

How to Handle the Deadly Hazards of Night Driving

POPULAR MECHANICS

SEPT. 1968
50 CENTS

What V
Owners
Think
of the
New Beetle

Exclusive!

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World's Greatest
Inventors Show**

**40 Pages of Ideas
To Make Your
House More
Livable**

Modernizing Old Doors

How to Build a Closet

\$15 Tricks That Look
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Floor Underlayment

Remodeling With Shelves

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**SEALAB III
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Home at
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Grand Prix of the U.S.

Dan Gurney's Column

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The 1969 Cars: What's really new about them? How do they compare? Twenty-six pages—eight in full color—of exclusive *PM* photos and first-hand reporting.

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Assistant Executive
Editor

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SEPTEMBER 1968

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LETTERS TO THE EDITOR

Skin problems

On page 119 of your May issue, you show a picture of the Tulsa "golden driller" and state that it "is constructed of fiberglass placed over a wire framework."

This is not the case. The exterior skin is made of Vonco, which is a special catalytic cement which we manufacture and on which we have patents pending.

Our company spent many hours working on this project and we've used this statue in our national advertising. Now our customers are questioning whether we've misrepresented our product in saying that the statue's skin is of Vonco.

MD CORPORATION
SPRINGFIELD, MO.

HARVEY J. DAVIS
PRESIDENT

The only misrepresenting was in the information supplied us by our news source. Obviously, it was wrong. Tell those doubting customers that you were right all along.

No deep-diver

I have reviewed the plans for the Markham semi-dry type submarine (*One-Man Sports Submarine*, page 90, June PM).

Mr. Markham includes on the first sheet most of the precautionary warnings that I consider desirable. There is only one additional precaution which I think should be included: namely, that the submarine should not be operated in waters exceeding 100 feet in depth. This should preclude a situation in which the submarine could sink to an irretrievable depth should buoyancy control be lost.

NAVAL SUBMARINE BASE, NEW LONDON GROTON, CONN.

GERALD J. DUFFNER
CAPT., MC, U.S. NAVY

Good word for Detroit

I very much enjoy your magazine. But I completely disagree with articles like Alex Markovich's *In the Driver's Seat of the Saab Sonett II* (page 22, July PM). How come everybody makes those little imported cars sound like such great sports cars? What about American cars like the Pontiac GTO? I think our American cars deserve much more praise than they get.

MASSAPEQUA, N.Y.

GEORGE WATTOFF

It'd be pretty difficult for Alex to say that the Sonett II isn't a nifty little machine when it really is. Besides, we do

(Please turn to page 8)

"Look who's smiling now!"

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LETTERS

(Continued from page 6)

say some nice things about American cars. For example, take a look at Len Sabal's comments on Dodge Charger (page 76).

Where credit is due

In your excellent article, *Our Wingless Airplane That Flies in Space* (page 64, July PM), you state that the lifting-body program goes back several years . . . that it began with the M-2. Nothing could be so wrong.

It is a historical fact that the lifting-body concept was originated by Vincent J. Burnelli in the early 1920s, and the present use of the idea by NASA reflects simple variations of the Burnelli designs.

MERRICK, L.I., N.Y. TED GEFFNER, P.E.

Disagrees with Dan

I much disagree with Jim Vincent and Dan Gurney when they agree that they don't like the idea of turbines racing anywhere (*Drivin' With Dan*, page 10, June PM). Theirs is a very narrow point of view.

I say let the turbines and any other types of engines be allowed in racing. Maybe this will lead to an earlier development of an automobile that costs less to drive and maintain, pollutes the air less and doesn't have to be scrapped before it is five years old.

If they want noise at the races, it shouldn't be too difficult to rig some kind of noisemaker which doesn't interfere with efficiency or pollute the air.

LINDSTROM, MINN. A. MINNICHOFFER

Track power

You called the 4000-hp Kestral (page 86, June PM) the most powerful single-engined locomotive in the world.

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GREENVILLE, MISS. HAROLD HOLIMAN

Some of the railroad buffs here still fondly remember 'em—but none of those locomotives is operating anymore.

Informed boater

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BROOKLYN, N.Y. JAMES PENDLETON

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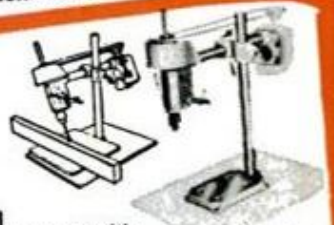
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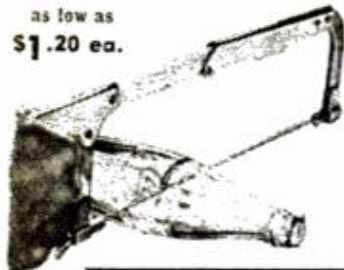


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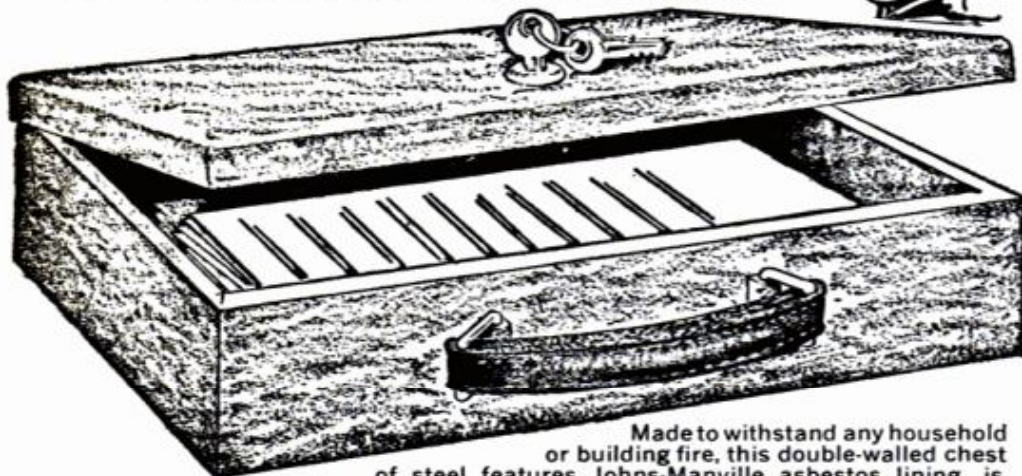
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ppd.

. . . as British as gin and tonic . . . as oriental as the mandarin dragon which twines about the cane from handle to tip . . . intricately carved in exotic wood. From the handle peers the face of an inscrutable Confucius. No colonial gentlemen would have walked the streets of Singapore or Mandalay without his sword cane. The old craftsmen of Tapei are about all gone. Sword canes like these are collectors' items already. In another while you may not be able to get them at all. A great buy at \$14.95 postpaid while they last.



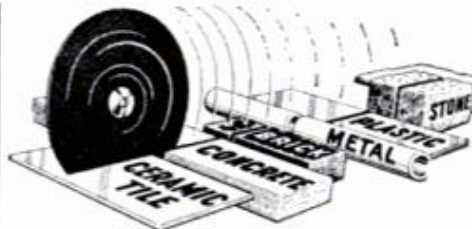
WATCH RUST DISAPPEAR NAVAL JELLY

is an extremely active new cleaner that removes rust by chemical combination . . . sticks to verticals and overheads. Brush it on, hose it off.

Use on pipes, fences, tools, tanks, all machinery. Eliminates sandblasting, scraping, etc. Easy and quick.

- 40# @ .65/lb. \$26 4# @ 2.00/lb. \$8.00
 10# @ 1.50/lb. \$15 #4 ppd.—other units FOB KC

Naval Formula X-300 Closeout Prices of this half-strength blue material write for details.



NAVAL ROUND SAW is a 7" silicon carbide disc that lets you do what Super-Hack does (except glass) . . . cut nearly anything. Ruse on drill or flexible shaft, sand with it too (has 5" rubber disc for back-up), and comes complete with all flanges and nuts. Made in England. \$5 each, 3 for \$4.50, ea. (total \$13.50) all postpaid.

MEREDITH SEPARATOR CO., Dept. PM-9,
310 West 9th St., Kansas City, Mo. 64105

Ship as follows (specify quantity):

- Super Hacks Fire Chests Reg. Larger
 Naval Jelly Round Saws Naval 5 Plastic
 Sword Canes Free Hospitality Mag. Subscription

Name _____

Address _____

City _____ State _____ Zip _____

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LIQUID PLASTIC



protects like a shield of unbreakable glass.

Polyurethane that applies like paint forms a skin so tough it won't crack, chip or peel. Cuts painting costs . . . covers and

WATERPROOF IN 30 MINUTES

Adheres to practically anything, stops leaks. Ideal for concrete, aluminum, wood, masonry, canvas, any metal. Clear—any major color. Just specify. \$5.95 per qt., \$18.50 per gal. We pay all shipping costs. Order NAVAL 5.

How to get rich

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

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

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

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

Cash by Mail

The business is Mail Order—and it's fabulous! Come up with a 'hot' new item . . . and WHAM!

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

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

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

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

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

Proof

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

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

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

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

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

The Secret

The secret of getting rich in Mail Order lies in *financial leverage*. It's a little-known, almost secret method—using other people's capital to make money for you!

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

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

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

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

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

Start Now

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

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

Free

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

If you are sincerely interested in starting a profitable business of your own . . . if you can see the tremendous advantages which Mail Order offers . . . then ACT NOW!

Mail the coupon today, or simply send your name and address on a postcard. No salesman will call. We will send you a free book—gift catalog, reprints of feature articles, plus complete facts about our program. Write to:

Mail Order Associates, Inc., Dept. 97
Montvale, New Jersey 07645



The thrill of receiving money in your mail is one you'll never tire of!

cent of your own money in merchandise! Your catalogs are printed with your name and address, so all orders come to you. Everything is "drop-shipped" for you, and there's up to 100% mark-up! You pocket the cash profits immediately—even before the orders are shipped to your customers!

Rush Coupon for
FREE BOOK!

plus reprints of
Mail Order
articles

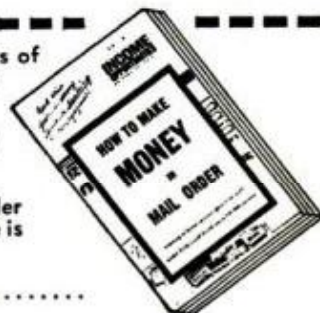
Mail Order Associates, Inc., Dept. 97
Montvale, New Jersey 07645

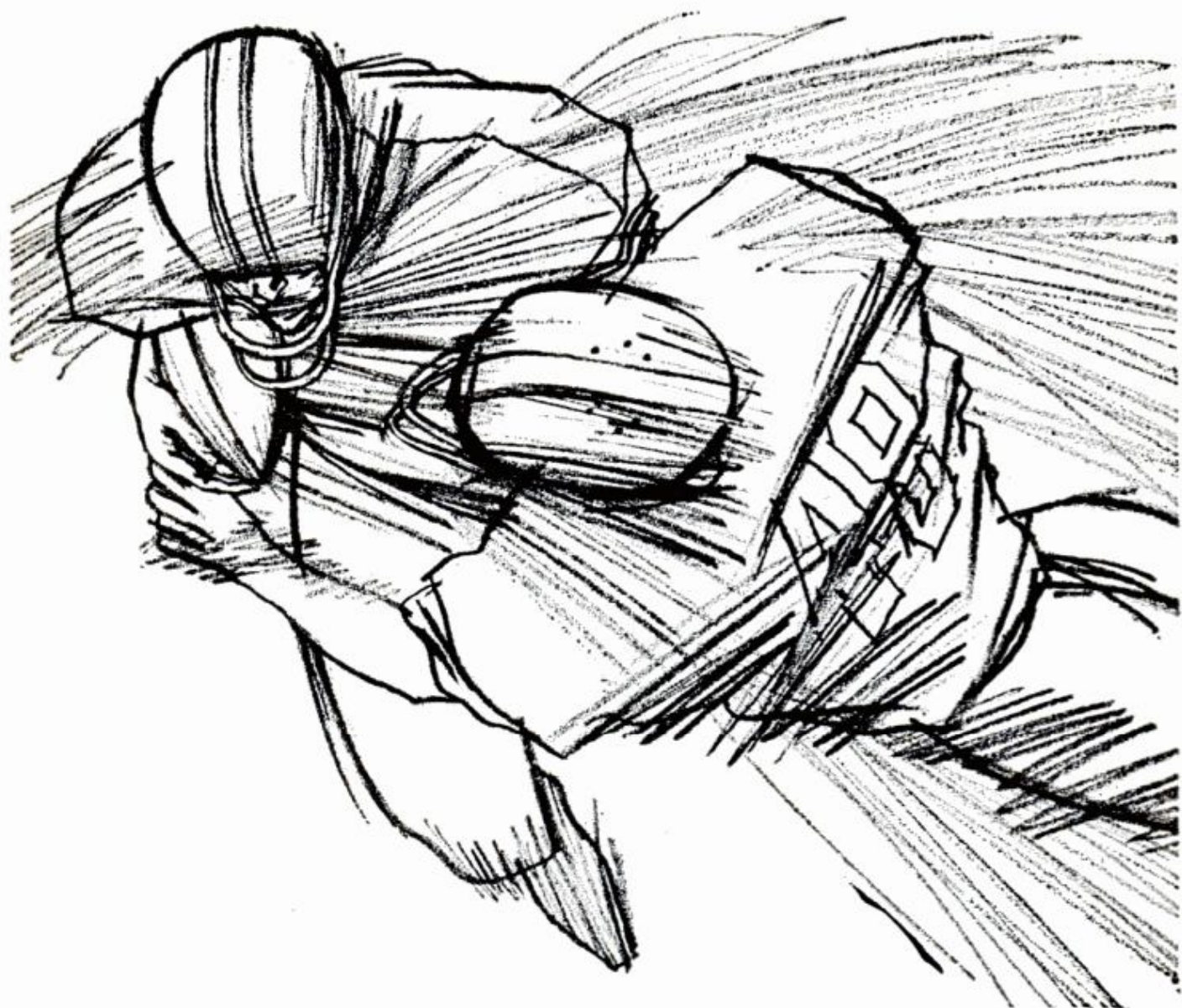
Please rush complete details on your Mail Order Program. I understand everything is free and there is absolutely no obligation. I am over 21.

Name

Address

City State Zip





**We put fiber glass in FGA® shingles
for the same reason it's in helmets:
*lightweight protection.***

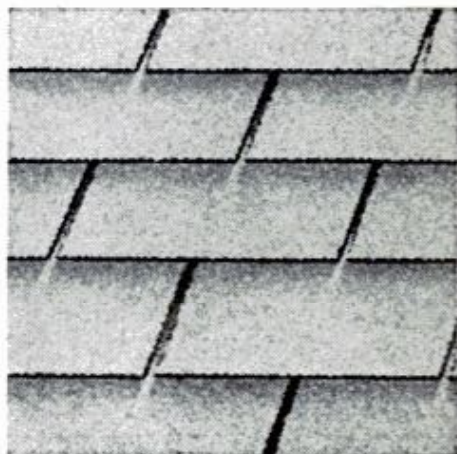
J-M's lightweight FGA® shingles give your roof special protection from weather, plus long roof life and low maintenance. Because fiber glass in shingles (as in helmets) resists cracking, curling, rotting and warping.

The combination of fiber glass and asbestos in FGA shingles also gives you extra fire protection. They've been awarded the Underwriters' Laboratories Class A fire rating—the highest given. And our Seal-O-Matic® feature makes them exceptionally wind resistant. They've actually withstood hurricanes.

If your roof needs replacing, do it with FGA shingles. They come in 14 wife-pleasing color blends. See them at your J-M dealer's.



Johns-Manville

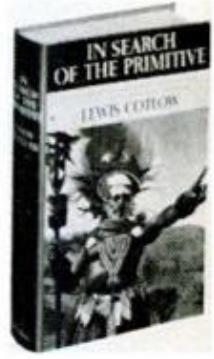
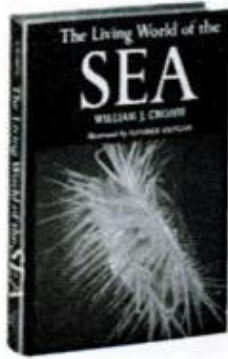
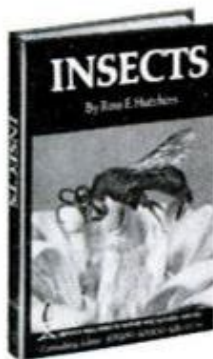


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See it whole—the beautiful and the brutal, the crowded jungles and the quiet woods, the natural worlds of beast, bird and insect and the mysterious worlds of man's first beginning. One book club brings it to you at its richest and most exciting, its most real—the Natural Science Book Club.

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"WRAP AROUND"
BITE**



NEW!

CHAN NEL LOCK

CURVED JAW

TONGUE & GROOVE PLIERS

Curved jaws that wrap around and really grab hold of round work such as pipe. Smooth, machined, undercut mating parts that can't slip the tighter *YOU* grip, the tighter *THEY* grip). Long, slender handles that give you tremendous leverage. Slim design that noses into hard-to-reach spots. In short, all the "muscle" of a pipe wrench PLUS the fast, easy handling

of a plier . . . **YOURS** with CHANNELLOCK Curved Jaw Tongue and Groove Pliers.

Available in two sizes:

No. 422, 9½ inch, 1½" jaw capacity

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CAUTION: Make sure you're getting the ORIGINAL, GENUINE CHANNELLOCK . . . look for the trade mark on the handle.

TOOLS BY
CHAN NEL LOCK
MEADVILLE, PA.



TUNE UP ELECTRONICALLY ANY CAR EVER MADE!

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

DWELL TACHOMETER

ASSURE - EASY STARTS, OPTIMUM PERFORMANCE and
MAXIMUM GAS ECONOMY with MODEL BT-162

MADE ORIGINALLY FOR THE PROFESSIONAL AUTOMOTIVE TECHNICIAN, MODEL BT-162 WILL PAY FOR ITSELF MANY TIMES OVER FOR THE AUTOMOTIVE HOBBYIST AND EXPERIMENTER.

The Model BT-162 will perform the services specified below in addition to many other tasks too numerous to mention:

- ✓ Assure precise adjustment of points that are slightly worn or pitted.
- ✓ Indicate the most effective point setting **without removing the distributor cap.**
- ✓ Read the average dwell of dual breaker points as well as individual dwell of each individual set of points.
- ✓ Indicate the correct settings for **external adjustment type distributors.**
- ✓ Car manufacturers' dwell angle recommendations are included in the manual provided with the Model BT-162 for all cars including the external adjustment type distributors specified above.
- ✓ It is no longer necessary to file points to smoothness when using the Model BT-162. The instrument will automatically make allowance for any existing "pitting" or "wear."
- ✓ To adjust for mathematically correct carburetor adjustment and thus insure maximum gas economy and quiet engine running, simply use the Tachometer section of the Model BT-162. Read the exact RPM while the engine is in neutral position. Then adjust the carburetor in conformity with the car manufacturer's recommendations as specified in the manual provided with the Model BT-162.
- ✓ To locate a "miss" you need only disconnect or "short" the spark plugs one at a time with the Model BT-162 switched to the Tachometer position. You will be able to instantly identify which particular plug (or frequently its wire lead) is responsible for the malfunction.
- ✓ Cars with automatic transmissions function efficiently only if the fluid pressures are correctly maintained and since manufacturer's instructions always refer to RPM the Model BT-162 (or an equivalent tachometer) is required to properly service automatic transmissions. Incidentally, the 5,000 RPM maximum range of the Model BT-162 is adequate for all car engines without any exceptions.

The Model BT-162 comes complete, ready to use. Tune-up and operating procedure manual included with your Model BT-162 describes in detail how to make all tests. Also includes manufacturer's dwell angle recommendations for all cars. American and foreign. Packed with information from cover to cover. The manual is yours to keep even if you decide to return the instrument.

\$29⁹⁵

SEND NO MONEY WITH ORDER PAY POSTMAN NOTHING ON DELIVERY

Try it for 10 days before you buy. If completely satisfied then send \$5.00 and pay the balance at the rate of \$5.00 per month until the total price of \$29.95 (plus P.P., handling and budget charge) is paid. If not completely satisfied, return to us, no explanation necessary.

ACCURATE INSTRUMENT CO., INC.
Dept. 589, 2435 White Plains Road, Bronx, N. Y. 10467

Please rush me one Model BT-162. If satisfactory I agree to pay \$5.00 within 10 days and balance at rate of \$5.00 per month until total price of \$29.95 (plus P.P., handling and budget charge) is paid. If not satisfactory, I may return for cancellation of account.

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Save Money! Check here and enclose \$29.95 with this coupon and we will pay all shipping charges. You still retain the privilege of returning after 10 day trial for full refund.

1. Training Means Money These Days

In today's job market, men with specialized training get the good jobs—and good pay. Trained men get the promotions and pay raises that count. In virtually every field, TRAINING spells the difference between staying where you are—and moving ahead.

Look over the list of fields below. In each, I. C. S. has been training men and women for years. Giving them up-to-date knowledge that will let them advance in their present job... or break into an entirely new field. I. C. S. can do the same for you—starting RIGHT NOW.

2. Jobs in Architecture, Building

ARCHITECTS—Qualify for advanced positions in architectural, engineering offices. I. C. S. courses begin with basics. Knowledge to help prepare for A.I.A. exams. Math. Drawing. Design. B'ld'ng, M'ch'n'r'l trades. Write "Architecture" on coupon for FREE booklets.

ARCH. DRAWING—One-course stepping-stone to architecture. Emphasis on drawing practice. No previous experience necessary. Apply now.

CARPENTRY—Largest demand area in building trades. \$4.07 average hourly wage. Over 20,000 openings yearly. Training needed. Send coupon NOW.

PLUMBING-HEATING—Earn \$4.30 hourly—average for plumbing-heating specialists. I. C. S. course has proven track record. Starts with basics. Mail coupon for FREE Success Kit.

3. Art Talent Sought

COMMERCIAL ARTISTS—Experienced artists earn \$150 and more weekly. But training is essential. Course starts with fundamentals. Job-related. Personalized instruction. Break into field full- or part-time. Write "Commercial Art" on coupon.

INTERIOR DECORATING—Non-technical course for homemaker, home furnishings salesperson. Study carpets, furniture, walls, windows, decor, color, taste. Mail coupon now.

SIGN PAINTING—Course prepares you to break into field. Covers all aspects: layout, design, painting, gilding, screen process. Send coupon for 3 FREE booklets.

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4. Automotive Specialists

AUTO ELECT. TECHNICIAN—More electrical equip. on cars—more need for elect. specialists. I. C. S. course covers the circuits, headlamp to taillights. Simply written, illustrated texts. Send coupon for 3 FREE booklets.

MECHANIC (GEN'L)—700,000 employed. 20,000 openings yearly, and employment on the upswing. Famous I. C. S. course taken by thousands in field. Coupon brings Success Kit.

TRANSMISSION SPEC'L'ST—If you now know cars, why not become a specialist? Course covers transmission troubles, testing, repairing, overhauling. Auto., standard.

5. Businessmen Make \$\$\$\$\$

ACCOUNTANTS—20,000 openings a year in this high-pay field. I. C. S. courses cover the basics plus 10 vital accounting specialties. Get information. Send coupon right NOW.

ADMINISTRATION—The key to business success. Famous I. C. S. course covers 3 vital areas: management, production, marketing. Write "Business Administration" on coupon.

EXEC. TRAINING—A company's as good as its top people. Learn to train men, to spot "comers." Mail the coupon.

MARKETING MEN—Advance to management? You'll need marketing knowledge. Course covers management practices, principles, with emphasis on marketing. Get started now.

PROGRAMMERS for digital computers. Space-age specialty. Earn up to \$15,000 yearly. Specialized—training vital. This course gives it.

PURCHASING—Advance to purchasing agent? Break into field? Take this course. Demand for PA's rising. Experienced men earn average salaries of \$8-\$15,000. Send for Success Kit.

SALESMANSHIP—I. C. S. is famous for this course. Covers basics of selling that stay same, no matter the field. 1,000,000 new salesmen needed 1965-75. Get started NOW. Write "Salesmanship" on coupon.

YOU CAN GET A BETTER JOB

by spare-time study with I. C. S.

SMALL BUSINESS MGT.—Run your own business. Course tells how. Covers purchasing, merchandising, sales, taxes, accounting, etc.—all you need to know.

TRAFFIC MGT.—Employment forecasts show upward trend for trained traffic people. Course covers entire traffic picture. Prepares you to enter or advance in field. Send coupon today.

6. Chemistry

CHEM. ENGINEERS—Youngest engineering field, expanding with industrial development. Course prepares you for registration exams. Also for breaking into chemical design, development or production departments. Send coupon for Success Kit. It tells whole story.

GEN'L CHEM.—A good course in gen'l chemistry? What easier way than at home, in spare time. Also covers basic math, physics.

NUCLEAR ENERGY—Course for engineers, technicians, maintenance men who want to enter nuclear field. Covers basic math, physics & chemistry leading to study of radioactivity and nuclear energy.

PLASTICS—Qualify as plastics technician. Take this course. Texts easy to read, written by experts. Mail the coupon for 3 FREE booklets.

PULP, PAPER SPECIALISTS—Courses cover engineering to paper machine operator. Demand field, exp'ct'd to increase 75% in next 25 years. Write for information.

7. How to Become a Civil Engineer

CIVIL ENGINEER—Famous course recognized by many states, prepares you to take exams. All aspects of civil engineering. Thousands of graduates. Write now for 3 FREE booklets.

HIGHWAY ENGINEER—Advance in field. Course complete, covers theory, practice. Recognized by many states. Send coupon now.

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SANITARY ENG'N'RING—Men trained in this field in constant demand. Course covers water treatment-supply, sewerage, eradicating menaces to health. Apply now.

SURVEYING, MAPPING—Course for man who wants to enter civil engineering field, but undecided about branch. Texts illustrated, simply written. Personalized instruction. Mail coupon.

8. Draftsmen in Demand

DRAFTSMEN—Over 4000 openings yearly. Senior draftsmen earn average \$550/month. Break into field? I. C. S. training in specialized area can help you. Don't delay. Choose field, then clip coupon.

ARCHITECTURAL drafting course covers arch. drawing, house planning, freehand & ornamental drawing, shades & shadows.

ELECTRICAL—Arithmetic, electricity basics, projection drawing, machine sketching, electrical drafting, other subjects.

ELECTRONIC—Math, mechanical drawing, formulas, electricity, electronic & printed circuit drafting, others.

MECHANICAL DRAFTING—Arithmetic, algebra, geometry & trig, projection drawing, mechanical drawing, machine sketching, others.

9. Electronics, Electricity

APPLIANCE SERVICING—More appliances mean more demand for servicemen. I. C. S. gives you know-how worth money from start. Clip coupon for Success Kit.

ELECTRICAL ENGINEERS—Demand field. Jobs in gov't, industry. I. C. S. training helps worker in field advance to junior, sr. eng'n'ring positions. Also helpful in preparing for registration exam. Starts with basics, if you have limited knowledge. Send coupon for 3 FREE booklets.

ELECTRIC MOTOR REPAIRMAN—Course starts with basics, covers AC, DC motors—perfect for would-be maintenance men, or those who seek advancement to supervisor.

INSTRUMENT TECHNICIAN—Specialists in electrical measuring & control equip. will be scarce in late '60's. Take advantage! Course gives training, starting with gen'l principles. Send for Success Kit right away.

PRACTICAL ELECTRICIANS earn an average of \$4.37 per hour. Get the know-how! Course covers building wiring, elect. equip'm't. Helps prepare for licensing, journeyman exams.

INDUSTRIAL ELECTRONICS—Technical-level course—thorough grounding in electronics. Take first step to cracking this rapidly expanding field. Mail the coupon.

ELECTRONICS TECHNICIANS—With 5 yrs. exp., they average \$6500—many earn more!

Be a specialist in this booming field! Course prepares you. Theory—you learn it. Plus practical application. Mail coupon now.

10. Engineering—a Profession

Take your first step to becoming a registered, professional engineer, with the help of famous I. C. S. courses. There are two routes to eng'n'ng: college and 4 yrs' exp. in field; or high school and 8 yrs.' exp. Then, state registration exam. I. C. S. courses help you obtain work where you can gain necessary field experience; give you knowledge you need to pass exams. Instruction available in Civil, Chemical, Electrical, Mechanical Engineering. Texts authored by authorities, are illustrated and simply written for quick comprehension. Study now, in spare time, for future success or retirement career in engineering. Write "Professional Engineer" on coupon. Do it now.

11. Success, Pleasure Through Better English Writing

BUSINESS WRITING—Command the written word—a key to business success! Course covers composition, copywriting, editing, typography, report writing. Send coupon for FREE Success Kit.

FREE-LANCE WRITING—A career for anyone with talent for writing. Course treats techniques, forms and—how to sell articles. Step-by-step instruction. Send coupon.

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12. More Formal Education

FINISH HIGH SCHOOL—It's never too late. And H.S. completion means much greater earning power and job security. I. C. S. High School programs let you complete your schooling at home, in spare time, at your own pace. Variety of courses offered: Business, Secretarial, Vocational, General. Complete only work you need for I. C. S. High School diploma. Start doing it now—by filling out coupon and mailing it!

COLLEGE PREPARATORY high school course also available. Take credits you need for I. C. S. H. S. diploma that prepares you for college entrance exams. It's never too late to start—if you have the desire. How about now?

LEARN LANGUAGES—Special, low-cost courses. Instruction by records, text, the world-famous Berlitz way. Specify language you're interested in: French, Italian, German or Spanish.

13. \$\$\$\$ in Mechanics, Shopwork

AIR CONDITIONING EXPERT—Experienced men make \$125 a week, average, and demand is rising. If you have basic mechanical knowledge, take this course. Instruction in maintenance, too. Write "Air Conditioning" on coupon.

INDUSTRIAL ENGINEERING—Advance to higher position in operation/management of industrial plant: this course gives the knowledge you'll need. Also first step to becoming registered eng'n'r. Send coupon.

INSTRUMENTATION—Several thousand new jobs a year in this demand field. A basic course. Write for Success Kit.

MACHINE DESIGN—A technical field itself, this knowledge is vital to draftsmen, and a big plus for production men, shop workers.

MACHINE SHOP PRACTICE—A basic course, giving overall knowledge of shop oper't'ns. Emphasis on practical facts. Personalized instruction. A must for the man who wants to advance. First step? Mail coupon.

MECHANICAL ENGINEERING—Within your grasp a high-pay field where at least 2600 new jobs open yearly. Write for Success Kit.

SHOP PRINTS—And how to read them. An authoritative, factual study. Vital to men who want to advance in shop work. Mail coupon now.

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Science Worldwide BY JOHN F. PEARSON

Houses can now be extruded—spun out in one continuous unit—on site. No forms or framing are needed. The construction technique employs a new epoxy resin material fed into a boom-mounted mold that forms, as it continually moves, floors, walls and roof. Curing takes only 10 seconds. The result: a house with four-inch thick walls that require no finishing inside or out. The method was developed by Midwest Applied Science Corp. of West Lafayette, Ind., and Amicon Corp. of Lexington, Mass. The companies claim that a building of 1000 sq. ft. can be erected in six hours by a crew of two.

Knee joints severely disabled by arthritis are now being replaced with hinges made of a cobalt-chrome alloy that is stronger than steel and relatively inert in the human body. Dr. Frank C. Wilson, a University of North Carolina orthopedist, reports replacing 16 knee joints. The metal hinges have enabled several to give up the use of wheel chairs or crutches.

Birds driven away from London years ago by polluted air are now returning. Increasing numbers of insect-eating birds—the first to leave when poisoned air kills bug populations—have been reported. House martins, which haven't nested in England's capital in 80 years, are back. Scientists credit the change to recent smog-control laws.

The radius of Venus has been determined as 6053.7 kilometers (about 3760 miles) by radar measurements made by Jet Propulsion Laboratory's Goldstone facility in the California desert. The accuracy of this finding was corroborated by Lincoln Laboratory's Millstone Hill radio telescope in Massachusetts. Lincoln puts the radius at 6050 kilometers, plus or minus 5 kilometers.

Steam—not oil—is what several big oil companies are drilling for in sites in California and Nevada. The goal is to tap vast "boilers" located from 600 to 8000 feet underground. The geothermal steam they contain can be piped off and used to generate electrical power, as is already being done in northern California and several foreign countries. Geologists say that the natural boilers are fed by subterranean streams and that the water is turned into steam by heat radiated from molten rock.

A satellite as tall as a two-story house and weighing about 1600 pounds is now being built for the Defense Department. Plans are to make it the basis for a worldwide communications system that will enable individual soldiers to contact distant command centers anywhere any time on a moment's notice. The satellite will be able to handle 10,000 two-way conversations simultaneously. It is expected to be in orbit late this year or early next.

How does stress of one's job affect a person's heart? Members of launch crews at Cape Kennedy are helping to find the answer to that question by wearing portable electrocardiograph machines while they work. Heart activity is monitored by three sensors on the chest. Signals are relayed to an eight-hour tape recorder worn at the waist.

Instructions for building a ground station that can receive local cloud-cover pictures anywhere in the world from U. S. weather satellites have been published by NASA. Detailed how-to directions, drawings, wiring diagrams and parts lists are contained in a 66-page booklet. It's said that a reliable receiving station can be built from surplus parts for less than \$500. The booklet is for sale as NASA SP-5079 from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. 22151. Cost: 50 cents.

Ten miles of 48-inch pipe are being laid on the floor of the Persian Gulf by a Texas-based international construction firm. Said to be the world's biggest buried submarine pipeline, it will carry crude oil from the rich Kuwait fields to tankers offshore. The pipe will be capable of loading big tankers at a rate of 15,000 tons per hour. ★★★

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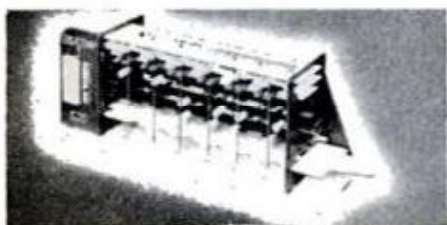
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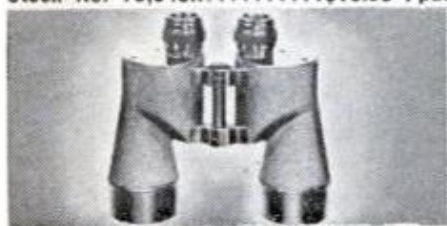
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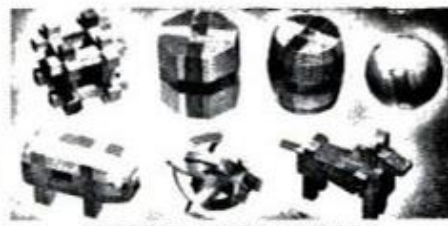
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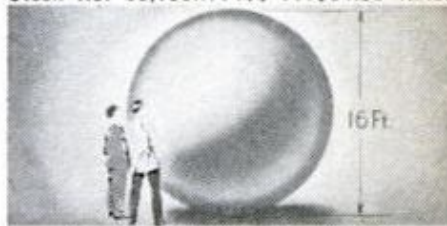
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I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there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

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

By Victor B. Mason

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

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

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

I Have All The Money I Need

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

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

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

A Fascinating and Peculiar Business

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

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

Are You Mechanically Inclined?

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

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

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

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

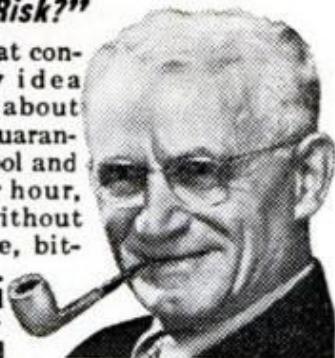
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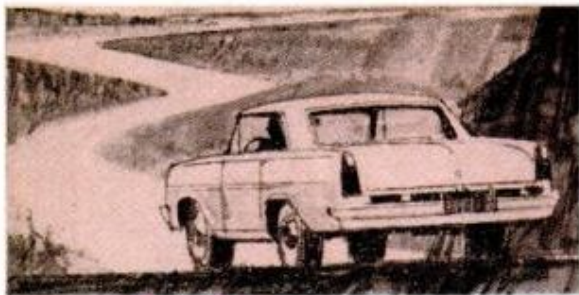
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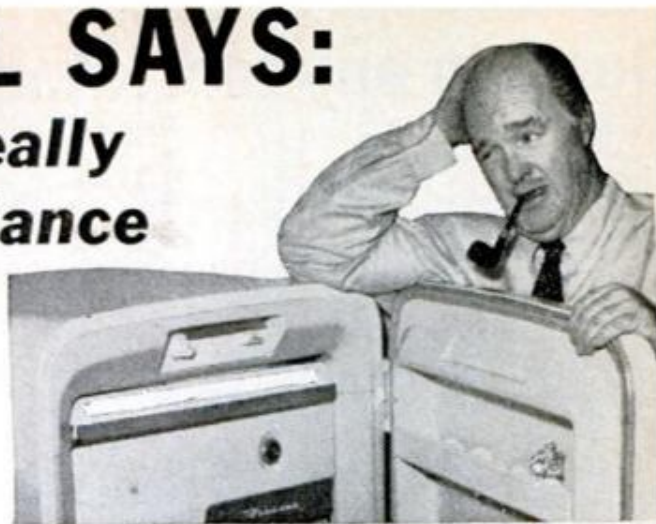
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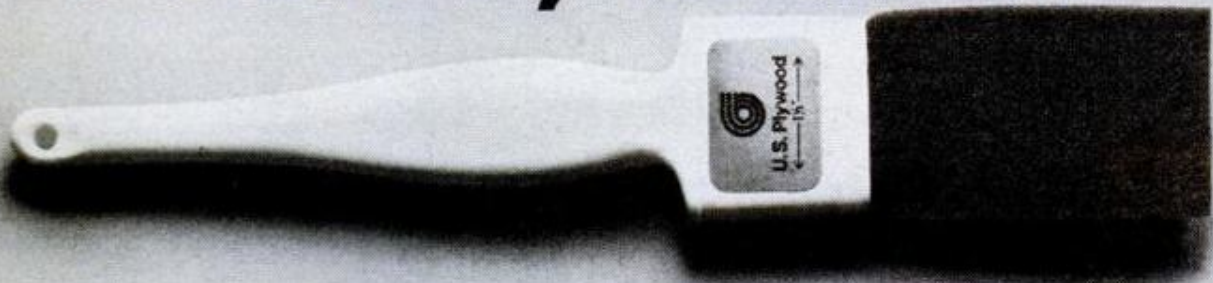
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LISTENING POST

BY BOB IRVIN

1970 FORD INTERMEDIATES—the Fairlane-Torino and Cyclone-Montego models—are getting an extra \$30 to 40-million facelifting. “We’re going to throw the book at them,” said one Ford man of the competition. The intermediates, all-new in 1968, will get only minor changes in 1969. A new Lincoln-Continental is expected to be ready in 1970. Next big change for the full-size Ford-Mercury and the sporty Mustang-Cougar models is due in 1971. All-new this fall, they will get only minor appearance alterations in 1970.

SEPARATE TAIL AND STOPLIGHTS for all new cars are being considered by the auto industry. “I see this coming in the future,” says Tom Kilgour, a top Chrysler engineer and chairman of a special auto-industry lighting committee. At present, the stop and brake lights are superimposed. Kilgour believes making them separate would provide more safety. He also thinks there’s a need for variable-intensity stoplights—brighter in the daytime than at night. But he notes this poses a lot of problems, citing, for example, the fact that on a foggy night the lights should be daytime-bright. It’s a good bet the proposal to separate tail and stoplights has a better chance of being adopted than the idea of having variable-intensity lights or the even farther-out suggestions for tricolor taillights—green, yellow and red.

NEW GM SIGNS should start appearing in numbers next year at General Motors dealerships. They will be based on the “GM Mark of Excellence” plaques that have been on all the company’s cars the past two years. The new corporate identity program—which follows similar moves at Ford and Chrysler—will cost more than \$200 million. The other two companies are pleased with the results of their programs.

TELEVISION INVESTIGATION AT AUTO ACCIDENTS is an interesting possibility. Cornell’s experimenting with the idea—transmitting pictures from a portable camera at the accident scene to a panel of experts seated before TV monitors. This would enable skilled investigators to be “on the scene” of every major accident. Two-way radio would also be used. The study’s being made under a government contract.

COMPUTERS IN CARS have a real future. First there was the Volkswagen computer-controlled fuel injection in 1968. In 1969, Ford will have computer-controlled antiskid systems on the Thunderbird and Continental Mark III. That’s just a start. An official of Kelsey-Hayes, which developed the skid-control system, believes a computer eventually can control about 100 different operations in a car—from adjusting power seats to shifting gears in an automatic transmission.

NEW ELECTRIC CAR, most interesting to come down the road yet, is a hybrid developed by General Motors. Called “Stir-Lec I,” the car is driven by an electric motor with energy from 14 conventional 12-volt lead-acid batteries. The unique feature is that the batteries are recharged while the car is moving by means of a Stirling heat engine. The Stirling engine was invented 150 years ago, but it’s being used in the hybrid car—actually a modified 1968 Opel Kadett—because it’s virtually emission-free. This is due to an external combustion chamber which provides almost complete burning of the kerosene fuel. The resulting heat expands hydrogen gas in the sealed engine cylinder. The gas pushes down a piston which drives a generator to recharge the batteries. This arrangement overcomes the limited range of battery-powered electrics, which take hours to recharge when the batteries run down. But GM’s hybrid, under optimum conditions, has unlimited cruising range at 30 mph, providing you stop every

(Please turn to page 34)



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(Continued from page 32)

150 to 200 miles to replenish the kerosene fuel for the Stirling engine. At the car's top speed of 55 mph, the range is cut to 30-40 miles because the batteries are using more power than the 8-hp Stirling engine can replace. GM Vice-Pres. Lawrence R. Hafstad says the car "has more promise than any other electric that we have had a chance to look at so far."

"Calvair" was the name of General Motors' first Stirling-powered car, a modified Corvair. While never shown to the public or press, it's been learned the car used thermal batteries instead of an external combustion chamber to provide heat for the 30-hp engine which actually drove the car. The "heat batteries" were 50,000 aluminum-oxide pellets, with charging by bottled natural gas. GM people called it "our zero smog car."

PREDICTIONS OF THINGS TO COME:

Automatic highways will be common by the 1990s, with many vehicles electrically propelled. This from Dr. William Seifert, assistant engineering dean at MIT. On the other hand, Transportation Secretary Alan S. Boyd says the electric car "is a pretty long way down the road" and doesn't see any possibility of the internal-combustion engine being replaced in the foreseeable future. Dr. Jack Goldman, one of Ford's top scientists, says battery power can't make it in cars unless it's combined with a second power source. Goldman says any electric car produced "in our lifetime will have to be a hybrid."

EXPERIMENTAL HYBRID ELECTRIC

car is being built by Toyota, the Japanese firm. It will use a small gasoline engine and electric storage batteries. Meanwhile, Chrysler's rumored to be talking with a Japanese firm about work on a rotary piston engine.

HIGHWAY PATROLMEN

may be too eager in pursuing people, according to the Physicians for Automotive Safety. The doctors' group says three out of four hot pursuits are for minor offenses, yet one out of five ends in death, five out of 10 in serious injuries and seven of 10 in an accident.

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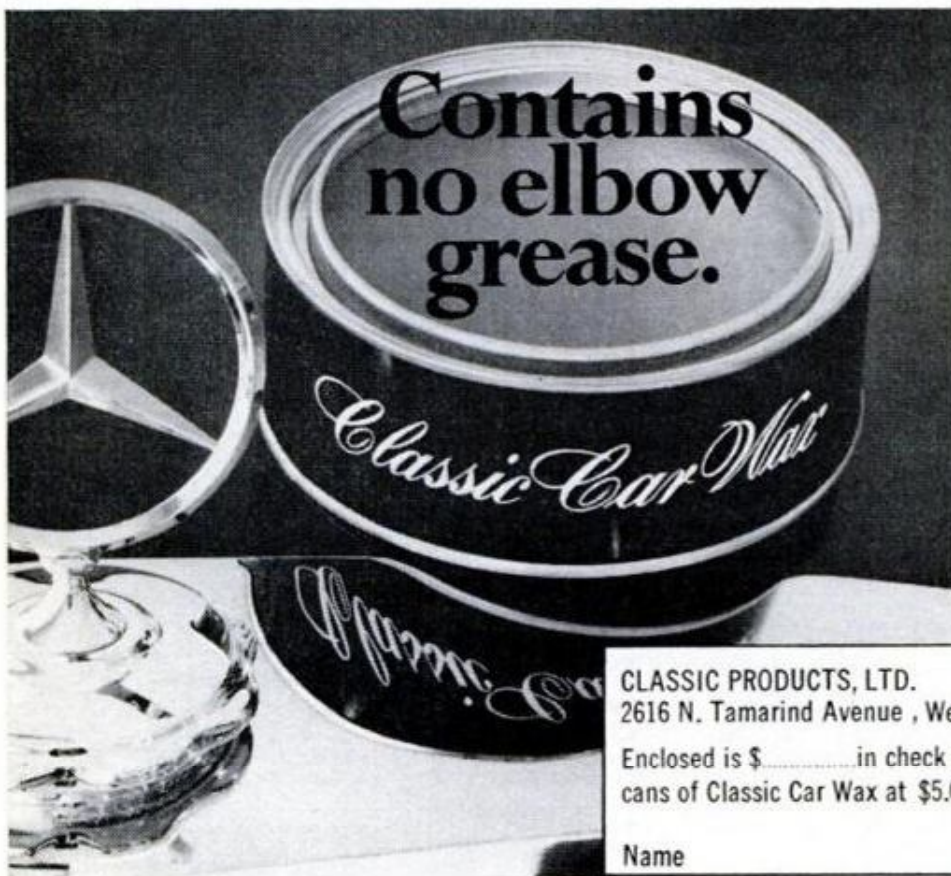
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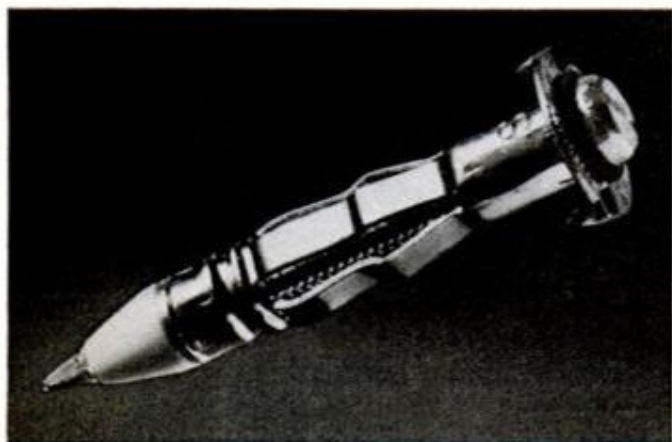
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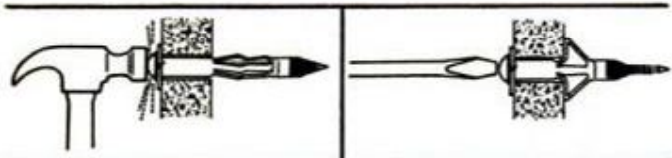
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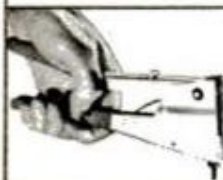
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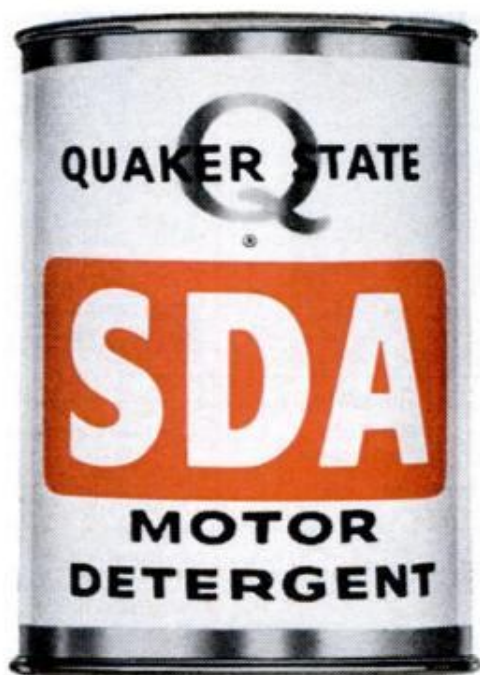
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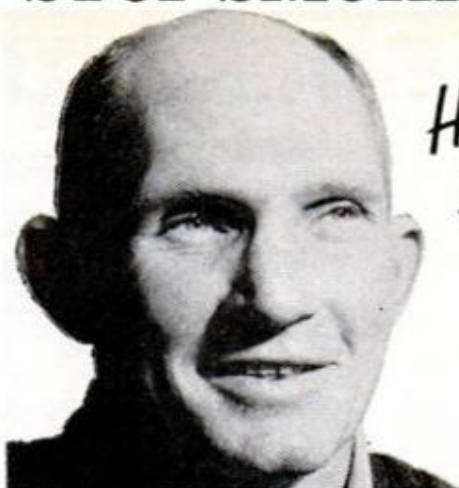
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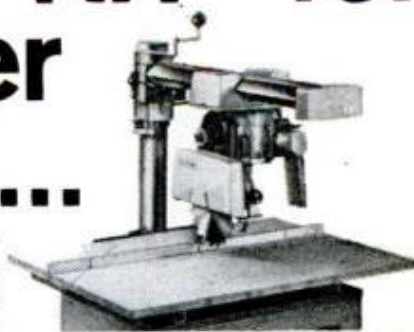
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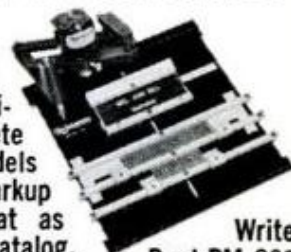
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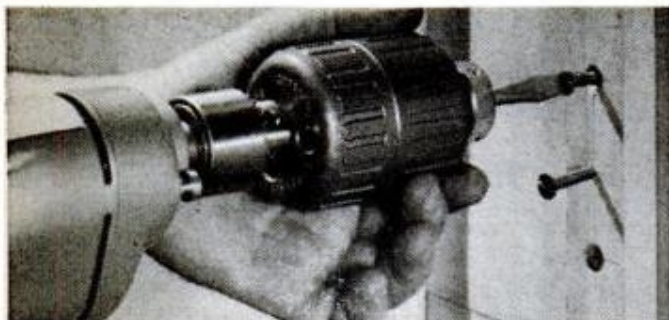
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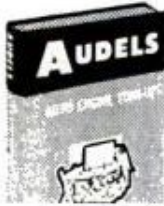
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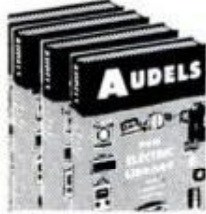
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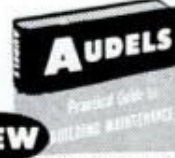
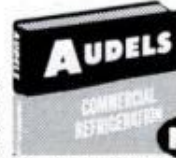
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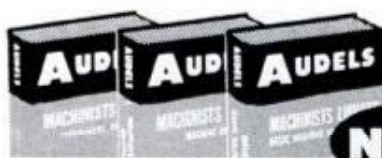
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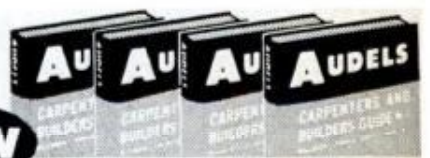
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What's the tire pressure on a racing car? When do you plan to retire from driving? What's the best vantage point for watching road races? Dan Gurney answers these and other provocative questions



ALL BUSINESS is Dan these days as his AAR shops crank up to fill orders for new Eagles following car's great success in this year's Indy 500-mile classic

Q. Since Indy, I have seen reference to your engine as both Gurney-Weslake and Gurney-Eagle. Are these different engines or one and the same?—Nate Goldberg, Miami, Fla.

A. One and the same. But to be perfectly correct, the reference should be Gurney-Eagle Stock-Block Ford. We changed the name shortly before Indy this year when our company took over the manufacture of the cylinder heads we utilize on our Ford racing engine at Indy and in sports-car competition. These heads were originally manufactured by the Weslake Co. of England. We have also rechristened our Grand Prix powerplant to Gurney-Eagle V12.

Q. With Camaro blitzing Mustang in Trans-Am racing, why don't you enter a car with your cylinder heads? As I understand, Trans-Am racing utilizes 302 engines, the same as you use in your Eagles.—Paul McDuffy, Menlo Park, Calif.

A. We are considering an AAR entry in the Trans-Am series in 1969. At the moment, the Ford 302 engine as we use it in our Indy car would not be eligible because Trans-Am rules require production-type cylinder heads. However, since these heads are now in production, we hope to have a chance of running them in the near future in this very interesting type of racing.

Q. I have been arguing with a friend about tire pressure. He says some racing cars use just as low a pressure as the street car (about 25 lb.), but I have always heard that very high pressure is used.—Conrad Githens, Steamboat Rock, Iowa

A. The pressure in general is probably lower than you think, but there are many variables including chassis setup and the type of racing you are doing. Stock-car tires may carry 50 lbs. or more for a given race. Drag racers may run as little as 4-lb. pressure;

it depends on what you are trying to achieve. Quite often, tire pressure is in the 30 to 35-lb. range.

Q. I occasionally read where you or your father used to be an opera singer. Is there any truth to this?—Clifford T. Hallingsworth, White Plains, N.Y.

A. As a singer, I might make a race-car driver. You probably are referring to my dad, John Gurney, who put in nine seasons as a bass baritone with the Metropolitan Opera Co. in New York.

Q. I had seen only oval track races until this year when I took in my first road race. Frankly, I found it much harder to watch and wondered if you had some suggestions.—Rod Renner, Travelers Rest, S.C.

A. Although most of the well-established road circuits have grandstand sections available, you should be prepared to move around a bit to get the most out of your next road race. I would suggest you get a program or listing of the cars and then try to acquaint yourself with the circuit. Look for a couple of the more interesting corners and see if there is a long straightaway that is accessible. Hilltops afford the broadest range of view, but the real opportunity that a road course presents is the great number of vantage points available for fans who wish to study every technique from braking and down-shifting to high-speed cornering.

Q. Is it true that Stirling Moss, the retired British World Champion, will soon be driving again in competition?—Joe Edwards, Dallas, Tex.

A. Moss, now 39, recently announced he would enter a European rally, emphasizing that it was not a race and he had no plans to return to racing per se. Although he is credited with 194 victories including rallies, and a brilliant career that ended in 1962 with a very bad crash at Goodwood, he never won the World Championship.

Q. I am familiar with the abbreviations "CC," "MM," "RPM," etc., but recently in an English paper, I saw two that stopped me—"IFS" and "RAC." What do they stand for?—Mike Tarkington, Lansing, Mich.

A. "IFS" probably refers to Independent Front Suspension and "RAC" is the Royal Automobile Club. The one you have to watch

out for is "IRS" which can mean independent rear suspension or Internal Revenue Service.

Q. I had a guy tell me there was once a car named "Arab." Is that true?—Ralph Clotne, San Francisco.

A. That one threw me, too, Ralph. Would you believe the "Arab" was introduced in Britain in 1927, a "super-sport, two-seater with a two-litre, four-cylinder engine" and "a top speed of 90 mph." That's what the book says, anyway.

Q. While spending a couple of months in Italy, I was disappointed to learn they no longer run the Mille Miglia race. When and why was it stopped?—T. L. Overbrook, Hutchinson, Kans.

A. The Mille Miglia, a 1000-mile race across the roads of Italy, was canceled because of the danger caused by the uncontrollable crowds who were being injured in increasing numbers. Taruffi led a 1-2-3 Ferrari sweep of the '57 race which concluded the legendary event after about 30 years of running.

Q. How old are you and when do you plan to retire? (I hope never.)—Roger Shroder, East Lansing, Mich.

A. Well, now, Roger, I am 37 as of April and to be perfectly truthful I have no specific retirement plans, although I certainly don't plan to race indefinitely. I would like to win the World Championship and the Indy 500, but I also find great satisfaction in building Eagle cars and operating a racing research development company like All-American Racers.

Q. Who won Le Mans this June? I haven't been able to find a word about it in the papers or magazines.—Margaret McDonnell, Elizabeth, N.J.

A. The French students. Because of the spring rioting in France, it was decided to postpone this year's 24-hour race from June until September. ★ ★ ★

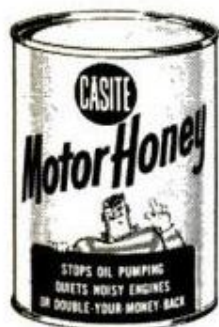
If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 58).

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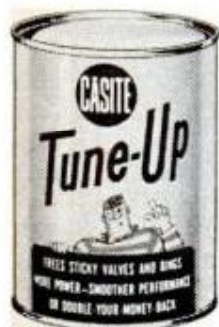
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Before your transmission jerks—or the seal shrinks—add Casite Smooth-Seal. The old irony about not giving the patient any medicine until it's too late is just as true with your car as it is with people. In your car — new or old — time and heat change the chemical composition of the fluid in the auto-

matic transmission. Time and heat also harden and shrink the transmission seal which can result in leaks. Smooth-Seal softens and expands hardened, shrunken seals to stop transmission leaks. It keeps good seals soft and pliable to prevent leaks. In addition, Smooth-Seal also cleans the surfaces of delicate internal parts. It restabilizes your transmission fluid because it also contains anti-foam agents and corrosion inhibitors. The result is smooth transmission action—no jerks—no jars. Smooth-Seal blends with all brands of transmission fluids. Add Smooth-Seal every 15,000 miles to prevent trouble and the first time gear shifting becomes erratic, or you notice an "oil" spot under your car. Saves money in transmission repair bills.



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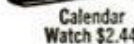
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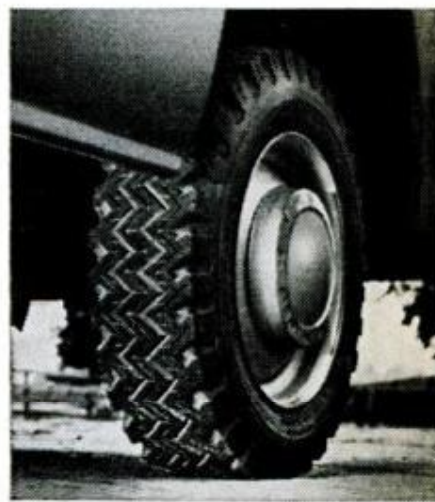
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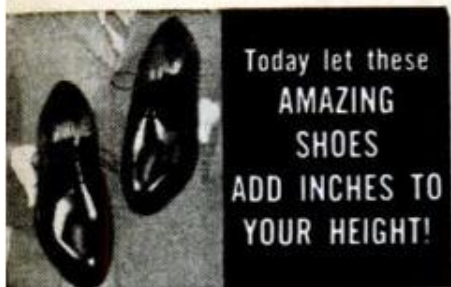
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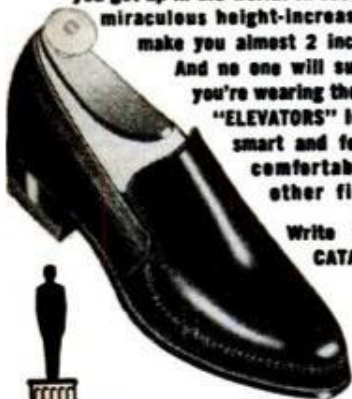
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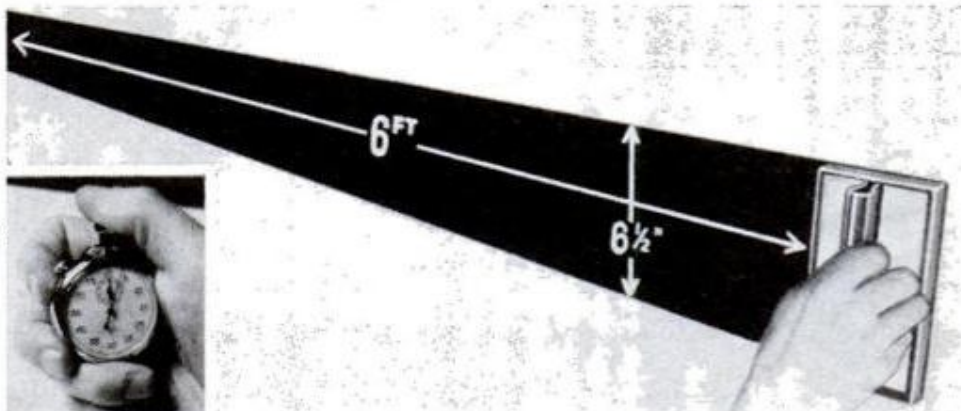
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SCIENTIFIC MASSAGE: BIG EARNINGS uncrowded profession. Learn spare time at home. Diploma awarded. Free catalog. Write: Anderson School, Dept. L-I-C, Princeton, Illinois 61356.

HOW To Make Money Writing Short Paragraphs. Information Free. Barrett, Dept. C-27-H2, 6216 N. Clark, Chicago 60626.

REFRIGERATION—Appliance course, Analyzer, \$29.95. Free literature. Ace Appliance, 1465 North Clifton, Springfield, Missouri 65802.

NEW Modular technique makes you successful advertising man overnight. Free details. Box 87-P9, Hollywood, Florida 33022.

BAKE New greaseless doughnuts in kitchen. Sell stores. Free recipes. Michael Ray, Waseca, Minn. 56093.

JANITORS—Cleaners—Custodians. Get a better job—Make more money. Become a maintenance supervisor. Homestudy details free: Maintenance Training, 907 Lakecrest, Fairport Beach, Ontario.

MAKE GIFT AND SOUVENIR ITEMS IN YOUR HOME FOR PROFIT. Send 50¢ for catalog which includes wholesale sources for hundreds of component parts and craft supplies. Merry Madison Handicrafts, Dept. PM9, 500 W. Florida St., Milwaukee, Wis. 53204.

BIG Money raising fishworms and crickets. Free literature. Carter Wormery, Plains, Georgia 31780.

SALESMEN—DISTRIBUTORS

FREE Selling outfit. Office supplies, furniture & equipment. Osoco, 15-PM North Jefferson, Chicago, Ill. 60606.

MAKE Extra \$25 to \$75 spare time! Take orders for double air cushion Bronson Shoes. Amazing comfort. Terrific men's, women's line for dress, work, play. Highest commissions. Shoes for yourself. Big outfit free. Write Bronson, Dept. 669, Minneapolis, Minnesota 55408.

SELL Advertising book matches. Write us today, we put you in business by return mail; handling complete line ad book matches in demand by every business right in your town! No investment; everything furnished free! Top commissions daily. Superior Match, Dept. M968, 7530 S. Greenwood, Chicago, Illinois 60619.

EARN Big Commission full or part time. Show America's largest line low priced Business Printing and Advertising Specialties. Plus calendars in season. No experience. No investment. No collections or deliveries. On-the-Spot commissions. Big Free Sales Kit samples hundreds items used daily by businessmen. Merchandise bonuses for you. Free gifts for customers. Build profitable repeat business. Start now. National Press, Dept. 806, North Chicago, Ill. 60064.

EARN Terrific commissions listing delinquent accounts. General Finance Company, 304-A Pickwick Building, Kansas City, Mo. 64106.

FREE Franchise: Everything you need for your own shoe business absolutely free. No experience. No investment. Immediate cash commissions. Earn 8 different ways with own franchise sales team. Make money with exclusive invention. America's fastest growing shoe company. Write: Ortho-Vent Shoe Co., 1189 Brand Road, Salem, Virginia 24153.

PERSONAL Protective Devices Now In Big Demand due to increased crime rate. Proven. Sell easy to Drive-ins, Stores, Nurses, Night Workers, Motorists. Sales experience unnecessary. Get profit details now. Hagen Supply, Dept. CLA9, St. Paul, Minn. 55107.

FREE, 206 Easy Ways to make money taking orders for exciting new products—spare time. Send name, age for 5 months free subscription. Opportunity Magazine, 850 N. Dearborn, Dept. 17-HS, Chicago 60610.

GET New shirt outfit free! \$90 weekly on 5 average orders a day. Famous quality made-to-measure dress and sport shirts at \$4.95 up, sell to all men. No experience needed. Full or part time. Write: Packard Shirt Co., Dept. 919, Terre Haute, Indiana 47808.

NEW Car Thief Signal, Lightning Seller. Samples for trial. Northwest Electric, Ave. 487, Mitchell, S. Dak. 57031.

GOOD MAN. Mature. Short trips around county. Part time. Excellent earnings. Write Cyclo Mfg., 3816 Dahlia, Dept. 158, Denver, Colo.

SELL ADVERTISING BALL POINT PENS—Advertising Specialties—Calendars. Free details, or sample kit \$1.00—(Refunded first order). Full or part time. Fleming, 6535-PM Cottage Grove, Chicago 60637.

MAKE Extra Money! Introduce new Miracle Cantreze Nylons. Amazing low price. Guaranteed never to run. We show you how. Big outfit, sample stocking free. Spare time cash year-round. It's easy. Write American Hosiery Mills, Dept. A189, Box 753, Cincinnati, Ohio 45202.

100% PROFIT—Sweet Georgia Brown Cosmetics sell fast. Write for Sample Case offer. Valmor, Dept. H, 2411 Prairie, Chicago 60616.

SELL Hertel Bibles—Part Time. Finest reference Bible available. Demonstrator and supplies furnished. Excellent commissions. Write International Book, Dept. PM, Box 118, Wichita, Kansas 67201.

AGENTS WANTED

EVERY Man a prospect. Refundable sales kit offer showing line belt buckles, tie clasps, money clips, cuff links, lapels, identification badges, individualized with customer's name and emblems. Cap badges for trucking, bus, taxi, police, firemen, also postal, letter carriers and heavy construction emblems. Choice 3000 emblems. Hook-Fast, Box 1088PM, Providence, R.I. 02901.

MAKE \$50.00 Daily selling air-operated vacuum cleaners to service stations. Free details. Inka Industries, 2401 Crocker, Houston, Texas 77006.

PRINTING, Advertising Salesmen—Excellent moneymaking sideline selling Decalcomania Name Plates, small quantities. Advertising Specialties, sign letters. Free Samples. Ralco XL, Boston, Mass. 02119.

YOUR Own business—Used suits \$1.50; overcoats 65¢; mackinaws 35¢; shoes 12½¢; ladies coats 30¢; dresses 15¢. Enormous profits. Catalog free. Nathan Portnoy Associates, 2109-AA Roosevelt Road, Chicago Ill. 60608.

CHRISTMAS CARDS—Business and Personal. Customer's name imprinted. Earn unusually high commissions from this medium- and high-priced line. No investment. No inventory. Free Sample Album. Process Corp. (our 47th year), 3436 S. 54th Ave., Chicago, Ill. 60650.

LIFETIME Income, Business Loan Representative Write: Financial 28 E. Jackson, Suite 1204-X3, Chicago 4.

BIG Money! Sell devices for personal protection! Write H&H Supply, Box 5073-C, St. Paul, Minnesota 55104. (Adults only).

SELL Gifts, Household Items—Make extra money. Gifts, Jewelry, Stationery, Greeting Cards. Experience unnecessary. Salable Samples on approval. Free—Catalog, Personalized Christmas Card Album, Gift Offer. Hedenkamp, 361 Broadway, Dept. PM-98, New York, 10013.

SELL Greeting Cards—Make extra money. Gifts, Toys, Jewelry, Stationery.. 600 items. Experience unnecessary. Salable Samples on approval. FREE—Catalog, Personalized Christmas Card Album, Gift Offer. Hedenkamp, 361 Broadway, Dept. PM-99, New York 10013.

FREE, 206 Easy Ways to make money taking orders for exciting new products—spare time. Send name age, for 5 months free subscription. Opportunity Magazine, 850 Dearborn, Dept. 17-HA, Chicago 60610.

MAKE Extra money—Show friends, neighbors—Gifts, Stationery, Toys, Jewelry, Greeting Cards. Experience unnecessary. Salable Samples on approval. Free—Catalog, Personalized Christmas Card Album, Gift Offer. Hedenkamp, 361 Broadway, Dept. PM-97, New York, 10013.

WILL You test new items in your home? Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee, 129, Akron, Ohio 44308.

AMAZING Christmas card profits, \$50.00 to \$500.00 cash in spare time. Plus bonuses. 250 easy money-makers. Free Personalized Album. Experience unnecessary. Charming \$1.00 "Sachet of Flowers" Keepsake Lavender Free for promptness. Approval samples. Creative, 4401 Cermak, Dept. 509-B, Chicago 60623.

BUSINESS KIT FREE! Postcard puts you in business! Complete line 275 shoe styles, jackets! New Discoveries pay Big Commissions. No investment. Send for Free Kit. Mason, K-602, Chippewa Falls, Wisconsin 54729.

WORLD'S Greatest Motivation Program Offers you unlimited earnings as Agent or Franchise Distributor. Choice areas available. Appeals to people in all walks of life. Address, Alpha Distributing Company, P.O. Box 816-M, Chicago, Illinois 60690.

WILL You test new items in your home? Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee, 128, Akron, Ohio 44308.

INCREASE Your income! Take orders for sensational advertising stickers. Free samples. Presstiks, 534-A Danube, Atlanta, Ga. 30305.

EMPLOYMENT INFORMATION

AUSTRALIA Wants You! Government assisted passage. Unlimited Opportunities. Latest Government Information and Forms \$1.00 Austco, Box 3623-E, Long Beach, California 90803.

FOREIGN And USA job opportunities available now. Construction, all trades. Earnings to \$2,000.00 Monthly. Paid overtime, travel bonuses. Write: Universal Employment, Dept. C-1, Woodbridge, Connecticut 06525.

HIGH Paying overseas jobs, Construction, other projects, Bonuses, Travel Expenses, Extras, International Information, 124, Cortez, Florida 33522.

OVERSEAS JOBS—Engineers, Construction, Refinery Operation, Medical, Clerical, Worldwide Integrated List—Where, How Apply. \$4.00 to OVERSEAS ADVISORY SERVICE, Apartado Aereo 2897, Barranquilla, Colombia.

TREMENDOUS Opportunities U.S.A. overseas, choose jobs—locations, transportation. Free details. Occupations, International Airport, Box 100-C10, Jamaica, N.Y. 11430.

JOBS GALORE AUSTRALIA!! Government assisted transportation! Information packet and forms \$1.00. Associated, Box 17 B9, Lafayette, California.

HELP WANTED

OVERSEAS Jobs—Australia, Europe, South America, Far East, etc. Openings in all trades and Professions. \$400 to \$2,500 monthly. Free Information write National Employment Service (Foreign Division), Box 2235 P.M.F., Miami, Florida 33159.

OVERSEAS Jobs—Europe, South America, Australia, Far East, etc. 2000 openings all trades. Construction, Office, Engineering Sales, etc. \$400 to \$2,500 month. Expenses paid. Free Information. Write Overseas Jobs, International Airport, Box 536-M, Miami, Florida 33148.

FOREIGN Employment information, Construction, other work projects, Good paying overseas jobs with extras, travel expenses. Write only: Foreign Service Bureau, Dept. PM, Bradenton Beach, Florida 33510.

REAL ESTATE—FARMS

CANADIAN Vacation lands: Full price \$385.00. 40 acres. \$10 month. Suitable cottage sites, hunting, fishing, investment. Free information. Land Corporation, 3768-C Bathurst, Downsview, Ontario, Canada.

\$1 ACRE—Canadian Border—hundreds campsites, islands, farmlands, directly from tax authorities. (Non-profit). Lists, photographs mailed. Register, Room 303, 110 Church Street, Toronto 1, Canada.

CENTRAL Ontario—Choice 640 acre Sportsmen's paradises still available—\$20.00 plus \$6.50 taxes yearly. Maps, pictures. \$2.00 (Refundable). Information Bureau, Norval 4, Ontario, Canada.

GOVERNMENT LANDS . . . Low, as \$1.00 acre. Millions acres. For exclusive copyrighted report . . . plus "Land Opportunity Digest" listing lands available throughout U.S., send \$1.00. Satisfaction guaranteed Land Disposal, Box 9091-PI, Washington, D.C. 20003.

CANADIAN Lands, seized and sold for taxes. Our 51st annual series of lists, describe many choice properties, situated from coast to coast, acquired by us through Tax Sale. Priced as low as five dollars per acre, guaranteed perfect title, small monthly payments, no mortgage. Beautifully situated hunting and fishing camps, where there is real sport; summer cottage sites, heavily wooded acreages. Now is the time to invest in Canada's minerals, forests and farms. Write today for free booklet with full explanation. Tax Sale Service, Room 301D, 85 Bloor St., East, Toronto 5, Canada.

FLORIDA CAMPSITES—Deep in the heart of the great Ocala National Forest—where few individuals have the privilege of owning land. Isolated yet accessible, with electricity. Good fishing, hunting. Warranted Deed. Pitch tent, park trailer, build lodge. Free maps and photos. Howard Verner, DeLand, Florida, 32720. AD66LS149

CANADA'S Finest lands, \$4.00 an acre and up. Acquired through estate liquidations. Suitable for hunting, fishing, camps, cottages, farming, timber, minerals, investment. Small monthly payments. Free descriptive booklet. Canadian Estate Land, 194 Wilson Ave., Suite 101, Toronto, 12, Canada.

CANADIAN Fishing and hunting lands with substantial water frontage at low prices. Heavily wooded. Well situated. Great investment potential. Free booklet. Northern Corporation, 194 Wilson Ave., Suite 101, Toronto 12, Canada.

40 TIMBERED Acres \$1650.00 Total Price. Wash.—Idaho—Mont. \$50.00 Down—\$25.00 month, in Northern Idaho, North-eastern Washington, and Western Montana. In the heart of lakes and big game country. All covered with growing timber. Access, title insurance with each tract. This is select land with natural beauty, recreational and investment values. We have tracts of many types and sizes from which to choose, including Waterfront property on Pend Oreille, Priest, Kettle and the St. Joe Rivers and in Pend Oreille Lake area. Your inspection welcomed. Write us for free list, maps and complete information. Write to: Dept. PI, Reforestation, Inc., P.O. Box 8146, Spokane, Wash. 99203.

IOWA Land—1 square ft. \$1.00. Void where illegal. Albert's, 601 West South, Jefferson, Iowa 50129.

FREE! Real Estate Catalog! Fall Edition! Farms, Ranches, Business, Recreational and Investment Property. BANNER Adv., P.O. Box 3333 GS, 19A, Springfield, Mo. 65804. "Real Estate Our Specialty"

FREE REAL ESTATE CATALOG loaded with outstanding bargains and actual property photos! Send for your copy today! SAFE-BUY REAL ESTATE, 712-PM West Third, Little Rock, Ark. 72203.

ALL NEW! FREE! Big 196 page FALL CATALOG! Thousands of properties described, pictured—Land, Farms, Homes, Businesses—Waterfront, Recreation, Retirement. Selected Best thruout the U.S. 68 Years' service, over 500 Offices, 39 states Coast to Coast. Mailed FREE from the World's Largest! STROUT REALTY, 80-RX E. 42nd St., N.Y., N.Y.; 7X S. Dearborn, Chicago, Ill.; 521-RX E. Green, Pasadena, Cal.

BUY Without risk for Retirement, Vacation, or investment—under America's only "No-Risk Purchase Plan"—in Carolina Coast multi-million dollar, 14,000-acre development. 10 year money-back guarantee. ½-acre homesites as low as \$495; \$5.00 down, \$5.44 monthly. Motel, hunting, fishing, golf, country club, right on property. Private ocean beach, 50 fresh water lakes. Write for free literature. (Not offered to residents of California, Florida, New York.) Boiling Spring Lakes, Southport 1-A, North Carolina 28461.

FREE. . . New FALL-WINTER CATALOG! Describes and pictures over 2,000 farms, ranches, town and country homes, businesses in 32 states coast to coast! Specify type property and location preferred. Zip code, please. UNITED FARM AGENCY, 612-PM West 47th St., Kansas City, Mo. 64112.

GOVERNMENT Lands One Cent An Acre. For exclusive report send \$1.00 to: National Lands, Box 241-E, Massapequa, N. Y. 11758.

MODERN RAMBLER with body shop and well established business 4 miles south of Duluth \$20,000. Write box 271, Carlton, Minn. 55718.

FARM AND GARDEN EQUIPMENT

EXTRA Income at home in Spare Time! Profit Booklet shows you how to start your own business with Classified Advertising. Only \$1.00. C. A. Martin, Popular Mechanics Dept., PM, 575 Lexington Ave., New York 10022.

SPRINKLER Systems. Easy assembled. Lawn, garden, orchard, etc. Buy wholesale. Free details. Waterchamp Box 3336 So. El Monte, California 91733.



FLOWERS, PLANTS and NURSERY SUPPLIES

WANT Greatest cash crop working for you? Write Ginseng, Asheville 53, N.C.

GROW A COAL CORAL PLANT Kit includes coal plus instructions. \$1.98. A.C. Oldt, 4250 South Drive, Allentown, Pa. 18103.



DRINKING WATER-PURIFIERS

MAILORDER Records help get Increased Business! Complete 32 Page Record Book shows your inquiries, orders, advertising, expense, etc. Only \$1.00. C. A. Martin, Popular Mechanics, Dept. PM, 575 Lexington Ave., New York 10022.

MAKE Bottled water from any water supply. Government developed process, pressure osmosis (R/O). We make simple home unit. Free details Waterchamp, Box 3336 So. El Monte, California 91733.

HOME CRAFTSMEN

CABINETMAKING MADE EASY and "How to Make Formica Counter Tops," two excellent guides let you build kitchen cabinets and counter tops like professionals. Extraordinary guides bring master craftsmen's shortcut methods. Satisfaction guaranteed. Write: Japs, 126-P Seventh North, Hopkins, Minn. 55343.

