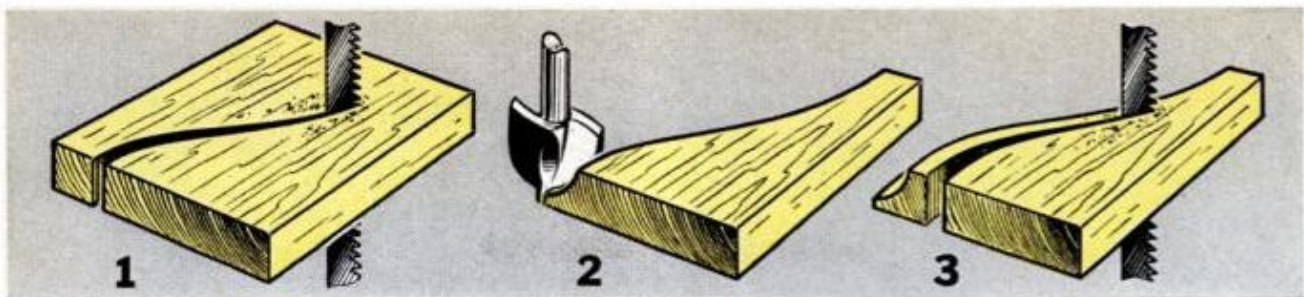
Technical Art by Fred L. Wolff



HINGING ARCHED DOOR and fitting columns finishes dry assembly. Door should swing without binding

STIFFENER, across bottom of seat, is optional part. Notice that the movement is not attached to case





PEDIMENT MOLDINGS of $\frac{3}{8}$ -in. stock are (1) cut using a bandsaw, (2) shaped with cove bit chucked in the router, and (3) separated from stock. The curve is reversed to make other half of the pediment

justing the movement supports up or down as required. You should see all the curved lines on the moon arch inside the arched portion of the stop and there should be about $\frac{3}{16}$ to $\frac{1}{4}$ in. between the outer edges of the spandrels and the stop at the sides; a little more at top and bottom.

This done, remove the movement (handle it carefully) and disassemble joints of the base which were assembled dry. Next, apply glue and reassemble permanently.

The hood and waist door frames require careful workmanship. The arched door is a bit tricky since rabbets are cut on both inner and outer edges; one to take the glass, the other to form a lip. If you have a router, buy a $\frac{1}{4}$ -in. rabbeting bit. With this equipment, the job takes minutes. Otherwise, drill a row of adjacent $\frac{1}{8}$ or $\frac{3}{16}$ -in. holes around the inner and outer edges of the arch and then chip out the waste with a sharp, narrow chisel. Rabbets on the straight parts can be run easily on the table saw.

The arched door

The four corner joints are splined miters, but the two members of the arch are joined with a dowel. The hinges for the arched door are of necessity something

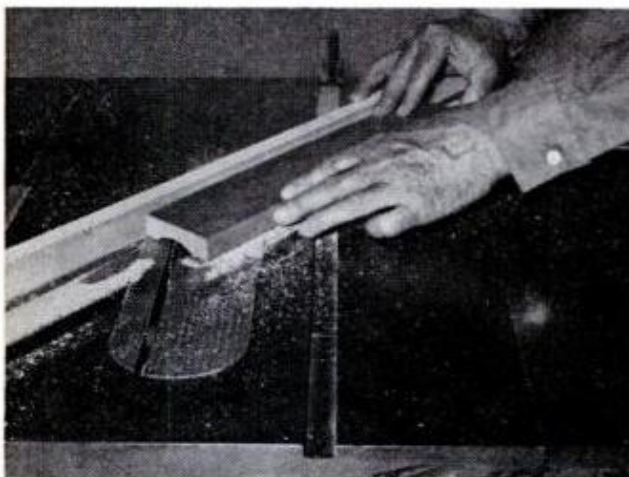
special. Both are of flat brass, but the upper hinge is offset. Though not common in old clocks, an offset hinge was used here to give the door arch a more symmetrical appearance when closed. After assembling and placing the door, the hinges may need light filing to obtain clearance for smooth opening and closing of the door.

The lower rail on the waist door is spline-mitered to the stiles but the upper arched rail is dowel-joined. Just how you make this joint depends on whether the corners are rounded or molded. With a router and a $\frac{1}{8}$ -in. bead cutter bit, you can run the molding all the way to the upper ends of the stiles, then turn the rail on end and cut a saw kerf the depth of the molding on both ends. To form the cope, undercut with a round file (or carver's gouge) to fit the rail's molded shape.

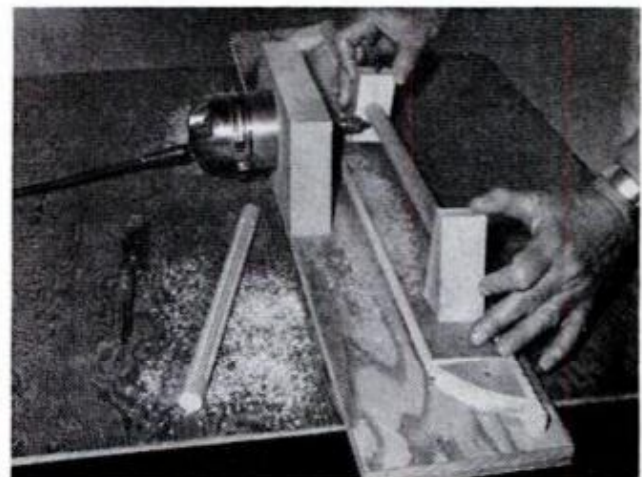
Since it is easier to do, and a straight-cut piece of glass costs less than a curved piece, rabbet the top rail $\frac{3}{8}$ x 3-in. to receive a rectangular piece of glass.

Final ornamentation

The pediment molding, which has the same contour as the pediment risers (correctly called swan'necks), is quickly cut *(Please turn to page 226)*



COVE CUT is made with guide clamped at 52° angle. Feed work slowly, raise blade $\frac{1}{16}$ in. for each pass

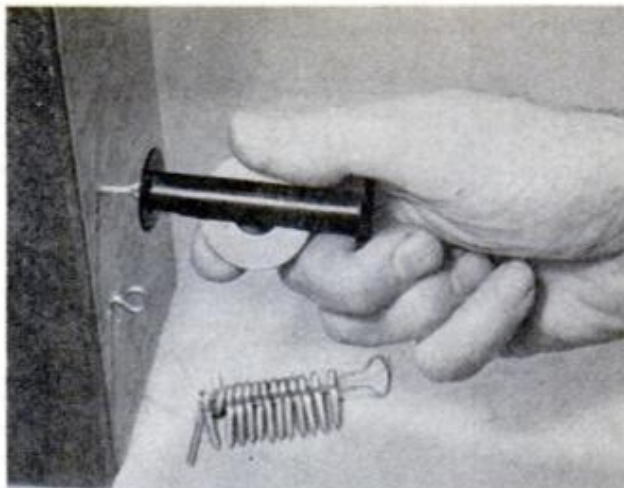


FLUTES ARE CUT with core-box bit and router. Jig for cutting tilts and slides between stop blocks

HINTS FROM READERS

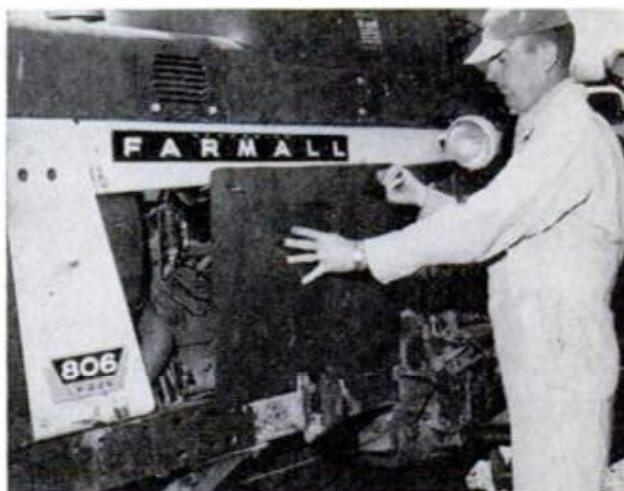
Film spool makes handy wrench

An empty photographic film spool can be used as a wrench for screw eyes and other flattened items, whose heads will enter the end slot far enough to be firmly gripped. To get better leverage, insert a large washer halfway through the film slot as shown. Though either end of most spools can be used, the 120 size or larger is preferable.—*Walter E. Burton*



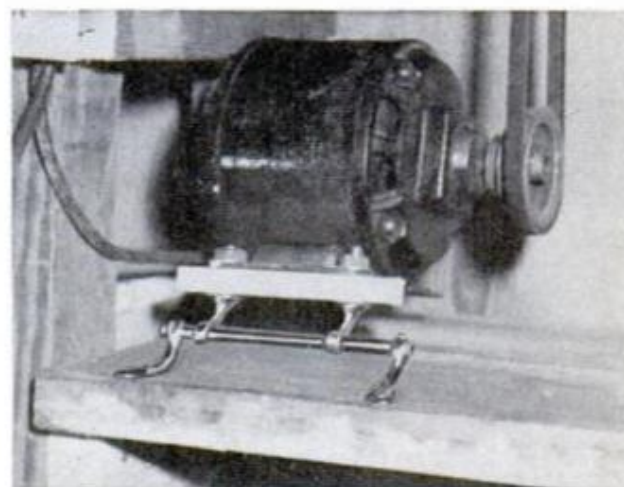
Panel muffles ignition noise

A radio mounted on your tractor is good company but noise caused by the ignition system can be annoying. A neighbor of mine discovered that by attaching a metal panel to the tractor, close to the distributor, the interference was stopped. Though it is held firmly in place by a couple of thumbnuts, the panel can be quickly removed and replaced.—*C. F. Marley*



Flat roof water drainage

Here's an easy way to drain water from a flat roof. To do it, drill a hole in a short length of 2x4 to accept the male end of a garden hose. Then, place the board in the water, insert the hose and weight the set-up with a cement block to keep it in place. Slowly turn on the faucet and then detach the hose. Gravity will drain the roof.—*E. G. Hayes*

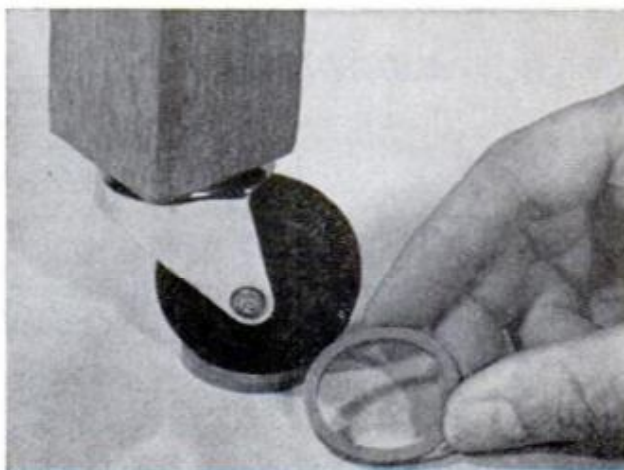


Electric-motor mount

Using the hardware from an old toilet seat, the motor mount at right can be made in an hour. To hold the shaft in place, when sliding the motor for a pulley change, drill and insert a small screw through the bracket and shaft. Use a wood block to raise the motor for proper belt tension and, if necessary, cut off the bolts for motor clearance.—*A. E. Rohmer*

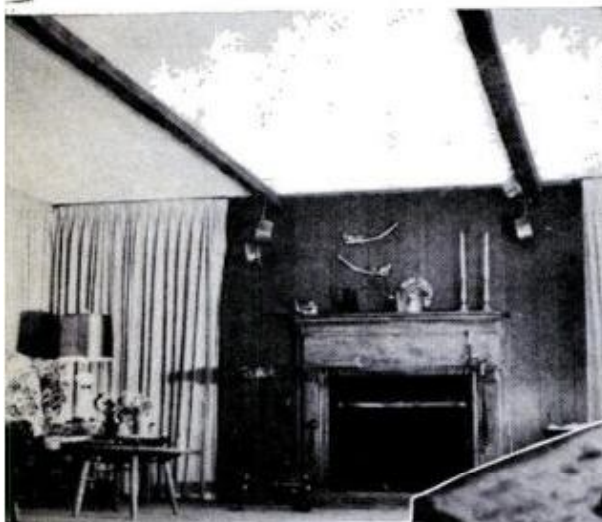
Quickie caster 'brake'

Caster-mounted furniture has a tendency to be moved about, especially when there are young children in the home. To make furniture stay where you want it, try slipping a rubber washer under each caster. The assorted-size package of washers sold for plumbing repairs will usually contain several of the sizes that you need.—*Ken Patterson*





BEFORE AND AFTER PHOTOS show clearly why antiquing beams is worth the effort



How to Make Your Own Antique Beams

By BERNARD POWELL



Using a homemade adz, you can add the ancient art of hand-hewing to your woodworking skills

DURING A RECENT house redecorating session, my wife decided that what we needed to complement our colonial decor was a beamed ceiling. Though I was aware of the new foam-type beams that are good reproductions, I decided that I would carve out my own.

To make them, I used rough-sawn, nondimensioned stock measuring about 4x6 in. that I obtained at no cost. Actual-

ly, the beams shown were flatcar dunnage (pine) salvaged from a railroad siding. The railroad people were happy to have me haul the timbers away. If you have no local railroad freight yard, you can substitute dimensioned lumber.

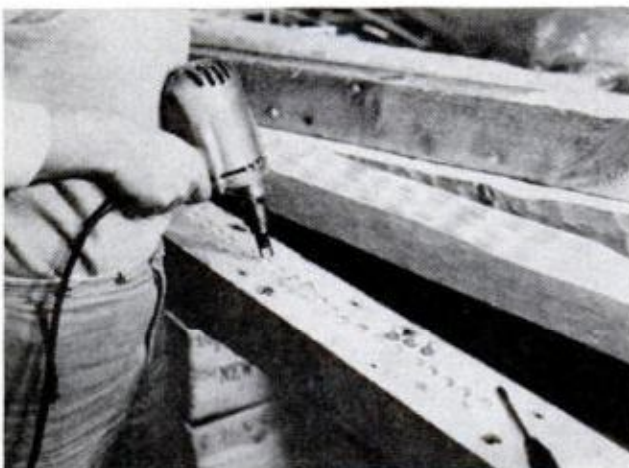
Make your own adz. Though the adz is a tool that has been in use for centuries—it was the only known method of dressing lumber—it is not easy to come by these



SURPLUS PICK-MATTOCK is rough-ground into an adz, using portable grinder. Bevel is on the inside



CUTTING EDGE is honed razor-sharp to insure fine cuts and ripples that mark work of genuine adz



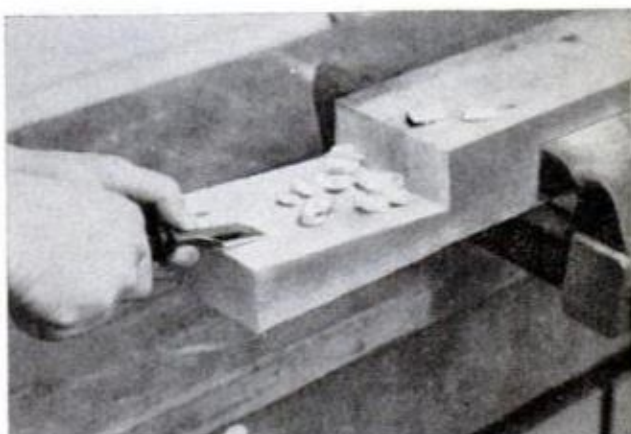
PLUGS ARE CUT from side that butts against ceiling, and are used to fill holes that came with timber



COATED WITH GLUE, the plugs are then driven into enlarged nail holes before adzing operation begins



EASIEST METHOD of adzing is to straddle raised beam. Use workstop or clamps to prevent movement



TO MAKE UP TIMBERS for long spans, beveled lap splices are cut on ends of beam to be joined

days. (And the chances are, if you do locate one, the price will be high.) Thus, my first problem was, how could I achieve an adzed look on my beams? I tried an ax, hatchet and a spoon chisel. None gave satisfactory results or the look that I wanted. The obvious answer was to make my own adz.

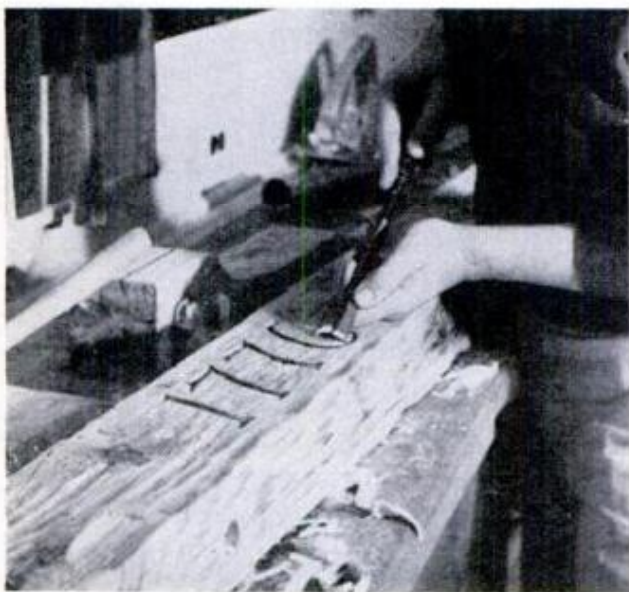
The dictionary describes an adz as a cutting tool having a thin arching blade

set at right angles to the handle. (The tool in the lead photo is a genuine adz.) So, I picked up a used pick-mattock (the mattock blade fits the description) at an Army surplus store for a couple of bucks. Then, I ground a razor-sharp edge on the tool. After doing over 200 feet of beam hewing with this homemade tool, I can say that it worked fine.

How to use an adz. To hew, you strad-



BEVELED SPLICES ARE CHECKED to insure fit, then assembled, using glue, lagscrews and dowel-plugs



DATE CARVED IN MAIN BEAM is optional but lends authenticity. Or, use the year you bought the house



BEAM END is chiseled out to receive wall-knee support. Kerfs made with a power saw speed this step

dle a timber that is securely held by workstops on the floor. Use short, well-aimed strokes down and towards you in the curvature of the blade. Your arms and the handle act as the radius. The blade is worked across the width of the beam stroke by stroke, removing several inches of stock in length and width with each chop.

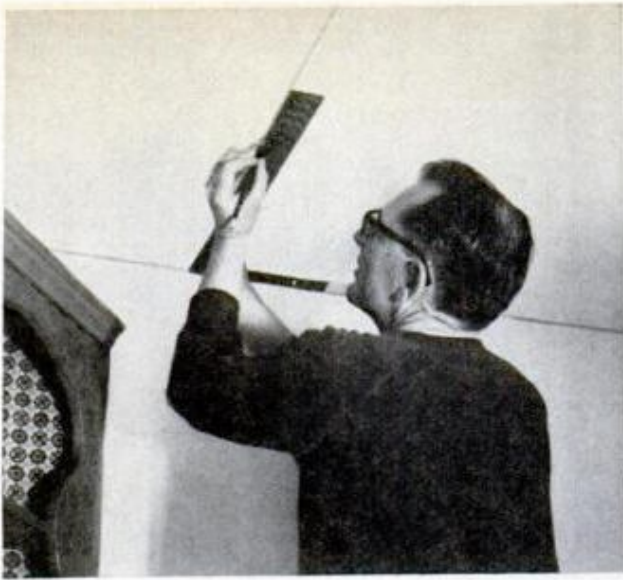
This is tricky. An angled stroke, or a hard chop that strikes a knot, can glance off and give a painful and serious cut in the shin. To avoid this, many pros working at a fast pace stand in wooden nail kegs to protect their legs. Your safest bet is to work slowly, always making certain that the cutting edge strikes *with* the grain on each stroke. When working over a knot, use much shorter strokes or a chisel.

Having a shorter handle than an adz, the mattock-adz shown on page 182 is best handled by elevating the workpiece and following the safety rules mentioned above. Do one side from end to end, then rotate the timber 90° and do the next side. Always work with the grain; cutting against it leaves deep, ugly gashes. Your first efforts may result in cutting sharp, jagged splinters. These can be removed with a hand chisel. You will find that as your skill increases, you will cut fewer jagged edges, and finally, none.

Installing the beams. Since the room where I planned to beam the ceiling had a wide entry, I ran a wide beam across the opening. The long-spanning beams (actually joists in old construction) are at



KNEE IS PERMANENTLY ATTACHED to main beam with glue and dowels before the beam is installed



CEILING JOIST CENTER LINE is established on both sides of room and chalkline is snapped across



PREDRILLED BEAM is positioned over chalkline, held fast by T-support wedged with shims, then bolted

right angles to the heavy beam. They simply butt the walls at one end and are let into notches cut in the heavy beam at the other. The notches are cut extra deep so that the beam can slide in as you swing the far end up, thus letting the beam clear the wall.

Installation goes a lot faster if you have some help hefting the beams into position. And, it's worth the time it takes to build a T-support, which, with several wedges and a helper, make installation comparatively easy.

Pre-drill and counterbore all beams for lagscrews and bolts while still in the workshop. Then lay out beam locations on the ceiling with ruler and chalkline. When a beam is positioned and wedged firmly in place, drill pilot holes into the joists to receive the lagscrews. After the beam is securely fastened, the shimmed T-support can be removed safely.

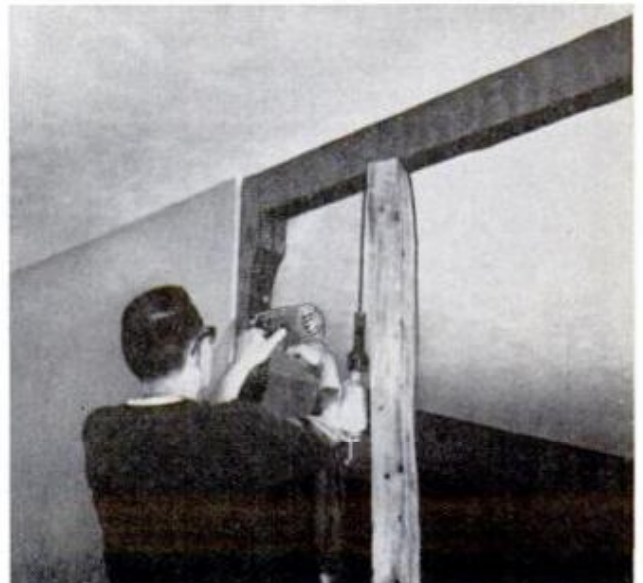
For extra support, I bolted knees to wall studs beneath each end of the heavy beam. About 18 in. long, the ones shown were found—as is—alongside the dunnage beams in the railroad yard. They had been discarded after serving as chocks under a large cast-iron boiler brought in on a flat car.

The beams shown were finished with walnut stain and two coats of semigloss varnish. This part of the job goes a lot faster if you do the staining and first varnish coat before the beams are in place. Then, it's a simple matter to touch up the few spots that might get bruised during installation and apply the second coat of varnish.

