

POPULAR MECHANICS

APR. 1967
35 CENTS

Build PM's
Go-Anywhere
'HIGH-TAILER'

How to
Make Your
Car Bring
More Cash

AMAZING NEW CONTROL STICK FOR YOUR CAR

Steer, Stop, Accelerate With One Hand!



FIRST PICTURES!

**Astronauts'
Out-of-This-World
Vacation 'Cabin'**

Page 142

18 Pages of Ideas and Things to Make for Your Weekend Home

'Gee-Whiz Guide' to Sight-Seeing

Dan Gurney's Inside Answers on Driving and Racing

All About Bag Mixes for Concrete and Masonry Jobs

Saturday Mechanic—Tips on Timing



Got kids who like action?



Got a wife who likes comfort?



Got a yen to go fishing?



...GET A SPORTSMAN!

Some boats are soft riding. Some have stability. Some have style. Some are designed for fishing. Some for cruising. Some for skiing.

There's never been one boat that does all these things exceptionally well — until now.

If you like to fish, but don't like to abandon the wife and kids, The Sportsman is your kind of boat. It has more usable space than conventional boats 2 or 3 feet longer. It has comfortable bucket seats that unfold into sun lounges (if the fish aren't biting, just relax).

The floor is flat. There's a casting platform forward where the pointed bow would be if it had one. The split windshield folds to provide

easy access to the foredeck. You can beach the boat and step off without getting your feet wet. And you can button it up with its tonneau cover to make it look like a runabout.

The Sportsman has all the sea-going characteristics that distinguish Evinrude's wide-track Gull Wing hull. You ride on a cushion of spray. It's soft, stable, dry.

It's the kind of boat that'll get you to where the fishing action is in a hurry—and in solid comfort. It does it quietly, smoothly, economically—with a choice of 90 hp V-4, 120 hp inline-4, or 155 hp V-6.

The more you know about boats, the more you'll appreciate what the Sportsman does for a fisherman — and his family.

See the Sportsman at your Evinrude dealer, listed in the Yellow Pages under "Outboard Motors." Catalog free. Write Evinrude Motors, 4068 N. 27th St., Milwaukee, Wis. 53216.

EVINRUDE
 first in  outboards
 Div. of Outboard Marine Corp.

Important! Don't skip over the next seven pages.

Unless, by chance,
you married into money,
or know it all,
or can't stand praise,
or don't want your pay to escalate,
or figure you're too old to learn,
or refuse help,
or can never be fired,
or have no urge to succeed,
or don't like to read anyway.

This One



K4HZ-D6U-BWGT

How to boost the payload you carry between your ears.

The importance of NOW!

You couldn't pick a better time to begin a course of specialized training.

Business is on dead center. There's no real prosperity, no real recession.

It's a wait-and-see period, a time for companies to size up employees in preparation for the predicted boom.

Get yourself ready—through home study. It offers important advantages:

Your time is your own when you study at home. You waste none of it commuting to and from class.

You set your own schedule, your own pace.

You learn while you earn, pay as you go.

You learn quickly. Nobody holds you back.

Rewards can come quickly, too. Many students get the promotions and pay raises they want even before they complete their course.

But the time to act is NOW.

Here's HOW:

I. C. S. is your best bet.

Not just because it's the oldest, largest, most respected of the home study schools.

But because it offers exactly what you want. With 253 programs, you have a much wider selection than from any other school . . . anywhere. (Each program is prepared by a recognized authority, edited by home study experts, guided step-by-step by a personal instructor.)

And because I. C. S. training pays off.

One recent survey showed that the average I.C.S. graduate increased his income by \$1000 within two years.

Another revealed that one out of every fourteen company presidents (men who made it all the way to the top) studied with I. C. S. at one time in their careers.

A magazine writer once called I. C. S. "The Harvard of home study institutions."

Find out why.

Free I. C. S. Success Kits

In addition to a special catalog describing the courses in your field of interest, I. C. S. will send you free the helpful 28-page handbook, "How to Succeed," together with an actual lesson demonstrating the I. C. S. method.

Mark and mail the coupon at the bottom of any of the following pages or the postage-paid card you'll find at the end of this section.

To excel in Electronics, Radio-TV, specialize.

A wise choice!

If you've selected Electronics-Radio-TV as the field in which you want to make good, you've chosen wisely.

No other field has a greater demand for skilled specialists, or a bigger shortage.

There are more good jobs than there are qualified men and women to fill them.

General training is essential. But, more and more, you're going to need specialized training in specific areas.

You're going to need the kind of training in depth that I. C. S. can give you, with 26 courses—far more than you can get from other leading schools.

But you owe it to yourself to compare schools, to select the right one for you.

That's just what the catalog (below) will help you do.

A wide choice:

1. Color Television Principles & Servicing
2. Communications Technology

3. Electronic Fundamentals
4. Electronic Fundamentals Programmed Course
5. Electronic Instrumentation & Servo Fundamentals
6. Electronic Principles for Automation
7. Electronics & Applied Calculus
8. Electronics Technician
9. First Class Radiotelephone License
10. Fundamentals of Electronic Computers
11. General Electronics
12. Hi-Fi Stereo & Sound Systems Servicing
13. Industrial Electronics
14. Industrial Electronics Engineering
15. Industrial Electronics Engineering Technician
16. Numerical Control Electronics & Maintenance
17. Practical Radio & TV Engineering
18. Practical Telephony
19. Principles of Radio-Electronic Telemetry
20. Principles of Semiconductor-Transistor Circuits
21. Radio & Television Servicing
22. Second Class Radiotelephone License
23. Sound Systems Specialist
24. Telephony, Electronics & Radio Communications
25. Television Receiver Servicing
26. Television Technician

Send this coupon or postage-paid card at end of this section



I. C. S. Dept. 86999Z, Scranton, Penna. 18515

Please send me "ELECTRONICS," your free 68-page catalog listing all 26 Electronics, Radio and TV courses with complete details. Also send "How to Succeed" and sample lesson.

Mr. _____
Miss _____ Age _____ Address _____
Mrs. _____
City _____ State _____ Zip Code _____ Working Hours _____ A.M. to _____ P.M.
Occupation _____ Employed by _____
Low rates to members of U. S. Armed Forces.
Approved for veterans under New G. I. Bill.

Sixty-seven ways to succeed in Business.

... with or without a computer.

Take a look at the want ads in today's newspaper. Note the many openings in all phases of Business. Now check the list of courses on this page.

You'll see a similarity, because I. C. S. accurately anticipates and meets the needs of Business, stays on top of the times.

Take computer training, for example. There are four programming courses for business people, as up-to-date as you'll find anywhere.

There's an I. C. S. course for just about anyone in Business. For clerks, stenographers and typists who want to move up. For foremen and supervisors. For junior executives. For those now in business for themselves... and those who'd like to be.

Select a program of training that meets your specific needs. The catalogs below can help you.

Choose yours:

Accounting

1. Accounting for Business Programmers
2. Auditing
3. Business Law
4. Cost Accounting
5. C.P.A. Review

6. Estate & Trust Acc't'g
7. Executive Accounting
8. Federal Tax
9. General Accounting
10. Industrial Accounting
11. Junior Accounting
12. Legal Accounting

13. Office Accounting
14. Practical Accounting
15. Public Accounting
16. Small Business Acc't'g
17. Starting & Managing a Bookkeeping Service

Business

18. Advertising
19. Basic Inventory Control
20. Basic Supervision
21. Business Administration
22. Business Management & Production
23. Clerk-Typist
24. Commercial
25. Cond. Business Practice
26. Condensed Marketing
27. Creative Salesmanship
28. Direct Mail & Mail Order Advertising
29. Engineering Secretary
30. Industrial Foremanship
31. Industrial Psychology
32. Industrial Supervision
33. Legal Secretary
34. Mag. & Newspaper Adv.
35. Man'g't & Marketing
36. Managing a Small Store
37. Marketing
38. Marketing Research
39. Medical Secretary
40. Modern Exec. Man'g't
41. Modern Woman as a Supervisor

42. Motor-Traffic Man'g't
 43. Office Automation
 44. Office Management
 45. Personal Income Tax Procedure
 46. Personnel-Labor Rel't'n
 47. Professional Secretary
 48. Purchasing Agent
 49. Railway Rate Clerk
 50. Real Estate Salesmanship
 51. Retail and Local Adv.
 52. Retail Bus. Man'g't
 53. Retail Merchandising
 54. Retail Selling
 55. Sales Management
 56. Salesmanship
 57. Salesmanship & Sales Management
 58. Shorthand
 59. Stenographic
 60. Supervision
 61. Systems & Procedures Analysis
 62. Traffic Management
 63. Typewriting
- COMPUTER COURSES**
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 65. Programming for Digital Computers
 66. Programming for IBM 1401 Computer
 67. Programming IBM System/360 Computer

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Please send me the free catalog I have checked, plus the 28-page handbook, "How to Succeed," and sample lesson. Accounting Business

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 Occupation _____ Employed by _____
 Low rates to members of U. S. Armed Forces.
 Approved for veterans under New G. I. Bill.

Power up for big pay. Get technical.

Where there's a will . . .

Industry is desperate for men with technical training. Colleges and trade schools can't begin to fill the need.

Become an I. C. S.-trained technician or engineer and you'll be on your way.

With good reason: I. C. S. has the largest home study School of Technology in the world, offers the most complete and comprehensive curriculum.

Courses start at operator levels, go up to Chemical, Civil, Electrical, Mechanical and Power Engineering.

There are special refresher courses for the graduate engineer who wants to keep up to date. Also special courses for management men who must make engineering decisions—and vice versa.

Make a decision now to get the facts.

. . . there are 68 ways:

Chemical

1. Analytical Chemistry
2. Chemical Engineering
3. Chemical Engineering Unit Operations

4. Chemical Laboratory Technician
5. Chemical Process Oper.
6. Elements of Nuclear Energy

7. General Chemistry
8. Instrumental Laboratory Analysis
9. Natural Gas Prod. & Transmission
10. Oil Field Technology
11. Paper Machine Operator
12. Paper Making
13. Petroleum Production
14. Petroleum Prod. Eng'r'g
15. Petroleum Ref. Oper.
16. Pipeline Engineering Technology
17. Plastic Technician
18. Pulp & Paper Eng'r'g Technology
19. Pulp & Paper Making
20. Pulp Making

Civil

21. Civil Engineering
22. Construction Eng'r'g
23. Highway Engineering
24. Math & Mech. for Eng'rs
25. Principles of Surveying
26. Reading Structural Blueprints
27. Reading Hwy. Blueprints
28. Sanitary Engineering
29. Sewage-Plant Operator
30. Structural Drafting
31. Structural Engineering
32. Surveying & Mapping
33. Water-Works Operator

Electrical

34. Elec. Appliance Ser.
35. Electrical Contractor
36. Electrical Engineering
37. Elec. Eng'r'g Tech.

38. Elec. Instrument Tech.
39. Elec. Motor Repairman
40. Industrial Elec. Tech.
41. Power Line Design & Construction
42. Power Plant Operator
43. Practical Electrician
44. Practical Lineman
45. Reading Elec. Blueprints

Mechanical

46. Aircraft & Power Plant Mechanic
47. Domestic Refrigeration
48. Fortran Prog. for Eng'rs
49. Hydraulic & Pneumatic Power
50. Industrial Engineering
51. Ind. Eng'r'g Tech.
52. Industrial Management for Engineers
53. Machine Design
54. Mechanical Engineering
55. Quality Control
56. Refrigeration
57. Refrigeration & Air Cond.
58. Safety Eng'r'g Tec'l'gy
59. Tool Design
60. Value Analysis
61. Vibration Analysis & Control

Power

62. Boiler Inspector
63. Industrial Bldg. Eng'r'g
64. Industrial Inst.
65. Power Plant Eng'r'g
66. Stationary Diesel Eng's.
67. Stationary Fireman
68. Stationary Steam Eng'r'g

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Please send me the free catalog which I have checked below, plus 28-page handbook, "How to Succeed," and sample lesson. Chemical Civil Electrical Mechanical Power

Mr. _____ Age _____ Address _____
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 City _____ State _____ Zip Code _____ Working Hours _____ A.M. to _____ P.M.
 Occupation _____ Employed by _____ Low rates to members of U. S. Armed Forces.
 Approved for veterans under New G. I. Bill.

There's real Jack in all trades. Master one.

It takes a real man!

Mastering a trade . . . going into business for yourself . . . these are among the most satisfying and rewarding of careers—with base pay up to \$7 an hour.

But it takes guts. And sound training.

With I. C. S. you have the advantage of guidance by experts in your field.

Texts are easy to follow. You learn from pictures, tables, step-by-step diagrams and from doing practical projects.

Your instructor takes a personal interest in your progress, gives you encouragement and suggestions, helps you move ahead fast.

The toughest part is making up your mind to mail the coupon (or card on the next page).

The rest comes easy!

And it takes real training!

Automotive Trades

1. Automatic Trans. Spe'll'st
2. Automobile Body Rebuilding & Refinish'g
3. Automobile Elec. Tech.
4. Auto. Eng. Tune-Up
5. Automobile Technician
6. Automotive Mechanic
7. Diesel-Gas Motor-Vehicle Engines

Building Trades

8. Air Conditioning
9. Air Cond. Maintenance
10. Building Contractor
11. Building Estimator
12. Building Inspector
13. Building Maintenance
14. Carpenter-BUILDER
15. Carpentry & Millwork
16. Domestic Heating with Oil & Gas
17. Heating & Air Cond.
18. Industrial Heating
19. House Planning & Interior Design

20. Indust. Air Conditioning
21. Mason
22. Painting Contractor
23. Pipe Fitting
24. Plumbing
25. Plumbing & Heating
26. Practical Plumbing

Shop Practice

27. Drill Operator
28. Foundry Practice
29. Industrial Metallurgy
30. Lathe Operator
31. Machine Shop Practice
32. Machine Shop Inspection
33. Metallurgical Eng. Tech.
34. Milling Machine Oper.
35. Multicraft Maint. Mech.
36. Practical Millwrighting
37. Rigging
38. Tool Eng. Technology
39. Tool Grinder
40. Toolmaking
41. Turret Lathe Operator
42. Welding Eng. Technology
43. Welding Processes

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Make your mark in Drawing, Drafting or Architecture.

Make your talents pay off!

The combination of a trained mind and a skilled hand commands universal respect—and a great deal of money.

Your ability to visualize, to create, to communicate through line and detail, opens up unusual career opportunities.

Some people start with talent. Others develop it. But talent alone is not enough.

You need to train it, refine it, make it pay off in money and satisfaction.

This is where I. C. S. can help you.

You learn by doing. You submit drawings and designs with each assignment. And you get back professional critiques.

Start by making your mark below.

Your choice of 24 ways:

Architecture

1. Arch. Drawing & Des'g'ng
2. Design of Plastic Prod.
3. House Planning & Interior Design
4. Review in Arch. Design & Practice
5. Review of Mechanical Systems in Buildings
6. Reading Architect's Blueprints

Art

7. Amateur Artist
8. Commercial Art
9. Commercial Cartooning
10. Illustrating
11. Interior Decorating

12. Oil Painting for Pleasure
13. Show Card & Sign Prod.
14. Show Card Writing
15. Sign Painting & Designing
16. Sketching & Painting

Engineering Drawing

17. Aircraft Drafting
18. Architectural Drafting
19. Design Drafting
20. Drafting Technology
21. Electronic Drafting
22. Pressure-Vessel & Tank Print Reading
23. Sheet-Metal Layout for Air Conditioning
24. Structural Drafting

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Please send me the free catalog I have checked, plus the 28-page handbook, "How to Succeed," and sample lesson. Architecture Art Engineering Drawing

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 Miss _____
 Mrs. _____
 City _____ State _____ Zip Code _____ Working Hours _____ A.M. to _____ P.M.
 Occupation _____ Employed by _____

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 Approved for veterans under New G. I. Bill.

68,000 reasons to finish High School.

It's never too late, BUT . . .

There's a \$68,000 difference between the lifetime earnings of the average High School graduate and that of the dropout.*

That's money you and your family could use—if you had a High School education.

Government facts show other differences:

- you're more likely to lose your job.
- you stand twice the chance of being out of work for 15 weeks or more.
- the few jobs open to you are almost sure to be the lowest-pay ones.

But—no matter how old you may be—it's not too late to get help the I. C. S. way.

With I. C. S., you take only those subjects you need, with personalized guidance.

You can earn an I. C. S. High School diploma, respected by business and industry.

In short, you can overcome the awful handicap of an incomplete education—now!

*Source: H. E. W. Dept. figures, 1965

Pick only the subjects you need:

1. High School Business
2. High School College Preparatory (Arts)
3. High School College Preparatory (Engineering & Science)
4. High School General
5. High School Secretarial
6. High School Vocational
7. Special High School Courses (These include a selection of some 50 Elementary, High School and Advanced subjects you may elect to round out your education.)
8. Advanced Mathematics
9. High School Mathematics

Send this coupon or postage-paid card.



I. C. S. Dept. 91999Z, Scranton, Penna. 18515

Please send me a free copy of "High School," your new 40-page catalog detailing the I. C. S. High School Program. Also send 28-page handbook "How to Succeed" and sample lesson.

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Low rates to members of U. S. Armed Forces.
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**Let's say you just bought
a used car from a VW dealer.
You're driving along a peaceful
country road and the motor quits,
the transmission drops out,
the rear axle breaks
and the electric clock starts to work.
Don't worry.**

Volkswagen dealers guarantee their used cars.

And the guarantee covers everything that makes a car tick.

So the engine, transmission, and rear axle will all be repaired or replaced free.

In fact, even if the electrical system shorts out, the front axle assemblies become unassembled and the brakes go out of adjustment on that peaceful country road, he'll repair or replace them free, too. Because he guarantees them all 100% for 30 days or 1000 miles. Whichever comes first.

If you know about used cars, you know this is the period when anything big that's going to go wrong with one will probably go wrong. Though nobody will be more surprised if it does than a VW dealer.

He completely inspects every car he gets as a trade-

in. And anything that needs repairing or replacing gets repaired or replaced right then and there, before he puts the Volkswagen guarantee sticker on the windshield.

Just so you won't be misled, it doesn't have to be a Volkswagen to rate the sticker. You'd be surprised at all the big cars people trade in just to get their hands on one of our little ones.

Big or little, any trade-ins with a guarantee sticker on them already have some of the dealer's money in them.

Enough for him to want to be really sure the one you drive away in isn't going to come back and cost him more.

But if it should, (1) it's always nice to know you do have a place to bring it back to, and (2) better him than you.



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



A cut above the rest



O.K., so you've decided to buy that riding mower. Now comes the critical decision. Which make of mower is really **worth** that extra investment. First, you'll want year-after-year dependable performance. You'll want Flex-N-Float action. No scalping. No gouging. You'll want tight maneuverability. Easy steering. 4 speeds forward and reverse. An Ezee-Start engine. And you'll want it to meet **all** A.S.A. safety standards. We've just described an Ariens riding mower. It's a cut above the rest. Isn't that what you're looking for?

Ariens COMPANY
161 Calumet Street • Brillion, Wisconsin



new from Fabulon... the ultimate in **wear ability**

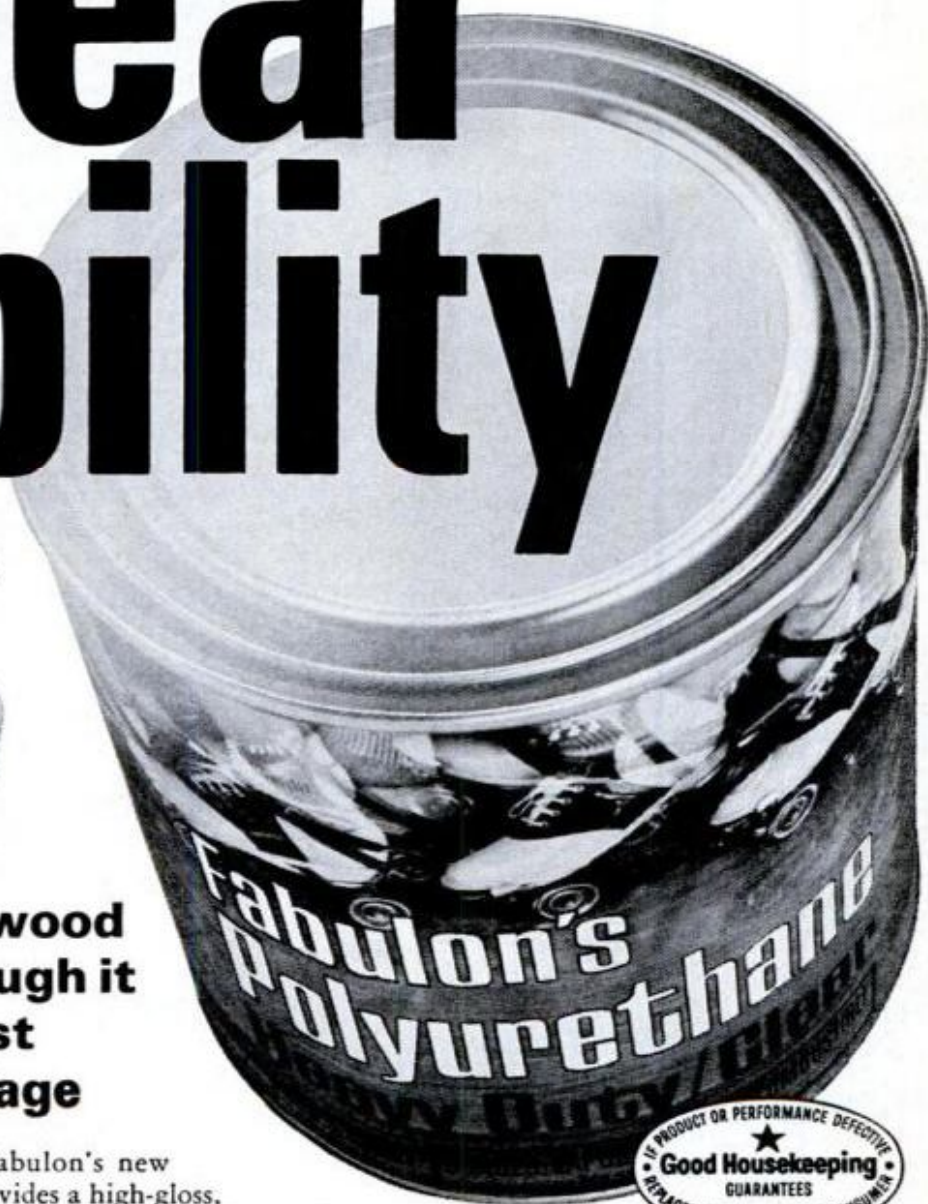


**a finish for wood
floors so tough it
could outlast
your mortgage**

On all wood floors, Fabulon's new POLYURETHANE provides a high-gloss, easy-to-care-for, amazingly-durable protective coating that just wears and wears and wears. Applies easily, dries in about 4 hours; 1 coat over old finishes, 2 or 3 over bare wood. Ideal for other uses . . . doors, trim, paneling, furniture, built-ins; also concrete floors. Outstanding resistance to soap, detergents, water, fruit acids, liquor, ink, pets . . . stains of all kinds. A product of Fabulon . . . first name in fine finishes for wood. At your favorite paint, hardware, lumber or building supply dealer. Send 25¢ for two wood-finishing how-to-do-it manuals.



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Cover Illustration: Arthur Dale Gustafson

NEXT MONTH IN POPULAR MECHANICS

Rodger Ward's Indianapolis Preview. A two-time Indy winner (now retired) takes a look at the cars and drivers slated to appear at the Brickyard this year.

PM Owners Reports: the Chevy Impala and Olds Cutlass. Read what the people who bought these cars have to say about them.

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APRIL 1967

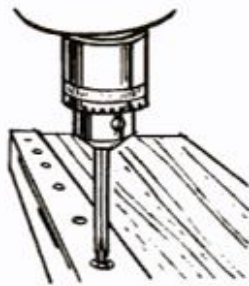


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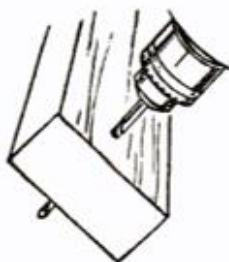
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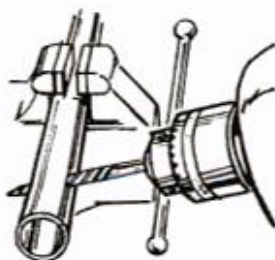
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LETTERS TO THE EDITOR

It's Boeing's

In your story *Helicopters in Vietnam* (page 107, Feb. PM) you gave the identification (on page 227) of No. 8 as a CH-46 Sea Knight built by Sikorsky. The CH-46 Sea Knight is built by Vertol, a division of Boeing in Morton, Pa.

Glenolden, Pa. **JAMES GENTILE**

Boeing, it is. We caught the error in time for part of the press run—as well as for the 18 by 24-inch print that we're offering readers. (That print plus one of U.S. Warplanes are \$1.95 from the Bureau of Information, Popular Mechanics, 575 Lexington Ave., New York 10022.)

No cool filters

I believe you made a mistake in *How to Keep Those Filters Filtering* (page 168, Nov. PM). You state that there is no way to tell when an oil filter is plugged. After a car has been run, the oil filter will be warm when you touch it. If it is cold after being run, it is plugged.

Bergenfield, N.J. **BRIAN GOODE**

Our *Saturday Mechanic* auto wizard, Mort Schultz, replies:

"I took an old oil filter and stuck it on my car. I ran it until good and warm. Sure enough, the oil filter was warm to the touch, and I know it was a plugged-up filter."

"Why was it warm? Simply because the outside casing conducted engine heat. These filters lie too close to the engine so they can't possibly avoid getting the heat."

Pile-up is most interesting

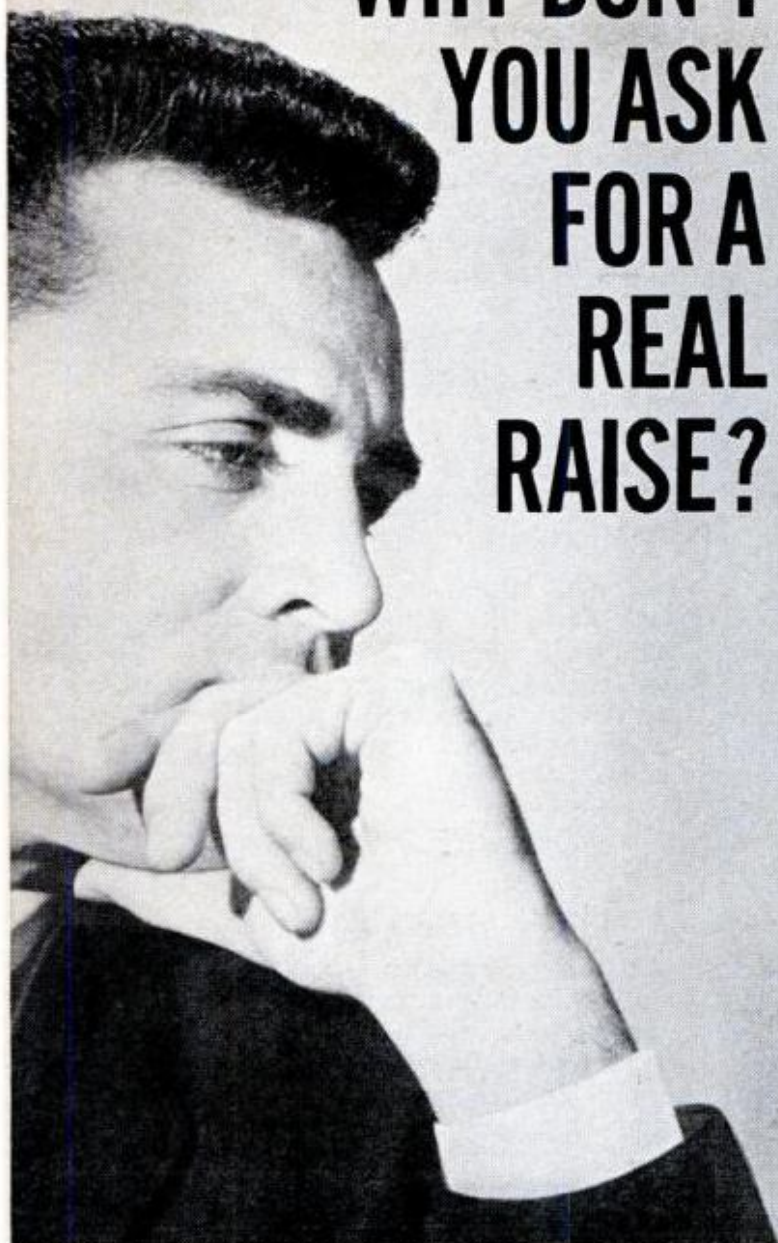
One of the most interesting articles I have read in PM was *The Big Pile-Up of 1966* (page 122, Feb. PM). All drivers should be acquainted with the list of "lessons learned" from the pile-up.

Southgate, Mich. **KEN CYAPSKI**

True—blue

One small point about *How to Take Better Christmas Pictures* (page 146, Dec. PM): You don't need to "stick to clear flashbulbs" with "indoor" film as the article suggests. Blue flashbulbs should be used whenever there is a need for flash.

(Please turn to page 8)



WHY DON'T YOU ASK FOR A REAL RAISE?

Think you may be turned down? Here's how ambitious men get important promotions without even having to ask.

If it's been a long time since you've celebrated a raise in salary, ask yourself why. Are you really worth more money? If you're not sure, look again at men who have moved ahead...men so clearly marked for promotion that when it came it was just what everyone expected.

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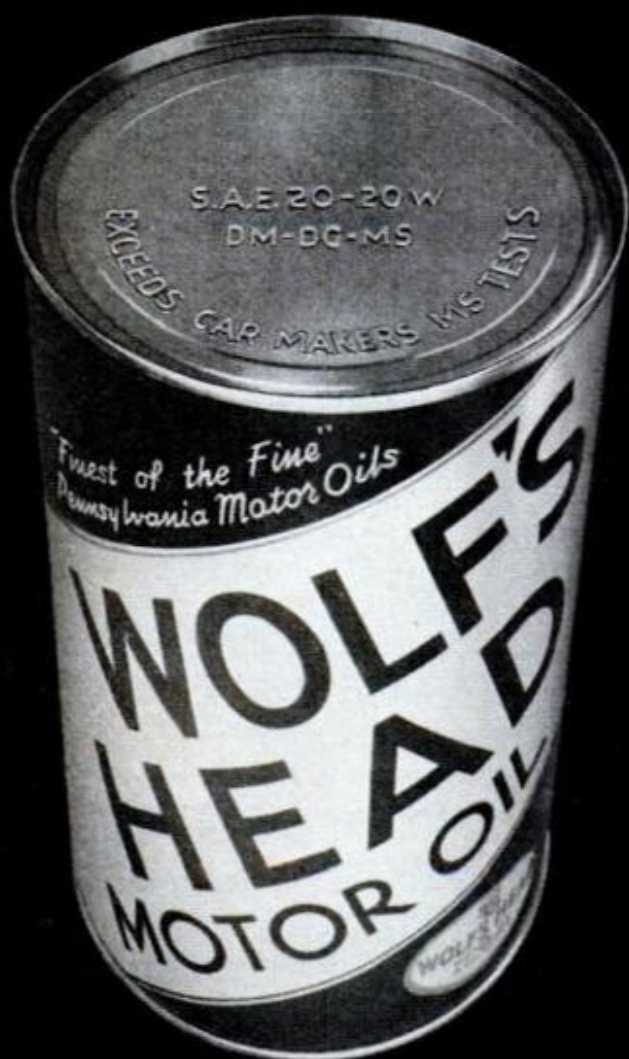
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LETTERS

(Continued from page 6)

There are, as a matter of fact, no color films which are balanced for clear lamps. It is literally true that blue flashbulbs are the answer with color films—indoors, outdoors, day or night.

(We have a dandy *Photolamp & Lighting Data* booklet that *PM* readers may have at the drop of a note to the Inquiry Bureau, General Electric Co., Nela Park, Cleveland, Ohio 44112.)

General Electric Co. L. F. MUEHLING
Cleveland, Ohio

True; blue flashbulbs are correct with most color films. In some cases, though, clear bulbs can be used with a filter. The best bet is to check the data sheet that comes with color film.

'Ridiculous'

I note that British drivers and police are using a *Wall-to-Wall Mirror* (page 121, Feb. *PM*). This is ridiculous. One inside rear-view mirror and one outside are sufficient, because the driver's body itself causes the blind spot. Five—or even ten—rear-view mirrors placed at any angle cannot rectify this.

Long Beach, N.Y. LAWRENCE RICELLI

Another way to go

Twenty Ways to Go in Snow (page 87, Jan. *PM*) is excellent. But . . . I think the author should have pointed out that if your car drives on the front wheels—as more and more do these days—some of these tricks will get you in trouble. Weight in the trunk, for example, would actually lift weight off the front driving wheels. Believe me, that's where you need all the weight you can get.

I have been driving lightweight, front-wheel-drive Saabs for about 10 years now. There was a lot of snow-driving gospel that I had to unlearn, but fast.

Sebago Lake, Me. FRANK LAWRENCE

Still can get 'em

Recently a neighbor told me that he had built an excellent model of a sailing ship from plans printed in *PM* many years ago. Is it still possible to get copies?

Larchmont, N.Y. FRANK SMITH

It is, indeed. Find the title and date of the article you want and send 15 cents for each page (we have to reproduce them by Xerox) to PM's Information Bureau, 575 Lexington Ave., New York 10022.

TOM McCAHILL SAYS:

"Good Appliance Repairmen are Scarce as Edsel Dealers!"

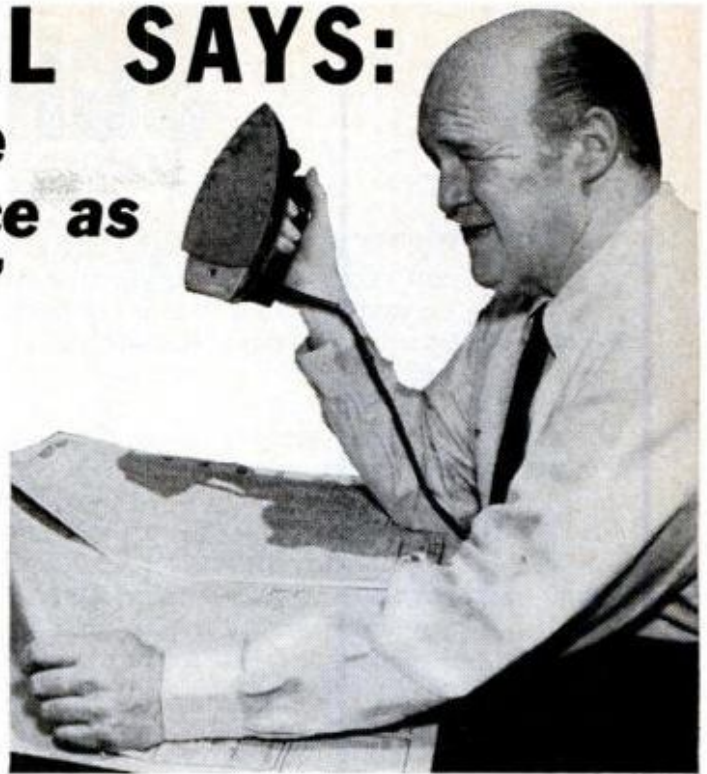
I don't think anything disturbs me as much as trying to find an appliance repairman . . . and finding out I'll have to wait my turn because he has more business than he can handle.

With over 400 million Appliances now in use, and more coming every year, there just are not enough repairmen around to take care of every Mrs. Jones who wants a broken Appliance mended in a hurry! And that's why a smart guy could really clean up in the Appliance repair field.

Some years back, almost anyone could do a fast repair on an iron or toaster with a bit of fancy tinkering. But today's complicated Appliances call for a special brand of know-how the average Joe doesn't have without training. Appliances are loaded with thermostat controls, solenoids, and special devices. Unless a repairman has a working knowledge of these parts, he won't even get to first base.

That's why I want you to take a good look at the home study course offered by the Appliance Division of the National Radio Institute. They show you all about repairing home and commercial Appliances—even farm Appliances and small gasoline engines. If you're interested, they also include a special package covering air-conditioning and refrigeration repairs. The cost is surprisingly low, and even includes a special Appliance Tester.

NRI is one of the biggest and best schools in the field, and has been around since 1914. They have a staff of 150 people in Washington, D.C., who are



equipped to guide you through the easy course with expert and personal instruction.

Take it from Tom . . . this is one of the easiest and most rewarding fields a guy can enter today. You don't need a college education, you don't even need to know the first thing about Electrical Appliances when you begin your training.

There's nothing to lose . . . except the price of a stamp on your letter or postcard. Fill out the coupon below *now*, before you turn the page. Get the full rundown on the training that can increase your spare time income or provide you with a business of your own a lot sooner than you think. In just a few short months you could be ready to take the first profitable step towards a new and rewarding career. Do it!

Tom McCahill

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BY JOHN F. PEARSON
SCIENCE
WORLDWIDE

YOUR ACCIDENT RISK is increased four times when you add a trailer to your passenger car, according to a traffic expert at Northwestern University. Research also shows, he says, that drivers in small foreign cars and sports cars have an accident rate 3.5 times greater than drivers in standard-size passenger cars.

IT'S A HARD LIFE for the macaque monkeys of Thailand, judging by a recent report in *Science*, a professional journal. According to a Johns Hopkins psychologist, the monkeys are trained to pick coconuts for their masters, working six hours a day and often seven days a week.

The monkeys operate in trees too tall for a man to climb safely and are trained to pick only ripe fruit. They work, says the psychologist, only to avoid punishment. If they horse around, they're in for a whipping.

BABIES PREFER TO BE BORN between 3:00 and 4:00 a.m., a British obstetrician reports after surveying 1331 births in one London hospital. He can't explain the phenomenon. He says it may be the mother's 24-hour biological clock at work, or simply that women are more relaxed at night. The most unpopular time for birth, he finds, is between 5:00 and 6:00 p.m.

A DRIVERLESS TRACTOR that can pull plows, harrows and other equipment over irregularly shaped fields has been developed at Reading University in England. The tractor is not controlled by radio. Instead, it follows a buried wire that carries alternating current. A row of search coils across the front of the tractor senses the vehicle's position relative to the wire and directs the steering mechanism.

HIGH AIR POLLUTION in any given year increases an individual's chances of dying by 20 percent. So says a report on filthy air in New York State issued recently by the state's health department.

"In Manhattan alone," according to the report, "40 million pounds of air contaminants large enough to be visible are deposited each year . . . In Erie County, more than two billion pounds of pollution are released into the air of that area, helping to drive up the state's death rate from lung diseases."

WORLD'S POPULATION hit 3.346 billion last summer, an increase of 65 million in one year, or 180,000 a day. Those figures come from the Population Reference Bureau of Washington, D.C., a private organization that keeps an eye on such things. At the present rate of growth, says the bureau, the world's population will be doubled by the end of the century.

A MINIATURE "DEAD SEA" has been discovered off the coast of North Carolina. A 60,000-square-yard basin is devoid of animal life, a condition that a Duke University marine biologist attributes to the presence of hydrogen sulfide gas. The poisonous gas forms because there isn't sufficient oxygen in the water. It seems that available oxygen is burned up by an overabundance of organic material that flows into the basin from a nearby sound.

SPLIT-SECOND DISINTEGRATION of coal is possible with a laser beam. This capability is reported by Bureau of Mines researchers who say the beam vaporizes the coal into gaseous chemical compounds. With further development, lasers might eventually prove the key to lower costs in producing acetylene and other industrial chemicals from coal.

HOW OLD IS MAN? Latest evidence—in the form of an elbow bone found by Harvard University scientists—indicates that an upright, manlike fellow lived in Africa about 2.5 million years ago. Before this discovery, man's age was thought to be about 1.75 million years.

An older precursor of man—and much further removed on the evolutionary scale—was recently described by Dr. Louis S. B. Leakey, famous for his many significant discoveries in Kenya, Africa. He announced that the study of fossils collected over a period of years indicates a pre-man creature lived in Africa more than 19 million years ago.

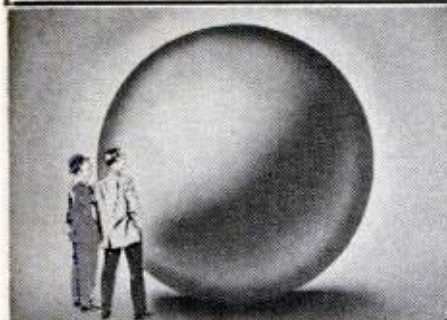
SONIC BOOMS from military planes have caused damage to prehistoric cliff dwellings in Arizona and to geological formations in Utah, according to the National Park Service. In one instance, an 80-ton piece of canyon wall reportedly was torn loose by shock waves from a plane that had broken the sound barrier. ★ ★ ★

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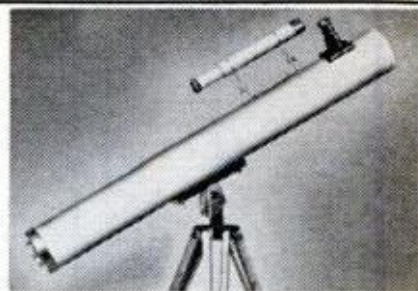
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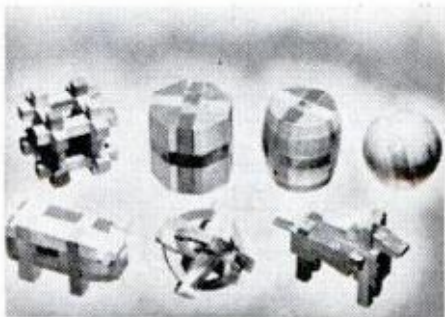
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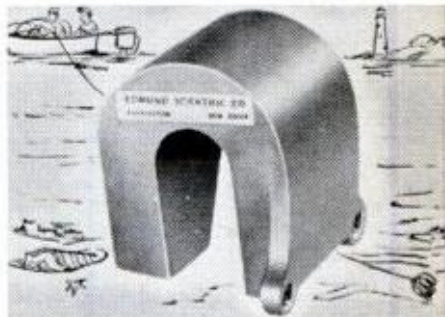
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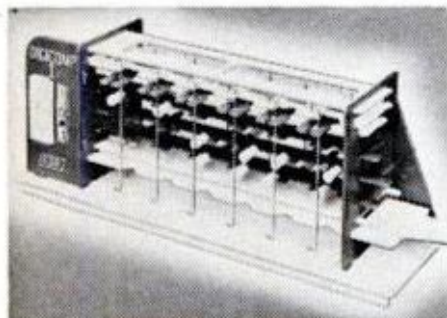
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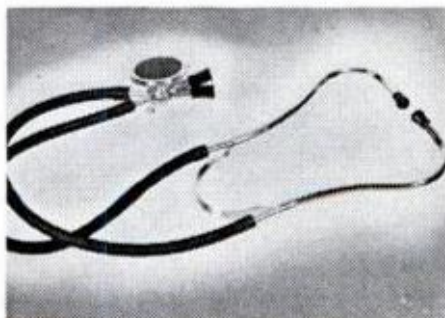
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BY KEVIN V. BROWN AVIATION JETSTREAM

TELEVISION TOWERS and aviation are heading on a collision course. As TV continues to expand horizontally its towers continue to grow vertically—sticking their tall metal spikes into what was once free air space.