WALNUT And Cherry tapered legs, lumber, gunstock blanks, picture frame moulding. Midland Lumber Company, Box 262, Savannah, Missouri 64485.

FREE Popular Mechanics 16 page illustrated catalog of publications, plans and projects. Booklet covers an extremely wide variety of do-it-yourself data on home remodeling, shop tools and machines, car repair, hobbies, crafts, boating, games, lawn and garden and hundreds of others. For your free copy write to Service Bureau, Dept. PE, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022.

PLANS For pool table with extra two-face top for table tennis and model railroad. Blueprints B1209 and building instructions \$3.50. Popular Mechanics Service Bureau, 575-M Lexington Ave., New York, N.Y. 10022.

SKIL-CRAFTS New 200-page '67-'68 Catalog. Largest selection of Leathercraft, Artist, Hobby and Craft Supplies from one source. Send 50¢ (refunded with first \$5 minimum catalog order). Skil-Crafts, Box 105-P, Joplin, Missouri 64801.

FOUNDRYETTE 2400 F. 1½ to 48 lb. capacity. Circular 10¢. Kansas City Specialties, Box 193, Middleton, Wis. 53562.

FREE! World's largest leathercraft catalog. Hundreds of Make-it Ideas. Tandy Leather Co., Dept. J-65, Fort Worth, Texas.

WOODWORKING Catalog and Manual 25¢. Plus free "101 Project Ideas." World's most beautiful veneers, lumber, plywood! Wood finishing, upholstery supplies, Cane, Lamp parts, Furniture hardware, Animal whittling blocks, 2,000 workshop products. Constantine, 2051-N, Eastchester Road, Bronx 10461.

101 PATTERNS Of smart Gifts, Novelties, Shelves, Action Windmills plus "Make Money Jig Sawing", \$1.00. Mastercraft, 95M, 7041 Olcott, Chicago 60631.

PLANS Bird Houses, Feeders. Send 10¢ for Brochure. Yeager, 1665 Linden, Homewood, Ill. 60430.

FAMILY Or party fun. Nine foot shuffleboard type game. Two evenings work. Plans, \$1.00. Williams, 824 Abbot Ave., San Gabriel, California 91776.

54J POPULAR MECHANICS

PLANS, Authentic Baby Barn Utility Buildings. Send 25¢ for brochure. Mini Structures, 204 Poplar, Westfield, Indiana 46074.

FIRE Conscious? Advanced design fire extinguishers—Kidde, Fantastic discounts! Postpaid. Free details. Richard Minnich, 11507 Lovejoy, Silver Spring, Maryland 20902.

UPHOLSTERY

MAILORDER Records help get Increased Business! Complete 32 Page Record Book shows your inquiries, orders, advertising, expense, etc. Only \$1.00. C. A. Martin, Popular Mechanics, Dept. PM, 575 Lexington Ave., New York 10022.

DO-IT-YOURSELF

EXERCISE At home on build-it-yourself physical fitness equipment, including bicycle exerciser, rowing machine, belt massager, and abdominal board. Send \$2.50 for blueprints B1208 and instructions. Popular Mechanics Service Bureau, 575-K Lexington Ave., New York, N.Y. 10022.

BURGLAR-FIRE ALARM Supplies and information. For homes and businesses. Send \$1.00 (refundable) for catalog to: Protecto Alarm Sales, Box 357-A, Birch Run, Mich. 48415.

WIRING SIMPLIFIED for home and farm. 127 pages illustrated instructions Postpaid \$1.00. Hood, 610 N. Bois d'arc, Tyler, Texas 75701.

WATER!! Drill Your Own Well for 2¢ per foot! New Invention! Free information. Deep Rock Drilling Company, Opelika, Alabama 36801.

EXERCISE At home on build-it-yourself physical fitness equipment, including bicycle exerciser, rowing machine, belt massager, and abdominal board. Send \$2.50 for blueprints B1208 and instructions. Popular Mechanics Service Bureau, 575-K Lexington Ave., New York, N.Y. 10022.

REFRIGERATOR Door gaskets—ELECTRIC RANGE parts. Send make and model for cost. Box 5465, Hamden, Conn. 06518.

REPAIR Manuals, automatic washers, dryers, dishwashers, 20 different manuals, \$2.75 each Ppd. Send make and model number. Major Appliances, 13106 Caine Ave., Cleveland, Ohio 44105.

MAKE GRANDFATHERS Hilarious toys. Instructions 25¢. Hill, Box 351 Point Arena, Calif. 95468.

AVOID Expensive television repairs, amateurs repair guide, \$3.50. Maine Electronics, Box 5673, Tucson, Arizona 85703.

WATER—Free! Drill your own well. Easy illustrated instructions. \$2.00. Butler, Box 67Y, East Longmeadow, Mass. 01028.

ARTS AND CRAFTS

MAKE Figurines, plaques, lawn ornaments. Molds, plastercraft kits, liquid rubber. Sample and catalogue 10¢. Wooley Company, Box 29-B, Peoria, Illinois 61601.

192 PAGE Handicraft Catalog. Free. All Crafts, Steece Bros., Box 177-PM, Sioux Falls, S. Dak. 57101.

WOOD VENEER Inlay Pictures. Easy new method to make beautiful inlays for profit or pleasure. Complete details—\$5.00. Collet, 620 Steiner, Pittsburgh, Pa. 15227.

BINOCULARS, TELESCOPES, MICROSCOPES, MAGNIFIERS

BINOCULARS Direct from manufacturer. Finest quality, tremendous savings! Request catalog. Koyu, 3850 Crenshaw Blvd., Los Angeles, Calif. 90008.

WORLD Famous "Dyname" Telescope. Build your own reflector telescope, mirrors, eyepieces, tripods, accessories. Request free brochures. Criterion Manufacturing, Dept. PP-23, Hartford, Connecticut 06101.

SCIENCE Bargains! Lenses, telescopes, binoculars, microscopes, kits, parts, war surplus. Send \$1.50 for beginner's 10-lens kit with instruction booklet. Order Stock 2-CH. Request free 148 page Catalog CH. Edmund Scientific Co., Barrington, New Jersey 08007.

BINOCULAR Sale! Free color catalog 100 models \$9.95-\$250.00. Write, United, 9043 So. Western, BCAT-8508, Chicago 60620.

MANON Binoculars. Buy direct from importer. Best quality and prices. Write: Manon, Dept. M, Box 1386, Huntington Beach, California 92647.



CAMERAS AND EQUIPMENT

POLAROID Camera Owners Make Extra Copies Instantly. Free Brochure. Rhedan Electronics, Box 42P, Bridgeport, Connecticut 06601.

WORLD'S Largest Buying Guide—800 Illustrations—50¢—Deductible With Your Order—Olden Camera—1265 Broadway, New York, N.Y. 10001.

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MAILORDER Records help get Increased Business! Complete 32 Page Record Book shows your inquiries, orders, advertising, expense, etc. Only \$1.00. C. A. Martin, Popular Mechanics, Dept. PM, 575 Lexington Ave., New York 10022.

BARGAIN Prices on film, cameras! Free price list. Michigan Photo Supply, 14321 Harper, Detroit, Michigan 48213.

PHOTO FINISHING

A FREE Kodak roll returned with each black and white or Kodacolor developed and printed, fast service, lowest prices, guaranteed quality send for free mailers. Economy Photo Service, Dept. P.M., Box 1111, Albany, N.Y. 12201.

CAMERA Fans! Expert photofinishing and fresh Kodak film returned: 8MM Kodachrome \$3.45; 8 exp. Kodacolor \$3.40; 35MM Kodachrome, 20 slides, \$3.15; 8 exp. black & white 99¢. We give you free photo stamps to redeem for gifts. Satisfaction guaranteed. Send exposed film or request mailers and complete price list. Direct Mail Photo, Box 8352-PM, Pittsburgh, Pa. 15218.

PHOTOGRAPHY For pleasure or profit. Learn at home. Practical basic training. Long established school. Free booklet. American School of Photography, 835 Diversey Parkway, Dept. 674-019, Chicago, Illinois 60614.

8X10 COLOR Enlargements 80¢ each—Special Trial offer from 120 color negatives, professionals only send business card with order. Professional, Box 1873, New Haven, Connecticut.

KODACOLOR—With this advertisement only—8-12 exposure, \$1.19. Astro Photo Service, Box 166M, Waterloo, New York 13165.

COLOR SLIDES

EXTRA Income at home in Spare Time! Booklet shows you how to start your own business with Classified Advertising. Only \$1.00. C. A. Martin, Popular Mechanics Dept. PM, 575 Lexington Ave., New York 10022.

35 MM Color slides, 10,671 Individually Sold, Described Encyclopedia-Catalog 10¢. Wolfe Worldwide, Dept. 14-98, Los Angeles, Calif. 90025.

VIETNAM IN BLAZING COLOR! Rare 35mm slides, 15 for \$5. Money orders, W. Vause, Dept. P, Box 31266, Diamond Hts. Station, San Francisco, Calif. 94131.

MOTION PICTURES AND SOUND EQUIPMENT

16MM sound-projectors, films, new, used for sale. Free catalog. National Cinema, 333 W. 57 Street, New York City, N.Y. 10019.

5,000 8-16MM MOVIE Films. Free catalogues. International, Greenvale, L.I., N.Y.

UNUSUAL Movie supplies. Free circular. Esor, 47th Holly, Kansas City, Missouri 64112.

FREE 64-PAGE CATALOG. All your movie needs. 8MM-Super 8-16mm. B&W and color film. Cameras, supplies, accessories. Home processing equipment. Sound stripping. Superior, 448 N. Wells, Chicago 60610.

8mm MOVIES—2" x " Color Slides—Biggest selection anywhere! Hollywood classics, great comedians, railroads, automobiles, trolleys, wars, travel, wild life, circuses, many others! 16mm. films also. Big catalog free! Blackhawk Films, 70 Eastin-Phelan Bldg., Davenport, Iowa 52808.

RADIO, TELEVISION AND HAM EQUIPMENT

BRAND New tubes. World's lowest prices on radio, TV-industrial, special purpose tubes. Write for free parts catalog. United Radio, Newark, N.J.

33¢ RADIO & TV tubes. Free list. Cornell, 4213-17 University, San Diego, California 92105.

POLICE—FIRE etc. on Broadcast radio! Brochure. Tunavertter, Woodsboro PM20, Texas 78393.

HOME Electronics course only \$26.95. Free literature. Edu-Kits, Department 698B, Hewlett, New York 11557.

HIFI, RECORDS AND ELECTRONICS

FREE Catalogues, 2000 hard to find unusual records. Rose's, 300 Chelsea, Louisville, Ky. 40207.

TAPE Recorders, hi-fi components. Sleep learning equipment, tapes. Unusual values. Free catalog. Dressner, 1523C Jericho Tpke., New Hyde Park, N.Y. 11040.

RECORDS! Discounts on all LP's. Free details. Citadel Record Club, Symphonette Sq., Dept. 2, Larchmont, N.Y. 10538.

NEW 45s! Forty Assorted, \$3.95 Post-paid, \$1.25 cloth included. JO-JA, 816-P North Western, Kokomo, Indiana 46901.

STEREO TAPE CLUB. Average cost \$3.78 (4 track), \$4.20 (8 track). Cartridges, cassettes, reels. No minimum purchases. Free brochure—catalog. STAR RECORDINGS—PM, Box 1055, El Paso, Texas 79946.

HOME Electronics course only \$26.95. Free literature. Edu-Kits, Department 697B, Hewlett, New York 11557.



MUSIC AND MUSICAL INSTRUMENTS

PLAYER Piano Rebuilding—get details from: Vestal Press, Vestal 11, N.Y. 13850.

GUITAR, Banjo Making books Plans, woods, necks, tools. List 20¢. Satinwood, 510 East 11th Street, New York, N.Y. 10009.

ELECTRIFY Player pianos, pump organs quickly, inexpensively with Lee Silent Suction Units. Write Lee Music, Box 595F, Tujunga, California 91042.

ACCORDIONS 5 switches \$159.95. Any size. Melody Music, 4909 West 95th St., Oaklawn, Ill. 60453.

ACCORDION Top brands. Buy direct. Tremendous discounts. Trade accepted. Free brochure PM. Accordion-O-Rama, 874 Broadway, N.Y.C. 10003.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin, PMM, Covina, Calif. 91722.

DRUMS, Electric guitars, amps, organs. Free catalog M: A.L.A.S. Import Company, 31 East 18th Street, NYC. 10003.

POEMS Wanted for new songs and records by America's largest song studio. Send poems. Free examination. Five Star Music, 6M Beacon, Boston, Mass. 02108.

30% DISCOUNT On any Name Brand musical instruments. Write for our low price. Freeport Music, Dept. A, 127 W. Sunrise Highway, Freeport, N.Y. 11520.

GUITARS, MANDOLINS, BANJOS complete stock of Gibson Martin fender free!! New 66 page catalogue parts and accessories, big savings New York discount prices send 50¢ postage, handling. Eddie Bell Guitar, 201 W49, New York 10019.

ACCORDION Manufacturing, 6846-P North Avenue, Chicago, Illinois 60635. Concertinas, Hohners, Chromatics, Guitars, Drums, New, Used, Tuning, Repairing, Wholesale Catalogs Free.

COUNTRY Record Albums free. Circular. Box A-, Arcadia, Calif. 91006.

SWISS Musical Movements, Mechanical-Electrical, Spielman, 131 West 42nd, New York 10036.

ELECTRIC Guitars. Modern cut-away designs. Complete plans—\$2.50. Collet, 620 Steiner Street, Pittsburgh, Pa. 15227.

MUSIC Catalogs, Guitar, Accordion, Piano, Mandolin. 25¢ each. Pagani, 289 Bleecker Street, New York 10014.

POEMS, Songs wanted for new song hits and recordings by America's most popular studio. Tin Pan Alley, 1650-P Broadway, New York 10019.

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Overlooking the obvious?

My friend's 1967 Dodge station wagon loses rear-axle lubricant so badly over the course of 400 miles that the back end of the wagon is splattered with the stuff. He's taken it to the dealer service department, but has received no satisfaction. What are they overlooking?—Elmer Gifford, Waldport, Ore.

I don't know, but they sure don't have that much to overlook. There are only two things that can cause such a loss of lubricant: 1. A bad rear-axle pinion seal; 2. A plugged vent valve on the rear housing, which could cause enough pressure build-up to blow the pinion seal.

Seeing red

Have you had any complaints about the temperature light of the 1967 Buick Wildcat? It goes "red," but the engine isn't overheating. The sending unit in my car was replaced when the car had only 50 miles on it, again at 3000 miles and now at 7000 miles it's acting up. Is the sending unit defective?—William M. Dean, Wilmington, Del.

Yes, to both questions. I've had complaints from owners of 1967 and 1968 Oldsmobiles as well as of Buicks, and the trouble seems to be a batch of defective sending units that have made their way into the field. The only cure, I'm afraid, is to double check whenever you see that red light go on—just to make sure that the engine isn't overheating. Then, replace the bad sending unit. As long as you're still within the warranty period, there should be no charge for this service.

Hung up

I have a starting problem with my 1966 MG 1100 sport sedan. At temperatures below 40° I must turn the engine over six to eight times in the morning before it will start. I follow recommended starting procedures. After it does start, the engine runs and starts perfectly for the rest of the day. Next morning, though, same thing. The car's been tuned up and checked with electronic testing equipment. Everything is fine. So what gives?—E.E. Unger, Midland, Tex.

Better ask me what isn't giving. I think that the chokes of your dual SU carburetors are hanging back. If the manually operated linkage isn't set just right, the choke needles won't drop into the orifices all the way or won't work in synchronization. This leads to hard starting and is a condition the electronic testing equipment won't pick up. My advice is to have the choke linkage set properly between the carburetors.

Raise your right hand

Suddenly, for no reason, the heater core of my 1967 Chevrolet began leaking so badly where the tube attaches to the core that I had to replace the entire unit. I don't know what could have caused this. Neither does the dealer. It happened, by the way, after the heater hose was replaced, but the mechanic says he was careful.—Marshall Moore, Lancaster, Pa.

You can't be careful enough when working around the core. Too much force exerted on the seams when removing the hose will split them. That's why the proper way to remove heater hoses (both of them) must be followed. If the hoses don't come off the tubes easily after the clamps have been removed, they should be cut just before the tubes. The remaining part of the hoses left on the tubes should be split longitudinally—then removed.

No indication

As you know, my 1960 Plymouth station wagon has an oil-pressure "idiot" light. I don't think it's working, because the light never goes on—not even when I turn the ignition key on to start the motor. Is this the way it should operate?—Lonnie Mills, Yucaipa, Calif.

No. That light should shine when you turn on the ignition switch and should go out when the engine starts and oil pressure reaches 5 to 12 pounds. You have a problem in one of three places: in the bulb, the wiring or the oil light switch. To find out which is at fault, run a ground wire from the oil light switch, which is at the oil pump just behind the oil filter, to the ground. Then turn on the ignition. If the light goes on, the oil light switch is

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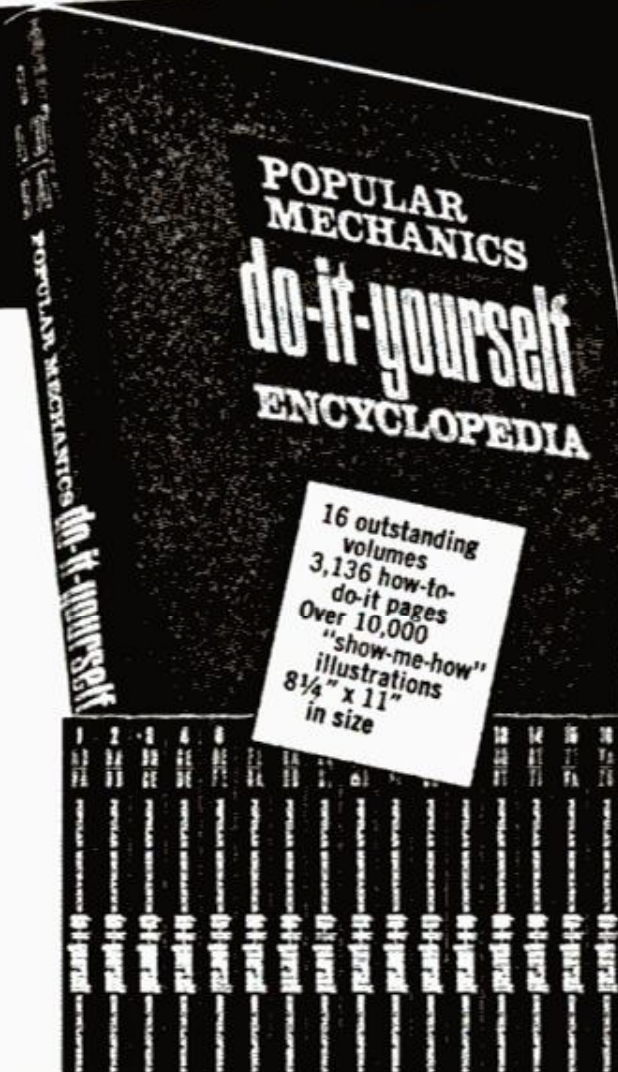
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AUTOMOBILE CLINIC

(Continued from page 58)

bad. If it doesn't, a defective bulb or wire is indicated.

Gas pains

My problem is a gasoline heater in a 1960 Corvair. When I turn it on, I get some heat, but then the thing starts backfiring. I shut it off for fear of a fire or having it blow up. Do you have a solution?—Joseph Nicotra, Ansonia, Conn.

Have a competent mechanic take the thing apart, clean it, check it for leaks, and overhaul it. This type of unit is much like an oil burner in a house. When the oil burner gets dirty or a part of it goes bad, it will "puff." Your Corvair gas burner does the same thing—that's the backfire you hear.

Grease job

It was right after I had my 1967 Buick greased that I noticed a drastic reduction in braking power. I took the car back to the dealer, and we found that the discs of my disc brake system were coated with grease. How did it get there?—Nathan Brilles, Minneapolis.

Well, I'd say that someone went a little giddy with a grease gun while lubing the front lower-control-arm ball joints, which lie pretty close to those discs. Next time, ask the man to be a little more careful and mask off the discs by inserting a clean piece of cardboard between them and the splash shield of each front wheel during ball-joint lubrication.

Psychedelic paint swirls

The paint on my 1967 Lincoln Continental is pretty faded, and I've tried hand buffing without success. Someone suggested an electric buffer, but I'm afraid it will leave swirls. What do you think?—Terry Ford, Ukiah, Calif.

An electric buffer in the hands of someone who doesn't know how to use it will leave "swirls." I put quotes around that word, because "swirls" are areas where paint gets burned by improper use of a buffing machine. The tendency on the part

of amateurs is to apply too much pressure. In addition, too many people use a 1/4-in. electric drill with a buffer attachment to polish their cars. Because it rotates at such a rapid rpm, this instrument is more likely to cause trouble. I'd suggest that if you can get a real buffer and wish to try it, go ahead. But watch that pressure. Better to use too little than too much. If you're not sure of yourself or don't have the proper equipment, leave buffing to a body shop. If "swirls" occur, they're responsible.

Service Tips

● **Owners of 1968 Dodge Coronets and Chargers with 426 Hemi engines** could be operating with the wrong oil dipstick. This car requires one quart more of oil than 1966 and 1967 models with 426 Hemis. But some early-production 1968 models were accidentally equipped with the 1967 oil dipstick which shows overfill when the '68 engine has a full oil supply—eight quarts.

● **1968 Ford or Mercury cars running at unusually high engine-idle speeds** may have a minor problem: The vacuum hose to the servo motor in the air cleaner might be improperly routed, holding the fast-idle cam in the "on" position. Have it checked by removing the air cleaner and inspecting for hose interference. Reroute the hose away from the cam mechanism, if necessary.

● **1968 Plymouth Valiant 170-cu.-in. engines (with automatic transmission)** may be stumbling and stalling. The problem lies with the metering wire of the step-up piston, which is inside of the carburetor. The wire helps to control the amount of mixture going to the cylinders. Some of these have been adjusted too short. So, if your Valiant is stumbling and stalling, especially during warm-up, ask your dealer to apply the cure as specified in service bulletin 68-14-6 (3/27/68).

● **1968 Chevilles built before Nov. 15, 1967,** should have drain holes in both front side members at the stabilizer shaft brackets. The frame has a dip in it at these points, which allows water to collect. This could lead to corrosion. Chevilles built after this date have drain holes drilled at the factory. If you don't have them, have your dealer drill them. If he hasn't heard of it, ask him to check page 5 of Chevrolet Service News No. 3 (3/68). ★ ★ ★

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

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QUESTIONS ANSWERED

HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Replacing curved rung

I have an heirloom highchair that's been in the family for generations. One lower rung is missing. The other three are curved about 3/4 in. so the missing one must have been bent to the same radius. How can I replace it?—R.R., Ark.

The original was probably made from hickory or white ash, the most bendable of native woods. You no doubt can locate a suitable piece of these woods locally. Select one that best matches the originals, and is sound and straight-grained. Cut it somewhat longer than required, round it to size with a drawshave or jackplane, sand smooth and place in a receptacle that will hold sufficient water to cover it. Weight the piece so it does not float. Then boil for at least two hours.

To make a bender, cut two pieces of 1x4, each about 6 in. longer than the part to be bent. Drill three holes in each piece to take 1-in. dowels; one hole near each end, about 1/2 in. above the center line. Center the third hole on the 1x4 about 1/2 in. below its center line, making the offset about 1 in. Insert 6-in. lengths of 1-in. dowel in the holes. Remove the rung from the water and immediately place it in the bender, feeding it over the first dowel, under the middle one and over the third, forcing the rung to take the bend. Leave it this way at least 36 hours, then remove it from the bender, cut it to length and install it in the original holes in the chair legs.

Pesky spray cans

I use spray cans quite frequently, but even though I invert the can and spray out the residue as directed, the next time I pick up the can the spray tip is apparently clogged and won't work. What does one do to make these things work?—B.E., Wis.

Look closely at the tip after spraying as directed; you'll often see a tiny bubble of the material covering the tip. This seeps back into the orifice and hardens. Thus the next time you try spraying you may get a fizz or two, a splatter of drops or, more likely, nothing. I've found that if I pull off the spray tip—after inverting and spraying out residue—and dunk it in lacquer thinner I have no further trouble. ★★★

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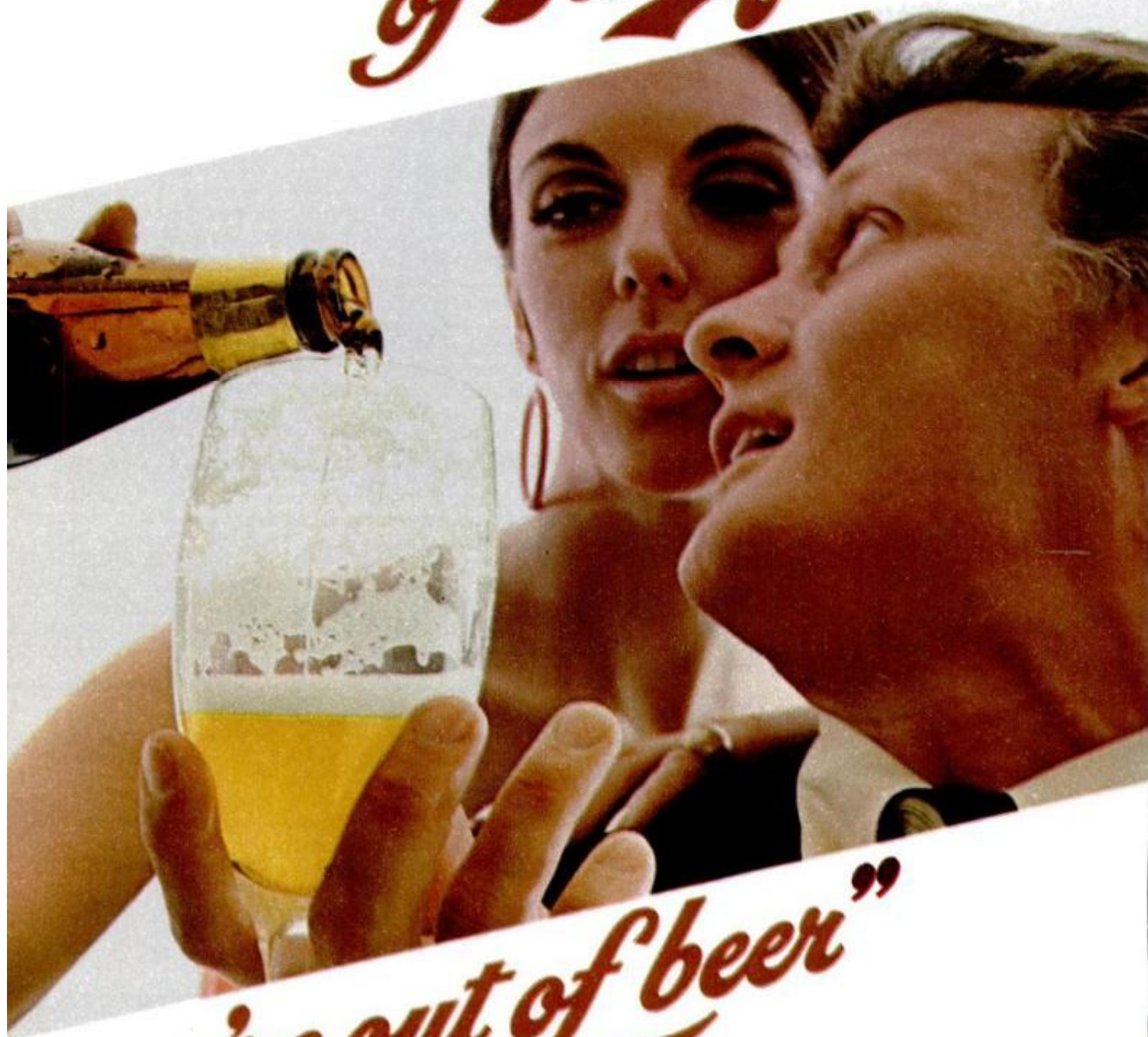
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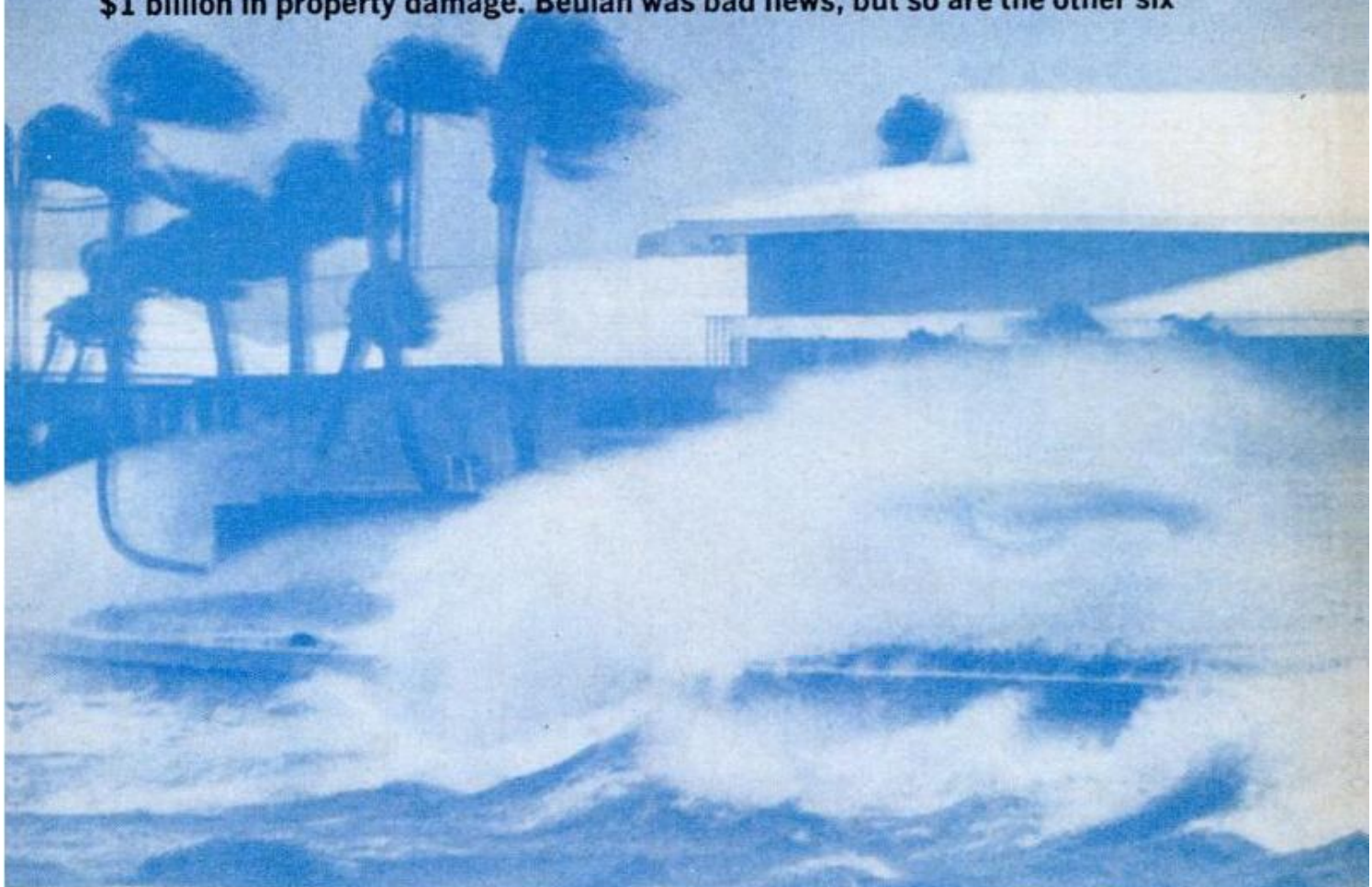
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HURRICANE!

When Nature Lays On the Lash By JAMES M. BERRY

SHE BOILED IN FROM SEA the morning of Sept. 20, 1967, with the force of 20 atomic bombs a second. Within two days, Hurricane Beulah had devastated 40,000 square miles of Texas with 160-mph winds, 30 inches of rain and 97 tornadoes sparked by the maelstrom. Wind-driven floods crumpled steel and concrete levees, caused entire towns to be evacuated and made hundreds of square miles of citrus-growing land resemble ocean. Thousands of poisonous snakes, whose natural habitats were disturbed, terrified survivors. When she was through, Beulah had cost 11 lives and \$1 billion in property damage. Beulah was bad news, but so are the other six



HURRICANE SPOTTER PLANE

TOP OF HURRICANE ABOUT 140,000 FT

HURRICANE

EYE

WARMEST AIR NEAR CENTER

10 TO 30 MI
RAIN BAND

WINDS WHIP UPWARDS AT 300 M. P.H.

HURRICANE
75 TO 200
50 MI RADIUS

WARM, WATER LADEN AIR
DRIFTS TOWARD CENTER
AT 10 TO 25 MI. PER HR.

FORWARD
MOVEMENT OF
HURRICANE ABOUT
20 MI. PER HR.

SEASWELLS

MIAMI

KEY WEST

SWIFT HIGH ALTITUDE WINDS

The Anatomy of a Hurricane

A typical hurricane bears down on the Florida coast at a relentless 20 mph. Warm, moisture-laden air from the Caribbean forms a gigantic counter-clockwise spiral. Heat from this rising vortex is carried away by high-altitude winds that create a chimney draft, evaporating wind-driven sea spray, increasing the hurricane's warm-air supply and boosting it to 40,000 feet. Devastating winds are racking Key West (left) and the sea surge is hammering Cape Kennedy and Daytona Beach (right). The eye will pass just north of Miami.

Illustration created especially for Popular Mechanics by Herb Matt, Sid Zigas and William Seifert

10 TO 30 MI.
RAIN BAND

JACKSONVILLE

DAYTONA

SEASWELLS, FIRST INDICATION
OF HURRICANE

WINDS
M.P.H.

GALE FORCE WINDS

400 MI. RADIUS

hurricanes that hit the United States in a typical June to November season. "Hurricanes," states the Department of Commerce, "cause more widespread damage than any other natural disaster." They also kill—an average of 75 people a year from Texas to Maine.

Better tracking and prediction have cut this toll of lives and property. But the real aim of meteorologists is more ambitious: to learn the anatomy of hurricanes so they can pull the eye-teeth of those heading for land. "Conditions that seem ripe for a hurricane often exist without one forming," says Dr. Cecil Gentry, the gentle, middle-aged director of Miami's National Hurricane Research Laboratory. "We're still missing some elements that go into hurricanes."

WEATHER TERMS

Cyclone: A low pressure storm area into which air spirals, usually forming clouds and precipitations. Cyclone centers are the low pressure areas on weather maps.

Anticyclone: A high-pressure area from which air spirals outwards.

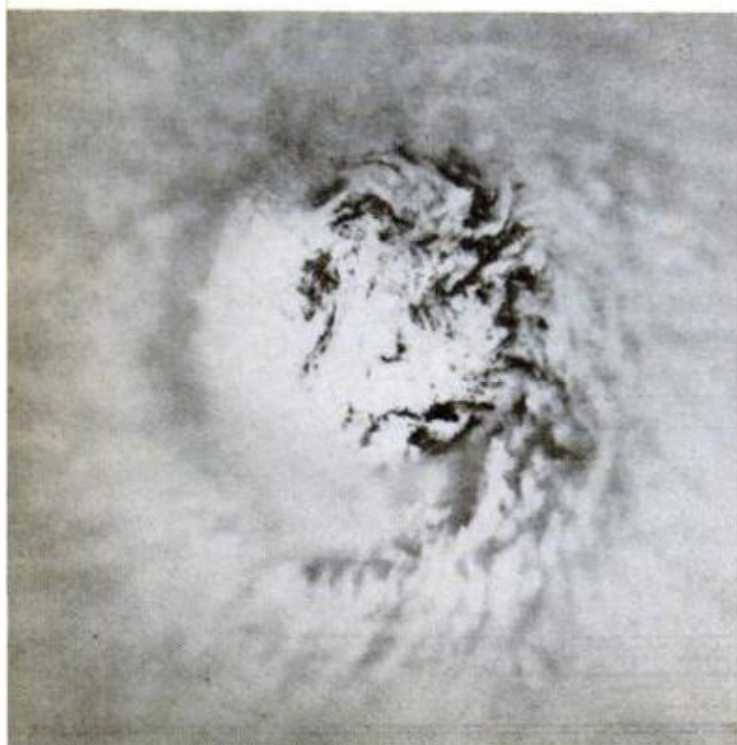
Gale: Winds from 39 to 74 mph. The Weather Bureau divides a gale into several categories. Strong gale: winds from 47 to 54 mph; storm: winds from 55 to 63 mph; violent storm: winds from 64 to 74 mph.

Hurricane: A tropical cyclone with winds above 74 mph. The word hurricane probably comes from the name of a Mayan storm god called Hunraken.

Typhoon: A term for hurricane commonly used in the Pacific.

Willy-willie: Australian term for hurricane. The Philippine name is even more exotic—*baguio*.

VIEW INTO THE EYE of Hurricane Ida from a high-flying U-2 plane reveals the dead calm in center



Details are lacking. But with the help of improved weather radar, satellite observations, airborne monitoring, and better global weather reporting, meteorologists have pieced together the best picture yet of a hurricane's conception and birth—the first steps in controlling its life.

Hurricanes that strike the United States begin in the Gulf of Mexico or Caribbean Sea as calm, low-pressure areas. Air from hundreds of miles away begins to drift into such an area; first sluggishly, then picking up to about 20 mph. During the trip, air soaks up heat and—most important—water vapor.

The air is also molded into a gigantic spiral by the Coriolis force—tendency of the earth's spin to cause fluids to rotate counterclockwise in the Northern hemisphere, clockwise in the Southern. As the soggy, warm air and the clouds it forms rush toward the spiral's center, it speeds up. At the vortex, the air winds skywards, expands, cools—then dumps its moisture as rain.

This rainfall is a hurricane's fuel supply. To become vapor, water absorbs heat, warming the spiraling cloud column and boosting its air upward as high as 40,000 feet. The quantity of heat released by the rain is so great that a hurricane's eye wall—rain clouds surrounding the calm, windfree center or

(Please turn to page 176)

EIGHT MAJOR STORMS of 1967 were tracked by satellite. Photo mosaic was made from computer tape



Night Driving: How to Handle Its Deadly Hazards

By E. D. FALES JR.



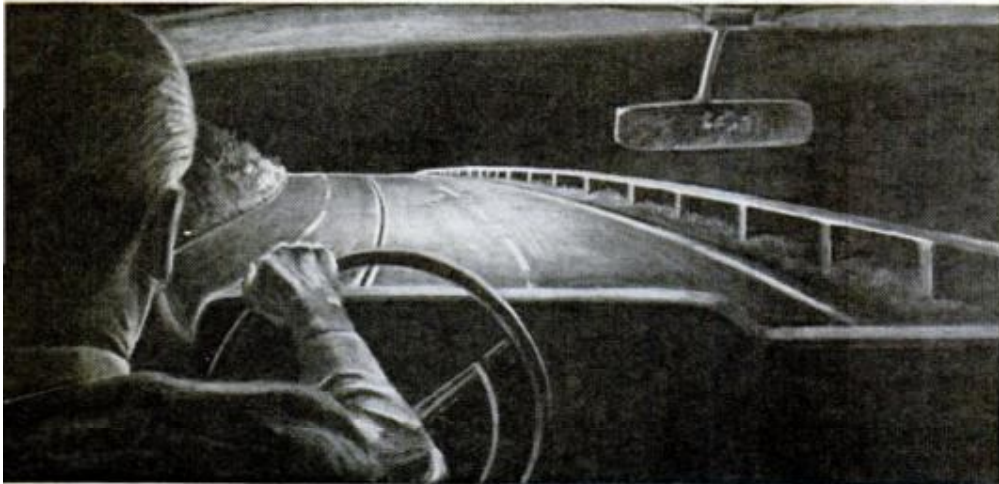
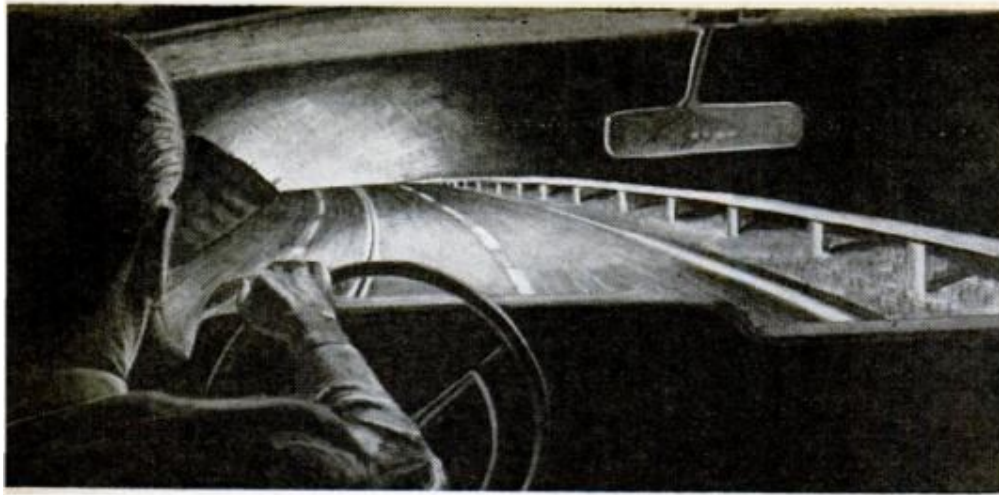
YOUR WORST ENEMY on the road after dark is the "wrong-way flyer," the fellow—usually stone drunk—who comes at you in your lane. Your best bet? Pull off the road to your right, thus avoiding a head-on

DRIVING AT NIGHT is three times as dangerous as driving in daylight. Weird things can happen.

I know personally how easy it is on a rainy night to steer for a silver birch tree on a curve. After many hours on the road a single silver birch can look like an extension of a white center line. I darned near followed that "center line" into the woods one wet, weary night when the road veered sharply to the right.

The wee small hours bring out all sorts of phantoms, too. For example, a Wyoming driver worried for years about hitting stray horses. One night his headlights showed a herd racing across the road, tails flying, manes tossing. Scared stiff, he went into a long, screaming skid. When he finally stopped he found not a horse in sight; not a hoofprint. His tired mind had conjured up a phantom herd.

Then there was the Texas trucker



APPROACH CURVES on low beams to check for glow of oncoming car. Your high beams will blot out the warning you need

who jackknifed one gloomy midnight. His partner, in another truck, stopped, ran forward, found his friend alive. "I hit a calf," the trucker said. But when they searched, there was no calf; there never had been. Another tired driver's phantom.

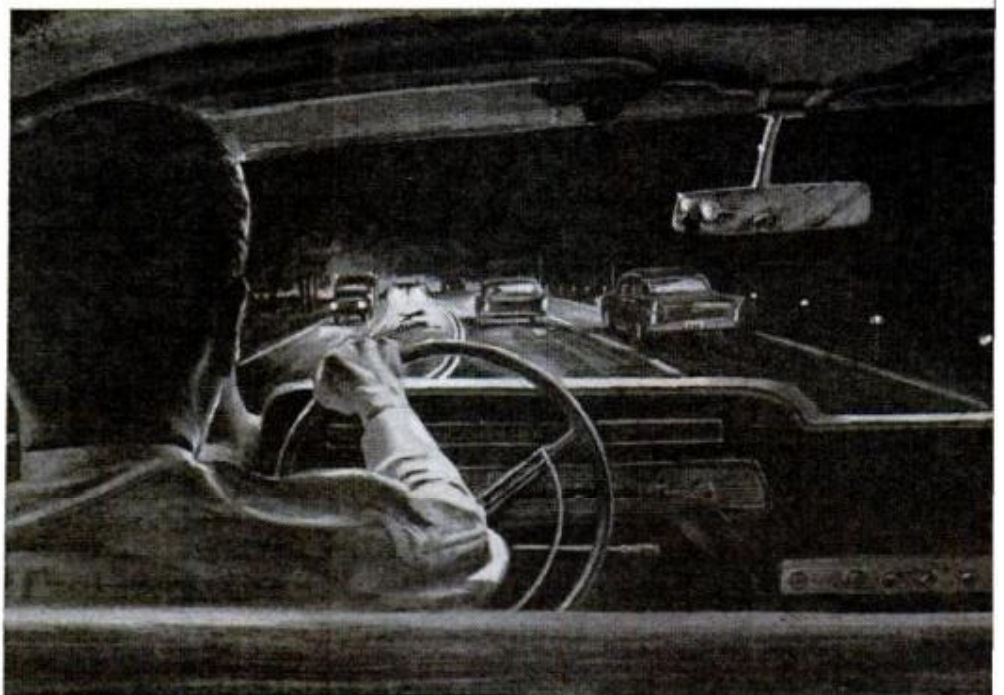
These two eerie cases are from the files of Dr. Alfred E. Moseley, Boston psychologist, who investigates accidents for lawyers. How can you avoid these traps? First, says Dr. Moseley, by letting someone else drive when you are bothered,

tired or angry. Next, by never driving more than ten minutes after your eyes get droopy. Finally, by being a 100 percent teetotaler, particularly when tired or upset.

What warning signs should you look for? Three, says Moseley: "First: applying the brakes suddenly without good reason. Second: misinterpreting night shadows and seeing things that aren't there. Third: 'homing in on'—aiming for—the wrong lights or turns." If *any* of these happen you're heading for trouble and had better knock off for a while.

Other night problems. I can add these pointers of my own, based on years of on-the-road investigation:

- *Quit getting sore* when you think someone is deliberately shining his high beams in your eyes. Usually he isn't. More on this later.
- *Know your own worst enemy* on the night road, the fellow police call the "wrong-



CLUES to night-driving vision include other drivers' lights, "reading" roadside reflectors, white lines, light reflections

way flyer." This is the mixed-up driver—usually stone drunk—who comes roaring toward you in your lane.

Warns the California Division of Highways: Look for him around bar-closing time. He's the fellow mainly responsible for those early-morning head-ons. California alone figures it had 33,000 "wrong way" incidents last year.

If you see a wrong-way flyer coming on a two-way road, your best bet may be to pull off the road—far off. If you can't, it may be best to stop at once. However, conditions vary. Twice I have met drunks coming fast on my side and I escaped only by steering left and passing them on my right. But this is highly dangerous. It makes *you* a wrong-way guy, and if the other fellow switches back to his lane a smart lawyer could make you appear to be at fault.

● *Use low beams on sharp curves.* Most drivers go into blind curves on high

beams, then get startled when someone comes around the curve without warning. It's a mistake to approach blind curves on high beam, since your brights blot out the advance warning glow of cars coming toward you.

● *But also use a warning "flick."* Going into a blind curve it pays to flick to brights once or twice, just for a second. This changes the intensity of light at the



DEER roam roads at night, especially toward dawn. A deer's eyes are highly reflective, often resemble reflection of beer can on the roadside

apex of the curve, helps the other fellow know you're coming.

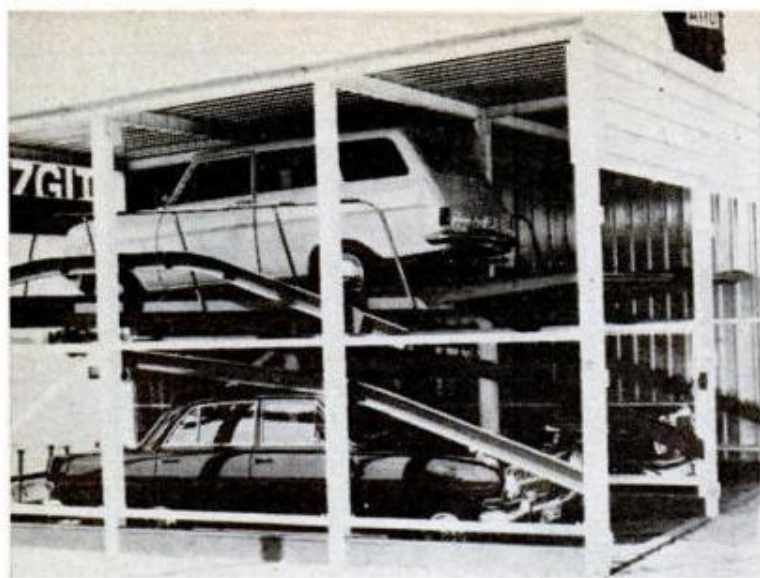
● *Look for "deer lights."* One of the worst (but least-known) night dangers is deer. Deer roam most states and many motorists have hit, or at least had a close brush with them. I have hit one, even had one jump over the hood as I turned into a farm road. Keep a sharp watch, especially toward dawn (when deer come down to feed in roadside ditches) for deer eyes. A deer's eye is as reflective as a cat's: it looks like a pocket flashlight, or the shiny end of a beer can, hung in bushes or small trees. When you see it, brake fast. Remember, a deer won't turn like a cat and run back into the woods; he usually jumps into the road.

● *Suppose you have to overdrive your lights?* It's absurd but true that most of our wonderful new roads are designed so you can't use your high-beam lights. If you do, you throw an unbearable glare at other drivers. Experts say: "Use low beams on high-speed roads, but don't overdrive them." Taken seriously, this would slow night traffic on all super-roads to 40 mph or less—for many low

(Please turn to page 204)

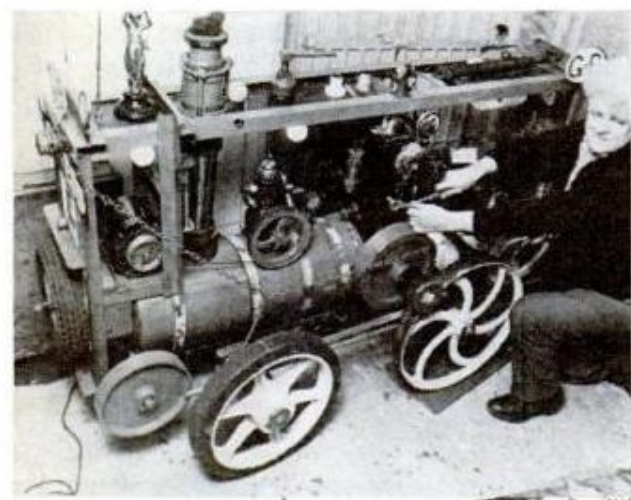
IF HEADLIGHTS GO OUT SUDDENLY, flick on your directionals to help you spot the road stripe





Two cars in one parking spot

For a two-car family with space to park only one car, a German firm has developed a garage that stacks the cars (as in the demonstration unit, above). To use the upper-deck car, the owner pushes a button, and the metal frame swings down (upper right) and out into the driveway so he can drive on or off. When frame is replaced, lower car becomes available (right).



Bedroom engineer

Stan Kipling of Sunderland, England, had an unusual workshop while he built his bright red steam engine. It was his bedroom. The reason? He found it very restful to work on the project at night when he couldn't sleep.



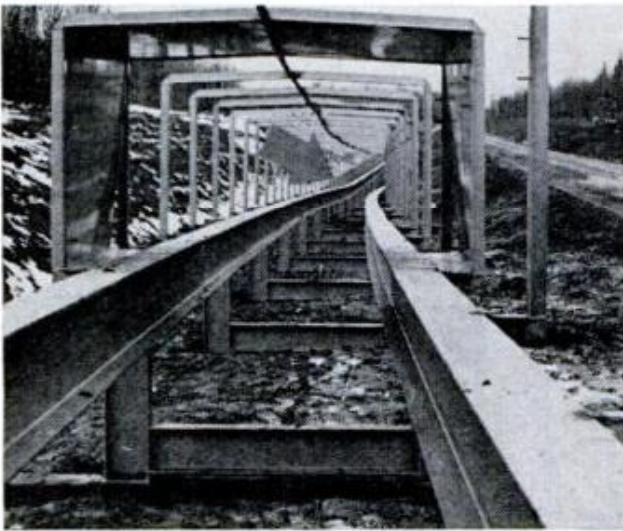
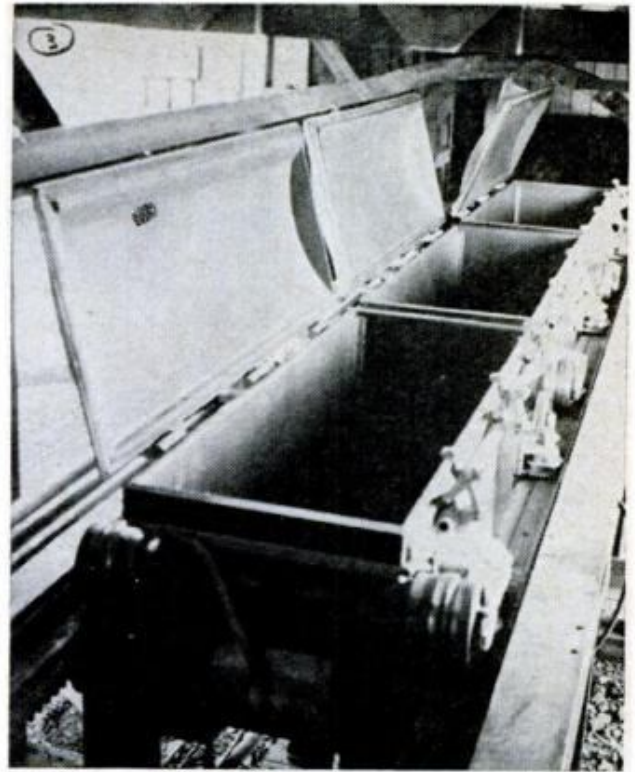
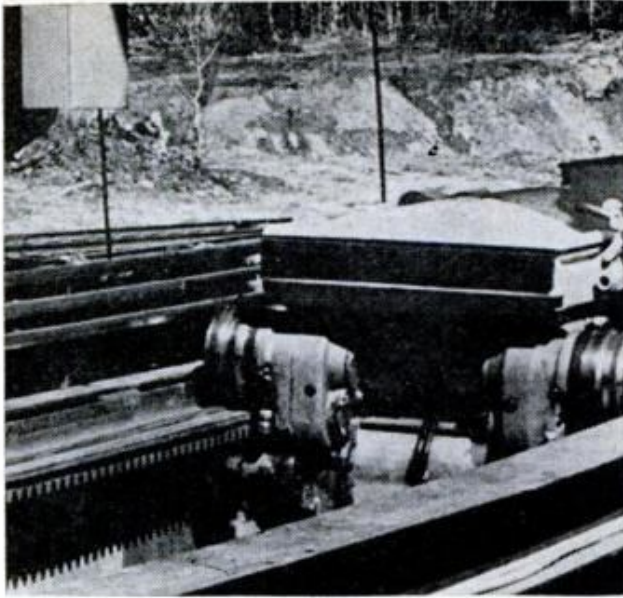
Homemade orchard pruner

Zane Newton of George, Wash., combined some pieces of equipment already on his farm to make a pruning machine for use in his orchard. The gas-powered cutter on the end of the boom can be set vertically for hedging (above) or horizontally for trimming the tops of trees.



Marine assault boat

The Marine Corps is testing this "riverine assault boat" for possible combat use. The 16-foot fiberglass craft is powered by a 35-hp outboard. It can carry 1500 pounds of supplies or six combat-loaded troops. Various weapons, including the 106-mm recoilless rifle and 81-mm mortar, have been mounted on it and fired during tests.



New ore-carrying system

An unusual system of transporting copper ore is scheduled to begin operating this year at White Pine copper mine in Michigan. The automatic system, the "Dashaveyor," features individually powered modules traveling over a 27,000-foot enclosed track on a dual I-rail. (Photos were taken before the track was enclosed.) The Dashaveyor system is also under study for transporting people at the Seattle-Tacoma International Airport.



Army works to keep its foot soldiers afloat

Getting across rivers, swamps and rice paddies is a major problem for infantrymen in an area such as the Mekong Delta. To help soldiers move more rapidly, the Army Limited War Laboratory has developed such aids as the foam-core bridge (left) and the eight-ounce, breath-inflatable flotation device shown at right. The bridge can be carried in sections and weighs only $2\frac{1}{2}$ pounds per linear foot. The "jacket" will carry a soldier plus 60 pounds of equipment.

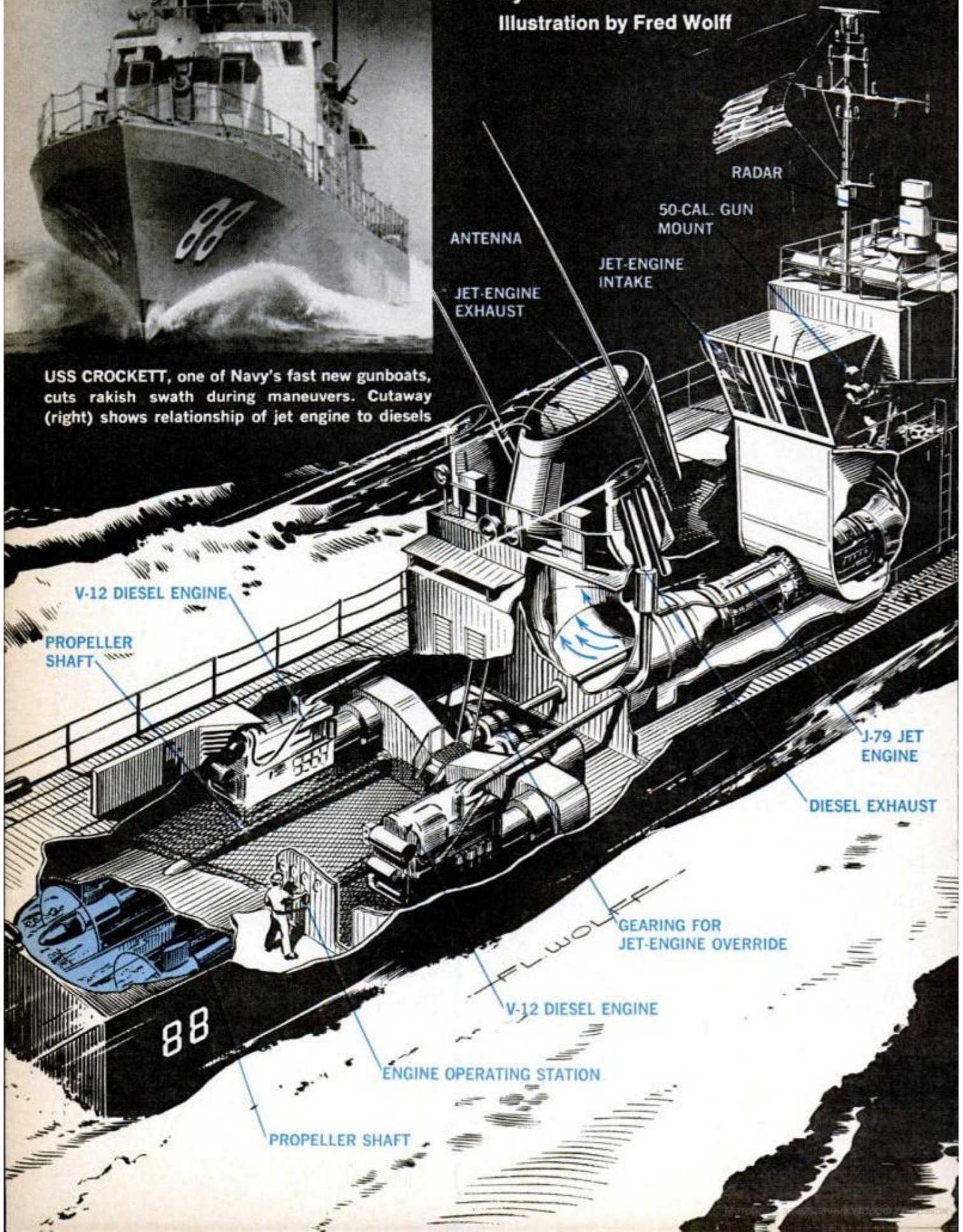
From a Dead

By ROBERT ZIMMERMAN

Illustration by Fred Wolff



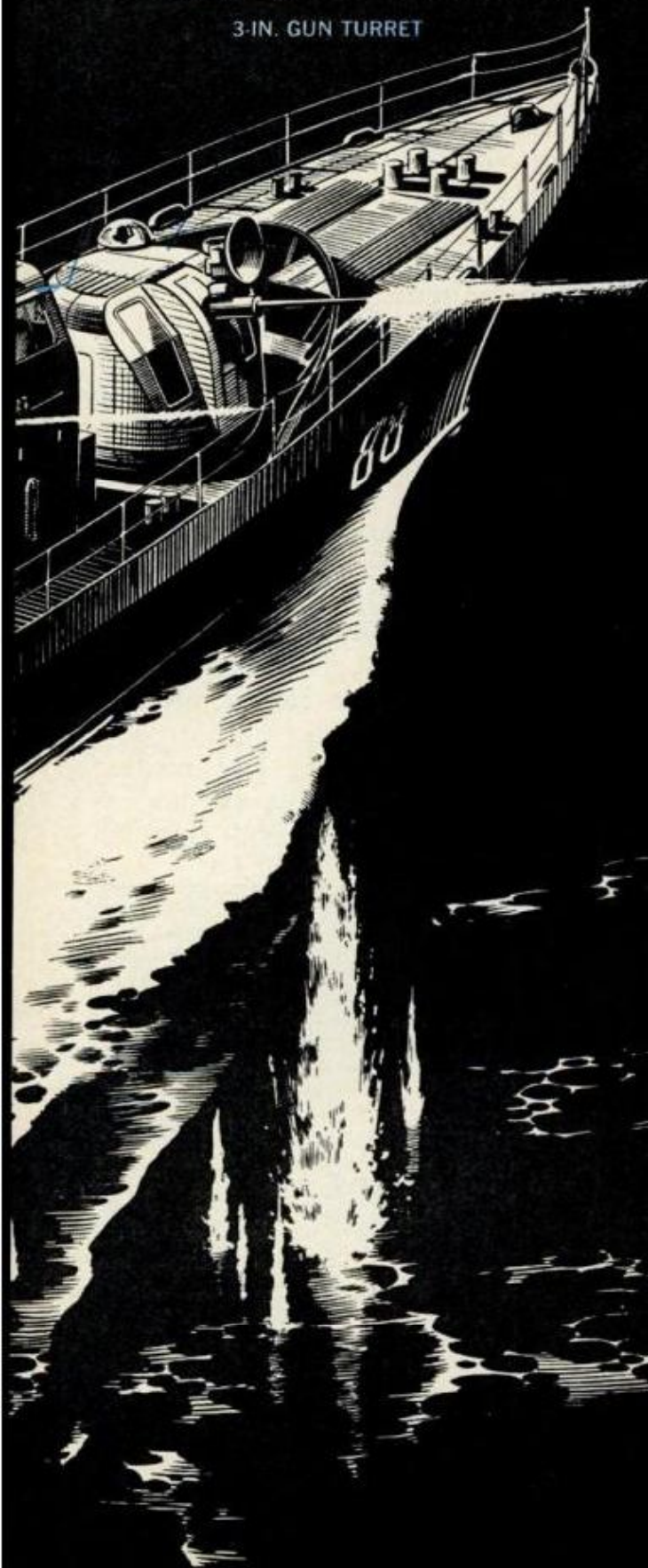
USS CROCKETT, one of Navy's fast new gunboats, cuts rakish swath during maneuvers. Cutaway (right) shows relationship of jet engine to diesels



Stop to 40 Knots In 75 Seconds

PILOT HOUSE

3-IN. GUN TURRET



The Navy's new, hard-hitting patrol gunboat is a 165-foot aluminum-hulled speedster that can switch from diesel to jet power—and the crew needs seat belts.

THE NAVY GUNBOAT USS *Gallup* had been plowing through the swells at 15 knots, no strain for her two 725-hp diesel engines. Then the helmsman pushed forward on a throttle marked "Turbine," and the sailor standing next to me on the bridge said, "Hang on."

I hung on and I'm glad I did. A sudden burst of power pitched up the bow of the 165-foot aluminum-hulled *Gallup* and we were off and running. The needle on the speed indicator began moving like the sweep hand on a watch—20 knots . . . 30 . . . 35 . . . 40!

That high-pitched whine mounting in our ears was a J-79 turbojet engine, the same kind that powers an F-4 Phantom II fighter. Only this one was pouring 14,000 horsepower into the *Gallup's* twin screws.

Lt. Cmdr. Bill Spane, the skipper, took over the helm, a swivel stool in front of a 10-inch steering wheel. He put the *Gallup* through flank-speed maneuvers that had us rolling into our spray. It was easy to see why the designers had called for anchored seats at each duty station throughout this revolutionary new warship—and why they added seat belts for good measure.

Spane sent a man scurrying to the top deck to haul down the colors. "Usually

we only do that in a typhoon," he said, "but we're wearing out too many flags."

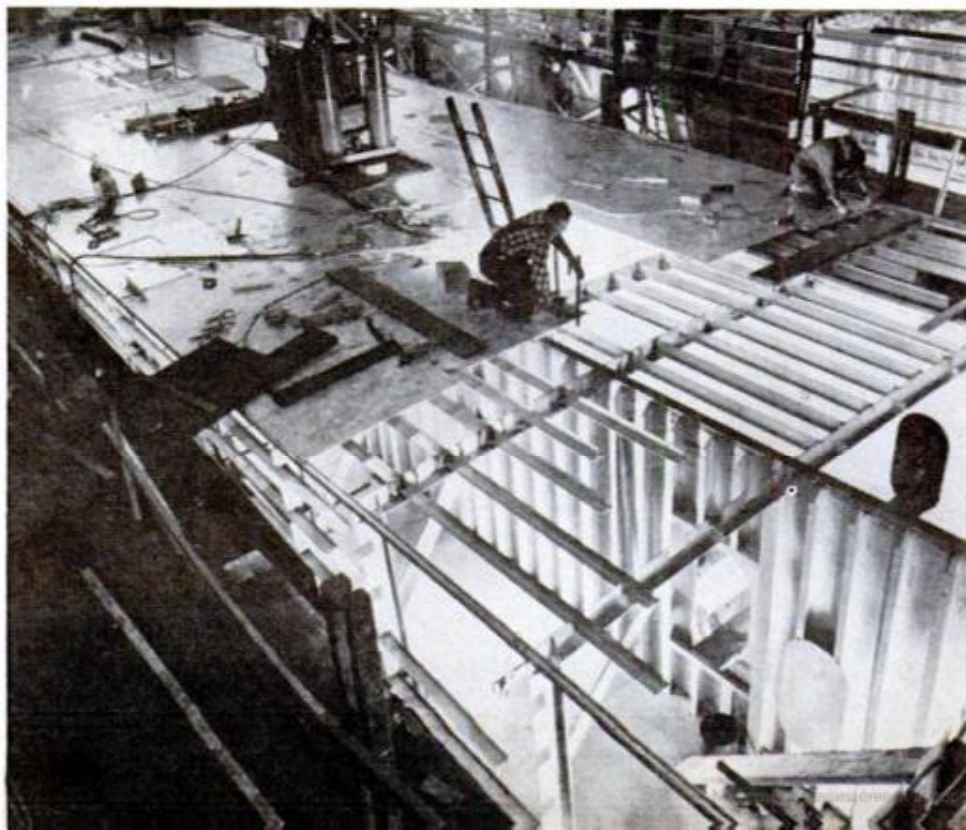
The *Gallup* is one of the first of a new class of Navy craft called PGs (for Patrol Gunboat). They're the largest all-aluminum ships ever built for the Navy and the first to use an aircraft jet engine.

The PG is the closest thing to a sports car in the fleet. It can accelerate from a dead stop to 40 knots in about 75 seconds. With its reversible-pitch propellers it can stop even more quickly—within two ships lengths!

Commander Spane invited me aboard for a training run out of San Diego be-



JET ENGINE geared in, PG boat races through practice missions with all hands at battle stations. At ship builder's (right), aluminum-alloy sheets are welded over what will be jet-engine room. More than 75 tons of the light metal are used in each ship, ranging from $\frac{1}{2}$ to $\frac{3}{4}$ inch thick. Made in Tacoma, they cruise down Pacific Coast to San Diego, before going to Vietnam assignment



fore he took the *Gallup* to Vietnam. The new gunboats are getting their introduction to combat in the "Market Time" patrol, helping other Coast Guard and Navy patrol craft keep an eye on Vietnamese coastal traffic for contraband shipments.

The PGs are the first U.S. warships in 40 years to be commissioned as gunboats—a class that dropped out of ship lists after World War II. A far cry from their predecessors—the 1200-ton jobs that could muster 12 knots plying the Yangtze River or ducking in and out of Latin American revolutions a generation ago—they're not only smaller but much, much lighter.

With aluminum ribs and hull plating, aluminum decks and fiberglass superstructure, the new PGs weigh in at 250 tons. Their 9½-foot draft means they can move fast with their firepower on shallow coastal waterways and rivers.

The main armament of this jet-age gunboat is a rapid-fire 3-inch gun, radar-controlled, on the forward deck. A single-barrel 40-mm cannon covers the stern, and .50-cal. machine guns are mounted on either side of the second deck.

The Navy hopes the low routine maintenance requirements of this essentially rustproof ship will give the

PG's small crew—28 men—enough time to tend to the high maintenance requirements of the power plant: three engines, an intricate power train and network of controls.

The system of gears and clutches that permits the General Electric J-79 to apply its power to twin propeller shafts—simply by overriding the two Cummins V12 diesels that drive the same shafts in normal cruising—is an engineering marvel.

On the bridge, the man in the driver's seat has direct control of the engines through switches and levers on a console within reach of the wheel. There's no need to call orders to the engine room below. Once the turbojet is started, it's ready for high-speed maneuvers at the touch of the throttle. There's no loss of power when shifting from diesel to turbine, or back.

Putting a J-79 into a boat hull had its problems. What about salt spray being drawn into the jet inlet? Designers placed the inlet 18 feet above the water line—in the second deck, facing aft. Air drawn to the turbine has to make a 90° turn to travel to the engine room and, thanks to centrifugal force, drops of moisture don't quite make the turn and can be drawn by a suction fan through slots in the elbow.

Exhaust from the J-79 also makes a



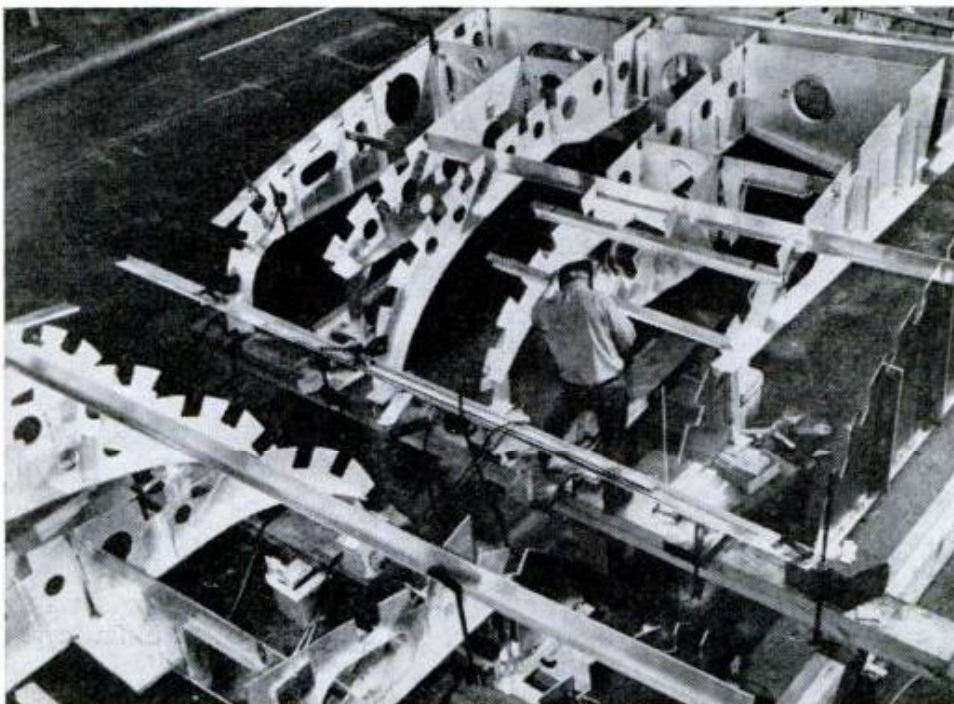
ON PG BRIDGE, helmsman (right) holds relatively small wheel. Jet-engine throttle is in foreground

right-angle turn, traveling from the engine room through a duct to a fat funnel at the rear of the superstructure.

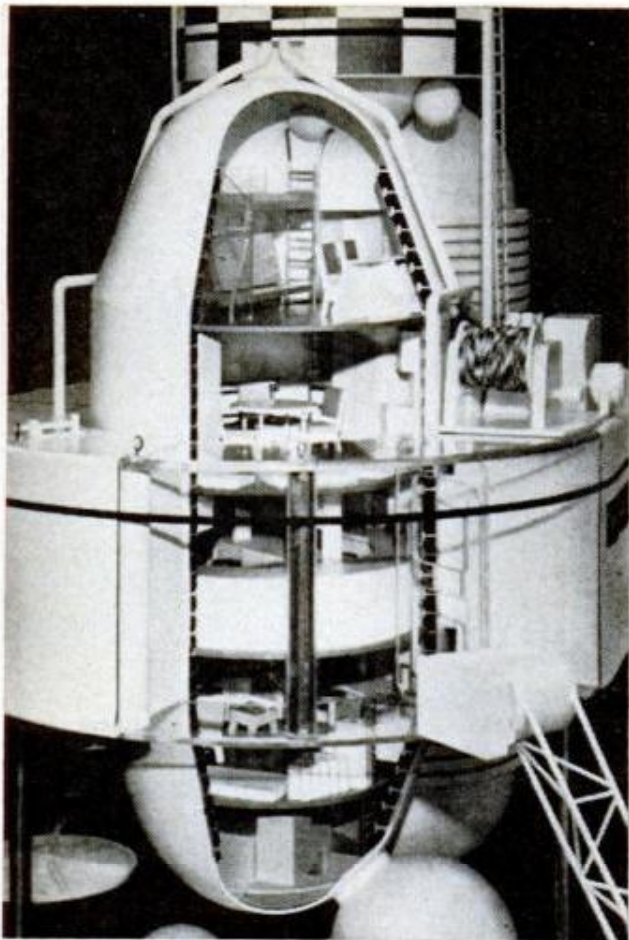
Construction of a PG doesn't start with a traditional keel-laying. Sections of the hull are fabricated upside down—around a center I-beam of aluminum—then flipped over and welded together, the I-beams forming the keel.

Handsome, clean and fast, the PGs offer a choice assignment for sailors, but they have to have a stomach for it—literally. Lightness and shallow draft

(Please turn to page 183)

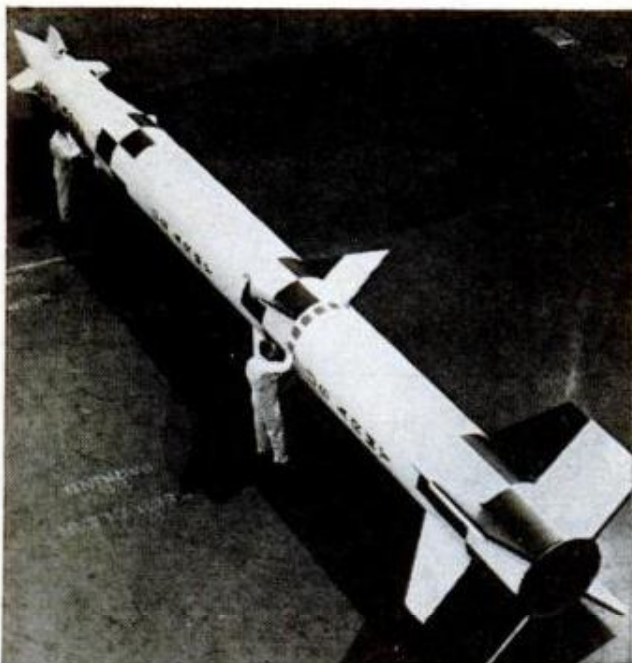


UPSIDE-DOWN construction of PG involves welding frames to center I-beam which becomes main keel. Six hull sections are made and flipped over, then all are welded together. The PG's three engines use same fuel, JP-5, simplifying refueling operations



Ocean-bottom apartment

A five-man scientific team will be able to live 30 days at a depth of 6000 feet on the ocean floor in this underwater station being developed for the Navy by General Dynamics.



Missile interceptor

Technicians work on a mockup of the Army's Spartan antimissile, being developed as a long-range interceptor capable of hitting warheads outside the earth's atmosphere.



Light snack

Weighing a butterfly's breakfast is easy, claims Statham Instruments, Inc. All you need is firm's sensitive transducer and a butterfly. (Weight: 0.009 gram more after meal.)



Luggage pack for jets

A new baggage container, developed by Goodyear for the Boeing 747 jet airliner, permits 60 pieces of luggage to be loaded and unloaded as a unit rather than piece by piece.



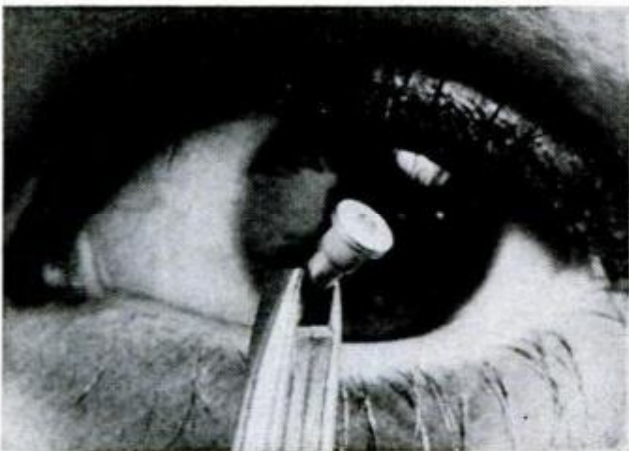
Plastic plane

Europe's first plastic-fuselage plane is the four-seat LFU-205, built by Germany's Leichtflugtechnik-Union. The plastic is lekutherm. The plane's 200-hp engine will move it at a top speed of about 225 mph.