★★★

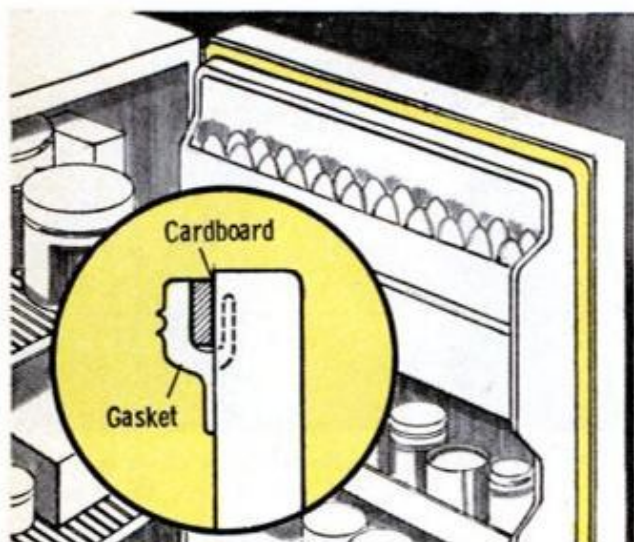


POST SUPPORTING BEAM stays put until all bolts are turned home. Knee is fastened to wall next

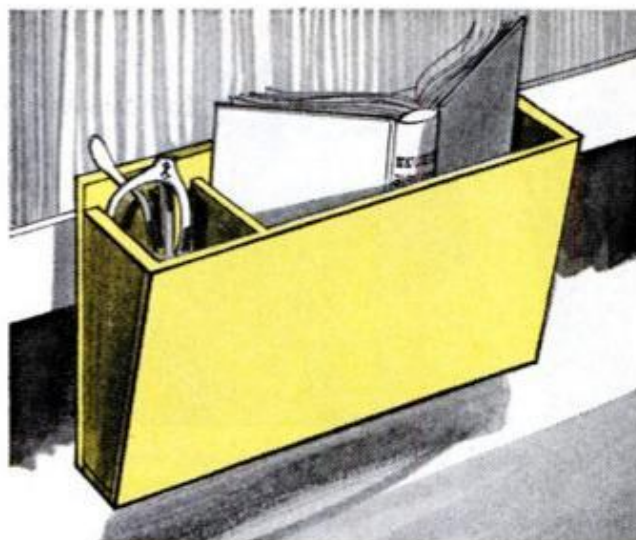


WALL KNEE, attached to beam, is positioned against the wall and drilled for lagscrews that will hold it

Solving home problems



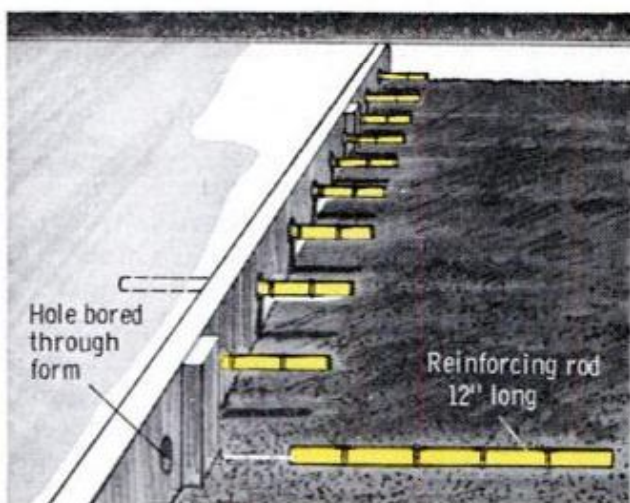
AS THE RUBBER GASKET on your refrigerator door ages it loses its sealing power. When this happens, you can add new life to the gasket by inserting several strips of cardboard behind it.—*Jean Dunn*



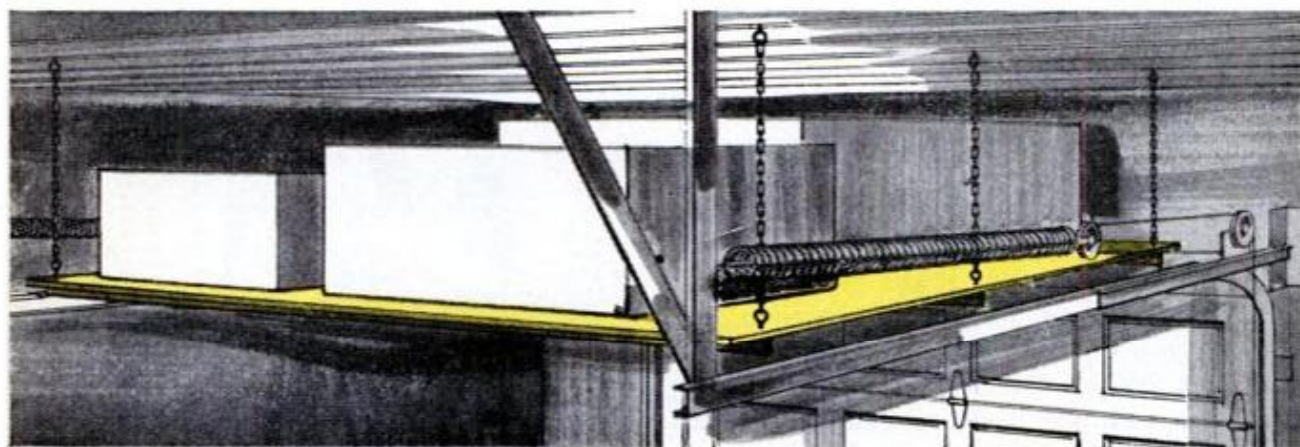
IF THERE'S NO NIGHT TABLE for your book and glasses, a holder such as this will do the trick when you're ready to drop off. It's made of a thin plywood and hooks over the bedrail.—*Roy Alkenbrack*



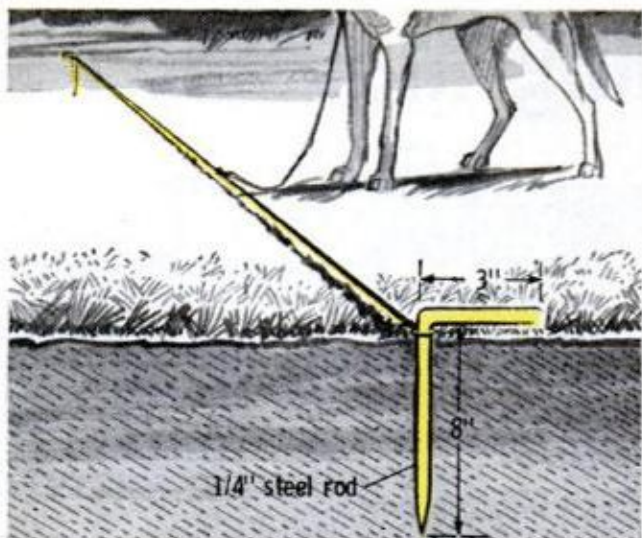
A STRIP OF PLASTIC BLEACH BOTTLE, 1x6 in., will make a better putt-putt "motor" for your kid's bike than a card and clothespin. Just wrap it around a seat support and fasten with a bolt.—*Joe Reinhardt*



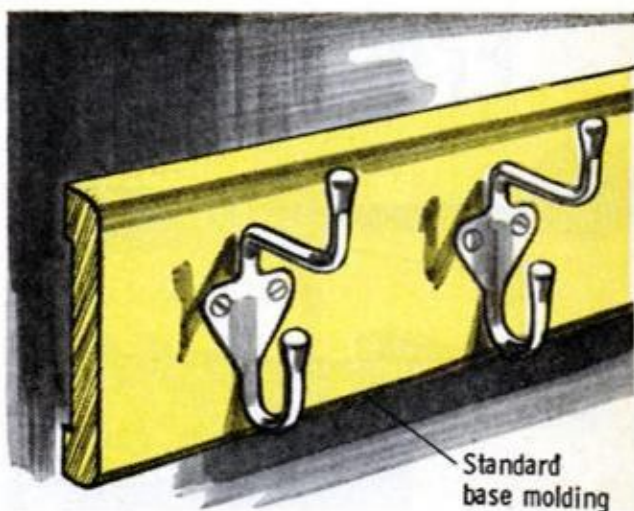
WHEN YOU POUR A SLAB in sections, avoid future cracking at the joint by reinforcing it with short rods. Bore oversize holes in the dividing form board and insert rods into the wet concrete.—*Victor H. Lamoy*



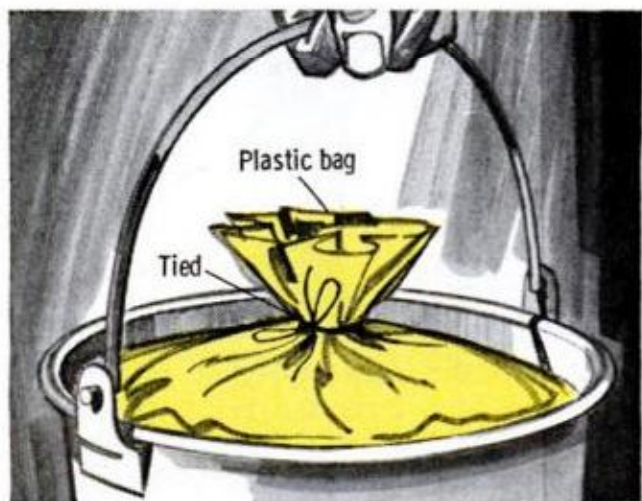
SPACE IS GOING TO WASTE between tracks of your overhead garage door. Two plywood sheets supported by lengths of 1-in. angle iron and hung with chain will add 64 more sq. ft. of storage.—*W. F. Wilson*



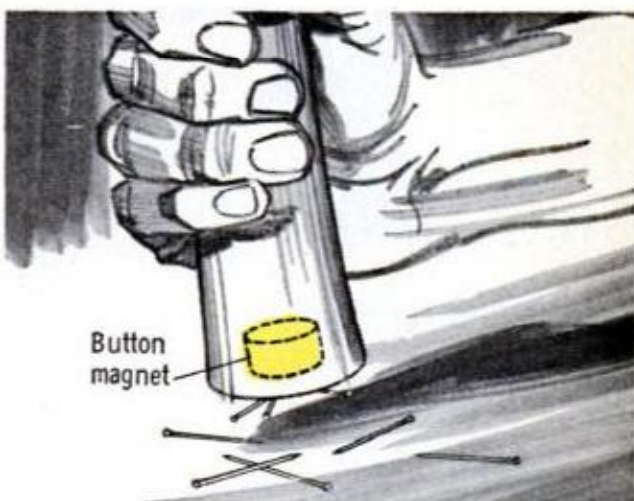
TWO L-SHAPE IRON STAKES passed through eyes in the ends of a galvanized wire and then driven into the ground, make a non-trip-over tether for your dog. The dog's leash is snapped to the wire.—*John Krill*



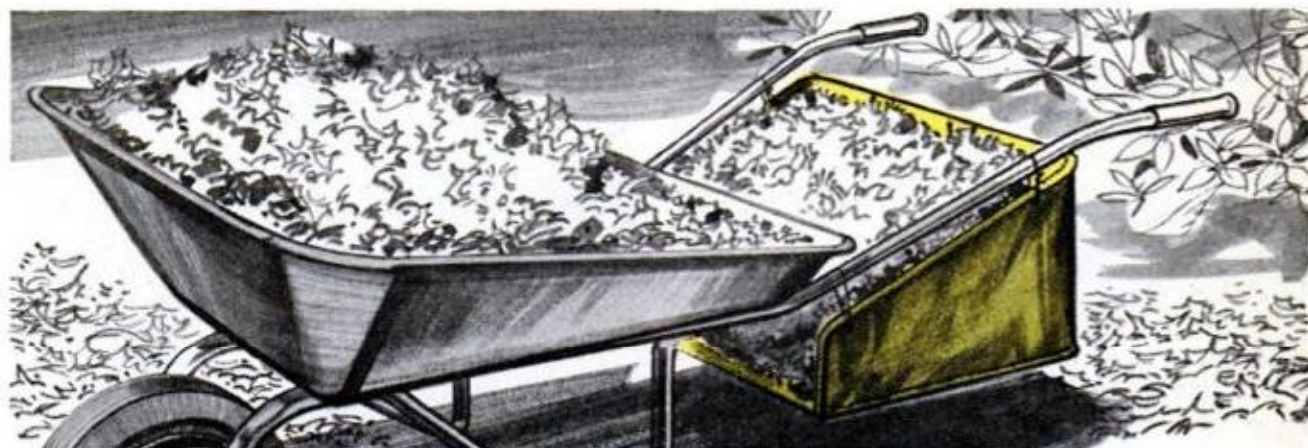
WHEN ADDING COAT HOOKS to a closet wall, a strip of door casing makes a neat rail on which to screw them. Besides being nicely shaped, the casing provides a solid surface for screws.—*Daniel Bousha*



WHEN WATER MUST BE CARRIED in an open container in the car, it will be sloshproof if you first line the pail with a plastic bag. After filling, bag is tied at the top with a bit of string.—*Andrew Vena*

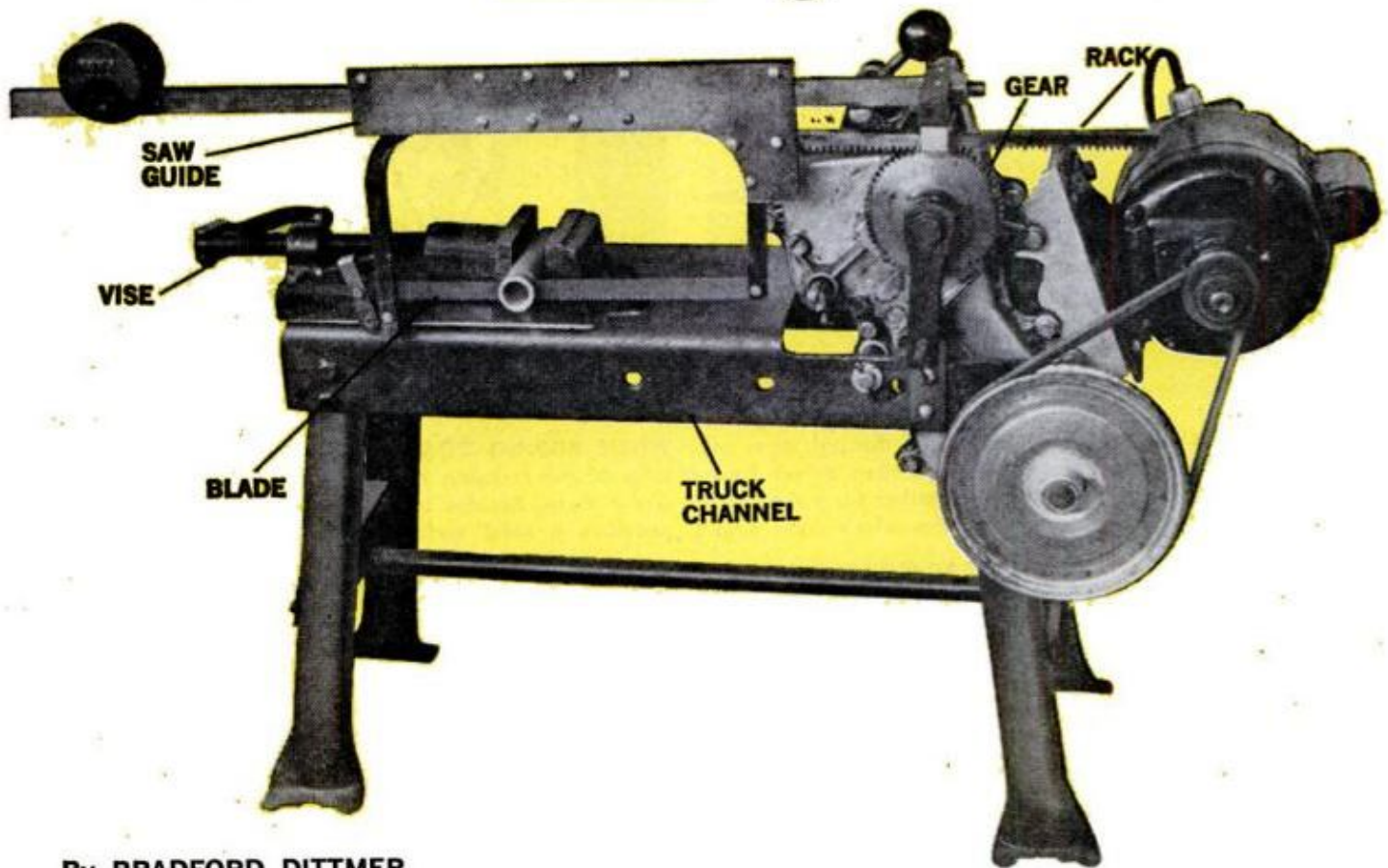


PICKING UP TINY NAILS is no problem if you embed a small button magnet in your hammer handle. Drill a hole slightly smaller than the magnet and tap the latter in place flush with the end.—*Joseph Braunstein*



YOU CAN SAVE YOURSELF STEPS when you make use of a grass catcher to increase the capacity of your wheelbarrow. Use pieces of wire to hang it between the handles of the barrow.—*Victor H. Lamoy*

Build This Power Hacksaw From a Washing Machine



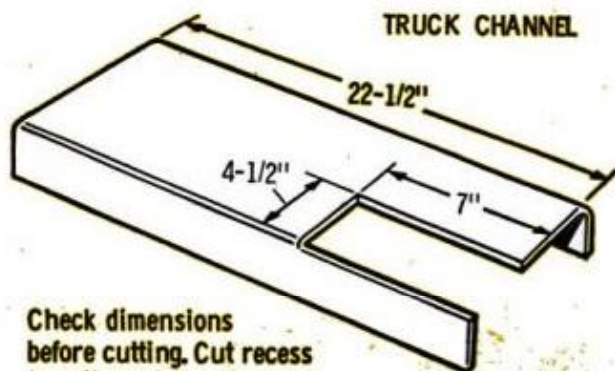
By BRADFORD DITTMER

A WELCOME ADDITION to any metalworker's shop would be a power hacksaw, but few home shops boast of one because of the cost. Happily, you can treat yourself to this luxury for less than \$20 by using the gearbox from a discarded washing machine.

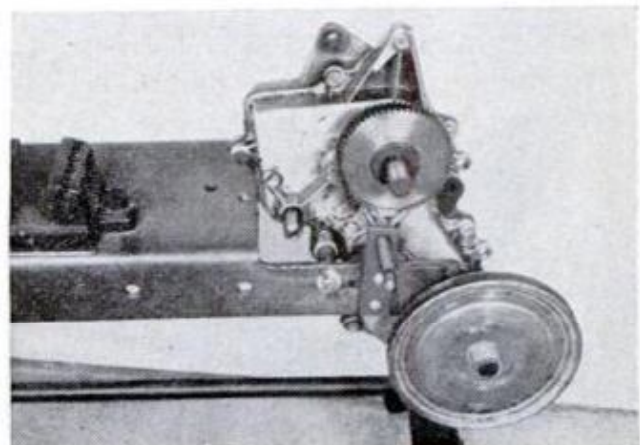
Though any make of washer having a back-and-forth impeller movement can be

used with the rack-and-gear method to drive the saw, I used a Sears Kenmore. The gearbox has built-in gear reduction, existing lugs for attaching a motor mount and saw guides, plus a 7-in. driving pulley. Half of the housing is gray iron casting, the remainder die-cast of a lightweight alloy.

Two changes were necessary: A hole



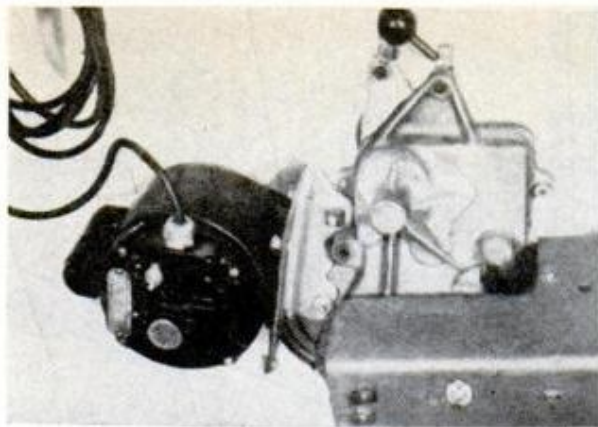
Check dimensions before cutting. Cut recess to suit gearbox used



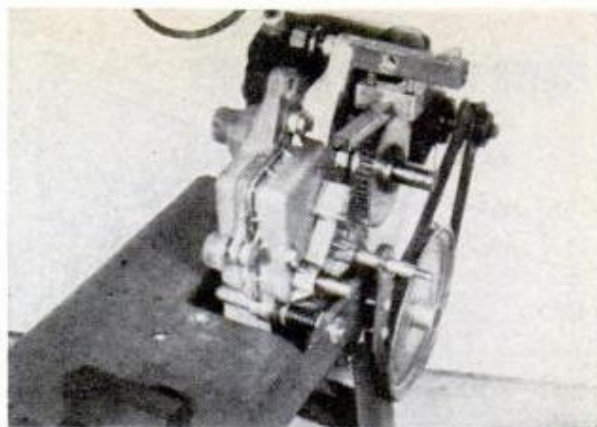
GEARBOX IS MOUNTED using 1/2-in. stock, washers and pins. Test dimensions first, using a wood base

TO INSURE ACCURACY, make a test stand using wood before cutting recess in the truck channel

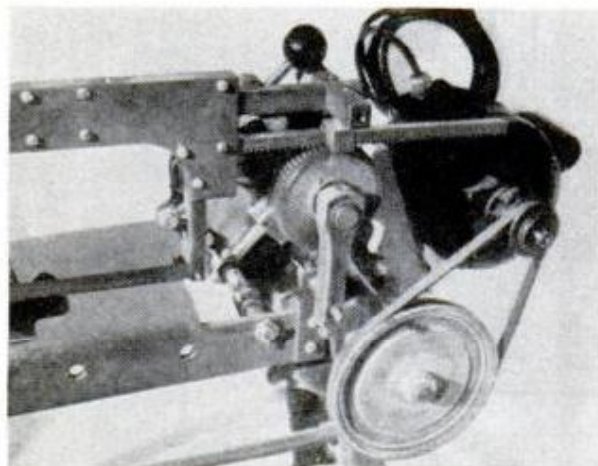
POPULAR MECHANICS



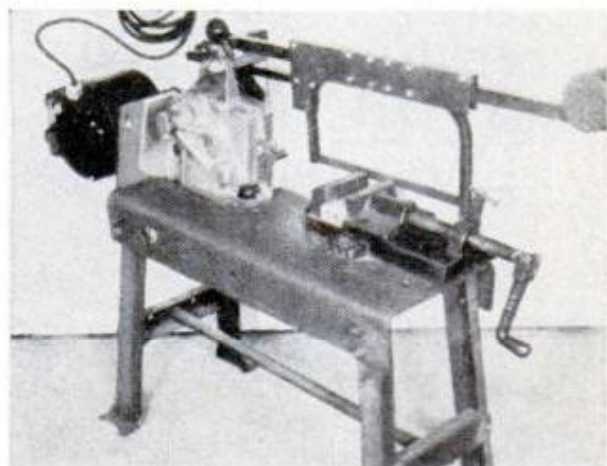
MOTOR IS MOUNTED on existing bolts on gearbox. Plate is fastened to an angle to receive the motor



60-TOOTH GEAR is mounted on driveshaft against collar. Key parts line up on this gear's center line



BRASS PLATE extended down one leg of saw provides way to attach rack, takes springiness out of leg



READY TO GO, author found saw worked better with counterweight added to outboard end of saw guide

had to be reamed in the large lug on the underside of the iron casting to accommodate the $\frac{1}{2}$ -in. rod on which the motor rides in the base, and the impeller shaft had to be shortened about 8 in.

If you slip a 16-pitch, 60-tooth gear over this $\frac{3}{4}$ -in. shaft and drive the 7-in. pulley with a $\frac{1}{4}$ -hp, 1725-rpm motor rigged with a 2-in. pulley, you get just about perfect cutting speed—72 strokes per minute. Stroke length is about $6\frac{1}{4}$ in.

Of cold-rolled stock, the saw frame is made simply by heating and bending it, using a wood template. Slots to cradle the blade are handsawed with a hacksaw. They're cut to accommodate the 12-in. power-hacksaw blades that are sold by Sears.

Since the saw operates smoother if the flat surface contacting the saw guides is long, use a straightedge along the top of the frame after bending. Place the blade so it will operate as a drag saw.

Make a trial-and-error wood base for setting up the machine. Use about 30 in. of 2x8 stock and saw out the recess as

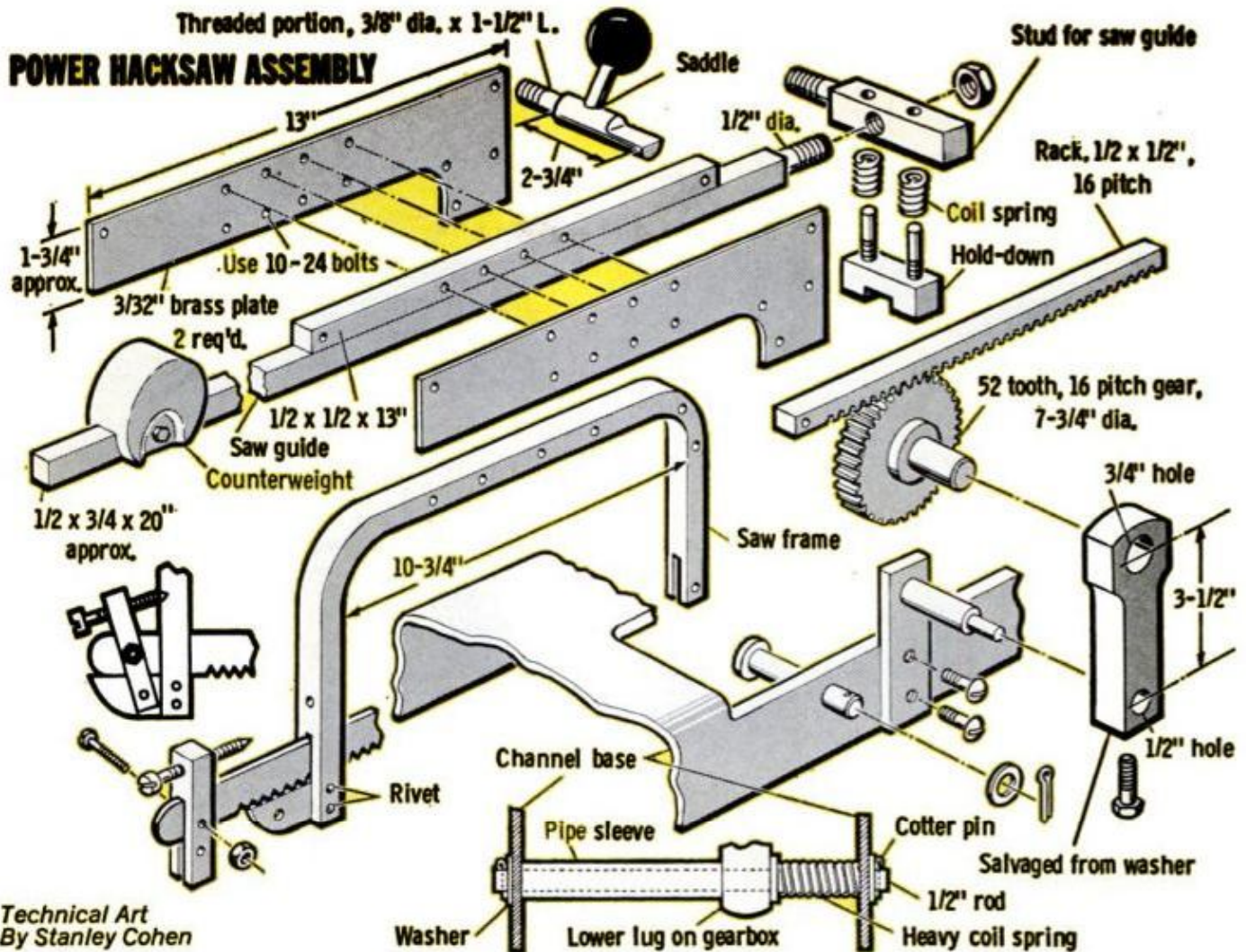
shown. About $2\frac{1}{2}$ in. back from the forward end of the recess and 1 in. down from the top surface, drill a $\frac{1}{2}$ -in. hole across the recess.

