

Driving: 'Split-Second' Maneuvers to Avoid a Crash

# POPULAR MECHANICS

JULY 1971  
50 CENTS

Hit Show:  
101 Famous  
Planes  
Page 62



**Fish, Surf,  
Hunt, Ski, Travel...**

**Have It All With This Kit-Built Camper for \$800**

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An Electronic Device  
That Stops Back Pain  
Page 68

Space Research:  
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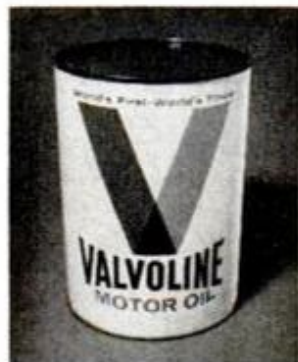
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JULY 1971

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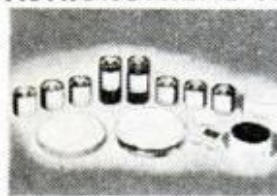
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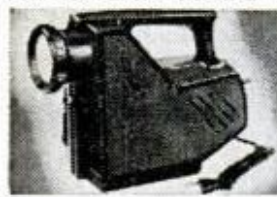
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# LETTERS

TO THE EDITOR

## Bad scene for pictures

I am very much against the *New Disposable Camera* (page 173, May PM). These new cameras will just be adding to the tons of waste and garbage on the Earth. LAKE PLACID, N.Y. MICHAEL NEY

## Hop and chop?

That *Prop-Powered Pogo Stick* in *Just Patented* (page 92, May PM) seems to have a lot of potential as a decapitation device.

CHICAGO

KEN GREENBERG

## Compound bow

In the News Brief *Pulleys Give Bow Added Punch* (page 75, May PM), you state that the Jennings Compound Bow "has just been legalized for competition by the NFAA."

According to the March 1971 edition of *Archery Magazine* (official publication of the NFAA), the compound bow was declared illegal in the bare-bow and competitive bow hunter divisions. It is legal only in the free-style division.

BROOKLYN, N.Y.

JEFFREY GREEN

## Takes issue 300th time

I just received my 300th *Popular Mechanics*. The first copy dates back to May 1946, and I have every copy.

MILAN, IND.

JOHN G. LATTIRE

## Just 21 cents more

In *New Tools* (page 38, May PM) you show a picture of our LRK Retractable Linoleum Utility Knife and list it for \$1.39 —our price a number of years back. Our current price is \$1.60.

ALLWAY TOOLS, INC. BRONX, N.Y.

DON GRINGER, PRESIDENT

## Unsafe trucks

I am one of the so-called "gypsy" truckers that Frank Tinker wrote about (*Unsafe Trucks Can Kill You!* page 63, May PM). He didn't do much checking.

I am sure that if he rode with me on a trip from here to New York City, he would find after riding with a "gypsy" and inspecting our trucks that we are much safer on the road than any union driver or large company.

I have before me a booklet put out by

(Please turn to page 8)

POPULAR MECHANICS



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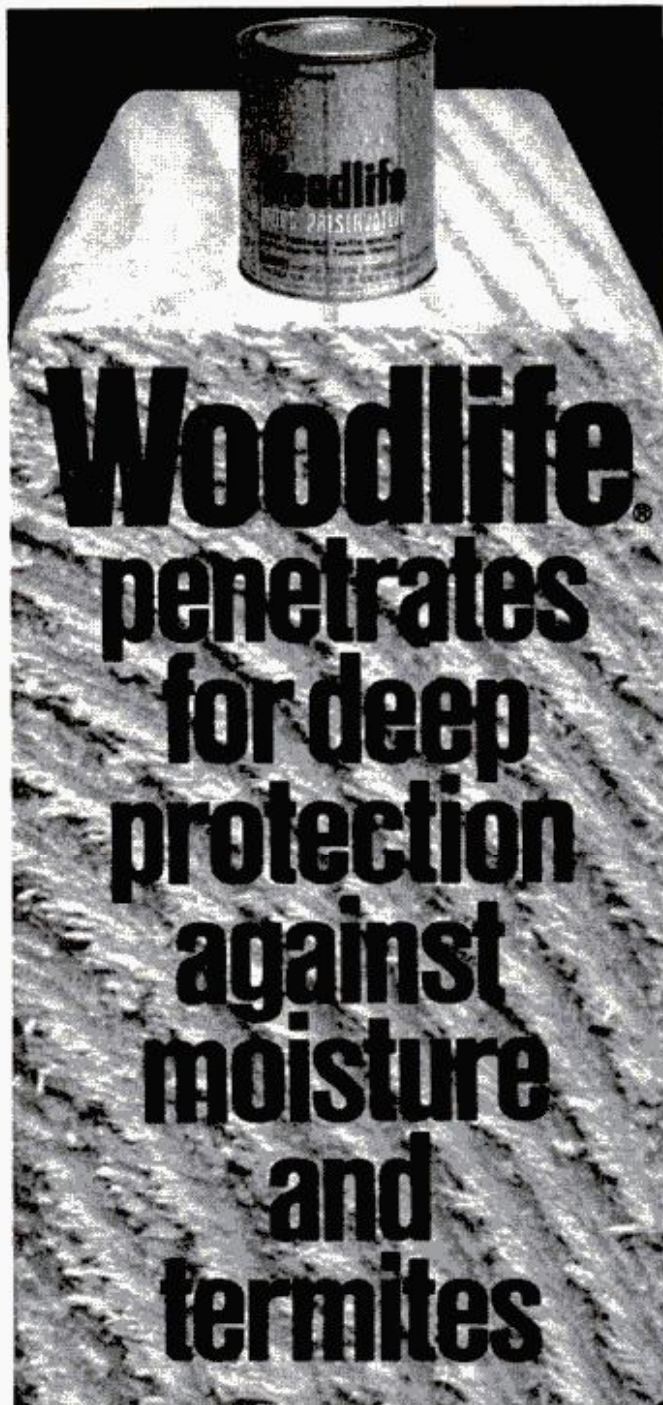
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## LETTERS

(Continued from page 6)

the Indiana Motor Truck Assn., of which I am a member, that states if it were not for your so-called "gypsy" you would not eat, and you would not have your house or anything that is in your house or office. Even mail is moved by truck. The next time you sit down at your table with meat, fruit and vegetables, give thanks for it—and for that so-called (by you) bennied-up killer of the highway, the "gypsy," for bringing it to you.

We gypsies kept you and all America alive during the last truck strike while your goody union drivers threw rocks at us off overpasses, shot at us and even killed a few of us. I feel this is an unfair story you have printed.

LASLEY TRUCKING      HOWARD E. LASLEY  
WOLCOTT, IND.

*"I am sure there are good, safe 'gypsy' drivers, just as there are unsafe ones," responds Author Tinker. "The figures and incidents I cited were not, however, inventions. They were corroborated by every person in the industry with whom I talked. The fact that so much of the country's commerce moves by truck means only that even more care should be taken by such an important industry. My suggestion, if you feel so strongly about it, is to work through your association to eliminate those operators who, whether you like it or not, are giving their fellow members such a poor reputation."*

The article on unsafe trucks was either badly cut or incompletely researched. The article is true, interesting and good reading, and I do not want to fault the author.

He is right about trucks that kill. Cars kill, too, for the same reasons that he pointed out.

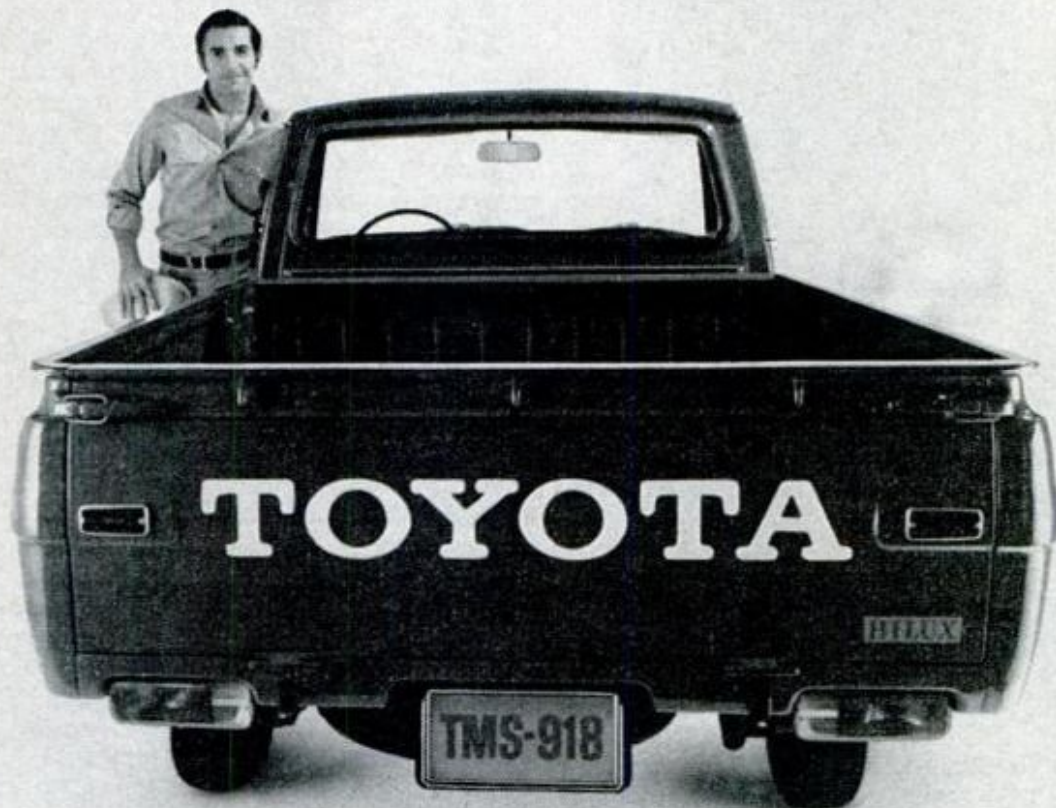
He is wrong, however, about "gypsies." These are a rare breed in the trucking field, and have been for some years. Trucking companies, freight forwarders, independent owner-operators and easier financing of tractors and trailers have just about driven them out of the business.

This is why: A new tractor, depending on make and optional equipment, costs in monthly payments, interest and required insurance (but not the multimillion-dollar liability or cargo insurance) upwards of \$500 a month. To meet payments like those, an independent owner-operator must keep his equipment in first-class condition so he can keep working and making his living. A rig in lousy condition is generally apparent from its appearance

*(Please turn to page 10)*



# Most people buy small trucks for the same reasons they buy small cars.



They eat less gas. Occupy less space. Are cheaper to maintain. Easier to handle. And cost much less to begin with.

In addition, some small trucks (namely our small Toyota half-tons) can do just what bigger half-tons do. We can carry a full 1,000-pound load in our 6-foot bed. And we can do it at highway speeds.

We've got an efficient 108-hp OHC engine. With 5 main bearings to help your engine live a longer, more rugged life.

And a heavy-duty suspension system for a solid ride. Empty. Or full-up.

And as you might have noticed, our small Toyota truck comes with a small Toyota price. \$1,978.\* Which includes a 4-speed synchromesh transmission. 6-ply tires. Flo-thru ventilation. Padded dash.

And some things a lot of bigger, more expensive half-tons don't have. Like a front towhook. Tie hooks all around the bed. And a spare tire under the truck that you lower with a hand crank.

Actually, there just might be more reasons to buy a small truck than there are to buy a small car.

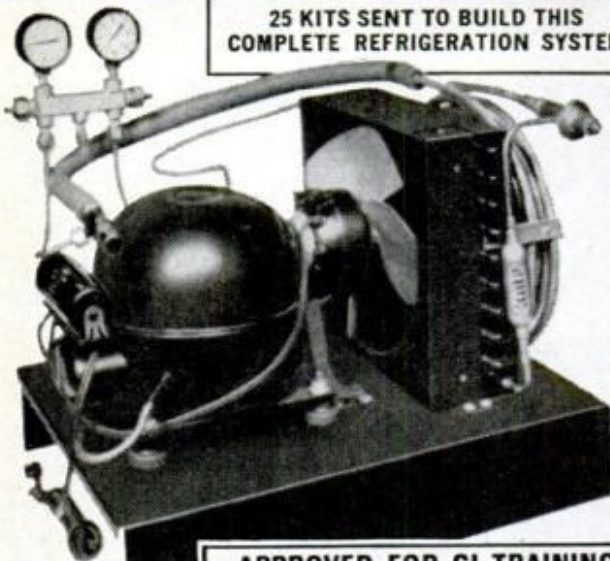
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\*Manufacturer's suggested retail price. Freight, dealer preparation, options and taxes extra.



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## LETTERS

(Continued from page 8)

and age. Few companies care to use older rigs for this reason.

The manufacturer cited in the article apparently didn't know the trucking business and the lawsuits that could and do result from truck accidents. He was looking for a gypsy. And he is a guy who will haul anything anywhere anytime if the price is right. But he is a rare, rare bird.  
PITTSBURGH, PA. JIM FAGAN

## How to load a trailer

You should have had *How to Tow a Trailer* (page 141, May PM) written by a person who knows something about trailers. The comments about rental trailers are inaccurate. As a U-Haul dealer for eight years, I have never let a trailer leave my lot without proper light hookups.

One gross error that you should inform your readers about is: how to load the trailer. *Don't try to balance the load over the axle of the trailer.* Always load 10 percent heavier in the front. The main reason for this is not the stress on the hitch but because an improperly loaded trailer is very unstable and apt to sway.

I don't know where you came up with your figures. Studies made for U-Haul show that by vehicle miles there are 80 percent fewer accidents with cars towing U-Haul trailers than with cars not towing trailers.

POWAY EQPT. RENTAL ROBERT CONNOR  
POWAY, CALIF. VICE-PRESIDENT

A trailer must be loaded so that 10 to 15 percent of its gross weight rests on the hitch ball. If this results in the tow vehicle's rear end being depressed excessively, this problem must be solved with an equalizing hitch or by supporting the vehicle's rear suspension.

HALF MOON BAY, CALIF. DONALD BEATY

## Wing adder

That add-on wing you published (*We Added On and Saved*, page 104, May PM) was intriguing to me and several friends who also are running out of living space. Is there any way of obtaining further information, instructions or plans?

COLORADO SPRINGS LEWIS CLARK

All reader inquiries about the PM wing addition are being handled by Money-Saver Projects Associates, Box 303, Chappaqua, N.Y. 10514. Write them for information; instructions and working drawings are available. ★ ★ ★



# No.1 Chain Saw Buy

## from the No.1 Chain Saw People



### New Homelite<sup>®</sup> 150 Automatic

**Easy to Handle** – Homelite's all-weather starter, fingertip controls, Sure-grip handlebar, perfect balance and quieter muffler make the new 150 Automatic chain saw a pleasure to use.

**Lightweight Power** – Aluminum and magnesium are the light-but-tough metals used in this super lightweight saw. The 150 Automatic will take care of every outdoor woodcutting job.

**Rugged Reliability** – The Homelite 150 Automatic is a simple-service-saw, built to last. It has the industry's only one-piece clutch – smoother, more reliable.

Here's the newest design in chain saws that includes automatic oiling for the cutting chain and guide bar at no extra cost!

Only **\$149<sup>95</sup>**

Manufacturer's suggested retail price with 12" bar & chain

The new Homelite 150 Automatic is available at more servicing dealers than any other chain saw sold. Check the Yellow Pages for your nearest Homelite chain saw dealer – drop in and see the No. 1 chain saw buy. Homelite, **Alextron** DIVISION  
12407 Riverdale Ave., Port Chester, N.Y. 10573

**HOMELITE**

No. 1 in Chain Saw Sales Worldwide



50 years  
and  
3 million  
chain saws  
old



# LEARN TO BE A SKILLED LOCKSMITH



Change combination of pin tumbler cylinder—EARN \$1.50 in 15 MIN.

**TYPICAL JOBS EARN YOU \$271 PART TIME (in only 53 hours!)**

Owner loses key; pick car trunk—EARN \$5.50 in 10 or 20 MIN.



Install new knob door lock—EARN \$15.00 in 30 MIN.

After-hour emergency opening—EARN \$2.50 to \$5.50 in 20 MIN.

## Hundreds have succeeded like these Belsaw Graduates:

**R. W. Davis, St. Louis, Mo.:** "I am doing a wonderful business thanks to your course in locksmithing. Last Saturday I took in \$110.00."

**Pierson Crook, Los Angeles, Calif.:** "I am making \$200 a month extra income with the Belsaw Locksmith Course. I would recommend your course to anyone."

Big demand for skilled Locksmiths! Earn big money spare time in your own home. Be your own boss. No layoffs. Steady year 'round income. Age and schooling are no handicap.

**BELSAW INSTITUTE** training... approved by master locksmiths... helps you start faster with easy picture lessons guided by your own mail instructor.

Get thorough job training on all types of locks. We supply tools, equipment and business help: how to start, how to charge, how to get jobs, how to earn while you learn and build a lifetime cash-profit business. Accredited Member National Home Study Council. Approved by State Board of Education. Approved for Veterans.



**This \$125 key machine is yours to keep!**

### MAIL COUPON—NO SALESMAN WILL CALL

BELSAW INSTITUTE, 102K Field Bldg.  
Kansas City, Mo. 64111

Send FREE book, "Keys To Your Future!"



Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



## Smog lifter

Plumes of warm, moist air—rising from this laboratory model of a proposed new cooling tower—are being studied by GE Research and Development Center engineers as a means of ventilating smog-laden skies over large cities. The study shows that a massive plume would pass through atmospheric inversions (when a layer of warm air pins down a layer of cool air and won't allow polluted air to rise). The tower would also let electric power stations discharge thermal exhaust thousands of feet into the atmosphere.



## Rooftop launching

It's an old story for Ron Clayton. Like its predecessors, his third boat, *Roofus III*, was launched through the roof after he built it in the attic. The sail went up just for the photo.



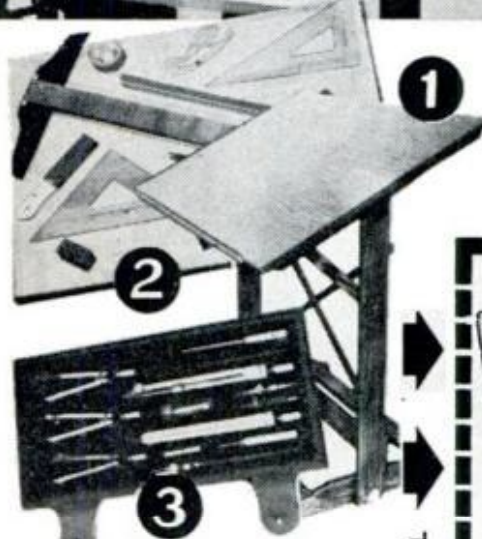
ALL G.I.S. VETERANS UNDER NEW G.I. BILL

# THESE 3 BIG DRAFTING KITS\* GIVEN TO YOU!

... when you train at home with us for a

## 1 HIGH PAY JOB IN DRAFTING

CUT OUT ENTIRE ENVELOPE... BOTH PANELS...  
FOLD IN HALF... SEAL (Staple or Tape) AND MAIL



\* Precision Drawing Instrument Set, Professional Drafting Board Outfit & Fingertip Tilting Drafting Table are given to you with your complete North American Course in Drafting.

### TOP AMERICAN EMPLOYERS WELCOME NASD GRADUATES

"We would be very interested in interviewing your graduates as potential employees."

— Remington Office Machines.

"At the present time we have several openings available for qualified Draftsmen. I look forward to considering graduates of your institution."

— Westinghouse Electric

"We have immediate openings for designers and Draftsmen and have a definite interest in interviewing candidates immediately."

— American Machine & Foundry

### HERE'S WHAT STUDENTS SAY

#### Big Promotion!

"18 months ago I was a laborer. Now I am foreman of 22 people in the Drafting Room. Thanks for making this possible."  
S. D., Mass.

#### 2 Raises and \$300 Bonus!

"I've had 2 boosts in salary and a \$300 bonus in 11 months. Wish I could shake hands with your staff in person."  
A. C., Calif.

#### Job Awaits Serviceman!

"Your Drafting Course has given me a good start. I already have a job waiting for me when I leave the service."  
L. I., FPO, New York

#### Gets Three Raises!

"Since completing my course I have been transferred from the foundry to the Engineering Department and had three raises."  
R. C., Ohio

Accredited Member, National Home Study Council



(A home-study program in association with



Rush me FREE "DRAFTING CAREER KIT"

## MAIL THIS HANDY POSTAGE-PAID COUPON-ENVELOPE...

Cut out *entire* Business Reply Envelope (*both* panels) along dotted line. Fill in coupon-envelope. Seal (staple, tape or paste). Mail today! NO POSTAGE STAMP IS NECESSARY!

Please send me your FREE "Drafting Career Kit," including 20-page CAREER FACT BOOK, 5-way DRAFTING INSTRUMENT, self-scoring APTITUDE TEST and SAMPLE LESSON. I understand there is no cost or obligation on my part, now or ever, and that no salesman will call.

Dept. 14177

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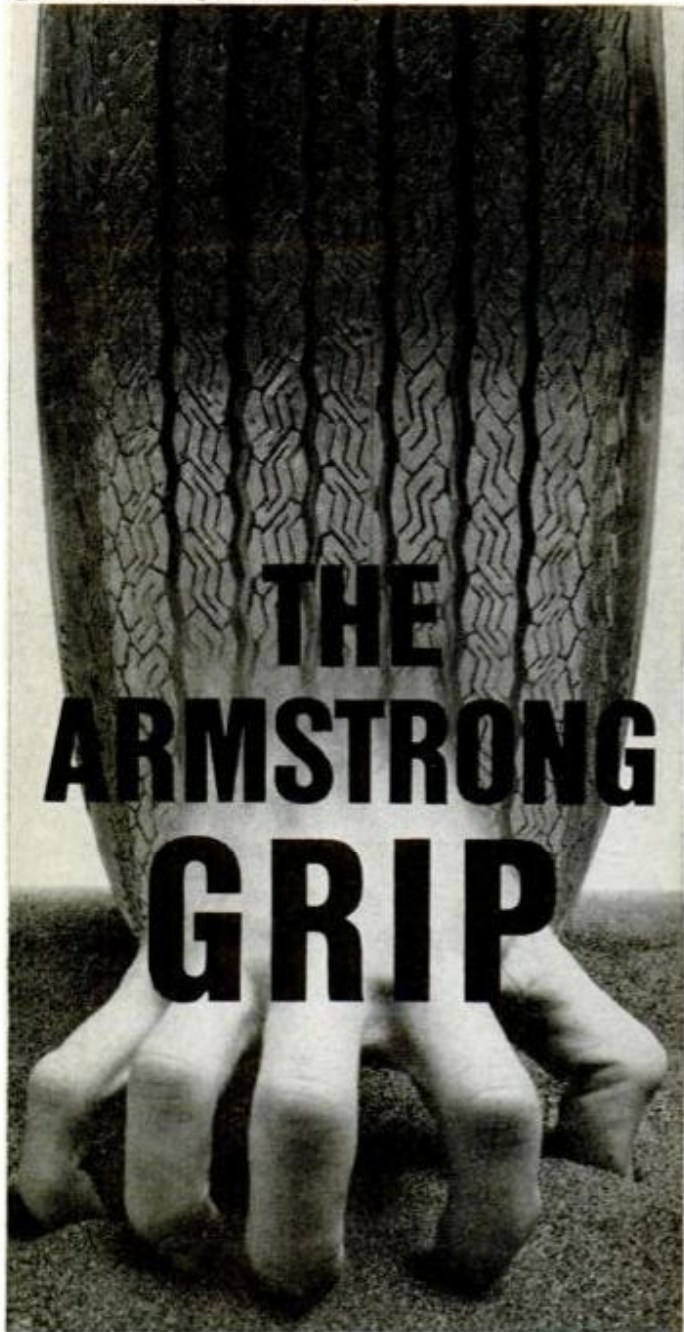
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# THE ARMSTRONG GRIP

## ONLY ARMSTRONG TIRES HAVE IT.

The grip that's grooved to hold the road in any weather or road condition, grab strong, grip strong. The grip you get with our great line of Armstrong Tires. We pioneered grip even before we introduced fiber glass tires. And we never stop trying to improve it. The Armstrong Grip. This year it's stronger than ever.

**ARMSTRONG TIRES**  
FIRST IN FIBER GLASS

## NEWS BRIEFS



### Three-dimensional pun

Few people could—or would—carry a pun to the degree that Gerald Scarfe, London artist, did. Here, in the form of an overstuffed, cowhide-covered piece of furniture, is a likeness of "Chair Man" Mao.



### One way to beat tax man

Hauling contractor Neville Brandstater has figured out a way to beat an Australian road tax that's imposed on semi trailers. He loads his trailer onto the prime mover and thereby turns the rig into a "tray body" truck once he's made a delivery and is starting back. The trailer is placed on the prime mover with a crane.



# TOM McCAHILL SAYS:

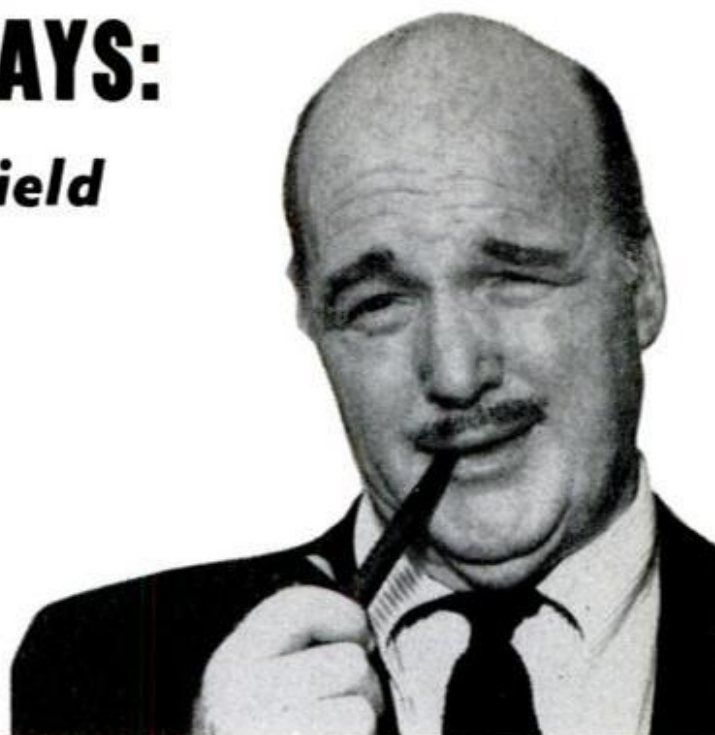
**"The appliance repair field is so uncrowded it's almost lonely!"**

Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a list of handy electrical gadgets for the home longer than Wilt Chamberlain's arm. The trouble is, the dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as knee-length skirts on teen-agers.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics' Electrical fields with more than fifty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

A few years ago, NRI recognized the increasing demand for trained Appliance Repairmen. They set about preparing well-illustrated, easy-to-understand lessons that teach you how to repair home, commercial and farm Appliances. NRI even added a professional Appliance Tester that's included in their low tuition. With the Tester and a few basic tools you probably already have,



you're equipped to service most Electrical Appliances. If you aren't making as much as \$4 to \$6 an hour in spare time fixing Appliances for friends and neighbors within a few months after enrolling, my name isn't McCahill.

The reason I'm no doubting Thomas, is because the staff at NRI is composed of experienced instructors who guide you through the course with more personal attention than you'd get in many classrooms. With the kind of help they give a student and the kind of course they have, you can be the man in demand in this field—even if you've never tried to rewire a plug, or got fed up with school at the 9th grade.

The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

*Tom McCahill*

TOM McCAHILL

APPLIANCE DIVISION, NATIONAL RADIO INSTITUTE  
3939 Wisconsin Avenue, Washington, D.C. 20016

APPROVED UNDER NEW GI BILL.  
If you served since January 31, 1955, or  
are in service, check GI line below.

600-071

OK—I want to see for myself. Send me the free book on Professional Appliance Servicing. No salesman will call.

Name..... Age.....

Address.....

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

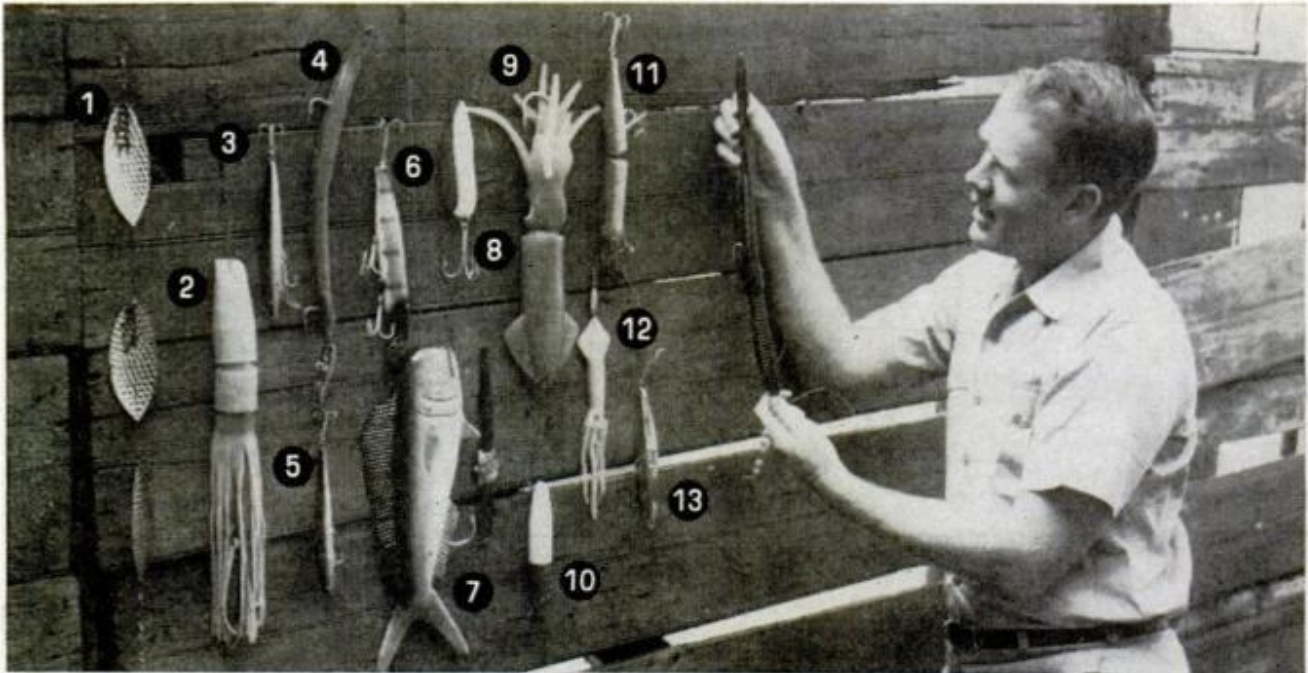
Accredited Member National Home Study Council.

Check for facts on new GI Bill.



# ALL OUTDOORS

By GEORGE REIGER



**A FEW SEASONS BACK**, an outdoor writer took a display model "flatfish" lure 26 inches long on a camping trip. He planned to troll the thing for some stunt photography. Trouble was, he kept catching fish! Bass and pickerel—not one as large as the lure!

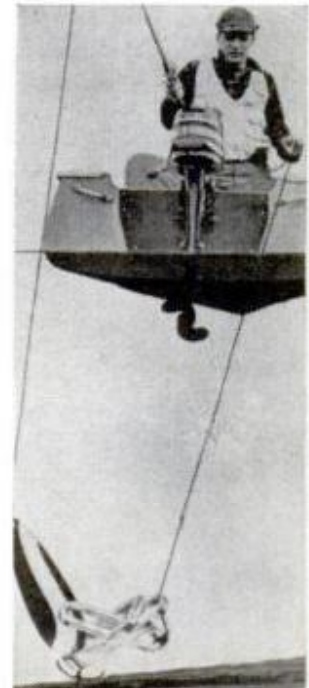
Since World War II, popping plugs, jointed minnows and streamer flies have taken up residence in tackle boxes of saltwater anglers. Now giant versions of these lures used by ocean anglers are moving into the tackle boxes of lake trout and muskie fishermen.

Large spoons have long been used to take big trout. Will even larger spoons take even bigger fish? Plastic worms have revolutionized bass fishing. Will still larger shapes like the gag "Texas Worm" I'm holding from Sportsman's Products, Marion, Ind., land lunkers? After all, those other lures are for real, and No. 4, the Garcia Alou "Cow Killer," is much like a huge worm and has already caught its share of giant striped bass.

Why do some fish attack food imitations larger than they can swallow? It's anybody's guess. Perhaps, fish will strike to drive away something different or which seems a threat.

In any event, supersize lures get results, and they're fun to experiment with.

Others shown are: (1) Dave Davis Troller, Eddie Pope Co., Altadena, Calif.; (2) Knucklehead, Sevenstrand Tackle, Westminster, Calif.; (3) Rapala Magnum, Normark, Minneapolis, Minn.; (5) Reb 2, Norman Mfg., Fort Smith, Ark.; (6) Giant Pikie, Creek Chub, Garrett, Ind.; (7) Dolphin, Leisure Lures, North Hollywood, Calif.; (8) Huskie Devle, Lou J. Eppinger Co., Dearborn, Mich.; (9) Squid, Leisure Lures; (10) Everett Tackle Co., Waltham, Mass.; (11) Jointed Giant Pikie, Creek Chub; (12) Sportsman's Squid; (13) Diamond Jig, Bridgeport Silverware Co., Bridgeport, Conn.



**TO SAVE LURES SNAGGED DEEP**, the Snagaway Lure Saver Kit (above, right) has 150 feet of 70-lb. test nylon and a retriever to slide down your line and lock onto lure below. \$6.95.

**REMEMBER ZONAR?** (See *Zounds! It's Zonar!* page 36, Mar. '70 PM). Mark II (left) provides salt-water anglers with air/temperature readings scaled to a species preference chart. \$99.95.





**Old Gold Filters. The cigarette for independent people.**

**"I want my cigarette to talk tobacco to me.  
But I only want it to say one thing: flavor.  
I smoke Old Gold Filters."**

19 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Nov. 70.

© 1971 Lorillard



# New tools you should know about



**TAPELESS RULER** made by USM, Consumer Products Div., Box 1139, Reading, Pa. 19603, is 8½ in. long (see inset), has five 7-in. extensions to lengthen handle for use beyond normal reach. Measures feet and inches, \$30.

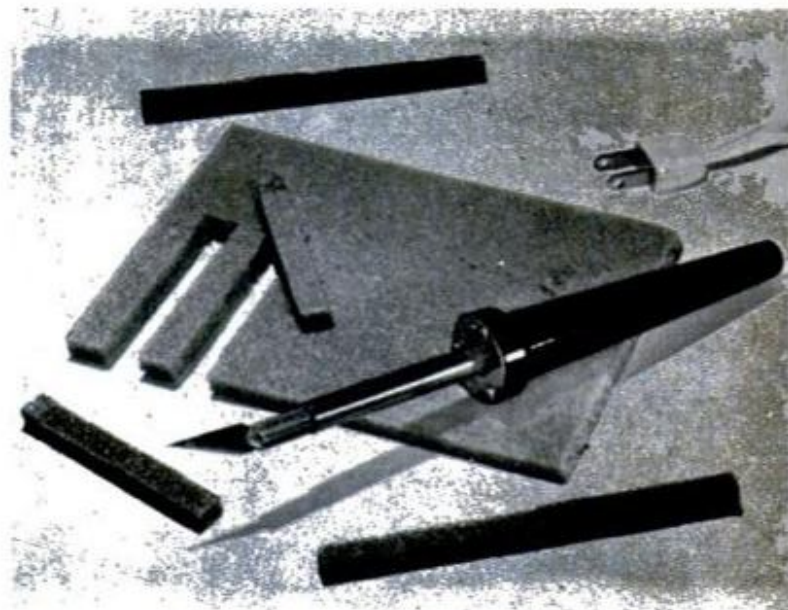


**WISE ACCESSORIES** called Swivel Blocks are designed for use between machine vise jaws and work that's tapered or of irregular shape. Blocks automatically adjust to transmit force as needed to eliminate the need for shims. Sold in four sizes, \$20 to \$40. Write Universal Vise & Tool Co., 8500 East Michigan Ave., Parma, Mich. 49269 for Bulletin 380-70.

**PRECISELY TAPERED BLADE** keeps this saw from binding during use. Dubbed White Knight, this 26-in. by 8-pt., \$8 saw is made of very flexible steel by Spear & Jackson Hand Tools, Inc., 30 Church St., New York, N.Y. 10007.



**WOOD-TURNING CHISELS** of high-alloy steel have precision-ground cutting edges, extra-long (10½-in.) handles. Set of eight: \$34.95 from Rockwell Manufacturing Co., 400 North Lexington Ave., Pittsburgh, Pa. 15208.



**DUAL-PURPOSE HOT KNIFE** holds standard knife blade in adapter chuck that can be removed to insert threaded end of soldering tip supplied. Knife cuts light plastics, epoxies, \$5. Weller, 100 Wellco Rd., Easton, Pa. 18042.





# According to most house paint ads, the quickest and easiest job is all you care about.



# The Dutch Boy believes you care about something else: a paint job that will stay looking good a long time.

We won't kid you and say there's nothing to it. Painting a house—even painting it with Dutch Boy® Latex House Paint—takes planning and work.

If the surface is new, or if it was painted with latex house paint before, your surface preparation may involve very little beyond resetting nails, puttying nail holes, or removing chalk.

If your house was painted with oil paint before, or you don't know if it was and can't find out, you should consult your Dutch Boy dealer and he will advise you as to what methods of surface preparation may be in order.

Two things particularly contribute to the long-lastingness of Dutch Boy Latex House Paint. One is that since the paint "breathes," moisture can't get trapped under it. The other is that the acrylic resin base of Dutch Boy Latex House Paint has the ability to lock in colors and consequently, the colors last for the life of the job and the job lasts longer.

If you've got shutters and trim that you want to look glossy, although you want the rest of the house flat, your

Dutch Boy dealer can sell you flat and glossy colors designed to work together.

And the painting of gutters and drain pipes is no problem, either. Dutch Boy Latex House Paint clings to aluminum, galvanized and copper surfaces for the life of the paint job—no special primer is needed.

As to the quickness and ease of the painting itself, Dutch Boy Latex House Paint actually flows on easier without dragging or sticking. It doesn't leave lap-marks when you stop and start, so that if you want, you can paint every weekend for the whole summer. Paint before and after the rain. And no matter what kind of a mess you make (and you can make a mess) it will wash up with soap and water.

But we're never going to tell you that painting a house is so much fun you'll feel like running out and doing it again. You have kids to raise and living to do and our main job is to help you forget about us for a long time.





# Add a Tag-Along Seat to Your Cycle

WHEN the Milton Kites bought his-and-her Hondas several years ago, they hadn't counted on their 3-year-old daughter, Vickie, wanting to get in on the fun of those cool summer-evening rides. So, Milt went to work, and, for a total cash outlay of about \$25, he added this comfortable tag-along seat for her.

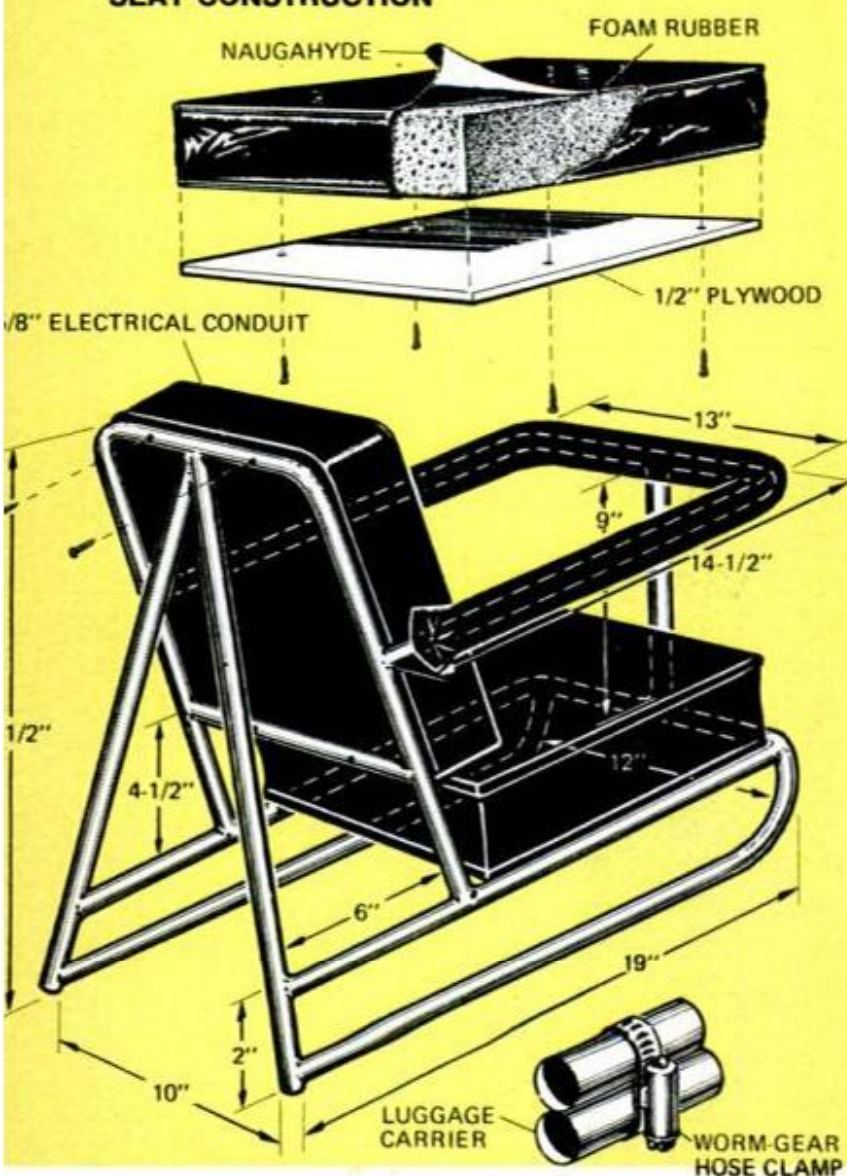
Except for the back and seat cushions, the entire framework is formed from common electrical conduit. Here a conduit bender (hickey) comes in handy, but even without one, you can bend the tubing without kinking it. Simply cork one end, fill the tubing completely with dry sand and cork the other end. After you've made the bends, remove the corks and pour out the sand.

Where one length of conduit joins another, file the end to fit the mating contour. For maximum strength, use silver solder for all the joints.

The back and seat cushions are pieces of 1/2-in. plywood padded with foam rubber. The Naugahyde covering will withstand a reasonable amount of sun and rain. To finish the framework paint it to blend with your cycle or to please your wife.

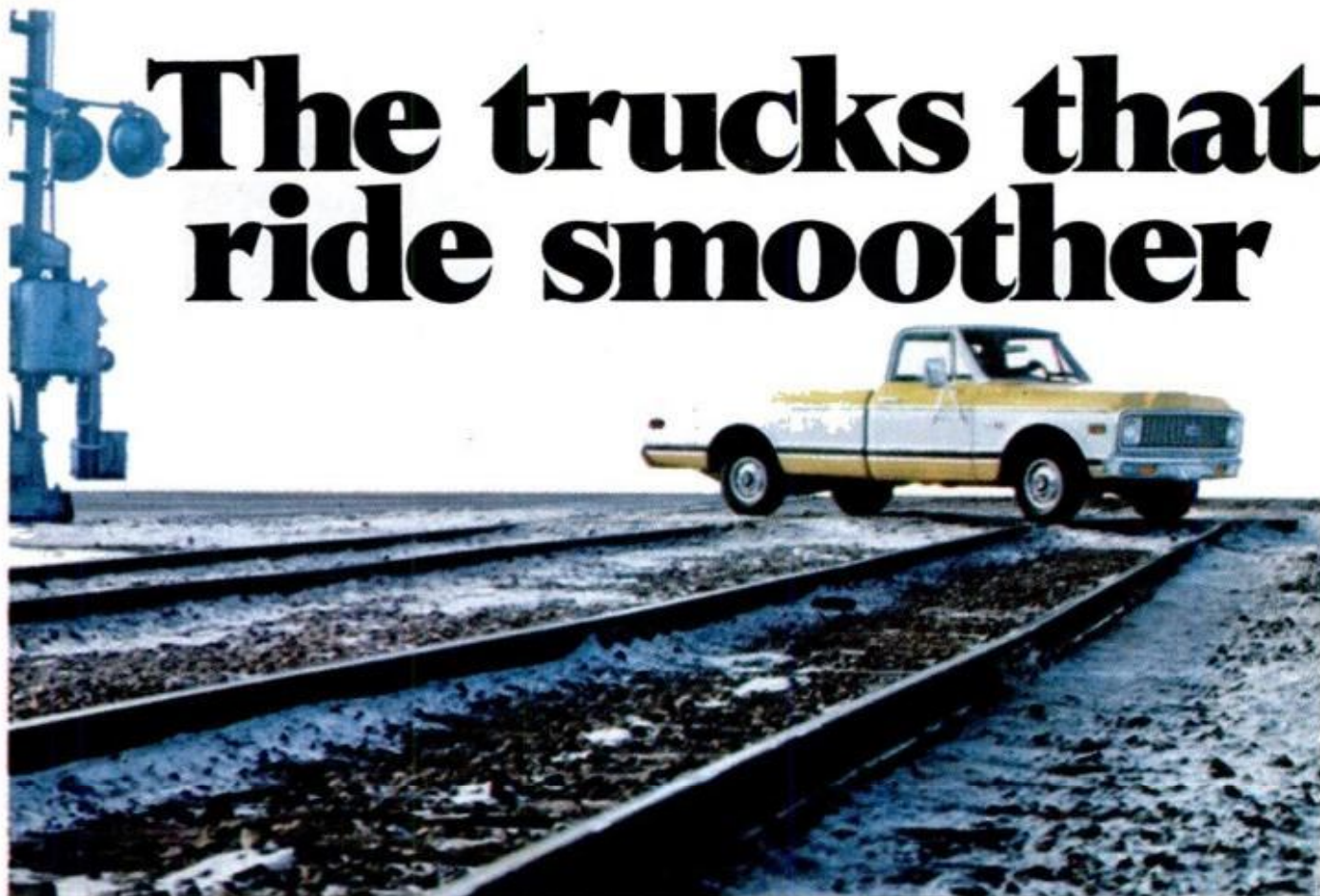
Worm-gear hose clamps are used to attach the seat to the luggage rack of the cycle.—Lugman House, Walnut Creek, Calif.

## SEAT CONSTRUCTION





# The trucks that ride smoother



## Smoother wide-stance Super Suspension

Over the years Chevrolet has led the way in engineering a smooth truck ride.

We were the first to introduce independent front suspension. We've built 1½ million more light-duty trucks with this type of suspension than anybody else.

In the rear Chevy leads the way by making available two-stage coil or leaf springs. Most



trucks don't give you a choice. And most trucks don't give you Chevy's steady wide stance ride. Chevy's Super Suspension. The smoothest truck suspension system going. And the trucks that ride smoother, work longer. That's a fact.

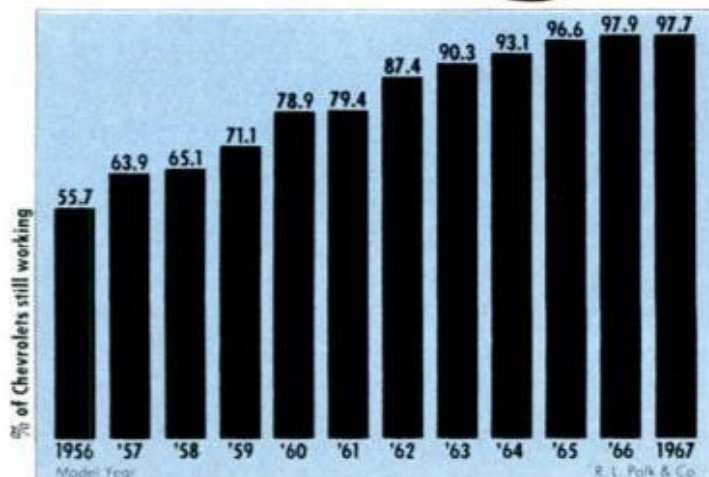
## Look at Chevy's work record

The chart below, based on the latest official figures from R. L. Polk & Co\*., shows how Chevrolets outlast other trucks.

Going back as far as 1956, for example, over 55% of the Chevy trucks of that model year are still going strong.

No competitive make has as many as half of its '56 models still working. Chevrolet trucks last longer because they're built tougher.

# last longer



**Totally tougher trucks**

Buckle up for safety.





# HINTS FROM READERS

## Neater sandpaper tearing

An easy way to tear a sheet of sandpaper to the width that your sander requires is to use your saw table as shown. First, determine the desired paper width. Then, using a block of thin wood with a width that equals that dimension, move the rip fence over and lock in place. Now, paper is held securely while you tear.

—Robert E. Smith, Batavia, N.Y.

## Drive stud becomes scriber

A threaded drive stud of the type used for fastening to concrete can be converted to a sturdy scribe for shop use. Because of its small  $\frac{1}{4}$ -20 thread, it's easy to fashion a comfortable, easy-to-grasp handle to suit your needs. The tough and hard steel pin is long-lasting, and a replacement costs just pennies.

—Anton Barkey, Sunnyvale, Calif.



## Pill vials store dies

Plastic pill containers make fine storage "compartments" for keeping button dies handy and clean when they must be stored in drawer or toolbox. The eight-dram size holds five 1-in.-dia. dies and the five-dram vial will corral seven  $\frac{13}{16}$ -in. dies. A cotton wad saturated with oil will keep dies free of rust during storage.

—J. F. Pilznienski, Dearborn Heights, Mich.



## Faster cleanup after spackling

Next time you have to patch a plaster-board wall, try this method for making after-job cleanup a snap. Mix your patching plaster (or Spackle) in a flexible plastic freezer container. When finished patching, let remaining material harden in the container; then flex the container to loosen material for emptying.

—John F. Bachman, Columbia, Md.



## Correction fluid aids layout

The white correction fluid which typists use to block out unwanted characters can be used when you lay out shopwork. Just spread a coat of fluid (which resembles white lacquer) on the metal. In a few minutes you can use a ballpoint pen to mark on it—as for positioning center points of holes to be drilled.

—B. W. Ervin, Kent, Ohio

POPULAR MECHANICS



# Springtime!



It happens every Salem.

**NATURAL MENTHOL™**  
Not the artificial kind. That's  
what gives Salem a taste as fresh  
as Springtime. It's only natural.



# 266 ICS

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Painting Contractor  
Reading Architectural Blueprints

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Office Automation  
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Retail & Local Adv'ting  
Retail Bus. Management  
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Salesmanship  
Sales Management

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Industrial Supervision  
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Personality Development  
Personnel-Labor Relations (U.S.A.)  
Supervision

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Chemical Analyst  
Chemical Engineering  
Chemical Laboratory Technician  
Chemical Process Equip. Design & Operation  
Chemical Process Op.  
Elements of Nuclear Energy  
General Chemistry  
Instrumental Laboratory Analysis

### CIVIL ENGINEERING

Civil Engineering  
Construction Eng'r'g Tech.  
Highway Eng'r'g Tech.  
Principles of Surveying  
Reading Highway Blueprints  
Reading Structural Blueprints  
Sanitary Engineering Technician  
Sewage Plant Operator  
Structural Eng'r'g Tech.  
Surveying and Mapping  
Water Works Operator

### COMPUTERS

Fundamentals of Computer Programming  
COBOL Programming  
Fortran Programming for Engineers  
Programming for Digital Computers  
Programming the IBM 1401 Computer  
Programming the IBM System/360 Computer, Introduction

### DRAFTING

Aircraft Drafting  
Architectural Drafting  
Design Drafting  
Drafting Technology  
Electrical Drafting  
Electronic Drafting  
Introductory Mech. Drafting  
Mechanical Drafting

Pressure-Vessel and Tank Print Reading  
Sheet Metal Layout for Air Conditioning  
Structural Drafting

### ELECTRICAL

Electrical Engineering —Electronics Option  
—Power Option  
Electrical Appliance Ser.  
Electrical Appliance Ser. with Equip. Training  
Electrical Contractor  
Electrical Eng'r'g Tech.  
Electrical Home Maint.  
Electrical Home Maint. with Equip. Training  
Electrical Instrument Tech.  
Electric Motor Repairman  
Industrial Elec. Tech.  
Industrial Electrician  
Industrial Maintenance Electrician  
Power-Line Design and Construction  
Power Plant Operator —Hydro Option  
—Steam Option  
Practical Electrician  
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Reading Elec. Blueprints

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High School Math.  
High School Secretarial  
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High School College Prep—Engineering and Science  
Preparatory Course for High School Equivalency Test

### MACHINE SHOP PRACTICE

Grinder Operator  
Industrial Metallurgy  
Lathe Operator

Mach. Shop Inspection  
Mach. Shop Practice  
Metallurgical Eng'r'g Tech.  
Multicraft Maintenance Mechanic  
Practical Millwrighting  
Reading Shop Prints  
Rigging  
Tool & Die Making  
Tool Engineering Tech.  
Welding Engineering Tech.  
Welding Process

### MATHEMATICS

Advanced Mathematics  
Math and Mechanics for Engineering Techn.  
Math and Physics for Engineering Techn.  
Modern Elementary Statistics

### MECHANICAL

Mechanical Engineering  
Aircraft and Power Plant Mechanic  
Hydraulic and Pneumatic Power  
Industrial Engineering  
Industrial Eng'r'g Tech.  
Industrial Instrumentation  
Machine Design  
Quality Control  
Safety Eng'r'g Tech.  
Tool Design  
Vibration Analysis and Control

### PETROLEUM

Natural Gas Production and Transmission  
Oil Well Servicing  
Petroleum Production Operator  
Petroleum Production Engineering Tech.  
Petroleum Refinery Op.

### PLASTICS

Plastics Techn.

### PLUMBING, HEATING AND AIR CONDITIONING

Air Conditioning  
Air Conditioning Maint.  
Domestic Heating with Gas and Oil  
Heating  
Heating & Air Conditioning with Drawing  
Industrial Air Cond.  
Pipe Fitting Plumbing  
Plumbing and Heating  
Plumbing & Heating Est.  
Practical Plumbing  
Refrigeration and Air Conditioning Serv.



# COURSES

## PULP AND PAPER

Paper Machine Operator  
Paper Making  
Pulp Making  
Pulp & Paper  
Engineering Tech.

## SECRETARIAL

Clerk-Typist Commercial  
Secretary, Engineering  
Sec'y, Legal Sec'y, Med.  
Secretary, Professional  
Shorthand Stenographic  
Typewriting

## STEAM AND DIESEL POWER

Boiler Inspector  
Industrial Building Eng'r  
Power Plant Engineering  
Stationary Diesel Eng's  
Stationary Fireman  
Stationary Steam Eng'r'g

## TEXTILES

Carding and Spinning  
Dyeing and Finishing  
Loom Fixing  
Textile Designing  
Textile Mill  
Superintendent  
Textile Mill Supervision

## TRAFFIC

Motor Traffic Man'g'm't  
Traffic Management

## TV-RADIO-ELECTRONICS

Cable TV Installer  
Commercial Radio  
Telephone License  
Electronics Technician  
Fundamentals of  
Electronic Computers  
General Electronics  
General Electronics with  
Equipment Training  
HI-FI Stereo and Sound  
System Servicing  
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Radio & TV Servicing  
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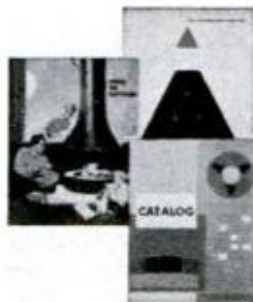
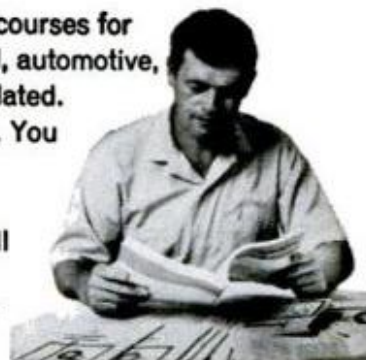
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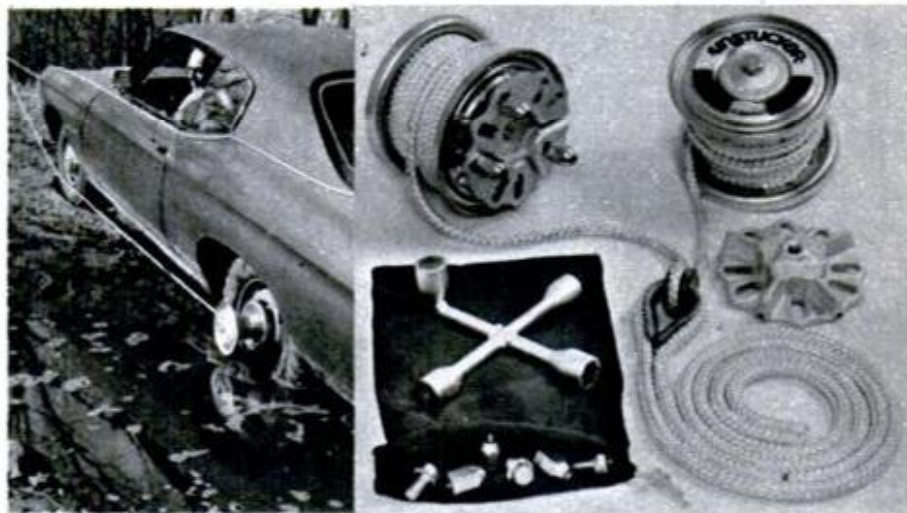
ON-THE-GO

# CAMPING

BY V. LEE OERTLE

MINI-MOTOR HOMES continue to be big items on the market, with the latest version being this Sightseer 18 from the company of the same name in Newark, Ohio. Designed to bridge the gap between small camper conversions and motor homes of 20 feet or more, this unit is built on a Dodge B-300 chassis. It's 18 feet long and inside we find the usual amenities—kitchen, toilet and compact eating-sleeping space—for a family of four. Though the company claims bunking room for six, we suspect the odd men out might be a bit cramped. Sightseer 18, fully insulated with polyurethane foam, indicates a maker hep to a growing interest in winter camping. Standard unit retails for \$5995; airconditioning and stereo are options.

**TOW TRUCK IN YOUR TRUNK?** That's what the manufacturer of Unstucker promises in the way of capability. An \$89.95 kit supplying 6000 pounds of pull will replace that electric and power-takeoff winch you've postponed buying. Once stuck, you first attach two special drums to your vehicle's drive wheels. This takes but a few minutes and requires no jacking up of your car. Then run a special high-test line between drums and an anchoring object. (If on a tundra without trees, you'll have to improvise the anchor!) That's all there is to it. You just step on the gas and the drive-wheel-mounted-drums should reel you free. From Sports Innovations, Inc., Minneapolis, Minn. 55435



**CHANGES COMING UP** for Golden Eagle Passports—again! Secretary of the Interior Rogers C. B. Morton wants to convert the annual \$10 carload recreation entrance permit to an annual \$4 individual permit for all persons 16 years and older. He recommends the continuation of daily fees for persons who don't wish to purchase an annual permit. The present passport expires Dec. 31. Look for major changes in 1972.

**AS PM PREDICTED** in *On-the-Go Camping*, page 66, April PM, the Department of the Interior has established a National Park police force. According to Secretary Morton the new Division of Law Enforcement is "only one of several measures to cope with the increasingly difficult law enforcement situation in the National Park System." Inspector Franklin A. Arthur, a 20-year veteran of the U.S. Park Police, which is still the overall law enforcement element in the Park

Service, will head the new division devoted specifically to security in the National Parks. Recruitment is under way.

**INDEPENDENT CAMP OWNERS** now offer reservations nationwide through a new association called Pathfinder Travel Park System. Franchised campgrounds no longer have a choke-hold on cross-country reservations. Operators of privately-owned campgrounds subscribing to this system can now handle the leap-frogging tourist and assure him a place to stay from state to state.

For site reservations, campers may call 1-800-648-3011 from California, Arizona, Utah, Idaho, Oregon and Washington. From Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio and Wisconsin, try 1-800-323-8111; from Illinois, 1-800-942-7071; from Nevada, 1-800-992-3501; and from all other states, 1-800-323-9111. This is a service of National Data Corp.—in some areas it's toll-free. ★★★

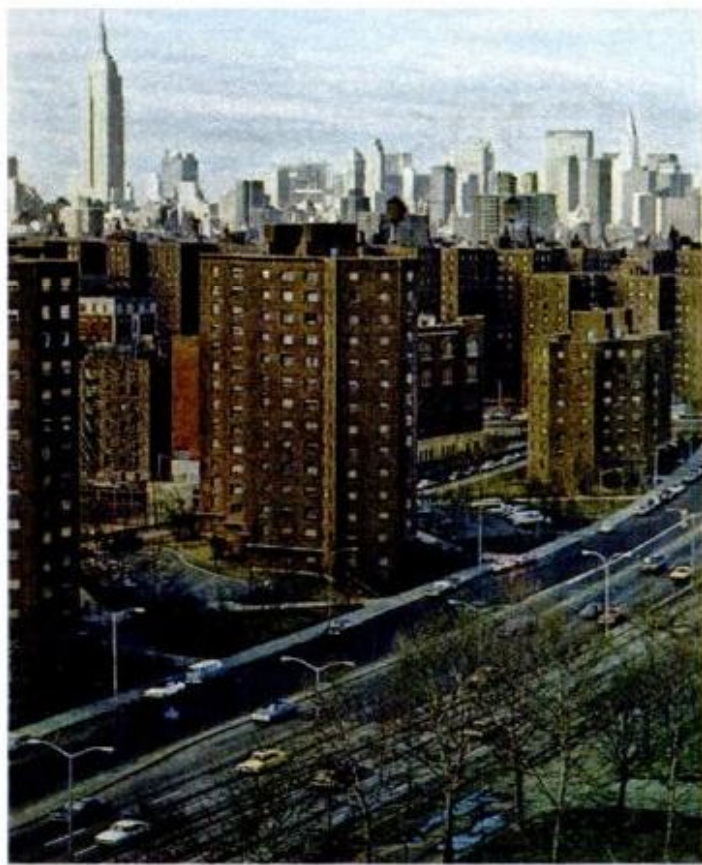


# To get you to drive around with a crankcase full of new Havoline, we drained ours. And we drove around Manhattan.

To prove that new Havoline Super Premium All Temperature Motor Oil is the finest engine protection money can buy, we drove a car for a mile with the crankcase full of new Havoline. Then we drained all the oil that would come out.

Off we drove around Manhattan. Up the F.D.R. Drive, then the Harlem River Drive, under the George Washington Bridge, down the Henry Hudson Parkway, around the Battery. Twenty-five miles of bumper-to-bumper, stop-and-go traffic. All the way back to where we started. The drive took almost one hour.

After a meticulous engine inspection, we discovered that not one part was harmed. So help us Havoline!



If only a thin film of new Havoline Super Premium All Temperature Motor Oil lubricated and protected our car's engine so not one part was harmed, you can imagine what a full crankcase will do for your car.

New Havoline resists thickening even under high-temperature conditions such as heavy-load, high-speed driving. That's when your car's engine works hardest. New Havoline prevents rust, wear, and sludge deposits.

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the right products for your car.



# Pollution Fighters' Newsletter

## Speeding patent applications

To inspire inventors to create more devices for curbing environmental pollution, the Commerce Department's Patent Office recently established a priority processing procedure to expedite applications for antipollution patents. If you have something, write to the office at 2021 Jefferson Davis Highway, Arlington, Va. 22210.

## Recycling mercury

Hearing-aid dealers in New York have joined the antimercury pollution campaign by urging customers to return used hearing-aid batteries for recycling. Twenty-five percent of all mercury manufactured is used in hearing-aid batteries that are normally discarded (they explode if they are burned). When the cases decompose, mercury seeps into the earth and water supplies. Recycling the batteries would also save mercury, which is in short supply.

## Tires to 'gravel'

Bookmobiles, bloodmobiles . . . and soon to come—tire-pulverizing-mobiles. Prof. Norman R. Braton of the University of Wisconsin has developed a method for reducing the volume of used tires, thus making their transport to market more economical. He freezes a tire at minus 80°F. in liquid nitrogen and then drops it into a hammer mill which compacts and pulverizes it to gravel-like consistency. Prof. Braton's plan for the mobile unit is to move it to locations such as service stations, junkyards and dumps to pulverize tires on the spot.

## Tires to oil and gas

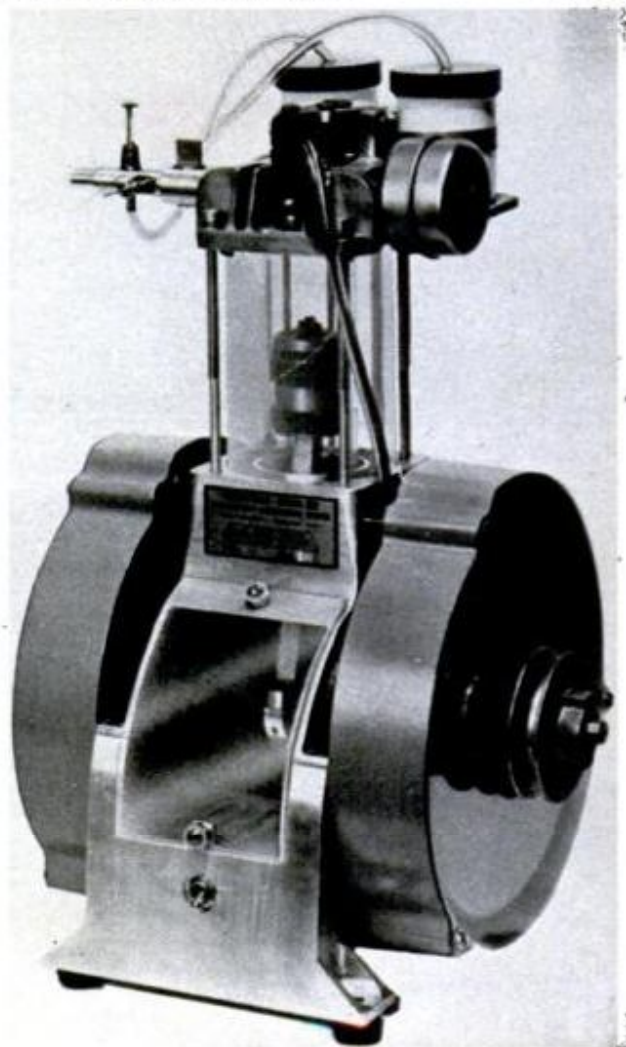
If strung out tread to tread, old tires discarded every year would circle the Earth twice at the equator! U.S. Bureau of Mines officials are continuing Firestone's idea (originally reported in *PFN*, page 42, Aug. '70 PM) to obtain large quantities of valuable chemicals, oils, gas and tar from old tires by destructive distillation. They're already recovering three barrels of oil and 1500 cubic feet of gas comparable in heating value to natural gas from a single ton of old tires.

## Pitch to powder

A sonic energy unit in operation at Merichem Corp., Houston, reduces waste refinery pitch to a powder for incineration with hydrogen sulfide. The whistle-like device generates 14,000 pounds of steam hourly, supplementing two main boilers. According to Merichem, sonic energy may soon be used to suppress smoke and dust, and to promote growth of bacteria in sewerage.

## Transparent engine for study

A unique transparent engine operating without need for oil in the crankcase is available from the Megatech Corp. The engine lets students observe combustion in the cylinder and effects of experiments with different fuels. With it, students can also measure horsepower, change compression ratios, study flame propagation, gas dynamics and emissions. Write the company at 365 Trapelo Rd., Belmont, Mass. ★★





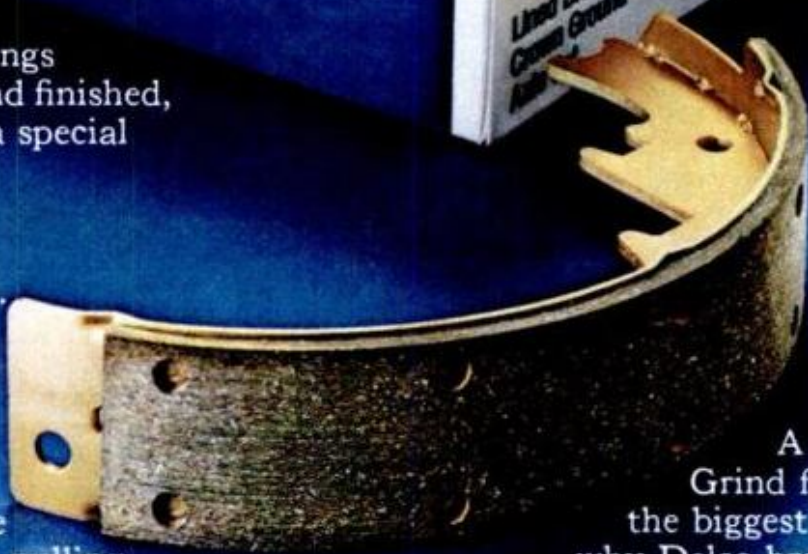
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Delco offers brake parts to fit all domestic and most foreign cars. Drum brakes or disc brakes, it doesn't matter.



**The more you know,  
the more you'll want Delco.**





# HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

## Stucco 'blisters'

*My sand-stuccoed home is quite old and lately a couple of bulges or blisters, each about a foot in diameter, have appeared on one wall. How can I do the repair myself?—W.W., Ind.*

Stucco patching is rather tricky; I hesitate to get you involved. I assume that by "sand-stuccoed" you mean sand-finished and by "old" you mean the stucco is applied over wood lath.