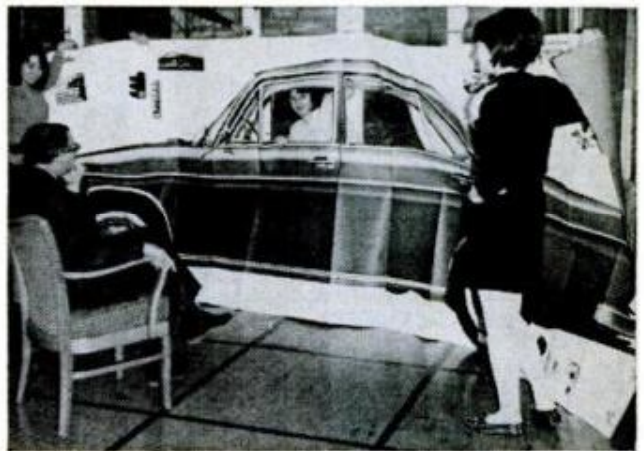
Research cat

An all-steel, catamaran-type vessel, the *Atlantic Twin*, is a new oceanographic-research boat built by Twin Hull Boat Co. The design, says the builder, offers maximum deck space, lower freeboard and great stability.



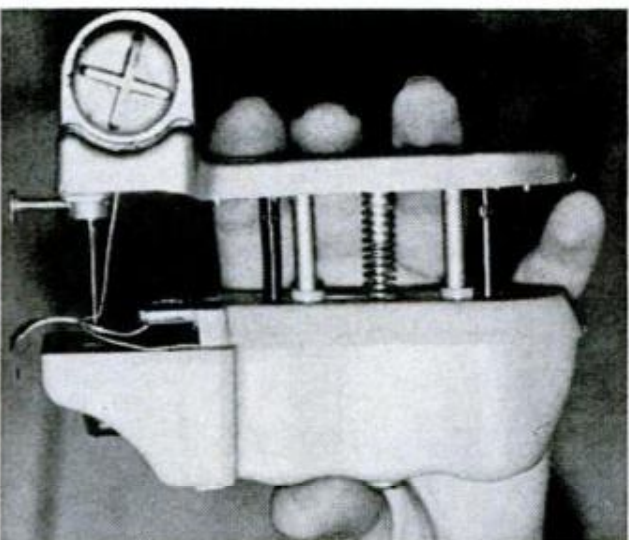
Improves laser systems

An electron flow, set off by light entering Texas Instruments' new laser detector, makes it 200 times more sensitive than previous detectors. Result: Improved laser instruments.



Nothing left to imagination

A German car maker, Audi, sends potential buyers a pamphlet that unfolds to reveal a full-size photo of the car with cut-out windows so they can see how they'll look in it.



Tiniest sewing machine

Hand-operated (by squeezing), the Jiffy Stitch sews seams and replaces buttons. The fabric goes between metal shoe and platform.



Quick check on drivers

It takes just five minutes for GE's Intoxograph to measure alcohol in a suspect's system by analysis of his breath.



Hard 'Charging' Through Old Mexico

So you want to drive to the Olympics? Better think twice
—it's a demanding trip for both the car and driver

Photos by the Author

By LEONARD E. SABAL



PYRAMID OF THE MOON



AZTEC RUINS AROUND PYRAMID OF THE SUN



ACAPULCO ELEVATOR



THE TRIP nearly ended when it was five minutes old. It was then I discovered the R/T's right-rear blind spot by almost playing The Matting Game with a fast-moving Corvair.

It wasn't until 6355 miles later that I forgave the Dodge designers. Suddenly I realized their 375-hp brute had made up for this isolated incident by surviving a blistering pace through deserts, mountains and Mexico City's mile-high altitude. It had proven its supercar status by zapping all comers from Los Angeles to Acapulco to New York. It had demonstrated its endurance and stamina by taking on Mexico's demanding roads and obstacles without once faltering. And, it had shown the need for careful car preparation for the odd situations you will encounter in Mexico. Eighty-to-zero emergencies are common—ancient road-

crossing reapers and wandering cattle lie around every bend. Good acceleration is just as important, especially as Mexican drivers tend to take personal offense when passed—and speed up. Indeed, driving in Mexico is a nerve-racking experience.

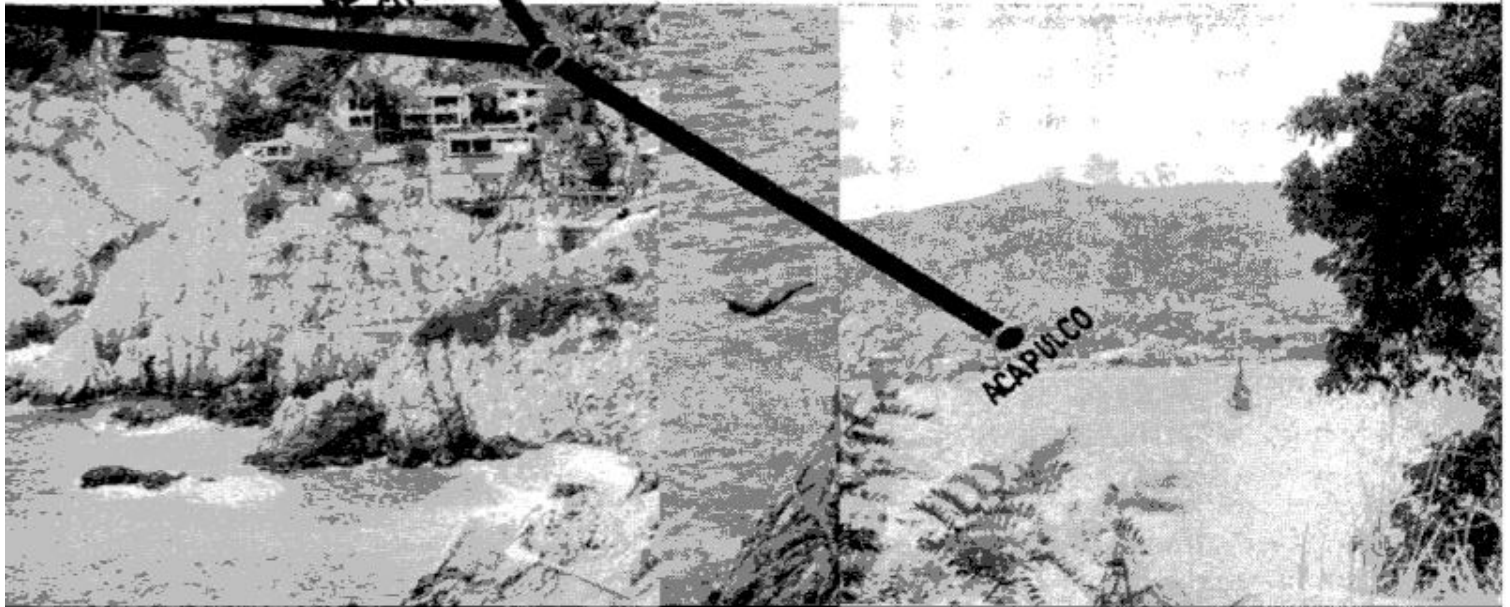
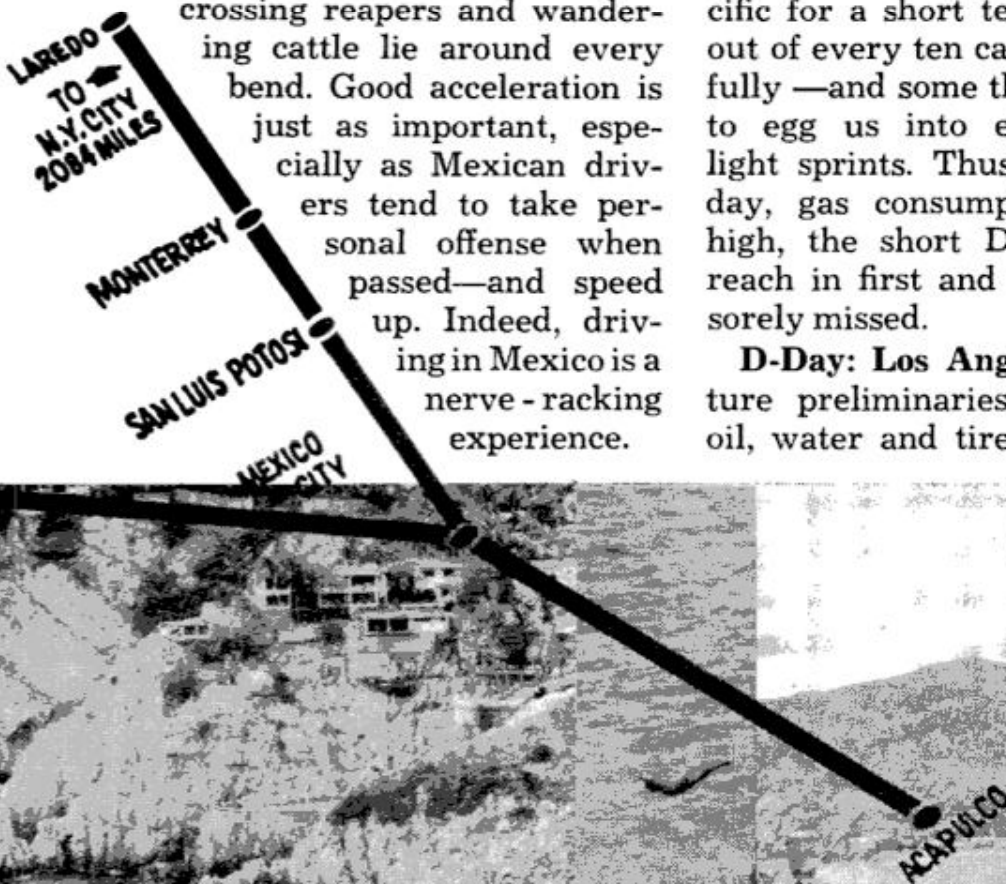
D-Day minus one: Los Angeles. The “white-hat boys” have gone all out on this one—new Goodyear Polyglas tires, heavy-duty clutch, full tune-up job. It's no wonder, either, for with 8300 miles on the odometer (all put on by West Coast automotive writers with access to Riverside), she was probably running like a two-banger MG Midget.

Surprisingly, there's no tach. In fact, it's outright ridiculous to equip any car with a high-performance 440-cu.-in. Magnum, a four-speed manual transmission and a 3.54 rear, only to forget the tachometer.

She idles smooth but is hard to get off the line at lights, primarily due to the 28-lb. clutch. After stalling twice, though, I learn the secret—you *can't* drive this monster slow and smooth. You've got to push her a bit. (Happy to oblige.)

Heading out to Marineland of the Pacific for a short test spin, about seven out of every ten cars look us over carefully—and some three of the seven try to egg us into eighth-mile, light-to-light sprints. Thus, at the end of the day, gas consumption seems a little high, the short Dart stick is a long reach in first and third, and a tach is sorely missed.

D-Day: Los Angeles-Tucson. Departure preliminaries include checks of oil, water and tires, ownership papers



CLIFF-HUNG EL MIRADOR HOTEL

DIVER

OVERLOOKING ACAPULCO BAY



TESTS OF EXCELLENT BRAKES were frequent, included cattle, landslides and questionable road signs

(a must at the border), tourist cards (free at a Mexican Consul or tourism office), maps (also free), and an emergency kit consisting of a fan belt, spare radiator hoses and clamps, sparkplugs, first-aid gear, flares and a few hand tools. Then it's off, using Interstate 10, to California 86 along the Salton Sea, and finally Interstate 8 to Tucson. During the entire trip, try to leave by six each morning, so you'll have full afternoons to spend sightseeing, shopping, poolside or at the beach.

Day's tally: 533 miles, 7½ driving hours. Average: 71 mph, 11.3 mpg.

D-Day plus one: Tucson—Guaymas. Heading south on U.S. 89, you begin to sense the proximity of Mexico—and suddenly you find yourself surrounded by the burros, colors, wagons and smells of Nogales. The American officials at the border crossing wave you on without hesitation, as does the first wave of Mexican customs officials.

Keep your eye on the right for the *Emigración* office, for it has to stamp your tourist card. It's also here that you should buy Mexican auto insurance if you haven't arranged for it already. Typically, it cost us \$40 to insure the Charger for three weeks.

About four kilometers down the road, car registration and customs inspection are held under one long carport. Here, there's a small clique of Mexican "expeditors" that will take you in hand and hustle you through the registration procedure, and then

through the casual customs count of your suitcases. Our smiling guide was quite helpful and thus was rewarded with two dollars when he finally whispered, "Senor, I no work for government—you can teep me now." I was amazed, however, to watch the staunch customs inspector nudge my expediter, while clearing his throat in the process. The smiling little man shrugged his shoulders, looked at me and started to say something, but I beat him to it by handing over another two greenbacks. *Everybody* then began smiling, especially me, because they had overlooked my recent discovery—the license plates did not quite match the numbers in the letter of authorization from Chrysler.

Off we went once more, with cries of "*Mucho gracias, senor,*" "*Buena suerte*" and "*No importante.*" The latter was in response to my final query about registering the camera equipment we had brought along. The two Honeywell Spotmatics and the big 200-mm telephoto lens cost about \$700 and one of the *last* things I wanted to do was pay U.S. customs duty on cameras bought in New York. As it turned out, my smiling friends were right—it's not important to register such equipment, but it's wise nonetheless to bring along your sales receipts.

Off we sped, free spirits, into sun-drenched Mexico—only to meet, in rapid succession, two dogs, one burro, three squawking chickens and two lane-straddling buses. You learn fast in

Mexico—towns mean people and people mean burros and dogs and chickens and cattle and 5 to 15-mph speeds. An approaching column of black smoke, on the other hand, means a fuming bus is on its way—to meet its maker, you think, from the way that it's driven. Straight down the line they come—only they stick about three feet into *your* lane! Not just one or two are like this, either. They're *all* lane-straddlers, and they don't move over—ever!

This first day in Mexico you also learn quite a bit of Spanish. *Peligroso* for example, means danger; *punte angosto* means narrow bridge (a *very* narrow bridge); *no rebase* means do not pass, and *Pemex* means stop for gas. Pass up a Pemex station and you likely won't find another for 150 miles.

Never leave your car completely unattended in a station, and always make sure they use only Pemex 100 from the yellow pump. The other grades smell like a mixture of kerosene and raw petroleum and, judging from the exhaust of Mexican vehicles, the mixture smolders rather than ignites.

Even the 100 is often of questionable quality, mainly because some operators can't resist the temptation to fill a yellow pump with half 100 and half low-grade gas.

In a short time, the air turns cooler, and you know Guaymas lies ahead. Yet you're still surprised when you round that hilly curve and see the Gulf of California for a fleeting instant—it looks so small on the maps.



AFTER MORE THAN 6000 miles of hard driving, the two-ply Polyglas wide treads showed very little wear

The best beaches and accommodations are those just north of the town. If you find yourself going over a long narrow bridge, turn back and look again for the colony of beach hotels. These all cater to tourists, thus the food is reasonably good and at most, the water is bottled. If in doubt as to the ice or water, don't be afraid to ask. Guaymas is a nice place to visit, but not for three or four days in bed.

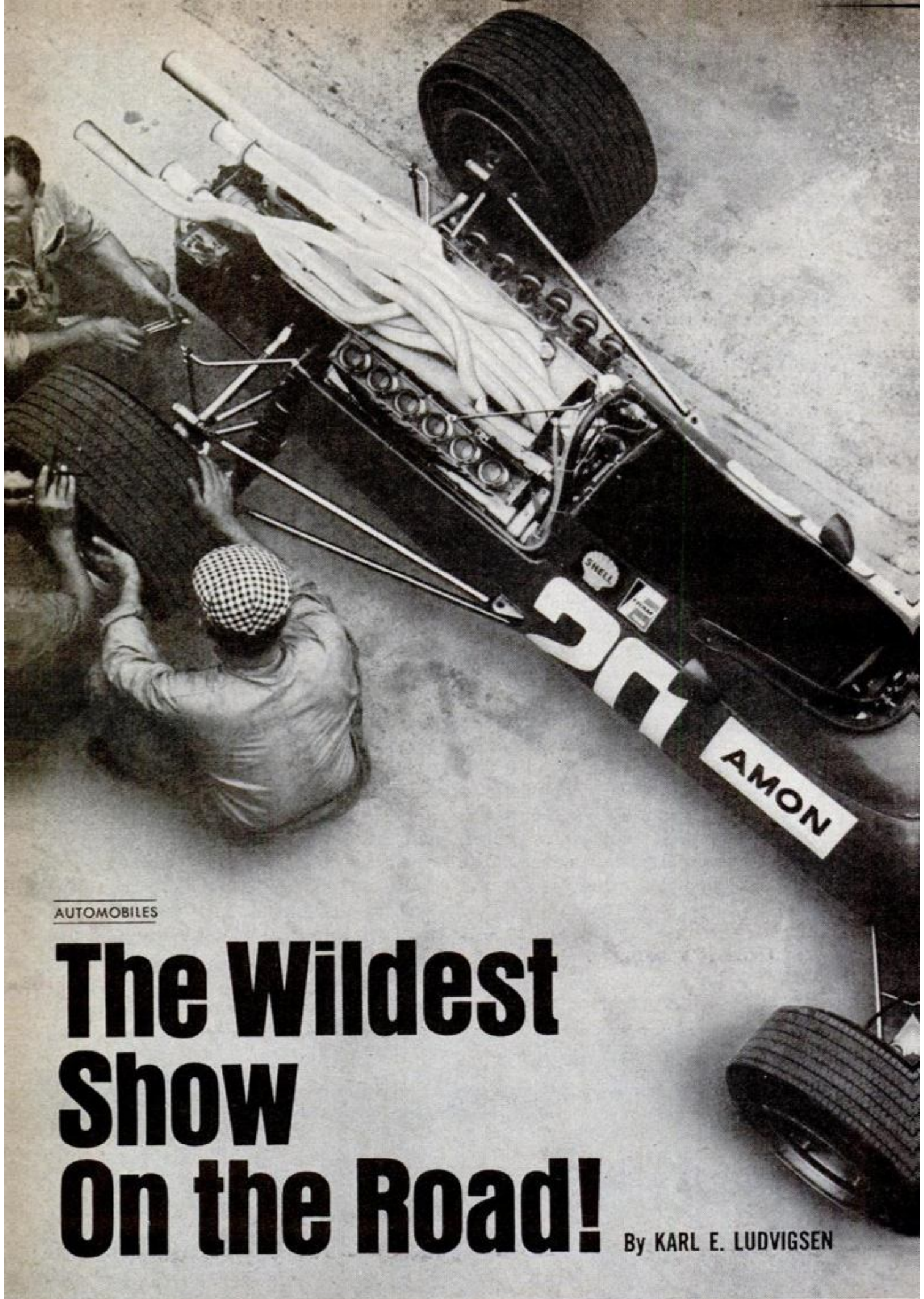
Day's tally: 347 miles, 5.1 driving hours. Average: 68 mph, 11.1 mpg.

D-Day plus three: Guaymas-Mazatlán. A half hour out of town, the roads open up and run arrow-straight for miles on end, with only slight curves and gradual slopes. This is where you can get into real trouble because the

(Please turn to page 202)

"HANDSOME," "BEST-LOOKING '68," "GUTSY" are among comments made by passers-by about Charger R/T





AUTOMOBILES

The Wildest Show On the Road!

By KARL E. LUDVIGSEN

It's not as rich as Indy or as fast as Daytona, but when the Grand Prix circus comes to Watkins Glen it's the Ringling Brothers of racing.



INDIANAPOLIS is longer and faster than any Grand Prix race—and richer than all of them put together. Fastest of all road-racing cars today are the spectacular Can-Am sports-racers, competing in a prize-packed North American championship. And nothing tops the speed and drama of the big stock cars on the banked tracks of the South, unless it's the powerful prototypes that run at Sebring and Le Mans.

With all this incredible equipment around, why do drivers and designers still develop with such devotion the classic Grand Prix car? Isn't it an outdated idea in this advanced age of turbine-powered, automatic-transmission racers? When asked about this, Bruce McLaren replied, with some amazement, "Why . . . because it's Grand Prix racing."

In saying little, McLaren said it all. G.P. racing is not a fleeting fad. It's the current expression of a tradition that dates from 1906. It's a tradition rich with heroic acts, racing drama, political power, industrial achievement and technical advance. Not until 1959, with the running of the first modern U.S. Grand Prix, did our country start to share in this exclusive apogee of the world's racing ambitions.

This glamorous tradition makes up the aptly-nicknamed Grand Prix "Circus"—setting up in town Thursday, practicing Friday and Saturday, and racing for gold and glory on Sunday. On Oct. 3 the "Circus" comes to Watkins Glen, N.Y., birthplace of modern road racing in America; on Oct. 6 the race will be held.

Grand Prix (French for "big prize") racing is unique in its total internationalism. Technically, any reputable organizer can stage a race for cars fitting the Grand Prix Formula 1; there are several nonchampionship races in England and Italy. But each nation is allowed to host only one race counting for championship points. Through the

OPEN WHEELS, simple cigar-like shape mark design of most Grand Prix cars. Note complex exhaust tubing

'50s, Indianapolis counted for points, but no longer. The first U.S. Grand Prix was at Sebring, the second at Riverside in 1960, and all since have been at Watkins Glen.

The Grand Prix calendar for '68 is the most crowded in history, with twelve championship events. In sequence, they're run in South Africa, Spain, Monaco, Belgium, Netherlands, France, Great Britain, Germany, Italy, Canada, United States and Mexico. No other form of racing comes close to such global acceptance.

The Grand Prix Championship is for drivers, not cars. This is significant. Because all the cars must conform to the strict Formula 1 design requirements, their performance abilities are similar, though far from identical. Today's G.P.

cars, with 400 or more hp, also demand the utmost in driving skill. Thus, Grand Prix racing may be the truest test—over 12 of the toughest tracks in the world—of all-round driving ability.

One of the great tragedies of recent racing history has made this year's championship a wide-open affair. Jim Clark of Scotland won the season's first race and looked like he'd win many more to earn his third championship. Recognized by his contemporaries as the most talented among them, he was later killed at a minor racing event in Germany.

If there's to be a successor to the great Clark, he'll be discovered this season. There are many candidates for the laurels. Another Scotsman, Jackie Stewart, has so far won a Grand Prix. A

Mexican, Pedro Rodriguez, has led one. Britain's Graham Hill, a former champion, won at Monaco, where another Briton, Dick Attwood, set the fastest lap. New Zealanders Chris Amon and Bruce McLaren have been in front, as have Frenchmen Jean-Pierre Beltoise and Johnny Servoz-Gavin.

Others who are always a threat for the lead are Jack Brabham (Australia), Jochen Rindt (Austria), John Surtees (Britain), Dan Gurney (United States) and the reigning world champion, Denny Hulme of New Zealand. So anything can happen at the Glen. The one regret is that there aren't more American drivers in today's Grand Prix "Circus." California's Phil Hill was a great world champion in 1961. Our own Ron Bucknum and Bob Bondurant gave it a good try, but are no longer G.P. competitors.

If it weren't for the tenacity and patriotism of Dan Gurney, Americans wouldn't have a car of their own to cheer for at the Glen. When the current Formula 1 was introduced in 1966, Gurney was ready with an organization to build the Grand Prix Eagle. It took a lot of guts. You have to respect the skill and courage of any man who says, "I think I can design and make a better car

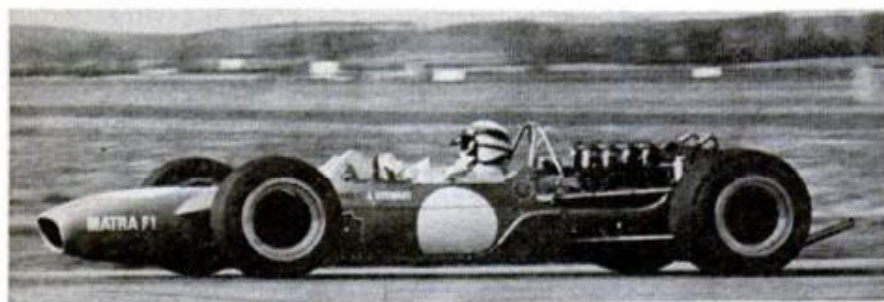
(Please turn to page 186)

DETAIL, WORKMANSHIP stand out on B.R.M.'s rugged, dependable V12

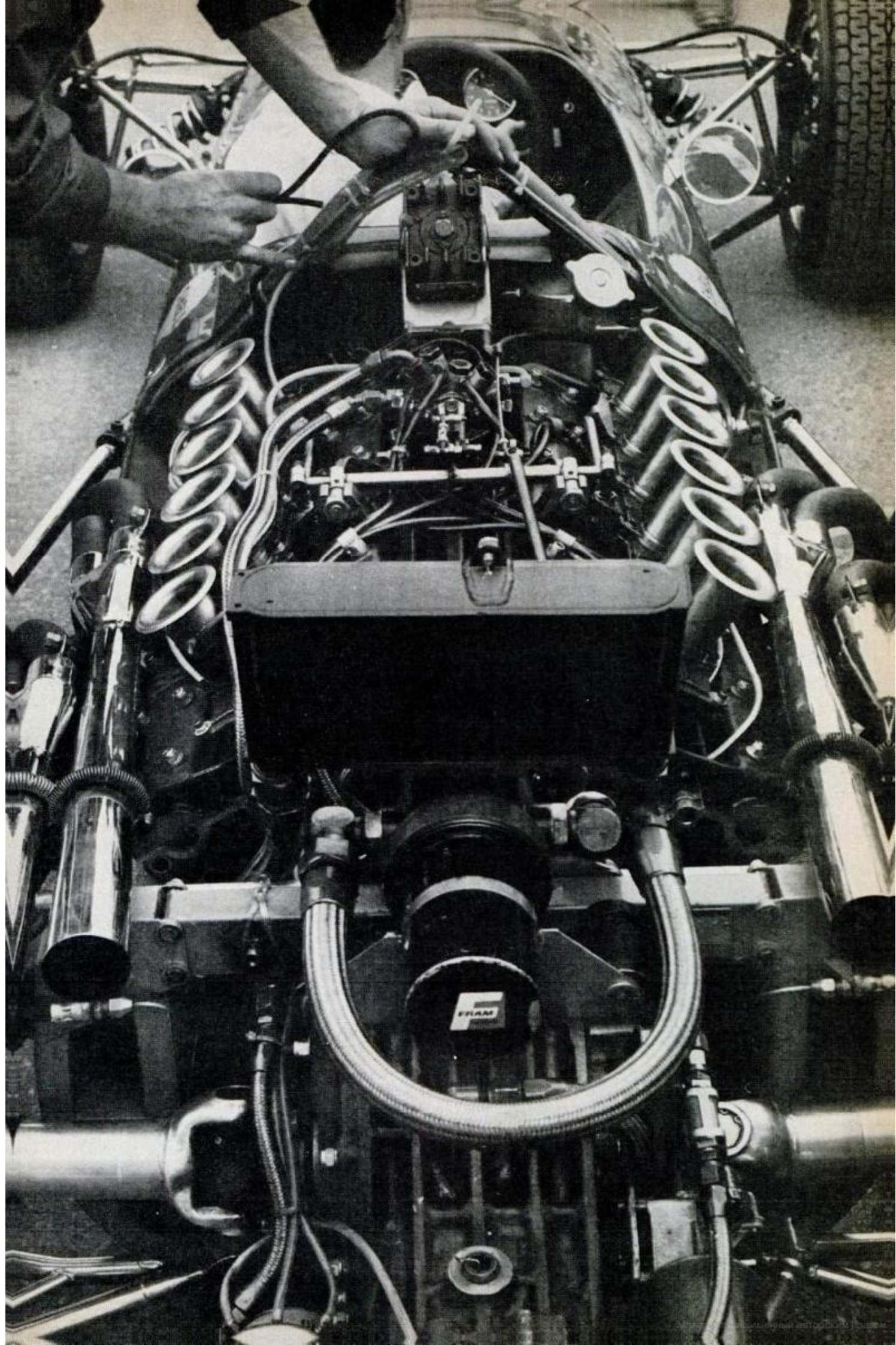
POPULAR MECHANICS



BRUCE McLAREN of New Zealand drives cars of his own design and make, powered by the Ford-Cosworth 408-hp V8. Note the fiberglass cone



JACKIE STEWART, a fine driver and one of the most popular Grand Prix stars, drives a French-built Matra powered by a British Ford V8 engine





What you should know about those Nifty, New Automatic Turntables

These modern hybrids now give you the convenience of a record changer and the quality of a turntable in one slick piece of hardware. Here's what to look for

By LEN BUCKWALTER

Technical Art by Associated Technical Services, Ltd.

MIRACORD: \$150

HI-FI EXPERTS are finally agreeing on one point: The "automatic turntable" has made it. That's the exotic new name for something once sneeringly called a "record changer." After decades of clanking, low-fi performance, the changer is enjoying remarkable improvement. The reasons are easy to find.

The automatic turntable is a marriage between the old changer and the single-play turntable—without the deficiencies of either. Until recently, the single-play model was the professionals' choice. They liked the combination of simple construction and the manufacturer's fanatical care in designing every last detail of motor, turntable and drive system. So the meticulous music lover willingly paid the big penalty—tedious loading of each disc—to

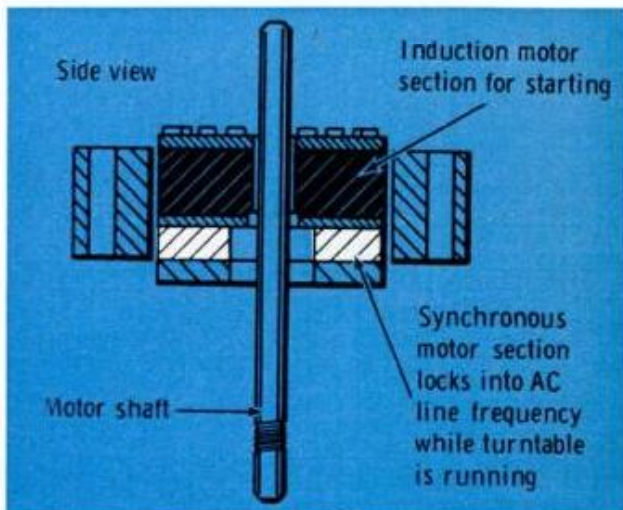
obtain the very best audio available.

Although record changers would mangle discs and add gargles and growls to music, they couldn't be faulted on sheer convenience. A changer automatically plays through a stack of discs for an evening of music. But thanks to the current crop of automatics, it's now possible to have the best of both possible worlds.

A typical automatic turntable operates three ways. Load it with a pile of records and it cycles through the familiar drop-play sequence of a record changer. Then there's semi-automatic play. A record is loaded and played singly, but you don't have to touch the tone arm. The disc is handled automatically by the changer mechanism. Most automatics include an extra, short spindle that rotates along with



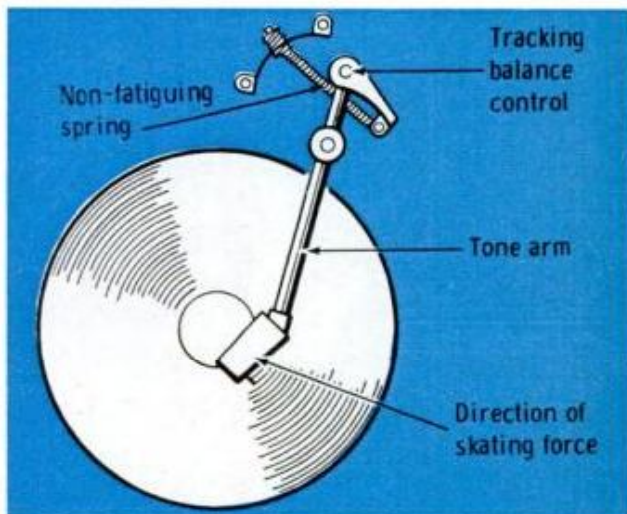
INGENIOUS MOTOR on this Garrard is one of many turntable refinements. Though basically an induc-



tion motor, it uses rotating magnetic field to lock on 60-cycle line frequency and keep speed constant



ANTI-SKATING CONTROL on the Dual 1019 puts arm under slight spring tension to offset tendency to



skid toward spindle. As spring stretches, clever geometry shifts leverage pivot to keep force even

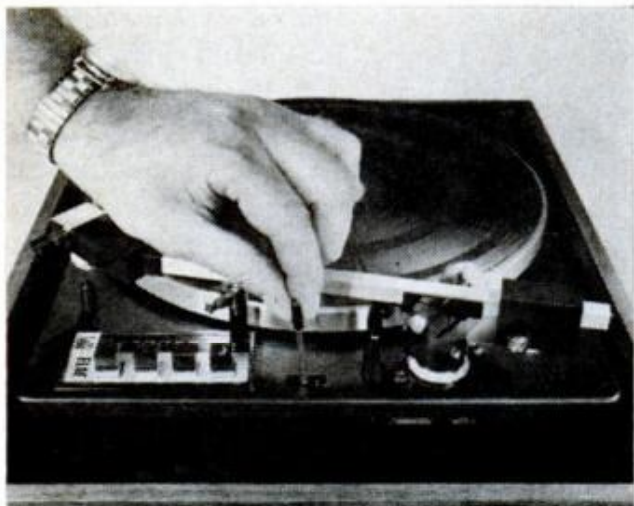
the disc. (The long spindle for changer operation doesn't turn.) To the purist, the advantage is that the record hole won't wear and ultimately cause the disc to wobble.

Finally, the automatic turntable can be played in a completely manual fashion. You can pick up the tone arm and place it anywhere on the record without the changer mechanism fighting back.

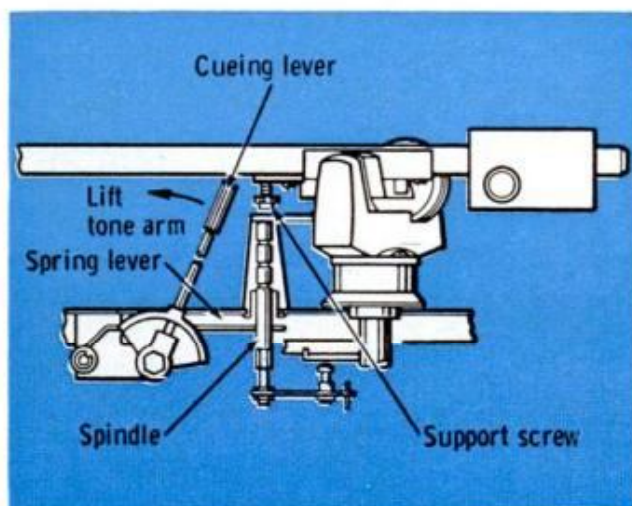
To obtain the benefits of the new automatics you'll encounter a price range of about \$30 to \$150. The general dif-

ference between models is twofold. First, higher-priced automatics possess considerable technical refinement to lick the problems that plagued old record changers. Second, the automatics are laden with a new spectrum of special adjustments you can make in the home. No longer does the factory lock the mechanical adjustments into some fixed or buried position. Many are now plainly visible and easy to manipulate.

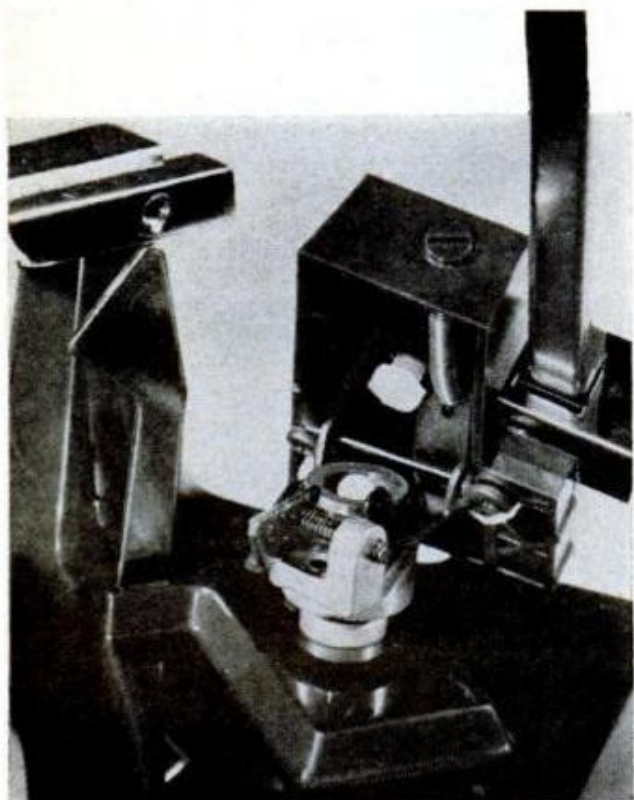
In the first area—technical refinement—the automatics can be judged on several counts. Manufacturers use a



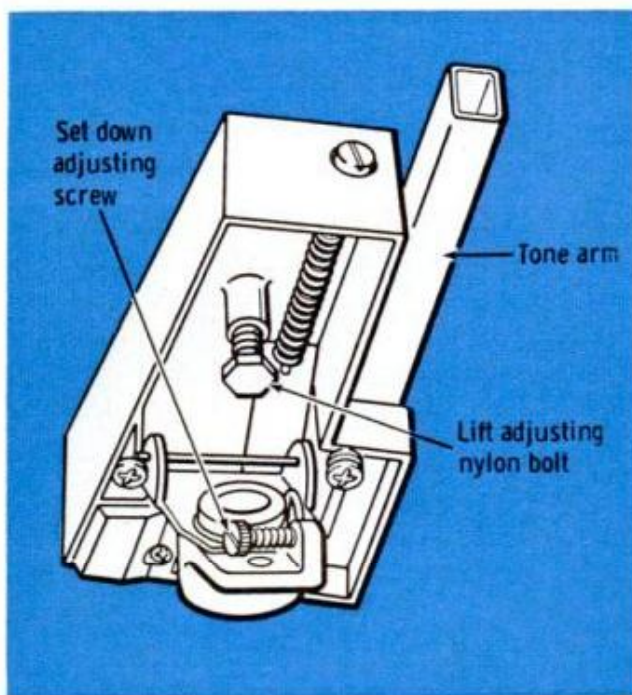
CUEING CONTROLS like the one on this Miracord save wear on your stylus and records. Moving the



lever gently lifts the tone arm and lowers it onto the record without your touching the arm yourself



DELICATE ARM SETTINGS, such as on this Lafayette, are typical of modern automatics. Screws on



post let you adjust arm's height to clear stacked records and its precise set-down on record's edge

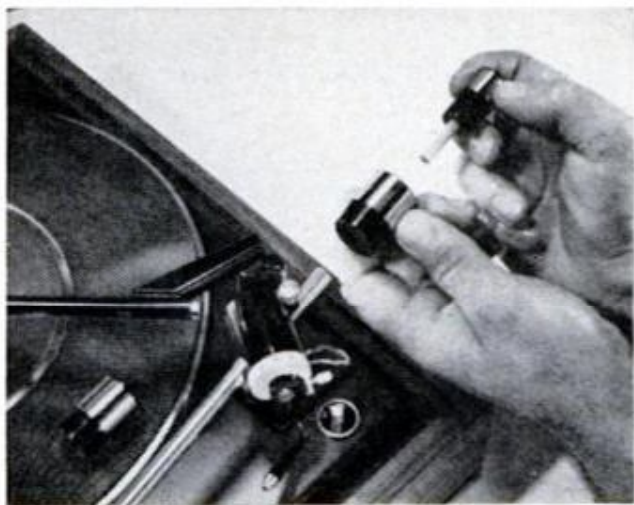
variety of engineering techniques, but they're all aimed at a common goal—to spin the disc at an accurate speed, change it gently, prevent mechanical noises from becoming part of the music and make the pickup cartridge track with great precision over the record grooves with little distortion.

That's quite a tall order. The successful automatic does it with extremely low levels of rumble, wow and flutter—three big sore points of old changers. You'll hear rumble as an unpleasant, low-pitched sound. It's transmitted

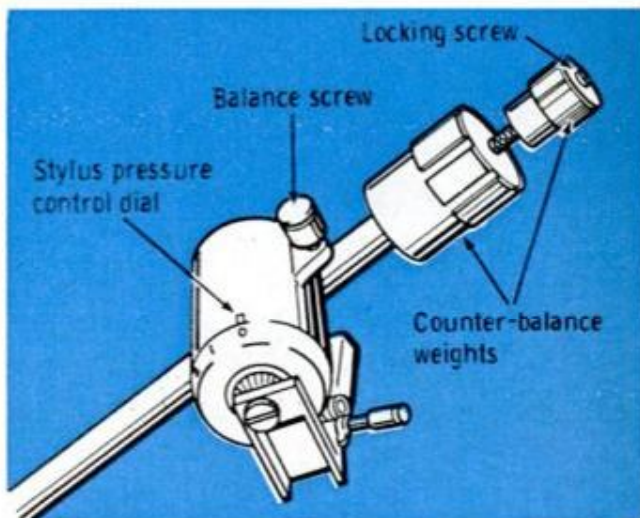
through the drive mechanism to the pickup cartridge and ultimately to the loudspeaker. If the rest of your hi-fi system is good in reproducing bass tones, turntable rumble must be low.

Wow and flutter also signal mechanical problems. An attentive ear will hear them when the record is sounding a solo instrument—the piano, for example. Wow usually produces a warbling tone for each revolution of the disc. Flutter is a rapid, continuously wavering quality. Virtually all current

(Please turn to page 188)



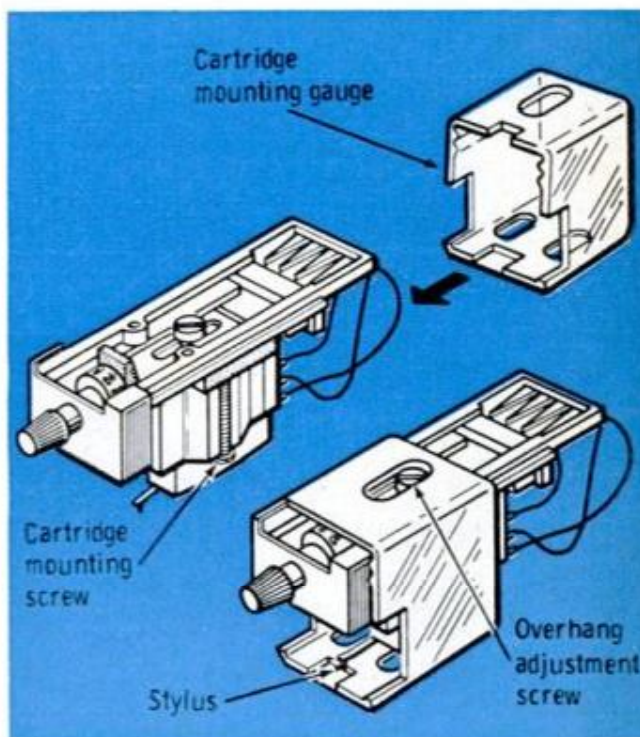
INTERCHANGEABLE WEIGHTS make it easy to adjust arm balance to any cartridge in this BSR McDonald



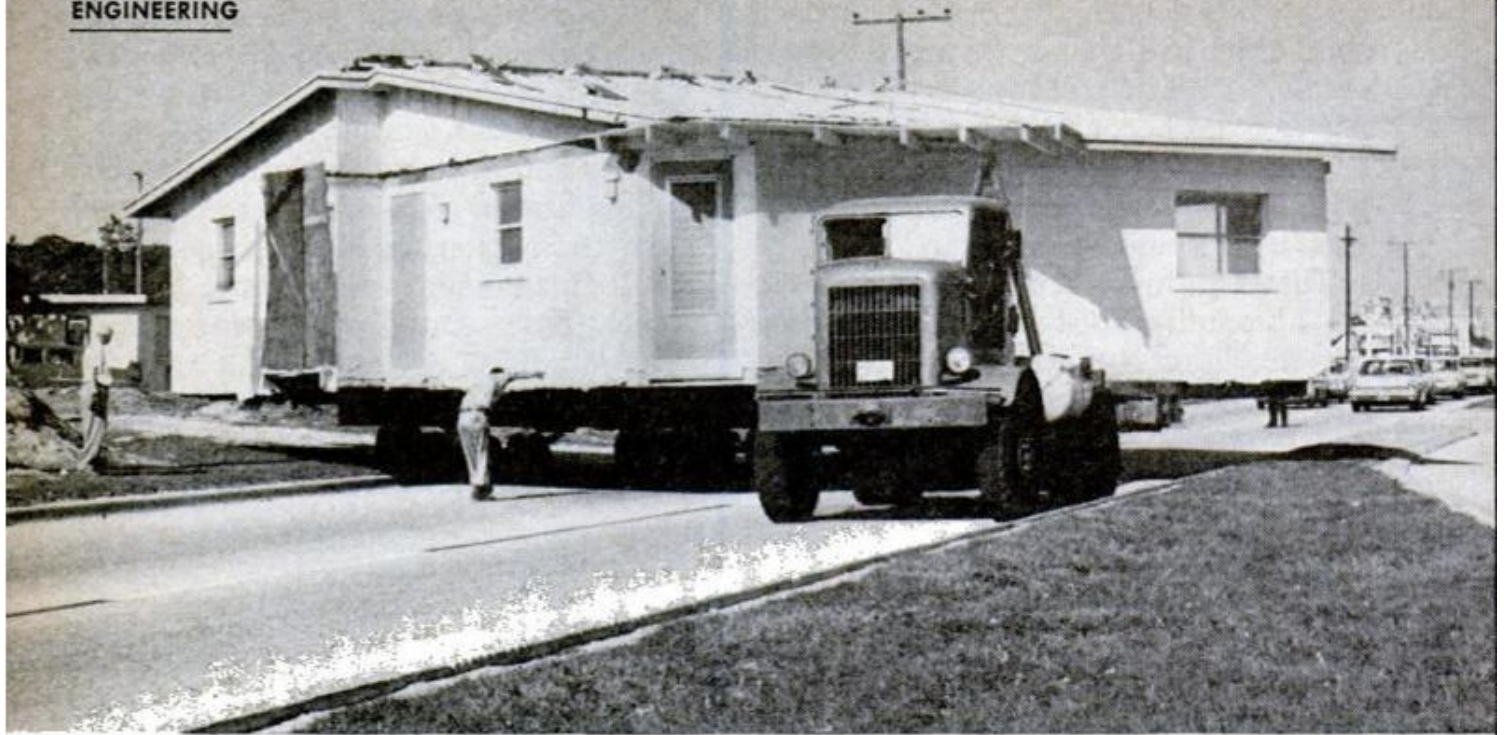
system. Metal cylinders can be used individually or telescoped to give various weight combinations



PRECISE PICKUP MOUNTING is aided by this plastic jig supplied with Perpetuum-Ebner models. Jig



properly aligns cartridge on mounting plate, then it's removed and plate is slid into tone arm head



STOPPING TRAFFIC, 90 tons of house hit the road starting a ticklish, two-day journey to a new location

HAVE HOUSE, WILL TRAVEL

Your best buy in a new home may be from those engineering magicians—professional house movers—who will deliver one to your lot, ready to live in, for as little as half the normal cost

By KEN WARNER

A CREW OF SIX MEN can move a 1300-sq.-ft., 90-ton house with a week's work. They can move it 100 yards, or 40 miles, without any damage. These facts make buying a house

c.o.d. a good way to save much of the money, time and agony involved in the normal construction job. The time is shortened by months; the agony is less by several gallons of perspiration; and



WILL IT MAKE IT? Negotiating a seemingly impossible turn calls for tricky maneuvering. Tractor must be unhitched, as shown at right, and the house



inched gradually around by winches. Wheels on inside of turn are blocked stationary so that load pivots on them, swinging around on the outer wheels

the money is down to about 50 percent. That's right: A moved house will cost about half what a similar house would cost built in the same place.

As a reporter, I can vouch for this personally, for I own such a moved house myself. While my wife and I use it primarily as a vacation cottage in the country, it's no ramshackle old barn. It's a 24x56-ft. ranch house with an 8x16-ft. glassed-in porch on one end. It was originally built on a slab at a site that is now a department-store parking lot 10 miles away.

The house and a two-car frame garage were purchased, *in place on the new site*, for \$7200. The mover guaranteed the house would pass the pertinent county codes, furnished the foundation and septic tank, and also guaranteed that only hairline plaster cracks would appear as the house settled on the new foundation—a four-block-high crawl space with the slab supported on pillars inside.

About \$800 more went into grading and filling, a pump, decorating, and some interior alterations such as floor-to-ceiling bookshelves. Of the total, \$7500 was borrowed on a first mortgage arranged before the mover's contract was signed. The banker saw the house and the new site and agreed. Later, he said he figured a conservative \$13,500 on the value of the finished house in its new location.

Professional house movers put it this way: "We figure the customer gets



WITH ONLY INCHES TO SPARE, house skins through a railroad crossing as driver heeds helper's hand signals—like a pilot approaching a carrier deck

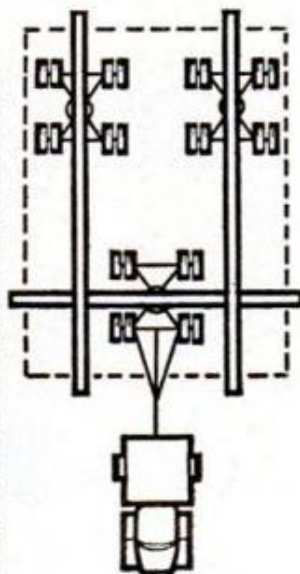
SEPTEMBER 1968

AUTHOR'S OWN HOME was moved from overgrown lot (top photo below) to new site 10 miles away (bottom photo). Note how appearance was actually improved by raising house from original slab to new crawl-space foundation. Moving job was relatively simple because house was long and narrow. Only problems were overhanging wires, being warded off by man on roof (center)





ON THE OPEN ROAD, house can breeze along at a respectable 15 to 18 mph. It must stick to secondary roads, though, avoiding heavily traveled routes



ON SOFT GROUND, crewman shores up wheels with metal mats used for jungle airstrips. Three-point wheel principle (diagram) makes load self-leveling



AT THE NEW SITE, house is jacked up so wheels can be removed from underneath. Temporary blocking will be built up around jacks to take main weight

by for about half," says the firm of William Adamowitz and Sons, Hillside, N.J. BMH, Inc., Columbus, Ohio reports: "With about half the cost of construction of a new house going for interior finish, it's easy to save money on a moved house. To move a good frame house about three miles will cost from \$2500 up, depending on the route." According to the Schwartz Construction Co., Bayport, Minn., "When we're lucky at bidding for houses displaced by highways, people can get some real bargains because up here we can move pretty cheaply. We move some good frame houses for as low as \$1200."

How do you find a house to move? The quickest way is to call house movers within 25 to 75 miles (depending on the terrain) of the chosen site. Find movers in the Yellow Pages of the phone books of surrounding towns available at your local phone company office. The first mover who has a house that might serve your needs is your teacher. Go see him.

Be prepared to be disappointed, and be prepared to talk about money, but don't lay all your cards on the table since you may wind up buying a house from this man and have to dicker. Learn all you can about the house-moving business locally and about any local problems and restrictions.

House movers are used to such calls. Most of the time, a mover has an "inventory" of houses due for moving and can show them right away.

It is also possible to find a house, make a direct deal with the owner, then have movers bid. Ordinarily, this means finding a house someone hasn't thought of moving yet, since the movers are the first to hear when a building is scheduled for moving. Obviously, a firm bid for the moving job is necessary before closing any deal.

Contractors' model homes and houses owned by state and county governments as a result of condemnation for new roads and other projects are other possibilities. The model house is more costly because it is a new house,

but the contractor generally just wants his cost out of it and it sells considerably under the same house built on your site.

For the ground rules on bidding for government-owned houses, call on your local road department. Often, you can get on a mailing list for the asking. Since movers bid low, a private individual buying a house just once can afford to go a little high and still come out ahead.

These are the main routes to finding a movable house. Dealing with a house mover is the simplest, but involves paying him a profit on the house. He earns this, of course, and, in return, can be induced to take on additional responsibilities during the dickering. Buying a house directly may get you the best price, but it also carries the liability that you, the owner, become the contractor thereafter. On the theory that amateurs can get hurt playing with professionals, dealing with the house mover is probably worth whatever extra profit he earns.

In choosing a house to move, apply the same criteria as in buying any used house. Wiring, plumbing and heating equipment should be carefully appraised since these systems have a high replacement cost and are often rigidly controlled by building codes.

If the house is in good condition, it will arrive in good condition. Indeed, it may be a better house once moved. Slab houses moved to crawl-space foundations generally are dryer thereafter; old houses gone slouchy are straightened up plumb; sometimes a house comes to life when reoriented relative to the sun and a new, more majestic view.

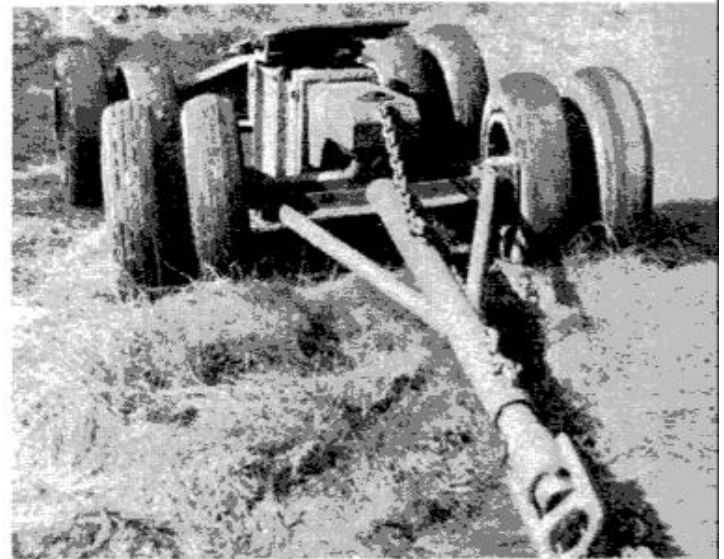
Structure and size are important. For moving, the all-frame house is best because it is lightest and strongest off its foundation. However, all types of masonry houses can be moved. States vary widely in their attitudes toward house-moving. Some, like Florida, enforce strict limits on load size; others, like Minnesota, allow the mover to haul

nearly any size load. Thus, a movable house in Florida must have one dimension of 30 feet or less at foundation level unless it can be moved in two pieces.

The structure of the house must be judged for strength. Often, what seem to be integral parts of the house are simply tacked on. Termites or dry rot



WITH HOUSE BLOCKED UP, wheels are pulled out. Foundation walls will then be built up to fill the gap and the house will be jacked gently onto them



TRAVELING GEAR consists of eight wheels on two independently suspended axles. Axles can tilt and twist to follow the ground without disturbing load

in a frame mean it is weak—let an expert look at it.

The mover is concerned only with the bottoms of most of the houses he moves. If plumbing and heating pipes project below the floor joists in the wrong places, he will simply cut them

(Please turn to page 190)

WHAT GUN FOR WHAT GAME?

You need different kinds of rifles for different game on different terrain in different parts of the country. As hunting season approaches, here's a rundown on what you should know about long arms

By GEORGE NONTE JR.

IS THERE ANY SUCH THING as an "all-around rifle"? One that is equally efficient on all sorts of American game in all the hunting areas of North America? Not now, in my opinion, nor has there ever been, in spite of great-grandpappy's bragging about his favorite Sharps or Winchester that would "kill any animal as far away as I could see it."

Of course, you can get by (and many do) with a single rifle—but it will be too heavy or too long, too light or too short, too powerful or not potent enough as often as it will be right. The big .375 Magnum ideal for brown and grizzly bear is completely out of place on whitetail deer. Conversely, the flat-shooting .225 Winchester that does so well on varmints and light game is certainly no elk or moose gun. Then, too, the short, light, open-sighted carbine that does well in Pennsylvania timber or Florida swamp is next to useless in the High Sierras or open prairie.

Depending upon how varied your hunting interests might be—and we refer *only* to hunting guns, not specialized target equipment—two, or at most, three rifle-cartridge combinations will do the job well on almost any game in virtually any part of this country.

When talking rifles, you talk models, like the Remington Model 660. When talking cartridges, you refer to caliber

and in many cases developer—the .284 Winchester, the .300 Savage, the 7-mm Remington. This confusion started years ago when one riflemaker would design a special type cartridge to fit a model of his rifle. Hunters liked the new cartridge, so other gunmakers would design their own brand of rifle to take the popular cartridge. So now you have Browning making rifles that take the .284 Winchester cartridge; Winchester making rifles for the 7-mm Remington; Remington making rifles for the .300 Savage; and Savage making rifles that take Remington cartridges. And all makers now have rifles that take the extra-high-powered Magnum shells in many different calibers.

Where to start? Small game, such as squirrels and rabbits, are the most popular and are taken at short range, in timber or close cover. In addition, they are easily killed, and you don't want to blow them to pieces—after all, you hunt them to eat. For this kind of shooting, you just can't beat a good .22 rimfire rifle loaded with high-velocity long-rifle ammunition. Take your pick of gun types: bolt action; slide action; automatic, or lever action. All of them have plenty of accuracy for small game. If the bunnies are tougher than usual in your area, then switch to hollow-point bullets, and they won't get far. The .22 rimfire is also good for close-up varmints of



Model 70
Winchester .270

Model 49 Ithaca
.22 single shot

Model 660 Remington
.350 Magnum carbine

Model 99-C
Savage .243

Browning .30-06,
Mauser action

small-to-medium size. Woodchucks are about its upper limit for clean kills. Even then, head shots are necessary. The .22 fits in—well, anywhere.

Stepping up a notch, we come to varmint shooting, from prairie dogs and crows, nearby, to rock chucks out at a quarter mile or so. This type work calls for more range and a much flatter trajectory than the .22 RF. A high-velocity .22 centerfire is the ticket here, combined with a fairly heavy-

superduper round pushing bullets at 4000 feet per second (f.p.s.). The .222 Remington with its superbly accurate 50-grain bullet at 3100 f.p.s, or the .222 Remington Magnum at 3300 f.p.s. is all you'll ever need. And, they don't make much noise or cost as much as the hotter, faster .22 centerfires.

West of the Mississippi, ranges get longer—as much as 400 yards or more in the Plains States where prairie dogs and coyotes are the favored targets.

BULLET WEIGHTS (in grains)

| CALIBER | Rabbit, squirrel, other small game and small animal pests | Woodchuck, fox, coyote, and other varmints | Deer, antelope, mountain sheep, and other medium-sized animals | Moose, elk, Alaskan brown bear, caribou, and grizzly | Elephant, rhinoceros, and other thick-skinned game |
|-------------------|---|--|--|--|--|
| .22 Rimfire | 27, 29, 36, 37, 40, 45 | | | | |
| .222, .222 Magnum | 50, 55 | 50, 55 | | | |
| .22/250 | 40, 45, 50, 55 | 40, 45, 50, 55 | | | |
| .243 | | 80 | 100 | | |
| .270 | | 100 | 130, 150 | | |
| .284W | | 125 | 125, 150 | | |
| 7mmR Magnum | | 125 | 125, 150, 175 | 175 | |
| .30-06 | | 110, 125 | 125, 150, 180 | 220 | |
| .300 H&H Magnum | | | 150, 180 | 220 | |
| .300W Magnum | | | 150, 180 | 220 | |
| .308 | | 110, 125 | 125, 150, 180 | 200 | |
| .308 Norma Magnum | | | 180 | 180 | |
| .338 Magnum | | | | 200, 250, 300 | |
| .375 H&H Magnum | | | | 270, 300 | 300 |
| .458 Magnum | | | | | 500, 510 |

BROWNING ARMS CO. CHART

barreled rifle and a good, high-powered scope sight.

The rifle should be a bolt action with locking lugs up front—unless you're partial to the new Remington Model 788 which uses multiple lugs at the rear of the bolt. The M-788 has proved itself just as accurate as front-locking types.

Because of design features for convenience and handling speed, lever, pump and automatics simply don't have the accuracy required for precise long-range work. Don't pick a short, light carbine. Get the longest barrel offered, and take the heaviest weight you can handle. Remember that you'll shoot this gun mostly from rest, and you won't be carrying it a lot. The extra weight won't inconvenience you, and it will make hitting easier.

Choosing a cartridge for small game depends a great deal upon where you'll be shooting. East of the Mississippi River, shots tend to be at 250 yards or less. For this range, you don't need a

Here you need 3800 to 4000 f.p.s. with 55-grain or heavier .22 bullets. The new .224 Weatherby, .22-250 Remington and the venerable .220 Swift are at their best in this kind of shooting. The lesser .22s already mentioned simply don't have steam enough for truly long-range work.

The most popular big game in this country is the whitetail deer. This species is found in every state except Hawaii, and is hunted legally in all but two or three states. There are far more whitetail now than when the first Pilgrim set foot on Plymouth Rock. The other kinds of deer follow it in shooting and eating popularity.

The whitetail is a highly nervous, easily-killed animal. And he inhabits fairly open timber where short ranges are the rule. The average shot is at considerably less than 100 yards. This means you don't need a powerful, flat-shooting rifle. Tens of thousands of .30-30 Winchester and Marlin carbines

(Please turn to page 192)

A LONGER, DEEPER, DARING QUEST FOR THE SECRETS OF LIVING IN THE SEA

This Fall the Navy's **SEALAB III** project will send five teams of aquanauts 600 feet deep—for a total of 60 days—to find: How long can man live and work effectively in the depths of the ocean? □ By Hans Fantel

“LOWER AWAY!” When that command rings out off California's San Clemente Island this fall, it will mark the beginning of man's boldest foray into the last unknown region on this planet. Gushing and gurgling from filling ballast tanks, the Navy's Sealab III will drop from sight and slowly sink to the bottom of the Pacific Ocean. Like the earlier Sealab I and II, the new Sealab III is a kind of ocean-floor hotel and research laboratory. Its two-room interior is crammed with bunks,





Telephone

Oxygen makeup system

Emergency bell

Stowage

TV monitor

Deep Diver work sub

Benthic trunk for air hoses

Power hoist

TV camera

Viewing port

LABORATORY AREA

Figure-eight cable attachments

Aft hatch

Hoist

DIVERS' STATION

Workbench

Concrete deck

Concrete deck

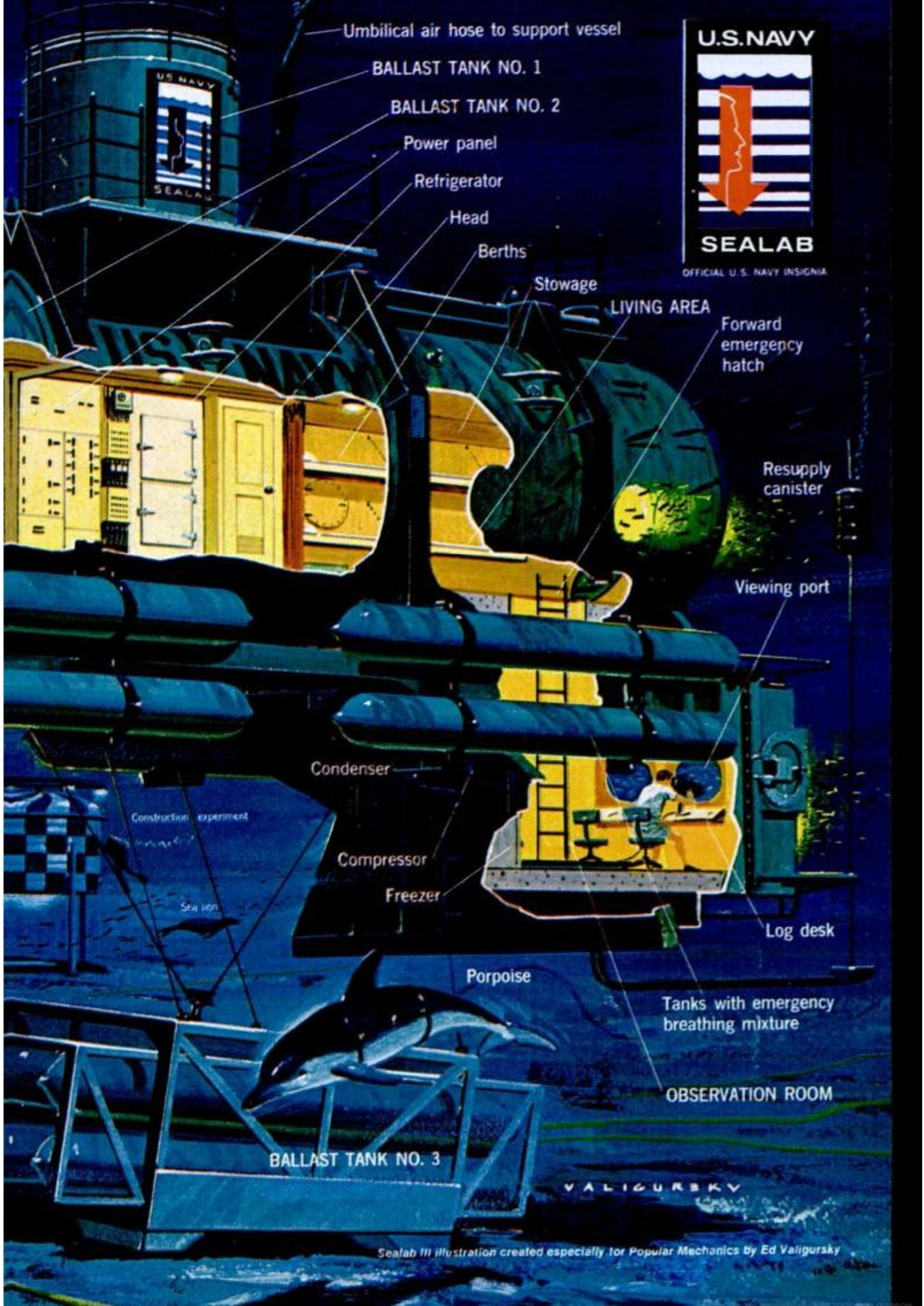
Swimming equipment storage

Air Hoses

Entrance hatch

Luminous guide lines

Divers' navigational aid



Umbilical air hose to support vessel

BALLAST TANK NO. 1

BALLAST TANK NO. 2

Power panel

Refrigerator

Head

Berths

Stowage

LIVING AREA

Forward emergency hatch

Resupply canister

Viewing port

Log desk

Tanks with emergency breathing mixture

OBSERVATION ROOM

Condenser

Compressor

Freezer

Porpoise

BALLAST TANK NO. 3

Construction experiment

Sea lion

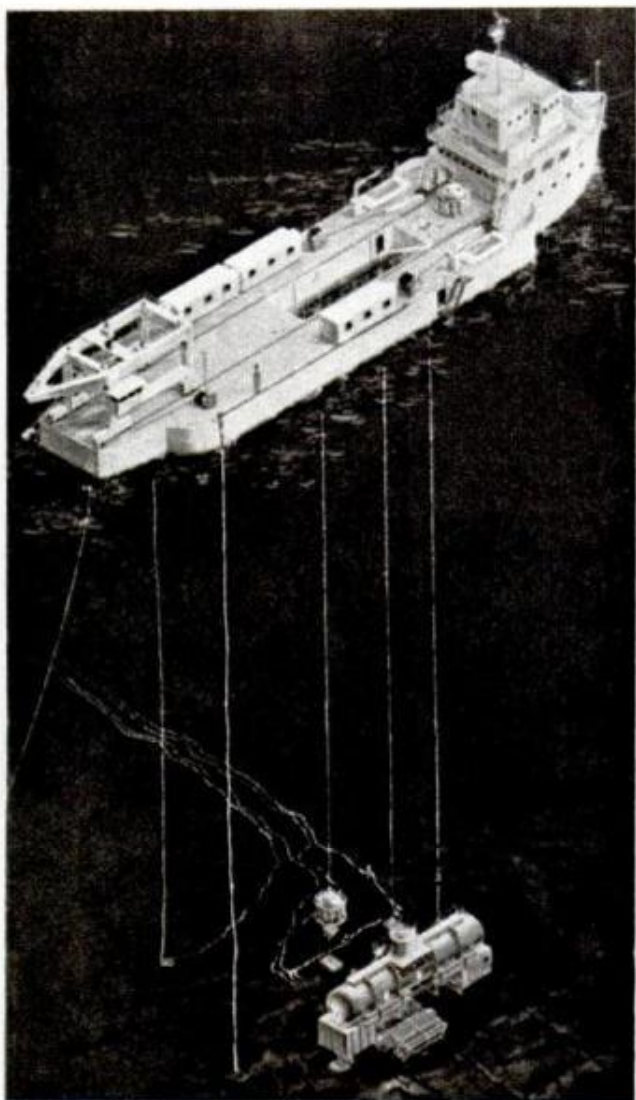
VALIGURSKY

Sealab III illustration created especially for Popular Mechanics by Ed Valigursky



SEALAB AQUANAUTS AND MEDICAL OFFICERS pose after a previous successful dive. Shown from left to right are Capt. George Bond, who initiated the program in 1957, Torpedoman's Mate Billie Coffman, Cmdr. Scott Carpenter and Capt. Walter Mazzone

IN ARTIST'S CONCEPT, support ship *Elk River* feeds transfer capsule to 600-foot level of Sealab III



fresh-water showers, desks, chairs, books, hi-fi and nearly all the comforts of home, along with a mind-boggling array of special instruments. But, unlike the earlier Sealabs, this new "life capsule" will rest at a depth of 600 feet—three times deeper than its daring predecessors. "The longest 600 feet in the world," one crew member said.

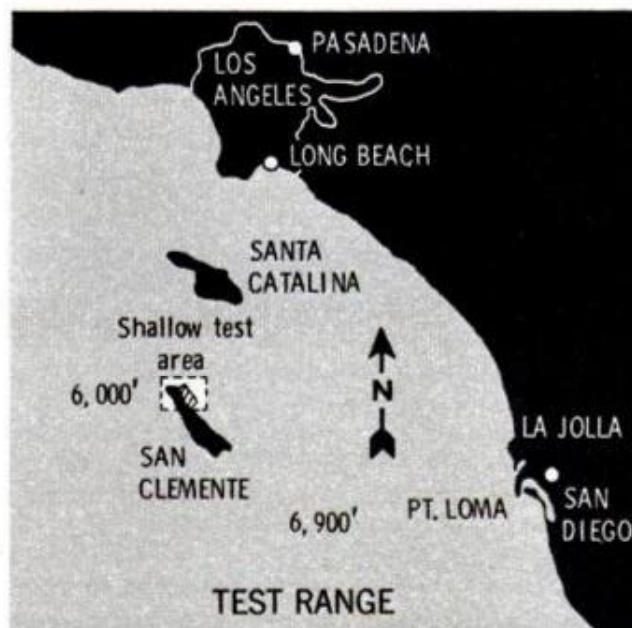
"Diving craft go deeper," a heavily gold-braided officer explained, "but in a diving craft—as in submarines—men live at normal surface pressure. They can't go outside. Our aim, by contrast, is not just traveling in the sea. It's *living* in the sea, going in and out at will like you do at your own home, working outside, and staying down long enough to accomplish major projects."

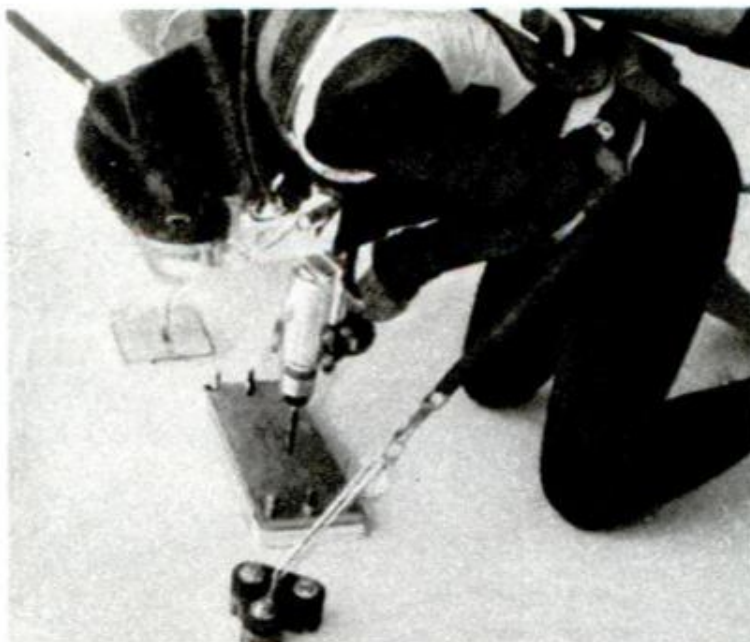
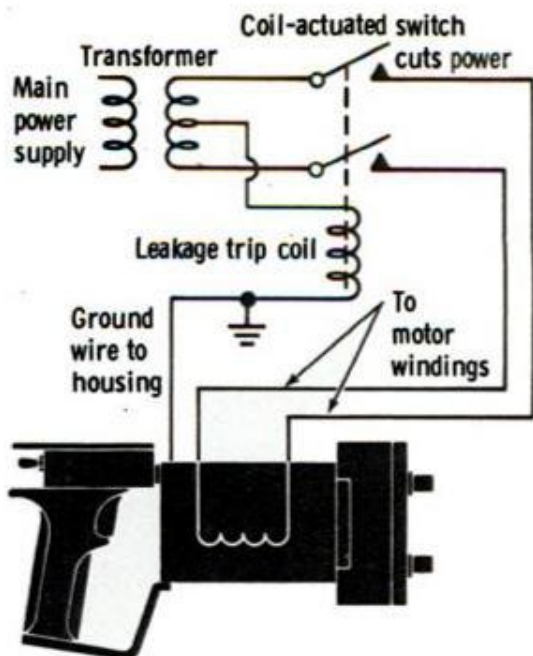
At this moment, all equipment is ready:

- The Sealab habitat—a huge steel cylinder resembling an outsize tank car, studded with portholes, floodlights, hatches, pipes, valves, ballast and auxiliary breathing tanks, painted bright yellow for underwater visibility. Moored to the ocean floor, the habitat is the basic undersea abode. From here divers swim out on work missions, dangling on 600-ft. umbilicals, going down on the sloping sea floor to depths of 750 feet.

- Two PTCs (personnel transfer capsules)—free-hanging, pressurized ele-

SEALAB SITE is just off coast of Southern California





SHOCKPROOF POWER TOOL for underwater use has ingenious safety shutoff. Any short circuit immediately trips a relay (see diagram), cutting power within 30 milliseconds—long before diver can feel a tingle

vators to lower aquanauts to the habitat and to bring them back up. Each holds four men and is hoisted up and down by a crane on the surface support ship.

- Two DDCs (deck decompression chambers)—pressurized living quarters about the size of a VW bus, located on the surface ship. On arrival from below, the PTC “mates” with the decompression chamber so that the aquanauts can transfer into the DDC under pressure. Then they are gradually decompressed over a period of 150 hours. Faster decompression would make the nitrogen in their blood bubble at body

temperature, causing the often-fatal “bends.”

- A “dry pot”—a sealed transfer chamber to deliver food, mail, newspapers and supplies to the habitat.

- A surface support ship, the *Elk River*, carrying out command and monitor functions, serving as communications center and supply store for the entire undersea operation.

The enemy to be vanquished in this Navy mission is the sea itself. It is powerful and unforgiving. The first mistake is likely to be the last. “We can’t forget this for a moment during the whole 60-day project,” says Lt. Cmdr. C. W. Larson, a Sealab briefing officer.

At 600 feet down, the sea presses in on the human invaders at a shattering 275 p.s.i. Just staying alive is a chore in this environment. Every breath becomes a scientific challenge, for at such pressure, the body reacts very differently than at the surface.

Pure air becomes pure poison. Its nitrogen, pressed into the blood by the extra pressure, knocks a man’s mind off its moorings, rendering him a helpless victim of the “rapture of the deep.” That’s why most nitrogen is removed from the aquanauts’ breathing mixture and replaced by helium—a physiologically harmless gas. Oxygen, too, must

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AMERICANS ARE NOT ALONE IN THE DEEP! Russia’s Sadko-2 (above) spent 10 days at a depth of about 82 feet with two men in it, and the Soviets have reported preparing Sadko-3 for further experiments, as well as Bentos-300, a transportable vehicle capable of depths close to 1000 feet, housing 10 aquanauts for two weeks

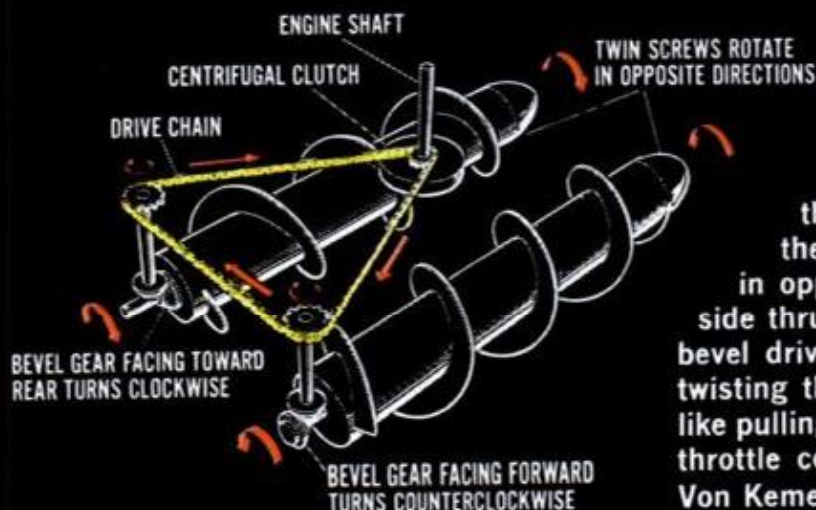
Greatest



EXCITING SNOW SKIMMER PULLS YOU ON SKIS

SO WHO NEEDS hills to ski? This gas-powered sled scoots through the snow while you hang on behind like a water skier. It hits 15 to 20 mph with a 4-hp engine and can reach 50 mph with added power. Propelled by two chain-driven augers, the skimmer is designed for cross-country jaunts or for ski buffs who live in flat areas.