Next, mount the gearbox on a rod inserted across this recess. Block up the back of the box, set it in position, fit and assemble the rest of the fixtures. This done, you can then determine the measurements that you will need to build the permanent stand.

Place the gear on the driveshaft tight against the collar and fasten it with a taper pin. When assembled, all parts on the mechanism are lined up on this gear's center line.

The brass hold-down is notched to fit over the rack. Clamp it in place and drill a hole through both parts on each side of the rack with a No. 7 drill.

Next, tap $\frac{1}{4}$ -20 threads and insert $\frac{1}{4}$ -in. bolts in the holes and saw off the heads about $1\frac{1}{4}$ in. above the stock. If necessary, enlarge the holes in the stud to assure an easy sliding fit. The springs slipped over the studs should be of a suit-



able length to maintain a moderate down pressure on the rack.

To make the saddle, saw out a half-round section under the saw guide. This allows the saw to swing down far enough to finish the cut. Fit this part with a suitable handle for turning to up and down positions. Since the saw operates when the saddle is in any position, there is no need for an extra switch to stop the saw automatically after the cut.

The part salvaged from the washing machine (see drawing) is slipped over the small end over the 1/2-in. stud. The bronze, brushed end goes over the gear shaft to act as an outside bearing. Finally, add a 3/8-in. setscrew to hold it securely on the 1/2-in. stud.

Run the saw out to the end of the forward stroke. The face of the rear vise jaw should be set 1/2 in. ahead of the rear leg of the saw. The saw guide should be level when the blade is about 3/4 in. above the floor of the vise. And, when the saw guide is level, the rack should be parallel to it.

When you have the rig checked out, use

the measurements from your temporary setup to make the permanent one.

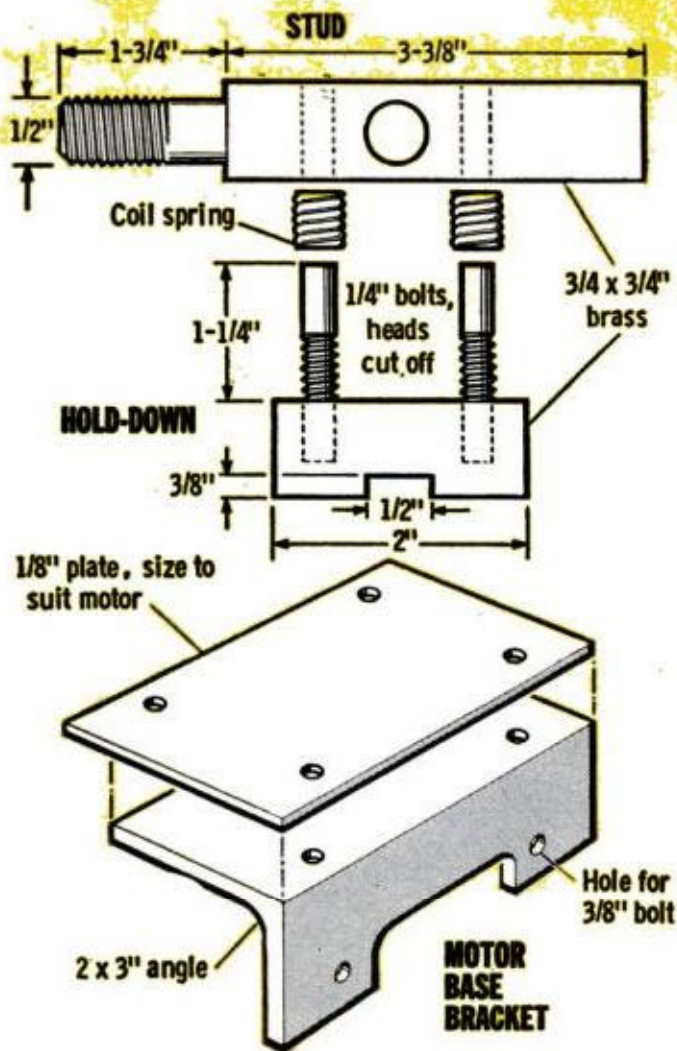
The base shown was made from 8-in. truck channel. (That explains those unused holes). The legs are of light channel with the lower ends heated and bent to serve as feet.

To set the gearbox, drill holes for the 1/2-in. rod square with the sides of the channel and parallel to the top surface. Set the gearbox on the rod, block it in its final position and cut a pipe sleeve to fit over the rod between the lug and the far side of the channel. On the near side of the rod, place a stiff spring and use washers if necessary to hold the box in position.

Drill a 1/2-in. hole in a short piece of 1/4 x 1 1/4-in. stock, and slip the hole over the 1/2-in. stud. Tip gearbox to its vertical position, clamp piece to the channel flange and drill for two 1/4-in. bolts. If the spring on the rod is tight, your gearbox is set.

The motor-base bracket is cut from 1 1/2 x 2 1/2-in. angle to fit over two existing lugs on the back of the gearbox. Drill the bracket so it can be bolted onto the lugs with 3/8-in. bolts. Since the 2 1/2-in. face is

HINTS FROM READERS

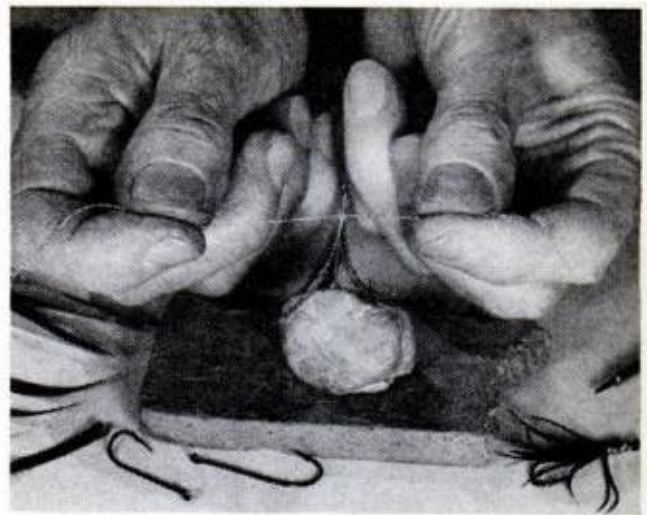


not wide enough to accommodate the motor base, use a plate—the size of the motor base—between motor and bracket. *Caution:* Be sure you set the motor so that the pulley is clear of the rack path on the back stroke.

Construction tips. It's easier to assemble the saw sliding mechanism if you clamp the saw, saw guide and top slide together. The brass plates can then be clamped in place and holes bored for 10-24 bolts to hold the unit together. After removing the clamps, bore the remaining holes.

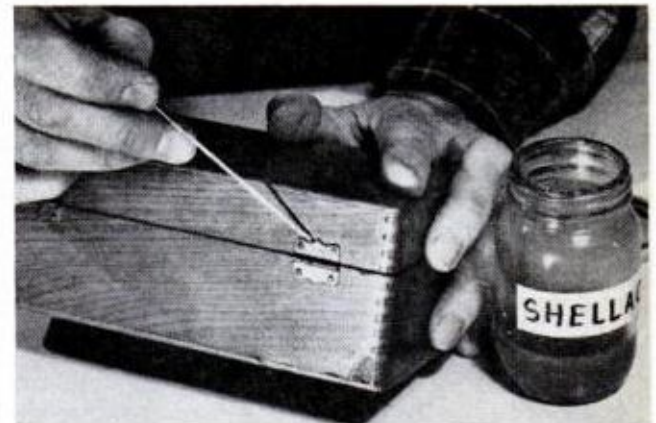
When using shims to insure a free-sliding fit, my experience has been that there is too much play when the shims are removed. Thus, I simply tightened the bolts to allow a free slide. It's not a must to use a 60-tooth, 16-pitch gear; a smaller gear—down to 50-tooth—can be used, but it will shorten the saw stroke.

The total cash outlay was about \$20. Lengths of cold-rolled stock can be picked up at a local machine shop. If you have difficulty getting the gear and rack, write to Chicago Gear Works, 441-451 N. Oakley Blvd., Chicago. ★★★



Clay pinch-hits as vise

When tying flies, you can keep both hands free to do the job if you sink the hook into a mound of modeling clay as shown. After pushing the hook in, firmly imbed it by compacting the clay with your fingers. I've found the clay holds the hook steady, yet permits easy removal when the work is done.—W. C. Wilhite



Anchoring loose hinges

The small hinges on trinket and other miniature boxes are often fastened with tiny screws or nails which usually work loose. To avoid having to plug the old holes and install new fasteners, try running shellac under each hinge leaf and tapping the existing nails back in place. Other materials, such as varnish or lacquer can be used, but be careful that the solvent (lacquer thinner for example) does not damage the finish around the hinges. The photo shows the shellac being applied with a wire dip. A brush could have been used but shellac seemed to flow better from the wire.

—Walter E. Burton

EXCITING NEW PRODUCTS

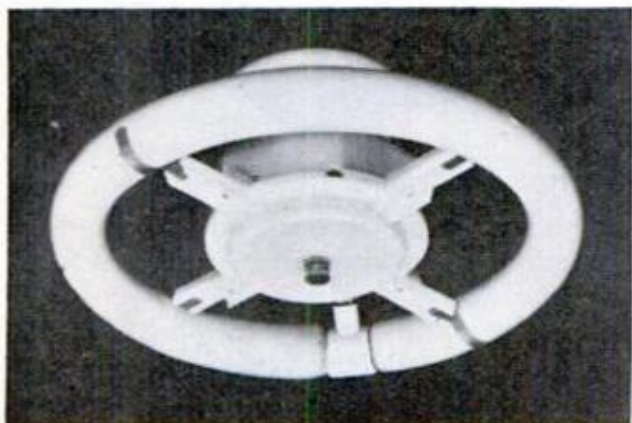
By CATHERINE BILSKI



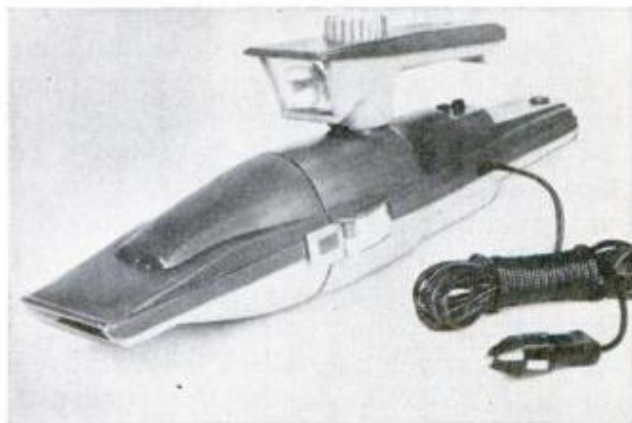
INDUSTRIAL-STRENGTH CLEANER to tackle really tough household cleaning chores has just been introduced by Texize Chemicals, Inc. Called Janitor-In-A-Drum, the cleaner comes in a 32-oz. plastic drum. It's particularly tough on grease and grime, great for cleaning up your power mower when putting it away for the winter. It can be used full strength from the container or diluted with water. Sells for 89 cents in supermarkets, drug and hardware stores.



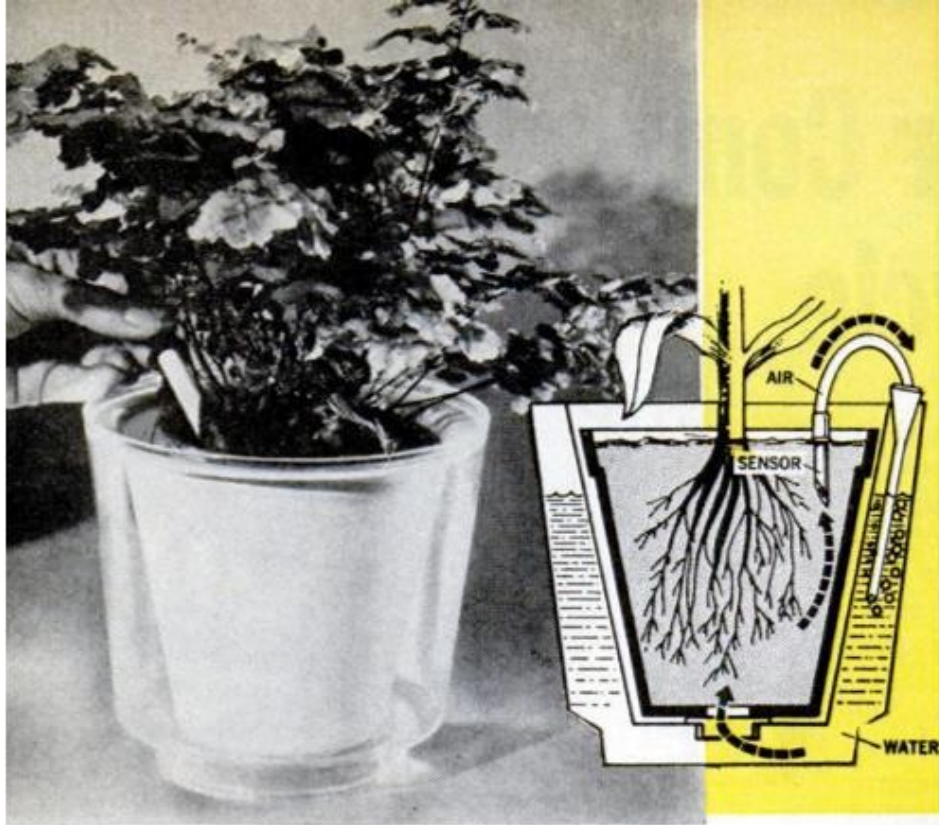
WORKSHOP AND GARDEN TOOLS can be renewed, protected, insulated and made safer to handle with Dip'n Grip. This liquid vinyl can be dipped, brushed or sprayed on to give a cushioned sure-grip coating on any metal, wood or plastic surface. Available in four bright colors, the liquid is sold in a 13-oz. resealable jar for \$2.50. Made by Resin Systems, Inc., 25-29 50th St., Woodside, N.Y. 11377.



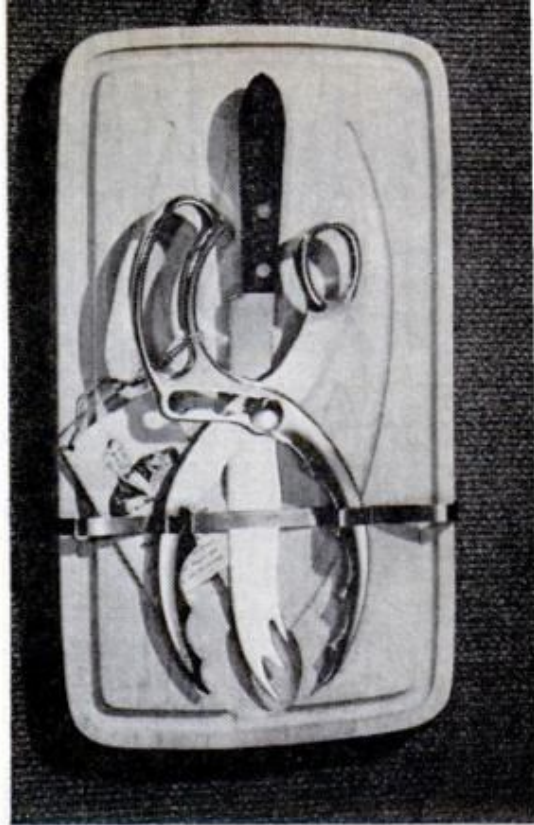
FLUORESCENT LIGHTS anywhere you need them are possible thanks to a new circular fluorescent tube which can be used in any incandescent socket. Gives bright shadowless light in kitchen, bathroom, garage, workshop. The circular tube comes in both 8 and 12-in.-dia. sizes, as well as in a unit combining the two. The tubes are manufactured by the Pacific Arlite Co., 4 15th St., San Francisco, Calif. 93105.



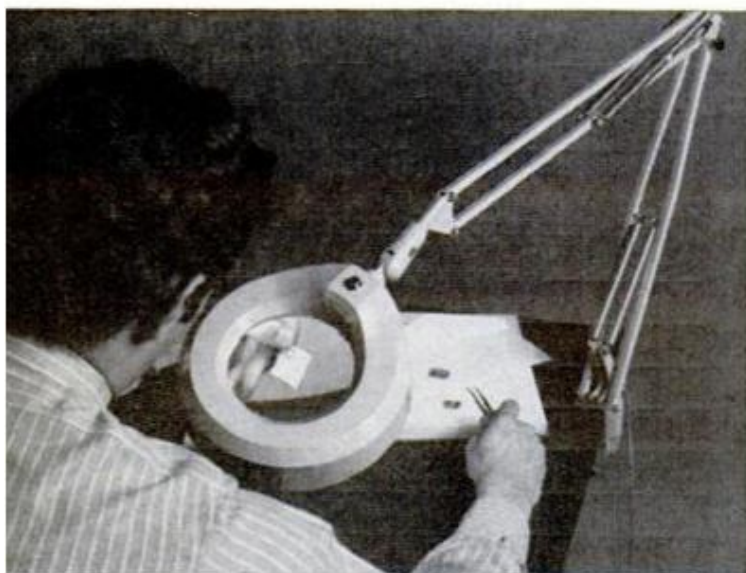
CLEANING YOUR CAR INTERIOR, or even defogging the windows is quick and easy with a device called Car-Vacuum and Defroster. Just plug it into the lighter socket. At one end is a powerful vacuum cleaner, the other a defroster that defogs windows, clears away snow and ice. A built-in swivel light lets you use it at night. \$14.98 postpaid from A. W. Williams Co., 5727 Floy Ave., St. Louis, Mo. 63120.



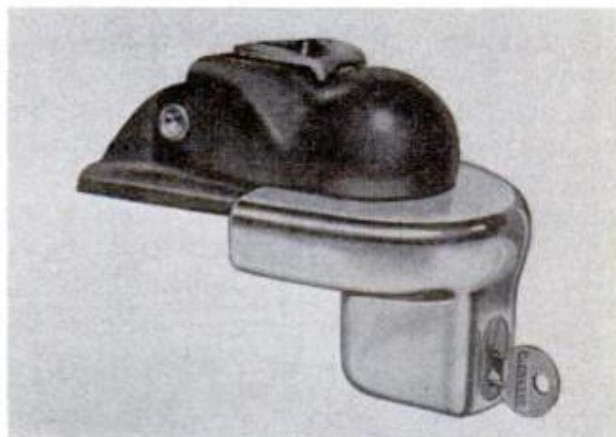
YOUR HOUSE PLANTS will stay healthier and live longer in the Plantender, whether you're at home or away. The Plantender is controlled by special sensors that read the moisture content of the soil and release water from a reservoir to your plant. This process always maintains the proper moisture level for your plants. A 4½-in. pot sells for \$6.55, a 7-in. pot for \$8, both postpaid. Made by Plantamation, Inc., 136 East 57th St., New York, N.Y. 10022.



NOW YOU CAN CARVE AND SERVE a roast with a single, all-purpose unit. Its prong-tipped knife which doubles as a serving fork, features a saw-toothed stainless steel blade with walnut handle, plus maple carving board. The aluminum tongs adjust to hold any size roast and can be used to lift food from a hot oven, grille or boiling water. The entire set can be hung up. It sells for \$16.95 from Habny's, 265 Huntington Ave., Buffalo, N.Y. 14214.



HERE'S AN ILLUMINATED MAGNIFIER of professional quality that's designed and priced for the home, workshop or small office. It combines shadowfree fluorescent lighting with 100 percent magnification. Ideal for model building, miniature construction, intricate wiring and other such jobs. Marketed as "Crown Lite by Luxo," it sells for \$34.50 complete, \$29.50 in kit form. Made by Luxo Lamp Corp., Port Chester, N.Y.



GUARD AGAINST THEFT of your boat, camping or travel trailer with the new No-Tow Trailer Lock. It fits 1 7/8, 2 and 2 5/16-in. couplers on Acme, Atwood, Big Boy, Marvel and others; protects against theft via a special rustproof cadmium housing. It's tamperproof and easy to install. Here's low-cost trailer-theft protection for only \$12.95 plus 95 cents postage from Holly House, 9924-M Edgecove, Dallas, Tex. 75238.

Add Winter Comfort To Your Cycle

BIKE RACERS use fairings on their motorcycles to reduce drag, or resistance, thus increasing racing speed. Though the fairing shown is not designed for that function, it does give winter riding comfort equal to commercially available plastic rigs that sell for \$100 or more.

Besides the monetary saving, the fairing has two other good points: 1. Being very flexible it will not cause injury in a spill; 2. It can be installed or removed quickly because you don't have to take the bike apart.

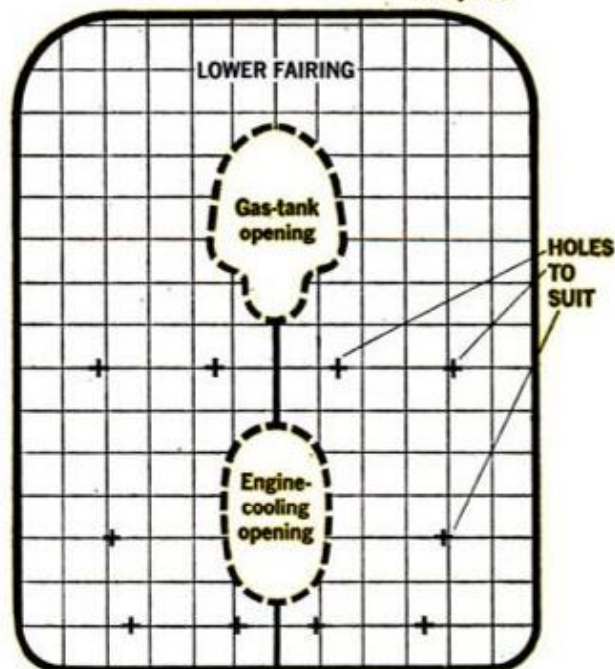
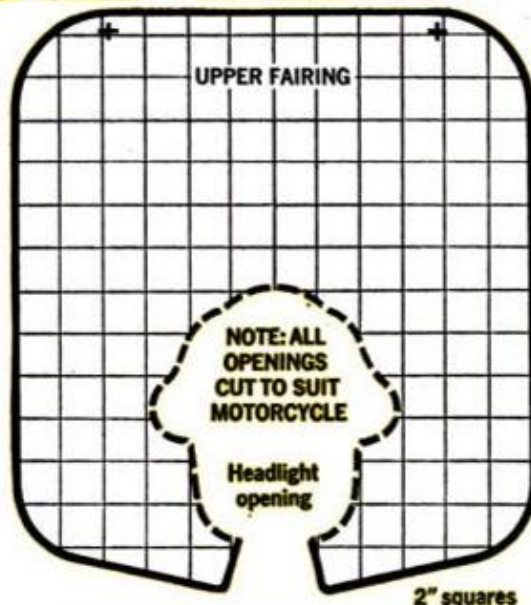
Cut from two 24x30-in. truck mud splashguards, the outfit shown cost me less than \$5 to make. Besides the mudguards you will need several 3/4-in. pipe clamps and wingnuts for mounting the lower fairing to the crash bars. Since there are many styles of motorcycles, scribe all cut-outs on cardboard to suit your bike. When satisfied with the fit, custom cut the mudguards.

Caution: Since cooling the engine is important, watch for overheating on short trial runs. If necessary, enlarge the air-cooling hole; you needn't remove the fairing. To purchase the mudguards, check the Yellow Pages under Truck Equipment and Parts.