Using a hammer and cold chisel, chip away all loose material back to solid edges and then undercut these edges to "key" new patching. Drive scaffold nails in a pattern over the opening; the projecting heads will serve as anchors.

Mix one part portland cement and three parts coarse, clean sand with just enough water to make an easy troweling mixture. Dampen opening and edges, then trowel the mixture into the opening, using enough pressure to force the material into contact well under the undercut edges. Fill to within  $\frac{1}{4}$  in. of the original surface. Score the fresh mix lightly in crisscross pattern with trowel point or a piece of heavy wire. Cure at least two days, keeping patch damp with a fine water spray.

Dampen again and apply a second coat of the mix, building it up to within  $\frac{1}{8}$  in. of the old surface. Leave this application smooth and cure it as before. For a final coat add about  $\frac{3}{4}$ -part lime to the mix and, after building it slightly above level of the surface, strike off the excess with a straightedged board. Let coat stiffen slightly, make a float by attaching a handle to a short length of 1x4, sprinkle water on the patch and work the float until you get a matching surface.

## Portable electric tools

*I want to buy four portable electric tools for my home shop, home repairs and occasional simple projects. Which should I buy? Will you outline their practical applications and limitations?—H.R., Vt.*

Books have been written about this. My answers must be limited to generalities. For portable tools I'd buy a saw with circular blade of sufficient diameter to cut through a 2x4, a drill with two-

speed switch, a belt sander and a sabre saw, also called a jigsaw.

None is designed for extreme accuracy. Even the most painstaking work with the circular saw won't quite equal the accuracy and smoothness of cut of a table or radial saw. A hand-held drill won't match the accuracy of a drill press. The portable sabre saw using coarse-toothed blades (in wood) can't equal the smoothness of cut and delicacy of curve you get with a conventional jigsaw. Extreme accuracy is not ordinarily a factor with a belt sander, which can speed hand sanding greatly.

The other three tools do their jobs with greater accuracy and in less time than you can finish the work by hand methods. They also have a considerable range of use, especially the two-speed drill which, with accessories, will drill holes in wood and metal, serve as a buffer-polisher, disc and drum sander, power screwdriver and so on.

## Playing with fire

*A friend recently showed me how to insert a coin in a fuse socket to keep the fuse from blowing. This doesn't seem right. Won't the coin pass more current than the wires are supposed to carry? Isn't this unsafe?—E.T., Okla.*

Dangers of this procedure have been so well covered in past years I thought it would no longer be approved by anyone. In older-type service boxes, fuses are your only protection against dangerous overheating of wiring and electrical shorts that may develop in lamps or appliances. Never replace a fuse with a coin or other metallic object serving the same purpose. Have your local electrician check why the fuse in your box let go before you insert a new fuse. It's extremely important to locate and eliminate the cause of a blown fuse. Otherwise, you risk a disastrous fire.

## Cleaning empty flowerpots

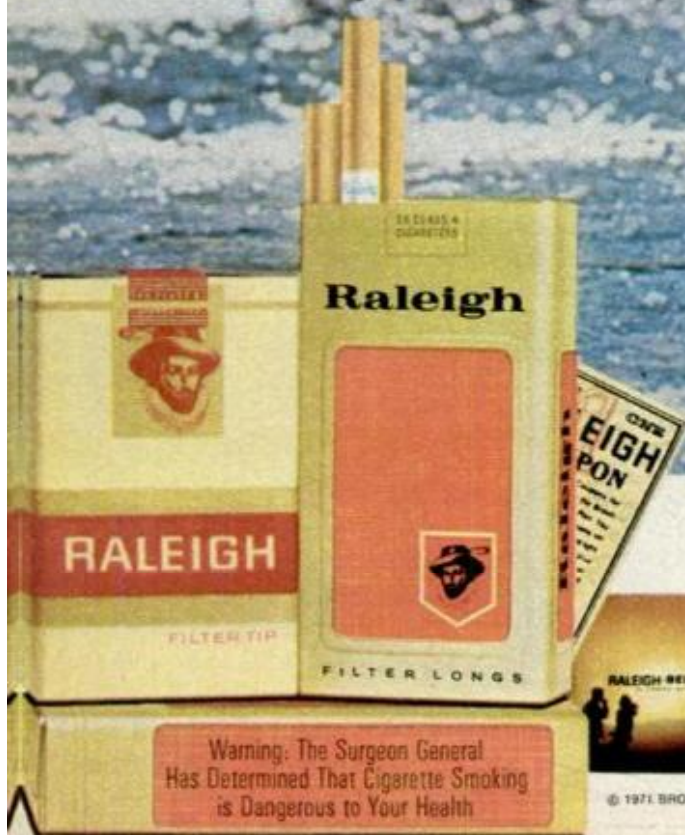
*I have a number of medium-size clay flowerpots that have become coated with a hard whitish substance that seems impossible to remove. Will some chemical do this without leaving a residue damaging to transplants?—L.R., N.M.*

Place the pots in a pail, cover them with clean water and then add a cupful of household bleach. Allow the pots to soak a half day or more, then remove and scrub them with a stiff-bristle brush. Rinse the pots in several waters and dry them before planting. ★★★



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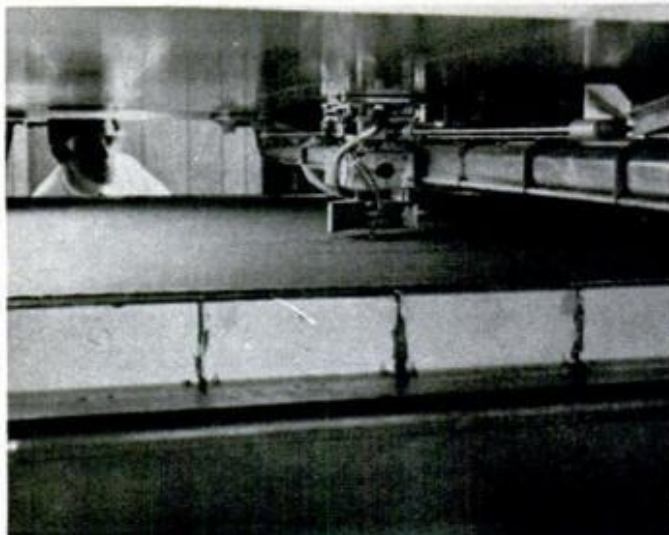
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Filter Kings: 17 mg. "tar," 1.2 mg. nicotine; Longs: 18 mg. "tar," 1.2 mg. nicotine, av. per cigarette. FTC Report Nov. '78

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## NEWS BRIEFS



### Laser goes to work for the clothing industry

Fabric can now be cut by a laser-operated, computerized cutter, described as "the first major advance in apparel manufacturing since the invention of the sewing machine." Watched by engineer Steve Toscano (left), the labor-saving device is demonstrated at Genesco, Inc., world's largest apparel company. At right, Bruce Campbell, Genesco technician, lifts the leg of a man's suit just cut by the computer-directed laser beam.



### Lotus jet turbine

Brazilian driver Emerson Fittipaldi is shown practicing in the new Lotus 56B jet turbine car at Brands Hatch, England, before the Daily Mail Race of Champions. Unfortunately, the new racing car had to retire from the contest with a collapsed front suspension.



### Alpine Renault A-310

First showing of the new Alpine Renault A-310 was at the Geneva Auto Show this spring. The body is fiberglass and the running components are derived from Renault production cars. The engine is a 1565-cc four-cylinder with an aluminum alloy block.



### People conveyor proposed for Munich

Superimposed on a photograph of Munich is the Transurban Traffic System proposed by the Krauss-Maffei Co. as a method of transporting people in the city. Passengers would ride on a conveyor belt through plastic and steel tubes at a speed of 11 mph.



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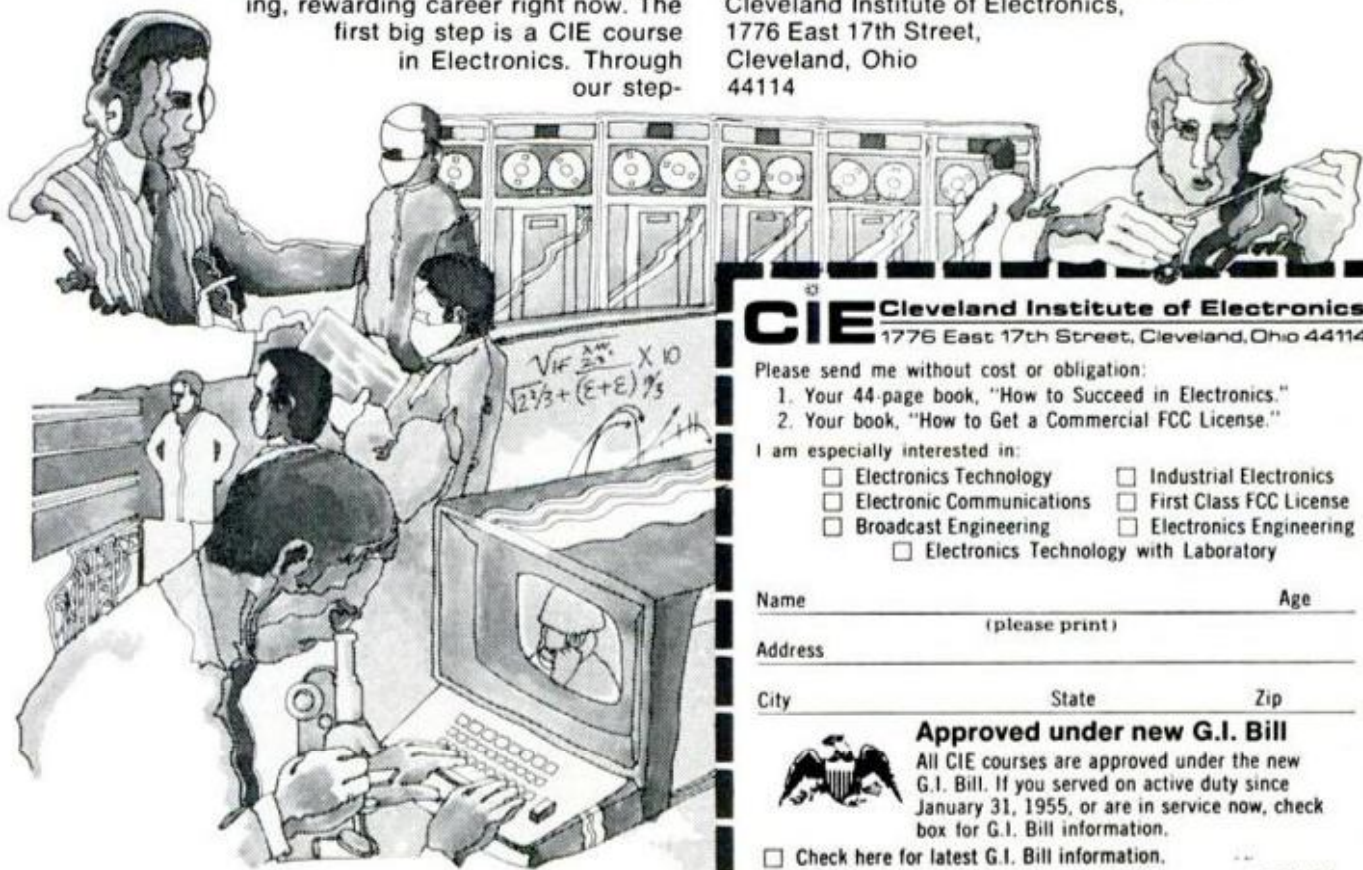
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**Long hair may be fashionable for young men**—but it's also dirty. In one New York hospital, according to a report in *Medical World News*, a series of infections in patients was traced to a long-maned member of an operating team. Tests showed that his generous mop provided a comfortable environment for a bacterium—*staphylococcus aureus*—that frequently is the cause of infection in hospitals. The problem was cleared up after the young M.D. had seen a barber and used a potent shampoo. Some hospitals now require that hairy surgeons hide beard and hair under a cotton helmet that covers most of the head. The traditional surgical mask completes the cover-up job.

**Help is on the way for seabirds that become coated with oil from tanker spills.** Usually they don't last long after being cleaned up. The trouble is that detergents dissolve both the oil and the natural wax that waterproofs the birds' feathers. As a result, birds die before they have produced enough new wax to protect them in their natural environment. Now, two Swedish scientists report having developed a cleaner that—like a wax-polish for cars—contains a built-in wax similar to the birds' own. In one recent case, according to researchers, 75 birds were successfully cleaned after an oil spill and returned to their feeding grounds within two weeks.

**A timing device so accurate it will lose or gain only one second in 50 years** is under development at NASA's Manned Spacecraft Center in Houston. It "runs" on electrons—from the rubidium atom—induced to resonate at a known frequency. The experimental clock, weighing but 19 pounds, will be used for future long-duration space flights.

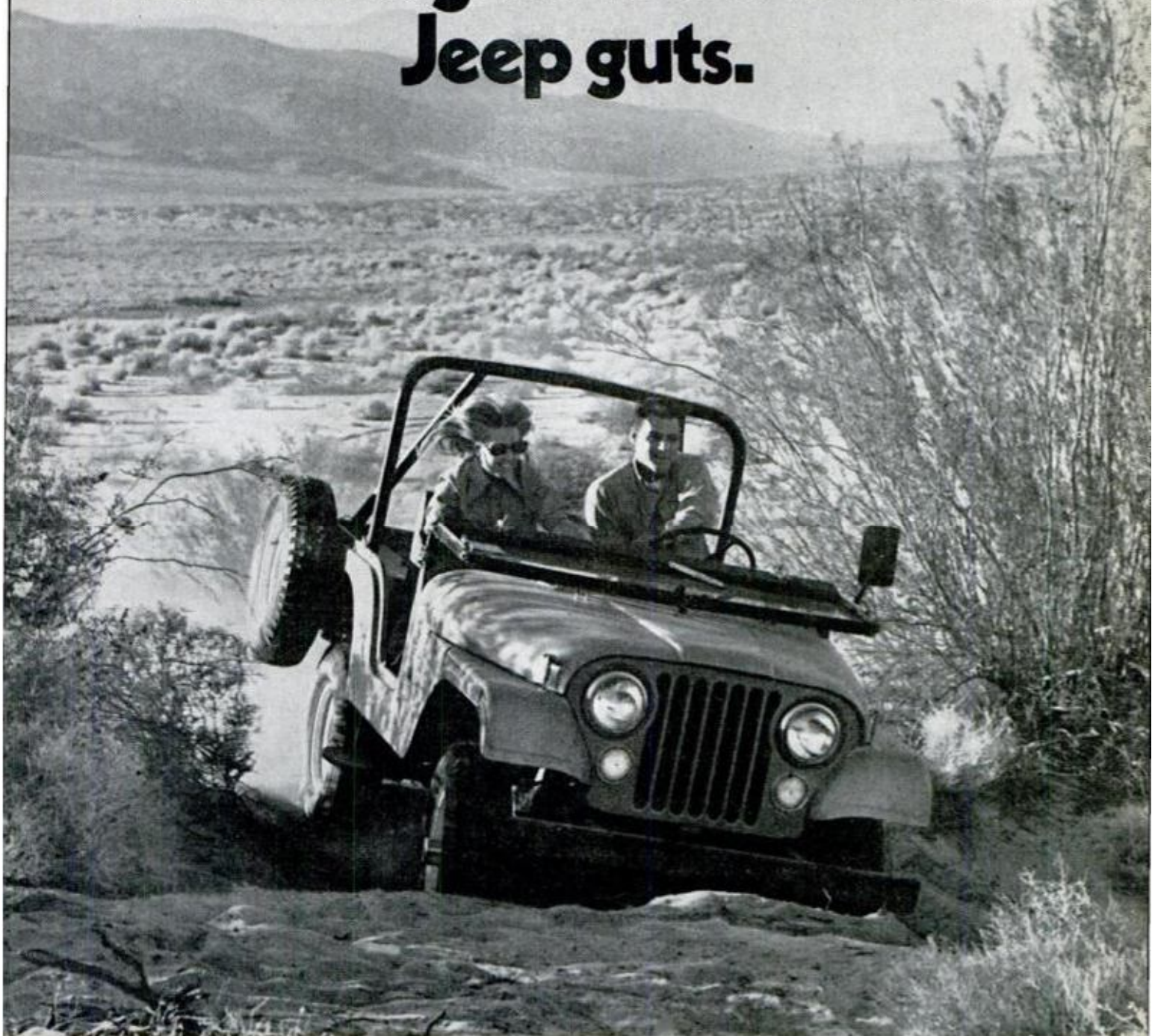
**Laughter consists of varying mixtures** of expiration, inspiration and interval pausing—components with characteristics that tend to give each person a unique laughing style. That's one of the findings in a study at Stanford University focused on laughter and its role in health. Dr. William F. Fry Jr., associate professor of psychiatry, wired volunteers to machines that measured physical responses as they listened to a series of taped jokes. Dr. Fry reports that laughter causes a complete disruption of the normal respiratory cycle—in excess of 10 seconds on occasion—and a faster heartbeat. It's possible that vigorous laughter could contribute to strokes in those who are susceptible, Dr. Fry notes, and he points to an already documented fact in medical literature—laughter's contribution to the precipitation of seizures in epileptics.

**How good are earthquake-resistant buildings?** The first comprehensive practical test of safety codes for such buildings occurred last February when the San Fernando quake hit California. Modern structures designed according to earthquake safety codes stood up well in regions of moderately strong ground motion, notes a report by the National Research Council. However, in regions of very strong shaking, similar buildings were severely damaged, and a few collapsed. Four hospitals were damaged so severely they became unusable just when they were needed most. Older school buildings suffered potentially hazardous damage under moderately strong ground shaking. "It is clear that existing building codes do not provide adequate damage-control features," the report states. "Such codes should be revised."

**The most accurate measurements yet made for determining size and shape of the Earth** were recently completed by U.S. and foreign researchers. Camera teams spaced 2500 miles apart took simultaneous photos of a balloon satellite. By comparing positions of the satellite against the background of stars, distances between photographic stations can be accurately determined. Analysis of the data will take about two years. ★ ★ ★



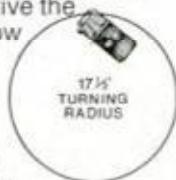
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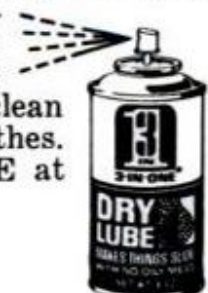
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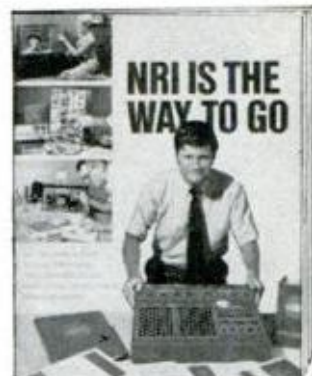
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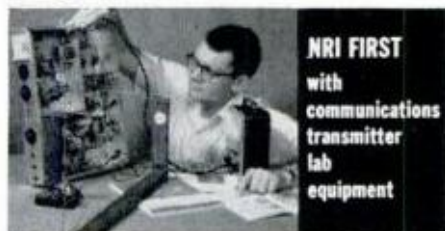




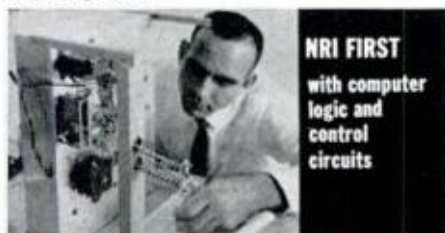
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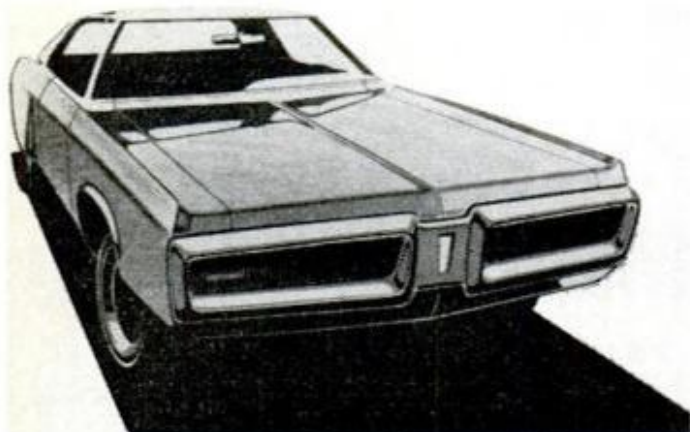
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DETROIT

# LISTENING POST

BY ROBERT LUND



**HERE'S THE CAR** (above) that almost got away. It's the big Dodge for '72. Scheduled to come out a year ago as a '71, it was held back when Chrysler took the bread-and-water cure to ward off a case of wolf at the door. The car's newer than it looks here. Sheet metal's new below the belt line, it has a tighter-on-the-road appearance and it's a couple inches shorter than this year's Polara. The picture also gives you a fair idea of what the full-size Plymouth and Chrysler will look like in '72, because they'll share the same side panels used by Dodge.

**CAN'T LICK 'EM . . . JOIN 'EM?** It now seems virtually certain American automakers will be manufacturing cars and parts in Japan for export to the United States in three to five years. No one in Detroit will admit as much for attribution for fear of upsetting negotiations now in progress. And the Japanese government doesn't look with favor on American auto companies buying in on Japanese firms because it could mean the loss of foreign exchange for Japan. But with nine months of selling the American minis against imports, domestic auto producers have resigned themselves to the fact they can't tame the imports with U.S.-made small cars.

**MINI INTERVIEW WITH THE MAN** all the mini-makers would like to beat, Stu Perkins, president of Volkswagen of America:

**PM:** Seers on both sides of the fence—in Detroit and some of the importers—are predicting the demise of mid-size cars. They say the choice is going to narrow down to two basic machines:

*small car and luxury car. Do you think it'll come to that?*

**Perkins:** When you say two basic groups, you're talking oranges and apples. A luxury car can be small and an inexpensive car can be big. I look for just as much variety in the future as there is now, maybe even more, but cars will be smaller than they were, say, in 1968. Buyers want more variety, not more size. Look at all the specialty cars that have come out in recent years. I think there's a vast market for a relatively small Cadillac. Why should a wealthy person who wants a Cadillac have to put up with the sheer mass of a Cadillac? Why shouldn't he have the convenience of luxury in a small package? Our Audi 100LS, for example. That's the way I think the market will go.

**PM:** VW's bringing in bigger, higher priced cars—first the Audi, now the 411. Does that mean you've reached a saturation point with the Beetle in the United States?

**Perkins:** Not at all. It's just that we want a broader range of products. Many of our owners were forced to give up VW because we didn't have a four-door. That didn't make sense. You don't force a customer to go elsewhere, so we brought in four-door models, to keep owners in the family. The small-car market's expanding and we don't see a saturation point for the Beetle. Personal transportation is the trend of the future and nothing fits that better than the Beetle.

**WHAT HAPPENS TO CARS** without frames—Camaro, Firebird, Mustang and Cougar, for example—when impact-resisting bumpers become law? There's no way to install the bumpers on cars with unitized bodies so the hang-on hardware will absorb the energy. If you put an energy-absorbing bumper on a unit body car and the car gets smacked, the force is transferred to the vehicle. The bumper doesn't soften the blow.

There's a rumor the frameless cars will be dropped at the beginning of or during the '73 model year, when the bumper standard becomes law. We'd bet against it. If the cars in question

*(Please turn to page 44)*



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## DETROIT LISTENING POST

*(Continued from page 42)*

continue to sell in fair volume, GM and Ford aren't going to let them go under. Not the names, anyway. The cars will have to be reworked and remounted and they'll be higher off the ground than the current versions. But they'll survive in a different shape and size.

**IF YOU'VE GOT AN IDEA** for a new engine to replace the polluting piston, this isn't the time to try to sell it to Detroit. The auto companies are disappointed with the lack of results from programs they've financed to develop alternatives to the internal combustion engine—electric cars, steam engines, engines that will run on liquified petroleum and various other exotic methods of propulsion.

Carmakers are still optimistic about the turbine over the long term, but they aren't expected to allocate additional development money to outside firms working on electric and steam cars when present commitments expire.

**CAN THE AUTO INDUSTRY** go a full model year without issuing a single callback to correct a defect or problem? Probably not, considering the number of new cars sold a year—something between 9 million and 10 million this year. But if '72 is your year to buy a new one, you're less likely to receive a bring-it-back-to-be-fixed notice than in any recent year.

Auto manufacturers think their chances of running a full year without a major recall will be as good in '72 as they are likely to be for a long time. It figures, because the fewer changes in a car from the previous year, the less chance there is of something going wrong. With most car divisions standing pat on changes on the '72s, there should be fewer recalls and a reduction in service complaints on the new crop of cars.

**IF YOU LIKE TO TINKER AROUND** doing your own repairwork, you may have to get a new set of tools in another year or so, particularly if you want to work on components stored behind the dash. Although the auto companies are still arguing they don't want to install air bags, they're working to miniaturize parts mounted behind the dash to make room to install the bags if and when the law says put 'em in. This means much of the gear behind the dashboard is going to be scaled down to mini size. Some of the stuff may be so small you won't be able to handle it with tools you have on the bench now. ★★★





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# Drivin' with Dan

What would it be like to drive an Indy car on the road? Why can't stock cars have superchargers? Will pollution controls affect auto racing's future? Dan Gurney answers these and other automotive questions

**Q.** *What would the Championship (Indy type) race cars be like to drive on our regular roads?—Craig Siphers, Stevensville, Mont.*

**A.** Difficult at best! They're not muffled; they get approximately 2 mpg at speed. They would probably get about 10 or 15 mpg on most public roads. Fuel is methanol rather than gas. They don't have self-starters or cooling fans to prevent overheating in traffic tie-ups. The drivers' eyes are only about 30 inches above the ground, so visibility would be limited while following other cars. Ground clearance is approximately three inches so going in and out of driveways would be tough. The cars would be very vulnerable while parallel parked. It would be extremely



**DRIVING FOR DAN** while Swede Savage is recuperating (quite nicely, we're happy to report) from his accident in the Questor Grand Prix, is Lee Roy Yarbrough. Bobby Unser and Lee Roy were slated to run Eagles in Indy 500 for Dan's All American Racers

difficult to avoid exceeding speed limits. Of course they don't have any lights or windshield washers, but they would be great at drive-in restaurants!

**Q.** *Would radial tires improve the gas mileage on my '71 VW?—Ernest Wittenbreder, Catawauqua, Pa.*

**A.** They won't affect the mileage very much one way or the other. I have heard that they do improve mileage in cases where the rolling resistance of the radial is less than that of conventionally constructed tires. You would also have to check the circumference to make sure that your odometer doesn't get tricked.

**Q.** *Why won't they allow superchargers or fuel injection in stock-car racing? Wouldn't they have more speed?—Steve Schomer, Harlan, Iowa*

**A.** Mostly because it escalates the costs of racing, but it doesn't seem to make the racing any better. Yes, the speed would probably be increased.

**Q.** *We are interested in starting some off-road and handicap dune-buggy racing and need some established rules. Where could we find them?—Keith Starn, Jamestown, N.Y.*

**A.** Try writing NORRA (National Off-Road Racing Assn.), Suite 200, 1616 Victory Blvd., Glendale, Calif., 91201. It sanctions the Baja 500 and Mexican 1000 and should be able to provide you with the latest regulations.

**Q.** *Will Denis Hulme continue to have the name McLaren on his cars since the death of Bruce McLaren?—Bryan Holmes, Phoenix, Ariz.*

**A.** Yes. Denny is the No. 1 driver for the McLaren Cars racing organization, which has  
(Please turn to page 44D)



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**DRIVIN' WITH DAN**

(Continued from page 44B)

continued to build and race cars with outstanding success in spite of the loss of Bruce. I'm sure he would be very proud.

**Q.** While it is not a major pollutant, auto racing contributes a great deal of emissions per car. What do you think will be the ultimate effect of this fact on auto racing?—Rod Hardesty, Cedar Falls, Iowa

**A.** Logically, I'd say that contribution of auto racing to pollution is infinitesimal. Two or three big jet aircraft takeoffs contribute more, in comparison. Auto racing may eventually be restricted to the use of certain fuels to the exclusion of others. I love the smells of a race. How's the air out there in Iowa?

**Q.** I never know what to say when the service station man asks me what weight oil I want? My car has run 40,000 miles. What should I say?—Cliff Middleton, Oakland, Calif.

**A.** Probably SAE 30 or a multigrade such as a 20-40W. Multi-viscosity oils like 20-40W, continuously maintain the appropriate viscosity independent of temperature.

**Q.** Can you tell me the name of the fastest funny car in the country?—Tod Snyder, Piqua, Ohio

**A.** I'm not sure if it is still fastest, but a few weeks ago it was still Don Prudhomme's Hot Wheels 'Cuda.

**Q.** Due to the high line pressures required by disc brakes, do your Eagles or other Indy cars use some sort of power-assist equipment?—Jerry Van den Honert, Pittsfield, Mass.

**A.** No, we don't use any sort of power assist—it's all muscle.

**Q.** What happens when you have your brake drums "turned"? Is this done in racing?—Mrs. I.W. Murcheson, Toledo, Ohio

**A.** This is a process of making the drums round and true so that the brake shoes have an even surface to rub against. Most racing cars use disc brakes, which must also be round, flat and true to work most efficiently. Yes, this is done in racing and also when the  
(Please turn to page 44F)



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## DRIVIN' WITH DAN

(Continued from page 44D)

drum or disc brakes are first manufactured.

**Q.** Why on earth did you stop driving Fords and start driving for Plymouth? What was the matter with Ford?—Jerry Ondrusik, Stirling, N.J.

**A.** Nothing was the matter with Ford. It was just a pure business decision.

**Q.** I have a '69 Mustang with F70-14 Polyglas tires. What can be done about the ridiculous under-steering on this bucket? The shocks are okay.—M.E. Buckney, Alderwood, Wash.

**A.** A bigger front antiroll bar, together with a rear antiroll bar, makes a great improvement. I'd say the largest standard front bar with about a 5/8-inch rear bar with adjustable connecting links would be a good place to start.

**Q.** What are the pros and cons of downshifting my '63 Chevy three-speed truck?—Bill Sanders, Garden Grove, Calif.

**A.** It should be perfectly okay if you match engine speed with car speed in various gears and don't over-rev the engine, grate gears or jerk the driveline severely. If you do it right, it should be fine.

**Q.** Why is it that American auto manufacturers have yet to develop an engine of small cubic-inch displacement with large horsepower output? Example: Ford 289 with 200 hp and Lamborghini 240 c.i.d. with 370 hp at 7300 rpm?—Richard Martinelle, Pittston, Pa.

**A.** Well, the Ford will probably run four times as long without attention, and all for about one-third the cost. It depends on what you want. A "hopped-up" 289 can probably put out approximately 500 hp at around 7800 rpm. The Lamborghini is a more sophisticated engine, to say the least, but then it was designed with different things in mind. The turbocharged Drake Indy engine can turn out more than 820 hp at 9000 rpm out of a mere 158 c.i.d.!

★★★

If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' With Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 48).



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## The troubleshooter.

Don Woosencraft is one of Green Bay, Wisconsin's star halfbacks. He plays for Ritz's Lounge in the Industrial League.

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He's a graduate engineer and he drives around 2,000 miles a month. "I solve problems," he said.

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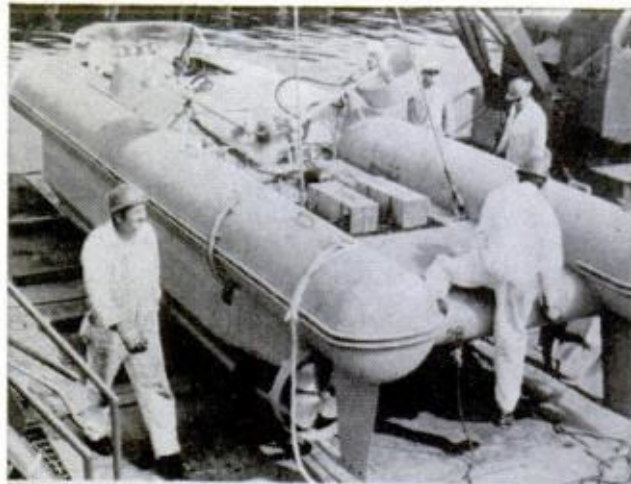


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## NEWS BRIEFS



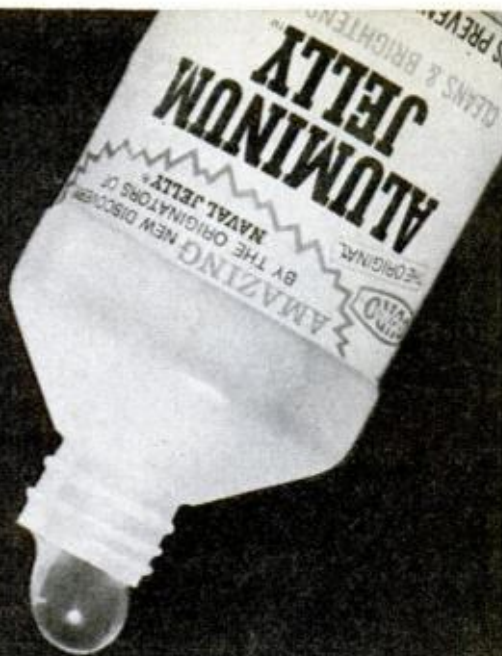
### Undersea 'pickup truck'

Scuba divers can use a new submersible as an underwater "pickup truck" to carry as much as 2000 pounds of cargo to depths of 120 feet at a speed of 2½ knots. Known as CAV (construction assistance vehicle), the 27-foot craft is being tested by the Navy. It is electro-hydraulically powered, and can supply power for divers' tools.



### Computer to watch planes

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## NEWS BRIEFS



### Shanghai makes like Detroit

When China recently allowed Western journalists to enter the country for the first time in decades, one of the points of interest for the visitors was the Shanghai Industrial Exhibition. Among the 5500 exhibits of products made in the city are the motor vehicles shown above: a bus, passenger car and several massive dump trucks. Other exhibits included printing presses, clothing, toys and power-generating equipment.



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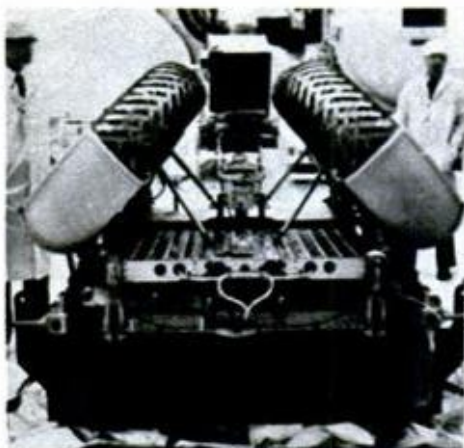
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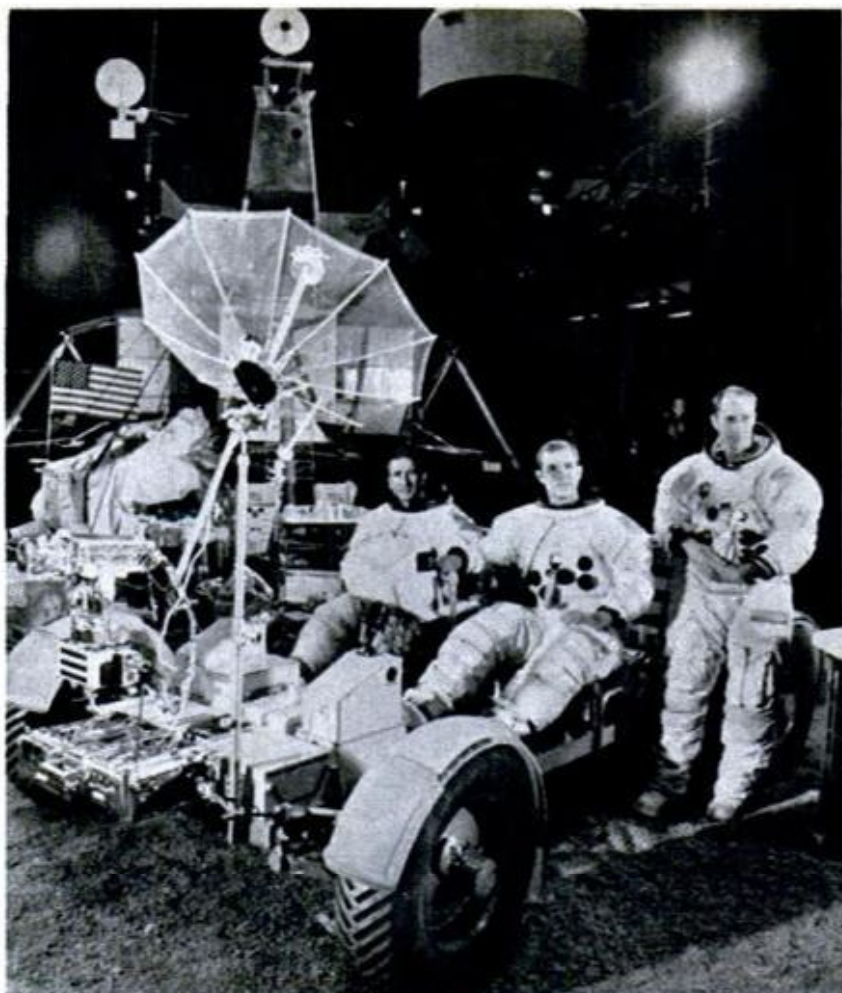


## NEWS BRIEFS



### Moon-ready

Carried to the moon by Apollo 15, the Lunar Roving Vehicle (LRV) will be unfolded after the landing (above) and used to carry two astronauts on three lunar traverses. The LRV is battery powered and weighs 480 pounds. Apollo 15 astronauts (right) are James B. Irwin, Cmdr. David R. Scott and Alfred M. Worden. Their flight is scheduled for a July 25 launch.

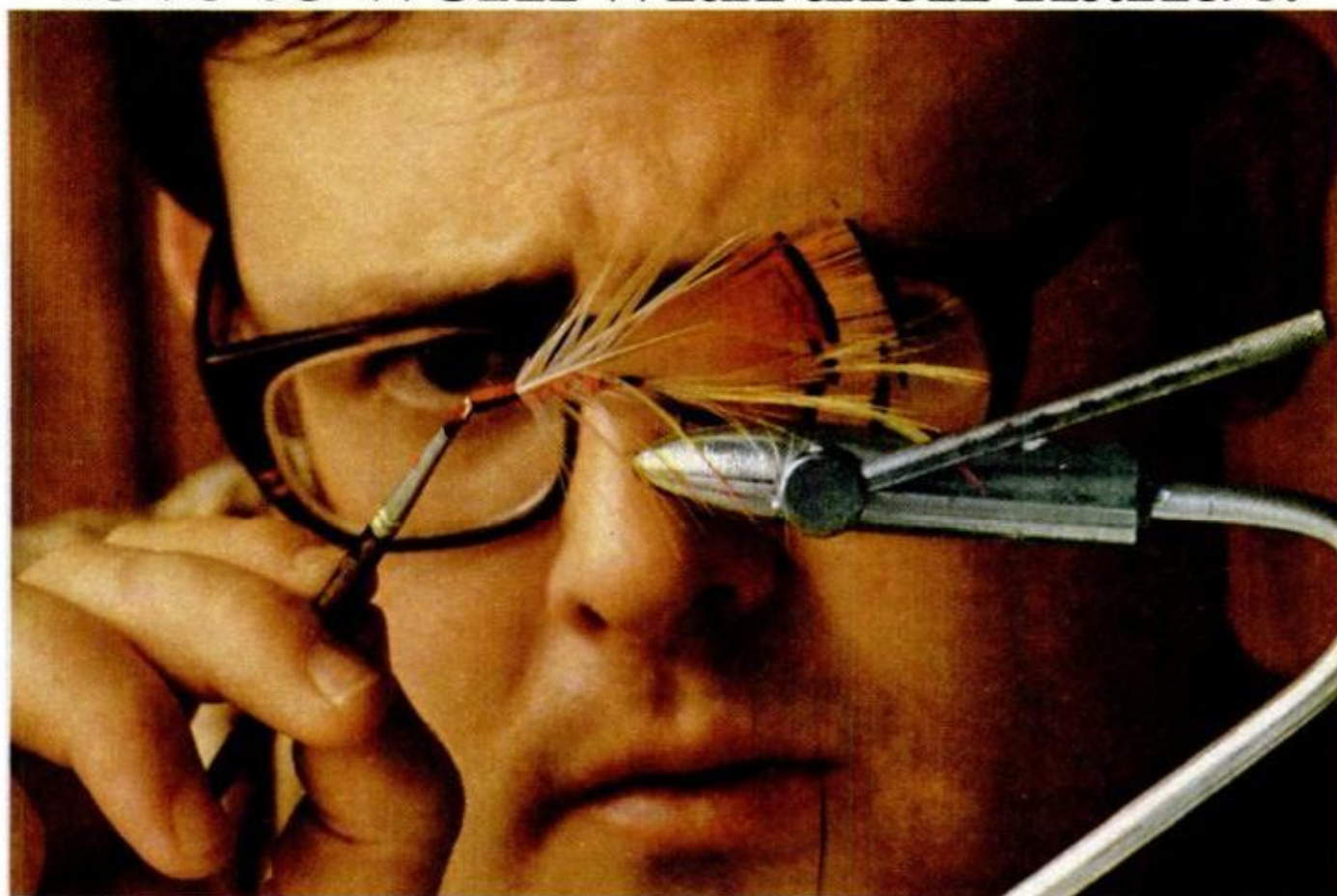


### Game of chess has faceless soldier pawns

After being a soldier all his life—and a prisoner during World War II—Henri Simon of Belgium concluded that soldiers are merely “faceless pawns” to be manipulated by others. A chess set he made, with faceless soldier pawns (inset), reflects his feeling.



# Old Crow's good taste begins with men who love to work with their hands.



Anthony Clark has a big responsibility. One false move of his hands and he's mixed the wrong measure of grain for the Old Crow formula. Does he ever miss? The proof is in the good taste of our Bourbon.

Making Bourbon which tastes good, bottle after bottle, made Old Crow famous. Back in 1835, our people took Bourbon-making out of the hit-or-miss category. Later, they handmade the first sour mash Bourbon. We still use our hands in making Old Crow.

After work, most of our men keep on using their hands. Anthony Clark calls on the same craftsmanship mixing grain as he does tying fishing flies.

For fly-tying plans, write: Old Crow, Box 675, Frankfort, Kentucky 40601.



Clamp hook in fly-tying vise, wrap with thread.



Cut wings, tail from feather. Attach to hook.



Shape feathers to resemble bug. For plans, see address at left.



## Old Crow

Made by good Kentucky hands

KENTUCKY STRAIGHT BOURBON WHISKEY. 86 PROOF. DISTILLED AND BOTTLED AT THE FAMOUS OLD CROW DISTILLERY CO., FRANKFORT, KY.



# SOLUTIONS FOR MECHANICAL HEADACHES

# AUTOMOBILE CLINIC

BY MORT SCHULTZ

## Replacement parts

*I am restoring a 1962 Corvette that needs a new padded dash. When I tried to get one from GM I was told it was out of stock. Yet I've been informed that the law requires automobile manufacturers to provide replacement parts for 10 years after a car is built. What's the score?—Steve Keel, Murray, Ky.*

You've been misinformed, Steve. As a service, not because the law requires it, automakers keep a stock of mechanical parts on hand for a number of years after a car is built. However, this is not necessarily true of trim items, such as a padded dash. I suggest you have an auto upholstery shop make one for you.

## Hot gas

*My 1969 Ford Fairlane with 302-cu.-in. engine came equipped with a 192° F. thermostat in the cooling system. Since gasoline was boiling in the carburetor, I switched to a 180° F. thermostat. This corrected the problem, but I would like to know if it will cause inefficient operation or harm the engine.—Rev. W.E. Fears, Red Bay, Ala.*

Neither. Later on in 1969 Ford modified the carburetor of this car to provide more efficient operation of the antipercolation valve. Since you have found your own solution to the problem, you may not want to return the car to your dealer to have the modification applied.

## Got the right time?

*In setting ignition timing with a timing light, should the vacuum advance hose be left in place or be disconnected and closed off?—Robert S. Pione, Cincinnati.*

Disconnected and closed off. Why? Because if there's a problem in the vacuum source which, in most cases, is the carburetor, it won't affect the timing.

## Potted potentiometer

*I have a 1970 Oldsmobile 98 with the automatic Comfortron heater and air conditioner. My problem is with air conditioner operation. When the temperature of the day is 80° or more and the car is used*

*for the first time, the unit won't come on automatically. I have to flick the selector switch in and out of the defog position several times. Once the conditioner starts to run, it will act properly for the rest of the day. What should be done?—Dr. P.L. Everett, Columbia, S.C.*

Replace that bad potentiometer!

## Delayed reaction

*My problem is with the automatic transmission in a 1968 Plymouth Fury II. When I shift into forward gear, it will sometimes take as long as 60 seconds to engage. The dealer says that this is the way it's supposed to work. Is he right?—Steven J. Rollins, Iowa City, Iowa.*

You've got to be kidding. If the transmission shifts hard once it finally does engage, have a mechanic look for a broken front-pump gasket. Otherwise the trouble is probably a plugged filter screen, loose bands or leaky clutch seals.

## Hot cable

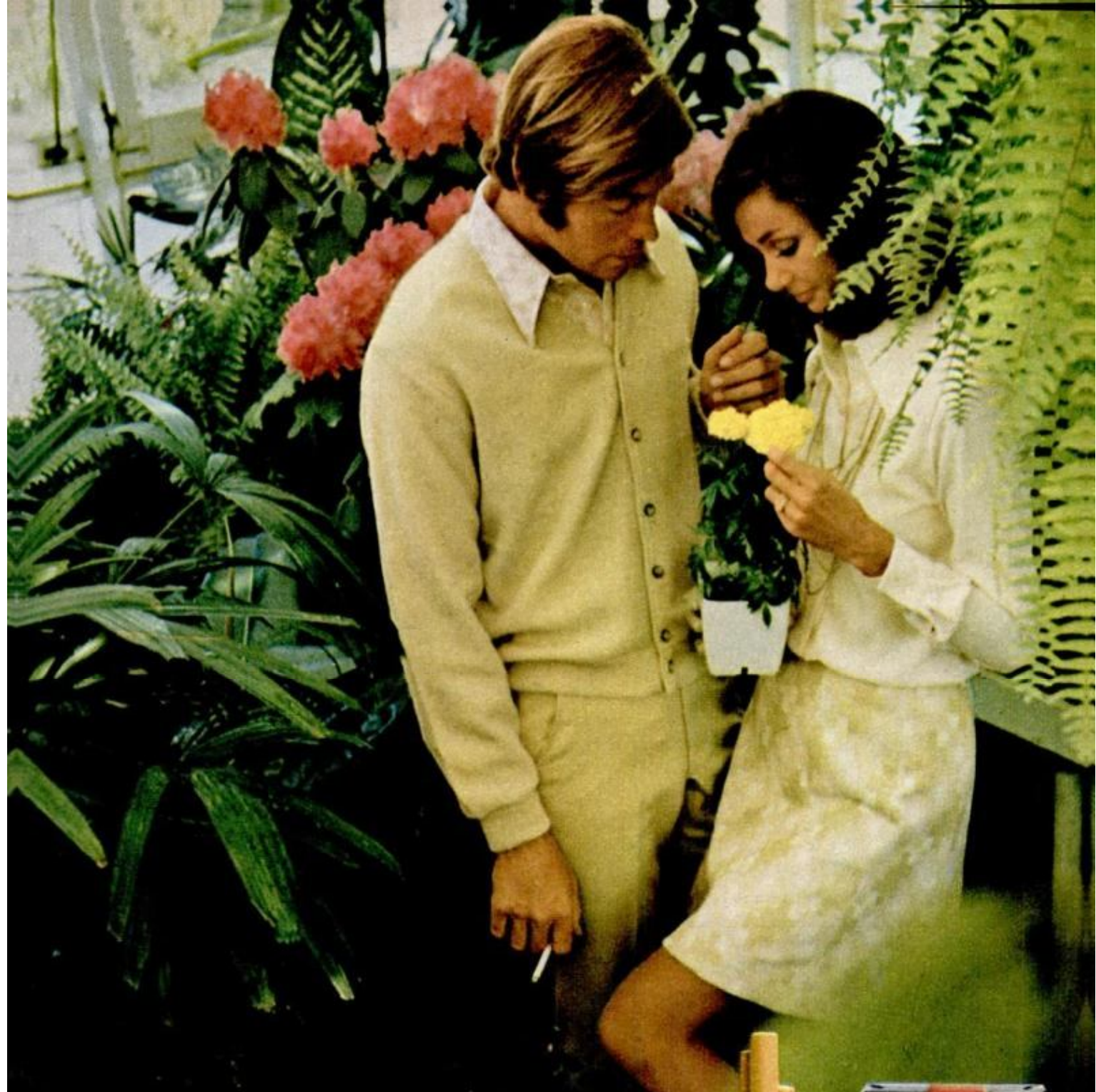
*I have a 1970 Pontiac GTO and a problem with the cable on my shifter. It's a TurboHydramatic transmission with the shift console on the floor. The cable has a plastic coating on the inside of the cable housing that gets so hot it melts and the cable separates. The dealer claims there is so much static electricity in the car that it welds the cable. I've replaced the ground strap from the firewall to the block with a bigger one, but still have troubles. Thus far I've replaced six cables. Please help.—Larry L. Brown, Modale, Iowa*

You're in the right forest, but on the wrong trail. The console should be grounded. Lack of a ground is allowing electrical current to take the path of least resistance, which is down the cable. Heat builds up and melts the plastic. Ground the console directly to the transmission body. It will stop the trouble.

## Coy coils

*My 1968 Volkswagen sedan has a chronic ignition problem—it burns out one coil after another. I've had the car examined*  
*(Please turn to page 50)*





Their garden? Just a window box on a city street.  
But they're choosy. They want it splashed with color.  
All year round.

Their cigarette? Viceroy.  
They won't settle for less.  
It's a matter of taste.

Viceroy gives you all the taste, all the time.



© 1970. BROWN & WILLIAMSON TOBACCO CORP.

King Size, 17 mg. "tar," 1.2 mg. nicotine; Long Size, 19 mg. "tar," 1.4 mg. nicotine av. per cigarette, FTC Report Nov. 70.

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## AUTOMOBILE CLINIC

(Continued from page 48)

by mechanics who replace parts, but don't solve the problem. Have you any suggestions?—Arthur C. Simon, Huntington, N.Y.

VWs have not been giving ignition-coil trouble, and there's nothing that I can point to as a cause, except for one possibility. Could it be that whoever is replacing the coil is putting on a 6-volt rather than a 12-volt coil? This might be true if he's using the part number printed on the coil to order a replacement instead of asking for a new coil by model year. VW stopped using 6-volt coils in 1966.

### Broken head bolt

*My problem is a broken head bolt that I attempted to remove by using drills. I snapped off an easy-out in the bolt and now I can't get that out, because it's of harder steel than any drill. What do you recommend?—John Parady, Millis, Mass.*

First, try to grasp the broken bolt with a cape chisel and spin it out. If that doesn't work, get a bolt that is one size smaller in diameter and of the same metal as the broken bolt. Electric weld it to the busted bolt, and then spin the whole bunch out at one time.

### Go-forward backup lights

*The backup lights on my 1969 Chevrolet Belair, with three-speed manual transmission, come on when the transmission is shifted into second as well as into reverse. They don't go out until there is a shift out of second. How do I go about correcting this?—Marshall A. Harper, Fort Seybert, W. Va.*

This happens because a dual-action switch is used that is engaged in both second gear and reverse. I suggest you remove it and put on a single-pole backup-light limiting switch you can buy in an auto supply store. Make sure it goes on the bracket in the reverse lever position, so it is engaged only in reverse.

### Low float?

*My 1964 Lincoln Continental stalls whenever I make a sharp or full turn at low speeds—for example, when turning*

*around in the middle of a street. It happens when the wheels are turned all the way in either direction, but only at low speeds. The service mechanic suggests that I have the idle set up. Is he right?—Richard J. Coughlin, Charlottesville, Va.*

He could be. Another possibility is a low float level in the carburetor.

## Service Tips

● **Chrysler Corp.** cars with 382-2 bbl. engines have had problems with engine surging and stumbling. One reason may be a warped air horn on the 1½-in. BBD carburetor that is causing a lean mixture. To find out, the air horn should be removed and a straightedge placed across the lower gasket surface of the air horn in line with the air-cleaner stud and parallel to the choke shaft. If an .011-in. or thicker feeler gauge can be inserted between the straightedge and air horn, warpage is present and the carb should be repaired with Carter Service Package No. 3579031.

● **Chevrolet** cautions you not to let anyone remove the filter-strainer assembly from the pickup tube in the gas tank without replacing it with a new one. It might solve problems you've been having because of a clogged filter, but only momentarily. If a new filter isn't inserted, water and foreign matter will travel from the gas tank and be trapped in the carburetor fuel-inlet area.

● **Speaking of filters,** Mercury says that the air-cleaner element in 1971 Montegos and Comets with six-cylinder engines should be replaced at 24,000 miles instead of 12,000 miles as originally recommended.

● **1971 engines:** The decrease in compression ratios and the retarded timing employed so that these powerplants can use unleaded and low-lead fuels present a potentially troublesome situation. As Champion Spark Plug Co. says, the 1971 models require hotter sparkplugs than previous models to compensate for the decrease in compression and horsepower. If these plugs are accidentally used in 1970 or earlier engines, you could find yourself with a ruined engine. George Galster, Champion's director of technical services, puts it this way: "If a plug for a '70 or older engine is used in a '71, plug fouling will probably result. But if some of the '71 plugs get into a '70 engine, piston damage is a real danger." ★★

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



# THE LITTLE CAR THAT GROWS ON YOU.

There are two ways of looking at the Vega Hatchback Coupe.

One, you can look at it as a sporty little 2-seater which, unlike most sporty little 2-seaters, has a back seat you can flip up on those rare occasions when you have three or four people aboard.

Or you can look at it as a sporty little 4-seater which, unlike a lot of sporty little 4-seaters, has a back seat you can flip down when you have a lot of stuff to haul, like on Saturday.

The Vega Hatchback was designed from the outset to be a Hatchback.

It isn't an afterthought.

It is a beautifully balanced, beautifully engineered car with a lot more than just a lot of loadspace to entice you.

There's Vega's surprisingly responsive overhead cam engine, for example. And standard front disc brakes. A double-panel steel roof, side-guard beams in the doors, a 50,000-mile air cleaner, foam-filled seats front and rear, even an electric fuel pump that cuts out to stop the car if the oil pressure ever drops too low.

Vega. It grows on you.

And it's growing on America.



Buckle your seat and shoulder belts.  
It's an idea you can live with.

JULY 1971



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# Which hand was sprayed with Off!™... 5 hours ago?



Unretouched photo

It shouldn't be too hard to guess. We'll even give you some clues. Off! has diethyl-toluamide (a fancy name for the most effective mosquito repellent ingredient ever developed).

We tested Off!, with diethyl-toluamide, in our labs. And in test after test, Off! not only kept mosquitos from biting immediately upon application—but up to five full hours later.

Off! comes in spray, foam or concentrated liquid. It repels mosquitos, chiggers, gnats and ticks hour after hour.

(Congratulations. You guessed right. The hand on the left was sprayed with Off!)

FROM **Johnson WAX**

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# HOW TO STEER CLEAR!

You're an excellent driver being safely passed on a two-lane road... a car pulls out from the left... the margin for safety is at an absolute minimum... only a split-second decision can avert disaster!

By E. D. FALES JR. / Illustrations by Roy Grinnell

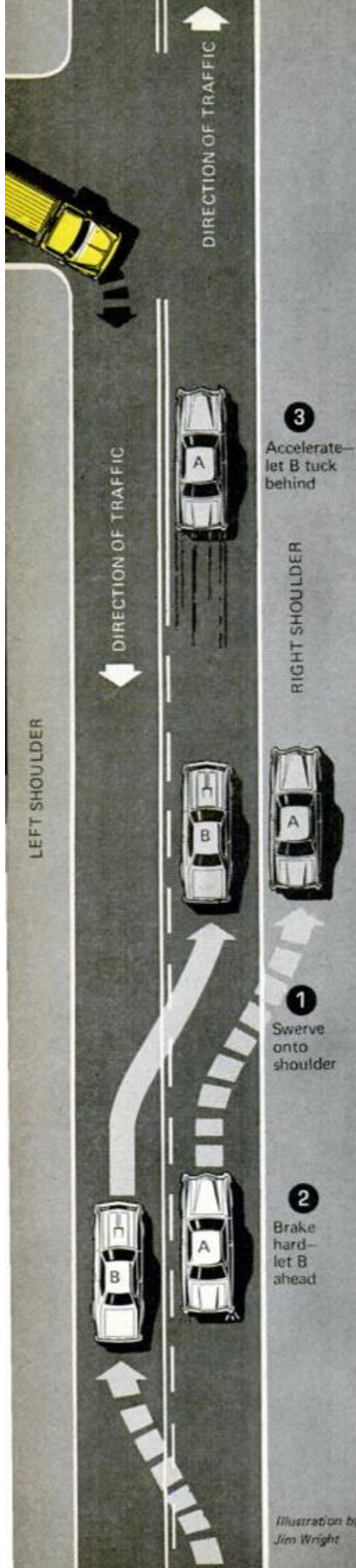
**Y**OU CAN SURVIVE A CLOSE CALL if, and only if, you drive like a racing-car driver! That doesn't mean driving at the high speeds it takes to win a race, but with the concentration and anticipation it takes to run with the pack and finish the race safely.

How?

First of all, if you are among the better drivers, you will not be the cause of close calls on the highway. But even the best driver can find himself in a situation not of his own making. The trick is to drive out of it.

Imagine your car is in the right lane in the illustration above. You are





driving at a reasonable rate of speed on the two-way road and are being passed, legally and quite safely, by the car that has pulled alongside you. Then, driving side-by-side, you see a car or truck pull out of the drive ahead! The passing car (car B in the drawing at left) is committed and trapped in a crisis situation caused by the vehicle coming out of the drive. You (car A at left) are blameless, but are going to be in trouble if car B has no recourse than to squeeze you to avoid a head-on.

What do you do?

If you're slow on the uptake, not driving with concentration and anticipation when this situation arises, you may become a victim: Car B can't possibly slow down and cut back in line behind you, nor can he speed up and cut ahead. He can do neither of these things without your skill and cooperation. If you're on the ball, you have three split-second chances.

- You can whip over onto the shoulder if it's wide and clear.
- If there's no shoulder, or there's a telephone pole alongside the road, load your brakes hard and let car B dive in ahead. Fine. Okay in theory, but what if car B has the idea of diving behind you? If he gets on his brakes, too, you'll both still be side-by-side!
- You can kick the gas hard and scramble ahead, leaving room for car B behind you. But what if the driver of car B opts for a desperate attempt to get ahead of you just as you, too, accelerate?

You have to figure out what car B is going to do and then take the *opposite* action, and do it in the time it takes to blink an eye. First, do what is initially a natural move: Lift your foot off the accelerator. Your car will slow ever so slightly. If your peripheral vision shows any forward motion of car B, he's still accelerating. Get on your brakes; he'll go ahead.

But if car B's fender fails to appear, you know he's throwing out the anchor for a panic stop and tuck: Pull out all stops, stand on the gas and go! If the two of you have worked as a team, a grateful car B will pull in behind—and you'll be safe, too.

Another type of unexpected emergency occurs when your visibility is suddenly reduced to zero or near zero. It could happen when your engine hood flies open, when debris flies onto your windshield or when you suddenly drive into smoke or fog. You've got to maintain your steering in your own lane while you slow to get off the road and stop safely. All you have to

**BLOCKED PASS** occurs when car or truck pulls out suddenly from a side road or drive trapping car B in passing lane alongside car A on two-lane road. Cars A and B must cooperate so that they both can get out of the jam. Good peripheral vision, instant decision-making and quick reflexes are necessary to make one of three steer-clear moves (see text)

Illustration by  
Jim Wright



do is steer to a safe stop while looking down at the lane marker alongside your door. What's essential is presence of mind when this once-in-a-lifetime situation arises. Try it to see how it feels, and you'll avoid panic when the real situation occurs.

A tricky situation that also requires great presence of mind and the ability to put yourself in the other guy's shoes can arise when you drive into the glare of headlights at night. The problem is compounded when visibility is further reduced by rain or snow.

Refer to the illustration on the following page and imagine that you're driving on a two-lane road facing the glare of oncoming traffic. Suddenly, in the other lane, you catch a fleeting glimpse of a child on a bicycle, a wreck, boulder or other obstruction or danger. This is a setup for a disaster because the glare of your headlights minimizes the oncoming drivers' ability to perceive danger ahead in their own lane. When they do see the danger they may swerve—into your lane! If you instantly *extinguish your headlights* you may save your own life and others! Your action will reduce the glare to the oncoming driver so his own lights will illuminate the danger and he can stop in time.

At the same time activate your warning flashers to alert traffic behind to the danger. You help other drivers steer clear, but you'll minimize your chances of being involved, too.

If you're driving at high altitudes you can run into dangerous whiteouts—blinding snow squalls—even in summer. A driver who has never seen one

**BLOCKED VISIBILITY** can suddenly occur and from any number of causes. The driver who has prepared for such an eventuality will be quick to use lane markings as a guide in slowing and steering to safe stop off the road

can't believe the blinding violence of a whiteout. You lose sight of *everything* except a hypnotic tunnel of whirling snow. You get dizzy and lose the road. Whiteout drivers have gone over cliffs, have been run down by cars and trucks, have been hit by plows.

Usually the answer to steering clear is absurdly simple: Turn around and go the other way. The seeming change in weather is really startling. The violence of a whiteout is usually caused by wind speed. This makes the snow seem worse than it is. But when you turn and run before the wind, all the violence ceases. Suddenly you're in a world of gently falling flakes. You can see! Run with the wind to a safe town or service area, and wait until the storm abates.

An unskilled driver may think his brakes are the only means he has to avoid a collision. He doesn't know the technique of alternately braking and steering—the stab and steer method—of avoiding a collision. You may come upon a sudden emergency ahead on the road—a pileup or fallen boulder—and, on the basis of your speed and road surface, instantly realize that it's impossible to stop in the distance remaining! If you just jam on the brakes, your wheels are going to lock up and you'll start a long, screaming skid. You can't steer when your wheels aren't rolling and chances are you'll go straight into the object ahead. The usual tame, controlled brake pumping that the pro







**QUICK THINKING AND COOPERATION** are what driving is all about. Driver above realizes glare of his headlights may keep oncoming driver from seeing bicycle. If he turns off lights briefly, other driver can see it

uses to drop speed on slippery roads won't work here, either.

The only way to steer clear is to cut speed sharply and steer around the obstruction. No half-hearted brake pumping; the brakes must be stabbed—and hard! The wheels will lock up but before a skid begins release your brakes just for a split second—take slight evasive steering action before stabbing again. As shown in the illustration at the right, a succession of stabs and steering will get you around the obstruction.

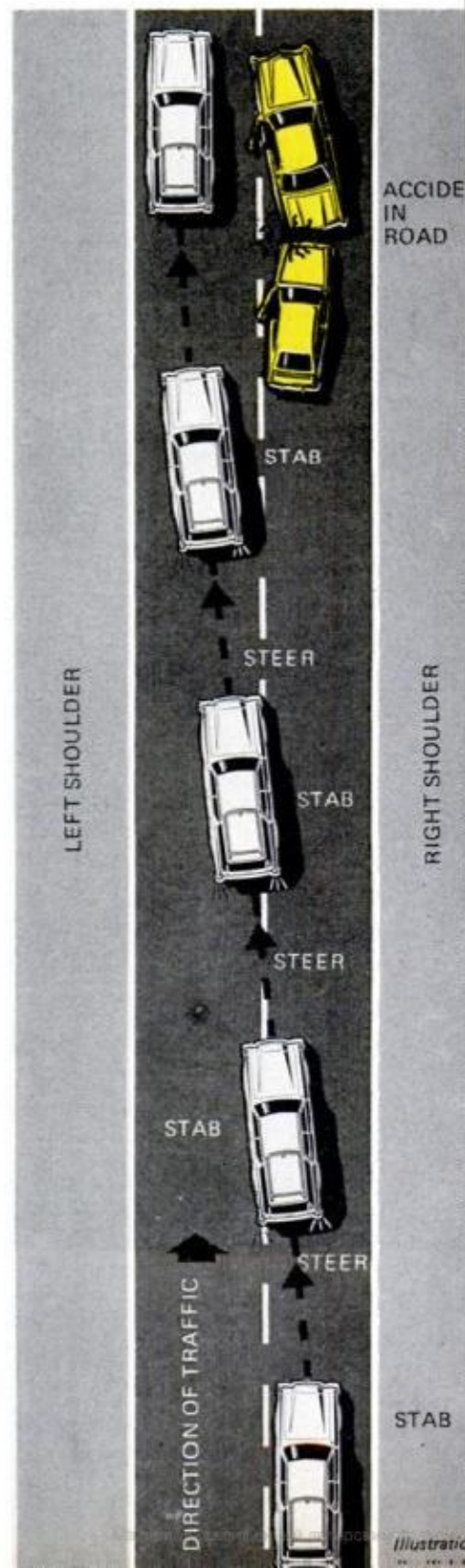
There's a situation where "steering clear" may consist of simply hanging on and relaxing. That's when you get into a long, fast spinout on ice. If a too-sudden acceleration or deceleration starts you going around like a stopwatch, you'll be better off if you let the car spin itself out. Momentum may cause you to spin down the road a fantastic distance, but you'll spin arrow straight—providing there's no crown to the road. Just hold the steering wheel firmly until at last, as your wheels get traction, you roll slowly off the road or regain control.

You can steer clear of a bad skid in some circumstances by "catching" the skid before it starts. The rule of thumb is to steer in the same direction your rear wheels skid. Another way to put it is: Steer your car the way you want it to go. When you sense you're starting to get sideways, steer "into the skid" to get the rear end of the car back into line behind the front. This rule works only during the first second or two of the beginning skid. If you don't catch it before your car veers around more than a few degrees, you're past the point of being able to correct the skid. And always remember, you can't steer if you're braking with your wheels locked up; only rolling wheels can be steered.

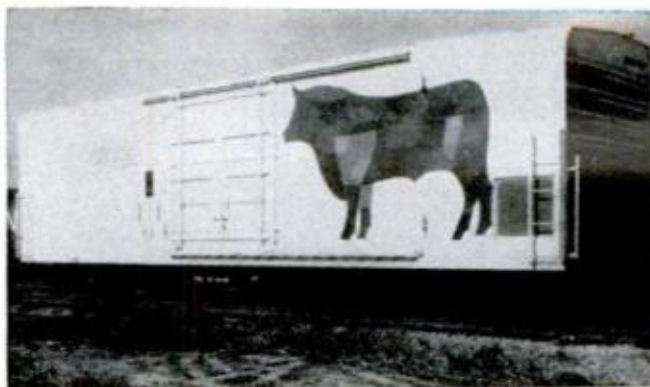
If your attempts to steer clear fail, there's nothing

*(Please turn to page 162)*

**STAB AND STEER TECHNIQUE** is used when it's impossible to stop in time to avoid a collision. Locked brakes prevent steering and could start a skid, so steering increments must be made between hard-braking jobs

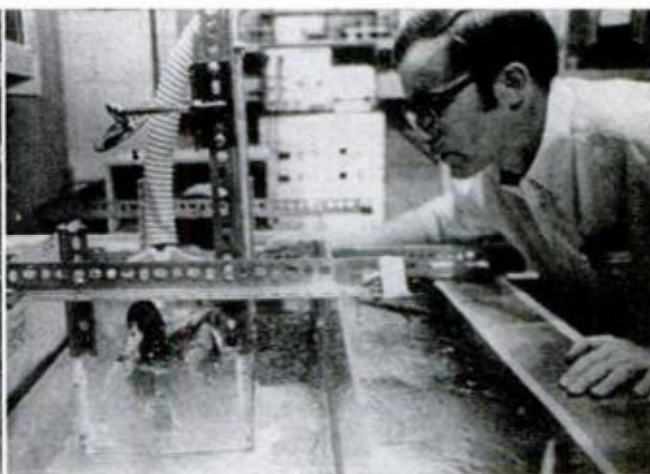






## No mistake about what's inside these freight cars

Freight cars on the Canadian National Railway have become traveling billboards that "advertise" their contents. Among the mobile signs are logotypes of newspapers displayed on newsprint-hauling cars (left) and a beef-cutting pattern that decorates refrigerated cars.



## Ducks prove to be inefficient swimmers

Ducks can swim at a top speed of 1.6 mph and are not as efficient as once believed. In fact, they use five times as much energy as a ship to reach top speed. In studies at Duke University, ducks were placed in a moving stream of water and covered with a plastic chamber so their oxygen consumption could be measured to determine the amount of energy used.