The clever part about the drive is that, while the chain always runs in the same direction, the augers turn in opposite directions to balance their side thrust. This is done by reversing the bevel drive gears, as at left. You steer by twisting the handlebar to the right or left, like pulling on the reins of a horse. A remote throttle controls speed. Inventor is Miklos Von Kemenczky of Greenbrook, N. J.



Gadget Show on Earth

This month more than 10,000 clever ideas, intriguing devices and far-out gimmicks will be unveiled at the big annual International Inventors and New Products Exposition at the New York Coliseum. Here and on the next six pages, by special arrangement with the show's producer, Patent Exhibits, Inc., is an advance look at some of the most exciting entries

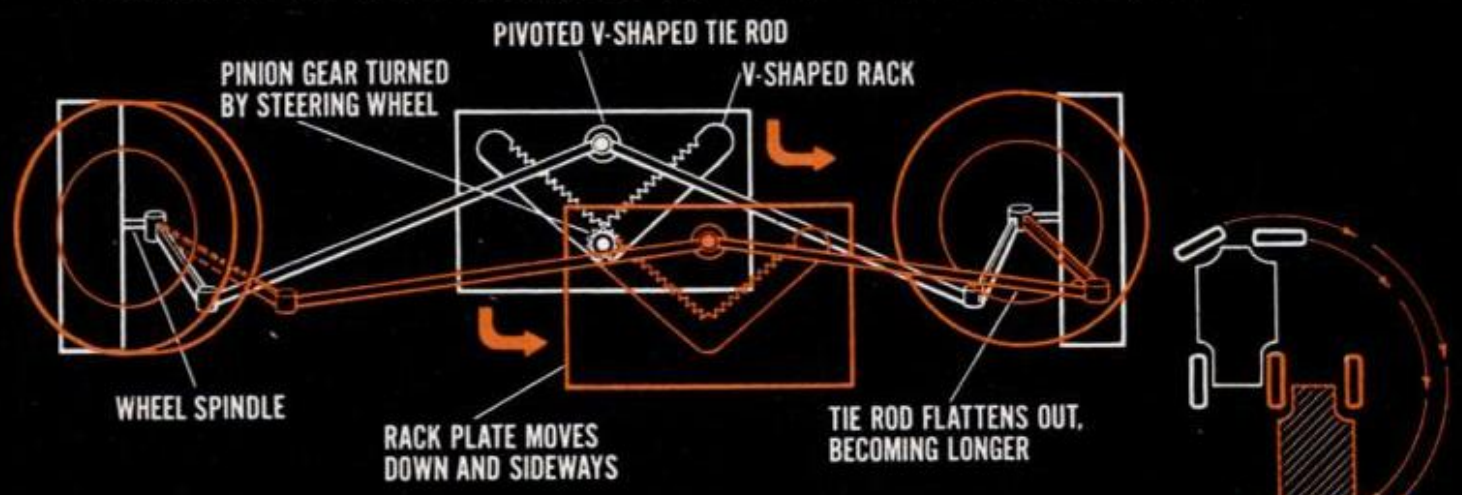
By SHELDON M. GALLAGER

Art by Fred Wolff

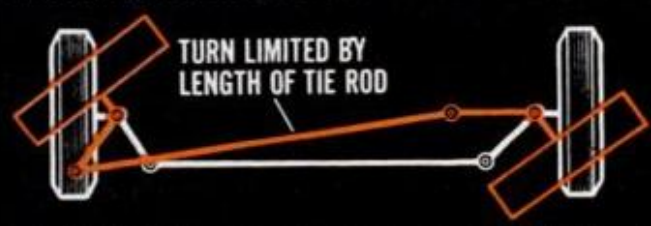
TURN ON A DIME? ALMOST!

PARKING in tight places is no problem for the car below—its wheels turn 90°. In narrow streets, it can turn in its own length, pivoting on one rear wheel. What makes this possible is a special jointed tie-rod linkage. The rack, instead of being straight, is V-shaped. As it's moved sideways by the

pinion gear on the steering wheel, it also rides downward. This forces the tie-rod arms outward, making them progressively longer as the turn tightens. The lengthened rods thus allow the wheels to swing farther around (cars with conventional fixed-length tie rods lock up at about 45°). André Rey of Albi, France, devised the system.

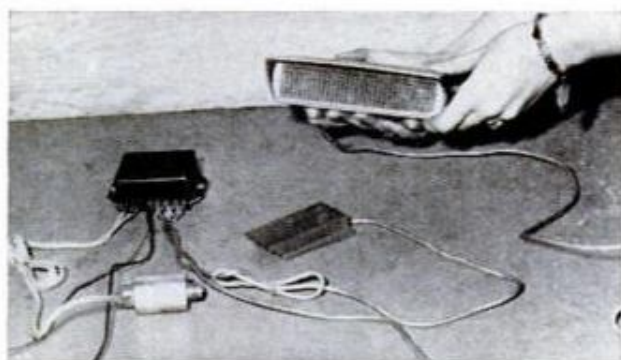
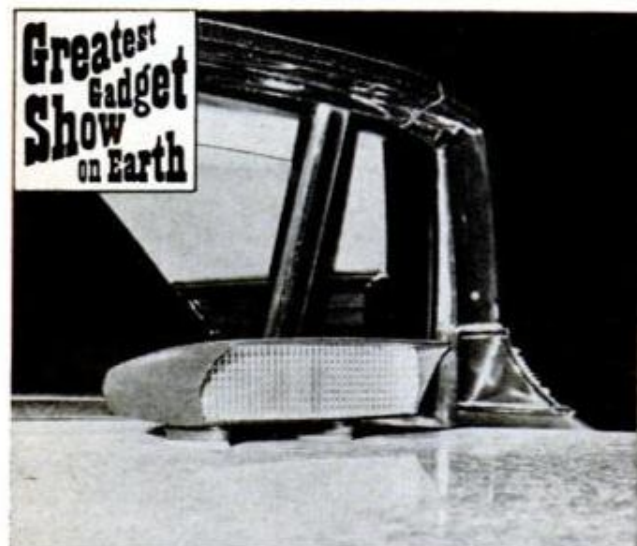
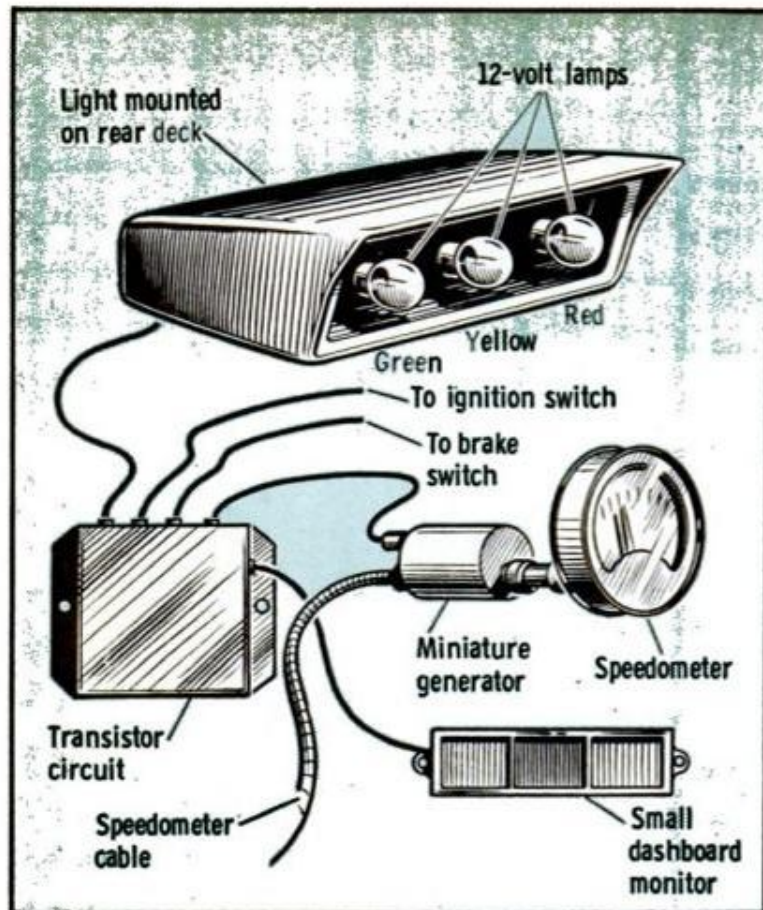


CONVENTIONAL STEERING ARRANGEMENT



NEW 90° STEERING





LIGHT WARNS OF SPEED CHANGES

CONVENTIONAL STOPLIGHTS tell you only that a car ahead is braking. This multi-colored accessory light flashes green if the car accelerates, yellow-green if its speed is steady and yellow only if it starts to slow down before actually braking—helpful in high-speed turnpike driving. Its heart is a clever speed sensor consisting of a tiny generator driven by the speedometer cable—the faster the cable turns, the more current it generates. Electronic circuits trip relays to turn the appropriate lights on or off. Pressing the brake adds red. Inventor is Norman H. Dankert of Michigan City, Ind.





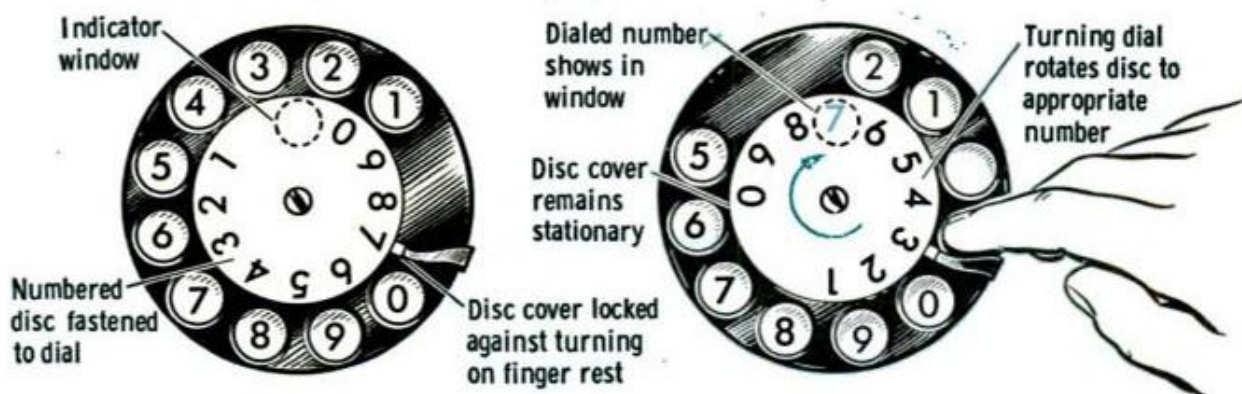
TWO-WAY TOOTHBRUSH DOES A SPLIT

YOU CAN CHANGE the shape of this toothbrush at will. The head consists of two curved rows of bristles mounted on pivots. With the rows side by side, you have a small, hook-shaped brush for getting in hard-to-reach spots. The handle is made in two strips so that sliding one over the other provides a bell-crank action that swings the bristles outward. This gives you a wide curved brush for scrubbing teeth in front. Raul Eklund of Lincoln Park, Mich., invented the convertible toothbrush.



SELF-SERVICE GAS PUMP

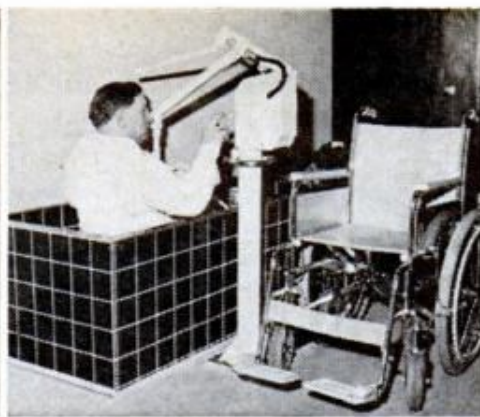
YOU PUMP your own gas with the system devised by Wilfred Smeiman of Dana Point, Calif. You drop a credit card into a slot, dial a secret code number, and the amount of the sale is electronically recorded and charged to your account. The idea could also be used for supermarket checkouts, self-service department stores and the like.



PHONE DIAL REMEMBERS FOR YOU

EVER GET halfway through dialing a long phone number and forget which digit you were on? This clever telephone attachment ends the guesswork. As you dial each digit, it shows up in a small window, helping you

to keep track of the number. A numbered disc turns with the dial. A cover plate with a window hole in it fits over the disc so that each dialed number shows up in the window as the dial is turned. Maurice Darimont of Jalhay, Belgium, designed the accessory to fit on any standard telephone.



PUSHBUTTON WHEELCHAIR HOIST

YOU'D NEVER GUESS that a wheelchair invalid could get himself in and out of a bathtub without help. With this electric-hydraulic hoist, invented by G. W. van Gerven of

Valkenswaard, Netherlands, he can do just that. Padded arms mounted on top of a pedestal grasp an invalid around the knees and shoulders, lift him out of the chair, then swivel around in a half circle and lower him gently into the tub.



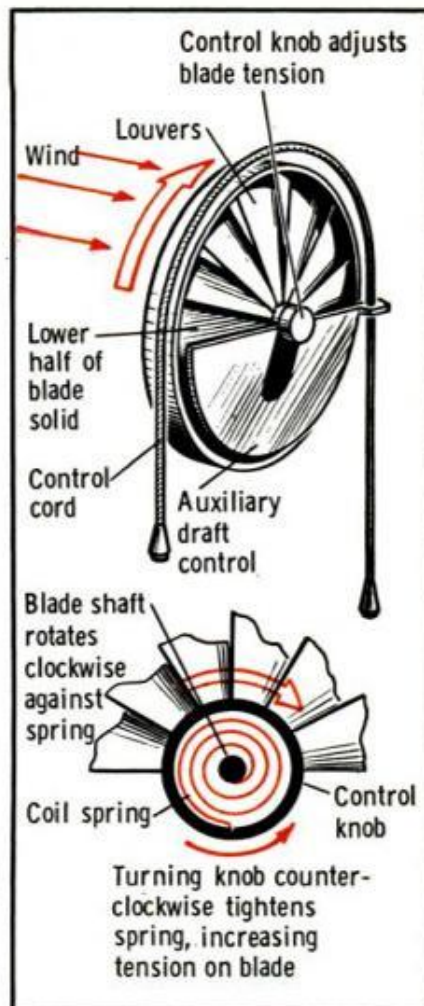
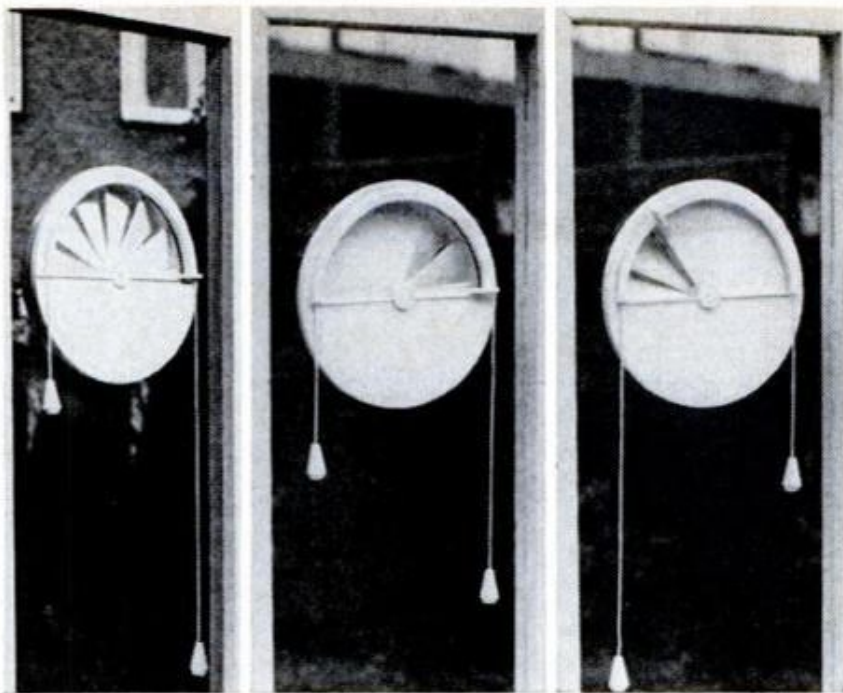
POP-UP MAIL FLAG

WHEN this flag flies up, you know the mailman has arrived. The counterweighted arm is held down by a tab under the door lip. When the mailman opens the door, the weight falls and the flag swings up. Aldo Margoni of Monongahela, Pa., invented it to supplement the regular mail-pickup flag, not used much today.



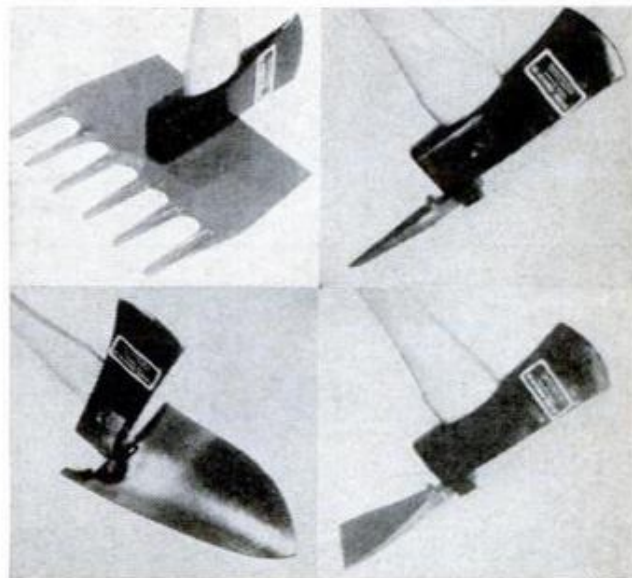
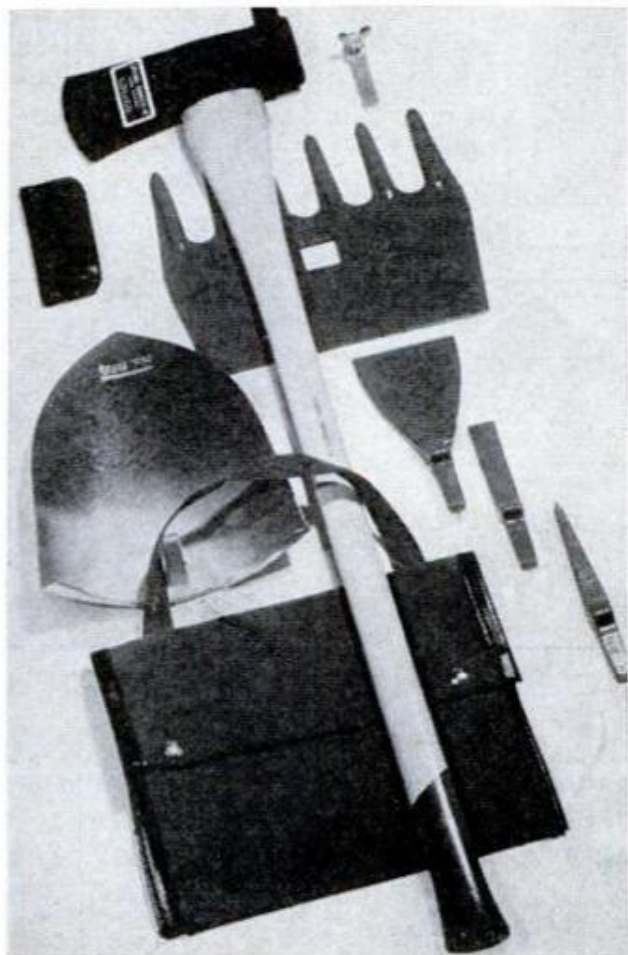
SLIP-IN SHOE RACKS

THESE quick-grip racks keep shoes flat and neat without the need for shoe trees. You just slip a shoe into the toe clamp and slide it forward in the track until the heel hooks under another clamp in back. Spring tension holds the shoes snugly and allows the racks to adjust to different sizes. Allsop Automatic, Inc., makes the racks for wall mounting or in a four-way swivel caddy.



THE HARDER IT BLOWS, THE LESS YOU FEEL IT

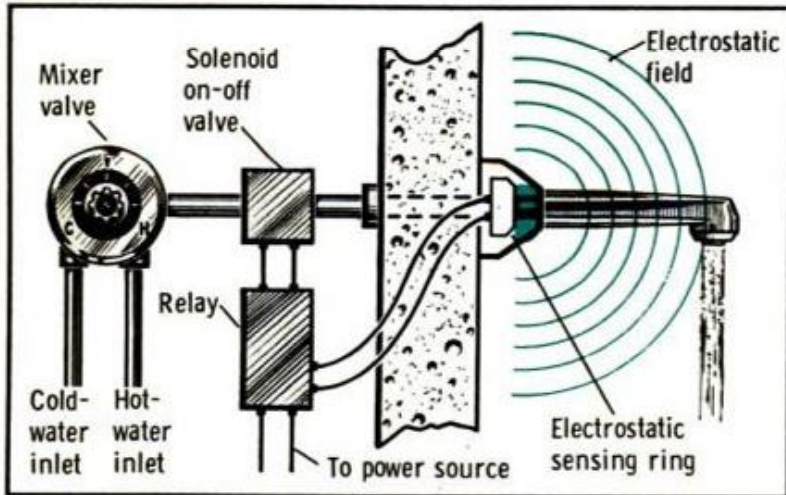
THERE ARE NO SUDDEN DRAFTS with this ingenious self-closing vent. If it starts to blow, air pressure rotates the louvered disc, shutting the vent (center, above). As the wind slackens, a spring forces the louvers open again. Vent area can also be adjusted manually (right). Inventor is E. M. van de Pol of The Hague, Netherlands.



IT'S AN AX, IT'S A PICK, IT'S A . . .

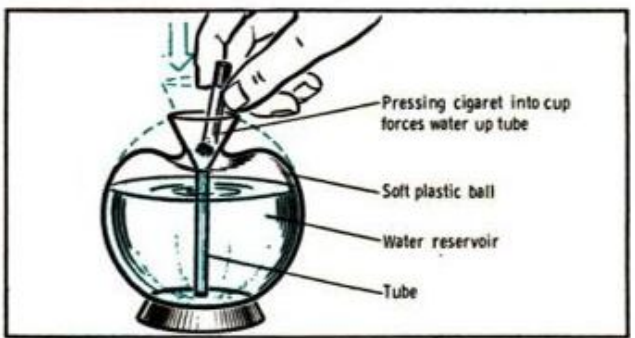
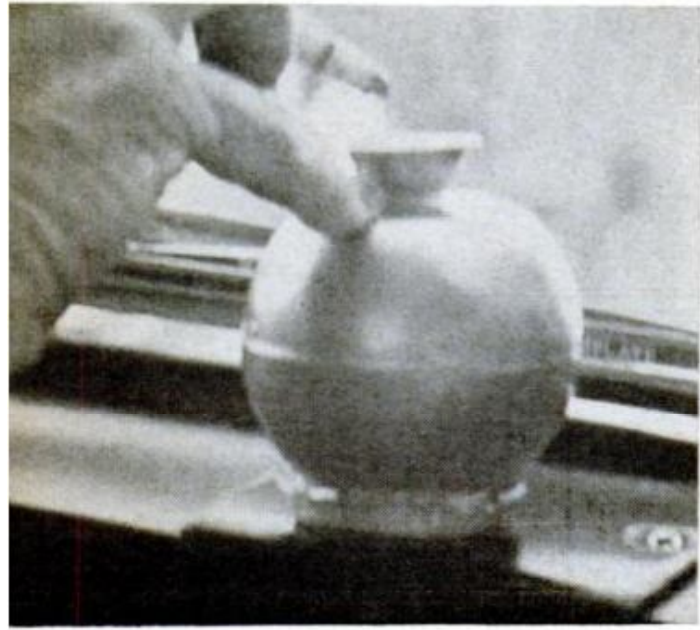
IF YOU COULD TAKE only one tool into the wilderness with you, this many-headed ax would be a good choice. Interchangeable attachments slip into a socket in the ax head and quickly convert it to a pick, hoe, mattock, rake and shovel. Fred Shandel of Albion, Calif., made the tool for campers, sportsmen and military survival kits.

**Greatest
Gadget
Show
on Earth**



LOOK, MA, NO HANDLES!

YOU'RE SEEING RIGHT—this faucet has no valve handles. It turns on and off almost magically at the wave of a hand. The trick? Moving your hand near the spout disturbs an electrostatic field, triggering a solenoid valve that controls the water flow. The West German firm of Rokal GmbH developed the electronic faucet for hospitals and public rest rooms to save touching dirty handles.



FIRE EXTINGUISHER FOR CIGARETS

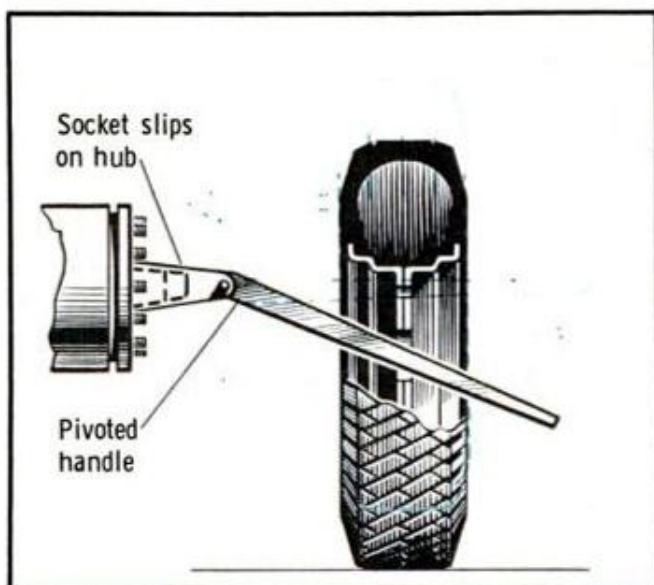
THIS WATER-FILLED BALL can't spill, but press a lighted cigaret into it and the water rises in a tube to put out the stub. It was devised by Kai Ferrelli of Hollywood, Calif., to lessen the danger of fire, especially when smoking in cars.



STADIUM SHELTER IN A SUITCASE

WATCHING cold-weather sports would be more comfortable with this portable seat and insulated leg bag designed by Flor-

ence W. Du Priest of Waco, Tex. At the stadium, you just open out the seat, climb in, and you're warm and dry for the whole game. For easy carrying, the bag and seat fold to the size of a small suitcase.

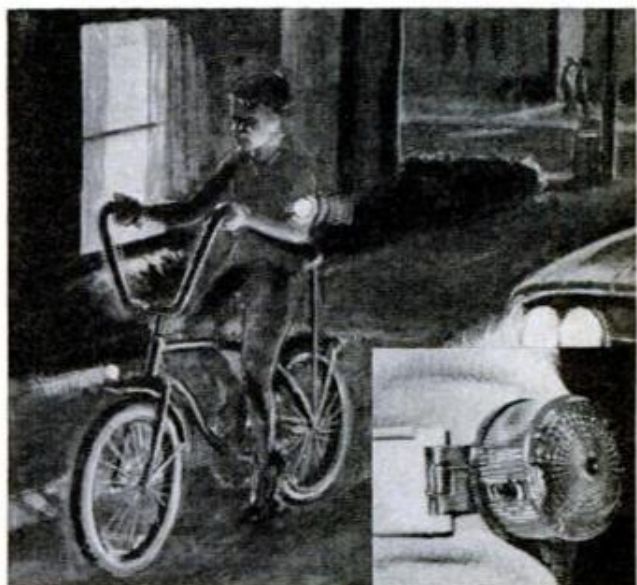


CHANGING A TIRE THE EASY WAY

HORSING A HEAVY WHEEL up on a jacked axle and getting the lug holes lined up is the hardest part of changing a tire, thinks Walter Dombeck of Ellwood City, Pa. To solve the problem, he came up with this handy lever. You slip it onto the axle, pull up on the handle, and lift the wheel neatly onto the hub. Then you line up the holes and slide the wheel onto the studs.

See these and other inventions at the Inventors Show, Sept. 12-15, at the New York Coliseum.

SEPTEMBER 1968



ARM FLASHER FOR BIKE RIDERS

IF YOU PUT warning lights on cars, why not on people? That's the idea behind this flashing armband lamp designed to protect bike riders and pedestrians on the road at night. The battery-powered yellow flasher slips around your arm and is held by padded spring clamps. The Egebo Co. of Dijon, France, markets the safety device and hopes to sell it in this country.

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VOLKSWAGEN

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



Handling's Fun, Economy's Tops, But Hold Tight on a Windy Day!

By **BILL HARTFORD**, Associate Auto Editor

Photos by Irving Dolin

"I take my grandsons fishing in it and they all love it!" beams an Iowa grandma about her new, automatic stick-shifting "Beetle."

Fishing? But that's impossible! Even if lots of owners say the "Bug" is extraordinarily air and watertight, and other sources report VWs have gone into the drink and stayed afloat for quite awhile, you simply cannot praise its "seaworthiness." There's no such category in our Owners Report!

Owners who stuck to the questions—and who stick to the road!—tell us about their VWs in no uncertain terms. They have no use for the vagaries of style; it's eating up asphalt at a few cents per mile that counts. Not that they don't pose their VWs in the driveway like all proud, new car owners, but, as they tell us, they do it with the satisfaction that the style is constant—even classic—functional and, to quite a few, strangely appealing.

But when they leave their driveways,

FAMILIAR SHAPE is part of landscape. But owners are aware of such things as rakish new gas-filler flap!

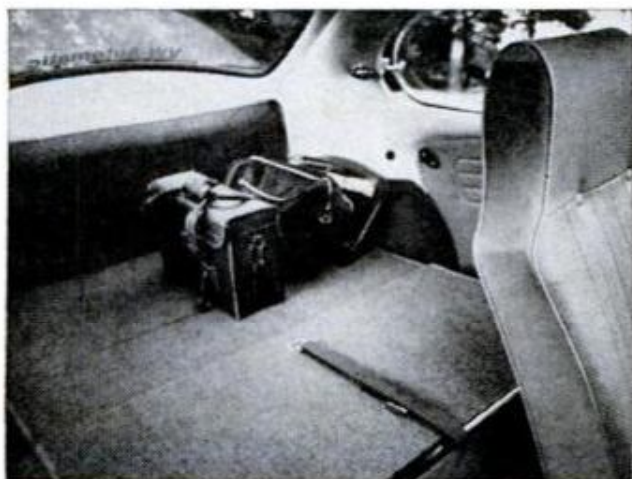




REAR-SEAT PASSENGERS agree that it beats walking. Luggage well behind the seat is convenient, however

both first-time and old-time Beetle owners can tell you what puddle-jumping is all about: First and foremost, it's fun. "I like the fun of driving it; it does things other cars can't," says a Delaware serviceman. "It's fun, and with the automatic stickshift I have a very happy wife," gloats an Arizona student. "It sets you free!" yells a Tennessee civil servant. "I love the way it handles," beams a Louisiana secretary.

A Utah welfare case worker finds it "fun to drive," but adds, "you can't afford to be hit because of its 'squashability.'"



FOLD-DOWN ARRANGEMENT of back seat is standard. Owners like semistation-wagon configuration

(It may be a lightweight, says a New Mexico writer, but "I feel more secure in my VW on the highway than in my bigger and heavier country sedan.") "Nimble" is a Maryland illustrator's word for his Bug. And, it's "fun taking hills and curves," says a Kansas student.

It's not all fun, however. A charge of poor "roadability" is the biggest indictment owners level against the VW's driving characteristics. But, as they say themselves, a guilty verdict is only handed down on windy days. "Hard to handle in



HEAVY NEW BUMPERS get praise, but owners find sloping hood takes beating from stones and insects

the wind," says a Nebraska investment analyst. "It's sometimes a bit difficult to keep on the road in the strong Delaware wind," says a teacher. A Maryland chemist finds "drifting in high winds" annoying.

A Texas housewife, who has learned to ride with the gusts, sympathetically says, "Complaints? None really, except the wind sure gives that car a bad time." A West Virginia civil-servant applicant likes the fact that he can "keep the VW wound tight all day long," but finds that "at high speeds when the wind is blowing hard or a tractor-trailer passes you, the car sways a little." A South Carolina production supervisor doesn't put it that mildly, however: "I hate to drive it in wind or pass a big truck at high speed . . . real nerve-racking . . . nearly get blown off the road." But he, too, is a forgiving owner: "Other than that I love everything about it; once you've had a VW you never want to be without one."

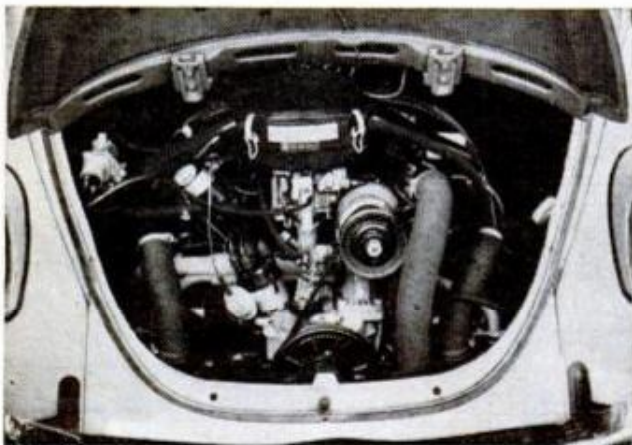
A Georgia master barber, who also gets



FRONT-SEAT ADJUSTMENTS allow comfortable positioning for drivers under five feet to over six feet tall

a bit nervous at high speeds, says he picked the VW "because you can drive it faster and harder than most small cars." But he'd like to see the car "lower to the ground so it can take curves better." Like a Georgia production supervisor, who likes the VW's "sport car feel," he must be running some real fast qualifying heats down to the shop. A law student in Carolina who also likes sports cars, says he "couldn't afford a Porsche, so got the best car mechanically."

His request that VW offer an optional Porsche engine for the Beetle is only one of many various options and refinements owners suggested. A *decrease* in horsepower is what a Minnesota steelworker wants; a "passing gear" with the automatic stick, requests a Tennessee telephone operator; "power windows," says a New York marketing man; "instruments instead of idiot lights," says a Kentucky radio engineer; "tinted glass!" squints a Georgia accountant; "a 13-gallon fuel tank," says an Indiana switchman; "a speaker in the roof so everyone can hear the radio," requests an Indiana tool and



IT'S NOISY, only 53 hp, a poor source of heat in winter, but is extremely reliable and economical



BUILT-IN HEADRESTS annoy drivers, passengers; restrict visibility enough to be a hazard, say owners

die man; "front luggage compartment designed for my golf clubs," says Delaware supervisor. "A convertible that doesn't look like a doll carriage," is the dream of a New Hampshire mechanic; and a "simple, splined shaft instead of the puny round shaft and setscrew to mount the windshield wiper arms," is one plea of an airline pilot/flight engineer who would probably be welcome in VW's "improvements" department.

If it doesn't have everything for everybody, what it does have is great economy—the best thing about the car to four out of five owners. Mileage figures for the manual four-speed and automatic stick-shift are given in the accompanying chart.

But fuel economy is only part of the story to VW owners. An Oklahoma office worker tells the rest, while summing up the feeling of the typical owner: "Good



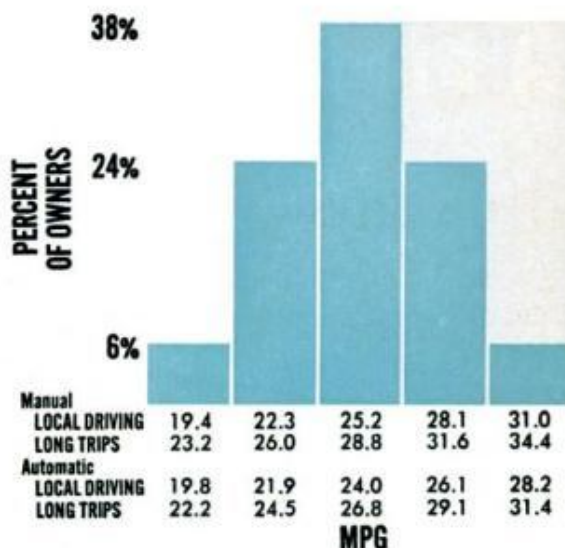
FRONT LUGGAGE COMPARTMENT is not easy to use, but owners like its capacity and efficient layout

fuel economy along with durability, minimum trouble and repair expense, and moderate depreciation combine to make the VW a real economy car." This owner backs up his conclusions with some rather impressive calculations. This is his sixth VW since 1960. He drove his first five a total of 209,474 miles, with the total cost of fuel oil, maintenance, taxes, insurance and depreciation being \$7,094.55. As he says, that's 3.3868 cents a mile. "My cost on Fords and Chevys was approaching nine cents a mile which I consider excessive." He averages 25.03 mpg overall, with his automatic stickshift, and with that, we'll let him have the last digit on VW economy. *Punkt!*

A couple of owners have a good word for the front seats VW introduced on the '68 models: "Front seats with built-in headrests add comfort to the ride," says an Indiana teacher; and "new, front, airplane seats are great," says a Georgia cab driver. A third owner, a Maryland store manager, praises the seats, too, but he has a suspicion, and correctly, that he's in the minority: "This sounds crazy but I liked the high seats at first glance."

From here on in the high-backs prove devastating to VW's renowned "annual

VOLKSWAGEN FUEL MILEAGE CHART



improvements" list. Federal safety standards notwithstanding, there must be a better way: "The high-back seats are hazardous for seeing the cars behind you," says an Alabama dental technician, who goes on to mention that he racked up \$321 worth of damage when he was hit while changing lanes. Next customer: "Change the seat backs; I hate them. The only reason I'm filling out this questionnaire is to

(Please turn to page 193)

Summary of 1968 Volkswagen Owners Reports*

Total miles driven 1,073,718

Average miles per gallon:
 4-speed manual transmission
 local driving 25.2
 long trips 28.8
 Automatic stick shift
 local driving 24.0
 long trips 26.8

Specific likes:
 Economy 82.4%
 Handling 68.8
 Durability 15.1
 Comfort 12.2
 Workmanship 8.3
 Size 7.8
 Trade-in value 6.3
 Style 5.8
 Power 5.9
 Roadability 5.4
 Construction 5.4
 Price 4.9

Specific dislikes:
 Roadability 19.5%
 Front seats 18.9
 Dealer service, availability and cost 12.4
 Rear-seat room 11.8
 Brakes 11.8
 Power 8.3
 Engine noise 6.5
 Slow, ineffective heater 6.5
 Vent system 5.9

What changes would you like?
 Eliminate high-back front seats (poor visibility to and from rear) 19.8%

More power (engine option) 11.7
 Heater (slow warm-up, inadequate at low speeds) 10.5
 More room in rear 9.3
 Vent system 8.0
 Brakes (eliminate screech) 6.2
 Wing-window knobs 4.3
 Trunk room 3.7

Transmission:
 Manual 4-speed 78.6%
 Automatic stick shift 21.4

Why the automatic stick?
 For wife/daughter 41.9%
 Don't like shifting in heavy traffic 41.9
 Just learned to drive 4.7
 Just like it 4.7

Had any mechanical trouble?
 No 62.9%
 Yes 37.1

What kind of trouble?
 Brakes 26.9%
 Electrical 16.7
 Carburetor 16.7
 Valve-cover gaskets 7.7
 Automatic transmission 6.4
 Automatic choke 6.4

Dealer repair satisfactory?
 Yes 64.3%
 No 31.4

Why the VW?
 Economy 29.3%
 Reputation 27.9
 Past experience 23.6

Durability/reliability 22.6
 Resale value 19.7
 Service availability 17.8
 Price 9.6
 Handling 9.6
 Construction 8.7
 Quality 7.7
 Performance 7.7
 Workmanship 7.2

Would you buy another VW?
 Yes 89.6%
 No 10.4

Is the VW your only car?
 No 61.7%
 Yes 38.3

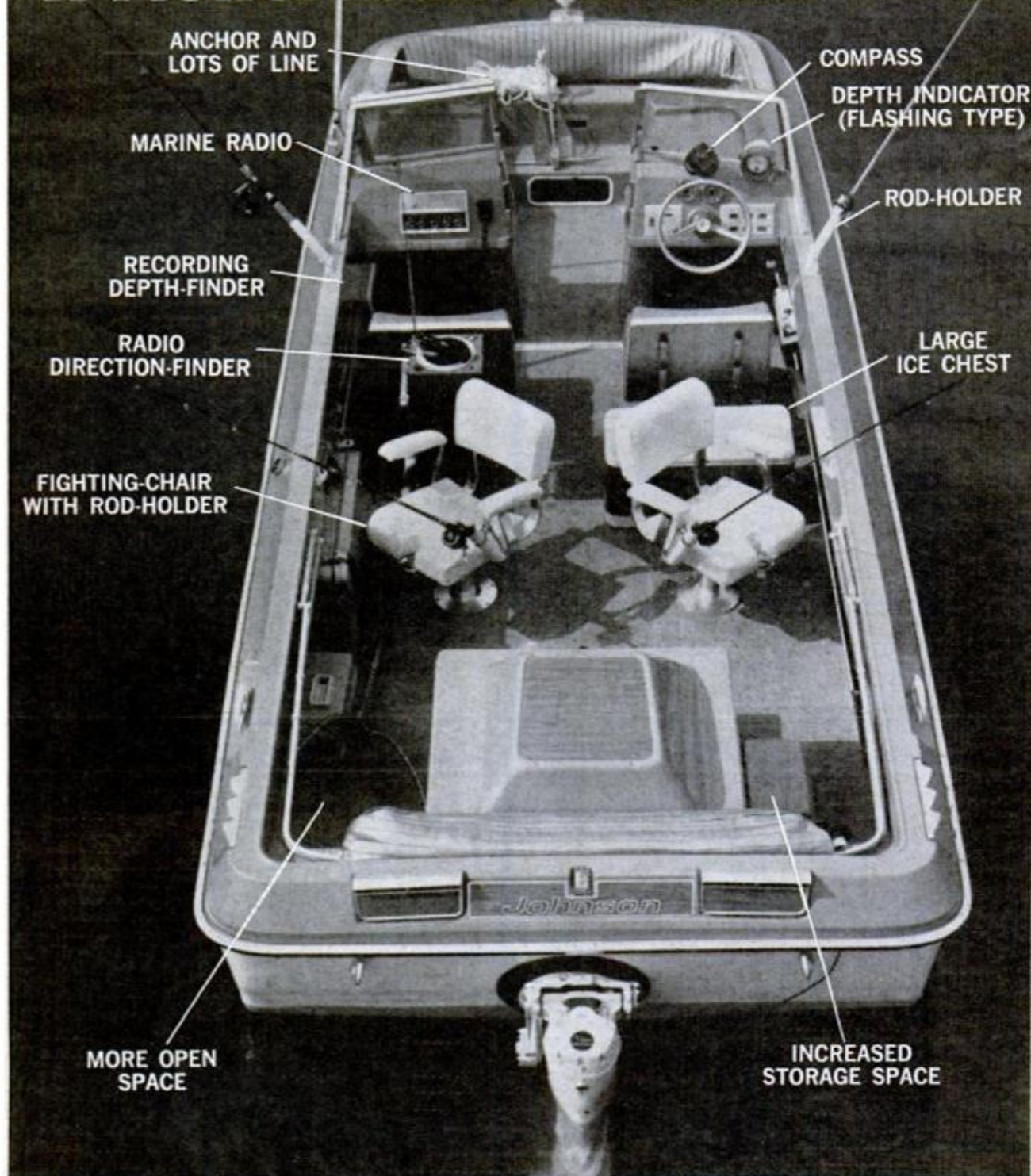
Other cars owned:
 Chevrolet 27.1%
 Ford 17.8
 Volkswagen 14.0
 Pontiac 14.0
 Oldsmobile 9.3
 Rambler 7.0

What options/accessories?
 Radio 80.7%
 Whitewall tires 32.0
 Opening rear windows 26.0
 Leatherette interior 17.1
 Undercoat 12.7
 Bumper guards 11.0
 Sun roof 9.6
 Cigaret lighter 8.3
 Gravel guard 8.3

Age distribution of owners:
 15-29 50.5%
 30-49 40.0
 50 plus 9.5

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

A Fisherman's Dream Boat



Here's how you can rig your boat to make it a great sport-fisherman

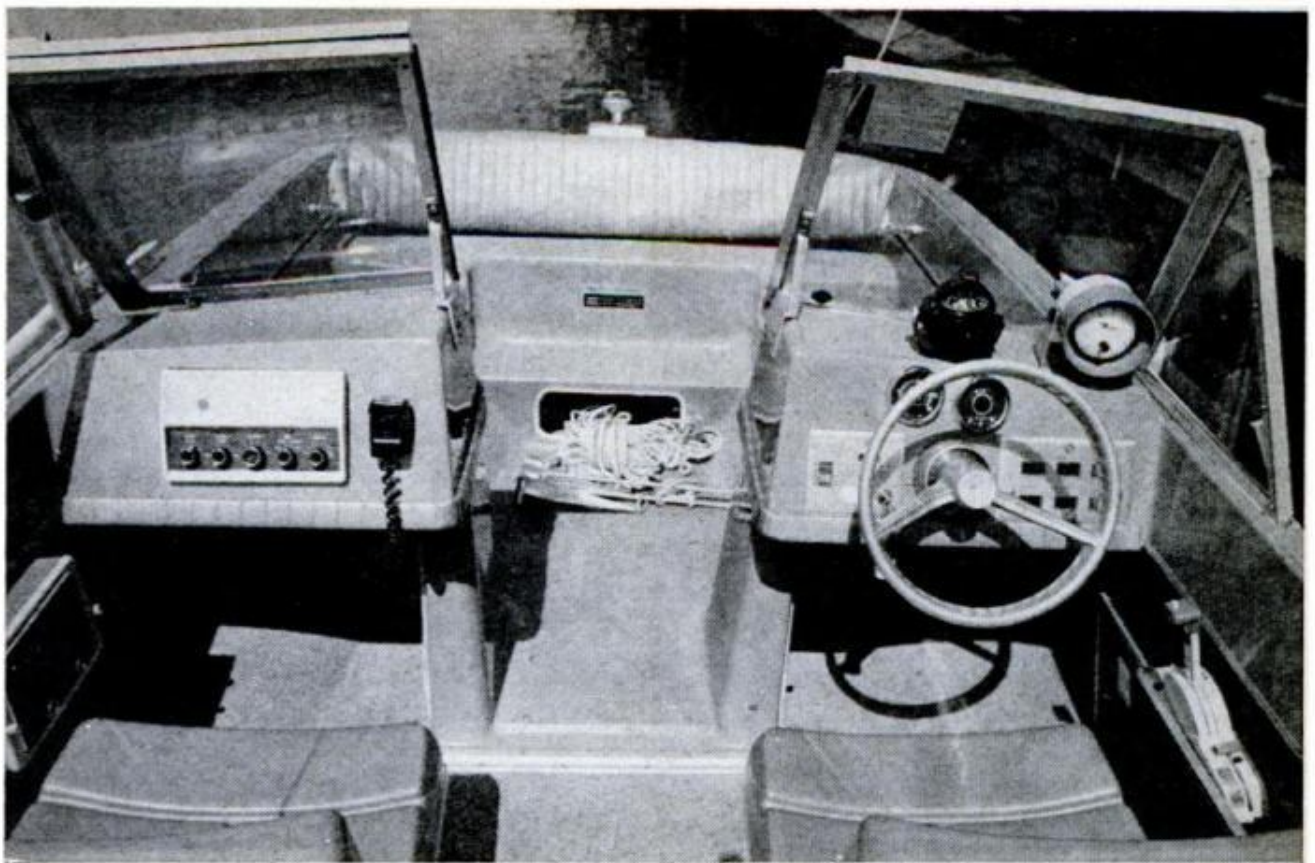
By PAT RICHARDS

YOU CANNOT BUY this boat as is. You'll have to equip it yourself.

But once you've added the electronic and fishing extras, you'll have a snappy sport-fisherman that'll handle almost any kind of fishing water—the swells off Mon-

tauk Point, the chop of the Gulf, the ripples of Lake Powell, the uncertain emotions of the Great Lakes. And this type of boat is trailerable to boot.

It was in the wake of a 40-mph line squall that blew up 15-foot waves in Lake



CLOSE-UP VIEW of installation of main electronic components. Note storage area forward for the anchor

Michigan that the idea for this boat was born. That was just a year ago this month. During that storm, more than 200 boats swamped or capsized. Miraculously, only seven persons drowned. Many fishermen were poorly equipped. They had no way of getting bearings once lost—they had no compasses, no charts. Others, without radio, never knew the storm was advancing.

Many were "inland" fishermen who didn't know that much about open waters. They had trailered their small boats to Lake Michigan, which can kick up in minutes to become one of the nastiest pieces of big water in North America. They were following the Coho salmon—many were too far offshore.

It was only last May that a tougher, unpredicted squall knocked down hundreds of boats along the Northeast coast.

Winds hit 60 mph, and the air crackled with rescue requests from Sunday boatmen. More than 100 calls for aid were recorded off Cape Ann, Mass. In Long Island Sound, distress frequency 2182 kc was jammed with rescue traffic.

Many of these boatmen knew what they were doing, and had the right gear. But others were not properly equipped when the storm hit, so had a rough time.

Following the Lake Michigan squall, engineers and boat designers at Johnson

Motors set out to build and equip a trailerable boat that could fish big waters safely, and which could get out of big trouble if necessary. They worked with electronics specialists from Ben-Mar, the marine division of Bendix Corp. Here's what the experts feel is necessary to transform any small fishing boat into the ultimate in a trailerable sport-fisherman. You can install any or all of the equipment depending on your needs and pocketbook. Prices listed are suggested retail.

The basic boat is the Johnson 191 Big

THE INTERIOR of the 19-foot Johnson 191 is designed to provide maximum room for fishermen



Fisherman—a 19-foot, gull-wing-hulled utility runabout with an 88-inch beam, 24-to-40-inch freeboard, and 81 square feet of open cockpit space, thanks to a walk-through dash and windshield and a convertible foredeck top that opens to leave the entire deck space clear.

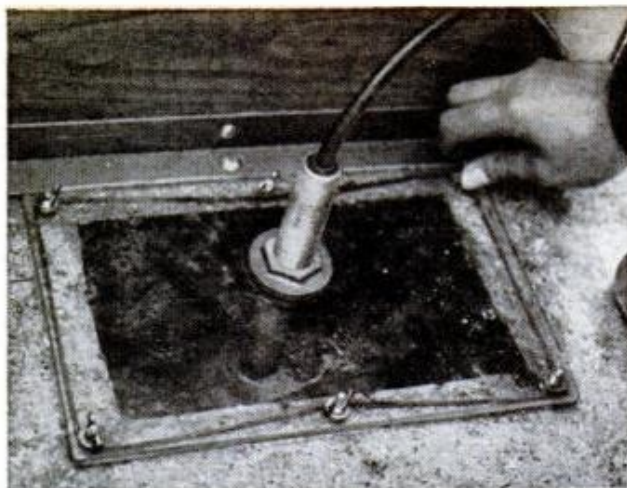
The Dick Cole-designed "Sea Foil" hull, an improvement on his original cathedral types, rides like a 25-footer even at speed through a good chop. With its high freeboard and deep, flared entry, it rides quite dry, even in a blow. The convertible top snaps in place to form a foredeck, and the windshield closes watertight to turn incoming water as nicely as any one-piece design. An optional full convertible top (\$130) with snap-on side curtains will button the boat up into a rainproof shelter, but with the stern curtain left off, you can troll dry through any rainstorm.

This boat is powered by a 120-hp, OMC stern-drive. Though not a great deal of power for the hull, it will plane four fishermen and their gear at an easy 25 mph, yet when throttled back to 500 or 600 rpm, it trolls as quietly as a five-horse outboard.

To this stock Big Fisherman (\$4595 f.o.b. Waukegan, Ill), Johnson's engineers added accessories and safety equipment until they were convinced that their boat was as comfortable and safe as a saltwater sport-fisherman—yet could be trailered easily at expressway speeds, and be planed comfortably for runs to the fishing grounds.

Since most big-game fishing means trolling, they removed the rear-facing

REGULAR COPPER SCREENING is all that's used on the engine compartment lid to cut down on static



PLEXIGLAS COVERS the inboard well for the depth recorder transducer. The well is filled with water

runabout seats and replaced them with two Pompanette fighting chairs (\$136 each). You may need only one. The flange-based chairs are secured to the deck with ordinary Molly bolts, which expand into the closed-cell flotation material beneath the fiberglass deck just as they would in the insulation behind a wall in your home. With their built-in rod holders, the fighting chairs are perfectly comfortable on long trolling runs, yet shock-absorbing enough for running through a chop. For the two bow-facing seats, adjustable nylon rod holders were mounted on the gunwales, just behind the windshield edges.

The built-in water-ski rack down the inside of the starboard cockpit wall serves as an excellent rack for fishing rods, too. A shorter rack on the port side holds other tackle secure and leaves room for a 20-gallon fuel tank, plenty for a day's running and trolling with an extra margin for safety.

For finding fish, keeping track of depth and bottom type and for navigation as well, two depth finders were installed—one flashing-dial type (\$120, DI-9) for instant readings, and one recording type for its built-in memory tape (\$370, DR-19). Ordinarily, the transducers for depth indicators are either mounted in a hole cut through the hull, or hung over the side or the transom. Either way, they are difficult to install permanently, and create drag when the boat is run at speed.

So the engineers tried two new, drag-free, easy installations. The transducer selected for the flashing-dial indicator is a flat-bottomed attachment that screws onto the transom with its bottom parallel

(Please turn to page 196)



Seats on wheels

Twenty-four giant, rubber-tired sections can be wheeled into place to increase seating space in San Diego's new sports stadium.



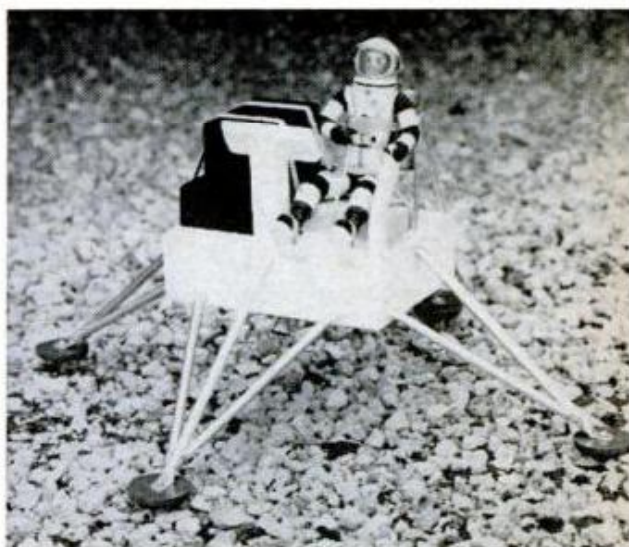
Can't blow its top

Heavy steel cables anchored in the ground keep the roof of this Bavarian guest house from blowing away in high winds.



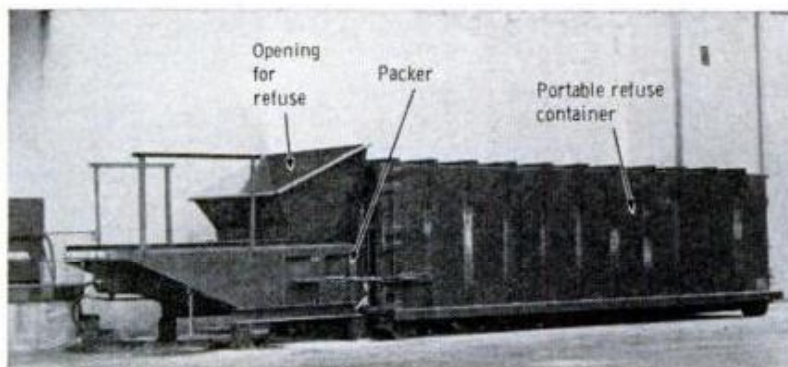
Music wherever it goes

Youthful San Francisco musicians perform through a \$30,000 vehicle created by Thomas Organ Co. The car has an organ, 14 speakers and 32 input jacks for guitars.



Moon runabout

Under study by TRW, Inc., is this model of a proposed "lunar flyer." It might someday be carried aboard Apollo lunar landing vehicles and used for exploration or rescue.



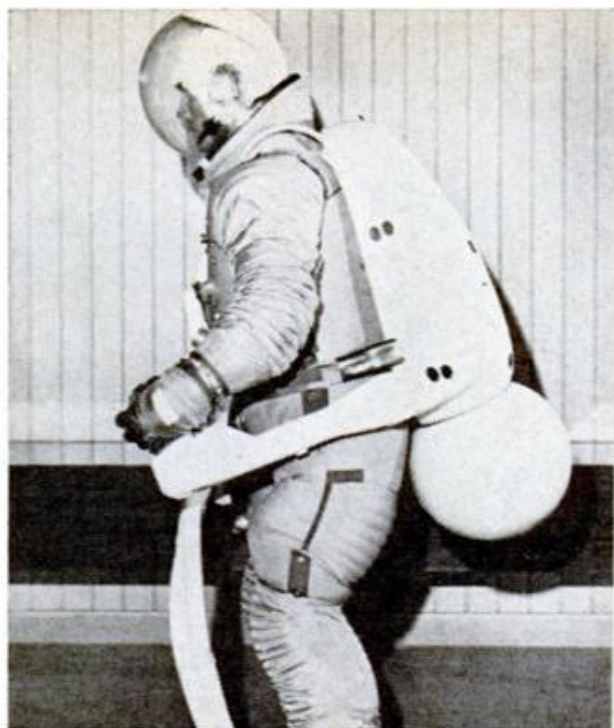
And there's no garbage man banging lids at 6:00 a.m.

Refuse disposal is quick and clean with the Swiftainer system. Trash, dumped into the packer, is compacted hydraulically in a portable container and carried off (right) for dumping.



No strings attached

No wire connections are needed to operate the new CBS Minicam Mark VI color television camera. It transmits picture information up to three miles via microwave to a base station. The portable unit weighs 18 pounds.



Space-station outboard

An oxygen jet-powered maneuvering unit is undergoing tests to determine its suitability for astronauts in space-station tests. The developer, North American Rockwell, has "flown" it on friction-free air bearings.



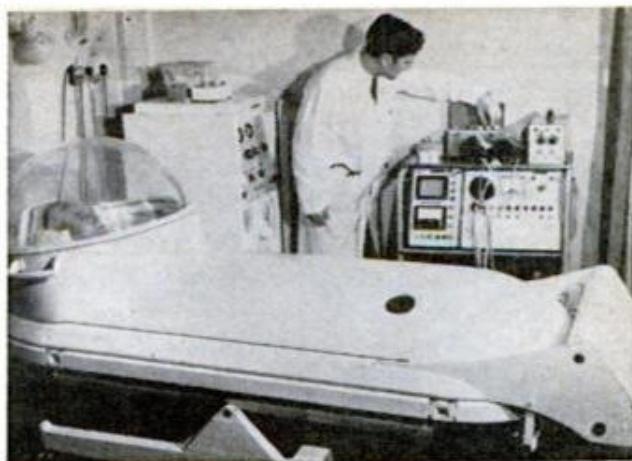
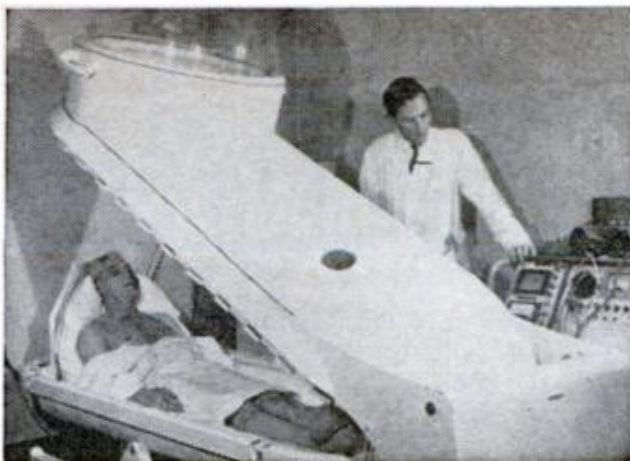
Hot spotter

A radio-controlled cart has been designed by German scientists to enter contaminated areas and map out the "hot spots" in the event of a nuclear accident.



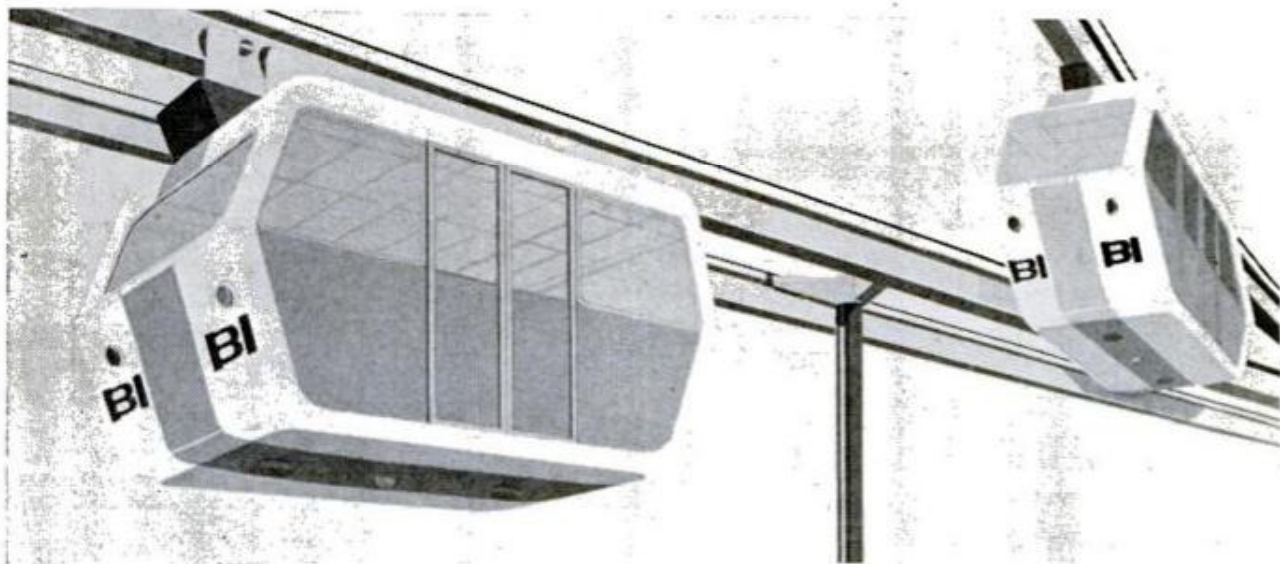
Live TV from the moon

Apollo astronauts will use this seven-pound camera to send live television pictures back to Earth during the United States' first moon flight. It's a Westinghouse product.



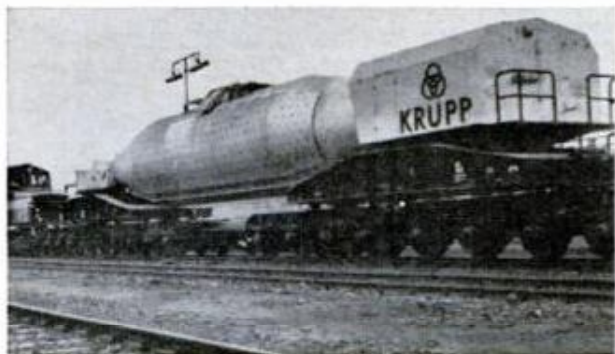
Hyperbaric oxygen bed saves heart patients in London

A single-patient bed system for administering hyperbaric oxygen treatment has been developed by the Medical Group of Vickers. With the chamber closed, the patient is in an atmosphere of pure oxygen at twice normal atmospheric pressure. Tests at Westminster Hospital, London, indicate heart-attack death rate can be halved with this treatment.



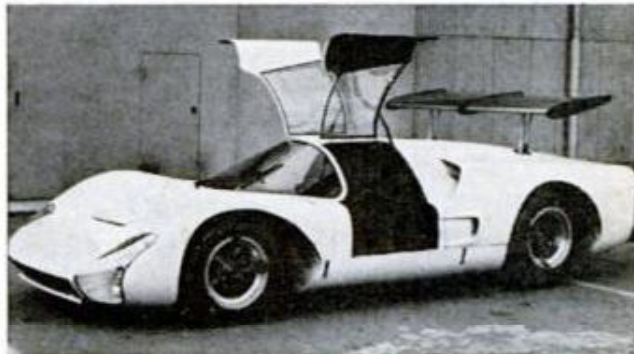
Air passengers will ride to terminal on a monorail

Monorail cars like those in the drawing will transport passengers and baggage between the Braniff terminal at Love Field, Dallas, and a remote parking lot. The three-quarter mile, overhead-rail system is expected to be completed by the end of this year.



Hot cargo

Firebrick and asbestos line the interior of Krupp's new "torpedo cars" which are designed to carry molten steel from one plant to another. Each car carries 165 tons.



Nissan's new racer

A new racing car from Japan, the Nissan R381, has a 5.5-liter engine that turns out 450 hp, driving the machine at a top speed of 198 mph. The body shell is fiberglass.

Don't Rely on 'Idiot Lights'

HOW TO INSTALL GAUGES THAT REALLY TELL YOU SOMETHING

By MORT SCHULTZ

WHEN IT COMES to instrumentation, even the auto manufacturers can't agree. A few years ago, many switched from those good old-time gauges to lights to warn you of electrical system, oil pressure or cooling system trouble. Now, some have switched back to gauges again. Still other manufacturers provide only one gauge, usually water temperature, but stick with ammeter and oil pressure warning lights.

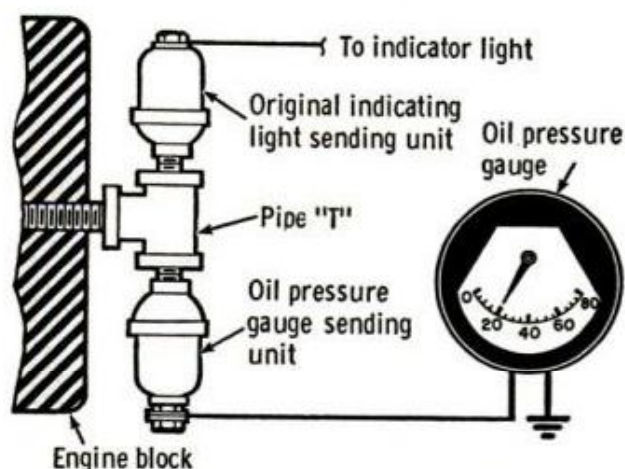
The "idiot" lights may be fine for some people, but anyone with a mechanical savvy who's interested in what goes on under his hood needs instrumentation.

The advocates of warning lights contend that a burned-out bulb, which is the chief danger, seldom occurs. But the other danger is that warning lights are calibrated to flash only when there's a com-

plete system failure or when a given function is working merely in degrees—you don't know if your engine is operating just inside the danger zone, where it's on the borderline of permanent and costly damage.

If you feel half-safe because your car is equipped with warning lights, go ahead and install your own instruments. When buying units, there are a few things to keep in mind. For instance, oil-pressure and water-temperature gauges function either mechanically or electrically.

Mechanical gauges employ pressure lines and cables, and are more difficult to install than those that are electrically operated—but the buffs like the challenge. For the family car though, I suggest the electric type. Just make sure that they are compatible with your car's electrical



OIL-PRESSURE GAUGE can be installed and connected without eliminating dash warning light. A T-pipe in the block will mount both electrical sending units

WATER-TEMPERATURE sending unit on this Chevrolet block operates dashboard indicating lights. It must be removed and replaced with unit in photo at right





THREE-GAUGE CONSOLE from Rite Autotronics is designed for under-the-dash. It's the easiest type to install

system. Most of today's cars have 12-v. negative-grounded electrical systems, so you need gauges designed for them.

If your car is equipped with a generator, the ammeter gauge you purchase need be calibrated only for plus and minus 30 amps. However, most of today's cars are equipped with a 45 or 60-amp. alternator. In this case, be sure to get a gauge that registers plus and minus 60 amps.

Indicating range is not a particular factor with oil-pressure and temperature gauges. Most show the same markings. A 0-to-80-pound oil-pressure gauge graduation, for example, serves virtually all cars. But you should know the normal oil pressure for your engine as specified by

NEW SENDING UNIT for water-temperature gauge is screwed into the engine block using a thread lubricant and the wire is led through the firewall



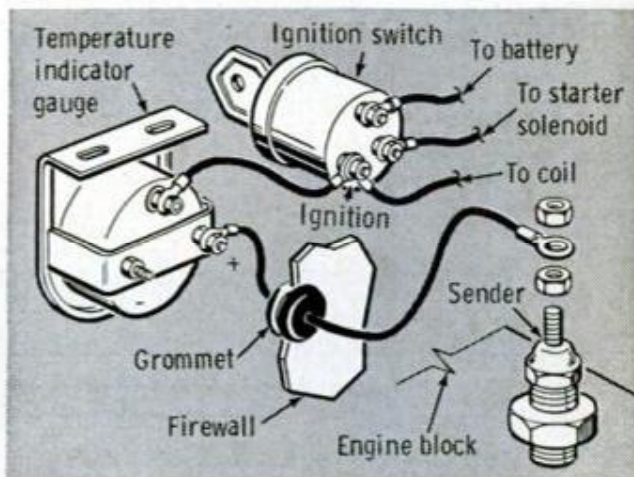
SEPTEMBER 1968

the manufacturers, so the gauge reading means something to you.

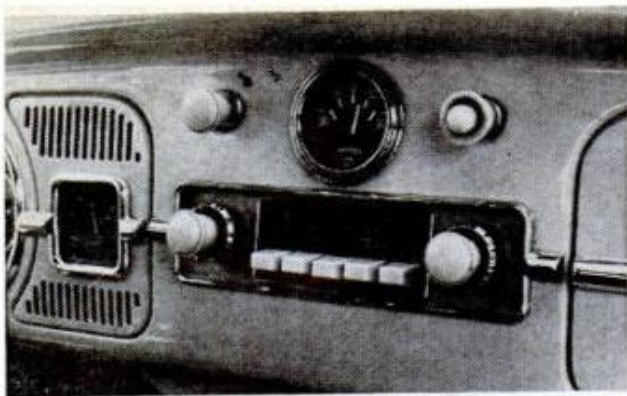
The best coolant temperature for the best engine performance is one that's as hot as possible without boiling out the coolant—anywhere from 180° to 210°. All cars can use a temperature gauge that's calibrated to a maximum of 240°.

Gauges come in many shapes, sizes and prices. Airguide Instrument Co. of Chicago, for example, makes a unique three-in-one gauge which has all functions (oil, amps. and temperature) shown on one dial face. This instrument (Model 1606) is electrically operated and comes with sending units, adapters and everything else needed for installation. It lists for

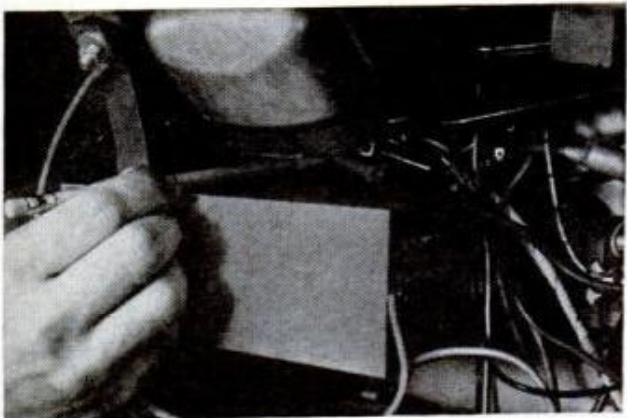
COMPLETED INSTALLATION of water-temperature gauge and sending unit. Negative terminal is connected to ground. Third wire goes to ignition terminal



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CUSTOM GAUGE INSTALLATIONS, as in this VW, are tough but rewarding. One lead from ammeter (below) goes to junction on light switch, other through roof to starter-solenoid lead in rear engine compartment

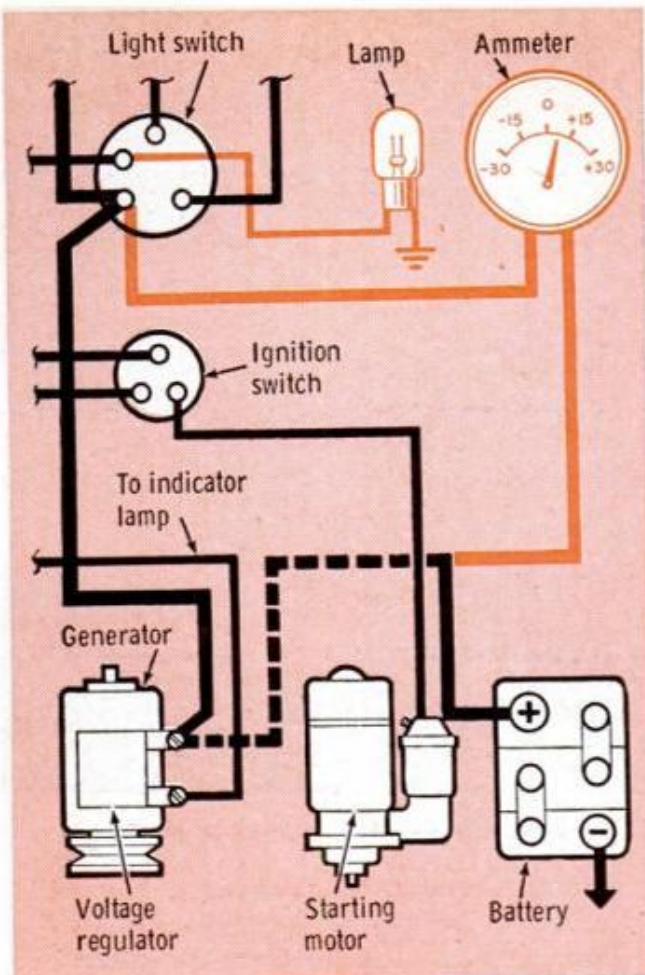


\$44.50, but can be bought for less. One automotive mail-order house, for example, sells the three-in-one unit for \$27.95. An automotive parts dealers in my area sells it for \$26.70.

You can buy good gauges for less. Rite Autotronics Corp. of Los Angeles makes a three-unit console (Model 957) with ammeter, water-temperature and oil-pressure gauges in line on a handsome panel. It lists for about \$30. A discount store in my area sells it for \$18.

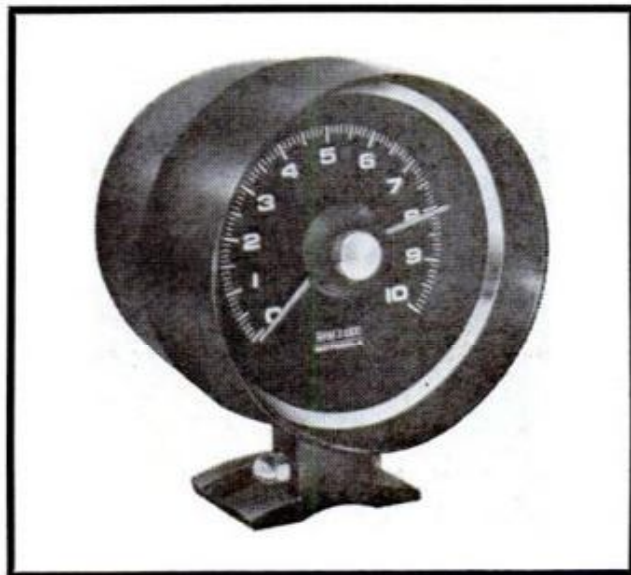
As a further example, Stewart-Warner of Chicago makes two units or retrofitting cars—Model 366-MJ, which has three gauges in a console, and Model 366-MK, which has an ammeter and oil-pressure gauge in a console. The 366-MJ lists for \$28.95, and the 366-MK for \$15.05. If you shop around, you can buy either for about 30 percent less.

The ease or difficulty of custom installing gauges depends almost entirely on your make of car, style of engine and number of accessories. For instance, on a Chevy Six installation is quick and easy. On a big V8 with airconditioning, power brakes and power steering, it's more difficult to get at the temperature and oil-pressure sending units.



The gauge you buy should have complete installation instructions. If it doesn't, I wouldn't buy it. The instructions should thoroughly discuss the connections that must be made for the unit to work properly. No instructions can be given for placing the gauge or gauges on your dashboard, however. That's up to you. The Stewart-Warner ammeter on

SOLID-STATE TACHOMETER for top-of-dash or steering column mounting is new from Motorola Automotive Products, comes in 8000 and 10,000-rpm models



POPULAR MECHANICS

the Volkswagen dash on page 120, just fits in the small area available and makes a good custom installation. A multigauge console, like the Rite Autotronics three-unit model on page 119, is designed to fit under your dash. To install it, find a good spot, drill mounting holes and attach the console with the hardware supplied.

To facilitate the hookup of the gauges, you should have your car's service manual handy. Illustrations in the manual's "instrument" and/or "electrical" section will let you pinpoint sending units to be removed and circuits to be modified. The drawing on page 118 shows a new oil-pressure sending-unit installation.

The wiring setup for an electrically operated water-temperature gauge is shown on page 119. Again, you have to locate and remove the sending unit for the warning light now in your car. When installing the new sending unit in the block, first coat the threads with Permatex to insure a sure-proof seal.