The Aircraft Owners and Pilots Assn. claims that at least 25 pilots have lost their lives colliding with them, and the situation seems to be getting worse. Twelve years ago there were only 14 towers over 1000 feet. Now there are more than 200, and two of them are 2000 feet. One in Fargo, N. D. (2063 feet), is believed to be the tallest man-made structure in the world.

The AOPA wants the federal government to regulate the construction of towers, clustering them in "antenna farms" so that the hazards to pilots would be confined to fewer areas.

ANOTHER HAZARD to pilots on the upswing is that old enemy of automobile drivers—Demon Rum. The Federal Aviation Agency reports that drinking is a factor in about 30 percent of all fatal lightplane crashes.

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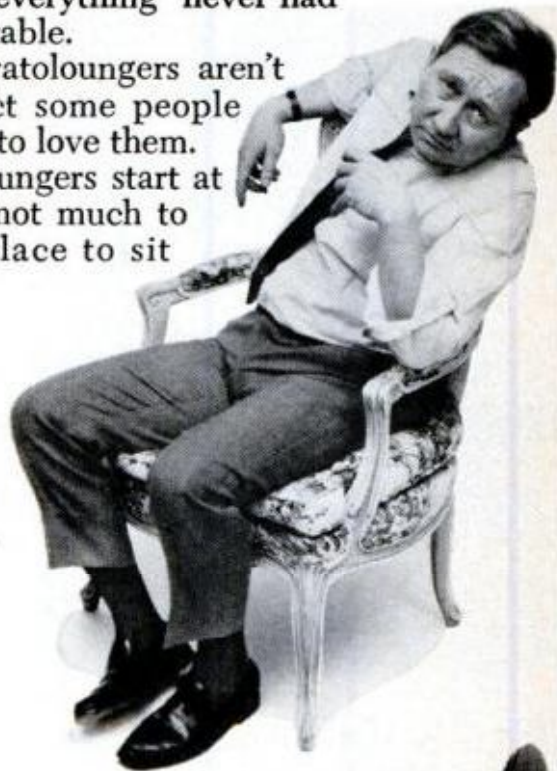
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1/4"	36	24	18	12	8	6	4	3	2
5/16"	24	18	12	8	6	4	3	2	1 1/2
3/8"	18	12	8	6	4	3	2	1 1/2	1
1/2"	12	8	6	4	3	2	1 1/2	1	3/4
5/8"	8	6	4	3	2	1 1/2	1	3/4	1/2
3/4"	6	4	3	2	1 1/2	1	3/4	1/2	5/8
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FROM THE PATENT OFFICE **NEW INVENTIONS**
BY M. J. PEDERSEN

HAZARDOUS NIGHT DRIVING may be made safer by a modification for headlamps that earned J. M. Szarkowski, Buchanan, N.D., patent 3,275,820. Conventional high beams provide maximum illumination, but they also produce glare that can be dangerously blinding to drivers of oncoming cars. A set of horizontal louvers, fixed to the headlamps, would direct the light onto the road and keep it out of the eyes of oncoming motorists.

SPACE SHIELDING to protect manned satellites from bombarding dust particles depends for its design on the amount of such particles in the space environment. A device for counting meteoroid particles in space that will help engineers design the lightest possible space shielding earned patent 3,277,724 for John F. Lundeberg, who assigned rights to the Boeing Co.

SURVEYS OF TV VIEWING in the future may be conducted by "snoopers" in the air, without the need to contact viewers. In processing an incoming signal from the broadcasting station, each receiver generates a small signal of its own. This signal varies depending on the station the receiver is tuned to. Picking up these signals with equipment carried in an airplane overcomes the interference that a similar land-based system encountered a few years ago. Arthur E. Jenks and David W. Ginn received patent 3,299,355 on the system and assigned it to Television Audit Corp., Winter Park, Fla.

AN ELECTRONIC IGNITION SYSTEM with a stabilizing circuit to control internal current is designed to increase the timing accuracy of automobile engines and, with it, the usable horsepower. Michael S. Fisher and Frederick S. Kamp were awarded patent 3,295,014.

SEALING PLASTIC SHEETS that do not join well with heat (such as Mylar and some of the polypropylenes) may be accomplished by means of high-frequency sound energy. A new process, for which Seymour Linsley and Joseph Di Meglio were awarded patent 3,294,616, has the advantage of applying the sealing energy continuously to the surfaces rather than intermittently as in previous sealers.

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AUTOMOBILE CLINIC

BY MORT SCHULTZ

Popping along together

A few of us 1966 Chevrolet owners—I have a Caprice station wagon—keep hearing popping sounds coming from the left rear in the area of the coil spring. Since I'm not alone in this, I'm wondering if you've run across this mystery before.—Herbert Kelnhofer, Hoopston, Il.

Let's say I've run across two conditions that could cause it—

1. I've seen some coil springs that haven't been properly seated. Loosen up

the spring and twist it around until it seats firmly.

2. I've also come across rear bumper brackets that have been rubbing against the body. It's worth checking on.

A slick engine

The car's a 1962 Sunbeam Alpine. Although oil consumption is only one quart in 2000 miles, there is always a light coating of oil over the engine. I've tightened every nut I could find. Other Sunbeam

(Please turn to page 26)

Service Tips

● **NEW SPARKPLUG FOR 1966 PLYMOUTH WITH 273 CID HIGH-PERFORMANCE ENGINE** equipped with four-barrel carburetor. The new plug, developed and released for this engine, is a Champion NLOY (Plymouth part No. 2642618), and it replaces the N9Y you've been carrying.

● **1965 OLDSMOBILE STARFIRE OWNERS** are confusing exhaust roar with differential gear noise. To find out where the noise is coming from, place the transmission in "D" range and accelerate to a speed at which the noise reaches its peak. Note the tachometer reading and car speed. Now, put the transmission in "S" range and do the same thing. If the noise follows engine speed, the exhaust system is making the sound.

Realignment of the exhaust system outlets can reduce the noise level. The outlets should have at least 3/4-inch clearance between the rear of the fender port when the system is cold. This adjustment is made at the front of the resonator. Also, the outlets must be positioned so the clearance is equal at top and bottom. The hanger at the front of the resonator is slotted to provide this adjustment.

● **1966 RAMBLER OWNERS WITH 199 OR 232 CID ENGINE** and air guard exhaust emission control will want to know that the engine-idle specs have been changed. The original 550 rpm has been upped to 575 rpm. To insure a correct ignition timing setting, reduce engine idle speed to 500 rpm maximum. Set the timing at TDC, $\pm 1^\circ$, and then set engine speed at 575 rpm.

● **PONTIAC HAS COME OUT WITH A TIP** for all car owners. It concerns the reason for getting a slightly higher than full reading on oil dipsticks. According to Pontiac, when you're checking engine oil level, the reading on the dipstick will vary depending upon engine oil temperature and drain-back period. When the engine is cool, the oil has had a chance to drain down into the pan, and you'll get a proper dipstick reading. Checking the oil level right after turning the engine off, however, usually shows a reading that's slightly above the full mark.

Each month Auto Clinic answers questions on car repair. For a personal reply, send 50 cents in coin to cover mailing and handling. Write Auto Clinic, Popular Mechanics, 575 Lexington Ave., New York, N.Y. 10022. One question per letter, please.



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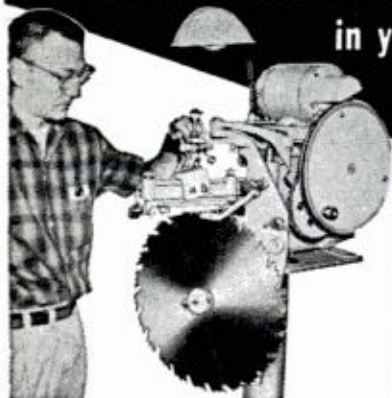
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AUTOMOBILE CLINIC

(Continued from page 24)

owners I know have the same problem. Is there a solution or do I have to live with it?—C. J. Kaloss, Coytesville, N. J.

You said it, pal. As far as I know, you'll have to live with it. But don't feel bad. You've got company—not only Sunbeam owners, but MG and Fiat fans, too.

Cannonball drive train

I'm the owner of a 1963 Tempest LeMans with 326 engine and three-speed stick. I've spent months and many dollars trying to get rid of a noise in the drive train. New clutch, throw-out bearing, transmission overhaul, and all have failed to stop it. Pontiac dealers tell me I have to live with it. You're my last hope.—Albert B. Vertefeuille, Lebanon, Conn.

I wish I had been your first hope. Might have saved yourself money, because the Pontiac dealers are 100 percent right. This is transmission gear noise, and there's nothing you can do about it. The noise has been suppressed somewhat in 1966 models with the installation in production of a spring-thrust washer between the countershaft and case. This thing absorbs some noise, but you can't modify your transmission to include it.

Tiger in the rear

My 1966 Comet convertible, which has a power transfer axle, gives out a growl from the rear end that's accompanied by a chattering that carries up through the driveshaft. The dealer's been nice. He's put in all new brake bands and turned the drums. Still, the tiger roars.—Lowell L. Gardner, Phillipsburg, N. J.

I'll bet you're not using the special lubricant in that locking differential. I'll wager it will muzzle that tiger. Its part number is C6AZ-19580-C.

Don't live with it

Have you heard anything of six-cylinder 1961 Ford pickups (223 CID engine) having a rattling vibrating sound? The thing seems to come from the driveline, mainly when pulling. I'm told this is common.—L. L. Neville, Sebastopol, Calif.

Right! It is common, but why run with the crowd when you can fix it. Pull the driveshaft and make sure there are no burrs on the splines. Then lube the splines with graphite grease. Check the condition

(Please turn to page 30)



... wherever the good jobs are... wherever the big money is, employers say:

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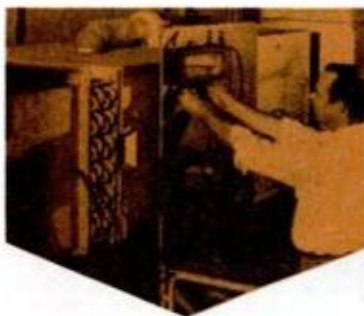
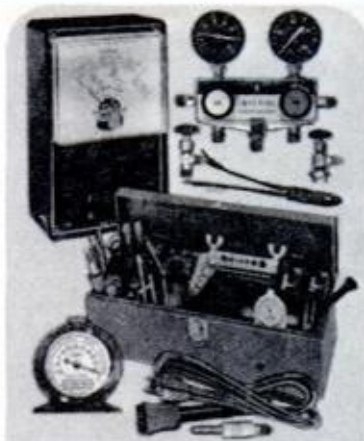
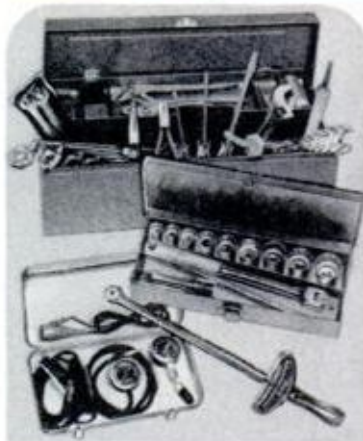
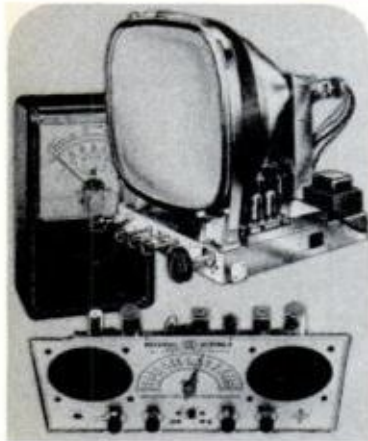
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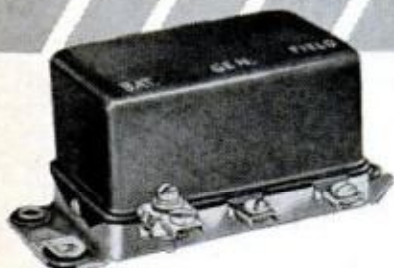
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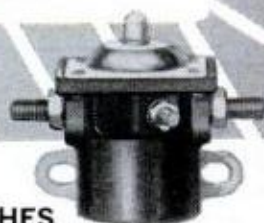
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AUTOMOBILE CLINIC

(Continued from page 26)

of the universal joints and replace any that are worn or damaged. That should do it.

Bugged-up push rods

I recently noticed a question in your column concerning Volkswagen valves not keeping adjustment. Let me tell you what I found . . . a bad batch of push rods. I examined a bunch of new ones and discovered that some were straight, but others had the ends secured at a slight cock. If a cock-eyed rod gets into use (and I bet there are lots of 'em in the field), the rocker arms will be actuated at an angle, and the valve adjustment will be too tight at times and too loose at other times. —M. K. Foss, Torrance, Calif.

Thank you, sir. I guess the moral of the story is to check on those push rods if you can't maintain the proper valve adjustment in your Beetle.

Stare it down

It keeps glaring at me like an ominous evil eye. I'm speaking of the "idiot" light which reveals the electrical system condition in my 1965 Rambler. It puts out a dim glow at all engine speeds. I know the electrical system's in good shape, so why the glare?—A. T. Kiley, St. Louis, Mo.

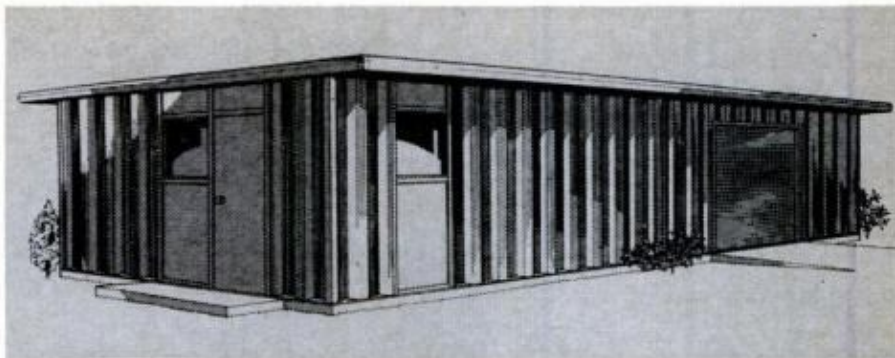
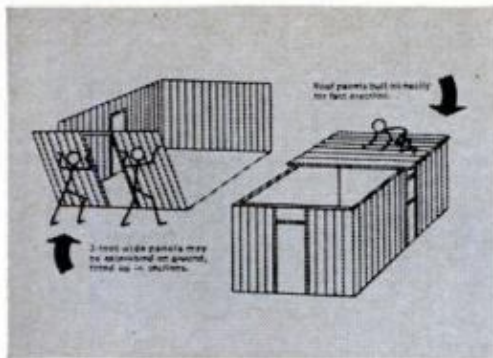
Why the glare? Because you probably have a loose connection at the alternator terminals. And you'd best check it out and fix it pronto, because continued operation in this condition can lead to alternator or regulator failure. Check the red wire to the output terminal of the isolation diode, the orange wire to the regulator terminal and the green field lead.

Squawk box

I just bought a used 1964 Olds Cutlass, which I like a lot. Except, it keeps talking to me. There's a squawking sound coming from the front suspension. Grease doesn't help. Any ideas?—Steve Glass, Portland, Ore.

One good one. A metal-to-metal squawk of the type you mention could result from the use of incorrect (undersized) front stabilizer shaft bushings in the front suspension. These leave a gap which allows the stabilizer shaft to contact the metal bracket. Solution: Have your friendly Olds dealer install the correct bushings (part No. 385130). ★★

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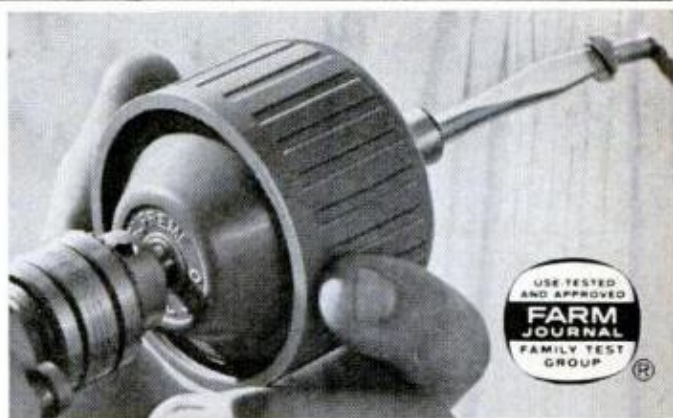
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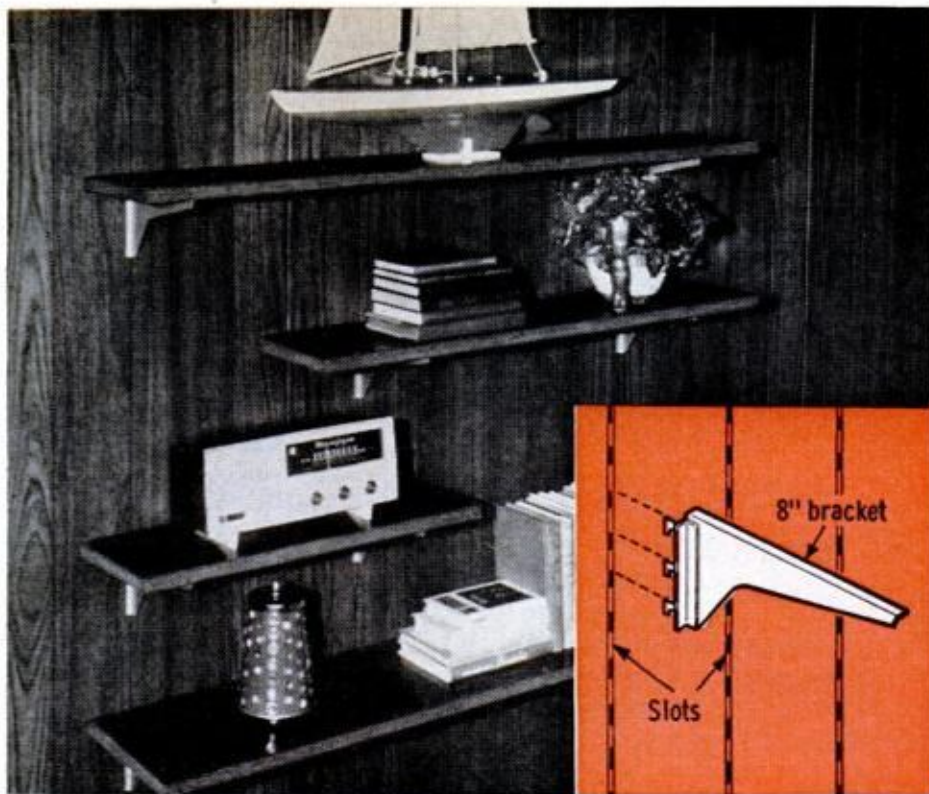
APRIL 1967

31

EXCITING NEW PRODUCTS

Shelf magic

You'll wonder what's holding the brackets until you look closely at Royalcote's Living Wall by Masonite. Slots in the random grooves of the 4x8-ft. panels accept self-locking shelf brackets to do away with metal standards. Slots accept picture hooks too. Really clever!



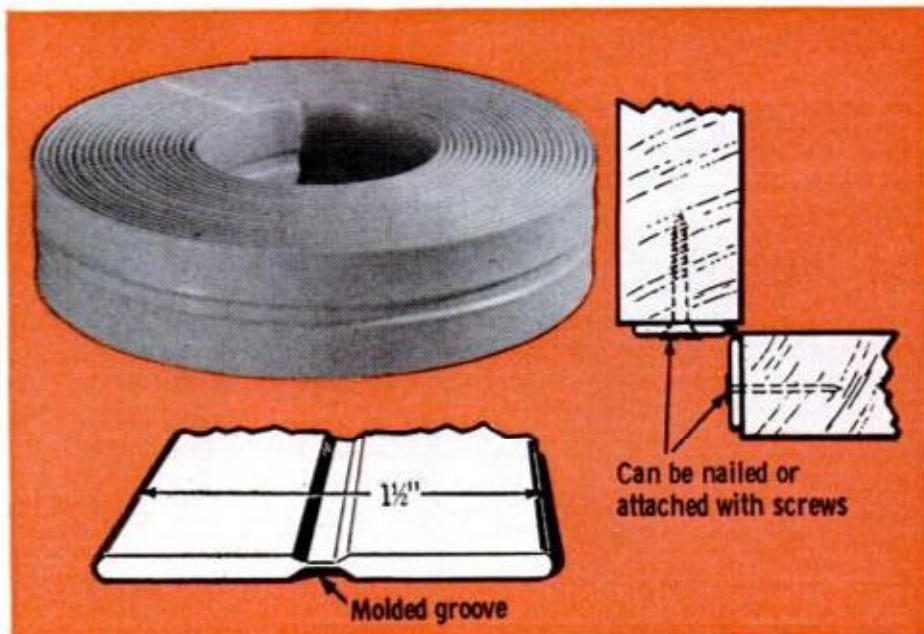
King-size tile

Prescored in molded polystyrene to look like four 12-in. tiles, Super Tile-Lite measures a whopping 24x24 in. to take less time, less furring and less adhesive to install. Interlocking flanges make the tile self-leveling, eliminating dropped corners. Made by U. S. Mineral Products Co., Stanhope, N. J.



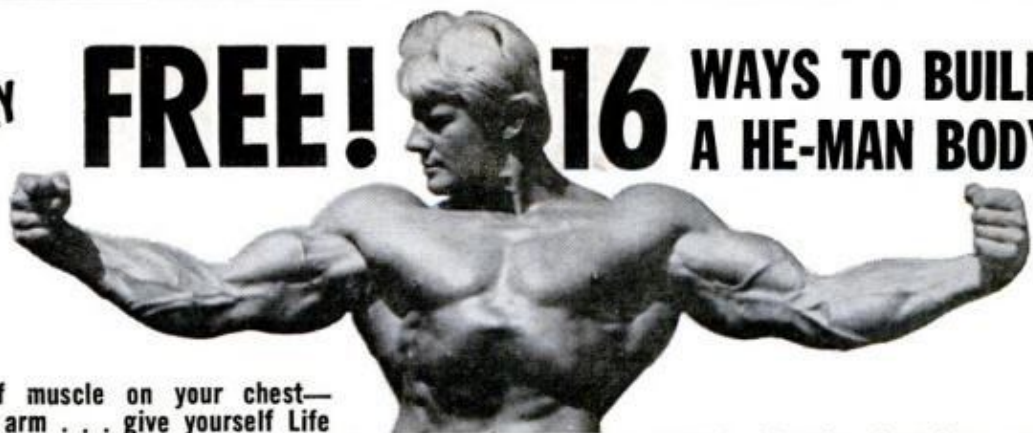
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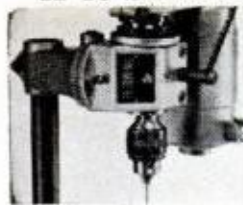
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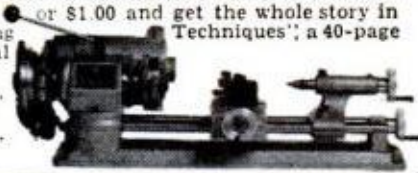
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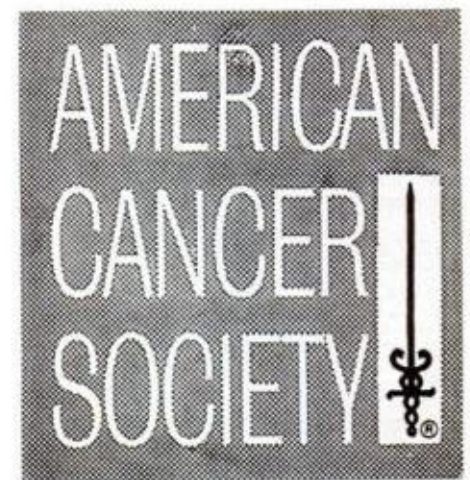
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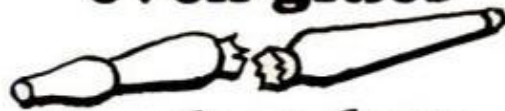
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

No-luck transplanting

I don't have any luck transplanting growing plants from a smaller to a larger pot. They seem to just shrink and wither and don't grow normally ever afterward. What am I doing wrong?—E.R., Okla.

You don't outline your procedures, but, ordinarily, older plants do not submit to transplanting as readily as do seedlings.

One procedure that usually results in minimum damage to the root system is first to have new soil ready, dampened slightly to a crumbly consistency. Also dampen the soil around the plant in the original pot. In the meantime, place several small pieces of broken pottery in the bottom of the new pot, sift an inch or so of new soil over the broken pieces, then run around the inside of the original pot to loosen the soil from the walls. Place a hand over the soil in the pot, up-end it, and strike the bottom lightly until plant and soil slide out.

Be especially careful not to break the soil away from the plant roots. Place the whole mass in the new pot, center it and sift new soil into the space between the old soil and the pot walls, packing it lightly. Don't fill the pot full of new soil. Leave an inch or so at the top and add a layer of peatmoss to retain moisture. Water the plant immediately.

A leak—or is it?

I live in a semi-desert area in a home with a basement, the walls of which are of concrete blocks with bricks above grade. The inside is plastered. After my lawn sprinkling system has been on for a time, a damp spot appears on the inside of the wall just below the bricks. After the spot dries, a white coating forms. A waterproofer doesn't seem to stop the leak or the formation of the coating. What can I do next?—M.N., New Mex.

Could be there's an opening of pinhole size in the brick masonry. The masonry probably is dry and absorptive much of the time, and water from the sprinkler may be absorbed into the wall, activating salts present in the masonry. The dampness works through the wall and, when it dries between sprinklings, the white coat-

(Please turn to page 38)

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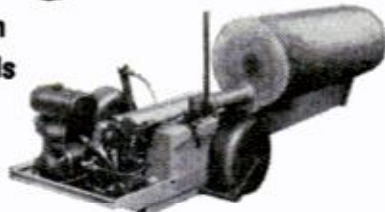
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HOMEOWNER'S CLINIC

(Continued from page 36)

ing—known as efflorescence—forms. You might try placing a temporary shield to turn the water from the sprinkler away from the wall. Then it may be possible to pinpoint the leakage and coat the outside of the wall with a waterproofer.

Rethreading with glue

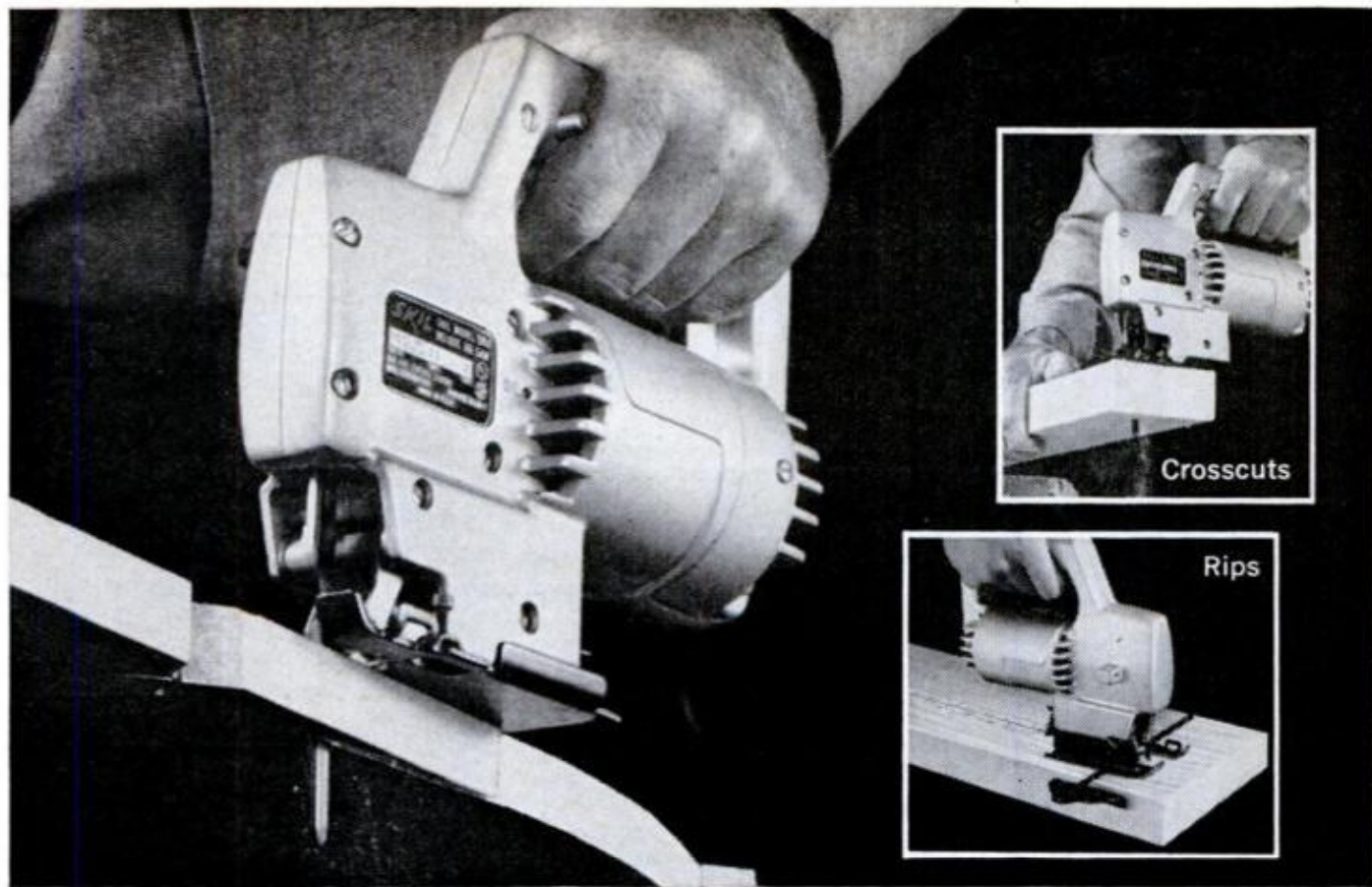
I have an old cabinetmaker's bench in my home hobby shop having a frame assembled with lagscrews. In attempting to tighten the screws, I stripped the threads several times. I can't conveniently use larger screws. Is there a way to make the old holes "smaller"?—O.E., La.

One way is to back the screws out and place a fair amount of quick-setting glue (any white glue) in the holes, spreading it as uniformly as possible on the walls of the holes. When the glue has set initially but has not fully hardened, turn the screws back in, seating each lightly. After the glue has set and cured, tighten the screws moderately. Ordinarily, screws retightened this way will hold securely.

Softening water hammer

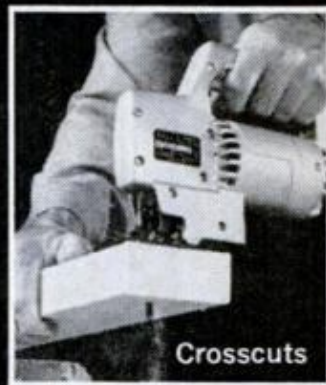
When I open or close the bathtub faucet on the hot-water side, there's a terrific hammering noise. The bibb washer has been replaced, and so far as I know there is a proper air chamber. The faucet is the wall type. I've had it apart, and it seems to consist of two sleeves that slide into a third fixed sleeve. The washer seat is in the second of the two sleeves. How can I stop the noise?—Y.K., Wis.

The second of the two loose sleeves—the inner sleeve, or seat—may be the offender. There is, or should be, a free washer between the two. If this washer, which also acts as a spacer, is missing or badly worn, then the inner sleeve may remain slightly loose even though the outer sleeve is tightened in the reassembly. If it is still loose, it can move forward and back like a piston at a very rapid rate. It can thus be the cause of the "terrific hammering." Disassemble the faucet again and replace this washer. Also examine the bibb washer you installed to make sure it is tight. Then reassemble, remembering that the outer end of this outer sleeve is shaped, recessed and internally threaded to form a packing nut. Don't draw it up too tight or you may have difficulty turning the faucet stem or spindle. Should the faucet still hammer, draw the outer sleeve somewhat tighter. ★★★

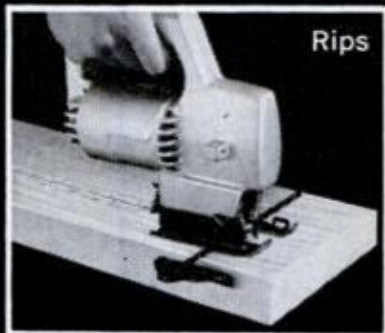


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Drivin' with Dan

How many drivers and mechanics make a living from racing? Who will be the star rookies at Indianapolis this year? What speed will win the pole position? Dan Gurney answers these and other provocative questions



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Q. Who do you expect to be the star rookies at Indianapolis this year?—Hank Shaw, New Haven.

A. John Surtees, Jochen Rindt, and Denny Hulme, who have advantages other so-called "rookies" sometimes do not enjoy in that they are established drivers. The same would hold true of top NASCAR drivers who might appear, such as Lee Roy Yarbrough.

Q. How many drivers and mechanics are employed professionally in racing? Is any training necessary? What is the average salary for a rookie and for a veteran like you? About how many hours a week do professional racing people spend on the job?—John Cooper, Dover, Del.

A. First, I'd guess there are probably 100 drivers and 200 mechanics who earn a living exclusively from racing, and many, many more who mix racing and some other activity in varying percentages. Second, success

seems to be attainable in proportion to the knowledge and skill of the participants. Income can range from subsistence, which is often the case for a beginner, to figures that compare to those of a top pro golfer. Finally, I'd say the professionals average 10 to 12-hour workdays. Race days are only a small part of the job.

Q. On some Indianapolis cars the body is off-center, closer to the left wheel than to the right. What's the advantage of this? Are your Eagles built this way?—Brian Peters, Madison, Wis.

A. Originally, this was done to distribute tire wear more evenly in the days when it was a big factor at Indy. Now, tires have improved to such an extent that wear is not nearly the problem it once was. However, in theory, "offsetting" is said to provide a small gain in cornering speed in that some of the load is taken off the outside tires and transferred to the inside ones. We are "offset" this year in hopes we'll go faster.

Q. Do you believe in compulsory safety inspection laws? I think they're a racket.—Hank McNary, Roanoke, Va.

A. I believe in safety and I don't believe in rackets, I'll say that much. There must be a way, but I'll be darned if I know. I suppose it all boils down to integrity of inspectors.

Q. How does your 12-cylinder Gurney-Weslake engine differ from the 12-cylinder Honda?—Eddie French, North Hollywood, Calif.

A. One big difference is that ours is smaller and lighter. Another is that Honda takes power out of a center gear-train halfway along the length of the engine, whereas ours takes it conventionally off the back of the crankshaft. The Honda is an all-roller bearing

(Please turn to page 42)

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DRIVIN' WITH DAN

(Continued from page 40)

crankshaft and connecting rod engine. Ours uses the more normal thin-wall shell bearings. Another difference is that Honda uses inlet ports between the camshafts. The exhaust ports are in the "V" of the engine, much as in the Ford Indianapolis engine, whereas ours has the more conventional inlet ports in the same place. In other words, our inlet ports are where Honda's exhausts are, and our exhausts are down below the exhaust cam in a more conventional position. Both have four valves per cylinder, both are fuel injection, both have similar horsepower. We think. (Would you believe we hope?)

Q. How fast will one have to go to win the pole at Indy this year?—Cecil Anderson, Warren, Ohio.

A. Under favorable qualifying-day conditions, I'd say 169 mph.

Q. How many pit stops do you plan to make at Indy?—George A. Richards, Ft. Lauderdale, Fla.

A. Two.

Q. You talk so much about Indianapolis and Formula 1. What about the World 600 at Charlotte? It has some pretty good drivers, too. I bet they could beat some of the Indy boys.—Henry McDonnell, Asheville, N.C.

A. I couldn't agree more. I've seen enough of those guys to know nobody races any harder than they do. Cale Yarborough looked extremely good in practice and qualifying at Indianapolis last year, and I'm sure his success will help bring more NASCAR drivers to Indy.

Q. I know they're not going to do it, but could they race stock cars at Indianapolis?—Bud Petersen, Atlanta.

A. Certainly they could. I think it would be a fantastic show, but the political problems which exist between USAC and NASCAR (which is the "they" I assume you mean) will probably prevent it from happening. There are some people, I suppose, who feel that it would be like having a Dixieland band in the Metropolitan Opera House.

Q. I saw an ad the other day by John Mecom offering used race cars. Some had been driven

(Please turn to page 44)

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DRIVIN' WITH DAN

(Continued from page 42)

by guys like A. J. Foyt and Parnelli Jones. They weren't cheap either—\$10,000 and up. Are they a good buy for someone who wants to get started? —Ben H. Fosdick, Newport, R.I.

A. Mecom is the Lola sports car distributor for the United States and I'm certain he would stand behind his cars. So, from that standpoint, they would be a good buy. Also, they would have been "sorted out," which is better than new in many respects. In buying a '66, you must realize there are '67s coming along with the benefits of another year's progress in racing. However, I don't recommend this sort of potent racing machinery for a true beginner.

Q. How come Lloyd Ruby isn't driving an Eagle again this year?—P. F. Garner, San Antonio.

A. Truthfully, it involves company politics. You will notice that so far all the Eagles have been Goodyear-shod. Ruby will be on Firestones because of his driving contract.

Q. I understand one of your rules is: "Don't push past the safety point. First, finish the race." Isn't this too conservative? How are you going to become World Champion without taking a few chances?—Peter Goldman, Fresno, Calif.

A. No, it's not too conservative. On the other hand, it's extremely difficult to do. What I mean is that a top racing driver is constantly having to evaluate where the safety limit is. He must use all his skill and judgment just to establish where the limit is at a given moment, then try to approach that limit as nearly as possible without going beyond it, yet not leaving any excessive margin before reaching it.

Q. Are you actually going to enter one of those low-cost 289-inch Ford engines at Indianapolis?—Jack Murphy, Palm Beach, Fla.

A. We have every intention of doing so.

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 24).

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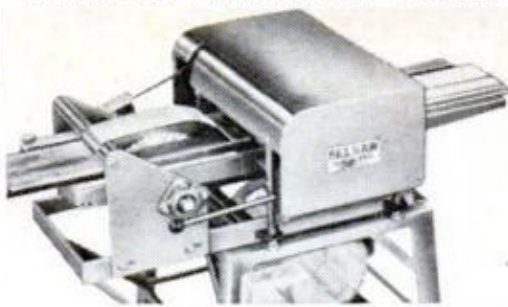
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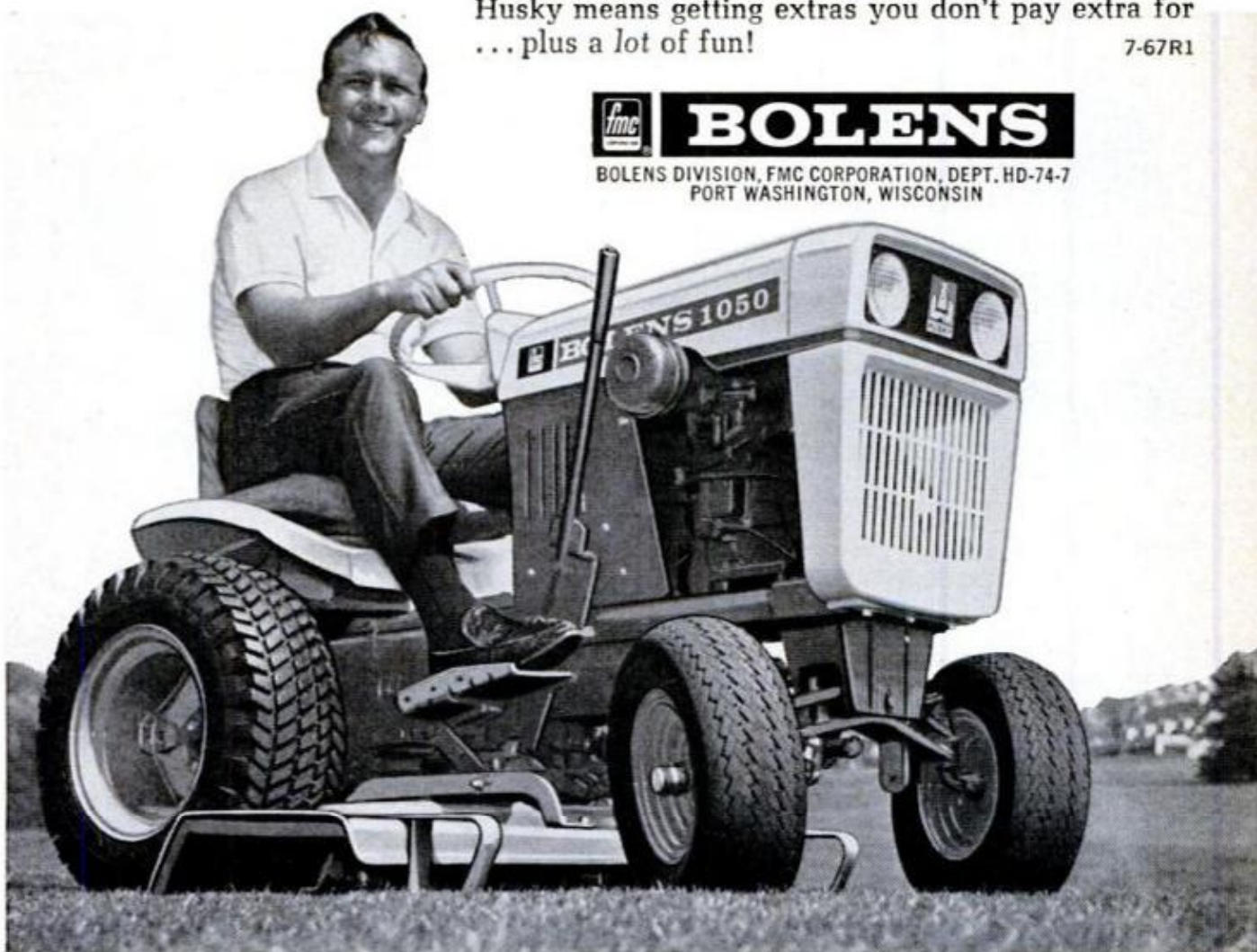
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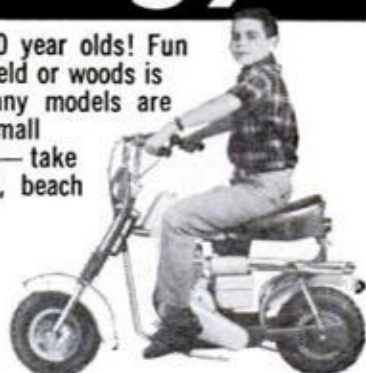
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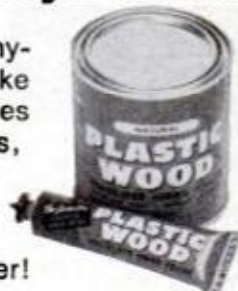
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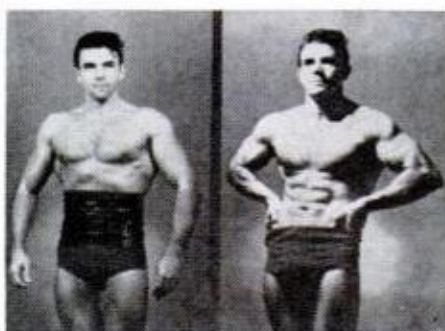
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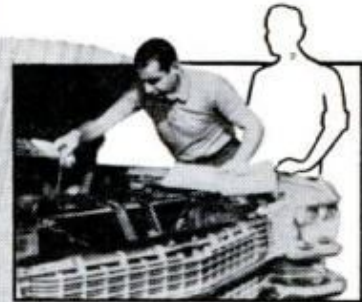
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WHAT'S NEW OUTDOORS

BY DAN FALES

WATCH OUT FOR RISING WATER if you're fishing a dammed stream. I remember one year I was fishing the north headwaters of a small river. About five miles upstream there was a small power dam. I'd waded out into the middle to get a cast behind a rock off the opposite shore. It had taken some doing to get that far out in the rather fast stream. The water was halfway between my knees and waist.