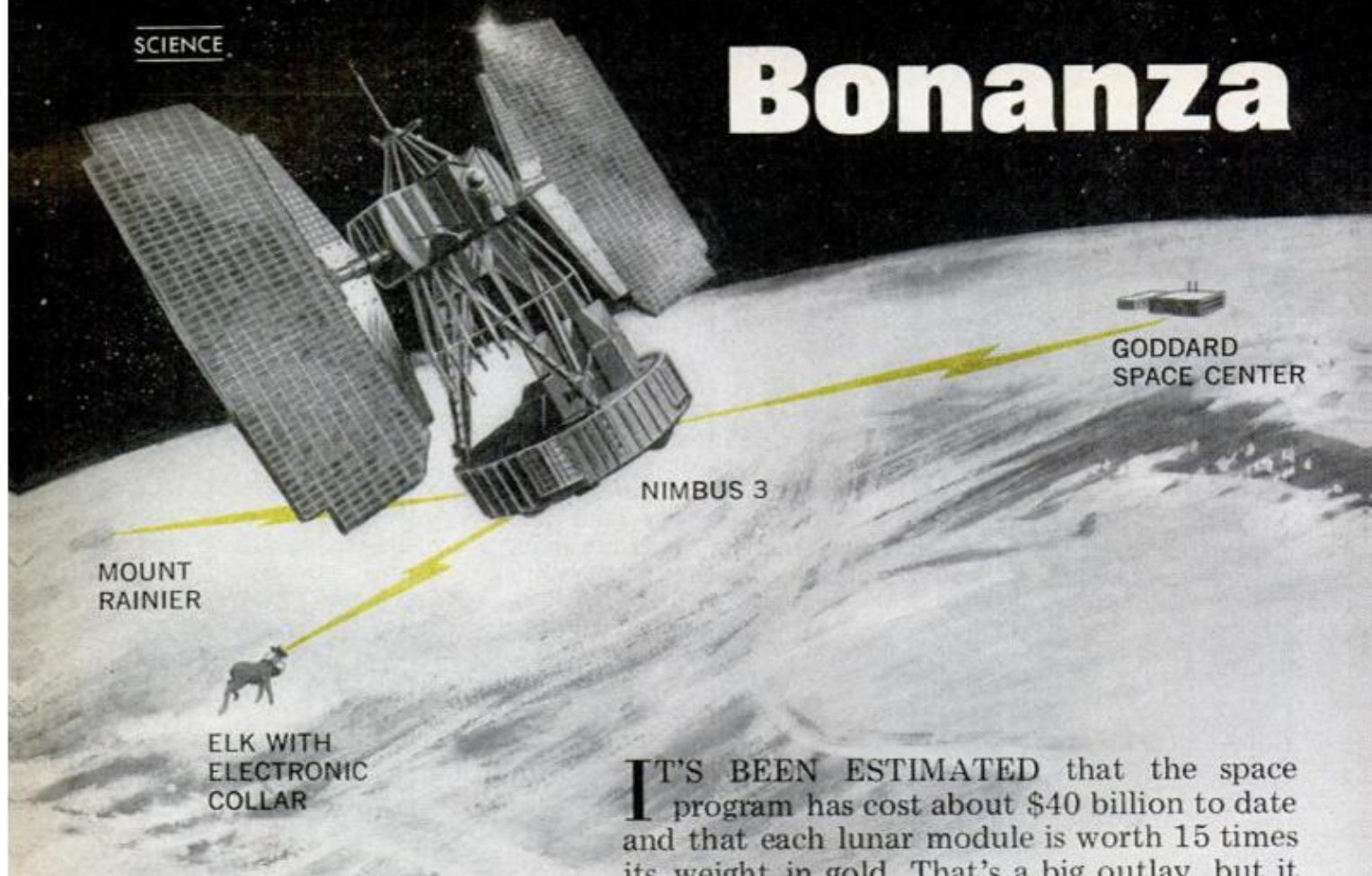


## Conversion turns Imperial into luxury RV

"Cozy Cruiser" is a Chrysler Imperial that has been converted into a comfortable camping vehicle with refrigerator, oven, water supply and sleeping space for four adults and two children. The builder says that a used Imperial can be purchased and made into a cruiser for \$1500 to \$3500—depending on luxury touches. Plans, which include instructions for cutting the car, are \$25 from Sterling Weber, 454 West Center, Logan, Utah.



# Bonanza



MOUNT RAINIER

ELK WITH  
ELECTRONIC  
COLLAR

NIMBUS 3

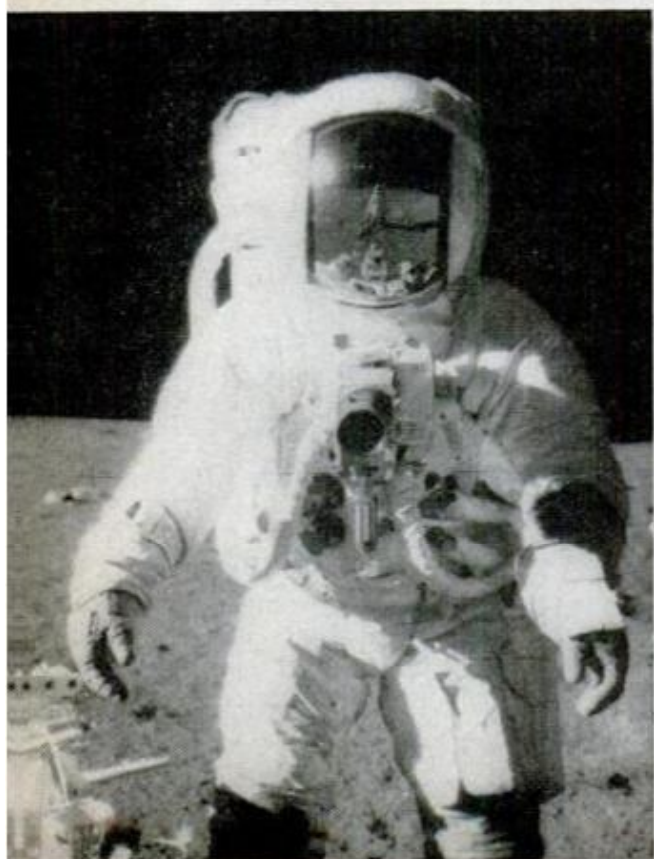
GODDARD  
SPACE CENTER

**SATELLITE WORKHORSE**, the Nimbus checks on the weather, monitors a dormant volcano atop Mount Rainier, and keeps track of radio-equipped wild animals. Coming are satellites that will spot oil and mineral deposits, crop diseases and pollution. Insulation developed for space garments can be used on Earth in torchproof gloves that are designed to withstand the heat of melting metals and in blankets and sportsmen's gear

**I**T'S BEEN ESTIMATED that the space program has cost about \$40 billion to date and that each lunar module is worth 15 times its weight in gold. That's a big outlay, but it has paid off in more than a spectacularly successful space effort. It's paid off in "fringe benefits" we all share: better cars to drive, improved communications, safer planes to fly in, more effective medical devices.

The total returns on our fringe benefits from space have been estimated at many billions of dollars annually, but some returns can't really be figured in dollar amounts. What is it worth to save a life with new ultrasound devices or with a sensor so small it can be inserted into an artery by means of a hypodermic needle?

While the tools and techniques devised for space research are being applied to everything from coal mining to medicine, NASA's efforts in developing new materials—superalloys and fiber-reinforced composite materials—promise





# From Space

By ARTHUR S. FREESE

Illustration by Fred L. Wolff

**Use of sound waves to detect heart defects, superalloys for advanced electrical power systems, insulating materials so efficient they keep a jug of coffee hot for a year—these are some of the dozens of amazing fringe benefits from our space program**

to make basic changes in the way machines and other devices are designed and built. Composite materials are already being used in certain airplanes, for example, and other NASA-inspired materials may add much to the crash resistance of your family car.

Special steels originally developed for rocket motor cases have now found their way into deep-diving submersibles and high-stress machines—and they have even been tried for tooth caps and dental bridges. Armco Steel Corp. has built a unique Group 7 racing vehicle with the exotic new aerospace materials. Designed as a laboratory on wheels, the stainless-steel car is now going through tests at Cornell Aeronautical Laboratories, Buffalo, N.Y.

Insulating materials have also undergone impressive development, for



**STAINLESS-STEEL RACER** (above) serves as a laboratory on wheels to find new applications for steel and titanium alloys developed for space. The Group 7 car is powered by a 445-cu.-in. Oldsmobile aluminum-block engine. Monique, a 500-pound cow elk (below), comes out of tranquilization and bounds away after being fitted with a 23-pound electronic collar which transmits her movements by radio to a Nimbus satellite



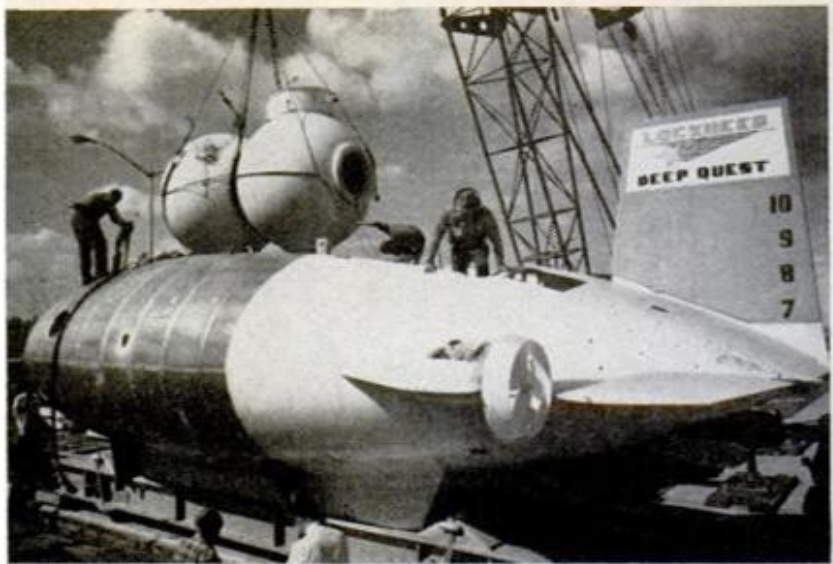


NASA has found ways to insulate a tank so well that, if filled with hot coffee the beverage would lose only one degree of heat in a year's time. Another insulating material developed for the space program has been incorporated into a line of sportsmen's blankets, a radar-reflective air-sea rescue signal and an emergency rescue blanket—all commercially available.

Our space program has even created an entirely new industry—commercial satellite communications—which has nearly tripled the number of international communications channels and brought intercontinental TV into being. Other satellites may soon be predicting earthquakes, tidal waves and hurricanes. The National Academy of Sciences sees the potential economic value of these running into some \$3 billion annually in the United States alone.

A Nimbus weather satellite takes the temperature of the dormant volcano atop 14,410-foot Mount Rainier eight times a week. Monitoring equipment at the volcano transmits detailed data to the satellite which relays it to Fairbanks, Alaska, and then to Washington, D.C. It's an important task: Early warning might have saved nearly 200 people killed in a Taal Volcano eruption near Manila in 1965.

Satellites have a number of other important applications. One of the most novel is monitoring the travels of wild elks and the bodily changes of hibernating grizzly bears. In the first experiment, a female elk named Monique was fitted with a 23-pound electronic collar and tracked by a Nimbus satellite. The red aluminum package withstood sub-freezing temperatures and dunkings in Wyoming's streams and rivers, its battery charged by solar cells, while providing scientists with a record of Monique's habits.



**MARAGING STEEL**, a specially processed nickel-alloy steel, gives added strength to the twin pressure hulls of Lockheed's Deep Quest

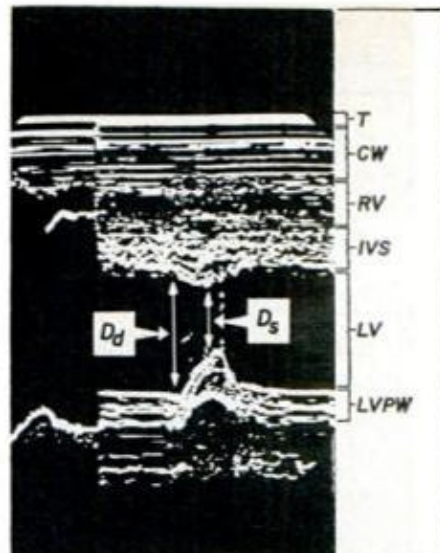
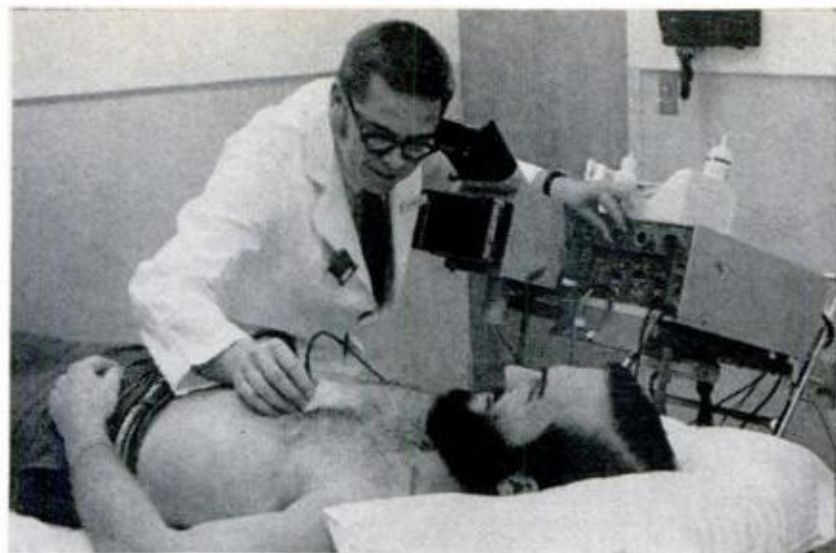
In the grizzly bear research now underway, a Nimbus is recording readings on the movements of bears in Yellowstone National Park, their body temperatures and the light, humidity and temperature variations in their dens.

In a more serious vein, Earth resources satellites are soon expected to locate new mineral and petroleum deposits, help improve agriculture by

### **You can share the space payoff**

The job of NASA's Technology Utilization Office is to give you useful information derived from the space program. *Tech Briefs*—3500 have been published—are available on request and cover new developments. Recent topics include shop techniques, welding, machining techniques, a new brushless d.c. motor, a low-cost insulation for pipes, a leakproof valve for corrosive chemicals and various electronic ideas. You can write for more details. The *NASA Technical Utilization Series* are state-of-the-art paperbacks which run up to 350 pages and cover such areas as high-velocity metalworking, magnetic tape recording technology, selected welding techniques, adhesives, sealants and gaskets, soldering electrical connections and many more. Prices range from 75 cents to \$3. A publication called *Transferable Technology* lists the books available along with other information. A letter to the Office of Technology Utilization, National Aeronautics and Space Administration, Washington, D.C. 20546, will bring this list and mailings of *Tech Briefs*.





**SONAR TRANSDUCER ON PATIENT'S CHEST** receives sonic impulses bounced against his heart's interior walls. Echoes (right) show heart at rest (long arrow) and pumping (short arrow). Blood flow can be calculated

spotting crop disease, and improve conservation and pollution control.

For the individual American, medical breakthroughs are among the most important fringe benefits from space. NASA borrowed ultrasonic sound from the bat to probe for defects in spacecraft and equipment. Now biomedical scientists of NASA's Ames Research Center in Mountain View, Calif., have joined with Stanford University Medical School doctors to adapt ultrasound to study of heart and blood vessels.

Like sonar, the sound waves are sent through the body's tissues to bounce off structures they encounter and produce a picture on a cathode-ray tube. Using this instrument, Stanford's Dr. Donald C. Harrison has led a team of physicians and scientists in a study of over 50 patients to obtain basic data on human heart beat and blood circulation. The amount of blood pumped with each heartbeat can be calculated and used to determine whether the heart valves are leaking and require surgery.

But this application is just the tip of the iceberg. A sensor smaller than the head of a pin can be injected into an artery and fed into the heart with a hypodermic needle, there to send back data without interfering with circulation. Developed by Grant W. Coon of NASA's Ames Research Center, it has already been used to measure blood pressure in experimental animals.

In other medical problem areas, the principle of the air bearing in the Saturn V's guidance gyroscope has been used in the design of an examination table that floats on a thin layer of air, supporting the patient free of vibration while doctors measure the force of his heartbeats.

A design for an unmanned walking lunar vehicle with eight legs connected to push rods has become a walking wheelchair for crippled children. Powered by motorcycle batteries and electric motors, it can clear curbs and climb stairs steered by the head movement of a child who can use neither arms nor legs.

The astronaut's space helmet has been converted to measure the amount of oxygen consumed by youngsters with heart defects, and a device originally designed to measure micrometeorite strikes is recording the tiny muscle tremors which warn of Parkinson's disease. Computer-enhancement techniques used to improve pictures from outer space are now vastly improving medical X-rays.

Research follows a path that is impossible to predict, and machines, materials and techniques that result from it have applications that cannot be foreseen. The greatest fringe benefits are yet to come. There is every indication that our investment in space will repay itself many times over. ★★★





# THE WINGS

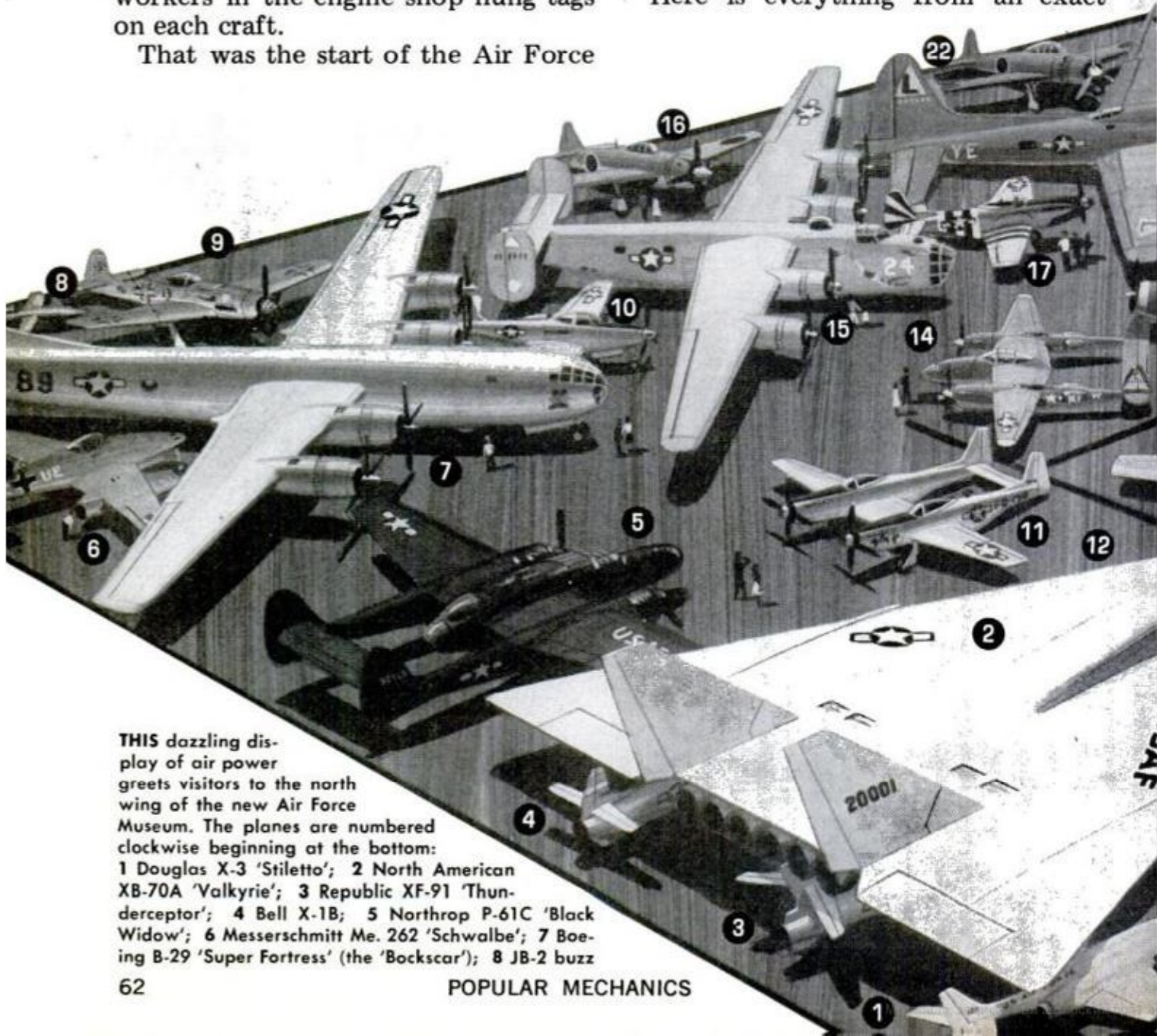
A FEW VINTAGE WORLD WAR I aircraft that no one had the heart to destroy posed a problem at Wright-Patterson Air Force Base. It was 1923, peacetime, and someone suggested that space might be found in a corner of the hangar used as an engine repair shop. The engines were moved aside.

Visitors heard about the old planes and would ask to see them. More were donated and both the collection and number of visitors constantly increased. Finally, to avoid questions, workers in the engine shop hung tags on each craft.

That was the start of the Air Force

Museum which is today the largest military museum in the world. So successful has it been—well over 600,000 visitors annually—that it has just moved into enlarged, attractive new quarters that resemble two huge hangars joined at the central entrance. The modular building, airconditioned to help preserve older fabric-and-wood aircraft, is located just a few miles from Huffman Prairie, near Dayton, Ohio, where the Wright Brothers conducted their early experiments.

Here is everything from an exact



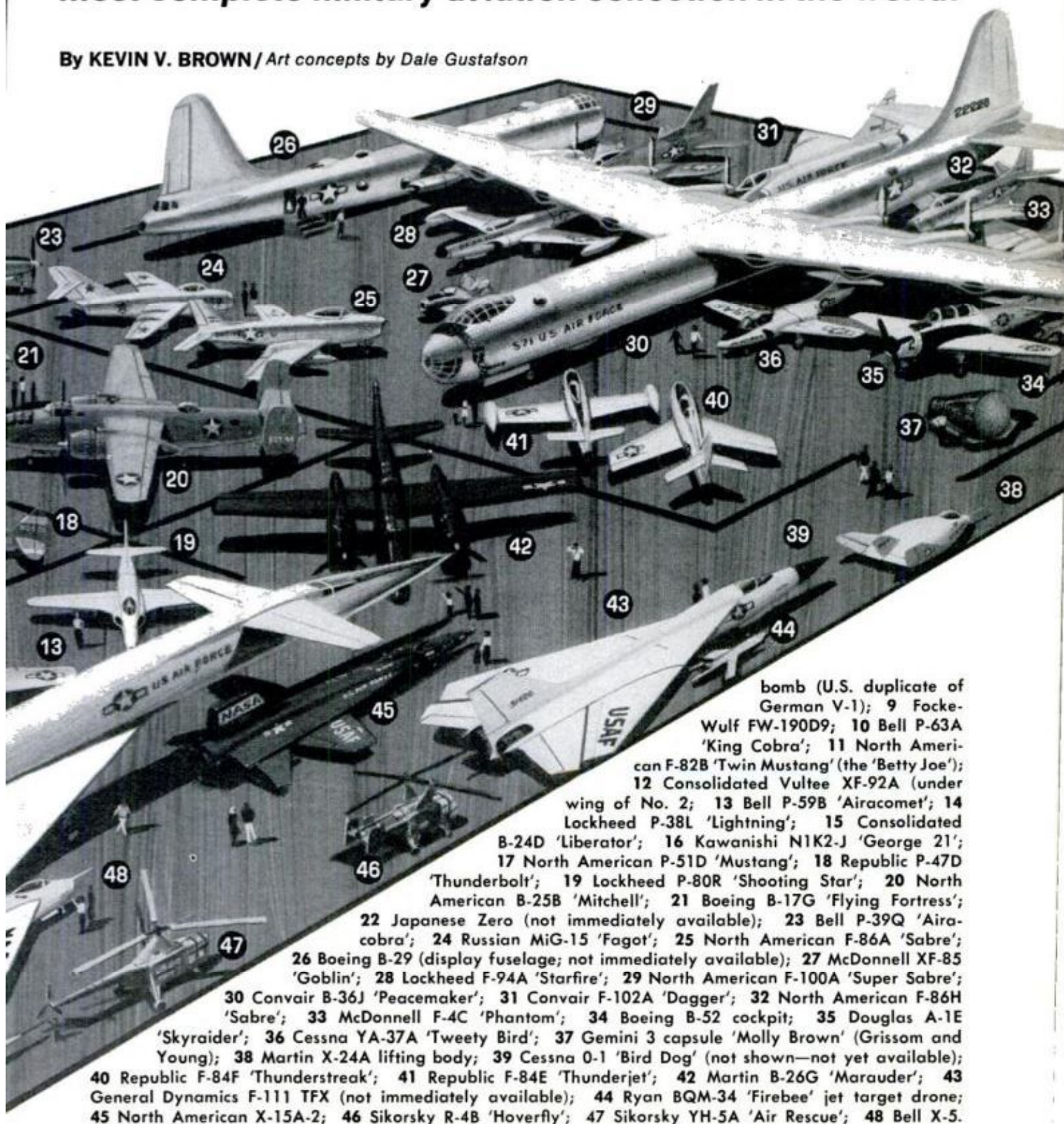
THIS dazzling display of air power greets visitors to the north wing of the new Air Force Museum. The planes are numbered clockwise beginning at the bottom: 1 Douglas X-3 'Stiletto'; 2 North American XB-70A 'Valkyrie'; 3 Republic XF-91 'Thunderceptor'; 4 Bell X-1B; 5 Northrop P-61C 'Black Widow'; 6 Messerschmitt Me. 262 'Schwalbe'; 7 Boeing B-29 'Super Fortress' (the 'Bockscar'); 8 JB-2 buzz



# OF BRAVE MEN

*If airplanes fascinate you, include the new Air Force Museum in your summer travel plans. You'll see the most complete military aviation collection in the world.*

By KEVIN V. BROWN / Art concepts by Dale Gustafson



bomb (U.S. duplicate of German V-1); 9 Focke-Wulf FW-190D9; 10 Bell P-63A 'King Cobra'; 11 North American F-82B 'Twin Mustang' (the 'Betty Joe');

12 Consolidated Vultee XF-92A (under wing of No. 2; 13 Bell P-59B 'Airacomet'; 14 Lockheed P-38L 'Lightning'; 15 Consolidated B-24D 'Liberator'; 16 Kawanishi N1K2-J 'George 21'; 17 North American P-51D 'Mustang'; 18 Republic P-47D 'Thunderbolt'; 19 Lockheed P-80R 'Shooting Star'; 20 North American B-25B 'Mitchell'; 21 Boeing B-17G 'Flying Fortress'; 22 Japanese Zero (not immediately available); 23 Bell P-39Q 'Airacobra'; 24 Russian MiG-15 'Fagot'; 25 North American F-86A 'Sabre'; 26 Boeing B-29 (display fuselage; not immediately available); 27 McDonnell XF-85 'Goblin'; 28 Lockheed F-94A 'Starfire'; 29 North American F-100A 'Super Sabre'; 30 Convair B-36J 'Peacemaker'; 31 Convair F-102A 'Dagger'; 32 North American F-86H 'Sabre'; 33 McDonnell F-4C 'Phantom'; 34 Boeing B-52 cockpit; 35 Douglas A-1E 'Skyraider'; 36 Cessna YA-37A 'Tweety Bird'; 37 Gemini 3 capsule 'Molly Brown' (Grissom and Young); 38 Martin X-24A lifting body; 39 Cessna O-1 'Bird Dog' (not shown—not yet available); 40 Republic F-84F 'Thunderstreak'; 41 Republic F-84E 'Thunderjet'; 42 Martin B-26G 'Marauder'; 43 General Dynamics F-111 TFX (not immediately available); 44 Ryan BQM-34 'Firebee' jet target drone; 45 North American X-15A-2; 46 Sikorsky R-4B 'Hoverfly'; 47 Sikorsky YH-5A 'Air Rescue'; 48 Bell X-5.

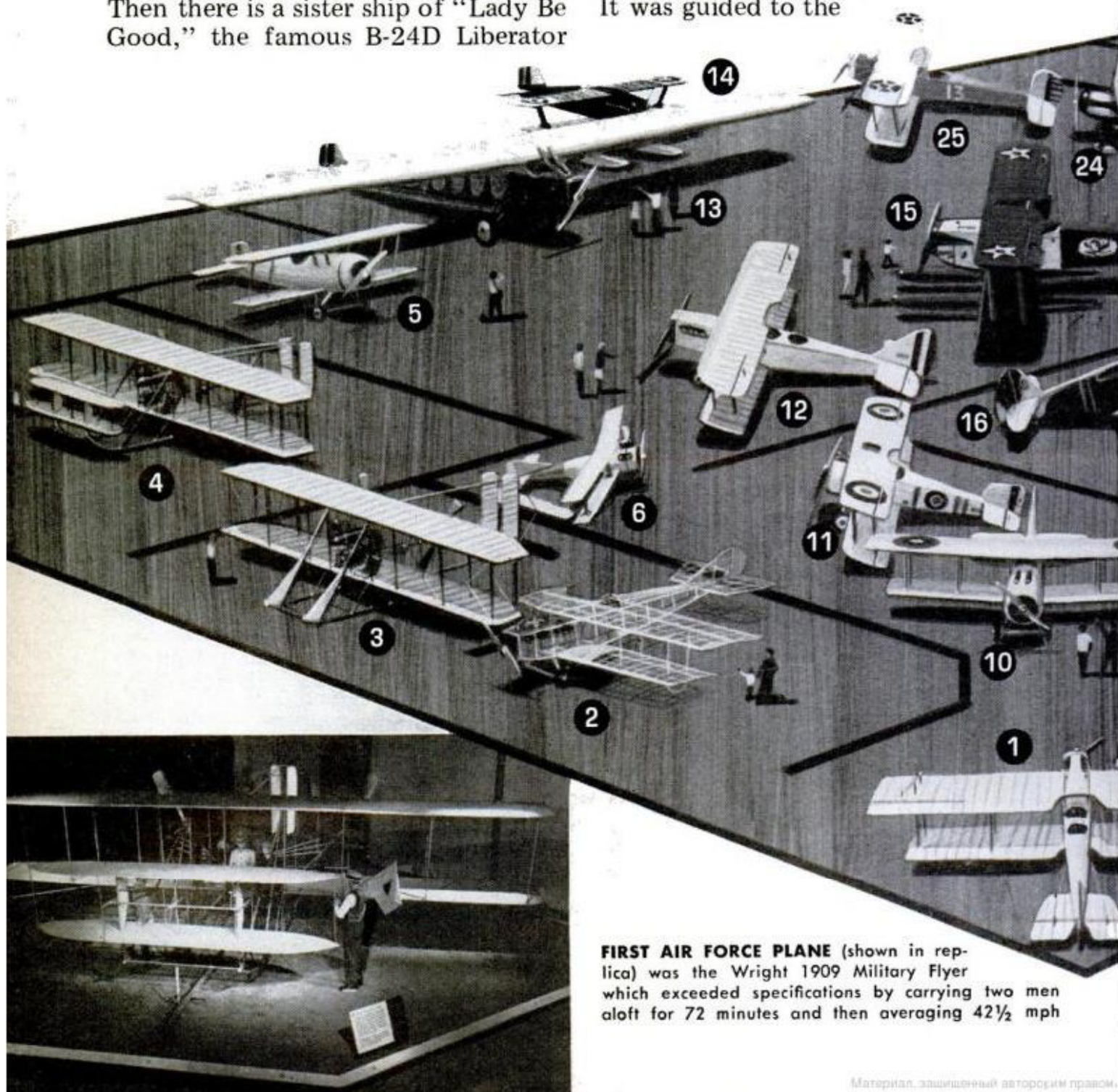


replica of the first military aircraft, the Wright 1909 Military Flyer, to the Boeing B-29 "Bockscar" which dropped the second atomic bomb on Nagasaki and helped end World War II. More exotic hardware includes the surviving XB-70 bomber, a plane designed to fly three times the speed of sound at altitudes above 70,000 feet; space capsules and lifting bodies like the Martin X-24A—intended to glide back to earth from outer space.

The history connected with the planes makes them doubly fascinating. Included is the first aircraft to circumnavigate the globe in 1924, the Douglas World Cruiser "New Orleans." Then there is a sister ship of "Lady Be Good," the famous B-24D Liberator

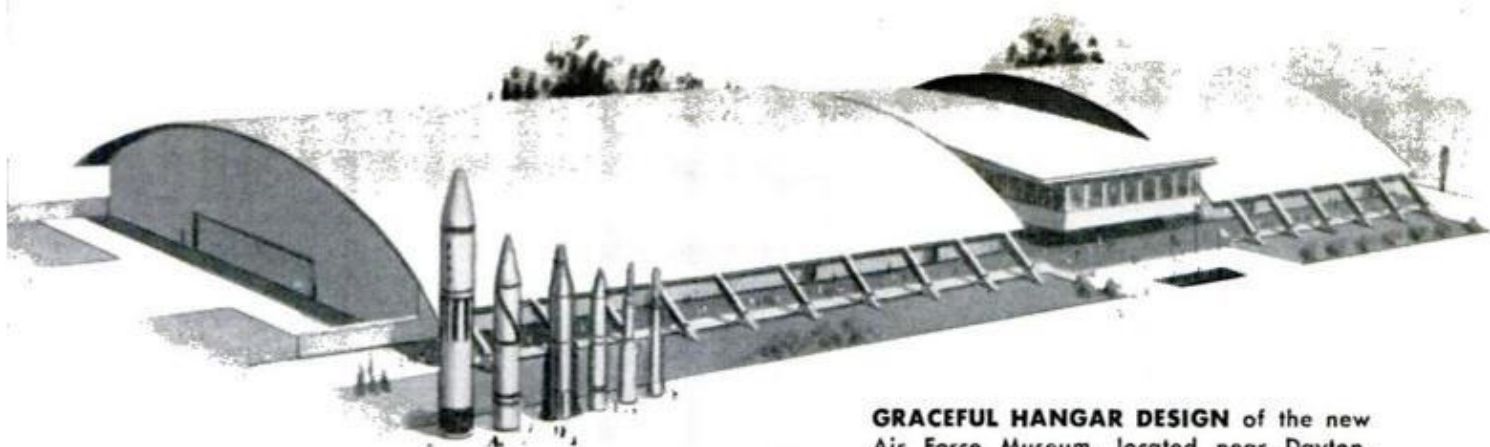
which disappeared on a mission from North Africa in 1943 and was found in the Libyan Desert in 1959. This ship is the "Strawberry Bitch" which also flew combat missions from North Africa. Another famous plane is the F-82B Twin Mustang, "Betty Jo." It made the longest nonstop flight ever made by a fighter on Feb. 28, 1947: 5051 miles between Hawaii and New York.

The museum has the world's first guided missile in the form of the Kettering Bug. Built in 1918 for the U.S. Army Signal Corps, the unmanned Bug could carry 180 pounds of explosives at 55 mph for 40 miles. It was guided to the

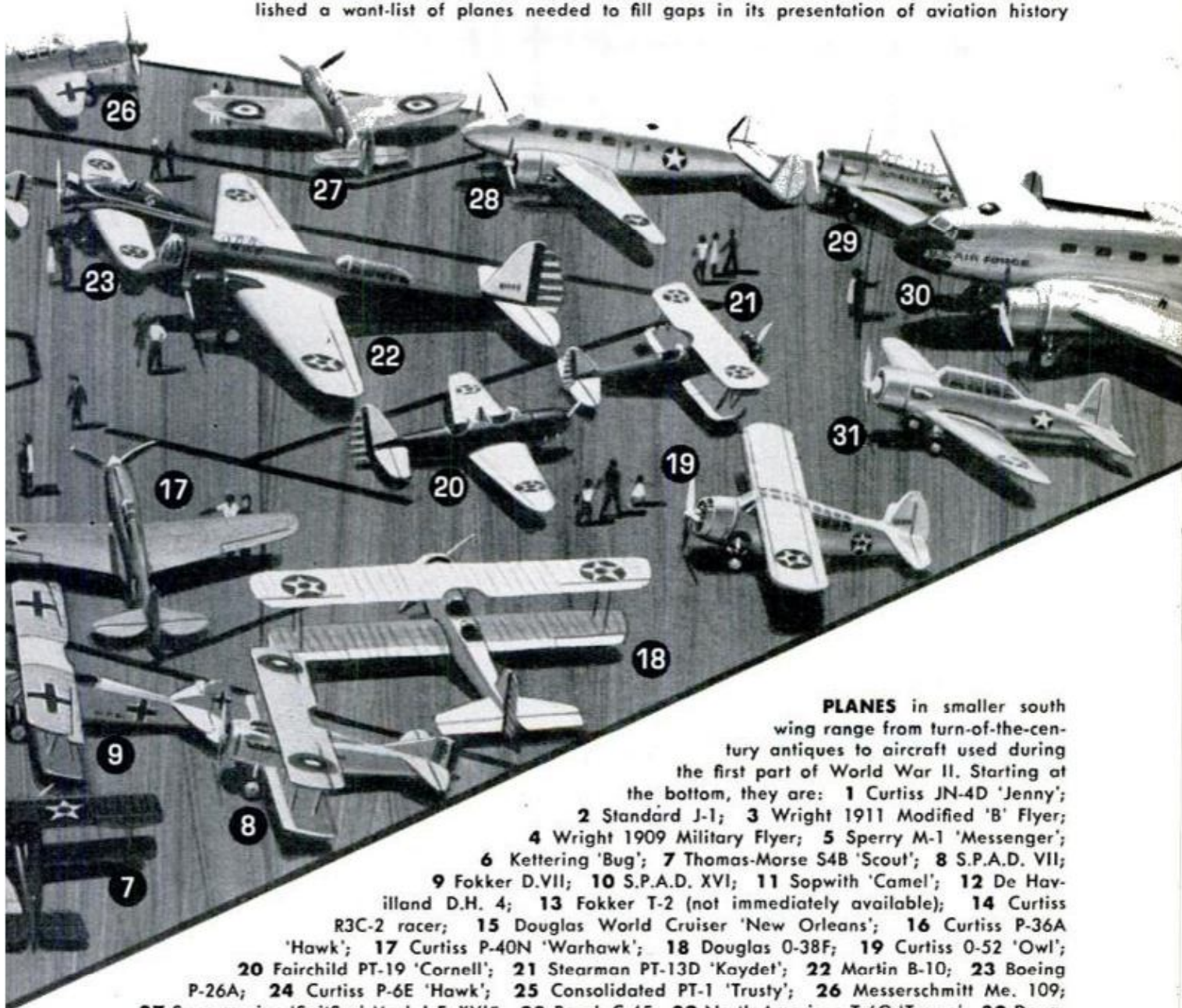


**FIRST AIR FORCE PLANE** (shown in replica) was the Wright 1909 Military Flyer which exceeded specifications by carrying two men aloft for 72 minutes and then averaging 42½ mph





**GRACEFUL HANGAR DESIGN** of the new Air Force Museum, located near Dayton, Ohio, houses a 500-seat theater, restaurant, shops, and up to 100 airplanes in north wing (left) and south wing (right). Interior display space totals 160,000 square feet, and additional planes will be on exhibit in areas outside the building. Planned for the future are displays of the missiles shown in the drawing such as the Chrysler PGM-19 Jupiter; Convair CGM-16 Atlas; Douglas PGM-17 Thor; Martin HGM-25 Titan I, and other smaller types. Appropriately located near a runway, the museum is constantly growing and has established a want-list of planes needed to fill gaps in its presentation of aviation history



**PLANES** in smaller south wing range from turn-of-the-century antiques to aircraft used during the first part of World War II. Starting at the bottom, they are: 1 Curtiss JN-4D 'Jenny'; 2 Standard J-1; 3 Wright 1911 Modified 'B' Flyer; 4 Wright 1909 Military Flyer; 5 Sperry M-1 'Messenger'; 6 Kettering 'Bug'; 7 Thomas-Morse S4B 'Scout'; 8 S.P.A.D. VII; 9 Fokker D.VII; 10 S.P.A.D. XVI; 11 Sopwith 'Camel'; 12 De Havilland D.H. 4; 13 Fokker T-2 (not immediately available); 14 Curtiss R3C-2 racer; 15 Douglas World Cruiser 'New Orleans'; 16 Curtiss P-36A 'Hawk'; 17 Curtiss P-40N 'Warhawk'; 18 Douglas O-38F; 19 Curtiss O-52 'Owl'; 20 Fairchild PT-19 'Cornell'; 21 Stearman PT-13D 'Kaydet'; 22 Martin B-10; 23 Boeing P-26A; 24 Curtiss P-6E 'Hawk'; 25 Consolidated PT-1 'Trusty'; 26 Messerschmitt Me. 109; 27 Supermarine 'Spitfire' Mark L.F. XVIIE; 28 Beech C-45; 29 North American T-6G 'Texan'; 30 Douglas C-47A 'Skytrain'; 31 Vultee BT-13B 'Valiant'. Among the significant missing links sought by the Air Force Museum are the Fokker D.VII, the famous WWI German fighter; the Boeing P-12, a U.S. pursuit craft dating from the 1920s, and the Seversky P-35, an all-metal pursuit plane. Sources of antique planes include other museums, individuals and manufacturers. Even parts are useful: The replica of the Wright 1909 Military Flier was constructed around an engine, props, and other parts donated by the Wright estate.





**S.P.A.D. VII** was one of the best of World War I. With U.S. designs lagging, pilots like Rickenbacker flew it. Its gun was synchronized, it did 130 mph, climbed to 22,000 and stayed together in dives



**THIS MIG-15** was flown to South Korea by defector who collected a \$100,000 reward. It climbed faster and had a higher ceiling than its adversaries. U.S. planes, however, were more rugged, dived faster



target by built-in, preset controls. A "descendant" is located in another corner of the museum: a replica of the German V-1 buzz bomb.

Other memorabilia associated with the growth of aviation—far too much to display—includes engines, parachutes, uniforms, wind tunnels and miscellaneous hardware from all over the world. A prisoner-of-war exhibit tells much about the hardships experienced by American POWs in German prison camps. Other special displays are devoted to balloon flights, dirigibles, the development of the atomic bomb, the Berlin airlift and the like.

Yet another sidelight is the Aviation Hall of Fame, reproductions of awards given by the Congress of the United States to those who have made significant contributions to aviation. The chief attraction, however, remains what it has always been: the aircraft themselves.

A constantly growing, ever-changing institution, the Air Force Museum has been dubbed an open-ended history book. Work on a new collection of rockets and missiles shows the title is justified. Although the display must await pouring of concrete pads outside the building, these machines will also take their place in the history book.

While a few of the planes shown on these pages are not currently ready for display, many additional types can be seen by visitors. The museum is constantly adding antique aircraft as well as recent planes and rockets being phased out of operational use.

Entirely dependent on voluntary contributions, the Air Force Museum carries forward the work of collecting airplanes and missiles, restoring and preserving them for the benefit of future historians. Appropriately near a runway, it is a fitting final resting place for the wings of brave men. ★★★

**F-86 SABRE** was the most successful Korean fighter with a kill ratio of 14:1—some 800 MiGs against 58 losses. It was first U.S. fighter to adopt swept wings for speed and set a 670-mph record in 1948





## Breath of fresh air

How to survive in a polluted environment is the theme of this display by a group of Dusseldorf artists. Inside a large plastic "tent" is a table set up to offer the resident of the enclosure a menu of oxygen. It's served to him via a mask from a single bottle on the table.



## Domes protect builders

Construction of two new Autobahn bridges went on without delay even during the bad weather of winter because the construction sites are enclosed in plastic air-supported structures. The cover over the bridge shown above is 190 feet long. A compressor keeps air pumped in to support the dome.

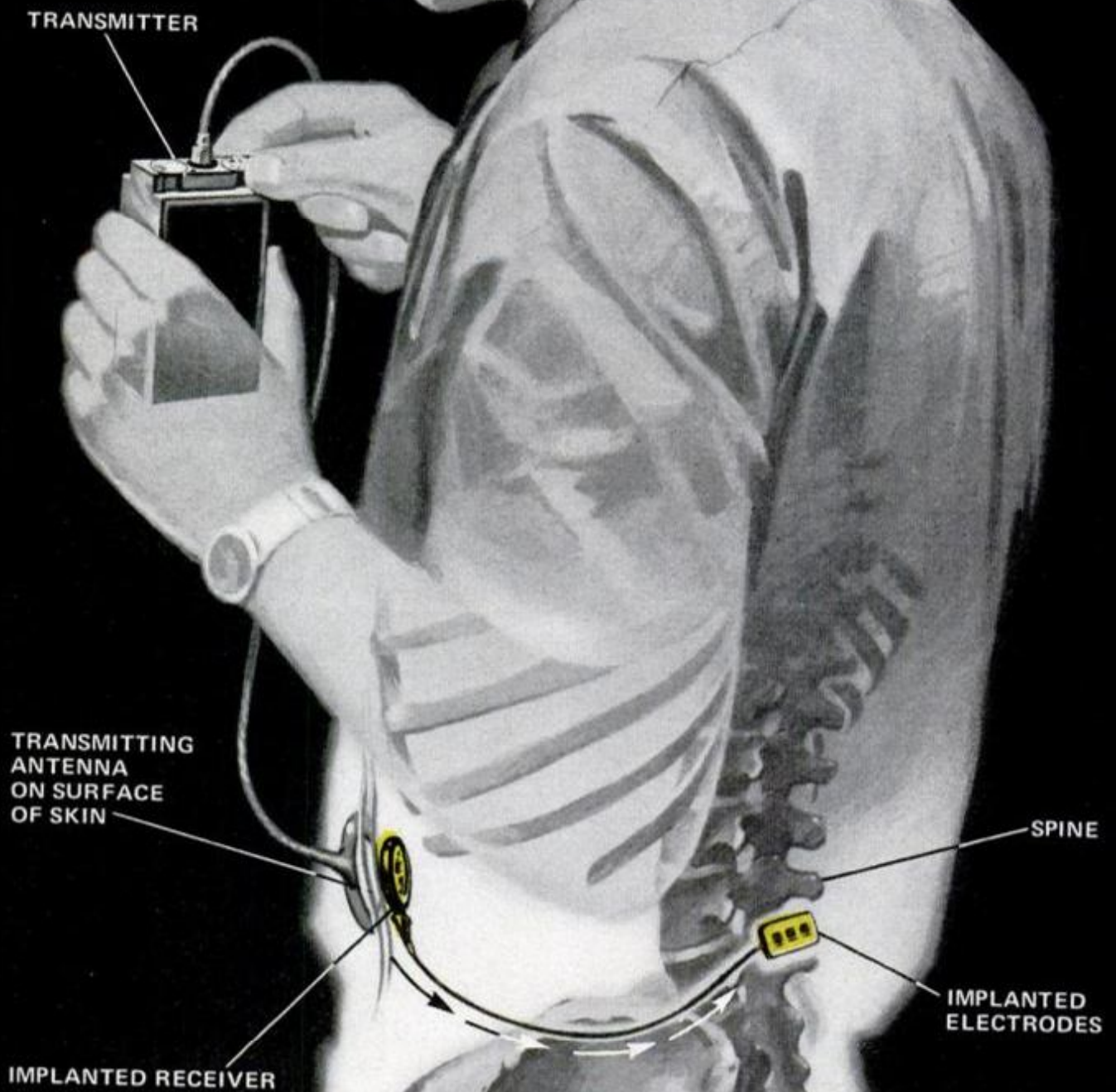


## Big truck to carry little truck and lots of water

Designed to fight unusually intense blazes—such as a fully fueled jumbo jet—this truck would rush to the fire and send in a remote-controlled mini-truck to apply an extinguishing spray. The proposed truck, which would carry 4000 gallons of water and 400 gallons of foam extinguisher, is the design of a Frankfurt, Germany, fire expert.



# NOW:





# An Electronic Pain Killer

**Many Americans suffer from pain so intense that they cannot work or even sleep. Drugs offer no relief. Now an experimental electronic device is enabling some of them to lead normal lives.**

By ARTHUR S. FREESE

Illustration by Roy Grinnell

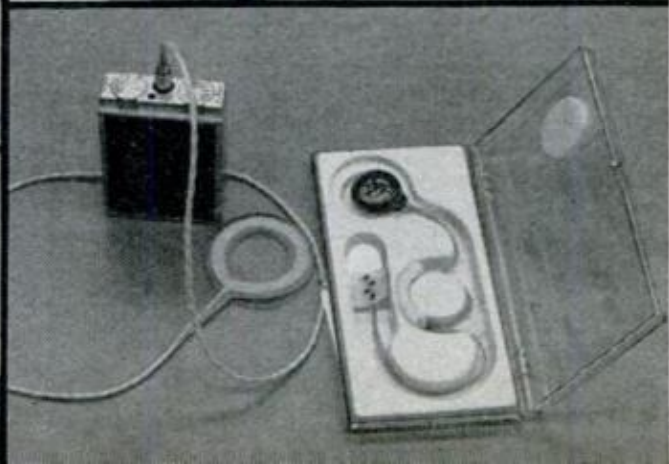
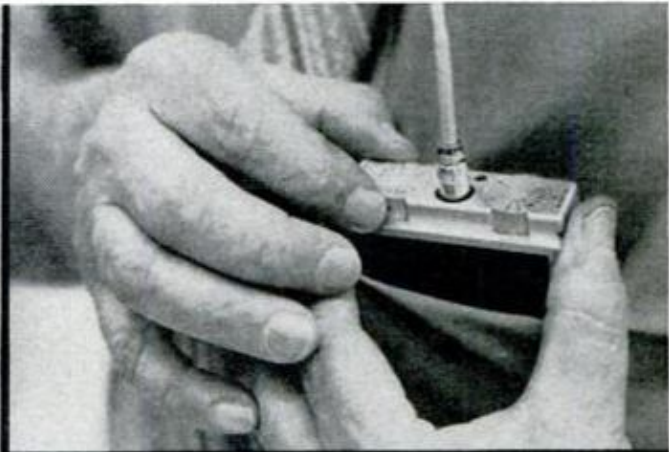
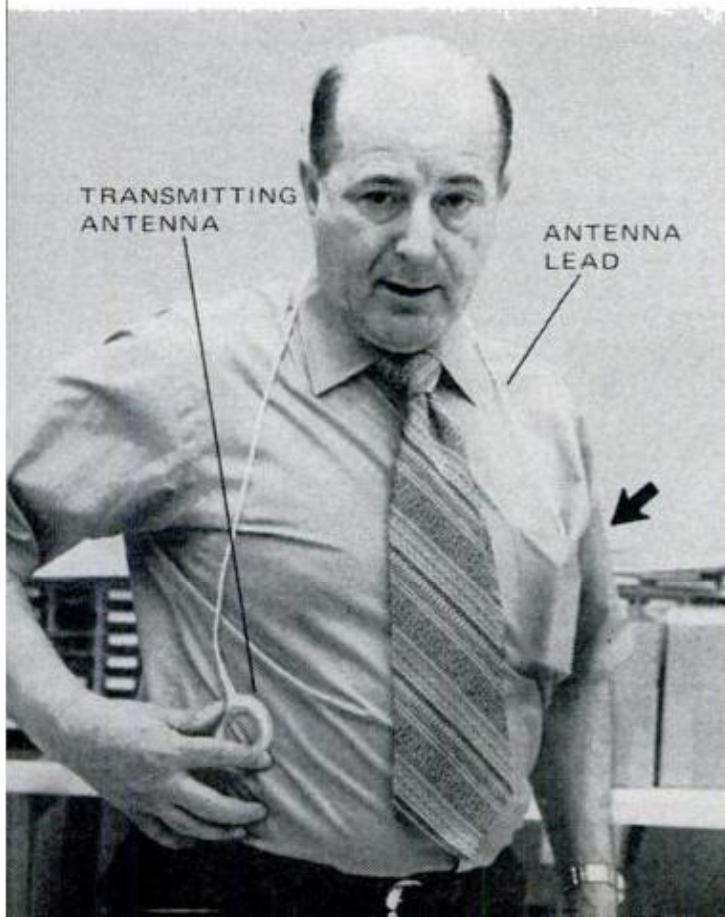
**E**LECTRONICS AND MEDICINE are combining to give new hope to those suffering from disabling, incurable pain. The answer? An amazing receiver and wire network inside the human body that transmits electrical impulses to nerves and literally blots out pain.

Pain due to various infirmities can be classed as an epidemic—one that causes millions of man-hours to be lost each year. Every one of us suffers from some pain from time to time, but for tens of thousands the suffering is almost constant and incredibly intense. In many of these hapless victims the pain is generated by a back injury.

The experience of a Nashville, Tenn., housewife shows how effective the new electronic pain killer can be. The victim of two spinal disc ruptures while driving on primitive roads in Africa, she found herself confined to bed with terrible, "unbelievable" pain. Removal of the discs—pads of cartilage that separate the bony segments of the spine—only made things worse. The pain was so intense she could not even concentrate on reading or doing the fancy needlework of which she was so proud.

Only after a dorsal column stimulator (DCS) was implanted under her skin

**ENGINEER ROGER AVERY SHOWS WHERE ANTENNA** is taped to skin when receiver is implanted below rib cage. In use, antenna lead from shirt-pocket transmitter is slipped inside shirt, then around neck. Other photos show how transmitter is turned on, and the latest DCS model made by Avery's electronic laboratory





near her spine was she able to return to the normal life of a housewife.

Our nervous system is electrical in nature, and its functioning can be altered by electrical means. The wires that are implanted for the DCS are enough to make an electrician scratch his head in disbelief. They are 6 to 30-inch multiple strands of stainless steel or platinum wire, each with up to 400 filaments so fine you can hardly see one of them. A single strand has less rigidity than a rubber band and a total thickness of only three hairs (10 or 12 one-thousandths of an inch in diameter).

This "pain circuit" is tunneled under the skin of the body, and one end is connected to the electrodes that actually stimulate the nervous system. They may be located against the spinal cord or even against peripheral nerves located in more distant parts of the body.

The other end of the pain circuit connects to a receiver. It is a tiny implantable unit made up of coils, resistors, capacitors and semiconductors, and is often located under the skin on the right side of the chest. The user of the stimulator simply places a small external antenna over the implanted unit in order to activate it. The antenna, in turn, is connected to a small

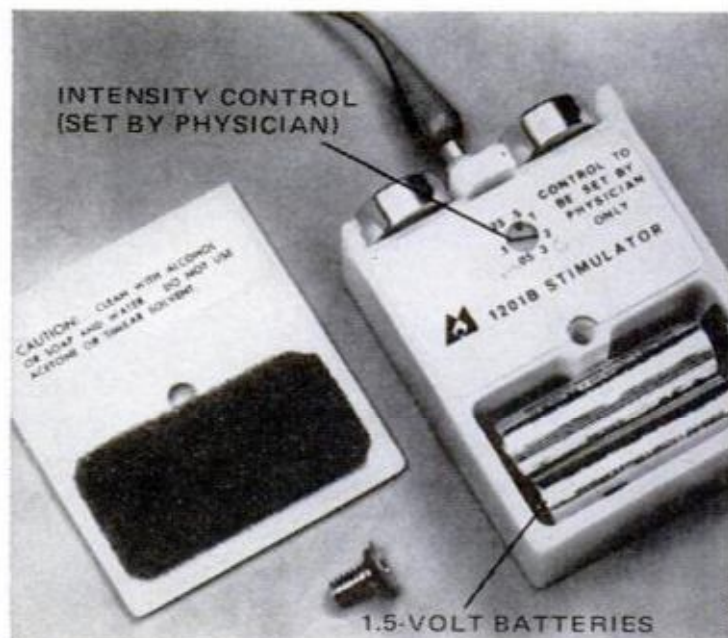
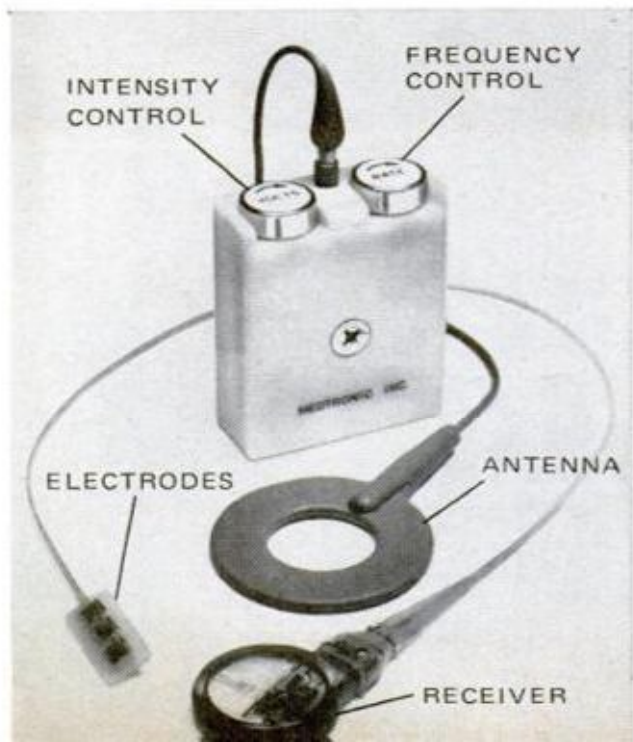
transmitter slightly bigger than a pack of cigarets. Worn on a belt or in a shirt pocket, it is fully adjustable for best pain relief.

Dr. C. Norman Shealy, chief of Neurosurgery at the Gundersen Clinic of La Crosse, Wis., inventor of the dorsal column stimulator, installed the first one on a human patient in April, 1967. Their most important use now, says Dr. Shealy, is to relieve the pain of "flunkouts from disc surgery."

Medical science will undoubtedly find new applications for the pain killer, however. Not only can pain from spinal injuries and phantom (amputated) limbs be relieved, but some cancer victims can be given a measure of comfort. Similar devices may one day help anyone with pain that does not respond to simple cures. Wires could reach to the spinal column, peripheral nerves and even to electrodes implanted in the brain itself.

Dr. Shealy is enthusiastic about results of DCS. He and other surgeons conducting clinical trials have installed almost 200 units to date, and about three-fifths of the patients report excellent relief from pain. Another fifth show moderate relief and only a final fifth—many of them emotionally disturbed—have not been helped.

**SINCE THE POWER SOURCE** is not implanted—but is in the transmitter—there is no need for multiple operations to replace batteries—a boon to the patient. Unit shown is made by Medtronic, Inc., Minneapolis





Some neurosurgeons see DCS and other electric pain killers as "the answer to certain kinds of intractable pain not responding to other known treatments." It is a measure of last resort—definitely not for such things as toothaches or broken legs.

Dr. Shealy says that the surgery—about as complex as a disc operation—presents no particular problems for either surgeon or patient. Though the procedure is still experimental, surgeons can tell you about former bed-ridden patients who now lead near-normal lives because of the effectiveness of DSC.

In his mid-50s, Elliott Gray (not his real name) had been confined to bed for seven years following disc surgery; any physical activity generated pain which no drugs could stop. Nearly three years ago, Dr. Shealy operated on Elliott, cutting a hole the size of a quarter in the skin over his spine.

The spine is actually a series of bones (vertebra) with a hole through their center for the spinal cord—the nerve tissue which carries electrical messages to and from your brain. The spinal discs are cushions of cartilage between the bones that permit you to bend and twist. When a disc ruptures or slips, however, the resulting pressure on nerves causes excruciating pain. In addition, scar tissue or bony

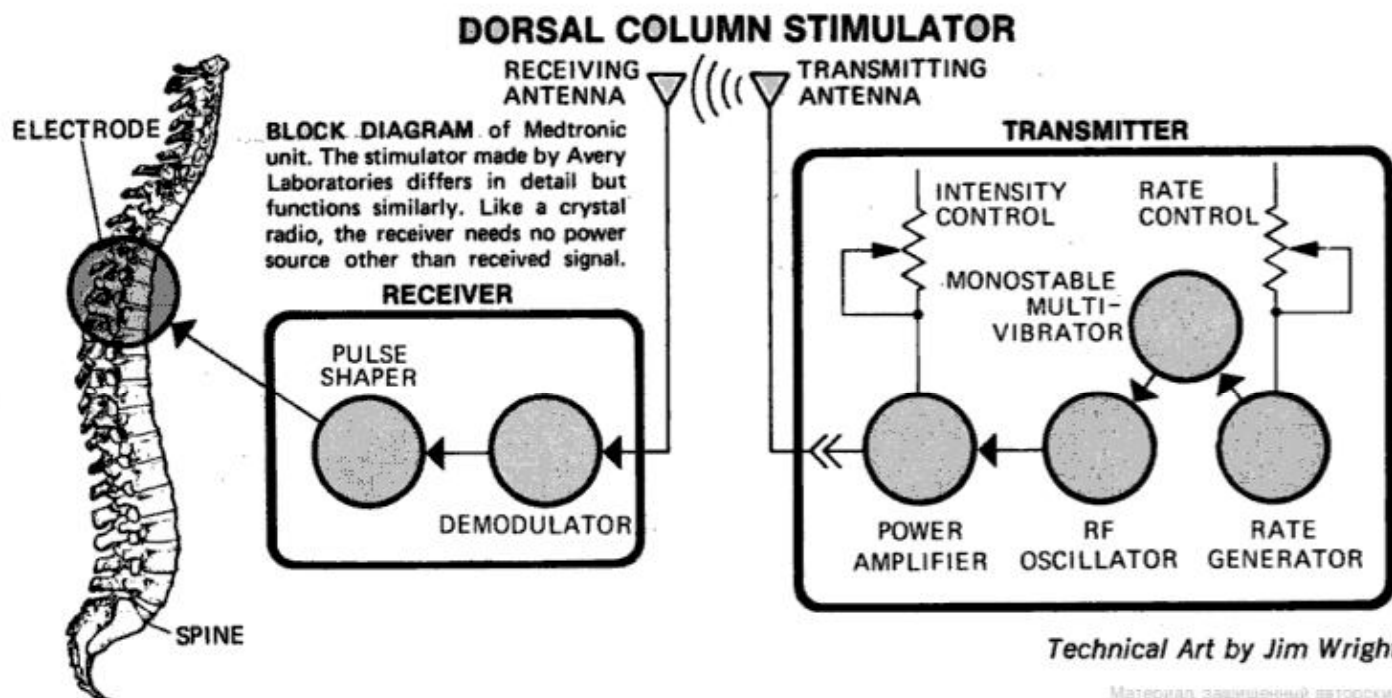
spurs can form and add to the pain, as in Elliott Gray's case.

In that operation, Dr. Shealy cut a slit in the outermost of the three layers of delicate tissue surrounding the spinal cord. Then he carefully placed a trimmed bit of plastic holding three platinum electrodes so that it just touched the spinal cord. Wires from the electrodes were fed along under the skin to the receiver—about the size of a man's wristwatch—placed below the rib cage on the abdomen and on a line with the arm. The incision was then sewed up.

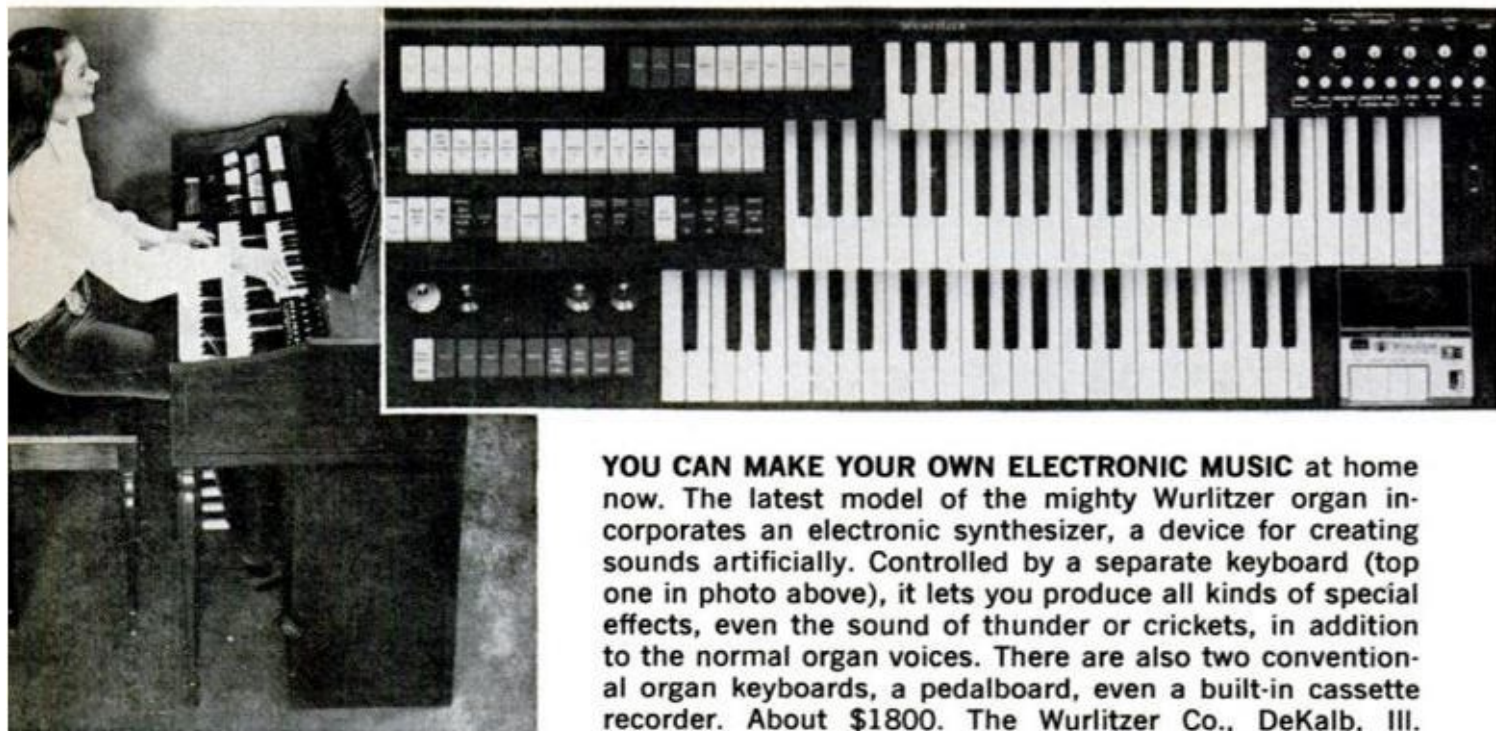
To the skin over the receiver Elliott now tapes a doughnut-shaped plastic antenna that plugs into a battery-powered transmitter which he carries in his shirt pocket. He can turn this on or off, or adjust the power or the rate of electrical stimulation. Since the operation almost three years ago, Elliott has been leading a normal life and was laying a new roof on his house when Dr. Shealy last saw him.

Two firms—Medtronic, Inc., Minneapolis, and Avery Laboratories, Farmingdale, N.Y.—make dorsal column stimulators. Roger Avery, who has been working in medical electronics for the last decade, started his small company just three years ago. Deeply committed to his work and concerned

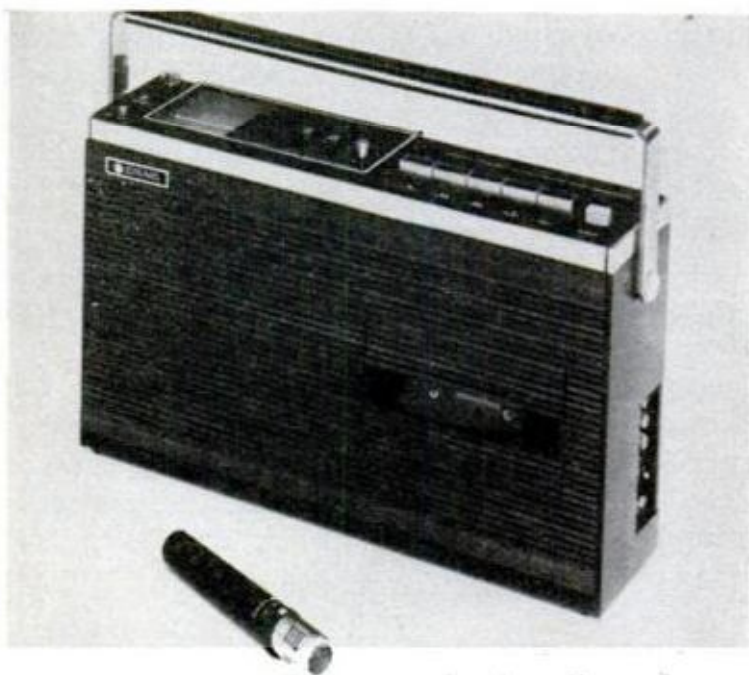
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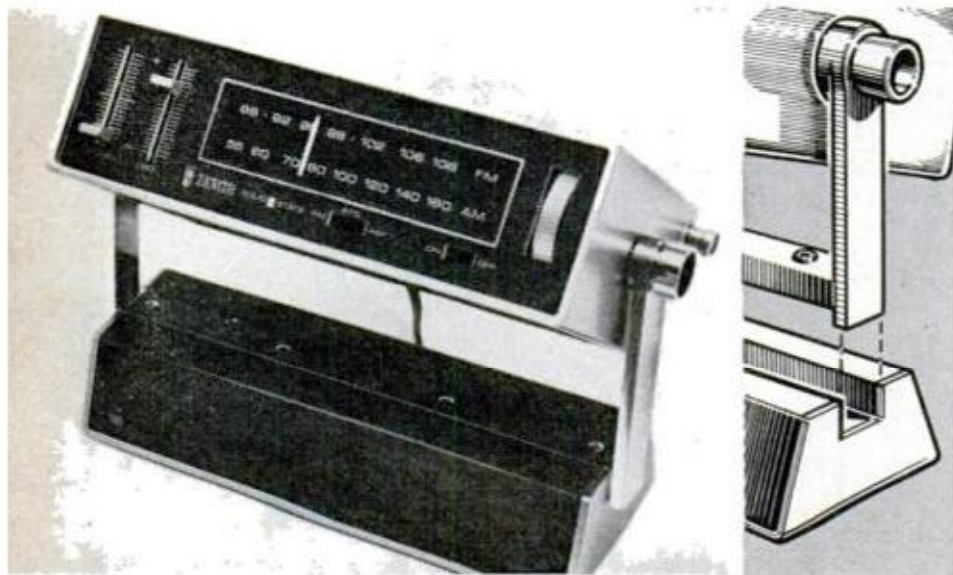


**YOU CAN MAKE YOUR OWN ELECTRONIC MUSIC** at home now. The latest model of the mighty Wurlitzer organ incorporates an electronic synthesizer, a device for creating sounds artificially. Controlled by a separate keyboard (top one in photo above), it lets you produce all kinds of special effects, even the sound of thunder or crickets, in addition to the normal organ voices. There are also two conventional organ keyboards, a pedalboard, even a built-in cassette recorder. About \$1800. The Wurlitzer Co., DeKalb, Ill.