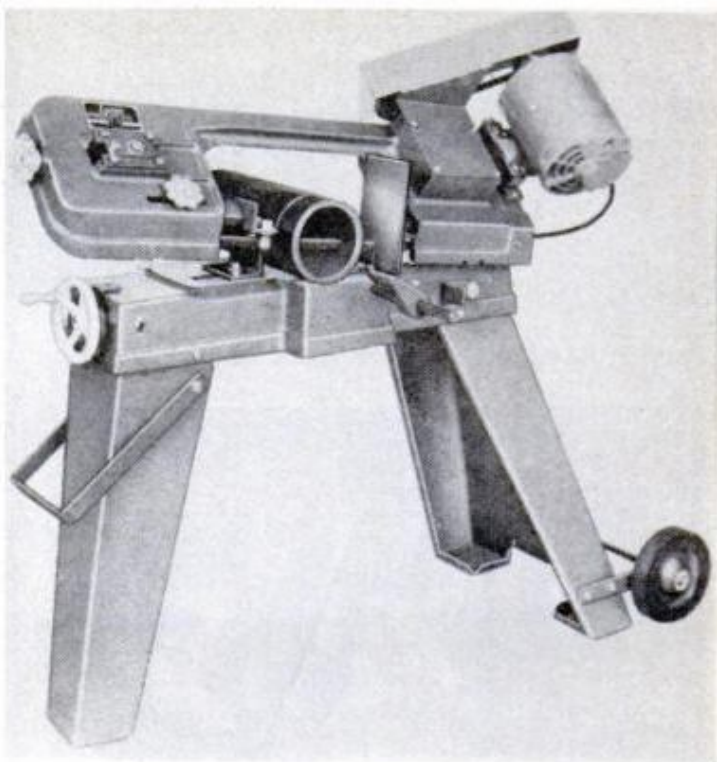
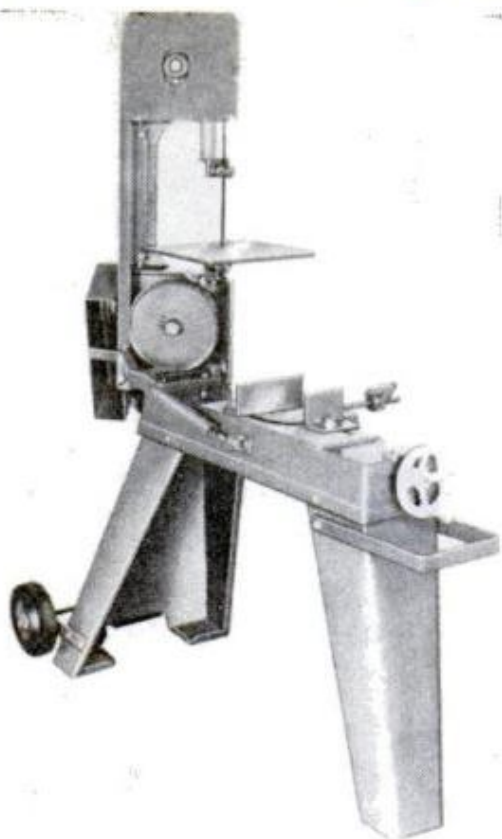
—Harold Humphrey



TO AVOID A CUTTING ERROR, scribe all cut-outs on cardboard first, and transfer outlines to mudguards. Use large shears to cut openings



New tools you should know about



Two bandsaws in one

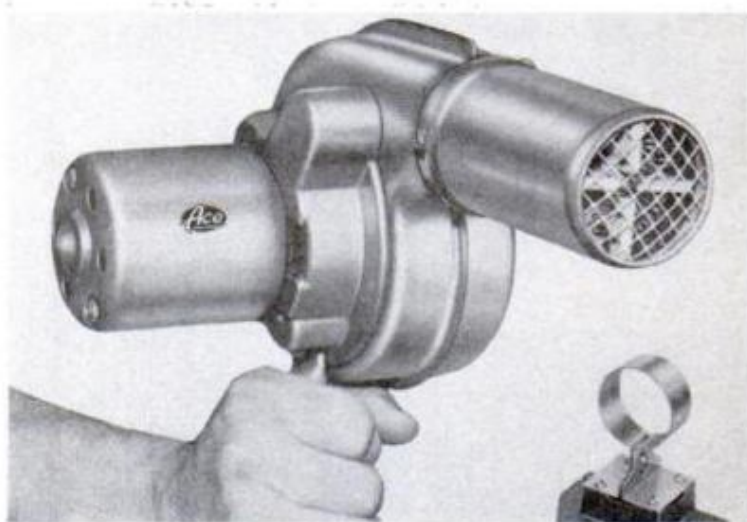
Constructed of ribbed cast-iron, the two-way metal-cutting bandsaw above can be swung upright for contour sawing. Three cutting speeds—65-120-220 f.p.m.—provide ample cutting range, and the machine shuts off automatically when the piece is cut. Takes up to 4x6-in. rectangular stock and 4½-in. dia. round. Model 4500, less motor, \$200. Lynn Engineering Inc., Albion, Ind. 46701 makes it.



Jigsaw with rotating blade

Built with a blade that swivels 360°, Thor's SpeedSaw lets the operator follow the cutting line—even on scrollwork—by steering the blade instead of the complete tool. Rated at 3.1 amps., its base tilts to permit 0 to 45° cuts right or left. Priced at \$45, the tool has a 2-in. capacity in wood, ⅛-in. in steel. Thor Power Tools, 175 N. State St., Aurora, Ill. 60607. Sold at hardware stores.

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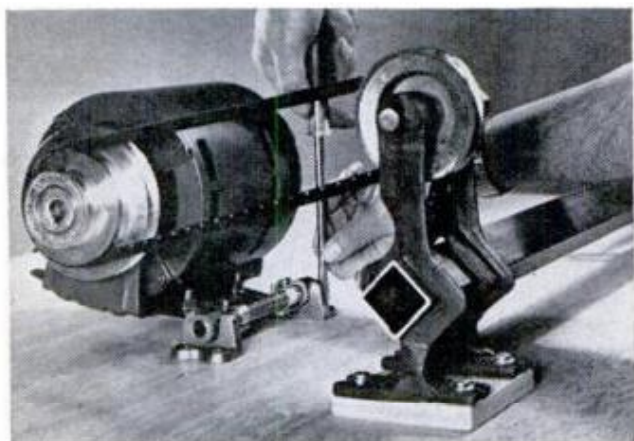
Dry-heat torch meets industrial standards

Heavy-duty heating element in this electric torch heats instantly, gives a concentrated blast of hot air that can be used to soften plastics, expand materials, cure epoxies and more. Available in four models, torches H-1, H-2 and H-3 have fixed heat ratings of 350, 500 and 750°F. respectively; H-5 has variable heat range up to 1000°F. Prices start at \$40. Bench stand shown is also offered. Ace-Sycamore, Sycamore, Ill. 60178.

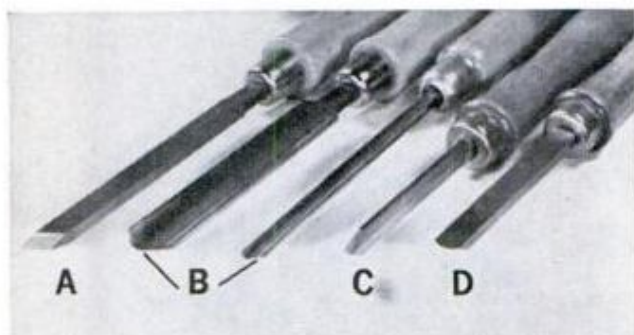
195



ALL OF THE ABOVE WOODEN ARTICLES were turned on the \$15 lathe shown at the top of the opposite page



MONORAIL MOTOR MOUNT, positioned behind the headstock, simplifies the changing of spindle speeds



FIVE CHISELS that get you started: A, skew; B, two gouges; C, parting tool, and D, scraping tool

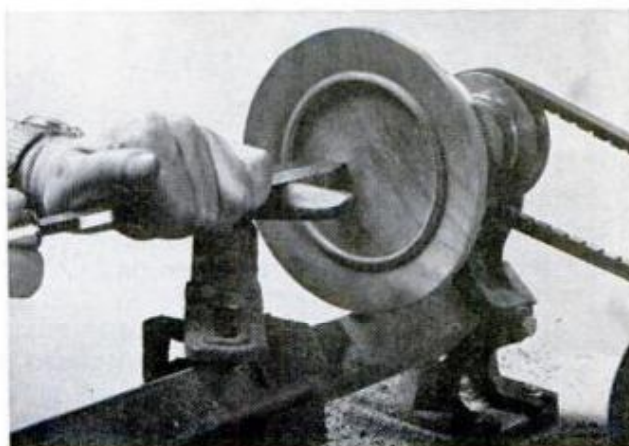


PARING CUTS are made with a skew chisel or gouge angled in such a way that bevel rides on the work

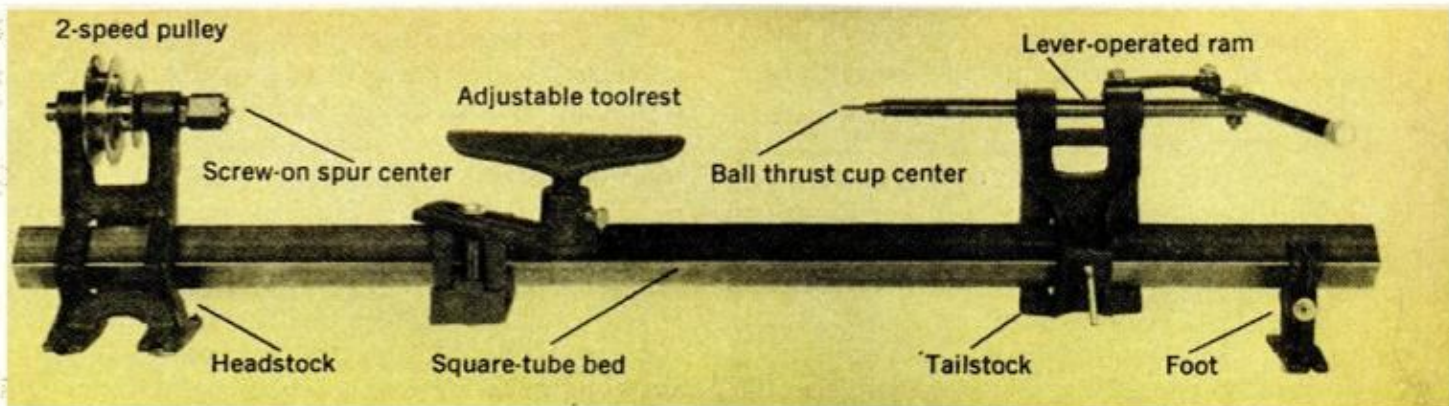
Woodturning Fun for Beginners

No woodworking tool is as fascinating to use as a lathe. More than any other tool, it is capable of producing a finished wooden product. If you have yet to try your hand, you can learn on a \$15 lathe

By JOHN BURROUGHS



MOST FACEPLATE WORK requires scraping cuts. The tool must be held horizontally and kept razor sharp



THIS STURDY LITTLE RIG, which arrived as pictured here, passed the author's tests with flying colors

NOT MANY EXPERIENCES in woodworking compare with your first try at woodturning. You'll find it sheer fascination to watch a block of wood take shape under the deft manipulation of a lathe chisel.

A wood lathe is actually a simple, comparatively inexpensive power tool made up of four parts: bed, toolrest, headstock and tailstock. You can spend several hundred dollars for a large, heavy-duty tool, but it's possible to buy a surprisingly serviceable lathe for the price of a steak dinner. American Machine & Tool Co., Inc., Royersford, Pa. 19468, sells the 36-in. lathe shown at the top of this page for \$14.95, less motor. It features a 6-in.-swing, rigid square-tube bed, lever-action tailstock and a two-speed spindle which turns in bronze bearings. The price doesn't include a faceplate, but one can be ordered for \$2.50.

Any lathe you buy should be mounted on a rugged benchtop or stand with the bed shimmed level and solidly fastened down. Ideally, the spindle centerline should be at a level slightly below your elbow or about 41 in. high. Use a 1725 rpm motor. If you haven't got a spare mo-

tor salvaged from an old appliance, AMT offers a GE saw-duty model, priced at \$18.80 if bought with the lathe.

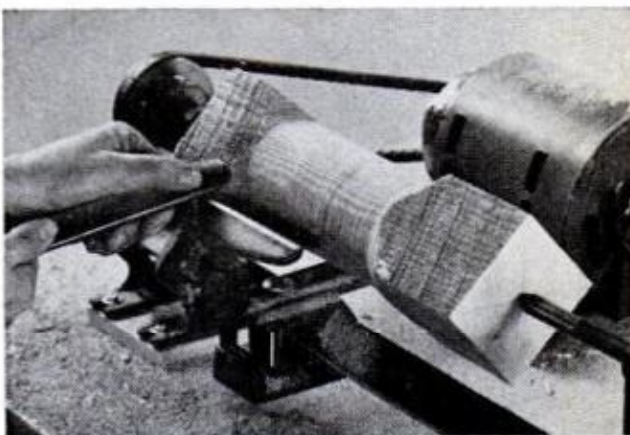
Before the stock to be turned can be mounted, the center points on the ends of the stock must be located exactly. If they are not accurate, vibration will result. Draw two diagonal lines from corner to corner, where they intersect is true center.

Next, mark true center with an awl or nail (if working with hardwood, drill the center about $\frac{1}{8}$ in. deep). Then, saw two diagonal cuts at what will be the headstock end to provide a starting seat for the spur center. With a softface mallet, drive the spur into the saw cuts. Never drive the stock against the headstock by hammering the other end. Hammering on the lathe can knock the headstock out of alignment and damage the bearings.

Replace the spur center on the headstock by threading it and the work, onto the spindle. If your lathe is the type with tapered slip-in centers, the spur center is removed from the work and replaced on the headstock. Then the work to be turned is pressed against the spurs so that they enter the grooves you cut previously. Move the tailstock until the point of



SMALL-DIAMETER WORK can be turned in chuck. Spindle nose on AMT 6-in.-swing lathe has $\frac{1}{2}$ -20 threads



STARTING AT CENTER and working to the ends, light shearing cuts are used to rough cylindrical stock

the ram lever, or dead center, is about $\frac{1}{2}$ in. from the work and securely tighten the tailstock to the lathe bed. Next, move the center against the work and then back it off so that the work turns freely.

The last step before actual turning is to adjust the toolrest. It should always be $\frac{1}{8}$ to $\frac{1}{4}$ in. above the centers. Never set it below the center line of work being turned. The top edge of the rest should always be parallel with the workpiece and about $\frac{1}{8}$ in. from the farthest projecting edge to insure clearance.

Though you can treat yourself to a full assortment of turning chisels, you really need only a few. A $1\frac{1}{2}$ -in. wide skew, plus wide and narrow gouges, will handle most work you'll want to do.

They can be used to make slicing or scraping cuts. Experienced lathemen use the first method. By angling the chisel upwards from the toolrest, its edge-bevel can ride the work and slice off thin shavings. The result is a smooth cut. It's a skill that takes practice but you can acquire it.

If you hold the chisel on the rest at a lower, near-horizontal angle, it will cut with a scraping action to tear, rather than shear, the wood fibers. This is an easier and safer way to use turning chisels but, since scraping dulls cutting edges, your tools will need frequent resharpening.

The skew chisel is used for smoothing cylinders, cutting V-grooves, shaping beads and squaring shoulders. To rough square stock round and for rough-shaping, use a large gouge. To round out coves roll a small gouge on the toolrest; first cut one side of the cove, then the other.

The various other tools are scraping chisels. With a little testing, you will find out that when doing faceplate work a round-nose scraper makes a smoother cut than a gouge. The parting tool is used primarily for sizing cuts measured with calipers. To make a cleaner cutoff, use the skew rather than the parting tool.

Work which cannot be turned between centers is turned on the faceplate. You simply screw-fasten the stock to the faceplate and mount the plate. If the job doesn't permit drilling screw holes in the stock, a piece of scrap stock is fastened to the faceplate and the stock is glued to this setup. To make separation easier, use paper between the stock and scrap.

Generally, faceplate turning is by scraping action, usually with a round nose or mortise chisel. The tool is held with the bevel side down and the point of contact is kept horizontal on a line passing through the center of the workpiece.

Woodturning tips you should know:

When cutting work off completely in the lathe, always cut free at the end nearest the headstock. Don't throw out broken files. You can grind special tools—a spearpoint or wide square-nose chisel, perhaps—from them.

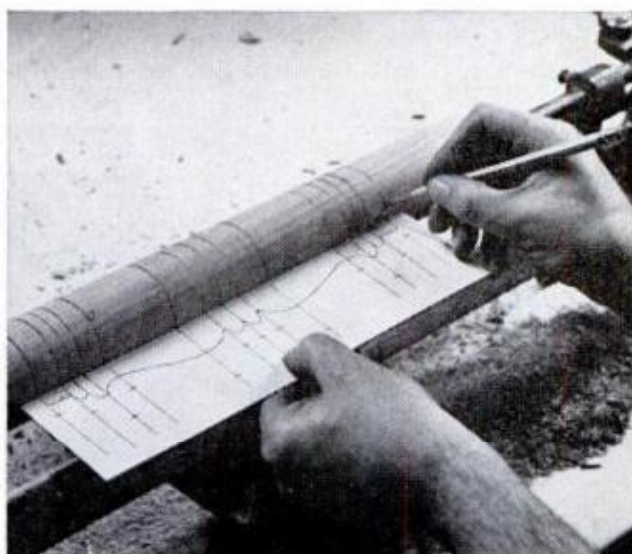
When using *any* turning chisel, always cut with—never *against*—the grain of the wood. If you cut against the grain, the chisel is sure to dig in and tear out a gash.

When turning work mounted between centers, always cut "downhill"; work from the larger diameter to the smaller.

While spindle speed isn't critical, moderately high speed generally gives cleaner



TO CUT OFF finished turning, make deep V-cuts to leave but $\frac{1}{8}$ in., stop lathe, finish with handsaw



HALF-SECTION DRAWING on cardboard simplifies duplicate turnings. Mark stock directly from drawing

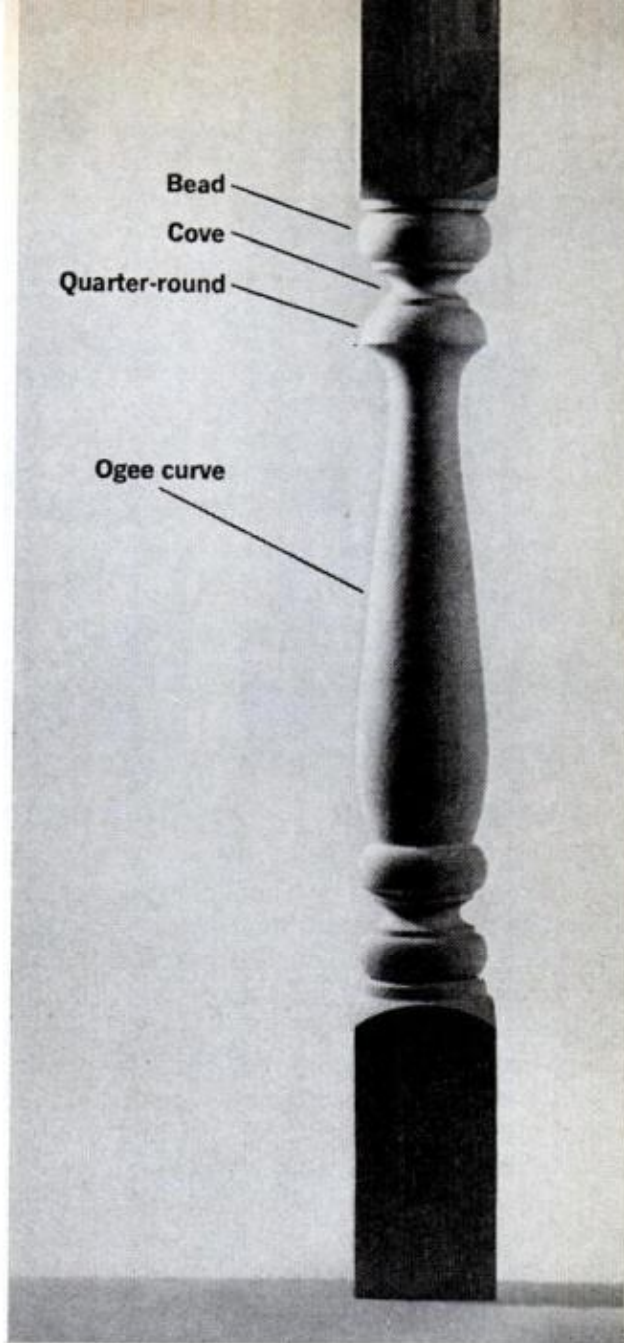
cuts. Make certain that lathework revved at high speed is securely fixed between centers and, avoid taking heavy cuts that will burn the chisel's cutting edge.

Though basic lathework is easy, planning a successful turned project requires some thought. Improvised designs—the kind you think up as you're turning them—usually turn out looking amateurish.

At the start, stick to traditional designs; use the same forms used in wood moldings as design elements. To help you visualize the finished product, make a full-size half-section drawing of a proposed turning. Don't hesitate to copy—or try to improve—turned work you admire.

Some woods are easier to turn than others. Pine, maple, walnut and well-seasoned fruitwoods turn beautifully. Ash and hickory are the best choices for tool handles. Beech turns nicely but is quite brittle. Mahogany is preferable for glued-up turnings. Some oaks are attractive when turned, and some aren't. The structural softwoods, fir and hemlock, tend to splinter when turned and, if coarse grained, are difficult to sand smooth.

When making small brass or aluminum turnings in a wood lathe, usually it is easier if you mount the work in a chuck screwed on the spindle nose. Carbide-tipped lathe chisels will turn soft metals, or you can grind a chisel shaped like a metal lathe bit from an old square file. Use a slow spindle speed for metalturning. Another way to use a wood lathe for metalwork is to turn solid or split patterns and then have them cast in metal at a job-shop foundry. ★★★

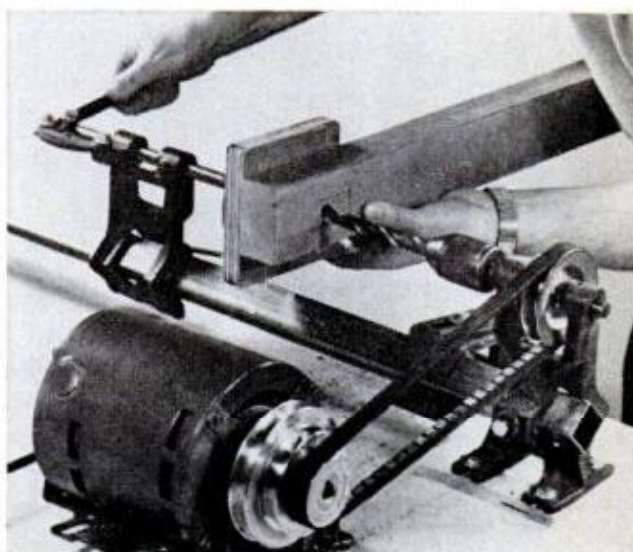


MAIN ELEMENT in spindle design is usually an ogee curve. Small steps between shapes are called fillets



PASTE WAX FINISH is adequate for small turnings. Wipe-on a half-dozen coats and buff each with a rag

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FOR DRILLING, faceplate can be screwed on lever-action tailstock ram. Wood block saves the faceplate

HINTS FROM READERS



On-the-spot clamp

During home wiring jobs when BX (armored) cable is used to add new switches and receptacles in stud-wall framing, you'll find a small clamp-on vise mighty handy. BX cable can be difficult to hold for cutting when strung through the studs. The vise simplifies holding of the cable since it can be clamped to a stud close to the switch box.

—George W. Smith Jr.



Work protector

A screwdriver bit in a brace or electric drill is a fast way to drive a lot of screws, but each time you risk slipping off the screw and marring the surface. If you bore a hole in a scrap of 1/4-in. plywood and pass it over the screw after you start it, however, you won't have to worry should you make an accidental slip of the wrist.

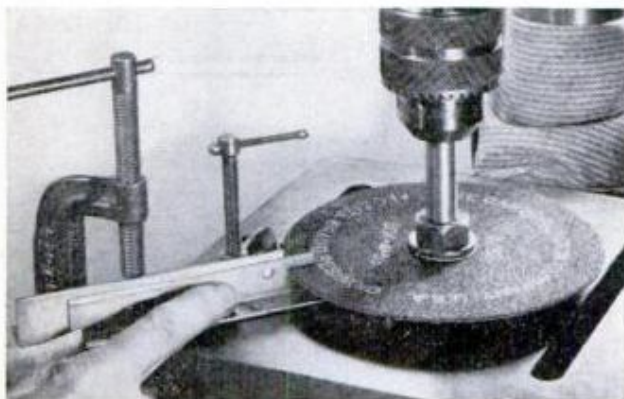
—Walter E. Burton



Use mineral oil

Kitchen tools such as egg beaters, food choppers, and mixers occasionally need a drop or two of oil. But don't use regular machine oil. Play it safe with mineral oil. You'll have no fear of oil contaminating food since mineral oil is odorless and tasteless. The eyedropper lets you add just a measured amount, drop by drop.