As shown in the diagram, attach the wire to the sending unit, run it back through the firewall and hook it to the positive post of the temperature gauge, assuming a negative grounded system. The gauge's negative post is connected to a clean ground. Finally, another wire is run from the middle terminal to the ignition side of the ignition switch.

A typical ammeter installation is shown on page 120. The wiring diagram shows how the car's electrical circuit was modified. The dotted line represents the wire removed between voltage regulator and

positive battery terminal. As modified, it can be seen that battery charging and discharging current must flow through the ammeter. The lamp illuminates the meter when car lights are on at night.

There are two other gauges you might want to consider for your car: a tachometer and a vacuum gauge. A tach will indicate the revolutions per minute of your engine and enable you to determine whether your engine needs tuning, when to shift for maximum acceleration with a stick shift, when to downshift to keep your engine from lugging, and when the engine is operating at the best cruising speed. It's easy to install—generally, one wire goes to the distributor primary terminal and the other to ground.

I think the vacuum gauge is even more important to possess than the tach. It tells you how hard your engine is working and can warn you of such things as a restricted exhaust, leaking intake system, and improper ignition timing (see *Use a Vacuum Gauge*, page 114, June '68 PM).

A good vacuum gauge for installation inside your car runs about \$20. Again, hookup is a cinch. To pick up the vacuum, tubing is connected to the intake manifold (or the intake manifold side of a vacuum booster pump if your car's so equipped) by means of adapters. The tubing is brought back through the firewall and connected to the gauge.

Go ahead, try it. Whether you replace one or all of your idiot lights, you'll be way ahead on gauging the state of affairs under your hood. ★ ★ ★

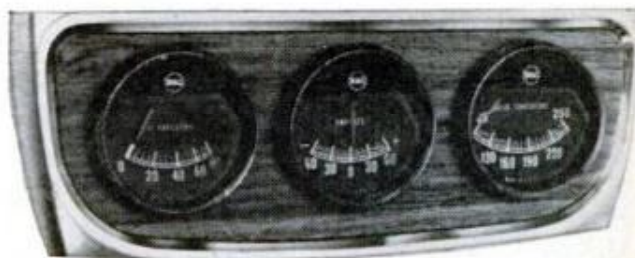
THREE-IN-ONE GAUGE reads amperes, oil pressure and engine temperature on one dial face. Airguide Instrument unit mounts on dash or steering column



SEPTEMBER 1968

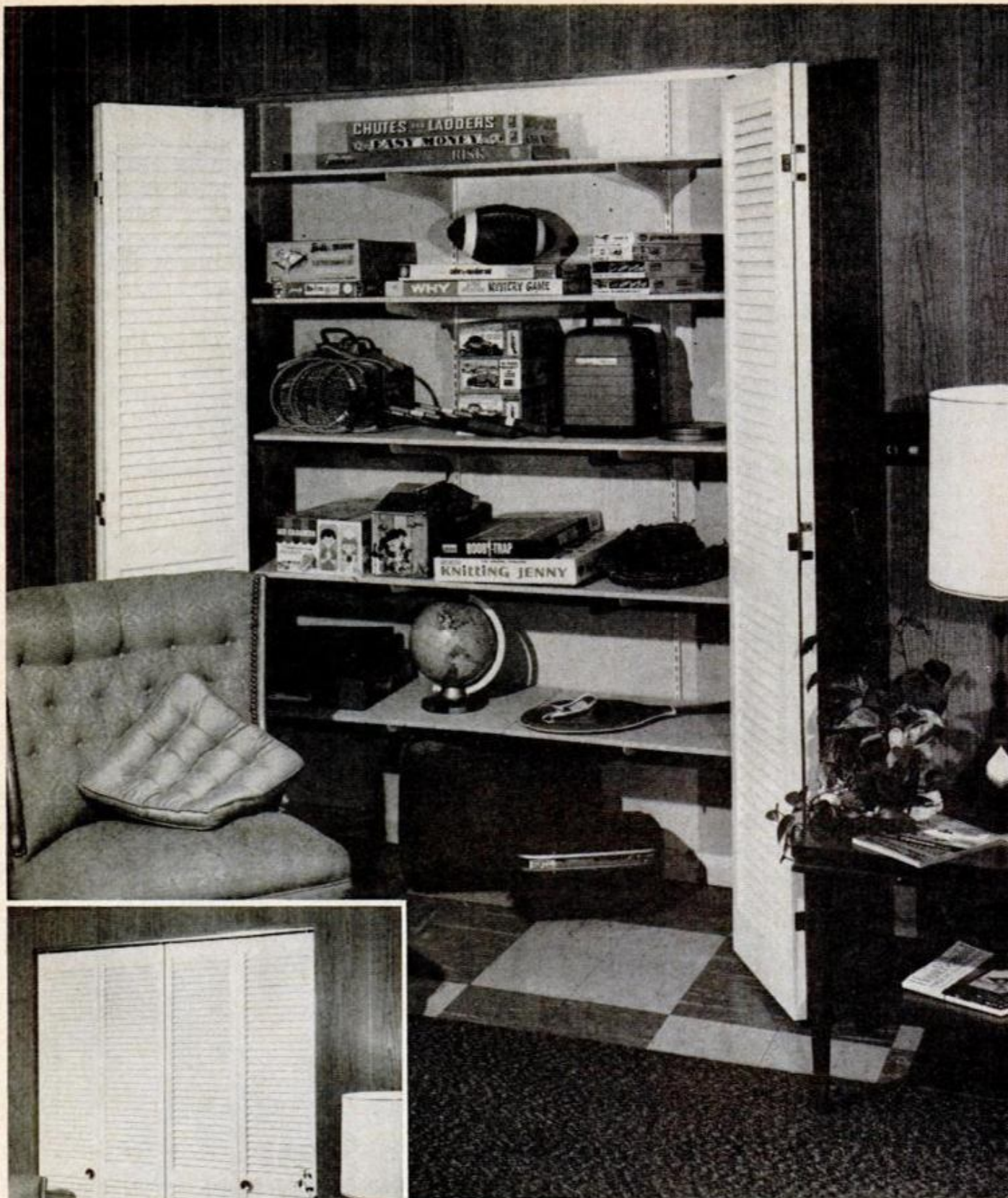


UNDER-THE-DASH CONSOLES combine various types of gauges. This Stewart-Warner unit includes a tach



DELUXE CONSOLE with standard instrumentation is chrome with simulated teak. It's RAC's Model 989

121



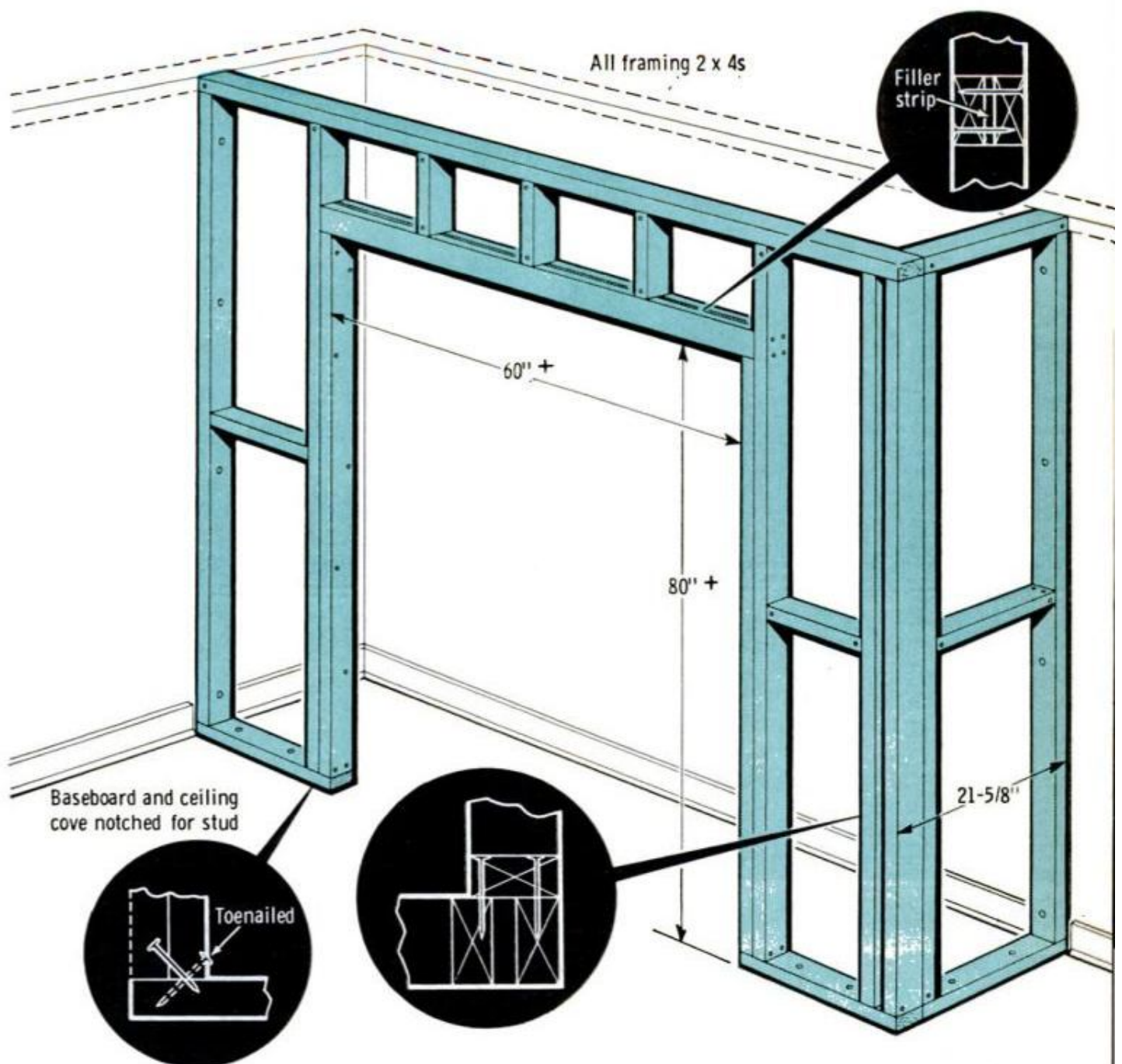
SHALLOW CLOSET such as this will hold a multitude of items. This one has taken over as a hobby closet to keep track of games, sports gear, movie equipment. However, these roomy shelves will be found handy for storing almost anything



LOUVERED BIFOLD DOORS give instant access to shallow closets and are most attractive. Pivoting on pins and sliding on overhead track, doors glide open with little effort. You can get them full louvered, as shown, or partially paneled

POPULAR MECHANICS

How to Build an Extra Closet



As little as 20 in. off the corner of a room will help relieve your storage problem in a weekend's time

By **WAYNE C. LECKEY**, Home and Shop Editor

Technical Art by Don Evans

FEW HOMEOWNERS CAN BOAST of having too many closets. More often it's a case of not having enough. The solution, of course, is to add another.

While the thought of building an extra closet could cause the less experienced home remodeler to turn and run, it's not

the major job it sounds. Actually, a good share of the task is rough work, particularly the framing. As to where to put it, most times there's a corner that will let you rob it of 20 in. or so without it being missed a bit. And as for it looking like a "sore thumb," you can see in the photos on



SLOTTED STANDARDS, 5 ft. long, are screwed to the studs in the back wall of the closet for solid support

page 122 that such a closet adds considerable eye appeal.

The length and depth you make the closet is up to you. I made it shallow so it would accept six 16-in. shelves, 8 ft. long. While the overall size can vary to suit your needs, the size given for the rough door opening should be maintained if you use standard-size 15-in. bifold doors. Here the actual width and height of the rough opening is determined beforehand by the way the opening is to be trimmed. For example, if $\frac{1}{4}$ -in. prefinished hardboard paneling is to be used, the rough opening is made $\frac{1}{2}$ in. greater than the finished width of 60 in., and $\frac{1}{4}$ in. greater than the finished height of 80 in. If, on the other hand, you plan to face the walls with plasterboard and trim the opening in the conventional manner with $\frac{3}{4}$ -in. jambs and casings, the rough opening would have to measure $61\frac{1}{2}$ in. wide and $80\frac{3}{4}$ in. high.

You can't go astray by following the drawing shown on page 123. Your very first step after plotting the closet's size on the floor, is to cut out 4-in. sections of the existing baseboard so the framing will butt tight where it joins the wall. When this is done, 2x4 plates are nailed to both the floor and ceiling, fastening the ceiling ones first so they can be used in locating the floor plates directly below. A plumb line dropped from the top plates will spot the

exact position of the floor plates quickly.

Whether you have anything to which to nail the ceiling plates depends on the direction the ceiling joists run. If they cross the top plate at right angles, you're in luck. If they don't, a few toggle bolts will do the trick. The same holds true in fastening the vertical framing members to the walls. Chances are they won't fall directly on a stud for nailing.

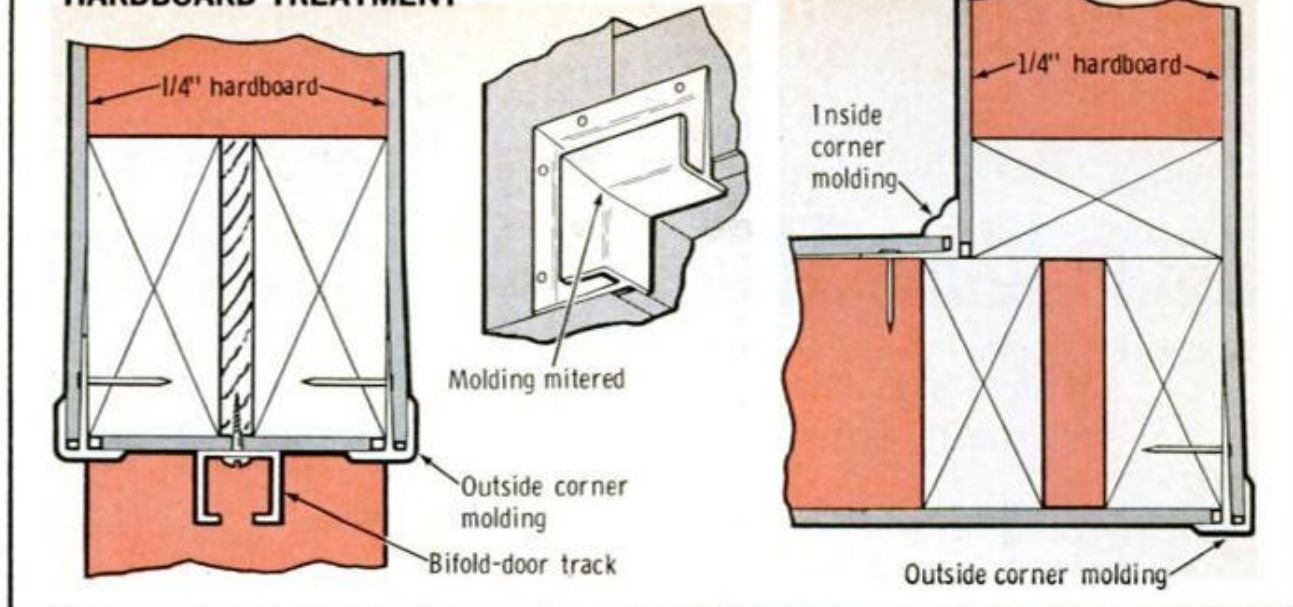
Once the top and bottom plates are in place, it's now a case of cutting the 2x4 studs to wedge between. The three-piece corner post is preassembled in the manner shown in the circular detail and then nailed in place as a unit. All studs are toenailed, and those framing the door opening are doubled up in the manner shown. Keep in mind that the studs should be placed 16 in. on centers.

I used prefinished hardboard paneling to cover the studs since I wanted to match the paneling which was already there. If you do likewise, the details at the top of the opposite page show how matching metal molding is used to add a neat trim to the hardboard around the door opening

TABS ON THE BRACKETS hook in slots of standards and a tap of a hammer or mallet locks them in place



HARDBOARD TREATMENT



and to both inside and outside corners.

In using hardboard (and the same procedure is followed in using plywood paneling), you first line the door opening with strips of paneling ripped $3\frac{1}{2}$ in. wide. These are cemented with special mastic directly to the studs and headers. Next, outside corner molding is applied around the outer edges of the opening, front and back, by nailing through the flange part of the molding. Note that it's mitered at the corners and nailed every 4 in.

From here on you apply the paneling to the studs and cut it to fit into the grooves of the molding. When you reach the corner, the same molding is applied in the same manner, first hooking it over the paneling, then nailing through the flange and inserting the succeeding piece in the molding as you continue around the cor-

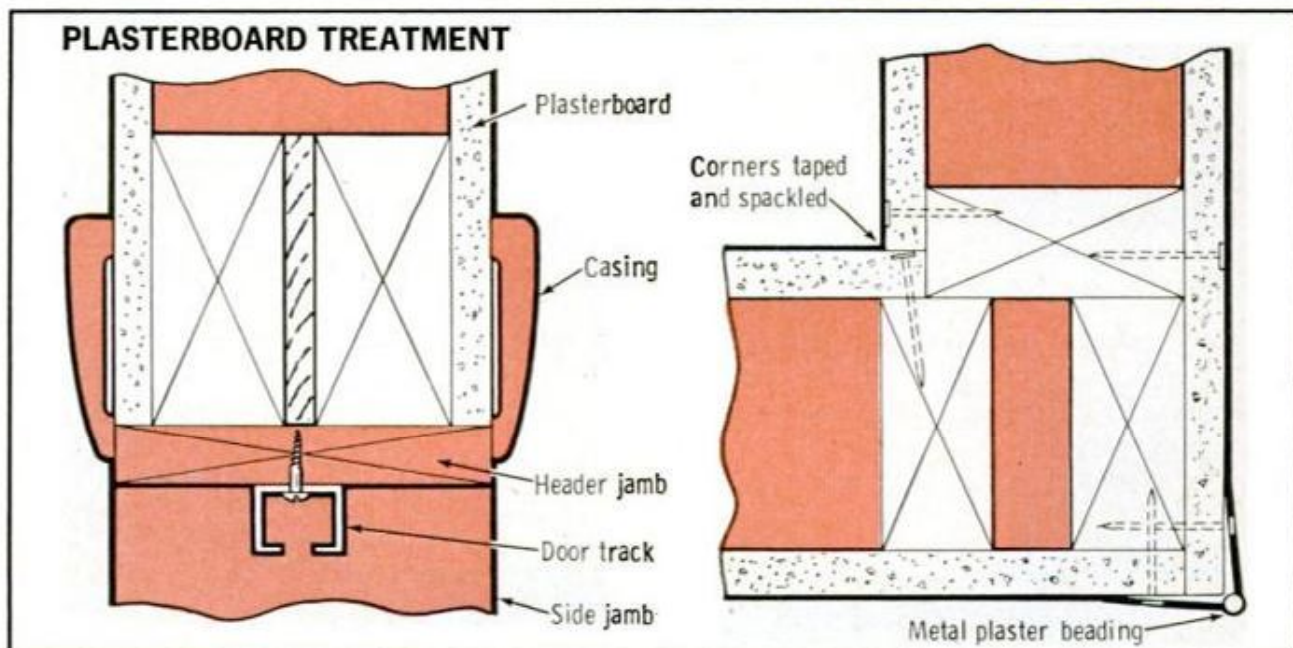
ner. Inside corners are trimmed similarly but with molding of a different shape.

If you plan to use plasterboard, study the drawings below. Procedure differs in that the door opening is lined with $\frac{3}{4}$ -in. jambs, ripped $4\frac{5}{8}$ in. wide, and centered so they project $\frac{1}{2}$ in. each side. The $\frac{1}{2}$ -in. plasterboard is cut to butt against the shoulders formed by the overhanging jambs, after which regular door casing is applied to cover the joint and add a finished trim. Regular plasterboard nails are used to fasten the $\frac{1}{2}$ -in. sheets, spacing them 8 in. apart.

Where the plasterboard laps at an outside corner, the corner is reinforced with a strip of regular metal plaster beading. The nails which hold it, plus those holding the plasterboard, are later covered with

(Please turn to page 198)

PLASTERBOARD TREATMENT



\$15

Home Ideas That Look Like a Million

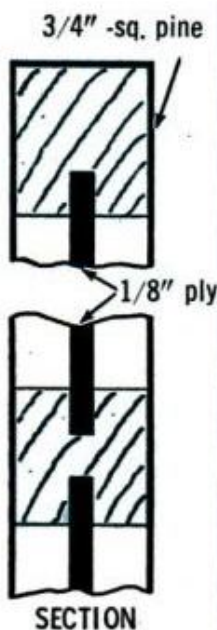
Little things that you can add over a weekend will make your home more livable than ever

By WAYNE C. LECKEY, Home and Shop Editor

THE ADAGE, "Home is what you make it," certainly applies when it comes to making home improvements, especially when you make them yourself.

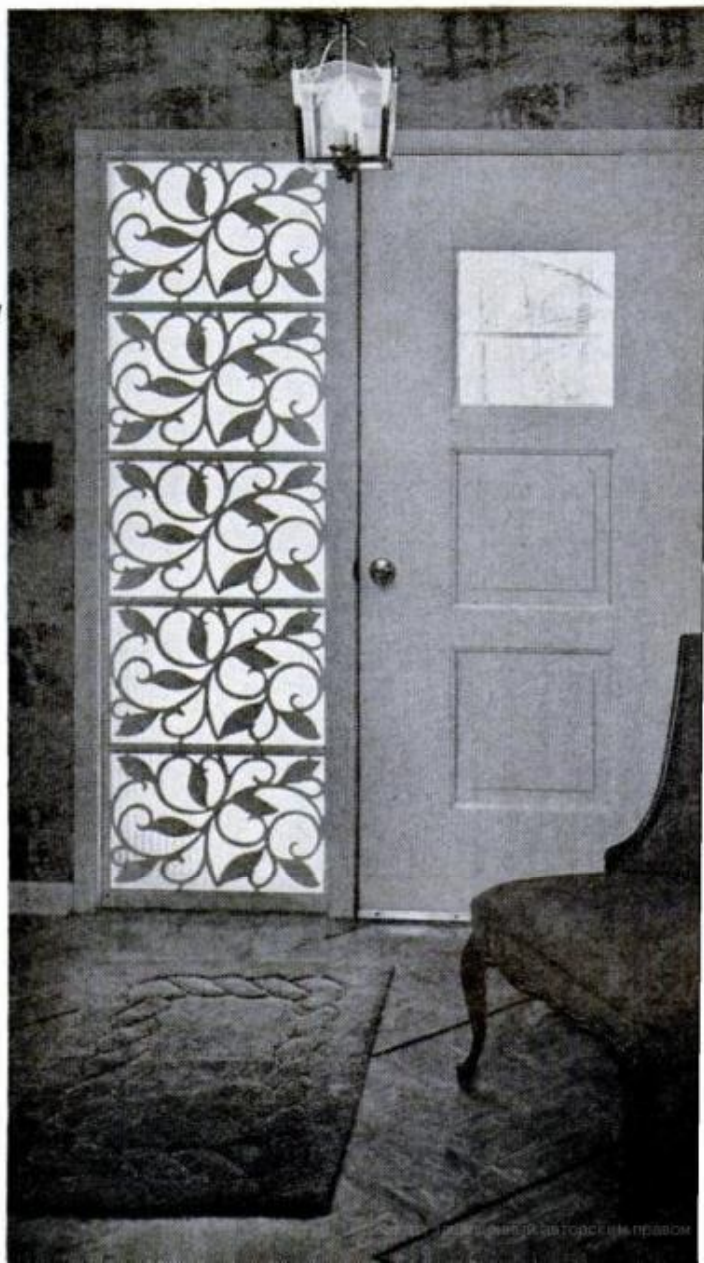
What's more, such improvements don't always have to be major projects. In fact, it's often the little things you add which make your home extra special.

Best of all, little improvements don't cost a fortune though they may add a "million." To prove it, not one of the eleven home improvements suggested on this and the following four pages will cost over \$15; some cost even less. While you may not borrow all eleven, just one will make your home a better place to live.



A Touch of Luxury

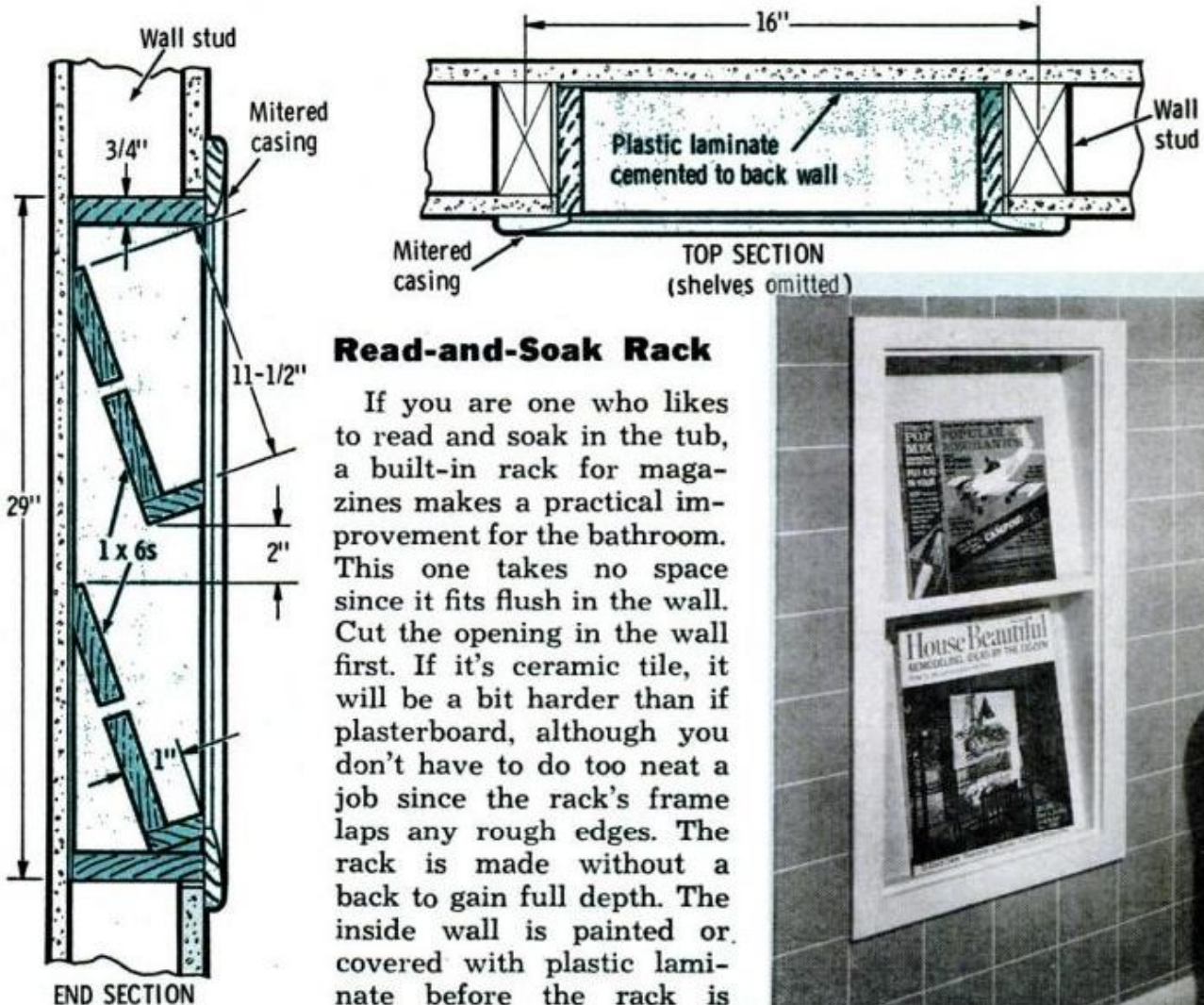
The graceful charm of a leaf-pattern grille can add a classic look to an austere foyer which features a plain glass panel. This one consists of five ready-cut wood scrolls grouped in a single mitered frame and held in the recessed window with four screws. The detail shows how the 3/4-in.-sq. frame members are grooved down the middle to fit over the edges of the scroll-cut panels and form a frame.





Countering With Light

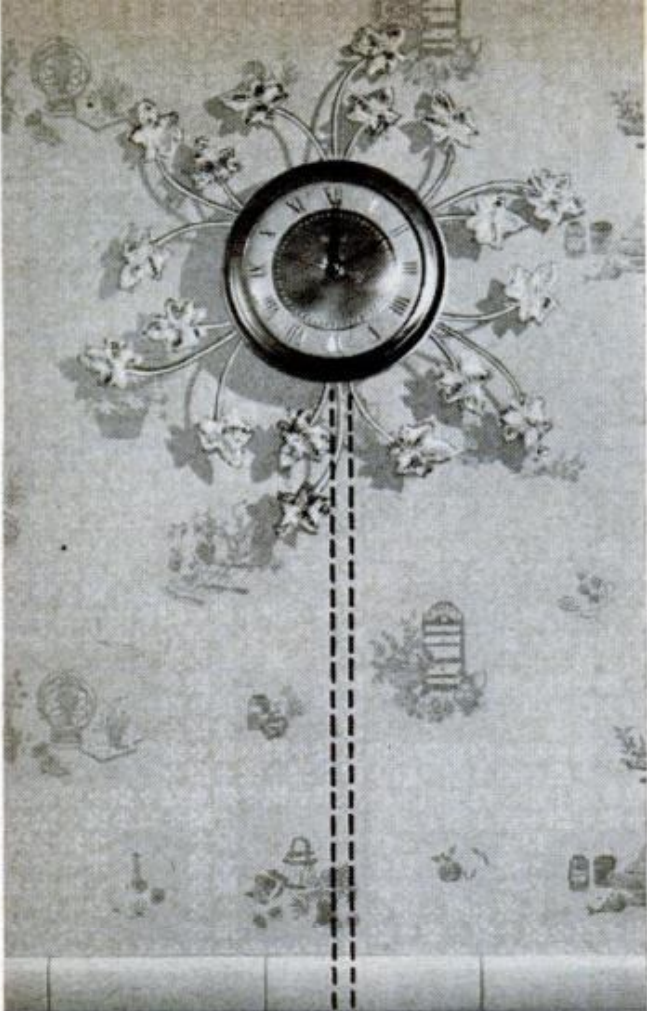
Extra thin fluorescent counter lights, made to fit the recessed bottoms of your wall cabinets, not only will add dramatic lighting to your kitchen but will help you see what you're doing. Being only an inch thick, the fixtures are practically hidden from view. To install them, you slip off the plastic cover, drive a couple of screws up into the cabinet and replace the cover. Several lamps can be ganged together end to end over a long counter.



Read-and-Soak Rack

If you are one who likes to read and soak in the tub, a built-in rack for magazines makes a practical improvement for the bathroom. This one takes no space since it fits flush in the wall. Cut the opening in the wall first. If it's ceramic tile, it will be a bit harder than if plasterboard, although you don't have to do too neat a job since the rack's frame laps any rough edges. The rack is made without a back to gain full depth. The inside wall is painted or covered with plastic laminate before the rack is set in place.

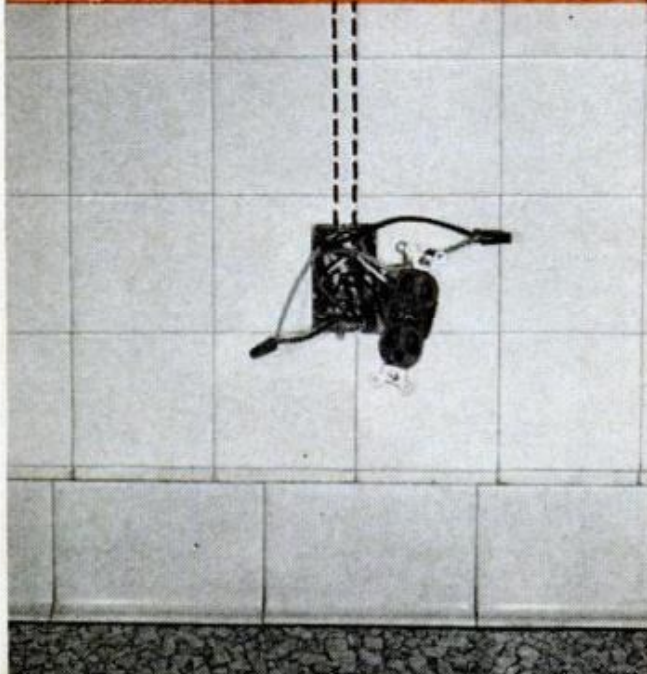
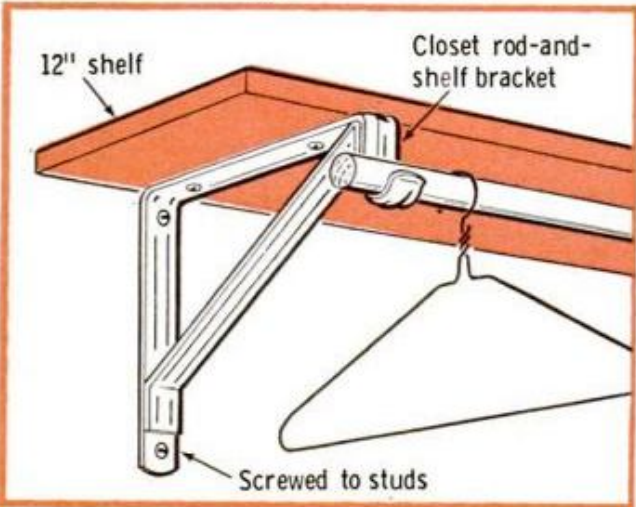
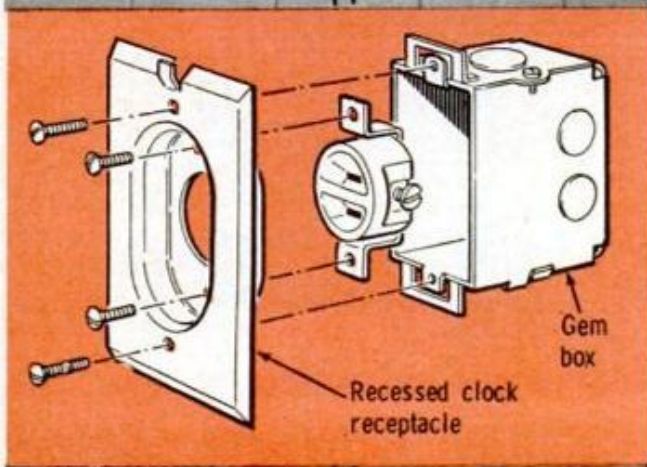




To Be or Not to Be—Seen

Simplest way to hang an electric wall clock is to drive a nail and let the cord hang down the outside of the wall. The neatest way is to install a regular recessed clock receptacle and conceal the wire inside the wall.

This becomes a simple job when you are able to locate the clock directly above a base receptacle since you then can tap into it for power. To make this timely improvement, buy a gem box and cut a hole for it in the wall. Then turn off the electricity and open up the base receptacle as shown. Pry open a knockout in the box and fish a long wire up through the hole until you can spot it through the opening at the top. Now hook the wire to the end of a prepared length of BX cable and pull it down through the hole in the base receptacle. Complete hookup by attaching the BX to the gem box and in turn to the clock receptacle, and finally tap into the wires in the base receptacle by twisting the white wire to the existing white wire and black wire to black wire. Tape the connections and you're in business.



An Idea Not to Be Shelved

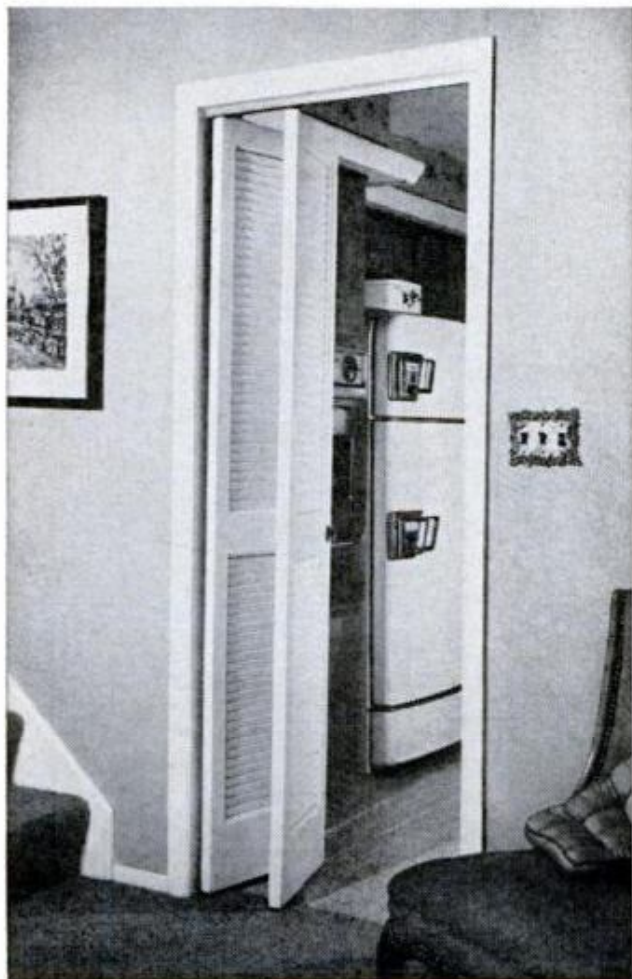
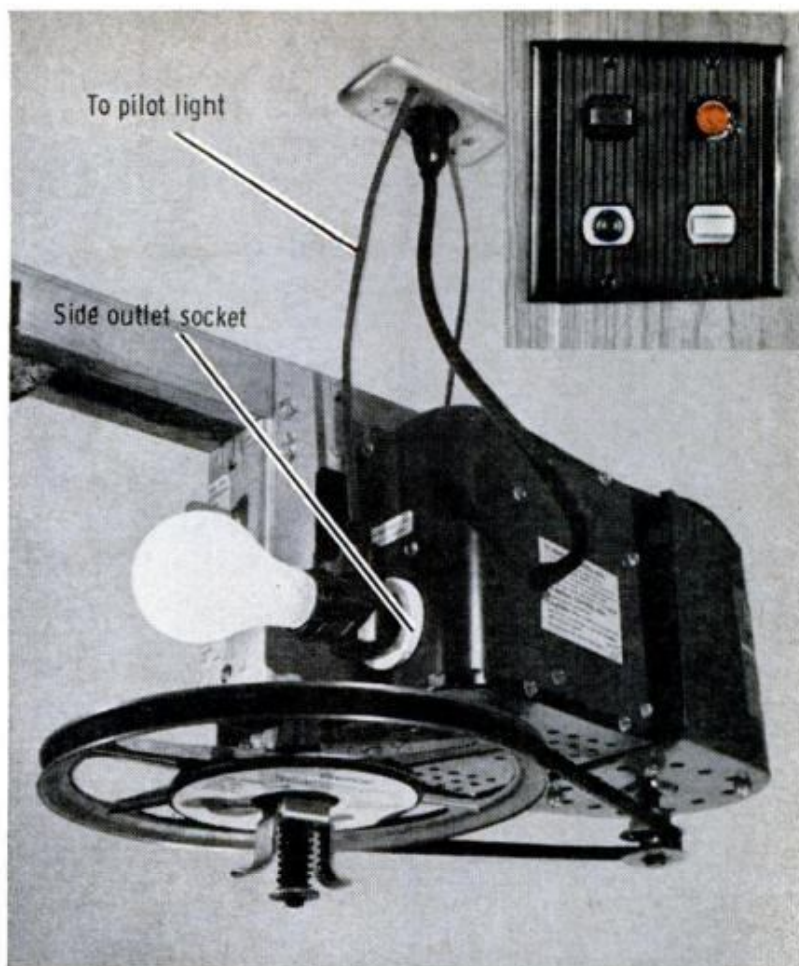
If you're looking for a simple way to add a shelf and hanger rod in a clothes closet, there's a clever metal bracket to be had which makes the job ridiculously simple. Instead of going to the trouble of resting the shelf on cleats at each end and installing recessed blocks to hold the rod, all you do is screw a pair of these brackets to the studs and the shelf to the brackets. A hook formed at the end of each bracket cradles the rod right up front. Where the shelf is fairly long, a third bracket installed in the center will eliminate sag in both the shelf and rod.

Pilot Won't Forget

Checking the garage door when you put the cat out is one way of being sure it is closed when you retire. But what if you don't have a cat?

This was our problem until I installed a pilot light in the kitchen. Now a glance tips us off since the pilot glows as long as the door is left open.

Rigging it required running BX from a new box in the kitchen to the box in the garage into which the electric operator was plugged. Then a plug on a wire from this box was plugged into a side-outlet socket screwed into the operator. Thus when the door is open and the light is on, the pilot is on. Granted, this improvement is most practical when the garage is attached and the operator is the type where its light burns as long as the door is open.



Wanted, Sight Unseen

If you have a situation where guests can look directly into the kitchen, louvered bifold doors politely block the view most attractively. What's more, they take less space than a regular door when standing open, and also permit free movement of air.

Such doors come in pairs, complete with hardware, to fit standard-width doorways. Some come already hinged, others have holes already drilled for top and bottom pivots.

To install bifold doors, first screw the channel track to the top of the door frame, placing it in the center. Next screw the L-shape bracket to the side of the door frame at the floor. Hinge the doors together if they aren't, and insert the three pivots in the holes provided.

To hang the doors, lift them so the two top pivots enter the track, then swing the doors in at the bottom to seat in the hole in the floor bracket. Vertical play in the doors is taken up with a thin, flat wrench (comes with the hardware) used to back out the floor pivot, that, in turn, raises the doors to hold them in the track at the top.

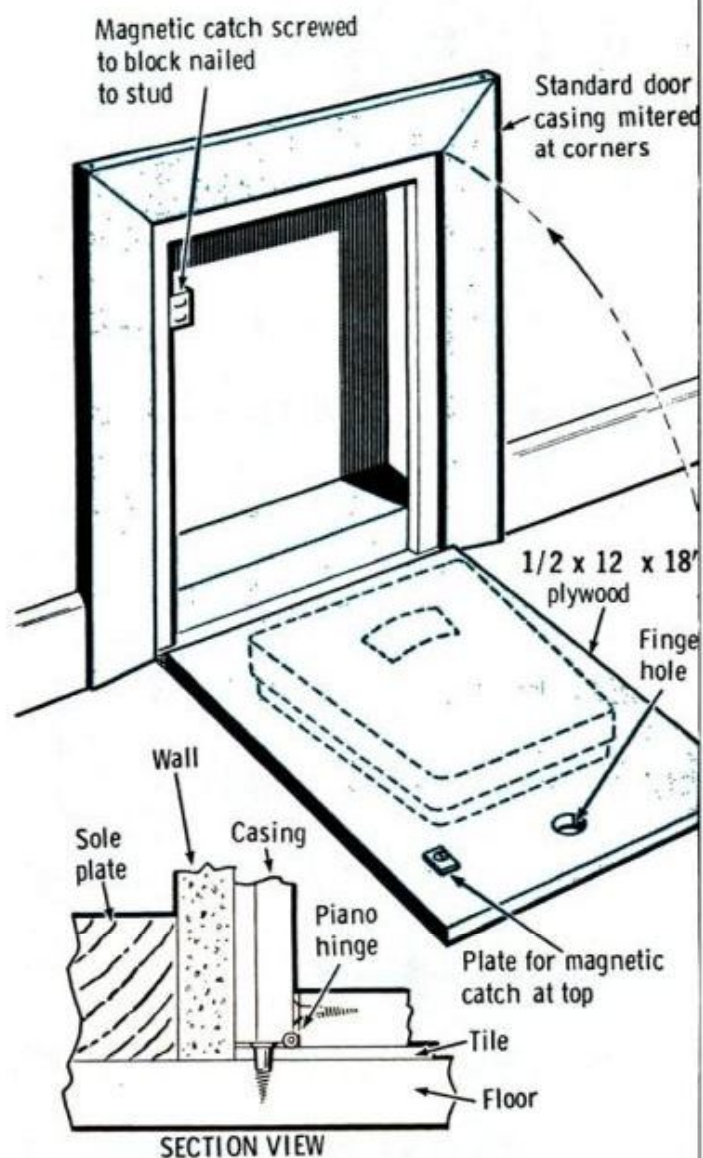
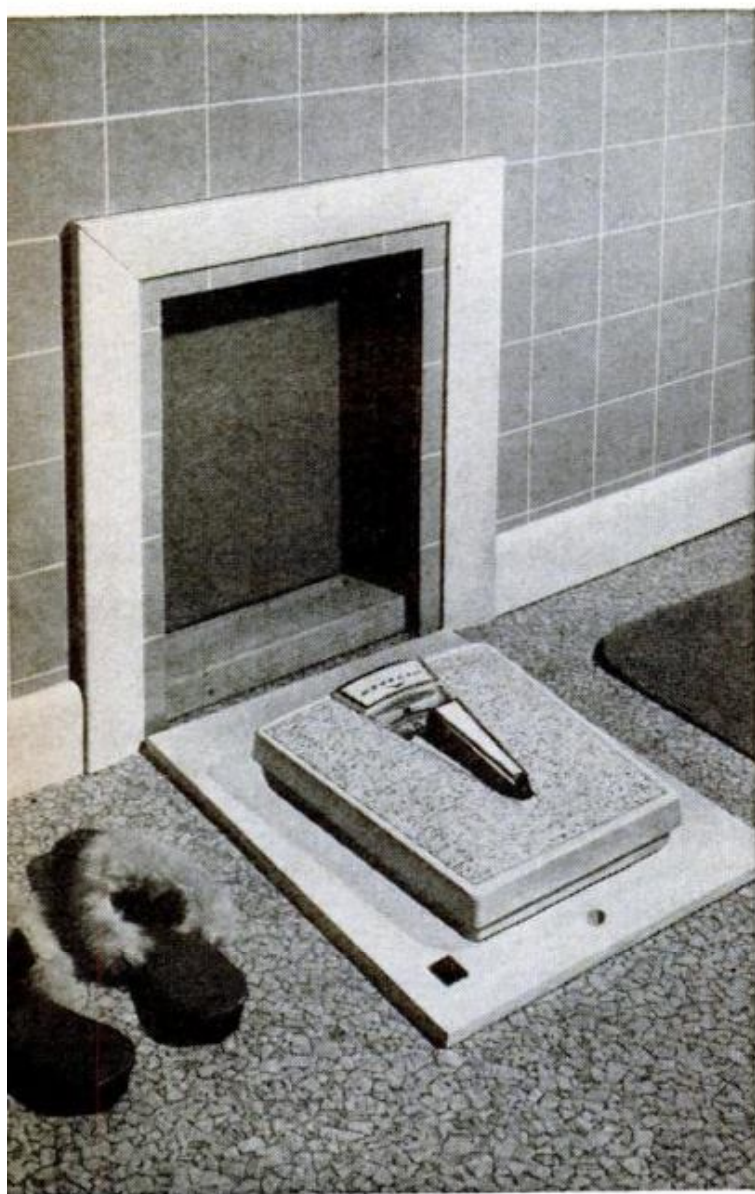
Now You See It, Now You Don't

Pardon the pun, but a bathroom scale can get underfoot when standing around waiting for that once-a-day weigh-in. However, you can make a scale disappear into the wall and yet be Johnny on the spot by attaching it to a swing-up door. First, pick a spot between two studs and cut a hole that's $\frac{1}{2}$ in. smaller on three sides than the door. Then hinge the door to the floor so it swings flat against the wall and laps the opening. Finally, the baseboard is cut back for a mitered casing which frames the door. A magnetic catch holds the door shut, and a finger hole lets you give a tug to open it. How you attach the scale to the plywood door depends upon the type of scale. Some have holes in the bottom which are adaptable, or a bottom which can be drilled for small bolts. Both door and casing can be painted to match the baseboard.



Knock, Knock, Who's There?

Callers won't be able to get one foot in the door when you're able to see them before they see you. You can provide this protection by installing a one-way viewer which lets you look out but they can't see in. Merely drill a $\frac{1}{2}$ -in. hole (head high) through the door, inserting one part of viewer from the inside and the other from the outside.

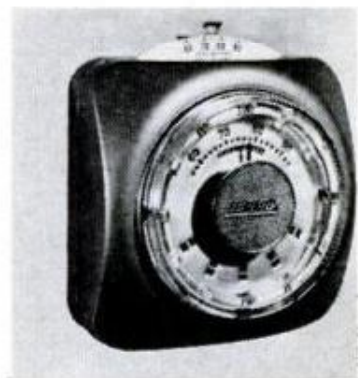
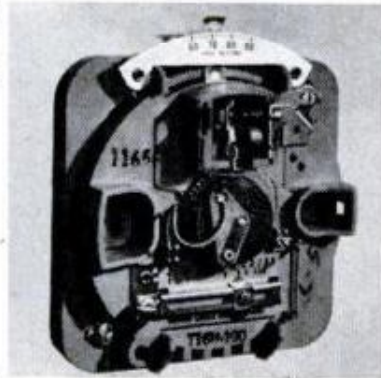
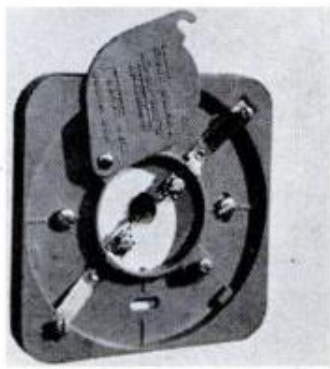
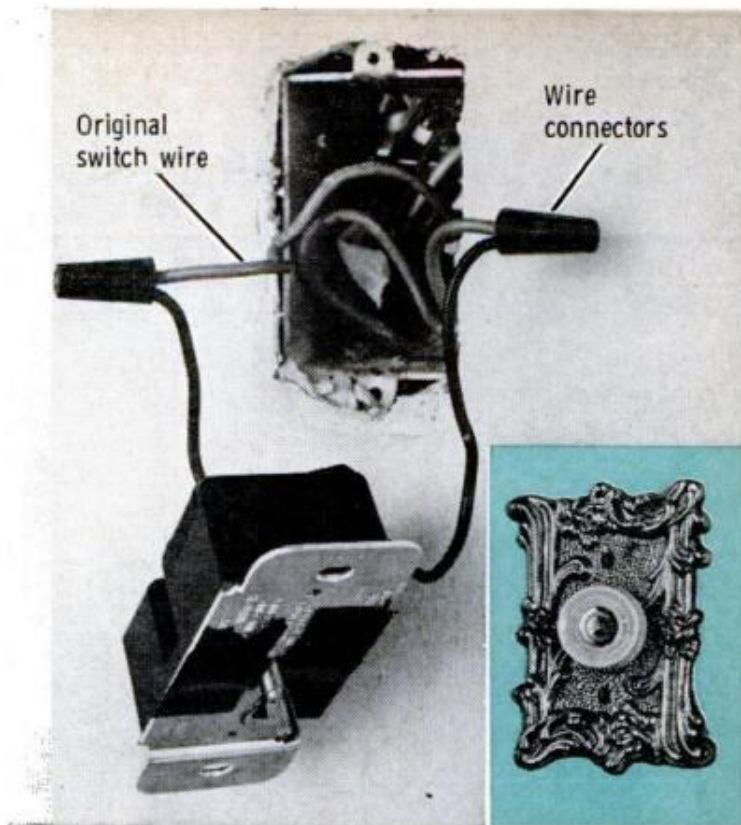


Let There Be 'Dim' Light

Like to be able to dim the light over your dining table to a soft candle glow? All you need do is replace the present on-off switch with a 500-w. SCR light dimmer control.

You can install one in minutes with just a screwdriver. First, turn off the electricity. Then take off the wall plate, back out the screws which hold the switch and remove the two wires. Now attach these same two wires to the terminals of the dimmer. It's as simple as that.

A turn of the dimmer's dial creates dozens of dramatic lighting effects—from full brightness to candlelight mood. You can buy dimmers that control both incandescent and fluorescent lamps.



An End to Heat Over-Ride

Many thermostats (especially the older models) have but one setting on the heat anticipator and, if it should not be the right one for your heating system, it causes a considerable variance in room temperature.

Modern thermostats, like the three-piece one shown above, have adjustable heat anticipators that allow perfect tuning of your system. Normally, by the time the heat from the furnace reaches the thermostat at a sufficient temperature to turn it off, the residual heat in the distribution system continues to raise the room temperature and over-rides the thermostat. Your thermostat setting could be 73° and the over-ride could raise it easily to 77 or 78°.

The heat anticipator does just what its name implies—it anticipates the exact

moment when the temperature will reach a given degree (this could be 68° in some cases). At this moment the anticipator, which is a tiny, wire heater coil within the thermostat, is energized. The heat it generates is enough to satisfy the thermostat so that the burner shuts off while the heat still remaining in the system is sufficient to bring the room temperature to the desired point. These modern thermostats are fully adjustable and they can be easily applied to all warm-air heating systems.

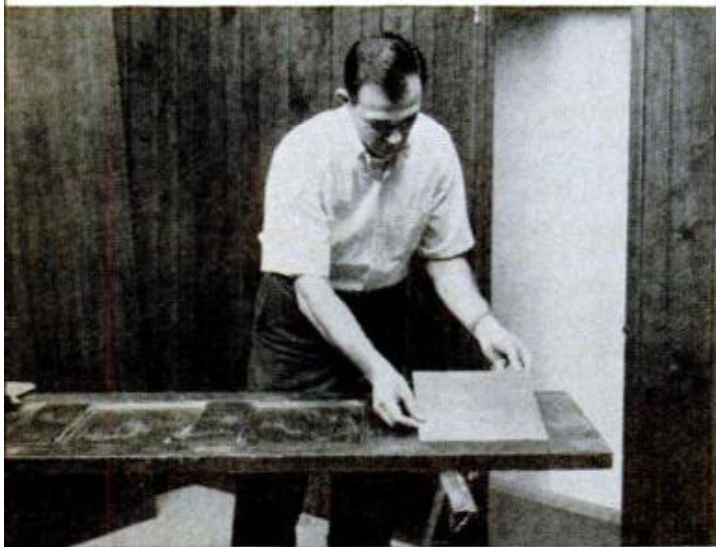
There's no mystery to replacing your old thermostat with a modern one. You simply remove the cover, disconnect the two wires which poke through the wall and connect these same two wires to the terminals of the new thermostat. There's no need to worry about getting a shock—it's low-voltage wiring (24-v.) like your doorbell's and won't hurt you a bit. ★★

Now You Can Panel An Outmoded Door

AFTER YOU'VE FINISHED paneling a room, you're faced with the problem of what to do with the door—especially if it's one of the antiquated recessed-panel-type doors. Until now, you had the choice of repainting or replacing it, and you still wound up with a contrasting door that detracted from the good-looking paneled areas in the rest of the room.

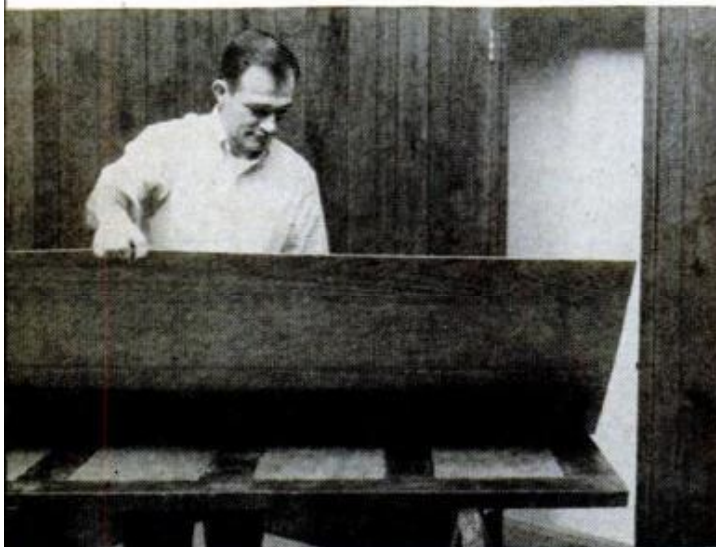
Now, however, you can panel any old

door so that it actually matches the wall paneling. The trick is to use General Plywood's new Eagle-Mate panels which are only $\frac{1}{8}$ -in. thick. With a choice of most wood species patterns and five pastel colors, the panels are available in one easily-worked size, 32x80 in. Costing about \$7 each, they are applied with contact cement, then trimmed with a saw and plane, or with a router.



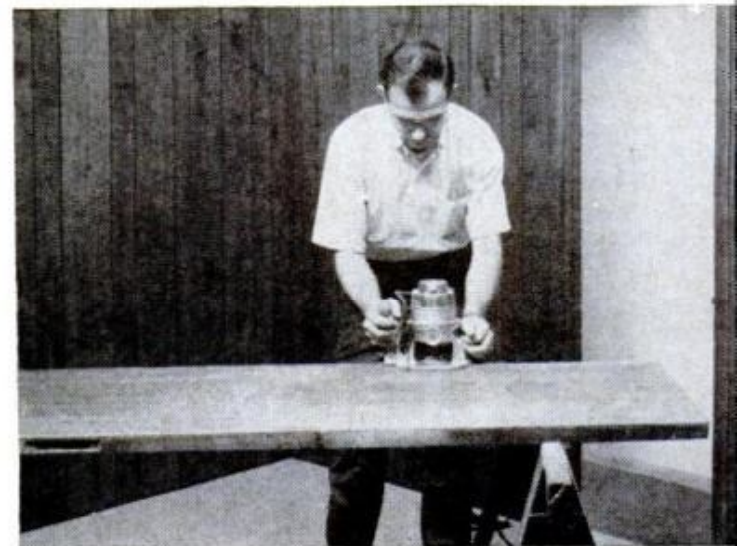
CUT PLYWOOD FILLER BLOCKS and cement or tack them in recessed areas of the outmoded panel door

CAREFULLY ALIGN THE EDGE of panel with the edge of door, then press on panel to remove air bubbles



APPLY A LIBERAL COATING of contact cement to both the door and $\frac{1}{8}$ -in. panel and allow to dry

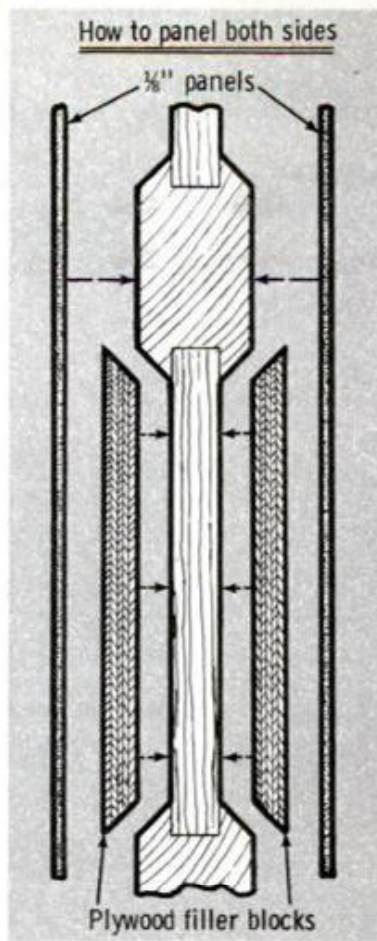
TRIMMING IS EASY if a router is available. If not, a small handsaw and careful planing do as well



Most important, however, is that no relocation of hinges or of the door jambs is required. When standard 1/4-in.-thick panels are added to a door, both the hinges and jambs have to be relocated so the door will open and close properly.

Application is the same for both flush and old panel doors, except that recessed areas in panel doors must be filled before cement is applied. As shown in the sketch at right, plywood filler blocks can be nailed or glued in place. It's not necessary to bevel the blocks, however, especially if curved molding lines the recesses.

For dealers handling Eagle-Mate panels in your area, write General Plywood Corp., 417 S. 32nd St., Box 1403, Louisville, Ky. 40201. ★★★



CHANGING scarred door (above) to modern door (below) takes an hour



New Building Products

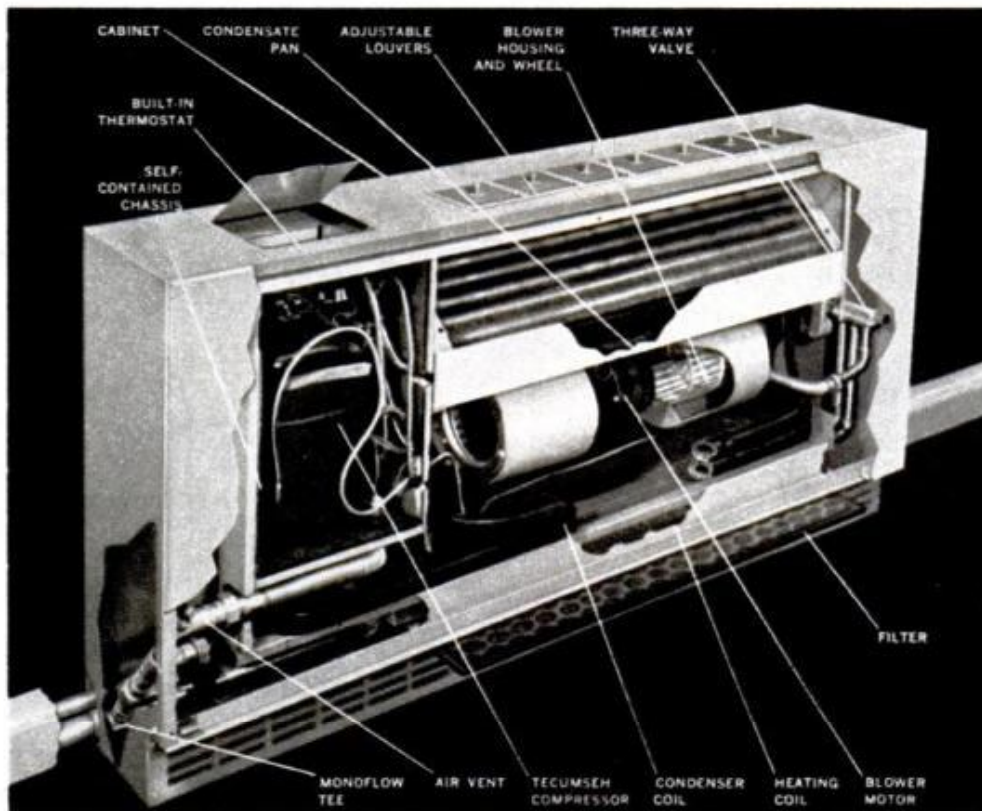
EVERY YEAR, the building supply industry comes up with a new assortment of special-purpose products. While these don't make a very big splash in the general market, they can be the answer to a prayer if they're aimed at your particular problem.

Climate Command, for instance, is a combination heating and cooling system which can simultaneously heat one room and cool another. Each unit in the system incorporates a self-contained air-conditioning chassis and a hot-water heating coil in a slim sill-height cabinet. The cut-away at right shows the basic component layout. Up to eight such units can be connected to a single loop of pipe.

Unlike most self-contained cooling units, the Climate Command condenser is water-cooled, thus reducing noise level and eliminating the need for a through wall opening.

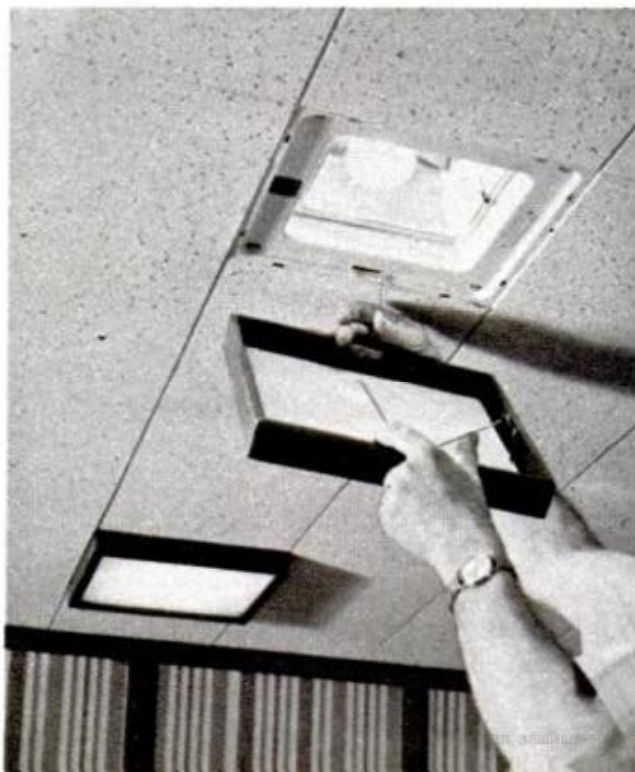
During the winter, hot water is circulated to provide heat in the normal way. In summer, unheated water is circulated to cool the condensers. During tricky between-season weather, warm water enables each unit either to heat or cool, according to individual thermostat settings. With 110° water, for example, a single unit can provide either 11,000 B.T.U. cooling or 6500 B.T.U. heating.

While designed primarily for office buildings



and high-rise apartments, this hydronic system might well solve your special problems. It's made by Slant/Fin Corp., 100 Forest Drive at East Hills, Greenvale, N.Y. 11548.

A development of more general interest is Armstrong's Tilemate light fixture (below). Made expressly for installation in a tile ceiling (it won't fit anywhere else), this moderately-priced 12 x 12-in. fixture matches the size of a standard tile and is installed in place of one of these tiles when you're putting up the new ceiling.



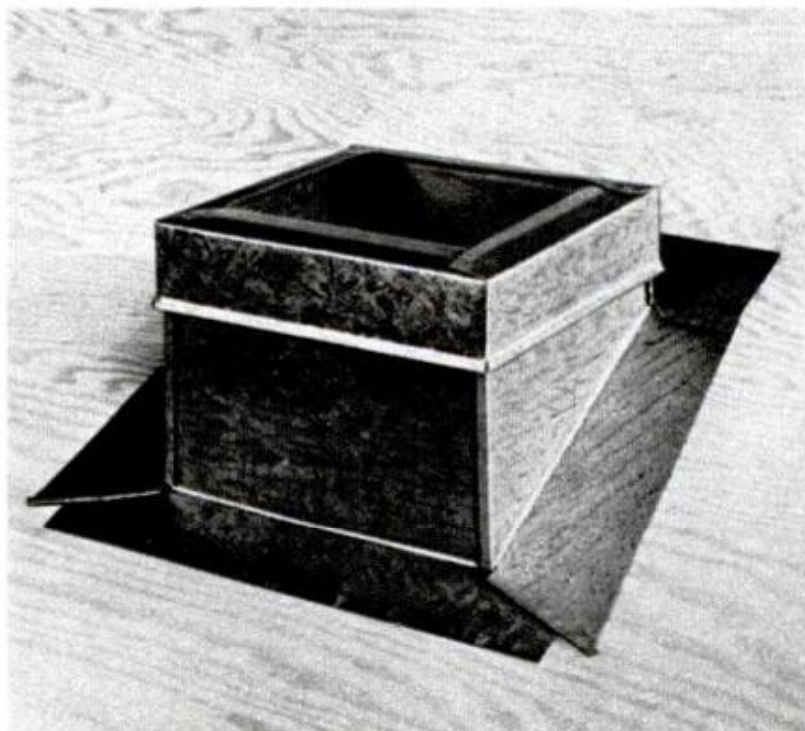
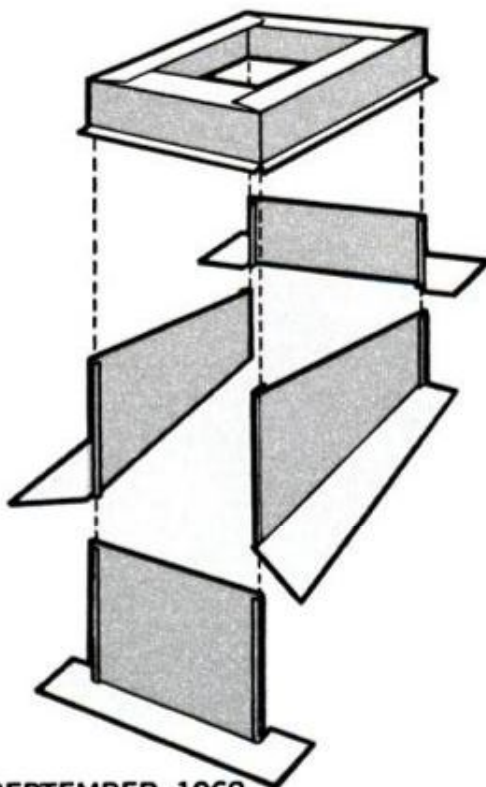
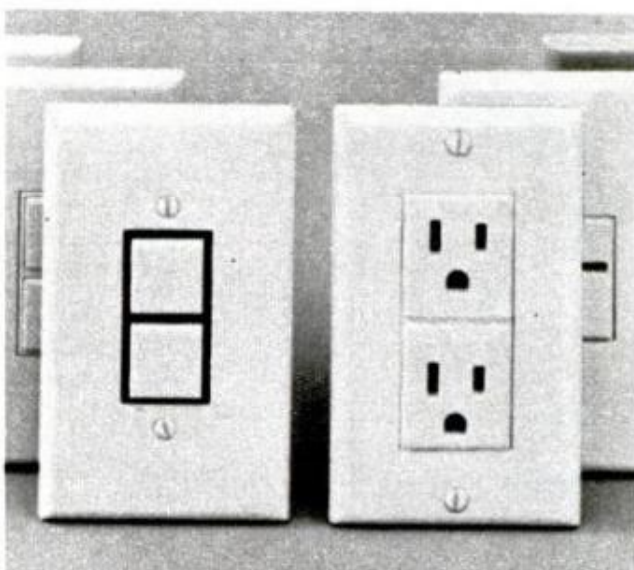
The secret of its simple installation is an adapter plate which fits into the tongue-and-groove tiles around it and serves as a base for the other parts. The exposed frame has a wood-grain finish. The fixture is priced at \$10.50. If you can't find a source in your area, write to Armstrong Cork Co., Lancaster, Pa., for the name of the nearest dealer.

More of an idea than a product, the glass block installation shown in the photo at right features a modular ventilator panel in the center which allows you to have both fresh air and light. These are being fabricated locally in many parts of the country, so you'll have to check the masonry contractors in your area for further information.

If you're looking for durability, check Leviton's new Centura line of pushbutton switches and grounding receptacles. (center right). The company backs each one with a 25-year guarantee. Available in a wide range of colors, they're made by Leviton Mfg. Co. Inc., 236 Greenpoint Ave., Brooklyn, N.Y.

Finally, you might be interested in a new concept in chimney flashing. A Wisconsin company is now marketing a preformed "all pitch" flashing kit (below), engineered to fit any chimney that protrudes through the slant slide of a roof. No soldering is required. Instead, all you have to do is caulk the interlocking seams. The whole flashing job can be accomplished in about 15 minutes.

These kits are available in sizes to fit all standard chimney-block dimensions. For price information and details, write to Miller Metal Products Co., 1310 Edgewood Drive, Appleton, Wis. 54911.



HOW TO BE 'Shelf' Sufficient

Standards and brackets provide simplest way to have too many shelves—if that's possible.



By WAYNE C. LECKEY

WHY HAVE WALLS just standing there when they could be holding shelves galore?

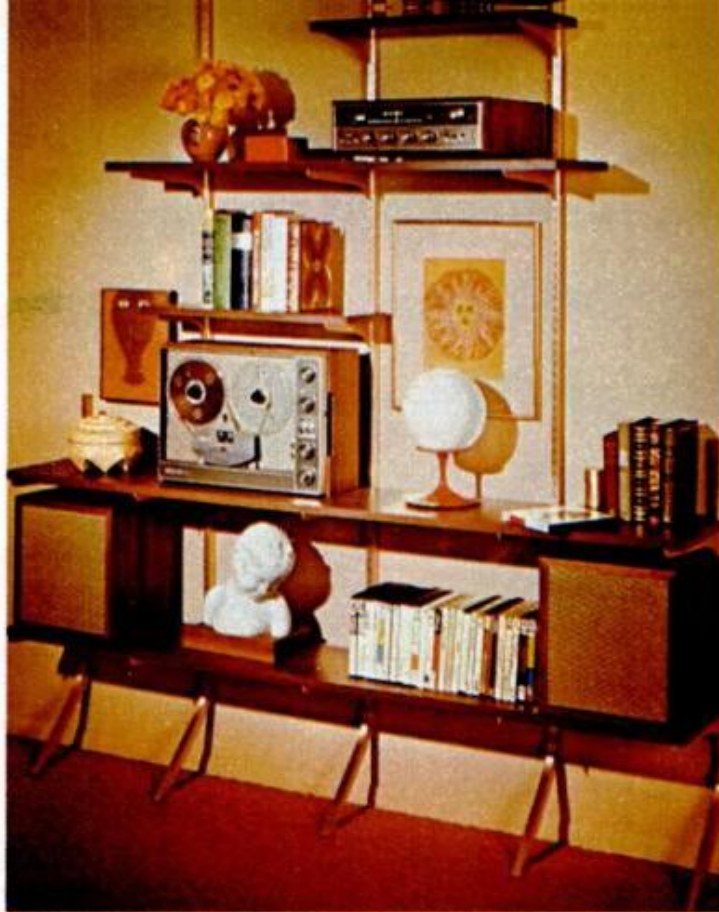
Slotted, wall-mounted standards and cantilevered shelf brackets, which hook into them, can transform such lazy walls into stunning workable "shelf-walls" in a matter of minutes.

That's how utterly simple it is to "build" your own custom-designed shelves for your favorite books, vases, art objects, trophies, hi-fi components—you name it.

Once the standards are screwed to the wall you can create dozens of dramatic shelf arrangements by merely inserting the brackets anywhere you want. When you tire of one arrangement, you can break it up and create a totally new effect by playing musical chairs with the brackets. And, such shelves are not limited to walls. Floor-to-ceiling poles are available for creating dramatic room dividers.

To top it off, the only tools you need are a ruler, drill, screwdriver and, for the room divider, a level.

While you can make your own wood shelves by cutting up flat boards or ripping them from $\frac{3}{4}$ -in. plywood, the job becomes a lot simpler when you buy them ready-made. Besides being nice and flat, they come completely finished, edges and

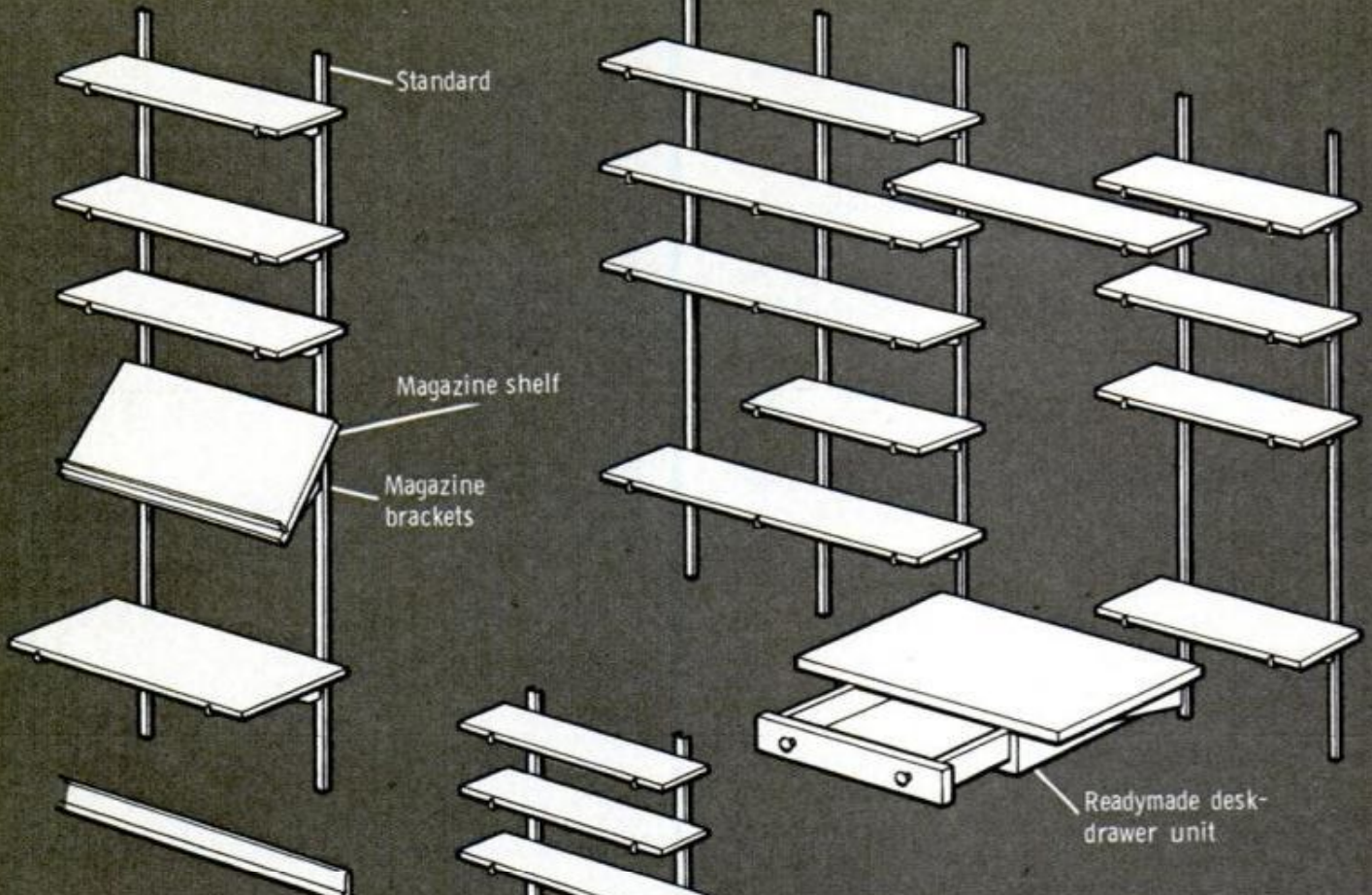


PORTA-POSTS rest on floor to support load, offer minimum defacing of wall, require but one screw

sides, with a choice of colors and wood grains. You can get them in 2, 3, 4 and 6-ft. lengths, and in 8, 10 and 12-in. widths.