# New in

**YOU CAN STAND 30 FEET AWAY** and operate the portable cassette recorder at left without any wires between you and it. A special wireless microphone triggers an FM circuit in the recorder to start or stop it at will. All you do is press a switch on the mike and the machine begins recording or shuts off. Also included in the battery portable is an AM/FM radio. \$139.95, Craig Corp., 921 W. Artesia Blvd., Compton, Calif.



**NOVEL TWO-WAY RADIO** serves as both a table model and play-anywhere portable in one. As a portable, the AM/FM radio operates on built-in rechargeable nickel-cadmium batteries. At home, you slip pivoted handle into a slotted base that plugs into 117-volt house current. The base contains a charger that automatically restores the batteries as the radio plays on a.c. While locked in the base, the radio can be tilted to any of three angles for easy operation of its controls. \$49.95, Zenith Radio Corp., Chicago.





**IT'S SO ACCURATE** that this new quartz-controlled wristwatch varies by less than a minute a year. Instead of the usual balance wheel, it uses highly stable resonant frequencies from a tiny quartz oscillator to keep the mechanism precisely in step. It is powered by a miniature mercury battery lasting 18 months. A Longines watch made in Switzerland, it's expected to cost about \$360.



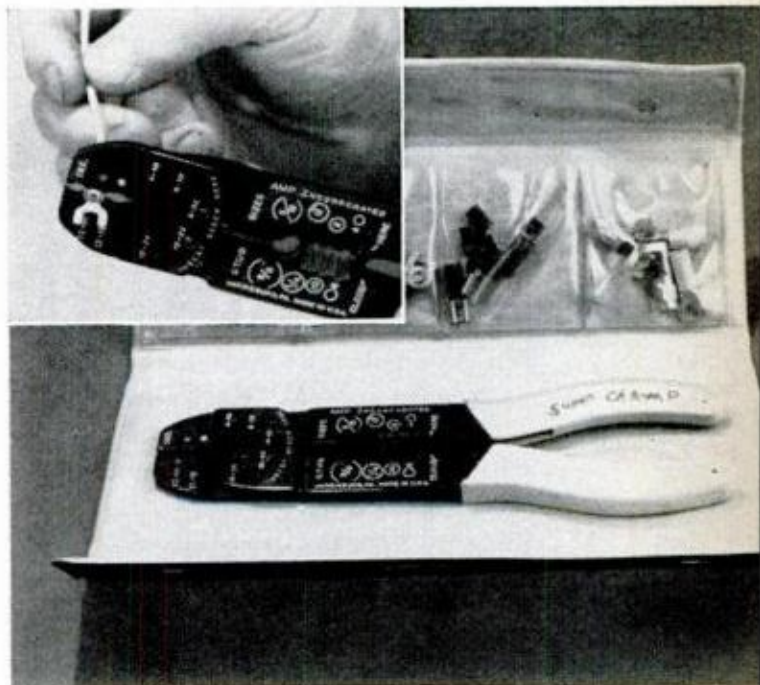
**ELECTRONIC PIANO TEACHER** tells you instantly whether you played the right note or not. Pressing each key lights up a bulb behind the corresponding note on the sheet music. If note and light don't coincide, you know you've made an error. David Beach of Stanford University developed the system.

# Electronics



**WANT TO HEAR RADIO BROADCASTS** through your car's cartridge tape player? Two new slip-in cartridge radio adapters give you a choice of AM/FM in one model or FM stereo in another. The adapters fit into the player's tape cartridge slot and operate from the car's regular antenna. Special two-way hookup cable makes it easy to attach the adapter radio to the antenna without disconnecting car's built-in radio. Sold by Audiotech, the AM/FM model is \$45 and the FM stereo model, \$54.

JULY 1971



**EVERYTHING YOU NEED** to apply a variety of solderless connectors is included in this handy fold-up plastic kit. Compartments in the kit contain a selection of spade lugs, ring-type lugs, splices and slip-together connectors to fit several sizes of wire. Also included is a crimping tool that cuts and strips wire and shears bolts. Price is \$9.95, American Pamcor, Inc., Box 1776, Paoli, Pa.

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**PM OWNERS REPORT**  
**BUICK OPEL**

A Nationwide Survey Based on  
870,000 Owner-Driven Miles



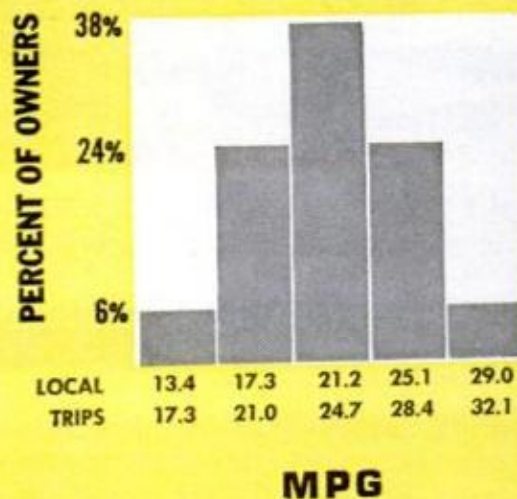
# Economy, Style and Handling Overcome the Shortcomings

By **MICHAEL LAMM**, West Coast Editor  
*Photos by Irv Dolin*

**B**UICK DEALERS offer quite a range of Opels this year—from the thrifty 1100-cc two-door (no longer called the Kadett but still the price leader at \$1878 p.o.e.) to the Vette-in-miniature GT sportster (\$3339 base and usually a wait for delivery).

Between these two, there's now the Opel 1900 series, available on these shores this year for the first time. Opel 1900s use the same 90-bhp engine as the GT and come in five body styles: two and four-door sedans, wagon, plus two coupes. All Opels have four-cylinder

**OPEL FUEL MILEAGE CHART**





engines, four-speed transmissions, rack-and-pinion steering. All but the 1100 use disc brakes up front.

These imports are all engineered conventionally—unit body/chassis, engine up front, and rear drive. Opel, of course, is a GM subsidiary, and as such it's run by Germans with U.S. help. Opel styling of late has become quite Americanized, a reflection of Detroit talent lent to the Russelsheim studios, and all models definitely cater to U.S. tastes.

Styling, though, ranked second to economy as owners' reason for buying. Many echoed the sentiment of a Texas house mover: "I got tired of feeding gas-guzzling tanks all those years." Others pointed to ease of maintenance and repairs, and several younger owners (31.7 percent are under 25) mentioned insurance discounts.

Our questionnaires went to owners of all Opel series, including the older Kadett and fuel-mileage summaries



**REAR-SEAT HEADROOM**, say owners, is more than ample, but legroom in rear was found inadequate



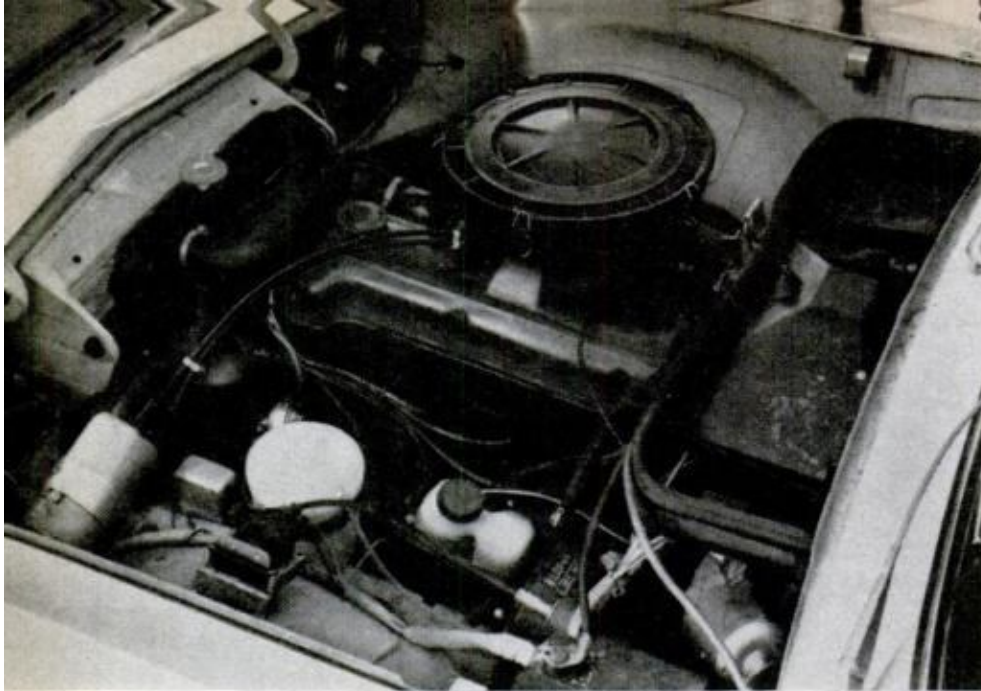
and other comments had to be grouped. The photos accompanying the story, however, all show the latest 1900 coupe.

**Comfort.** "Shocks are tight, thus ride over sharp bumps is quite uncomfortable." "Car is a little unstable in crosswinds." "I am a traveling salesman and have taken the Opel on straight 600-mile trips. I have been very pleased with the ride. I tend to get drowsy when I drive my Impala for long stretches, but the Opel is fun enough to keep me alert." "Before the airconditioning was installed, front legroom was adequate, but now it's all gone." "I am 6-foot-4 and the front is comfort-

**STYLING OF 1900 COUPE**, car shown in all accompanying photos, is striking and great improvement over other models, owners agree. Interior is neat, but some ask for minor changes in seats and the dash







**ENGINE COMPARTMENT** of 1900 packs same 1900-cc, 90-hp, four-cylinder engine used in GT model. Car has much improved performance over 1100-cc models. All models have four-speed stick, rack-and-pinion steering; all but 1100s, front disc brakes. Owners like economy, but some want more power

able, but the rear is the same as in all small cars—if you're over seven years old, sit up front."

**Quality.** "One of the best." "Much better than most of the other cars we looked at and test drove." "Impressive, like VW. It's solid German workmanship—no rattles at all." "Good craftsmanship." "A lot of workmanship for the money." "Good, but nothing like

**REAR STYLING THEME** of 1900 coupe is well liked by owners, some of whom note similarity with GT models



**TRUNK ROOM** received specific praise from over 10 percent of owners. Efficient layout was also liked



Mercedes." "Excellent." "Better than U.S. cars." "Too many minor faults."

**Problems.** "Rear window leaks, rubber moldings improperly put on." "Oil leaks—with cast-iron block and pot-metal timing cover, expansion rates are different, causing this leak." "No room in front with factory-approved air conditioner installed . . . would never have ordered air if I had known." "I think the government's regulation to make seatbacks high enough to block whip-lash has cut vision so all cars are unsafe now. Rear passengers can't see out front and front passengers out back."

"My wagon keeps running on. Have had it back three times. Am using premium but she still diesels." "Bad ash-tray position." "Oil filter hard to change." "The way this car jacks up is ridiculous. With the screw jack and the location of lift holes, it's almost impossible to keep from scratching the paint or having the car fall off the jack."

**Specific likes.** "Easy handling and parking." "Holds road good at high speeds." "Low initial cost, excellent gas mileage, superior handling in city and on highway, good pickup, front-seat comfort." "Sporty looks." "Economical." "Well built." "Quite a large trunk for such a small car." "I keep getting over 28 mpg on regular." "I own two, a Kadett wagon and a GT. Both are well built, good-looking, easy-to-work-on cars. And both perform well."

**Recommendations.** "Windshield



washer switch should be on dash, not on floor." "Bigger glovebox." "Needs more power." "Softer suspension." "The GT shouldn't look like a midget Corvette." "Would like disc brakes all around and a larger engine." "More room in the back seat." "Shifting into fourth gear, you hit the ashtray with your hand." "Front bumper should extend out farther to prevent hood knicks from other cars while parking." "Hood support is Mickey Mouse." "A person shouldn't have to wait three months for a new taillight lens."

**Re dealers.** "Our dealer must be the best in the country; never a problem the warranty didn't take care of." "I brought the car in three times and the carburetor was still the same. The service manager blamed problem on design, said all Opel carbs had same problem." "Extremely well satisfied." "The dealer here is slow and unresponsive; it took four months to get some weatherstripping." "I did a lot of looking and got the best deal from Opel dealer." "My dealer is courteous and fair but Buick-Opel doesn't seem to have a workable parts distribution system or an effective mechanic training program. There is a tendency to call poor performance 'normal operation.'" "After



**OPEL HANDLING** got top billing from nearly 60 percent of owners who like it more than the economy!

comparing it (1900 wagon) to Datsun and Toyota, my only reason for buying Opel was availability of service."

The parting shot comes from a missionary. "We returned to the United States about a year ago after 20 years in Africa, where we drove a variety of cars—VW, Vauxhall, Daihatsu, Jeep and Opel. The last was our favorite all around. So after wrestling a 1966 Catalina for almost a year, we traded for a new Opel 1900 wagon. It is much easier to park and drive, more economical, and I have been most impressed with the way it handles in western New York's snowbelt." ★★★

## Summary of 1971 Opel Owners Reports\*

Total miles driven	871,044
<b>Average miles per gallon</b>	
Local driving	21.2
Long trips	24.7
<b>Series:</b>	
Kadett 1100	13.6%
1900 series	53.3
Rallye 1900 coupe	19.6
GT sportster	13.6
<b>Body styles:</b>	
4-dr. sedan	5.7%
2-dr. sedan	38.5
coupe	29.9
wagon	25.9
<b>Why the Opel?</b>	
Economy	50.7%
Style	36.8
Size	16.8
Past experience	11.0
Handling	8.6
Price	7.7
Performance	7.2
<b>Specific likes:</b>	
Handling	59.7%
Economy	51.5

Style	47.1
Comfort	20.4
Ride	14.1
Trunk room	10.7
Power	10.7
<b>Specific dislikes:</b>	
Economy	14.7%
Rattles	12.2
Dealer service	8.6
Power too low	7.1
Harsh ride	6.6
Carburetor problems	6.1
<b>What changes would you like?</b>	
More power	9.6%
Seat style	6.9
More legroom	6.4
Interior style	5.3
Bigger tires	5.3
Better dash layout	4.8
Better materials	4.8
<b>Had any mechanical troubles?</b>	
No	59.7%
Yes	40.3
<b>What kind of trouble?</b>	
Carburetor	29.8%
Electrical	16.7
Oil leaks	9.5

Brakes	7.1
Shifting mechanism	6.0
<b>Did you repair it yourself?</b>	
No	96.5%
Yes	3.5
<b>Dealer repairs satisfactory?</b>	
No	53.0%
Yes	47.0
<b>Is the Opel your only car?</b>	
No	62.1%
Yes	37.9
<b>Other cars owned:</b>	
Chevrolet	19.2%
Pontiac	18.5
Buick	18.5
Ford	12.3
Oldsmobile	8.5
Volkswagen	7.7
<b>Age distribution of owners:</b>	
15-29 years	48.5%
30-49 years	35.0
50-plus	16.5
<b>Would you buy another Opel?</b>	
Yes	74.3%
No	25.7

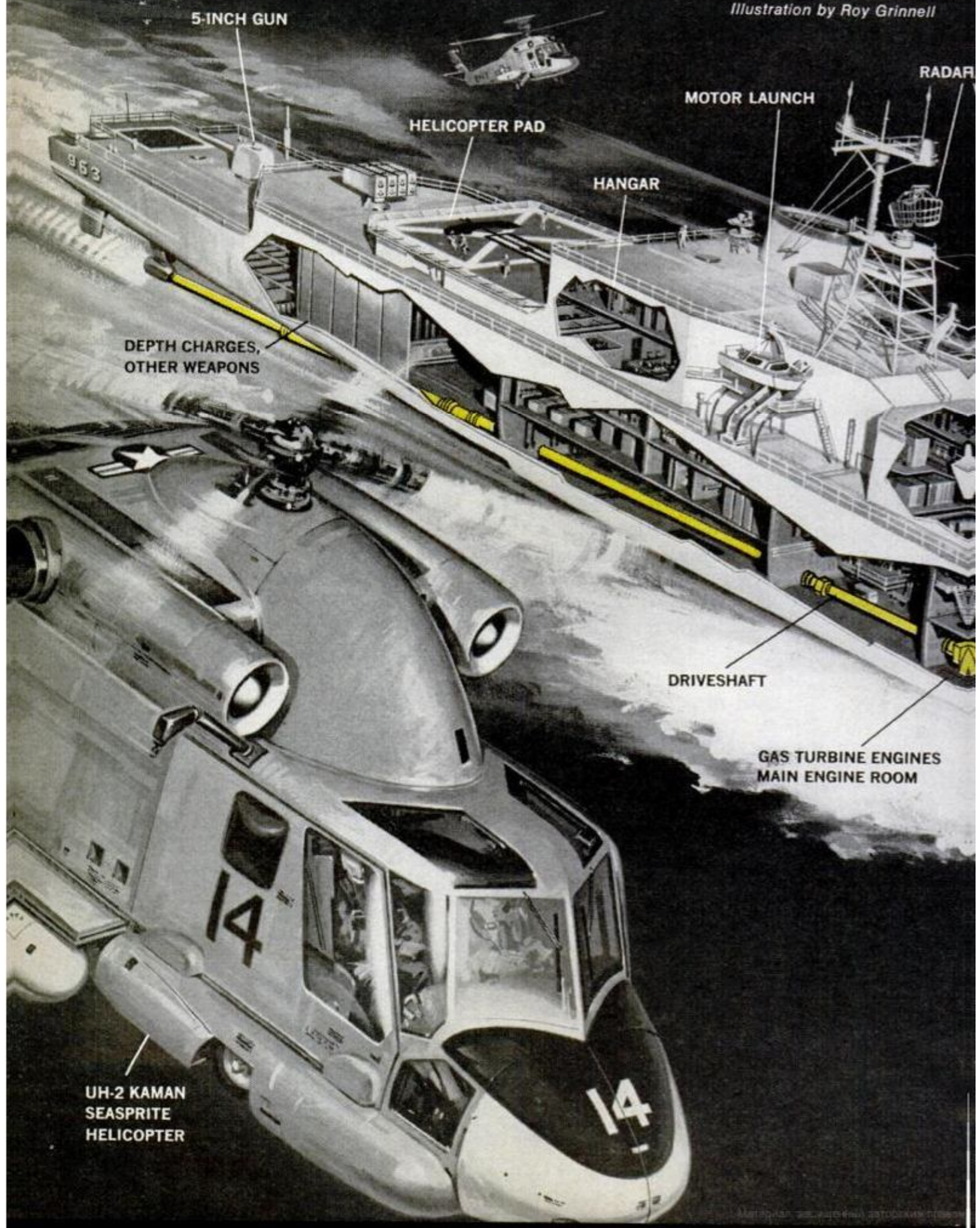
\*Percentages might not equal 100% due to rounding and/or insufficient data.



# First Look at the

By MORT SCHULTZ

Illustration by Roy Grinnell



5-INCH GUN

HELICOPTER PAD

MOTOR LAUNCH

RADAR

HANGAR

DEPTH CHARGES,  
OTHER WEAPONS

DRIVESHAFT

GAS TURBINE ENGINES  
MAIN ENGINE ROOM

UH-2 KAMAN  
SEASPRITE  
HELICOPTER

14



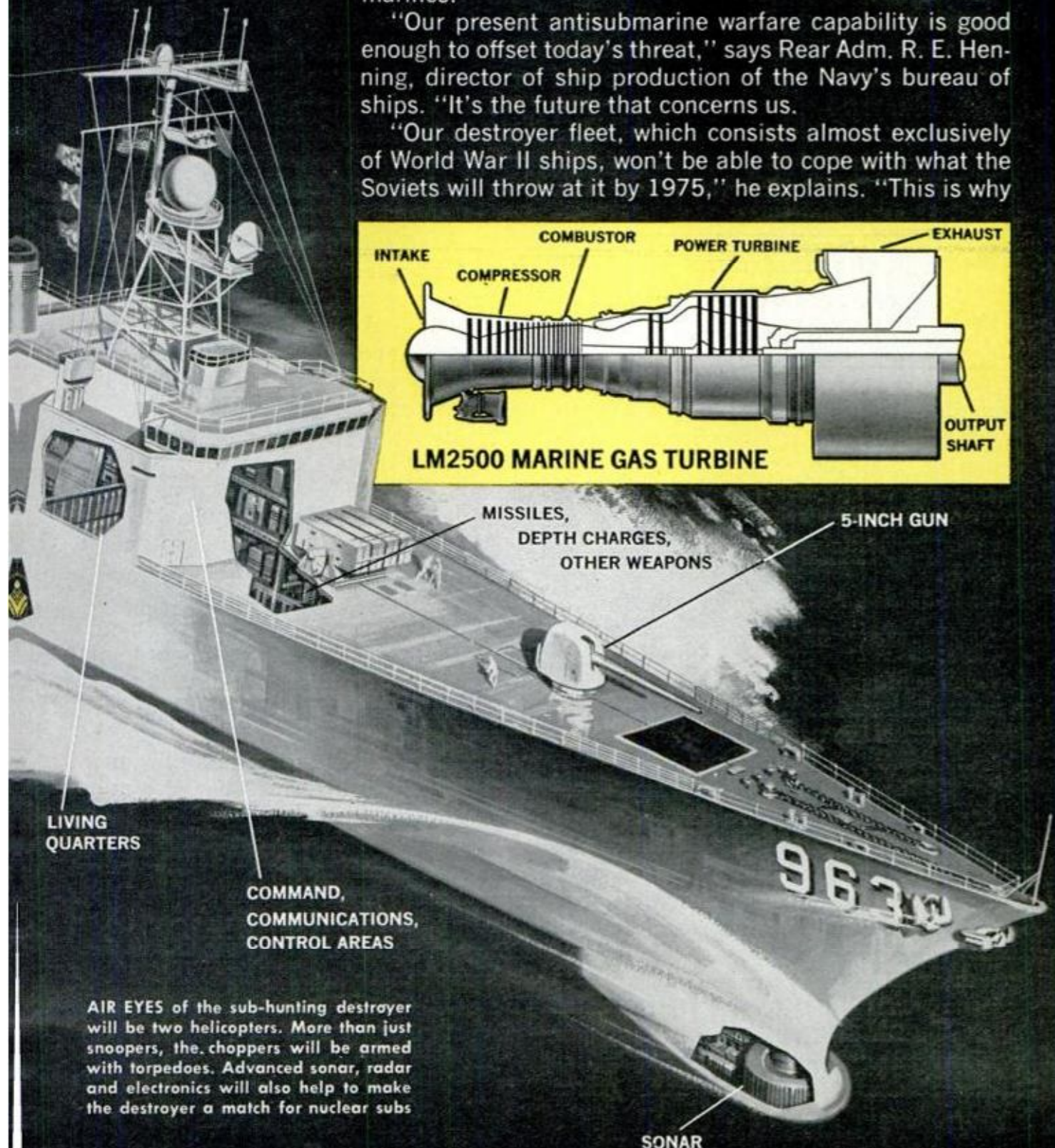
# Navy's New Destroyer

The quietest ship in the fleet will have long eyes—her own helicopters; big ears—advanced underwater surveillance gear; and a mighty punch—rocket-assisted torpedoes that home on enemy subs.

THEY WON'T BE LAYING THE FIRST PLATE for the DD-963 until early in 1973, but the new destroyer will be ready in time to counter the growing threat of Soviet submarines.

"Our present antisubmarine warfare capability is good enough to offset today's threat," says Rear Adm. R. E. Henning, director of ship production of the Navy's bureau of ships. "It's the future that concerns us.

"Our destroyer fleet, which consists almost exclusively of World War II ships, won't be able to cope with what the Soviets will throw at it by 1975," he explains. "This is why



**AIR EYES** of the sub-hunting destroyer will be two helicopters. More than just snoopers, the choppers will be armed with torpedoes. Advanced sonar, radar and electronics will also help to make the destroyer a match for nuclear subs



we are about to build the DD-963."

The first DD-963, called the Spruance class in honor of the late Adm. Raymond A. Spruance, who commanded the Fifth Fleet at the Battle of the Philippine Sea, June 1944, will be launched in 1974. Thirty are planned at a cost of \$83.4 million per ship.

Vice Adm. Hyman Rickover, father of the atomic submarine and this country's leading authority on undersea craft, explains the magnitude of the Russian threat in this way:

"The Soviets in the last two years have introduced more new submarine designs than have ever been put to sea in all of naval history during a comparable period. They continue to strive for improvement in sub design."

One design the Russians are now

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**... the destroyer will carry ... two torpedo-armed helicopters.**

---

testing is a ballistic missile with a 3000-mile range that is fired from a submarine that they call, ironically, the Yankee class. This represents a big step-up in power from the 50 or so subs the Russians now have that can hit targets 1300 miles away with ballistic missiles. From the Gulf of Mexico, these subs could blast Chicago, Detroit, New York and other targets with nuclear missiles. It's estimated that the Soviets also have about 300 nonnuclear subs. In a conventional war, they would be used to sink our ships—with torpedoes and ship-to-ship missiles—and deny us use of the seas.

Ship-to-ship missiles are referred to by Navy men as antiship cruise missiles. One type, the Russian Styx, has a 22-mile range, greater than that of many guns carried by our warships.

The Israeli navy can vouch for the effectiveness of the Styx. On the night of Oct. 21, 1967, the Israeli destroyer *Elath* was patrolling off Port Said at the mouth of the Suez Canal when

three Styx missiles fired from the Egyptian destroyer *Osa* blew her out of the water.

How the DD-963 will actually detect, track and destroy missile-firing enemy subs is obviously a secret. It's known, however, that a major weapons system the destroyer will carry is comprised of two torpedo-armed helicopters. They extend the ship's antisubmarine warfare (ASW) arm by hundreds of miles.

The use of helicopters is in line with a new Navy program called LAMPS—Light Airborne MultiPurpose System. It calls for putting helicopters on 100 or more destroyers for ASW missions.

The new destroyer will also be armed with rocket-assisted ASW torpedoes and, scuttlebutt has it, with nuclear depth charges. And, it will house the latest electronic warfare equipment.

Navy officials wince when you mention electronic warfare—it's that secret. So we have no way of knowing exactly what the DD-963 will carry. However, there undoubtedly will be equipment on board to jam guidance systems of enemy missiles and torpedoes.

No doubt, if a black box is ever developed that will cause an incoming missile or torpedo to turn around and head back to its launcher, the DD-963 will be able to accommodate it. In planning the DD-963, allowances have been made for weapons and systems that may be developed 10 years from now.

The new destroyer will be equipped with Sparrow air defense missiles and two five-inch guns. Although the primary mission will be ASW, it may be asked to carry out normal gunfire missions in support of amphibious assaults and certain land operations.

According to R. H. DuBois of Litton Industries, the company building the new destroyers, "The DD-963 will be the quietest surface warship in the Navy, which will give it a great tactical advantage during ASW missions." (DuBois is the Litton vice-president in charge of the program.)

The destroyer's silence is due mainly to its gas-turbine powerplant, which



## HOW DD-963 STACKS UP AGAINST A WORLD WAR II DESTROYER

	USS <i>Allen M. Sumner</i>	DD-963
Commission Date:	1944	1974
Length:	376' 6"	559'
Beam:	40' 10"	54'
Speed:	35 knots	40 knots (estimated)
Displacement:	2200 tons	7000 tons
Crew:	350	250
Aircraft:	None	2 helicopters
Armament:	Six 5-inch guns; Ten 21-inch torpedo tubes	Rocket assisted torpedoes Nuclear depth charges Air-to-air missiles Two 5-inch guns <i>(Above information unofficial)</i>
Propulsion:	Two main steam turbines driving two shafts	Four gas turbines driving two shafts

purrs like a kitten compared to the big steam turbines of our present day destroyers. The *Spruance* will be the first U.S. warship to use gas turbines.

Gas turbines allow "all ahead flank" one minute after start-up from cold iron. This is a far cry from the couple of hours required by the steam jobs.

The gas turbine in the DD-963—there will be four—is the General Electric LM 2500, a marine version of the jet engine that powers the giant Lockheed C-5 air transport. The four engines will produce 80,000 shp (shaft horsepower) and drive two screws.

The engines can be used together or independently. This capability, coupled with two reversible-pitch screws, adds to the destroyer's maneuverability. Reversible-pitch screws are also used because gas turbines, like jet engines, can't be put into reverse gear. Reverse thrust is used.

The gas turbines also will contribute to a cleaner environment by burning a distillate fuel instead of the Navy's standard fuel oil. The new fuel burns cleaner and doesn't coat boilers and fuel lines with sludge that has to be cleaned out and dumped overboard.

Like many other things aboard the DD-963, the LM 2500 turbine is designed with automation in mind. It is started, by pushbutton and controlled by a single power throttle. Only one helmsman is needed—not the usual two.

The *Spruance* will be equipped with automatic troubleshooting gear. For example, the combat control system will have self-testing computer hardware with indicators to pinpoint a malfunctioning module or circuit board. The ship will be made as maintenance-free as possible, with the use of the latest paints, plastics and space-age circuitry. Accordingly, it will require fewer men to run it than present destroyers—250 as compared to 350.

The destroyer will be produced at Litton's Ingalls West Shipyard in Pascagoula, Miss. It will be built in modular form, for which Japanese and Swedish shipyards are famous. Four large sections (modules)—fore, amidships, aft and superstructure—will be fabricated and joined at final assembly.

Structurally, the DD-963 compares to the light cruisers of World War II. The USS *Oakland*, for instance, commissioned in 1943, had a 6000-ton displacement. The DD-963's displacement will be about 7000 tons. Overall length of the *Oakland* was 541 feet with a beam of 52 feet 10 inches. The *Spruance* will be 559 feet long and have a beam of 54 feet. The *Oakland*, however, required a crew of over 600 men.

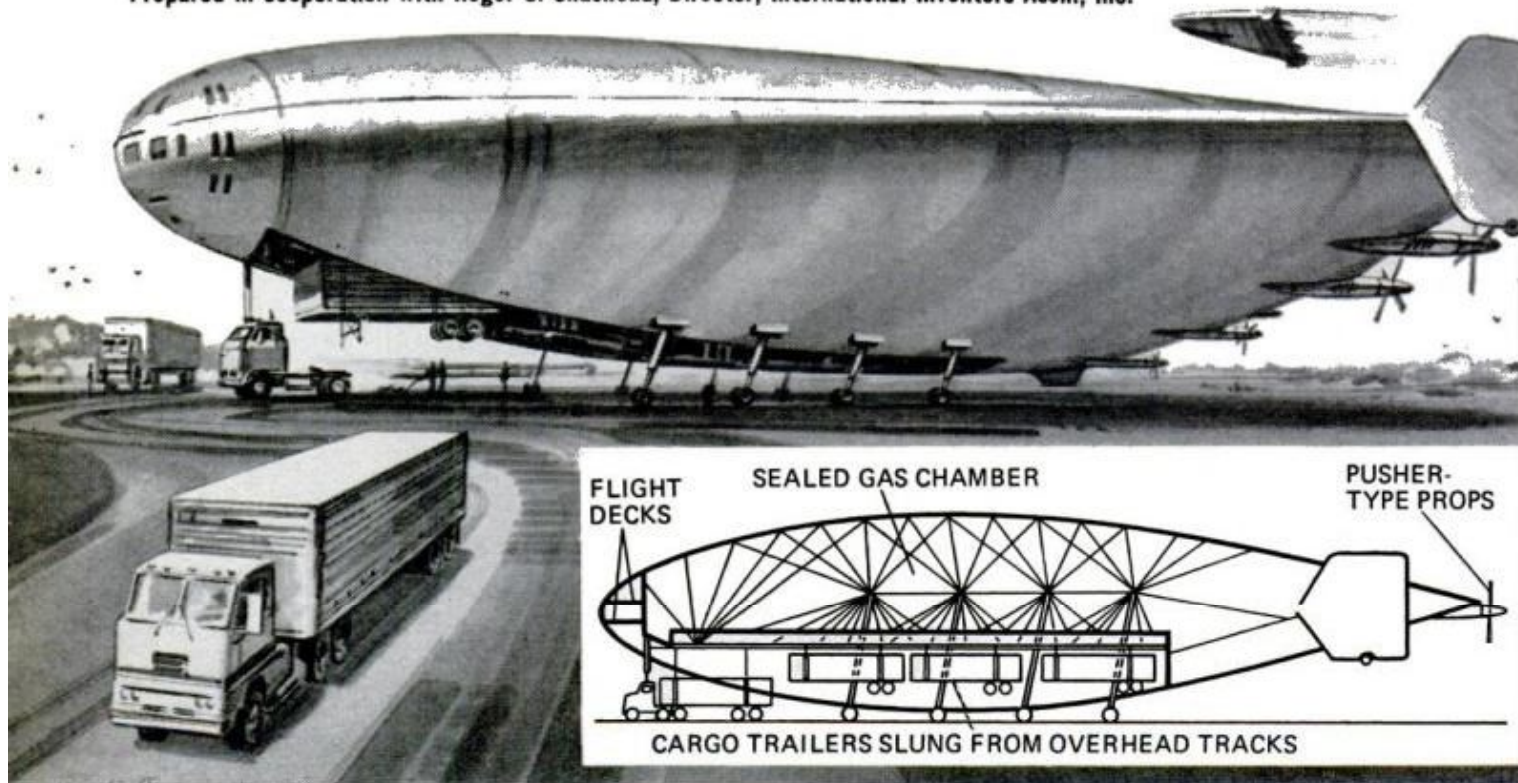
The DD-963 has a tough assignment: to counter Russia's nuclear sub threat of the future. Navy men think she will have the sensitive ears, high speed and big punch needed to do the job. ★★



# Just patented

## PM'S PICK OF THE NEW INVENTIONS

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

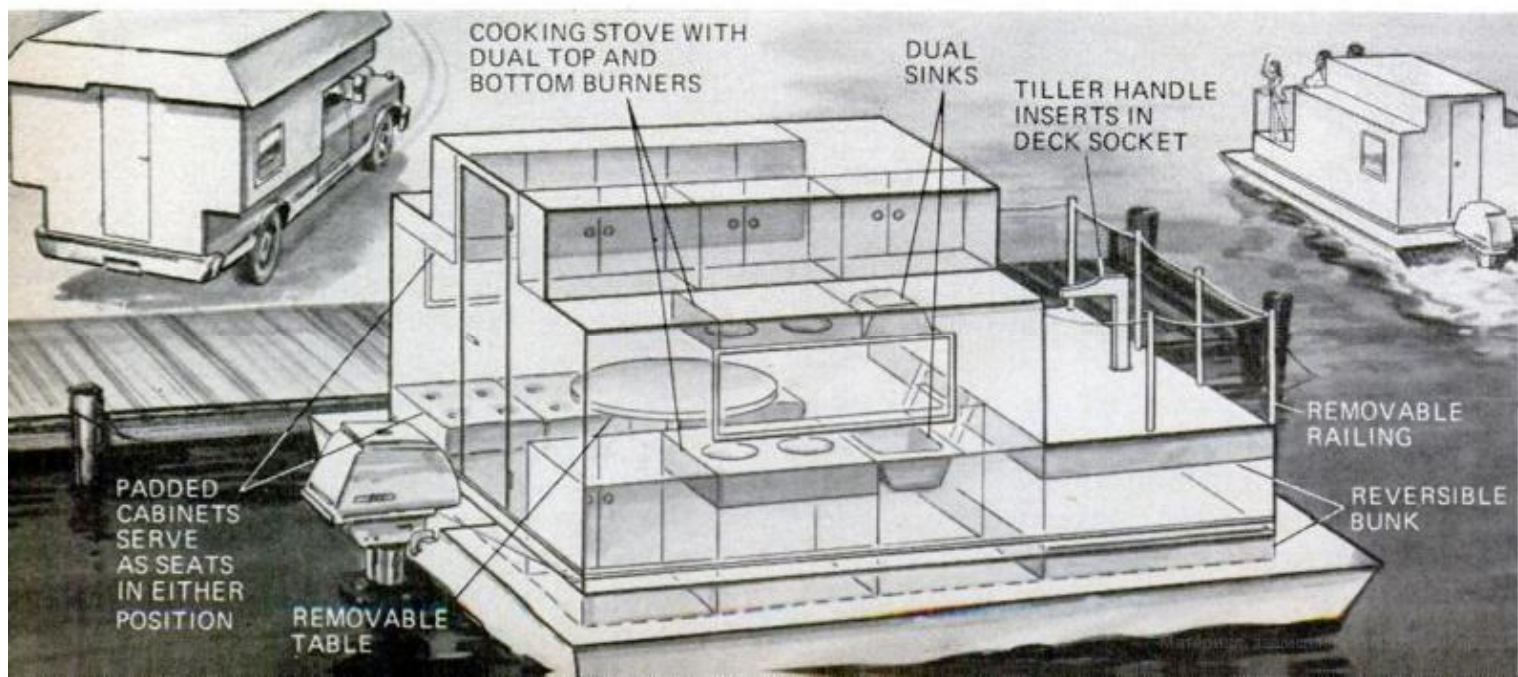


**1. HALF AIRPLANE, HALF DIRIGIBLE**, this monster hybrid is designed to combine the advantages of both. The rigid, wing-shaped fuselage has the speed of an airplane, but gets added lift from a gas-filled chamber, enabling it to carry many times more cargo weight. Huge cargo trailers are backed under

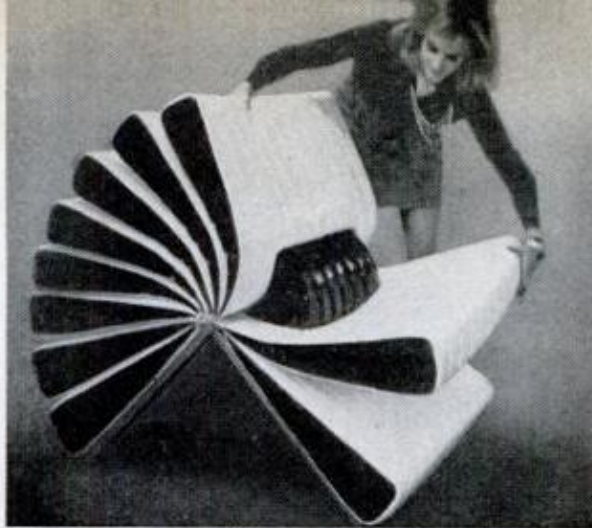
the loading doors and hoisted by cranes onto overhead tracks for fast transportation to distant points. At the landing site, tractor units pick up the trailers for delivery to local destinations, thus saving long hours of road travel. The giant ship is powered by pusher props along the trailing edge

**2. JUST FLIP IT OVER** and this two-way pickup camper becomes a small outboard-powered houseboat so you can enjoy vacation travels on either land or water. The camper's slope-sided roof doubles as a shallow hull when the structure is inverted. Inside, duplicate rows of built-ins serve as overhead

cupboards or seats and bunks, depending on which is on top. Twin sink and cooking facilities can be used in either position, and a removable table fits into a socket in the floor or roof. Hydraulic jacks are used to tip the camper body out of the pickup, like a dump truck, for launching in water

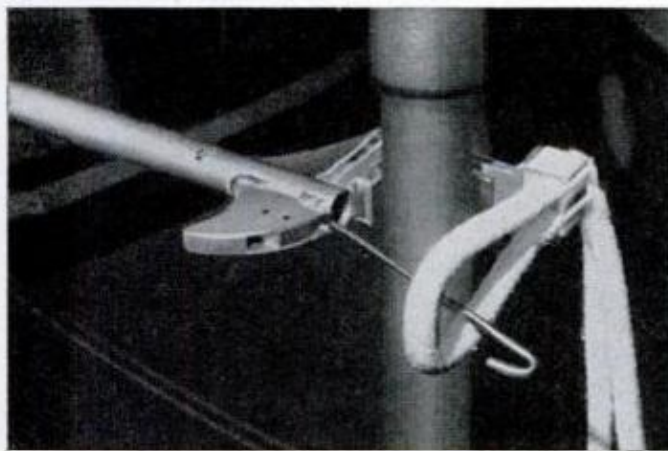




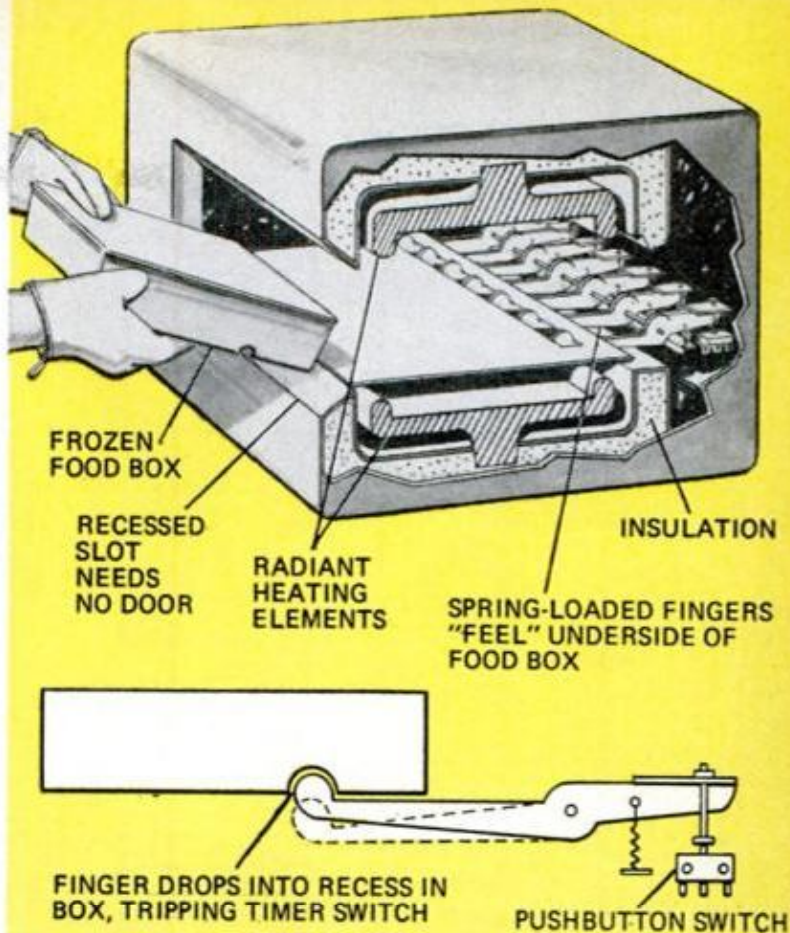


**3. IT LOOKS LIKE A GIANT BOOK**, but it's really a chair. Turning its "pages" lets you adjust its height and angle of tilt to convert it from a straight-back seat to a reclining lounge—or anywhere in between. The wedgelike plastic segments are loosely attached to a metal frame so they can be flipped over one at a time to vary the seat's shape. To reverse its direction, you merely flop it over without turning it

**5. HOW DO YOU ATTACH A ROPE** to a post when you can't reach the post? This ingenious boat hook does the job for you. As you near the dock, you slip the end around the post. The end holds a loop of rope in a spring clip. You then extend a wire

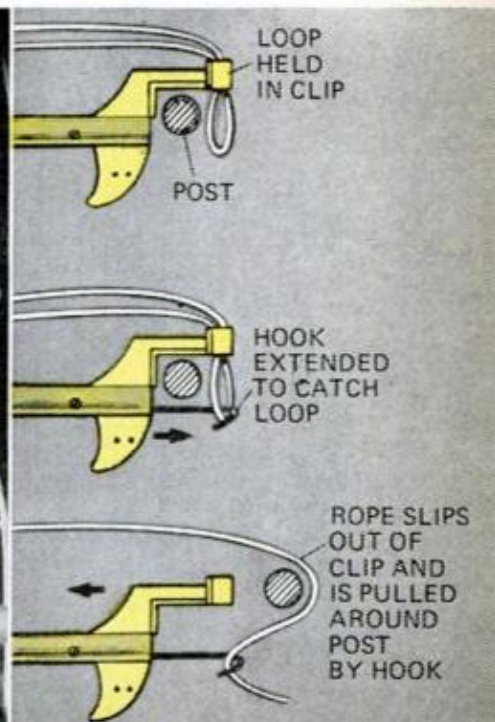


Inventors of the items shown on these pages are as follows: 1. John R. Fitzpatrick, Levittown, Pa. and Juergen K. Bock, Toms River, N. J. (No. 3,486,719); 2. Gerald R. Platt, 5909 Emigration Canyon, Salt Lake City, Utah (No. 3,522,967); 3. Pierre Cardin; 4. Pierre Tanguy, Pierre Carre and Jean Le Boulbouech, 2 Rue Bodelio, Lorient, France; 5. Rudic Products, Ltd., Moorside Rd., Winnall, Winchester, Hampshire, England. The International Inventors Assn., Inc., is located at 680 Fifth Ave., New York, N. Y. 10019.

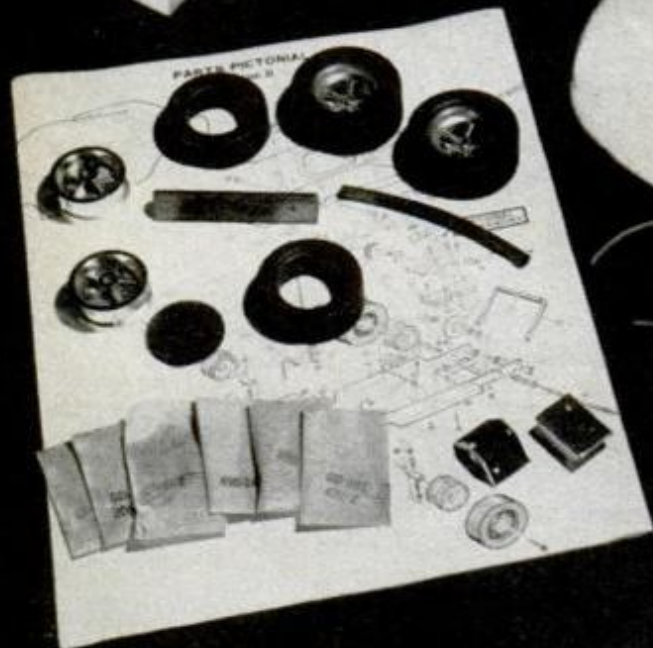


**4. AUTOMATIC COOKING** is the object of this clever self-regulating electronic oven. It's designed to take frozen foods packed in specially coded containers. Each package has a series of small recesses in the bottom arranged in a coded pattern according to the type of food it contains. Spring-loaded feeler switches inside the oven are triggered by the coded recesses, setting up a circuit that automatically determines the correct cooking time and temperature for the food

hook, as shown in the photo at left, below, snaring the loop on the opposite side of the post. As you withdraw the tool, the loop slips out of the spring clip, as in the drawing at right, and the free end is pulled back to the boat, snugly anchored around the post







# Small-Scale Car, Big-Scale Thrills

Heath's gleaming new radio-controlled model racer hits 200 mph in scale speed and handles with all the excitement of its big brothers. You can build it from a kit

By SHELDON M. GALLAGER

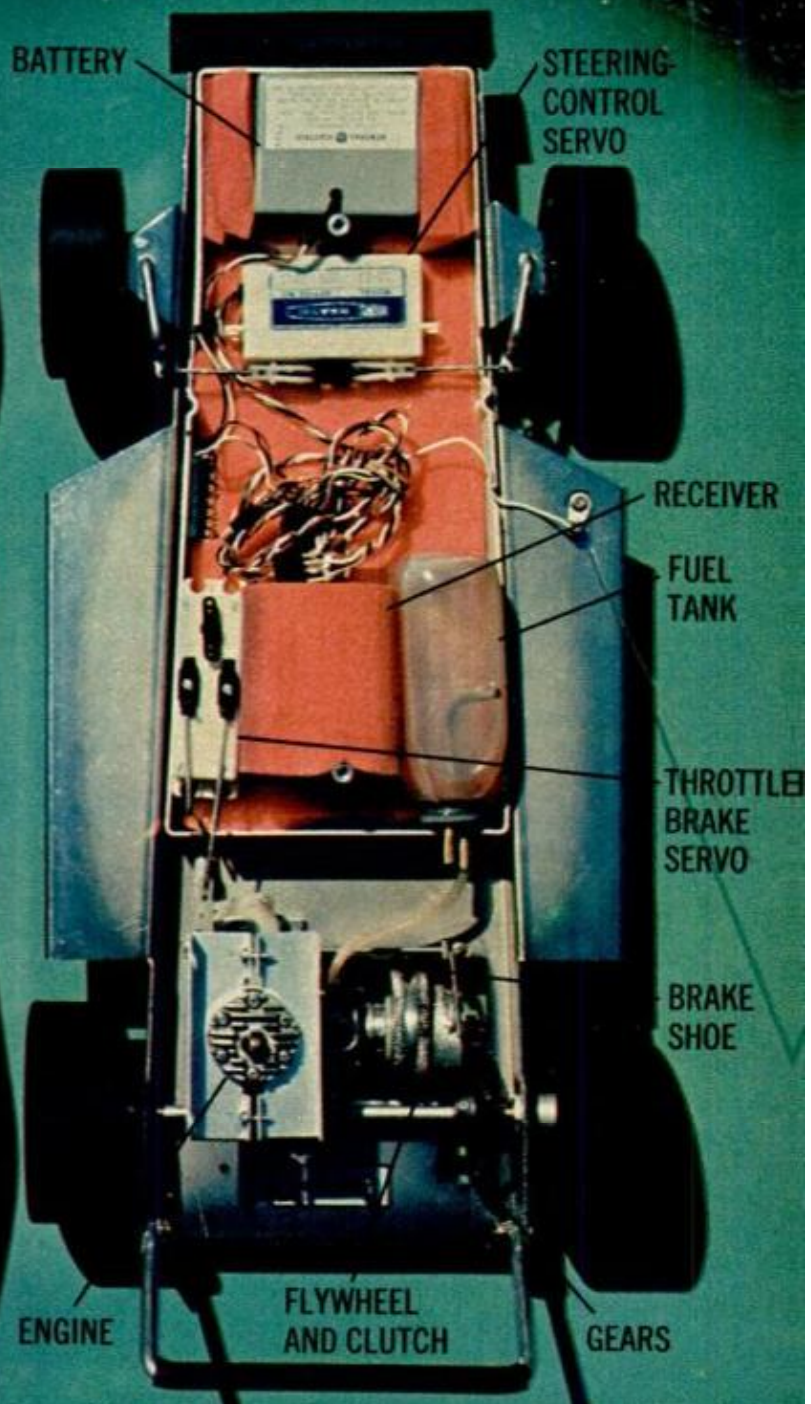
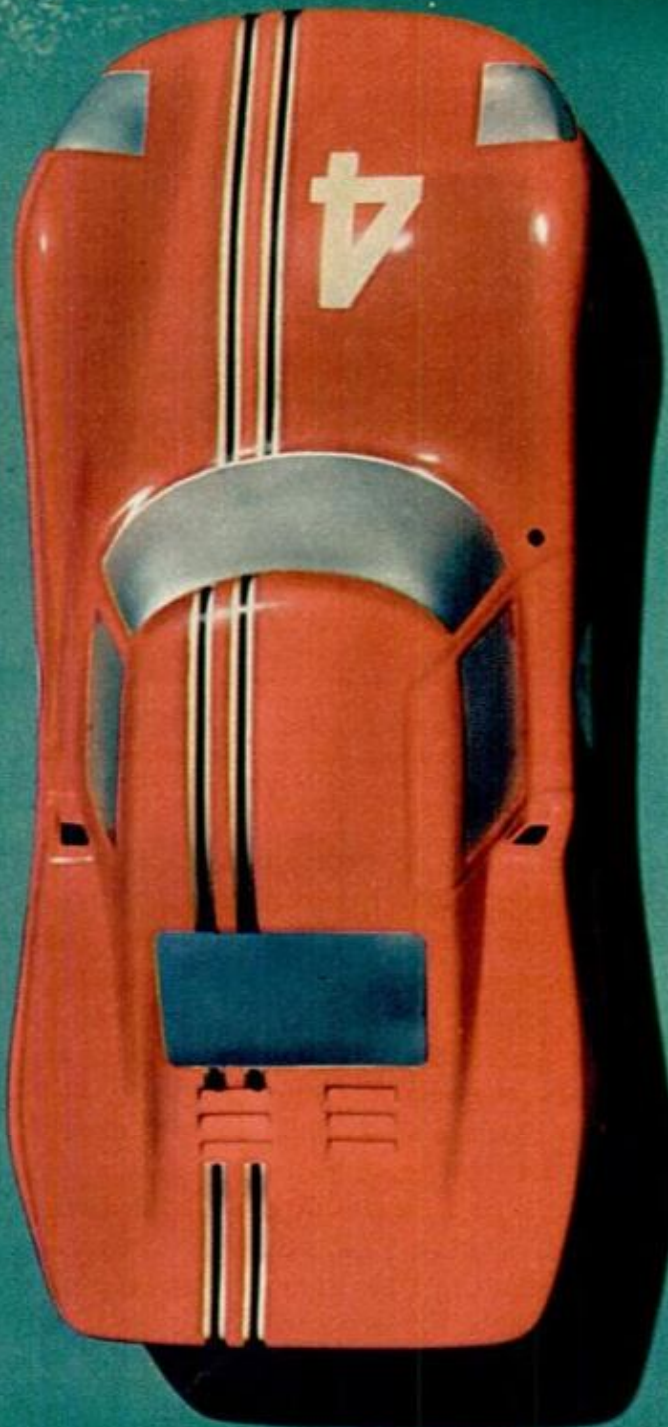


**TRANSMITTER** has two joy sticks, one operating crosswise to control steering and other up and down for throttle and brake. Telescoping antenna pulls out from top

**T**WENTY-FIVE MILES AN HOUR may not sound very fast, but when it's a 20-inch-long model racing car roaring along, that's a scale speed of 200 mph! Operating two miniature control sticks, you deftly guide the screaming car through harrowing S-turns, pull it out of near-disastrous slides and slam it down straightaways just as if you were actually behind the wheel of a full-size Grand Prix racer.

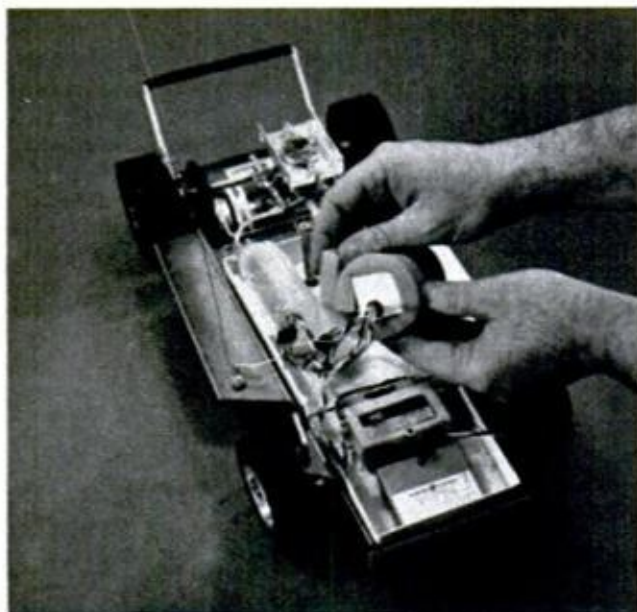
This is the kind of fun you and the kids can have with Heath's sporty new speedster, the company's first R/C model car kit. Called the Spectre, the car is powered by a .19 model-airplane gasoline engine and really does hit true speeds of up to 25 mph—fast for models of this type. It's controlled remotely through a tiny radio receiver hidden under the hood. Two joy sticks on the transmitter give you control of steering, accelerating



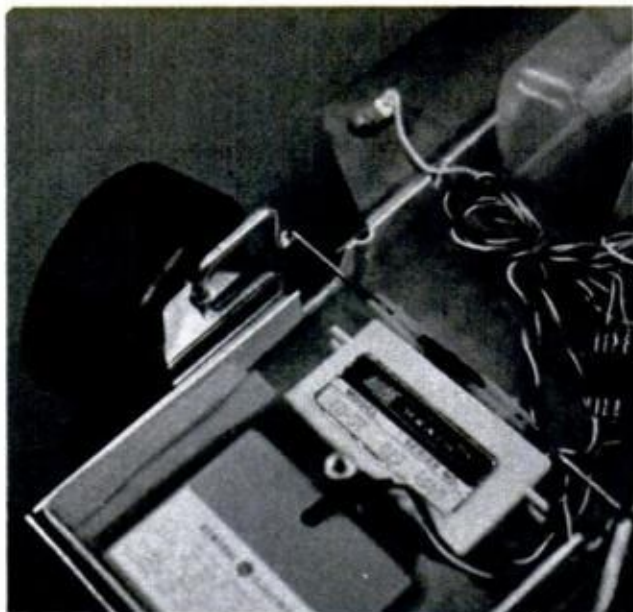


Photograph by Fred L. Wolff

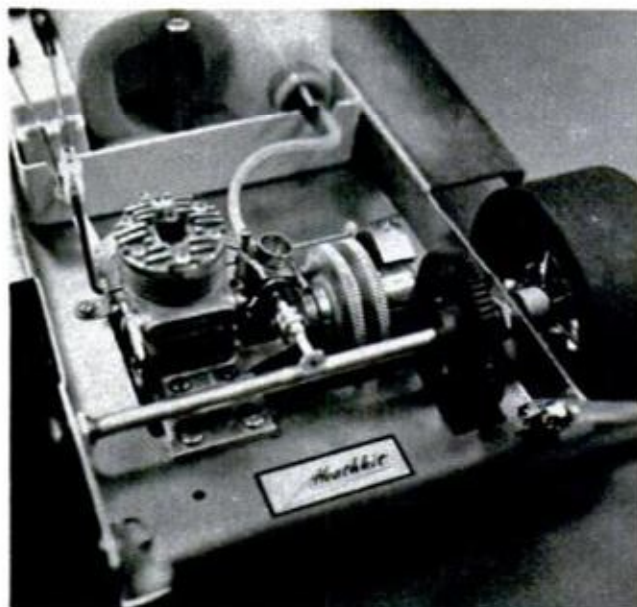




**DELICATE PARTS** are wrapped in foam padding to cushion them from road shocks. Receiver, fuel tank and throttle/brake servo go in center of the chassis



**RACER'S NOSE** houses battery and steering servo. The servo is linked to control arms on the wheels so that the wheels turn as it moves from side to side



**MOUNTED SIDEWAYS**, tiny power train runs from engine at left through flywheel and clutch to gears at right. Brake shoe bears against clutch housing



**PLASTIC BODY** quickly snaps on and off chassis with no other fastening. This enables you to get inside easily to start the engine and make adjustments

and braking. You can head into a turn at full throttle, then "back down" fast by hitting the brakes just as real racers do. Controlled slides are possible through nimble handling, and occasionally you go into a spinout that's as spectacular as any you see on big tracks.

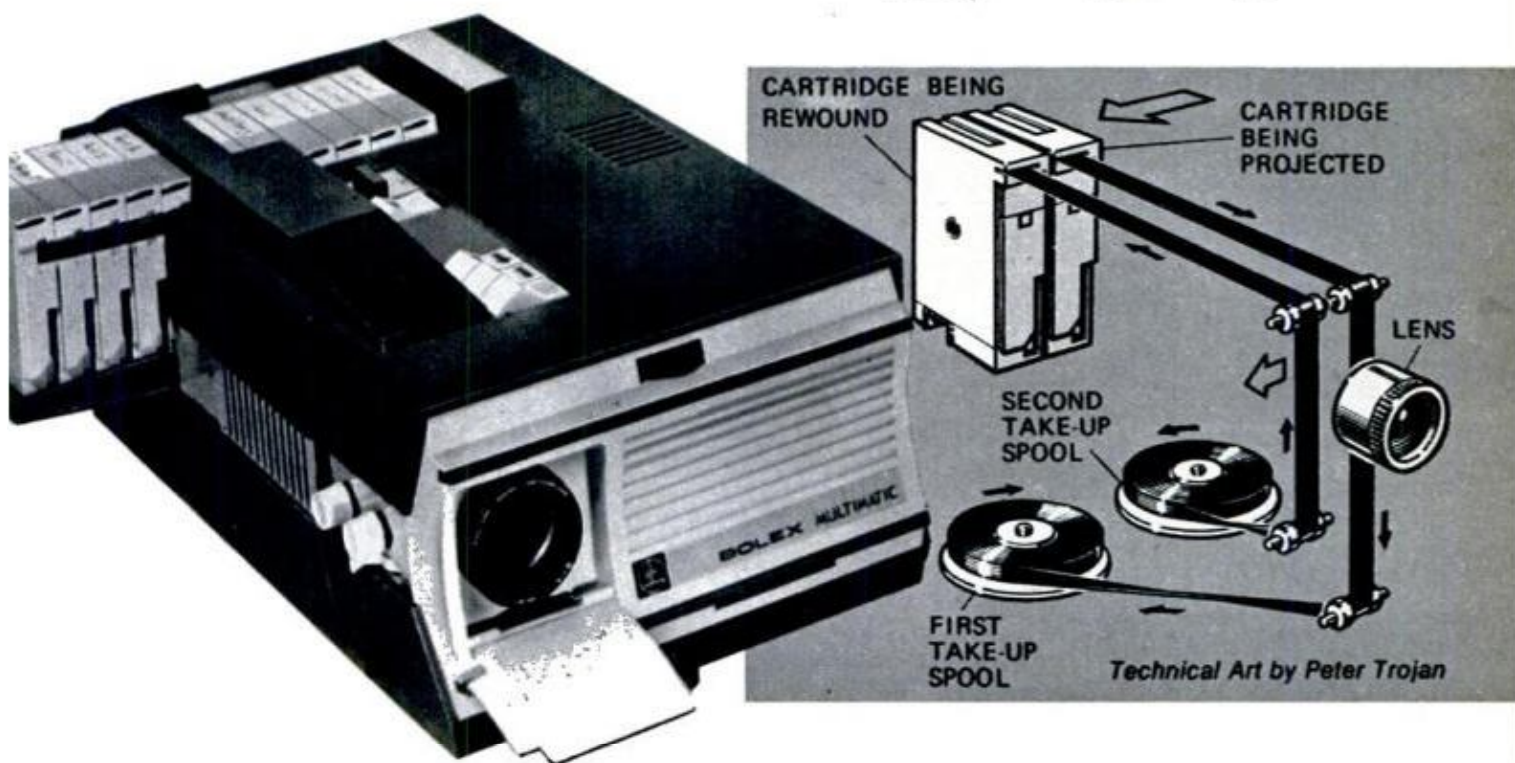
The model is built to a 1/8th scale with a wheelbase of 12 inches and an overall length of nearly 20. Fat rubber tires and a wide track of over 7 inches give it good stability at high speeds. The detailing is so fine you can actually adjust the caster and toe-in on the front wheels

for maximum performance. A gear reduction of 5.5 to 1 provides good torque. Two servomechanisms operate the steering and throttle/brake linkages.

By itself, the Model GD-101 car kit sells for \$49.95. The engine is \$19.95 and comes assembled. The Model GD-57 radio control is \$129.95 in kit form. It includes the transmitter, receiver, two servos and rechargeable batteries. While only two channels are required for operating the racer, a third channel is available for other model-control applications. ★★★

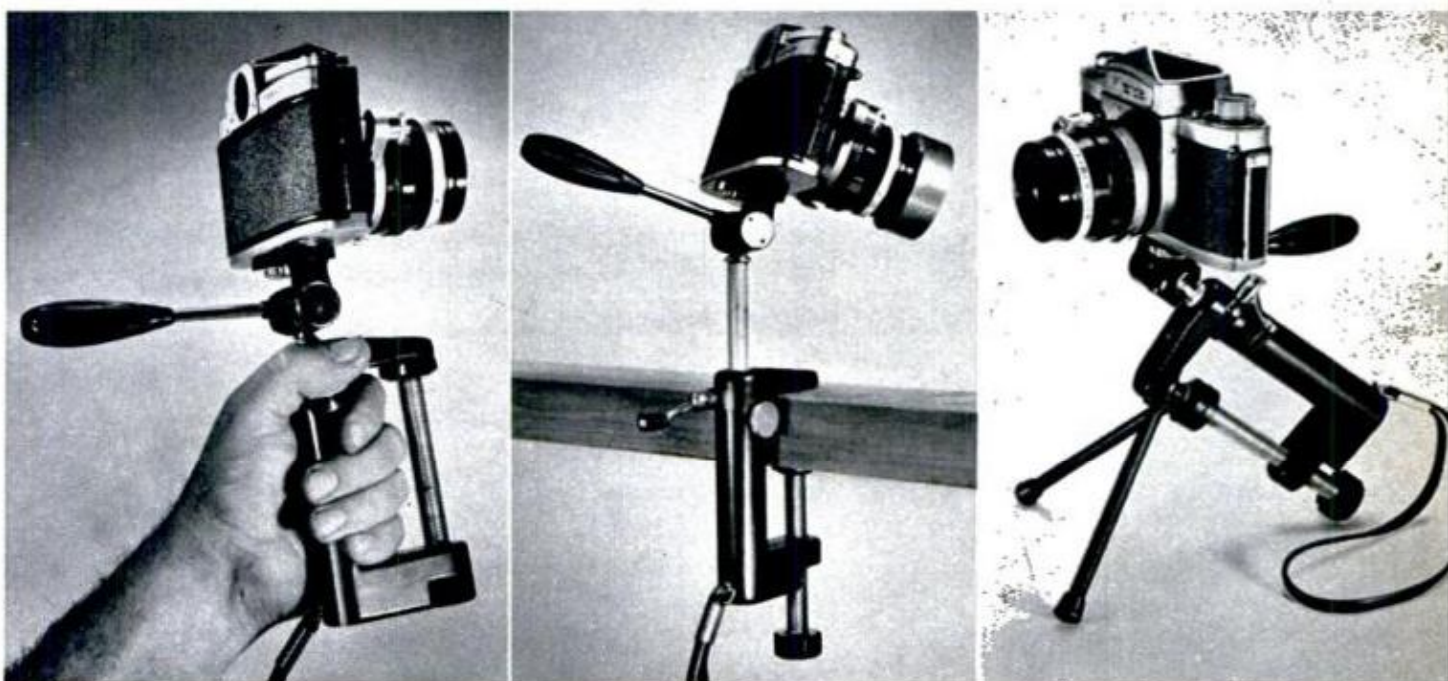


# New in Photography



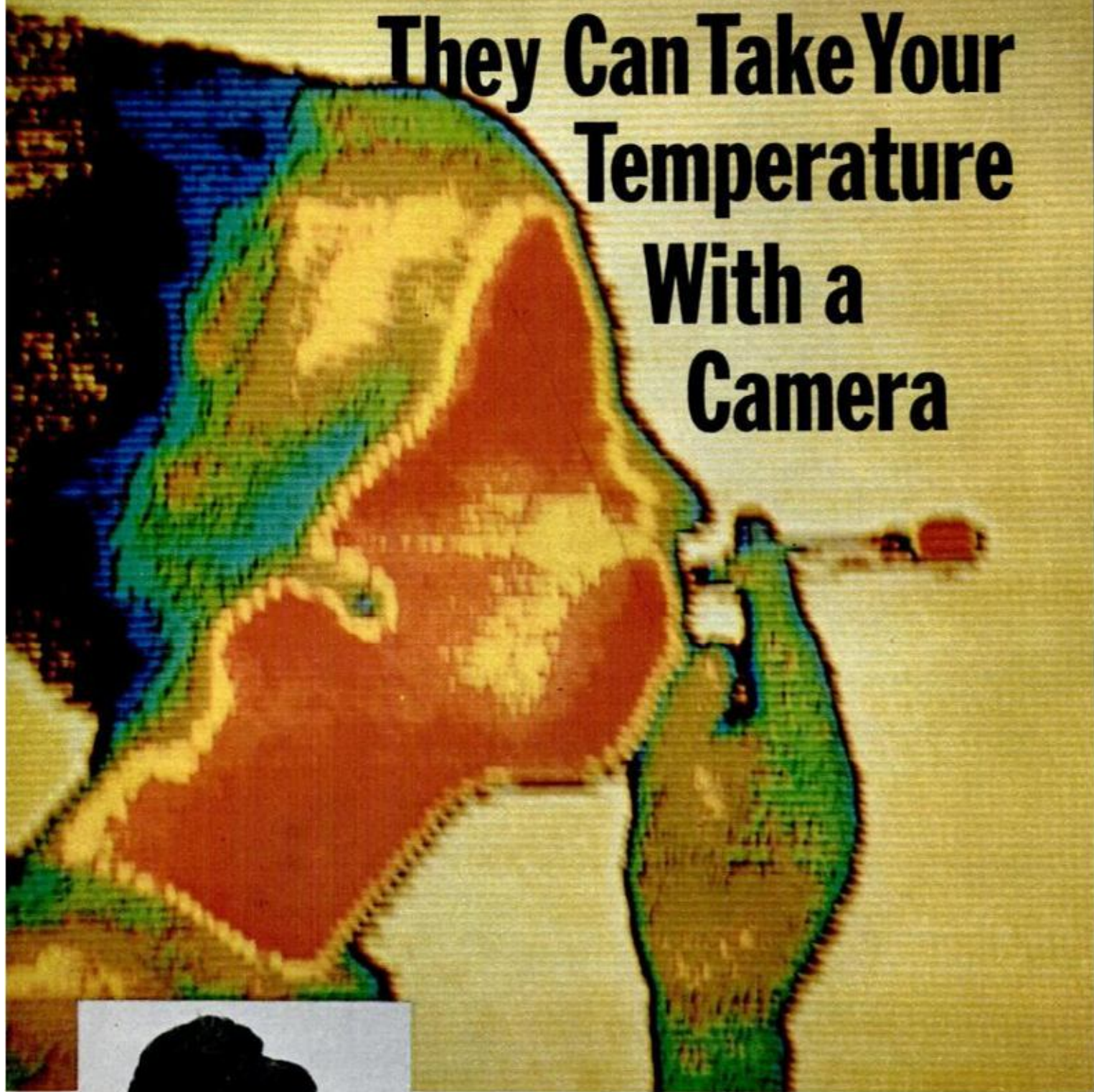
**FIRST CARTRIDGE-CHANGING MOVIE PROJECTOR** is this ingenious Bolex Multimatic. You load in up to six cartridges of Super-8 film and they're projected one after another just like a record changer. Each cartridge is automatically rewound as the next one is being shown so your viewing is uninterrupted through the whole stack. This is made possible through the use of separate take-up reels, as shown in the drawing. Plastic cartridges take standard 50-foot reels of film. Price not yet announced. Paillard, Inc., 1900 Lower Rd., Linden, N. J.