After several unsuccessful casts, I noticed the water was now waist deep. I couldn't understand it. I hadn't moved. Then I remembered the dam and scrambled for shore. Sure enough, someone had opened the gates to pump more water to the power station. If I'd stayed in mid-stream, water would have flooded my boots creating a serious situation.

If you're going to fish below a dam, check to see what time the flood gates will be open. There's generally a daily schedule available at the power station.

IN THE DOLDRUMS between hunting seasons, many sportsmen keep their eye by varmint hunting. Remington Arms Co. now has a varmint-grade version of its Model 700 bolt-action, center-fire rifle.

This hefty nine-pound addition to the Model 700 comes equipped with a heavy target-type tapered barrel. The Varmint, as it's called, is chambered for five of the most popular varmint calibers—222 Rem., 223 Rem., 22-250 Rem., 6-mm Rem. and 243 Win. Because most varmint hunters use scopes, Remington has not included any type of sights on this model. However, standard equipment includes front and rear blocks for mounting varmint or target-type scopes. The receiver is drilled and tapped for sight mounting. Also standard is a match-type trigger.

The Varmint has all the regular features of the larger caliber Model 700's including the strong recessed bolt face which encloses the cartridge head completely with a ring of solid steel. Walnut stock, custom checkering, Monte Carlo comb and cheek piece, detachable sling swivels and a carrying strap are all standard on the Varmint. Price is \$169.95.

BEER-CAN SLING is the newest item in outdoor accessories. This sling dispenser is a 40-inch refrigerator tube that keeps beer or canned soft drinks cold after they're taken out of a home refrigerator.



The tube is lined with a light nonconducting material which helps preserve the coldness for several hours. A long spring inside the tube is depressed as the cans are placed in the container—which will hold up to six cans. The tension of the spring will cause the cans to pop up when the lid is removed. The Cold Keg Can Popper-Upper is made by Premiums, Inc., Seattle, Wash., and is available for \$15.

SHOTGUN SYMPHONICS were heard at a recent performance by the Saint Louis Symphonic Orchestra of Tschaikovsky's *1812 Overture*. There were some unusual musical instruments added to the ensemble—Winchester shotguns and ammunition. The need for these sporting firearms came as a result of a requirement by the composer of eight cannon. The orchestra compromised and used Winchester Model 1400 shotguns, fired by the rhythmic fingers of John Warden and his daughter Judy, an attractive 17 year old who is the world ladies' skeet-shooting champion. Winchester-Western drew the part when the Saint Louis *Globe-Democrat* reported the shooters were having some difficulty locating blank shotgun shells. Olin Works rushed a supply of Western Popper-Load smokeless blank shells used primarily for field trials and dog training. Reports indicate the symphony was a booming success.

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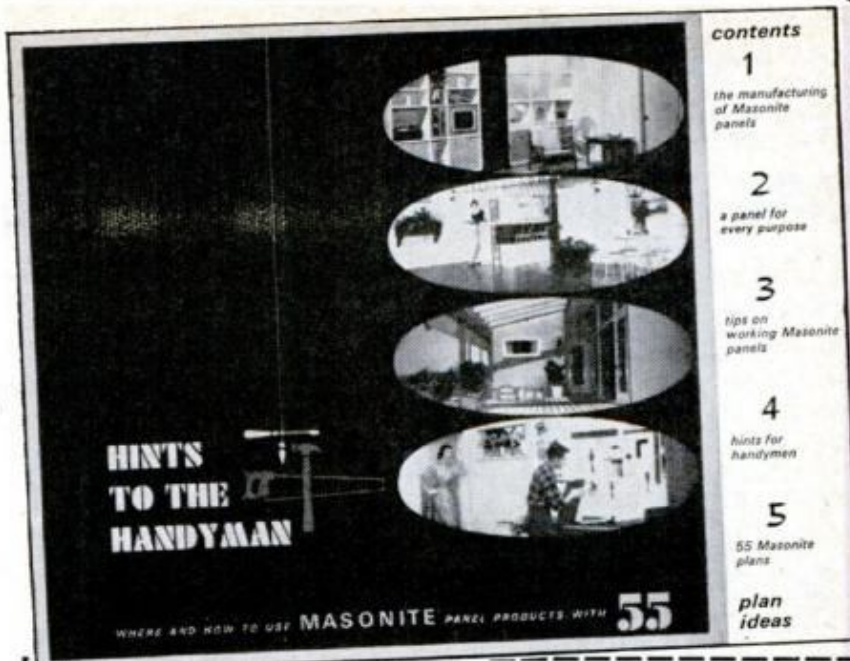
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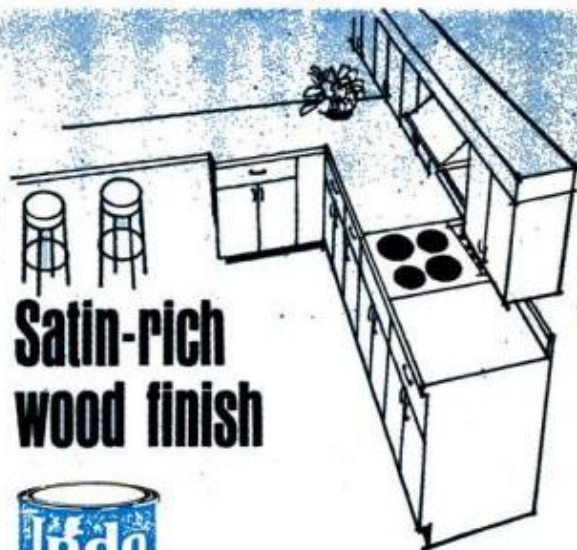
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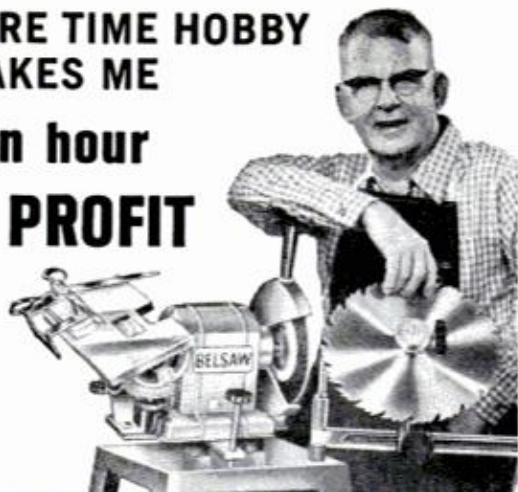
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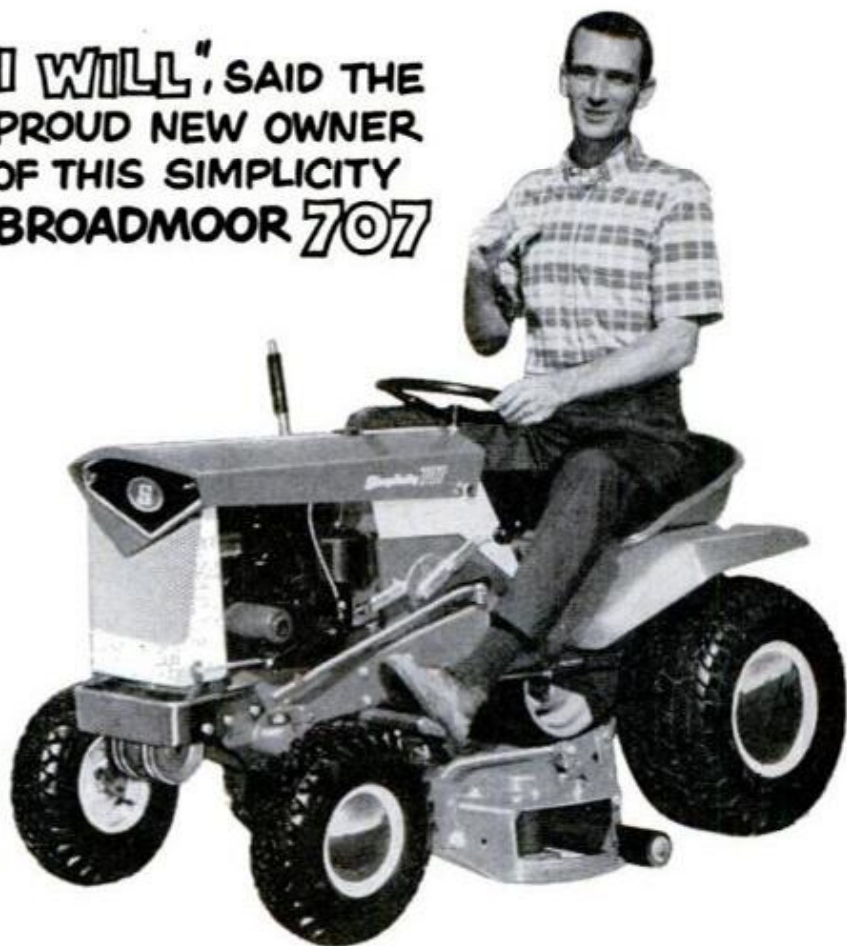
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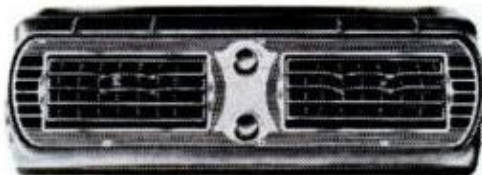
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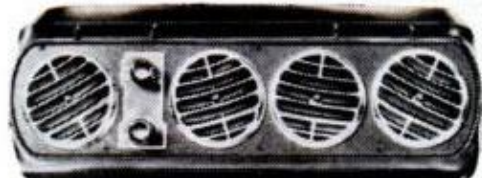


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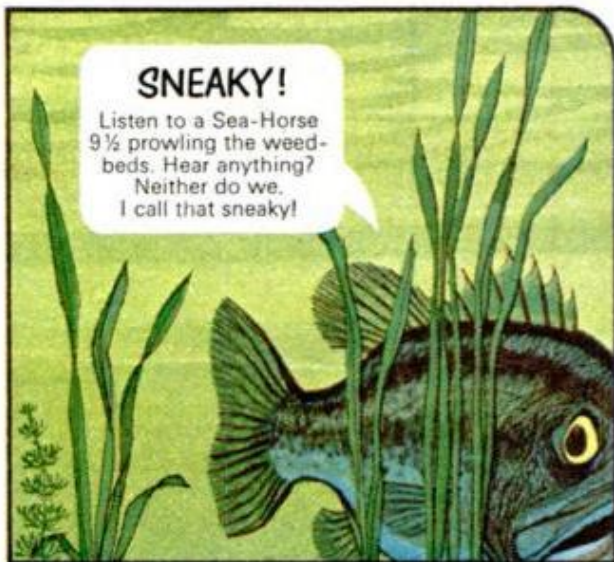
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really
bugs me



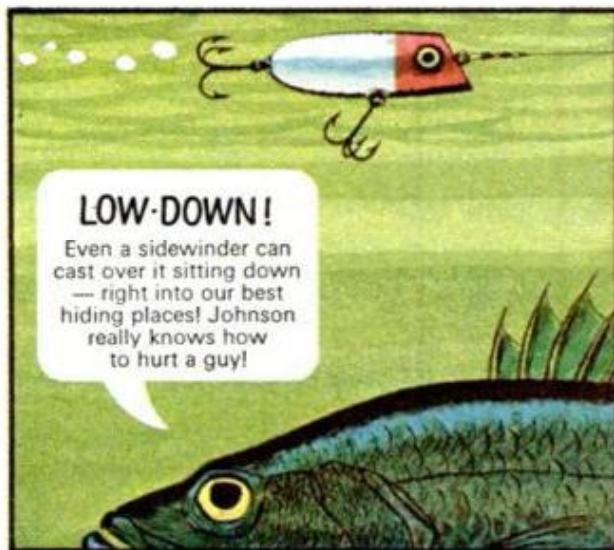
SNEAKY!

Listen to a Sea-Horse
9½ prowling the weed-
beds. Hear anything?
Neither do we,
I call that sneaky!



RELENTLESS!

Invades
my favorite sanctuary
without half trying!



LOW-DOWN!

Even a sidewinder can
cast over it sitting down
— right into our best
hiding places! Johnson
really knows how
to hurt a guy!



AND
IT'S
OOOPPPPS!

The "go get 'em" design of our 9½ is improved with new vibration dampeners and fuel metering. Silky smooth even below 500 rpm, even in rough water. Easy stow, easy carry, too. For more motor lore, see the fisherman's friend, your Johnson dealer. Or write: Johnson Motors, Waukegan, Illinois 60085 Dept. PM-47.



World's largest selling outboard . . .

the sweet and low  **Johnson 9½**

First in dependability • Sea-Horse motors, Sea-Foil boats, Air-Buoy skin-diving gear, Skee-Horse snowmobiles • Division Outboard Marine Corporation

DETROIT

LISTENING POST

BY BOB IRVIN

PONTIAC MAY DROP ITS SPLIT-GRILLE THEME on at least some of its 1969 models. The split grille first appeared in 1959. Another Pontiac "trademark"—vertical headlights—was discontinued on the Grand Prix with the 1967 models, a trend that may also be extended to other Pontiacs in the next couple of years.

FORD AND CHEVROLET ARE WORKING ON AMIDSHIP-ENGINE SPORT CARS and they're expected in the early 1970s. Roy Lunn, who put the winning Ford GT together, is spearheading the project at Kar Kraft, the company's specialty shop in suburban Dearborn. Chevy's project will be a new Corvette. In the meantime, the Mako Shark may be out in '68.

GENERAL MOTORS IS TESTING SOME FOUR-DOOR VERSIONS of its Riviera-Toronado-El Dorado body, but is watching sales of the '67 four-door T-Bird before deciding which way to go. Could be out first at Buick. As reported here in March, Buick may also grab the GM "F" body (now on the Camaro and Firebird) for a sporty car of its own next year.

FORD'S MUSTANG WILL BE ALL-NEW IN 1969, reports one insider. Classic Mustang proportions will be the same, but the styling is all new.

RUMORS PERSIST THAT THE CORVAIR HAS HAD IT, despite denials by GM brass. Speculators point to GM's efforts to clean up all litigation involving the ill-fated car. Competitors insist 1967 will be the last year.

PEOPLE ARE USED TO SIDE VENT WINDOWS. That's why some have complained about recent moves to discontinue them on luxury cars such as the T-Bird. Some execs at Ford and GM privately admit they don't like the trend either, are pushing to re-evaluate plans to extend ventless windows to other lines.

CUSTOMER COMPLAINTS LED TO THE DECISION by Ford vice-presidents Charles Patterson and Lee Iacocca to drop those rolling door locks which, unfortunately, had a tendency to lock as the cars were going through the car washes. The company that supplies Ford is trying to get the system reinstated by offering a "fail-safe" design. Drivers would activate a switch to bypass the automatic locking mechanism before entering a car wash.

GENERAL MOTORS WANTS TO BE THE FIRST COMPANY to make disc brakes standard on all its cars. It's shooting for 1969 models. Kelsey-Hayes has come up with a simplified one-cylinder system that could make this possible. Ford's eyeing the idea, too.

ELECTRIC CARS AREN'T FINDING MUCH SUPPORT with officials at Ford of Britain. One official of FoMoCo's English subsidiary rattled the brass back home when he told me he didn't think American car buyers would be interested in a limited-range, battery-powered "city car"—precisely the type of vehicle that's being touted so loudly here. He agrees with GM that to attract American buyers any electric car will have to match current cars in range and performance.

GM'S TURBINE ENGINES may have their first public test in Greyhound buses. The company reportedly wants to put 12 in buses on long intercity runs to see how they

(Continued on page 82)



Pontiac Motor Division

What ever happened to the funny little 6 ?

Quite a while ago we decided six-lovers should have available to them all those things that particularly delight V-8 lovers. Such as prestige, power and highway performance.

So we made even our most menial Pontiac long and luxurious—and decidedly not menial.

We even designed a brand-new six cylinder engine for it, with an overhead cam like famous European sports machines have. It has all the reliability, economy and quietness of a six with the

power of an eight. It delivers 165 hp from regular gas. And you can order a premium-gas version that puts out an almost unbelievable 215 hp!

All our Tempests and LeMans are available with this superb Overhead Cam Six. (And come with the GM safety package that includes folding seat back latches and GM's energy absorbing steering column.) So when people ask what ever happened to your funny little six, tell them Pontiac got hold of it.



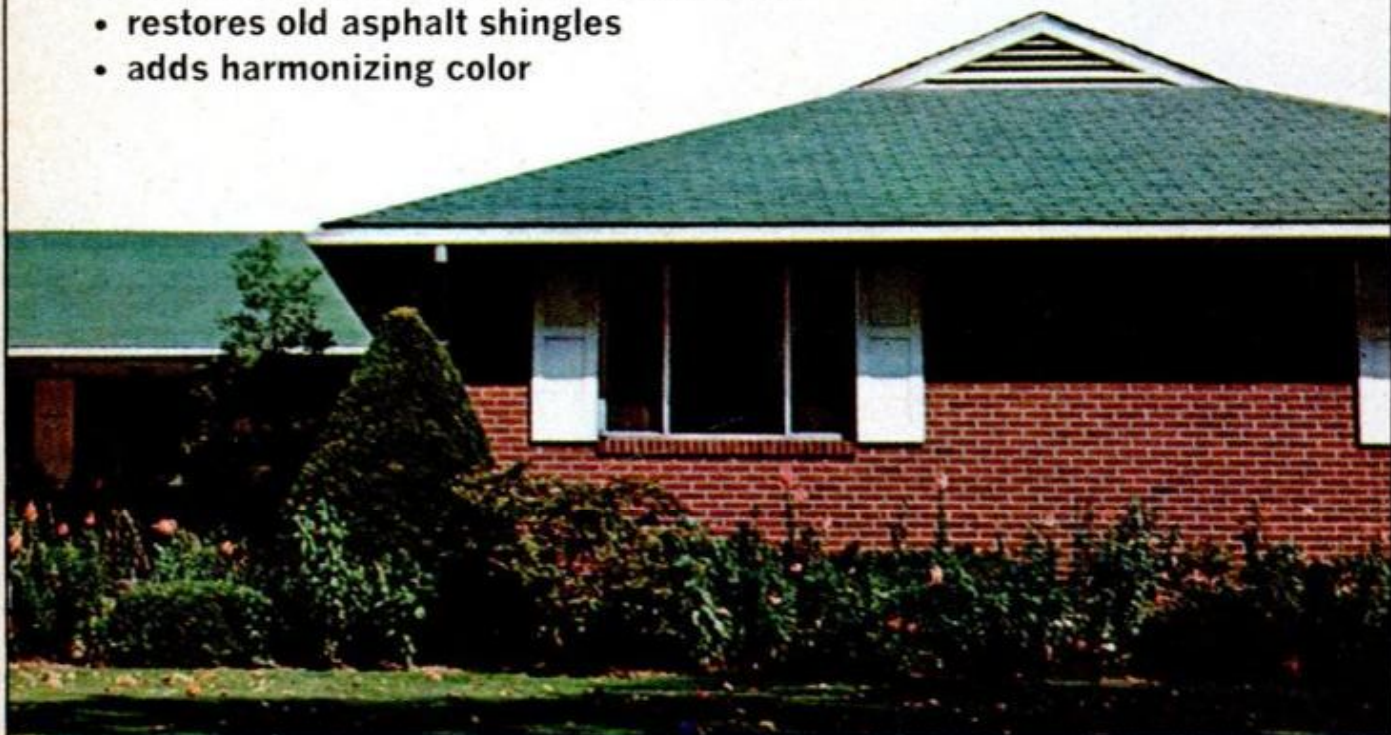
MARK OF EXCELLENCE

Wide-Track Pontiac

Paint on a "new roof" in beautiful color

New aluminum roof coating • stops leaks

- restores old asphalt shingles
- adds harmonizing color



Before you spend money on a new roof, ask your paint dealer about a remarkable, brand-new aluminum roof coating being introduced this month. There's a choice of fade proof colors. One coat weatherproofs and beautifies. And at a fraction of the cost of a new roof.

Users report they apply it for less than \$10 per 100 sq ft. It can add 5-10 years to the effective life of your present roofing.

Developed by Alcoa Research Laboratories, this new coating has been tested for more than five years under many weather conditions by Alcoa and several large paint companies.

They found it particularly effective on asphalt shingles, where it stops leaks by sealing small nail holes and cracks, bonds roofing granules, gives uniform appearance to old, patched surfaces.

New colored aluminum roof coatings, made with Alcoa® Pigments, will soon be marketed by many leading paint manufac-

turers. If your dealer doesn't stock these coatings, he can get them for you.

Aluminum Company of America
480-D Alcoa Building
Pittsburgh, Pa. 15219

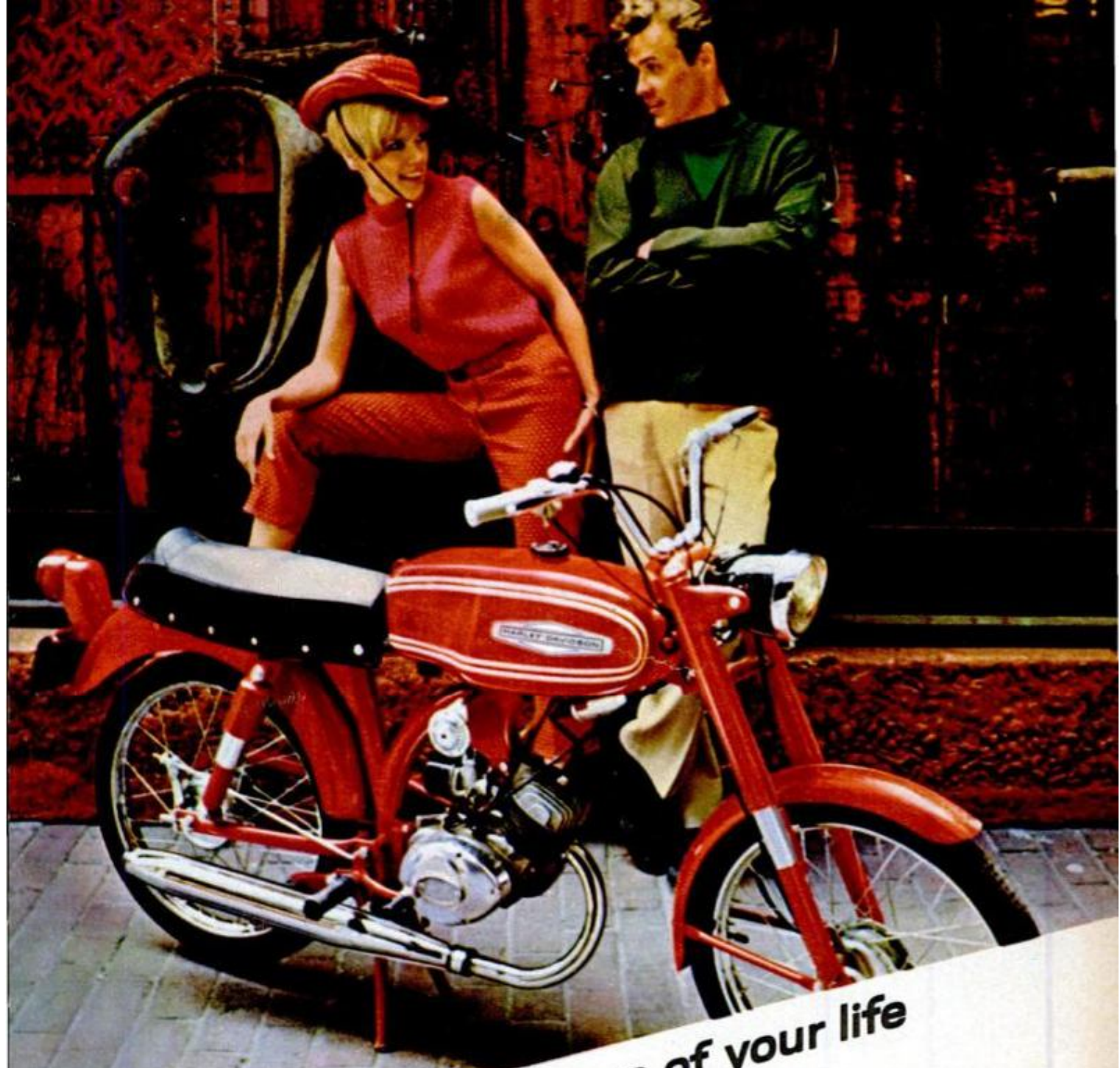


Please send your folder on colored aluminum roof coating. My name and address is:

My dealer's name and address is:

Change for the better with Alcoa Pigments.





for the action time of your life



Take charge of command performance—M-65! Pick your brand of action from 65cc all the way up to 1200cc . . . take charge prices, too! Sport or custom, road or trail, Harley-Davidson is your style . . . out in front to start and out in front to stay. See the Yellow Pages for your nearest Harley-Davidson dealer and get a piece of the action. Today!

**HARLEY
DAVIDSON**

DETROIT LISTENING POST

(Continued from page 78)

stack up against the diesels. Ford's leaning in the direction of testing by selected truck fleet users.

BIG CHANGE COMING in 1969 on GM's standard-size "B" body used by Chevy, Pontiac, Buick and Olds. General trend will follow the long deck, short rear end theme of the Riviera-Toronado-El Dorado cars. Cars will be lower, more streamlined.

U. S. SAFETY STANDARDS are posing problems for specialty vehicles, as reported last year here, but the government's not going to kill the market. For example, Travco, makers of the Dodge Motor Home, will probably register the vehicle as a truck unless the government does what has been asked—set up a special category for such vehicles as motor homes, Jeeps and sports wagons. Speaking of specialty vehicles, Ford's new Econoline van and sport wagon is due out next November. And Chevy's working on a camper vehicle that could be ready by 1970 if the market continues to grow.

CHRYSLER CANCELLED PLANS to convert its standard-size cars to frame-body construction in 1969. Tooling costs are said to be too high. The cars will be new, but unitized construction will be used. Suspension will also be the same—torsion-bar front and leaf-spring rear.

AUTO CRITIC RALPH NADER says he started thinking auto makers could build safer cars after watching well-padded "dodge-ems" collide at amusement parks. He contrasted that with the carnage caused by the sharp knobs and hard metal surfaces on car interiors.

DUAL-ACTION TAILGATE is expected to be introduced on Chevy wagons in 1968, two years behind Ford. Both firms are working on tailgates of this type with concealed hinges. GM now has a section of the Tech Center devoted solely to station wagons. Look for even more changes by 1970.

FERRARI'S BIG SWEEP of the Daytona 24-hour Continental, while discouraging to Ford, doesn't mean the Dearborn go-boys are easing up in their racing efforts. But Ford may give up on the so-called J-car, a smaller package than last year's all-conquering Mark II. Car seemingly has just enough wrong with it in enough places to justify its scrapping. What will succeed it is anyone's guess.

POPULAR MECHANICS



WHY . . .

do more
professionals
use *Weller* guns
than all other
makes combined?

Weller invented the soldering gun.

Weller guns feature exclusive fingertip dual heat control.

Weller guns heat up to 40% faster than other guns. No waiting.

Weller guns deliver up to 28% more heat per rated watt than other guns.

Weller gun tips are solid copper for longer life and greater soldering efficiency. (Pre-tinned for your convenience.)

Don't settle for less than Weller . . . the soldering gun of professionals. Available in 100/140, 140/210 and 240/325 watt ratings starting at \$6.95 list. On sale wherever better tools are sold.

WELLER ELECTRIC CORP., Easton, Pa.
WORLD LEADER IN SOLDERING TECHNOLOGY

Independent engineers put Ford pickups through torture tests at Riverside...racked up 67,000 miles in 63 days.



After 67,000 miles: Ford ride and handling almost like new.

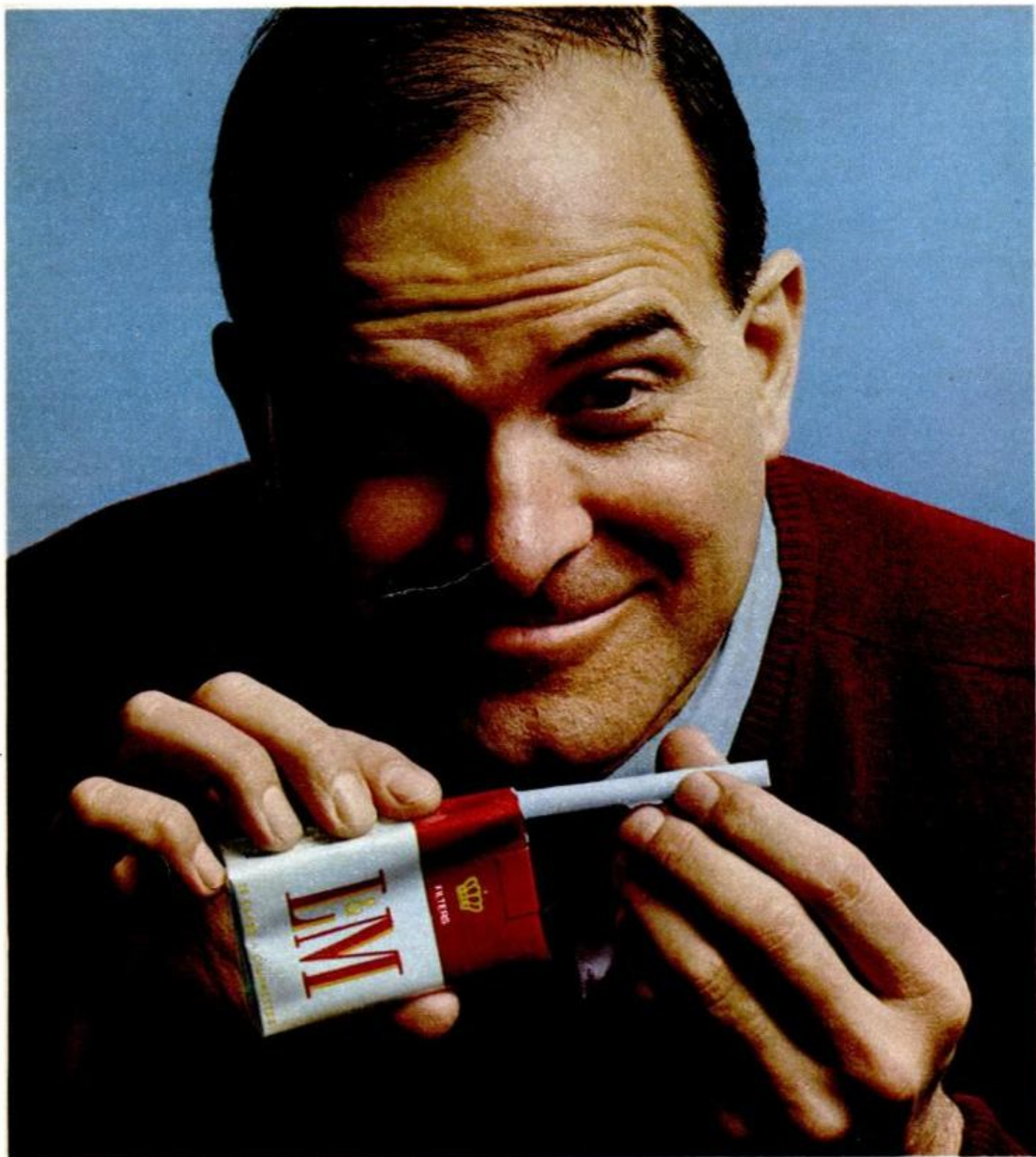


Few pickups ever have accepted so punishing a challenge. Day and night for 63 days at famed Riverside International Raceway, Ford's F-100 Twin-I-Beam Pickups churned out 67,000 miles of hairpin turns, reverse incline turns, mud and gravel roads in 100° track temperatures. Certified results: Overwhelming proof of the superior dollar-for-dollar value of these 1967 Fords. In ride, comfort, handling, noise level—in virtually every category that you as a consumer consider important—independent testing engineers and the 22 test drivers involved found Ford superior. See your Ford dealer for the fact filled official report.



Twin-I-Beam Suspension





I, bold, brawny Bob Bevens, am a flavor grabber.

I never took a thing in my life. Before Petey Hansen joined my engineering crew, that is. You've seen Petey. Red hair. Freckles. Always smoking those L&M's.

So, last week, while he's out surveying, I grab one of his L&M's. Not bad! Not sharp. Not flat. But a good round flavor you don't get in any other filter cigarette.

Later, while Petey's busy, I grab another L&M. All of a sudden I'm a flavor grabber. Me, the chief engineer. So I run down to the corner and buy my own L&M's. I dig, when you grab hold of an L&M, you grab hold of flavor.

Now, will the guy on the crane who grabbed my L&M's please toss 'em back down!

A PM editor gets a taste of tomorrow's driving:

YOU 'FLY' THIS CAR WITH A STICK

EXCEPT FOR the flashing red light on the roof, there doesn't seem to be anything special about the car. It's a stock Plymouth. But when you slide behind the wh. . . whatever it is, you find your feet on a flat, pedal-less floor. You cautiously place one hand on a mallet-shaped machining that you assume makes this car do whatever it does.

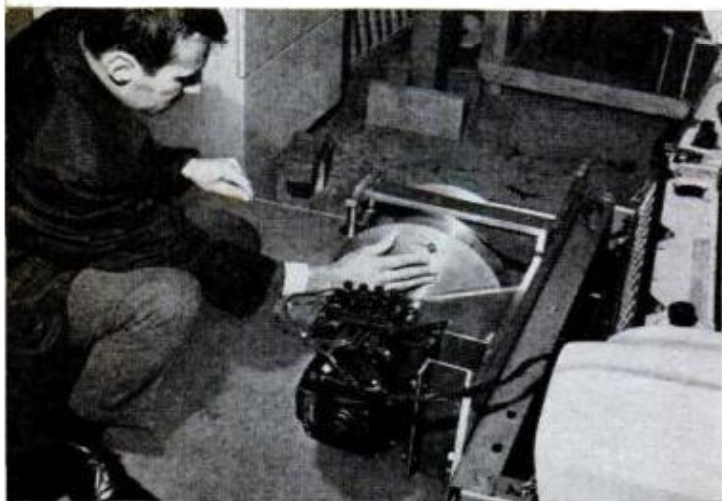
What the car does is respond to the slightest movement of your hand on the control

Acceleration, braking and steering are all combined in this single airplane-type control—a first step toward hands-off driving on the automated highways of the future.

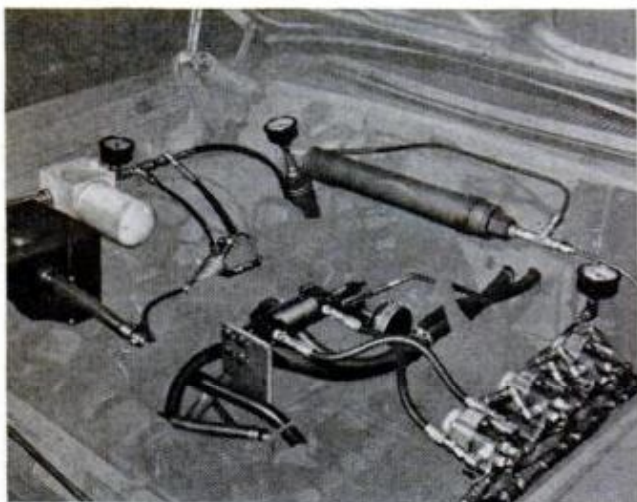
By **BILL HARTFORD**



A FEW MINUTES AT THE STICK, even in Ohio snow, was time enough to master the experimental system



TAKE-UP DRUM WINDS CABLE attached to car ahead. Distance sensing will be electronic on future roads



HYDRAULIC SYSTEM IN TEST CAR replaces mechanical linkages to actuate throttles, brakes and steering

stick: Push forward and you accelerate; pull back and you brake; lean it to the left or right and off you go in that direction. It might be the get-away car of a one-armed bank robber, but actually it's the brainchild of a team of professors at Ohio State University.

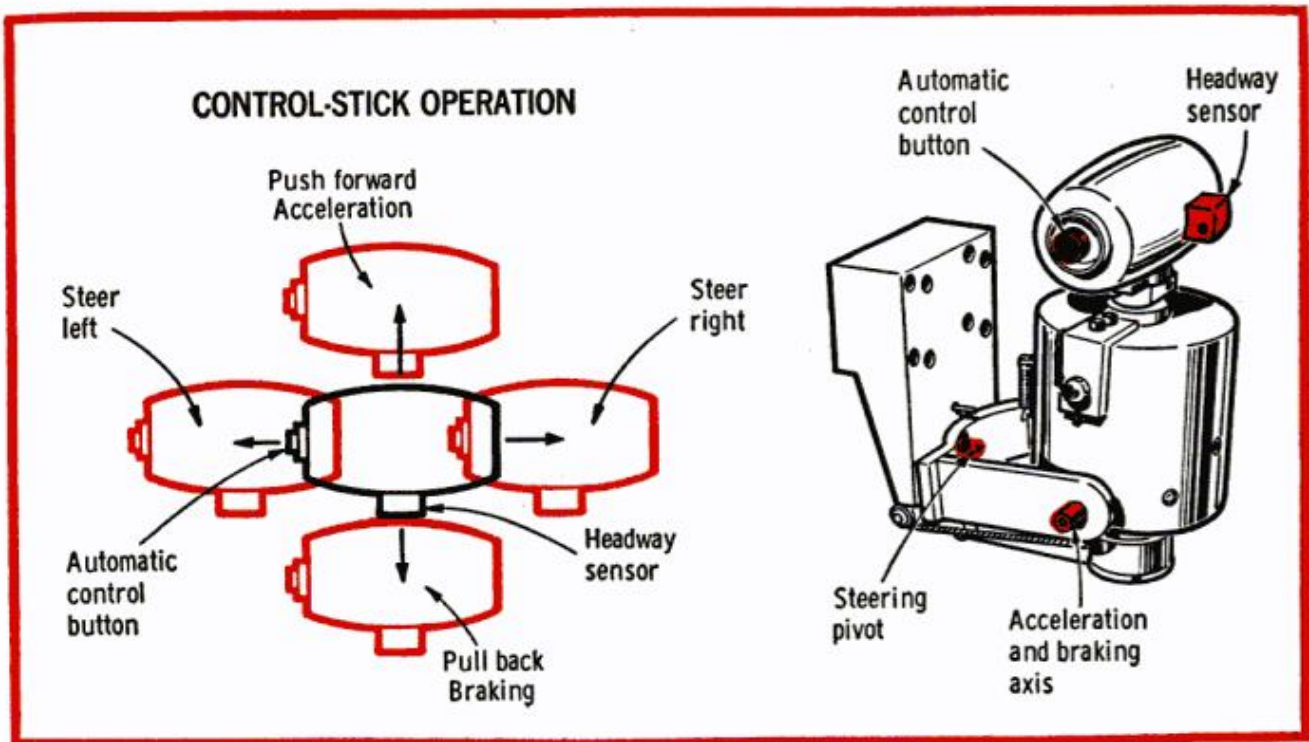
The University's Communication and Control Systems Laboratory rigged the car with the control system as part of its research program in methods of better automobile control. Dr. Robert L. Cosgriff, head of the lab, briefed me on the development of the stick and what to expect when driving with it. Dr. Robert Fenton, a young member of the laboratory staff and designer of the stick, explained further the details of this futuristic control as he not-very-futuristically Volkswagen'ed us down U.S. 71 to where the test car is garaged.

I could say that driving the car is as simple as following the operational diagram on the facing page, but it's not. The fact that there are two planes of motion for complete vehicle control requires real coordination to regulate speed and steering simultaneously.

After feeling my way around a small track for a few laps, I conquered an inclination to jab for a nonexistent brake pedal, and the new and strange control motions became almost habit. I then ventured onto the country roads that were already cleared of the recent snowfall and drove with full confidence in my control of the car with the stick.

Bob Fenton assured me that if it weren't for the slippery conditions, I would be ready to be a guinea pig for his more advanced research. Normally, I would have pulled up behind another car, referred to as the "lead car," and had a cable connected from a drum on my front bumper to the rear of the lead car. It sounds like a towing arrangement, but that's not the name of the game.

The "game" is to follow the lead car maintaining a specified distance, or "headway" as the experts say, between yourself and the lead car. The cable measures the headway and indicates it



STICK OPERATION AND CONFIGURATION prototype design. Further development of automatic highway will apply human factors to design, operation and placement in future cars

on a dial on the dashboard on the passenger side where you can't see it.

It sounds like a simple enough task, but Fenton's tests show that there isn't a person who can maintain the headway without oscillating between extremes greater and lesser than the specified headway. The driver will drop back, speed up, and slow down—and this is with the lead car maintaining a constant speed. When the test is run with the lead car varying its speed, the results show even greater variance from specified headway.

Just when Fenton's test subjects are ready to give up, he flicks a switch and engages what he calls a "tactile headway sensor." Its purpose is to assist a driver in maintaining an accurate headway by adding the sense of touch. His subjects have already realized that their visual perception isn't equal to the task.

Fenton had already pointed out to me the sensor running through the head of the control stick. It's nothing more than a "finger" which recesses or protrudes from the front of the head an amount proportionate to deviations in headway. The finger is programmed to remain flush in the head as long as

the specified headway is maintained. But if you imperceptibly begin to drop back from the car ahead, you feel the finger recess in the head and you push the control stick to adjust.

Similarly, if you begin closing on the car ahead, you feel the finger protrude an amount proportional to the distance you have deviated from the specified headway, and you move the stick backward to decrease your speed. Bob assured me that slight movement of the finger, indicating movement of the car's position in relation to the car ahead, would greatly improve my ability to maintain headway. All the drivers he tested previously stuck like glue to the car ahead when they reran the course.

This control stick with its tactile assist for the driver is not a device that'll enable you do to some fancy tailgating—as I thought at first. It's actually part of a long-range highway program to solve the problem of handling high-density passenger car traffic that's already choking our highways.