Shelf standards (as well as the brackets) are available in finishes to blend with





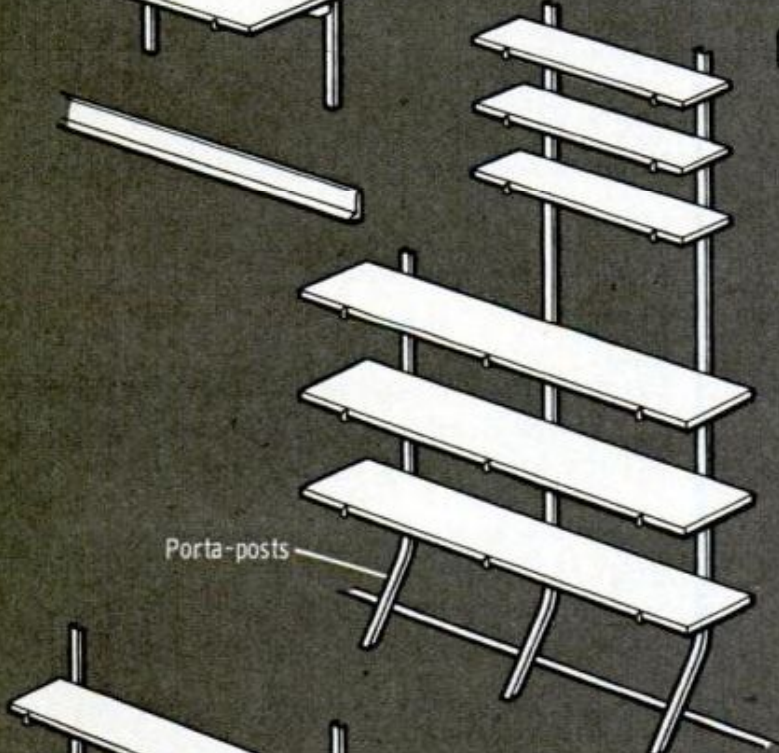
Standard

Magazine shelf

Magazine brackets

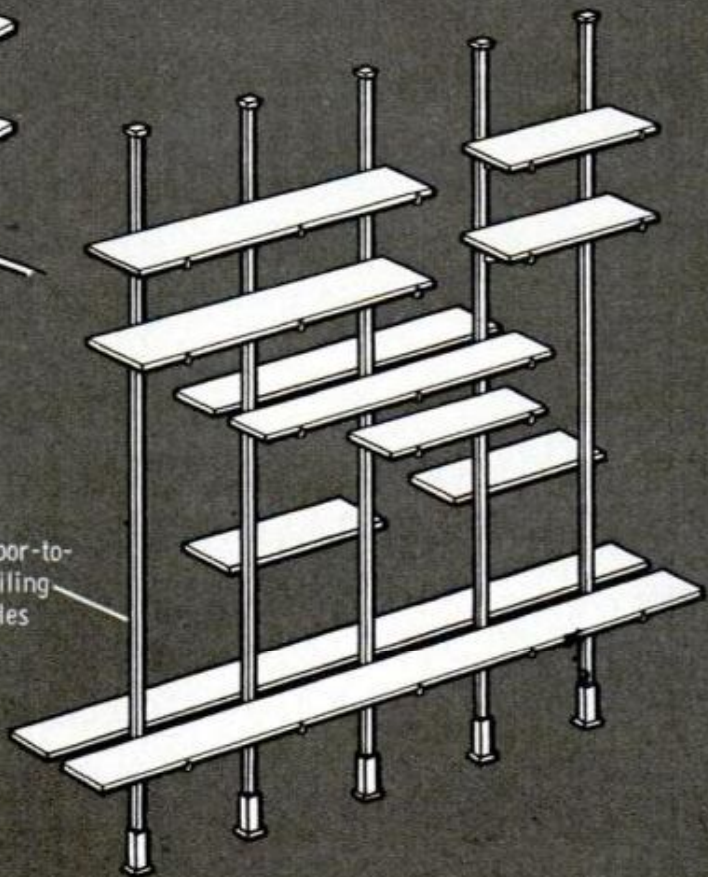
Readymade desk-drawer unit

The many design possibilities available will lead you to an endless variety of shelf arrangements — there is no limit. What's more, you can move the shelves and brackets around to your heart's content for totally new and dramatic wall effects.



Porta-posts

Magazine shelf



Floor-to-ceiling poles

any color scheme. They come in 1, 2, 3, 4, 5 and 6-ft. lengths, both in steel and aluminum, and anodized, brushed or plated. Finishes include antique copper, satin bronze, gold, charcoal, white, black and walnut.

In addition to plain channel-shape standards, you can get slotted ones called Porta-Posts which are particularly practical for apartments since one screw is all that's necessary to fasten each post. The posts are made by the Dorfile Mfg. Co. of Portland, Ore.

Bracket lengths match shelf widths and range from 6 to 16 in. You can get 14-in. ones which support magazine shelves at a 45° angle, and there's even a desk-shelf complete with drawer.

Sears offers a unique free-standing room divider of standards and brackets which requires no nails, screws or drilling, nor floor-to-ceiling poles.

Masonite features with their Royalcote Living Wall a clever shelf-and-bracket system which requires no standards. The brackets hook into the slotted paneling.

Spacing of the standards is dictated by the type of wall, shelf width and load. Where the shelves will display many books, a maximum spacing of 24 in. is recommended. For lighter loads, it can be up to 36 in. If the wall is paneled with solid tongue-and-groove boards, you have no spacing and load limits—screws provided will hold with complete safety. However, if the wall is paneled with 1/4-in. plywood or hardboard, the load per lineal foot of 8-in. shelf should not exceed 20

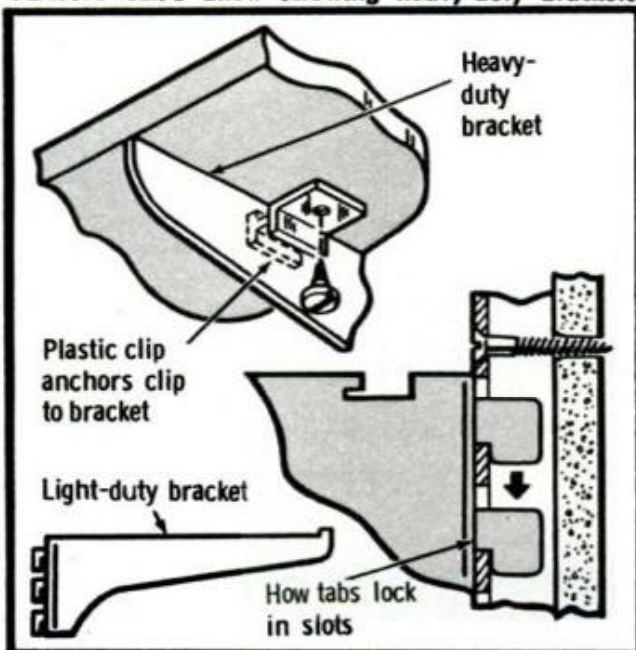


SLOTS IN THE GROOVES of special paneling take place of standards to support brackets and shelves

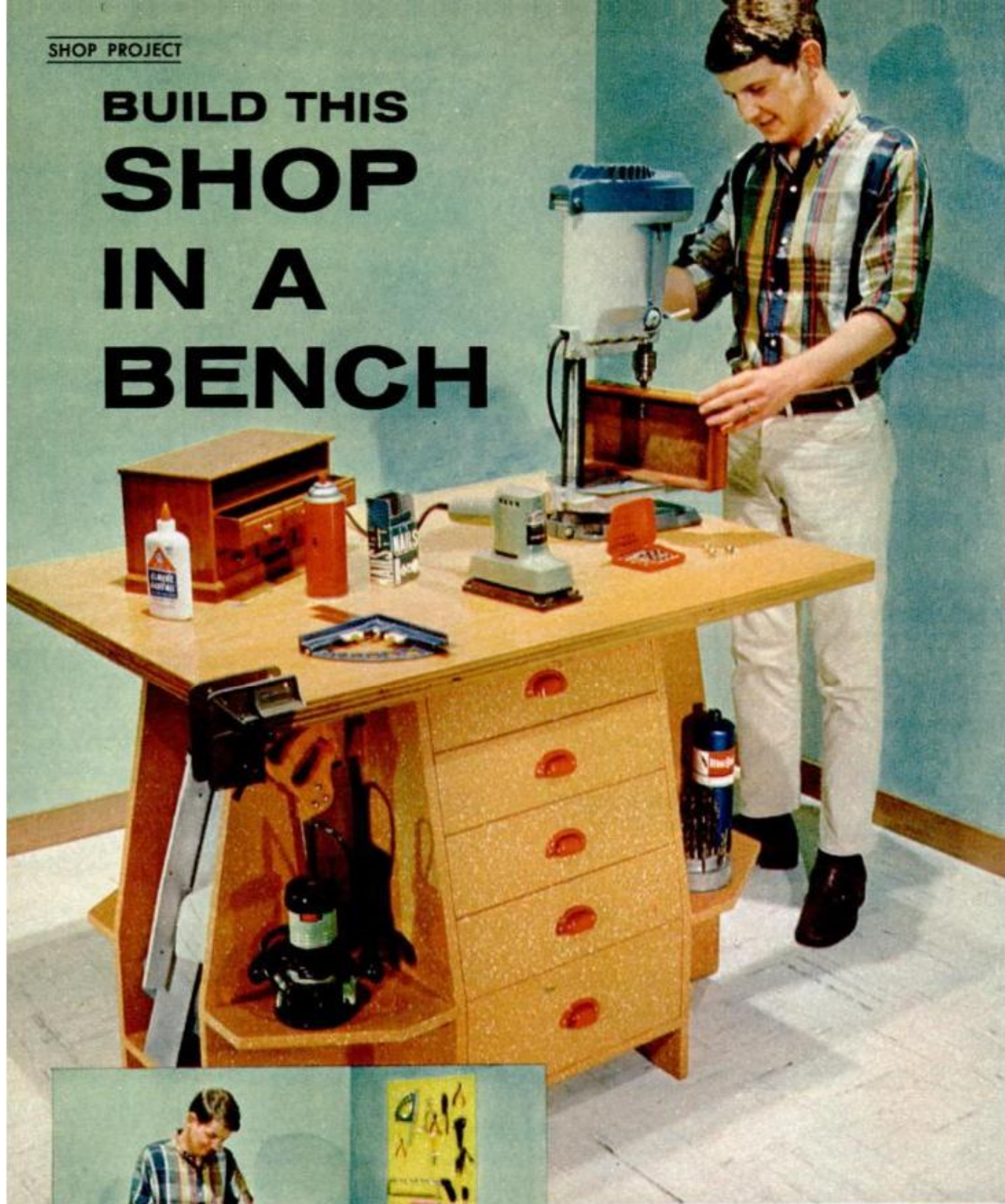
lbs., 15 lbs. for 10-in. shelves. In walls of plaster or plasterboard, screw anchors must be used for each screw.

In attaching the standards drive the top screw first and let the standard swing free. It will plumb itself, after which you can mark and drill the other holes. A hammer tap on the base of each bracket will wedge it securely in the slots. ★★★

PLASTIC CLIPS allow screwing heavy-duty brackets to shelves after tapping brackets in slots with mallet



BUILD THIS SHOP IN A BENCH



THE BENCH becomes a tool stand when you want to drill a hole. Lightweight drill press is lifted from its stall in base and set in anchor holes drilled in the benchtop. Jointer is parked at opposite end

Technical Art by Graphic Presentations Services

WITH POWER TOOLS parked in the base, workbench top offers big uncluttered work area which lets you spread out layout and assembly jobs. Note stall in the front of bench which holds circular saw

Serving as a combination tool stand and workbench, this space-saving work center becomes a workshop in itself

By WAYNE C. LECKEY, Home and Shop Editor

IF YOU HAVE a hankering to get started in the rewarding and relaxing hobby of making and fixing things but are stymied for a place to work, here's the perfect answer to the question of space.

We call it a shop-in-a-bench and that's just what it is—a self-contained island work center which can be equipped with both hand and power tools to let you have the time of your life in just 3x4 ft. of space.

Not only do you have a king-size workbench with a top that's accessible from all four sides, but a bench which serves as a power-tool stand at the drop of a hat.

A drill press, a 4-in. jointer and an 8-in. circular saw are conveniently parked in stalls in the base of the bench. Thus when you want to saw, plane or drill a board with the accuracy of a power tool, you simply reach down, grab the tool you want, plunk it in predrilled holes in the bench top, plug it in and away you go. It's not necessary to bolt the machines in place.

When you want to clear the deck and use the big 3x4-ft. top for layout and assembly work, you can do it in a jiffy by returning the tools to their respective stalls.

In addition to all this, the bench has five roomy drawers, plus four shelves, where you can store all the hand and portable electric tools you'll ever need, all within easy reach.

While these stalls are dimensioned to accommodate Rockwell's three Compactools, they can be made to suit other small-size, self-contained machines.

The quick-change, no-fastening feature of the machines is accomplished by fitting their bases with $\frac{3}{8}$ x 2-in. bolts which are left projecting. Registering holes drilled in the benchtop for the projecting bolts on each machine are all that's needed to anchor the machines. When through using them, you simply lift the machines out of

the holes and park them in their stalls.

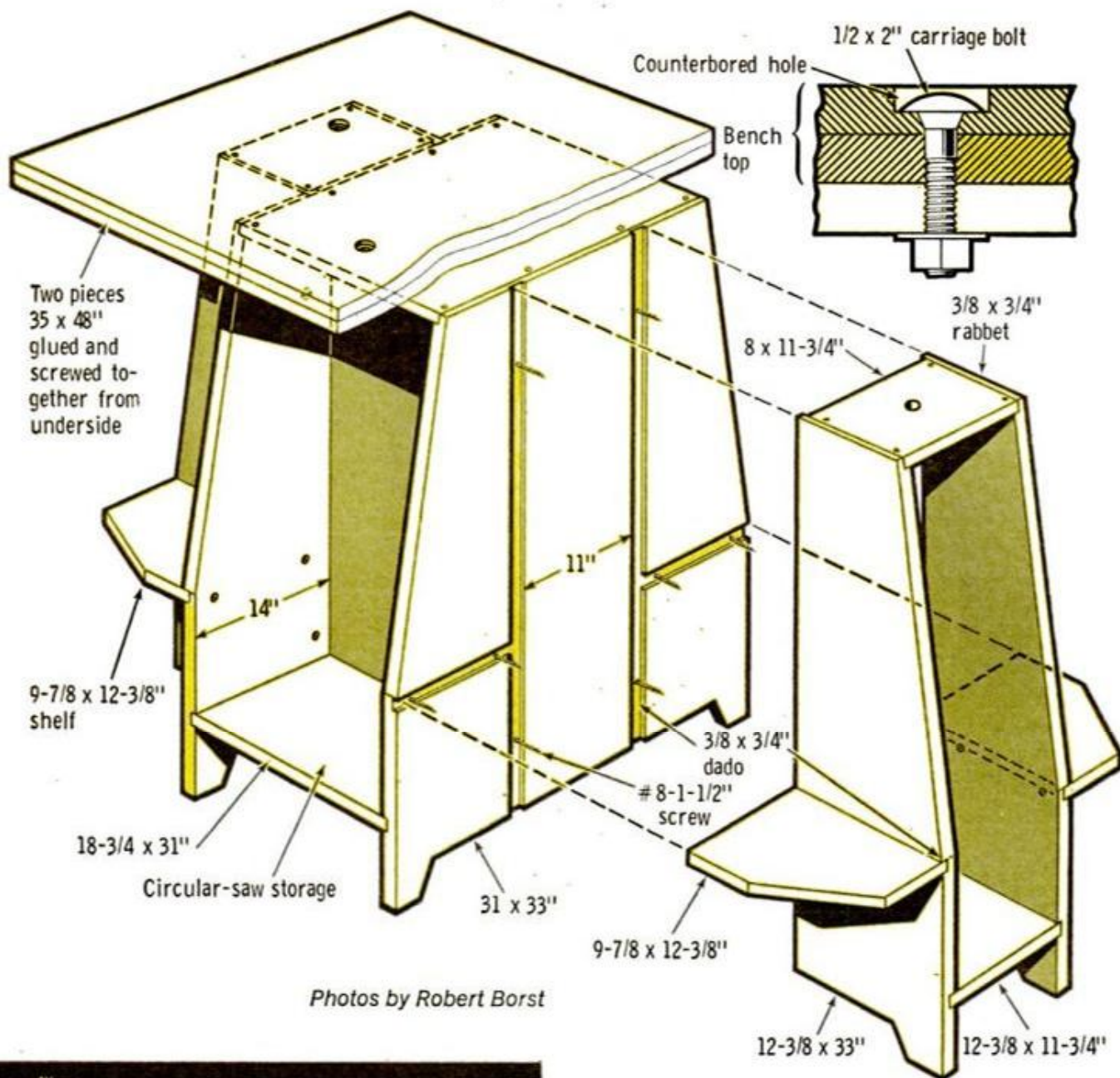
Two sets of holes are provided for the circular saw which lets you position it to suit the shape of the room and the size of the work. For example, if the room is long and narrow and you want to rip a 10-ft. or longer board, the saw is set in the four holes which will let you rip the length of the room. Conversely, when you want to crosscut a long board, you set the saw in the four holes which let you crosscut the length of the room. This way you can make the most of cramped quarters and be



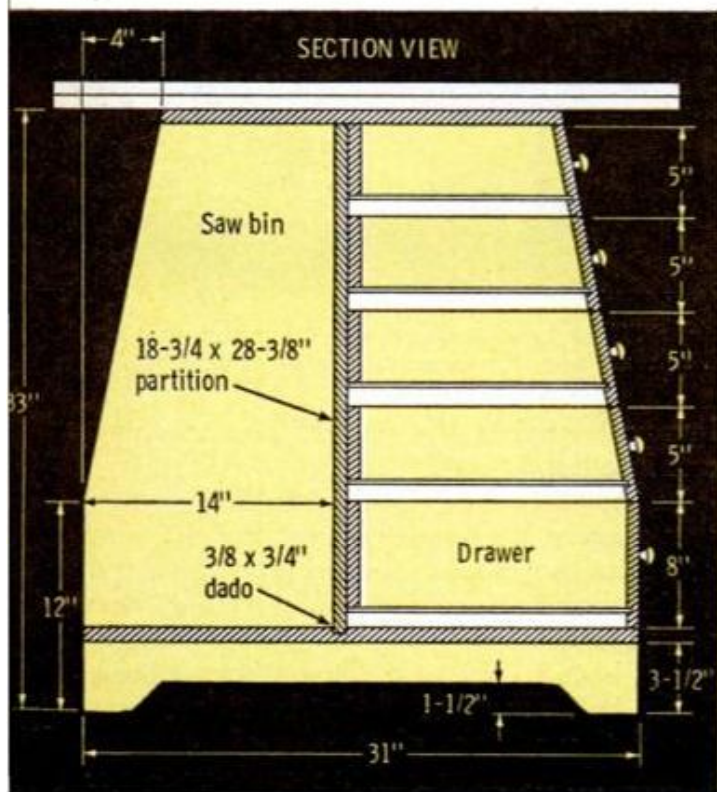
POSITIONING SAW on bench with relation to room's size lets you rip and crosscut long boards easily and without hindrance

less restricted in the size of the work you can handle.

In the case of the drill press and jointer you merely have to drill out the original holes in the machine bases to accept the $\frac{3}{8}$ -in. bolts. However, the circular saw requires bolting a $\frac{3}{4}$ x $9\frac{1}{2}$ x 12-in. plywood base to the saw's sheet-metal base. Four holes for the $\frac{3}{8}$ -in. bolts are first bored through the plywood and counter-bored $\frac{1}{4}$ -in. deep on the underside for



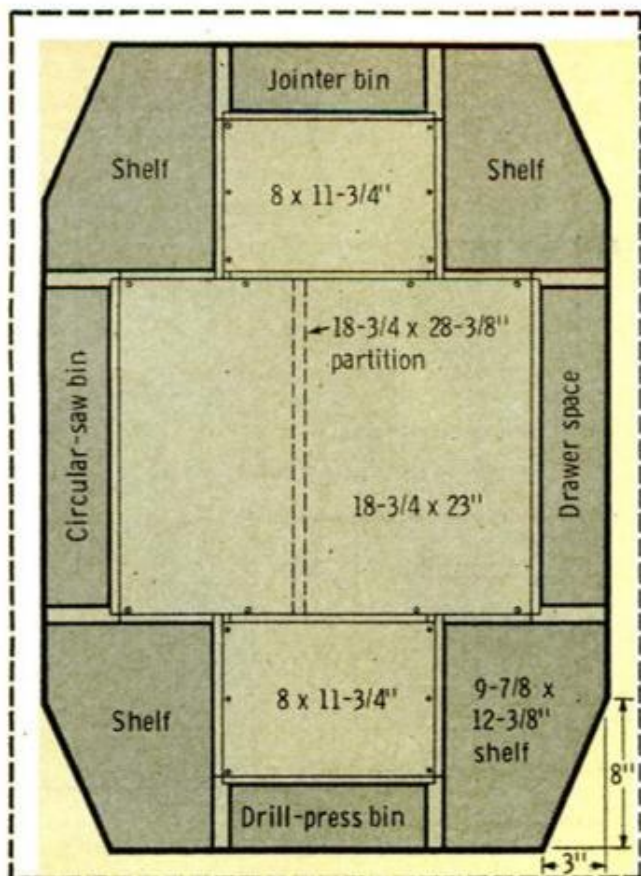
Photos by Robert Borst



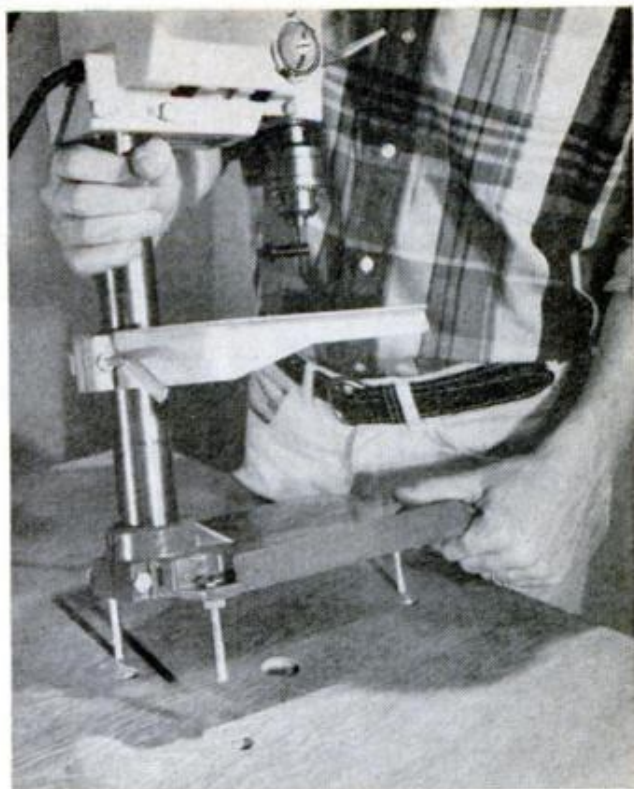
the nuts. Next, the holes in the saw's base are marked on the plywood, then drilled for $\frac{3}{16} \times \frac{3}{4}$ -in. stovebolts and also counterbored for their nuts. The stovebolts are used to attach the plywood base to the saw.

The bench, entirely of $\frac{3}{4}$ -in. fir plywood, is made in four sections; a main drawer section, a jointer stall, a drill-press stall and a double-thick top. The four sections are designed to bolt and screw together so the bench can be dismantled for easy transporting and for negotiating turns, doorways and stairs.

Start making the main drawer section first by laying out the two dadoed ends. These are made in pairs and the dados cut before the members are tapered. Dadoed joints make the sturdiest bench, but you can skip them and use plain butt



TOP VIEW



REGISTERING HOLES in benchtop receive projecting studs on each machine to anchor it while being used

joints. Likewise, the rabbeted joints across the top of the ends can be butt joints. The partition, in turn, fits a dado in the bottom member and dados in the side members, although these, too, can be mere butt joints. Nail and glue the five parts together, leaving the drawer runners until later.

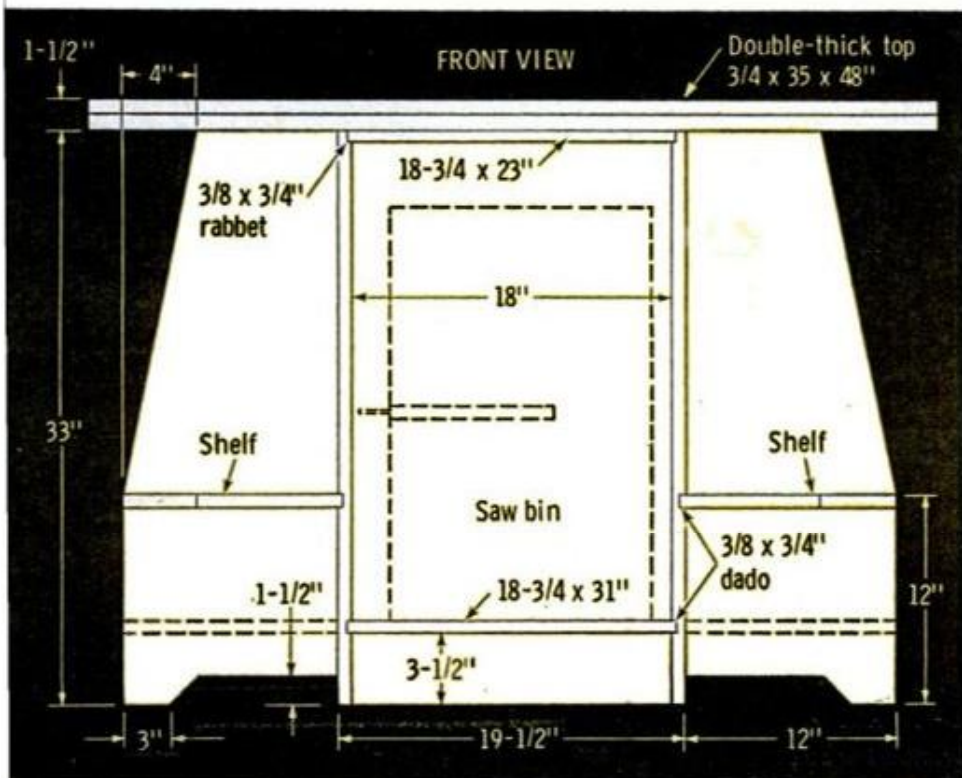
The drill-press and jointer stalls are twins and identical in size. Should you not

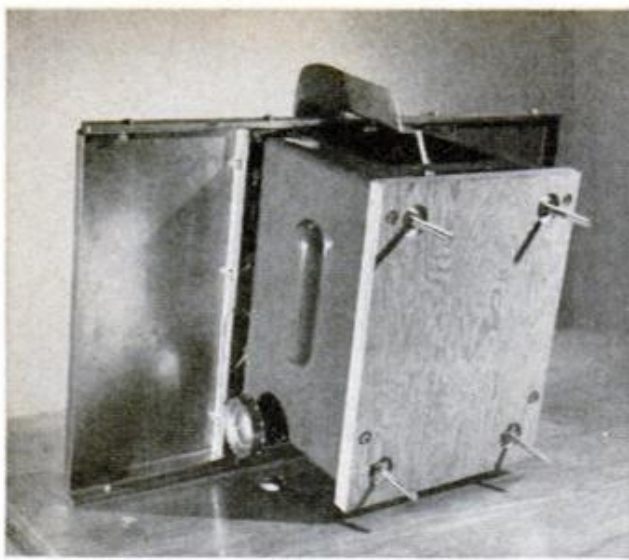
join them to the main section in dados, you don't have to deduct the 1/4-in. depth of the grooves from the dimensions given, everything will still fit. In either case, 1 1/2-in. flathead wood screws are used to attach the stalls to the main section. Note that the stalls slant inward at the top to match the main section.

Short lengths of dowel glued in blind holes in the side of the stalls, as well as in the sides of the main section, provide pegs for hanging saw blades, the saw's rip fence and miter gauge, and countless hand tools, which will save drawer space.

The benchtop is made extra solid by gluing and screwing together two thicknesses of plywood. The screws are driven from the underside. The top is attached to the base with three husky 1/2 x 2-in. carriage bolts set flush in counterbored holes. A bolt is located over each of the three stalls. Either a clamp-on or edge-mounted vise can be added to the top.

Except for the bottom

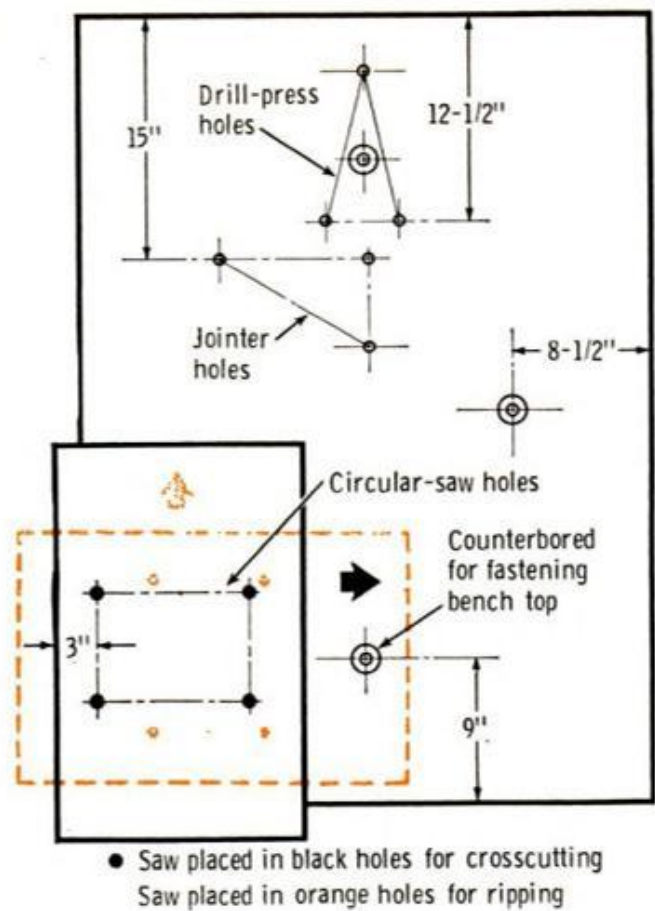




A PLYWOOD BASE is added to the saw's base to accommodate the four studs which fit holes in benchtop drawer, the drawer fronts are slanted to match the slant of the main section. Fronts, sides and backs are cut from $\frac{3}{4}$ -in. plywood, while the bottoms are $\frac{1}{4}$ -in. hardboard. The sides are dadoed for the backs and join the fronts in rabbets. Top and bottom edges of the slanting fronts are beveled so they are level, and the drawer-bottom grooves which are cut in the backs of the drawer fronts, are cut at the same angle. Similar grooves are cut in the drawer sides but these are made at right angles. Finally, $\frac{3}{8} \times \frac{3}{4}$ -in. grooves are run down the center of all drawer sides for the runners on which they slide.

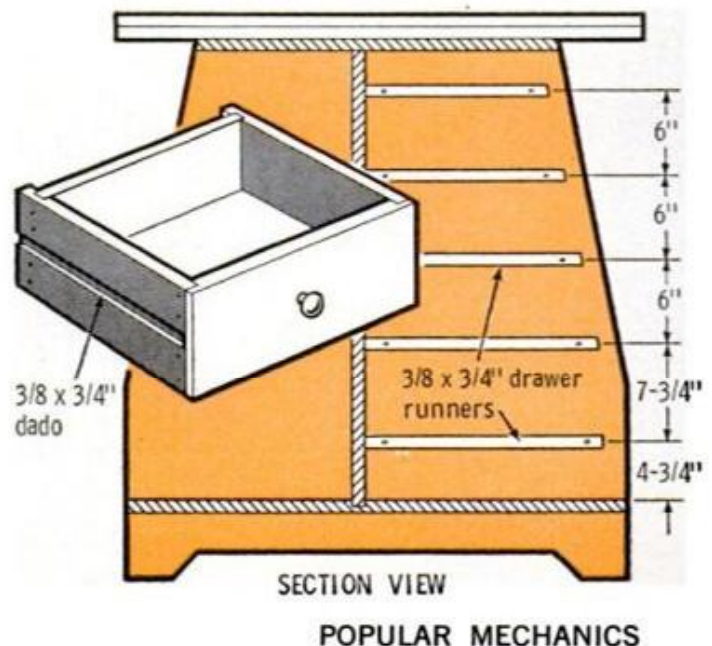


FIVE ROOMY DRAWERS provide lots of storage for both hand and portable tools, sandpaper, nails, screws



Now assemble the drawers with glue and nails and add knobs or pulls. Cardboard shims between the drawers will help position the runners so the drawers will have proper clearance. If they should rub or bind, a skimming cut through the saw will do the trick. Wax applied to the runners and grooves will make the drawers slide freely when loaded.

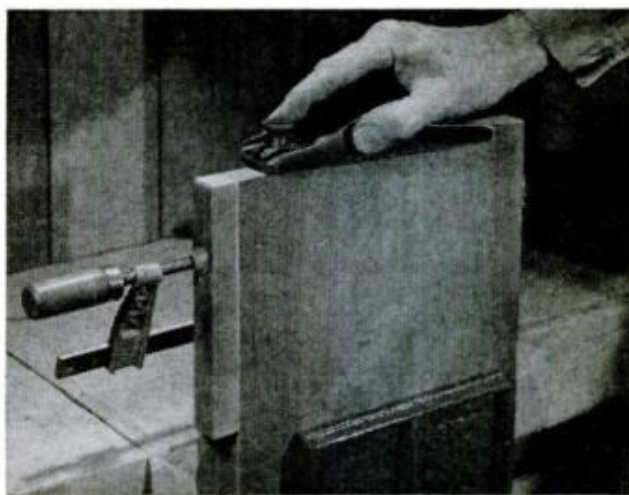
A 4-in. junction box screwed to the side of the bench and fitted with four cover-mounted outlets, plus a 10-ft. cord, will make it handy to plug-in your power tools right at the bench. ★★★



HINTS FROM READERS

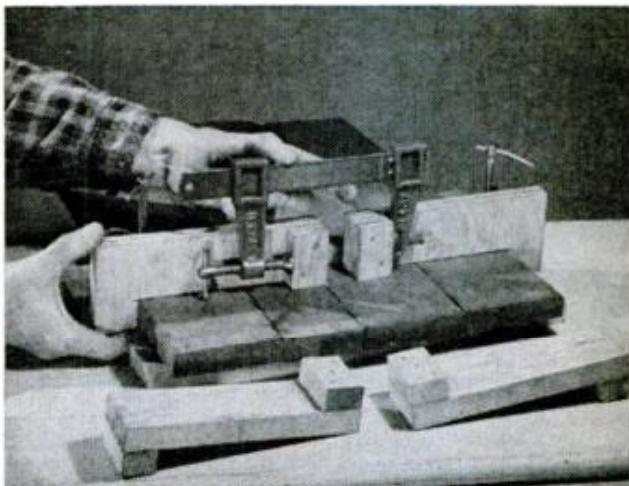
Stop splitting when planing

To eliminate the danger of edges splitting when using a butt plane for end planing, clamp a block of wood of the same thickness to the end of the board being planed. Flush with the surface, it will act as an extension of the area being worked and can be planed down right along with the work. Splitting will occur in the edge of the block, not in the work.



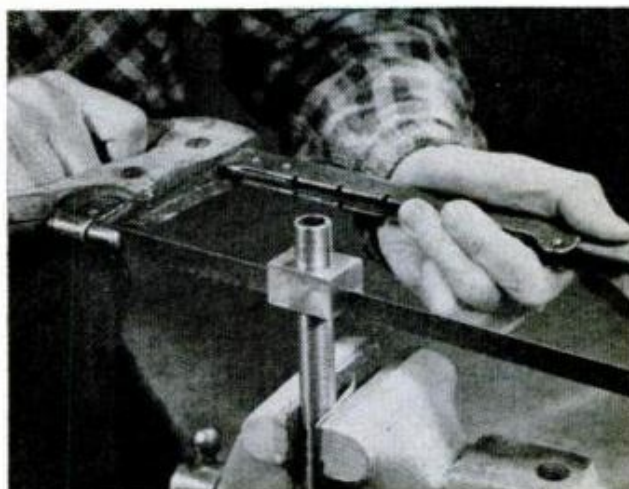
Use C-clamps as bar clamps

In an emergency, C-clamps can be used on a job which would normally require bar clamps if you make up wooden extensions to increase the capacity of the C-clamps. The L-shaped extensions can be cut from any scrap stock of sufficient length to achieve the desired span. Ideally, they should be of the same length, though this isn't absolutely necessary. Wood blocks screwed or nailed to the ends of the extensions should be small enough to fit between jaws of the clamp.



Easy way to slot tubing

To ensure accuracy when making lengthwise cuts in tubing or shafts, make up a simple hacksaw guide from a hardwood or metal block. Drill the block so that it will slip over the work and cut a slit for the saw blade halfway through the block running across the diameter of this hole. The guide rides the back of the blade and follows the cut. All you have to do is work the saw and keep the cutting action vertical. You'll be surprised how much easier this makes such jobs.

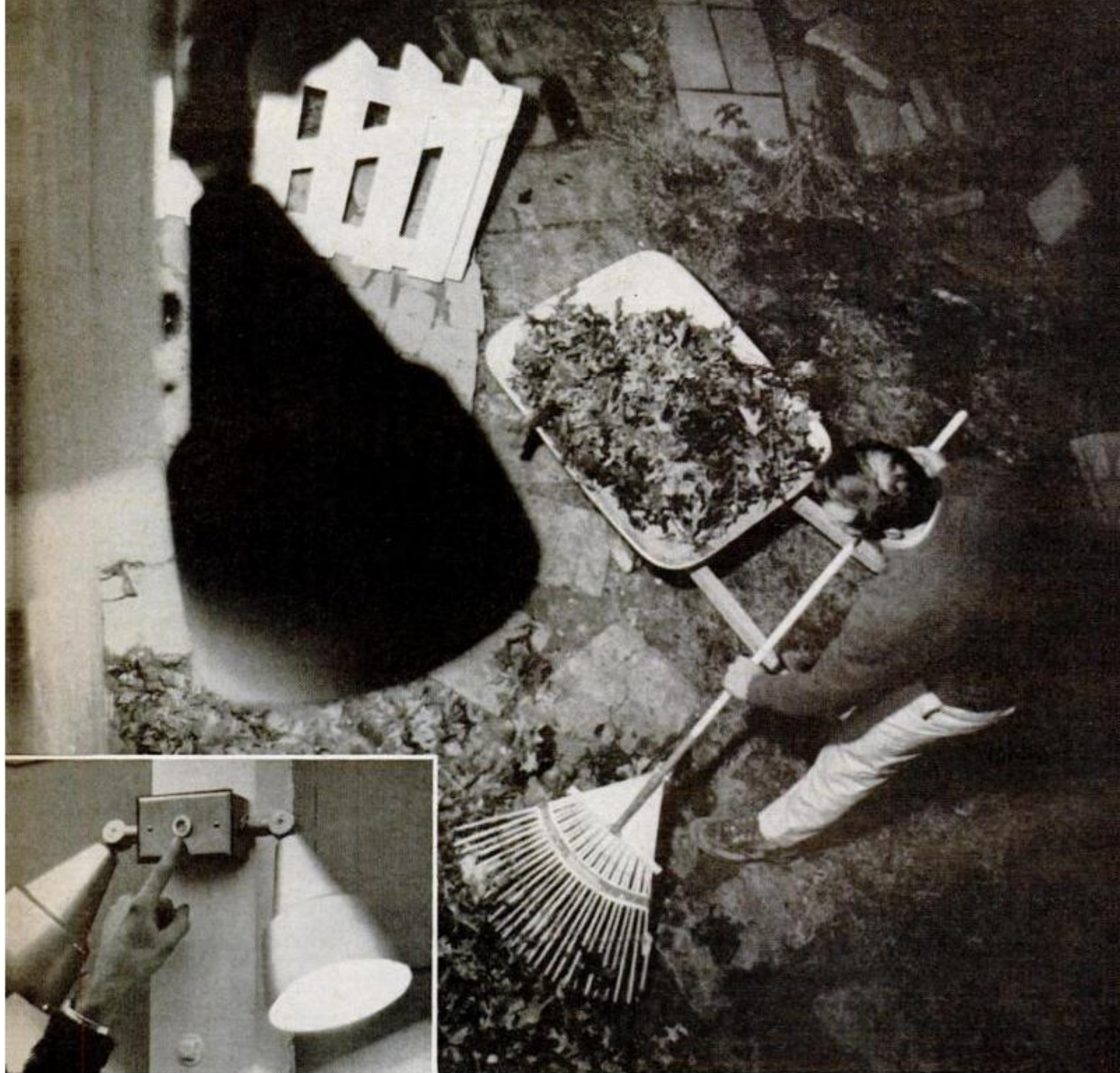


Smooth cuts with cold chisel

When using a cold chisel to cut sheet metal, clamp the work in a vise so that the cutting line is flush with the top of the vise jaws. Hold the chisel at a slight angle to the work so the cut will run from right to left (if you're right-handed) and keep the short bevel of the cutting edge flat against the top of the vise. By tapping the chisel lightly with a hammer you can produce a smooth shearing action which results in a clean and even cut in the sheet metal.

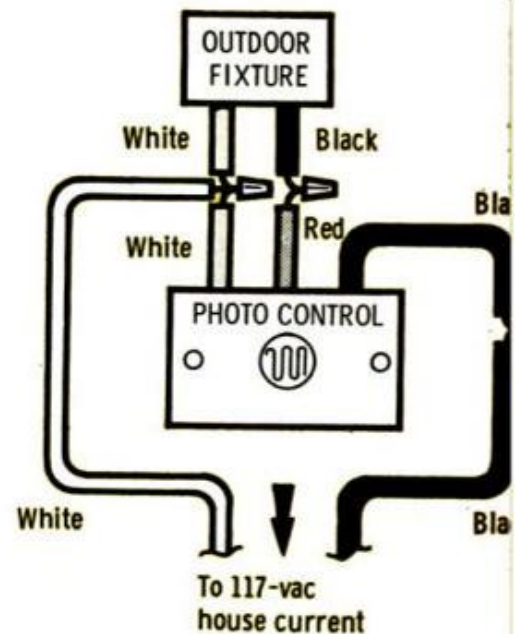


Let Your Lights Turn On Automatically with OUTDOOR PHOTO CONTROLS



Yard lights that flash on by themselves let you finish those last few evening chores without interruption and end the apprehension of leaving your home in the dark when you're away

By BILL HARTFORD



ANY OUTDOOR JUNCTION BOX will receive this stainless-steel plate with photo control from LGM Electronics. The Model W-300, rated at 300 watts incandescent, controls outdoor PAR lamps in two Bryant B-1100 fixtures. Wiring diagram at the right shows how the three leads from control are connected into the circuit

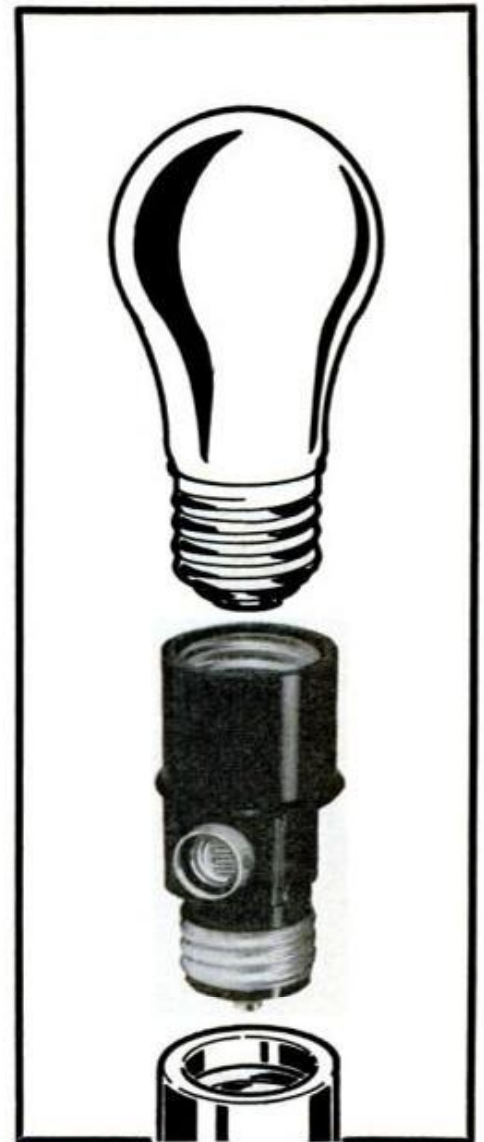
THERE'S NOTHING NEW about the phenomenon of light-sensitive photocells. Practical switching devices—the familiar electric eye, for example—use them and are familiar to us all. But what is exciting and different is the packaging of photocells in a variety of easy-to-install outdoor controls for yard lighting that are increasingly available at electrical supply stores, mail-order houses and even some department stores.

One such configuration is a photo control plate that replaces the cover plate of an outdoor junction box. The photocell triggers a switch in the control to turn your lights on at dusk and off at dawn. Wiring it into your outdoor lighting circuit is simple. Solderless connectors are the easiest way to tap the leads into the existing circuit.

Another type of photo control has the photocell mounted on a collar for a permanent lamp post installation. You can also get photo controls incorporated in swivels, in tubes and in variously shaped cases for meeting any conceivable installation requirement.

While the controls are easy to install, there are a few tips to follow so you won't be scratching your head over a blinking outdoor light or one that's on during the day and out at night. So that the light doesn't go on during the day, avoid installing the control in heavy daytime shadows. Similarly, don't have it pointing toward a streetlight or other light source that would keep it from turning on at night. Brief flashes from car headlights, incidentally, won't affect the controls since they have a built-in time-delay circuit.

Finally, make sure the photocell isn't exposed to light from the lamp it controls or the lamp will blink on and off. Use a shield between the cell and lamp if necessary. ★ ★ ★



SIMPLEST TYPE of home photo controls screws into outdoor lamp sockets and turns on and off bulbs up to 150 w.

PAINT YOUR HOUSE



WITH A ROLLER

Now that water-base paints have moved outdoors you can use the same painting methods on the outside of the house as on living-room walls

THE ROLLER REVOLUTION in do-it-yourself painting is about to spread outdoors.

Actually, the only thing that has held it back this long was the lack of good exterior water-base paints. Now that these have been perfected, there's no reason why you can't tackle the job of painting your house with the same confidence you have when painting a bedroom. The only real difference is in the size of the job.

Preparation is the same as for painting your house with a brush, which in turn is basically the same as preparing to paint with a roller indoors. Surfaces should be reasonably clean—wash any particularly dirty spots—and free of loose paint. Check for areas which may have to be scraped, and do this a couple of days before you plan to paint.

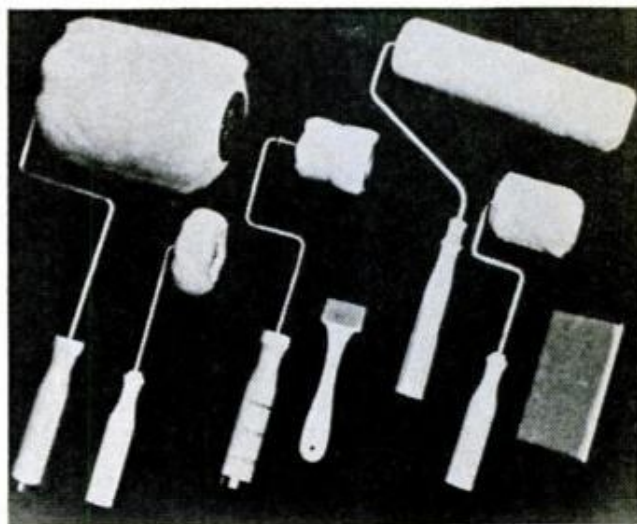
Putty nail holes and cracks. Reset any nails that have worked out. Renail clapboards or shingles that have pulled away from the surface, using extra nails if necessary.

The day before you paint, stake back foundation plantings. Just drive a couple of stakes in the outer edge of the bed for

FOUNDATION PLANTINGS should be tied back if necessary and covered with a dropcloth or newspapers



SEPTEMBER 1968



ROLLERS AND PAINTING PADS are special-purpose tools. For top results, don't skimp on your equipment

each bush and tie one end of a line to one stake, then pass the line around the bush so you can pull it away from the wall and tie it to the other stake. When painting, cover the bushes with a dropcloth or old newspapers for additional protection.

Buying the paint should present no special problems. Since you'll be using a roller, you'll have to stick with some brand of water-base paint, and here, as with many

NONSKID GRID helps you to load rollers. Hardware cloth is shown, but EZ Painter sells a sturdier unit



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USE SASH FLATS for window mullions and trim. Other special-purpose pads and daubers will speed the job

other home-improvement materials, it generally boils down to a matter of getting what you pay for. Special sales may offer a chance to save a little on the total cost, but real bargains in paint are rare.

Before you head for the paint store, take a few measurements to get a rough idea of the area to be covered so you'll know how much paint to buy. Make a mental note of the different surfaces you'll be working on; this will determine the kinds of rollers you'll need and how many.

Nap length is one important consideration when selecting rollers. It may vary

MATCH ROLLER to the area to be covered. Small one coats a railing much faster than standard size would



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SEGMENTED ROLLER on a flexible core wraps around downspouts so you can paint them in one easy pass

from $\frac{1}{4}$ in. (most common, and still best for most work) up to $1\frac{1}{4}$ in. (special-purpose length for extra-rough masonry, chain-link fences and other unusual jobs).

A short-nap roller will lay on the smoothest coat and is best for smooth surfaces. A long-nap roller is better for rough surfaces, because it can reach the bottoms of minor irregularities. For the best compromise between smoothness and coverage capability, always pick the shortest nap that will handle the job efficiently.

The type of fiber is also important. Always choose a synthetic. Natural fibers

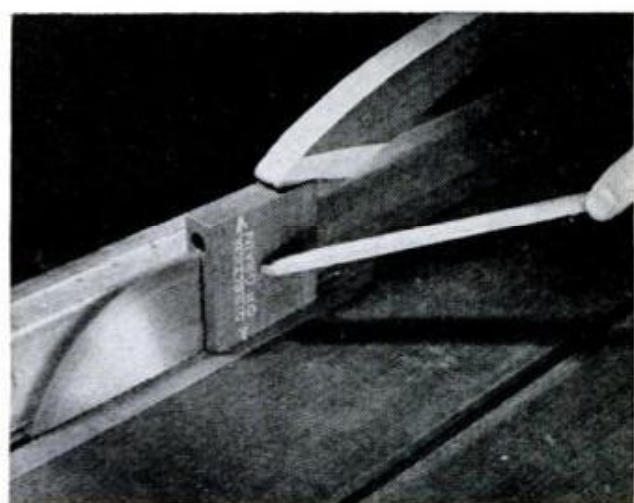
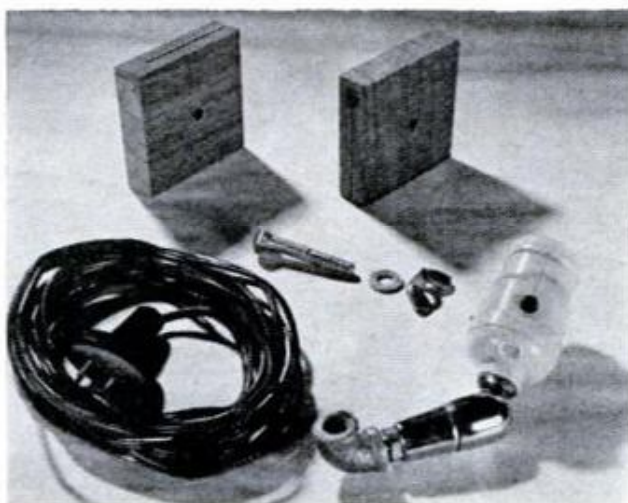
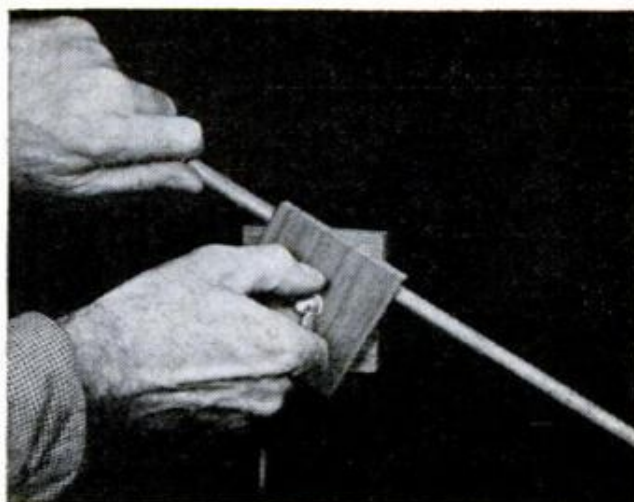
(Please turn to page 195)

TO STORE ROLLER overnight, just wrap in foil or a polyethylene bag and place it in your refrigerator



POPULAR MECHANICS

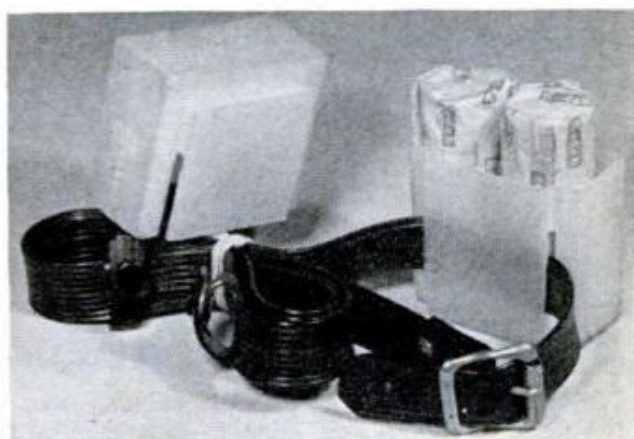
PHOTO HINTS



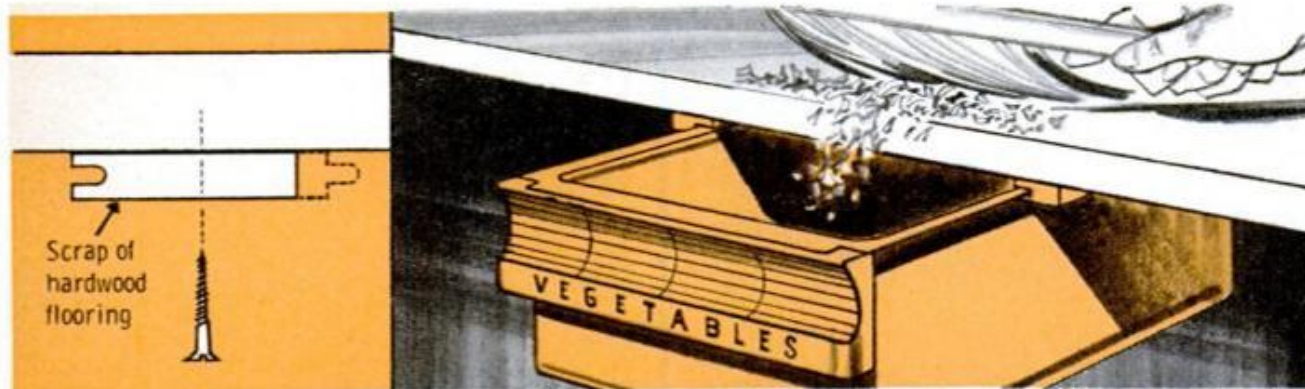
BUILD YOUR OWN BOOM LIGHT. Commercial boom lights are costly, but you can put this homemade version together for about \$3. The boom is made to fit on a regular light stand. For the main arm, you'll need a 4-ft. length of $\frac{1}{8}$ -in. galvanized pipe, threaded on one end. The power cord is hidden neatly inside the pipe so it's not in your way. For the lamp socket, it's best to use the plastic type so you can move it around easily without having to touch hot metal. To the socket, add a lamp swivel. These are available at hardware stores and lamp shops. Thread the swivel onto a 90° pipe elbow. The elbow, in turn, is screwed onto the threaded end of the boom pipe. The boom is mounted on a

light stand by means of a homemade swivel that enables you to slide the boom in and out and tilt it in any direction. This consists of two split blocks of wood held together by a bolt and wingnut (upper right). The boom slides in a hole in one block, and the other block slips over the top of the light stand. Tightening the wingnut squeezes the blocks and locks everything rigid. The blocks are 3 in. square and $\frac{3}{4}$ in. thick, preferably of hardwood. Drill the holes across the grain, then carefully cut the slits with the grain on a table saw (bottom photo at right above). The block that fits on the light stand should be drilled only part way through so it can't slide down.—F. L. Greenwald

IF YOU'RE ALWAYS RUNNING OUT OF FILM because it's inconvenient to carry along extra rolls, here's a solution. Make a handy belt pouch for your film supply from an ordinary plastic container of the type designed to hold a pack of cigarettes. Such containers usually have an extra compartment at the side for matches that makes them easy to alter for the purpose. Slots cut in this compartment allow you to run a belt through the container without interfering with the main space. Matching slots cut in the upper half of the container let the lid slip on and off over the belt. The pouch will hold two rolls of 620-size film or four 35-mm cartridges. Carrying one or more pouches around your waist will put the film where it's easy to reach and keep your hands free.—Arthur L. Ramos



Solving home problems



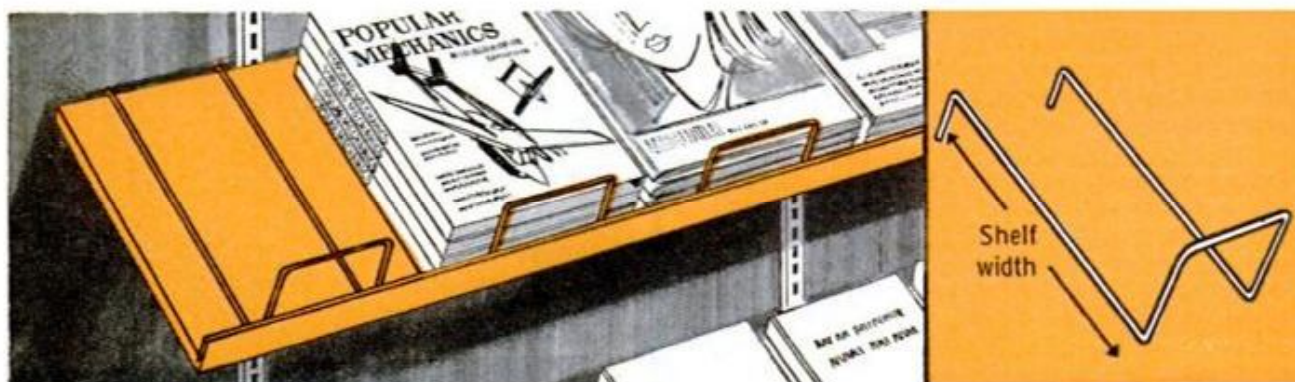
DEBRIS DRAWER on the underside of your workbench slides out to catch the mess when you're cleaning up. Use the vegetable bin from an old refrigerator, mounting it on tracks made of grooved hardwood flooring



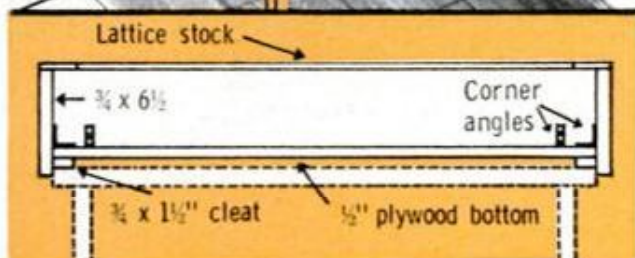
TO MAKE ONE KEY stand out from the others on a loaded key ring, drill an offcenter hole in the top and slip the ring through this. It's great for a key used often or one you have to find in the dark



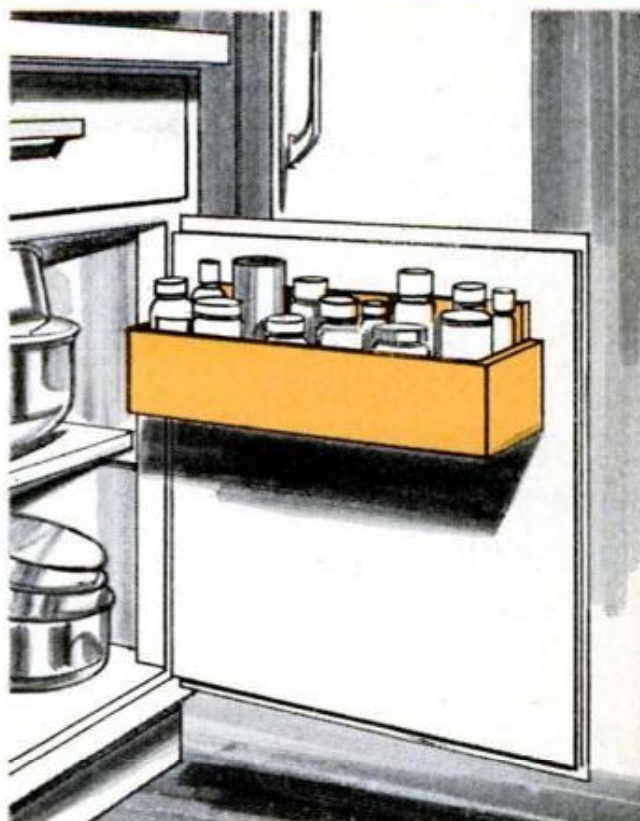
LIGHT-DUTY WALL HOOK to hold a couple of suits or dresses can be made by cutting off the upper part of a heavy coathanger and bending the cut ends to form mounting loops for screws. Bend hook out 90°



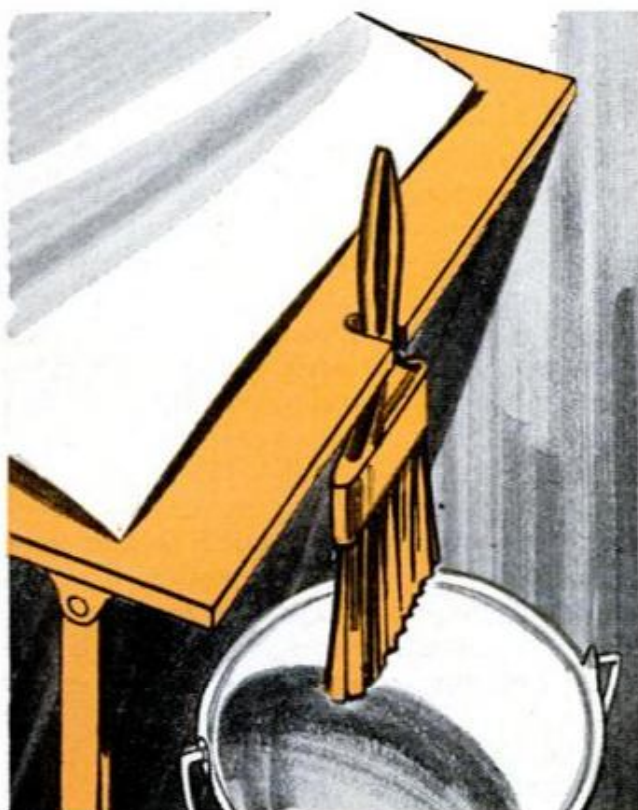
TO INCREASE CAPACITY of an inclined magazine shelf, make extension brackets of coathanger wire to fit the shelf. These will hold three or four times as many magazines as the normal retainer lip on the shelf



INDOOR SANDBOX is a real mom-saver for those rainy days. It's just a shallow tray with a plywood bottom and a narrow rim which (hopefully) keeps the sand inside. Mount the tray on a cut-down card table



HIDDEN SPICE RACK hung on the inside of a cupboard door near the kitchen range will protect spice containers from heat, dust and cooking film. Make it from plywood and finish to match the cupboards



HANDY HOLDER for a paperhanger's paste brush can be made by sawing a square notch in the end of the table slightly narrower than the wide portion of the handle. The paste pail below will catch any drips



BATHTUB VANITY with its own mirror is also the fold-down door to a space-saving storage cabinet installed between the studs. Make the whole thing from exterior plywood and finish to match the bathroom tile

How to Install Underlayment

Any resilient floor covering requires a smooth, firm foundation. This quick course in underlayment covers the three materials you can use under tile or linoleum.

By ARTHUR MIKESSELL

Technical Art by Don Evans



THE BEST TIME to learn about underlayment is *before* you add that extra room, *before* you remodel the kitchen or *before* you convert the garage into a family room. Otherwise, you may discover too late just how important this special foundation is to a new tile or sheet floor, and that's the most expensive way to learn.

Today's resilient floor coverings are all relatively thin. Under the pressure of normal wear, they soon lose that fresh-from-the-carton flat surface and settle to conform to the contours of the surface on which they have been laid. If you have a good underlayment installation, you have nothing to worry about since the surface is perfectly flat.

On the other hand, if the surface is an improper underlayment installation or if you've omitted underlayment entirely, your new floor will soon begin to show high and low areas. High spots automatically receive more than normal wear and they don't take long to show it. Cracks may develop. The floor loses its like-new appearance long before it should and ultimately will have to be replaced much sooner than would otherwise have been necessary.

Underlayment not only provides the



MASONITE PHOTO

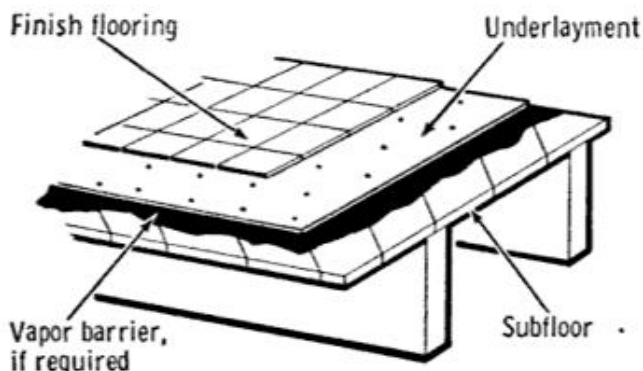
necessary smooth and firm foundation for your resilient floor, but also adds a certain degree of stiffness. While not a structural member, the sheet nature of the material has the effect of spreading the load over a larger area, a fact of particular importance if you're putting down resilient floor covering over an old wood floor.

There are other advantages to underlayment not directly related to the floor covering it supports. Insulation, for instance. That extra layer of material can make a big difference, especially if the floor happens to be located over a crawl space.

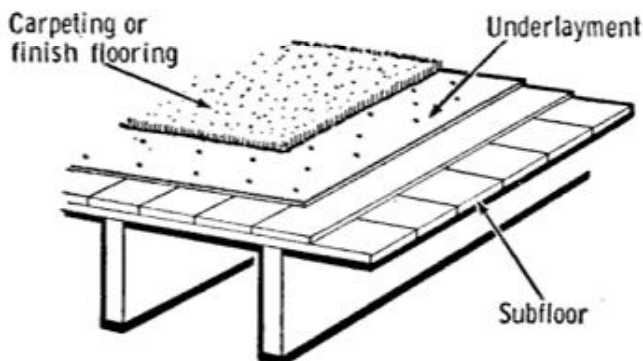
Underlayment also cuts down on noise transmission. That noisy game of table tennis in your basement rec room will seem much quieter to anyone in the room above if the sound has to penetrate through another layer of material. Like-

TYPES OF APPLICATION

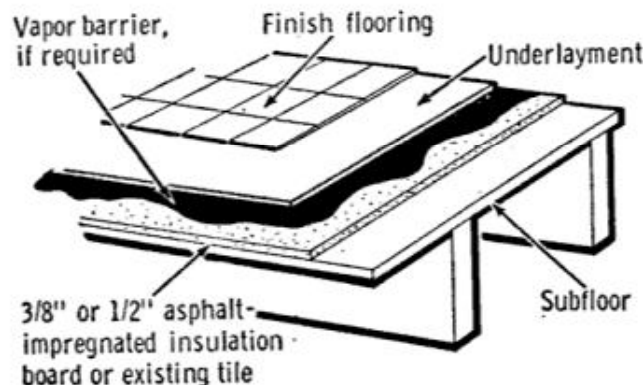
OVER WOOD SUBFLOOR. When an underlayment is being installed directly above a damp basement or an unheated crawl space, apply a suitable vapor barrier between the subfloor and the underlayment material



OVER OLD WOOD FLOOR. Remove the base shoe and check the existing floor for flatness and freedom from any protruding nails. The underlayment is stiff enough to bridge small irregularities, such as those that exist in a washboard floor, but any large gaps or low portions should be filled and all high spots should be cut down to furnish a solid base



OVER OLD TILE FLOOR OR FILLER LAYER. When it's necessary to build up a new floor to the level of an adjacent floor, asphalt-impregnated insulation board of the required thickness may be used as a filler between the subfloor and the underlayment. Of course, this is assuming that you anticipate no more than normal traffic and average loads. If you expect heavy concentrated loads, you'll need a dense filler, such as additional layers of underlayment. Fasten the filler material to the subfloor, then use at least 1½-in. underlay nails when installing the underlayment. You may install an underlayment directly over an existing tile or linoleum floor, provided that you first remove any loose pieces. However, be sure that it's dry and free of protruding nails



wise, an upstairs nursery having a resilient floor covering laid on underlayment will be better insulated from downstairs noise than if the underlayment were omitted.

Underlayment can be any of three different materials: plywood, hardboard or particleboard. All are specially manufactured for use as underlayment.

Plywood underlayment, for instance, has a "C" pluggier face ply which has been fully sanded for maximum smoothness. Under this is a "B" or "C" veneer designed to reinforce the face ply and resist puncturing. For reasons of economy, the remaining veneers and back are "D".

You can also buy plywood underlayment of the same construction bonded with exterior-type glue for use where unusual moisture might otherwise create a problem.

If you decide to use plywood, be sure to buy underlayment grade. Don't be tempted to go to the more economical "C-D Plugged." This is similar to underlayment, but that veneer beneath the face ply is "D" instead of "B" or "C." This means that knotholes measuring up to 2½ in. are permitted, so it's not as well suited to resist dents and concentrated loads.

Combination product

Incidentally, in new construction you can use a special 1⅜-in. plywood which combines subfloor and underlayment. This "2-4-1" grade not only saves time during installation but performs just as efficiently as separate subfloor and underlayment layers of plywood.

Hardboard underlayment is made by "felting" selected wood fibers, then consolidating them under heat and pressure. The resulting material is dense, grainless and moisture-resistant.

Masonite's hardboard underlayment features the normal smooth hardboard surface on one side, while the other is planed smooth to provide uniform thickness. Printed on each panel are installation instructions, nailing locations and edge alignment marks.

Georgia-Pacific's hardboard underlayment has a coarse-sanded surface to increase adhesive bonding properties.

As noted in the table, some floor-covering manufacturers specifically recommend bonding their products to either the smooth or rougher side of hardboard

FACTS ABOUT UNDERLAYMENT

DESCRIPTION

HARDBOARD

3x4' and 4x4' sheets 1/4" thick

PARTICLEBOARD

4x8' panels in thicknesses of 1/4, 3/8, 1/2, 5/8 and 3/4"

PLYWOOD

4x8' panels in thicknesses of 1/4, 3/8, 1/2, 5/8 and 3/4". Face ply, plugged C; back ply, D

PRELIMINARY WORK

HARDBOARD. Existing subfloor should be clean, dry, securely fastened and free of protruding nails. Where floor is irregular over large areas, low portions should be filled or high spots sanded to provide solid base. (Joint fillers are not recommended.) If atmosphere is abnormally damp due to wet concrete, wet plaster or other temporary conditions, wait until room has dried out before beginning installation. When humidity conditions are close to normal, unwrap panels and stand them on edge separately around the room for at least 24 hours to stabilize to existing conditions.

PARTICLEBOARD. Same precautions as for hardboard concerning atmospheric moisture, condition of subfloor and stabilizing period. For installation over unexcavated crawl space, make sure foundation is well-vented and install a vapor barrier directly over the ground. Never apply directly to concrete or below grade. Hot-air ducts and area over furnace must be well-insulated to prevent localized drying of floor components. Vapor barrier must be installed over subfloor if it's square-edged dimensional lumber. (This is recommended as "good practice" even when subfloor lumber is tongue-and-groove.)

PLYWOOD. Where floor may be subject to unusual moisture conditions, use exterior-grade panels. Choose 1/4" for installation over plywood subfloors or lumber subfloors in which the boards are 3 5/8" wide or narrower. With lumber subfloors made up of wider boards or those that are particularly uneven, go to 3/8" thickness.

FASTENING

HARDBOARD. Use 1 1/4" ring-grooved underlay nails or 4d cement-coated sinker nails. Begin nailing at the center of each panel and work out toward the edges. Nails should be spaced 6" o.c. throughout, but no closer than 3/8" to edge. Drive nailheads flush with surface. You can also use staples to fasten underlayment, but you'll need a "spotnailing" machine. Recommended are etched or galvanized divergent chisel-point or plastic-coated staples 7/8" long, such as those made by Spotnails, Inc. These should be spaced 6" o.c. throughout the body of the panel, but only 3" apart along the edges and no closer than 3/8" to edge.

PARTICLEBOARD. Nails or staples should be long enough to penetrate subfloor at least 3/4". Begin at center and work outward. Use 6d ring-grooved nails for 3/8"-5/8" thickness, spacing them 10" o.c. throughout body, 6" o.c. along edges and no closer than 1/2" to the edge. If stapling, use 1 1/8" galvanized divergent chisel-point staples for thicknesses to 3/8", 1 3/8" length for 1/2" thickness and 1 1/2" for 5/8". Staples should be spaced 6" o.c. throughout body, 3" o.c. around the edges and no closer than 1/2" to the edge. Staples should be countersunk.

PLYWOOD. If nailing, use 3d ring-shank nails for thicknesses to 1/2" and 4d nails for 5/8 or 3/4". Space them 8" o.c. throughout the body and 6" o.c. along the edges. Staples should be 16-ga. (18-ga. for 1/4") and long enough to penetrate at least 5/8" or completely through subfloor. Staple spacing is 6" o.c. in body and 3" o.c. along edges. Unless subfloor and joists are thoroughly seasoned material, countersink nailheads 1/16" just prior to laying the finished floor to avoid nail popping. Staples should be countersunk 1/32".

APPLICATION

HARDBOARD. Start in one corner, fastening each panel securely before laying adjoining panel. (Note: Some floor-covering manufacturers specifically recommend bonding their products to the smooth surface or the rough surface. Check this before installing first panel.) Stagger panel joints in one direction. If subfloor is lumber, plan layout so that continuous joints in underlayment are perpendicular to the direction of boards in the subfloor. Avoid placing underlayment joint directly over joint in subfloor. Allow 1/8" space between wall and underlayment. Fit panels loosely, leaving space about the thickness of a dime between adjoining edges. Before putting down finish floor, check all joints for rough edges caused by cutting and use sandpaper or a block plane to smooth any rough areas.

PLYWOOD. Stagger all joints with respect to subfloor joints. For maximum stiffness, place face grain of underlayment across supports and end joints over framing. Allow 1/32" space between panels. Fill any damaged or open areas (joints or splits wider than 1/16", for instance), but don't bother filling nail holes. Sand down any surface roughness around nails or along joints before installing finish floor.

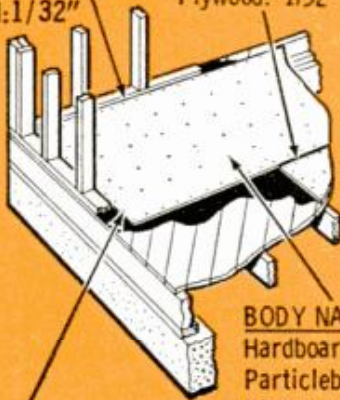
INSTALLATION TIPS

EDGE SPACING

Hardboard: 1/8"
Particleboard: 3/8"
Plywood: 1/32"

PANEL SPACING

Hardboard: thickness of dime
Particleboard: none specified
Plywood: 1/32"



BODY NAIL SPACING

Hardboard: 6" o.c.
Particleboard: 10" o.c.
Plywood: 8" o.c.

EDGE NAILING

Hardboard: 6" o.c. ; 3/8" from edge.
Particleboard: 6" o.c. ; 1/2" from edge
Plywood: 6" o.c.

underlayment, so be sure to check this before you begin the installation.

Particleboard underlayment is made up of matted wood fibers which have been compressed to uniform density and bonded with special adhesives under heat. It's hard, durable, resilient and will resist sharp blows.

When installing underlayment, be sure to stagger the joints in bricklayer fashion. Also, be careful not to locate these joints so that they will coincide with joints in the subfloor. Ideally, the long axis of the underlayment should be at right angles to that of the subfloor.