**IT'S A CAMERA GRIP, CLAMP, TRIPOD**—it's all these things in one. The versatile photo aid will serve as a camera grip for steadier hand-held shots. It will clamp a camera to any handy support, such as a table, post or fence railing. Its miniature pan-and-tilt head can be raised and lowered on a geared elevator column for precise adjustment of camera level. Clamped to accessory legs, it becomes a shorty tripod for tabletop photography. The Miida Tri-Clamp is sold by Ace Photographic Supply Corp., 132 Ipswich St., Boston, Mass. Price is \$22.50.





# They Can Take Your Temperature With a Camera



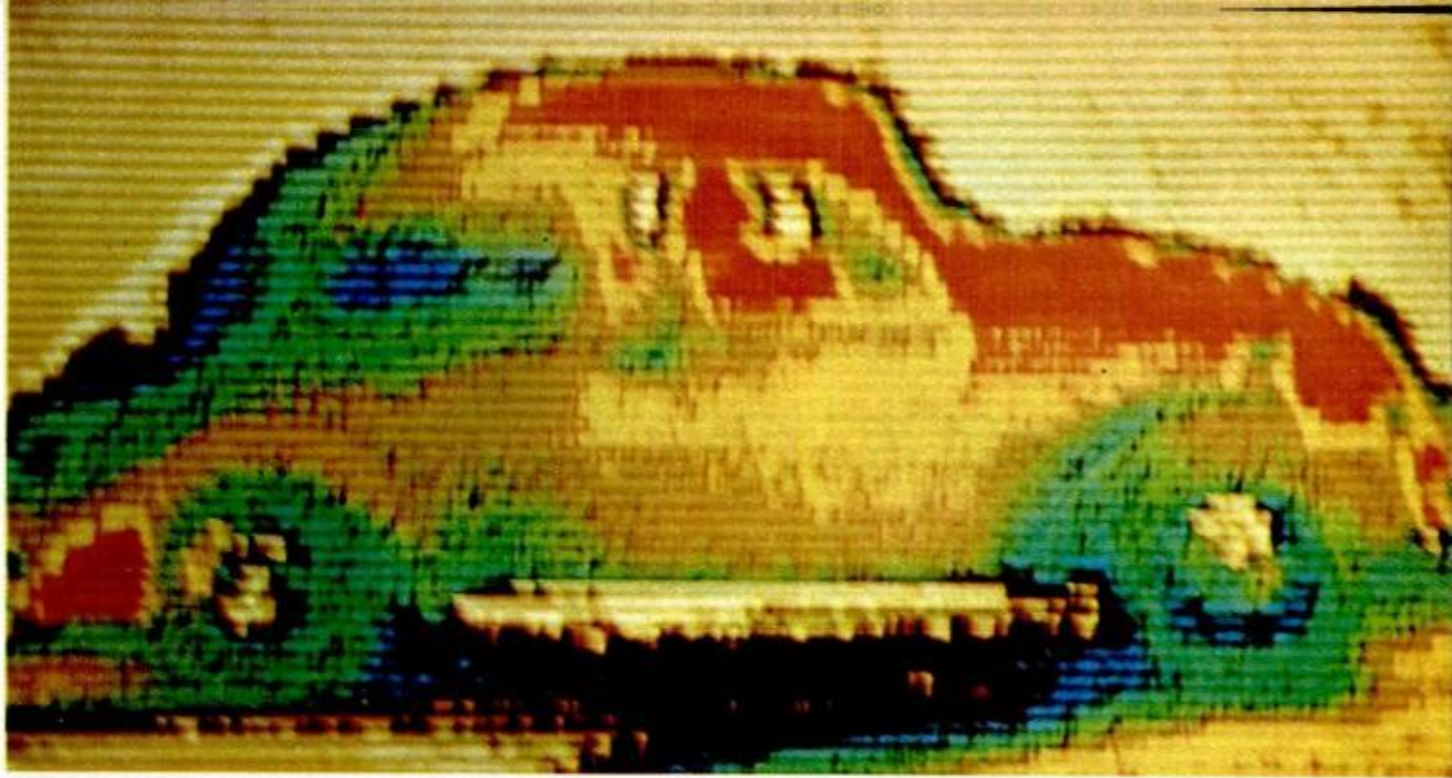
**PORTRAIT OF A LADY** smoking a cigaret. Color photo at top of page, made with infrared camera, shows hottest regions around cheeks, neck and forehead. Next hottest are the yellow and brownish areas. Coolest spots are indicated by the blue and green patches. Note red at burning tip of cigaret

Thermograms made with an infrared camera show temperatures in colors, making it possible to spot failures in equipment before something blows up or breaks down.

By **SHELDON M. GALLAGER**

**S**MUGGLERS TRYING TO CONCEAL illegal cargo inside huge tank trucks were sure nothing would be detected when police stopped them and merely photographed their rigs. To their surprise, the hidden goods clearly showed up on special film called a thermogram. As authorities



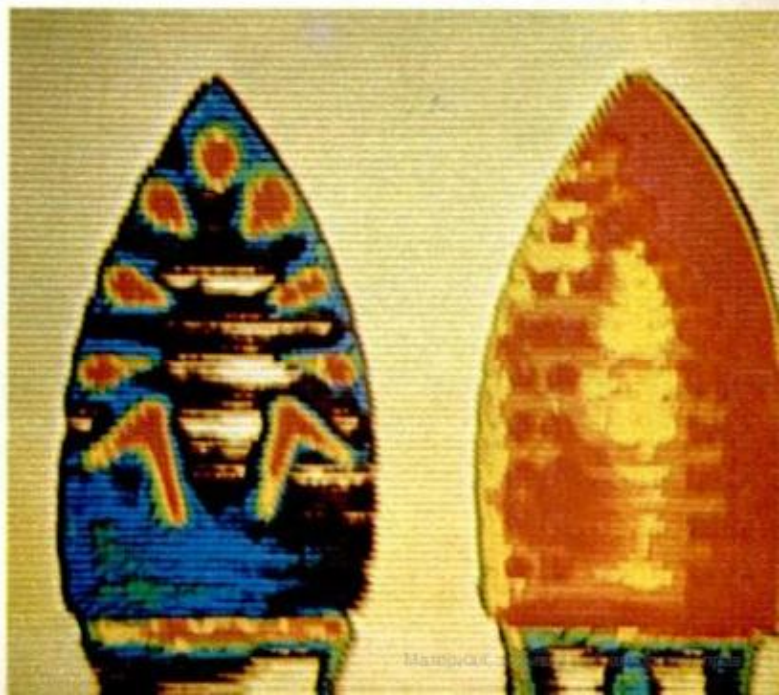
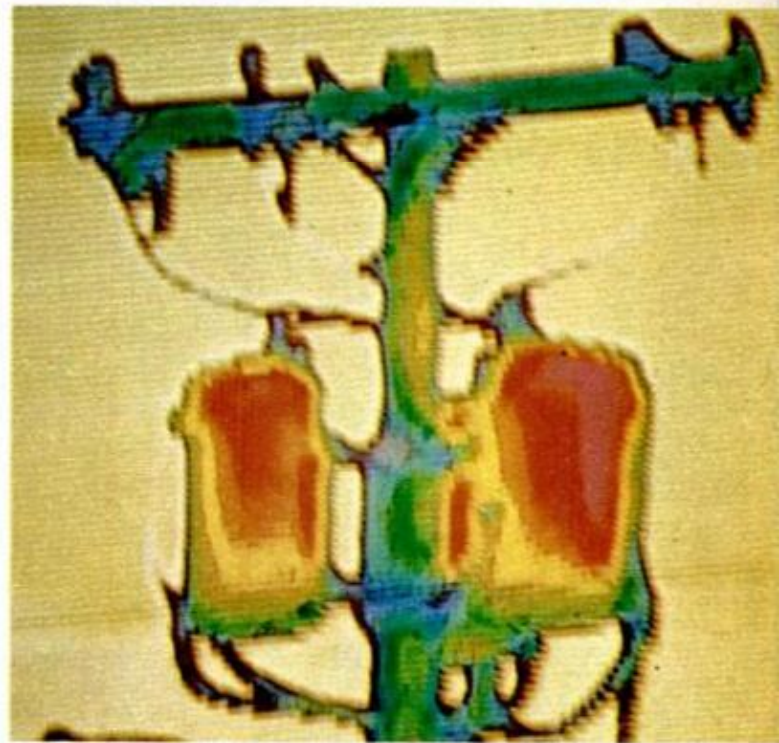


**THERMOGRAPHIC PROFILES** of common objects reveal interesting heat patterns. Telltale spot of red at rear of Volkswagen above is from car's engine and exhaust manifold. Red areas around hood and roof are radiant heat from sun. In photo of pole transformers at center right, blotchy red and yellow areas indicate uneven cooling—a possible design fault that could lead to premature failure. Two steam irons at lower right are set for identical temperatures, but one on right is much hotter and heat pattern is not uniform. Such evidence helps manufacturers to design more efficient equipment

suspected, liquid contents of the trucks remained cool, even in daytime heat, but the secret compartments warmed up and stood out as a different color.

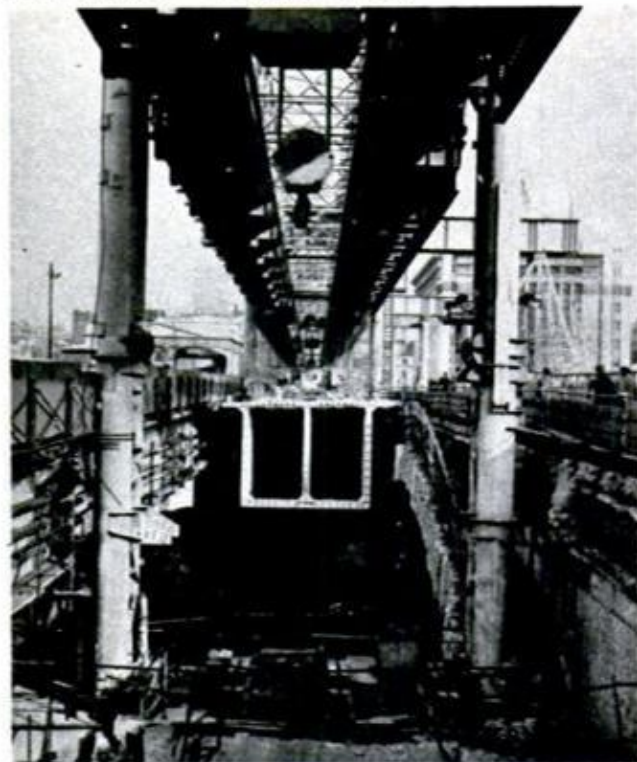
Thermograms are "heat maps" made by a camera sensitive to infrared radiation. All substances give off some infrared and the hotter they are, the higher the intensity of radiation. The camera scans the subject and converts the various levels of intensity into different colors ranging from deep red for the hottest areas to dark blue for the coolest. Technicians studying thermograms can spot equipment failures before they happen—an overheating bearing in a generating turbine, hot spots in boiler walls, a resistor about to burn out in an electronic circuit.

In the same way, they can test the efficiency of thermal insulation or airplane de-icing equipment. The thermograms shown here were made with equipment designed by Barnes Engineering Co. of Stamford, Conn. ★★





## NEWS BRIEFS



### London Bridge is going up

Taken during the final week that traffic was crossing the 140-year-old London Bridge, this photograph shows its new replacement to the left and part of the old bridge at the right. In the center is one of 356 box units of the new bridge that have been precast nearby. When completed in 1972, the \$10-million bridge will carry six lanes of traffic. Builders reported that hundreds of medieval curiosities were recovered during dredging.



### What's this all about?

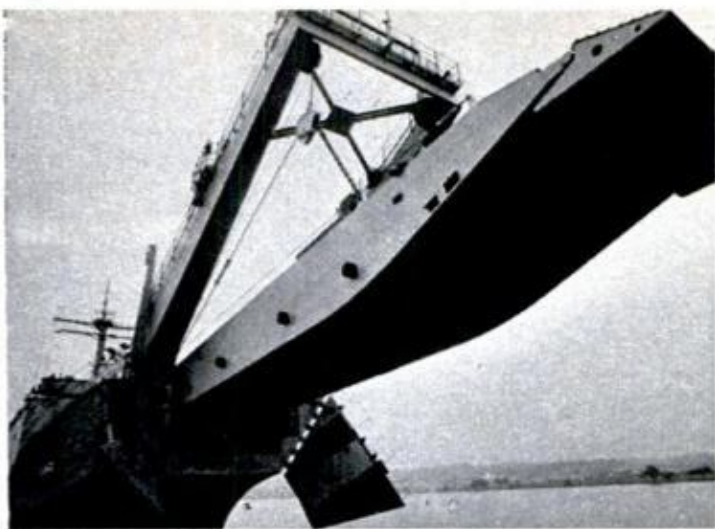
Looking a bit skeptical about the whole thing, a youngster at Cincinnati General Hospital models a new plastic bag developed for the maternity ward. Newborns are placed in the bag to prevent chilling after birth, cause of death to some infants. Called the "Life-saver," the transparent bag was developed by a team of pediatricians and an electrical engineer at the University of Cincinnati Medical Center.



### No falling now

When Jim Fox of Sarasota, Fla., noticed that many novice bicyclers were too afraid of falling to rent bikes from his rental concession, he devised a side-by-side arrangement that won't tip, is pedaled by two and steered by one rider. It's so popular he's marketing a do-it-yourself conversion kit.





## Big gangplank for new LST

Distinguished by a rectangular catwalk extending from the bow (left), the Navy LST *Newport* lands troops and vehicles (430 men plus 2000 tons) from a huge ramp that rolls out of the bow (above) like a huge tongue. Top speed is 20 knots.



## Lady on the cleanup crew

The only woman driver on the London street-cleaning crew is a 50-year-old grandmother, Mrs. Cynthia Pipkin, who has been put in charge of one of the city's newest pieces of street-cleaning equipment. Mrs. Pipkin, who took special training in order to qualify to drive the "monster vacuum cleaner," pilots it along the streets of North London. She reports that males in the department are proud of her, rather than resentful.

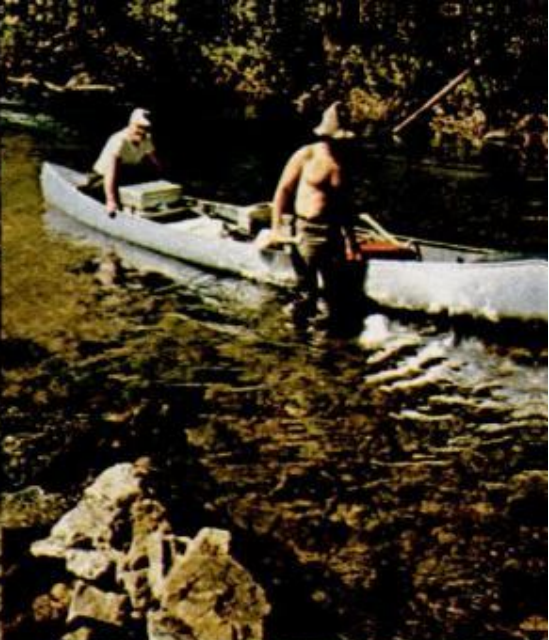
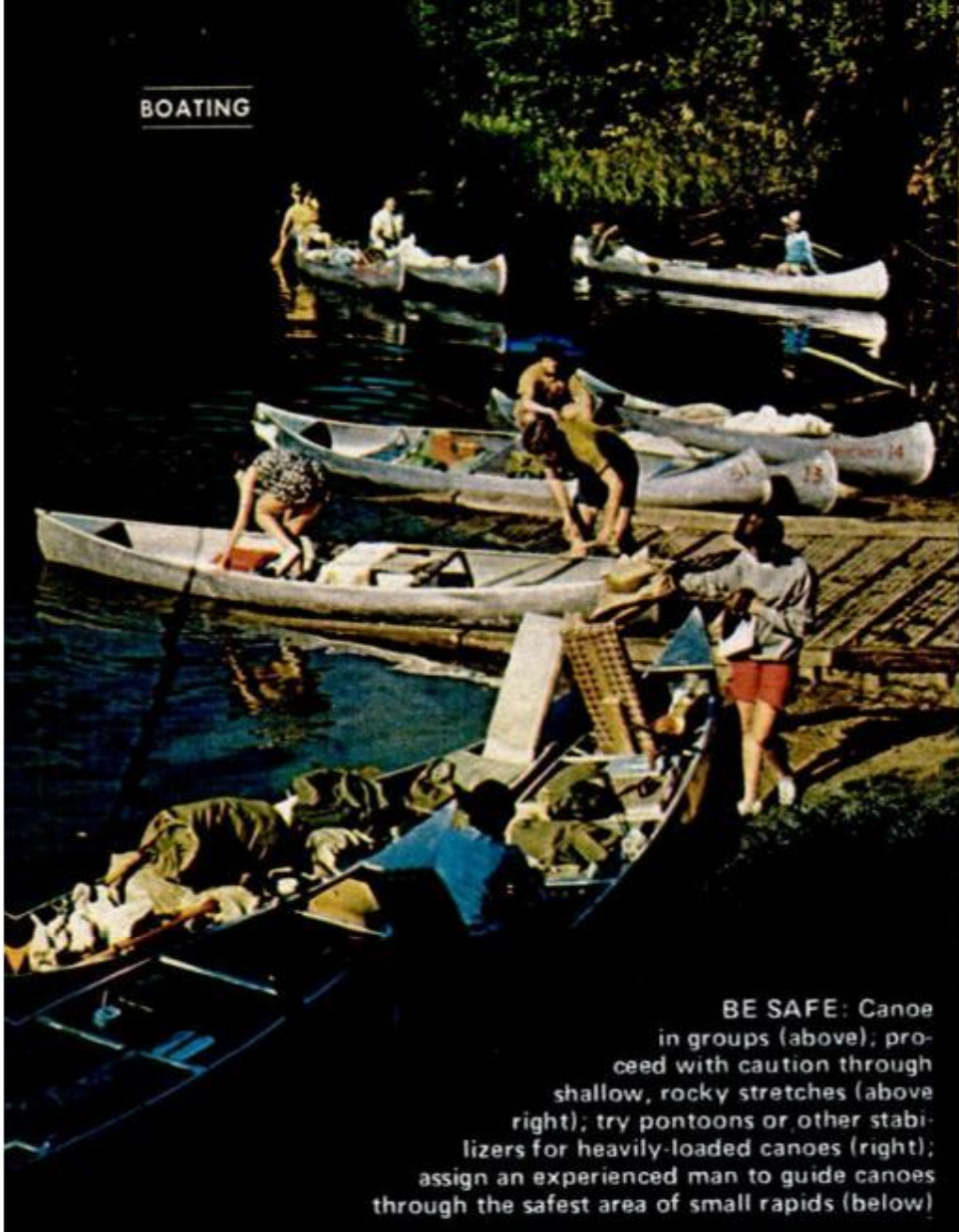


## Speed-up in dugouts

Some dugout canoe builders in Central America have taken a big step in technology. They're still building the same dugouts, but nowadays they're using modern chain saws to do the digging out. They carry the saws into the jungle so they can rough out the outside and inside of the canoe; this makes the log much lighter for carrying back to their shop in the village. This boat-building team is from Mango Creek in the British Honduras.



**BOATING**



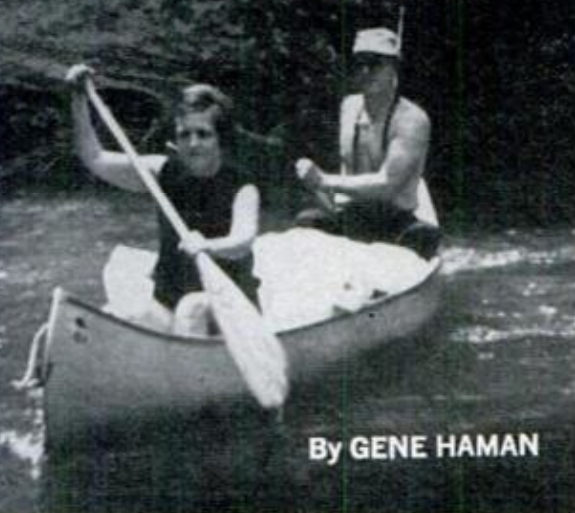
**BE SAFE:** Canoe in groups (above); proceed with caution through shallow, rocky stretches (above right); try pontoons or other stabilizers for heavily-loaded canoes (right); assign an experienced man to guide canoes through the safest area of small rapids (below)





# BACK-YARD FLOAT TRIP

You don't have to go to the Ozarks for a memorable float trip. Chances are you're within 100 miles of outstanding water overlooked by even the people who live on it.



By GENE HAMAN

**WHAT MAKES** a floatable stream? Almost any river deep enough to float a canoe, flat-bottom boat, jonboat, inflatable boat or kayak, and with enough current to move the craft. The river doesn't need to be famous nor in deep wilderness.

Decide first what you want: a quiet, easy one-day trip, a weekend trip with one night of camping, a dash through white water and rapids, a week's vacation and fishing, or a wilderness vacation with gear supplied by an outfitter.

● *How much do you want to spend?* Float trips can be relatively inexpensive, particularly if you own a canoe and adequate camping gear. My wife and I and another couple last summer spent 2½ days on a river about 150 miles from home for \$20 in all.

If you don't own a craft, try to bor-



**WHEN CASTING FROM A CANOE**, it's best to have bow man fish while the stern man controls the boat



**BIG FLAT-BOTTOMED HULLS** are ideal for carrying lots of cargo and passengers, but are unwieldy



**THIS COUPLE SOLVED** their cramped quarters and weight problems by paddling canoe and towing raft

row one. You'll find few places to rent a boat unless you're near a famous float stream. Later, after you're familiar with floating, you'll know better what you need and what's available. Canoes cost from \$140 to \$400. Paddles, cushions, life jackets can add another \$20 to \$50.

If you plan to float little streams with plenty of fallen trees and sharp twists and turns, 10 to 15-foot boats are ideal, but their small carrying capacity and lack of room are long-trip nuisances.

On all other streams, 15 to 18-foot boats are advisable. Many Ozark outfitters use 20-foot jonboats for up to five men and their gear. Inflatable craft are stable, store in a car trunk, but are sluggish on water. Kayaks are fine for one-day trips, but storage is limited.

Canoe paddles are your best all-around propulsion. Oars on flat-bottom





**AS YOU APPROACH ROUGH WATER**, stop all boats safely upstream and scout rapids below from bank side. Then assign somebody in your group to stand guard by the safest chute while everyone else floats through

boats are fine, but a good long paddle will give you as much or more leverage, store out of the way easily, and can be used from any position in the craft.

Paddles cost \$3 to \$8. The correct length should reach from ground level to just below your chin when you're standing. Be sure to take at least one extra paddle on all trips; two are better. If you plan to use your paddle as a push-pole, tack a metal strip onto the toe of the paddle, or buy paddles with it mounted. Rocky stream bottoms can chew up a paddle in a hurry.

Always take patching gear for the craft you're using. And be sure to have proper tools to make repairs.

Buy good life preservers, and have them easily available if you don't wear them all the time—children should always wear them. If you're floating a rough river, keep one on.

Collect maps and data about the stream you plan to float. Many conservation departments publish excellent guides to float waters in their states, but usually don't give mile-by-mile descriptions. For more detailed maps, get county or U.S. Geological Survey maps, or ask the state conservation offices for other sources.

● *Always play safe.* Take two craft, if possible. One may be punctured or overturn, and you'll need the second for emergency work. Small, two-man canoes are just that; don't overload them. If you're new to canoes, practice



**OVERNIGHT TRIP** may involve more gear than you realize; be sure to pack heaviest items in the middle



**CHOOSE HIGH GROUND** for a campsite and be sure to allow enough daylight to get properly set up

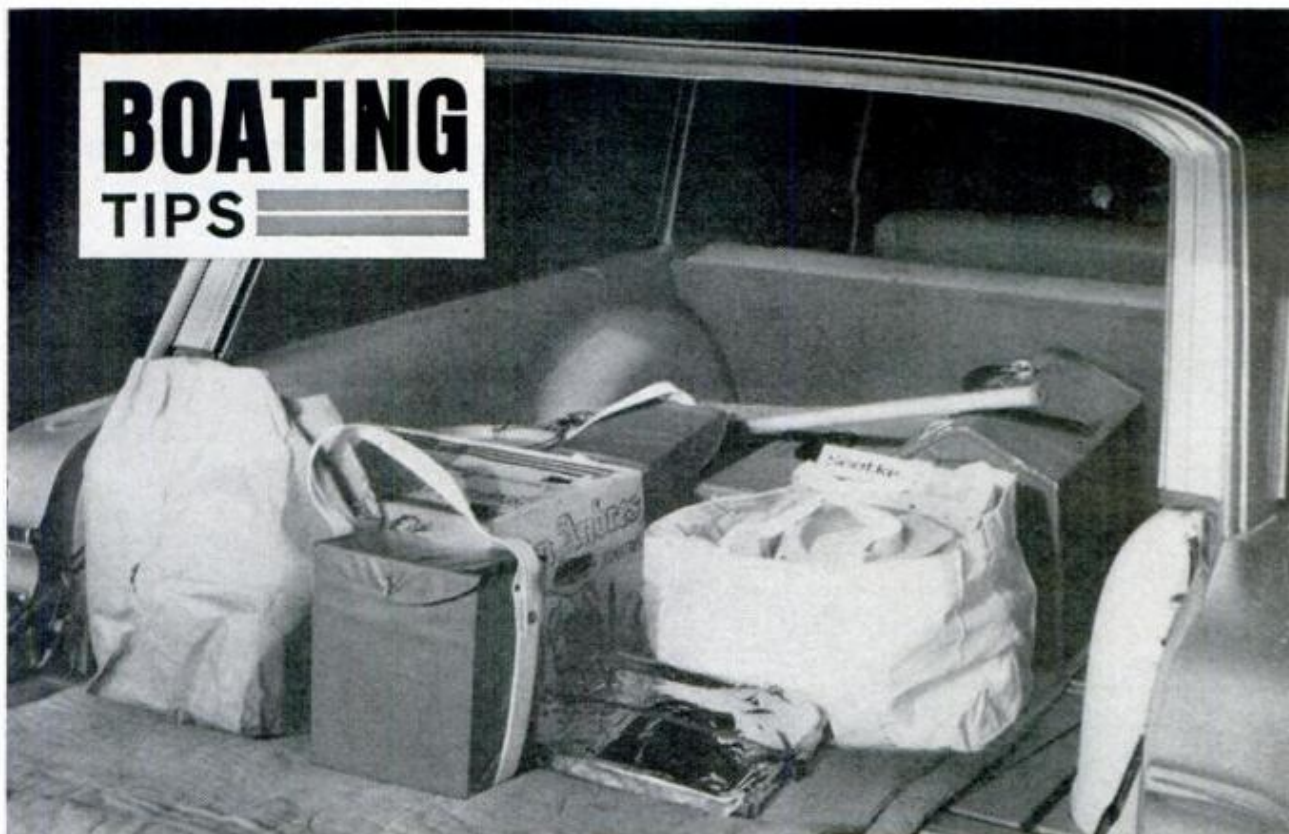
paddling on a quiet lake. Learn the basics of canoe handling without worrying about current.

When you leave for your float trip, give an outline of your travel plans to a neighbor, a local ranger station if in Forest Service country, a conservation

*(Please turn to page 160)*



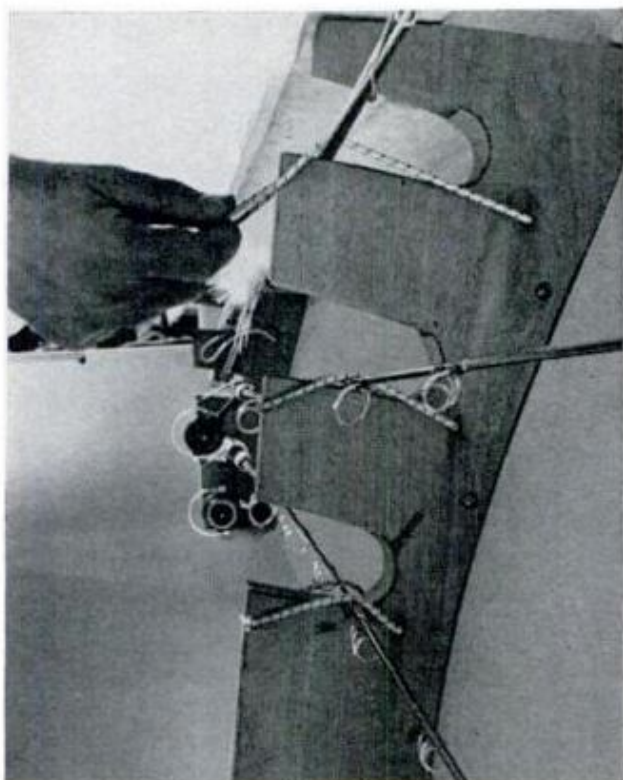
# BOATING TIPS



## Speedy, quiet way to carry gear

On your next outing, before you stash all the odd items of equipment in the back of your station wagon, lay an old quilt on the floor and pack your gear on it. There'll be fewer rattles, and when you're ready to unload, just pull quilt toward the tailgate and the gear will follow.

—Lee H. Schrimpf, Tulsa, Okla.



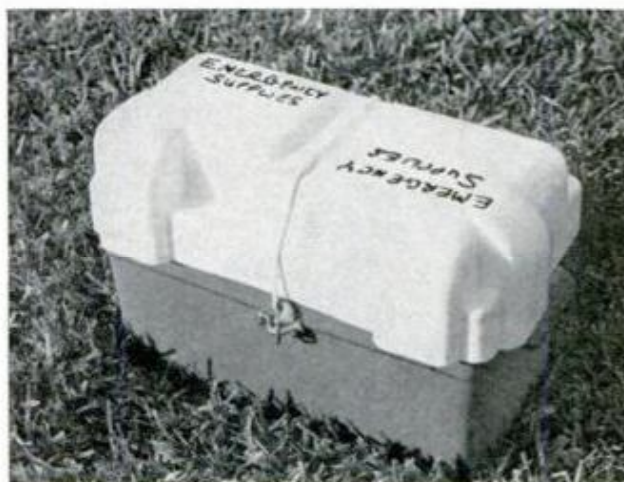
## Quick-action rod storage

Your best fishing-rod holders are sturdy and keep the rods out of the way, yet permit their speedy use when needed. This simple design (left) uses elastic shock cord, making it a snap (pun intended) to put your rods away at the end of the day or have them out when fish are spotted.

—Lefty Kreh, Miami

## Emergency dry-storage container

A perfect dry-storage compartment (right) for any boat is a plastic battery box. Its slipover cover keeps water from entering, while openings for the electric cables provide built-in "handles" and allow air circulation. Without circulation, your kit may become a swollen, corroded mess, especially in a saltwater environment.—Lefty Kreh, Miami





# The Seaworthy Seamaster



By **GEORGE W. REIGER**  
Boating Editor

**PM tests some original thinking about boat design on a trip through the Cape Cod Canal to the Elizabeth Isles**

**I**T'S NOT THE BIG WAVES that kill you; it's the day-after-day pounding through chop that grinds you down."

I first heard this bit of nautical wisdom from a New England lobsterman while teaching sailing one summer at Tabor Academy in Marion, Mass. Twenty years later I returned to the Bay State and found a boat designer working on a solution to the problem of bumps and bruises afloat.

"Most small-craft hulls are unnecessarily wide, have snub-nosed bows or poor weight distribution—all elements of design just begging for a rough ride while underway in choppy seas," says Bob Whittier, nationally-known boating columnist and builder of the Seamaster.

"These hulls are okay over rippled surfaces. But boaters generally find themselves pushing through one to three-foot waves anywhere there's open water and a breeze. So they bounce and get wet and cuss and have to slow down to keep from coming apart and accept this aggravation because they assume a rough ride is the

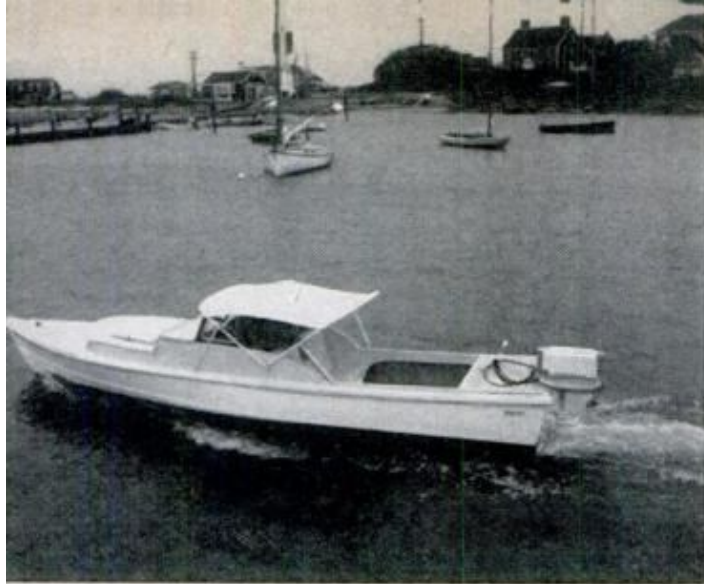


**LOW, NARROW PROFILE**, plus light weight, makes Seamaster easy to tow on a 1500-pound trailer and a cinch for one man to launch and load by himself

POPULAR MECHANICS

Материал, защищенный авторскими правами





**WHILE ACCELERATING**, center of gravity remains forward, bow doesn't rear up, avoiding huge wakes



**BOB BRAVES RAIN** on the run to Plymouth for a sailor's eye view of replica *Mayflower* on display there



**CALM OF CAPE COD CANAL**, along with following tide, offered a respite from wind and storm outside



**CURRENTS ARE FIERCE** in channel off Woods Hole. Buoys are often completely keeled over by the tide

price you have to pay when boating on open water. Nonsense!

"My Seamaster is designed for the man who has owned a boat or two and is tired of being slammed around. He's no longer tempted by ads showing bikinied babes water-skiing behind a broad-beamed and overpowered hull. He's after a comfortable outboard cruiser for himself and his family."

With this as a guideline for what to expect, Bob and I made an overnight trip with a Seamaster from Duxbury Harbor, through the Cape Cod Canal and out to Cuttyhunk Island, farthest of the Elizabeth Isles stretching into the Atlantic. Along the way we visited Plymouth and Woods Hole. We didn't complete the round trip because of a dirty carburetor; not because the hull

couldn't take the ample doses of wind and rain we encountered. The Seamaster lived up to its name throughout.

Her hull is longer in proportion to her beam than any boat I've tested—canoes and kayaks excepted. One advantage of this shape is that the boat naturally planes at a flatter angle than does a short, wide hull. The point of contact between the Seamaster's bottom and the water she's riding through is ahead of, rather than below or behind, the seats—and this goes far toward taking the migraine out of speeding through choppy seas. The deep vee of her bottom forward rides low enough to perform its intended job of dividing the waves.

In addition, a long hull straddles short, choppy waves so there is prac-





**TRIP TO CUTTYHUNK** is one of the most satisfying weekend trips a boatman can make. But the sea gods, seeming to know that our excursion was a "boat test," threw wind and rain at us for 48 hours

tically no pitching or bounce. When riding over large waves we were comparable to a kayak or double-ender which tend to rock over big wave crests rather than shoot off them and come down with a jolt. Since passengers sit over the widest part of the hull amidships, their weight does not make the bow ride low when the boat is moving slowly off plane. Even with a full load of gear stowed forward, we rarely found waves washing over the bow, and not once did we "nose in."

On the run from Plymouth to the Cape Cod Canal, gale-force winds almost forced us to cancel the trip. But our stubbornness, plus a following sea that was easier to run from than fight, kept us going and helped show another advantage of the Seamaster shape.



**ENORMOUS STORAGE AREA** forward permitted us to stow pop tent, duffels, tackle boxes, fishing rods and spare water jugs—and still provided ample space for an extra seat or two in the bow for passengers



**SINCE 22-FOOT HULL PLANED** with 45-hp Chrysler engine, gas consumption was far less than it would have been with a larger outboard. With 18-gallon integral tank, we made just two fuel stops on trip

If a big-beam boat yaws in a following sea, the wave will pick her up and throw her around side on to the wind. The ultimate consequence may be a rolled-over boat. In seas that had ocean freighters picking their way cautiously to the mouth of the Canal, the Seamaster's comparatively narrow transom lifted well. No wave ever got much of a grip on her. We were never in danger of broaching.

A narrow transom has other advantages. When starting to move, the Seamaster sucks along far less water than a "beamy" boat. Thus acceleration is rapid. The stern does not dig in, so she doesn't "drag her heel" when trying to speed up. There's no "rearing up" on takeoff; the entire hull rises smoothly to plane.





**WHILE NOT LIVING IN AS HIGH STYLE** as our houseboat neighbor, we found our tent good shelter, lobster trap (foreground) a decent seat, and Bob's Thermos of coffee a great starter for early risers at Cuttyhunk

One of the most pertinent features of this unique design is its economy. Because the Seamaster's nose does not point skyward, more of her bottom remains in the water, and loading per square foot does not suddenly increase and demand high power. The bottom stays at a more efficient angle to produce lift with minimum drag. Brute force isn't needed to drive this boat.

With a 45-hp Chrysler outboard, we got at least 25 mph from the 22-foot hull. With a little more thrust, (though the hull is rated to take up to 75 hp, 65 hp will do nicely), and the correct propeller for the job, the Seamaster should do 35 mph with ease. Better yet, use a 65-hp engine, throttle back to 20-mph cruising speed and save on fuel like you never thought possible with a two-cycle engine.

Peculiarly, one advantage of the Seamaster may have cost Bob some customers. The narrow, clean-running hull produces little wake, which makes the Seamaster an ideal launch from which to monitor the efforts of college crews. Bob took a cruise one day on the Charles River and caught the experienced eyes of local rowing coaches. Almost before he could say Seamaster, he had sold boats to Harvard, the Mas-

sachusetts Institute of Technology and Boston University. Other schools saw the Seamaster when competing and, soon after, orders came from Yale, Columbia, Pennsylvania and others.

But Bob has mixed feelings about this apparently great luck: "Of course, I'm proud to have Seamasters owned and used by such fine schools. But I designed the boat as an all-purpose family outboard cruiser, and now many potential customers assume it's a crew launch and that's all."

Yet Bob's reputation and the great interest the Seamaster gets wherever she goes should find him more clients. When our stuttering outboard made the run back to Duxbury uncertain, we pulled into Woods Hole, called Mrs. Whittier and asked her to meet us with the trailer. While waiting, a small crowd gathered to admire the boat. I thought Bob would sell her on the spot!

She trailers easily (a 1500-pound rig is sufficient), handles most any sea, provides great storage space for all gear needed for a week's camping trip, and has a foldaway windshield for best visibility and breeze on nice days. Price: \$2250. For more information, write Bob Whittier, Drawer T, Duxbury, Mass. 02332. ★★★

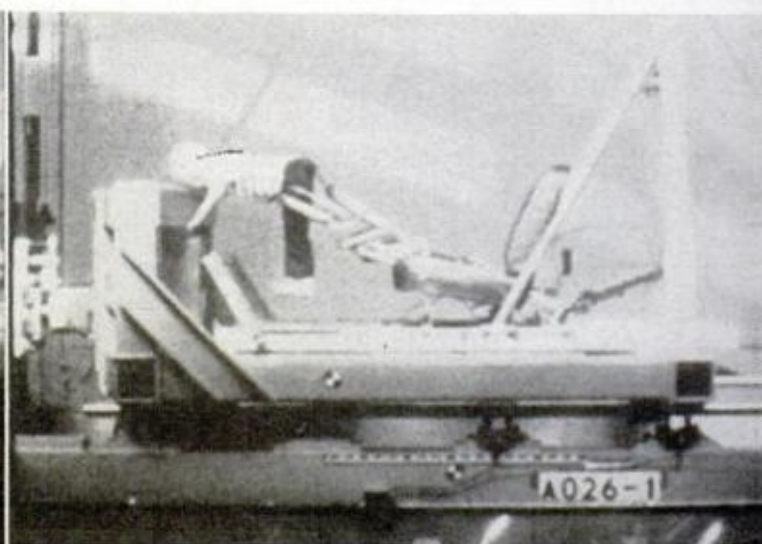


# How

By **BILL  
HARTFORD**  
Auto  
Editor



**SAFETY SEAT**, Protecta-Tot from Firestone, is for kids weighing from 15 to 28 pounds



**SIMULATED COLLISION AT 16 MPH** at University of Michigan, Highway Safety Research Institute. Impact sled carries tubular-frame, hook-under-type child seat offering poor restraint for anthropometric child dummy

**SIDE PROTECTION** is given by Klippan Safety Auto Seat for kids up to about 42 inches and 50 pounds

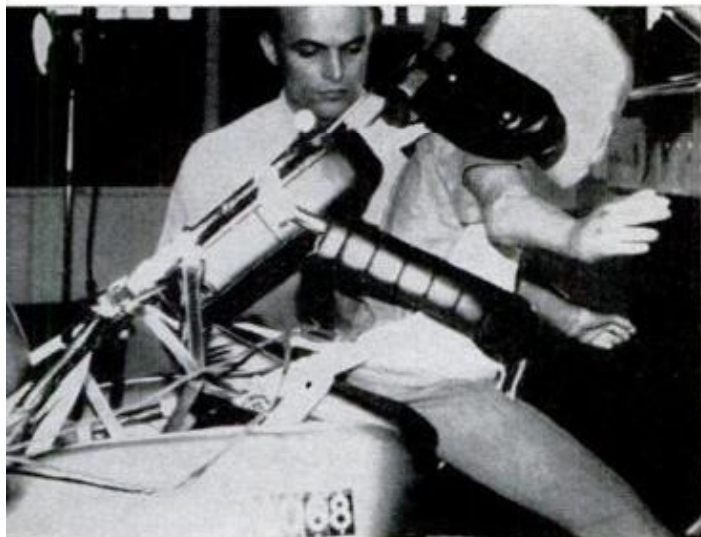
**INFANT SAFETY CARRIER**, made by GM's Fisher Body Div., secures young ones who are not yet able to sit





# to BELT YOUR KID -and Save His Life

Here's everything that you should know about the safe restraining of children who are too young to wear the conventional lap and shoulder belts.



FRAME OF THIS SEAT, held in place by adult lap belt, collapsed in simulated 20-mph collision on sled

**P**ROTECTING THE KIDS is instinctive with parents—except when it comes to their riding in the family car! Raincoats and galoshes are always ready near the front door at home, but chances are the rear seat belts are buried somewhere behind the back seat when you go riding.

That's why the automobile continues to be the leading cause of accidental injury and death of tots, toddlers, pre-teens, teen-agers and young adults.

Parents aren't entirely to blame (even though allowing the kids to ride, unbelted, in the front seat is inexcusable, and allowing them to stand, nose to the windshield, is tantamount

to criminal negligence!). Even the most concerned parents have had to face a lack of information about the long-neglected subject of children's safety in the car: Should children use lap belts? At what age? What about shoulder belts? And just how good are car seats for kids? The answers have been slow in coming.

Last April a federal standard went into effect specifying the static loading requirement a child's seat must meet before it can be manufactured. The standard has banned manufacture of hook-on type seats, but hook-on types are still on the shelves. Those that have been manufactured before April 1 can still be legally sold. *Don't buy one!*

Extensive impact-sled testing by the Biosciences Div., Highway Safety Research Institute at the University of Michigan, has revealed the strengths and weaknesses of many child seat designs, and revealed specifics about a child's physiology that must be taken into account in a determination of the type of restraint system used for various ages.

A New Jersey-based organization, Physicians for Automotive Safety, is stressing the need for auto restraint systems and is putting pressure on the automobile dealer who, it found, all too often does not stock child safety seats





**DRIVING IN STATION WAGONS**, kids should be in passenger seats and belted. Unrestrained children in the rear cargo area will become missiles in collision

—even the effective ones manufactured by the dealer's own company.

A *PM* survey of New York area dealers supports this finding. Seats were in stock at less than 50 percent of the dealers called.

Effective protection is offered only by devices that distribute crash loads over as large a body area as possible; are secured to the body of the vehicle by a standard lap belt or special attachment; are sufficiently strong, energy-absorbing and free of possible injury-producing components.

Distributing crash loads widely over the body is an important factor in protecting children because they are top-heavy. Proportionately, their heads are heavier than an adult's and jackknifing of their torsos in an accident can cause spinal injury.

This fact is taken into account in two of the seats shown here—the Firestone and Ford seats. The impact cushion or shield restrains the upper body and head in a frontal impact. The Firestone seat, made by the firm's Hamill Manufacturing Div., is specified for tots between 15 and 28 pounds. The Ford seat is for youngsters up to 50 pounds.

Pediatricians recommend that children attain a weight of between 40 and 50 pounds and be about four or five years of age before making the move to standard adult lap belts. Smaller children could sustain internal injuries from the belt exerting too much pressure on the abdominal area. Even for the child of required weight, it is recommended that the child be placed on a firm cushion so that the belt falls across the pelvic area and describes a 45° angle in relation to the floor.

Shoulder belts should not be used by a child until he reaches a height of about 55 inches, which usually occurs at about age nine or ten. Here height, not age, is the important factor, according to Arnold W. Siegel, noted crash injury



**ADULT SHOULDER BELT** and combination lap belt (always wear both; never the shoulder belt without the lap belt) cannot be worn by children until they reach a height of about 55 inches. Seven-year old (above) is 47 inches tall and too small. Girl 12 years old and 59 inches (below) checks strap for tightness





investigator for the University of California at Los Angeles.

As shown on the facing page, the diagonal shoulder belt, on a wearer below a certain height, can fall dangerously across the face or neck in a collision. Further, in a frontal collision the top-heavy and still-developing child would possibly experience a spinal-cord injury if his head snapped forward while his shoulders were restrained by an adult shoulder belt.

Children who are under lap-belt age and weight but are old enough to sit by themselves require one of any number of restraint systems on the market. When you pick one make sure it meets Federal Vehicle Safety Standard No. 213 for car seats. Harnesses must conform to Standard No. 209 Type 3. The device must be so marked.

Among other seats that afford good child safety and effective lateral impact protection, in particular, are the Klippan seat and the safety seat that Volvo makes for its model line of automobiles. The Klippan seat can be installed facing forward or rearward. The Volvo seat faces rearward only after the front passenger seat is reversed on its mounts.

Infants from birth to about 20 pounds should be secured in a car cradle or infant carrier like the GM unit shown on page 100. This is a rearward-facing type

that's secured by the adult lap belt. In a frontal collision the impact is spread over the child's entire torso. He is held in the cradle by wide belts in the event of a rear impact collision or rollover.

Car-bed bassinets for infants are generally flimsy, but a good type is one that can be secured in place and the infant held in it by wide belts across his upper and lower torso, or by strong webbing that zips over the top of the bassinet.

To take children's auto safety a step further is to get into the prenatal period. Here the traditional concern has been that lap-belt pressure on the mother's womb would increase injuries to mother and fetus in a collision.

A recent study, however, of over 200 pregnant accident victims, published in the *New England Journal of Medicine*, reveals that no evidence could be found that lap belts increased the mortality of either mother or fetus! Maternal death was found to be reduced slightly while fetal loss remained about the same. The death of the mother was the leading cause of the death of the fetus, concluded the obstetrician and statistician who conducted the study.

No matter how you look at it, the belt is a safety device that, if used, would save thousands of lives each year. Don't be permissive: Belt your kid! And save his life. ★★★

**SAFETY SEAT** (below) held by lap belt, is Ford's Tot-Guard for two to five-year-olds up to 50 pounds. Volvo's safety seat (right) mounts on passenger seat after it's turned to rearward-facing position. Train kids right and they'll remind you about buckling up!





# Portable TVs You Can Play at a Picnic ... On a Patio... By a Pool



**They don't just have a handle—they run on batteries, will play anywhere and now even come in color models. Here's what you should know about these handy, take-along TVs**

By **LEN BUCKWALTER**

**A** "PORTABLE" TV SET used to be something that weighed up to 90 pounds, operated only on house current and—incidentally—had a handle on top. Some models you could actually pick up. But that's all changed now. Today there are dozens of truly portable portables that don't trail a power cord, play anywhere you want to tote them and are light enough to handle with ease. The smallest weighs less than 2 pounds with the average being around 15 to 20. At least two models offer color. Prices run from under \$100 to over \$300, with a number in the \$100 to \$120 range.

These trim, all-purpose portables operate on either 117-volt a.c. or 12-volt d.c. When you're at home, you simply plug into a wall outlet as with a conventional

TV set. In a car, boat or camper, you can take power from the 12-volt electrical system, enabling you to enjoy TV on a camping trip or cruise. Some models even come with a handy adapter cord that plugs into the cigaret-lighter socket on your car's dashboard.

When you're really off in the wilderness with no source of power, you can operate on rechargeable batteries. These may be built into the set or may be in a separate power pack that plugs into the back of the set. This depends, to some extent, on the size of the set. Power requirements go up sharply as screen size increases, necessitating heavy batteries. Thus, large sets generally have separate power packs to keep their weight manageable. Smaller sets may have built-in batteries where





**WHERE TO PUT THE BATTERIES** is the big question in a portable TV and manufacturers solve the problem in different ways. Sharp's 9-in. model (above, left) has separate power pack in a leather carrying case you can sling over a shoulder. This saves weight, eliminates need to lug batteries along when you are operating on external power. Panasonic's 5-in. model (above, right) has built-in batteries housed in a compartment in the rear. This is possible in smaller sets where battery weight is less, is handy because it makes TV self-contained with nothing extra to carry. Toshiba's 9-in. model (lower right) has a power pack in a removable base. You simply place the set on the base when you want battery operation and detach it when you don't. At top of opposite page is the 9-in. Magnavox portable that has a separate power pack and removable sun shield

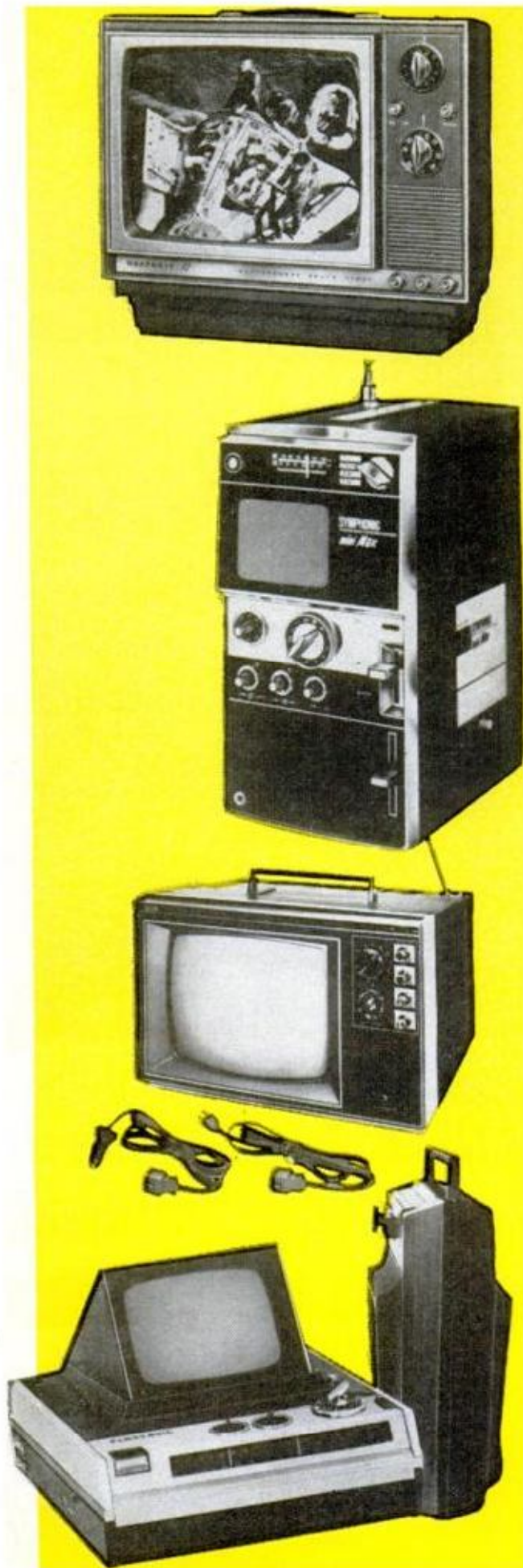


the added weight is not enough to become cumbersome.

Both arrangements have their advantages. Which is best for you depends somewhat on the kind of use you're going to give your portable. Built-in batteries save having to carry around an extra pack and are handy if you plan to do most of your viewing away from a power source. On the other hand, the separate power pack frees you from having to lug batteries around when you don't need them. If most of your viewing is in a car or boat you may find the detachable pack a welcome feature. Also, since it's an optional accessory item, you don't have to purchase it right away if you don't need it, saving some money. Battery packs are \$20 to \$40 extra.

Some makers offer a third arrangement, a kind of clever compromise. The





battery pack is separate, but it's in the form of a detachable base that fits under the set. With the base attached, you can carry the whole thing around as a single, self-contained unit. When you don't need the batteries, you simply release a couple of catches and slip the base off.

Most portables use rechargeable batteries, although a few of the smallest can operate on ordinary flashlight cells. A fully charged battery pack provides about four hours of viewing time. You'll clearly see when the batteries are running down—the picture starts to shrink. Recharging takes about 15 hours and can be done as you play the set on house current.

Despite recharging, batteries will not last indefinitely, however. They'll take 100 to 200 charge-discharge cycles before permanent exhaustion sets in. To conserve them, it's wise to operate on external power as much as possible. If you want to play the set in the back yard, it will pay you to install a weatherproof outdoor outlet and use house current rather than battery power. For mobile use, most car, boat and camper electrical systems will easily supply the ampere or so of power these mini sets require—about the same as a car's dome light. One caution on car installation, though: Don't operate a TV set in a moving vehicle without first checking your state's law on this point. Most states prohibit TV viewing in the front seat of a moving vehicle and many rule out the rear seat as well.

What's a good screen size? You can't apply living-room standards to a portable because your viewing habits and needs are generally different. Usually, fewer people are watching at a time and you're at close quarters with the set, such as in a tent, camper or boat. For these reasons, the screen can be smaller than you'd want at home. Portables vary in tube size from Panasonic's incredibly tiny 1½-incher up to 12 inches (measured diagonally across the tube face). As weight and cost go up sharply with tube size, most sets are in the

**SOME UNUSUAL PORTABLES** are shown in column at left. From top down, they are Heath's kit-built 12-in. model sitting on removable power-pack base; Symphonic's 3-incher with a built-in cassette tape recorder; Hitachi's 12-in. color model, first color portable to reach the market; and Panasonic's clever pop-up design in which a 5-in. screen swings up from inside the case for viewing, then folds out of sight when not in use. Both the Panasonic and Symphonic models also incorporate AM/FM radios

POPULAR MECHANICS



moderate 7 to 9-inch range. This is entirely adequate for the small-group viewing you'd have on a family outing and makes for good portability.

One helpful accessory to consider is a dark-tinted plastic window supplied by some makers. Since portables are often viewed outdoors, sunlight can be a problem, causing glare and reflections that wash out the picture. The tinted window acts as a sun shield, reducing glare. However, it also steals a little picture brightness on indoor viewing. For this reason, some shields are designed to be removable. If you plan to do most of your viewing inside, this could be an important feature to look for. A few models also come with removable plastic covers to protect the tube face from accidental knocks when traveling—another useful extra.

All portables have built-in telescoping antennas as well as connections for an external antenna. When you're home, you can hook on to your regular rooftop antenna for maximum signal-pulling power. Portables also have a built-in loop antenna for receiving UHF channels.

Several models offer an added AM/FM radio and one, the Symphonic, even boasts a built-in cassette tape recorder. The two color sets are Hitachi's 12-inch model priced at \$369.95 and Panasonic's 4½-inch size. The latter is not yet on the market, but is expected to be available soon. Its price will be announced later. If you like kit-building, Heath has a 12-inch model that can be assembled in about 15 to 20 hours. The accompanying chart lists additional portables according to screen size, weight and price. Prices and weights given do not include batteries except where the batteries are built-in.

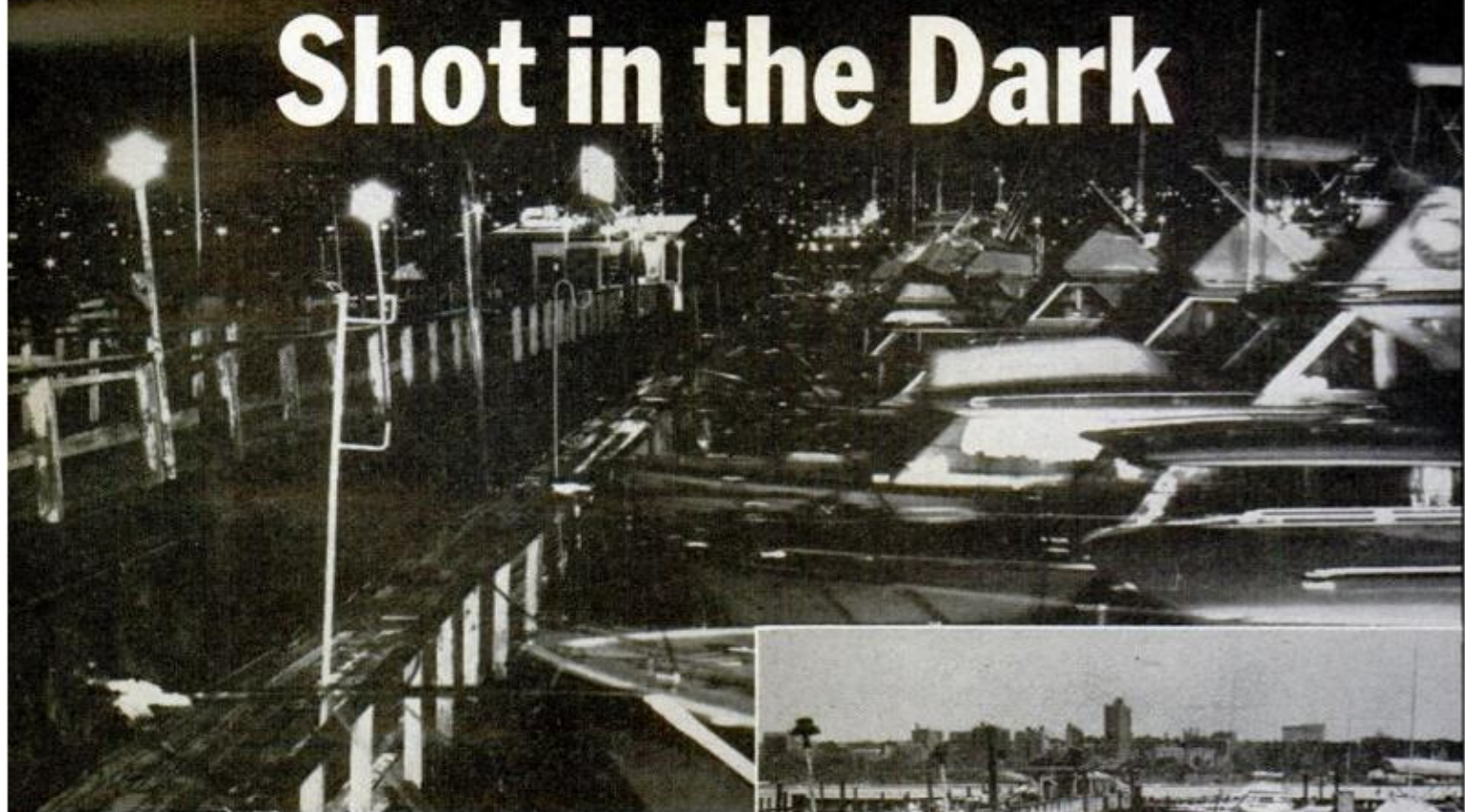
What kind of performance can you expect from these mini portables? Operated indoors on a rooftop antenna, they'll pull in stations like a conventional TV. Even outdoors on their single rabbit ear, sets tried by *PM* proved to be remarkably good at distances up to 50 miles from the transmitting station. Reception in a moving vehicle is difficult, however, because the constantly changing flow of mountains, power lines, bridges and other structures tends to cause reflections and ghosts that make the picture fluttery and unstable. If you're determined to try, there are special antennas for car installation that may prove helpful. ★ ★ ★

## Buyers Guide to Portable Battery TVs

Make	Model	Screen Size (diag. inches)	Weight (lbs.)	List Price
Admiral	9P400	9	12	\$110
Emerson	7HP02	7	10	\$99.95
General Electric	TR120RVY	5	10½	\$149.95
	TR100TEB	9	12¼	\$114.95
Heath	GR104A	12	20	\$124.95
Hitachi	IU-53	9	12	\$109.95
	IU-54	9	16	\$149.95
	CWU-210 (Color)	12	42	\$369.95
Magnavox	IT5261	8	16	\$119.90
	IT5260	9	17	\$124.90
Motorola	XP259F	9	13½	\$119.95
Panasonic	Color (Not yet avail.)	4½	17½	(Not yet avail.)
	TR-001	1½	17⅞	\$299.95
	TR-415BA	5	10½	\$149.95
	TR-425R	5	13	\$179.95
	TR-469B	9	13¼	\$109.95
	TR-339RA	9	14	\$149.95
Philco	B321UAV	8	11¾	\$89.95
Sears	57K5060N	5	9	\$117.95
	57K5019N	8	15	\$89.95
	57K5025N	12	22	\$117.95
Sharp	SQ-65P	9	14½	\$114.95
	SU-66P	12	17½	\$119.95
Sony	TV-510U	5	7½	\$109.95
	TV-710U	7	9½	\$99.95
	TV-720U	7	9½	\$109.95
	TV-110U	11	16	\$129.95
Symphonic	TPS-5050	3	5½	\$169.95
	TPS-300	3	7	\$299.95
Toshiba	T0901C	9	11.9	\$179.95
Ward's Airline	63B11960R	9	20	\$97.95
	63B11741R	12	24	\$114.95



# Shot in the Dark



Here is proof that shooting at night often gives more dramatic results than in daylight. These useful tips will help you pick the best subjects and exposures

By BURT MURPHY

**N**IGHT ADDS A NEW DIMENSION to photography. It's like walking into another world—a world full of exciting challenges and possibilities you may never have noticed in the daytime. The reason is that night photography represents a completely different concept from normal shooting. In daylight, you are shooting subjects illuminated by light from an external source that rarely shows in the picture. At night, you are, for the most part, shooting lights themselves—flashing street signs, brightly shining windows and store fronts, glowing ribbons traced by auto headlamps, shimmering reflections on snow and water, and the like. You are mainly photographing *effects*, rather than actual scenery.

This is what makes night photography



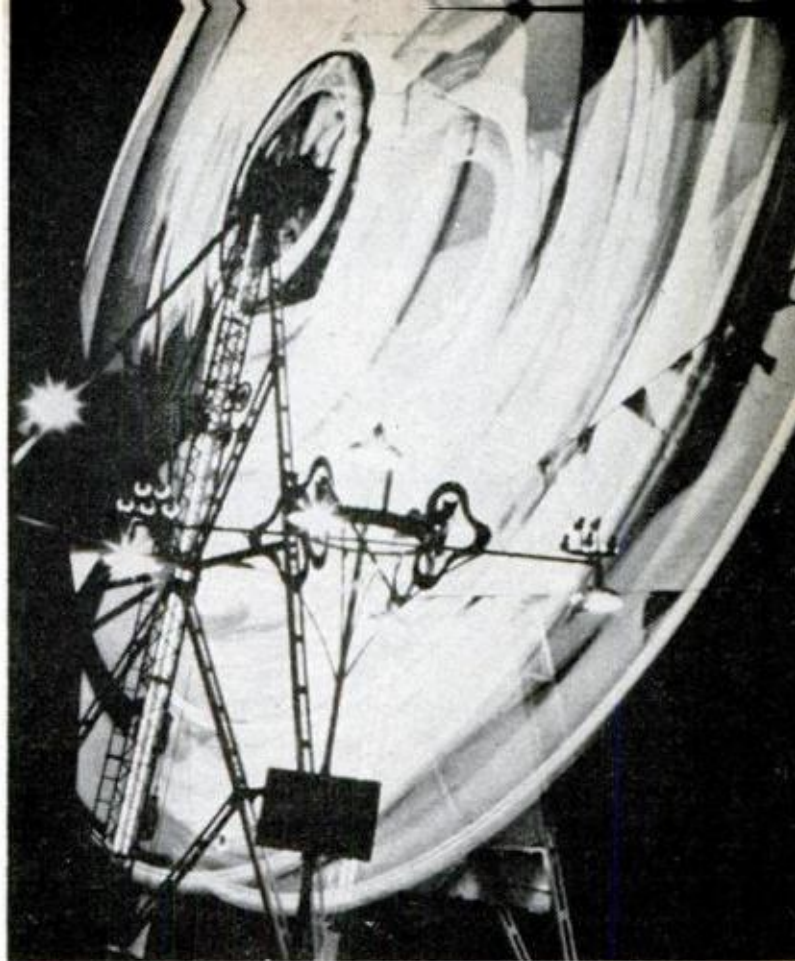
**MARINA AT NIGHT**, made at 1/8th second and f/4 on Tri-X, is much more dramatic than same scene in daylight. Slight blur is caused by boats bobbing in water during exposure, but is not objectionable

so fascinating. Subjects that seem drab and ordinary in daylight suddenly take on new drama in the dark. A city street by day is just another street, but at night it becomes a teeming, glamorous bustle of neon signs and lighted shops full of adventure and excitement. You have to look at subjects with different eyes at night and use different techniques. Floodlighted marinas, illuminated fountains, amusement parks, airports, dingy waterfront scenes, docked ocean liners, hulking bridges outlined in necklaces of lights, city skylines, large electric billboards—all these are candidates for dramatic night pictures. Even in small towns there are many good night subjects that might easily be missed—a spotlighted church spire, an historical monument or war relic, a picturesque





**LIGHTNING IS EASIER TO SHOOT** than you'd think because it provides light to take its own picture. Instead of trying to catch it, you just open shutter on time, wait for the flash, then close shutter



**WHIRLING WHEEL OF LIGHT** is amusement-park ride deliberately shot at long exposure—8 seconds at f/11 on High-Speed Ektachrome. Striking effects like this Kodak photo are not possible in daylight

police station or firehouse, a lonely farmhouse on a snow-blanketed hillside, or the eerie shadows cast by moonlight in an ancient graveyard.

Because you're interested in recording lights at night, flash is of little help. Flash photography is not the same as true night photography—there's an important difference. A flash picture is merely the equivalent of a daytime shot made with artificial light as a substitute for the sun. The flash will wash out the very lights and shadows—the mood-creating patterns—that you're trying to capture.

In night photography, you have to expose for the light that's available in the scene. This means using fast films, such as Tri-X for black-and-white and High-Speed Ektachrome or Ansco's D-500 for color. You can also experiment with some of the even faster films that go up to 1200 or 1600 ASA. These produce grainier results, but are three to four times more sensitive to light.

**COUNTRY CHURCH IN SNOW** makes picturesque night scene. To get enough illumination, this one by Kodak was actually shot at dusk—a trick you can use when full darkness would make shooting impossible

JULY 1971

Exact exposures are difficult to pin down in low light situations. A light meter is virtually useless. You have to be willing to experiment. The idea is to find a possible starting point, then bracket your exposures by several stops in both directions. The accompanying table lists exposure times for some typical night scenes. More detailed exposure guides are available at photo shops.