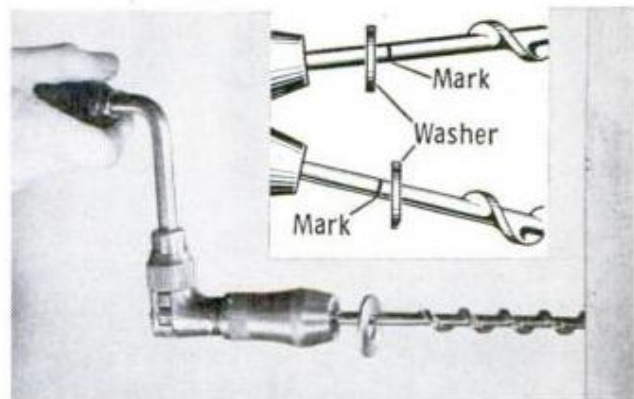
—William Swallow



Drill press takes over

When you have no bench saw, use your drill press to slit the end of metal pieces. Mount the abrasive cutoff wheel securely in the chuck and clamp a length of steel angle to the table for a fence. Then lock the spindle at a height to suit the work. While the photo shows the wheel exposed, a guard should be improvised.

—W. G. Greenwood

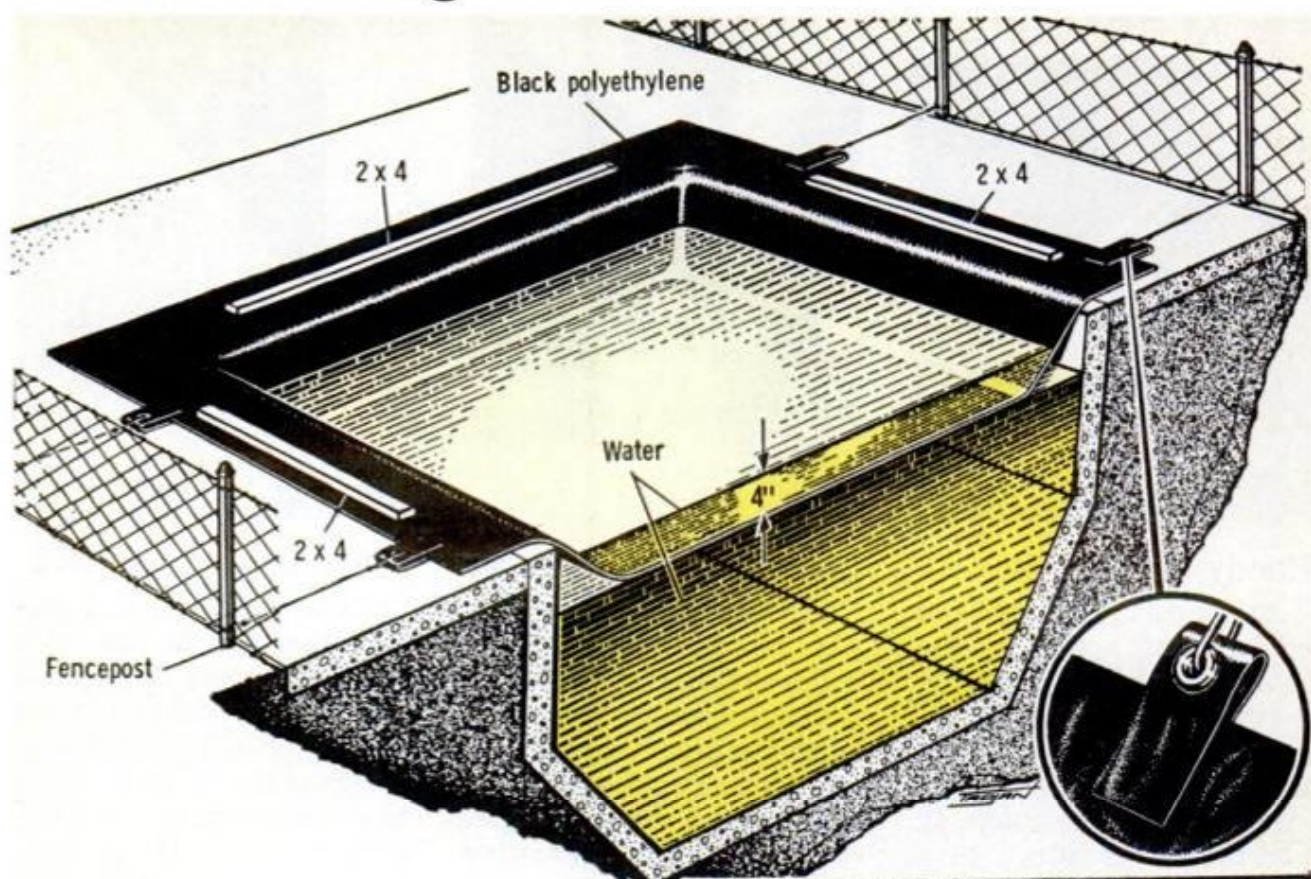


Washer levels auger

When you use a brace to bore a hole horizontally, here's a simple trick to tell if the auger is level. Pass a large washer over the bit before inserting it in the chuck and mark the shank. When the auger is held low, the washer will climb on the shank, when high, it will creep down; when level it will stay on the mark.

—R. S. Tupper

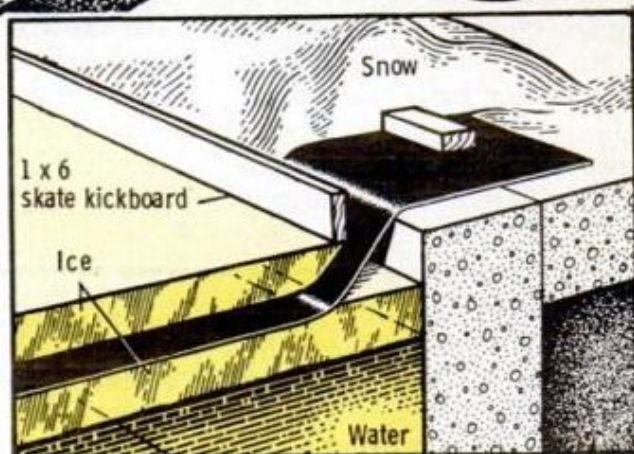
Plastic Sheeting Makes Low-Cost Pool Cover



LIKE ALL SWIMMING POOL OWNERS, I, too, was faced with annual spring-cleaning problems; scooping out leaves and other debris, and then running about 32,000 gallons of water through the filter. Since buying one of the commercially available pool covers that sell for about \$200 would have taxed our budget, I decided to make my own. And, using the materials shown above, I did it for less than \$30.

Using a 28x50-ft. piece of 6-mil black polyethylene plastic (\$25), a package of 10 Ty-downs (\$1.19) and a roll of patching tape (\$1.39), all purchased from Montgomery-Ward, I went to work. First I lowered the water level to 1 ft. below the pool edge. Then, with a helper, I spread the black plastic over the pool. To prevent it from blowing away, the self-adhering Ty-downs were secured to the cover at about 15-ft. intervals around the perimeter of the plastic and each was then tied to the nearest fencepost. Finally, to keep the wind from lifting and tearing the pool cover, I laid several 2x4s around the edges.

To keep the cover down in the pool, I added 4 in. of water. Happily, this layer also becomes our winter ice-skating rink.



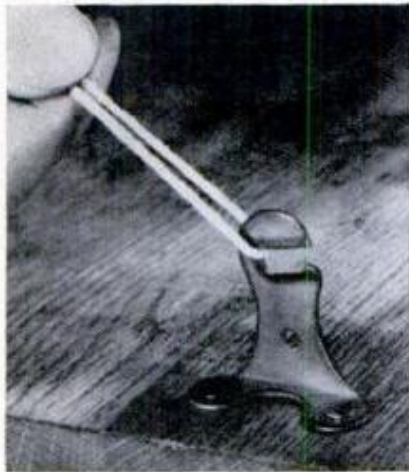
The beauty of the setup is that each spring when you remove the cover, you will find no algae. (My guess is that it cannot form without light). More important, there are no leaves for you to spend weekend hours dipping out and hauling away.

One word of caution: Though the polyethylene cover will hold a heavy load of debris, until the water is frozen it will not hold a man with his weight concentrated in one small area.

The first cover I made lasted four winters, but it would have lasted longer if my 120-lb. German shepherd had not decided to join me one day when I was testing the ice for strength.—Sven Corsak

HINTS

FROM READERS



Handy string cutter

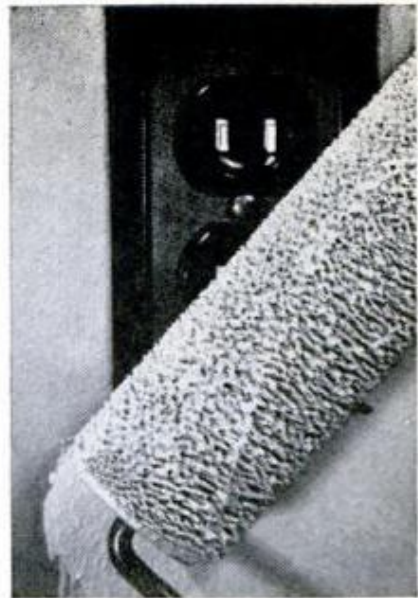
Attached to the wall in a convenient spot in the kitchen, or mounted on the toolboard in your workshop, a window shade bracket can serve as a string cutter. To make it, file the inner curve to a knife-edge. To avoid an accident, be sure to fasten the cutter high enough on the wall so that it is well out of reach of young fingers.—William Swallow



Spool saves shade roller

When hammering the pin in place on a shade roller that has been altered, it's poor practice to rest the spring end of the roller on the floor or workbench. Instead, place the end in an empty spool. No matter how hard you tap, there is no chance of damaging the other end. For stubborn jobs, the spool can be clamped in a vise.

—William Swallow



Protecting prong holes

Since dark-colored receptacles can be an eyesore on a light colored wall, here's a safe way to paint them to match without clogging the holes. Using a frozen-sucker stick or other nonconductive material, insert a short length into each hole so that it protrudes slightly. After painting, remove strips with your fingertips, not pliers.

—Joseph Singerman

NEXT MONTH IN SHOP AND CRAFTS

HOW TO FINISH YOUR BASEMENT LIKE A PRO. When remodeling a basement, framing and paneling are the easiest parts of the job. What gives most do-it-yourselfers grief is the solving of such nitty-gritty problems as how to box-in the beam, finish off the cellar-stair wall and build almost invisible access doors to pipes and crawlspaces. You'll find out how the pros solve these problems in the December PM.

LOOK WHAT YOU CAN DO WITH A BELT SANDER. It's a versatile tool that will make your workshop hours a lot happier. For the latest in what's offered in belt sanders, plus tips on the right way to use them, read PM next month.

HOW TO ANNEAL, HARDEN AND TEMPER STEEL. If these metalworking techniques have you mystified, you will be surprised to learn that all three are actually easy to do. The story also includes a handy color-reference scale and instructions for making your own workholding tongs. You'll find it in the December issue of PM.

STORAGE IDEAS FOR EVERY HOME. Special 12-page section rounds up ideas galore for making use of every square inch of living space in your home. We've found some spots that are right under your nose and some that aren't. To learn how to utilize all of the space that your home offers, pick up the December issue of PM.

PLUS: Solving Home Problems, New Building Products Roundup, How to Make a Jigsaw for a Dime . . . and more.

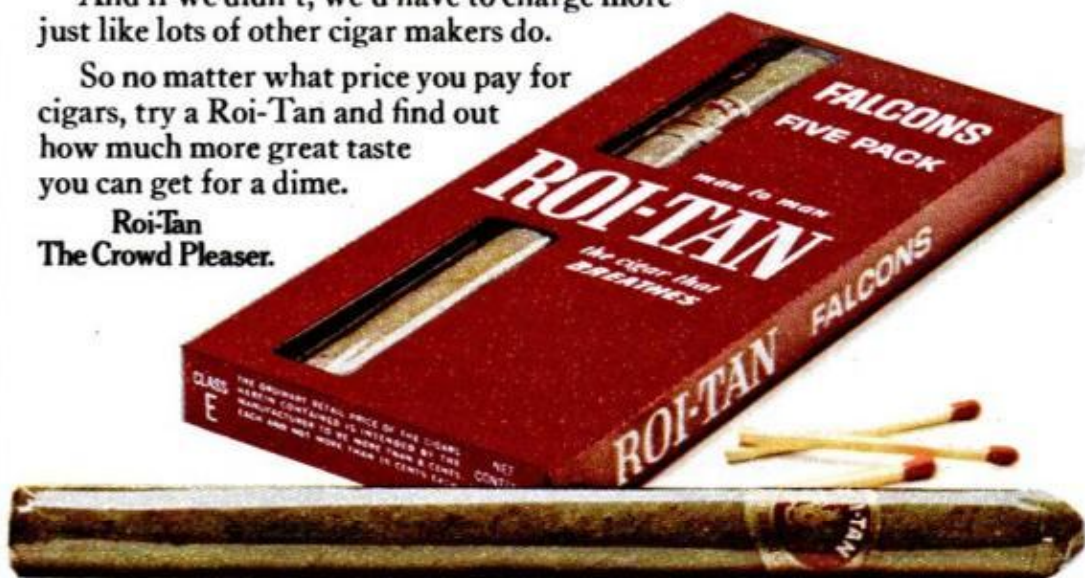
If Roi-Tan wasn't the best selling ten cent cigar, you couldn't buy it for ten cents.

There's only one reason you can buy a fine tasting blend of imported and domestic tobacco like Roi-Tan for only a dime. The fact that we make so many of them.

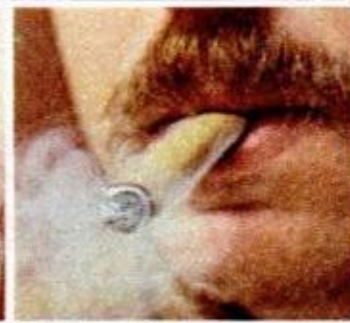
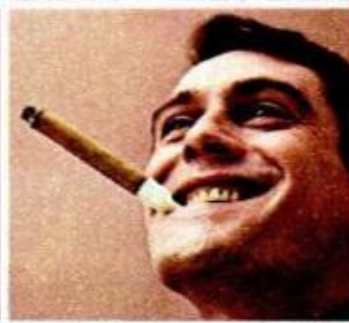
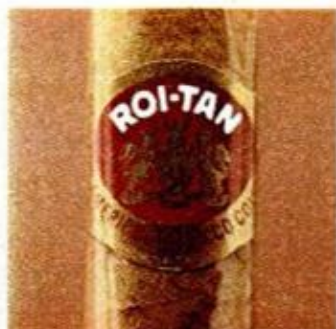
And if we didn't, we'd have to charge more just like lots of other cigar makers do.

So no matter what price you pay for cigars, try a Roi-Tan and find out how much more great taste you can get for a dime.

Roi-Tan
The Crowd Pleaser.



Stylishly long slender cigars are becoming more and more preferred by today's cigar smoker. Another reason why the Falcons are one of the more popular of the many Roi-Tan shapes and sizes.



BIG AIRLIFT TO NORTH SLOPE

(Continued from page 97)

eration. An estimated 2000 workers were on the Slope last spring; soon there may be 5000. A mountain of supplies is necessary to maintain such an army. A drill rig itself may use 2500 gallons of fuel daily, and its supporting camp another 1000, depending on the cold. Machinery kept running constantly soon breaks down and, if repairable, is returned to rear area shops.

We fly an amazingly diverse collection of aircraft between Fairbanks and the Slope. With the historic DC-3 and C-46 Commando at work again, it's like old home week for veteran pilots. Few modern planes fitted the requirements of economy, short-field capabilities and hauling capacity that the Slope operation called for. I flew a C-46 last winter and noted wryly that it carried more, and from shorter strips, than any modern twin-engined turboprop.

Below Dumbo and me on the aerial bridge, light planes ferry geologists and oilhands to remote sites, where a fleet of helicopters take over. Huge sky cranes also haul heavy loads across the tundra. Above us, four-engined DC-6s and DC-7s shuttle to the larger strips.

But because reciprocating engines are under a tremendous handicap in Arctic conditions, turbine-powered equipment is increasingly favored. DeHavilland Twin Otters serve for light hauling, but the really heavy cargo such as generators, pipe, and even trucks or vans, is carried by a growing fleet of Lockheed Hercules turboprops. In an initial test, a Herk proved its ability by hauling over 500,000 pounds of cargo in a three-day, 15-flight session. Six months later a dozen of its sister craft were on the line at Fairbanks, making this the largest commercial fleet of these behemoths now at work.

We manage from three to six round trips to the Slope daily with piston aircraft, switching off the engines only for short periods at Fairbanks, where heaters are available. (The faster Herks top this performance.) On the Slope itself, with the Arctic blasts adding incentive, we hold our turnaround time to 10 minutes by rolling loads of fuel drums or other packaged goods down a light portable ramp from the plane's door. Pilots and anyone else aboard automatically become cargo handlers.

The Herks usually carry loads that cannot be handled so casually, but by containerizing freight and using the larger strips where fork lifts and tractors are available, they can be turned around equally fast.

In the public mind, an operation such as the Slope oil lift may be thought of as a gung-ho, hell-for-leather spree that is largely uncontrolled and partly suicidal. Nothing could be further from the truth. The pilots, many of them free-lancers, are all competent specialists, vitally interested in making this as safe an operation as possible.

To illustrate just how routine flights in the airlift have become, let's go for a spin in Dumbo. We boot off the snow at FAI (Fairbanks) and plow straight north to the low-frequency beacons at Chandalar and Sagwon. Even along this 300-mile stretch we are on instrument flight plans. You understand why when you see the frequent flash of passing traffic at this relatively low altitude and the contrails at higher flight levels. At Sagwon the route fans out.

When the oil lift first started, we were largely on our own after leaving Sagwon for the descent into the constant overcast. Communications with ground controllers usually faded completely.

Now, as we descend for a landing at Kuparuk or Ugnu, the situation is entirely different. Last spring the FAA set up a control system to provide planes on instrument flight plans with at least minimum spacing. We now ask for clearance before changing altitude or deviating in any way from the flight plan filed in Fairbanks.

The controller in Anchorage, without radar, must coordinate traffic over the Slope through a single RCAG (remote controlled air-ground) outlet at Prudhoe Bay. With traffic so heavy, however, the single radio frequency is often overwhelmed. Aircraft are left holding in the fog, or are held on remote strips when unable to obtain departure clearance. This, of course, will change when the FAA acquires other outlets and frequencies, as it plans to do.

This time we get immediate clearance. As we break out of the low overcast and feel solid ice beneath Dumbo, we comfort ourselves with the thought that things on the Slope are pretty much the same as they are in Los Angeles or New York, with published intersections, standard instrument departures, and a heavy reliance upon the sophisticated machinery of aviation.

Flights such as the one described have demonstrated that Alaska's great oil "rush" can be supported by the unusual aerial bridge. Only a small portion of the petroleum-bearing lands here have been plumbed, so the boom and the bridge will grow. I'm sure we'll be working Dumbo on the Slope for some time to come. ★★

Dodge



1970 Dodge Coronet. It still believes a low priced car ought to be low priced.

A good low-priced car is hard to find. A roomy (six-adult-capacity), low-priced car is even harder. Enter the 1970 Dodge Coronet. Very big for its price. Choice of 17 lively models, running all the way up to the sporty bucket-seated 500, shown above. Besides all-new looks you can be proud of, the Dodge Coronet

500 has an all-vinyl interior, carpeting, three-spoke steering wheel, a 318 V8, and more than 20 reassuring safety features. And all for a price that will drive you right out of the high-rent district. Without sacrificing all the extras you want. 1970 Dodge Coronet—a brand-new, good-old, low-priced car.



If you care
how much
you pay . . .

you could be
**DODGE
MATERIAL.**

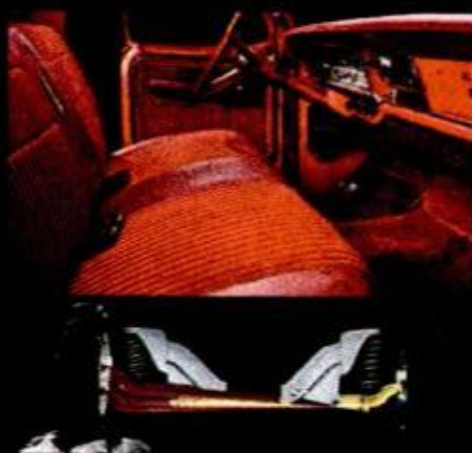


Picks up
where other pickups
leave off:

Ford Ranger XLT



In recent years, the upper limit in pickup luxury has meant just one thing, the Ford Ranger. This year, Ford makes pickups even more attractive with the Ranger XLT. Inside the roomiest of all cabs is the quiet luxury of a fine car. Deep-cushioned, pleated-cloth and vinyl-trimmed seats. Carpeting that continues all



ing that continues all the way up the dash panel. And many options, including air conditioning, power front disc brakes, Cruise-O-Matic drive, and a choice of five great engines. See how luxurious a pickup can be... see your Ford dealer.

Twin-I-Beam front suspension is Ford's better idea for smooth riding. Two I-beam axles for strength; coil springs for easy going.



Flex-O-Matic rear suspension. With heavy-duty rear springs, automatically adjusts rear spring length to keep the ride smooth, with or without a load.



Now! Four levels of style and luxury in the pickup that works like a truck rides like a car



Ford Ranger XLT



Ford Ranger



Ford Sport Custom



Ford Custom

Each is available with complete equipment packages for special uses: Farm and Ranch Special, Contractor Special, Heavy-Duty Special and Camper Special.

FORD
PICKUPS



SECRET BETTER THAN PATENT

(Continued from page 112)

mous empire on a formula known to just two men who periodically retire to a locked laboratory to mix up batches of the secret essence, called 7-X. The formula's exact proportions defy successful analysis, even by such modern methods as chromatography and infrared spectrum analysis.

Similar to such stringent safeguards are the steps taken by one of the leading perfume manufacturers to keep the secret of its thousands of formulas, which have been worked out over a half-century. After each formula is created, it is typed on cards that are filed in a fireproof steel and concrete vault in the company headquarters. Moreover, in case of nuclear attack or natural disaster, duplicates of the formulas are stored in a vault buried under a mountain 100 miles from the headquarters building.

Another company that goes all out to safeguard vital secrets is E.I. du Pont de Nemours, which considers the process of making nylon confidential. The basic technology is known. The key to making the fiber commercially lies in the area of shortcuts and improved ways of doing things. It is this kind of know-how that du Pont safeguards through precautions such as building its own machinery for key steps in the manufacture of nylon. It also requires both its employees and outside vendors to sign agreements not to disclose "confidential" information to others.

Du Pont has taken similar precautions regarding another synthetic fiber, Qiana (pronounced kee-ah-nah), which combines the appearance of silk with drip-dry qualities. Developed over the past 20 years at a cost of \$75 million (compared with \$27 million for nylon), Qiana was referred to over the years simply as "fiber Y."

Chemists and scientists working on the project were forbidden to discuss it with outsiders or even other du Pont employees. Combining a sense of precaution with a flair for publicity, du Pont introduced Qiana in 1968 by having models wearing garments made from the fabric closely watched by armed guards to prevent anyone from snipping off a sample.

A Midwest company that makes special alloys for the aircraft industry won't even permit mention of its name because its alloys are compounded by a secret process.

The cost and trouble created by such precautions might lead one to wonder why any company would consider a padlock better than a patent. If a trade secret is so valuable, why not take advantage of the

protection offered by the government when it grants a patent?

In the first place, it takes several years to obtain a U.S. patent. The du Pont company found out that it can take even longer. In 1952, du Pont filed a patent application on a method for treating plastic film so that it can be printed on. Within three years, 11 other companies had filed applications for similar patents. It wasn't until 1966, following a round of examinations by the Patent Office and a court challenge, that du Pont finally received its patent. In the meantime, its competitors had been free to use the treatment process without paying any royalties.

Even when a company receives a patent, its worries are not over. Though the patent offers protection for 17 years, it is a public document, accessible to anyone who wants to see it. And anyone who wishes to may attempt to design around a patent,

Odds in patent cases favor defendants by a wide margin.

departing just enough from the details of the original invention to beat a possible infringement suit.