Detailed instructions for installing each of the three types of underlayment may be obtained from your lumberyard or directly from the manufacturer. For a brief outline of these recommendations, check the table above. ★★★

AUTOMATIC PAINT TRAY MOUNTS ON ANY LADDER

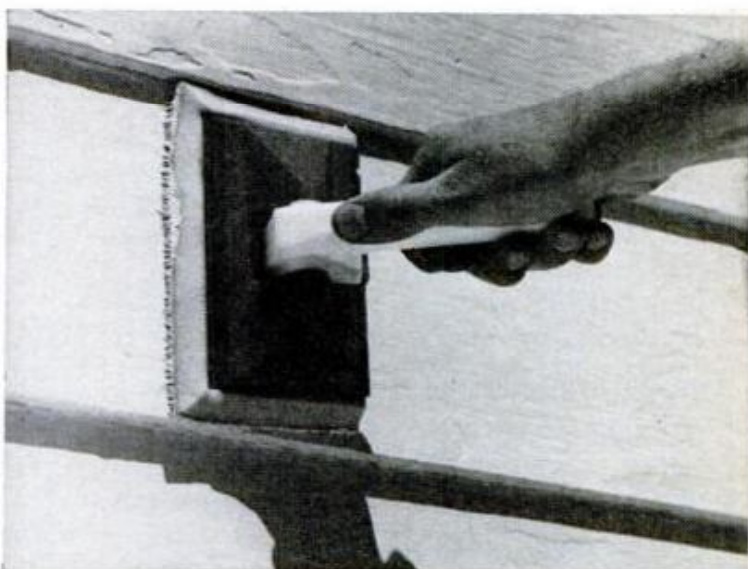
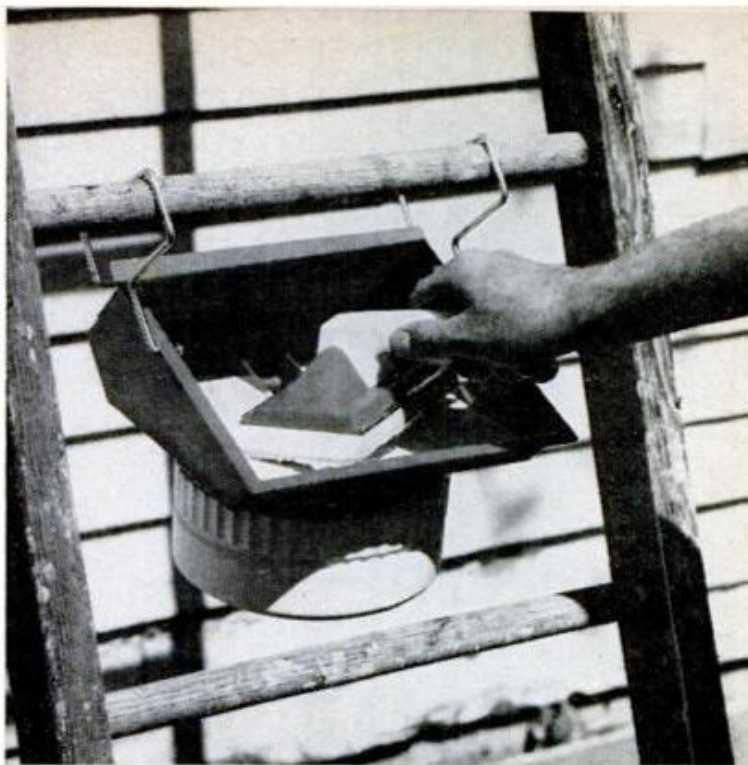
WATER-BASE PAINTS designed for exterior use made it possible to use a roller when painting the outside of your house. They also led to development of an entirely new type of applicator—the foam-plastic “painting pad.”

Basically, this consists of a handle unit and a foam pad having fibers on the painting face. You simply load the pad with paint and wipe it on the surface.

You can replace the foam pad in most models for about the same cost as a paint-roller cover. Like rollers, many have handles threaded for extension poles.

Up to now, painting pads had one big drawback—you had to have a paint-roller tray to load the flat face of the pad. While this presented no problem at ground level or on a stepladder, it made pad painting from an extension ladder almost impossible.

EZ Painter's new Tip'n Dip paint tray, which sells for \$3.49, is an ingenious solution. The wire bracket can be hooked over the square edge of a stepladder step or hung from the round rung of an extension ladder. It also doubles as a carrying handle.



WIRE BRACKET allows tray to hang level (top photo). You can use it with either a painting pad, above, or a paint roller

1. FILL RESERVOIR



2. TIP TO FILL TRAY



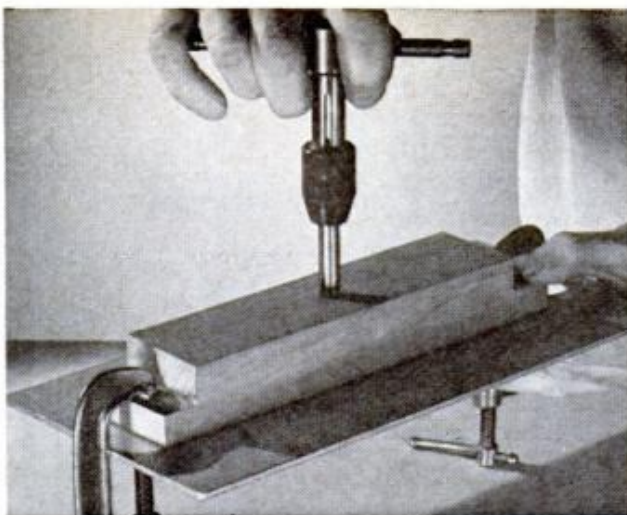
3. LOAD PAD OR ROLLER



HINTS FROM READERS

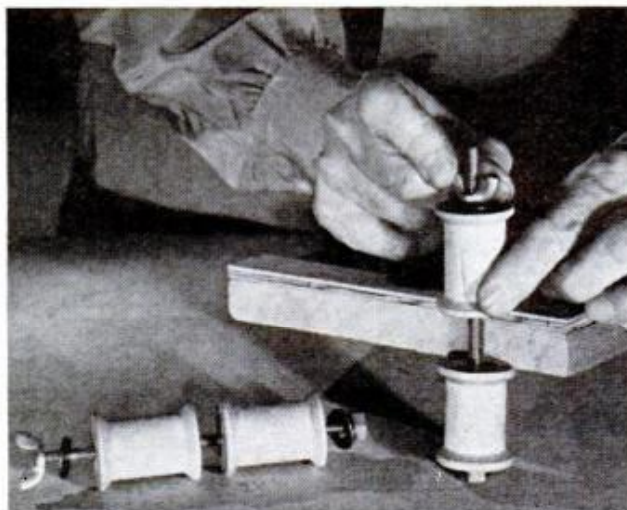
Use guide to tap thin metal

A small wood block with clamping shoulders cut in either end will simplify the job of tapping holes in thin metal. Just drill same-size lead holes in the block and the metal, then align the hole in the block with the hole in the metal and cut threads all the way through. The block has the effect of thickening the metal and serves as a guide for the tap as it threads the hole in the metal.



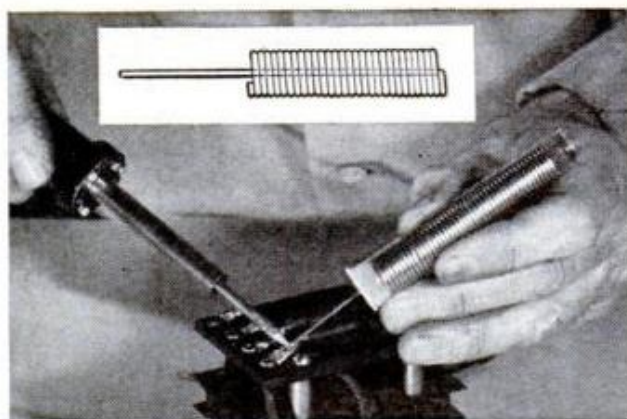
Mini-clamp for small jobs

Occasionally, you may run into clamping jobs too delicate for the clamps you have on hand. The best solution is to make up small clamps such as those shown at right. Each requires a pair of spools, two large washers and a long bolt with a wingnut. The washers go on the ends to provide bearing surfaces for the bolt head and nut. For most small jobs, tightening the wingnut with your fingers will produce sufficient pressure. If more is required, grip the bolt head with a wrench. It's a great idea for hobbyists.



Handy solder dispenser

Any small straight-sided plastic bottle with a screw-on or snug-fit cap can be turned into an easy-to-use solder dispenser with a minimum of work. Drill a hole in the cap to feed the solder through. Next find a dowel or shaft having a diameter slightly smaller than that of the bottle and coil the solder around this. Leave one end long so it can be pulled up through the coil and out the top.

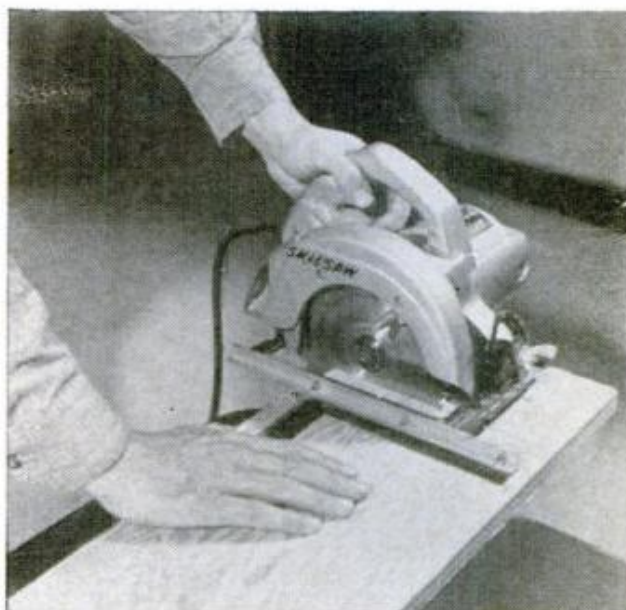
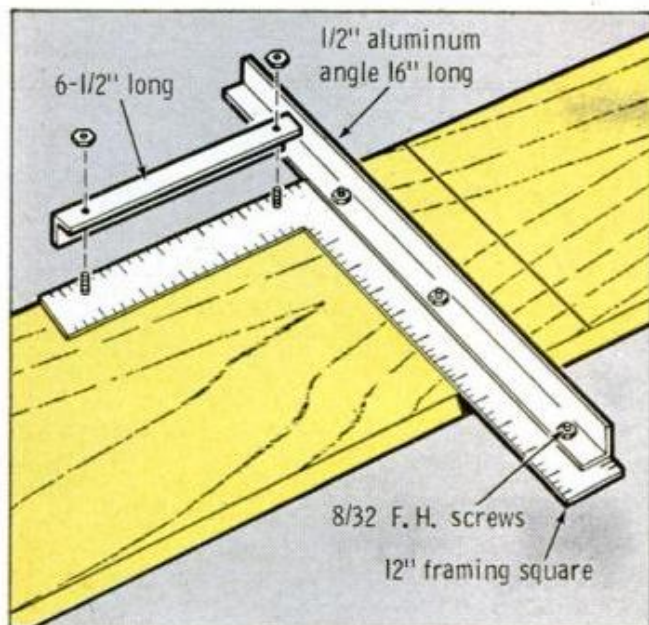


Improvised marking gauge

When you need a marking gauge you can easily improvise one with a wooden clothespin. Cut off one leg of the pin flush with the bottom of the notch to form a shoulder which will ride against the edge of the stock. Then drill marking holes at desired intervals, measuring from this shoulder. If you need greater capacity than that offered by a clothespin, the same basic idea can be used with any light square stock in your scrap box. Just cut a shoulder, then drill marking holes.



Crosscut Guide for Your Portable Power Saw



THIS SIMPLE SAW GUIDE is the handiest possible accessory when you run into a job requiring table-saw accuracy from your portable power saw. Made from a 12-in. framing square and two lengths of aluminum angle, it will handle stock up to 12 in. wide which is sufficient for most cutting jobs of this type. You can make it for about two dollars.

Mount the aluminum angle on the square with countersunk flathead screws so that it will lay flat on the stock. The shorter piece of angle fits against the edge of the stock and automatically aligns the square. The longer piece guides the saw.

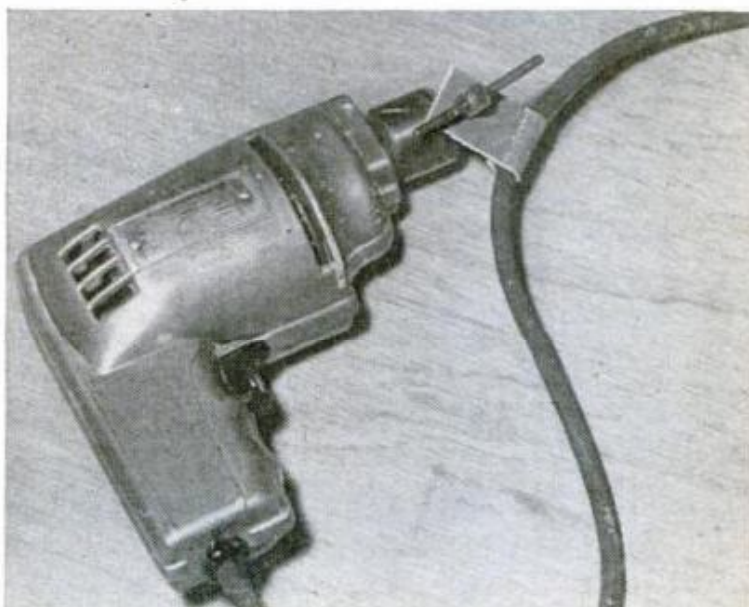
Incidentally, the guide shown here is strictly for southpaws. If you're right-handed, change the angle mounting accordingly.—*Joseph L. Barry Jr.*

Syringe proves handy in shop

A battery-filling syringe can be a valuable addition to your shop. It's great for forcing solvent or oil into hard-to-reach spots, and it holds enough fluid to make frequent refilling unnecessary. Such a syringe is also handy for washing the parts of a firearm without completely dismantling it.—*Wayne M. Judy*

Improvised chuck-key holder allows key to turn freely

There are plenty of chuck-key holders on the market today, and most of them work quite efficiently. However, this easy-to-make holder not only ranks right up at the top in efficiency but costs practically nothing. It's made from a scrap strip of sheet metal roughly 3 in. long. Just drill a hole near one end slightly over-size for the key shaft and crimp the other end around the drill cord about a foot from where it enters the handle. Then drive the key handle out, slip the shaft through the hole and replace the key handle.—*William Waggoner*



How to Put a Keen Edge on Irons and Chisels

Once you know how blades are sharpened originally, resharpening them becomes a simple 3-step procedure

DURING THE MANUFACTURE of a plane iron or chisel, a blade is heat-treated to make the steel hard enough to "take" a cutting edge and tough enough to "hold" it. After the blade is surface-ground, the business end is ground to a 25° to 30° bevel, yielding a wedgelike edge acute enough to cut wood fibers, yet beefy enough to resist nicking. The edge then is whetted true and honed smooth.

Thus, resharpening such a blade is really a metal-finishing job. If you repeat the manufacturer's three original finishing steps, you can resharpen *any* beveled cutting tool scalpel-sharp in minutes.

The first step is to true the blade's flat face; the second, to recut the edge-bevel; third, to hone both faces perfectly smooth.

You'll need two oilstones; a combination coarse-and-fine stone for whetting, and an Arkansas stone for honing.

Most combination stones are made of vitreous-bonded synthetic abrasive grit, such as silicon carbide or aluminum oxide. Silicon carbide stones are sharper and fast-cutting. Aluminum oxide stones cut slowly, plowing shallow scratches and leaving a smooth finish.

Arkansas stones are finely-textured



By JOHN BURROUGHS

natural white rocks actually quarried in the Ozarks. They're available in two quality grades, hard and soft. Hard Arkansas stones are expensive and slow-working, but hone superbly and wear forever. Soft Arkansas stones are cheaper and slightly faster-working, but are more porous and thus wear faster. (All stones should be saturated with non-gumming mineral oil before use.)

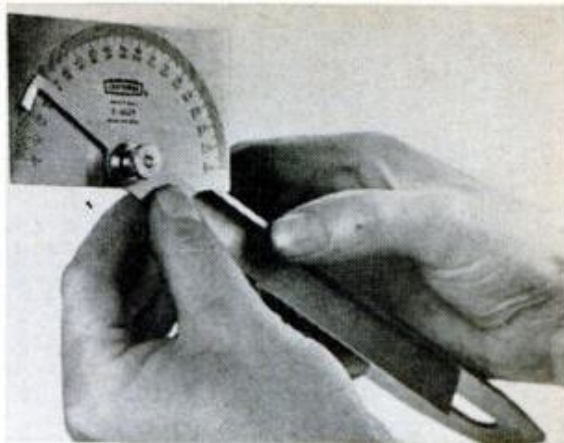
Ordinarily a bevel-edged blade won't require grinding. When the cutting edge is chipped or badly nicked, however, grind down the bevel on a 70-grit aluminum oxide wheel to remove the nicks. Take care when grinding not to heat the blade enough to draw its hardness.

Whetting the flat side of the blade, the initial step in resharpening, produces a perfectly true plane surface by removing minute rust pits and scratches *without* rounding the cutting edge. Place the blade flat on the fine-grit side of your combination stone and lightly work it over the stone without rocking. With plenty of oil, suction will help keep the blade flat. Continue whetting until the steel has a smooth, true finish edge to edge.

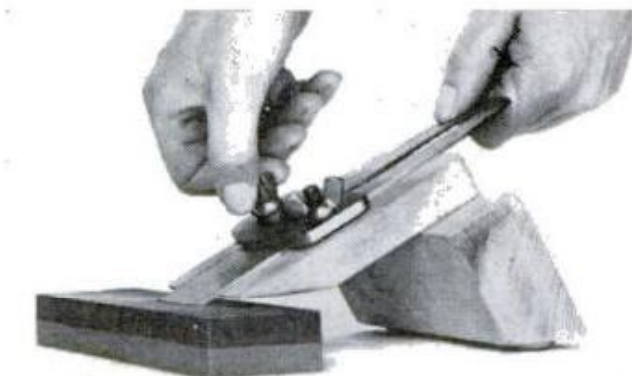
To whet the blade's edge bevel (the



TRUE THE FLAT FACE of the blade on the fine-grit side of combination stone. Oil is necessary



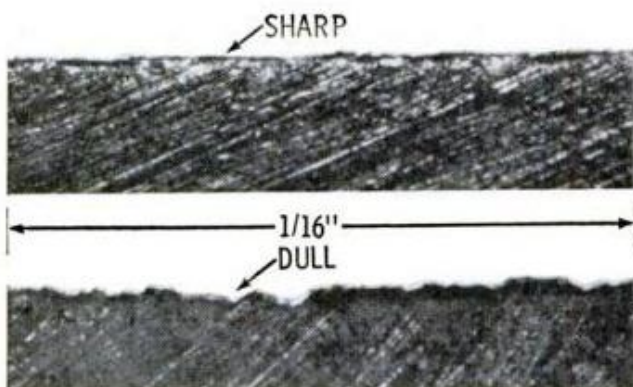
BEVEL ANGLES range from 25° for finish work to 30° for rough cutting. Always maintain original bevel



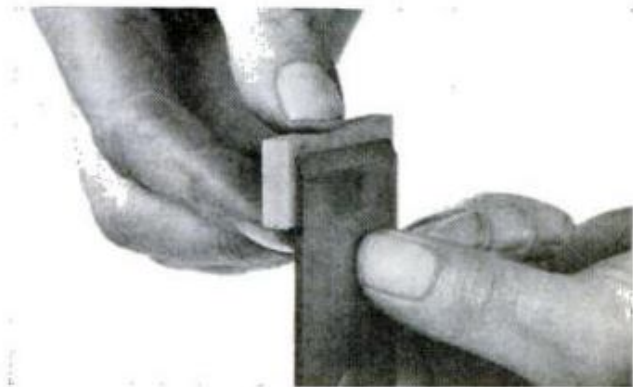
WHETTING BLADE PRECISELY is simple with aid of jig shown. Rig a wingnut clamp to hold the blade



SWIRL BLADE on coarse side of stone to true bevel and grind out nicks. Then finish-whet on fine side



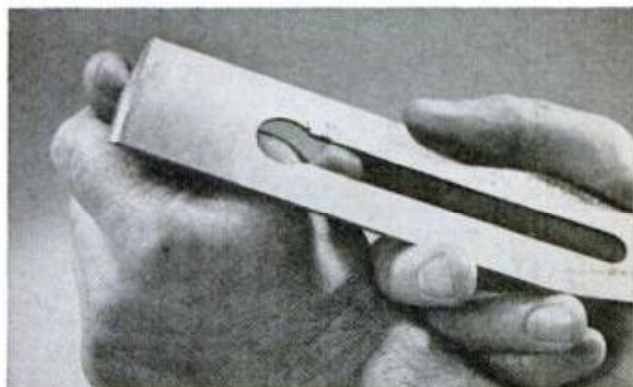
MICROPHOTOGRAPH of 1/16-in. portion of plane iron shows cutting edge before and after oilstoning



HONING BACK AND BEVEL with a pocket-size hard Arkansas stone leaves cutting edge scalpel-sharp

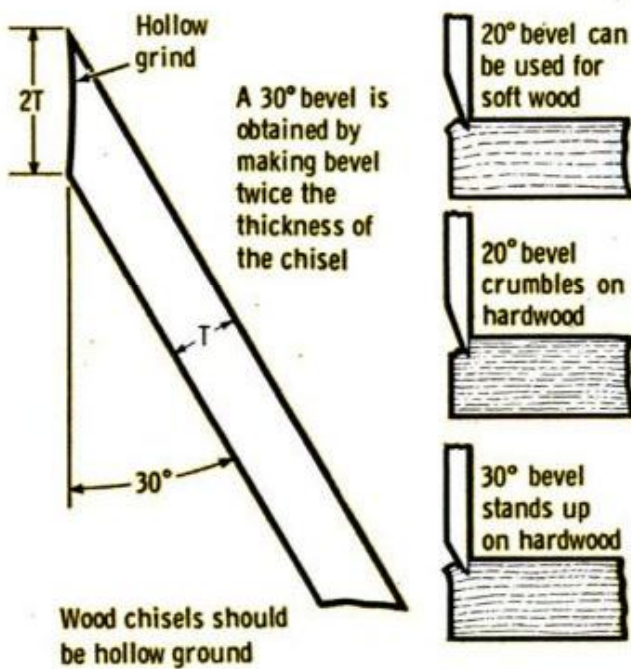
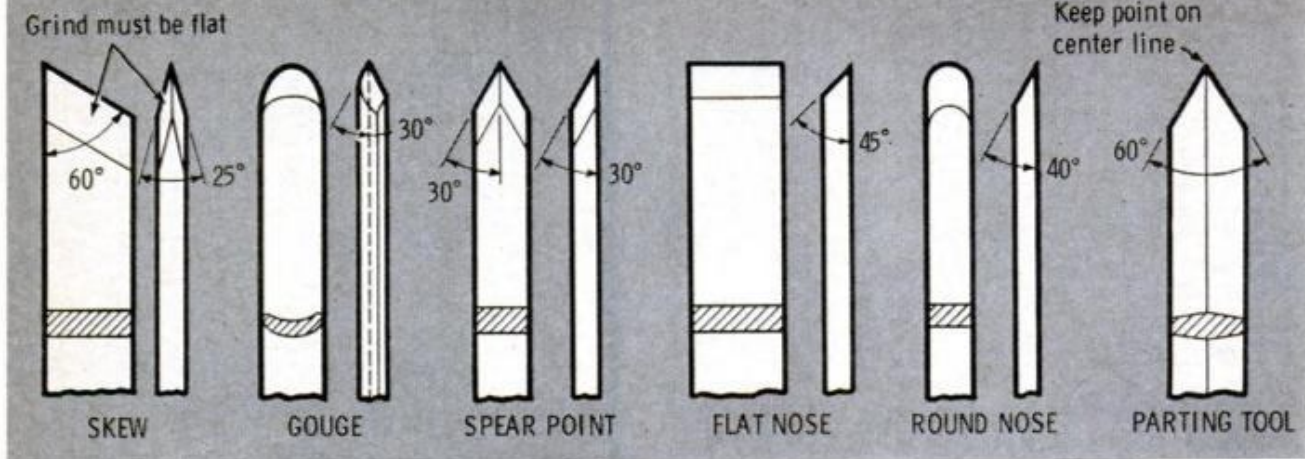


WITH A BENCH-SIZE STONE, keep the bevel flat on stone surface to avoid rounding the cutting edge



STANDARD TEST FOR SHARPNESS is to push blade lightly over thumbnail. Edge should bite, not slide

GRINDING ANGLES FOR WOODTURNING TOOLS

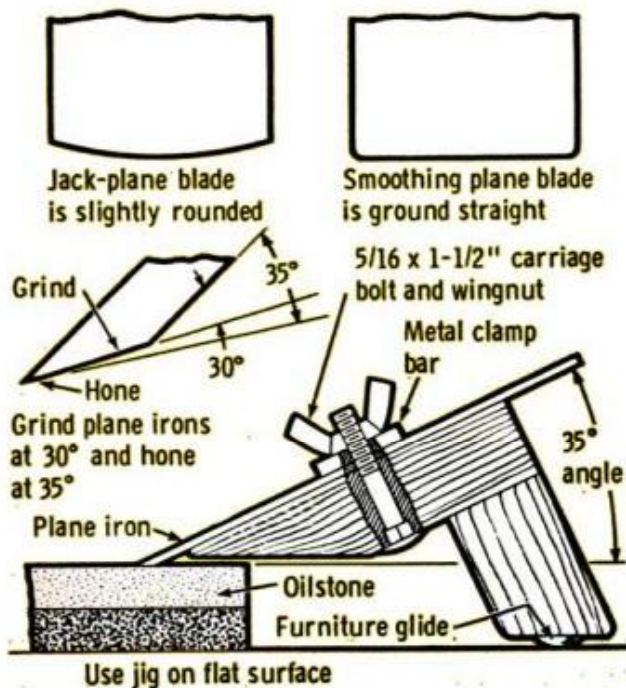


second step), switch to the stone's coarse-grit side. While it's possible to whet the bevel with the blade held freehand, you can do a better job if you clamp the blade in the sharpening jig shown in the photos and drawing. Secured in the jig, the blade can be swirled rapidly on the coarse side of the stone with firm pressure, which will quickly cut the bevel perfectly true. Then re-whet the bevel on the stone's fine-grit side. Finish this fine-whetting by using very light pressure—just the weight of the blade—to whet away any burr or wire edge on the cutting edge. Lubricate the stone liberally with mineral oil and at intervals wipe it clean with a rag to prevent the grit from loading with metal cuttings and swarf.

Blades of hand planes used for edge-joining are sharpened straight across, like chisels. Blades of jack planes used for surface planing have slightly rounded corners to minimize lap marks. To round a plane iron's corners, carefully stone ends of the edge-bevel freehand when you've finished jig-whetting.

Finish-honing the edge on an Arkansas stone, the last step, is really a polishing operation. Removing little metal, the Arkansas stone polishes out the minute scratches left by the synthetic stone's grit and thereby smooths microscopic ragged sections along the cutting edge. The edge honed to a mirror finish cuts more cleanly and stays sharp much longer.

To hone an edge with a pocket Arkansas stone, clamp the blade edge-up in a vise. Holding the stone flat, work it back and forth first along the edge-bevel and then across the flat face, honing both sides of cutting edge equally. If you use an Arkansas bench stone, keep the blade's flat face squarely on the stone. ★★★



HOW WOULD YOU DO IT?

Gaining those extra inches

"The new jet they just delivered won't fit into the hangar, Mr. Keen," reported the company pilot. "The doorway has 17 ft. of clearance, but the tail of the plane is 17 ft. 4 in. high."

"Can we notch the opening and roll the plane in?" asked the vice-president.

"No, the lintel is a load-bearing steel girder," said the chief mechanic. "We'd have to cut it and weld in a new section."

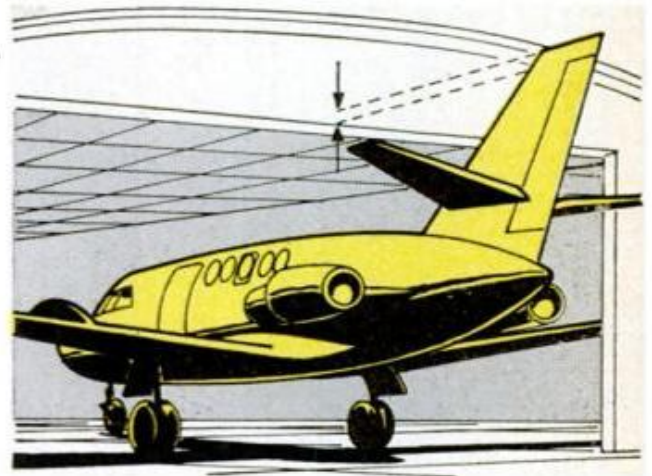
"Not enough time with that hurricane due in eight hours," injected the pilot.

"Wait! Instead of cutting, let me try *adding* something to do the job!" exclaimed the chief mechanic. "Just give me another man to help."

Three hours later, the plane, completely intact, snugly stood in the hangar.

How was it done?

Tail 4" higher than hangar opening



Thinking twice did it

"Got to string eight lengths of wire across this new quarter-mile stretch of fence," moaned Pete. "Since it's a straight run, though, I can tie one end to the first post, secure the reel to the Jeep and unreel the wire as I drive. But I'll never make the eight trips in time to see the rodeo."

Pete's crony took the wire and examined it. "It's light and flexible," said Steve. "I saw a big old hoist pulley just lying over by that gully. Why don't you use it and run the eight wires in four trips? That would get you to town in time."

Pete paused before answering. "I don't see how I could do it in four trips."

"Bet you the price of two tickets you can," retorted Steve.

Can you explain how?



A matter of rigging

Preparing to install his newly-overhauled auto engine, Ted dollyed it into the driveway between his and his neighbor's garage and then stretched a rope tight from roof to roof.

"That's 1000-lb.-test nylon line," he told Jim. "With my one-ton tackle hooked to the center of the line, that 650-lb. motor won't be any trouble to lift."

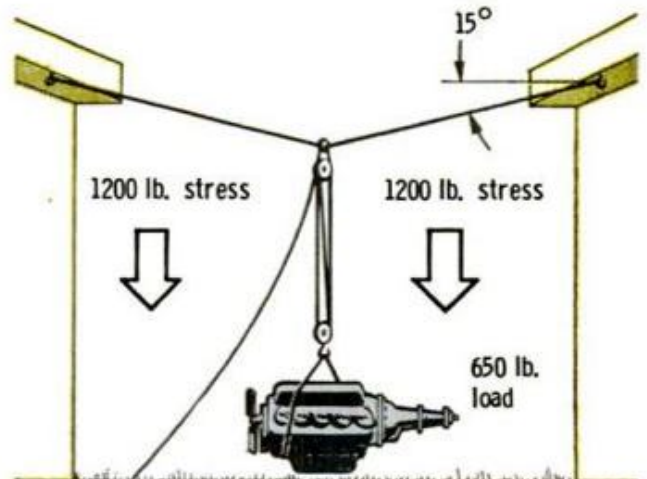
"The line's sure to break," warned Jim.

"You're kidding," scoffed Ted. "The line's practically doubled. It should stand up under a ton, not just 650 lbs."

He hauled on the tackle. The line sagged in a shallow V and broke. Ted, however, re-rigged the tackle and five minutes later, the engine was ready to be installed.

How did Ted do it?

(Answers can be found on page 197)



Build PM's Maneuverable Mini-Mover

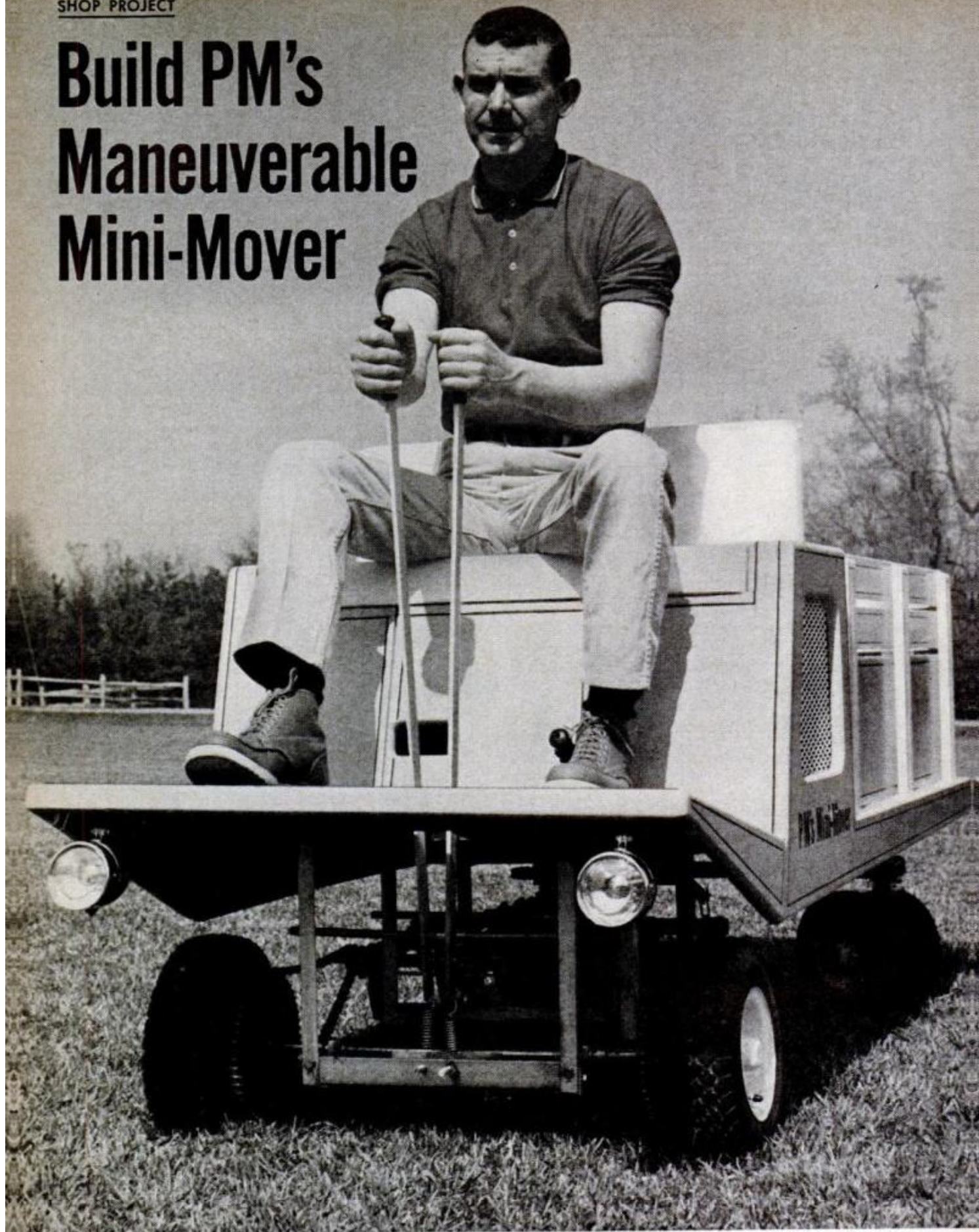


Photo by the author

It's a classy, sassy little utility vehicle you can make for under \$400

By LEONARD E. SABAL, Workshop Editor

Part 2: Body and Finishing

THE BODY of the Mini-Mover is constructed of exterior plywood, with the exception of the trim pieces, which are cut out of pine.

Cut all pieces to size, then assemble with glue and screws. It may be easier if you first align the sections with each other by using finishing nails.

Before assembling the front compartment panels, rabbet the inside edges to accept the sliding center panel. Use a table saw or a router if available. (You can also use the router to round off the edges of the side panel cutouts and deck trim).

In order to clear the heads of the chassis bolts, drill clearance holes on the underside of the cargo bed. Use a $\frac{3}{4}$ -in. spur bit, but make certain the point does not penetrate the top surface of the bed.

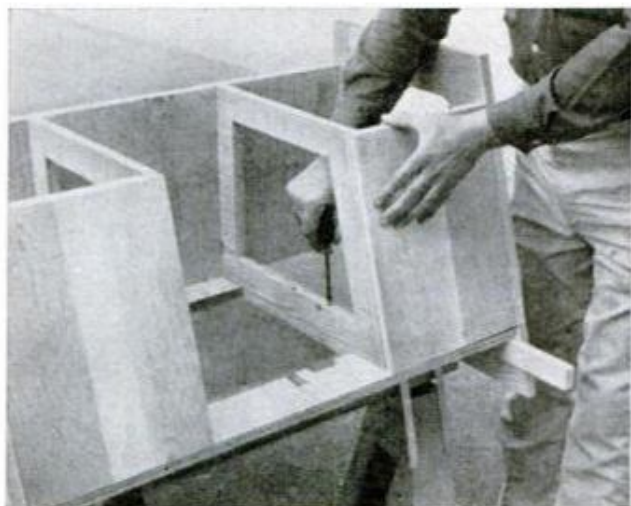
Placement of the metal grilles as indicated provides ample ventilation for the 4-hp engine. Outer sections of the grille are held in place by thin cleats with a rab-

beted edge. The inner sections fit into a dadoed frame of pine strips that borders the inner cutouts.

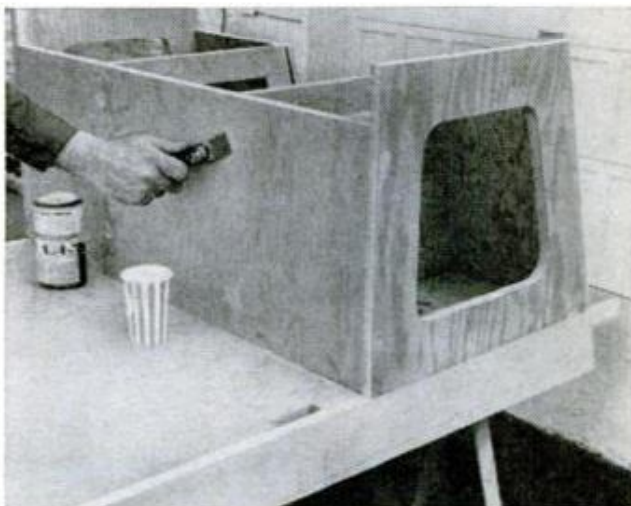
To keep the outer edges of the galvanized sheet lining from lifting, especially when the vehicle is used without the sideboards, a coating of contact cement must be used. Apply the cement to both the lining and the bed, allow it to dry, then fit the lining on the bed and pound it down with a hammer and block of scrap wood. Be sure, of course, that the bed is free of oil and dust before applying the cement.

The basic body can now be secured to the chassis with carriage bolts that also keep the galvanized sheet from lifting in the center. Make certain, however, that the cleats for the sideboard posts are attached to the underside of the bed before fitting the body to the frame.

The sideboards and seat are assembled next. Construction is straightforward, as detailed on page 167. Just be sure to



ALIGN PLYWOOD SECTIONS with finishing nails, then use glue and screws to assemble sturdy body

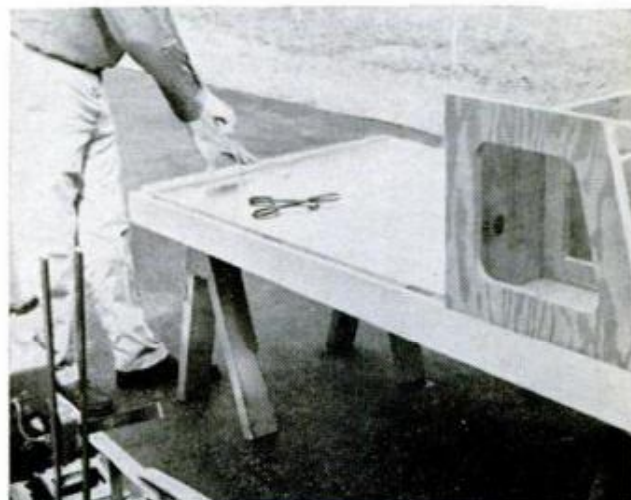


SINK ALL SCREWS and fill holes with wood putty. Allow putty to dry thoroughly before sanding smooth

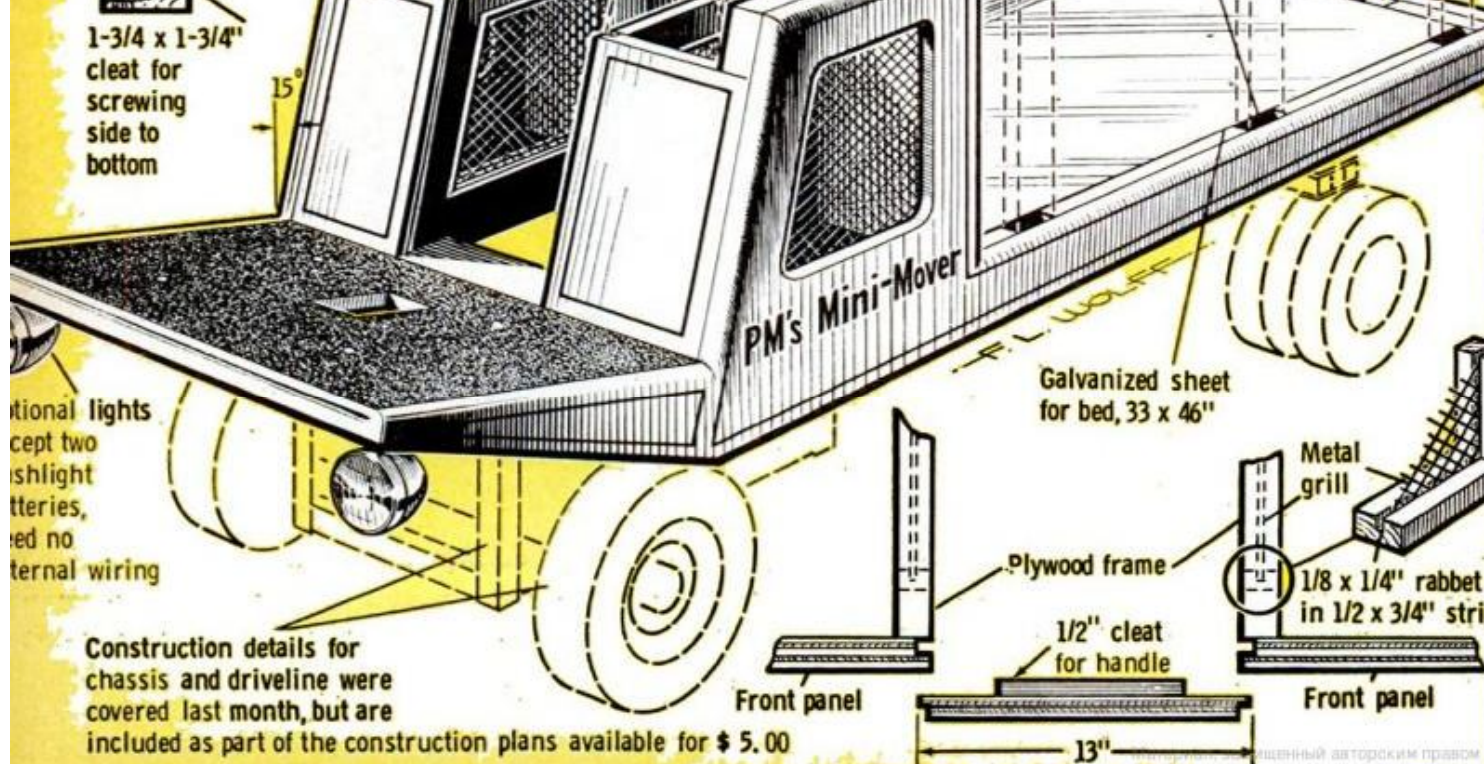
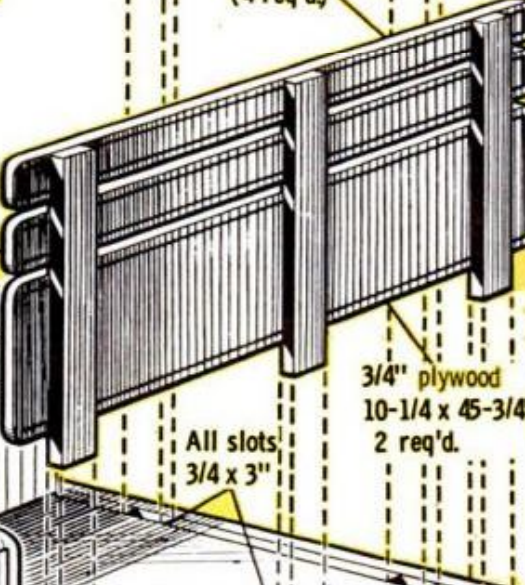
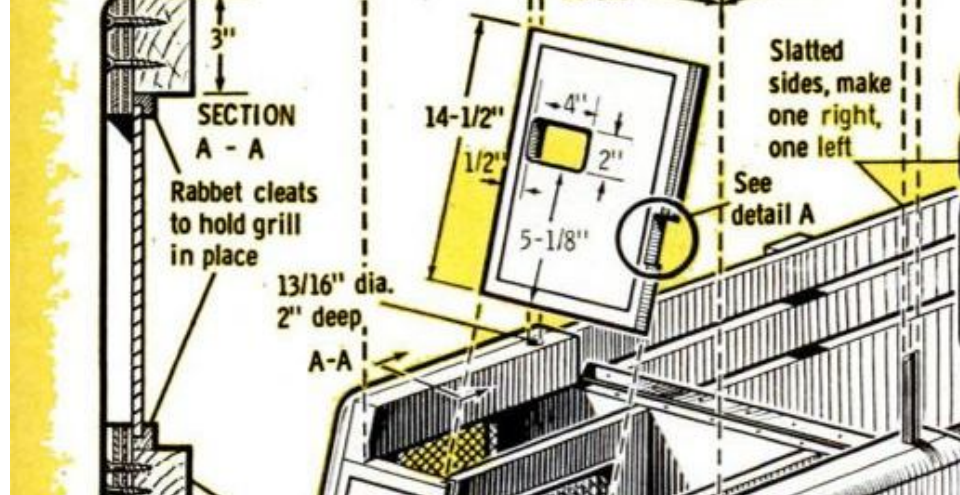
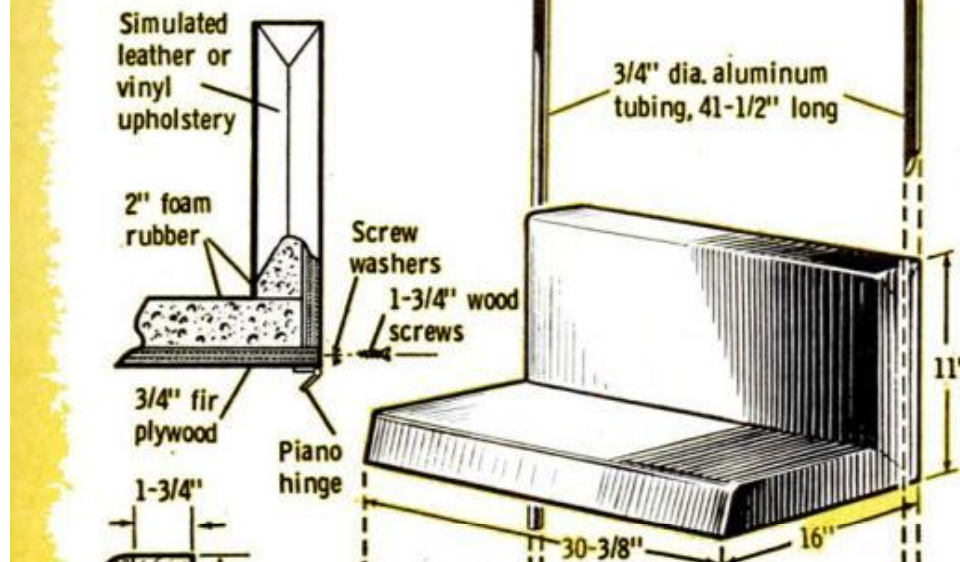
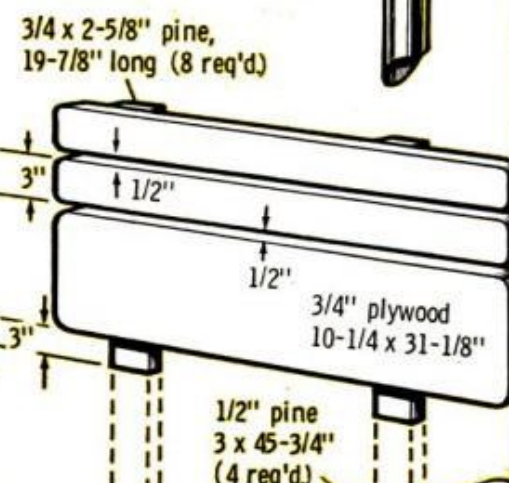
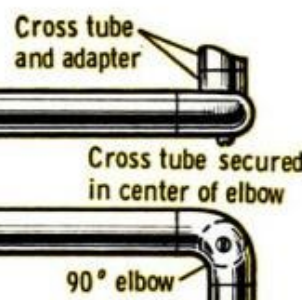
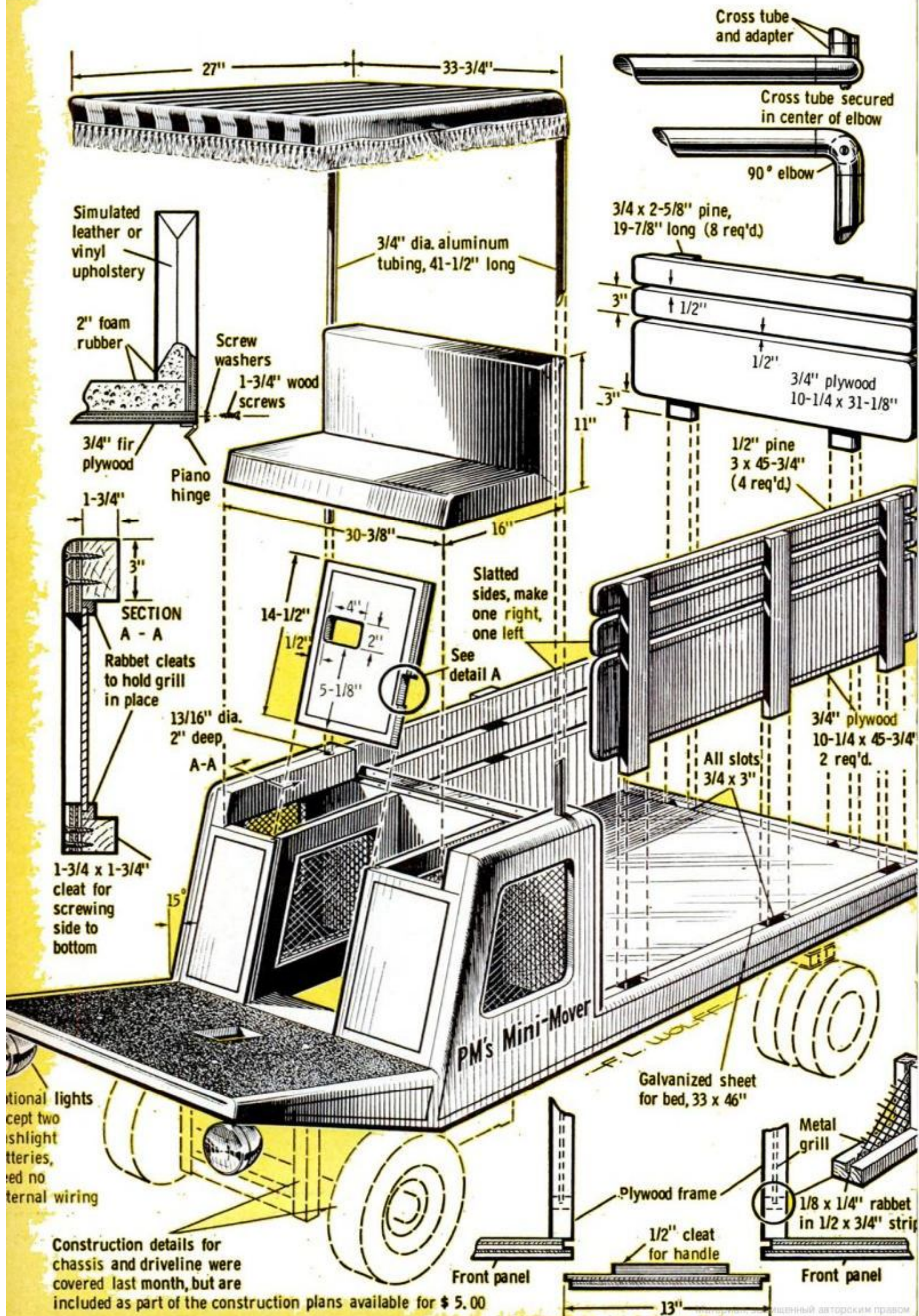


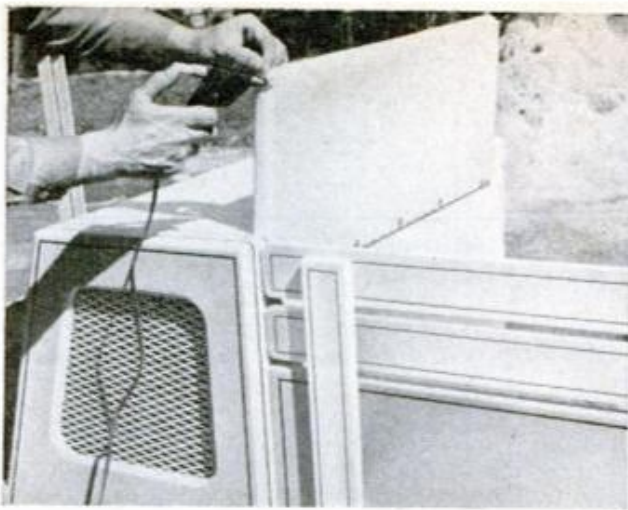
POSITION SIDEBOARD POSTS accurately by the use of a block of wood as a vertical placement guide

SEPTEMBER 1968

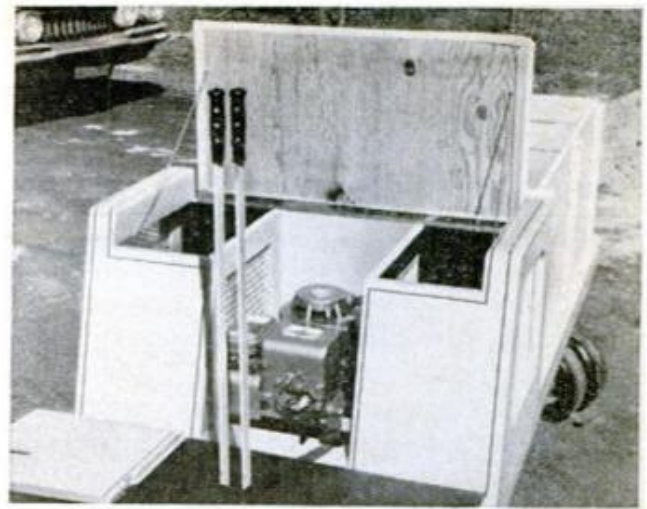


MEASURE AND CUT galvanized sheet for bed so it covers the cargo area just inside the post holes





USE SIMULATED LEATHER or vinyl to cover foam-padded seat, and attach it with tacks or glue gun



FINAL TOUCHES include chain keepers for seat, mat for floorboard, bicycle grips for control handles

use a wooden guide to assure uniform vertical placement of the sideboard posts, which are set slightly below the top rail.

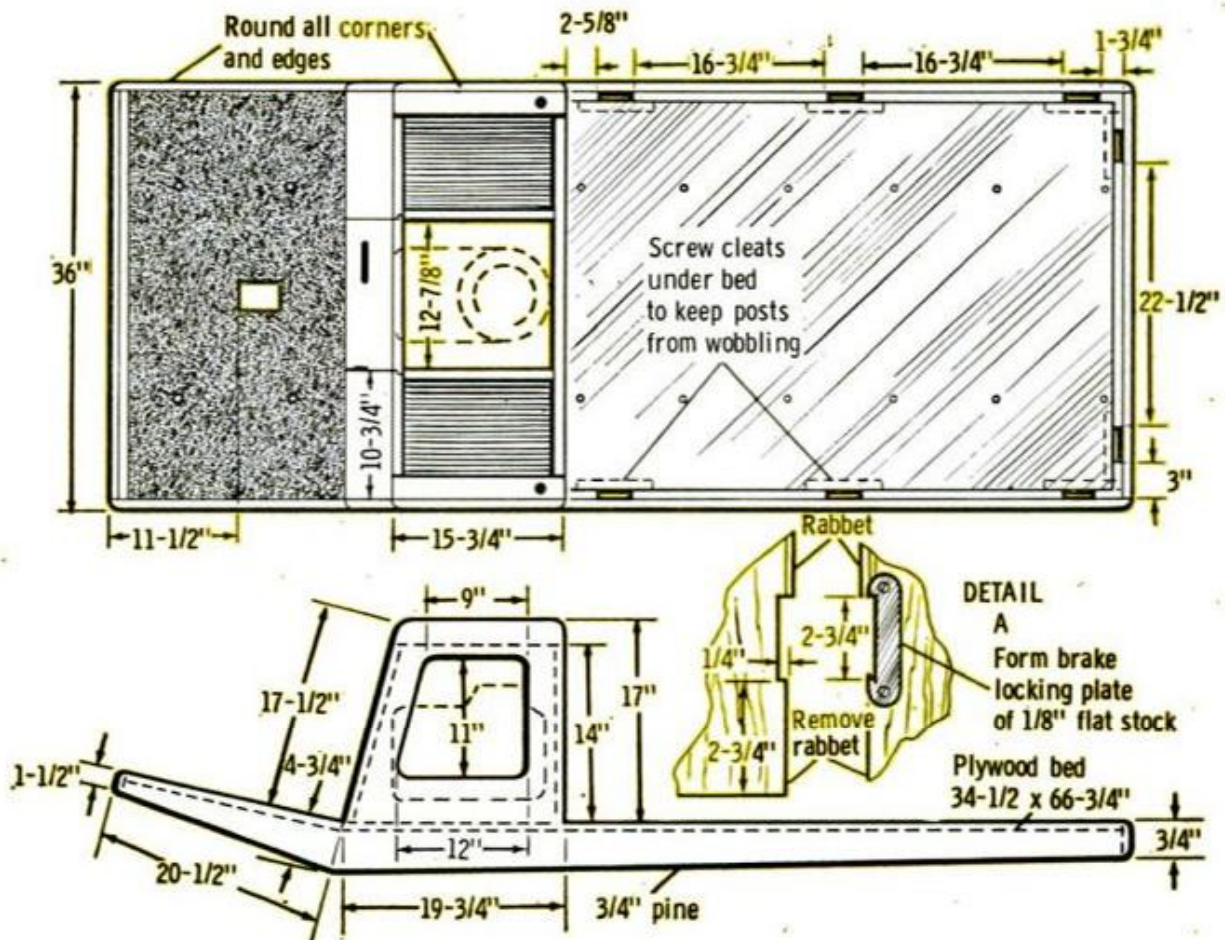
The canopy frame is made of Reynolds aluminum tubing and fittings. Note, however, that the T-butt connector is placed directly in the center of a 90° elbow. The final effect is that of a three-way elbow, which, unfortunately, is not a part of their do-it-yourself aluminum line.

Finishing the vehicle consists of applying

a coat of primer, followed by several coats of exterior paint. Striping, $\frac{1}{8}$ or $\frac{1}{4}$ -in. wide, adds a professional look. To complete the job, cement rubber floor mats to the footboard and to the bottom of the tool compartments. ★★★

PLANS AVAILABLE

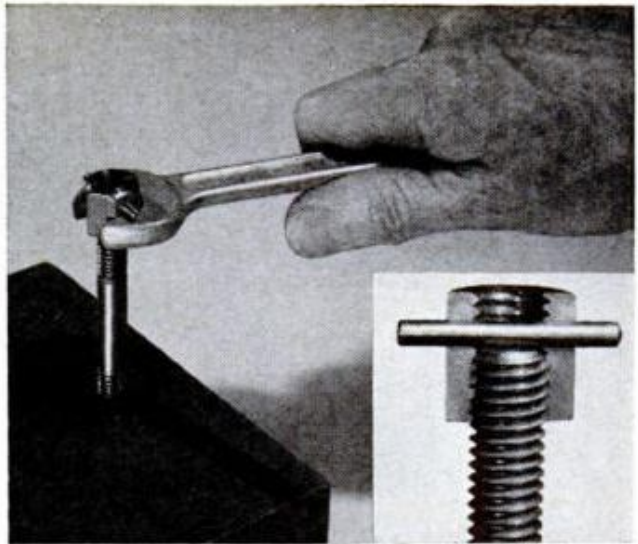
For complete instructions and large detailed plans, send \$5 to Mini-Mover, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022.



HINTS FROM READERS

Shop-made stud driver

When you find it necessary to drive a stud, but don't have the proper tools at hand, try improvising a driver from a matching nut. Drill a hole completely through the nut and drive a tapered pin into it. Be sure to leave enough room below the hole to allow for a good grip with the wrench. The pin stop will prevent the nut from jamming on the stud. To remove, just back the nut off the stud.



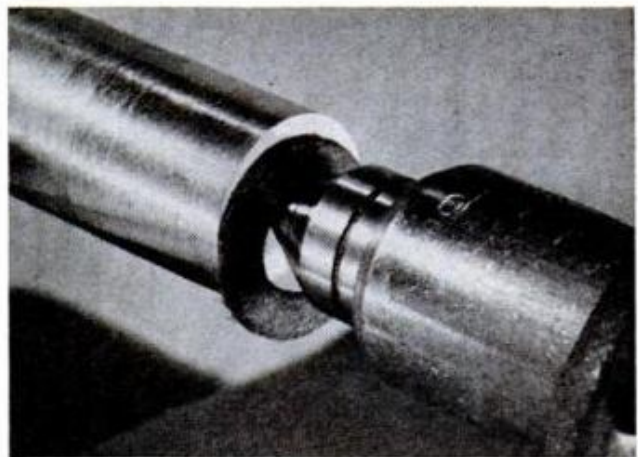
Tape masks glue joints

Some glue is always squeezed out of a joint once clamping pressure is applied. To eliminate the job of scraping away this excess, mask both sides of the joint with cellulose tape. Lay the tape close to the edge of the joint and press it firmly to insure good contact. Once the glue hardens, pull off the tape and the glue will come with it. This is especially good when regluing finished joints which might be scratched during clean-up.



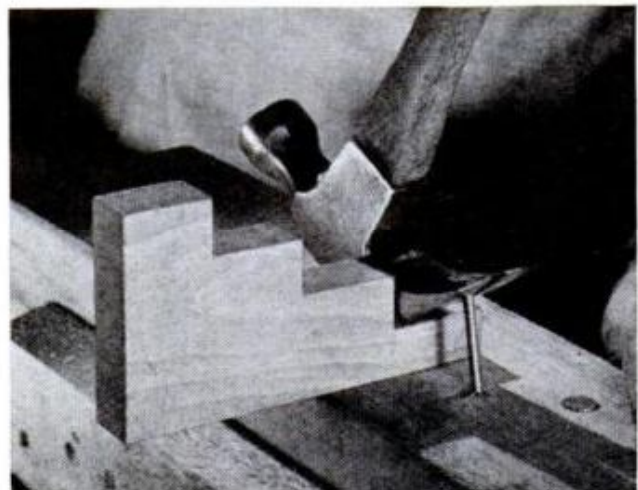
Automatic tailstock oiler

When working with your metal lathe, you can forget about the need to oil the tailstock center repeatedly if you slip an oil-saturated felt washer on the spindle before you clamp the work in the lathe. If the job is very large, it may be necessary to give the washer an occasional extra dose of oil. However, for the average job, the original oiling is sufficient. When not in use, store washers in a small bottle with enough oil to cover them.



Step block for pulling nails

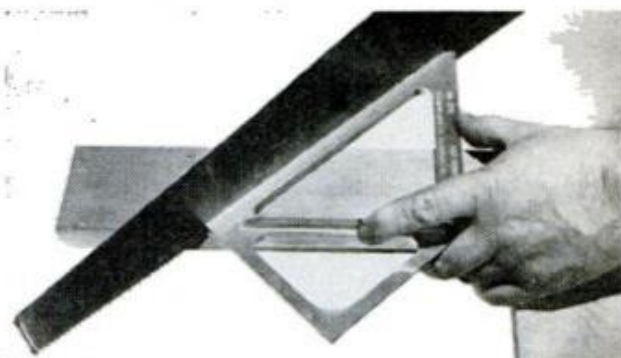
Use of the simple step block shown at right is a big improvement over the usual practice of placing a scrap of wood under the hammerhead when pulling nails. As a nail is pulled, you can move the hammerhead up the steps for the best possible leverage. The block shown was cut with steps slightly less than 1 in. high. For stubborn jobs, make shallower steps. Another advantage of this block is that nails come out straight so they can easily be redriven if the job requires it.



New Tools You Should Know About

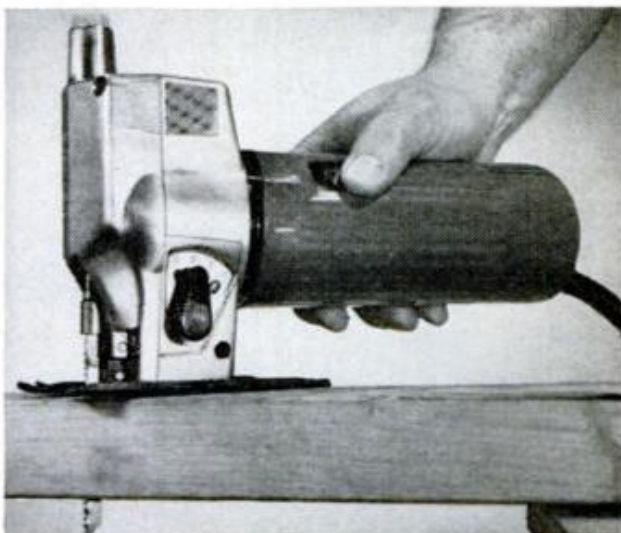
Guide for cutting miters

Designed as an on-site substitute for a miterbox, a compact new miter-cutting guide called Trim Square features a beveled lower edge to prevent the saw teeth from coming in contact with the guide during cutting. It's small enough to fit your pocket, fine for cutting all types of molding. Sells for \$2.98 from Estwing Mfg. Co., Rockford, Ill. 61101.



Orbital jig saw

To increase cutting performance, the new Bosch-Lesto jigsaw features orbital saw-blade movement. You can select any of four different degrees of orbital movement to achieve maximum cutting efficiency with different materials. If desired, it can also be set for straight reciprocating movement. The new model (8554) is designed for cutting wood up to 2 1/4 in. thick and metal up to 1/4 in. thick. It operates at 3000 strokes per minute and weighs only 5 3/4 lbs. Standard equipment includes three blades, a screwdriver, a spare blade-setting screw and a spare set of carbon brushes. It's \$99.50 from Robert Bosch Corp., 2800 S. 25th Ave., Broadview, Ill. 60153.



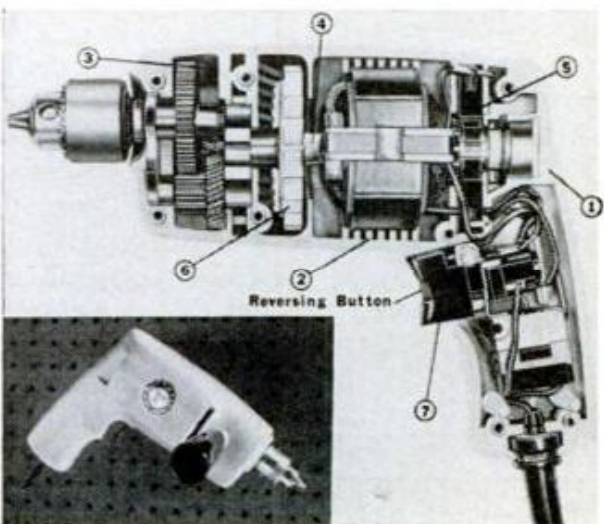
Heavy-duty glue gun

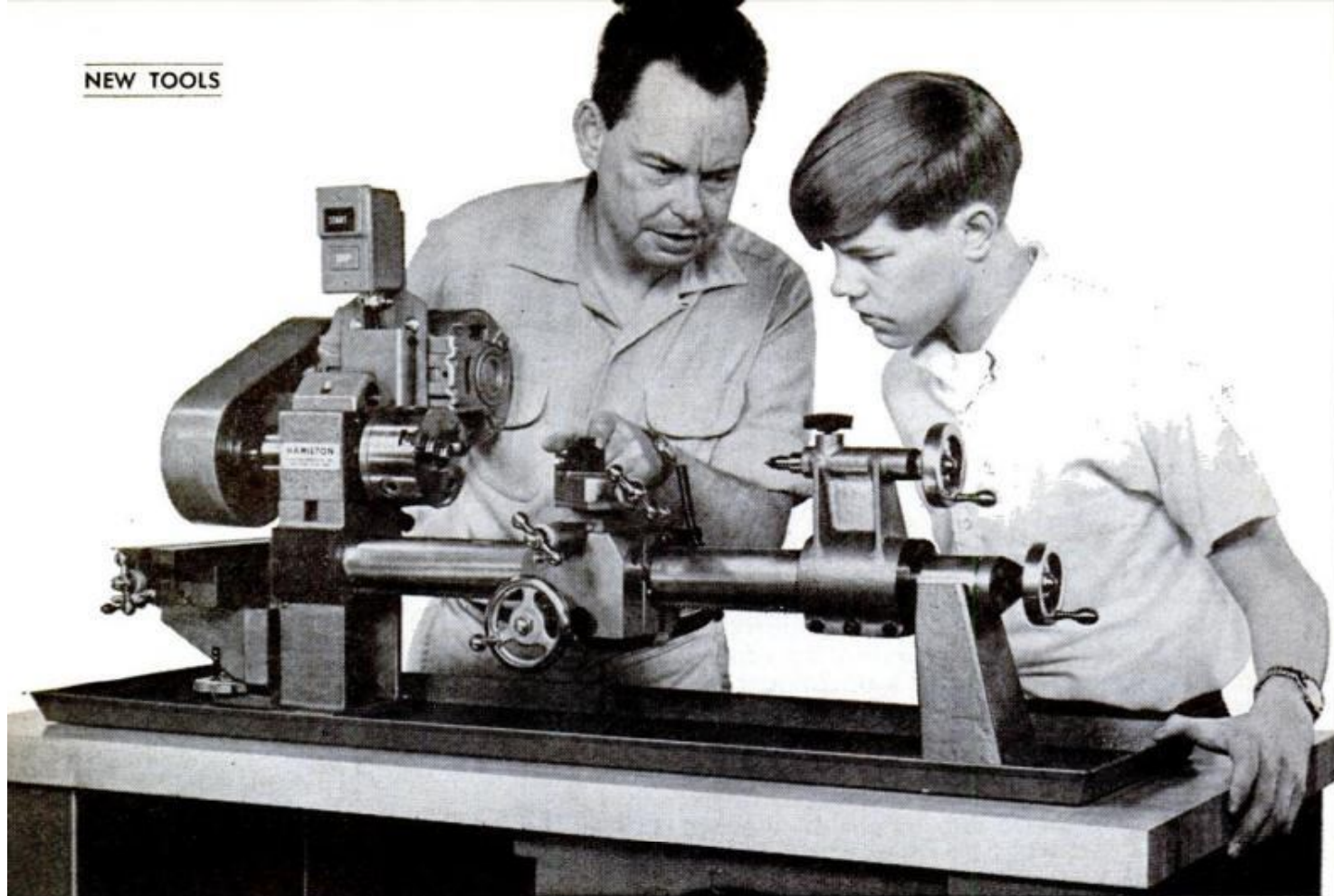
A new glue gun, the Professional Model 250, is a heavy-duty industrial-rated version of the original Thermogrip gun introduced by United Shoe Machinery two years ago. Designed for 60-second bonding of a wide range of materials, the unit employs sticks of hot-melt polyethylene-based glue which hardens through cooling in seconds, eliminating the need for clamping. The 1 1/4-lb. Model 250 sells for \$22.95, including 60 sticks of glue. It's made by United Shoe Machinery Corp., 221 Oley St., Reading, Pa. 10601.



Variable-speed reversing drills

Two new Green Line portable drills from Rockwell are described by the company as "the world's first all-insulated, shockproof, variable-speed reversing drills." As the drawing shows, both 1/4-in. and 3/8-in. drills are insulated at seven points: 1) nonconductive case, 2) structural frame, 3) structural gear housing, 4) nonconductive armature shaft sleeve, 5) nonconductive phenolic brush holders, 6) hard nylon fan, and 7) remote control safety switch with nonconductive thermoplastic shield. The 1/4-in. Model 72 sells for \$29.99 and the heavy-duty 3/8-in. Model 79 for \$34.99 from Rockwell Mfg. Co., 886 N. Lexington Ave., Pittsburgh, Pa. 15208.





Versatile Package Combines Lathe and Milling Machine

By JOHN BURROUGHS

ALTHOUGH IT WAS DEVELOPED to help teach teenagers basic machining skills, the Hamilton Lathe/Miller would make a great addition to any home workshop.

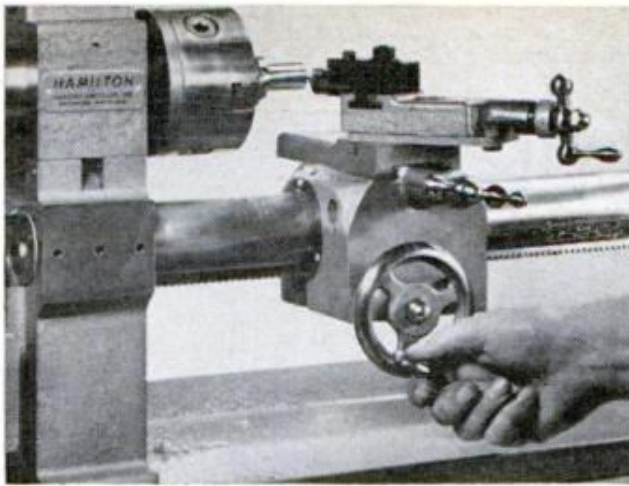
Just rotate the motor-and-spindle assembly 180° to convert the tool from a 6-in.-swing lathe to a small horizontal milling machine. Set up one way or the other, the beautifully built 150-lb. unit will enable you to perform all basic turning, milling and drilling operations; yet it's compact enough to fit a small bench top.

Used as a lathe, the tool has a 15-in. capacity between centers. Its way is a honed, 2-in. diameter solid steel shaft that can be dressed smooth with an oil-stone if damaged. The carriage has standard pattern, gibbed-dovetail cross and compound-rest slides.

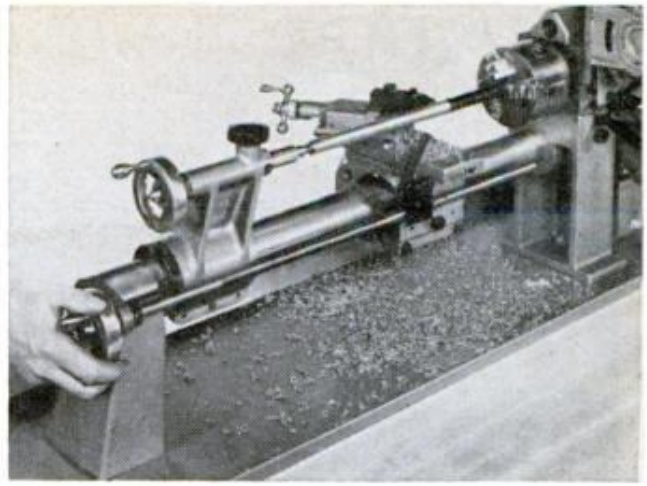
The spindle is a lubed-for-life (but re-

placeable) ball-bearing cartridge with a 3/8-in. bore and a No. 1 Morse taper turned after the unit is assembled. The step-pulley drive features a 3/16-in.-wide Gates Polyflex V-belt with a rated life of 10,000 hours and can be adjusted for eight speeds from 360 to 2820 rpm.

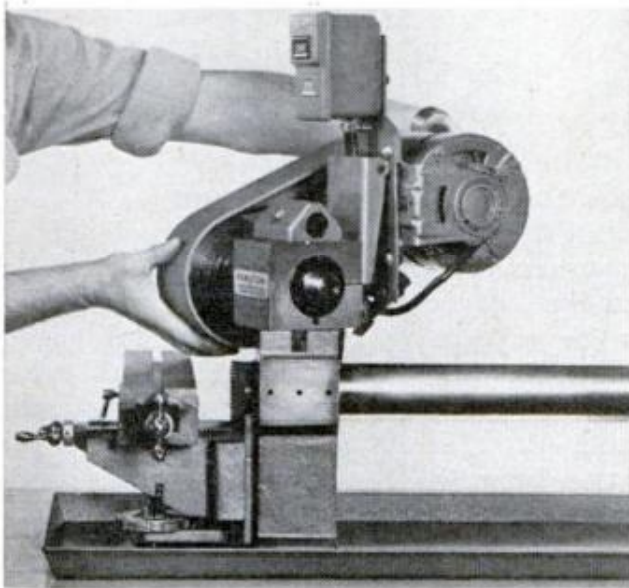
Rotated for milling, the spindle indexes squarely above the 14-in.-long milling table. The entire table slides vertically on the headstock casting, providing a height adjustment of 4 1/4-in. Calibrated feed-screws allow the table to travel 8 in. longitudinally and 3 in. transversely. A drawbar secures the milling arbor in the spindle's taper. Adapters to hold end mills or shell mills are available as accessories. For more information, write to: Hamilton Associates, Inc., Machine Tool Div., 1716 Whitehead Rd., Meadows Industrial Park, Baltimore, Md. ★★



LATHE'S WAY is solid 2-in. dia. steel shaft. Carriage has dovetailed cross feed and compound slides



HAND-CRANKED LEAD SCREW provides even feed for finish cuts. Half nut on carriage back engages screw



CONVERT LATHE TO MILLER by rotating spindle and motor 180°. Headstock assembly indexes accurately

TABLE OF SPECIFICATIONS

DIMENSIONS

| | |
|--|---------|
| Overall length of machine | 38½ in. |
| Overall width | 17 in. |
| Overall height | 21 in. |
| No. 1 Morse taper in spindle and tailstock, with ⅜-in. hole through spindle. | |

LATHE

| | |
|--------------------------|--------|
| Swing over bed | 6 in. |
| Swing over cross slide | 3 in. |
| Distance between centers | 15 in. |

MILLING MACHINE

| | |
|---------------------|--------|
| Table length | 14 in. |
| Table width | 2¾ in. |
| Table travel | 8 in. |
| Cross travel | 3 in. |
| Vertical adjustment | 4¼ in. |

T-slot ⅜-in. wide along table center. Cost of basic machine without motor or switch is \$650 f.o.b. Full line of accessories available.