You'll find that some subjects, such as bright street signs, can be shot at speeds up to 1/250th of a second—as fast as for







**LIGHTED FIREHOUSE** standing guard in the dark is good example of local subject that goes unnoticed in the daytime, but takes on character at night. In this case, flash was fired during a time exposure to give slight added illumination. Close-up of the firehouse door (right, above) creates interesting light pattern



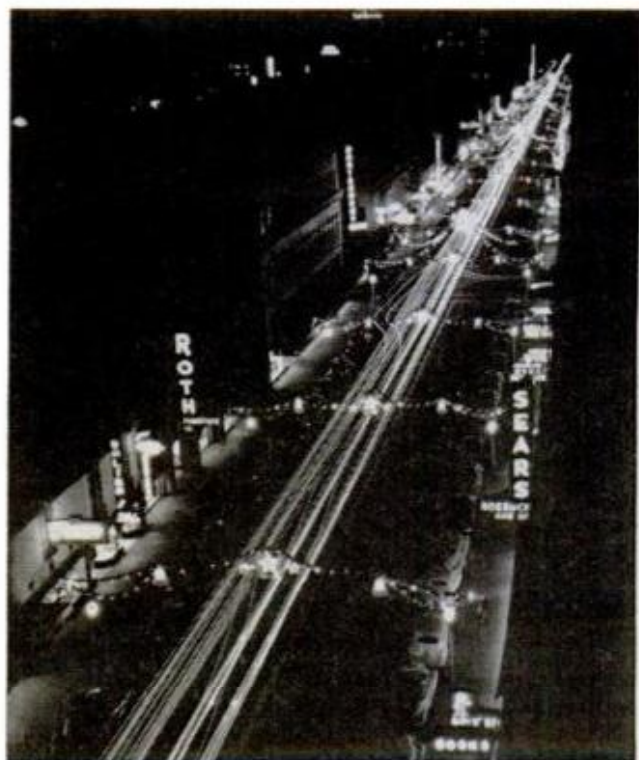
many daylight scenes. Most dimly lighted subjects, however, will require time exposures of one to two seconds or even longer. This calls for a camera with a Bulb or Time setting. You open the shutter, count off the appropriate number of seconds, then close it.

When you get into time exposures, you'll discover a curious fact—the time intervals can vary over a considerably wide range and still produce basically similar results. You may, for instance, go all the way from 2 seconds to 5 seconds to 10 seconds and get three usable pictures with minor variations in mood and effect. The longer the exposure, the more overall illumination will be present, but the individual sources of light will begin to burn into the film and become blotchy and indistinct. You have to strike a happy medium between the two extremes. Sometimes a single light source, such as a street lamp, is intentionally allowed to become blurred to get better illumination on the scene as a whole. On the other hand, if you want sharp pinpoints of light, go for shorter exposures even though the rest of the scene will appear darker.

The exposure times shown here are for a lens opening of  $f/4$ . This is close to wide open for many lenses, especially telephotos. Since mood rather than detail is more important in a night scene, shooting at a large opening is usually safe and gives you the benefit of faster shutter speeds. Where depth of field is critical, such as on well-lighted close-ups, you can close down two or three stops for greater sharpness. Adjust your shutter speed accordingly by increasing the time one stop for each decrease in opening.

A tripod or other camera support is virtually a must in night photography since most of your exposures will be below  $1/60$ th of a second—the cutoff point for safe hand-held shots. It's also best to use a cable release instead of pressing the shutter tripper. It will minimize camera shake when the shutter is opened and closed.

There is one exception to the no-flash rule in night photography. A flash can sometimes help to add a little extra illumination on scenes where there is not enough front light to show the subject clearly. Buildings lighted from inside, for instance, are frequently too dark on the



**RIBBONS OF LIGHT** are traced by automobile headlamps intentionally blurred through a time exposure of several seconds. Always use a tripod or other firm support to steady camera during such exposures



## TYPICAL EXPOSURE TIMES FOR NIGHT SCENES

(All times are for an opening of f/4. Adjust one stop shorter or longer for each stop of increase or decrease in opening.)

TYPE OF FILM	TYPE OF SCENE		
	NEON SIGNS	STREET SCENES	FLOOD-LIGHTED BUILDINGS
KODACOLOR-X KODACHROME-X EKTACHROME-X	1/30	1/15	2 sec.
HIGH-SPEED EKTACHROME	1/60	1/30	1 sec.
TRI-X	1/250	1/125	1/4

outside to register on the film. Firing a flash during a time exposure can give enough front light to outline the subject without killing the light coming from inside. The firehouse shown in one of the accompanying photos was shot in this way. The shutter was opened, the flash fired, then the shutter closed. Most flash-guns have an open flash button that permits them to be fired manually without using the camera's built-in synchronization. Do not attempt to use the normal flash setting as this will produce an ordinary flash picture, not a night picture.



**LONELY VIGIL** of a policeman on a deserted, snowy street corner is captured in this spur-of-the-moment photo shot from the window of a nearby building. Such scenes are simple, but they create strong moods

JULY 1971

There are other tricks you can use, too, to create the appearance of more light than there actually is. Deliberately long exposures will cause moving lights to blur into streaks, creating fascinating patterns of motion. The whirling amusement-park ride and ribbons of auto headlamps shown here are examples of this technique. By allowing dim lights plenty of time to register on the film, you can often take pictures that would be otherwise impossible.

Shots made in snow or after a rain also appear to have more light because of the reflective surfaces. Another dodge is to shoot at dusk when there is still a little sky light. The result will often look like a night scene, but will have sufficient added illumination to show detail that would not be apparent in full darkness.

Moon shots are difficult because the earth's movement during the exposure causes the moon to appear as a streak. The answer is to leave the moon itself out of the picture, but expose for the rays it casts. Such effects are weird and otherworldly, but can be striking. You can also simulate moon shots by shooting into a setting sun and underexposing to let the surrounding area go dark. Using a red or yellow filter will help to create the effect of a darkened night sky. ★★

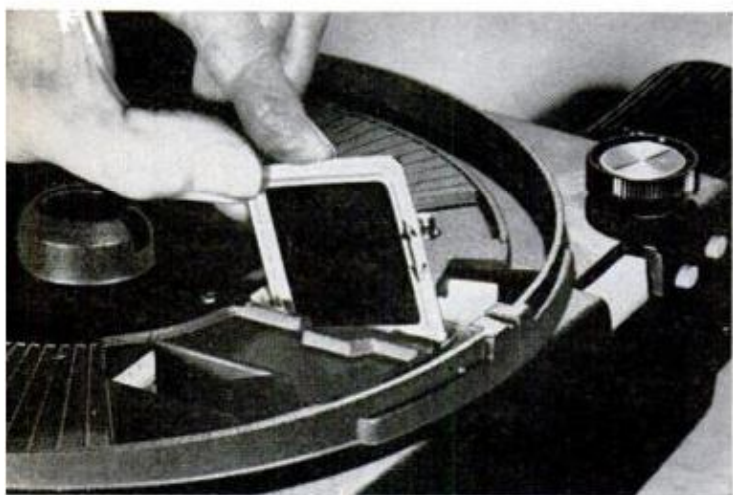
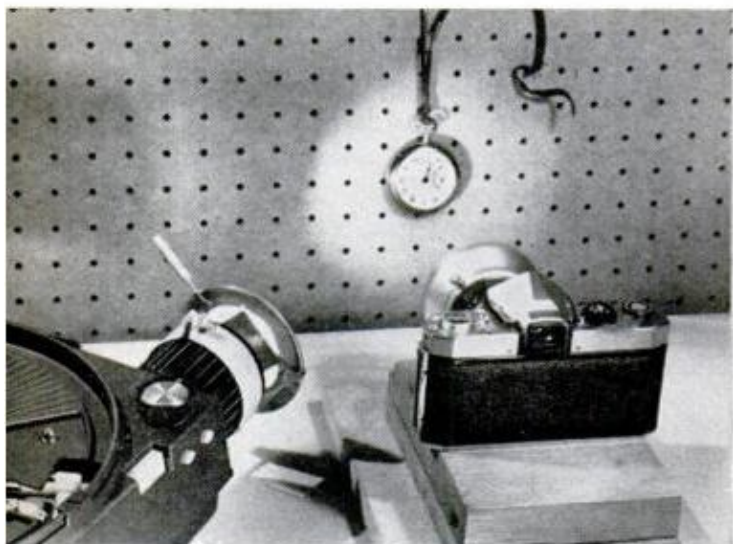


**REFLECTIONS ON WATER**, here from buildings along a river, are more spectacular at night because of the shimmering lights. Wet lamplighted streets after a rain also produce eye-catching night effects

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# PHOTO HINTS



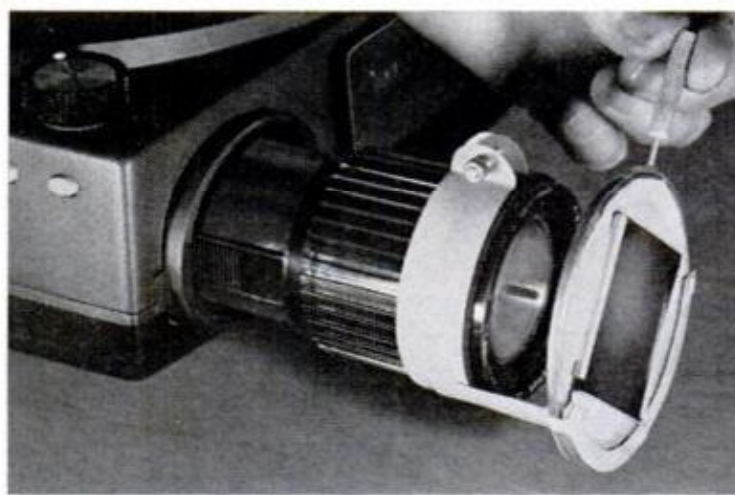
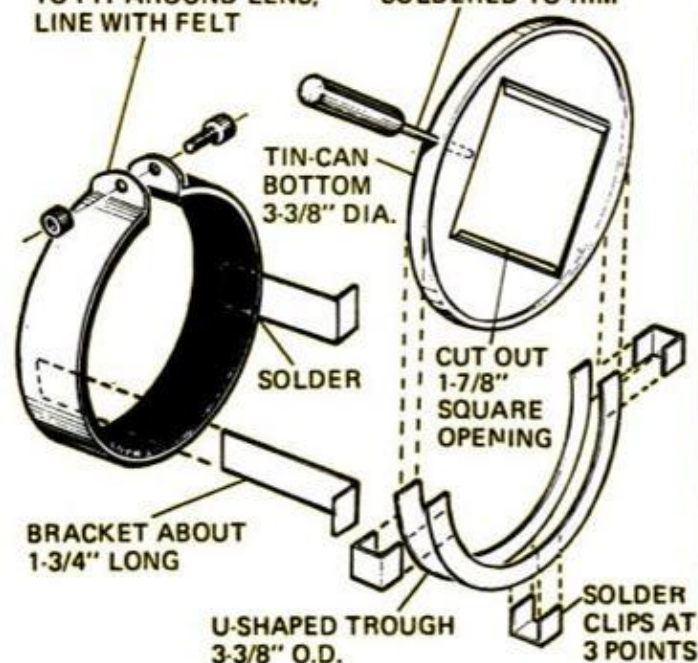
## Mounting polarizing filters

Polarizing filters are handy for reducing glare when photographing glass, metal or other shiny surfaces. You need one over the light source and one over the camera lens. Either one must be able to rotate to vary the polarizing effect. Glass filters are expensive, but you can use 2x2-inch squares of plastic polarizing material available in packs of 20 for \$2.50 from Edmund Scientific Co., Barrington, N. J. 08007. One neat dodge is to use a slide projector as the light source. Mount a square of filter material in a standard slide binder and slip it into the projector. Another square can be mounted in a circle of cardboard and taped over the lens. Fasten it to a filter ring or sunshade so it can be rotated. You can also make a rotating filter holder for either the camera or projector from scrap metal and a tin-can bottom, as shown at upper right.

—Walter E. Burton, Akron, Ohio

THIN SHEET METAL TO FIT AROUND LENS; LINE WITH FELT

SMALL HANDLE SOLDERED TO RIM

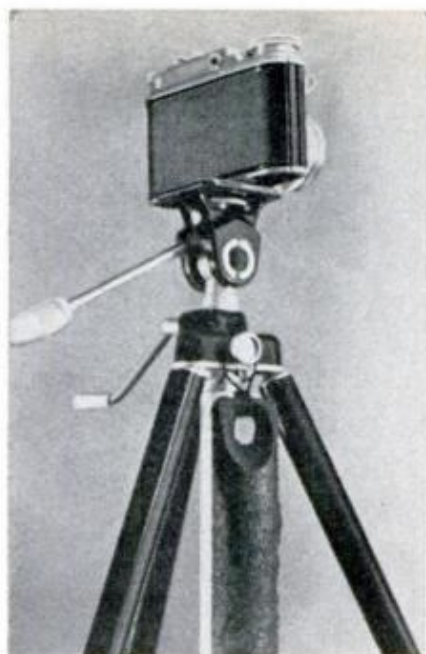


## Ever-present film reminder

You won't forget what type of film you have in the camera with this simple trick. Each time you load the camera cut off the end of the film box and fasten it inside the lens cap with clear tape as a reminder.

—Robert Hertzberg, Flushing, N. Y.





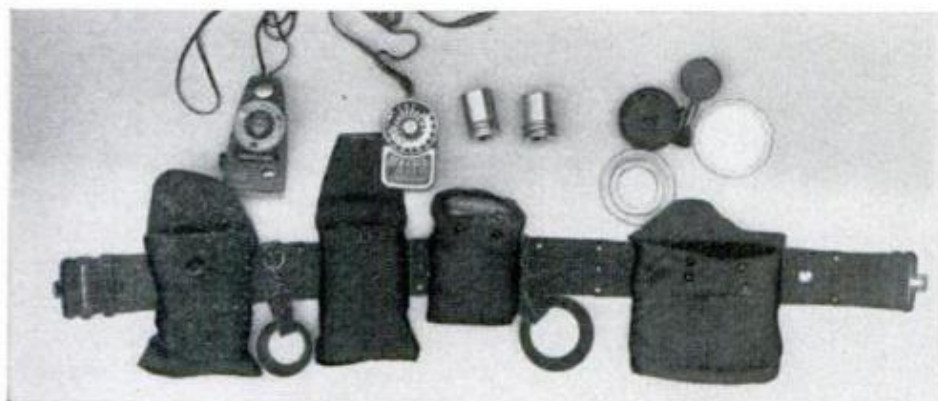
### Handy tripod weight

An old sash weight will help to steady a light tripod against breezes.—*Mike Cannon, Spokane, Wash.*



### Easy camera mount from pipe fittings

This swivel-jointed pipe stand will hold a camera at any angle for tabletop photography and can be clamped to other supports. The 1/2-inch fittings are locked with 1/4-20 thumbscrews.—*Robert Hoppough, Chico, Calif.*

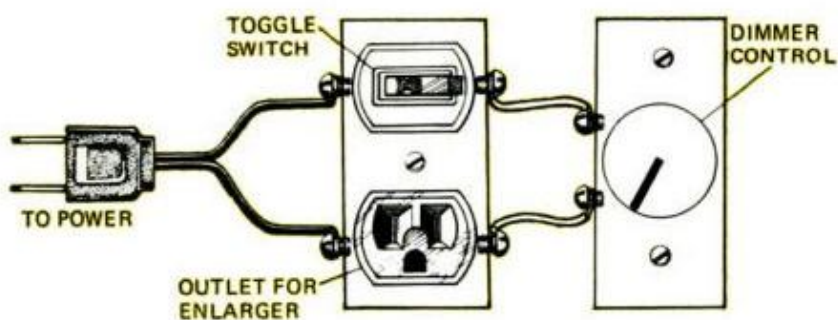


### Ammo belt holds photo aids

A web-type Army belt will put photo accessories within easy reach and save



carrying a bag. Available at sports and Army-Navy stores, it can be fitted with clip-on ammo pouches to hold film, filters, meters.—*Ed Monroe, Schuyler Lake, N. Y.*



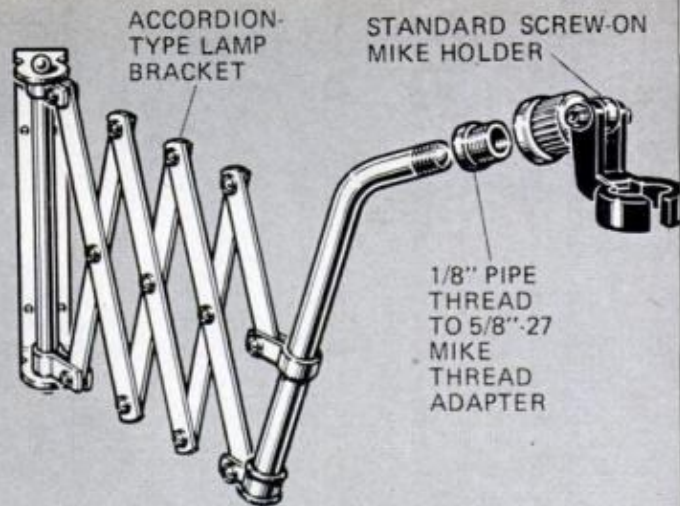
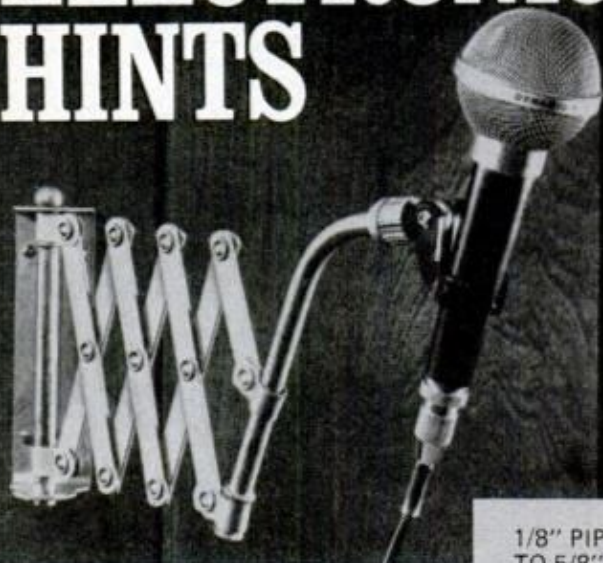
### Add your own enlarger control

If your enlarger doesn't have a variable-intensity light control for slow and fast papers, you can add one with a wall dimmer. Substitute the next higher-

wattage enlarger bulb for your present one. Using test prints, calibrate the control so it dims the new bulb to the same brightness as the old one for fast papers. For slow papers, turn up the dimmer.—*Frank Greenwald, Western Springs, Ill.*



# ELECTRONIC HINTS



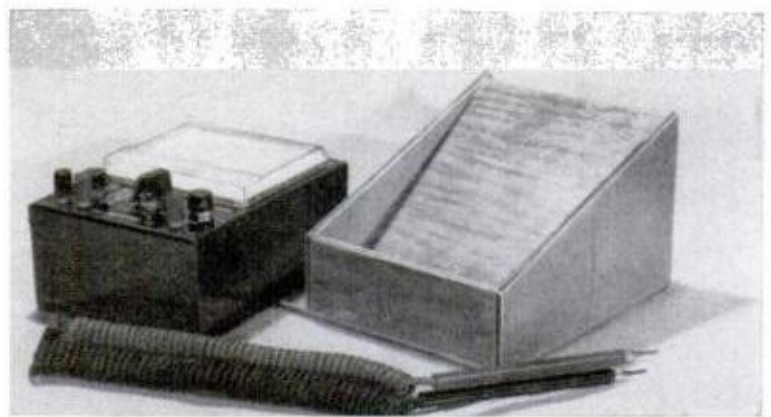
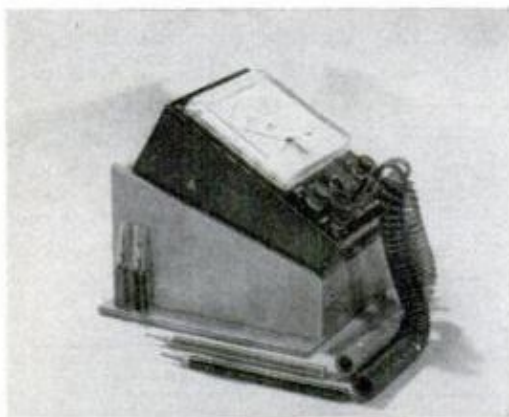
1/8" PIPE THREAD TO 5/8"-27 MIKE THREAD ADAPTER

FLATTEN END AND DRILL FOR 1/4" SCREW



## Two improvised mike holders

An old accordion-type wall lamp makes an ideal mike holder for a ham or CB rig because the mike can be extended when needed or retracted neatly out of the way. The other holder, made from a short length of 1/8-inch lamp pipe, lets you use a tripod as a floor stand when you need a tall mike support. Both require a special adapter that mates 1/8-inch lamp pipe to 5/8-27 mike thread. These are available from mail-order houses like Allied and Lafayette.—Norman Fallon, New York



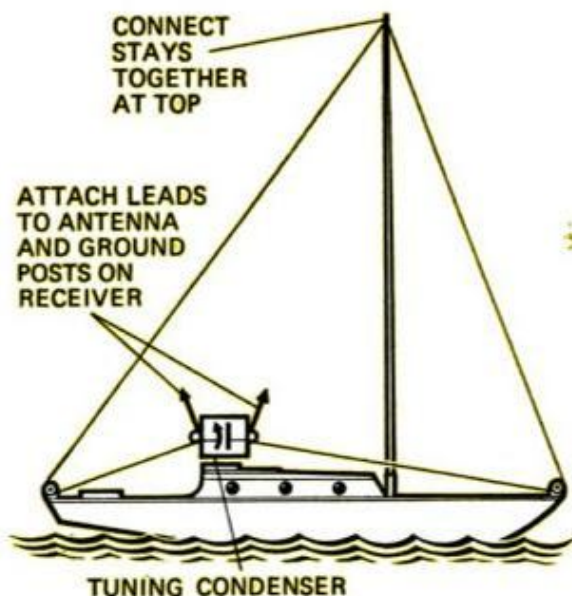
## Slope-front meter caddy for easier-to-read dial

This sloping stand holds a VOM or similar tester for easier reading, can be made of 1/4-inch plywood to fit your own meter. Sides slant from 4 1/2 inches in back to 2 inches in front. Supporting shelf is at a

slightly sharper slope so the sides form a lip to hold the meter. Bottom extends about an inch on one side, acting as a ledge for storing extra test tips.

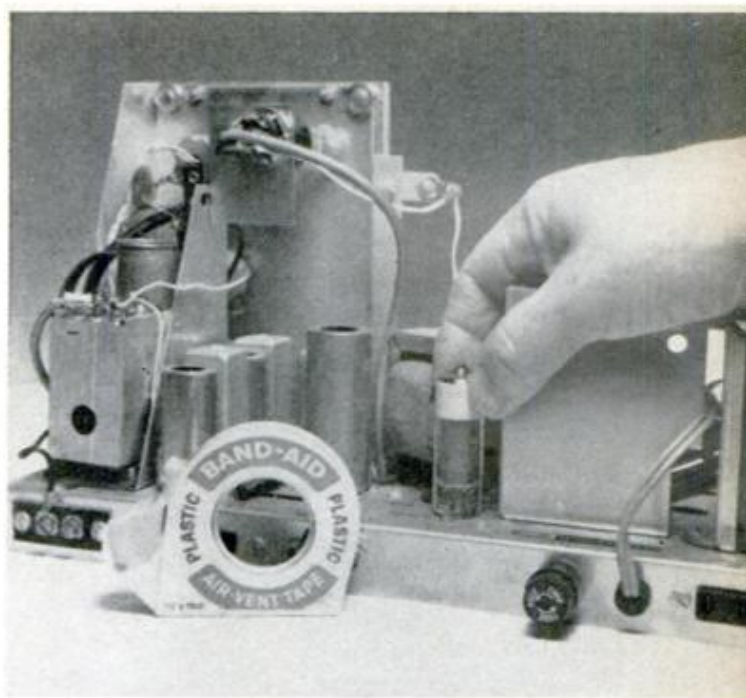
—Marshall Lincoln, Wickenburg, Ariz.





### Simple sailboat antenna

Wire sailboat stays can serve as a powerful antenna loop for a radio. Connect the stays together at the top, then run wires from the lower ends to the antenna and ground posts on the receiver. Connect a broadcast-band tuning condenser between the wires to tune loop for maximum gain.—Norman Fallon, New York



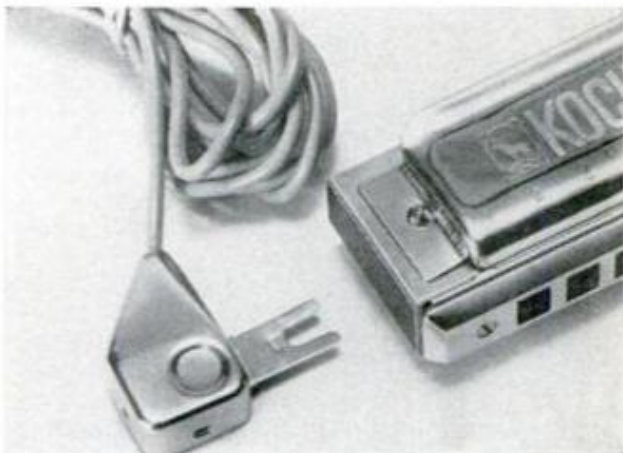
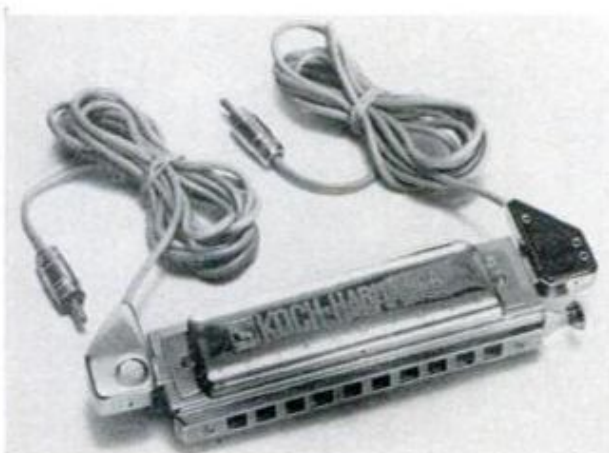
### Nonslip tube-pulling aid

Glass radio tubes are often hard to remove because your fingers slip on the smooth sides. Wrapping a ring of adhesive tape around each one near the top will give you a good grip and speed the job.—Robert Hertzberg, Flushing, N. Y.



### Handy toter for small parts

Fasten five or six glass jars to a piece of wood scrap, add a handle, and you have a convenient carrier for small electronic parts such as plugs, jacks, terminal strips and other connectors. Attach the jar lids with three screws in each and curve the ends of the wood to match the lids' shape.—Don Shelton, Chicago, Ill.



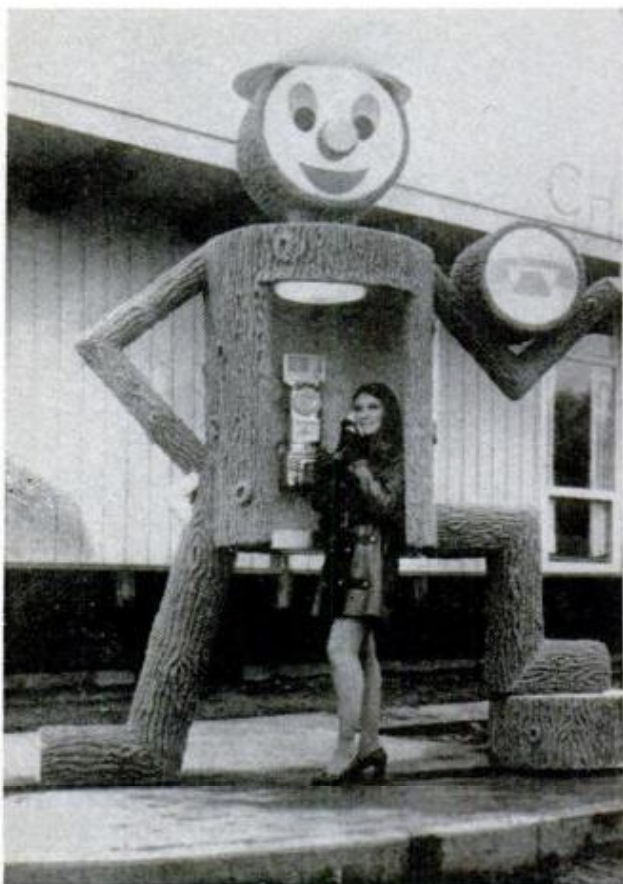
### Amplify your harmonica with your hi-fi system

You can play a mouth organ through your hi-fi system with two contact mikes having slotted mounting tabs (right, above). Loosen cover-plate screw at each end of harmonica, slip tab under plate, JULY 1971

then retighten screw. Plug mikes' cables into mike or auxiliary inputs on amplifier. Mikes are available for about \$1.50 from Lafayette Radio, 111 Jericho Turnpike, Syosset, N.Y.—S. Koblick, New City, N.Y.

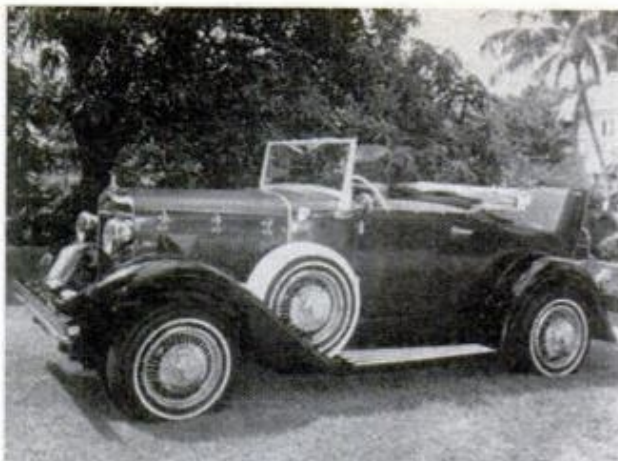


## NEWS BRIEFS



### Inside information

Anyone who makes a telephone call from the Chamber of Commerce phone booth in Prince George, B.C., can't help but be aware of the area's chief industry—lumbering. However, a close look at the timber giant will reveal the fact that he's made of fiberglass.



### Back to the good old days

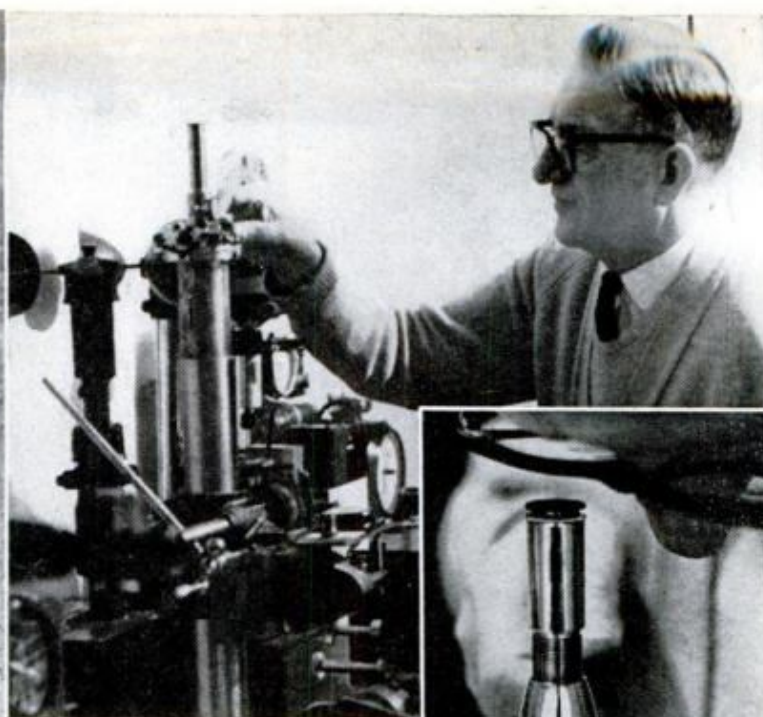
It looks like a return to the 1930s down in Palm Beach, Fla., where Classic Industries is turning out Model A sedans, roadsters and convertibles on International Scout chassis. Body parts are molded of fiberglass, and the top frame parts are made of aluminum alloy. The cars have 111-hp, four-cylinder engines and three-speed synchromesh transmissions.



### Moon walk for \$1.95

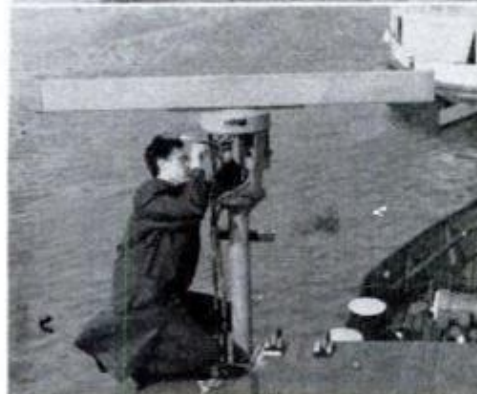
Students in Madison-Simis School, Phoenix, can experience "moon gravity" in an ingenious device invented by science teacher Donal Tamuty and built for \$1.95. Each student is strapped into a parachute harness (left) and counterbalanced by weights (above) that total five-sixths of body weight. The connecting rope runs through two bicycle wheel rims.





## His hobby: collecting dust

A lifelong hobby of collecting samples of dust (photo, above left) and studying them in his home laboratory (right) has made George Aitken of Worcester, England, an expert on the subject—and a consultant to pollution fighters and miners. Aitken has some \$17,000 worth of laboratory instruments for his studies.



## 'Radar map' helps them cruise the Danube in foul weather

Heart of a new navigation system that enables boatmen to cruise the Danube during thick fog and at night is the "radar map" (inset). The map shows the river as it appears on a radar screen; thus, the navigator can follow his course by watching the radar (right) and checking the image on the screen with that of his map. At upper left is the riverboat of Hungarian shipmaster Karoly Szekeres, one of the inventors of the map. (Co-inventor is cartographer Beno Ratoti.) At lower left is a revolving radar antenna on the boat.



## EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



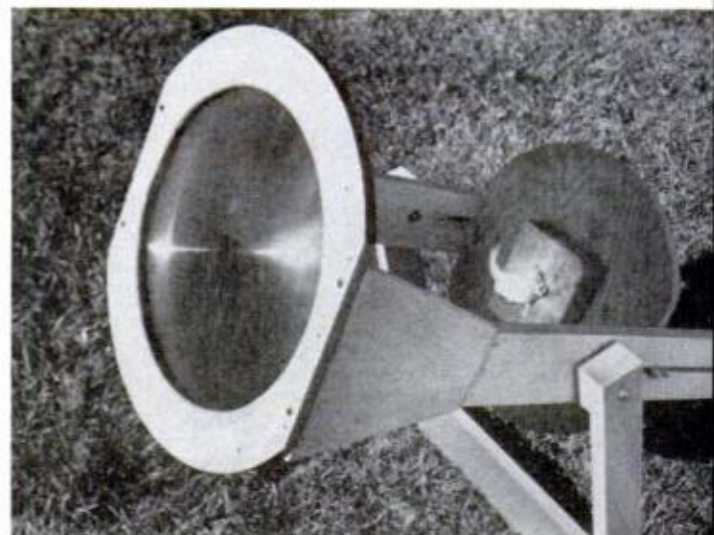
**SIX TINY REPLICAS** of Spanish swords in a stand 4 inches high make this Spanish cocktail set ideal for spearing olives, onions, snacks, hors d'oeuvres and canapes. Rich gold plate and enamel finish lend a note of elegance to the small swords. Price is \$5.38 postpaid from Cazin Co., Dept. MPI, 526 Maple St., Apt. 1, Redwood City, Calif. 94063.



**NO LEAKING AND NO CLOGGING** are the advantages of the Typhoon lawn sprinkler that won't wear out, either. It's made of rugged high-impact plastic, has no moving parts and is self-cleaning. Covers up to 1250 sq. ft. in a 40-ft. diameter. Available for \$3.29 at hardware and garden stores, it's made by the AFA Corp., Box 262, Palatine, Ill. 60067.



**SOLAR ENERGY FURNACE** can be used to start campfires, charcoal briquets, or for just plain fun cooking—"sun-burgers," "sun-steaks" and the like. The Fresnel lens is approximately 1/16 in. thick, 11-1/8 in. sq. and has an effective speed of about f/1.5 producing temperatures that reach 2000°F. Stand shown is not included in the kit but you do get instructions for building it, plus a 14-page booklet on the furnace, solar energy and its applications. Ideal in science projects for setting up a demonstration of how solar energy is harnessed at present, the Solar Furnace Kit No. 70,533 sells for \$6. To order, clip this article and send it with your check to Edmund Scientific Co., 380 Edscorp Building, Barrington, N.J. 08007.







**ILLUMINATED HOUSE NUMBER**, which also lights entrance, has a photocell that automatically turns on light at dusk, off at dawn. The number plate is engraved with your house number and is replaceable for \$2.50 should you move. The unit can be wired for manual or automatic operation, comes complete with 40-watt bulb and hanging bracket for \$20.35 postpaid. Give house number when ordering from Machine Engraved Products Co., Box 3901, Charlotte, N.C. 28203.

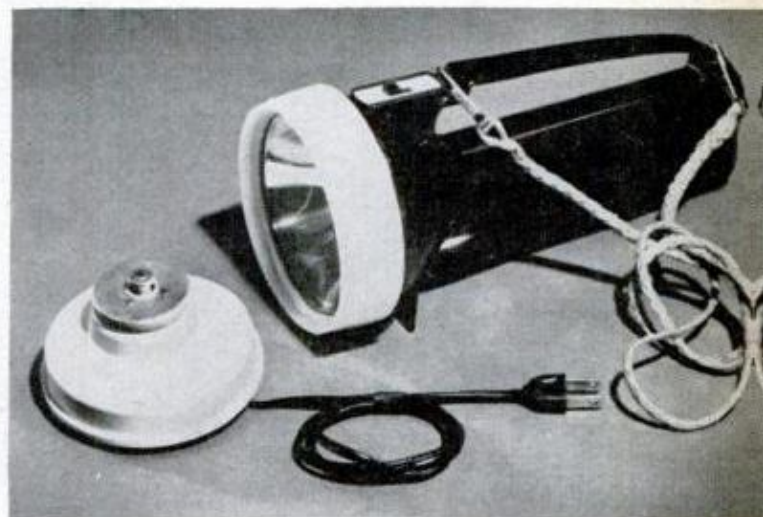


**SHOWER-ALL**, a wall shower, a hand shower, can be used to convert an existing tub without shower, add convenience to a tub with a fixed shower or replace a worn-out showerhead. Sold at department stores; model C (shown) has a suggested price of \$24.95, including attaching hardware. Its design makes it ideal for bathing babies, for shampooing and for the infirm. Jaclo, Inc., 35 Lafayette Ave., Brooklyn, N. Y. 11217.



**ANY CLOSET** can be a pleasant-smelling, moth and insect-repellent clothes closet in a matter of minutes with an application of Rustic Cedaroma. It comes in powder form and can be applied by brush 15 minutes after mixing with warm water. Brushes and utensils will clean easily in warm water. It's priced at \$9.95 per gallon, plus \$1.50 for postage and handling. Order from Jennie Jones, Box 73, Blackridge, Va. 23916.

JULY 1971



**LIGHTWEIGHT, DURABLE** and waterproof are some of the features of the Dynalite flashlight. It's battery-operated, floats in water and will not rust, dent, crack or peel. Comes with nylon shoulder sling. Model 917 with battery charger that fits in head (left) sells for \$15.50 plus 90 cents postage. Kay Lynn Gifts, Dept. 41, Worland, Wyo. 82401.

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**ESTIMATE:  
FOUR SHOCK ABSORBERS (INSTALLED)**

Have it done		Do it yourself	
Parts:	<b>\$50</b>	Parts: (up to	<b>\$40</b>
Full list:		20% off list)	
Labor:	<b>\$12 to 14</b>	Labor:	<b>0</b>
		Your time	
Total:	<b>\$62 to 64</b>	Total:	<b>\$40</b>
<b>YOU POCKET</b>		<b>\$22</b>	

# New Shocks ... and You **SAVE \$22!**

By MORT SCHULTZ

## SATURDAY MECHANIC

**W**HEN SHOCK ABSORBERS need replacing, you can save at least \$12 in labor by replacing them yourself. This figure does not include the discount that you should get from an automotive supply house on the parts themselves. If that discount isn't 10 to 20 percent off the list price of the shocks, tell the guy to forget it.

I came up with these figures by asking an automobile dealer, a local mechanic and a chain store operator what each would charge for labor to replace front and rear shock absorbers on a 1968 Volvo 145 station wagon. The dealer and mechanic wanted \$12, the chain store, \$14.

Once you decide to do the job yourself and save this money, hunt around for a place to buy parts. Every auto parts store I visited said they'd give me 20 percent off retail list price. Standard shocks for the car cost \$12.50 each, a price comparable to that for shocks for most Detroit makes. So the saving over and above labor was another \$10. Twenty-two bucks can buy a lot of groceries.

The front shocks and rear Load-Adjusters used to illustrate this job are Koni units, more expensive than the standard shocks priced out for the Volvo wagon, but chosen by the owner for their firm ride and their ability to be adjusted for desired damping.

Bear in mind that the amount of discount on parts depends a lot on competition and whether certain makes





of replacement parts are fair traded. I live in a very competitive area where there's an auto parts store every block. But no matter where you live, you should be able to get 10 percent off retail. If you can't, you may want to deal with a mail-order house. Generally, the parts in their catalogs reflect a discount of approximately 20 percent.

When do you replace shocks? J. W. Farley, manager of service at the Chrysler-Plymouth Div. of the Chrysler Corp., says that "shock absorbers on endurance test cars, which have been operated in excess of 50,000 miles, have been inspected and tested with no detectable change in performance." Shock-absorber manufacturers have long recommended that shocks be replaced after 25,000 miles of use.

"A car that operates primarily on the freeways might get as much as 50,000 miles from a set of shocks," a spokesman for Monroe concedes. "However," he adds, "shocks on cars that are driven on rural roads very often fail in less than 25,000 miles."

You can take this to mean that the 25,000-mile figure is the average life expectancy of shocks, and that car owners who don't want to take either the time or trouble to inspect shocks should replace them at this mileage.

Once a set of shocks has completed 25,000 miles of use and still remains in service, a test should be made every 5000 miles. Bad shock absorbers can be a safety hazard.

Farley makes still another point: "It's not necessary to replace your shock absorbers in pairs," he declares. Shock-absorber manufacturers claim that shocks should be replaced not just in pairs, but in sets—that is, if you replace one, replace all four of them.

According to the spokesman for Monroe, replacement of shocks in sets (or at least in pairs) is necessary in order to allow a car to maintain its "balance." Farley calls maintenance of balance a "mistaken belief." In other words, it doesn't matter if a shock is old or new—if it's in good condition, it will allow a car to maintain "balance."

I'd recommend that you use common sense: Make sure that your shocks are really shot before you relegate them to the junk heap. Bad shock absorbers will usually reveal themselves while you're driv-



**FRONT SHOCK** is secured at its bottom end to the bottom A-arm. Two screws hold the shock's cross pin

ing. Since the purpose of these parts is to control the action of the car's suspension system, wheel bounce and/or front-end shimmy often means that the shocks have gone bad.

Chassis noise (a rattle or "clunk") also indicates shock-absorber failure, as does skidding and side-sway of the car as you go around a curve.

Bear in mind, though, that each of these problems is caused by other malfunctions. That's why the testing of shocks before replacement is advised. You could throw away perfectly good shocks and be left with the trouble.

The ultimate test is to remove each shock from the car and check it carefully on your workbench. First, clean off all

**TOP END** of front shock absorber on this car can be reached in wheel well without removing the wheel







**REAR SHOCK** is secured at bottom end to the axle-carrying control arm. Use "nut-buster" if necessary

dirt that's caked on the upper and lower mounting bolts. Removing these bolts is the toughest part of the job. Swabbing the hardware down with a penetrating oil and letting this soak in for a couple of minutes will make your task easier.

Holding a shock right side up—that is, in its mounting position—extend it fully. Now, reverse this position so that the shock is upside down and collapse it slowly. Repeat this procedure three or four times. If the shock feels loose, you should replace it.

What's a "loose" shock? It's relative: The best way for you to find out is to get your hands on a brand new part and see what it feels like.

Bench testing should be done when you aren't sure if a shock needs to be replaced, or when you decide that it does and you take it off the car. You might as well be sure before buying a new one.

However, the time-honored test of bouncing the car is still valid; that is, bounce up and down on the car, front and rear. If the car bounces more than one and a half times after you hop off, the shocks may be worn. Take them off and check them on the bench.

Whenever you're at work underneath the car, make it a point to examine each shock for oil leakage. The presence of oil



**DAMPING FORCE** of Koni shock can be increased as required by turning adjuster nut in valve assembly



**LOTS OF LEVERAGE** may be needed getting off old shocks (left). New replacement (right) for rear shock of this station wagon is heavy-duty stabilizer type intended for carrying heavy loads and for safer towing



on the outside of the shocks always means that seals are worn. Then there's no need to hesitate—replace the shock.

A shock-absorber bushing can go bad without the shock itself being affected. This will usually result in a chassis noise that sounds like "clunk." To check a bushing, grasp the shock firmly and try to move it. If it's loose, see if you can tighten up on the mounting nuts. If this doesn't help, the bushing is shot.

Shock-absorber bushings of many cars, but not all of them, can be replaced. In some models there are shocks that have irreplaceable integral bushings and cross pins, or integral bushings and sleeves. Where these go bad, the entire shocks have to be replaced.

However, if the bushings are of the conventional kind, you can get replacements at an auto parts store. To be on the safe side, take a shock with you and compare the shape and size of the new bushing with the old one.

To replace a bushing, knock the old one from the eye with a metal pin, drift or some such tool. Next, you should spray the new bushing with a liberal amount of silicone lubricant to make it pliable. Then work the bushing into the eye by hand. Be sure that you use silicone lubricant only; a petroleum-base product will cause the rubber bushing to deteriorate. ★★★



**DOUBLE TROUBLE** with this shock includes ruptured seals and well-worn bushing that caused "clunking"

JULY 1971

## NEW FOR YOUR CAR



**YOU GET A BACK RUB** as you drive along with this electric massaging device. Designed to relieve sore back muscles on long trips, the motorized backrest plugs into the cigarette-lighter socket on the dashboard and provides a gentle, rhythmic action. It's available for 6, 12 or 24-volt electrical systems. \$119.95. Niagara Therapy Corp., Adamsville, Pa.



**LIQUID LIGHT**—that's literally what you get in this chemical lantern for changing tires and other emergency use. The light is produced by two interacting chemicals in much the same way as a firefly's glow. The chemicals are kept separated in a plastic tube by a seal. Bending the tube ruptures the seal to activate the light. Developed by American Cyanamid Co., the tubes are ideal for emergencies as they last indefinitely until activated. Look for them on the market this fall.

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# A Jewelry Box

## For Your Queen

Made of rare woods and featuring a Swiss musical movement, it is sure to become a treasured family heirloom

By TOM H. JONES

Color Photo by Robert D. Barst

**T**HERE COMES A TIME in any serious woodworker's career when he has a desire to build pieces that his family will treasure. An anniversary gift for his wife, perhaps, or a graduation present that his daughter will cherish and eventually pass on to *her* daughter. This jewelry box is just such a project.

Surprisingly, it is a lot easier to build than a first look may imply. It features a case veneered on all sides and a single-tune musical movement which plays when the lid is opened. Though veneering requires care and accurate cutting, none of the steps is particularly difficult.

● *Panels.* Cut all veneer blanks slightly

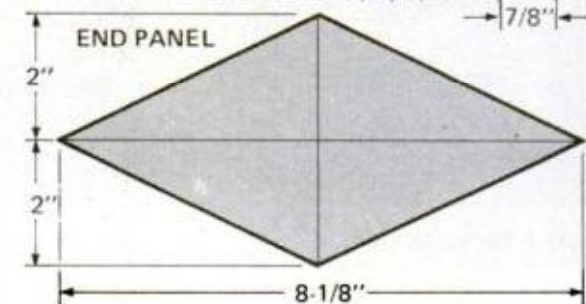
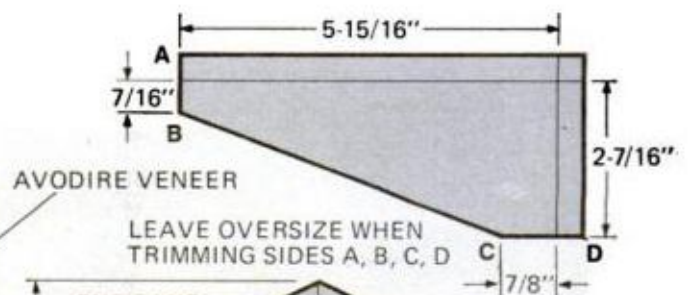
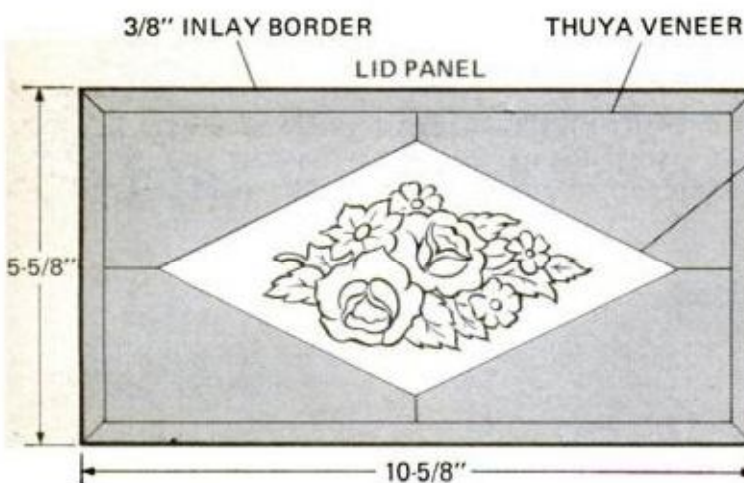
oversize. And, since it is brittle, the face of thuya, or any fragile crotch or burl veneer, should be taped (masking or

### PM'S CRAFTSMANSHIP LOGOTYPE

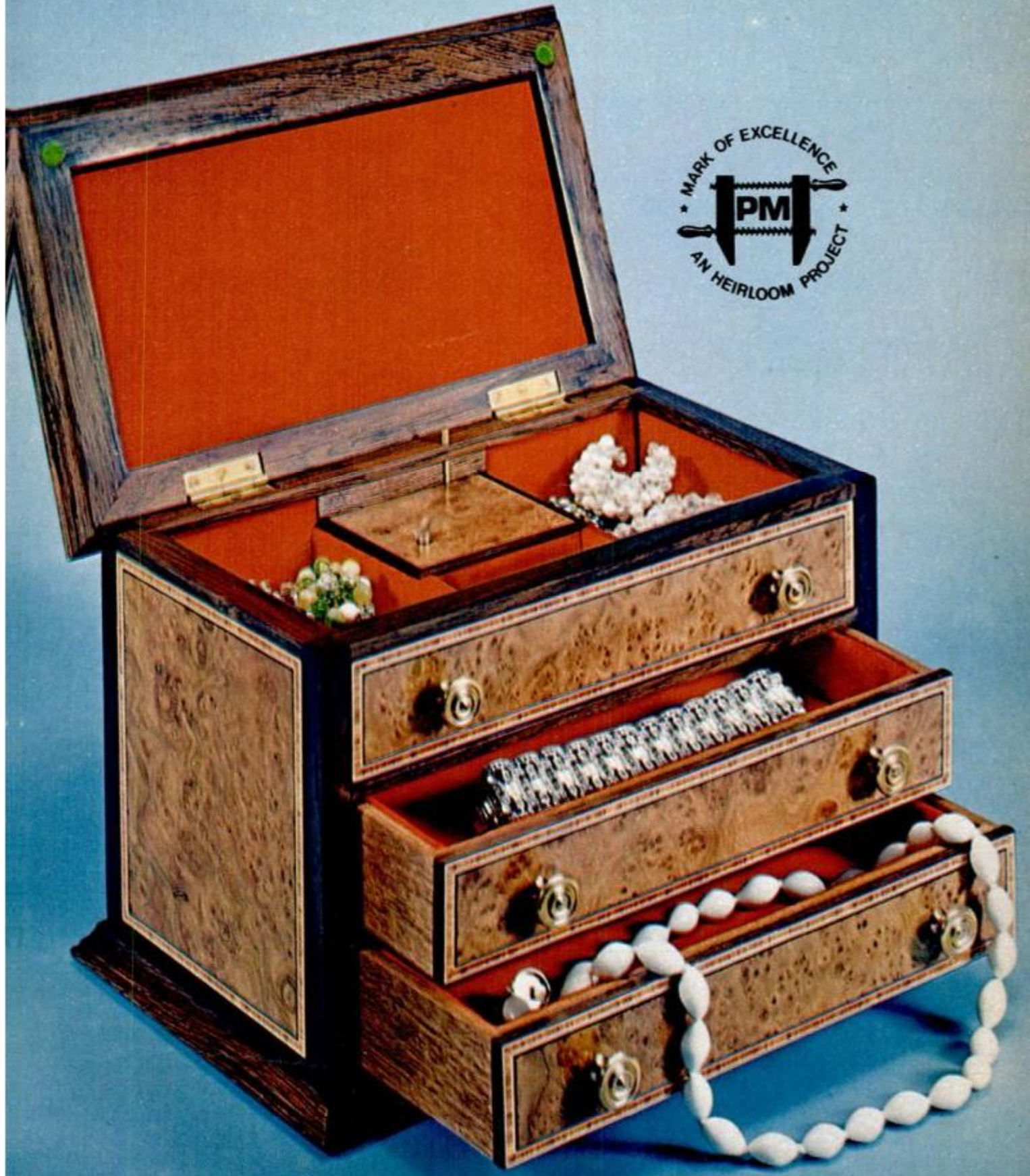
Starting with this handsome jewel box, *PM* will periodically present projects intended especially for the skilled woodworker. Though not necessarily hard to construct, all projects bearing *PM's* Mark of Excellence Stamp (see facing page) will have one important feature: Each will merit retention by the builder's family. In short, each will be an Heirloom Project.

—The Editors

### LID VENEERING DETAIL

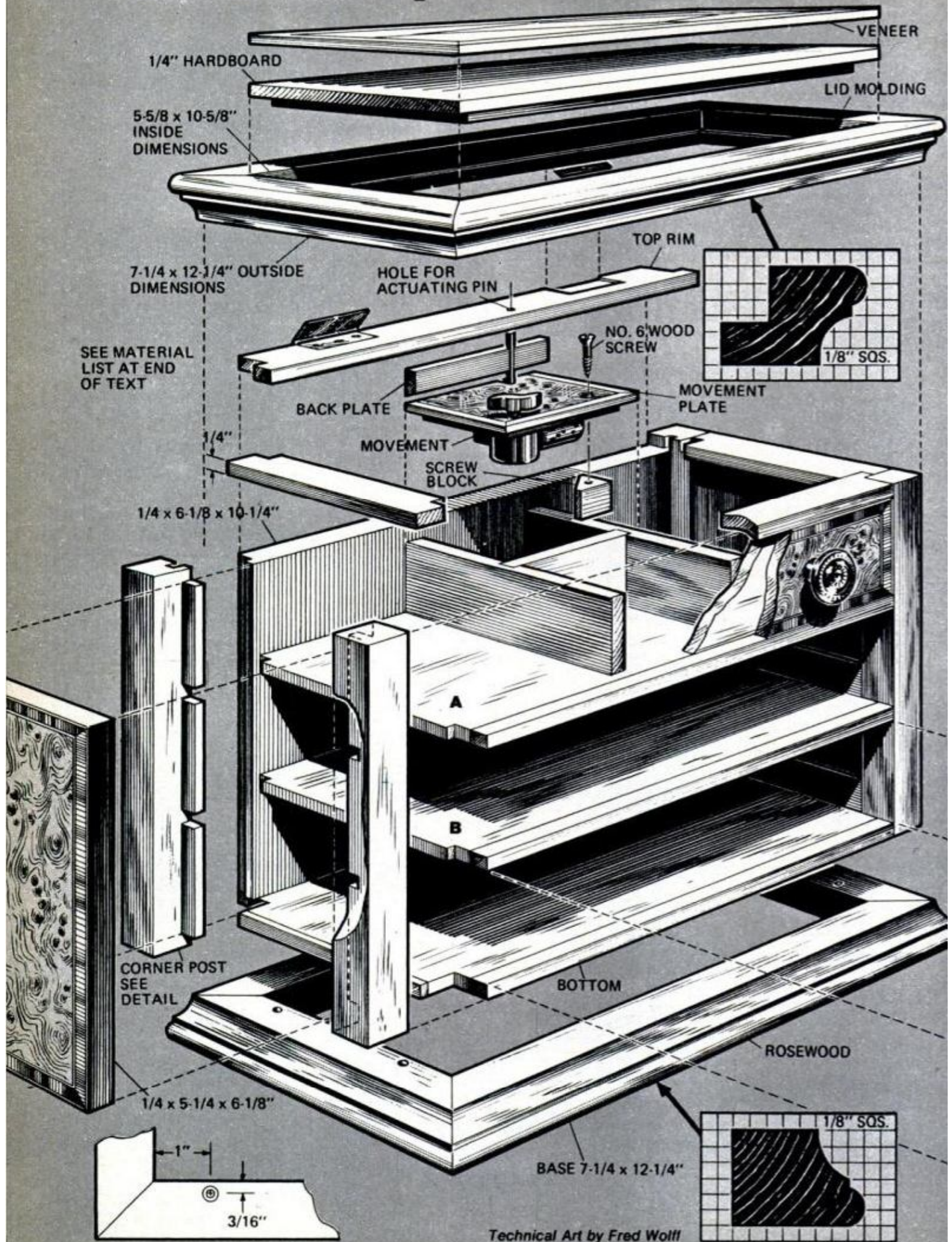








# General Assembly



Technical Art by Fred Wolff



kraft) near all edges and across any cracks before you cut it with a knife or veneer saw. Apply white glue liberally to the veneer (remember, keep the taped side outside) and affix the veneer to hardboard. Clamp this between waxed paper and cauls and, applying pressure slowly, work from the center out.

Trim the oversize veneer blanks to remove loose veneer and excess glue from edges, peel off tape and rough-sand the veneer to remove all glue that has seeped through. Finish the blanks by trimming to dimensions shown in the drawing.

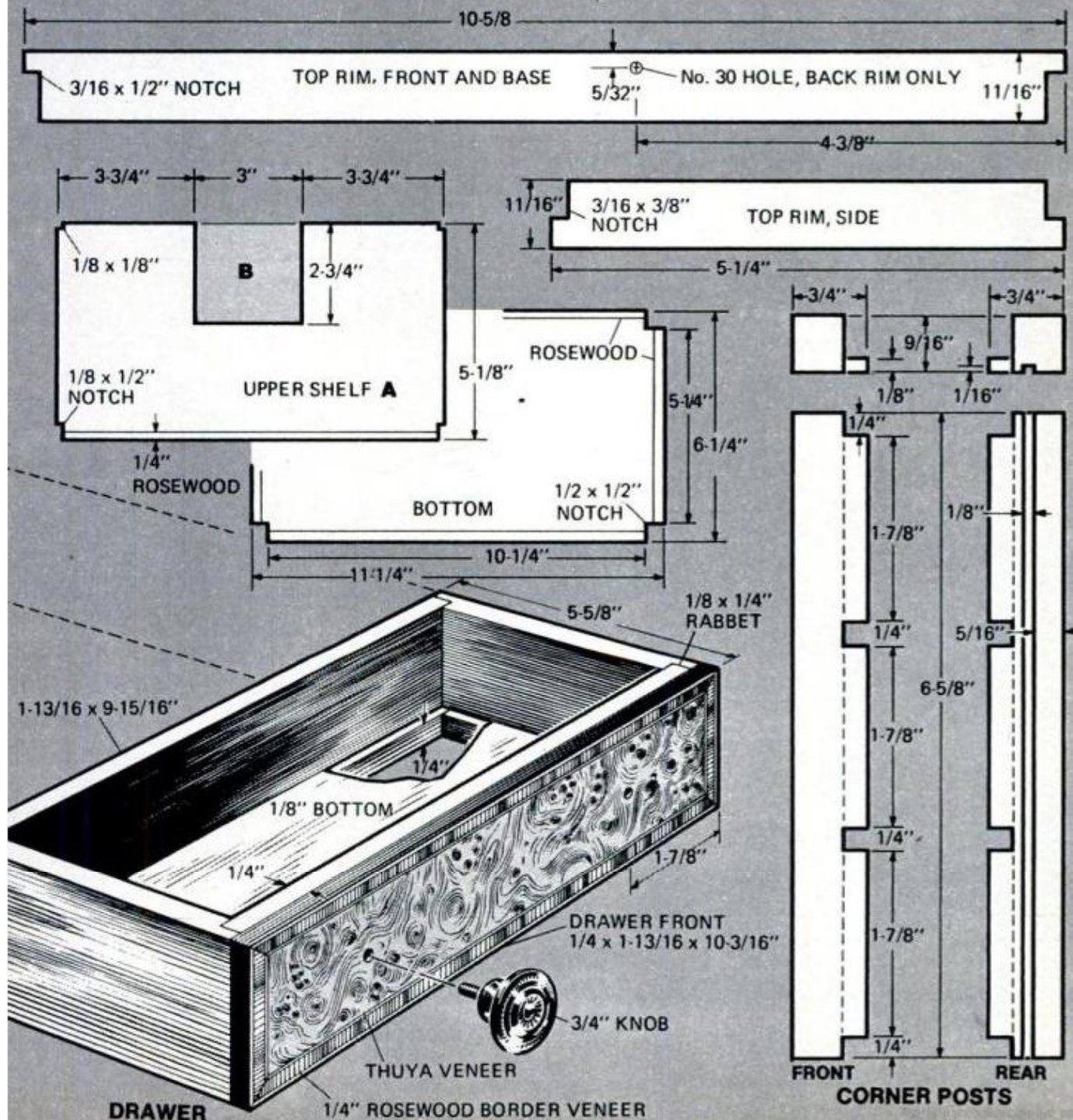
Cut oversize backing panels from plywood and glue them to the back of each veneered panel. Trim the plywood panels flush with veneered panels on all sides, except the ends of the back panel which

are trimmed  $\frac{1}{16}$  in. oversize to fit the grooves in the rear corner posts.

● **Drawers.** Cut three blanks for drawer fronts from  $\frac{1}{4}$ -in. hardboard and veneer them with thuya. After rough-sanding the veneered blanks, trim two of them for drawers and the third for the false drawer. Glue rosewood veneer to all four edges of the two drawer fronts and sand these to size. Now remove  $\frac{1}{4}$  in. of thuya from all four sides of the three drawer fronts with a sharp chisel and glue the inlay border in place. Locate knob screw holes, stack and clamp the drawer fronts and drill the holes.

Drawer parts are of  $\frac{1}{4}$ -in. mahogany and  $\frac{1}{8}$ -in. plywood. Glue drawer fronts to the drawers with the bottom edges

*(Please turn to page 170)*







## BASIC CAMPER: \$800

### ACCESSORIES

MATTRESS FOR OVERCAB BUNK	\$33.90
DINETTE CUSHION SET	\$59.90
CONVERTIBLE BUNK	\$64.24
SINK AND WATER TANK KIT	\$28.51
BOTTLE-GAS SYSTEM	\$38.53
THREE-BURNER GAS RANGE	\$32.97
THREE-BURNER RANGE WITH OVEN	\$89.95
ICEBOX	\$33.81
REFRIGERATOR (4 cu. ft.)	\$257.95
GAS FURNACE	\$71.90
CURTAINS AND DRAPES	\$53.83
EXHAUST HOOD (VENTED)	\$6.76
EXHAUST HOOD (POWERED)	\$21.95
INTERIOR GAS LIGHT	\$10.83
ELECTRICAL CONVERTER	\$44.95
UNLOADING JACKS	\$74.95
PORTABLE TOILET	\$77.32
EXTENSION STEP BUMPER	\$67.05
INTERCOM SYSTEM	\$39.95



# A \$1200 Camper From a Kit For \$800

You can save one-third of the cost of a factory-built pickup camper by making this 9-footer from a precut kit and equipping it yourself

*Photographed at Cypress Gardens, Fla.,  
By Monty Monts de Oca and Jerry Imber*

**F**ROM KIT TO CAMPER in just 50 hours! That's the boast made by the maker of this handsome pickup camper kit. The kit costs \$800 and by putting it together you'll get a basic camper that's worth \$1200. For \$400 more (the cost of accessories) you can end up with a camper the equivalent of which would cost you \$1600 if bought ready built.

Manufactured by Luger Industries, Dept. PM, 1300 East Cliff Rd., Burnsville, Minn. 55378, the 8-ft. 10-in. Rover shown here is fun for the entire family, from building it right on through to your first camping trip. And, happily, the instructions that come with the kit are well illustrated with easy-to-understand line drawings.

You will be particularly impressed with the Luger firm's attention to detail. For example, every part you need to assemble the camper is included, from the smallest fastener up to the large, precut and factory-finished interior paneling.

Pictured on the following pages is the step-by-step assembly procedure for building the Rover Model 4085 camper which can, if desired, sleep six.