To accommodate growing traffic, cars on future highways will have to be packed in tight, and will have to move

(Please turn to page 207)



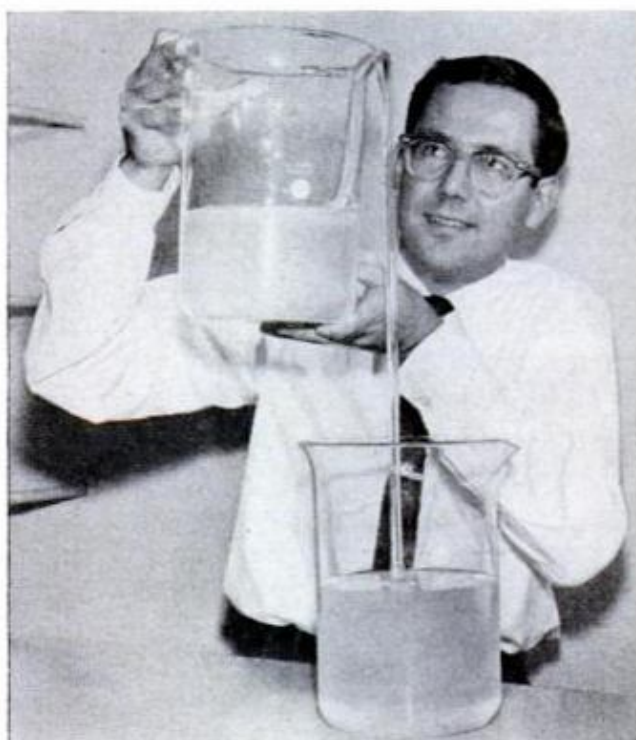
French train zips over rail on an air cushion

Leaving behind a cloud of white smoke (left), a prototype of the French Aerotrain made its first full-speed runs recently on a concrete rail. It achieved an average speed of 186 mph during the trial. The train, which is expected to be able to travel 250 mph, is suspended on its inverted T-shaped rail by a cushion of air. Forward propulsion is supplied by the propeller at the rear plus, during the tests, a rocket engine (right).



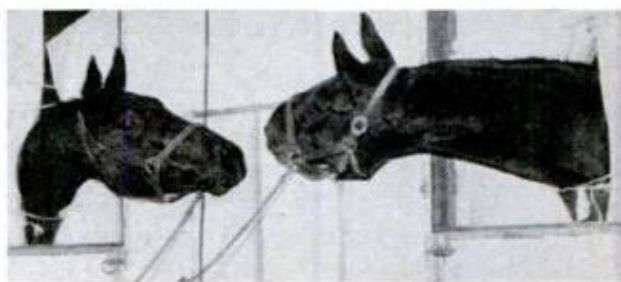
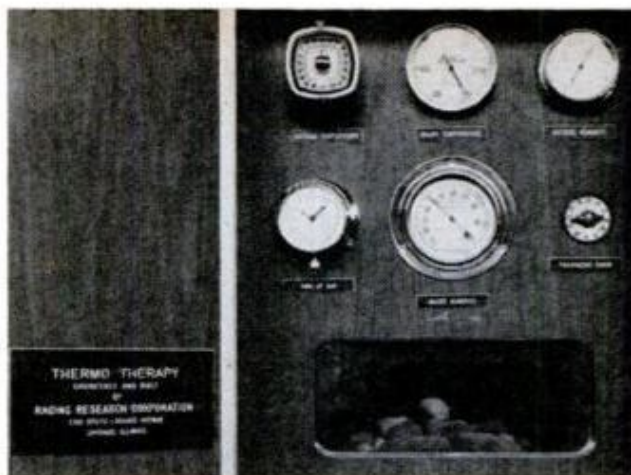
Waterfront safety

Water erupts from valves of "water-cushion" bumpers as two cars (top) meet in a head-on collision at a combined speed of 30 mph. Bottom photo shows the cars after impact. The rapid displacement of fluid absorbs the impact. Passengers in cars were unharmed.



Elastic water

Water that climbs uphill over a beaker's edge and whose flow can be stopped by cutting it with scissors has been discovered at Caltech. The liquid is more than 99 and 44/100 pure water; the other ingredient is polyethylene oxide, a polymer powder.



Horses shape up in a sauna bath before racing

The 190° dry heat of a sauna seems to be as beneficial for horses as it is for humans. Racehorses at Roosevelt Raceway near New York City have been taking their prerace warm-ups in a portable sauna (left). One nag, which hadn't won a race in two years, came in first after a session in the sauna trailer. Heated konno stones (top right) from Finland supply the dry heat. At lower right, two horses compare notes while basking.



Built to tilt

Able to carry 1580 cubic feet of powdered plastics, a new British highway tanker can be unloaded in a matter of seconds. A telescoping lift, powered by the truck's engine, tilts the giant container, and the load flows out. Four manufacturers built the carrier.

APRIL 1967



Tank destroyer

By holding the target in his sight, the gunner operating the Army's new heavy assault weapon, TOW, directs its wire-guided missile automatically to the target. The missile is loaded like a round of ammunition. TOW was developed by Hughes Aircraft Co.

91



CHRYSLER NEWPORT

Most owners replying to PM's survey think of this medium-priced "big car" as outstanding for the money. But many were unhappy with what they consider poor workmanship

By BILL KILPATRICK, PM Auto Editor

IN TENNESSEE, there's a furniture dealer the Chrysler Corp. ought to seek out and install in some sort of hall of fame—complete with banquet and laudatory speeches.

The man has owned 39 Chrysler cars and approximately 40 Dodge trucks over the past 42 years—vehicles for which he has paid over \$225,000. Were this gentleman a horse player, he'd be referred to as "a producer for the game," the kind of customer whose brand loyalty dances in and out of a manufacturer's sweet dreams.

Not only is this man loyal to Chrysler, he also (with one exception) has done all this business with the same

local dealer during those 42 years.

But contrast this lasting love affair with the experience of a Florida real estate broker who—of his new Newport—wrote:

"Never again. I don't have room to list the things wrong with this car."

As opposed to sweet dreams, this is the sort of customer who haunts a manufacturer's nightmares—a buyer lost to the fold forever.

Still, based on *PM's* survey of 1967 Newport and Newport Custom owners, Chrysler execs can look forward to a preponderance of restful nights. In general, owners of the car think that it's a winner.

NEWPORT INSTRUMENT PANEL was adjudged neat and easy to read by owners. Note recessed knobs

LOUD COMPLAINTS about glove compartment were voiced by many owners. Most said it was too small





They like the way it handles, affording this particular attribute a Frequency-of-Mention Rating (FMR) of 52.7 percent, its comfort (44.1 percent), its ride (39.2 percent), style

(33.8 percent) and economy (31.1 percent).

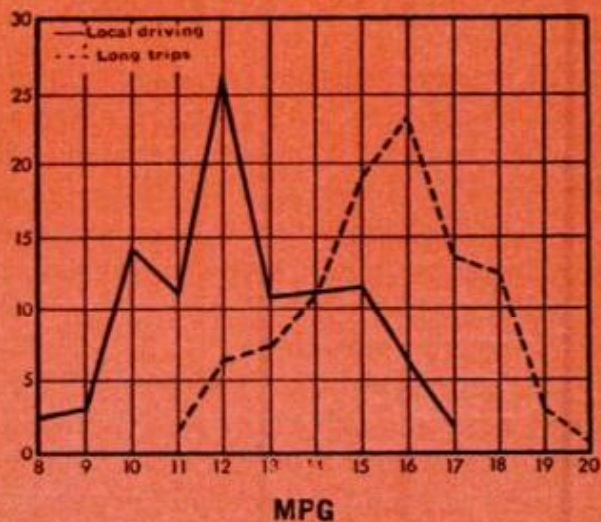
Even some of the boosters, however, aren't too happy over such things as workmanship and quality control (25.6

PLUGS are hard to get at, according to Associate Auto Editor Bill Hartford, who burned a hand trying

MILEAGE FIGURES bounce around for Newport. Best open-highway mpg reported: 21. Worst: a so-so 10



CHRYSLER NEWPORT GAS MILEAGE CHART





SPARE TIRE ACCESS is not exactly a comfort or joy, says Hartford (above). "Had to climb in to get it."

percent of the owners surveyed said they left something to be desired), poor gas mileage (18.3 percent), the design and size of the ashtray (8.5 percent), wind noise (6.7 percent) and a smallish and what many owners felt was a poorly designed glove compartment (6.7 percent).

The Newport four-door sedan was purchased by 65.3 percent of the owners surveyed by *PM*. The two-door hardtop was the next most popular model (16.3 percent). The four-door hardtop was next at 14.7 percent, the wagon at 2.9 percent, and lastly the convertible at 0.8 percent.

Owners went down the line in favor of the 383-cu.-in. engine, 99.1 percent of the cars covered in the survey being so powered. Only 0.9 percent of the owners had Newports equipped with the more muscular 440-cu.-in. engine.

The same sort of lopsided percentages applied to both transmissions and carburetion. Automatic transmissions were in 98.7 percent of the cars surveyed; the remaining 1.3 percent were equipped with the three-speed manual. Carburetion was 90.8 percent two-bbl., 9.2 percent four-bbl.

A summary of the likes, dislikes, preferences and general driving and ownership experiences of Newport owners surveyed by *PM* appears on



REAR-SEAT LEG AND HEADROOM is good in Newport, owners say. Comfort ranked second in praise

the opposite page. Percentages listed reflect the frequency with which owners mentioned specific items. The summary is based on 1,207,824 miles of both local and cross-country driving during which owners averaged 14 mpg overall. (The Newport got 15.980 mpg at this year's Union/Pure Oil Performance Trials. See Page 10. Also, see gas mileage chart on preceding page.)

Comments pertaining to Newport owner cheers and boos are listed below, again in order of frequency mentioned. The boldface asides are mine.

As mentioned earlier, leading the cheers are praises for the Newport's handling qualities.

"Handles well for both city and open highway driving."—Virginia teacher.

"Hugs the road good, especially on corners."—Vermont factory worker.

"Doesn't fight with curbs on a narrow street."—Iowa farmer.

Next in volume were cheers for the Newport's comfort.

"Most comfortable car I've ever ridden in, including higher-priced Cadillacs and Lincolns."—Alabama used-car dealer.

"As comfortable as your favorite chair."—Indiana farmer.

"For a medium-priced car, the Newport is outstanding for driving comfort."—Iowa dairyman.

"Passengers voluntarily commented favorably in comparing the comfort of our Newport with their own cars of other makes."—Alabama supervisor.

Newport owners also seem to like the way the car rides.

"Smooth riding over rough roads."—Nevada nurse.

"Nicest riding car of any I've ever owned or ridden in."—North Dakota farmer.

"Just returned from a skiing trip to Wisconsin with three of my co-workers and their comments regarding the car's ride were extremely favorable."—Minnesota salesman.

Next on the praise list are kudos favoring the Newport's styling.

"Best looking car of all the '67s."—New Mexico warehouseman.

► A statement sure to get an argument started anytime.

"Bumpers are heavy and extend up enough to prevent many minor dents."—Delaware chemical engineer.

"A fine car to look at."—Vermont salesman.

Many owners had kind words for the Newport's economy, particularly the fact that regular grade gasoline will do just fine. Typical of such comments is

this one from a Kentucky school superintendent:

"We find it economical to operate. On regular gas, too."

"Mileage is good for a big car."—Oklahoma oil field worker.

"Get good mileage for the size of the car."—West Virginia clergyman.

► He's averaging 16 mpg.

Switching to owner dislikes, a somewhat startling 25.6 percent had unkind thoughts regarding what they deemed poor workmanship and/or quality control. I use the word "startling" because I know Chrysler, along with all the other manufacturers, has going a crash program on quality control. It figures that in any mass-produced item there are bound to be slip-ups, but 25.6 percent seems to indicate the program is a bit less than completely effective. Consider this pointed opinion expressed by a Virginia executive:

"Factory assembly practices have to be the poorest I've ever seen."

"Seems a shame to build such a nice car and then not finish it properly."—Alabama farmer.

"One headlight wasn't plugged in and

(Please turn to page 210)

Summary of Chrysler Newport Owners Reports*

Total miles driven	1,207,824	Had any mechanical trouble?		Newport your only car?	
Average mpg	14.0	No	50.8	Yes	41.1
Specific likes:		Yes	49.2	No (own two)	50.8
Handling	52.7%	What kind of trouble?		No (own three or more)	8.1
Comfort	44.1	Carburetor	20.0	Other cars owned?	
Ride	39.2	Brakes	15.0	Chevrolet	16.7
Style	33.8	Electrical system	13.3	Plymouth	13.2
Economy	31.1	Door locks	7.5	Ford	11.8
Performance	15.3	Heater	6.7	Rambler	9.7
Power	13.5	Air vent control	6.7	Dodge	6.9
Visibility	10.4	Leaks	6.7	Bu'ck	6.9
Price/value	6.3	Steering/steering wheel	5.8	Volkswagen	6.9
Steering	5.9	Speedometer	5.8	Chevrolet pick-up	6.2
Room	5.4	Windshield washer	5.0	Chrysler	4.9
Specific dislikes:		Dealer service satisfactory?		Valiant	4.9
Poor workmanship	25.6	Yes	60.7	Ford pick-up	4.2
Poor economy	18.3	No	36.8	Pontiac	3.5
Ashtray	8.5	"Partly"	2.5	Oldsmobile	3.5
Wind noise	6.7	Why the Newport?		Buy another Newport?	
Glove compartment	6.7	Past experience	36.3	Yes	93.4
Dealer service	4.9	Price/value/trade-in	25.3	No	6.1
Paint job/finish	4.9	Style	21.1	Maybe	.5
Door fit	4.3	Recommendation/dealer reputation	16.5	Got front disc brakes?	
Water leaks	3.7	Economy	7.6	No	68.6
Carburetor	3.7	Dealer service/attitude	6.8	Yes	31.4
Engine noise	3.0	Size	6.3	Age distribution of owners:	
Rear visibility	3.0	Ride	5.9	20-24	14.7
Road noise	3.0	Weight	5.1	35-54	51.8
2-ply tires	3.0			55 and over	33.4

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



NASCAR OBSERVER'S FLAG goes up to indicate that test car is about to run out of premeasured gallon of gas

What the Pure Oil Tests Prove About Performance

The 1967 Performance Trials show that there's more to impartial tests of American cars than meets the eye

By **BILL KILPATRICK**, PM Auto Editor

EXACTLY ONE GALLON of gas is carefully poured into test "tank" before each car starts off grid. Gas is fed directly to fuel pump via see-through fuel line



THE PUBLIC IS INVITED FREE, but I couldn't count 10 people in the Daytona Speedway stands at any time during the three days I was there. The show—the annual Pure (now Union Pure) Oil Performance Trials—isn't exactly hot ticket. A newsman I know borrowed a half-remembered sports-page line and said that watching the trials is "like watching the grass grow."

He was right; with the exception of the occasionally wild and woolly braking tests, the trials are pretty dull. Once a spectator figures out what's go-

POPULAR MECHANICS

ing on and appreciates the theory and practice of the actual tests for economy, acceleration and braking, things settle down to a ho-hum routine. Yet this doesn't detract from the validity and importance of what the trials prove.

Yawns aside, they show clearly and impartially *what* cars in specific size and power classes—given skilled preparation, in most cases by factory teams—get the best mileage per gallon of gas, have the best passing scoot, and stop in the shortest distance when their prewarmed brakes are slammed on. The value of the trials' results to the average new-car buyer, however, can be a bit elusive.

To be declared an overall class winner, a given car need not earn the maximum possible points (ten for first, nine for second, eight for third, and so on) in each of the three tests. In Class VIII (Sport Intermediates), for example, an Oldsmobile 4-4-2 won by finishing third in the economy test (18.552 mpg, good for eight points), second in the acceleration test (from 25 mph to 70 in 5.760 seconds, good for nine points), and *ninth* in the braking test (234 feet to come to a complete stop from 65 mph, good for only two points). Thus the 4-4-2 won with a total of 19 points.

But does this mean it's the best all-round sporty intermediate you can buy? I guess the answer depends upon what you want in a car.

In this same class, a Chevelle 396 got the best mileage (18.790 mpg), a Ford Fairlane GT was quickest from 25 mph to 70 (5.585 seconds), and a Plymouth GTX had the best brakes (183.4 feet to stop from 65 mph). On a cumulative point basis, three cars—a Buick GS 400, the Chevelle 396, and a Dodge R/T—shared second place, each with a total of 16 points. To a potential buyer, any one of these cars might be preferable to the class-winning Olds 4-4-2, and for any one of several reasons.

The Dodge R/T, for example, had the poorest economy (14.144 mpg),

but it scored third in acceleration (5.895 seconds) and third in braking (192.4 feet). On the other hand, the GS 400 proved a comparative dog on acceleration (6.775 seconds, earning the car no points at all), but it stopped in 187.4 feet (good for nine second-place points) and got a fairly decent 18.406 mpg (fourth place, seven points).

The same sort of potential buyer confusion can stem from trials results in Class IV (Standard Eights). The class was won by a Ford Custom that earned ten first-place points for economy (20.125 mpg), ten first-place points for acceleration (12.030 seconds), and nine second-place points for braking (1177 feet). Yet this class in the trials included (along with a Chevrolet Biscayne and an Ambassador DPL) a heavier Chevy Impala, Ford Galaxie, and Plymouth Fury III—cars that account for about 40 percent of sales in the U. S. market. Do the results mean that the Ford Custom is the best standard eight you can buy? Again, it depends upon what you want.

The Impala, for example, a big gun in Chevy's perennial claim to industry sales leadership, earned seven fourth-place points in the economy test (17.217 mpg) and the same number of points in the acceleration test (12.870 seconds). But the car walked off with class braking honors by stopping from 65 mph in 166.8 feet.

CHILLED GAS, both regular and high test, depending upon carmaker's specs, is used in the economy runs. Gas is iced to equal underground tank temperature





FIFTH-WHEEL-EQUIPPED OFFICIAL CAR carefully checks all distances covered by test cars. Wheels, calibrated each day, are accurate to one-tenth foot

Take the Galaxie. It earned eight third-place points with 18.271 mpg, six fifth-place points with an acceleration time of 13.595 seconds, and eight points again by stopping in 179.1 feet. The Fury III, entered by an independent (not the factory), got 16 mpg and six fifth-place points, nine second-place points for accelerating from 25 to 70 mph in 12.270 seconds and five sixth-place points for stopping from 65 mph in 233.7 feet.

So, if, along about now, and as a potential new-car buyer, you're beginning to get the idea that the differences separating winners from losers in the various classes are somewhat

slight, you're tumbling to something else the trials prove. Although probably not on the minds of either the manufacturers, the Union Pure Oil Co., or the National Assn. for Stock Car Auto Racing (NASCAR), under whose rigid supervision the tests are conducted, the trials also reflect the fact that imagination in car design and engineering is not necessarily Detroit's long suit. Today's cars not only look alike, they perform with an almost slavish sameness.

In any size, power and price class, buyers of American cars don't have much choice, tending to prove also that in the auto market's precisely defined competitive slots, cost accountants are the industry's King Kongs.

Watching the trials and duly noting down the results periodically announced over the Speedway's public address system, I couldn't help but wish some daring automaker had designed, built and marketed a car made of, say, pressed grass and powered by a jewel-like steam engine fired by an everlasting can of Sterno. Or something *different*, anyway. As it was, the only car in the trials different from all the others in basic design and engineering was the Class I (Super Deluxe)-winning Olds Toronado with its front-wheel drive. And as an engineering concept, fwd isn't exactly a spanking new show-stopper.

NASCAR OFFICIALS supervise all phases of tests, certify the results. Tests are conducted under rigid rules



This year's trials, which ran January 14 through 18 and involved 86 models of new Detroit-built cars, were not without a dash of spice, however.

Nine of ten varying Pontiacs were disqualified after NASCAR technical inspectors—acting on complaint by a rival company—detected hanky-panky in the cars' fuel supply systems. Somehow, each of the disqualified cars was rigged to carry a smidgeon more fuel than trials rules permit. This bit of sub rosa inventiveness had enabled a Le Mans and a Tempest to win predisqualification economy "honors" in Class V (Intermediate Eights) and Class VI (Intermediate Sixes).

The Pontiacs were prepared by a young Daytona Beach car wizard named Vernon Blank, a man NASCAR's official disqualification announcement termed a "nonfactory representative." On its official trials results list, however, Union Pure did not employ the ever-present asterisk to indicate that the Pontiacs were prepared by a "professional independent."

Disqualification of the Pontiacs gives you a good idea of how impartial and on-the-up-and-up the trials are. NASCAR's rules for the event are rigidly enforced and there's an army of officials on hand to supervise things.

The trials also prove there's nothing like know-how when it comes to getting the most out of your car. If you

can set it up to perfection, and if you have the driving skills of a professional, you *might* get comparable mileage, acceleration and braking. The trials indicate a given model's *possibilities*, not necessarily the average owner's probabilities.

In addition to the classes mentioned earlier, overall winners on a cumulative point basis were:

Class II (Deluxe Eights)—Oldsmobile Delmont 88.

Class III (Medium Eights)—Oldsmobile Delmont 88.

Class V (Intermediate Eights)—Oldsmobile Cutlass Supreme.

Class VI (Intermediate Sixes)—Ford Fairlane.

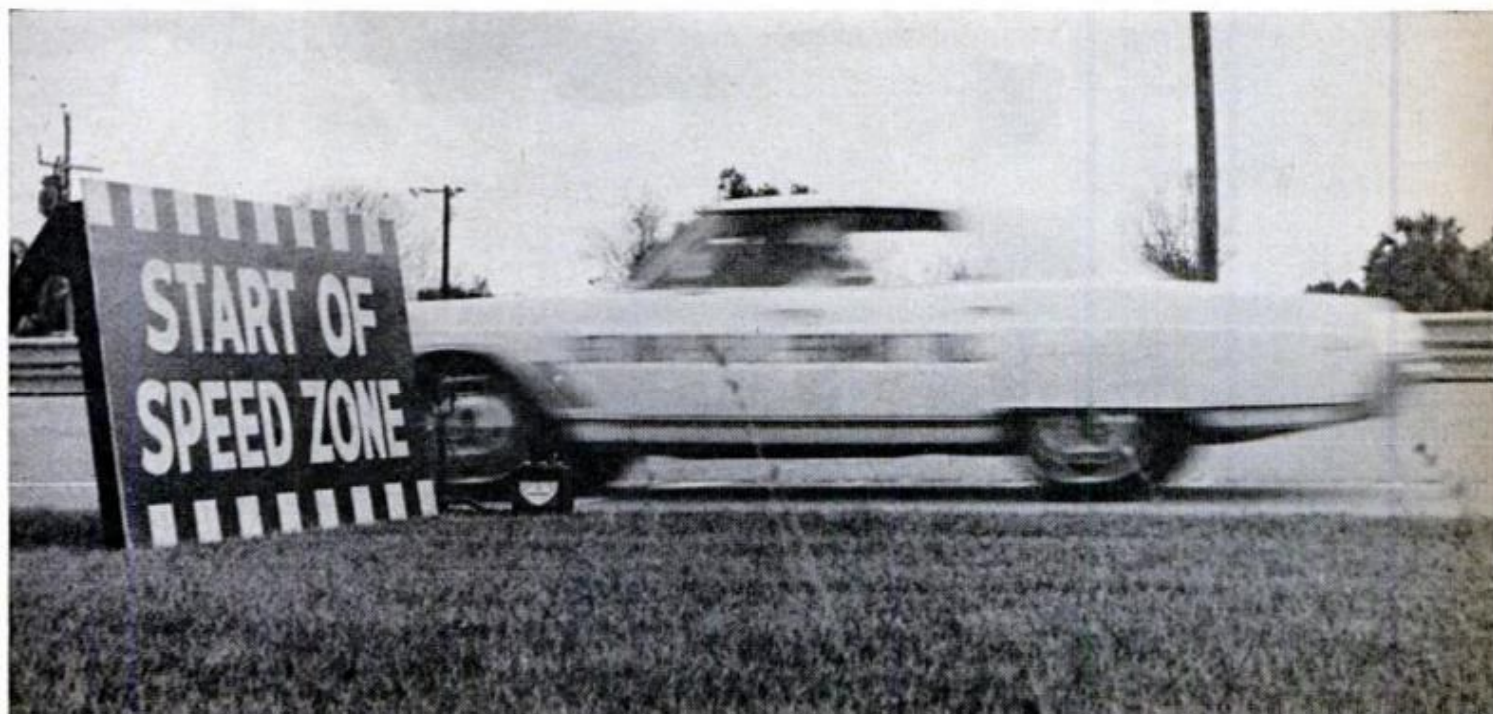
Class VII (Compact Sixes)—Rambler American 220.

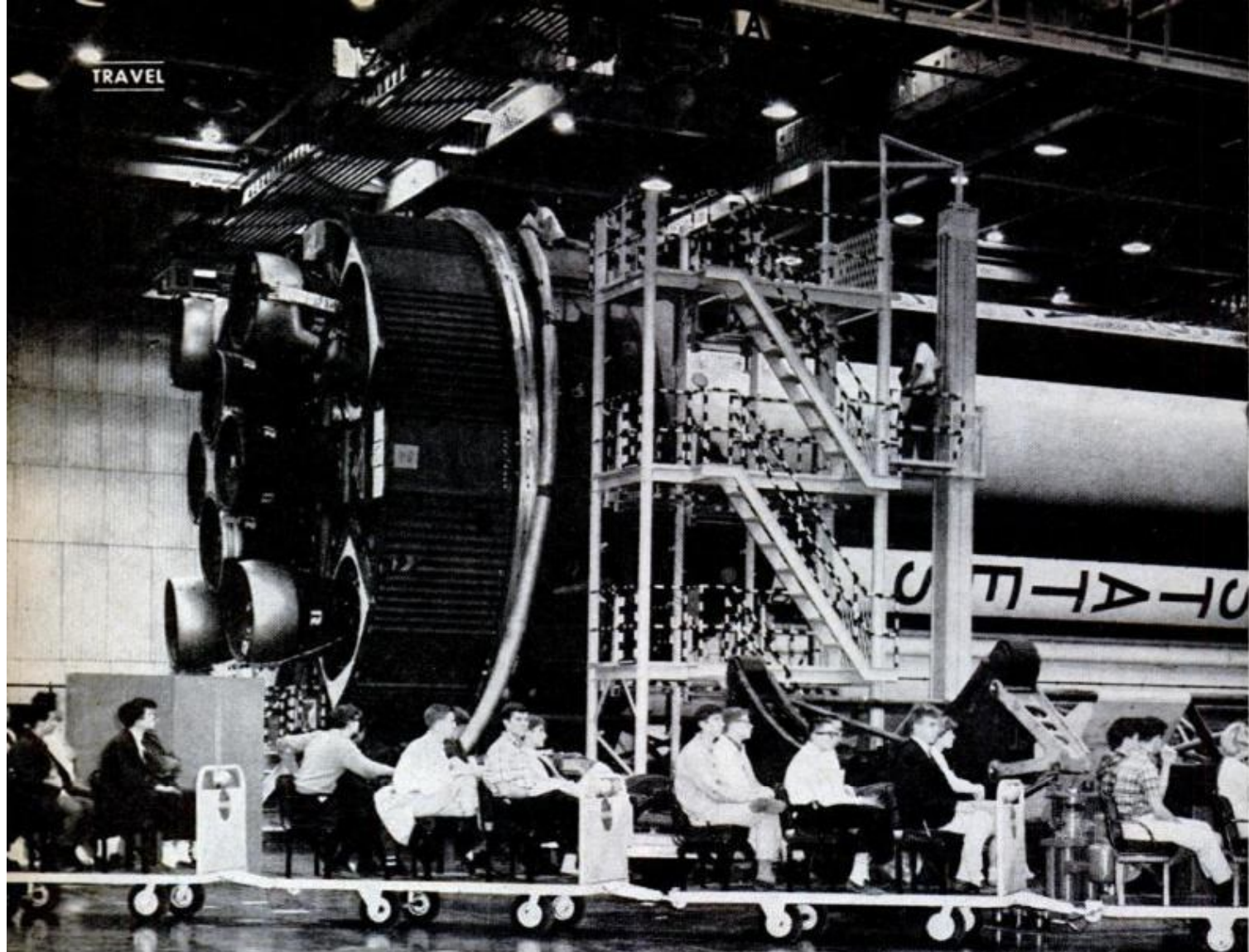
Class IX (Sport Compact)—Ford Mustang.

You'll note a preponderance of Oldsmobiles. I don't know whether or not this means anything, or if the auto-safety agitators would approve, but I noticed that before each Olds set off on its economy test, a member of the Olds team would turn the outside rear-view mirror to face the side of the car, the idea being—I guess—to cut wind resistance down to a minimum.

I would imagine this particular ploy is largely illusory, but it indicates the lengths to which the teams go to do well in the trials. ★★★

VARYING SPEEDS are called for in economy test, but cars must maintain a minimum average of 40 mph for run





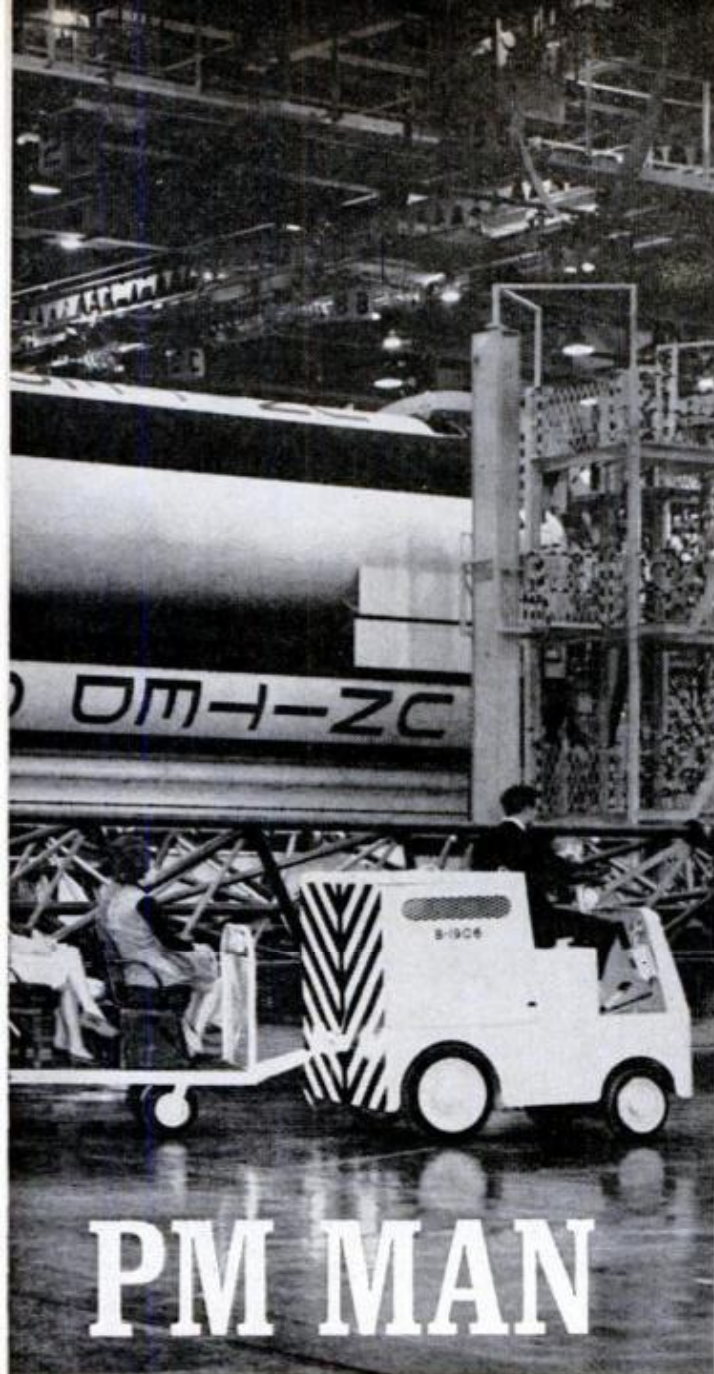
'Gee Whiz' GUIDE FOR THE

GIANT SATURN ROCKETS are built at NASA's Michoud assembly facility (above) in New Orleans, La. Visitors can tour plant on small "trains." Below, visitors start tour of Minnesota's Tower-Soudan iron mine

Photo by Minneapolis Tribune



**51 vacation
stop-offs
that will
add real
excitement
to your trip**



PM MAN



PALM SPRINGS AERIAL TRAMWAY in California offers the spectator an excellent view of the San Jacinto Mountains and the spreading valley 5873 feet below

By **RICHARD DUNLOP**

WHAT'S THERE TO SEE this summer for the vacationing man with a lively interest in guns, ships, airplanes, railroads, industries or space? Actually, the United States is a wonderland of many exciting things to see and do for the mechanically minded dad off on a family trip.

Here is a handy guide to tours and exhibits that will interest father and son, while mother and daughter take in gift shops. The guide, divided into regions for easy reference, lists some of the most interesting places to visit in each area. It does not include traditional tourist attractions, nor does it

attempt to list everything available. It is intended to hit the high spots, giving you an idea of what to look for.

Northeast

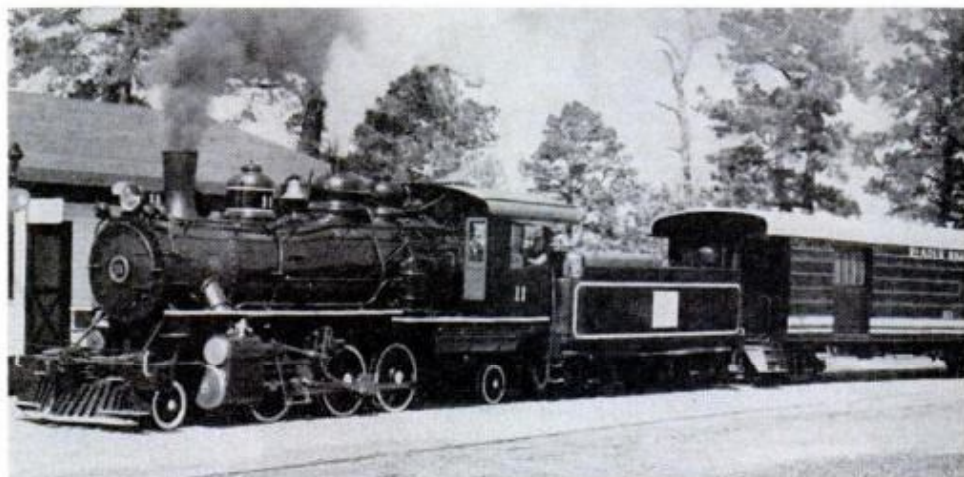
MYSTIC SEAPORT, Mystic, Conn.—Buildings, wharves and ships from the days of sail can be visited. Open 9 to 5 daily. Adults, \$2, mid-Oct. to mid-April; \$2.50, mid-April to mid-Oct.; children under 16, 50¢.

SEE SUBMARINES BY BOAT, Groton, Conn.—A 1-hour boat tour on the Thames River passing U.S. Submarine Base, Coast Guard Academy, Navy Underwater Sound Laboratory. May



Photo by Albert Fenn, Life Magazine

ASSEMBLY LINE tours (above) are available at many automobile manufacturers in Detroit, Mich. Ships crossing the highway (upper right) are always a dramatic sight along the St. Lawrence Seaway in upper New York State. The Possum Trot Line in Reader, Ark., (right) is only one of hundreds of steam-engine railroads that operate throughout the country. This particular line is actually a working railroad, carrying freight and passengers into Arkansas on a regular schedule



27-Sept. 15; daily; adults, \$2.50; children, \$1; under 4, free. Weekend tours to the U.S. Naval Submarine Base can be arranged by writing a month in advance to the Visitor Control Officer, Box 11, Groton, Conn.

SATELLITE TRACKING STATION, 3½ miles east of Andover, Me.—Huge radome covers the antenna that communicates with satellites. Reception center. Open daily 9 to 5, May through Oct. Free.

CRANE PAPER MILL, Dalton, Mass.—Tour of mill making specialty papers such as duplicating and blueprint papers. Tours start from Crane Museum; Mon. through Fri., 2 to 5 p.m., June through Sept. Free.

RUGGLES MINE, 2½ miles east of Grafton, N.H.—A tunnel leads to a historic open-pit mica mine. Open Sat. and Sun. from June 15 to July 1 and from Labor Day to Oct. 12; open daily from July 1 to Labor Day; hours 9 to 6. Adults, \$1.25; children 6 to 12, 50¢.

ARMY SIGNAL CORPS MUSEUM,

Myer Hall, Fort Monmouth, N.J.—U.S. and foreign signal equipment is shown. Mon. through Fri., 10 to 4:30. Free.

BERTRAND SNELL and Dwight Eisenhower Locks, on the St. Lawrence River Waterway at Massena, N.Y.—Visitors can watch as ships are lowered and raised. Mon. through Fri., 8 to 4:30; weekends, 8:30 to 5, from Easter to last of June; until Labor Day, 8:30 to 8:30; rest of year, Mon. through Fri., 8:30 to 4:30. Free.

CORNING GLASS CENTER, Corning, N.Y.—A 200-inch mirror disc, largest piece of glass ever cast, is in the museum. Visitors watch Steuben glass craftsmen at work. Open June, Sept. and Oct. daily 9:30 to 5; July and Aug. from 8:30; remainder of year, Tues. through Sun., 9:30 to 5. Free.

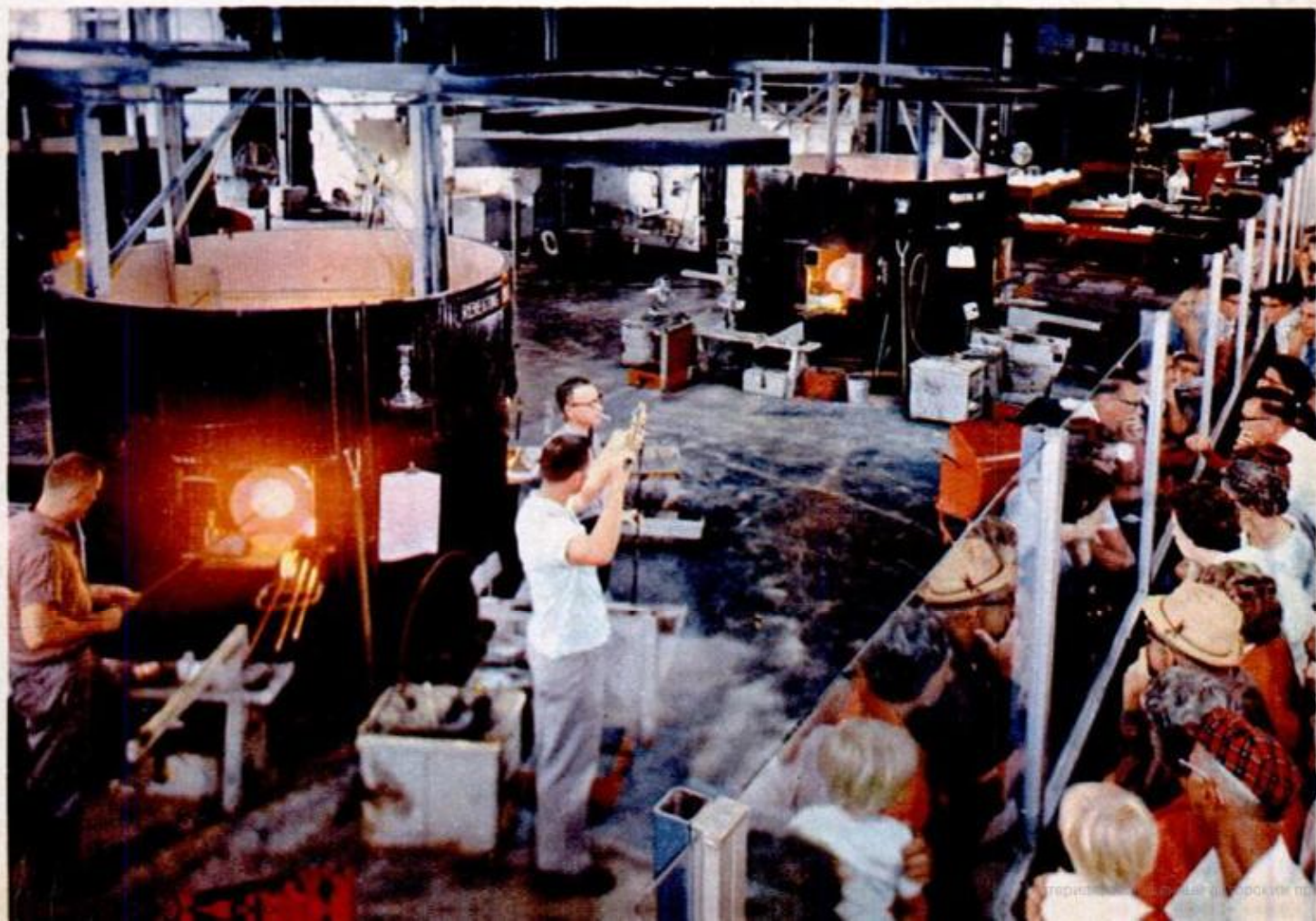
EASTMAN KODAK CO., Rochester, N.Y.—Tours of Kodak Park Works, 200 Ridge Road W. (film, paper and chemicals) and Kodak Camera Works, 400 Plymouth Avenue N. (photo-

(Please turn to page 200)



U.S.S. NORTH CAROLINA is anchored near Wilmington, Del. This mighty battleship of World War II is open to visitors. An amazing light and sound show is staged every night. Sound effects and flashing lights are used to re-enact the many battles in which the *North Carolina* participated during its war duty

GLASS BLOWING has always fascinated young and old alike. At the Corning Glass Center in Corning, N.Y., visitors can watch as master craftsmen create the delicate vessels for which Steuben Glass is famous. In the museum, visitors see one of the largest optical mirrors ever produced for an observatory





Sheep in man's clothing

When he found his sheep losing weight in winter, an English herder dressed some in jute coats and let others roam "naked." The coated sheep gained an average of 3½ pounds while the unclothed again lost weight.



Laser alert

Heart of a future auto-collision warning system will be this RCA solid-state injection laser. Invisible infrared laser signals reflected from the car ahead would indicate closing rate and set off a warning, if necessary.



Horizontal pipe

Built to telescope, a Swiss pipe with a horizontal bowl has a wire mesh to hold tobacco in place. To clean it, the smoker uses the stem to push the ashes out.



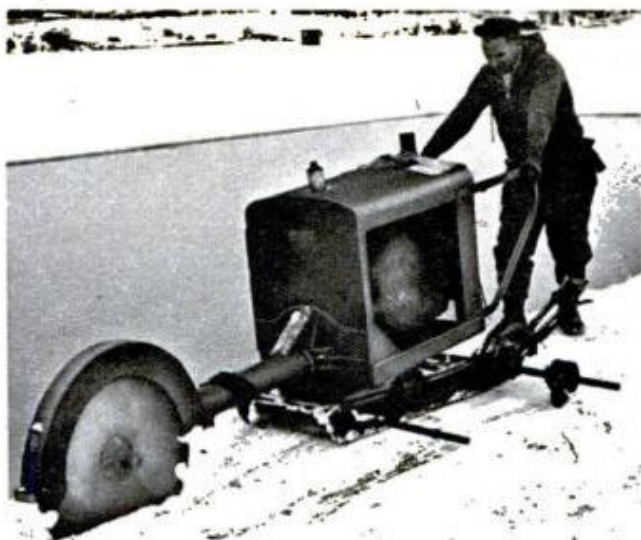
Riding high

Skilike foils lift the Hi-Foil, a small outboard motorboat, out of the water as it travels 30 mph. English-made, it is controlled by handlebars and hand-throttle.