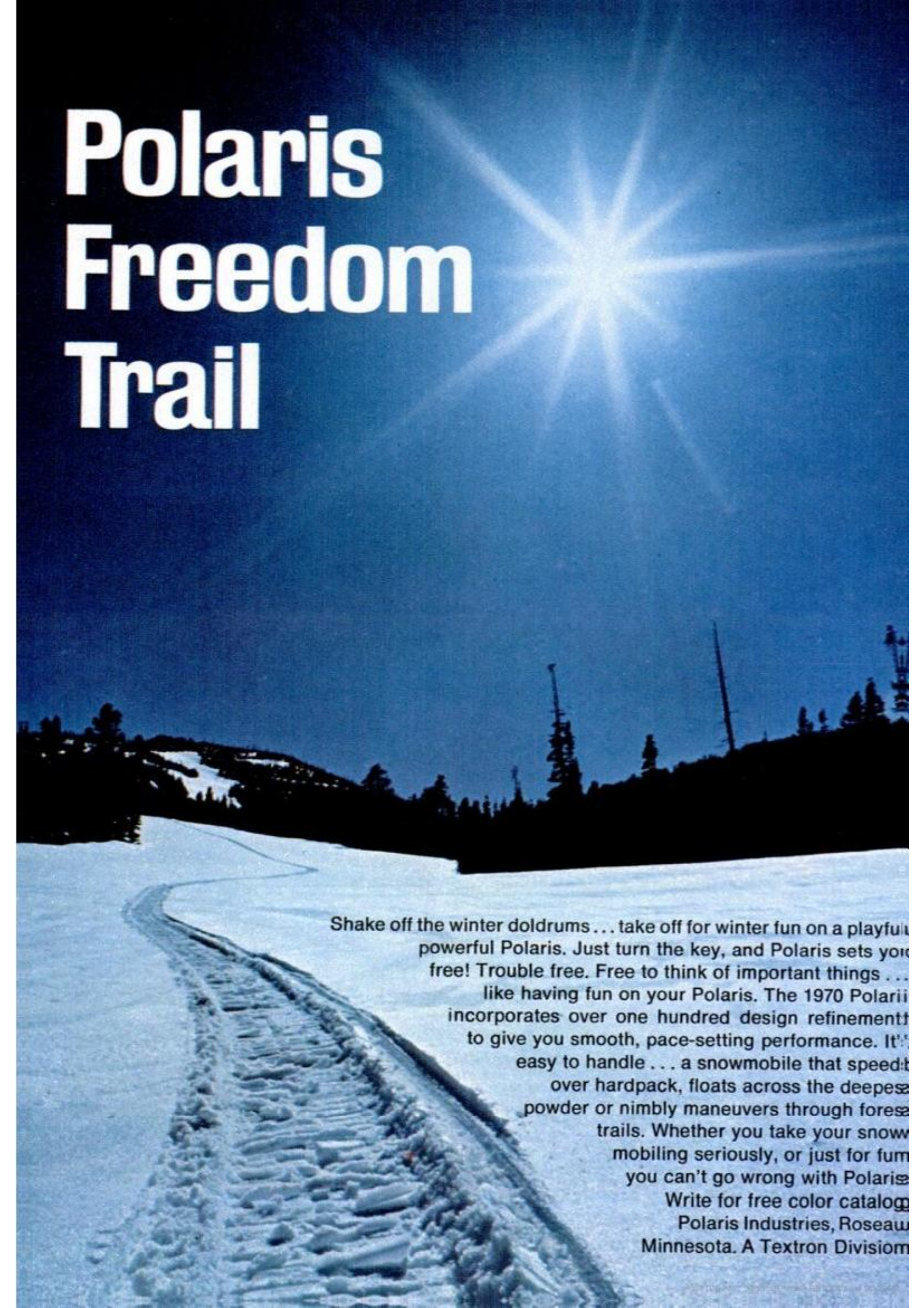
While it may seem that such subterfuge would be prevented by law, this is perfectly legal. Indeed, a major reason patents are made public is to encourage their widest possible use and to stimulate changes and improvements.

The odds in patent cases favor defendants by a wide margin. One expert estimates that the side which sues for patent infringement wins only one time out of four. Even if a company wins a patent suit, the expense of the court battle may make its victory costly. A firm that won a patent infringement case involving electronic equipment used to pinpoint the location of ships exploring for offshore oil spent more than \$100,000 in legal fees during the three-year litigation. Marvin Glass, a leading independent toy designer, says that he pays a patent attorney \$75,000 a year just to file patent-infringement suits in his behalf.

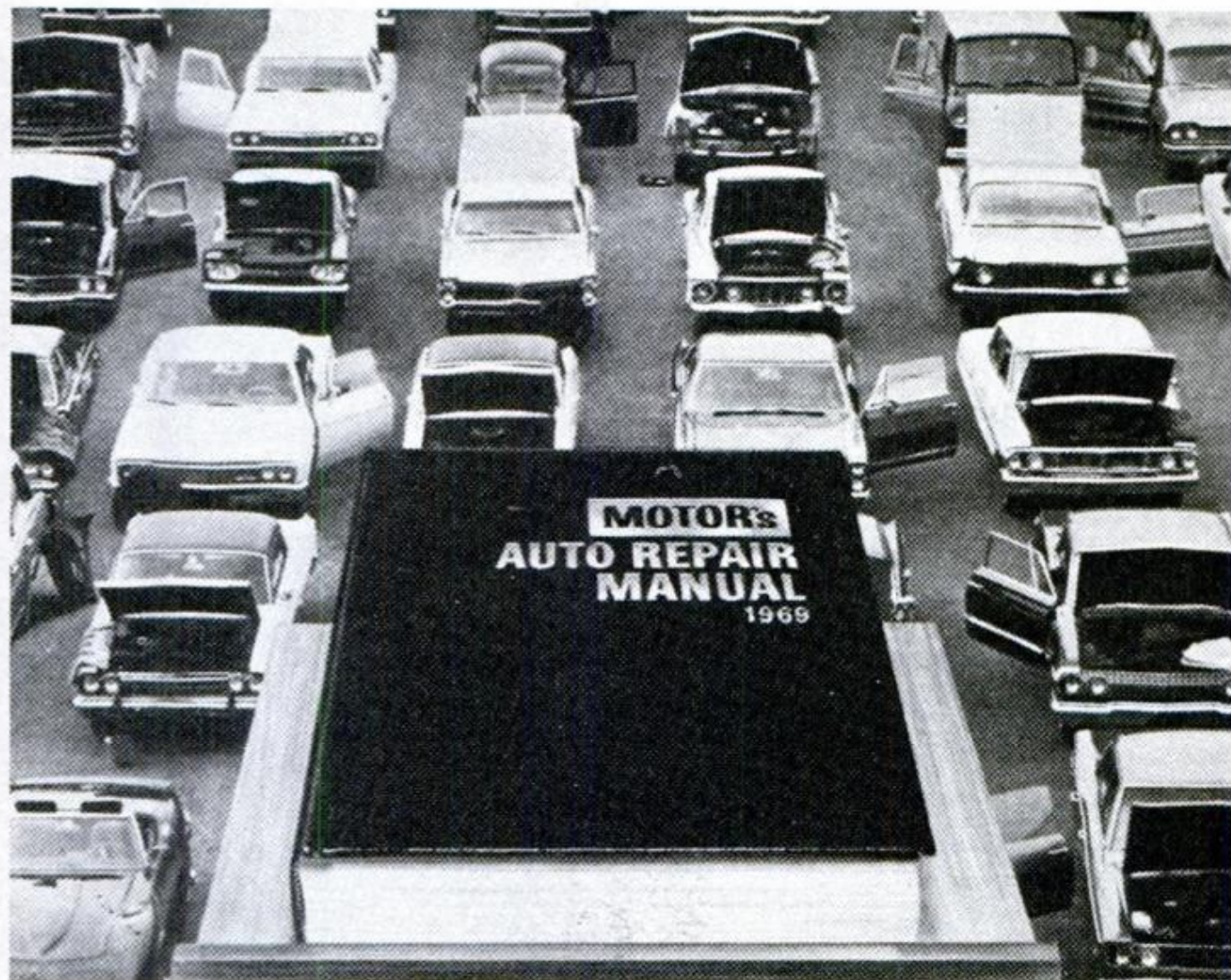
By contrast, a company that decides to try to keep its secret—and is successful—can hold onto its monopoly indefinitely. If the company does have to go to court to protect its secret, its chances of winning are much better than if it were initiating a patent infringement suit. According to one top New York lawyer, it's ten times more difficult to defend against a charge of

(Please turn to page 211)

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SECRET BETTER THAN PATENT

(Continued from page 208)

stealing a trade secret than of infringing a patent.

But the unpatented invention tends to invite outright industrial espionage. Government and private security experts estimate that U.S. industry annually loses at least \$2 billion in pirated trade secrets, among them many unpatented pieces of hardware and ideas. Thus, when three highly paid engineers spent years developing a water desalting process for an American company—then quit their jobs, went to a Middle Eastern country and set up their own firm—the U.S. company lost millions of dollars in research costs.

In another instance, an industrial spy posed as a policeman investigating a suspicious flashlight on the roof of a Midwestern plant late one night. When he left, he had in his pocket a sample of a special, unpatented sewing-machine spindle sought by one of his clients, who promptly copied the better design.

More fortunate was the Time-O-Matic Co. whose best selling product, an automatic circuit breaker used in display signs, was not original enough to be patented but still was sufficiently novel in design to be a closely guarded secret. Knowing that lack of a patent made it possible for anyone to manufacture the unit, two trusted employees who had access to blueprints took an entire year to memorize every line on the drawings, then quit and set up their own company.

In a court suit brought by Time-O-Matic, the judge enjoined the former employees from manufacturing their circuit breaker, holding that even carrying away mental pictures was a violation of a confidence. When a padlock fails to prove superior to a patent, rulings like this encourage those who would rather try to keep a secret than patent it. ★★★

SNOW SURVIVAL

(Continued from page 107)

well. (For information about these new poly-foam products, and a price list, write to Ocate Corp., Box 2368, Santa Fe, N.M. 87501.)

New and improved cold-weather clothing, combined with a little common sense and caution means that a modern snowmobiler need not jeopardize his life, even under the most frigid conditions. Substituting confidence for fear, he can convert breakdowns and blizzards from potential tragedy to adventure. ★★★

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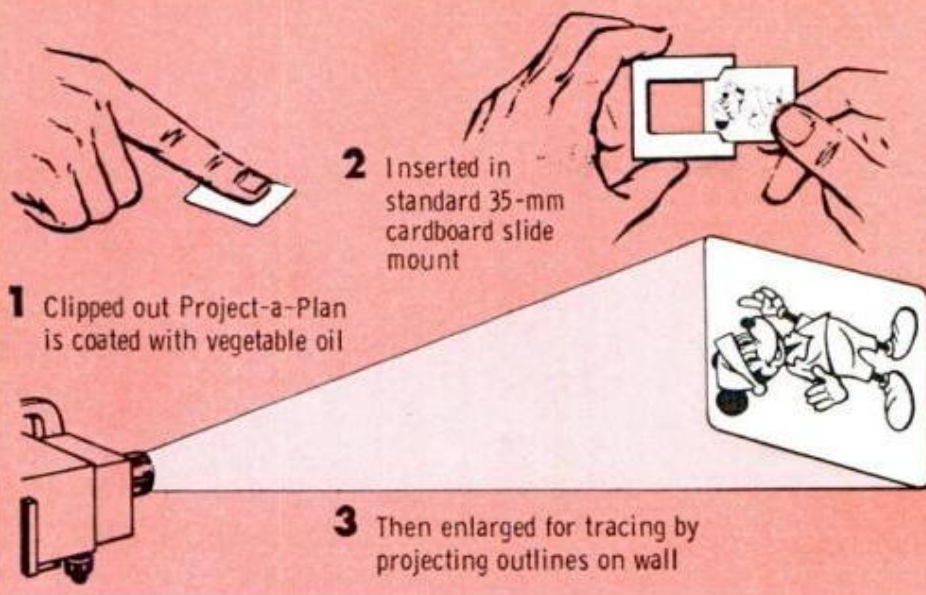
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HOW TO USE PM'S PROJECT-A-PLANS



1 Clipped out Project-a-Plan is coated with vegetable oil

2 Inserted in standard 35-mm cardboard slide mount

3 Then enlarged for tracing by projecting outlines on wall

EVEN if you've never used the Project-a-Plan method before, you'll find it's as simple as 1, 2, 3. First, clip the drawings from the magazine page. Next you rub the fronts and backs with a little vegetable oil to make the paper transparent. Finally you insert the paper 'film' in a regular 35-mm cardboard slide mount. You now have a black-and-white slide that can be used in any 35-mm slide projector. Thus, you can blow up the pattern to whatever size you want, and then trace the projected outline directly onto the display, all ready for your painting

BUILD PM'S CHRISTMAS CARD

(Continued from page 169)

on the outside. Use weatherproof hot glue and well-set nails to install the corner strips. Then feather them out to a perfect corner and flush with the sides, using a block plane or belt sander.

Assembling the motor into its housing takes a little time. The important point to remember is to be sure that the V-belt is taut and clears the motor mounting brackets. Chances are, with the motor unit assembled and running on your workbench, a few minor adjustments will be called for.

For example, after running the motor about 15 minutes, you will probably have to back off the Allen setscrew holding the drive pulley and reposition the pulley. Also, depending upon how accurately the mounting brackets are bent, you might have to mortise the plywood side slightly to provide clearance for the motor and shaft.

The sides of the three triangular boxes are of 1/4-in. tempered hardboard, the tops and bottoms of 1/2-in. exterior plywood. If you decide to substitute other materials, be sure you compensate for dimensional variance and make certain that the material used is exterior grade.

To make it easy to draw the Disney characters, they are presented in *PM's* exclusive Project-a-Plan slide format. Mounted in 35-mm slide frames, and moistened with vegetable oil, they can be projected directly onto the display. The outlines can then be traced with charcoal or Magic Marker. Next, the outlines are painted with black enamel and, when dry, the appropriate colors filled in. The paint,

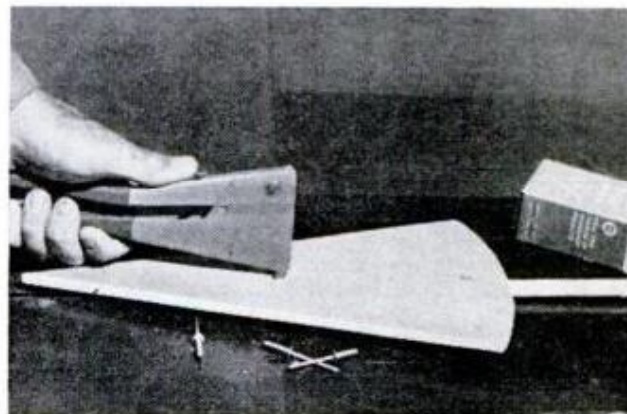
of course, should be outside enamel and the entire display first primed with a paint sealer coat.

If lettering the Christmas greeting on the blurb is beyond your skills, use stick-on letters—such as Contact—to finish that part of the display. But, if you do, be sure to cover the letters with at least two coats of exterior varnish or they might peel off during the first snowfall.

The drive and free wheels that give the display its revolving action are actually pool bumpers. Experimenting with several materials proved that soft rubber gave the best friction for the required motion. If you are unable to obtain them locally, you can order a pair by mail from the Armor Co., Box 290, Deer Park, N.Y. 11729. Price is \$1 per set postpaid.

If you have difficulty locating the small electric motor, write Canal Electric Motor, Inc., 310 Canal St., New York, N.Y. 10013. The one used on our model is a 10-12 rpm, a.c. gear motor, 115-v., 60-cycle. Cost is \$9.50 f.o.b. N. Y. ★★

TREES ARE ASSEMBLED using Pop Rivet Tool and aluminum rivets. The greeting blurb is fastened to the pole with two threaded studs; use the same tool for it



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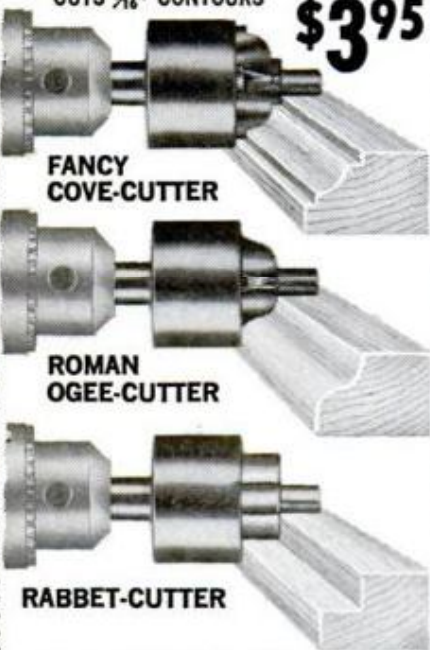
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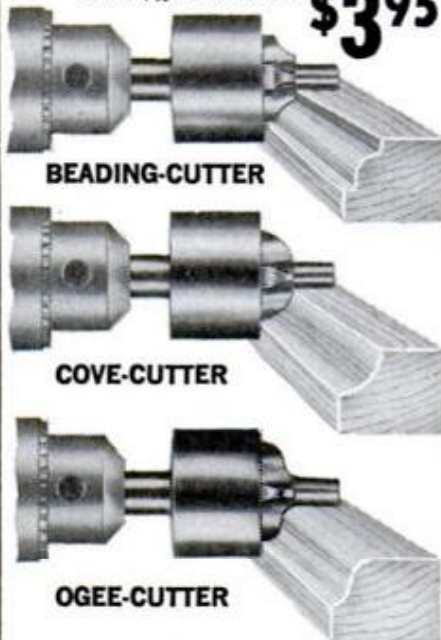
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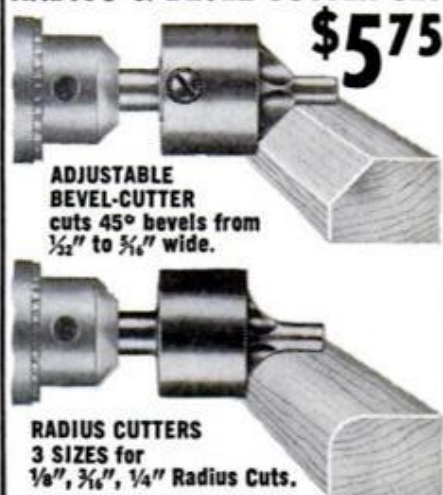
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TELEPHONE END TABLES

(Continued from page 172)

inate to the plywood and this is brushed on directly from the can, one coat on the wood and one coat on the laminate. Both coats are allowed to dry until when touched with a piece of brown paper, none lifts off before bonding.

All the exposed edges are banded first with 7/8-in.-wide strips, letting them overhang each side 1/16 in. for filing flush with the plywood surface. The strips are mitered at the corners, butted elsewhere. Once the two coated surfaces meet and are tapped with a hammer and block of wood to assure good contact, you can file the material immediately.

After all edges are covered, then the flat surfaces are covered, letting the laminate overhang the edges 1/16 in. Again, final trimming is done with a flat file, only here the filing is done at a slight angle to avoid defacing the edge banding. Strips of wood 1/4 in. thick are helpful in positioning the laminate on the surfaces. These are placed on the dry-to-the-touch adhesive and the laminate is placed on top. After aligning the laminate, the strips are pulled out one by one as the two coated surfaces touch. Both sides of part (C) are covered. Notice how the same color laminate has been carried across the top of the table. This is optional, of course; you may want to handle it differently and use just one color. ★★★

CHESS SET FOR CHRISTMAS

(Continued from page 165)

melt Styrofoam, check the label carefully when selecting the paint.

Being an open-grain wood, the walnut does require filling. To do it, make a paste, mixed to about the consistency of heavy cream, using walnut filler and walnut oil stain. Rubbing with the grain, work the filler into the open pores of the wood. To remove the excess, wipe off with strokes across the grain so that the filler remains packed in the pores. Allow the cabinet to dry for at least 24 hours. To finish, apply two or three coats of lacquer. When this is dry, apply a paste wax and buff it to a soft luster. ★★★

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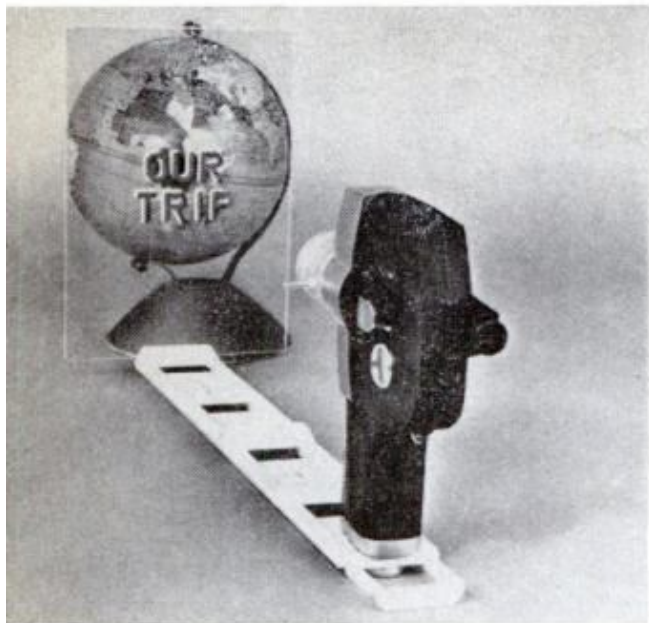
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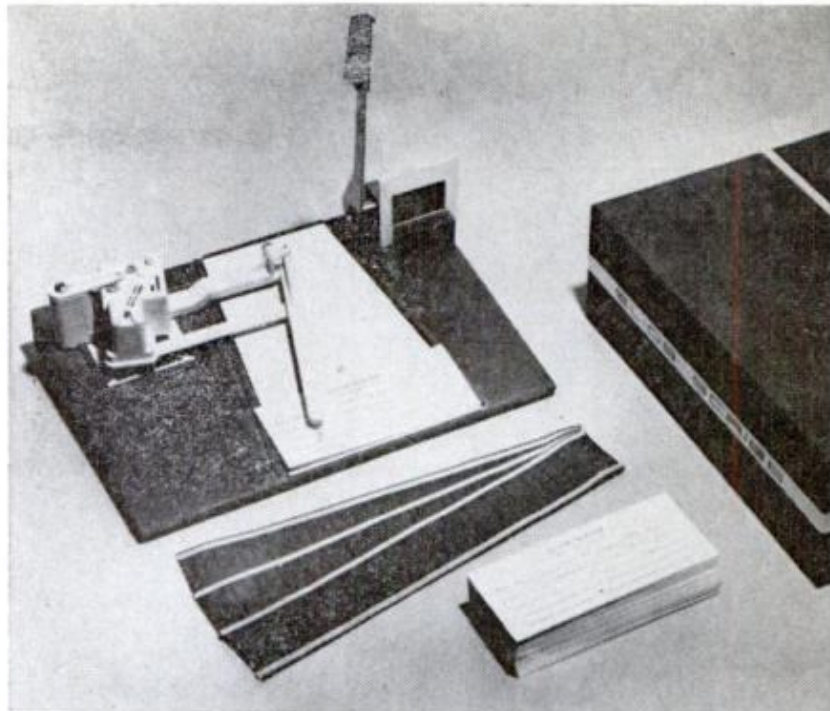
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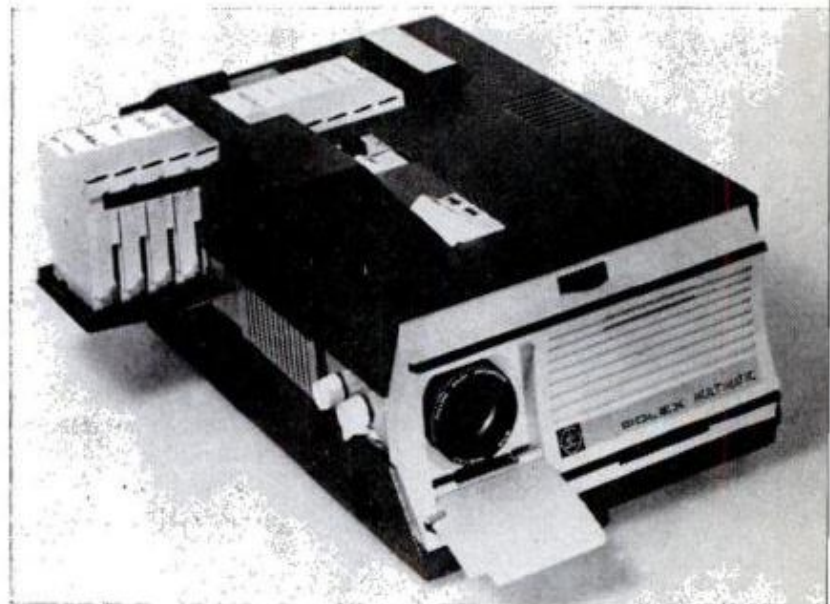
UNUSUAL MOVIE EFFECTS are possible with the titling rig above. It consists of a slotted base attached to the camera. Titling cards are slipped into the slots at different distances to vary image size. Three-dimensional self-adhesive letters can be arranged on a clear-plastic sheet and photographed against a background object or scene. You can also shoot live action through masks of various shapes. The Ultima titling base is \$6.50 and a kit of letters \$4. Ehrenreich Photo-Optical Ind., 623 Stewart Ave., Garden City, N.Y.



TITLING SLIDES is easy with this device. You punch a small window in the cardboard mount under the picture and insert a plastic strip. Then you place the slide under a pantograph and write the title in your normal handwriting. The pantograph reduces your writing on the strip so it appears on the screen along with your slide. \$24.95. Pantographic Co., 1310 S.E. 7th Ave., Portland, Ore.



LOOKING LIKE A TRIM 35-mm camera, Honeywell's soon-to-come Pentax 6X7 features a new, larger film size— $2\frac{1}{4} \times 2\frac{3}{4}$ in.—the so-called "ideal" format. Like the regular 35-mm Pentax, the new model is a single-lens reflex and offers a wide choice of interchangeable lenses. You get 10 exposures from 120 film, 21 from 220 film. Price not yet announced.



CARTRIDGE-LOADING PROJECTOR shows Super-8 movies one after another. Six 50-foot reels of film, placed in plastic cartridges, are held in a tray. As each cartridge is shown, the Bolex projector automatically goes on to the next one while rewinding the previous one. Cartridges are self-threading and take any 50-foot Super-8 reels. Price is \$229.50. Paillard, Inc., 1900 Lower Rd., Linden, N. J.