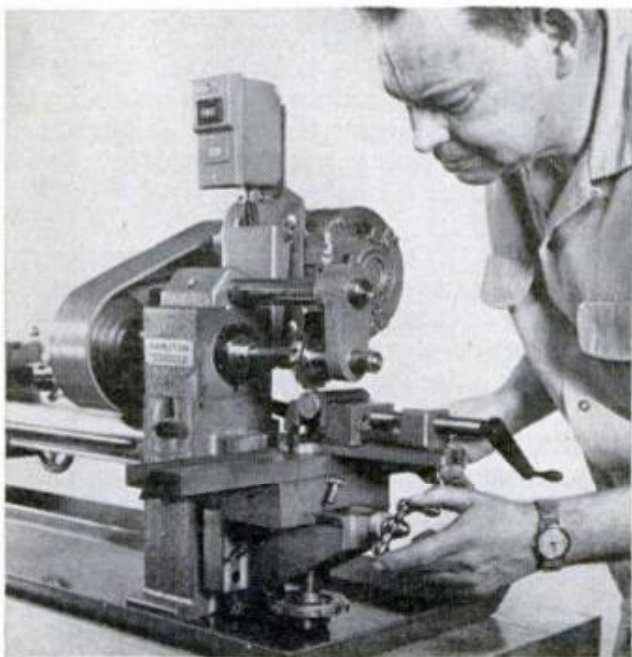
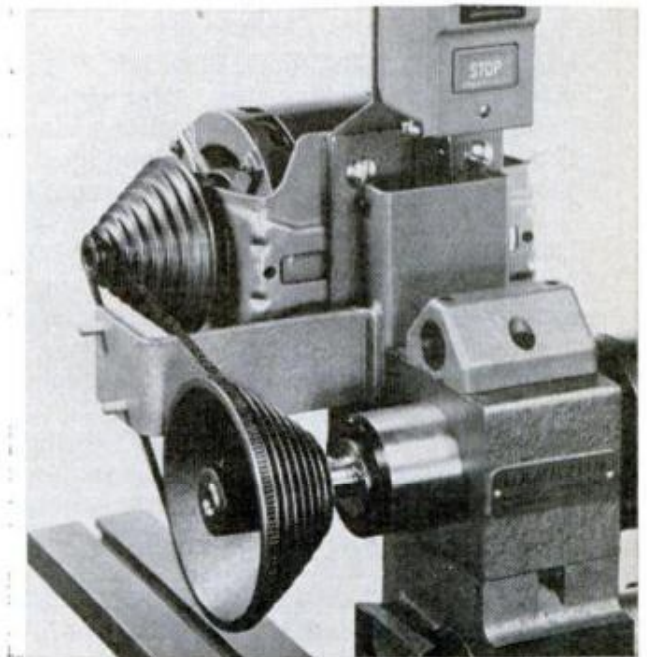


TABLE FEATURES VERTICAL, four-way horizontal feed. Auxiliary overarm assembly supports arbor cutter



EIGHT SPEEDS from 360 to 2820 rpm are provided by unusually narrow belt riding in the step pulleys

HINTS FROM READERS



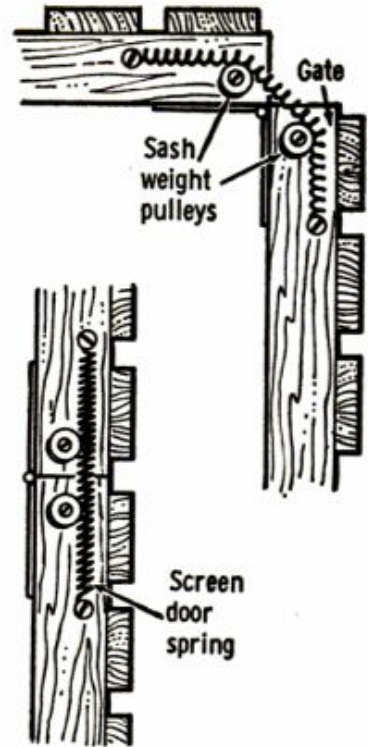
Barn-door handle

Closing the upper part of a stable door from the inside is usually a job involving a lot of unnecessary effort. The only place to grip is the bottom edge. An ordinary doorstop midway on the crosspiece offers a more efficient grip and cuts the risk of pinched fingers. —G. E. Hendrickson



Hammer pad

When pulling nails with a claw hammer, you may find there isn't enough room to slip a block of wood under the head to protect the surface of the wood. At such times, try using a broad-bladed putty knife in place of a block. It offers protection, and is handy to hold. —L. C. Schultz



Gate closer

Using a couple of old sash pulleys and a screen-door spring, you can make a simple mechanism which will close any gate automatically. Mount one pulley on the gate and the other on the gatepost, stretch spring across both and anchor ends. Spring closes gate. —W. B. Rasmussen

NEXT MONTH IN SHOP AND CRAFTS

HOW TO LAY CONCRETE BLOCKS. Even if it's your first attempt, you can easily turn out a professional-looking wall. After all, the best jobs are often produced by an interested beginner who cares enough to pay close attention to the important details. In the October issue you'll find a profusely illustrated how-to story covering all these details, so be sure to get a copy. Here's one you'll want to clip and file.

HOME-BUILT FLIGHT SIMULATOR FOR UNDER \$200. Powered by a paint-sprayer compressor, this "Duncan Trainer" uses salvaged aircraft instruments that have been modified to operate by air pressure. With surprising realism, it simulates cross-country and instrument approach flight, while an instructor-operator outside cranks in headwinds or rough air conditions to keep you alert. If you like flying, don't miss it.

DOWN-TO-EARTH FACTS ABOUT PREFINISHED SIDING. PVC, aluminum, hardboard, plastic-coated wood—all those ready-to-go sidings have their pros and cons. The October issue contains an in-depth comparison, covering everything from price to performance. It's a must if you've been thinking of putting on new siding.

HOW TO USE A SOLDERING GUN. Sooner or later, every do-it-yourselfer finds himself faced with a soldering job. Next month's PM has a full rundown on the different types of guns, how they work and which one is best for which job. Chances are it includes a tip or two you're not familiar with, so be sure to read this one.

How much can one motor oil be expected to do?



- exceed all car manufacturer specifications.
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- give better protection at high operating temperatures.
- include engine-protecting features of a heavy 40 weight, with easier-starting quality of a 30 weight.
- be suited for all types of driving, interstate or "Aunt Minnie" and-go driving.



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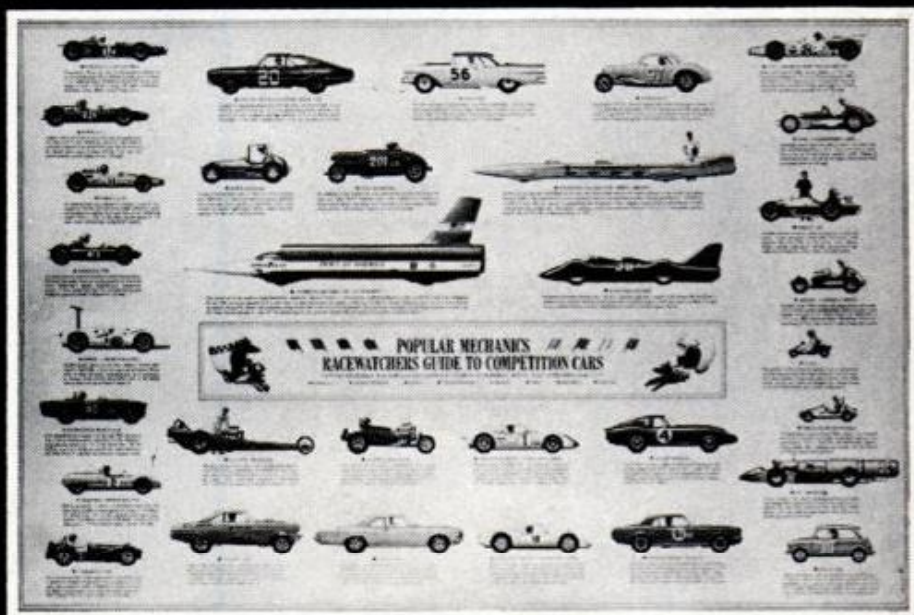
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HURRICANES

(Continued from page 64)

eye—is 10° to 15° warmer than air just 20 miles away.

Until now, the spiral-shaped disturbance—which probably sports torrential rains and gale force winds—is only a cyclone, Weather Bureau parlance for any great storm where air spirals into a low pressure area. To become a full-fledged hurricane, the storm needs at least one more element: high-altitude winds. “You have swift tropospheric wind currents to carry away the warm exhaust,” explains Dr. Gentry. “Otherwise it would be like covering a chimney. The hurricane would fill up with its own heat and die out.”

With water vapor whirling up from below for fuel, and a chimney draft created by winds above, the storm resembles a huge, inverted whirlpool in which air whips up the vortex and out the top at a steadily increasing rate. When the winds reach 75 mph the cyclone is officially a hurricane. It's at about this point that the storm starts a self-perpetuating feedback system. The screaming winds churn the sea into a fine spray, aiding evaporation, and increasing the hurricane's fuel supply—and fury—even more.

A few years ago, meteorologists estimated that a mature hurricane gulped up one million tons of water each second. Recent evidence suggests they were wrong. The figure is perhaps four times that.

One fact is certain. In a fully developed hurricane, water-sogged air spirals up the storm's vortex close to 300 mph. Happily, friction slows ground-level wind speeds. Anemometers have nailed a hurricane's windspeed at 200 mph. But the instruments break off at about this point, and no one doubts that the speed is much higher. Estimates peg top velocity at 250 mph, even more. One ship captain, caught at sea, logged it: “Winds infinite.”

Typhoons—hurricanes originating in the

Pacific ocean—are feared even more. Because typhoons travel greater distances before striking land, they often rev up to even more ferocious heights. A damage-control petty officer aboard an aircraft carrier during a typhoon reported: “Our flight deck was about five stories high, and waves were spraying over it. The destroyers were plunging into huge troughs, leaving the ship's rear half poking out of the wave. Then, the stern would bury itself while the bow hung in space. It was dangerous for the smaller ships, but it was also a majestic sight.”

The wildest winds are usually within a 50-mile radius of the eye. Beyond that, their savagery falls to a mere gale. The change is often abrupt. One of the most intense hurricanes on record, on Labor Day of 1935, cut a swath of destruction through Miami only 40 miles wide. Just one-half mile made the difference between houses reduced to splinters and those suffering only broken windows.

Recently, I visited the sleek Computer Center Building at the University of Miami where I met Dr. Gentry. There, with the help of a nearby blackboard which he covered with diagrams, he told how long a hurricane takes to build up.

“Hurricanes don't form at all at the equator, there's no Coriolis force there. They have to be at least 350 miles away. But not too far, since they need to pass over sea water of at least 85°. When conditions are just right, a hurricane can bloom in 24 hours. In lower latitudes, where the Coriolis force is weaker, they may need several days.”

An average hurricane travels 12 to 14 miles an hour, Gentry explained, although some have been clocked at 60 mph. Over warm water, hurricanes last anywhere from a few days to a month before a shift in the tropospheric winds or atmospheric pressure kills them off. If they run any distance over land or cold water, the life

(Please turn to page 178)

WHAT TO DO WHEN A HURRICANE THREATENS

The United States Department of Commerce suggests that residents of Gulf and Atlantic coastal areas take these steps before and during a hurricane:

- Every June through November recheck your supply of boards, tools, batteries, nonperishable foods, and other equipment you'll need when a hurricane strikes.
- After the first radio alert, keep listening for warnings that the hurricane is heading for your town. Make plans well ahead of the storm's arrival. Being marooned is a dangerous situation.
- Leave low-lying areas that might be covered by the storm surge. Moor your boat securely and leave it. Don't return to check it once wind and waves are up.
- Board up windows, close storm shutters or, use tape to prevent flying glass slivers.
- Store outdoor objects that might become lethal

missiles: garbage cans, toys, garden tools, signs, porch furniture.

- Store drinking water in clean bathtubs and large jars. Flooding may contaminate the supply.
- Check all battery-powered equipment: radios, lights especially. A portable radio may be your only link with the world once the hurricane strikes.
- Keep your car fueled. Service stations may be inoperable for several days due to flooding.
- Remain indoors during the hurricane, even if the calm eye passes over your area. The winds will lull for a few minutes to a half an hour. But then they'll rise abruptly from the opposite direction. Stay away from river banks and streams. Flooding can be severe and sudden.

Meet another good sport.

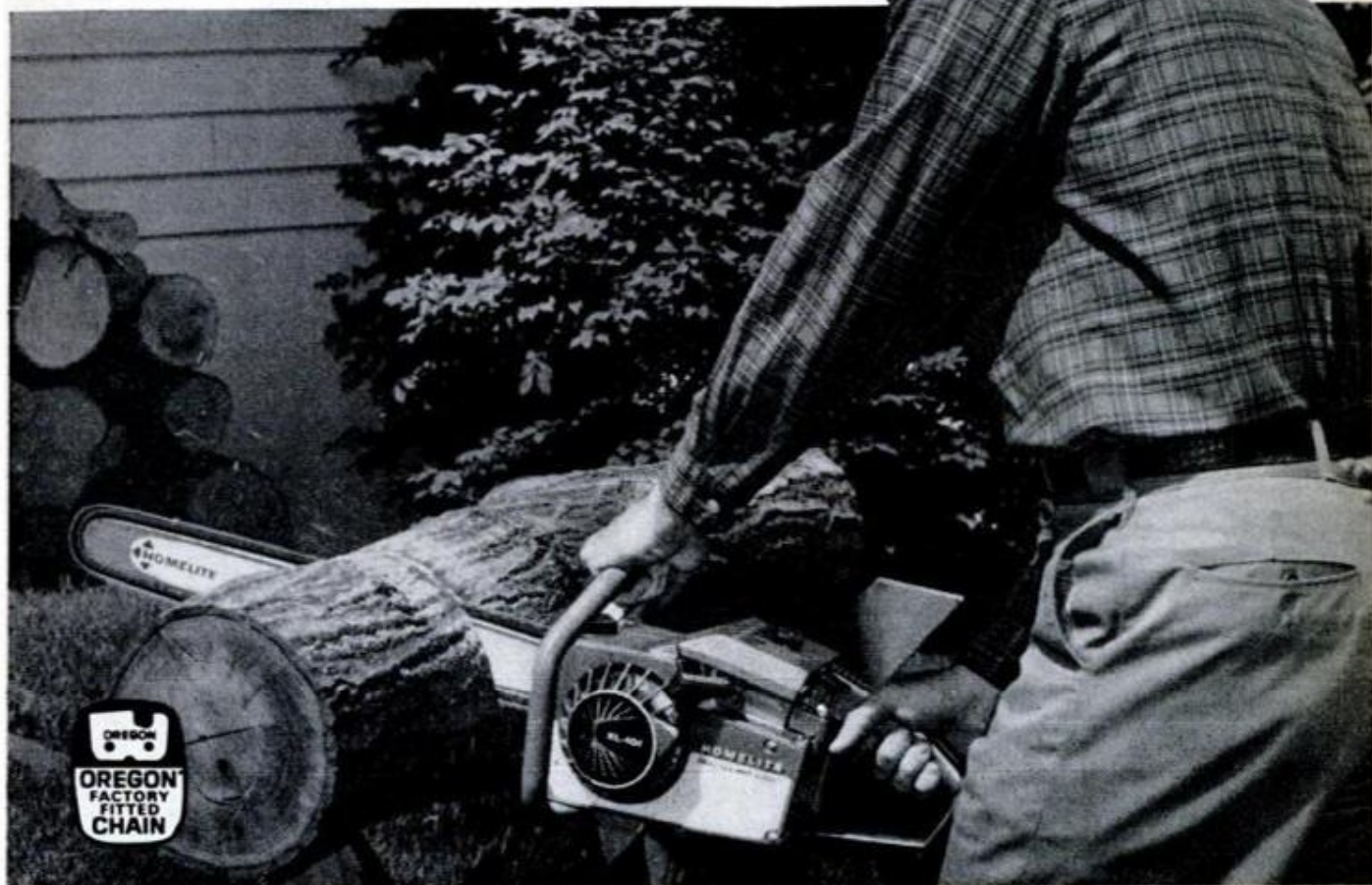
This is the Homelite XL-101 chain saw, a light 10½ pounds* of pure muscle. It cuts through a 12-inch hardwood log in 12 seconds, and fells trees up to four feet in diameter. Perfectly balanced, easy to handle, with a new narrow bar that virtually eliminates pinching. Great for cutting firewood and pruning trees. See it at your nearby Homelite Dealer. He's listed in the Yellow Pages.

*less bar and chain

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Use aluminum **Dow Corning® metal sealant** for sealing casement and storm windows; gutters, ducts and downspouts; air conditioners and exhaust fan casings; etc.

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DOW CORNING

DOW CORNING

HURRICANES

(Continued from page 176)

expectancy is short. "Dry land or cold water cuts off a hurricane's moisture supply."

A hurricane's whimsical route is decided by prevailing seasonal winds and giant high and low pressure systems that begin as far away as Alaska or Africa. Generally, Atlantic and Gulf hurricanes are nudged towards land by the trade winds. But when they meet a high-pressure region, they veer off in an erratic, vexing path that meteorologists can predict with complete accuracy only 24 hours in advance. Hurricanes form off the southern coast of California, too. Luckily, west-moving winds usually blow them to sea.

Veteran hurricane watchers along a seacoast don't need Weather Bureau reports to know that trouble is on its way. A hurricane's battering winds generate long, lazy sea swells that roll out from the fury at 30 mph or so. During summer, a swell ordinarily strikes land along the Gulf of Mexico every four or five seconds, and along the Atlantic coastline about every eight seconds. Swells from a hurricane 2000 miles away slow this tempo to one about every 12 seconds.

"You can feel the crash of a hurricane's swell a mile inland, especially when the storm is only 300 or 400 miles away," claims Ferdinand Quentha, a suntanned, 65-year-old Portuguese fisherman living on the Florida keys. "The day may be sunny, the sky clear of clouds. But when I hear that beat I get ready to beach my boat and lay away food and water."

Paradoxically, the greatest damage from hurricanes isn't made by wind. Much more dangerous is the storm surge. The low pressure under a hurricane's center sucks up the sea one foot or more above normal level. In addition, the winds pile up water 10 or more feet above *this*. The combination—the storm surge—is added to daily high tides. Much of the highly populated Atlantic and Gulf Coasts is only 10 feet above average sea level. Consequently, the storm surge of a healthy hurricane advances over land like a slow-moving tidal wave. But not always so slow moving. One storm surge mounted a narrow creek bed in Galveston, Tex., forming a wall of water 20 feet high that carried barges upstream like toy boats.

Storm surges have killed more people at one time than any other single catastrophe. In 1737, a hurricane's storm surge snuffed out 300,000 lives in Calcutta, India. In 1900, more than 6000 people drowned in Galveston, and as late as 1957, 380 persons drowned when Hurricane Audrey blasted Louisiana. The hurricane warning service

of today has cut down this toll drastically.

Even major property damage may be avoided if a joint Navy-Department of Commerce program—Project Stormfury—pans out. A hurricane's wind force is a measure of the barometric difference between its low-pressure center and higher-pressure outskirts. The bigger this difference—called pressure gradient—the greater quantities of soggy air whip into the vortex. The gradient and the storm's fury drop if pressure around the vortex rises or the pressure 15 to 20 miles away falls. Project Storm-fury aims at the latter. Its weapons: silver iodide bombs.

Silver iodide particles released by the bombs offer nuclei around which cool vapor can condense into raindrops. The resulting squalls release heat, which warms the air and causes it to rise, dropping the barometric pressure well behind the vortex. The hurricane isn't stopped. But the gradient is lowered and its force abated.

"Remember, the destructive power of wind is proportional to the square of its velocity," explains Dr. Robert Simpson, director of the Miami-based National Hurricane Warning Service. "Cut that windspeed by only 10 percent and you've done a real service."

Since its formation in 1962, Project Stormfury has seeded two hurricanes. Results were encouraging, but not conclusive. "We need more monitoring flights to show us the best time and place to seed clouds," says Cecil Gentry, who also heads Stormfury. "Hurricane seeding is a complex task and we need to know a lot more about the best way to do it."

During the last four years, no hurricane came within the range of Stormfury's planes at the moment for best seeding results. This year, about 20 aircraft can be mustered from the military and government agencies to bomb and monitor likely storms. (Planes are no longer used to find storms; satellites do the job.) "Man's weapons against hurricanes aren't yet very potent. But at least if one threatens the U.S. this year meteorologists just won't stand around cursing the bad luck," said one young meteorologist at Miami.

Project Stormfury is investigating only cloud seeding, and admittedly not with the striking or monitoring force it would like to wield. The problem: money.

"We have less than one million dollars for our program," explains Gentry. "The average hurricane dollar damage per year is \$300 million, and some single hurricanes have cost \$1 billion. What we're spending on research to understand and control hurricanes is insignificant compared to what real modification could save. Just insignificant." ★ ★ ★



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SEALAB III

(Continued from page 99)

be reduced and carefully metered out to compensate for the added pressure. After months of simulated dives in pressure chambers, Navy doctors formulated what they consider the optimum breathing mix for a depth of 600 feet: 2 percent oxygen, 4 percent nitrogen and 94 percent helium.

One of Sealab III's main objectives is to test this mix and its effect on the body. "Each time we go deeper and add more pressure," explains Cmdr. Larson, "we face a new set of problems. The main question is simply this: Can man live and work safely and efficiently at such depths for long periods?"

To find out, Sealab will send five separate teams of eight aquanauts to the bottom. Each team, consisting of Navy divers and civilian scientists, will stay down for a 12-day span. Nearly every waking hour of these total 50 days is packed with performance tests.

Cmdr. M. Scott Carpenter, the second astronaut to orbit the earth, and a team leader during Sealab II, will be the senior aquanaut, directing each team's effort during the experiment.

TEAM 1: as soon as the habitat is lowered, Team 1 follows down in the PTC. Its first job is to level the habitat, using turnbuckles on a huge anchor block to which it is attached. Then the men enter the habitat through a special chamber—a kind of foyer that looks like a small indoor swimming pool. The pressure of the habitat, equal to outside sea pressure, keeps the water from bursting in, and the pool forms the "door" between the dry world inside the habitat and the wet vastness all around.

What is normal under such pressure? As yet we don't know. Certain enzymes in the blood rise far above their usual level. Is that dangerous? Or is it a natural body adjustment to pressure? Sealab may provide the answer to many such questions. Heartbeat, breathing, temperature, urine, saliva, blood pressure and composition, sweat rate, and other body functions for the men below will be constantly monitored aboard the *Elk River*.

Setting up housekeeping will be the next job for Team I. It will check every part of the habitat—ports, hatches, drains, ballast—then try to determine the right temperature for comfort, still unknown because pressurized helium carries off body heat much faster than surface air. Various heating systems will be tested, including radiant heaters, duct heaters and heat supply through the recirculating breathing mix.

Cooking is a special problem. Open flames are out. There's not enough oxygen to make them burn. Besides, they'd foul the atmosphere. Hot plates don't work either. The helium draws off so much heat that they never get hot. Sealab uses an infrared oven for cooking.

The first few days will be a constant round of testing. "Even simple gadgets act strangely down there," Larson laments. "And the more complex ones become quite unpredictable. For instance, the television cameras through which men topside monitor the habitat often go haywire in helium. So we had to redesign them with high-pressure seals. Similar problems crop up for almost every piece of gear. Floodlights, electronic gear, navigation systems, cameras, sensors, depth gauges, compasses—everything had to be modified for the added depth."

After this equipment shakedown, the divers swim out on their first job: Setting up an undersea weather station to register tidal changes, currents, turbulence, salinity and water temperature.

While these data are telemetered topside, the divers themselves have their breathing, temperature and heartbeat monitored by telemeter circuits. "This is essential," says Capt. George Bond, Sealab's chief medical officer. "The diver himself may not notice anything wrong, yet he may be heading for trouble. For example, the first sign of oxygen deficiency is when you black out. But through physiologic monitoring we can give the diver advance warning."

Next come the lobsters. Instead of taking lobsters out of the sea, the Navy plans to put them in. They're bringing a group of live lobsters all the way from Maine. The idea is to see if Maine lobsters will thrive in the Pacific.

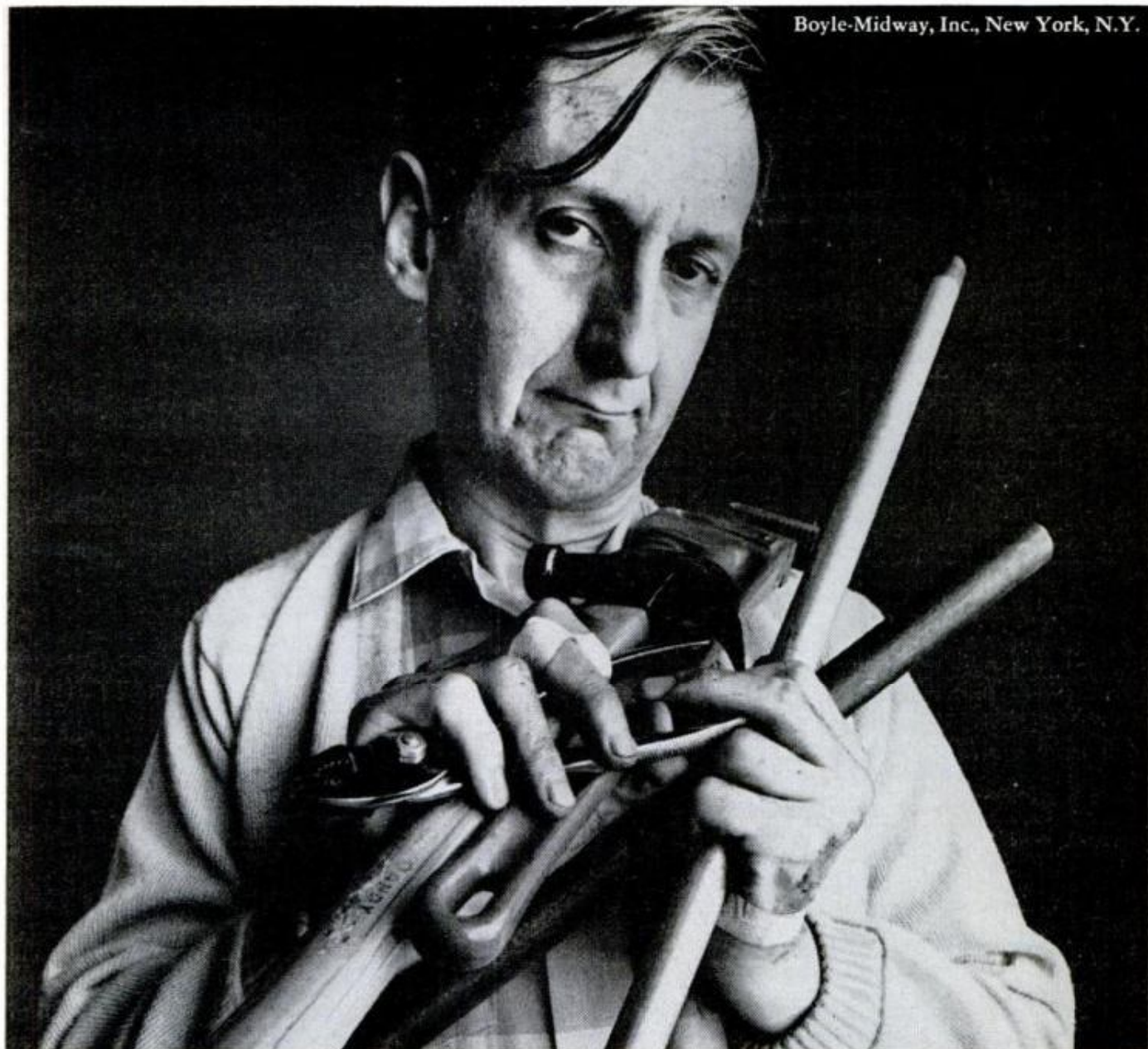
TEAM 2 immediately gets to work on its main mission: salvage. In the last Sealab the salvage test consisted of raising a sunken aircraft by blowing it full of buoyant foam. This time the task is trickier. It calls for lifting a solid mass of concrete and steel by attaching cables and flotation gear.

Because divers, like spacemen, are nearly weightless, they can't work with regular tools. A hammer might swing an aquanaut; a wrench might twist him around. Special zero-reaction tools had to be developed for underwater use.

No sound escapes. All of it is trapped in special silencers. For in the sound-magnifying sea, a pistol crack might deafen an aquanaut.

While working on their salvage project, Team 2 aquanauts will test three different

(Please turn to page 182)



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SEALAB III

(Continued from page 180)

kinds of rubber wetsuits. One is electrically heated, the other is heated by a web of tubing constantly flushed with warm water from the umbilical. The third suit has its own heat source—a radioactive isotope which warms the water in the suit.

Out on the job, the diver normally gets his breathing mix from the habitat via umbilical. A special regulator adjusts the oxygen to the extra body demand during hard work. But each diver also carries an emergency supply on his back in a scuba-like system with several special features.

To keep up 275-p.s.i. pressure at normal breathing volume takes great amounts of gas. Ordinary open-circuit scuba would last only a few breaths. But Sealab's Mark VIII breathing gear recirculates about half of the diver's exhaled breath, scrubbing it clean of carbon dioxide and refreshing it with small amounts of oxygen. This stretches the diver's backpack emergency breathing to at least 20 minutes, giving him a chance to get back to the habitat.

"We could make it last even longer if none of the exhalation had to be dumped out into the sea," says David Harrell of the Navy's Ocean Engineering Branch. "But so far, our gas mixture controls just aren't accurate enough to permit closed-loop operation."

Special tools

TEAM 3 concentrates on building underwater structures. It plans to build a livable bottom habitat 15 feet tall from parts lowered by crane. The site will be lit by a gigantic chandelier of high-penetration iodine-vapor floodlights dangling from a topside crane. Much of the assembly work will be done with a newly developed multipurpose tool that can drill, cut, saw holes, grind, tap and tighten bolts. Powered by a $\frac{3}{8}$ -hp motor, it is the first such tool with epoxy seals to keep out water even under high pressure. As a special safety device, it has a 30-millisecond cut-off switch to prevent electrocution of a diver by a possible short. The second habitat will be built with a new kind of quick-connect structural fastener, and the divers will try to determine what size bolts, screws, rivets and other hardware are most convenient to handle.

Anticipating the future building of large sea-bottom factories and mining installations, Team 3 will test the bearing strength of the bottom soil to see if it can support such structures.

TEAM 4, handling ocean technology, will

conduct underwater visibility tests, evaluate systematic search patterns, and to try a new hand-held sonar. Scanning the bottom with this miniaturized sonar, the diver hears sounds which reveal objects and terrain features in murky water. "Sometimes we can't even see two feet ahead down there," grumbles a Sealab diver. "That portable sonar will be a big help in finding our gear—or just finding our way back to the habitat."

TEAM 5 does the cleaning up. Its job is to find and retrieve various pieces of equipment left on the ocean floor previously. This gives it a chance to take a fish census, record fish talk, film and photograph fish with remote-control cameras and measure bioluminescence—the eerie light given off by many undersea organisms. The data will aid in "ocean farming"—the building of abundant herds of marine animals to assure adequate food supplies for an increasingly hungry world.

One sea creature in particular will be part of the marine biology program. Tuffy the porpoise—an old friend of the aquanauts—will again act as general helper, carrying messages, tools and supplies, and retrieving lost divers like a Saint Bernard. "Man's best friend in the water," quips a sailor. "A regular undersea-dog."

Tuffy has already gone down as far as 550 feet, and everyone hopes he can make it to 600. He may be able to go that low partly because he doesn't have to breathe under water. One big gulp of air lasts him the whole trip. However, the deeper he goes, the less time he can stay on the bottom. If he can go to 600 feet, he may be limited to 1½ minutes. In any case, Tuffy will enjoy company on this mission. Harbor seals and sea lions may join the act as messengers and carriers.

All five teams will repeat basic physiology tests so they can be cross-checked against each other. And all five will share in experiments designed to overcome a major problem: communication.

Plain talk is impossible. Helium and pressure raise the pitch of a man's vocal cords and alter the acoustics of his mouth. When he speaks he squeaks. Unless his speech is "unscrambled" by complicated electronic gear topside, it's hard to understand what he says.

It may take many months to analyze and evaluate the whole mass of experimental data logged by the five teams. But when the results are in, they will help open up the vast area of the ocean floor—an area three times as large as the United States, an immense storehouse whose riches still lie untouched. Whatever we learn from Sealab III, it will be a key to a vital extension of man's domain. ★ ★ ★

0 TO 40 KNOTS IN 75 SECONDS

(Continued from page 73)

make the gunboats rough riders in a heavy sea. The USS *Asheville*, which was first to report to San Diego, ran into such rough weather moving down the coast that it had to steer for shelter in a northern California port. "They ought to rename us USS *Cork*," one haggard crewman said.

In Vietnam the *Gallup* has been operating out of Da Nang and Cam Ranh Bay, something of a lone wolf among the Coast Guard cutters and Navy Swift boats that are the mainforce of the Market Time Patrol. "The others can't keep up with a PG," Spane said.

One day the Market Time commander sent out the *Gallup* and the 82-foot Coast Guard patrol boat *Point Orient* to shadow a steel-hulled trawler moving down the coast from North Vietnam. "The *Point Orient* had to get under way six hours ahead of us in order to be at the rendezvous point when we arrived."

A sharp-eyed pilot on air patrol had put them on the tail of the trawler. He thought the vessel was riding too low in the water for a trawler heading toward the southern fishing grounds.

His tip turned out to be a good one. The *Gallup* and the *Point Orient*, along with a destroyer and a Swift boat, followed the trawler for three days. At 2 a.m. on the fourth day they saw its dark shape moving toward the South Vietnamese shoreline.

The *Point Orient* used blinker-signals in International Morse to demand that the trawler stop. It didn't. Then the Coast Guardsmen turned a searchlight on the suspect, and a Vietnamese interpreter used a bull-horn to call out an order to surrender. Still no response. The *Point Orient* pulled back and fired a shot across the trawler's bow. The trawler kept moving, and its doom was sealed.

Bill Spane wheeled the *Gallup* into firing range and his men let go with all they had—the 3-incher, the 40-mm and the .50-cals. The *Point Orient* and the Swift began plastering the trawler, too.

Guns concealed on the trawler's deck made a brief, feeble response but the fight was too one-sided to last more than a few minutes. By the time the trawler nosed onto a bar, fires breaking out on deck, the crew was swimming for shore.

The trawler yielded 1500 weapons—machine guns, submachine guns, rocket launchers and rifles—a million rounds of ammunition, some mines, plastic explosives and detonators. There was also 5000 pounds of TNT which appeared to be rigged for scuttling the ship—something the crew never got around to doing. ★★★

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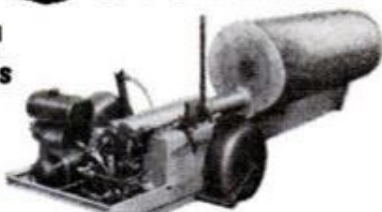
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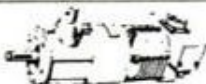
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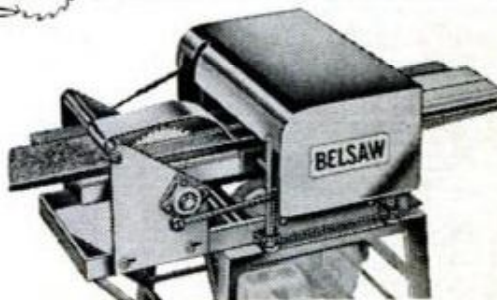
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WILDEST SHOW ON THE ROAD

(Continued from page 82)

to suit this formula than any other engineer and builder in the world."

The "Formula" sets the limits on car design. Formula 1 is for Grand Prix cars; Formulas 2 and 3 are lesser levels for smaller and slower cars. Most of the Formulas down the years have regulated engine size above all and the current one is no exception. Supercharged engines may be of a displacement no larger than 1.5 liters (91.5 cu. in.), while unsupercharged engines have to be no larger than 3.0 liters (183 cu. in.). All the engines so far have been 3 liters, unsupercharged.

The cars may not be lighter than 1102 pounds, must run on pump gasoline, carry a self-starter, and have basic safety features such as a rollover bar and dual master cylinder. They're not allowed to enclose the wheels with fenders or bodywork, so they've all taken on a simple cigar-like shape, from which the first variations are appearing this year.

Grand Prix cars are incredibly compact, wrapped tightly around their drivers. Tall Dan Gurney literally "puts on" his Eagle, twisting down under the 12-inch steering wheel to recline almost flat on his back in a form-fitting magnesium container filled with gasoline. Fuel tanks act as the frame in most Grand Prix cars, just as the engine is also a part of it. From front to rear these machines are intricate sandwiches of alloy steel, aluminum, magnesium and titanium, each costing between \$60,000 and \$75,000. A Ford-Cosworth V8 engine—one of the simpler designs—costs \$25,000.

Supertight competition in Grand Prix racing is bringing the cars closer together in design. The V12 engine is favored by all except Repco of Australia, maker of Jack Brabham's engines, and Ford of Britain, whose Cosworth-built engines power Lotus, McLaren and some French Matra cars. Both use V8s. All but B.R.M. use four valves for each cylinder—two intake and two exhaust—an arrangement from the '20s and '30s.

All Grand Prix cars today are rear-engined, independently suspended with coil springs, fully disc-braked and fueled by injection systems. About the only body work they've needed is a fiberglass nose cone covering the radiator and front end (many cars at the Glen will run with no cover around the engine). But some drivers will follow the examples of Lotus and McLaren, who use the power of air flow to press the tires tight to the road. McLaren started the season with a modified "wedge" shape. Colin Chapman car-

ried it to an extreme with his Indianapolis turbine cars and latest Grand Prix cars.

These new aerodynamic ideas will work very well at Watkins Glen. At 2.3 miles, it's a short track. Only Monaco and Jarama in Spain on this year's calendar are shorter. But it's also fast, exceeded in average speed only by Belgium's Spa circuit and Italy's Monza. On the five right-hand turns and three lefts of Watkins Glen, the high speeds will generate the maximum downward pressure from a wedge-shaped body.

A racer who crosses that narrow line between control and disaster at the Glen will find fewer obstacles this year. Responding to suggestions from the Grand Prix Drivers Assn., an informal but effective alliance of top drivers, Watkins Glen director Cameron Argetsinger moved back earth banks and modified guard rails to add safety for drivers and spectators alike. A new, enlarged Kendall Technical Center will house the cars for the inevitable changes of broken engines after practice.

Grand Prix teams like the informal hospitality of Watkins Glen—and the rewards. The U.S. Grand Prix is the only one that pays no starting money, instead guaranteeing prize money to every entrant in the 20-car invited field. From a purse of \$105,400, the winner will collect \$20,000, the G.P. season's largest prize.

Nineteen sixty-eight is Enzo Ferrari's 20th-anniversary year in Grand Prix racing using cars bearing his own name. His is one of the classic team organizations—providing the cars for drivers who are motivated to race for a pittance plus the glory of holding the wheel of a blood-red Ferrari. Chris Amon and Belgian Jackie Ickx will drive two of the three cars Ferrari will bring to the Glen.

Britain's B.R.M. cars first raced two years after Ferrari. For '68, B.R.M. abandoned a complex and controversial 16-cylinder car to build an orthodox V12 that's been going very fast in the hands of Pedro Rodriguez and Dick Attwood. A private team will enter a third B.R.M. at Watkins Glen for Britain's Piers Courage.

John Cooper, whose simple and effective cars started the rear-engine revolution in Grand Prix racing, is trailing the development trends today. He has built lighter cars around the 390-hp B.R.M. engine this year, and engaged Belgian Lucien Bianchi and Briton Brian Redman as drivers.

Another classic team with tremendous financial resources has been formed by France's Matra, a leading aerospace supplier. One blue car in the U.S. Grand Prix will be all-Matra, to be driven by

Jean-Pierre Beltoise. Another will have a British Ford V8 engine entered privately by Jackie Stewart.

John Surtees has been helping Japan's Honda develop its latest Grand Prix design. With a roller-bearing crankshaft, the car's V12 engine will shriek to 15,000 rpm and develop over 450 hp. Another loner will be Dan Gurney with his latest, slimmest Eagle. By Glen time Dan hopes to develop 480 hp from his compact V12.

Goodyear helped Gurney become a builder as well as a driver, as it had earlier helped Jack Brabham. The light Brabham cars have collected championships in the first two years of the current Formula and would be favored to repeat if Brabham were not grappling with new development growing pains.

Another Goodyear beneficiary is Bruce McLaren. Bruce, a Brabham protege, first built sports cars in his own name and then graduated to Grand Prix cars in 1966. McLaren starred in the Can-Am series last year, seizing Denny Hulme as a teammate and keeping him for the '68 Grand Prix season. The orange McLarens use the 408-hp Ford-Cosworth V8. An older McLaren, with B.R.M. engine, is entered by Sweden's Joakim Bonnier.

McLaren admits his best hope for Grand Prix wins this year lies in fielding better-prepared cars than Team Lotus, which uses the same light, compact Ford engine. When it stays together, the Lotus-Ford is almost unbeatable. Jim Clark won with it at the Glen last year, and Graham Hill has taken on new life with his fine Lotus victories this year.

The mustachioed Hill, with three previous Glen wins, is an odds-on favorite to collect his fourth silver trophy filled with New York State champagne. Lotus major domo Colin Chapman will back Hill with Mario Andretti of the U.S. in a second car, and a third may go to Mexican Moises Solana. A fourth Lotus-Ford will be entered by whiskey scion Rob Walker, driven by Switzerland's Jo Siffert.

Something new always happens in the month between the German Grand Prix and the Italian G.P., the last European event before the "Circus" begins its three-race North American tour.

There could be a new Honda, or a new four-wheel-drive car from Ford of Britain, or an Indy-style turbine-powered Lotus. Whatever they are they'll be coming to Watkins Glen to send the sound of their shrill exhausts ringing across Seneca Lake. At their wheels will be 20 of the worlds' bravest men, in search of every available championship point in the season's next-to-last race. That's when the Grand Prix "Circus" gets serious. ★★

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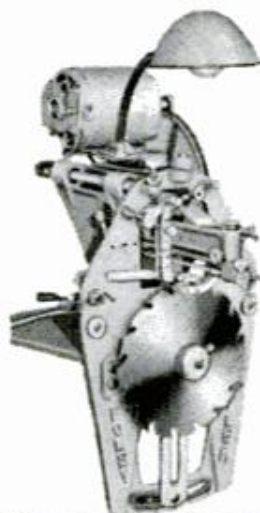
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THOSE NEW TURNTABLES

(Continued from page 87)

automatics slash these disturbances well below levels of older changers.

Speed accuracy of the turntable also reflects quality. While many listeners won't detect small changes in record speed, a turntable should spin at a constant rate. Equipment makers use two types of motors (hysteresis-synchronous and the induction motor), but there's general agreement on one point. Either motor can deliver good performance in a well-designed system. Unlike early changers, most automatics won't start out at one speed, then vary as the tone arm nears the center of the record.

Checking turntable speed is easily done by viewing a strobe disc (included with some models) as it rotates under a fluorescent light. An accurate turntable should freeze the strobe markings to signify true speed.

Another sign of a good automatic is the ability to trip the record-changing cycle when the pickup cartridge is adjusted to an extremely low tracking force. Old changers needed a strong jolt as the record ended to trigger the cycling mechanism. High forces, though, are disastrous to today's delicate stereo cartridges. These pickups often track at the low force of about a gram or so, which leaves precious little mechanical action for tripping the changer. Trip devices in the automatics should cycle at such low pressure.

Special features to look for

Besides these basic requirements, there is a welter of other features appearing on automatics. Many improve operating convenience, while others answer the complex problem of making a stereo cartridge operate with extreme precision. And here is where individual differences between models become increasingly apparent. Let's consider these features in some detail to see what manufacturers offer.

Anti-skating. Today's trend is toward lighter tone arms and needle forces to reduce distortion and record wear. But as weight and friction disappear, a new force creeps in. It's termed "skating." As the arm rides the record groove, it develops a mechanical force that tends to thrust the needle toward the center of the record. The sidewise action causes uneven wear in the groove walls and some distortion.

To counteract the force, manufacturers install "anti-skating" devices that apply a slight offsetting push on the arm in the opposite direction. It's usually a weight or spring that's adjusted in the home to accommodate different cartridges. In the

typical model, a knob is adjusted until it agrees with the number of grams recommended by the cartridge manufacturer for his specific pickup.

If you choose an automatic capable of operating at low needle force, say 1 gram, the anti-skate feature could help extract the last bit of fidelity from the system. A low-cost changer would hardly improve since high needle force and friction wipe out the skating effect.

Stylus force. Nearly all automatics go to considerable lengths in the matter of stylus force. It's the weight or pressure that bears down on the stylus (needle). Old changers had a coarse spring for this adjustment, but the new automatics boast elaborate counter-balance systems for far more precise control. Most current cartridges are designed to operate at a force of about 1 to 5 grams, and the arm should be adjusted to the number recommended by the manufacturer. If force is excessive, there'll be increased distortion and wear. Too little force causes groove-jumping when someone walks near the turntable and also some increase in distortion.

In many automatics, there's a two-step stylus force adjustment. First a counterweight on the rear of the arm is adjusted until the arm is perfectly balanced (hovering in air). Then the recommended stylus weight (in grams) is dialed with a knob. If a scale of weight isn't provided, a separate stylus gauge is used.

The arm counterweight, incidentally, does more than control stylus force. By balancing the tone arm assembly, the arm becomes resistant to changes in level. It means your mounting shelf or turntable base won't have to lie perfectly level.

Turntable speed. Although all automatics aim for great precision in controlling motor speed, several models introduce an additional control to allow the listener to readjust turntable speed. This could prove valuable to serious listeners, music students and instrumentalists. By adjusting the control, the pitch of recorded music can be matched to that of a live, solo instrument (piano or organ, for example).

The control varies disc speed by some 6 percent, about a half-note change. If the listener wants the turntable to rotate at normal speed, he places a strobe disc on the turntable to make the adjustment. Other changers latch on to the 60-cycle line frequency as the reference for turning a disc at rated speed.

Most machines provide four basic turntable speeds used in recording—16 $\frac{2}{3}$, 33 $\frac{1}{3}$, 45 and 78 rpm. Some units drop the 78 since music is no longer recorded at that speed. This may be a factor if you have a collection of old 78s. The 16 $\frac{2}{3}$

speed is mostly for "talking book" discs.

Cueing device. This is one handy accessory featured in most automatics. It overcomes the touchy job of grasping a tone arm by hand and setting down a fragile needle at a desired point on the record. It could prevent damage caused by a needle skidding across the grooves.

The cueing control usually works like this: You press a lever that elevates the tone arm a slight distance above the record. Once the arm is clear, it's safe to grasp it by hand and move it to any section of the disc. Release the lever and the arm gently descends onto the record surface.

The same lever also acts as a "pause" control. If you wish to stop the music any time, just operate the cueing control. After the desired pause, release the arm and the music resumes at precisely the same point.

Cartridge and arm adjustments. Makers of automatic turntables construct tone arms to cope with "tracking error." It's a mechanical wrinkle that starts when the original master disc is cut. Since the disc-cutting point rides on a lead screw, it travels a straight line over the disc from start to finish. But once the disc reaches the home turntable, it's played back with a tone arm. The arm swings over an arc that doesn't quite agree with the straight path taken by the original cutter.

To minimize this discrepancy, tone arms have a bend, or offset, at the cartridge end. The cartridge, however, must be installed with careful alignment to keep tracking error at a minimum. This has led to a number of mounting aids that serve as installation guides. Some turntable makers provide a special plastic form that's temporarily snapped onto the cartridge. An adjusting screw is then manipulated until the stylus is positioned opposite a reference notch.

Another source of error is "vertical tracking angle." Again, there's a discrepancy between the original disc cutter and the home playback system. It develops as the stylus changes angle as records pile up on the turntable. One maker provides a dial that changes the angle according to the number of records on the turntable; another supplies a special wedge to achieve a similar effect. These features could hold appeal for someone looking for the ultimate in cartridge adjustment.

One welcome feature of most automatics is a comprehensive instruction manual that details critical adjustments. If the needle skips opening bars of music or fails to clear the top record of a stacked turntable, you won't have to call the serviceman. Most manuals provide clearly illustrated instructions on how to readjust these settings. ★★★

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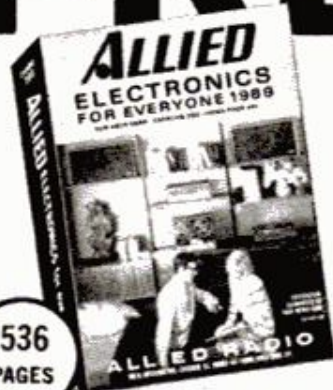
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HAVE HOUSE, WILL TRAVEL

(Continued from page 91)

off, unless restrained by agreement ahead of time.

Two-story houses present varying problems. They are always more expensive to move because more overhead wires and other obstacles must be dealt with. Where state height limits exist, the situation is more drastic. There is a standard cure: Cut the roof off and move it separately. Fireplaces and outside chimneys call for special handling. Where the masonry is old, movers hesitate to guarantee results.

Foundations affect costs at both ends of a moving job. From a crawl-space block foundation to another just like it is simplest. From an old basement to a new basement is nearly as easy, but the new basement is expensive. Putting a slab on a crawl-space foundation is simple enough once the house is at the new site, but moving a heavy slab costs plenty.

The final judgment on the feasibility of moving a house, particularly where it might need surgery, should be left to the man who'll move it. Movers can move anything, but sticking to basic do-it-all-the-time types of houses is the best way to save money.

Depending on where you move to, there may be special deed restrictions, zoning ordinances and regulations concerning setbacks. These must all be reviewed before the deal is set.

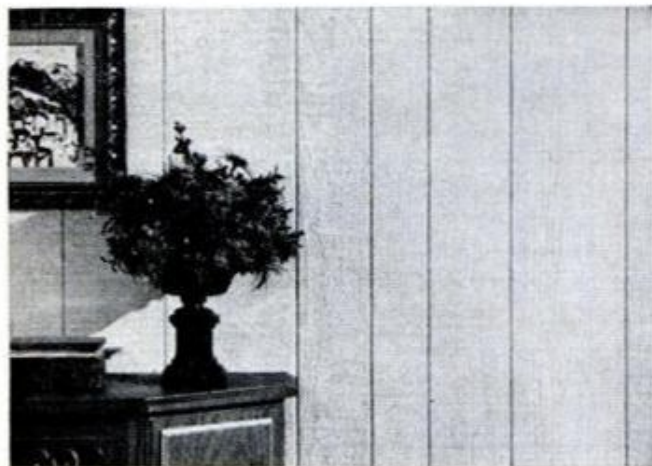
How the house will be placed on the lot should also be taken into consideration. Taking a house that was built to face north and moving it to where it faces south will change the lighting and the heating. Be sure, too, that there is sufficient clearance between trees and other obstructions on the new property to get the house in. There must be an opening about 12 inches wider than the narrowest dimension of the house, but a good mover can even shave it closer than that.

Oddly enough, despite all the application of brute force, nothing inside the house is harmed. If I were to move my house again, I wouldn't even take the dishes out of the cabinets or the pictures off the walls. It isn't done with mirrors—the house is simply kept rigidly level with itself during the entire job. It tilts and swings, but it neck racks or twists. It is suspended on three points, and these keep it always moving as a unit.

Getting a mover to move a house, or buying a house from a mover, is just like any other business deal, with give and take on both sides. One can bargain hard

(Please turn to page 196)

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WHAT GUN FOR WHAT GAME?

(Continued from page 94)

kill deer every year—mostly in the heavier-settled states east of a line running generally north and south along the west boundaries of Arkansas and Missouri. In this area, a short, light, fast and easy-handling carbine is your best bet. No higher degree of accuracy is required to hit a deer less than a football field length away, so lever, pump, or automatic will do just as well as a bolt gun. And, most hunters can get repeat shots off faster from them than with the bolt action. All the major manufacturers turn out guns in this class, so there are many models to pick from.

Relatively light cartridges are fine for eastern deer hunting, and they also do fine for the occasional small black bear or southern hog you might decide to hunt. The popular .30-30 Winchester is a favorite, as are the .300 Savage, .35 Remington, and the .44 Magnum. The .308, .284, and .243 Winchester do a very fine job, but really have more velocity and power than necessary. However, the more modern guns of the type best suited to eastern hunting are chambered for them. So, don't hesitate to use them.

Bigger game

Moving westward, we start running into more open country and longer ranges. The game gets bigger and tougher, too, though deer still outnumber all other species. And, we find the big mule deer, as well. More powerful, flatter shooting rifles of greater accuracy are needed. Generally speaking, this means a bolt-action rifle with 22 or 24-inch barrel. The bolt gun is chambered for the most powerful cartridges. And because of rigid one-piece stock construction, it has long ago proven its ability to shoot closer than lever, automatic and pump guns. A western gun will be heavier than a carbine for eastern hunting, but the weight will pay for itself. Classic examples of the western rifle are the Winchester Model 70 and Remington Model 700, though all other makers produce similar models. You'll have no trouble picking one that suits you.

It goes without saying that on all the longer ranges of western hunting a scope is highly desirable, if not downright essential. The 4X seems to be about the best choice.

A cartridge of the .30-06 and .270 Winchester class will handle every animal to be found in the Western states. With the heavier-bullet factory loads, they'll stop elk and grizzly. And, they shoot flat and

accurately enough to take medium-to-large game out at 300 yards or so. Expert riflemen use lighter calibers such as the .308 and .243 Winchester and the 6-mm Remington on big western animals, but they aren't recommended for the average once-or-twice-a-year hunter.

We can't pass by the Magnum calibers. Of course, they are good—more power for heavy game, flatter trajectory for long-range shots. And, if you already know you can handle the kick and noise of a 7-mm or .300 Magnum, either is better than the .270 or .30-06. But, most hunters don't shoot well enough to handle the "big bruiser" cartridges. If you can't shoot a 7-mm Magnum as well as you can a .270—use the .270. Missed or poorly-hit game doesn't often wind up in the freezer, so pick an adequate cartridge that you can hit with well.

Far North

Outside the 48 contiguous states, we have Alaska and portions of Canada where the biggest and meanest North American game is found. Moose in these areas are big, but not particularly hard to kill nor are they likely to eat you if you just make them mad. Grizzly, brown and polar bears in these areas take plenty of power. They run frighteningly big, and there's quite a list of deceased hunters who didn't have enough gun to put the big bears down quickly.

The ideal bear gun isn't to be had. It should be short, fast-handling and very powerful. Nearly all the extremely powerful guns today are bolt actions which aren't as fast-handling as other types. Consequently, short-barreled bolt guns are the rule, though the discontinued Winchester M-71 lever gun works out well. So does the Marlin .444 lever gun, but its high trajectory and relatively low energy beyond 100 yards limit its use.

Bear cartridge

A short bolt gun such as the Remington M-660 or Winchester M-670 is an excellent choice, but don't forget to get in plenty of bolt manipulation practice so as to be able to ram in fast follow-up shots.

The bear cartridge should be the heaviest you can shoot well enough to keep all your bullets on a dinner plate at 100 yards. The 7-mm Remington Magnum, .300 Winchester Magnum, and .338 Winchester Magnum are excellent, as is the .350 Remington Magnum. If you can handle it, the old .375 H&H Magnum isn't too much. If you *must* use a lever gun, the only current model worthwhile is the Marlin in .444 caliber, but don't try any long-range shots—energy and velocity

drop off very rapidly away from the muzzle.

Hawaii has goats, deer and wild pigs, all rather small, and they are hunted in mountains. A flat-shooting rifle easy to carry is the best choice. Take your choice of action types since ranges aren't too great, and moderately good accuracy is all that's required.

A relatively light, high-velocity cartridge is best. The .243 Winchester and 6-mm Remington are perfect for Hawaii use, so why look further?

If all this makes you think you'll need a half-dozen guns to get in reasonably varied hunting, don't despair. We've already indicated the .243 Winchester and 6-mm Remington do fine on deer and black bear, and they'll take elk and moose if carefully used. And they have the velocity and flat trajectory, even with the heaviest factory-loaded shells, to do well in the western states. When we look at their light-bullet load performance, we find they aren't far behind the hot .22 centerfires for varmint use.

This means simply that if economics do limit you to one good centerfire rifle, you can accept that fact and still be able to hunt everything but the big bears without being very seriously handicapped. A medium-weight .243 or 6-mm bolt gun with 22-inch barrel and a 3X-9X variable scope will do well by you in all the states, so long as you use it with care on elk and moose, and learn to live with its roar when varmints are the order. ★★★

VOLKSWAGEN OWNERS REPORT

(Continued from page 111)

tell someone my back hurts."—Maryland business machine serviceman.

Comfort and driver visibility (and therefore, safety) aren't the only complaints. Passengers in the back feel "isolated" as a Maryland technician complains. They don't see much of the road either.

Owners sound off freely about various small things: hard-to-use vent window knobs, the notoriously inadequate heater, and so on. But when it comes to engineering, workmanship and durability, they are hushed with respect. Many say they'll keep their Beetles "for the life of the car," "til it wears out" and "as long as it lasts."

Whether they plan to go all the way with their VW or trade-in American style before the tires and battery poop out, almost all compare the quality of VW workmanship to that of cars made in the good ol' U.S. of A. And that's one reason they say they buy a Volkswagen. Is anyone at home listening? ★★★

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TO CLEAN ROLLER, hold it by the handle and spin it in a strong blast of water from your garden hose

PAINT HOUSE WITH A ROLLER

(Continued from page 150)

like lamb's wool and mohair will soften and lose body in water-base paint. Stick with Dynel, Dacron, Pronel, Bak-O-Nel or one of the other man-made fibers. These not only stand up to water, but are tailored to suit the job (For instance, fibers for use in long-nap rollers are given more body than those commonly used in short-nap rollers).

Quality of construction is relatively easy to judge. The roller core should be plastic, or at least plastic-impregnated, in order to stand up under heavy use. The ends should be beveled slightly so they won't spread beyond the edge of the core and become overloaded with paint.

Be sure to get a roller frame with a threaded handle, so you can use it with extension poles. Sectionalized poles are best since they can easily be tailored to the desired "reach."

Start painting in the morning, as soon as the dew has evaporated. Begin on the north or west side and work around to the south or east side. Always start at the top and paint down, so you can cover drips and spatters.

When you take a break, saturate the roller with paint to offset drying until you return to the job. Also, watch for paint setting up in the roller while you're using it. This sometimes happens in hot dry weather, and many painters alternate two rollers to avoid it. The one not in use is dunked in a pail of water.

For overnight storage, just wrap the rollers in foil and put them in the refrigerator. At the end of the job, though, give them a thorough cleaning. A good roller is no throwaway tool. ★★★

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A FISHERMAN'S DREAM BOAT

(Continued from page 114)

to the bottom of the boat—almost like a trim tab.

The recording indicator needs a more permanent and sensitive installation. They solved that by cutting out a 6 by 8-inch area of deck just ahead of the engine box, then removing the closed-cell foam beneath it to form a box but leave the outer fiberglass hull intact. With the box sealed with fiberglass and filled with water, the transducer works as if the remaining hull weren't there at all, even with the boat moving. A Plexiglas lid, sealed with an oversized O-ring and held down with thumbscrews, permits easy checking on the water inside, and easy removal when necessary. Result: Both depth indicators work at optimum, but with no drag on the hull at speed. You may decide only one type depth recorder is best for your boat.

Between the fixed seats and the fighting chairs, the engineers left a space that just fits a big portable ice chest on the starboard side and four to six buoyant cushions on the port. Nonswimmers aboard wear buoyant vests, however; they are issued to all hands in rough weather. But the 191 hull contains 32 cu. ft. of built-in, closed-cell plastic flotation, which is enough to float 2000 pounds—even when the boat is completely filled with water.

For navigation—as well as for keeping a straight trolling course—a big Airguide marine compass (\$30) was installed in a gimbal mount on the driver's dashboard. He can watch the engine instruments, the compass, and the flashing-dial depth indicator without turning his head.

For emergency navigation—as well as for receiving weather, marine, and broadcast band radio—a Ben-Mar RDF (\$220) radio direction finder was installed on a bracket behind the fixed port seat.

For two-way conversations, and for calling help in an emergency, they installed a 150-watt Ben-Mar marine radio (\$525, Skipper 750 with antenna) on the dash facing the fixed port seat. The radio also permits conversation with Coast Guard monitors, aircraft, and other marine radios, an important feature when fish are being hunted over wide areas. A 10-foot whip antenna, mounted on a retractable base bracket, folds back out of the way when not in use, or when passing under low bridges. The radio unit itself was simply installed by cutting through the dashboard fiberglass with a saw and using the brackets provided with the radio.

All that electronic equipment makes it essential to eliminate static from the engine's ignition system. And the snug en-

gine box of the inboard-outdrive makes that a simple job. The engineers bought 32 feet of ordinary 24-inch copper screen (\$10) at a hardware store, and stapled it inside the engine box like upholstery fabric to completely surround the engine. The screen was grounded to the engine block, and static disappeared.

To ground each depth finder, two standard Ben-Mar grounding plates were installed on the hull bottom, near the transom. All other electronic gear is grounded to the battery.

Other safety gear packed in the boat's commodious storage areas include:

- A Danforth anchor, big enough for a 25-foot boat, with 200 feet of half-inch nylon line, to insure a long line and a good bite for the anchor.
- A three-foot-diameter, collapsible canvas sea anchor, which opens like an umbrella in the water to hold the boat's bow to the wind in case of an engine failure in water too deep for anchoring.
- An emergency flare kit, with six red flares.
- A hand bilge pump and a plastic bailing scoop.
- A spare propeller and a small tool kit.

With a good hull and a tight top, plus its emergency equipment, this Johnson boat can handle most waters in any fishable weather. What's more, its features can be applied to almost any seaworthy hull, for fishing on *any* potentially dangerous water. ★★★

HAVE HOUSE, WILL TRAVEL

(Continued from page 190)

when buying the house from the mover who will also move it. Often, movers are working against a deadline for removing a house and clearing the ground. The closer they are to that deadline, the readier they are to shave the price or make other concessions.

In any event, get a lawyer. He is needed either to draw a contract or to pass on the mover's contract. The contract should specify money payments—most moving jobs are handled like construction work with the contractor drawing money as he completes certain phases—damage adjustments, quality of work, type of foundation and time of completion.

In no case should there be a final payment without proof of waiver of lien rights. The many other details—such as well digging, city water hookup, heating and electrical service—are all the same as with a new house. The one big difference with house-moving is that it's always cheaper, if you work it right. ★★★

HOW WOULD YOU DO IT?

(Continued from page 163)

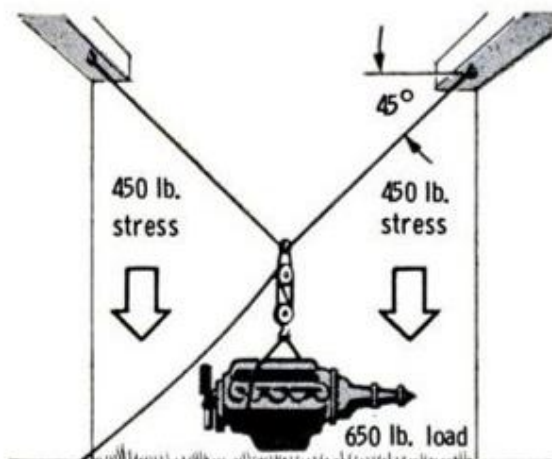


The chief and his helper built a platform about 10 ft. long and 1 ft. high inside the hangar. When the plane was rolled up one end of the platform, the tail was lowered enough to clear the lintel. When rolled down the other end, the craft then set level.

Second "pulley" reel



The old hoist pulley was mounted on the rear of the vehicle and the supply spool was staked into the ground. The wire was then run around the pulley and anchored to the first fence post. Thus, as the Jeep pulled away, it unreeled two strands of wire at the same time.



A single line fastened directly above the engine would have held it, but when stretched between two points and then loaded, the line is subjected to vector forces greater than the actual weight. Jim increased the sag angle and the line easily lifted the load.



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BUILDING AN EXTRA CLOSET

(Continued from page 125)

joint compound. Just how you do this, as well as tape joints, is explained in detail in a booklet called *How to Remodel With Drywall*, a copy of which can be obtained by writing to Popular Mechanics, 575 Lexington Ave., New York, N. Y. 10022 and enclosing 35 cents, plus 15¢ for postage and handling.

Louvered bifold doors are ideal for shallow closets. They open wide for full access, help ventilate the closet and are good-looking. Two pairs of 15-in. doors will fit a 60-in. opening perfectly. They come complete with hardware and full instructions for hanging. Some even come ready-hinged and primed.

Completion of your closet requires adding matching baseboard along the floor and molding at the ceiling, and, of course,

either papering or painting the walls if you used plasterboard.

Popular standards and brackets provide the easiest way to add shelves to your closet. Being fully adjustable, you can place the boards wherever you want them, and add as many as you want. Solid support is assured by locating the standards over studs. Where this can't be done, plastic screw anchors or fiber plugs should be used in plastered walls.

I used 1/2-in. plywood for the six shelves and supported each one with five brackets. The trick in getting the 8-ft.-long shelves in place is to first put all six boards on the floor of the closet (resting them on edge) and then raise them one at a time as each of the five brackets is hooked in the standards. The brackets shown are of the heavy-duty type which features a plastic clip that's used for screwing the shelves to them. ★ ★ ★

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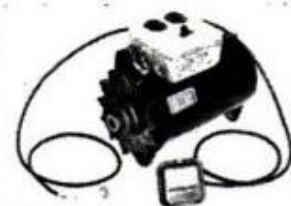


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'CHARGING' THROUGH OLD MEXICO

(Continued from page 79)

sun begins to play tricks on your eyes.

It beats down on the asphalt surface and creates a glare that looks like the sky—thus, you may be heading for the top of a hill, or heading into a curve or towards a straight section of road. In any event, the glare is potentially dangerous.

If there's a passing car or cattle on the other side of the hill, you're in trouble. If you're heading into a curve with cattle on the other side, you're in trouble. And if you're heading straight for the mirage and there are cattle on the other side, you're in trouble. In short, you must *always* remain alert and always expect the unexpected. Needless to say, the unexpected is usually a small herd of cattle or a frightened (but frightening) vulture with a 5 to 8-ft. wingspan.

Since Mazatlán is basically a fishing and tourist town, any of the hotels along the seawall or beach are recommended. Shopping facilities for souvenirs are excellent, with prices hard to beat in other Mexican towns. Your best bet for dining is either one of the seafood or Italian restaurants.

Day's tally: 493 miles, 6.7 driving hours. Average: 74 mph, 11.4 mpg.

D-Day plus four: Mazatlán-Mexico City. For the last two days, the roads have been well-paved and empty of traffic, permitting a bit of high-speed driving. Thus, we covered the 330 miles to Guadalajara, our next scheduled stop, well before noon—and decided to continue on to Mexico City that same day. That was a mistake, because Guadalajara marks the end of the open roads and the beginning of a twisting, winding and hazardous 420-mile stretch ending finally, in Mexico City. Maximum speeds drop from 60 and 70 mph down to 20 to 40 mph, tiny but crowded towns crop up one after the other, and the fumes from impassable diesel-burning trucks and buses create a horrible headache.

This was the only time spent on Mexican highways at night—and I wouldn't try it again. Buses seem to take up more room, cars run up behind you without any lights, you can't help but think there's something on the road in front of you, and you know that if you have a mechanical failure, Mexico's emergency Green Squad won't start patrolling again until nine in the morning.

Finally, however, we did arrive—tired, hungry and edgy—only to find that our paid-in-advance reservations at the Ambassador Hotel didn't mean a thing, because 15,000 Rotarians and their families were in town. After more than an hour-and-a-half of telephone calls, it became

obvious that every hotel in the city was booked solid with the conventioners—and so we happily accepted the desk clerk's kind invitation to stay with his family until an open room could be found.

Day's tally: 756 miles, 17 driving hours. Average: 44.5 mph, 12.3 mpg.

The great Mexican tragedy

Once a cosmopolitan and sophisticated center, Mexico City is being ruined by, and for, the Olympics. Streets are being torn up for a subway system, hotels are hastily being erected, traffic through the city is almost always at a standstill, and tourists are shaming some of the best restaurants in the world by dining in their shirtsleeves.

The population of Mexico City now exceeds 7 million; another 1000 to 100,000 Mexicans will either be working or visiting in the city during the Olympics; the subway system likely won't be finished, and it's doubtful that hotel accommodations will be sufficient for the many thousands of American and European tourists, athletes and officials.

Thus, many will find themselves in situations similar to ours—except we were fortunate because our plans were flexible. It took only three days to learn how much Mexico City has changed—and so we left for Acapulco as soon as possible. There, a few days at the beautiful El Mirador Hotel restored my faith in Mexican charm, and allowed us to rest up for the long but uneventful trip back to the United States via routes 57 and 85. In fact, after the drive down Mexico's western 15, routes 57 and 85 seemed dull, with only an occasional panic stop for goats and cattle.

Points to remember

Mexico City hopefully will revert back to a marvelous metropolis once the Olympic fever subsides, in which case, there will be a restful haven at the end of your journey south. But to get there safely, you'll have to use common sense, concentration and a well-prepared and well-maintained car. The battery level, oil, water and tires should be checked each morning. Keep a running log of mileage and route progress (if only to keep the passengers occupied). When leaving your car in any hotel garage, note the odometer reading—youngsters have been known to take guests' cars for nightly joyrides, especially if they're as impressive as the Charger. Impressive, indeed—for when it came time to return the R/T to the Dodge Boys in New York, my wife firmly refused to come along. Her reason: "I hate to see a grown man cry." ★★

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NIGHT DRIVING

(Continued from page 67)

beams shine no more than 100 feet ahead.

So what can you do?

● **Reflection driving.** You must learn a whole new technique of driving by reflection. Quit relying on your own lights (which are really quite feeble, even on high beam) and learn to see by other means. For example:

1. **Steer by other driver's lights.** Cars ahead of you cast a good deal of side glow. Let this "sweep" the road for you.

2. **Read the reflector-posts.** These form a corridor of light against which a stalled car or truck shows up black.

3. **Read the road-striping** (edge-stripe and lane-stripes) as far ahead as possible. Debris, dogs, even pedestrians show up as a black break in the stripe.

4. **Read the reflection of oncoming lights in the road.** And watch for the night mirage effect—"puddles" of reflected headlights. Eyeing these closely tells you much about the road beyond your headlights.

Many drivers don't let reflections work for them. The side sweep of approaching headlights is not bright, but it can tell you a great deal about what is ahead in your lane if you'll read it carefully in the last quarter-mile before a pass. Even taillight reflections show lane stripes and bumps before your own lights pick them up. Today's bright red lights actually help illuminate many high-speed roads.

● **If your headlights ever go out,** you'll never forget the experience. On a deserted road far from lights it's terrifying. On a busy road, other car lights will help you and your big problem will be to get to the shoulder fast before you're hit. Here's what you can do to survive:

1. **Get your left turn signal on—quick!** If there's a center line, most turn flashers will pick it up and guide you to a stop. Practice this trick mentally and often, or when the time comes you'll be so shocked it may take precious seconds to remember.

2. **If no center line,** hunt for the edge with your right-turn flasher.

3. **If all your lights go out** (as when a battery cable parts), steer by the lights of other cars—if any.

4. **In dire emergency** (only) put a passenger out with a flashlight to walk the shoulder and lead you.

5. **On deserted roads** in critical emergency remember that you can also run backward using your backup lights. Never try this when other traffic is moving. It's very hazardous because those feeble lights can look like two beer cans to drivers coming from behind.

In general, should your lights go out,

proceed cautiously if they suddenly come on again. A loose wire may have made contact. In any event, the lights may go off again in seconds. Prepare for it.

Never assume other drivers can see you. At 30 mph they may; but at 60 they'll hit an unlighted car before they'll see it. **Best bet:** Pull far off the road and wait for help.

● **What about the fellow who won't dim** or, worse, throws his brights into your eyes just before he meets you? Most of us get sore and fight back with our own brights. And we wonder: "Why did he do it? How could any driver be that dirty?"

The answer, I have learned in roadside interviews, is: The "won't dim" driver usually doesn't even know he offended you! He didn't mean it. And sometimes he thought he was dropping his beams instead of raising them. Another cause: headlights out of adjustment. If he can't dim, blinding him with your highs won't make him less of a hazard to you.

Maryland police have found that when a driver won't dim for you, he may be drunk. He doesn't notice you at all.

I have also found that he is sometimes cold sober but dog-tired. After many hours on the road, a tired driver acts a little like a drunk. He's dazed.

Some drivers who suddenly blind you actually haven't touched the foot switch at all. Here's what happens. Say you come up one side of a hill, some other fellow comes up the other side. He's using brights. As he gets to the top he politely kicks the beams down for you—pouring his low beams straight into your eyes because he's above you. If he's on a right curve (a left curve, to you) you get it all the worse.

Remember this at hilltops. Sometimes it pays to keep your beams up a few seconds longer so they will sweep the sky over his car as he ascends the slope.

● **What to do when tired.** We've all been given lots of advice: open the windows, turn on the radio, stretch, shout, drink coffee. Forget it. If a sudden need for sleep overwhelms you, there's only one thing to do—*sleep!* Stop in a safe place. A 30-minute nap works wonders.

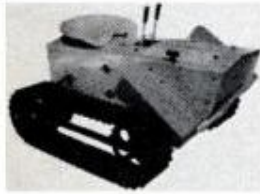
The other antisleep tricks, Dr. Moseley says, actually increase your danger. They may work for five minutes. But then sleep moves in again—with no warning, no nodding head, no sudden presleep quiver.

Never fight sleep, Moseley says. It fights back and tricks you. Stop and let sleep take over. On a long vacation trip you may need *two* short naps, a half hour apart. After that you should feel great. Two naps often seem as good as a night's sleep. ★★★

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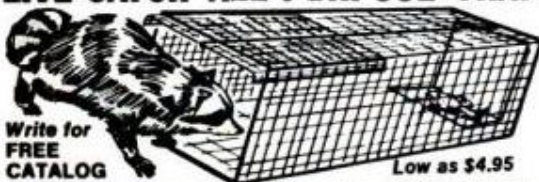
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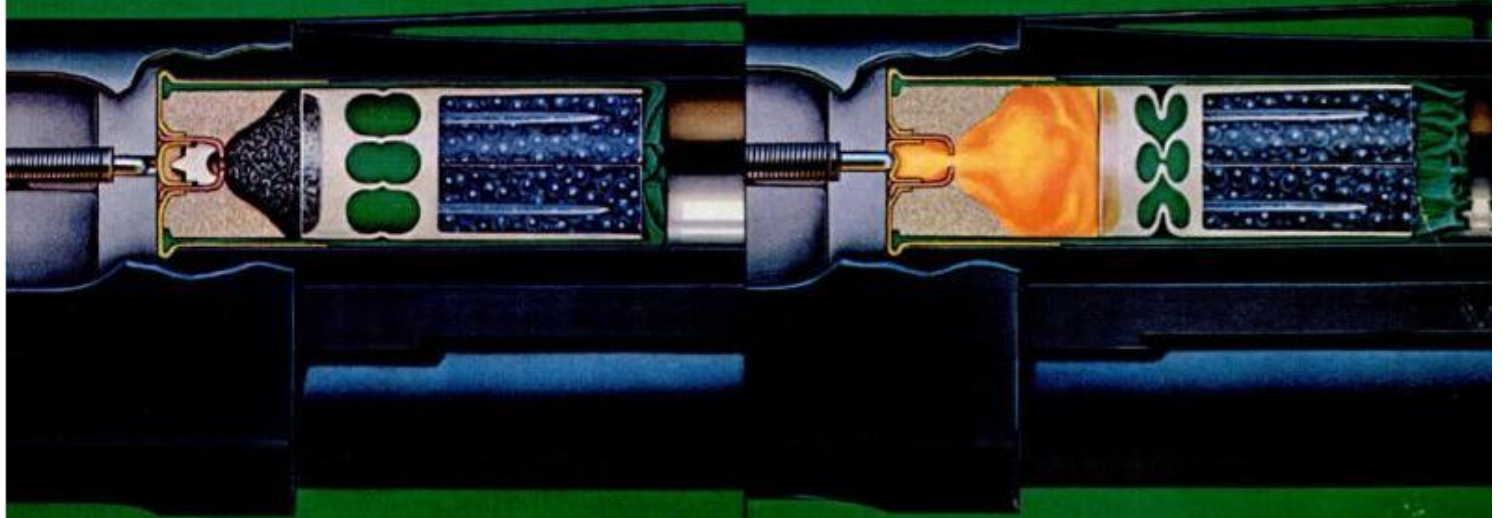
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