'Rithmetic in the round

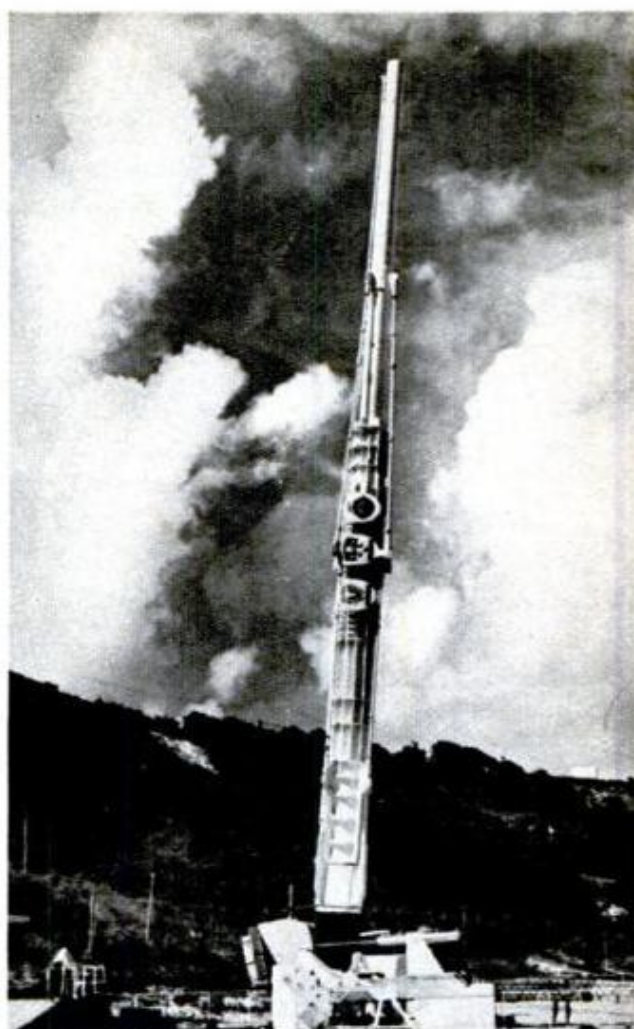
Circular outside and flexible inside, a school building in Flushing, N.Y., has no permanent interior walls. Partitions are moved about to enclose or separate different classes, according to need. About 150 pupils, from kindergarten through second grade, are taught by team-teachers in a nongraded program. The central recessed area of the building is for large group activities, while peripheral areas can be partitioned or curtained off for music, dramatics or blackboard instruction. Upstairs is a library—located over the sunken area shown in the photo at far right. The building is part of New York Public School 219 in which a great deal of experimental work and teacher training is carried on.





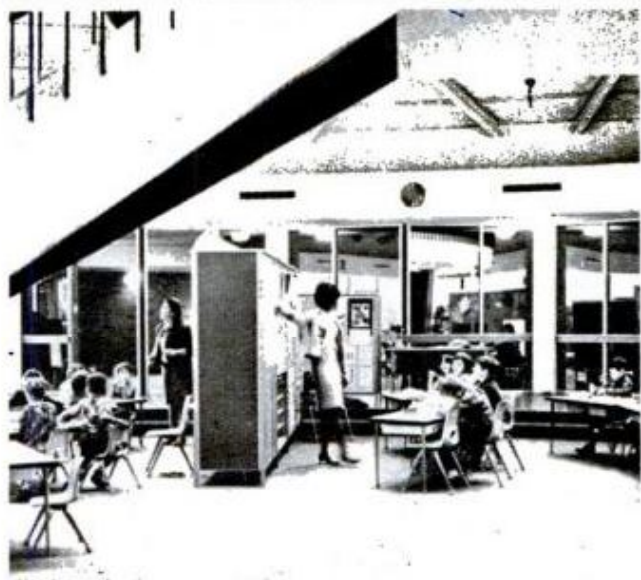
Last of the icemen

Back in the old days, the Goulette family of Iron Mountain, Mich., would cut and sell 500,000 cakes of ice a season from Lake Antoine. Now, with competition from refrigerators, it's more like 1000, but they still do it the same old way, with a home-made Rube Goldberg rotary ice saw on skids (top) and gasoline-engine-powered conveyor belt that carries the blocks to a storage building.



Long shot

Made from two surplus 16-inch naval cannons, this "launcher" will fire space bombs into the upper atmosphere for research purposes. Located on Barbados Island, the gun measures 120 feet from top to bottom and is believed to be the largest "cannon" in the world. The bombs will release luminous clouds used by physicists of the Martin Co.'s research institute to measure electric fields.

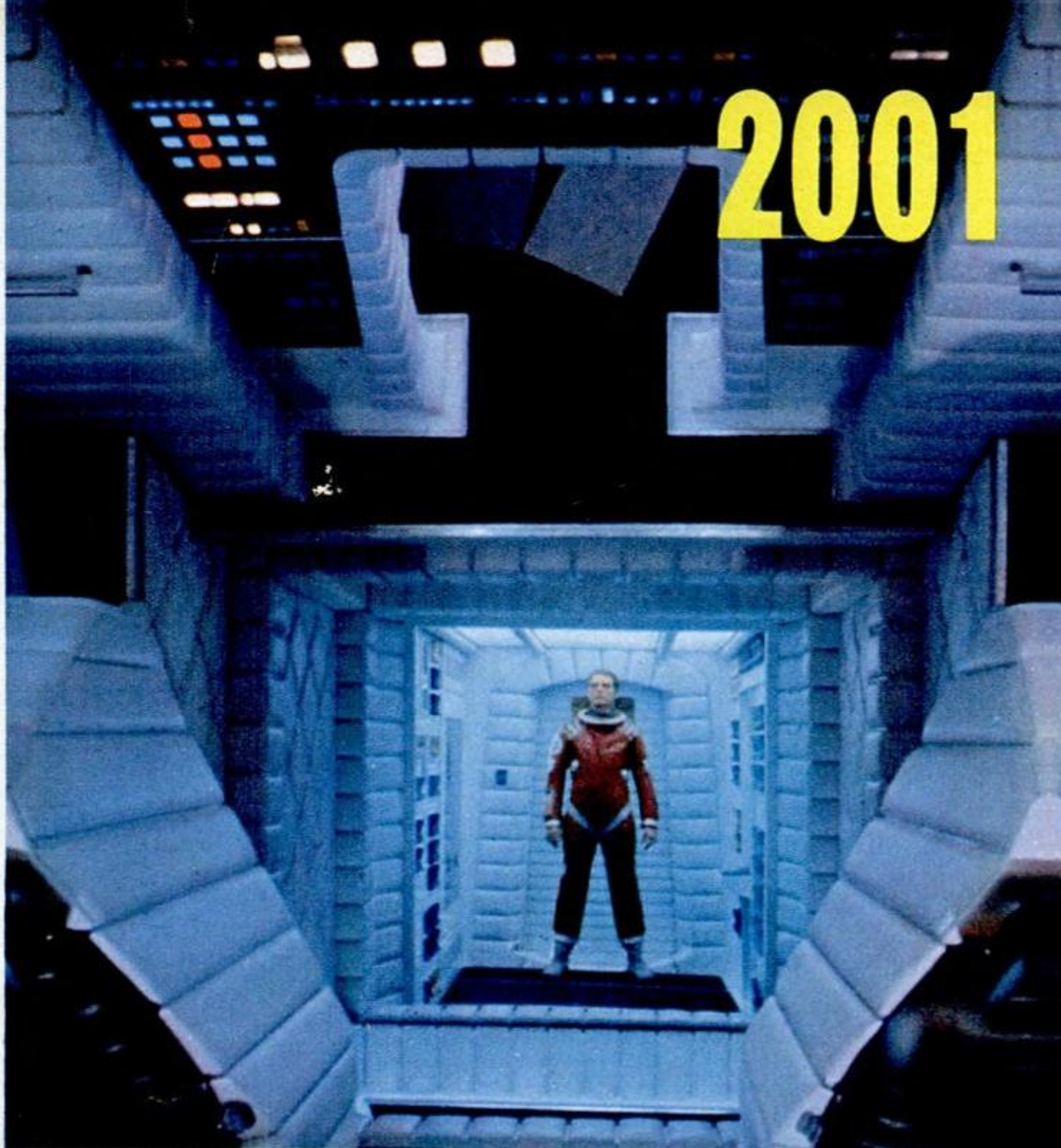


APRIL 1967



105

2001



BACKSTAGE MAGIC FOR A TRIP TO SATURN

Weightless people walk up walls and across ceilings; men and objects hover in mid-air; authentic spaceships pierce the void at cosmic speeds in a remarkable new movie. Here's how studio wizards achieved startling realism

By RICHARD F. DEMPEWOLFF

Illustrations: Howard Schafer

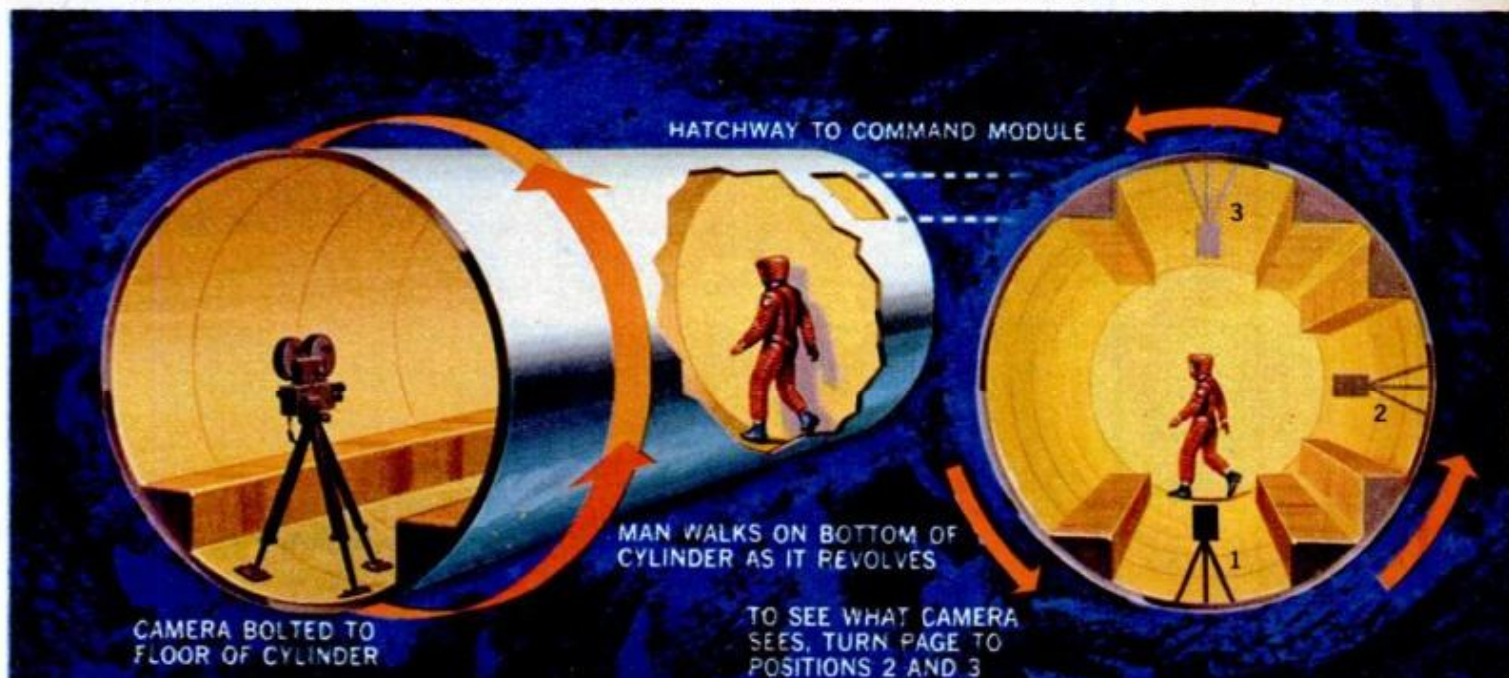
ARTHUR C. CLARKE, noted authority on outer space, picked his way carefully across the surface of the moon a few paces ahead of me. Off to our left was the crater *Tigo*.

"You're standing on the landing pad for the *Aries 1B* moon shuttle," Clarke called back over his shoulder. "Be careful not to step on any moon base buildings. They're plaster. They'll bust."

We were exploring a 30-by-30 model of the moon's landscape on top of a three-story-high scaffold in MGM's Borehamwood studios, near London.

Far below, on the floor, several full-scale spaceship command modules were under construction, bristling with instruments, buttons and multicolored lights. For months, in the sprawling complex of studios, cameras had been filming eerily lighted sequences of spectacular vehicles moving through the solar system; interiors of orbiting spaceships in which "weightless" people walk up walls and cross ceilings upside down; fantastic scenes in a pinwheeling 42-foot centrifuge inside *Discovery*—a deep space probe on its way

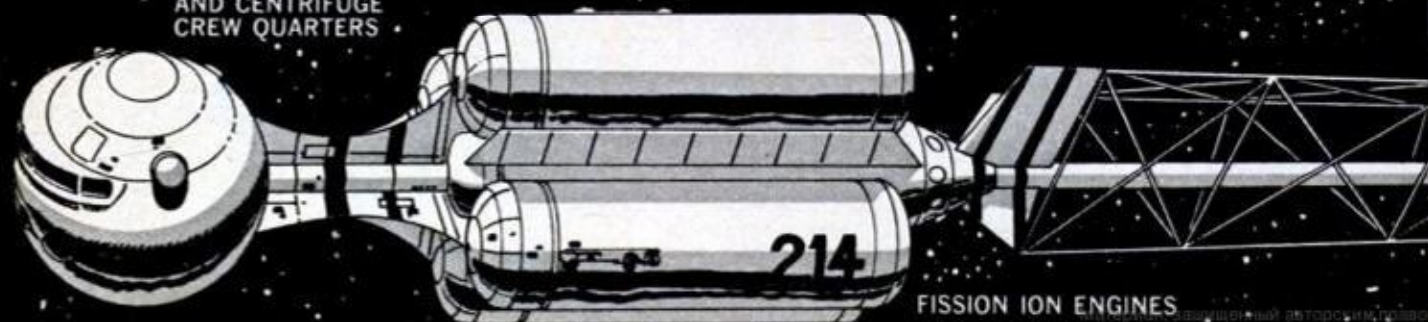
COMMAND MODULE of the Saturn vehicle (lower photo at left) provides weightless environment for volunteer one-way explorers. They approach it via weightless corridor (top left) where they walk along the ceiling, walls or floor. Rotating device (below) enabled cameras to show them walking on walls and ceiling



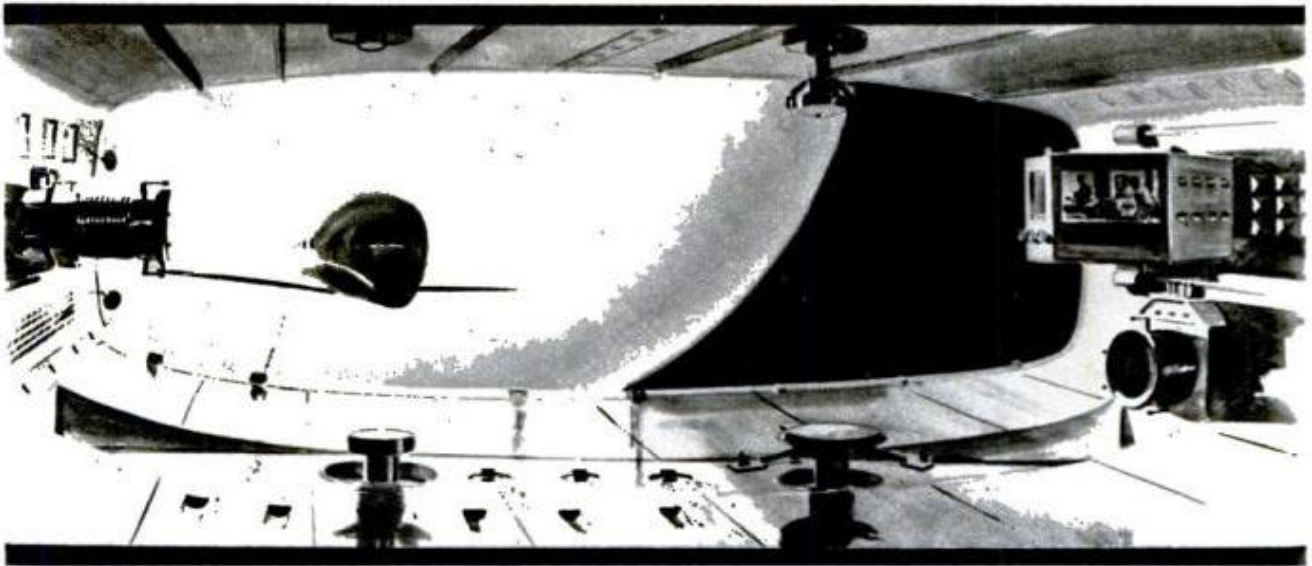


SATURN VEHICLE (below) has fission plasma engine. Crew in sphere is protected from nuclear unit (right) by 600-foot frame. Centrifuge in sphere provides gravity. To show it in action, studio built 40-foot centrifuge (above). Cables through hub allowed cameras inside to dolly ahead of actors as wheel rotated.

COMMAND MODULE
AND CENTRIFUGE
CREW QUARTERS



FISSION ION ENGINES

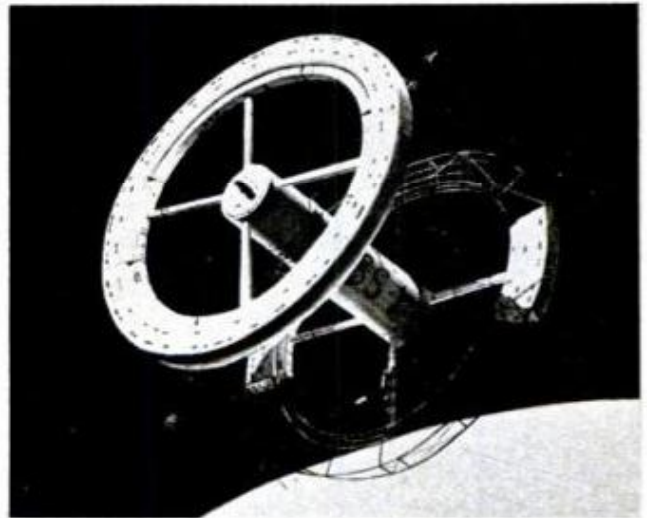


SPACE STATION (at right below) is assembled in orbit, midway between the earth and moon. It is a stepping stone to our moon base for 2001's explorers. Travelers arriving from Earth use rocket-plane shuttle, Orion, with conventional wings for earth landings. It is shown above approaching the space-station dock

to Saturn with a volunteer crew of one-way explorers.

I was witnessing the wrap-up of a gargantuan three-year effort by director Stanley Kubrick and an army of experts to produce the forthcoming adventure movie entitled *2001: A Space Odyssey*. The film story, written by Kubrick in collaboration with Clarke, a famous science fiction writer, is based on a book Clarke wrote called *The Sentinel*.

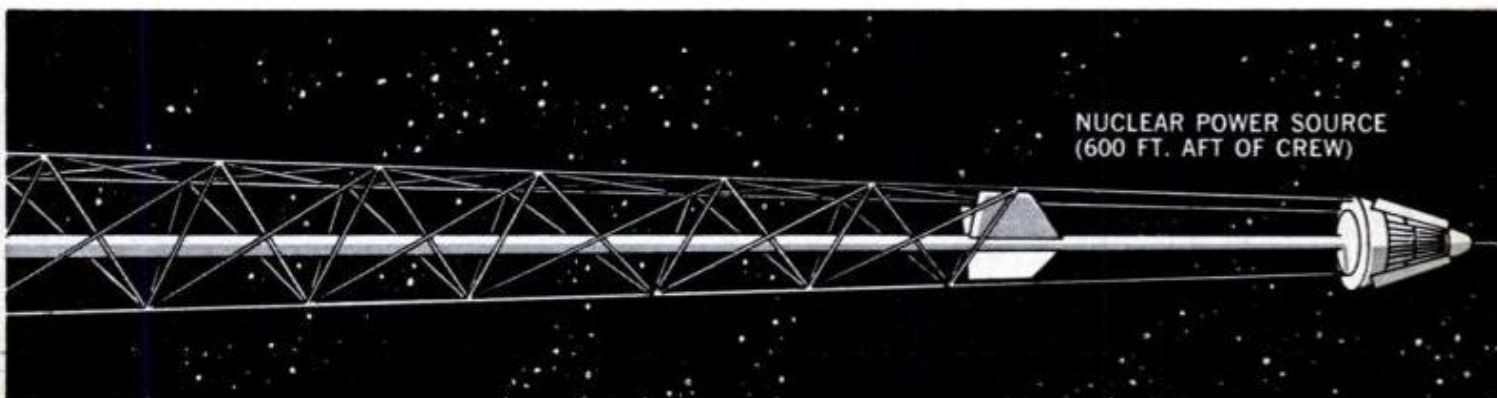
As Arthur Clarke tells it, by the year 2001 our first moon colonists have established a base of 1000 people in preparation for a manned probe of deep space. A wheel-shaped space station 600 feet in diameter, which spins to provide gravity, has been assembled in orbit 200 miles above the earth. *Orion*, a rocket-driven vehicle resembling a conventional airliner, with delta wings for earth landings, shuttles about 40 passengers at a clip between the earth and the space station. *Aries 1B*, a rock-



et-propelled bubble about 50 feet in diameter, ferries people between the space station and the moon base.

Adventure begins when moon base instruments go haywire due to a powerful magnetic field near the crater *Tigo*, during lunar night explorations. Men dig and unearth a huge black monolithic artifact, apparently put there by intelligent beings. Atomic dat-

(Please turn to page 218)





MEET PM'S HIGH-TAILER

It's rugged. It's roomy. It'll go anywhere — roads or no. It was designed for PM at Illinois Institute of Technology, and you can build it from PM's easy-to-follow plans.

TRUDGING THROUGH TRACKLESS WILDERNESS or zipping down a super highway are all part of a day's work for PM's High-Tailer.

With High-Tailer, you can take your family to places you'd always bypassed before. Until now, getting there with all the necessary equipment to stay has been impossible. But for a loaded High-Tailer, fallen trees, rocky slopes or pitted fields are not problems. Sparkling streams or clearings where deer and elk graze are all in easy reach if you're driving High-Tailer.

Camping in the most secluded spots high in the mountains or on a sea-shore are musts in this versatile adventurer. High-Tailer will get you there, let you stay as long as you want with no crowds or hotel bills. Then it will bring you back in fine style.

This snappy camper has many features, but one of the most unusual is its availability—you cannot buy High-Tailer anywhere. But if you're mechanically minded and are handy with tools, engines and a welding torch, you can build one by following the plans.

High-Tailer was designed by an expert at the Illinois Institute of Technology. E. Hubbard Yonkers of IIT's Institute of Design came up with an idea for a rugged vehicle that could be built by an average mechanic anywhere in the

world and could also be used in the most primitive of underdeveloped areas. Incorporating some *PM* suggestions, Yonkers designed and built a vehicle that *PM* readers can assemble and drive.

He started with four basic ideas: 1. A driver should be able to take High-Tailer just about anywhere. 2. Not only should High-Tailer be able to travel over tough terrain, but it should do so with heavier loads than could be carried in a four-wheel-drive vehicle. 3. High-Tailer must be easy to build. 4. Materials and units such as the engine, transmission, front and rear ends should be available commercially on the open market. It took Yonkers two years to design and finally build High-Tailer. But when it left the shop, it was exactly what he wanted.

PM editors took High-Tailer on test drives. It performed beautifully: smooth as a sedan on highways—rugged as a mountain goat in high country. High-Tailer waded streams with no problem and jogged across fields like a pony.

The big 9.50 x 14 tires raise the chassis enough to clear brush and small boulders. A spacious canvas-covered cargo area can carry enough equipment for a month's stay in the woods. Fold-down sides provide enough room to sleep a family of five comfortably without worrying about rain or dew.

Fine for sportsmen and farmers, too

But High-Tailer is not restricted to family camping, alone. It can be used by fishermen or hunters looking for those "virgin" areas where wildlife has never seen sportsmen. High-Tailer can take you to big beaver ponds, so isolated that yearling trout aren't wary of fish lures—or to hidden hunting grounds.

But this isn't all that High-Tailer can do. It can be an amazing workhorse for farmers or ranchers. Its rugged construction and large cargo space make High-Tailer a natural for carrying seed or equipment around the farm. Ranchers will find it very useful for carrying heavy loads over miles of range. High-Tailer will do all this and still take the family camping, summers.

Three features make High-Tailer a perfect all-purpose vehicle: 1. the unique tubular frame that swivels, giving High-Tailer the action only found in independent-wheel suspensions; 2. the recommended Corvair rear engine that means better traction when needed in rugged country; 3. body styling. Depending on your needs, you can have any type of body—flatbed, stake bed, box bed, rugged transport—even the body of a telescoping camper.

Only a few minor changes are necessary in using the front and rear assemblies of a Corvair 95 truck. Downgearing of the rear end adds power for hard climbing or for engine-braking when nosing down steep grades, or taking humps and ditches.

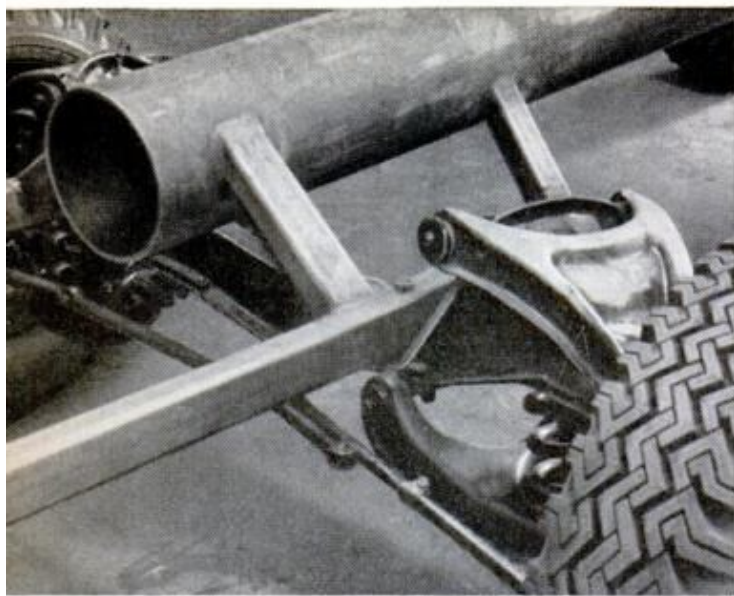
Here is a brief rundown on how the unique chassis of High-Tailer is constructed:



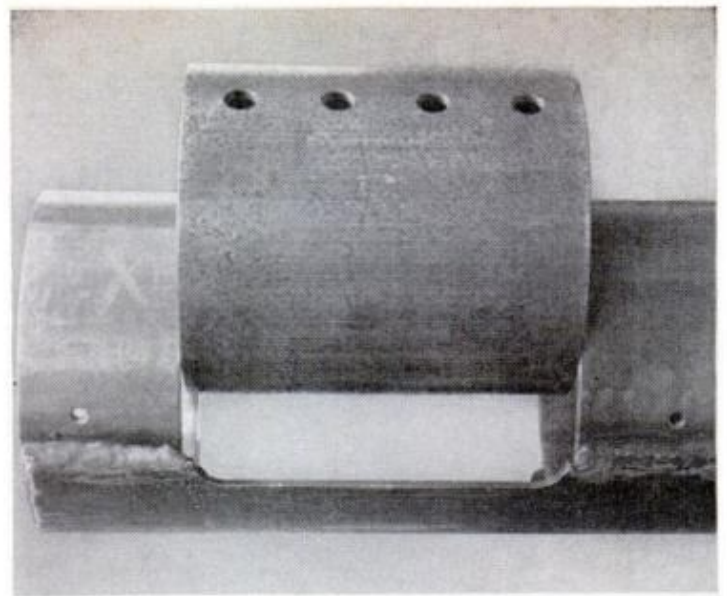
FLAT TRUCK BED makes bedding down no problem for the whole family when camping out. Side and end flaps button down things snug as a bug in a rug



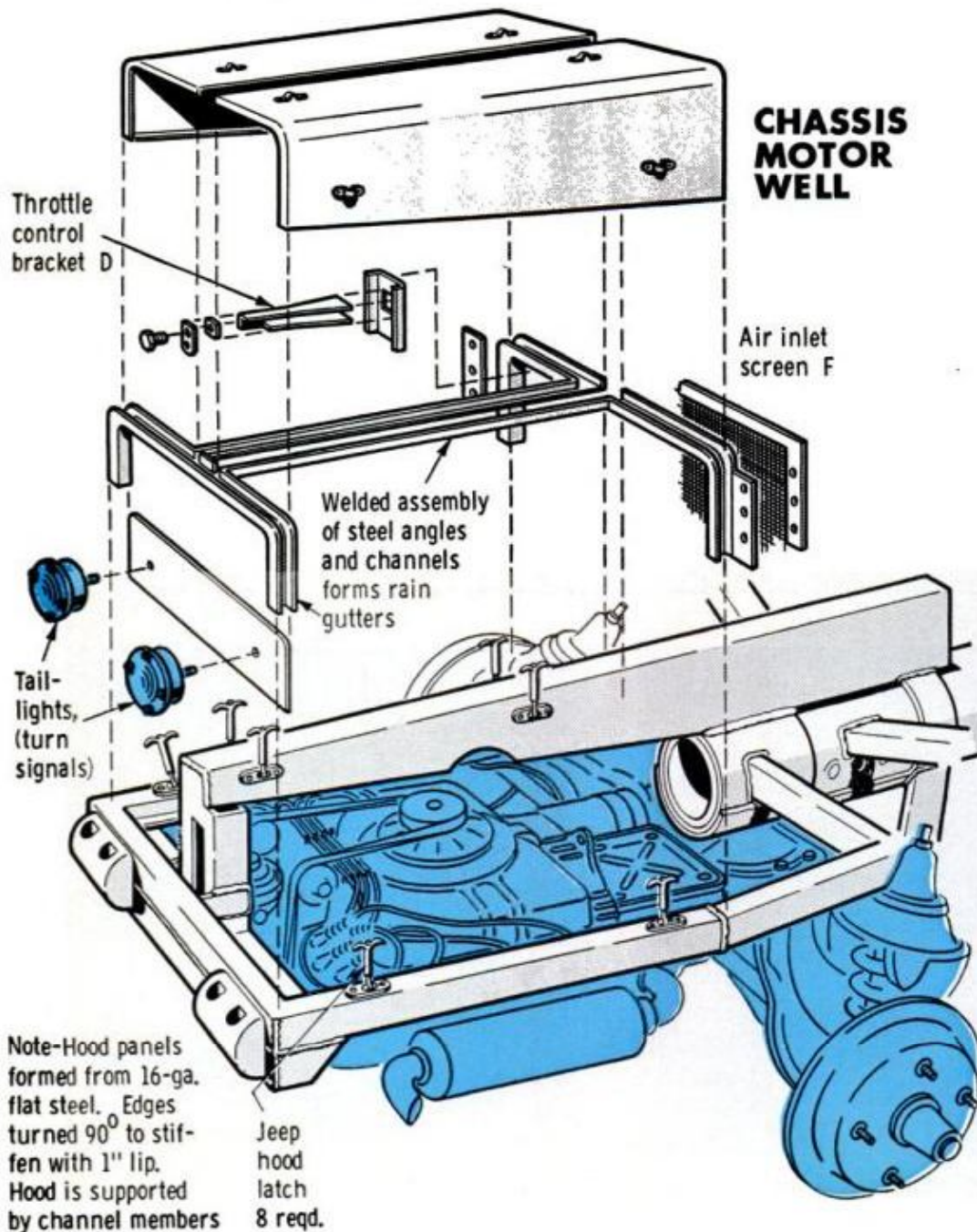
WHEN IT'S TIME FOR CHOW, raised side flap lets truck bed serve as convenient counter for help-yourself serving, also place for stove and foodstuffs



WELDED STRUTS are used to attach the front-wheel assembly and the cockpit framing to forward end of the chassis tube. Strong welds are important here



ARTICULATING JOINT prior to slipping over the tubular chassis member. It consists of three rings; two outer ones swivel, center one bolts to the tube



The main element of the chassis frame is a steel tube 8 ft. 8 in. long. At its rear is a swiveling fitment with three telescoping rings, one fixed and the others free to rotate. The latter are welded to a 120° segment so that they will slip-fit over the rear of the tube. The fixed section slides over the tube and is clamped in position.

The chassis tube is supported on four struts at both front and rear ends, and the bed supports are carried on two struts at each end. To take lateral and vertical stresses, plus downthrust of the load, the rear tube-supporting struts are at opposing angles with their upper ends welded to free members of the rotating fitment. Lower ends of the bed-supporting struts are welded to the fixed member of the assembly. The tube's forward end is held by

struts whose lower ends are welded to long horizontal members of the cockpit sub-frame. The latter members are bolted to the front-axle mounting pad. After the assembly is completed, an additional member is welded in to form a bracket.

The four struts supporting the chassis tube at the rear have their outer ends joined to inner and outer mounting pads on the rear axle, after substitution of a short length of steel tubing for the original dampeners.

To locate the chassis tube for placement of the struts, the axles are set on suitable supports, squared and leveled, one with the other. Once the parts are located, they are blocked temporarily to prevent shifting—especially the axles. Dimensions for many of these parts are given on the plans

WIDE PANORAMIC WINDSHIELD fitted with twin wipers provides driver and passenger full unobstructed view



only as close approximations, since the struts must be hand-fitted.

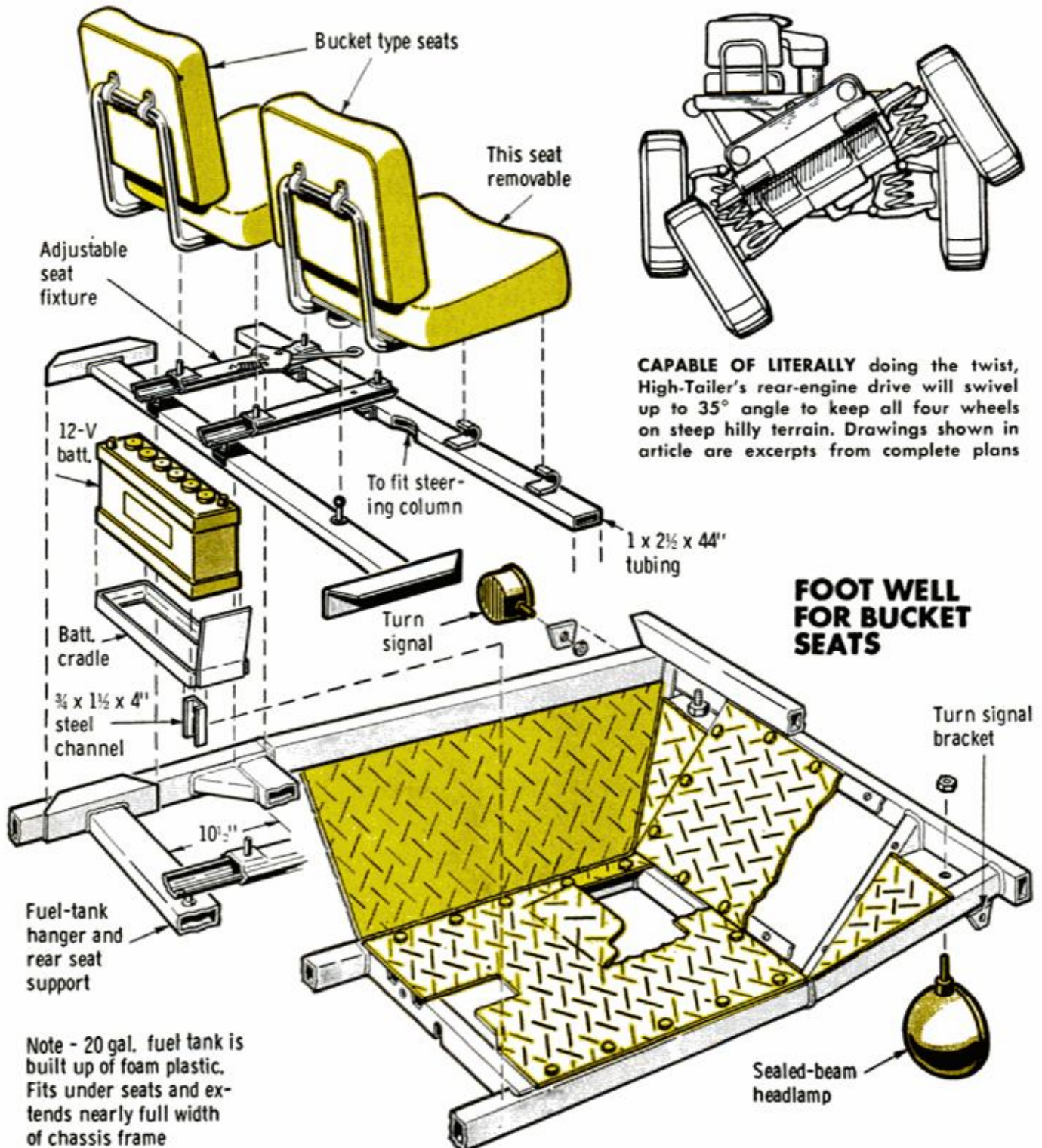
The Corvair 95 steering gear, original idlers, connecting and relay rods and the tie rods are also used with but slight modification. The steering column, a steel tube, is fitted into a slot cut in the end of the tubular chassis frame. The gear housing is held by two brackets welded to the end of the chassis tube. One of these brackets also supports the gearshift lever assembly, which extends along the chassis tube to the transmission input shaft.

One of the major construction steps is

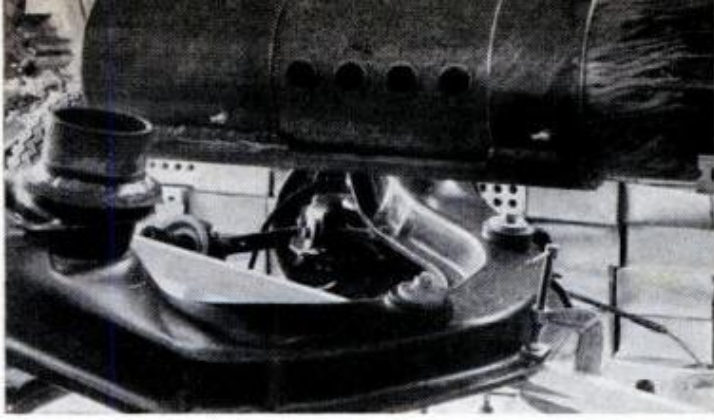
making parts for and assembling an offset steering arm, which consists of a single yoke fixed to the steering column and a double yoke which slides on the former to permit timing chain adjustment.

Plans available

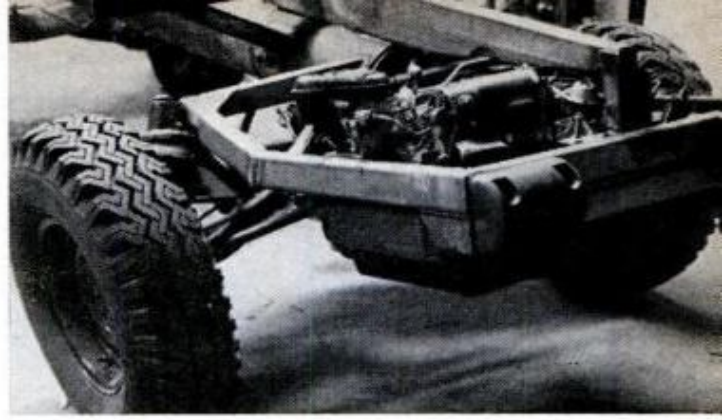
The drawings presented are mere excerpts from a complete set of detailed plans available. To obtain them, mail a check or money order for \$1.50 to Popular Mechanics Bureau of Information, 575 Lexington Ave., New York, N.Y. 10022. Please allow three weeks for delivery. ★★ ★



Note - 20 gal. fuel tank is built up of foam plastic. Fits under seats and extends nearly full width of chassis frame



TUBE IS PERCHED over rear-wheel assembly for preliminary fitting of the supporting struts which will later be welded to rotating fitment of the tube

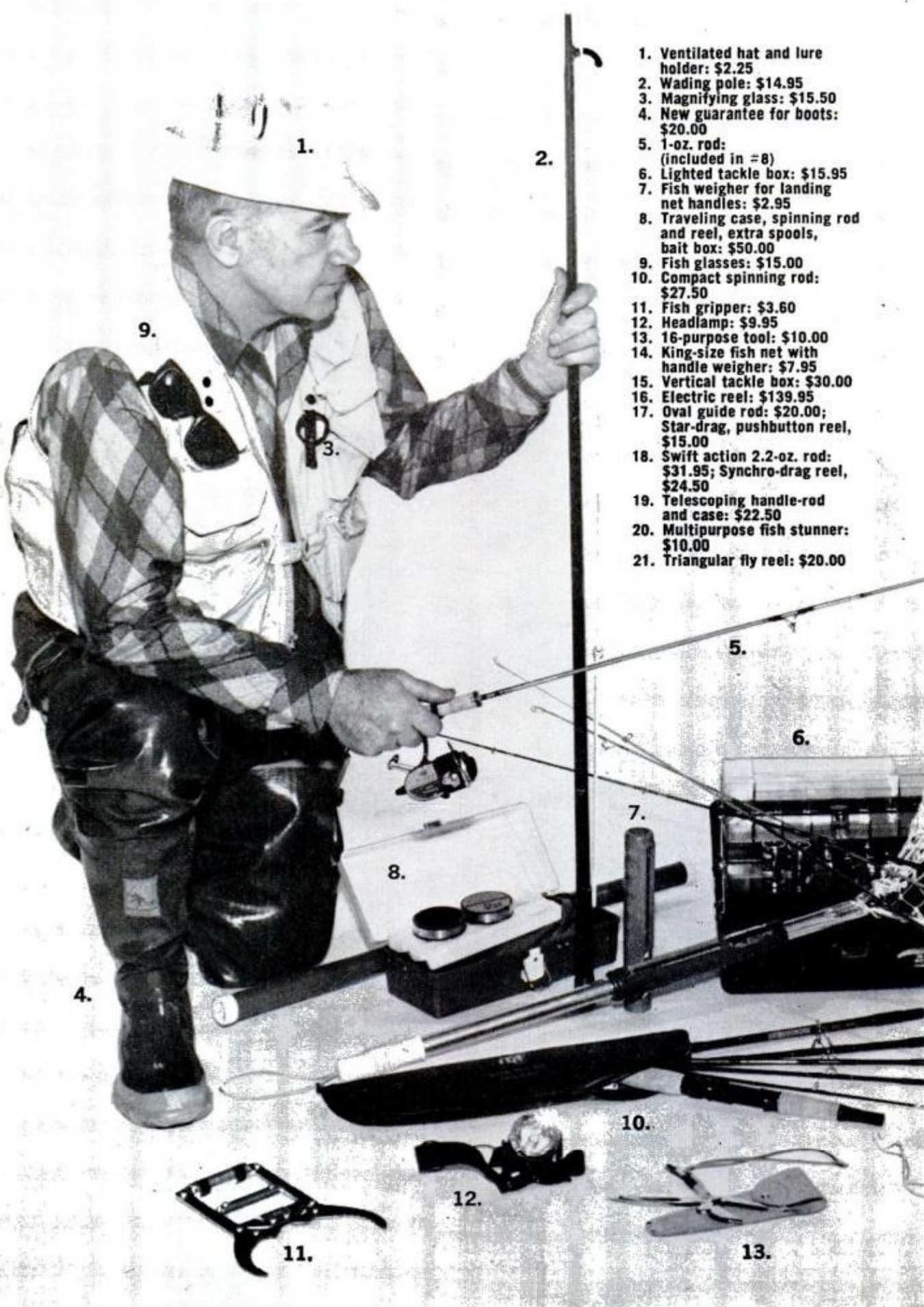


BED-SUPPORT STRUTS are welded to the fixed fitment that's bolted to the tubular chassis member. Additional support members also extend over engine well



WITH BACK CURTAIN ROLLED UP, there's no blind spot to rear. Note, too, how chassis twists with terrain

New Fishing Extras



1. Ventilated hat and lure holder: \$2.25
2. Wading pole: \$14.95
3. Magnifying glass: \$15.50
4. New guarantee for boots: \$20.00
5. 1-oz. rod: (included in #8)
6. Lighted tackle box: \$15.95
7. Fish weigher for landing net handles: \$2.95
8. Traveling case, spinning rod and reel, extra spools, bait box: \$50.00
9. Fish glasses: \$15.00
10. Compact spinning rod: \$27.50
11. Fish gripper: \$3.60
12. Headlamp: \$9.95
13. 16-purpose tool: \$10.00
14. King-size fish net with handle weigher: \$7.95
15. Vertical tackle box: \$30.00
16. Electric reel: \$139.95
17. Oval guide rod: \$20.00; Star-drag, pushbutton reel, \$15.00
18. Swift action 2.2-oz. rod: \$31.95; Synchro-drag reel, \$24.50
19. Telescoping handle-rod and case: \$22.50
20. Multipurpose fish stunner: \$10.00
21. Triangular fly reel: \$20.00

**Today's fishing equipment is light, compact, easy to use.
Now the angler can have everything from electric gear to 1-ounce rods**

By **DANIEL C. FALES**
PM's Outdoor Editor

HAVE YOU EVER FOUND that perfect fishing spot, but had no tackle? Or have you ever been hip deep in a trout stream wishing for a steadying pole?