The Rover's convertible dinette offers the comforts of optional thick-padded

**LEFT:** In 50 hours, you can convert kit into camper

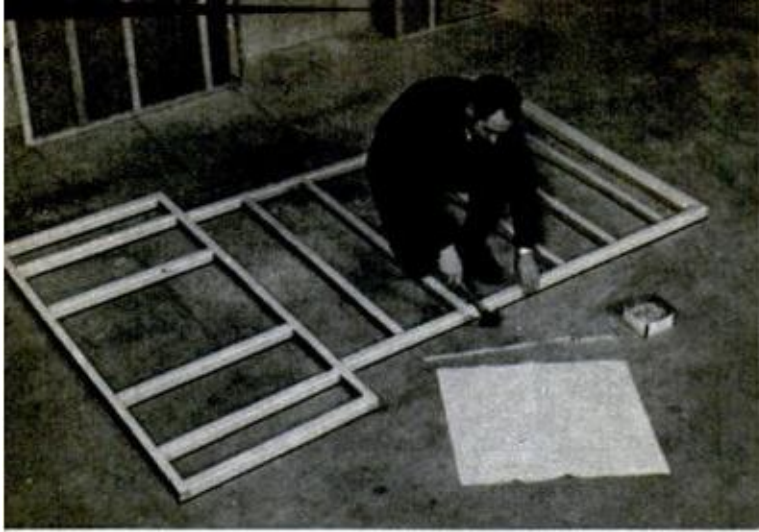
**RIGHT:** Dinette (top) seats three comfortably. Kitchen (second photo) can be equipped with three-burner range-oven. Optional bunk over dinette (third photo) sleeps two—as does dinette bunk (bottom)

JULY 1971

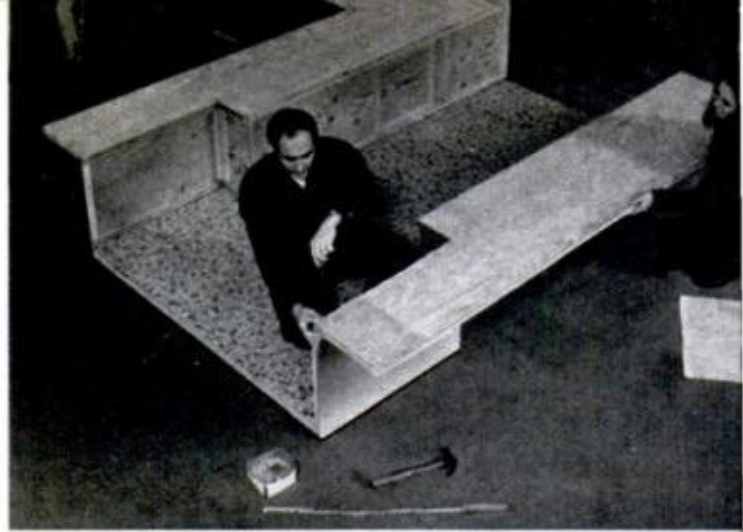
129



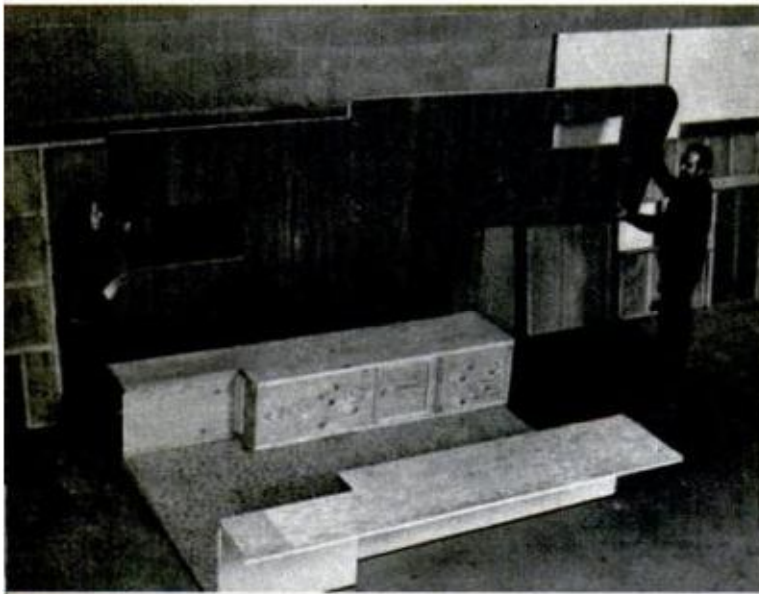




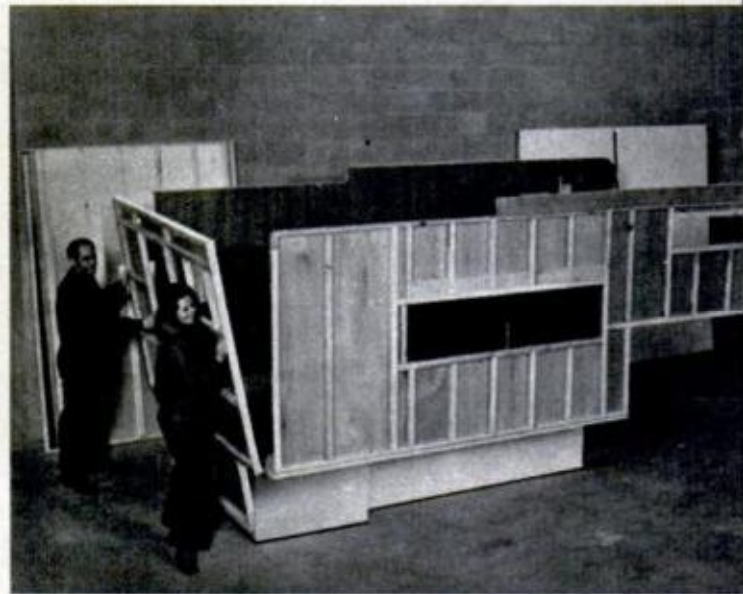
**EXTERIOR SECTIONS** are laid out first. Two by fours and precut, prefinished paneling are included in kit



**CAMPER-FLOOR BASE** is completed and covered with linoleum. Next, wall sections are fastened to the base

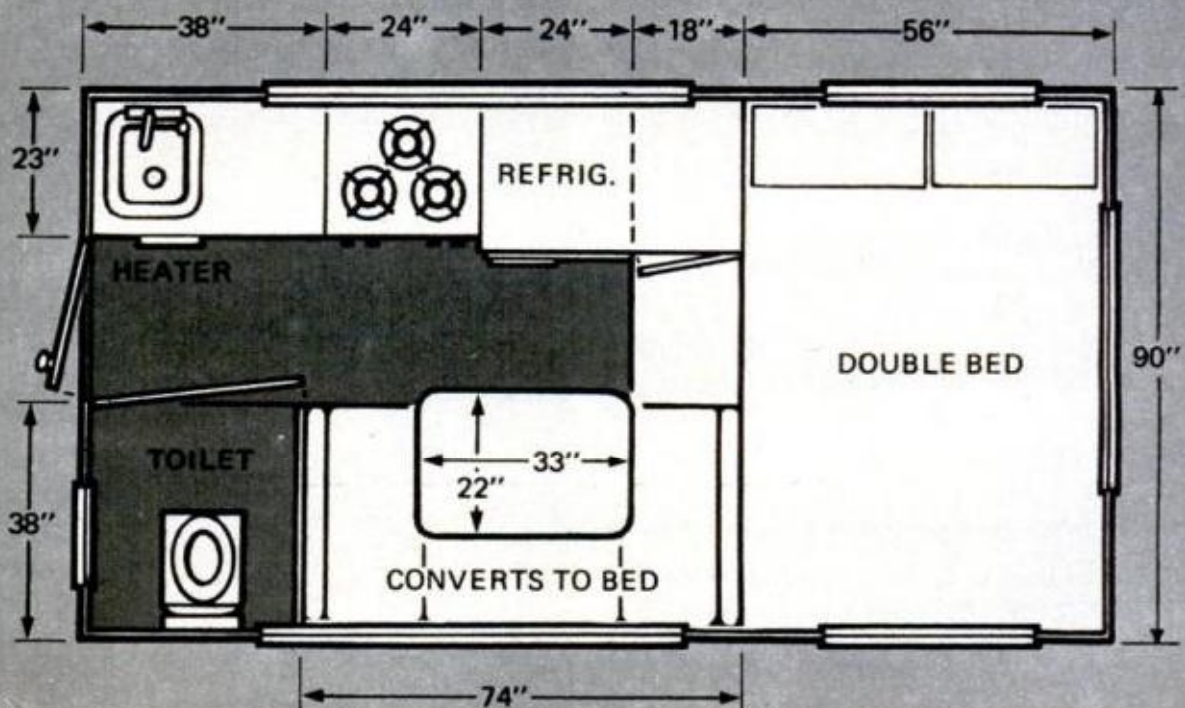


**ASSEMBLED CAMPER WALL** is placed in position on camper base. Instructions are clear, easy to follow

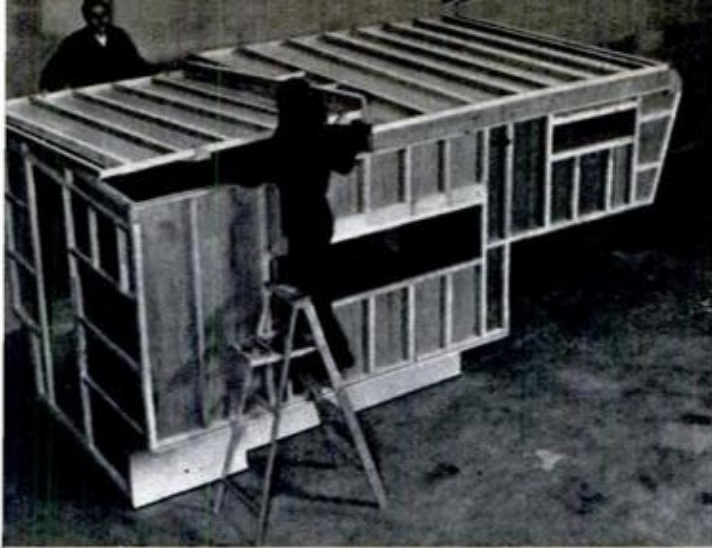


**WITH SIDES AND ENDS IN PLACE**, the kit is well on its way to becoming a finished pickup camper

## CAMPER FLOOR PLAN



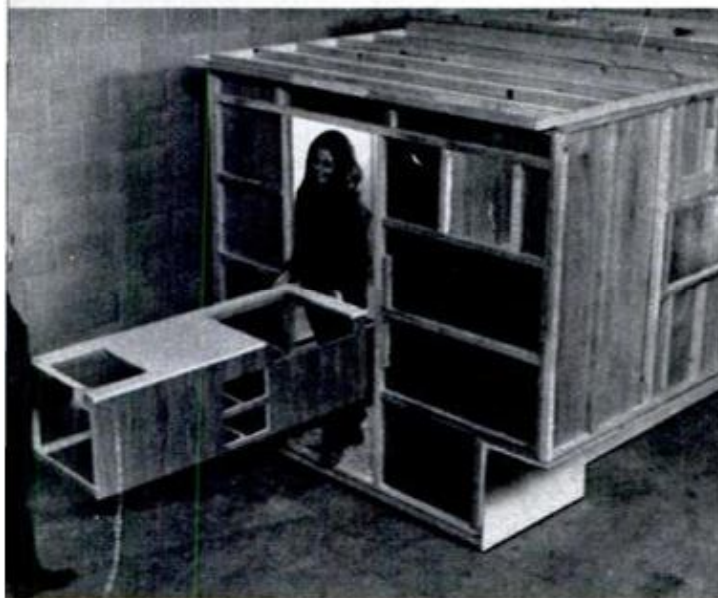




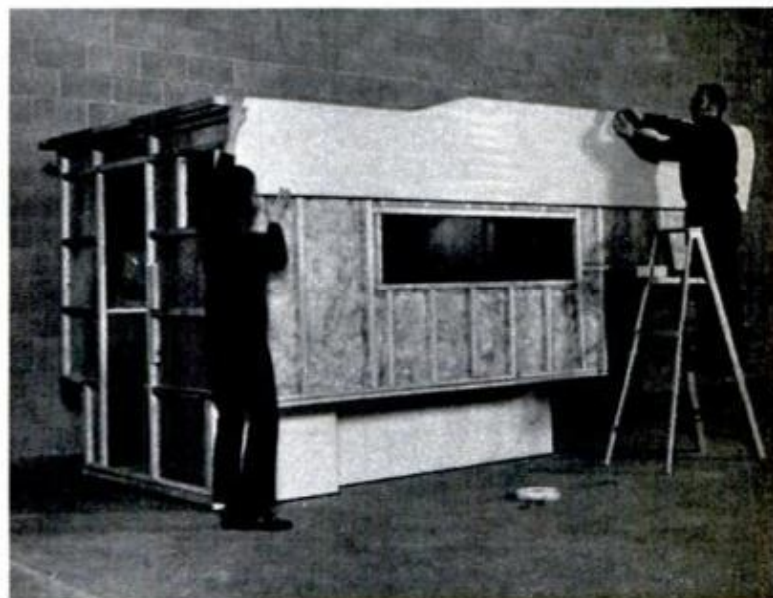
**ROOF SECTIONS** are dropped in place after the side walls have been erected. This completes basic camper



**INTERIOR PARTITIONS** are also precut and pre-finished. Camper can be assembled in about 50 hours



**ASSEMBLED KITCHEN COUNTER** is slid into place. Camper can be assembled using regular hand tools



**FIBERGLASS INSULATION** goes in next, is skinned with a factory-supplied aluminum exterior covering

foam cushions, overhead light and a sturdy table topped with Formica. Accessory curtains for the cab-over bed area and windows are color coordinated with the handsome interior. The smartly styled interior features a plastic-laminated 3-ft. kitchen counter plus roomy cabinets above and below counter and sink. The optional ice box or refrigerator is of ample size for the average family's camping needs.

You can purchase optional extras immediately or, if you want to keep your initial investment low, begin with the bare essentials and add accessories as you can afford them. The breakdown on page 128 lists major accessories and what they cost.

A couple, obviously, can get by with a minimum investment. A family with four children will have to lay out a little more initially, but a couple of family vacations will quickly amortize the cash outlay.

Luger states that "any standard 3/4-ton

pickup equipped with the extra equipment recommended by its manufacturer for camper carrying use" will suit the Rover. This will usually include heavy-duty rear springs and shocks, extension rear-view side mirrors and heavy-duty tires. Other optional pickup equipment such as automatic transmission, power steering and brakes, deluxe interiors, bucket seats and the like is strictly a matter of personal taste and how far you want to stretch your vacation budget.

The kit price includes everything needed to assemble the camper as shown, but it does not include accessories listed on page 128. The kit does supply all exterior aluminum covering, insulation, structural framing members, interior paneling, cupboards, kitchen countertop and the like. For more information on the Rover, write Luger Fun Camper Kits at the address noted on page 129. ★★★







# Make This Charming Colonial Wall Clock

Photos by Robert D. Borst

**YOU'LL HAVE** a handsome timepiece for the rest of your life when you make this Early American wall clock. What's more, it's simple to make; if you have no way of forming the turnings and the moldings, you can buy them ready-made. In fact, the wood and everything else—even the finishing materials—are available in a kit. All you have to do is cut out the front and make the simple box attached to the back.

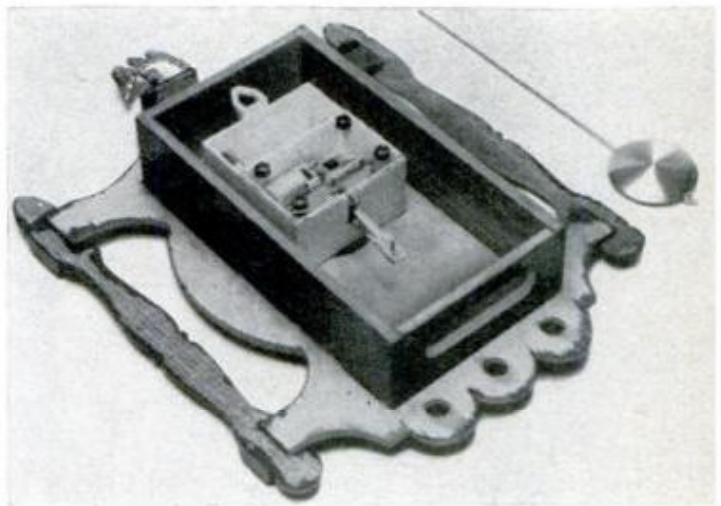
However, if you have scraps of walnut gathering dust in your woodbox, you can buy the battery movement, dial, pendulum, stars and eagle separately and make the case from your own wood.

If you start from scratch, you first must make a full-size pattern for the front of the clock by ruling off 1-in. squares on paper and enlarging the squared pattern given on page 134. To enlarge the magazine pattern you draw in each square of the large pattern the same portion of the outline that appears in the corresponding square of the small pattern. You need only draw a half-pattern.

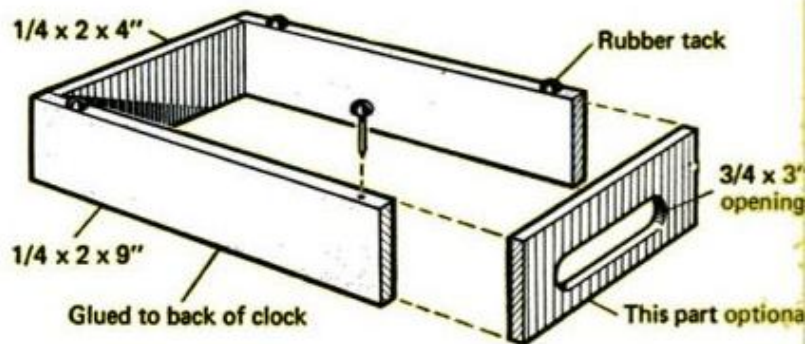
The blank turning square for the split spindles is built up by gluing two ½-in.-thick pieces together with a piece of paper between. This trick permits prying the two halves apart with a knife blade after the turning is completed. This one turning makes both split turnings.

Ordinarily, a three-sided box open at the bottom is all that's necessary to house the movement on the back of the clock. However, should the plywood front have a slight warp or cup as it sometimes does, a fourth side on the box will help pull the plywood flat when you glue and clamp the box in place. If the bottom piece is needed, remember that it must have an opening for the pendulum.

From here on it's simply a job of adding the blocks for the eagle's perch, gluing the molding and split turnings to the jigsawed



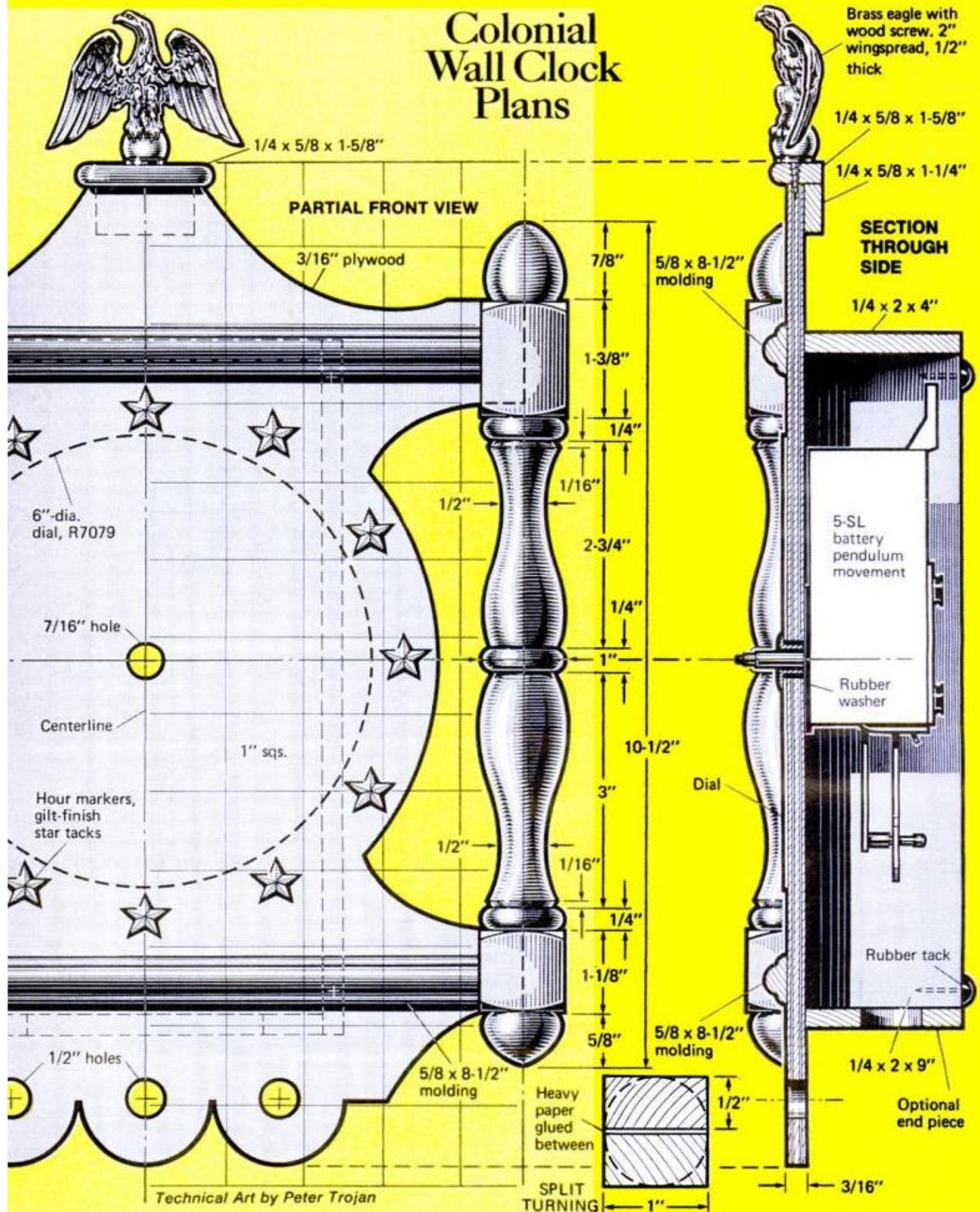
**IF BOTTOM IS USED** in box housing the movement on back of clock, a slot must be provided for pendulum



**STARS AROUND DIAL** are lightly tapped into pre-drilled holes located on 6½-in.-dia. penciled circle



# Colonial Wall Clock Plans



front and finishing the case by applying a combination stain-filler, followed by two coats of waxing lacquer, rubbed between coats. The dial and clock movement take only a few minutes to install.

The kit, as well as separate parts, is available from Gaston Finishes, 3630 East 10th St., Bloomington, Ind. A complete kit sells for \$29.50 postpaid; without the wood parts, it's \$19.50. ★★★

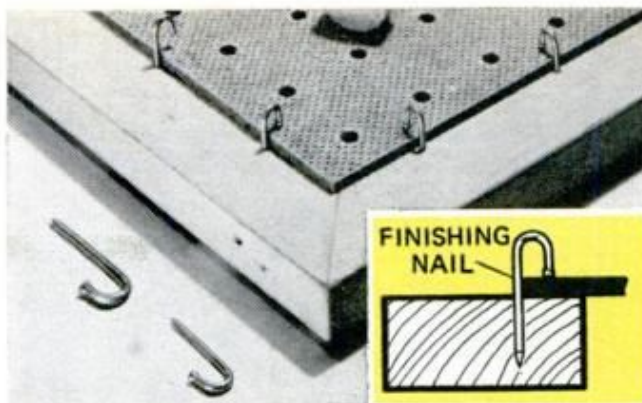


# HINTS FROM READERS

## 'Fishhook' nail holds panel

A simple way of fastening a panel over a framed opening is to use nails fishhook fashion to clamp the edges. The fasteners are ordinary finishing nails with the head-ends bent to press firmly against the panel back. The panel is not penetrated, and it can be easily removed by rotating each of the hooks about a half-turn.

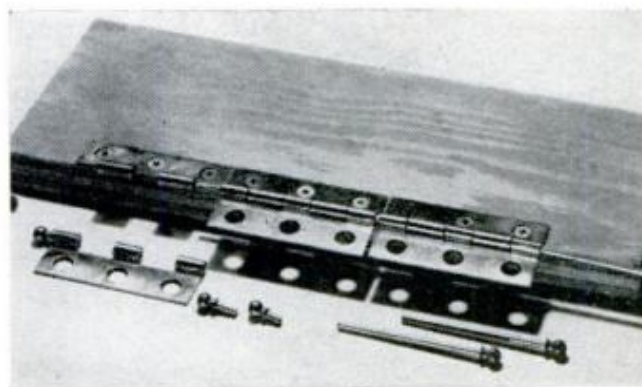
—Walter E. Burton, Akron, Ohio



## Homemade continuous hinge

Recently, when I needed a length of piano hinge, the thought occurred that I already had the materials to provide a good substitute at no cost. I simply fastened a series of butt hinges in place and joined them by a single "pin." This pin can be a length of coathanger wire or other wire that fits the knuckle-holes snugly.

—B. W. Ervin, Kent, Ohio



## Tap makes scale marks

A thread-cutting tap can be used as a die for imprinting scale marks in soft sheet aluminum. For example, the 3/8-16 tap shown at right gives a scale having 1/16-in. divisions. Simply squeeze the tap against an aluminum blank in a vise using hardboard as a backing between tap and jaw to prevent damage to the tap's threads.

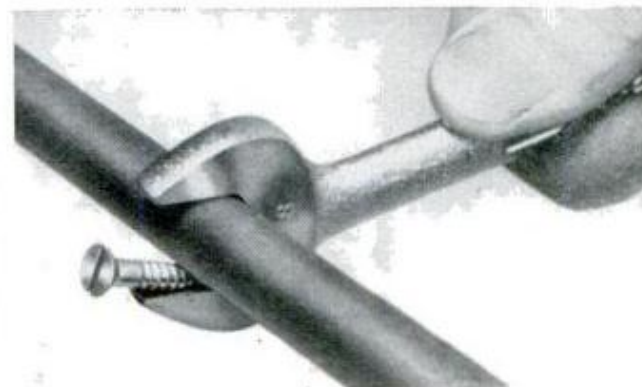
—W. B. May, Oak Park, Ill.



## Improvised pipe wrench

Next time you can't find your pipe wrench, use your open-end wrench to turn a small pipe. Simply place a wood screw between the pipe and lower jaw of the wrench; the threads will provide enough grip to turn the pipe. If working with copper, wrap a turn or two of friction tape around threads first.

—William Swallow, Brooklyn, N.Y.



## Aluminum marks lathe work

A piece of soft aluminum wire clamped in a lathe toolpost can be used to mark positions for cuts to be made on shafting or other darkly-coated stock. Mount rod as for turning, bring wire tip against it where mark is desired, and hand-rotate the spindle. The aluminum will produce an easy-to-see shiny mark.

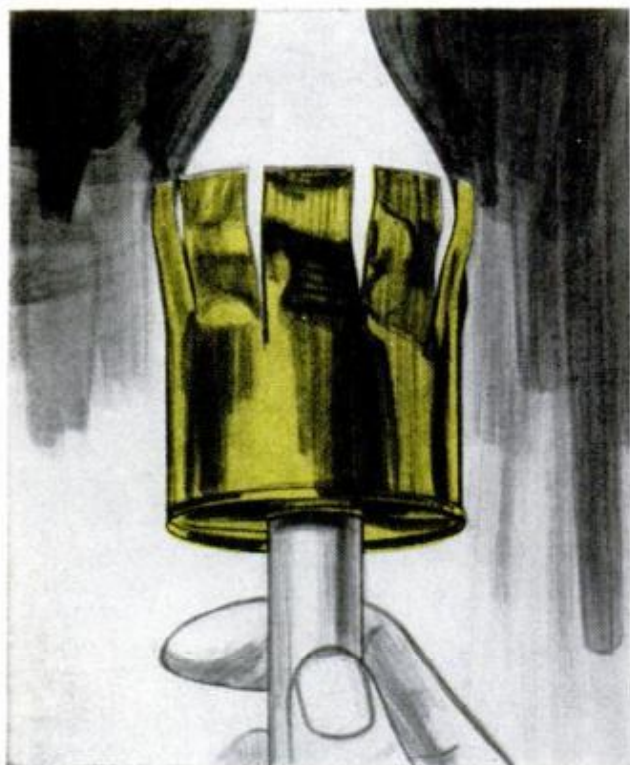
—Walter E. Burton, Akron, Ohio



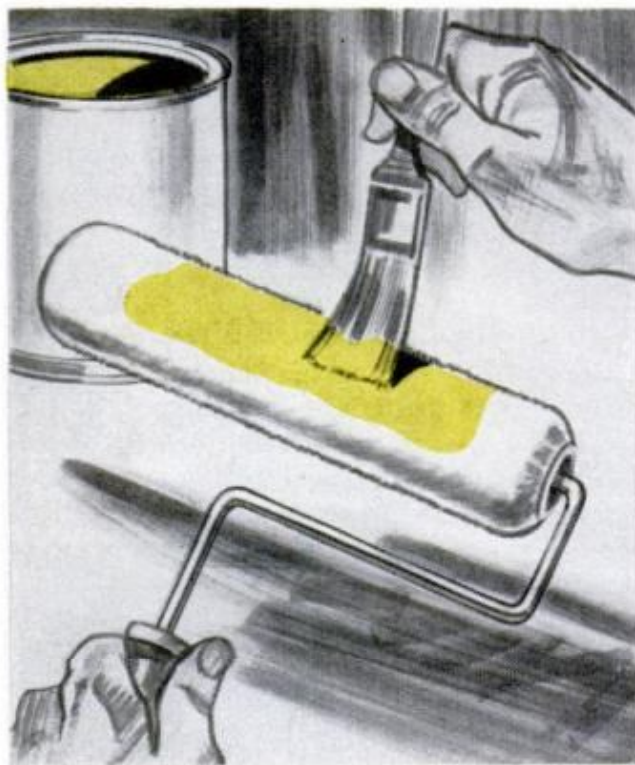




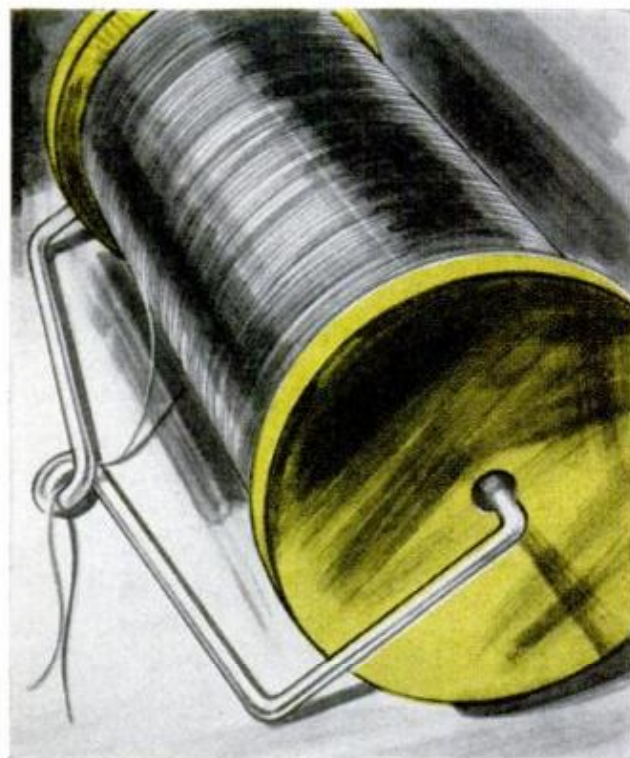
# SOLVING



**CEILING LIGHT BULBS** are a snap to replace if you fashion a bulb gripper from a tin can. Simply make 2-in. cuts down from the can rim and fasten the can to a broomhandle.—*William Swallow, Brooklyn*

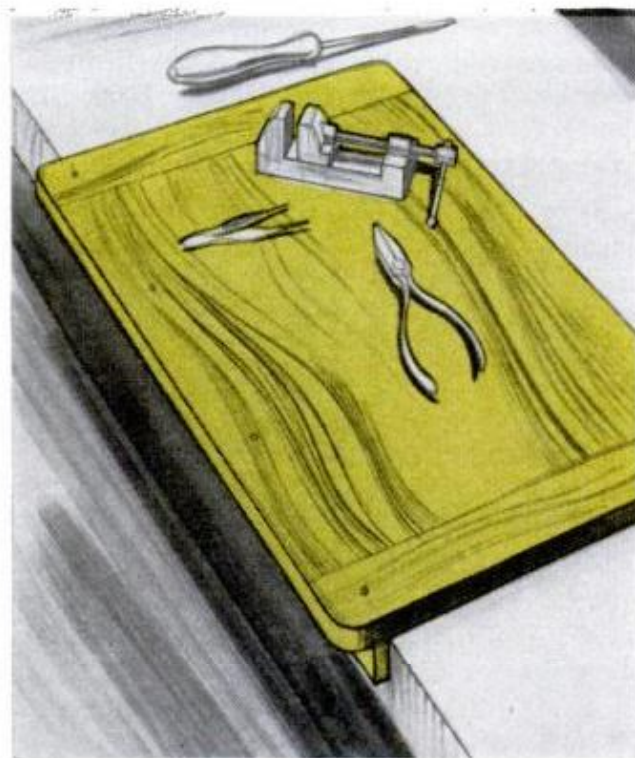


**WHEN A WALL** needs a touch-up job here and there, don't bother dirtying a paint tray. Simply transfer the paint from the bucket to the roller with a paintbrush.—*John Pilznienski, Dearborn Heights, Mich.*



**WIRE AND THREAD SPOOLS** won't unwind and tangle if you bend and affix a short length of wire as shown. End of wire is then threaded through the loop and never gets lost.—*W. H. McClay, Pasadena, Calif.*

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**PORTABLE "WORKBENCH"** for those fix-it jobs at the kitchen table can be made from an old cutting board or plywood scrap. Simply attach an apron to hold it in place.—*J. H. Millholland, Haverford, Pa.*

POPULAR MECHANICS

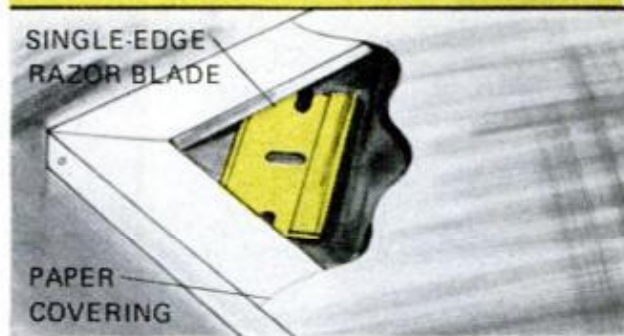
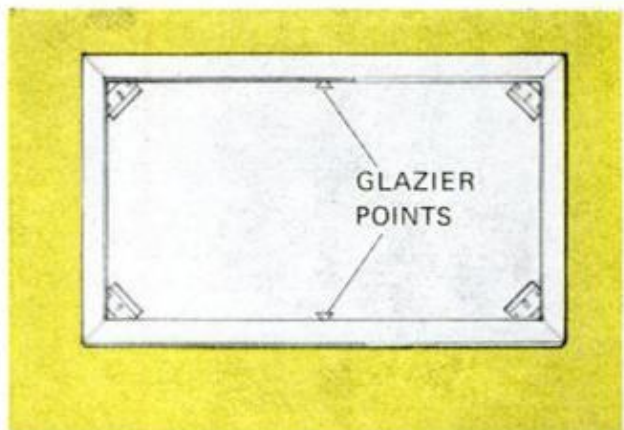


# HOME PROBLEMS

Illustrations by Adolph Brotman, Worman Associates



**ADD FLOWER POWER** to your back-yard fence by hanging potted plants the easy way. Just add a wire ring under each pot's lip and attach a bale. To hang, use a shelf bracket.—*W. H. McClay, Pasadena, Calif.*



**PICTURE MOUNTING AND FRAMING** goes quicker if you substitute old single-edge razor blades for those tiny glazier's points at the corners. Trick saves looking for tools.—*M. K. Fox, Wellesley Hills, Mass.*



**LIQUID SHOE POLISH** works great as a touch-up paint when repairing rust spots on wrought-iron furniture. The idea is not recommended for items (brazier) where fire is present.—*Pat Hylas, Woodhaven, N. Y.*

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**EMERGENCY CANDLE HOLDERS** for a blackout can be rigged quickly by using handy cans of food as nontip bases. Place candle against can and snap hefty rubber band around both.—*William Swallow, Brooklyn*

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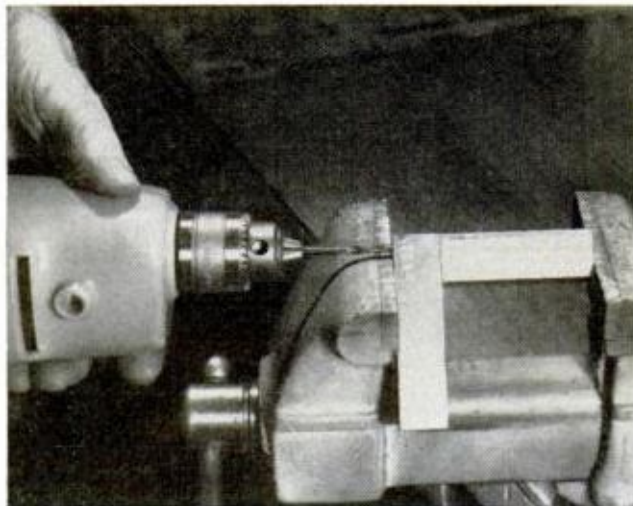
You'll be able to machine a reasonably perfect ball-shaped knob or neat convex segment on a decorative spindle with this . . .



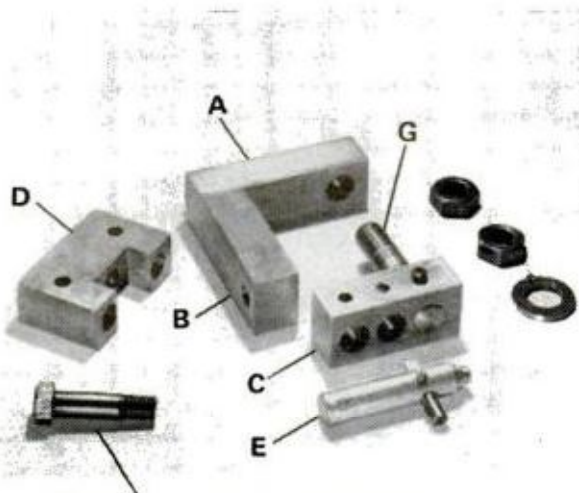
# Lathe Ball-Turning

By WALTER E. BURTON

SEVERAL EXAMPLES of what the attachment can do are shown above. Diameters here are  $\frac{1}{4}$ ,  $\frac{1}{2}$  and 1 in. Variations need be limited only by your imagination



PORTABLE DRILL is used to make holes in part B (see page 140) for the two  $\frac{1}{8}$ -in.-dia. pins which help to join and align part A with the upper end of part B



3/8-16 x 1-1/2" CAPSCREW

PARTIAL ASSEMBLY: A and B are joined and block C is attached to pivot (G). Cutter-post assembly (E in foreground) uses a section of  $\frac{1}{4}$ -in. rod as the cutter

MANY KINDS of ball-turning gadgets have been devised for lathes. I designed this bit for machining ball-shaped knobs and pulls, for forming rounded ridges and edges and for making convex segments on decorative spindles and handles. It works like a charm.

To be able to accomplish these turnings, you need a cutter that can be pivoted properly around a fixed center. The attachment shown, designed to do just that, consists essentially of a steel-bar frame supporting a lever-controlled swinging arm. Extending down from the arm is a rod in which the cutter is mounted.

Possibly this arrangement would work consistently without a support for the lower end of the cutter rod, but this end was provided with an adjustable screw whose head slides over a steel plate. The downward cutting force against the cutter is thus counteracted partially by the plate, lessening stress on the supporting frame and reducing the tendency to chatter.

The model, made from available shop stock, was dimensioned to fit a 9-in. lathe to machine balls ranging in diameter up to about  $1\frac{1}{2}$  in. Set up as shown, the attachment normally shapes most of a ball but leaves it attached to a stem. By carefully adjusting the cutter until its tip can cut to the center without the holder or other part striking the work, you can machine a ball completely, or until it breaks off.

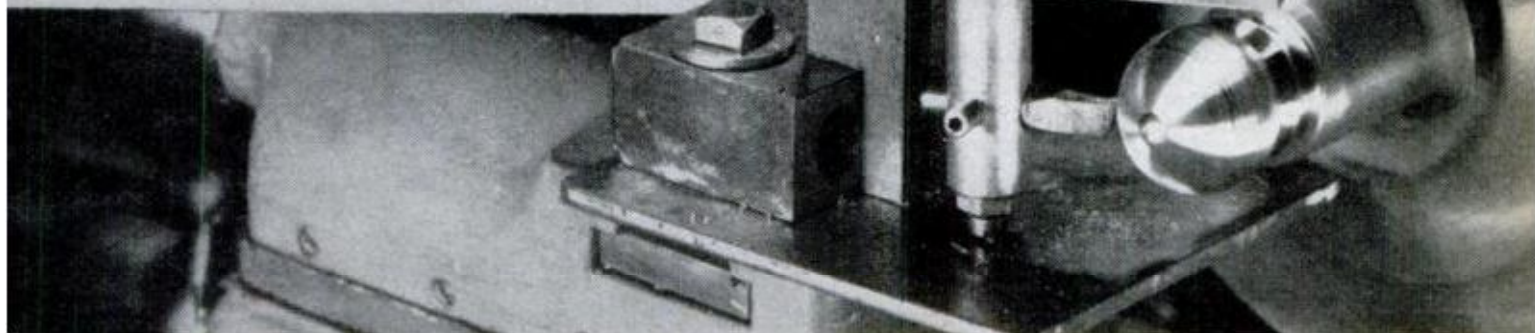
The attachment is clamped to the compound slide of the lathe, in place of the usual toolpost assembly, by two bolts engaging a bar (J in drawing, page 140) in the T-slot. It could be manipulated to

POPULAR MECHANICS



# Attachment

Photos by the Author



make concave cuts within a limited radius range. Even a greater range might be machined with a simpler setup described later.

Parts used in the model attachment include four steel blocks, a steel plate, and miscellaneous bolts and screws. Much of the frame, represented by pieces marked A, B and C, was made from  $\frac{3}{4}$  x 1-in. steel bar. The base block (D) is wider in order to span the T-slot in the compound slide. A steel plate (F),  $\frac{1}{8}$  in. thick, was interposed between D and the compound to serve as a platform over which the cutter-holding rod slides. Strip J was made to fit the toolpost slot of the lathe.

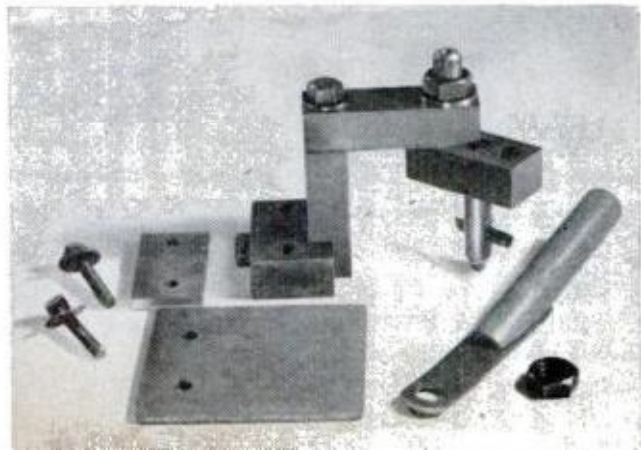
The  $\frac{1}{2}$ -in. shaft (G), which serves as the pivot for the swinging movement of

**BALL-SHAPED KNOB** is machined (above) with ball-turning attachment that's mounted on a 9-in. lathe

the tool, was a piece of  $\frac{1}{2}$ -20 bolt whose diameter happened to be reasonably accurate. It could have been made from drill rod or shafting threaded at one end. The cutter holder (E) was made from the same bolt. For ease of construction, bolts and pins were used to join the sections forming the frame of the model illustrated. The  $\frac{3}{8}$  and  $\frac{1}{2}$ -in. holes in A were drilled and reamed to be reasonably perpendicular to the drilled surfaces.

The joint between A and B was assembled by first drilling, in A, a  $\frac{3}{16}$ -in. hole where the bolt is to go, then flanking this with two  $\frac{1}{8}$ -in. holes for pins. The two

**BALL-TURNER DISASSEMBLED.** To fasten each of the joints, bolts and pins were used in the attachment

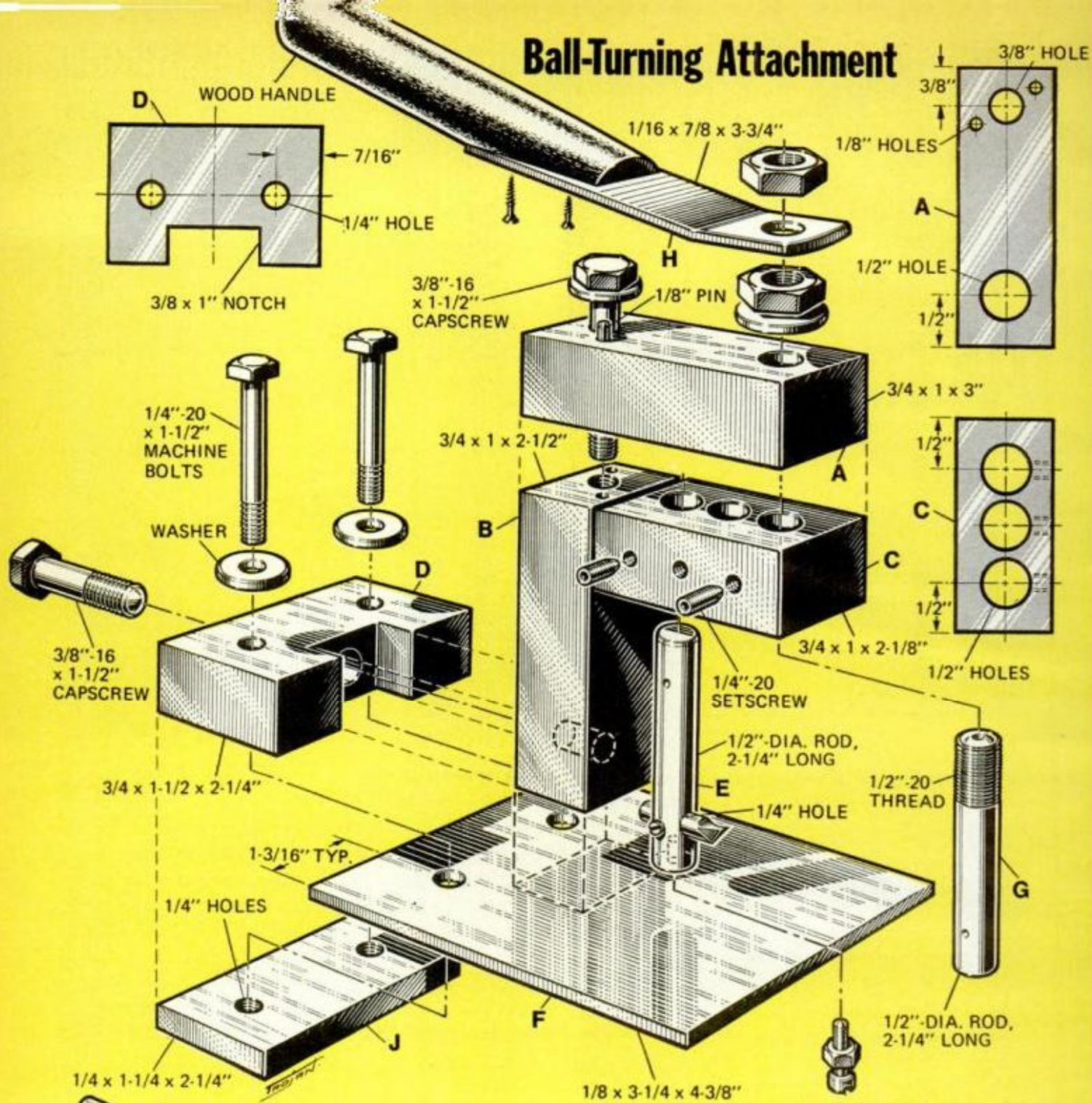


**BLOCK,** seen from below, shows how swinging block pivots so it just misses upright part on the frame

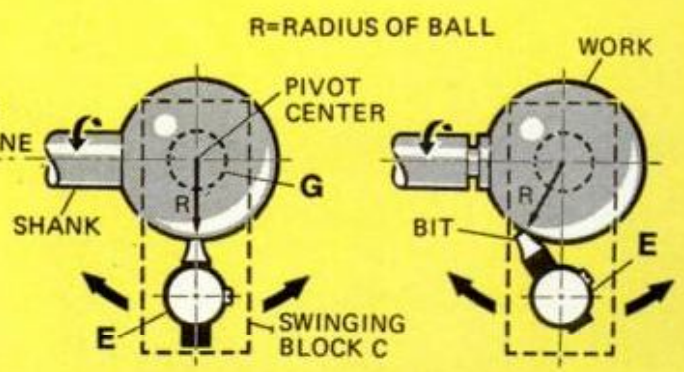
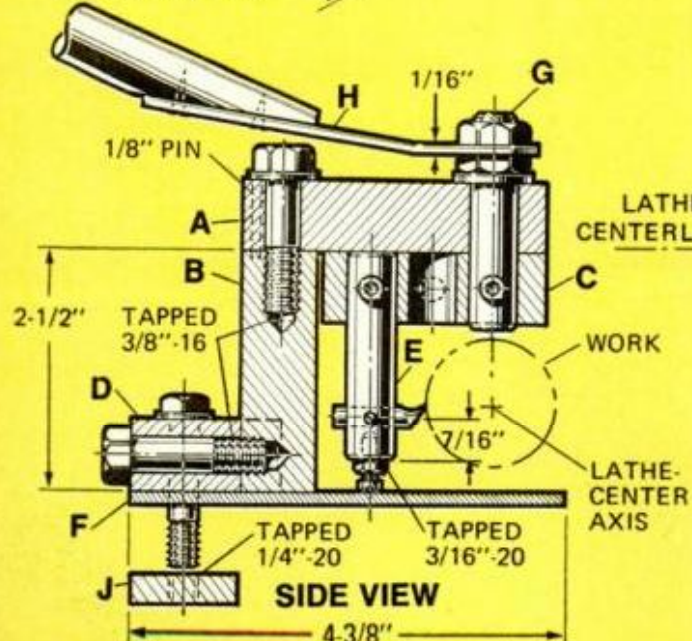




# Ball-Turning Attachment



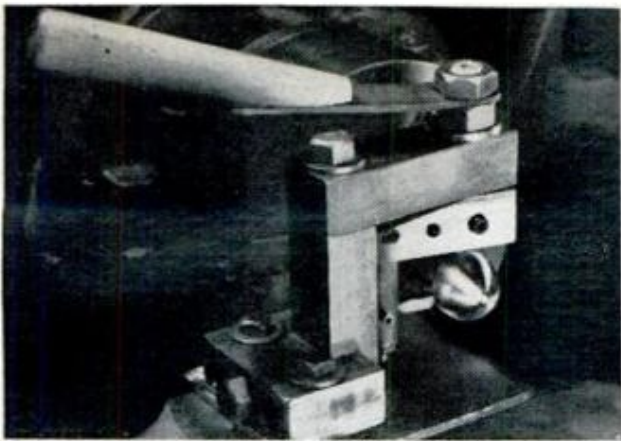
Technical Art by Peter Trojan



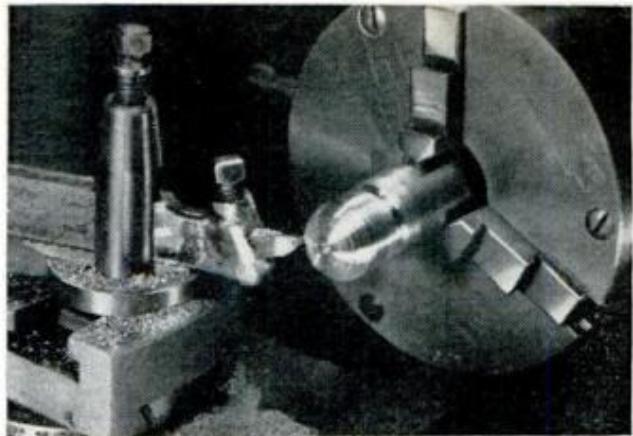
**NORMAL SETUP** has bit-point approximately in plane of bolt G and rod E. Finished ball has stem (as for a drawer pull)

**WHEN BIT** is swung to one side by rotating E, tip cuts closer to the centerline. The bit cuts on both the side and tip





**TWO 1/4-IN. BOLTS** hold the attachment in position over the toolpost slot of the lathe carriage



**THE 1-IN. BALL** is first roughed out with conventional tooling to save wear and tear on ball turner

parts were clamped, in alignment, in a vise, with one pinhole exposed. Each pinhole was made in B with a portable drill—the first pin being installed to help align the parts for drilling the second pinhole. The second pin was added to help hold the parts in alignment while the  $\frac{7}{16}$ -in. hole was continued into B. Then the  $\frac{7}{16}$ -in. hole in A was enlarged for a  $\frac{3}{8}$ -16 bolt, and that in B tapped for the bolt thread. Of course, the end of part B had to be square to form a right-angle joint.

The base block (D) was notched to a depth of  $\frac{3}{8}$  in. to receive the upright (B). The notch was milled but could have been made by drilling and filing. A  $\frac{3}{8}$ -in. bolt through D engages a threaded hole in B to hold the joint firmly together.

The swinging block (C) has a row of three  $\frac{1}{2}$ -in. holes, two for the cutter rod and one to attach the block to pivot bolt G. Each hole was provided with a  $\frac{1}{4}$ -20 set-screw. A handle is attached to the top of bolt G with two nuts to control swinging;

**PARTS FOR MODEL SHOWN** were shaped from available stock which was lying about the author's shop



**TO GENERATE CONCAVE CHAMFER** on 1-in. brass rod, swinging compound slide is brought into play



**CONCAVE CUTS** can be made without attachment, using bit mounted in holder and compound swing





the nuts shown were reduced to about  $\frac{3}{16}$  in. A brass washer between the lower nut and arm A acts as sort of a bearing. The handle was made by drilling a  $\frac{1}{2}$ -in. hole near one end of a  $\frac{1}{16} \times \frac{7}{8} \times 3\frac{3}{4}$ -in. steel strip and attaching a  $\frac{3}{4} \times 4$  in. wooden handle.

The cutter-holding rod (E) is approximately  $2\frac{1}{4}$  in. long in the model. Its lower end has a  $\frac{3}{16}$ -20 bolt and locknut positioned as shown. Its upper end is clamped in block C with a setscrew. The hole for the cutter was not drilled until the attachment had been assembled on the lathe. Then it was easy to mark the position of the cutter with respect to the lathe axis—using a scribe point in a tailstock chuck. The hole is placed so the cutting tip of the cutter normally is aligned with the axis.

The attachment shown uses  $\frac{1}{4}$ -in.-dia. high-speed steel bits, so a round hole was made in E. If square cutter bits had been used, the hole could, of course, have been filed square. The bit setscrew on the model is 8-32.

Two positions were provided for cutter-holder E in block C, so that a range of ball diameters could be covered without having to use cutters with very long overhang. Ball diameter is adjusted by positioning the cutter tip with respect to the centerline of bolt G. It would help to provide a tiny hole on the lower end of G to indicate its center—from which measurement could be made. Two adjustments control cutter position: selecting the hole in block C and sliding the cutter in its

hole. Care is taken that the tip of the cutter is not swung out of alignment; it usually should be in the same plane as the centerlines of bolt G and cutter-rod E. The cutter shown was ground with a fairly narrow point, a modest side rake and some back rake. It seemed to work very well on brass and steel. Because of the side rake, it cut more freely in one direction of swing than the other.

It seems desirable to have a little vertical play in bolt G. Platform F was not perfectly flat and play permitted the bolt at the bottom of cutter rod E to ride freely throughout its swing—aided by a film of oil under it. Under the cutting pressure against the cutter, everything in the prototype became rigid enough to produce nonchattering cuts.

To make concave cuts, arm C could be swung  $180^\circ$  to project outward beyond the axis of G and the cutter reversed in its hole. If this were contemplated, platform plate F should be extended far enough to support the cutter rod in its outermost position.

However, there is a way to make concave cuts on the average lathe without attachments other than the regular toolpost, cutter and holder. This is done by loosening the screws that lock the angle of the compound rest, so the compound can be swung around its pivot center while a cut is being made. The more the distance between toolpoint and center of the swing can be reduced, the shorter the radius of curvature. ★★★

## NEXT MONTH IN SHOP AND CRAFTS

**IS YOUR NEXT VACATION 30 FEET AWAY?** Will your budget allow travel and other extravagances? Instead of going into hock, why not put a few dollars into your own property and make your investment a long-range proposition? To help you, PM editors have rounded up 23 pages of ideas that let you make your home grounds your year-round vacation headquarters. Included are plans and ideas for building a slip-proof diving deck, fold-flat cookout table, patio appliance center, roll-out entertainment wall and back-yard game layouts, plus instructions for wiring your patio for sound. You're sure to get more fun from today's inflated dollar by reading the August issue.

**HOW TO MAKE TIGHT-FITTING DOWEL JOINTS.** The surest sign of knowledgeable craftsmanship in your furniture is tight, hairline joints. This article gives all the basics for working with dowels, and how to make the job even easier by using one of the low-cost, modern dowel jigs that are available.

**PM SHOP-TESTS SEARS' LATEST RADIAL SAW.** It's a rugged powerhouse built to take abuse and we proved it in PM's workshop. Bonus: We came up with a base you can build that makes this tool even more versatile. You'll find the test results next month.



# Add This Sander Table to Your Faceplate Lathe

By C. W. BALL



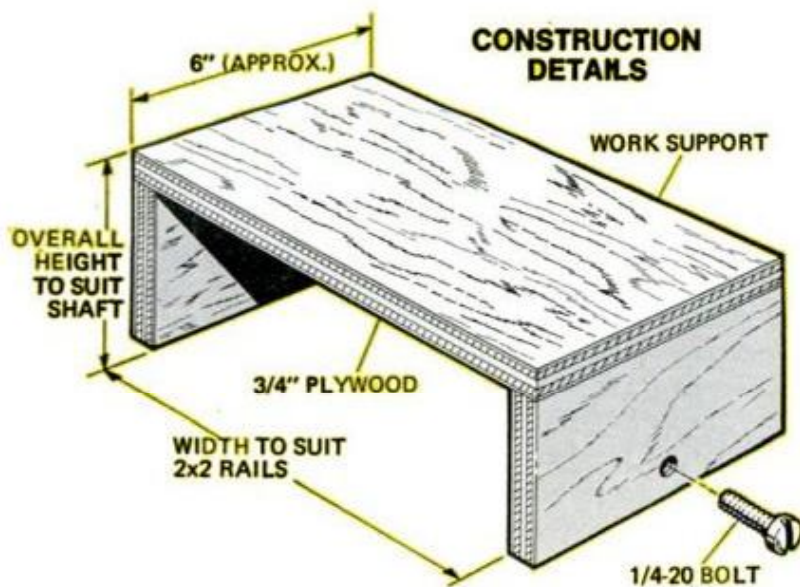
The basic tool appeared in PM last November. Here's how one reader increased its versatility.

WHEN *Popular Mechanics* published a story about a shopbuilt faceplate lathe (*Make This Faceplate Lathe From Odds and Ends*, page 194, Nov. '70 PM), the idea so intrigued me that I built one. Since then, I've had a lot of fun with the tool making things that previously were out of my realm.

Somewhere along the way, I chanced upon the table idea you see here—a simple affair made from  $\frac{3}{4}$ -in. plywood—an addition prompted by several free-hand sanding jobs.

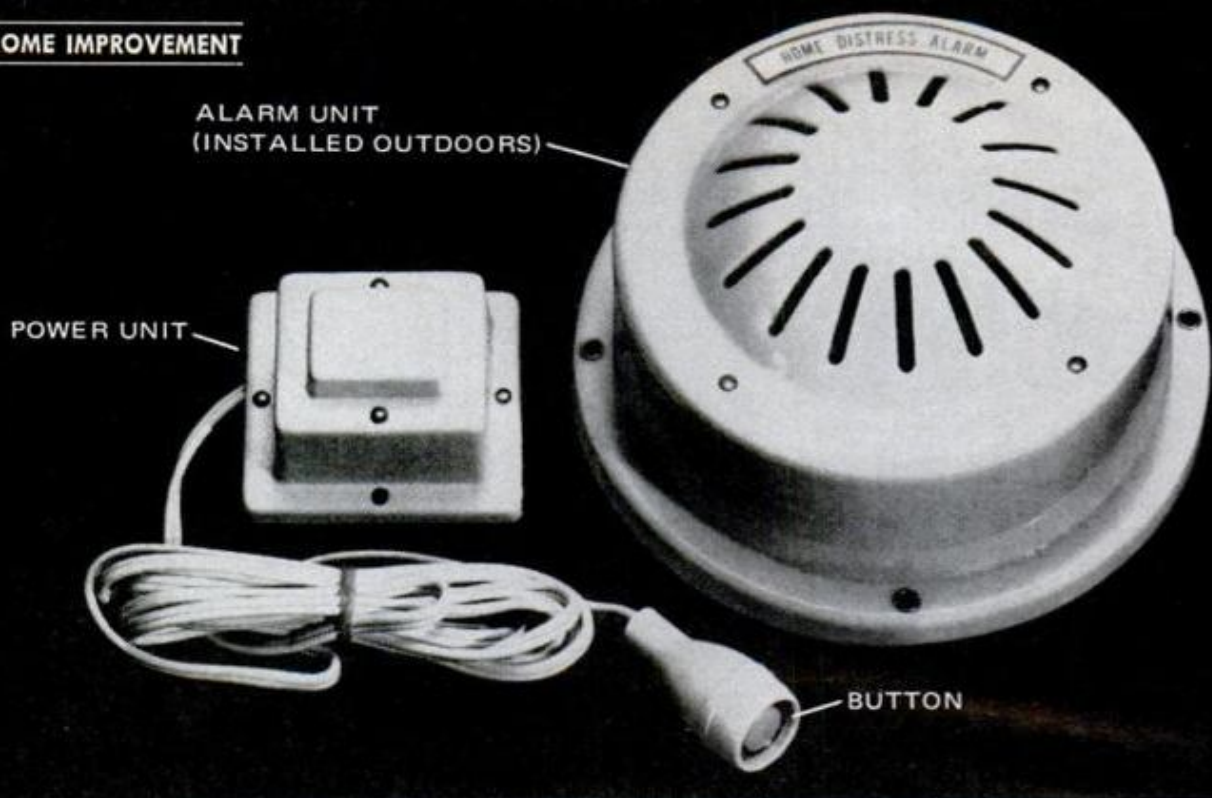
I mounted the motor on my "lathe" high enough to permit the use of an  $8\frac{1}{2}$ -in.-dia. plywood disc (on a sheave) with sandpaper glued on as a disc sander. The prototype was built to fit snugly on the toolrest guides and needed no extra support. Unless the fit is tight and the wood doesn't expand or warp, it's wise to use a locking bolt. The  $\frac{1}{4}$ -20 bolt so used in the drawing (left) is threaded through one platform "leg" in order to bear against a toolrest guide.

Square work can be hand-held. To sand circular workpieces, drive a nail or screw up through the platform the appropriate distance (radius) from the disc to serve as a pivot. ★★★





## HOME IMPROVEMENT



**DISTRESS ALARM** has siren and flasher in unit installed outdoors; when you trigger it with a pushbutton switch located in a bedroom or other handy spot, you alert neighbors that there's trouble present. Nox-prowl costs \$40; for brochure write Star Sprinkler Corp., Dept. PM, 4545 Tacony St., Philadelphia, Pa. 19124

# Inexpensive Alarms

By **HARRY WICKS**, Workshop Editor

Photos by Robert D. Borst

**U**NTIL RECENTLY, when you locked your house to go away for a weekend or vacation, there wasn't much else you could do—other than alert the local police department to keep an eye on things—to protect your home and property. Most anti-intrusion devices were too sophisticated in design and expensive to install.

With the annual "loot" in home burglaries now estimated at more than \$10 billion, you had good cause for concern as you pulled away from the curb. Happily, several manufacturers have turned their engineering skills to producing and marketing home intrusion products priced within reach of the average homeowner.

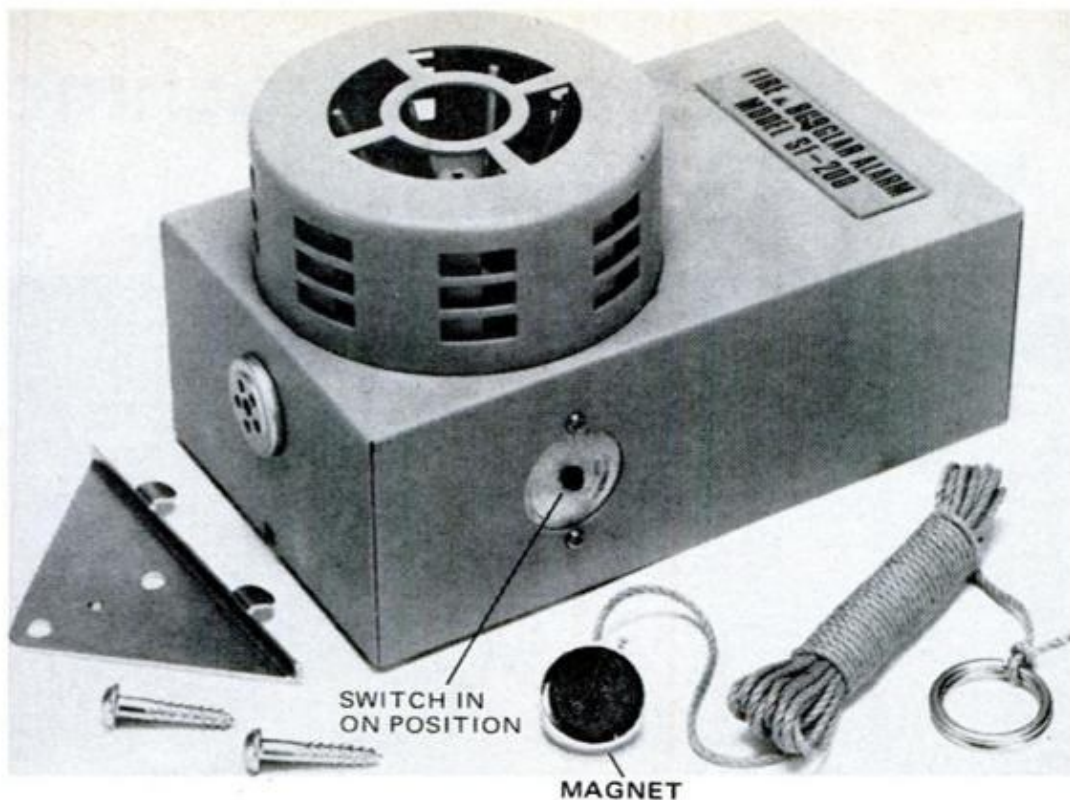
The alarm pictured above (unlike the others) is not actually an anti-intrusion device. But it's ideal for invalids and, therefore, is included in this roundup. It's mounted high on the exterior wall. When a prowler is spotted, you can push

a button control to set off a wildly blinking light and an ear-piercing siren. The neighbors hear the racket, the prowler heads for cover and you have the time to dial the police.

After testing the alarms shown, I recommend two things when making a choice: 1. An added feature such as a fire-alarm or pre-entry warning is a plus; and 2. an intrusion alarm operated by batteries is probably better than one plugged into house current. The latter consideration is good in event of power failure or brown-out (when break-ins are more likely), provided you make a practice of checking the alarm every 60 days.

One other point: Tell your neighbors that you have installed an alarm. If it's activated while you're away, they'll call the police. Conversely, let those within earshot know when you are testing the setup to avoid false alarms. ★★★



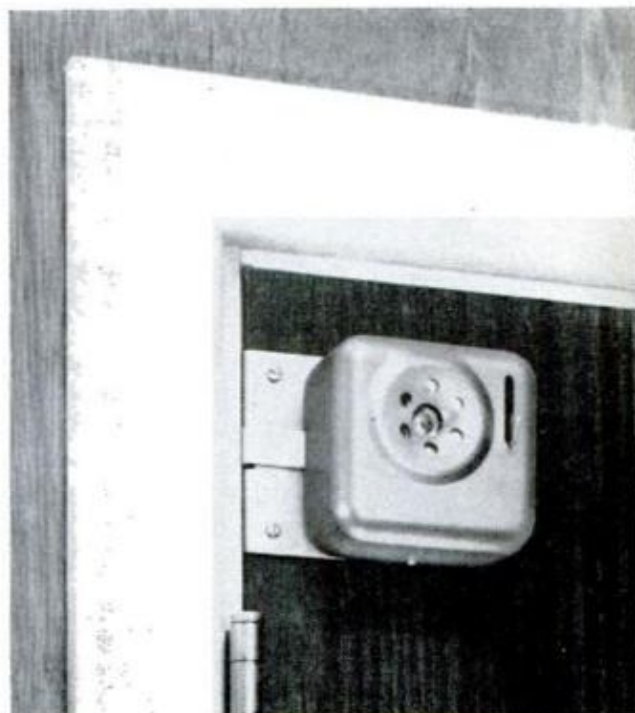


**DOOR-MOUNTED DEVICE** contains a siren, an automatic fire sensor activated if temperature reaches 135° F. and a magnetic switch to guard against intruders. Battery-operated Sensor SF 200 is available for \$18.98 and 50 cents postage from Sunnyside Shoppers, Dept. PM, 10180 S. E. Sunnyside, Clackamas, Ore. 97015

# Scare Off Burglars

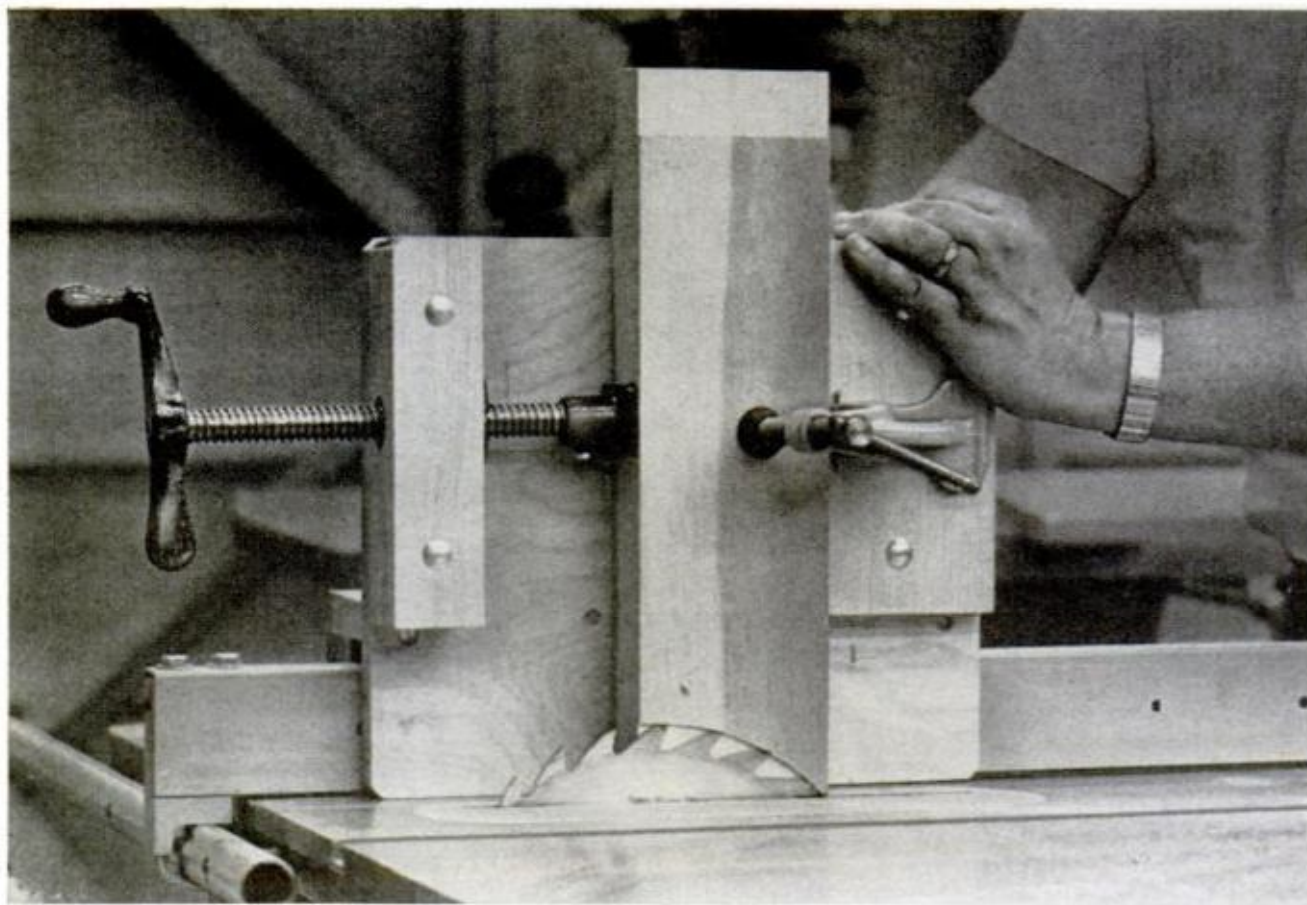
**BURGLAR-ALARM GUARD** from Stanley Hardware. The Stanley Works, New Britain, Conn. 06050, is pre-entry alarm that sounds a warning before door is opened. Pressure exerted on deadbolt triggers alarm. In steel case, it's sold for \$9.99 at hardware stores

**BATTERY-OPERATED ALARM** for mounting on any door or window makes a low penetrating sound to warn of intruders. On-off switch deactivates unit when desired; \$4 postpaid from Feasline Trading Co., Dept. PM, 325 Skyline Drive, Feasterville, Pa. 19047





# Build a Tenoning Attachment For Your Table Saw



By **ROBERT K. WALLACE**

**T**HIS TENONING ATTACHMENT will quickly prove itself to be an extremely useful addition to your table saw. With the exception of the handle, all of the parts can be quickly cut on the table saw.