(Please turn to page 222)

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AH10	10	4-3/4	2-3/4	1-3/8	18	2.29
AH12	12	5-3/4	2-5/16	1-1/16	36	3.95
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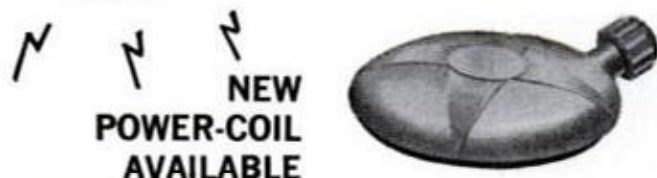
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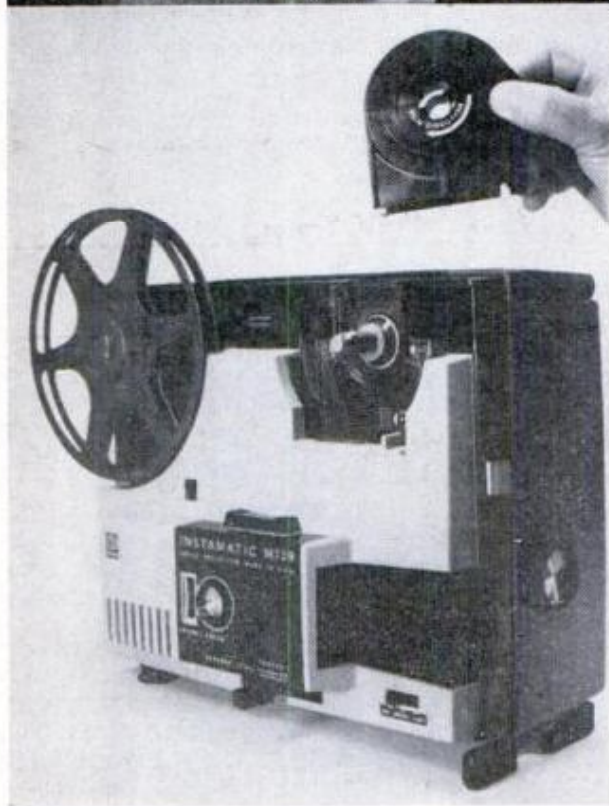
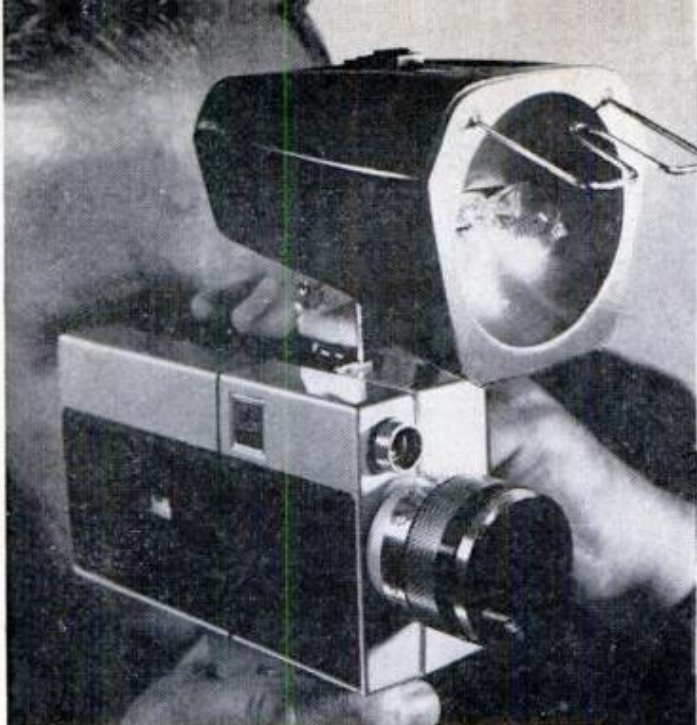
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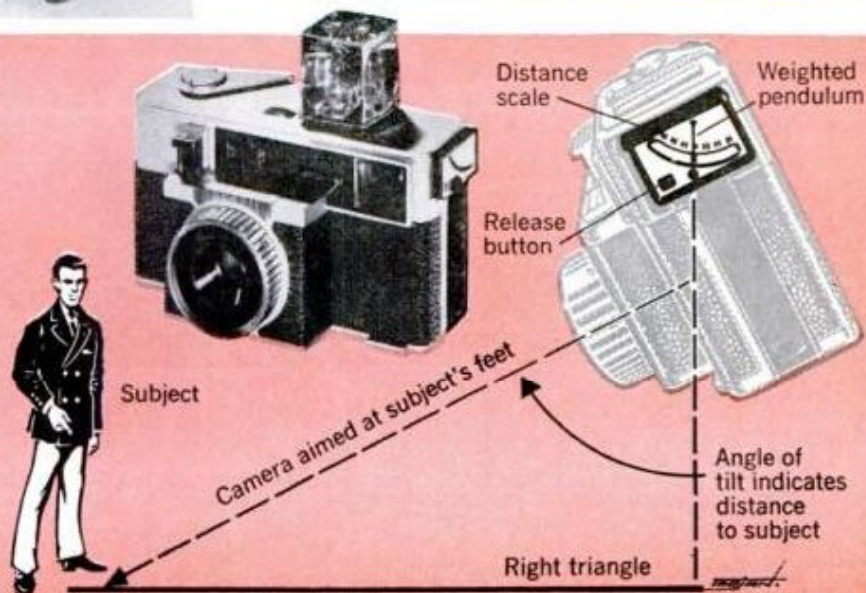
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NEW COMPACT MOVIE CAMERAS from Kodak are smaller and handier than ever. Five Instamatic Super-8 models range from \$29.95 for the simplest, the M-22, to \$99.50 for the M-30 electric zoom version at upper left. All models have foldaway pistol grips and accept an accessory floodlight for indoor use. With the M-30, you can zoom in and out electrically by merely pressing a rocker switch on top that actuates a tiny motor. There's also a manual zoom control. Along with the new cameras, Kodak's cartridge projectors announced last month simplify the whole process of shooting home movies. You pop a cartridge into the camera, expose it, then send it off for developing. When the film comes back, you slip it into another cartridge (lower photo at right above) and insert it in the projector for automatic threading and rewinding without touching the film at all. For more on Kodak's new projectors, [see October PM, page 159.](#)

AUTOMATIC FOCUSING has been added on three new Bell & Howell still cameras. The clever system is called Focus-Matic. By aiming the camera at your subject's feet, you establish an angle that, through triangulation, indicates the lens-to-subject distance. A pendulum measures angle, giving correct focusing distance. System is available on two instant-load cameras and one 35-mm model. Prices are \$57.50 to \$87.50.



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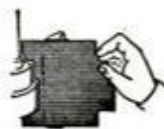
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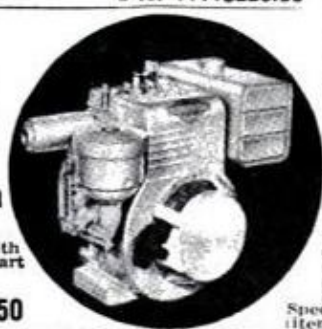
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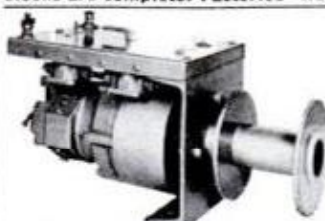
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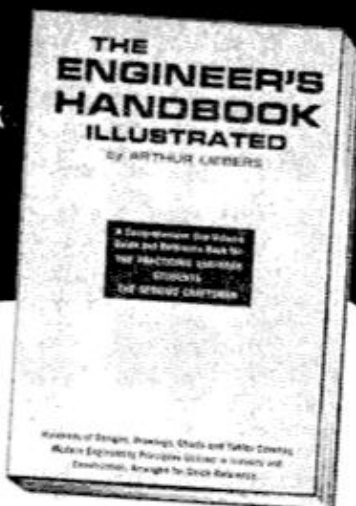
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PM'S HALL CLOCK

(Continued from page 180)

using a cove bit chucked in your router as shown. Be sure you cut a right and left section. The same shape molding extends to the back ends of the pediment sides.

The scrolled side ornaments are made next and attached as shown in the photos. The fluted columns can be set in brass capitals or you can turn your own in a lathe. Since the large cove moldings are made on the table saw, they require a lot of sanding to remove the saw marks. To smooth them, make a block having a convex face of the same radius as the cove and glue sandpaper to the face.

To make the miter cuts, tilt the saw blade to 30° and set the miter gauge to 54¾°. Run the cuts with the material right side up and flat on the table. Use a sharp, 6-in. combination blade and move the stock slowly and uniformly through each pass. To finish, make the rabbet cut as indicated.

After mitering, the coved pieces are attached to the waist with No. 0, ⅜-in. flat-head brass screws driven in the rabbet at top edge of the molding. The beading that follows covers the screwheads. (On the clock shown, the heads were so nearly invisible on the light wood that beading was omitted.)

The back panels are ⅛-in. birch plywood cut ½ in. narrower than the overall width of the base, waist and hood. When these are placed, allow ¼ in. at each edge and fasten with equally spaced No. 1, ⅜-in. flathead screws. Finally, screw the retaining strip between the waist and the hood back panels.

You can use your preferred method of finishing. I stuck to a standard maple finish. After staining to a honey color, I applied two coats of clear lacquer. To obtain a soft satin sheen, I finished by rubbing with steel wool and wax. ★★★

NEW CRASH BARRIERS

(Continued from page 93)

oped by the Texas Transportation Institute at Texas A & M University.

Crash barriers made of large aluminum tubes, called "Tor-shoks," have been installed on the Kansas Turnpike. When a car hits the barrier, the tubes telescope inside larger tubes behind them. The inner tubes are fitted with several steel-wire rings. The force of a collision makes the rings turn inside out and rotate—like a tight rubber band on a finger. The friction dissipates the force of the impact—quickly, powerfully and gently. ★★★



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Bolens Husky Arctic

Both the 5 and 7 hp Huskys are built with a big appetite for snow. Both models have 4 forward speeds plus reverse to tackle anything from a snow shower to a blizzard. Electric starting is optional on either. And an exclusive adjustable differential on the 7 hp Husky matches pulling power to ground conditions. Visit your Bolens Husky dealer. He'll show you how to take the work out of winter.



Bolens Husky Tractor™ with Snow Caster

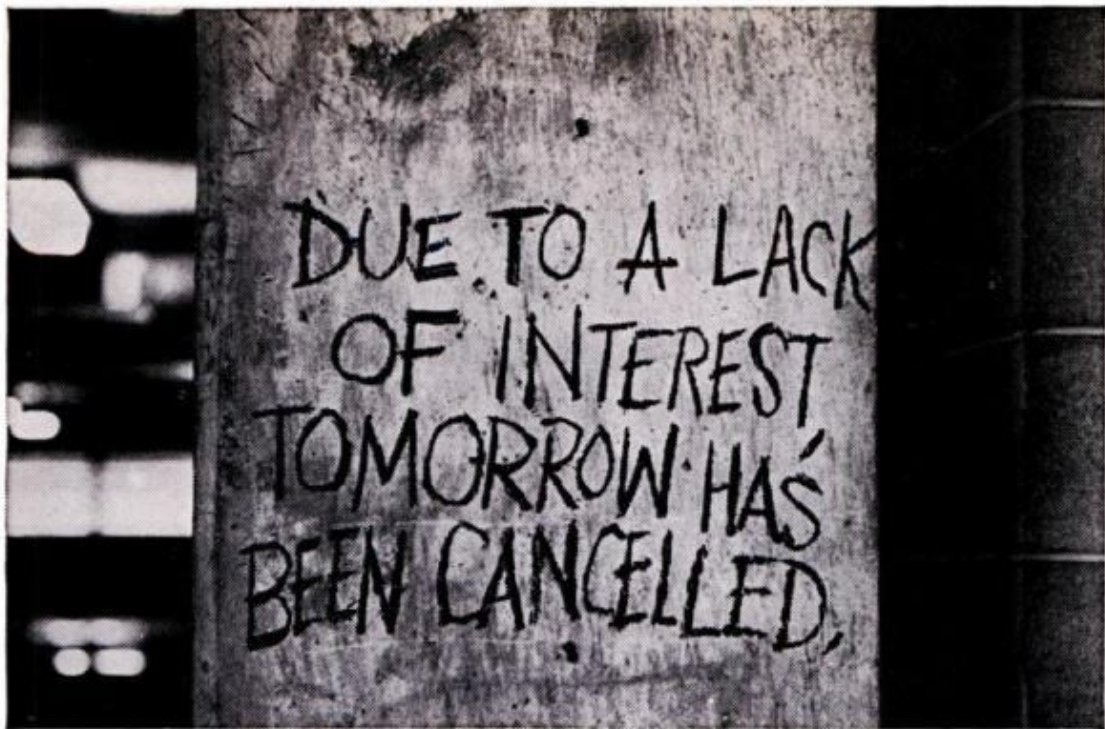
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BOLENS DIVISION, FMC CORPORATION, PORT WASHINGTON, WISCONSIN



Sounds ridiculous, doesn't it?

But what if everybody in this country were to throw their hands up in despair and say they don't give a hoot.

Indeed, there would be no tomorrow.

But fortunately, Americans have a way of solving their problems.

And that's just what's going to happen in these troubled times. Simply because it's always been an American tradition.

Now, how can you, as one little ole citizen in this big, wide country of ours, be of any help?

Well, take a minute and think about a U.S. Savings Bond.

That's right, a U.S. Savings Bond.

No, it isn't an immediate remedy for all our ills. But it helps.

If everybody were to buy just one \$25.00 Savings Bond (cost \$18.75), your country would be stronger economically to wipe out some of those scars we've been sporting.

Of course, everybody would be helping themselves, too. If you were to sign up on a Bond purchase plan where you work or bank, you'd have quite a nice nest egg for yourself one of these days.

You'd have a lot more dollars in the kitty for things like college educations, that new home, or a secure retirement.

So think about a U.S. Savings Bond today.

And then go out and buy one.

Tomorrow.



If they're lost, stolen, or destroyed, we replace 'em.

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HOUSE FOR \$7500

(Continued from page 133)

a short-term construction loan, money that's actually used until the home is completed; second, long-term mortgage money to be repaid in monthly installments over 10 to 25 years.

A qualified person can usually find construction money. Usually it is set up in a lump sum of, say, \$10,000. The money will be released to the builder in five payments:

- 20 percent when the slab or basement is completed;
- 20 percent when the house is closed in and the roof shingled;
- 20 percent when the rough plumbing, heating and wires are installed;
- 20 percent when the house is completed, and
- 20 percent 30 days after completion.

The latter allows time for mechanics' liens to be filed. Some lending institutions make these construction loans but ask that you obtain the mortgage elsewhere.

To get an idea of actual cost of the \$7500 house, assuming a 25-year mortgage at 8 percent interest, I've come up with the following total cost figures:

- Owner built: \$17,103.42;
- Built with limited owner participation: \$22,804.57;
- Contractor built: \$50,171.42.

These figures are based on an appraisal I had made which put the value of the house at \$22,000.

These costs are for the same house, only the mortgages and the way of construction vary. They point up how important it is for you to build your home yourself. ★ ★ ★

HOW TO READ AN OIL CAN

(Continued from page 137)

have to drain it. It will perform properly over a wide spectrum of temperature from below 0 to 100° F.

The designation W (for Winter) after an SAE number means that the oil is suitable for low-temperature use. Note that an oil can may be marked both SAE 20W and SAE 20. This means that the oil can be used whether the car manufacturer recommends the use of an SAE 20W oil or an SAE 20 oil. Because of refining methods, the oil is a dual-graded product which meets the requirements of both cold and warmer-weather operations.

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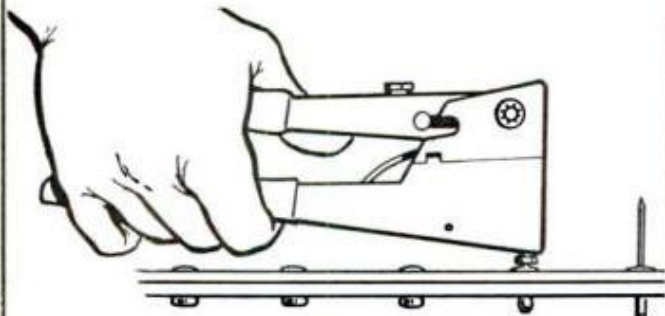
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WINTERIZE YOUR CAMPER

(Continued from page 119)

every time a brief sunny period comes along.

Now, observe the following tips for specific types of recreational vehicles:

● *Travel trailers.* Spray a light oil onto the spring leaves. Lube zerco fittings on spring-shackles. Pull a plastic bag over the front coupler handle and tie it down (keeps coupler from rusting). Clean and repack wheel bearings on the chassis.

● *Pickup camper coaches.* If the coach will not be used during winter months, remove it from the truck with loader jacks. (You can rent loader jacks from many equipment yards or local coach dealers.) Loosen hold-down bolts or turnbuckles. Set coach down on wood blocks, *never* directly on ground. While the coach is off the truck, inspect its exposed underbelly for signs of splitting or swelling. Coat exposed areas with heavy mastic or weather-sealing paint recommended by local coach dealers. (Some sealers become sticky in hot weather.)

● *Motor homes.* All self-propelled recreation vehicles should be given a complete chassis-lube before storage. Engine maintenance should include oil change, oil-filter change, air-filter cleaning or replacing, and so on. Any service performed on your family car should also be performed on the motor home or van camper. Follow the same advice on tires: block up, deflate. If vehicle might be used occasionally during the winter, do *not* deflate tires, but rotate them at least once or twice each month to avoid flat-spotting.

● *Tent-trailers.* Clean fabric tops thoroughly *before storage*. Do not fold down a wet top. Dry it out first. Remove stains from fabric sidewalls or tops immediately. Keep the unit locked.

Despite all these precautions it's a mistake to ignore the recreation vehicle during the winter. At least once a week, walk around it and make a quick visual inspection. After every storm, enter the coach and look for signs of leakage or puncture-damage to roof. Don't let anyone lean objects such as bicycles, chairs or garden tools against the coach during the winter. In time, such treatment will dimple or dent the aluminum.

Using these winter-storage tips will save you time, money and trouble when you hit the road in the spring. ★★★

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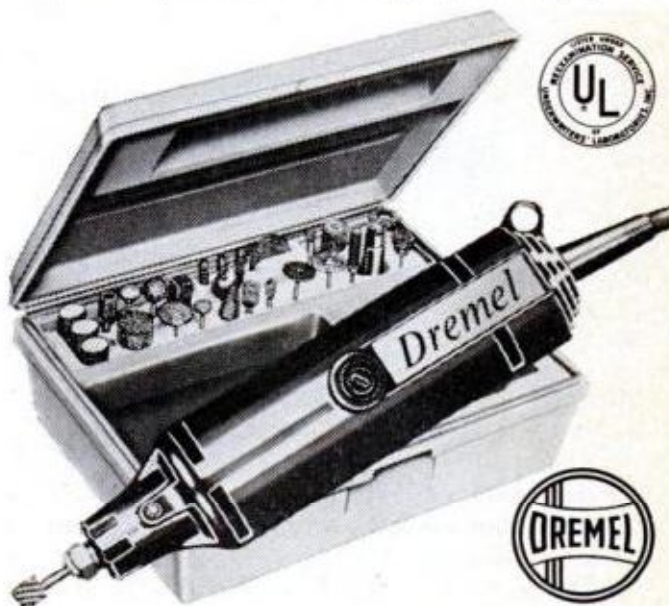
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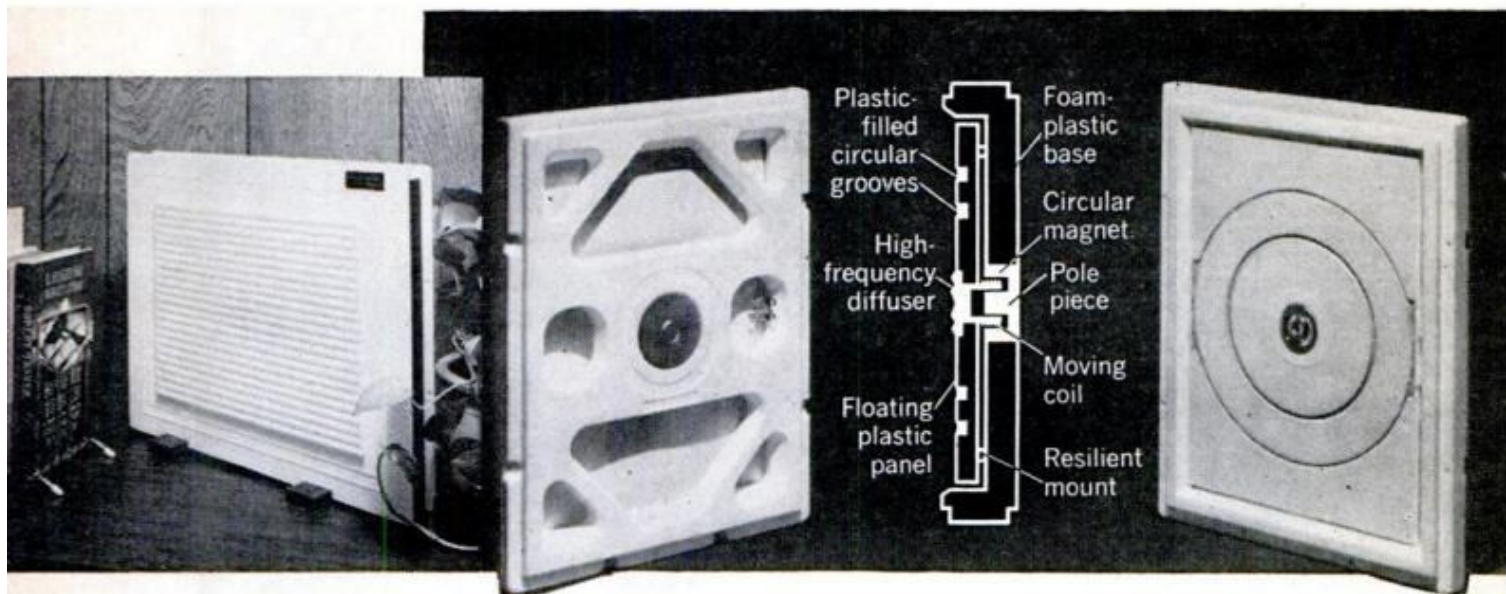
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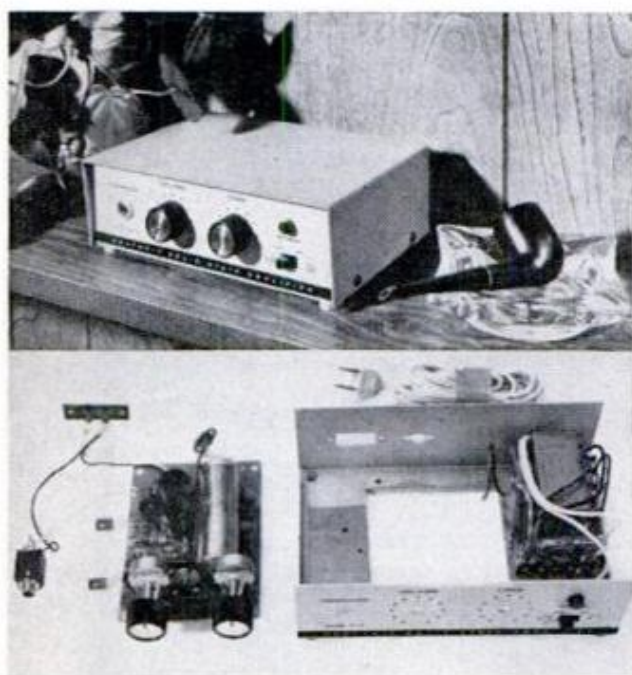
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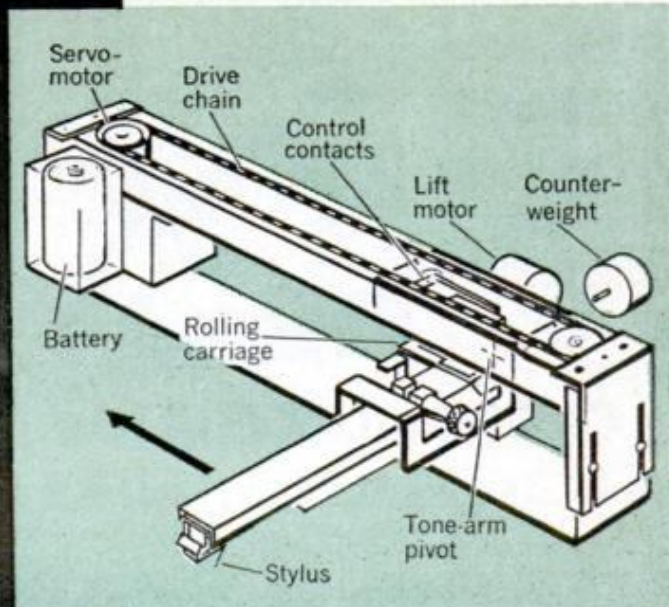
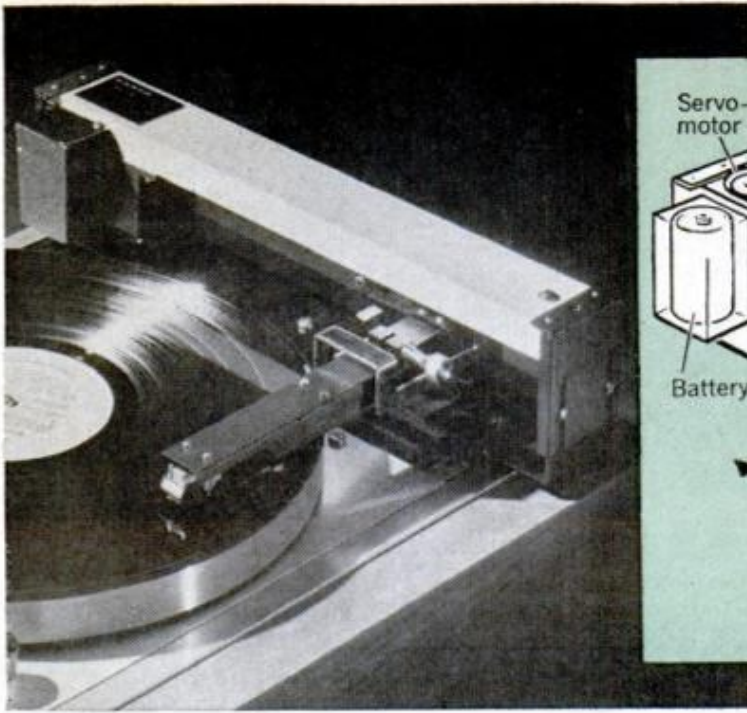
the effect of a large cone without the tendency of a large cone to flex and buckle, causing distortion. Weighing less than four pounds, the flat speaker can be carried anywhere or mounted on a wall. It's weatherproof for outdoor use, works underwater. Several models are available from \$7.95 to \$19.95. Magnitran Co., 311 E. Park St., Moonachie, N.J.