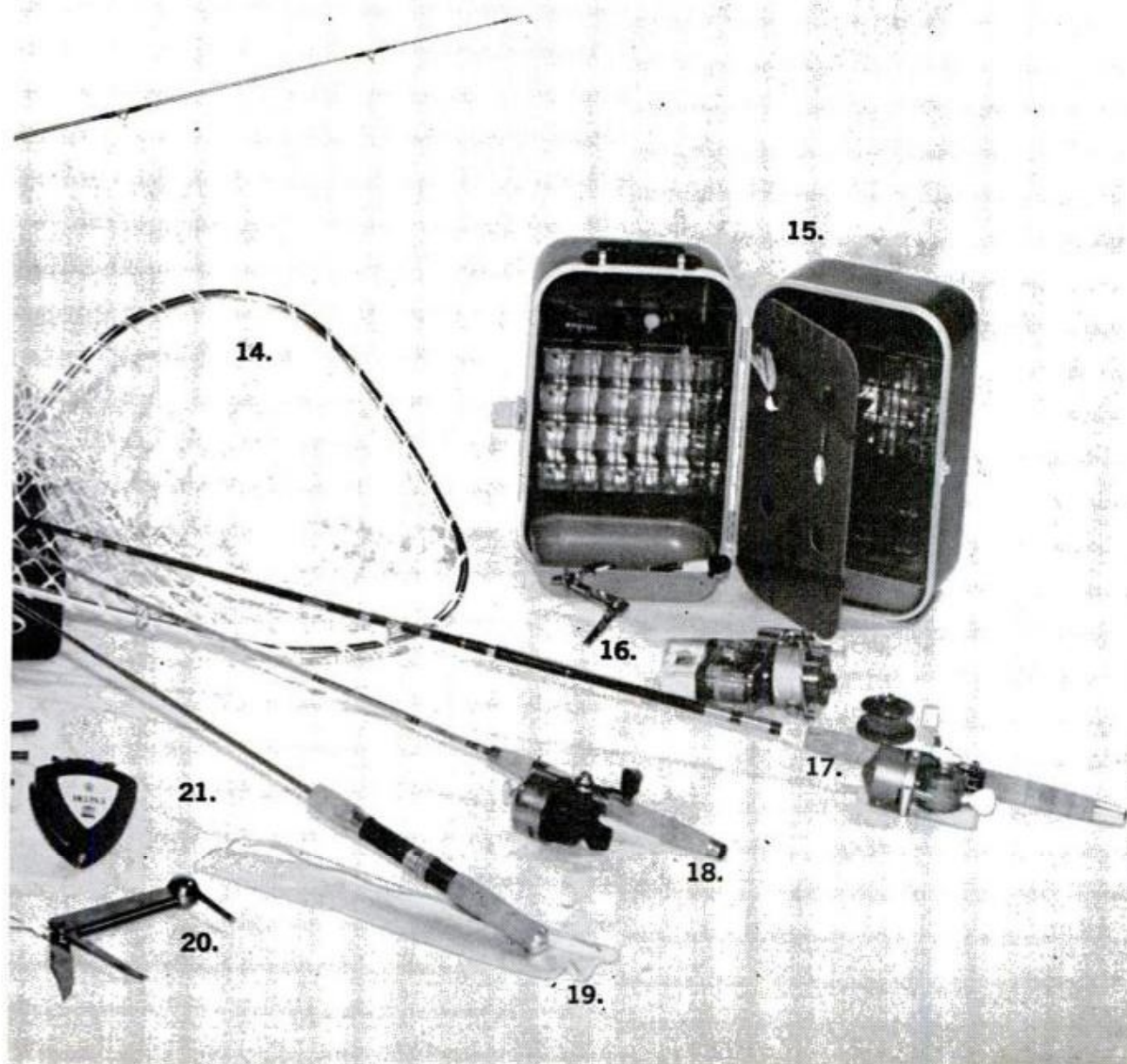
Well, I have and I'll bet you have, too. But things are changing.

Today it's no longer necessary to be caught "tackleless" or to be without the right equipment for the job.

Now you can have a fishing rod, reel and lures so compact that they will fit into any traveler's suitcase. Or you can have a single tool that can do 16 different jobs.

These are extras in the fishing-tackle line. They're really not what you would call basic gear needed to catch fish. But all are well worth their weight in diamonds when you need them.

Here's a roundup of 21 items that are useful, compact, light in weight or just plain interesting. Most are available at your local tackle shop. Some are produced only for Abercrombie & Fitch Company, which has main stores in New York, Chicago and San Francisco. If you're not near an A & F store, you can order from the company at 360 Madison



Ave., New York. The following numerals refer to the photo on the preceding pages.

1. Fishing Hat. I carry my most popular lures in my hat. They're easy to reach and don't tangle. Utica Duxbak makes this hat, ventilated for head comfort. The open-mesh section is also a natural for holding small-hook lures.

2. Wading Pole. Browning's wading pole is great for probing a stream to locate a hidden hole—before you step in it—freeing snagged lures from trees and steadying yourself in a fast stream.

3. For Eyeglass Wearers. If you don't like to wear your glasses while fishing but need to see knots or flies, there is now a "pin-on" magnifying glass. Just snap the lens down and peer through the glass. (Detail photo on next page.)

4. Guaranteed Boots. Today's waders are guaranteed against *normal hazards*. That's right, B. F. Goodrich promises that if you use their Litentuf boots in sporting activity *for which they were designed*, they'll repair or replace them if damaged by cuts, rips or tears.

5. Light Traveling-Tackle. A & F's "Banty" lightweight tackle includes a 1-ounce spinning rod and compact reel.

6. Lighted Tackle Box. It's just the thing for finding lures at night. This Old-Pal box runs on two batteries.

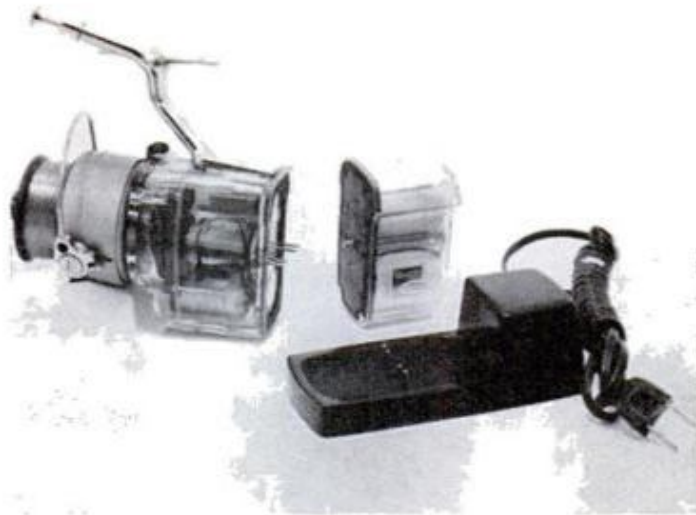
7. New Scale Kit. If your fishing net handle has a 1-inch diameter, you can get a scale from Way-King that will attach to your present net. Way-King is made by Ernco Enterprises, 315 Eighth Ave. South, South St. Paul, Minn.

8. Lure Box and rod holder for item 5.

9. Fish Glasses. If you want to see what you're *not* catching, use polarized fish glasses. These, made by Renauld, filter out light reflected off the water so you can see below.

10. Six-Section Rod. Another handy rod for storing in a suitcase is A & F's "Safari" pack. This 7-foot spin-casting rod fits into an 18-inch case.

11. Fish-Gripper. By squeezing the handle of this Han-D-Gaf, tongs clamp fish, holding him firmly. Made by O. A. Norlund Co., Lewistown, Pa.



ELECTRIC REEL breaks down into reel unit and power pack. Grip button runs reel. Pack is rechargeable



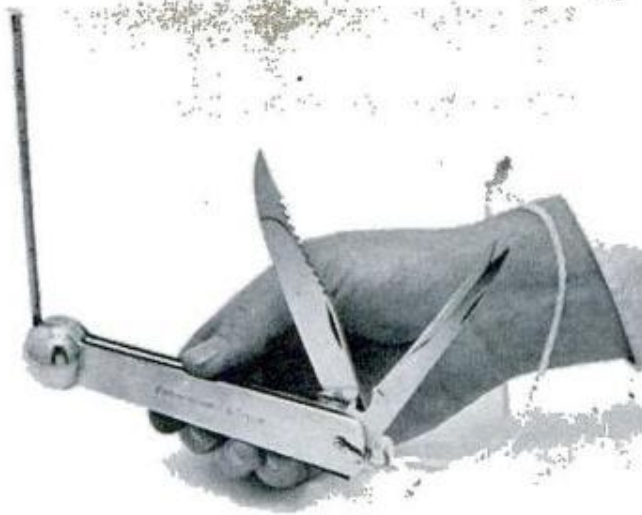
HANDLE ROD is very compact—fits anywhere. Spinning reel is True Temper's new improved Model 150

12. Headlight. The new "Starfire" is a rechargeable light that either stands on its own base or can be strapped around the head like a miner's lamp. Good for putting gear away and finding your way back to the car after dark. Made by Puritron, New Haven, Conn.

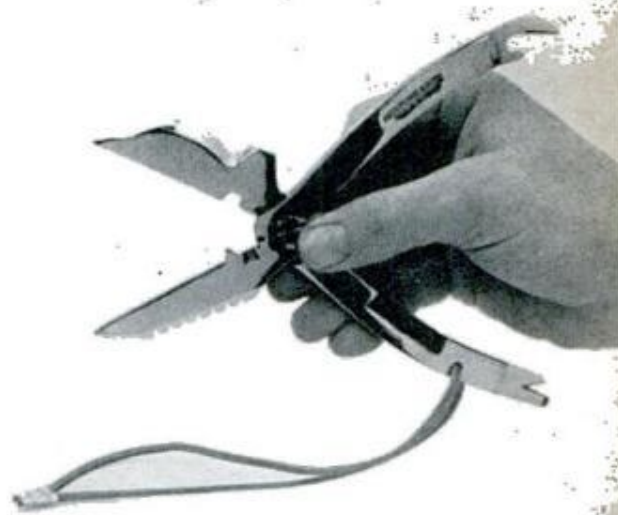
13. A & F's Multi-Tool. This small compact, stainless-steel item can do 16 jobs. Attachments include knife, scaler, hammer, screwdriver, openers, hone, shot splitter and nail puller.

14. Fish Weigher and Net. The new Way-King net and scale (up to 18 pounds) is available from Ernco.

15. Up-and-Down Tackle Box. The interesting new "Tackle Satchel" is a



FISH STUNNER has knife, scaler and hook remover, plus metal tape measure which makes ball heavy



MULTI-TOOL can do 16 jobs. With this item and the fish stunner, you need little else for any fishing job



CLOSE-UP of magnifying glass that pins to your vest. It's in un-snapped position for viewing of tiny items



OVAL GUIDE is new. The guide saves wear on line, lessens friction for freer casts and greater distances

vertical tackle box with a center panel for coiling leaders, loose line and trolling lines. This unique box is made by Setwell Co., Traverse City, Mich.

16. Three-Speed Electric Reel. For \$139.95 you can buy an Old-Pal spinning reel run by rechargeable power packs. (See photo, opposite page.)

17. Oval Guides. An oval-shaped guide will lessen wear on your line. That's what True Temper says about its new oval-guide fishing rods called "Brand X." (See photo above.) The reel is their new improved Flipline—a pushbutton closed-face spinning reel.

18. Ultra-Light Rods. Heddon's Mark

III rod is one of the liveliest around. The reel shown on the rod is Garcia's Abu-matic 150 with a new drag system.

19. New "Handle Rod." This fine copper spinning-utility rod is so named because it telescopes into the handle for easy toting in suitcase or briefcase. Made by Champion, Shellington, Pa. (Detail photo on facing page.)

20. Fish Stunner. This stainless-steel tool, made for A & F, has a metal tape measure in the ball.

21. Triangular Fly Reel. Garcia's new-shaped fly reel, Delta 3, can be adapted for left or right-hand operation. The shape makes for longer line life. ★ ★ ★



RAMBLER REBEL

HANDLING TOPPED list of Rebel owner praises, although some felt stiffer suspension would improve the car

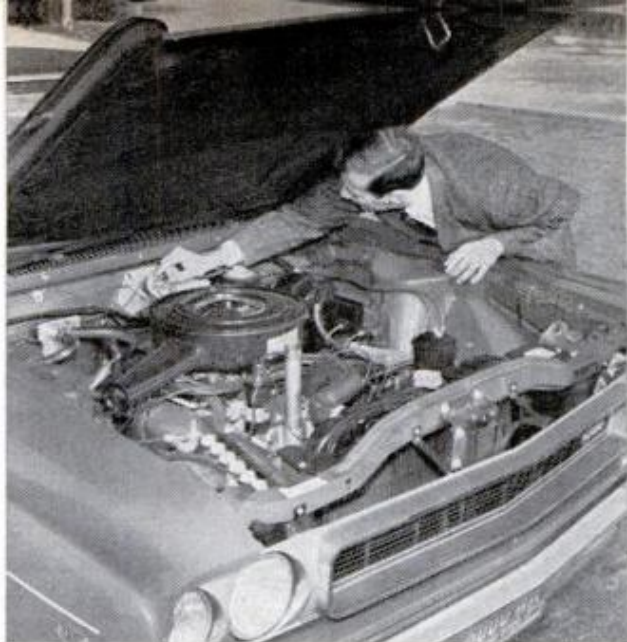
By **BILL KILPATRICK**, PM Auto Editor

THE MANUFACTURE and marketing of automobiles has got to be a frustrating business. Regardless of how hard a manufacturer tries, regardless of how carefully he plans, he goes to the marketplace certain that part of his effort will turn to ashes. To wit:

Over the years, American Motors has vigorously promoted itself as the champion of the "average" motorist—the customer who wants a no-nonsense, economical car. In fact, an AMC executive once told me—a note of genuine pride in his voice—that his company made cars for "Moms and Dads."

So imagine the company's dismay when—after successfully establishing exactly the image to which it aspired—it discovered that a great number of "Moms and Dads" seemingly had kicked the habit and gone all-out for performance, plunking their car-buying dollars down for zoomy-looking cars that by their very nature seemed to thumb their noses at everything for which AMC stood.

So the company switched signals. The result was the introduction last year of a reasonably hot V8 engine, the appellation "Rebel" to what had been the



ENGINE COMPARTMENT LAYOUT in Rebel affords easy access to components. *PM's* car had 290 CID V8

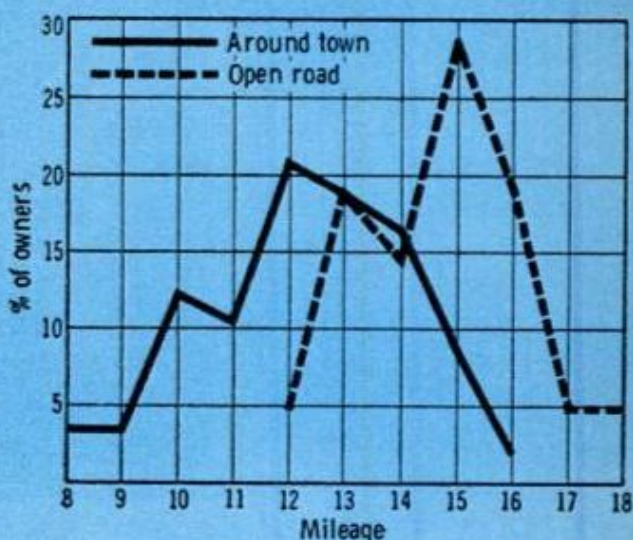


REAR-SEAT COMFORT was considered good by majority of owners, though possibly a bit snug for 6-footers



RECLINING SEATS are pretty much an AMC trademark, were deemed a plus factor in 48 percent of purchases

REBEL SST GASOLINE MILEAGE



GOOD GAS MILEAGE has always been AMC feature, yet several Rebel owners complained of poor economy

"Classic" line, and a new and zesty advertising and promotion campaign.

Yet if *PM's* survey of 1967 Rebel owners is any indication, many AMC enthusiasts would like to see the company return to an all-out "Moms and Dads," economy approach.

Typical of such sentiment was this comment by a Rebel-owning Ohio pastor: "The car is no longer a compact and less and less is it an economy car. To me, American Motors was the last hope for an American economy car."

The thought comes to mind that the pastor or anyone else can buy a Rambler

American 220, traditionally billed as an economy car. But along this same line, in marginal notes to *PM's* questionnaire, a number of Rebel owners applauded AMC's announced plans to re-enter the economy car market with a newly designed small car. Also—and rather interestingly—several owners, while expressing over-all satisfaction with their new Rebels, said they preferred previously owned AMC cars, particularly the '62-'65 Ambassador.

A clue to these and similar comments might be that almost half (47.1 percent) of the Rebel owners replying to



more solid and conservative buyers.

Regardless of why they bought the car, however, the general impression given by respondents is that they like the new Rebel very much. Despite the usual bleats about poor and indifferent workmanship, which registered an FMR (Frequency-of-Mention Rating) of 11.1 percent, owners came on strong in their praise of the Rebel's handling (55.1 percent) economy (42.6 percent), and styling (39.8 percent). In addition, positively stated opinions favored the car's ride (29.0 percent), driver and passenger comfort (18.8 percent), and power and pickup (15.9 percent).

Topping the poor workmanship beefs were complaints about excessive wind noise, affording it an FMR of 14.1 percent. Along with poor workmanship, an equal number of complaints concerned dealer repair and service (11.1 percent). Poor economy was mentioned (9.6 percent), as were what many owners felt were sloppy brakes (8.9 percent). Several said their new Rebels burned too much oil (6.7 percent), and quite a few thought design of the car afforded poor rear visibility (5.9 percent).

A summary of the likes, dislikes, opinions and general driving and ownership experiences of Rebel owners replying to *PM's* survey appears on the opposite page. Percentages listed reflect the frequency with which owners mentioned specific items. The summary is based on 678,996 miles of both around-town and highway driving.

Rebel owner comments pertaining to their likes and dislikes about the car

are listed below in order of frequency mentioned. The boldface asides are mine.

As pointed out above, heading the praise list with an FMR of 55.1 percent are kudos for the way the car handles.

"The handling is superior."—Ohio salesman.

"Car is easy to manipulate."—Maryland bookkeeper.

"Handles well on both turnpikes and small roads."—Kentucky salesman.

Next on the hit parade are praises for the Rebel's economy. Overall, as noted elsewhere, owners reported an average of 18.0 mpg.

"Extremely economical on gas and oil."—Maryland accountant.

► This comment is based on an mpg average of 16.4. Some who berated the Rebel's economy said they were getting up to 20 mpg. Like I said, making and selling cars must be a frustrating business.

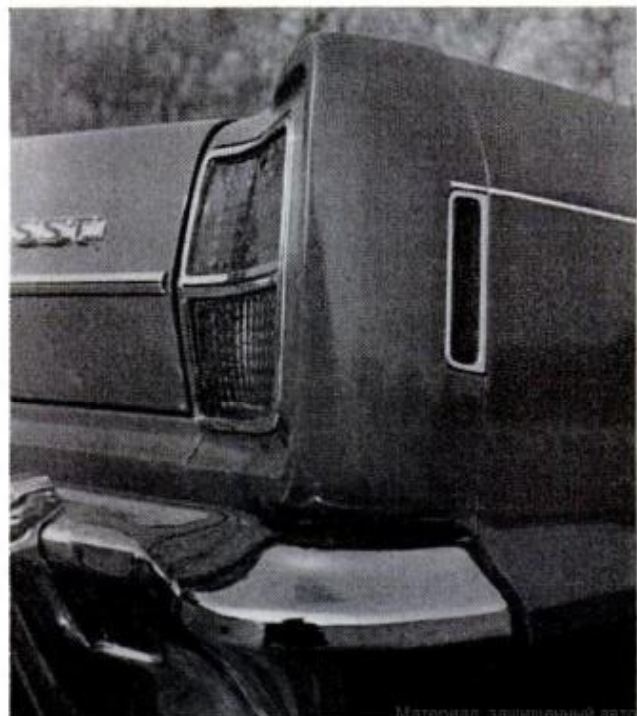
"Get good gas mileage."—Florida building inspector.

"Car's a money-saver on gas."—Ohio construction worker.

Almost to a man (there were a few dissenters) Rebel owners like their car's styling, affording it an FMR of 39.8 percent.

"Am impressed with the car's styling. It has been taken for a much higher priced car."—Wisconsin salesman.

REBEL WINK LIGHTS, owners say, are an outstanding safety feature, particularly for nighttime driving



Summary of AMC Rebel Owners Reports*

Total miles driven678,996

Average mpg.18.0

Model:

55018.6%
77062.3
SST6.8
Did not answer12.3

Engine:

232 cu. in. Six76.4
290 cu. in. V819.1
343 cu. in. V81.8
Did not answer2.7

Transmission:

Flash-O-Matic85.7
3-speed manual11.0
Shift Command1.9
4-speed manual1.5

Specific likes:

Handling55.1
Economy42.6
Styling39.8
Good ride29.0
Comfort18.8
Power/pick-up15.9
Performance15.3
Room11.4
Value9.1
Quiet7.4
Workmanship7.4
Reclining seats5.7
Interior styling5.1

Overall size4.0

Specific dislikes:

Wind noise14.1
Workmanship11.1
Dealer service11.1
Poor economy9.6
Brakes8.9
Burns oil6.7
Poor rear visibility5.9
Poor window fit/mechanism5.2
Poor heater5.2
Rattles4.4
Water leaks4.4
Poor handling4.4
Loose trim4.4

Had mechanical troubles?

No53.5
Yes46.5

What kind of trouble?

Transmission11.9
Brakes (pull to right)11.9
Carburetor9.9
Door action (poor fit)8.9
Door locks6.9
Brakes (general)5.9
Oil seals5.0
"Minor"5.0

Dealer service satisfactory?

Yes69.0
No31.0

What options/accessories?

Radio52.1
Power steering28.5
Reclining seats (std. on some)24.7
Special windshield (tinted)18.3
"None"17.2
Courtesy lights16.7
White-wall tires15.1
Air conditioning12.9
Power brakes10.2
Heater7.5
Special wheel covers/hub caps7.0
Twin-grip axle5.9
Clock3.8

Rebel your only car?

Yes63.9
No36.1

Other cars owned?

AMCs44.9
Chevrolet16.7
Ford7.7
Buick7.7
Volkswagen6.4
Dodge6.4
Mercury3.8

Age distribution of owners:

20-2914.6
30-3916.9
40-4927.0
50-5919.2
60 plus22.3

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

"Styling is perfect. Hard to believe it's made by Rambler."—Massachusetts warehouse supervisor.

"Like the styling better than any other '67 car."—Texas, retired.

In fourth place on the praise list with an FMR of 29.0 percent is the Rebel's ride.

"Doesn't sway on corners, yet seems to have a softer ride."—Minnesota teacher.

SPARE TIRE should be handled with care if car's rear-seat speakers protrude into trunk as shown here



"Rides better than the '66 Classic I had."—Florida, retired.

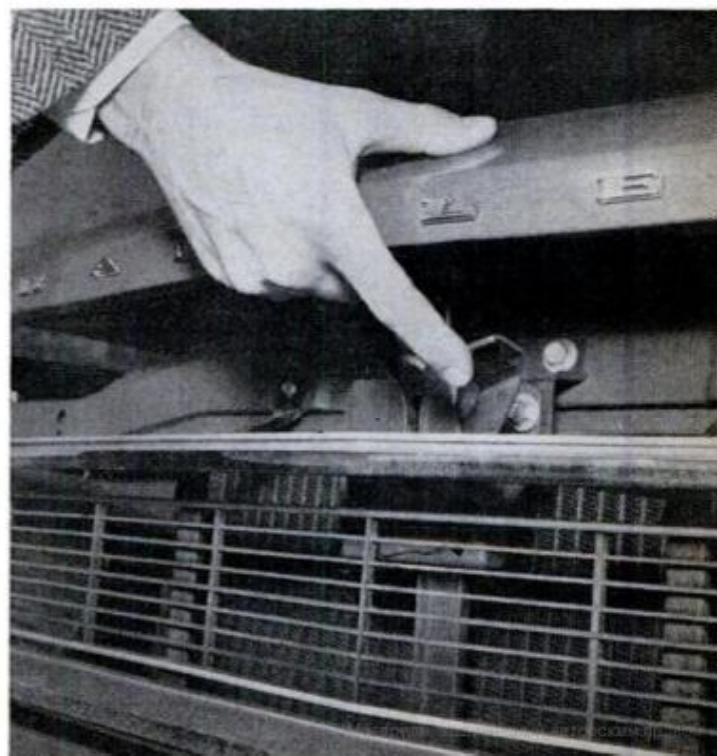
"Feels like a big car."—Alabama state employee.

The complaint list was headed by the wind-noise gripe, which racked up an FMR of 14.1 percent.

"Wind noise very noticeable around center posts from 40 mph on up."—Washington shop foreman.

(Please turn to page 222)

ONE-HAND HOOD RELEASE makes it quick and easy to gain access to the engine compartment for servicing



Aboard the Navy's Newest Seagoing Laboratory

Probing the ocean floor, analyzing the water from bottom to surface and sampling the air above, the *Silas Bent* is our most advanced floating lab. A PM editor tells how the ship mapped a two-mile-high underwater mountain

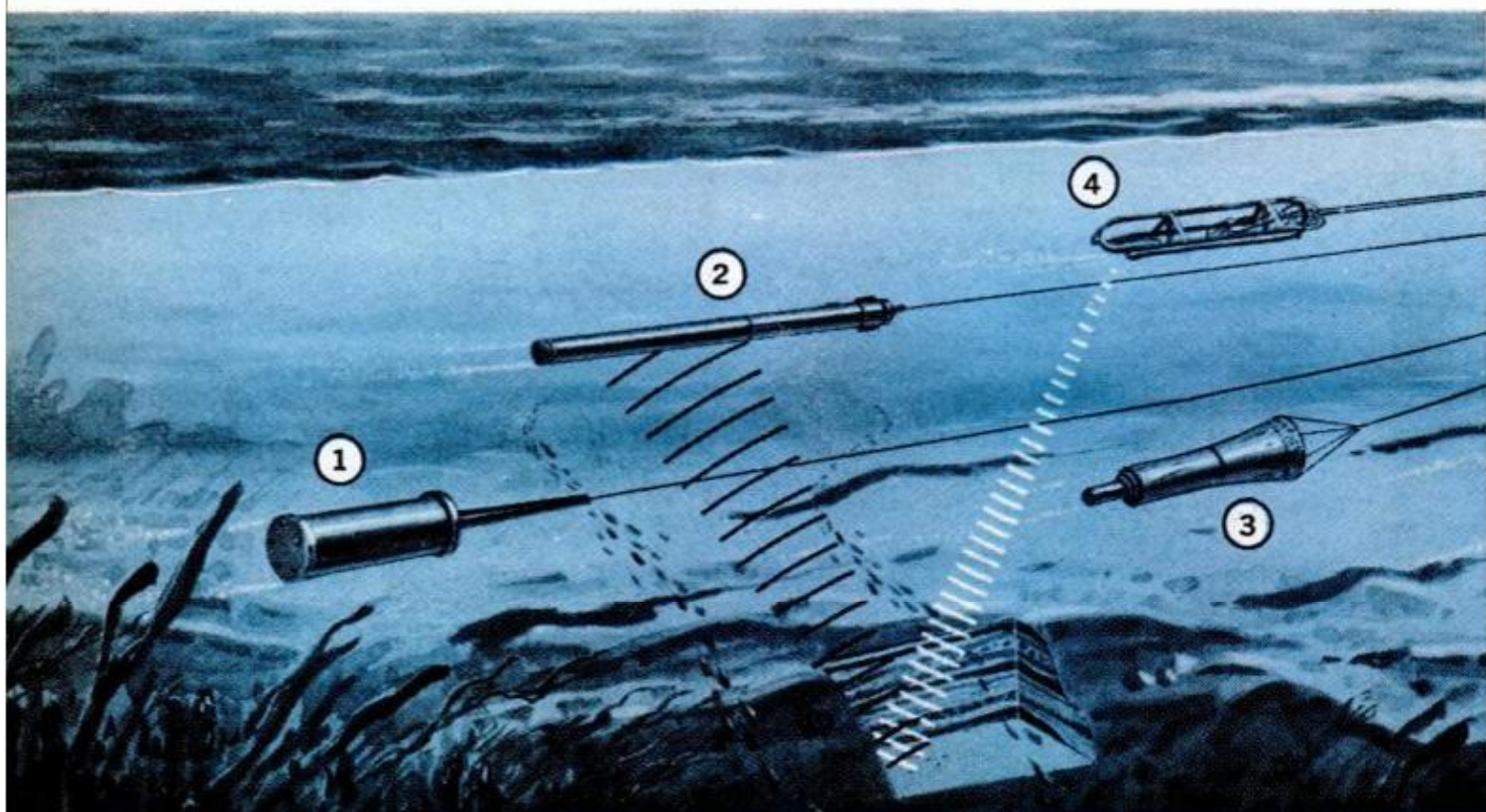
By JOHN F. PEARSON

YOU COULD FEEL the engines of the USNS *Silas Bent* open up after we had crossed Great Sound and passed Spanish Point and Cobbler's Island. Soon the ship was being pushed at a rate close to its top cruising speed of 15 knots. Bermuda, with its lush green hills and white-roofed houses, lay directly astern. Ahead was the broad expanse of the Atlantic.

On the deck below the bridge, I leaned against the starboard rail, soaking up sun that came out of a brilliant sky and gazing down at water that was an intense blue. I was on board for *PM*, the first reporter to see the Navy's newest seagoing laboratory in operation.

When I boarded the glistening white vessel earlier that afternoon, I thought that she looked a bit like a yacht, a bulky yacht perhaps. She is 285 feet long, 2600 tons and has an endurance rating of 12,000 miles at 12 knots. The ship is under the technical control of the U. S. Naval Oceanographic Office and is manned by a civilian crew of 44 men and officers.

Frank Anderson, oceanographer and chief scientist for the mission, ambled up to clue me in on the trip. Anderson is better than six feet tall and broad-shouldered. Though in his forties, he has a boyish face that seems an incongruous backdrop for the cigars he favors.



1. UNDER WAY, the *Silas Bent* tows magnetometer at greatest distance. Device, which measures earth's magnetic field, can be influenced by ship's field

2. LOW-FREQUENCY SONIC SIGNAL is picked up by hydrophone after it has penetrated layer of sediment and bounced back. This produces sub-bottom profile

3. BIOLOGICAL NETS are towed at reduced speeds, gathering samples of plankton and other organisms

4. THE "SPARKER" has sets of electrodes that arc every few seconds, creating big gas bubbles in the water. When they burst, they produce sound waves

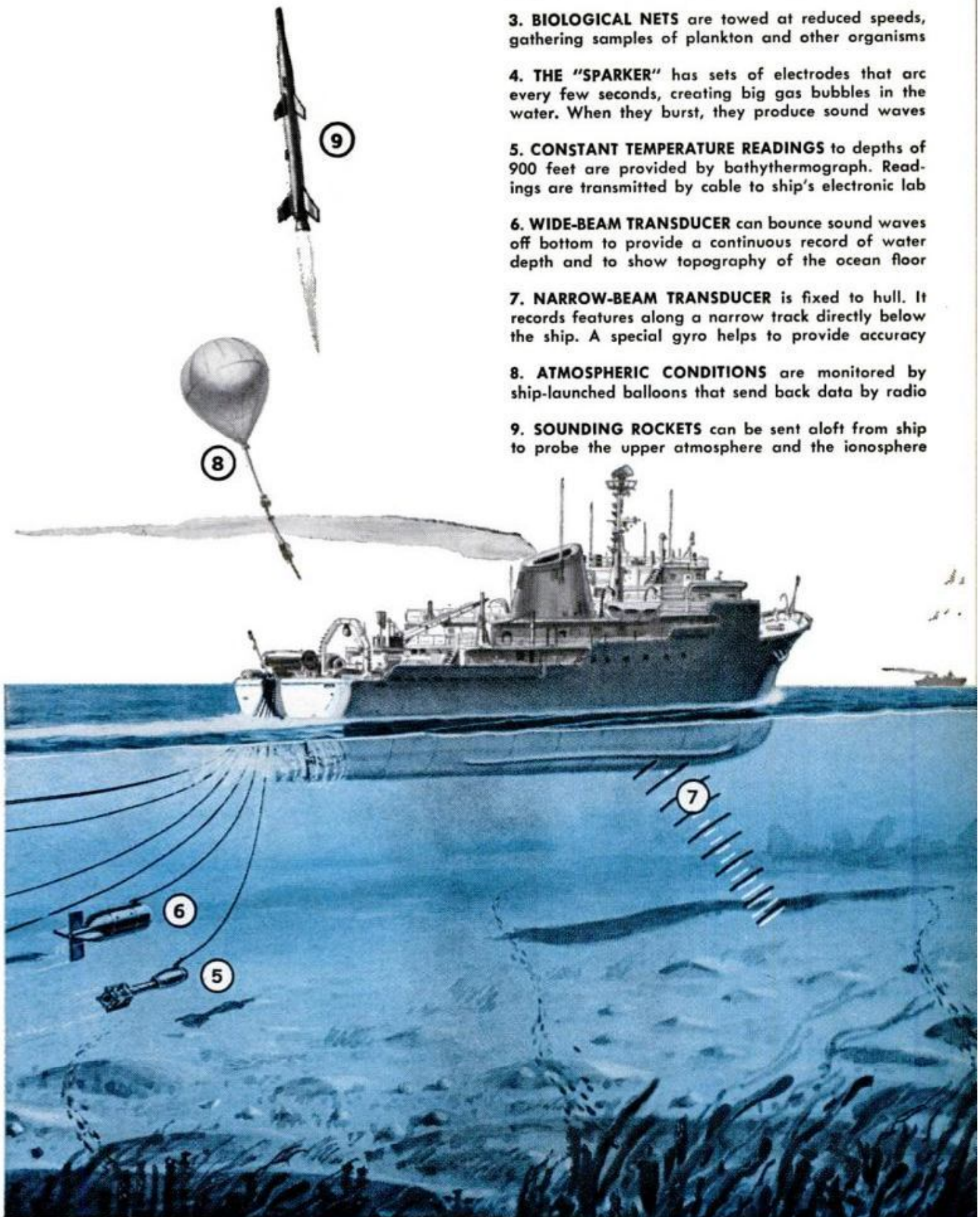
5. CONSTANT TEMPERATURE READINGS to depths of 900 feet are provided by bathythermograph. Readings are transmitted by cable to ship's electronic lab

6. WIDE-BEAM TRANSDUCER can bounce sound waves off bottom to provide a continuous record of water depth and to show topography of the ocean floor

7. NARROW-BEAM TRANSDUCER is fixed to hull. It records features along a narrow track directly below the ship. A special gyro helps to provide accuracy

8. ATMOSPHERIC CONDITIONS are monitored by ship-launched balloons that send back data by radio

9. SOUNDING ROCKETS can be sent aloft from ship to probe the upper atmosphere and the ionosphere





NANSEN BOTTLES are stored in "wet" lab. They are an old but still very good way to get water samples and temperature readings at assigned depths



ELECTRONIC RECORDING LAB is the heart of the *Silas Bent's* various scientific systems. Here, all data are put on tape and fed into the computer



MEMBERS OF SCIENTIFIC PARTY check the sparker and clear it of seaweed after pulling it in by hand. The insulated cable transmits electric pulses

"We're heading for an area about 130 miles northeast of here," he told me. "Our orders are to make a survey of the Muir Seamount. I guess we'll be out three days in all. That's a short one for an oceanographic mission."

Seamounts, I learned, are isolated volcanic cones that dot ocean floors, especially the floor of the Pacific. Cones have to be more than 500 fathoms (3000 feet) in height to qualify as a seamount. They have the same profile as their lava-spewing cousins above sea level. The islands that make up Bermuda are of this origin, though their crests are composed of coral.

Seamounts have long been of interest to the Navy because some of them represent hazards to shipping. Interest in them and in oceanography in general grew with the development of the deep-diving nuclear submarines and sophisticated naval warfare systems. Today's oceanography has real military value.

Ocean concepts have changed

"We know a lot less about the ocean than we do about space," Anderson told me. "It was only about 30 years ago that the thinking was that the ocean bottom was smooth because of the settling of sediment over billions of years. We know better now."

Anderson headed a party of 19 scientists for this trip, including eight oceanographers, one navigational scientist, two mathematicians, four electronics engineers and four technicians. The ship has accommodations for 28 scientists.

I spent the next three days finding out what made the *Silas Bent* so much better than other ships in probing for the secrets of the oceans. Until this ship slid down the ways, the Navy's fleet of surveying vessels was made up of conversions of World War II ships designed for other purposes—seaplane tenders, mine-sweepers, and the like. Survey operations were inefficient, requiring a lot of manpower to make but a few measurements. Oceanographic

instrumentation was still fairly primitive, producing data requiring great amounts of manual processing. Big backlogs of raw survey data clogged the Naval Oceanographic Office in Washington, D.C.

In the late 1950s, planning was started on a new class of ships designed especially for investigations of the oceans, ships with automated, computerized scientific systems. The *Silas Bent*, the first of these, was delivered to the Navy in July, 1965. After scientific equipment was installed, extensive shakedown cruises were begun. They're still going on. As the ship carries out missions (such as the tracking of the Muir Seamount), the scientific systems are still being evaluated.

The ship has different capabilities when under way and when "on station." Here are the main data-gathering systems when under way:

- There are two hull-mounted sonars and one towed transducer for bouncing sound waves off the bottom to get depth readings and bottom profiles.
- There is a towed "sparker" and hydrophone system that uses low-frequency sonic signals, which are capable

of penetrating the layer of sediment and getting a profile of the sub-bottom.

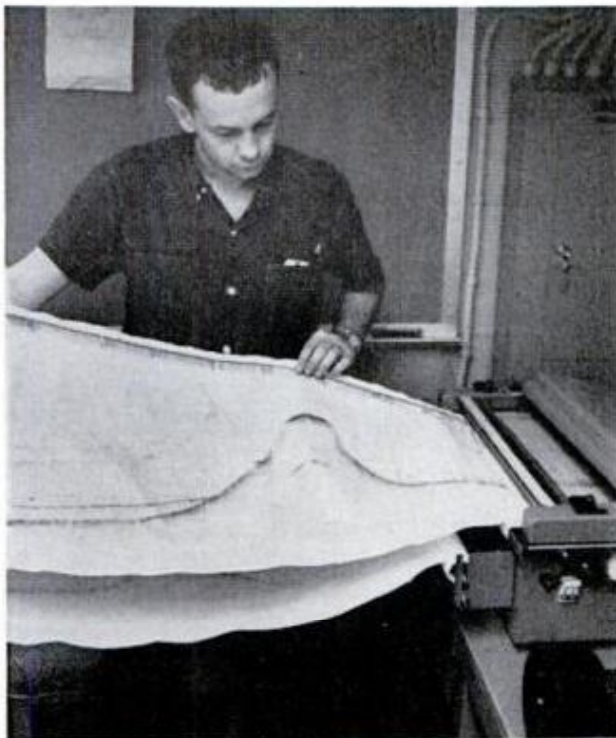
An on-board capacitor bank sends an electric charge through a cable to the sparker, towed about 50 feet behind the ship. The sparker is a frame that carries several sets of electrodes. When the pulse comes through, the electrodes arc, creating a big gas bubble in the water. The bubble bursts, sending sound waves down to the bottom. The return waves are picked up by the hydrophone, towed some 300 feet behind the ship, and the signals are relayed to the electronics recording lab aboard ship.