The main frame of the attachment is of  $\frac{3}{4}$ -in., seven-ply birch plywood. For desirable strength, the remaining parts are of maple.

Begin by cutting the main frame to the dimensions shown. It's important that this board be perfectly square (and flat) since it is actually the "backbone" of the attachment. Next, cut the front and rear clamp mounts to size and drill the required holes. Square the rear clamp to the top edge of the main frame and mount it with two  $\frac{1}{4}$ -in. carriage bolts. Align the front clamp with the front edge—and top—of the frame and also bolt this in place.

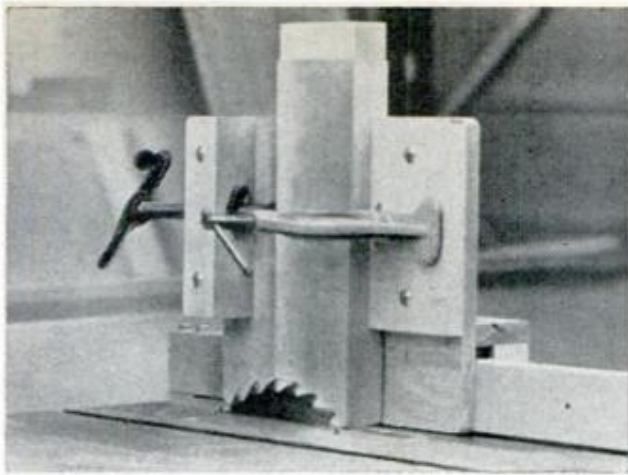
For accuracy, proper alignment of the rip fence with the attachment is a must.

The attachment must mate with the fence to allow a slide-fit without binding, yet it should not be so loose that it will cause inaccurate cutting. After cutting the guide boards to suit your rip fence, mount the handle support board with  $1\frac{1}{2}$ -in. No. 8 f.h. wood screws to the main frame. Clamp the outside guide-board to the rip fence with two layers of newspaper between the outside guide-board and the fence. When mounting is completed, remove clamps and newspaper. (The paper strips are needed to insure clearance for easy sliding.)

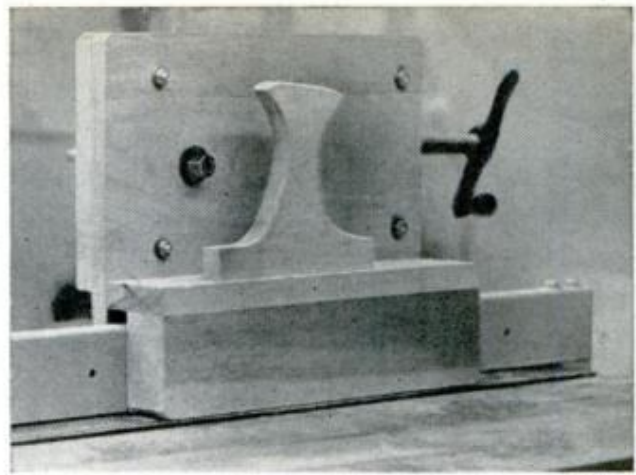
The front clamp is a 9-in.-long  $\frac{11}{16}$ -in.-screw assembly used in veneer presses. The rear clamp is a 3-in. hold-down clamp (Jorgensen No. 1623; the mounting bolt comes with the clamp). Both clamps are available from woodworker supply houses such as Craftsman Wood Service, 2727 South Mary St., Chicago, Ill. 60608.

To finish my attachment, I simply rubbed





**HOLD-DOWN CLAMP** grips work securely, permits operator to work while keeping hands clear of blade



**HANDLE CAN BE CUT** as shown, then shaped and contoured to provide comfortable grip when using rig

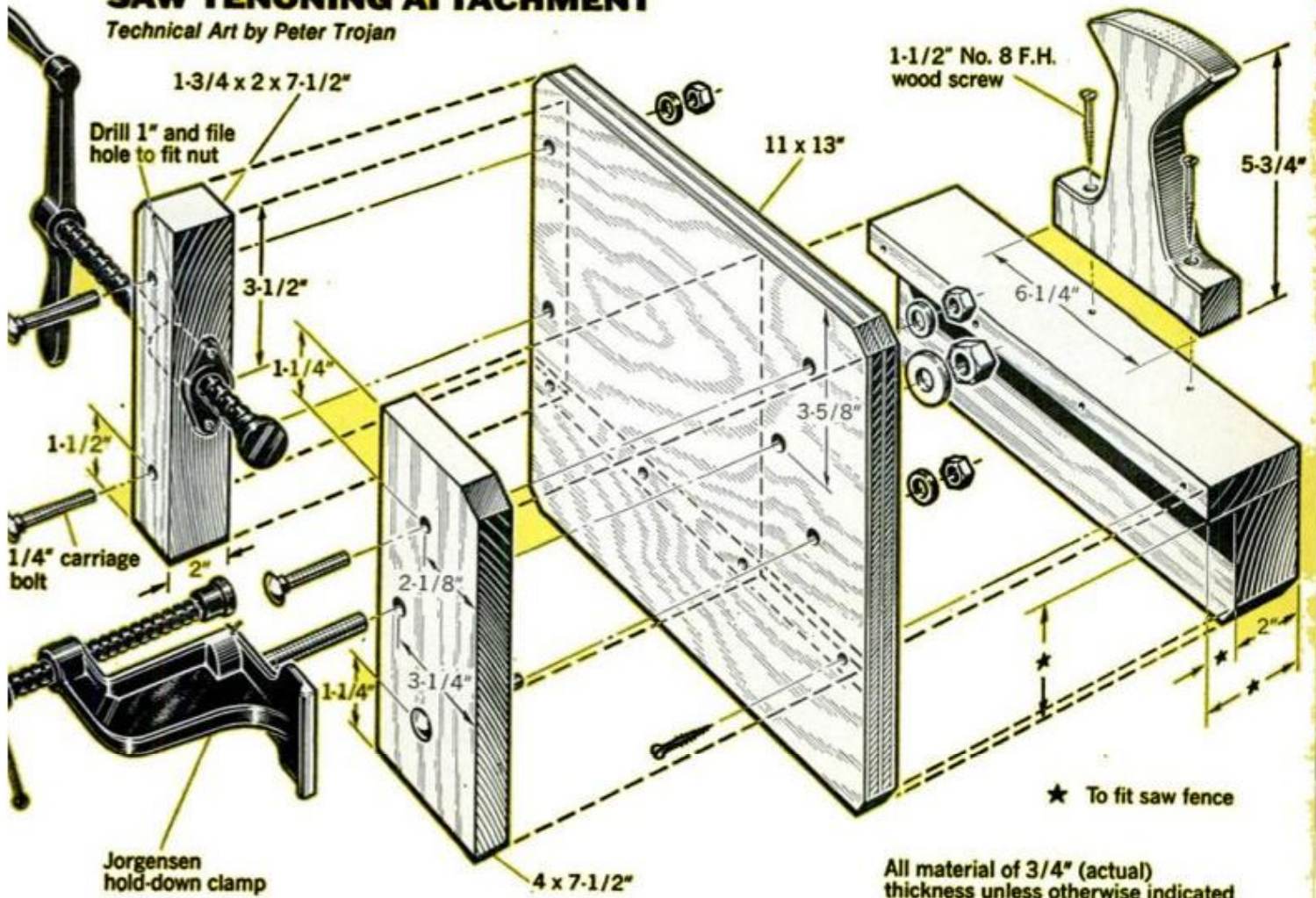
a liberal coating of Trewax Carnuba Plus (wax) into the wood surfaces.

Both "stub" (two cheeks) and "true" (four cheeks) tenons can be cut with the attachment. To make the additional cheek cuts required for the true tenon, merely rotate the stock in the clamps.

In some instances (depending on the stock being cut) the rear clamp alone may be used to hold the stock in place. In these cases the front clamp can be removed to make the attachment lighter to push. Now, you'll be able to cut tenons in production fashion. ★★★

## SAW TENONING ATTACHMENT

Technical Art by Peter Trojan





# HINTS FROM READERS

## Self-stick label aids layout

A self-sticking label can help you lay out hole positions and other details on a reasonably clean metal surface. It provides a nonslip base for the point of a compass which holds a ballpoint pen to draw easily seen lines that indicate hole centers. After punch marks are made, the label can be removed.

—Walter E. Burton, Akron, Ohio

## Clamps from garden hose

Midget C-clamps suitable for applying light pressure to glued joints in relatively thin sections can be made from garden-hose segments. When split lengthwise, a segment can be sprung open to slip over a joint. Such clamps can also be used to hold assemblies of cardboard in alignment before applying an adhesive. Long segments seem to work best.

—B. W. Ervin, Kent, Ohio

## Wrenches used in tandem

You can get extra power from an open-end wrench by linking one end of a box-end wrench in the outer jaw as shown at left. Before applying the force, make certain that the linkage will not slip and that each of the wrench handles is sturdy enough to withstand the stress.

—W. B. May, Oak Park, Ill.

## Lift-out storage bins

Here's an easy method that makes compartmentalized small-parts drawers more convenient. By lining the small "bins" with curved pieces of linoleum or vinyl floor tile, it is then an easy matter to slide out small brads, tacks and screws. The system prevents pricking your fingers.

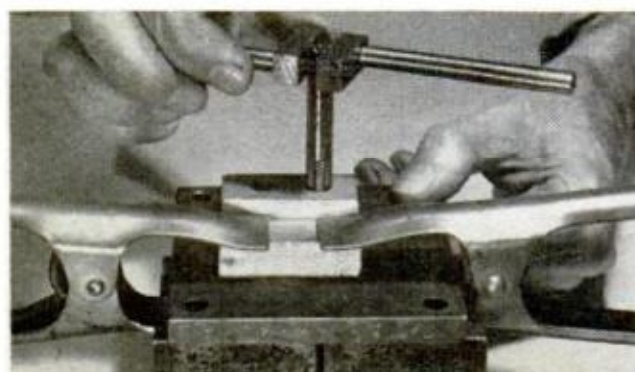
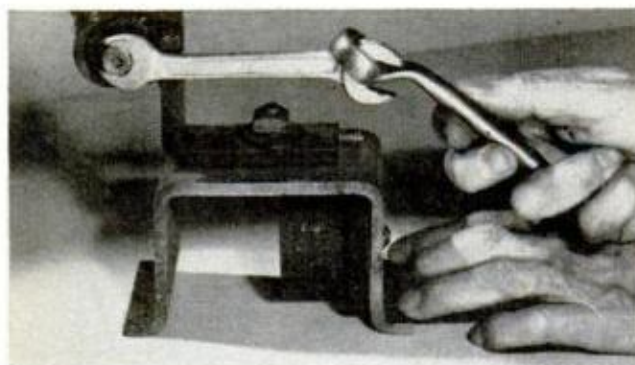
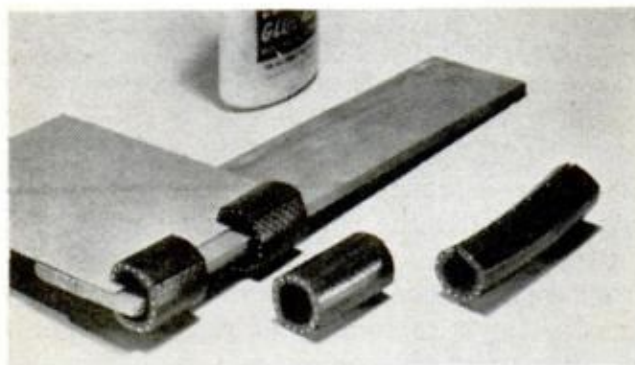
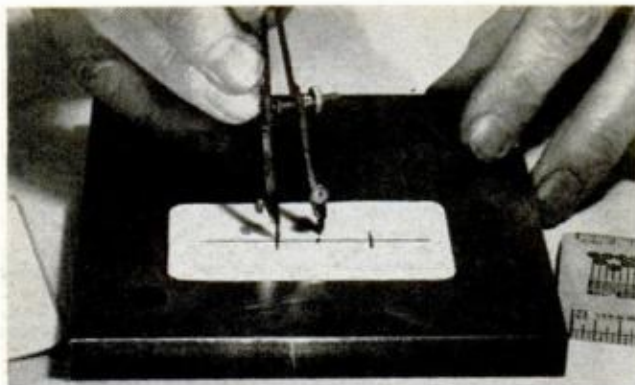
—W. H. McClay, Pasadena, Calif.

## Hardwood serves as tap guide

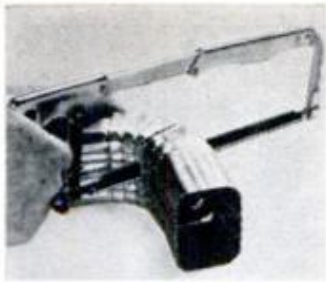
A hardwood block with a hole in it often is superior to a metal one for getting a tap started straight, and if you drill the hole slightly on the small side, the tap goes through without much effort. Bore this hole to the tap's o.d. and insert tap far enough to project beyond block so it can be centered over hole to be tapped. Then secure block with clamps.

—Walter E. Burton, Akron, Ohio

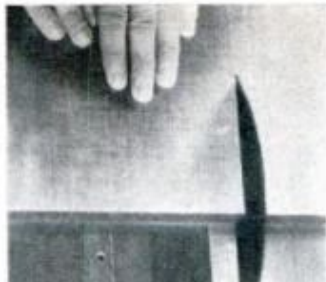
POPULAR MECHANICS



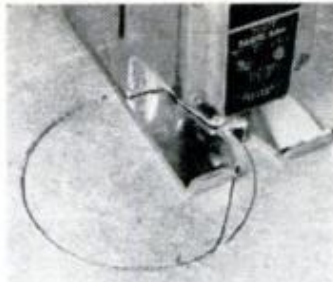




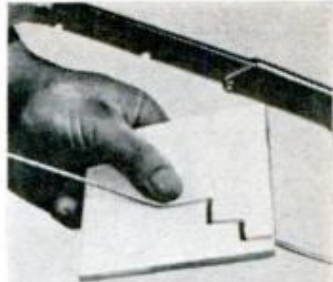
**Hacksaw Blade.** New! Virtually unbreakable. Makes thin, straight cuts. No need to protect the edge when you carry it in your toolbox.



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*The Look of Classic Wrought Iron*

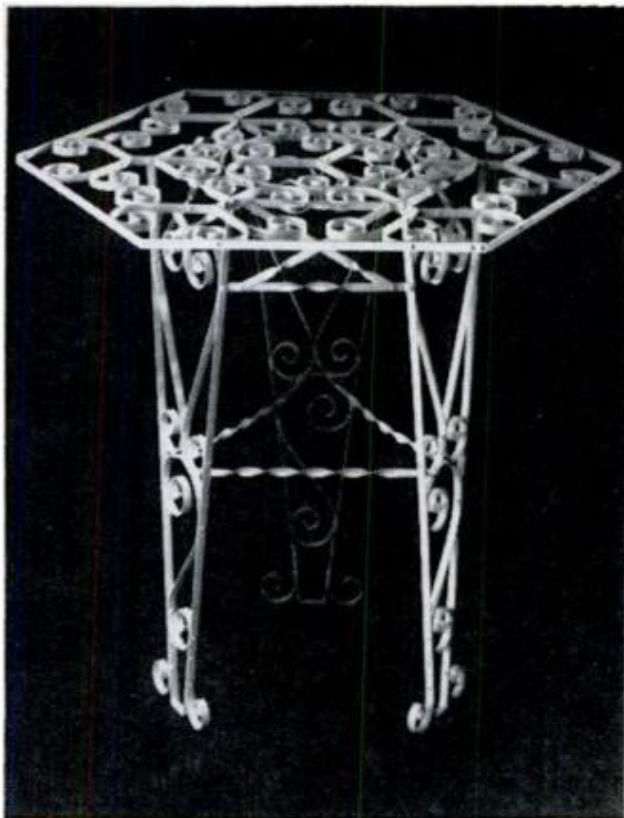
# You Can Make This Chair For \$15

By WAYNE C. LECKEY,  
Home and Shop Editor



**W**ith a unique metal-forming tool you can make all kinds of graceful garden furniture.





**M**AKE YOUR PATIO BLOOM this summer with flower-cushioned wrought-iron furniture; then when winter comes you can move the furniture indoors and brighten your den or sunroom.

With a three-piece toolset we described in *Ornamental Scrollwork You Can Do at Home* (page 192, March '70 PM), you can form any number of graceful pieces of furniture for your home and yard for a lot less than you can buy them in a store. Once you have acquired the toolset, you can make the chair shown on the opposite page for as little as \$15—the cost of the strap iron, cushion and paint.

Forming straight metal strips into uniform, graceful curls is actually fun, and the scroll plate makes it easy to duplicate identical S and C-shaped curls almost automatically. The punch-shear makes rivet holes in the metal, also cuts it. The riveting-forming tool sets rivets, rolls circles or curves, makes neat right-angle bends.

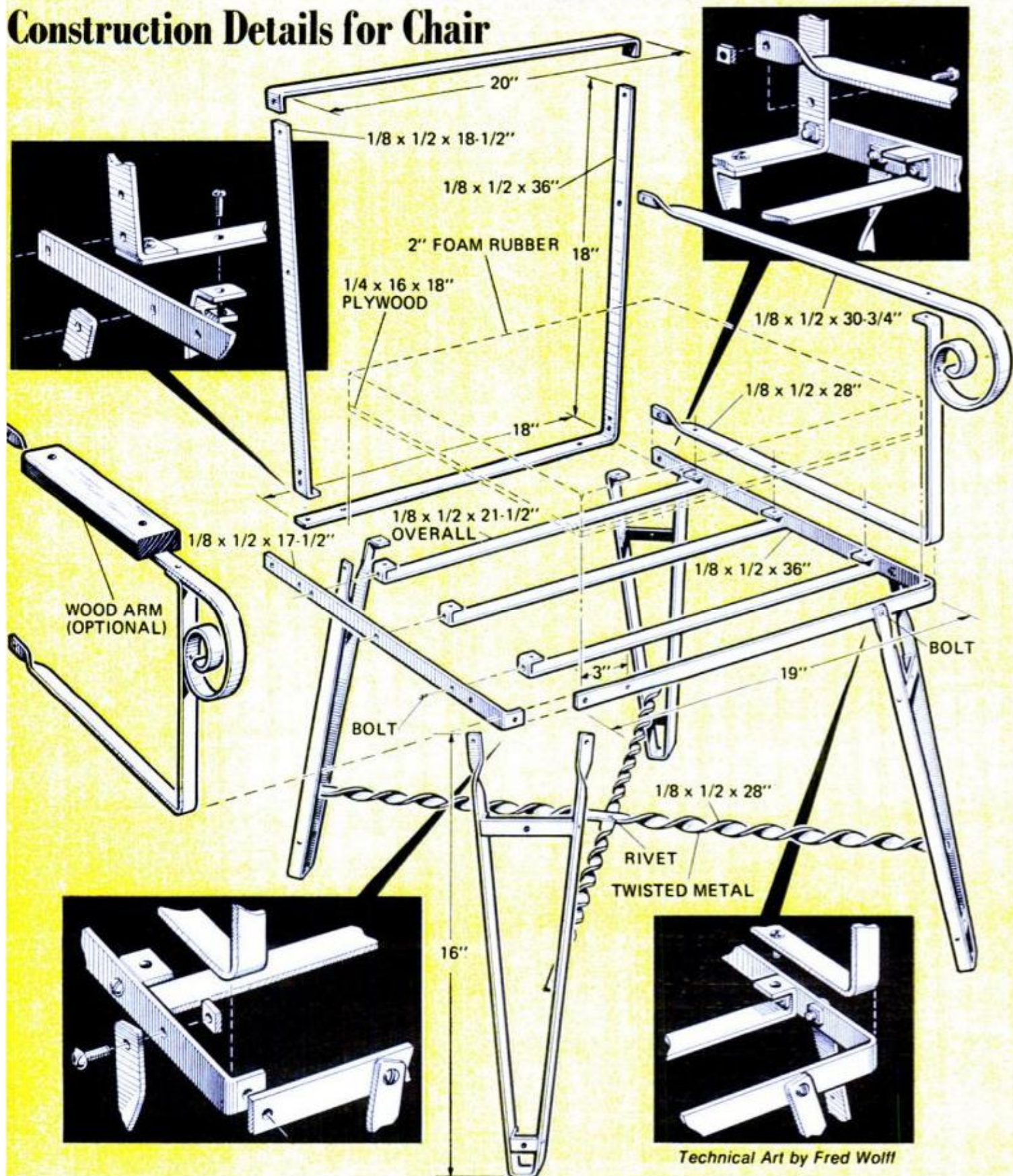
Although many scrolls required to make the handsome armchair are alike (see page 156 for required number of each), they must be bent to conform to a full-size paper pattern. Using the grid system of enlarging, you can "blow up" the patterns on page 156 by ruling on wrapping paper the same number of squares given and then drawing in the scrolls. (Draw in each square of the large pattern the part of the scrolls shown in the corresponding

**OTHER FINE EXAMPLES** of wrought-iron furniture you can make with the three-piece imported toolset shown on page 158 are these attractive, glass-topped tables (above) and handsome ice-cream-parlor chair (below). Full-size patterns for these and other pieces may be obtained for \$1 each from the importer, Creative Educational Services, Inc. (see text)





# Construction Details for Chair



square of the small pattern. To save time, get a set of full-size bending patterns for the chair by sending \$2 to Chair-Bending Patterns, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.

Make the chair back first. Three separate strips form the outside framework (drawing, above), one bent at right angle to provide one side and bottom. Drill four pieces where indicated and fasten together

with rivets. Next, form ring D (see page 156) and rivet the butted ends together with a splice. Now place the framework on a flat surface with ring in the center. Fit scrolls in place as you make them, reshaping where necessary (note in the half-pattern on page 156 that one of the two scrolls marked A is shorter than the other and has but one curl). When all 14 scrolls nest neatly inside the frame,



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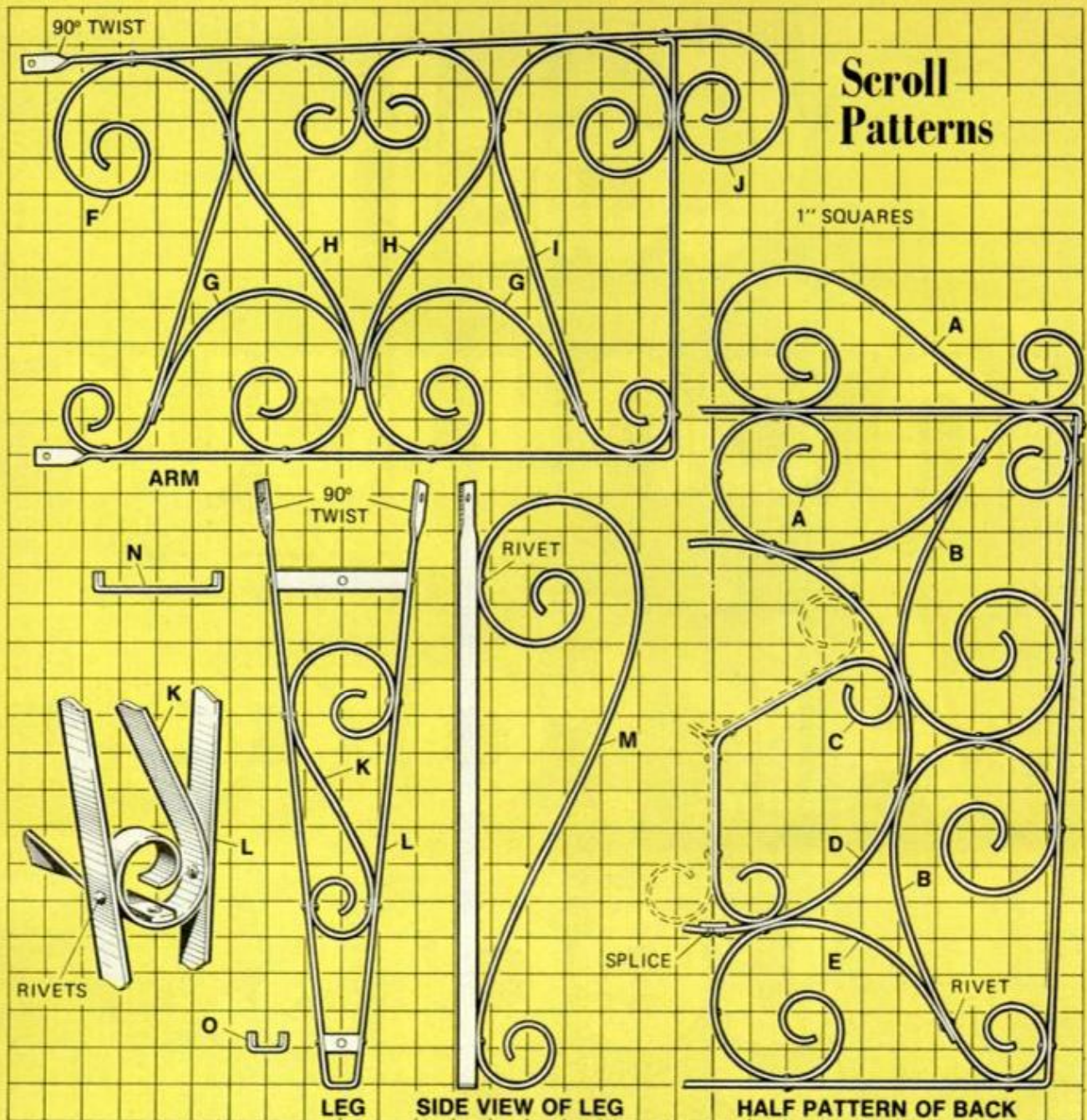
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SARLA COULT

I understand there is no obligation.

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## NUMBER OF SCROLLS REQUIRED

### CHAIR BACK

A - MAKE 4  
 B - MAKE 4  
 C - MAKE 3  
 D - MAKE 1  
 E - MAKE 2

### CHAIR ARMS

F - MAKE 2  
 G - MAKE 4  
 H - MAKE 4  
 I - MAKE 2  
 J - MAKE 2

### CHAIR LEGS

K - MAKE 4  
 L - MAKE 4  
 M - MAKE 4  
 N - MAKE 4  
 O - MAKE 4

mark and punch the rivet holes and rivet all into a single unit.

Make arms similarly, the straight pieces first, then scrolls. Twist the ends 90° to attach arms to the chair back. Punch and rivet the parts of each arm into single units and set aside. If you wish, add wood armrests.

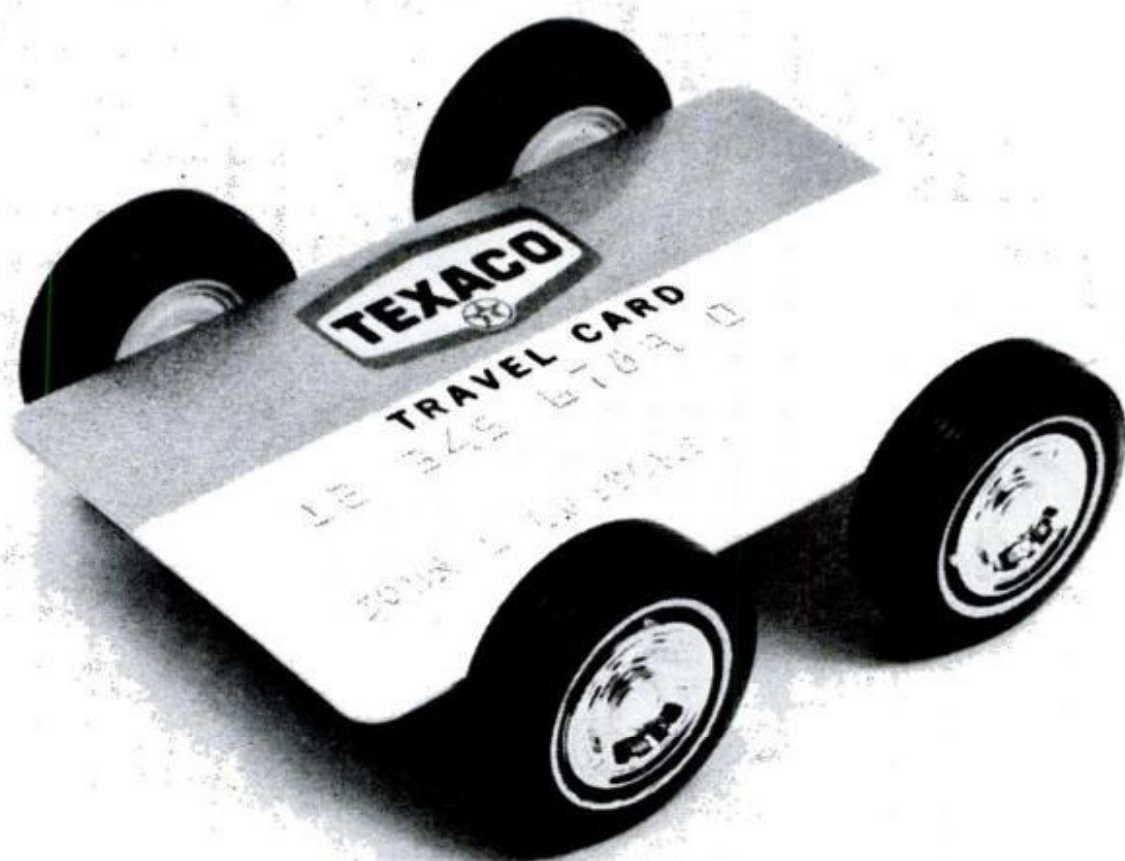
Make all four legs alike, except for the upper ends. Ends of the front legs are

twisted but one end of each rear leg is left straight and the other is angle-bent. Use rivets to join leg parts, small bolts to attach leg assemblies to the seat frame.

The latter is formed from flat strips, punched (or drilled in the case of bolts) and bent as shown. Arms are bolted to upturned ends of the seat-cushion slats.

Start assembly of the chair by bolting the arms: first to the seat frame, then to





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More than ever, the Texaco Travel Card is probably the busiest in the industry... the only one honored under the same sign in all 50 states and Canada. One more reason why it pays to be associated with Texaco.

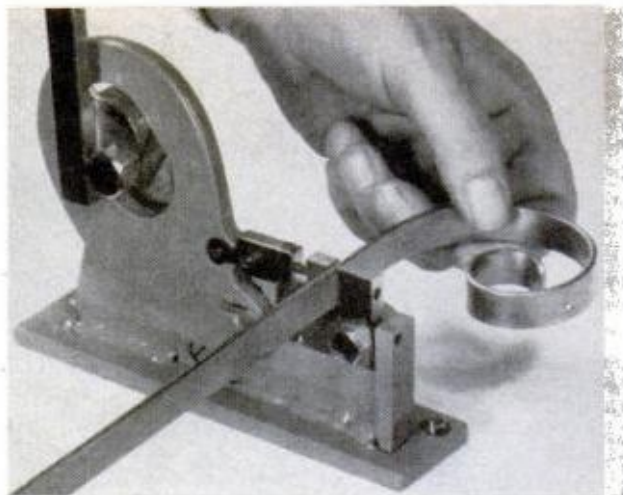
The local Texaco Representative can tell you about the many others. See him or write to: Manager—Retail Sales, Texaco Inc., 135 East 42nd Street, New York, New York 10017.



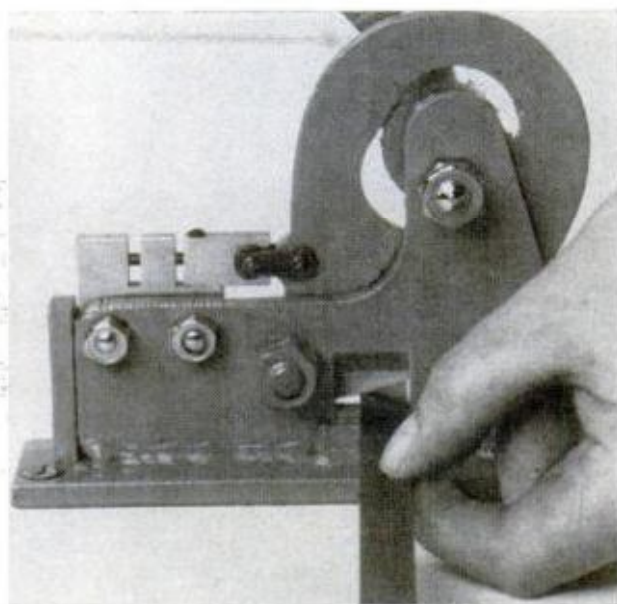




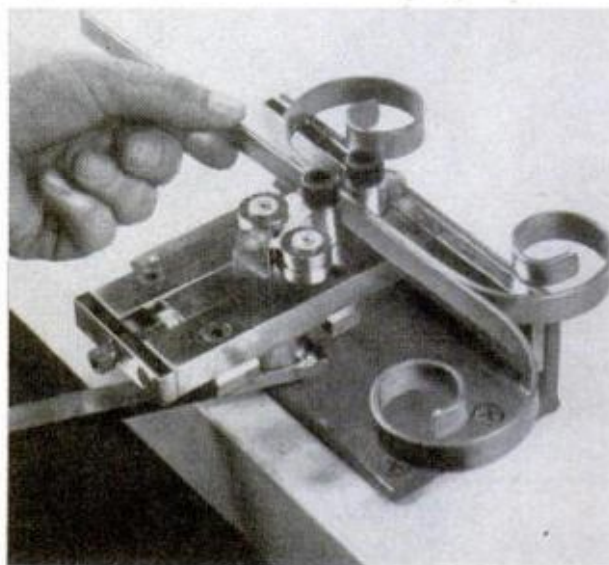
**TO BEND CURLS**, studs on scroller grip metal strip so you can wrap it around raised spiral on plate



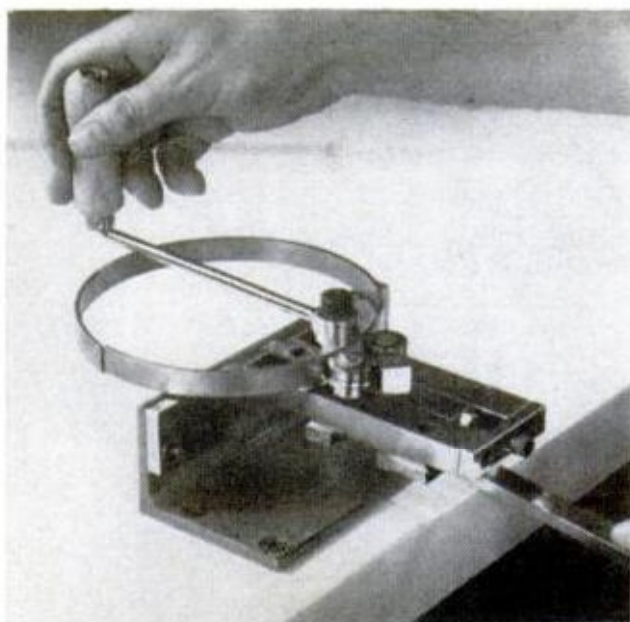
**RIVET-HOLE PUNCH** produces clean 1/8-inch holes in metal as you pull down on powerful cam-lever handle



**PUNCH ALSO ACTS AS SHEAR** for cutting the metal strips. Sharpened lower edge works like a guillotine



**RIVETER-FORMER** squeeze-sets rivets against anvils held by Allen-head screws when lever is pulled hard



**TO ROLL RINGS**, anvils are replaced with a crank-operated roller. Lever pressure determines the radius

the chair back. Bolt the legs next and, finally, the twisted-metal stretchers.

To make a stretcher, clamp the end of a long flat strip in a vise and twist the other end with an adjustable wrench. Keep twisting until you have a spiral strip 26 inches long. Rivet stretchers together where they cross and attach ends to cross members of the legs with small bolts.

The cushion is a small board cut to fit, padded with 3-in. foam rubber and covered with a floral fabric stapled to the underside.

Spray the completed chair first with a metal primer, then with two coats of gloss-white lacquer. The toolset, imported from England, can be obtained for about \$79.50 and shipping charges from Creative Educational Services, Inc., Box 154, Parsippany, N.J. 07054. The metal is available in 3-ft. and 4-ft. lengths. ★★★



The week was a grind with phone calls and late nights and skipping lunches but now the job is done and . . .

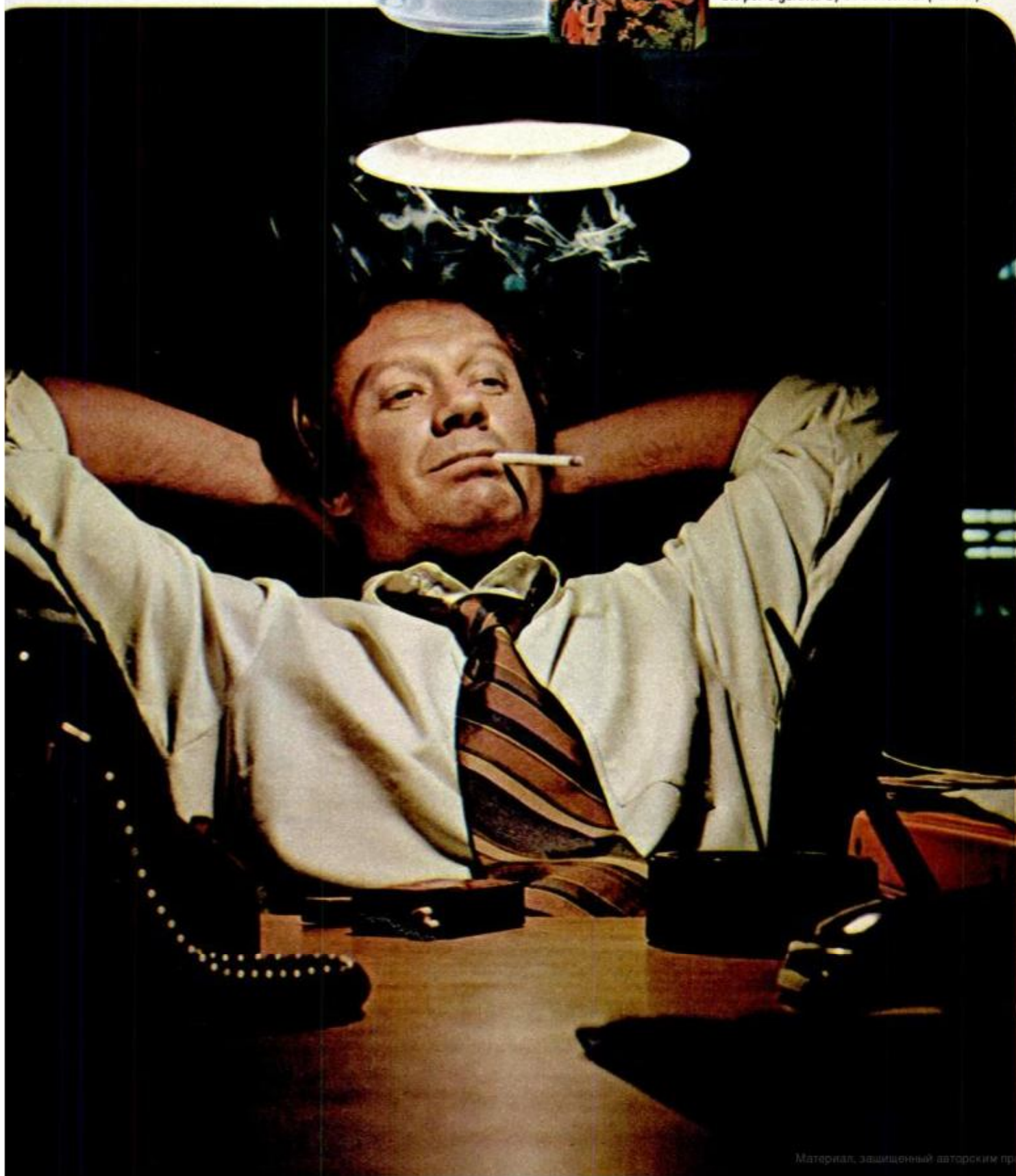
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## BACK-YARD FLOAT TRIP

(Continued from page 94)

official or law enforcement office. Tell them where you are going, how long you plan to be on the river, and when and where you will come off it. Then let them know you're safe when you arrive!

Check local restrictions. Some waters may pass through Forest Service areas where you need a fire permit. During fire danger periods, you may not even be allowed on the water. Some wilderness areas have stringent woodcutting and camping rules to preserve their primitive quality.

In normal waters you can cover 10-15 miles a day. A serious fisherman will cover only six. Distances vary according to obstacles, water depth, weather, and your own physical condition.

No matter what length trip you plan, remember this: *Never hurry!* Floating is

---

**You may be required to have an ax, shovel and water bucket—essential firefighting gear.**

---

best when it's leisurely—you have more fun and won't be exhausted afterward.

● *Learn to read water.* A "V" pointing upstream means the water is moving around some obstruction; be sure you're safely to one side of it. A "V" pointing downstream nearly always points to the safest passage; water between obstructions is usually deeper, flows faster.

When you come to a really rough spot, get out of the canoe, tie a rope to each end and walk it through. You and a partner guiding the craft from shore can maintain control and float the canoe through with relative ease.

Overnight and three-day camping trips involve more work, gear and planning than one-day floats, but can be more rewarding. Many excellent float sections are too long to be covered in a day.

● *Camping takes preparation.* Store all camping and personal gear in waterproof plastic bags or duffel bags. If you are unable to locate bags, buy sheet plastic, cut it into suitably-sized squares, and be sure to knot or wire-wrap it soundly around the gear. It's advisable to tie the packages to your canoe. Put all perishable foods in a tight camp cooler.

Take at least one change of clothing and a couple of sock changes. It's cooler on a river than on land; when shadows lengthen, you may want a light wind-breaker or long-sleeve shirt. Take loafers

or extra sneakers for camp wear. Dry feet are a comfort.

Load each craft with weight amidships, and lighter material fore and aft. A well-loaded craft is easier and safer to handle.

Take a small hand ax, a collapsible saw and an army shovel. If you plan to float through Forest Service land, you may be required to have an ax, shovel and water bucket—essential fire-fighting gear.

Take plenty of parachute-type nylon cord. Large rope is unwieldy and unnecessary. Include a first-aid kit, and know how to use it. (Ideally, you will have taken a basic Red Cross style first-aid course at some time in the past.) Know which nearby towns have a doctor.

Carry drinking water if there is any doubt about the water you're floating on. Few streams now are clean enough to drink from; some can still provide cooking water. Take water purification tablets if you don't have the space for enough stored water. Carry matches in several sealed containers and store them in various places; always carry one with you personally. Carry enough cooking gear, but try to double on uses when possible. If you're using an open wood fire, soap the outside of all pots before placing them near or over the fire. They may become blackened, but the soap forms a protective layer that washes off easily.

● *The best campsite* is a clean, breezy river bar. Many officially designated floating streams, like the Eleven-Point in Missouri, have primitive campsites on their banks, built by the Forest Service or Bureau of Outdoor Recreation. Well located, they are usually quite comfortable.

Don't wander through the brush back from a stream. Much land along floatable streams is private property. And you may get lost. River banks are generally of higher elevation than the land directly behind; the jungles in the low land to the rear are quite often swampy, nearly impassable and insect infested.

If you can't find a suitable river bar, choose the highest, clearest land available near the river. Such areas are usually breezy and relatively insect-free. Remember to clear a safe zone around the firesite. If the bank is of unstable sand, don't camp too close to the lip; the bank could suddenly give way during the night. This is a rarity, but I've seen it happen.

After a few runs on local rivers, you may want to try "big time" float trips in the Ozarks. For information, write state conservation agencies in Arkansas and Missouri; also the American Canoe Assn., 400 Eastern St., New Haven, Conn. 06513, or the United States Canoe Assn., 6338 Hoover Rd., Indianapolis, Ind. 46260. ★★



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## ELECTRONIC PAIN KILLER

*(Continued from page 71)*

that people may expect a cure for just about anything from the devices, Avery quips that his DCS "looks as if almost anyone in the world could build it—and between you and me there's a good possibility they could."

Avery's modesty as an electrical engineer, however, is apparent from the sophistication of his DCS and other equipment produced for research on the nervous system. Reliability is critical in devices implanted in human flesh, and he guarantees his receiver and wire leads for the life of the patient. The stainless steel wires are carried in thin-walled Silastic tubes and the wristwatch-sized receiver is encapsulated in epoxy. All of the implantable devices can be sterilized with steam before they are put to use.

The transmitter, which Avery terms "the most sophisticated little pulse generator of its size," is about 4 inches long, 3 inches wide and 1½ inches thick. Its transistorized circuitry consists of a variable pulse generator feeding a radio-frequency transmitter. The electrical pulses are thus transmitted through the skin and detected by the tiny internal receiver. (An even smaller transmitting unit, powered by rechargeable nickel-cadmium batteries instead of ordinary zinc-carbon types and improved in other ways, is ready to go into production.)

The patient himself sets the transmitter for best relief from pain. He can deliver up to 25 volts to the stimulating electrodes (2.5 to 5 volts is the most common setting) over a range of pulse frequencies—usually between 30 and 60 hertz. The duration of each pulse is usually set by the doctor and ranges between 50 and 300 microseconds. Some patients use the device continuously while others will run it for half an hour and remain free of pain for as long as two days thereafter.

It is still something of a mystery how electricity works to relieve pain. Dr. Shealy believes the current passes through the spinal cord sideways and actually short-circuits pain. Another surgeon active in the field thinks that it masks pain by stimulating the nerves going to the brain. He sees the DCS as a counter-irritant like the old-fashioned mustard plaster or dental poultice. In other words, if you have a headache and someone hits your toe with a hammer, your head will stop aching—at least you won't notice it.

The DCS doesn't completely eliminate pain but does reduce it to a bearable level for those in whom it works. However the pain is replaced by a buzzing or tin-

gling sensation, a slight vibration that one wearer describes as the feeling of a cat's throat when it purrs. One of Dr. Shealy's patients gets good relief from her pain from cancer, but after three or four hours the sensation annoys her and she turns the DCS off for a while even though the pain returns. Some surgeons have even had to remove devices because patients didn't like the feeling. So, there are drawbacks, and many questions remain to be answered.

Yet, DCS does work well in some patients. Ask young Don C. who lives in New York City. He's had four operations and "with each one it's been downhill—this device is the only positive thing that's happened to me since the whole thing started." Don suffered a disc injury during judo practice in 1955, and it gradually got worse until he was unable to work.

Don's DCS was installed in January, 1971, after he had spent four years as an invalid. It cut his pain to about a quarter of what it was. "There's hope now," he says. "It has made the pain bearable and that's enough. I'm very thankful." ★★

## HOW TO STEER CLEAR!

*(Continued from page 56)*

left to do but take the impact of a frontal collision. Newer cars are designed with energy absorbing S-frames and chances can be on your side that you'll live through a collision—if you are wearing a combination lap and shoulder belt. There has yet to be a highway fatality in the United States at speeds under 50 mph when the driver was wearing lap and shoulder belts! And if you can steer out of a collision situation, your ability to do so may depend entirely on the belts' keeping you in the right position behind the wheel where you can control your car. ★★

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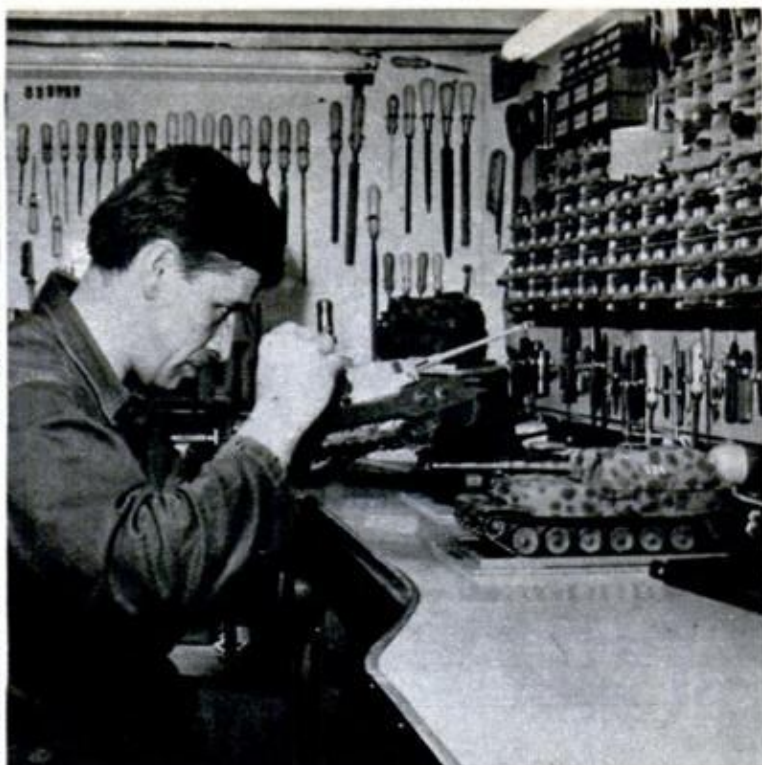


# GOODYEAR

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## NEWS BRIEFS



### Hair-spray cans help make up a tank corps

Using such materials as plastic from old refrigerators and the lids of spray cans (for gun turrets), Eugene de Passeroy of Antwerp fashions military tanks in 1/24th scale. Some of his models are radio-controlled; all have two gear speeds and can climb, go through water and over obstacles. So far, Passeroy has made some 50 tanks. At upper left is a German Elephant (between wheels of a Sherman); at lower left is a Russian T-34/85.



### Swiss expert skis with both feet on single ski

Hans Schmid, Swiss electrician, demonstrates that a skier can get along as well on a single ski as he can on two. At left, he's shown with Monoski, a single, raised plate that's placed on the ski to hold the bindings for both boots. At right, Schmid is shown taking a jump on the single ski.



# Vantage the no cop-out cigarette announces a menthol breakthrough.



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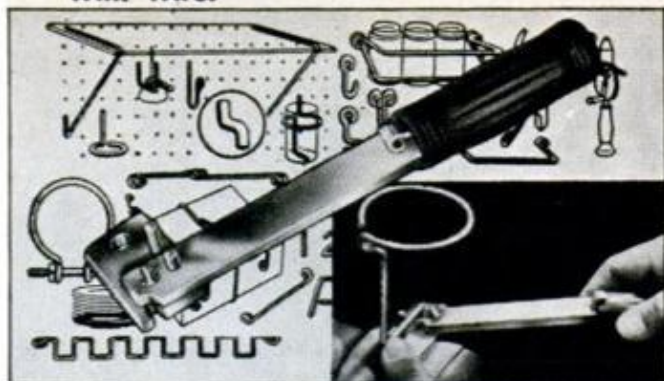


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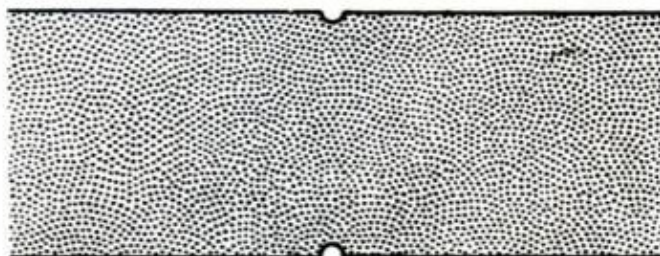
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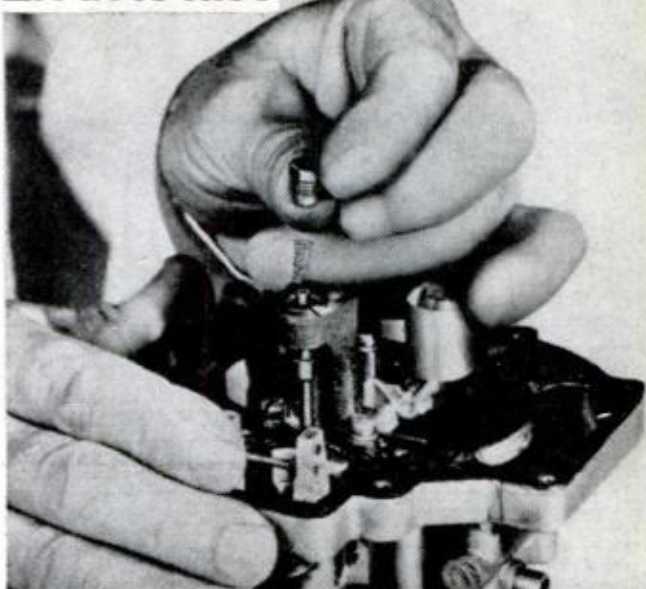
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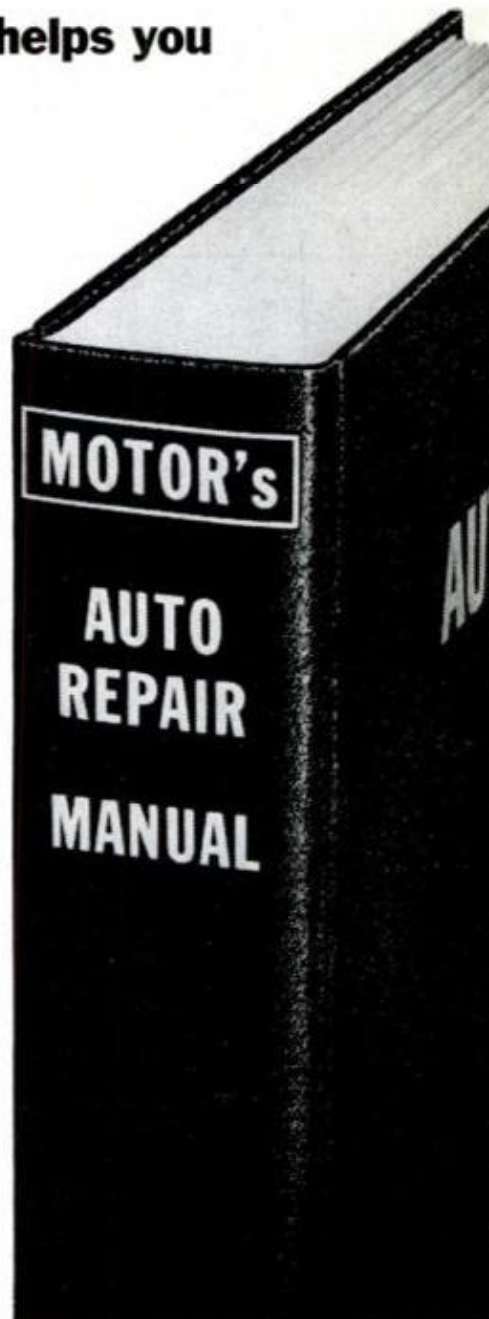
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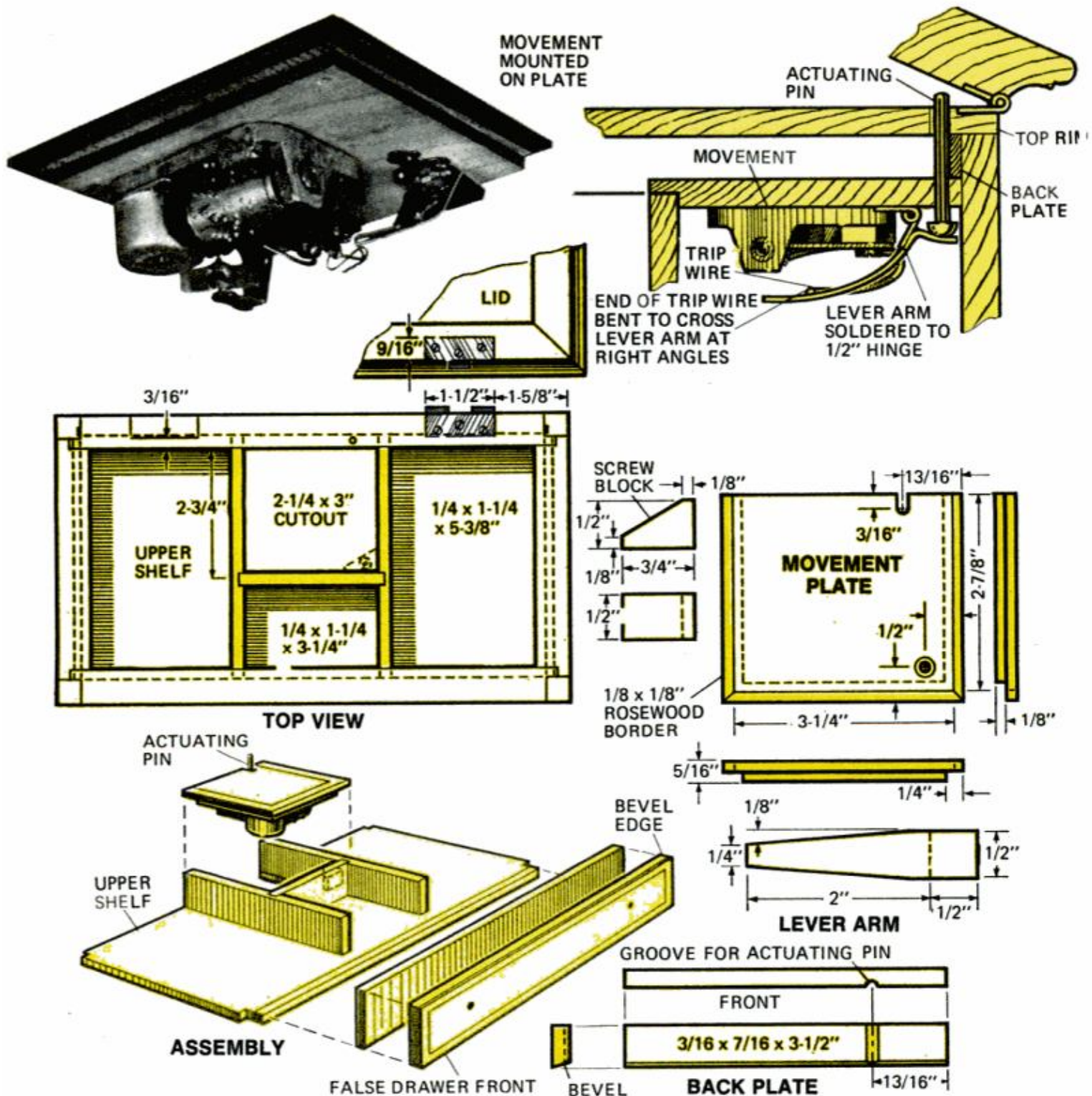
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## JEWELRY BOX FOR YOUR QUEEN

(Continued from page 127)

flush. Redrill the knob screw holes and countersink them on the inside (velveteen lining will cover the screwheads).

● **Lid and base.** Select the portion of floral inlay to be used and carefully trim away mahogany background and unwanted portions with a sharp chisel. Then, lay out the pattern for the avodire diamond shape on white paper. Center the floral inlay and trace the outline with a sharp pencil. Cut avodire veneer and two pieces of scrap veneer and glue the pattern to one piece of the scrap veneer. Sandwich

the avodire veneer between the scrap pieces and tape the edges securely.

With a fine blade in your scroll saw, cut out the floral pattern and taped veneers together. After you cut to the outside of the diamond pattern, carefully separate the avodire veneer from scrap.

● **Movement.** A little trial-and-error fitting is in order here. Before cutting blanks or drilling any holes, refer to the movement that you have on hand and determine dimensions from it. (They may vary from those of the model used in the prototype.)

● **Finish.** To finish your jewel box fill any

(Please turn to page 172)



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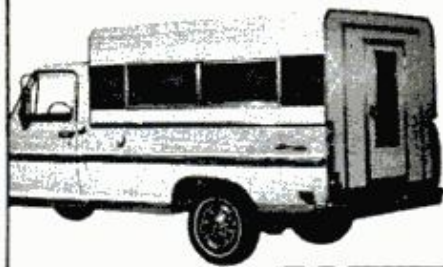
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(Continued from page 170)

imperfections with a wood paste such as Duratite, using colors to match adjacent wood. After sanding, dust thoroughly and apply five coats of clear lacquer diluted 20 percent with lacquer thinner. Allow each coat to dry completely, sand lightly with 8/0 paper and dust with a tack-rag. Rub down the last coat with pumice and water, follow with rottenstone and water and wipe away all traces of powder.

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### MATERIALS LIST

Amount	Description
5 sq. ft.	Thuya veneer
1 sq. ft.	Rosewood veneer
1 sq. ft.	Avodire veneer
1	Floral inlay (M111A)
15 ft.	1/4" inlay border (56)
3 ft.	3/8" inlay border (6)
2 sq. ft.	1/4" hardboard
2 sq. ft.	1/4" birch plywood
3 sq. ft.	1/8" birch plywood
1 sq. ft.	1/4" Honduras mahogany
1 pc.	3/4x6x36" rosewood
1	Single-tune Swiss musical instrument
1 pr.	Narrow 1 1/2" butt brass hinges
6	Brass knobs
1	Miniature brass hinge
1 pc.	.016x1/2x2 1/2" brass sheet
Misc.	Red velveteen (for lining), white glue

Note: Numbers in parentheses are from catalog of Albert Constantine & Son, Inc., 2050 Eastchester Rd., Bronx, N.Y. 10461. Musical movements are available from Constantine, from Craftsman Wood Service, 2727 S. Mary St., Chicago, Ill. 60608, and other woodworking supply mail-order houses. Rearrangement of parts on the movement panel may be necessary to compensate for different locations of trip wires in various movements.

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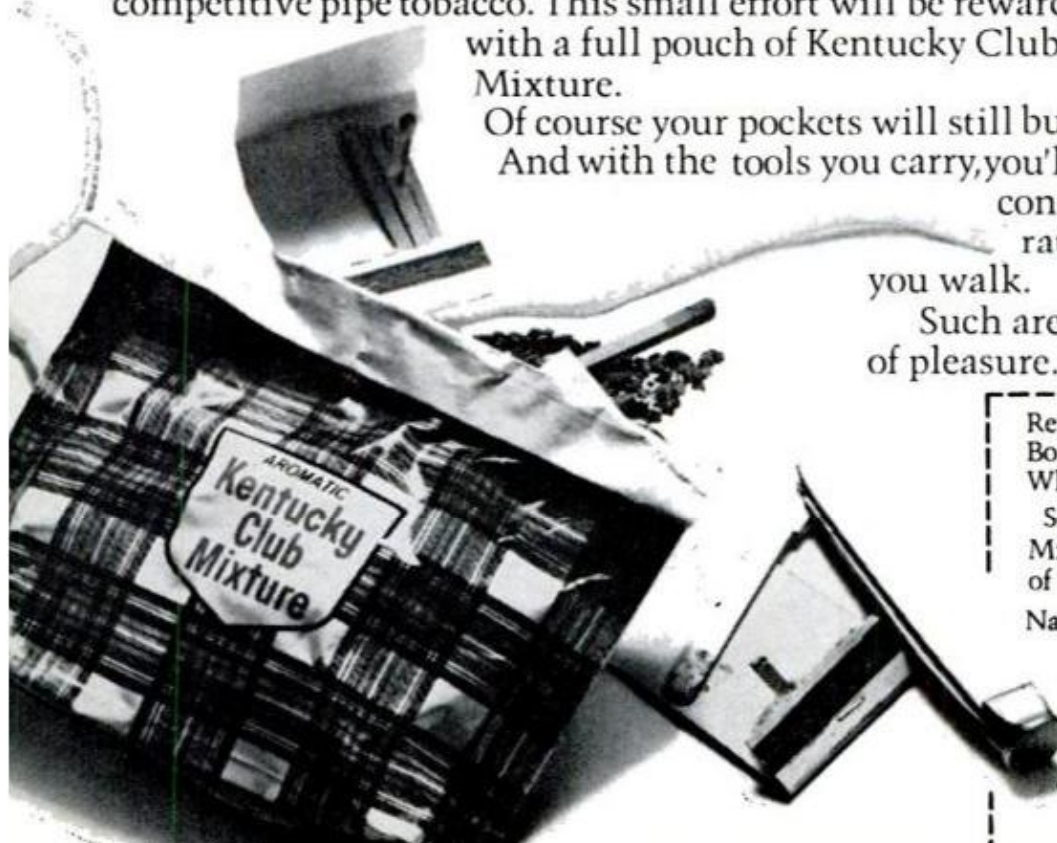
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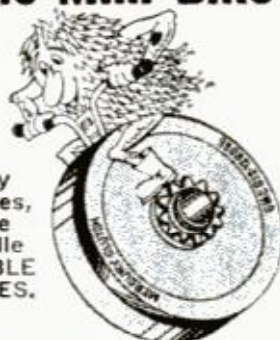
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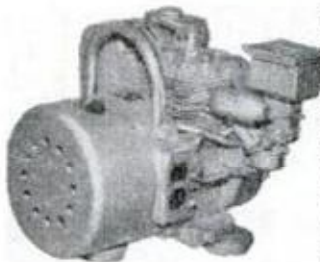
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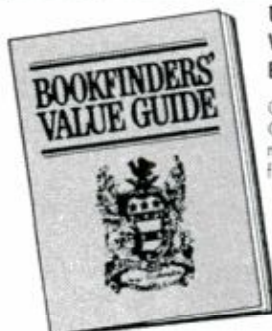
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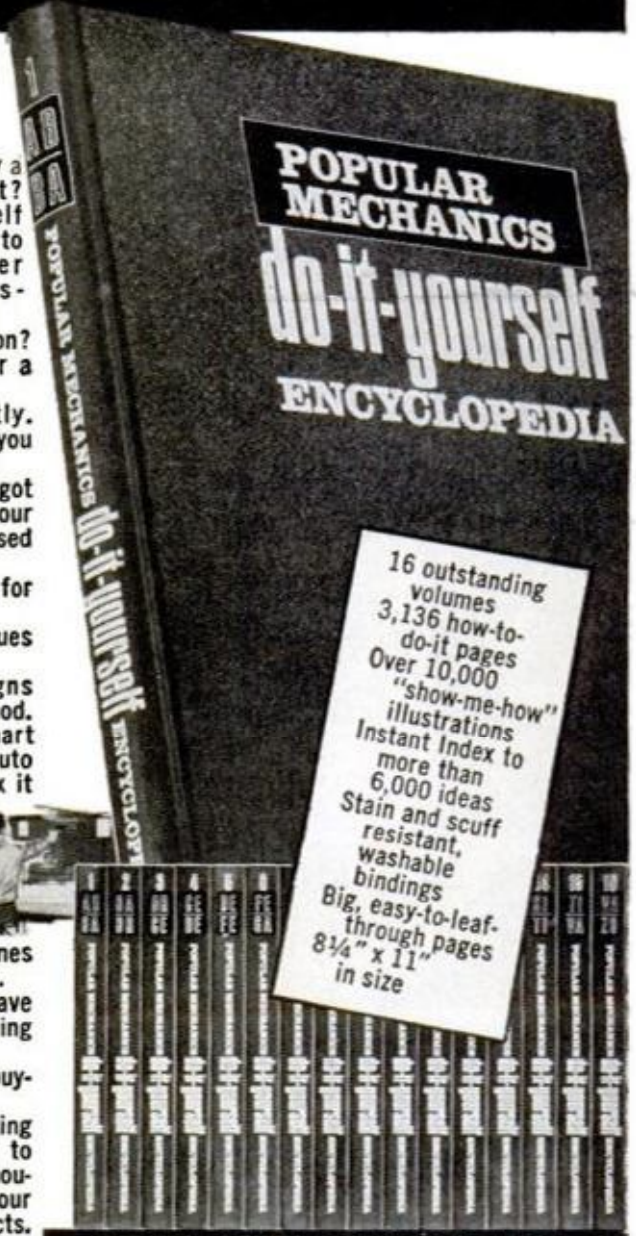
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(Continued from preceding page)

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(Continued on next page)



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# How can a pickup work like a truck, ride like a car?

## Consider these facts:

Ford pickups give you better ideas. And better ideas are what make a Ford a better buy. For example:

### Biggest cab of any pickup.

Combined headroom, legroom, shoulder room and seat height dimensions exceed those of any other pickup cab.

### Only Ford has Twin-I-Beam independent front suspension.

Wheels step over bumps independently to smooth the ride.



### Levellest, quietest ride of them all.

Virtually no nosedive on braking, less side-sway on curves. Independent tests proved Ford is quieter than all other leading pickup makes.

### Most luxurious.

Choose from four levels of luxury . . . all the way up to the unique Ford Ranger XLT, most luxurious pickup ever built.



Distinctive good taste marks the XLT: wood-tone accents, thick-pile carpeting, deep-cushioned seats upholstered in pleated cloth and vinyl, plus luxury options like AM/FM stereo and air conditioning.

### I-beam front axles.

A Ford exclusive. Both axles are drop-forged I-beam design. Everybody's *big* trucks use I-beam front axle design for greater strength.

### Radius rods help hold alignment

of the front wheels and reduce road vibration. Only Ford pickups provide radius rods.



**Self-energizing brakes** stop quickly, smoothly, with little pedal pressure. Self adjusting for lower service costs.

**Welded, instead of bolted, pickup box** stays strong, resists working loose, means greater quietness, less chance of rust.

**Leaf-type rear springs**, like all big trucks use, for better stability. Exclusive Flex-O-Matic rear suspension, standard on F-250 and with heavy-duty springs on F-100, keeps the ride smooth, with or without a load.



Make sure your next pickup includes the better ideas you get only from Ford. See your Ford Dealer for the pickup that works like a truck, rides like a car.



A better idea for safety: Buckle up.

**FORD  
PICKUPS**





Discover a smoother menthol.

Come all the way up to KOOL.



*Cunningham*

Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health

King Size, 18 mg. "tar," 1.4 mg. nicotine; Long Size, 19 mg. "tar," 1.3 mg. nicotine av. per cigarette, FTC Report Nov. 70.

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