MIDGET HI-FI AMPLIFIER costs only \$19.95 in kit form, is ideal for adding a second, inexpensive sound system in a den, bedroom or playroom. The 4-watt, 5-transistor single-channel amplifier accepts any monaural source—ceramic phono cartridge, tape recorder or monaural tuner. The Heathkit AA-18 is less than 8 in. long, can be assembled in a few hours. There's even a convenient front-panel phone jack. Heath Co., Benton Harbor, Mich.



TWIN MICROPHONE KIT includes a built-in preamplifier-equalizer, connecting cables, floor-stand adapters and other accessories all in a handy carrying case. The mikes are 200-ohm low-impedance types that, with the pre-amp, can be equalized for tape and auxiliary amplifier inputs. The preamp has separate low and high-gain controls and a switch for stereo or monaural use. Price for Pro-200 is \$100. Radio Shack, 730 Commonwealth Ave., Boston.



MOTOR-DRIVEN TONE ARM moves across a record sideways, always keeping the stylus tangent to the grooves. This duplicates the straight-line motion of the original cutting head and eliminates the tracking error caused by pivoted tone arms that swing across the record in an arc. The cartridge is mounted in a chain-driven carriage that's

pulled along a track by a tiny battery-powered motor. As the stylus rides inward on the record grooves, contacts close, causing the carriage to move along with it at exactly the same speed. The action is so delicate the stylus tracks perfectly with as little as half a gram of force. The SL-8 arm is \$149.50. Rabco, 11937 Tech Rd., Silver Spring, Md.



DIRECT-DRIVE RECORD PLAYER has no belts, gears or other moving parts. The turntable is actually an extension of the motor itself and turns with it. The motor is a slow-speed, brushless d.c. type with its stator under the turntable's center. Revolving around the stator is a ring-shaped rotor magnet attached to the turntable. The turntable thus spins at the exact speed of the motor with no complicated drive train to cause variations. Rumble, wow and flutter are virtually eliminated, providing distortion-free listening. Developed by Panasonic, the player is expected to go on sale early next year. Price has not yet been announced.



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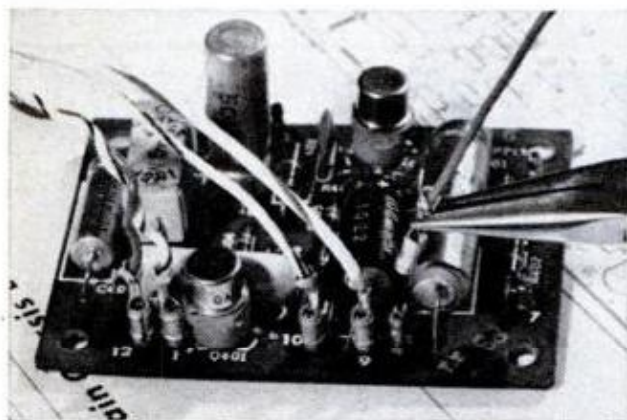
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By SHELDON M. GALLAGER

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(Please turn to page 240)



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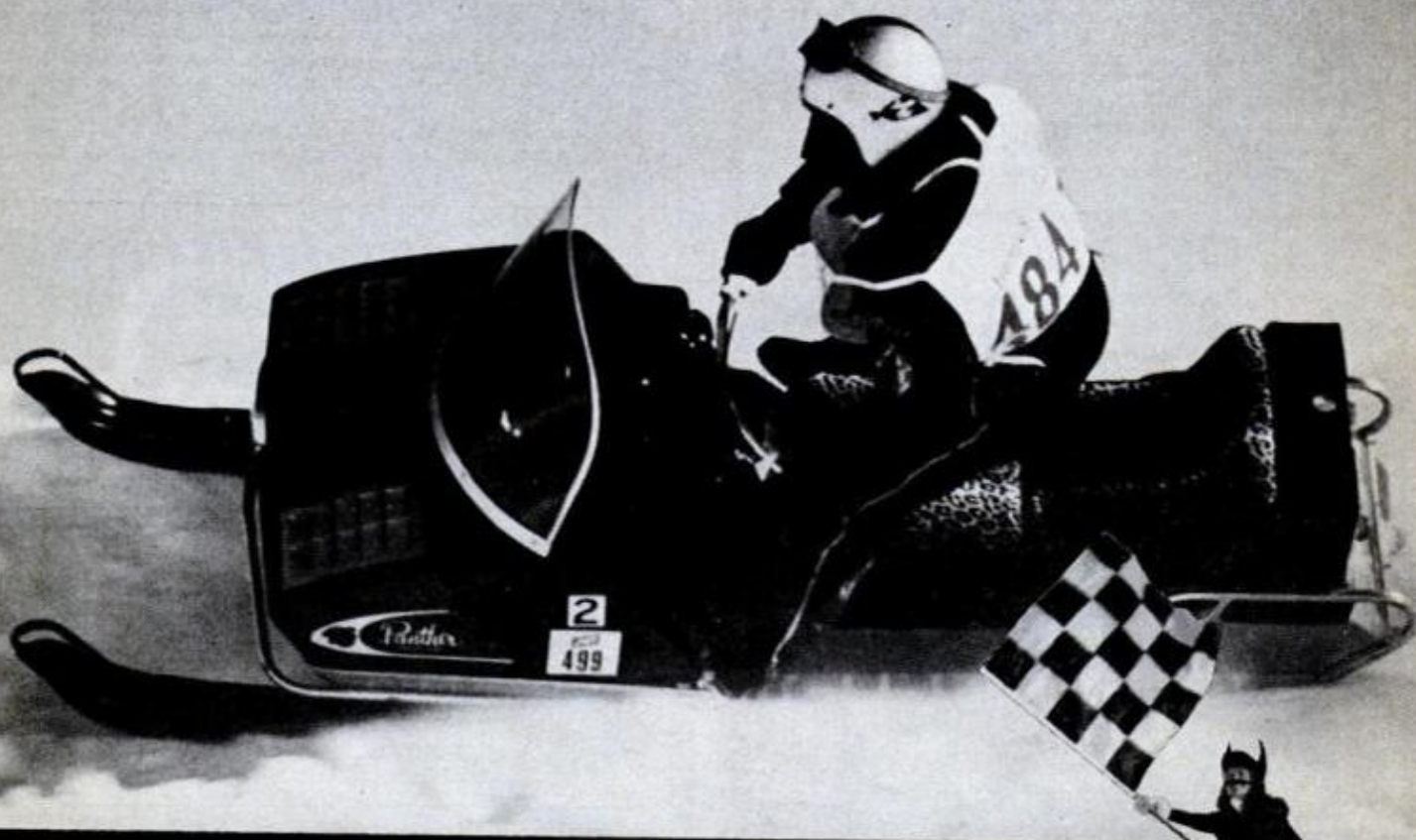
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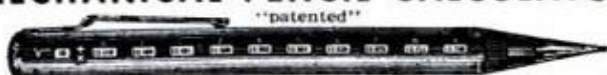
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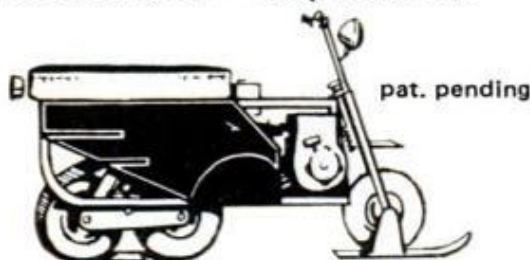


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PRESORTED PARTS come packaged in these three crushproof plastic trays. Two slope-front ones in the foreground hold pieces in pockets numbered to correspond to wiring steps in the assembly manual

SCOTT'S NEW STEREO KIT

(Continued from page 236)

other components, such as a turntable and tape recorder. It doesn't quite put itself together, but everything has been done to make its assembly smooth and painless.

The parts come packed in plastic trays, neatly sorted in little bins. Each bin is numbered to match a particular assembly step and contains only the parts used in that step. There's no hunting for a tiny piece among hundreds of others jumbled together. Wires are cut to length and also grouped according to the steps in which they're used. The pictorial diagrams are in full color—unusual for a kit manual—and match the color of the wires.

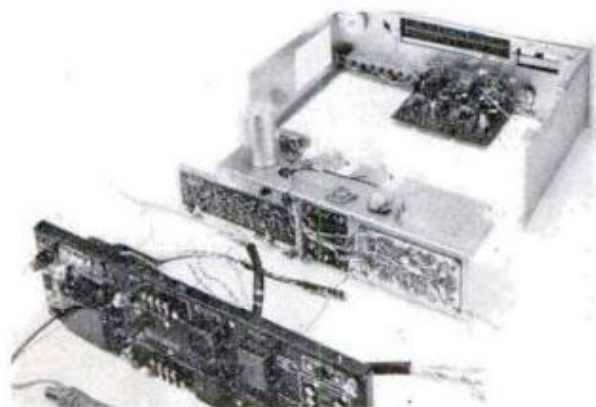
The biggest timesaver is the use of pre-wired subassemblies. Most of the small parts like resistors and diodes come already soldered on printed-circuit boards. The tuner front end is also prewired and factory-aligned. All you do is mount these subassemblies in place and interconnect

them. A system of solderless connectors—new to hi-fi kits—simplifies wiring in the final stages when things begin to get tight. The wires are fitted with tiny metal collars. You merely push them onto posts and they snap in place.

As you come to that final, nervous moment when you're ready to fire up the completed set for the first time, you don't have to worry that a minor miswire may cause your handiwork to go up in smoke. Scott's engineers have come up with a neat trick here. You plug an ordinary light bulb into the back and a special test switch puts the bulb in series with the receiver's power circuits. The bulb permits the set to function, but absorbs enough power so there's no danger of blowing delicate components.

In use, the smartly styled black-and-brass receiver also offers some thoughtful extra conveniences. There are dual microphone jacks right on the front panel to simplify stereo recording, along with a stereo headphone jack. In addition to six rotary controls, a seven-section pushbutton switch handles such functions as speaker selection, FM muting and tape monitoring. Two panel meters indicate signal strength and provide precise zero-center tuning. A built-in testing system lets you use these same meters to run on-the-spot checks on the set's circuits without special laboratory test instruments.

The 100-watt solid-state receiver provides 50 watts of power on one channel in monaural operation and 40 watts on each channel for stereo. Frequency response is 15 to 25,000 cycles. Assembly time was found to be about 60 hours, spread over several weekends. Price for the LR-88 is \$339.95. While the same set is not available in assembled form, it's estimated to be comparable in value to finished receivers selling for \$400 to \$500. Maker is H. H. Scott, Inc., Maynard, Mass. ★★★



PULL-APART CHASSIS makes it easy to reach all parts. Most wiring is done on three main subsections—front panel, rear panel and center divider—then these are joined for making interconnections



CLEVER LIGHT-BULB TRICK lets you turn on power to make final wiring checks without danger of damaging delicate transistors. A switch puts bulb in series with circuit to absorb part of power safely

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The greatest detectives in history would be hard pressed to track down somebody to fix a bum toaster or dishwasher these days. It's funny: you have no trouble finding any number of so-called experts who'll fix a leaky pipe or a home run through the picture window. But electrical appliance repairmen are still as scarce as hippies in bathtubs.

If you're lucky enough to get a repairman to come from across town, he'll eventually have your bum dishwasher humming again like bees at a picnic. He'll also present you with an oversized bill. That's where the picnic ends.

If you're in the market for more money you don't need to be a super-sleuth to find it. Look for clues in your own hacienda. If you're typical, you own a couple dozen appliances, counting your wife's hair dryer, power tools and usual plug-ins like air conditioners, toasters, refrigerators, freezers, fry pans, and on and on. A lot of men like yourself have built rewarding full-time businesses after starting part-time earning \$5 and more an hour fixing broken appliances. Others have found full-time jobs as Service Technicians. And when you hit Social Security years, think how great it would be to pick up a little extra cash doing as much Appliance Repair as you cared to do.

The Appliance Division of the National Radio Institute in Washington, D.C., has a great low-cost, home-study course covering every type of Appliance repair in detail—from toasters and irons to air conditioners, refrigeration equipment and one-lung gas engines. There's a section on farm and commercial appliances, too, if you're interested in a big payoff, for when major appliances go kaput, they're as useful as moose antlers on a mouse.

To get technical know-how, NRI starts you with basic principles of electricity. You can gain ex-



perience through actual practice, using an Appliance Tester included in the low cost of training. It's the same kind of tester a professional would use while charging you six bucks an hour. With the tester and a few basic hand tools, you can be repairing Appliances long before you finish the course. All you need for a shop is a corner of your basement or a card table left up between poker games.

You'll be amazed at how easy NRI has made this course. Lessons are bite-size and loaded with photos and drawings so you see how each appliance comes apart—and goes together again. Men who felt they were as handy as icemen in the Arctic have nothing but praise for this great training.

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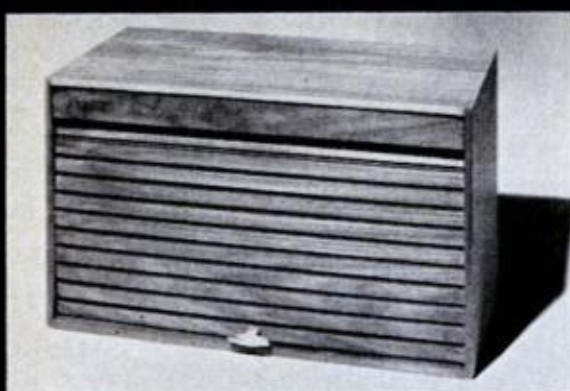
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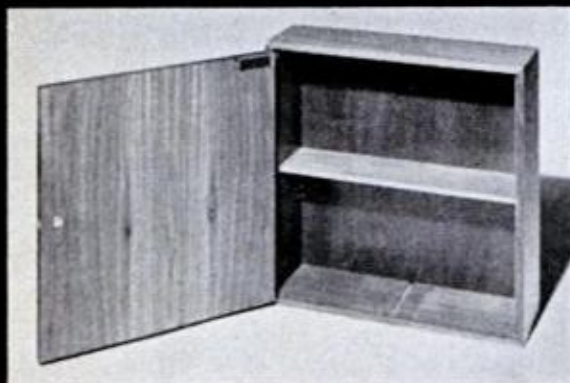
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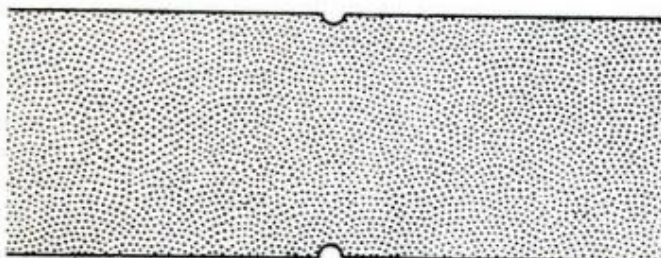
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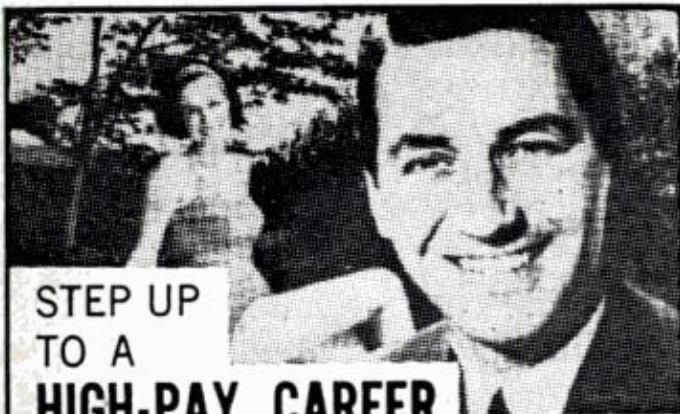


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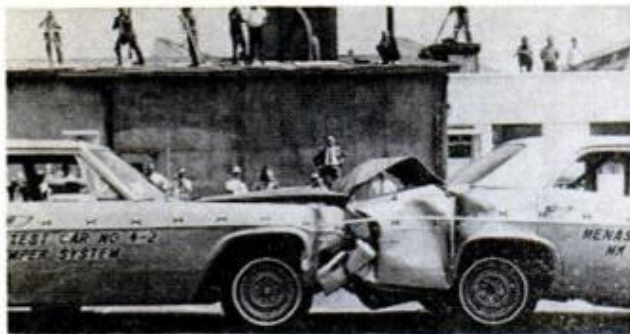
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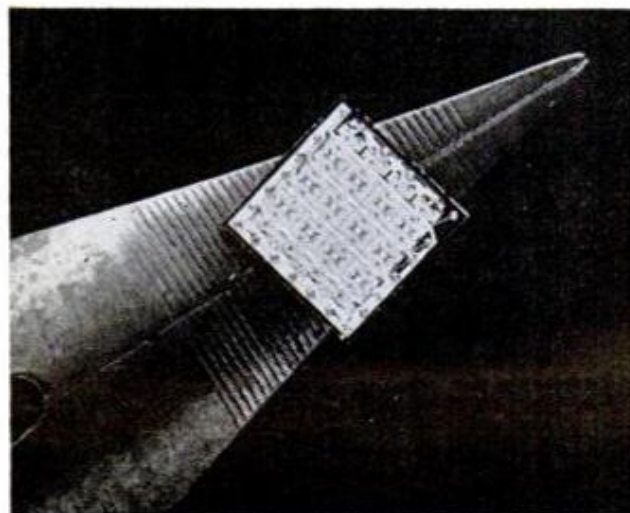
POPULAR MECHANICS

NEWS BRIEFS



New bumper absorbs shock

Each of the above photos shows a car crashing into the rear of another at 30 mph. In the top picture, both cars have conventional bumpers—and damage is extensive. In the lower photo, the cars are equipped with a new shock mount system developed by Menasco Manufacturing Co., Burbank, Calif.; damage is minor. The system utilizes a compressible silicone compound to absorb the shock transmitted by pistons in the mount.



Brainy wafer

There are 64 complete electronic memory circuits on this chip of silicone (shown for size comparison on the nib of a pen). The circuits, which can transmit electronic signals in as little as 3-billionths of a second, are used in the buffer memory of IBM's newest computer, System/360 Model 195.

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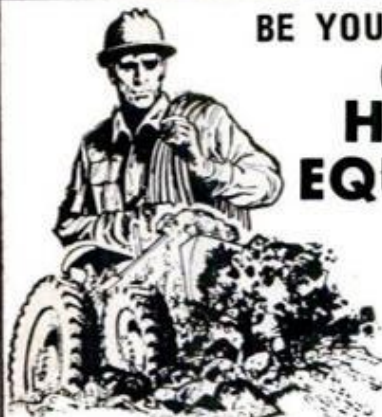
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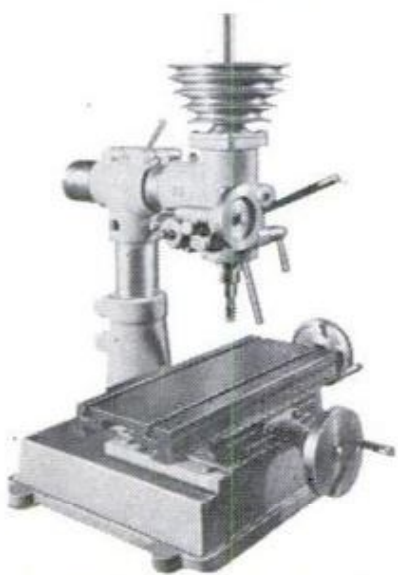
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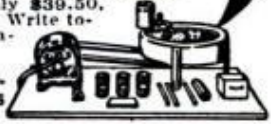


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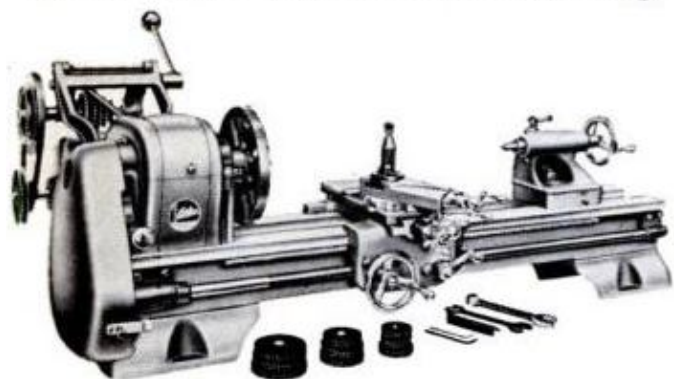
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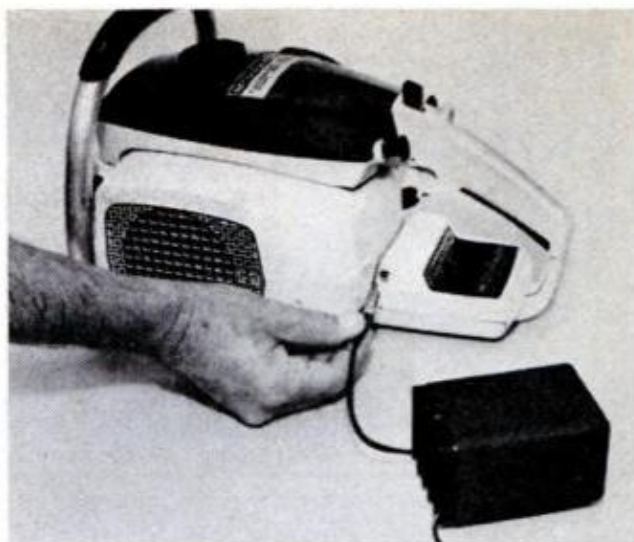
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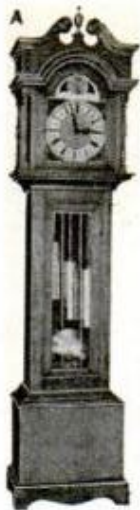


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The rapid charger, about the size of two cigaret packs (photo above), is expected to extend the usefulness of countless battery-powered devices like the array below. Already on the market is a 15-minute charger for Honeywell's Strobonar electronic flashguns (bottom photo). Looming big for the future is the possibility of quickly rechargeable electric cars.



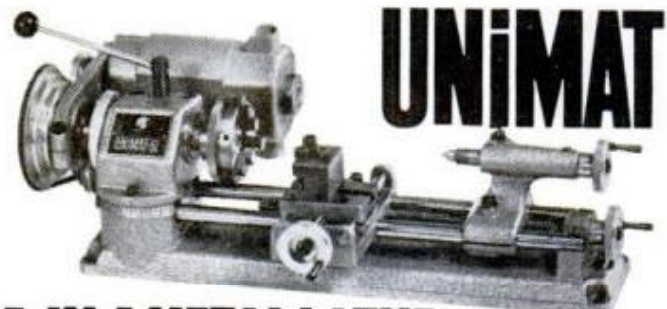


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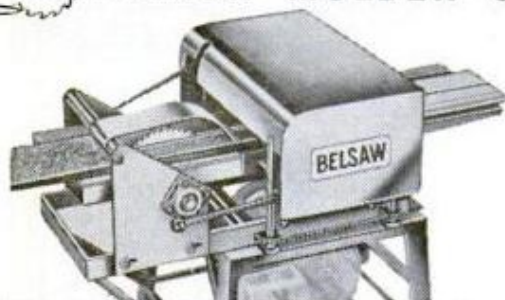


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