Repeated day and night

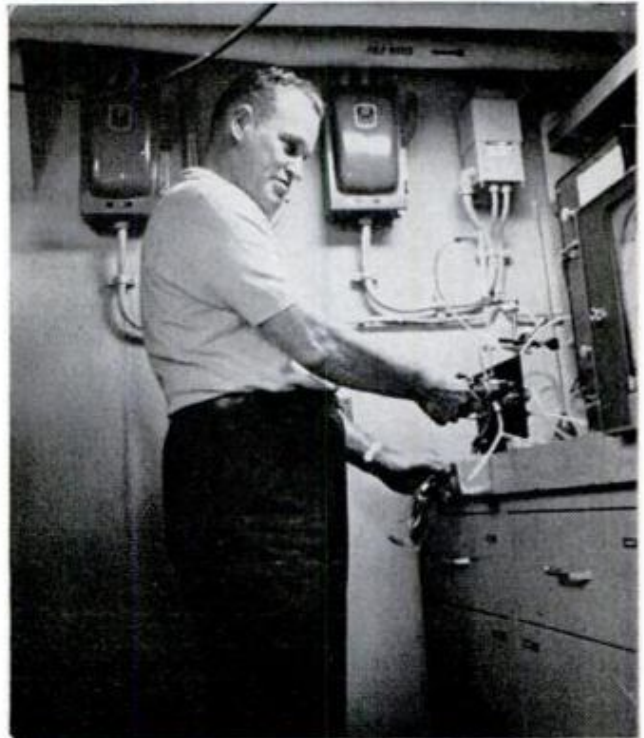
The cycle is repeated every few seconds, day and night, to create a continuous sub-bottom profile on graphic recorders. (At night you can see the flash behind the ship just before you hear the hollow boom of the bursting bubble.)

- Constant recordings of the surface temperature of the water are obtained from a towed "fish" containing a delicate sensing mechanism.

(Please turn to page 224)



SHARP PROFILE of Muir Seamount appears on recorder in the electronic lab. The two tracings at left in graph represent bottom and sub-bottom profiles



DEVICE BEING ADJUSTED by scientist automatically analyzes water samples—another example of sophisticated instrumentation to be found on *Silas Bent*



Electric three-wheeler

An electrically powered three-wheeled shopping cart needs only six feet of space for parking and can carry 56 pounds of groceries. Invented by electrical engineer David Fox, the Trilec—as he calls the vehicle—runs off two car batteries. Its top speed is 20 mph. Mrs. Fox is shown seated on the vehicle—though, so far, her husband has had to do the shopping; she doesn't have a license.



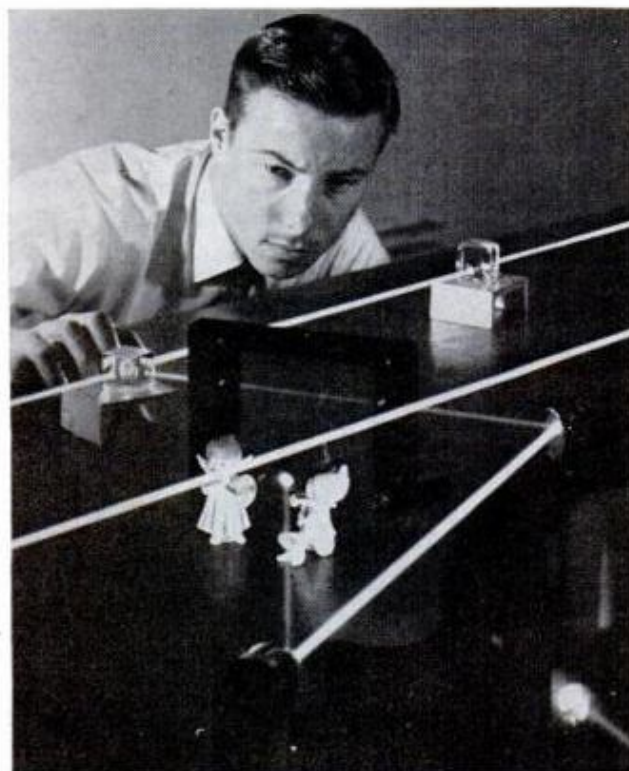
First-class clock

When a cesium timepiece was returned to the U.S. Naval Observatory recently after being on loan in South Africa, it was given first-class treatment, including a seat on a passenger plane. The clock, accurate to one-millionth of a second, had to be connected to the aircraft's power supply during the flight to keep it running. The clock weighs 215 pounds.



Skin-diver's special

Century's new 20-foot Trident, designed specifically for skin divers, features retractable bow ramp and underwater viewing port as standard equipment. Options include gin pole and tank compressor. There's an outboard model and a sterndrive (twin 60s) model.



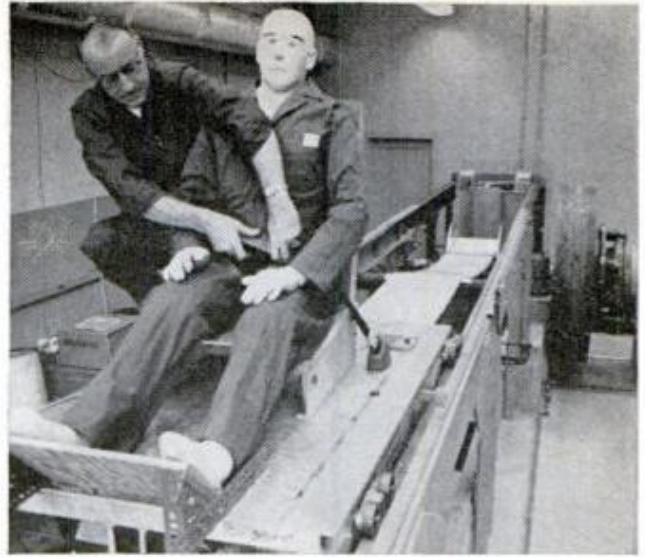
Laser snapshots

Using light rays from a laser, a Hughes Aircraft scientist records a hologram without use of a lens. In reconstructing the image, by playing the laser light back through the plate, observers can see the pixelike figures in true three-dimensional form at any angle—as if looking through a window. Ultimately, scientists believe, holographic techniques will be used for target recognition from air to ground and, some day, we may have holographic movies and television.



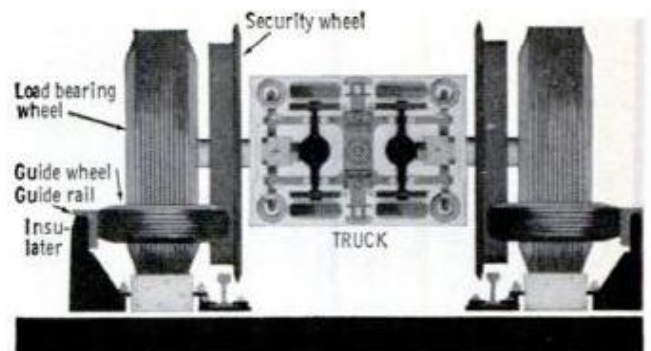
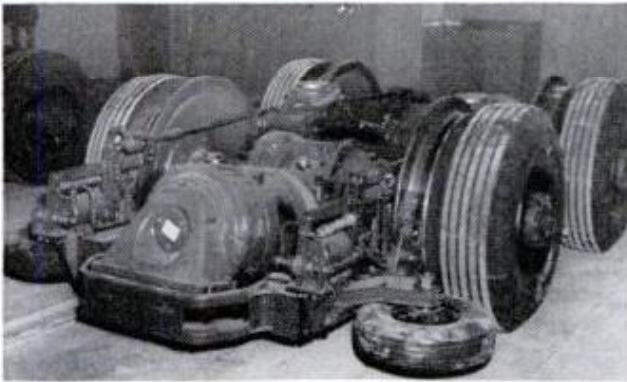
Warm gloves for cold water

Reacting with salt water to generate heat, a new thermal cream (being mixed with water in these gloves) will keep hands of downed aviators and divers warm in icy waters. Navy scientists plan to design a complete flight suit.



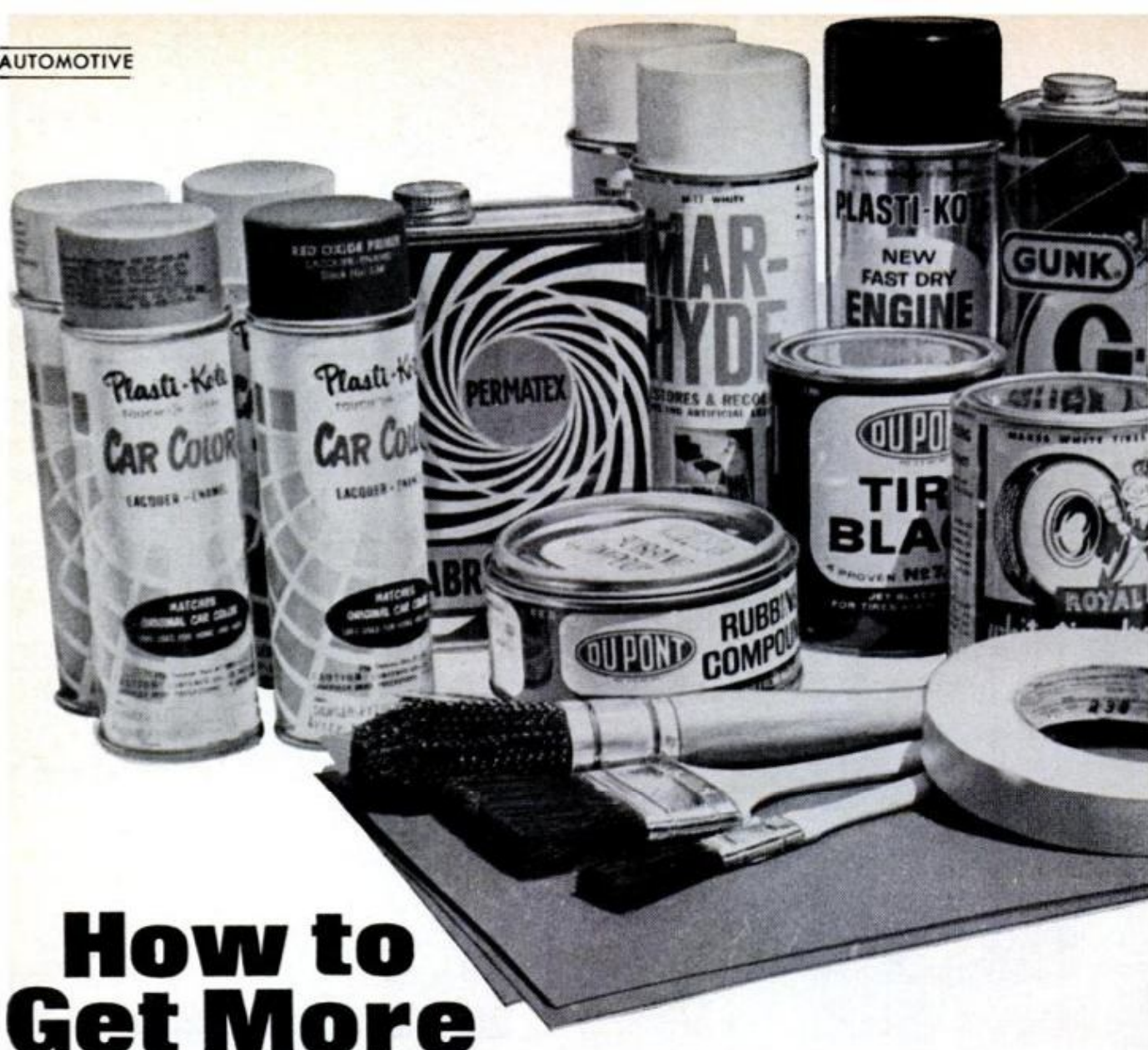
30-G jolt

To test automobile seat belts, the National Bureau of Standards has a machine that yanks a seat on a sled backward, producing "collision" forces of up to 30 Gs on the seat belt and dummy occupant of the seat.



Montreal's rubber-tired Metro is quietest subway

The world's newest subway is also the quietest. Patterned after the famous Paris system, trains on the new 16.1-mile Montreal Metro run on rubber tires. Each car rides on two eight-wheel trucks (top left photo). Nine-car trains consist of three three-car units; the first and third cars of each unit have motors and the center car is a "trailer." The drawing shows how the steel security wheel rides clear of the rail. Each of 26 stations (bottom) has different decor. The newest link in the subway system is scheduled to open this spring; it will run under the St. Lawrence River to serve Montreal's world fair, Expo 67.



How to Get More for Your Old Car

A modest investment in reconditioning materials—plus a weekend of elbow grease—pays off at sale or trade-in time

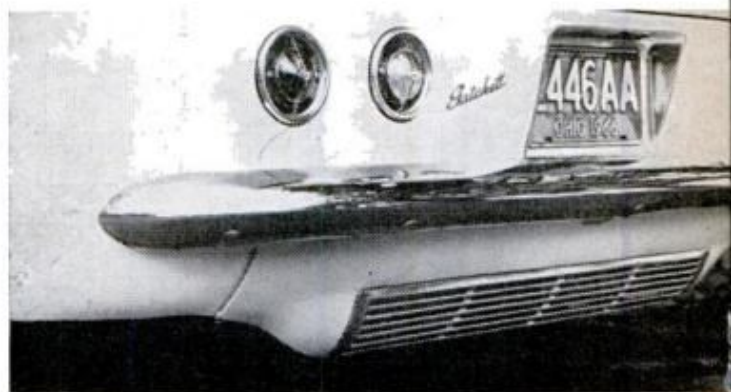
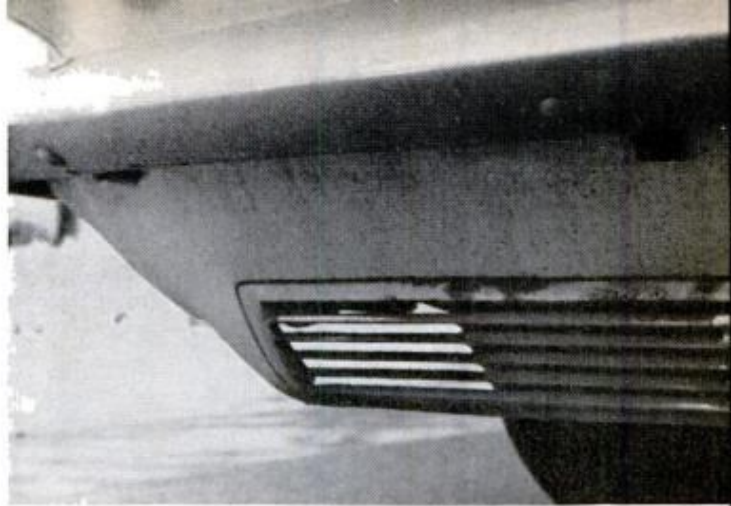
By JAMES B. COLBORNE

HOW WOULD YOU LIKE to get up to \$200 more than you think you can when the time comes to trade or sell your car? It's easy, if you are willing to invest a weekend of work and about \$20 to \$25 for supplies. All you have to do is perform a basic appearance reconditioning job on the old bus. And that's not too hard if you will take the time to do a professional-like job. The necessary supplies are so packaged today that even a rank nov-

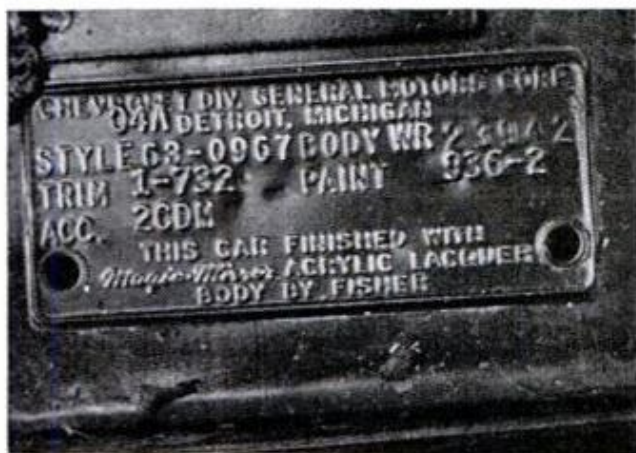
ice can do a job that will add many dollars to the value of his automobile.

Car dealers have known for some time that the appearance of a used car can make or break a sale. They also know a reconditioned car will bring more money than one that hasn't been reconditioned.

Not too long ago a dealer I know purchased a 1959 model at auction. Appearance-wise, the car was a mess. He had a basic reconditioning job per-



FRONT AND REAR UNDER PANELS below the bumpers are hardest hit by dirt streaks, road tar, paint nicks from flying pebbles, and shine-dulling film (top photo). After cleaning, polishing and touch-up paint, car looks 100 percent better (lower photo)



TO MATCH PAINT for a good touch-up job, look for this identification plate on your car. It will give code numbers for the original trim and body colors formed at a cost of about \$20 and took the car back to the auction where it was resold to another dealer for a net gain of \$155. Because of similar experiences, many dealers today are reconditioning their used cars before placing them on the resale lot.

To recondition your car, start with the engine compartment. The first step is to clean thoroughly the engine and surrounding compartment.

Remove the air cleaner and cover

the carburetor opening with a waterproof material such as polyethylene film to prevent any foreign matter from entering the carburetor. If the car is more than two or three years old, it is a good idea to cover the distributor. This can be done easily with a polyethylene sandwich bag.

Clean dirty underhood insulation by cutting into the material about 3/16-inch deep and peeling off the dirty layer. The remaining insulation will look like new. If the insulation is beyond saving, replace it. New material can be purchased from a dealer or at an automotive supply house.

Brush a degreasing compound over the entire engine and engine compartment, following the manufacturer's instructions. Be sure not to overlook the underside of the engine block and A-frame. Apply the degreaser to the underside of the hood if the insulation has been removed. Degrease the radiator, firewall and battery, and don't



GRIME-ENCRUSTED ENGINE shown at left above looks old before its time, can hurt a car's resale value just by its grimy appearance. At right above is



the same engine after a degreasing bath, shiny new paint and polish—a gleaming transformation that will reward you handsomely in added resale dollars

forget that air cleaner you put aside.

Allow 10 minutes for the chemical to work. Then rinse the compartment and engine with a garden hose.

Replace the air cleaner and start the engine. Let it idle for about 10 to 15 minutes to dry it for painting.

Start to work in the trunk while the engine is drying. Remove the spare tire, tools and jack and degrease them. Scrub out the trunk. This is a vital step, as used-car dealers agree that the trunk reveals the care a previous owner gave his vehicle. Paint all five tires with a suitable tire dressing.

Now check the engine compartment and clean all metal surfaces and rust spots with steel wool and brush off any dust. Remove the radiator and battery caps. Mask all nuts and bolts, brackets, accessories and labels with newspaper and masking tape. Remember, you don't want to paint any white metal that was not originally painted. The engine compartment is now ready for painting.

Use an aerosol packaged engine paint—the same color as the original—and paint the engine. Keep a rag soaked with a cleaning solvent handy to wipe off overspray.

Next, use an engine-type black paint to refinish the compartment. Start at the firewall and work forward. Use the same black paint to spray the tire tools and jack.

Clean the battery caps and replace

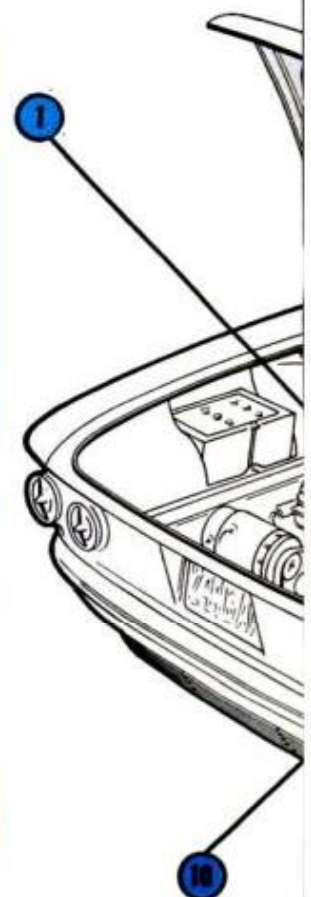
(Please turn to page 226)



DON'T OVERLOOK the little things. A fresh coat of paint on jack and other tools takes only a few minutes with a spray can and gives car a shipshape look

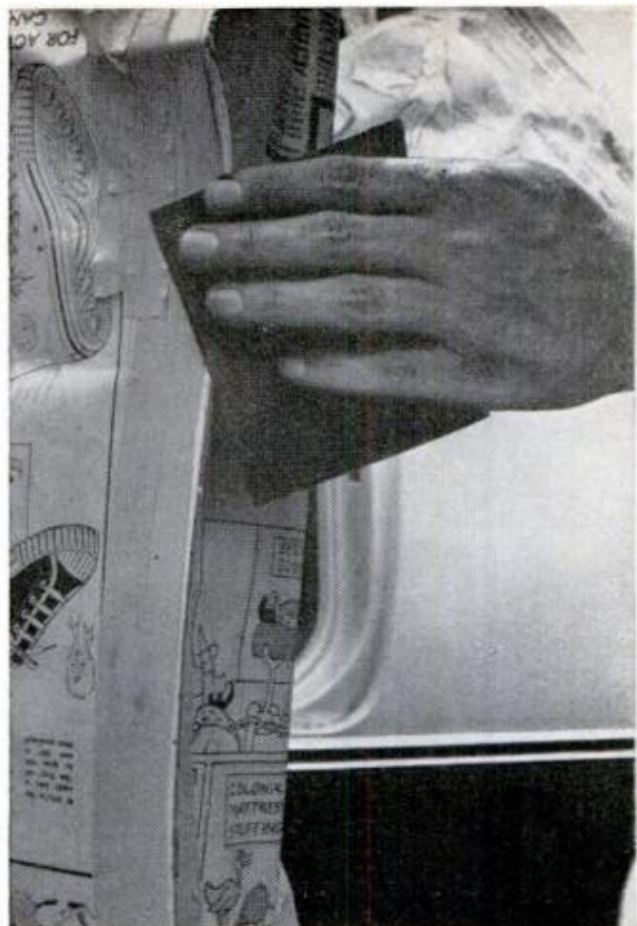
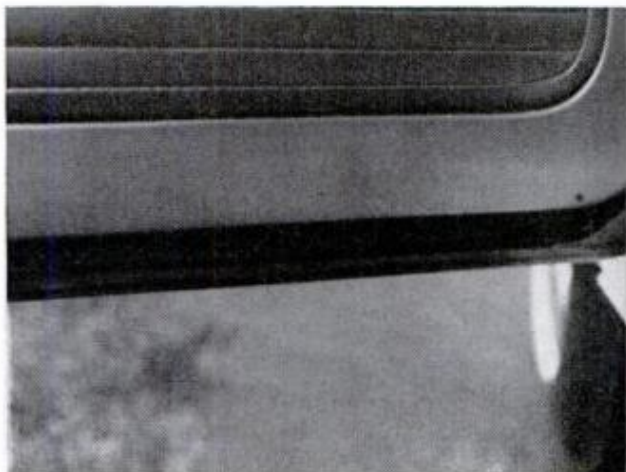
CHECK THESE 10 KEY SPRUCE-UP SPOTS

1. Paint engine and compartment and polish bright metal.
2. Renew convertible window with plastic cleaner; if badly scratched, replace.
3. Restore convertible top with special top dressing.
4. Scrub out trunk; clean and repaint tire-changing tools.
5. Touch up nicks; remove rust spots; restore paint luster with rubbing compound.
6. Remove scuff marks; tint material if necessary.
7. Clean and paint floor pads; replace if badly worn.
8. Clean upholstery; re-color faded areas if necessary.
9. Coat walls of tires with special tire dressing.
10. Polish chrome trim; remove rust from pitted areas.

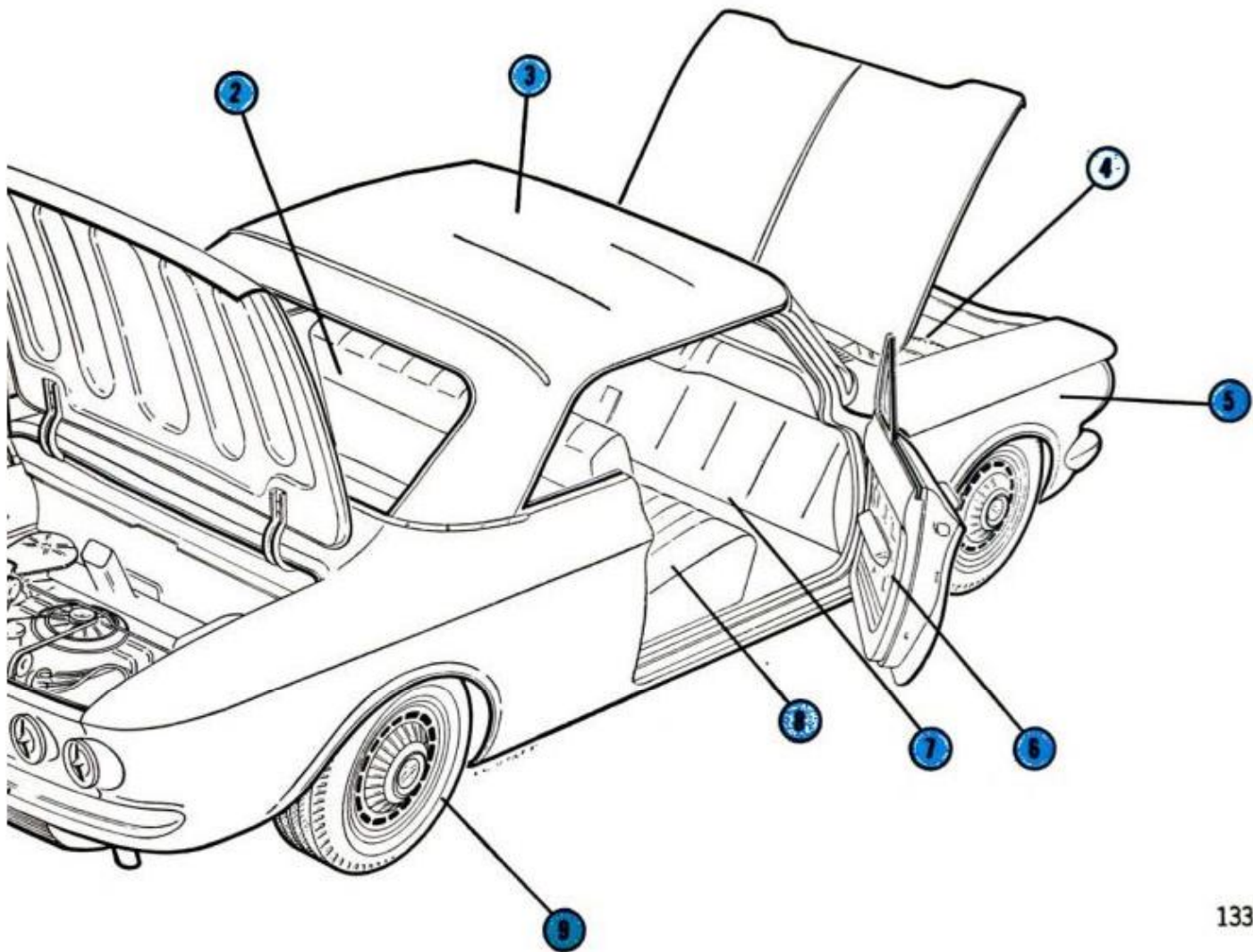


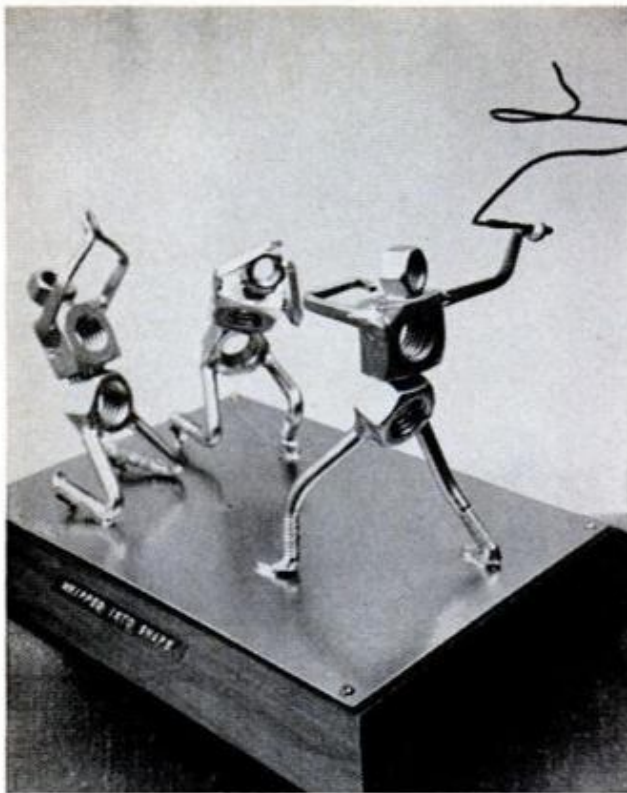


INSIDE DOOR PANELS take a rough beating at their lower edges (above). Scuff marks can be removed and the material retinted for a like-new look (below)



SLICK PAINT JOB calls for careful masking of surrounding areas with newspaper. Sand rough chipped spots so new and old paint will blend



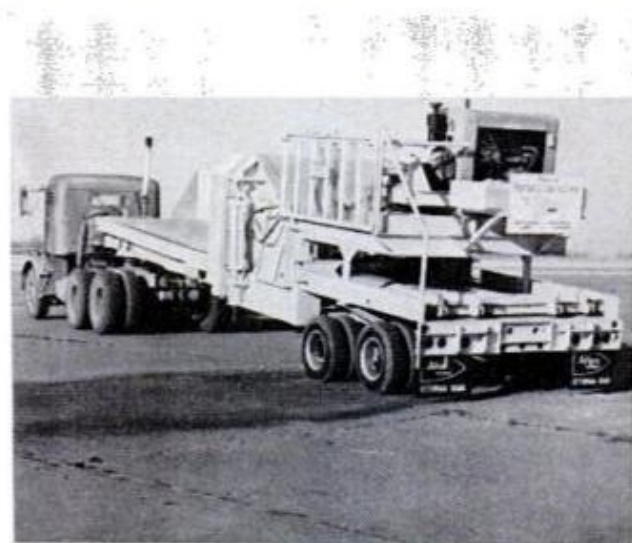


Nuts and bolts sculpture

Nuts, bolts, screws and the like lying about in his auto-repair shop inspired Brooklyn mechanic Leon Lefton to try his hand at an unusual form of art. He decided to weld the odds and ends together into pieces of sculpture. Within 10 months, he had his work dis-

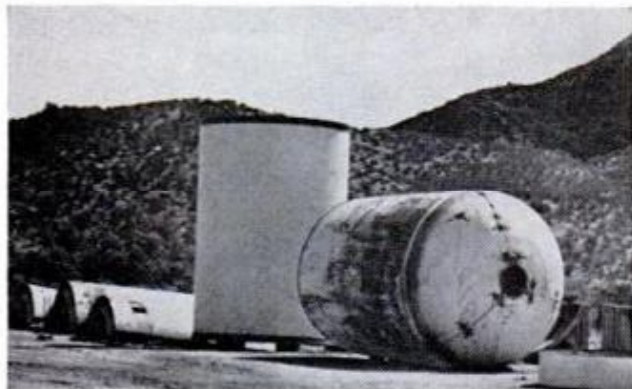
Machine munches on cars

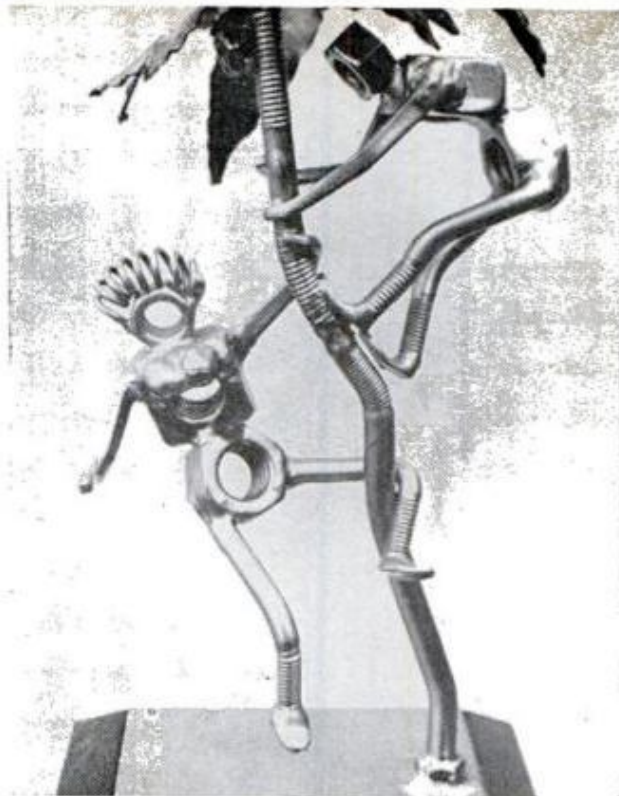
Able to be towed to any site (right), a new hydraulically operated crusher can flatten 100 junk-car bodies a day so that they can be loaded aboard flatbed trucks and economically transported to a processing center for reclamation of the metal. Car bodies are fed into the Car Crusher's jaws (center, right), and each body comes out the other end (far right) 6 inches thick, 72 inches wide, and the length of the original car. The machine is built by Al-Jon, Inc., Ottumwa, Iowa.



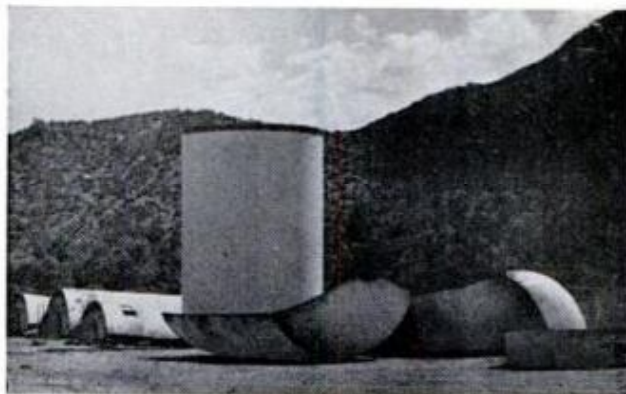
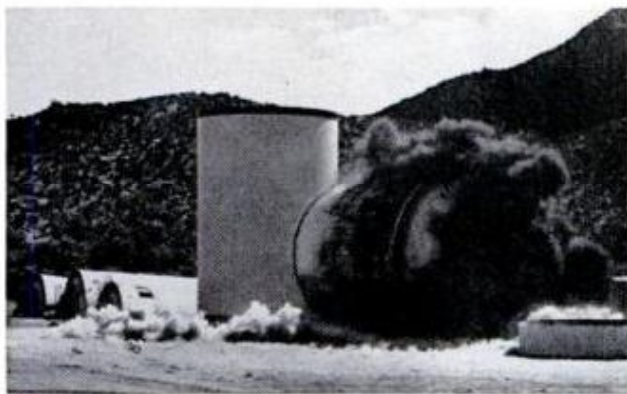
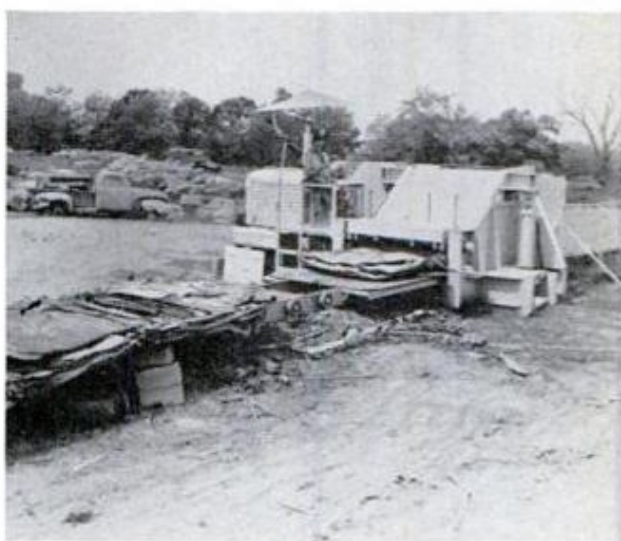
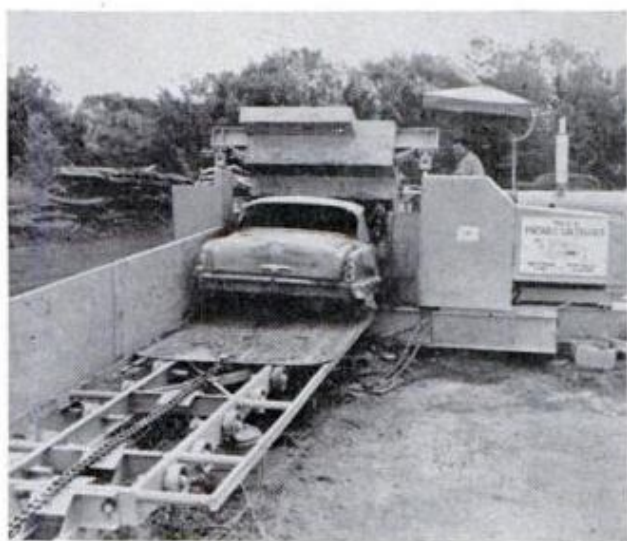
Real side-splitter

Explosives replaced a cutting torch recently when Lockheed Propulsion Co. wanted to split a large steel rocket-motor chamber into sections. The charges were placed radiating from the center of the chamber's nose (right). When the charges exploded (center, right) they neatly cut through the half-inch steel of the chamber and left it in three sections (far right). The chamber, which had been used by Lockheed for testing solid propellants, was then sold for scrap.





played at an art museum and fair—and he set prices ranging from \$75 to \$1000 on the pieces. At far left is *Whipped into Shape*; in the next photo he sprays gold lacquer onto *Discotheque*; in the third photo, Lefton is shown at work, and at right is *Tree for Two*.





2-Way Stretch in Space

A corset manufacturer, who knows how to make tight-fitting garments flexible, has created most of our astronauts' space suits, and is now working on wear for the Apollo crew.

By HARLAND MANCHESTER



WELL-DRESSED ASTRONAUT, like Neil Armstrong (left), gets fitted by girdle manufacturer. Casts of hands and feet (above) are just part of process

IT'S SOMETHING like knowing how a woman holds herself together. It takes some of the glamour out of it. And, these days, there's nothing more glamorous than an astronaut.

Want to know what he wears when he goes off on his storybook voyages? Well, there are long johns, special knit undergarments, tiny lights on his pinkies and aluminized coveralls with custom-made boots, gloves and helmet, among other things.

Actually, it's not as bad as it sounds. There's a real man inside all that, but even the best of men, when he ventures beyond the earth's protecting atmosphere, must bring his own atmosphere and his own protection with him.

It's just a happenstance of time and the elements that a girdle manufacturer became the best qualified to provide this protection. It takes no stretch of the imagination—no pun intended—to understand why an industry experienced in the two-way stretch on earth was asked to hold our astronauts together in space, yet still leave them comfortable enough to maneuver, if not at a cocktail party, at least on a space mission.

The manufacturer is the David Clark Co. of Worcester, Mass., which began its corporate career making bras and

girdles for women (and men, who buy girdles as "torso-support garments"). As the space age dawned, the firm began making girdles of sorts for air and space crews, starting with parachute harnesses and G-suits, then getting into high-altitude and space suits.

Among the problems of existing in space that Clark's suits have helped to overcome are: the lack of gravity in which a body just floats and flops around and loses some coordination; the lack of atmospheric pressure, so a body must bring its pressure with it or it would explode; the lack of atmospheric protection from the white-hot heat of the sun and the black cold of space, so a body must protect itself from heat and cold at the same time; and the lack of atmosphere itself, which contains oxygen, without which no earth body can exist.

That's a lot of comfort to build into one two-way stretch, but Clark claims its suits have spent more time in space and near-space than any other, including flights in Air Force and Navy supersonic jets, the X-15, and new Gemini spacecraft.

The space flights, of course, need the most attention, and the well-dressed astronaut begins suiting up from the skin out. His long johns, made of cot-



HEAD SIZES (those of Astronauts Cunningham and Borman are shown here) are taken to create each helmet to fit individual astronaut's skull contours



WHITE ROOMS, where cleanliness may be ahead of godliness, are used to make close inspections on finished suits in an atmosphere free of dust

ton for absorption, ventilation and warmth, cover him from neck to wrists and ankles. They also include pockets for biomedical instruments and ducts for biomedical lead lines so the medics on earth can monitor his temperature, heart rate and blood pressure while he works in space.

Over his underwear goes a multilayer garment, again covering him from the neck to the wrists, but this time covering his feet as well, like coveralls with booties. The layers, starting inside out, include one of oxford nylon cloth, a naturally smooth finish that rides well on the long johns and also helps diffuse ventilation gas over the body.

The next layer, made of neoprene-coated, rip-stop nylon, is the gas container and the one that actually encloses the astronaut in his own atmosphere, pressure and all. The main ventilation ducts, usually visible at waist level, lead to a network of channels extending over the torso, the legs, feet, arms, and head. Oxygen enters by the inlet duct and waste gases leave by the outlet duct. Hoses, attached to each, are also attached to the spacecraft's environmental control system.

The next layer is Clark's major contribution to spacewear and a patented industrial secret. No one at Clark will discuss it, but the general principles can be assumed, and the general principles were developed long ago with the two-way stretch.

When the human body wants to expand, either from obesity or, in space, because of lack of resistance from any atmospheric pressure, it must be restrained. If it is restrained too much, it becomes immobile and useless. Hence, the two-dimensional stretch, which allows it to stretch up and down, and side to side, but not in and out, especially not out. (Right, ladies?)

So, in Clark's space suits, the restraint layer of braided line is so designed that it molds the gas container to the contours of the body, yet allows maximum mobility of the limbs without stiffening them at statuelike angles.



TWO-WAY STRETCH is shown by Clark executive. PM photographer was allowed to see—but couldn't touch—this Clark patented creation for spacewear

The final, outer layer protects everything inside it, including the astronaut, from extremes of heat and cold and radiation. It makes the final integration of all the inlets and outlets, to insure they are pressure-proof and leakproof. Some of the outer layers, depending on the individual astronaut's mission or personal predilections, have accessory pockets for accessory equipment. On at least one mission, one of them carried a baloney sandwich.

The helmet, gloves, and boots complete the astronaut's ensemble. All custom-made to fit each individual astronaut's head, hand and feet sizes, they integrate pressure-tight with the torso assembly.

The fiberglass helmet includes, among other things, microphones, earphones, ventilation channels and a port for drinking under pressurized conditions.

The gloves contain a fingertip lighting system, battery-powered, for reading instruments and turning dials at the same time. The helmet and gloves are more or less screwed onto the torso assembly and made pressure-tight. The boots just lace onto the suit, since the suit itself encloses the feet.

There are several more accessories. One, called a neck dam, is carried in



NASA INSPECTOR makes periodic visit to Clark plant to test suits in production. Here he blows up suit to check for leaks just like old-time inner tube

one of the outside pockets. It's used when the astronaut expects to climb out of the capsule while it's floating on water after re-entry. Made of neoprene, it fits over the neck ring and clings to the astronaut's neck like a rubber turtle-neck dickie. It keeps water from seeping inside the space suit, and it saved one astronaut's life when his capsule sank.

That's about it. The Clark people are most proud of their suits' extra-vehicular activity—their ability to protect the astronaut outside the capsule, yet still allow him considerable flexibility to do his EVA chores.

"We made it so he could tie his shoe laces in space," said one executive.

They remind visitors of the first films of the Russian cosmonaut Leonov "walking" in space. It showed him stiff-jointed, arms and legs spread like an overstuffed doll. Major Edward White and the other American space walkers, held together by the two-way stretch, seemed in complete control of their movements, flexing, twisting and turning with remarkable agility.

The complete suit weighs about 23 pounds. Before it is okayed for delivery, typed inspection reports on every detail of its construction make a stack



"GIFT-WRAPPED" and ready to go, suit is prepared for shipment to Space Center at Houston. Individual case, with astronaut's name on it, is used

a foot high. The small American flag and the individual astronaut's name patch, which are sewn on the suit, also have to pass rigid tests. The suits are handled in a "white room" under rigid conditions of cleanliness so that no bit of lint or dirt can cause trouble. Once it passes muster, each suit is packed in its own case—"gift wrapped," as they say at Clark—after being sheathed in a clean plastic bag. It is then shipped to NASA's Manned Spacecraft Center at Houston where it is hung with care in guarded closets.

Two flight suits and a training suit are made to order for each astronaut, so the storage racks at Houston hold rows of suits valued at about \$1,000,000, probably the most expensive tailor shop in the world. David Clark maintains a crew at Houston to make any last-minute minor adjustments.

The suits are so personal that there is only one hand-me-down in the lot. Michael Collins can wear a suit originally made for James Lovell.

Some of the suits, which have logged millions of space miles, may someday hang in museums. Right now visitors aren't allowed to get too close. Clark is vigorously protecting its proprietary rights to the two-way stretch. ★ ★ ★



Fireman's bridge

A 30-foot "fire-fighting bridge" on a new Hamburg, Germany, fireboat enables the boat's crew to board a burning ship with ease. Water and foam are used to fight the fires.



Sinuous seats

Undulating strips of steel, covered with foam rubber and upholstery, are used by a French designer to form his "Djinn" furniture. He makes chairs, stools, couches and chaise longues with those materials.



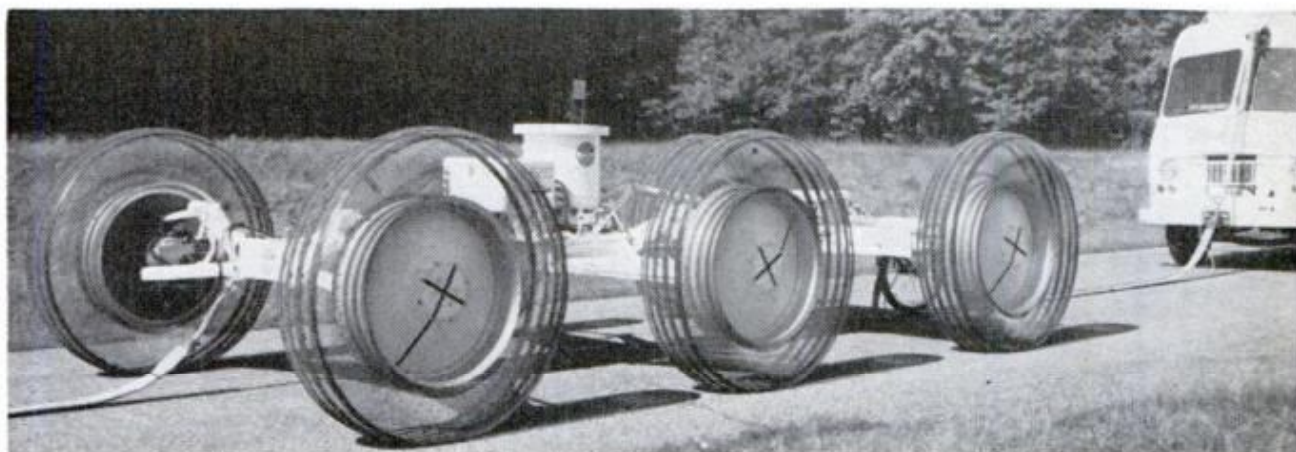
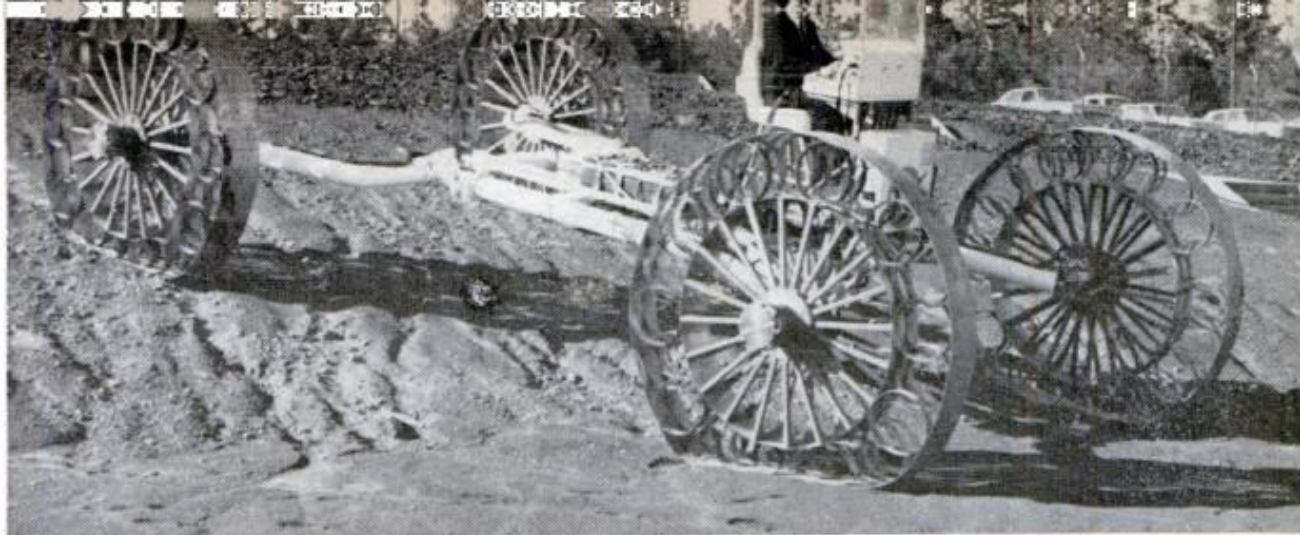
Marine with a flare

Packing cases for artillery shells plus gunpowder and a little baling wire make up the home-made flares that Marine Sgt. A. A. Aguilar uses in Vietnam to light up his outfit's security perimeter at night.



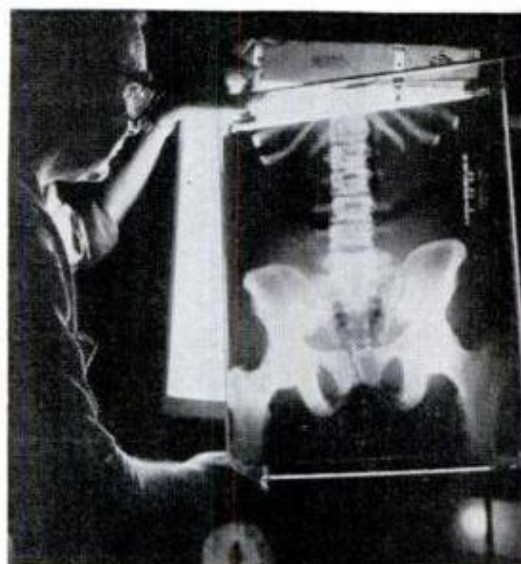
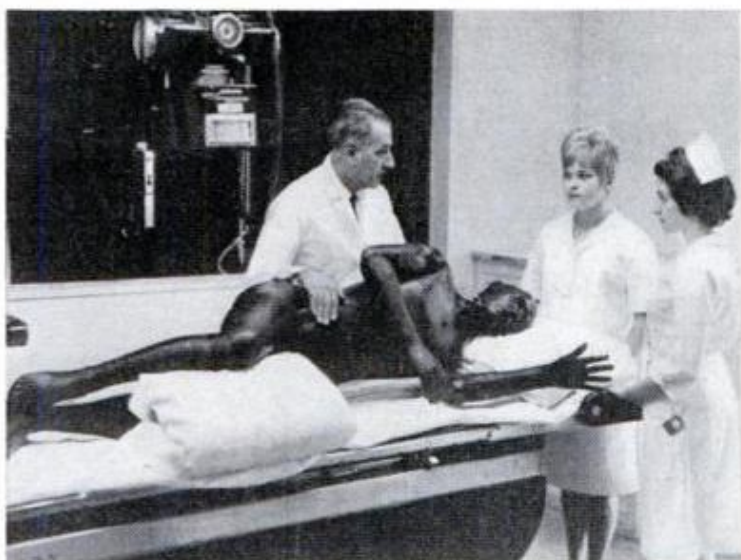
'Roaring monster' takes on prisoners

Crewmen of a U.S. Navy air cushion vehicle are shown here taking aboard captured Vietcong soldiers during an operation conducted in the Plain of Reeds in South Vietnam. The Navy says that the Vietcong are more likely to surrender to the "roaring monsters" than to fight.



Out for a Sunday drive—moon style

Among the many concepts for vehicles that will travel on the surface of the moon—once we land there—are these strange-looking machines that are being tested by the National Aeronautics and Space Administration. One, built by Bendix (top), has wheels made of titanium circles; the other, by General Motors, has wire-mesh wheels.



Tireless patient for X-ray students

He isn't much to look at, but he certainly photographs well—if you're using an X-ray camera. "He" is a specially constructed dummy built around a human skeleton. All his internal organs are in place, made of material that will appear in X-rays like the organs of a living person. There's even a network that duplicates the principal blood vessels of the body; filled with an opaque fluid, the circulatory system can be studied on X-rays. The dummy, designed by Samuel W. Alderson, is used to teach X-ray technology.

Astronauts' Vacation House

When Gordon Cooper and the late Gus Grissom learned they couldn't take their families to the moon, they built them this down-to-earth duplex high in the Colorado Rockies



GORDON COOPER and the late Gus Grissom built a two-family house

THE EXCITING HOUSE on the opposite page is not on the moon, despite its out-of-this-world setting. It is 9500 feet up at Crested Butte, Colo., a historic mining town reborn as a major ski resort in the Rockies.

The jagged mountain behind the house is Crested Butte Peak. An aerial gondola orbits skiers three-fourths of the way to its top. The floor-to-ceiling windows and eight-foot deck look west over a valley and a 60-meter ski jump.

The house belongs to two families—the Gordon Coopers and that of the late Gus Grissom—who live most of the year near the Manned Space Flight Center in Houston.

Astronaut Grissom, who was to have commanded the first three-man Apollo flight this year, and Astronaut Cooper, the first man to go into orbit twice, had never been up in space together. But they had done just about everything else adventurous as a team. They drove a high-powered racing boat in California's Salton 500 (see *Salton's Savage 500*, page 138, Nov. '66 *PM*). Last year they entered a car at Indianapolis.

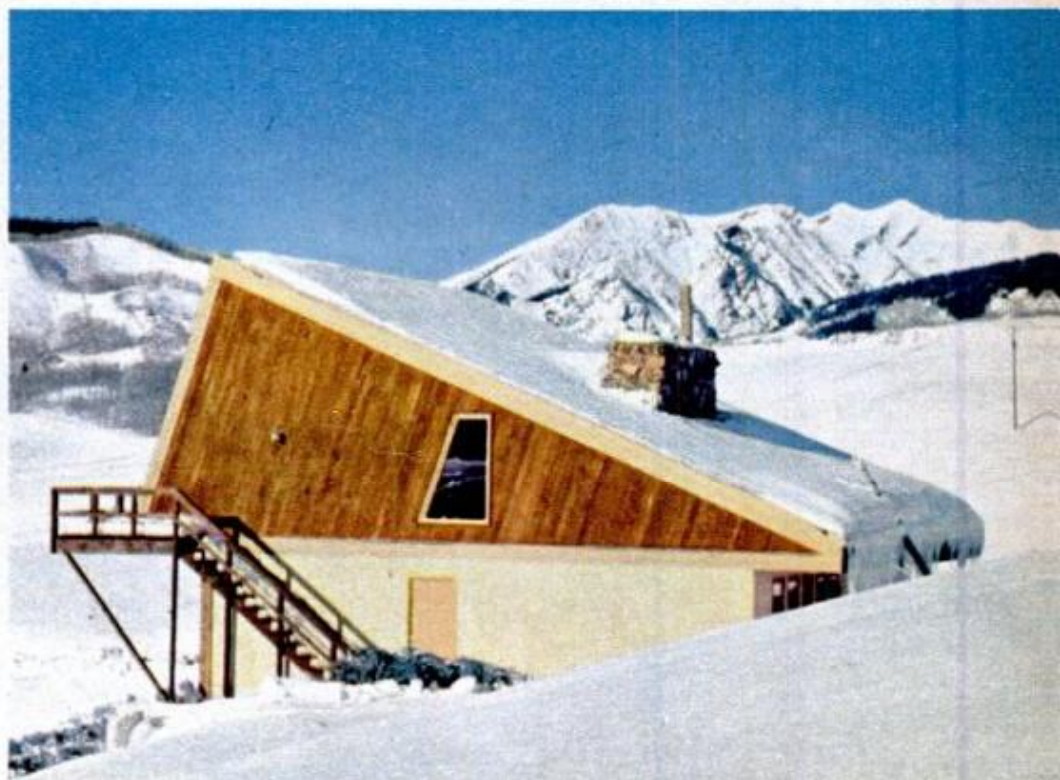
Several years ago they brought their families to Crested Butte to ski. The Grissoms: Gus, Betty, Scott, 16, and Mark, 13; and the Coopers: Gordon, Trudy, Camala, 18, and Janita, 17, liked Crested Butte and wanted to return.

The families also liked each other so well they decided to build a vacation house together. Or rather, they built houses right next to each other. That isn't quite right either. It's a duplex downstairs and a single house upstairs. *PM* has never seen anything like it. We think Gus and Gordo came up with a unique house, even though Col. Grissom got to enjoy it all too briefly. (If you're still puzzled, look on page 144.) Each family has separate sleeping apartments, but they share a single kitchen, a dining room and a length-of-the-house living room.

Architect John Shaver, of Salina, Kans., had designed several other homes in Crested Butte, but none like this one. The house is 42 feet wide and 35 feet deep. The lower level, built above separate basements, each with a one-car garage, is divided into two



CRESTED BUTTE PEAK, the "Matterhorn of the Astronauts," peers over shoulder of the Cooper-Grissom house. Spacemen Slayton, Scott and Anders own neighboring lots
Photos by Alanson D. Hegeman





14 Fresh Ideas for your vacation home

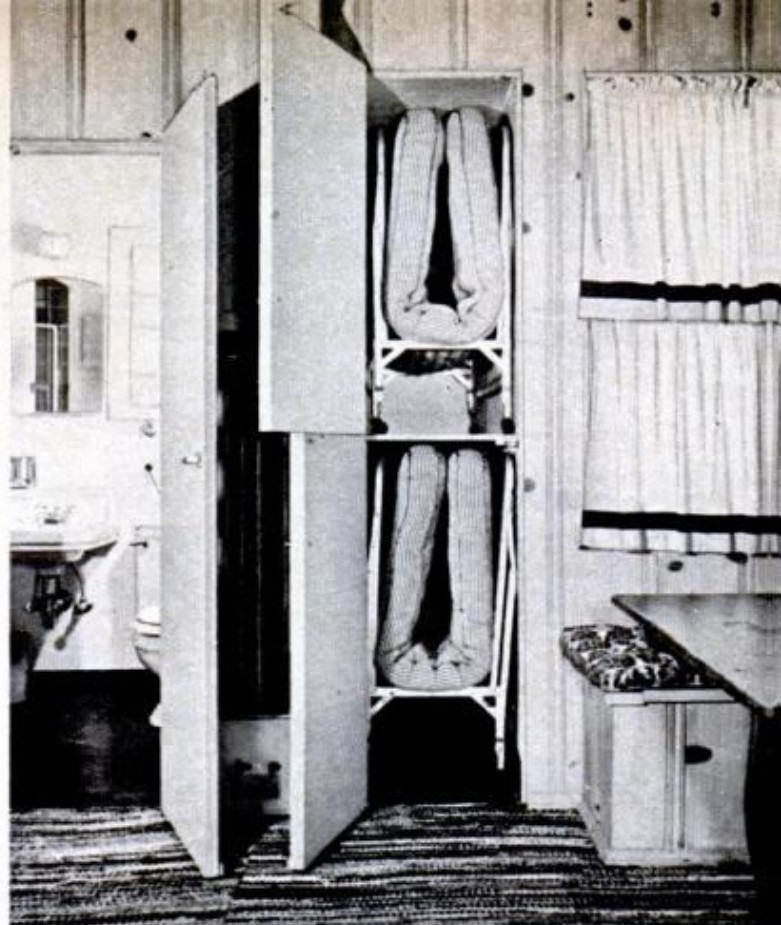
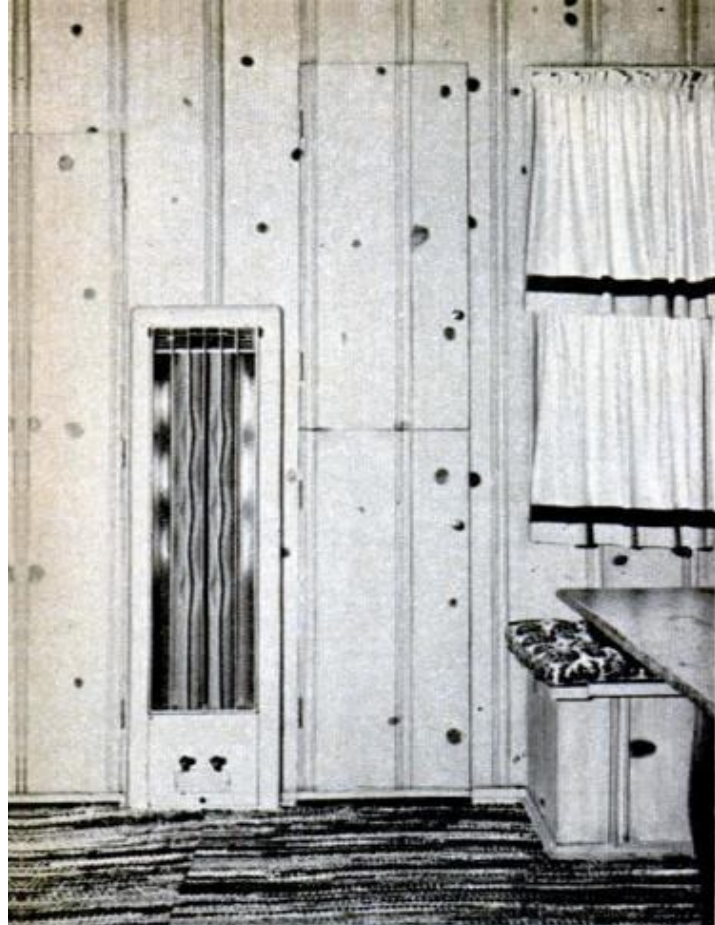
Dip in and take the ones you want—on saving space, gaining storage, building in comfort and convenience or just plain getting more fun out of your family hideaway

American Plywood Assn. photos

THERE'S EVERY GOOD REASON for making your vacation home easy to live in. At the top of the list is *your vacation*. You earned those two or three weeks, so you surely don't want to spend the days fighting make-do conditions inside the four walls of your cabin. Make this the year you put your second home into smooth-running shape—for you, your wife and kids. And do it during the next spate of weekends so you won't burden your vacation with construction chores. Run through the ideas here. You'll really find more than 14, since most photos have two, three or four good tricks to borrow. Then, have a ball on your vacation.

PREFAB SPIRAL STAIRCASE at entry leads to second-floor sleeping quarters and a second bath plus a sauna



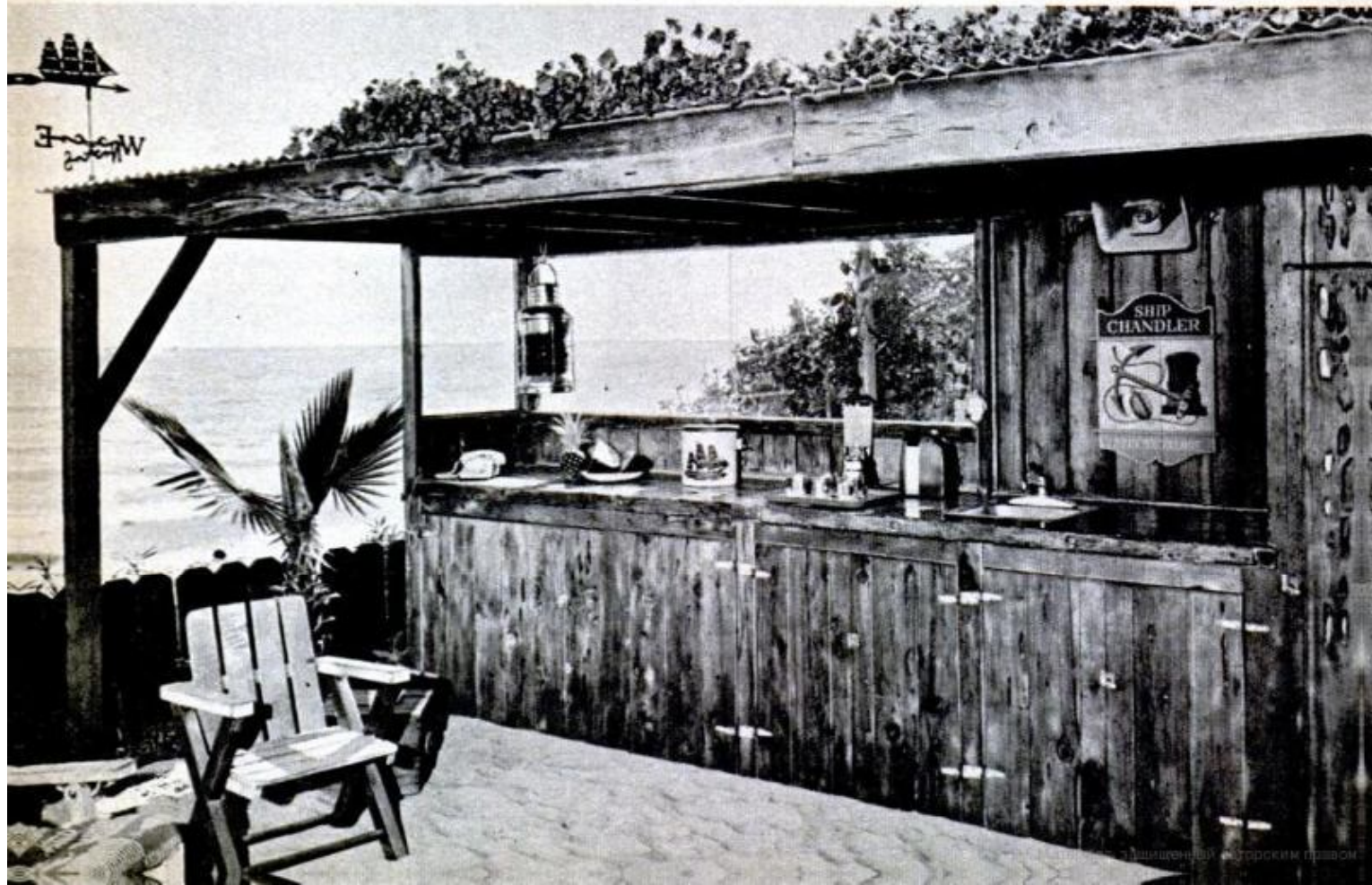


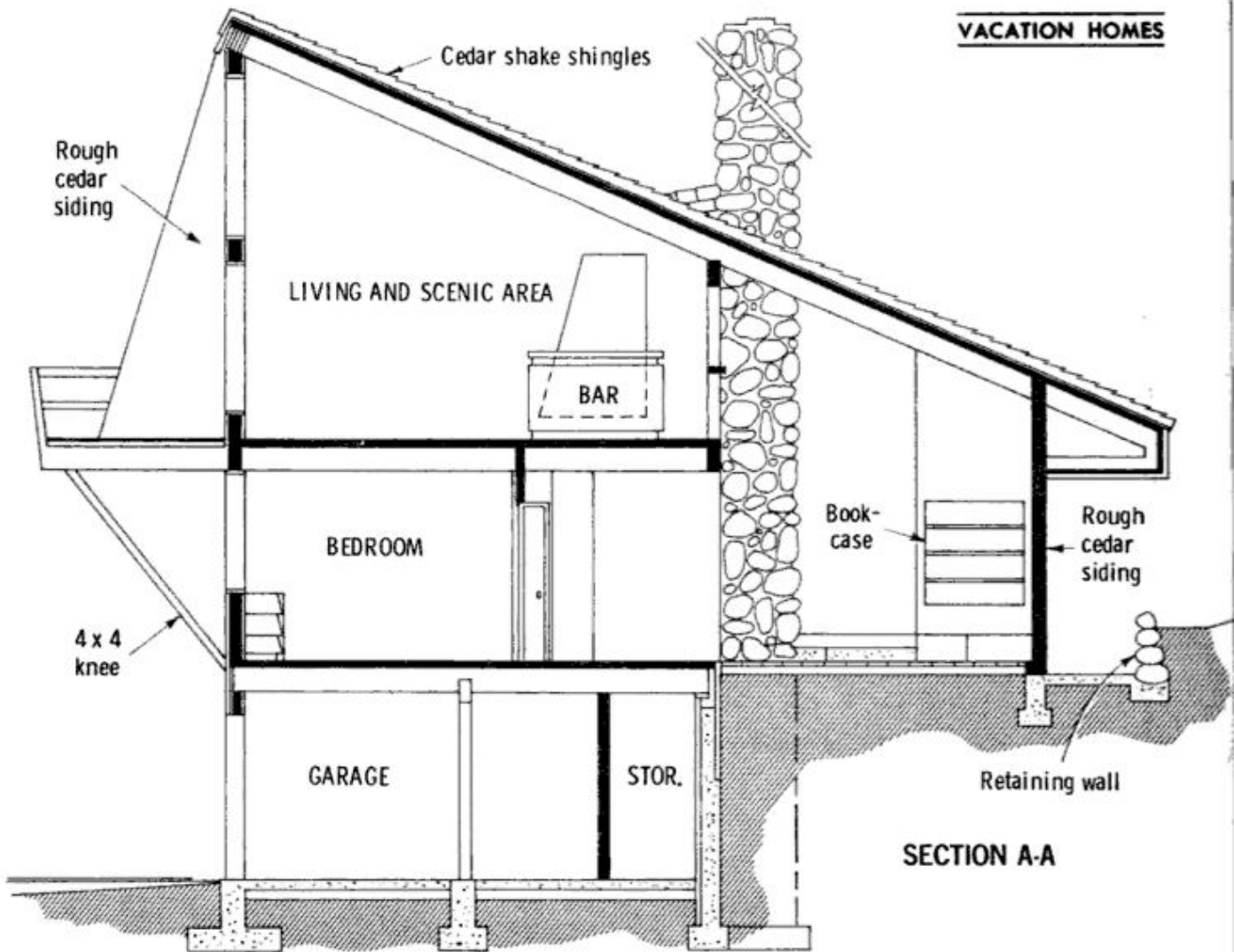
Photos by Robert Cleveland

YOU'RE BOUND to have a houseful of guests at least once during vacation. Here's a trim, space-saving way to store the beds you'll need. Figure about 45 in. for height of the folded cots. Shelf is a piece of $\frac{3}{8}$ -in. plywood. And there's more storage space inside the window bench, right

WHY NOT build in your own beach party? This cabana is equipped to serve hot or cold snacks, beverages. Built of cypress, it has a sheet-metal roof, glass behind counter to block the wind. There are plug-ins for small appliances; space at right for refrigerator. Designer-owner is John Pugh

Photo by Fritz Taggart





Drawings by Zik Associates

separate sleeping apartments, each with two equal-sized bedrooms, big linen closet, bath and a private entry. Each entry has a closet for winter clothing and a floor of quarry tile with a drain in the closet for easy cleanup of tracked-in snow. Bedroom windows go from floor to ceiling, with 16-inch, bottom hopper units for ventilation.

Cantilevered stairway

The north sleeping apartment has an entrance into the kitchen two steps up at the rear. The kitchen, U-shaped, has a laundry on the opposite wall. The other sleeping apartment connects with the dining room, without any step-up. This means you are two steps up from the dining room to the kitchen, an L-shaped extension of the fireplace hearth forming the first step. The dining room has bookcases and built-in sofas in one corner and a fireplace of native stone

with a built-in wood storage on the interior wall. At the extreme south end a cantilevered stairway, suspended by ½-inch steel rods, leads up to the carpeted living room, which sweeps across the entire 42-foot length of the house. Two rows of vertical windows, each row 7 feet 2½ inches high, afford a panorama across the valley. The lower tier of windows also has hopper units for ventilation.

Another stone fireplace and wood-storage unit uses the same chimney structure as those in the dining room. On either side of this fireplace open railings permit you to look down on the dining room and kitchen. Ceilings throughout the house are exposed beams and decking.

Because the Crested Butte area is cool in summer and affords great fishing, the house was designed for year-round use. ★ ★ ★

VACATION HOMES

SHORT-ORDER DINING along a lunch-counter table provides the ultimate in convenience when serving the family or weekend guests. Long bench fitted with individual foam-rubber cushions accommodates maximum number of persons in a minimum of space. Kitchen appliances, plus row of wall cabinets, line the walls of Texture One-Eleven plywood paneling

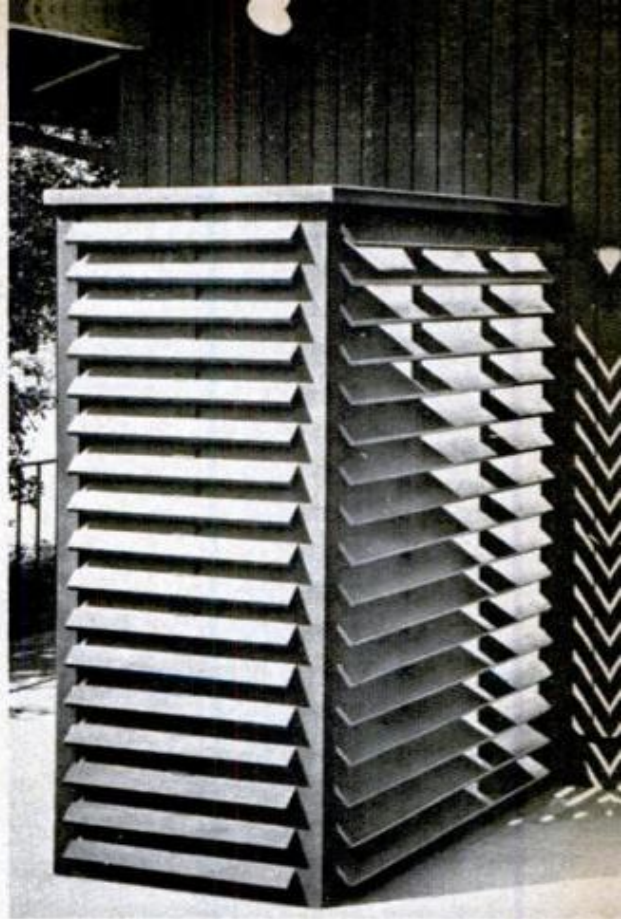
SITTING AROUND AN OPEN FIRE can be done indoors in this smartly-designed vacation home by Henry P. Glass Associates. Inviting sofas, along with wood benches, surround a free-standing central fireplace to make this social area a perfect spot for weekend guests to warm to any occasion. Sofas line hex.-shape well 24-in. deep, part of home's foundation



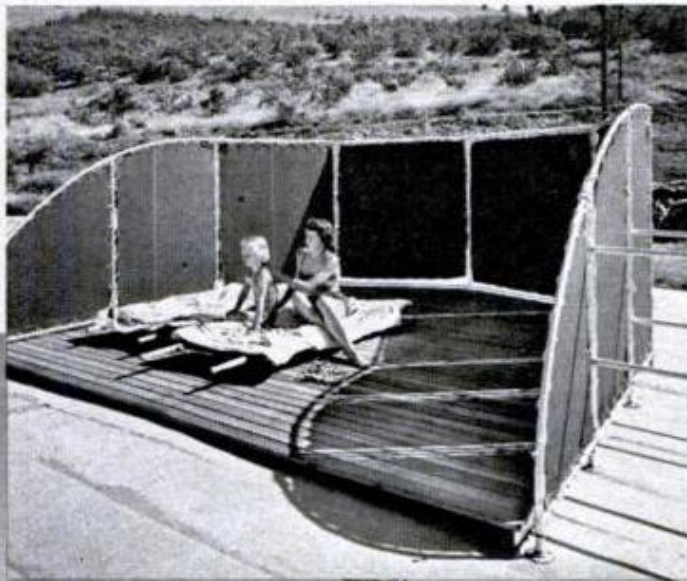


STACK THE FIREBRICK vertically and give yourself a smart looking, economical hearth and spark fence. Bed-sofa and built-in shelves squeeze every ounce of use from the space available

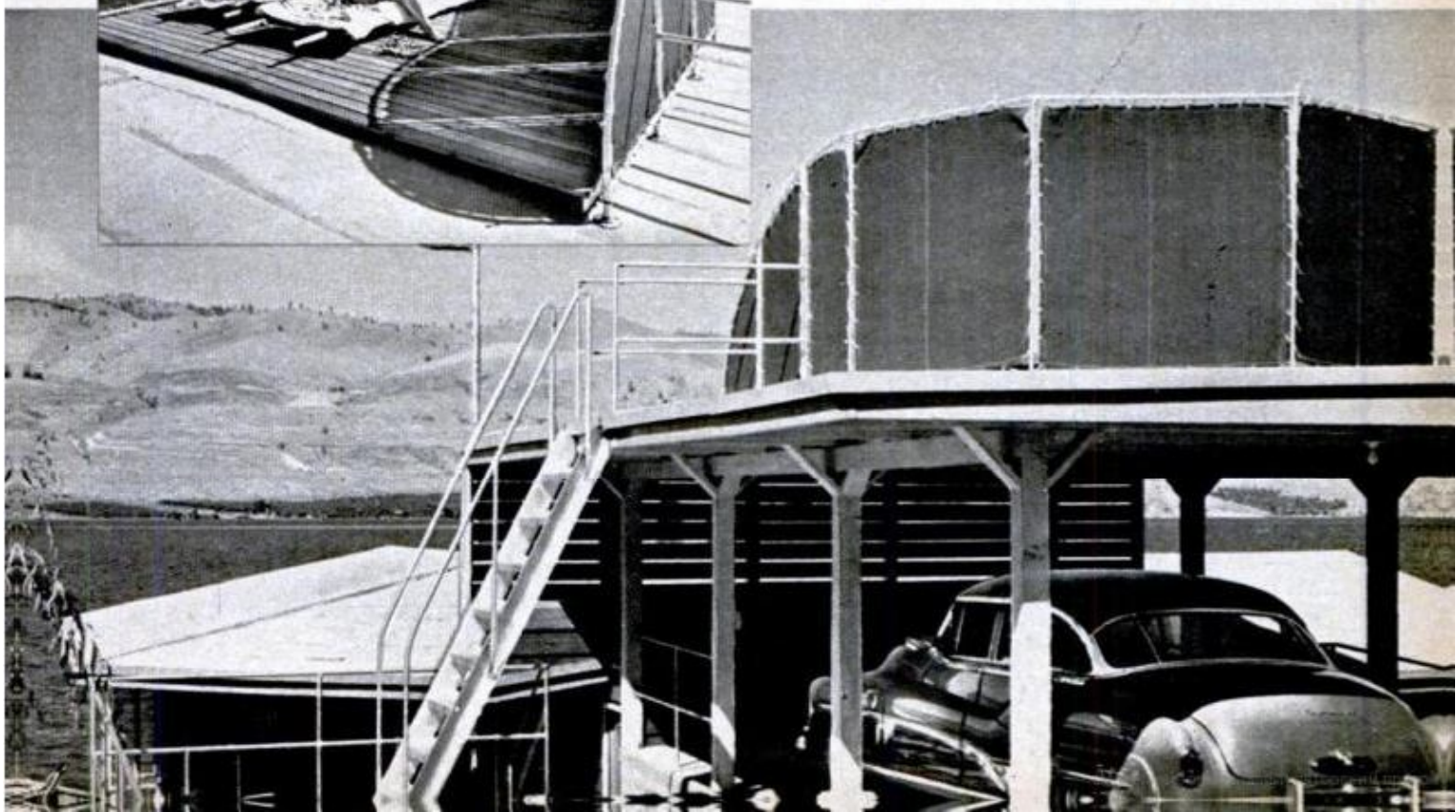
Photos by Charles Pearson

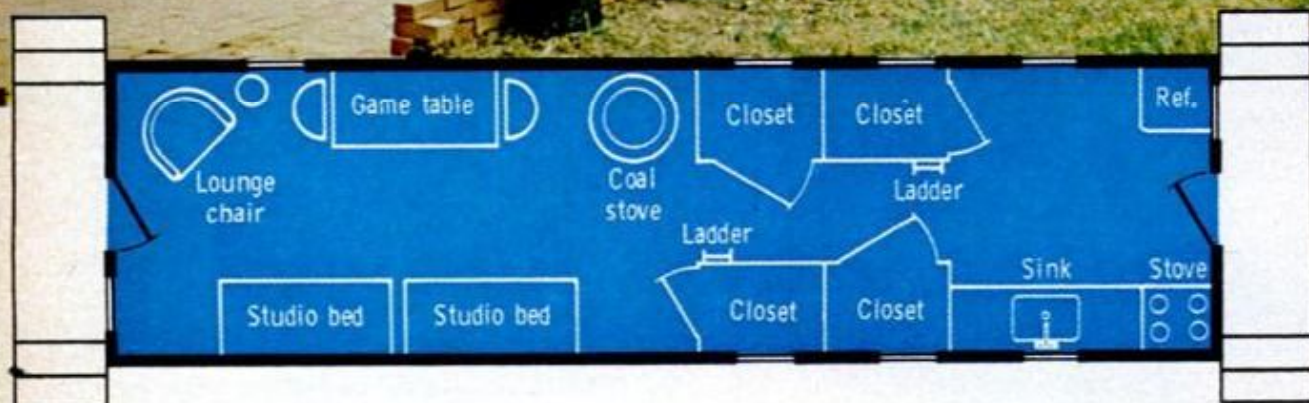


REDWOOD ENCLOSURE delivers privacy for outdoor shower, keeps the spot aired out. The $\frac{1}{2}$ x4-in. slats are set at roughly 30° from the vertical. The frame and slats are cut from heartwood redwood, highly resistant to water rot. Enclosure blends well with redwood siding



GO TOPSIDE and stretch out in the sun! Put up a rig like this and soak up sun comfortably, even on windy days. Any well-supported flat roof will do. In this case, owner lashed a dark-green canvas to a metal pipe frame, laid down fir deck, and added the steel steps leading to canvas gate



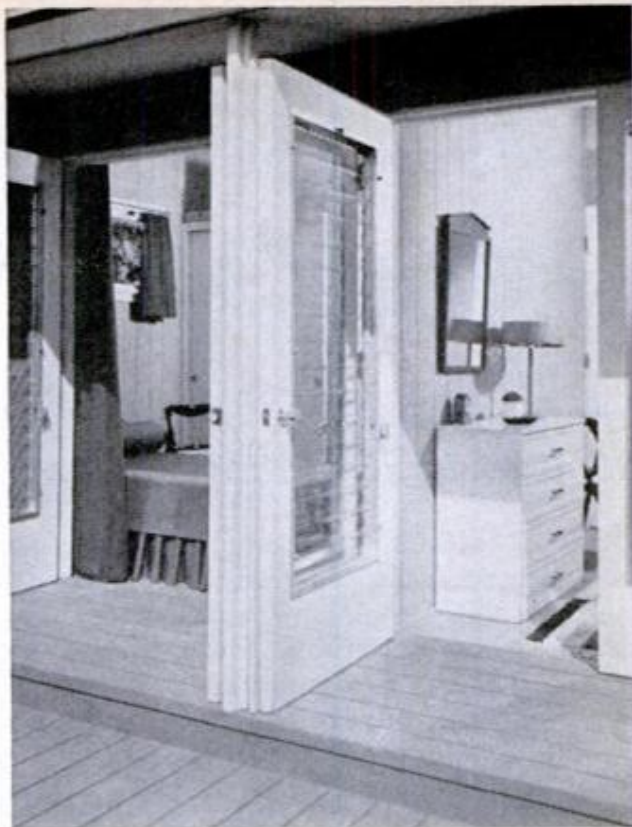


YOU'RE NOT SEEING THINGS. That's a real caboose above. If you're lucky, you may latch onto one for \$100, as the owner of this beauty did. Cost \$200 to truck it to the site. New lumber, fixtures and appliances, much paint and many weekends of work turned it into a weekend cottage with a workable floor plan. The leggy creature below is a Virginia coast beach house that will stay put, even in a hurricane. High water, not high wind, is the real wrecker in a storm, and water washes under this home
 Photo above by Sam Pierson
 Photo below by Taylor Lewis





STORAGE WALL or simple partitions are smarter-looking and easier to build if you make use of pre-finished plywood wall paneling. Just frame out and nail up the panels. Also, system can be economical



SWIM BEFORE BREAKFAST sound appealing to you? Not hard to do here, since double, wood-framed jalousie doors open out from the bedrooms. George Matsumoto, AIA, designed house for Masonite

CUT DOWN TIME waiting to shave and wash in the morning. Built-in lavatory in this bedroom backs up to bath plumbing. Double doors close to make it look like a closet. Four-drawer chest is built in, too

Photo by Fred Rola

AT LEAST SIX STORAGE IDEAS are visible here. Pick those that fit your needs best. Stud-deep can and dry good shelves back up to living room cabinet. Wood is western pine. Desk has a plastic top

Photo by Robert Cleveland

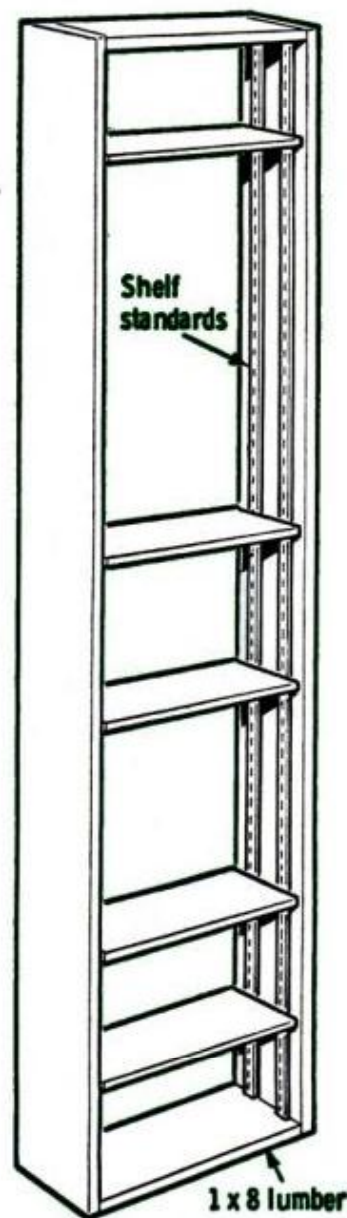


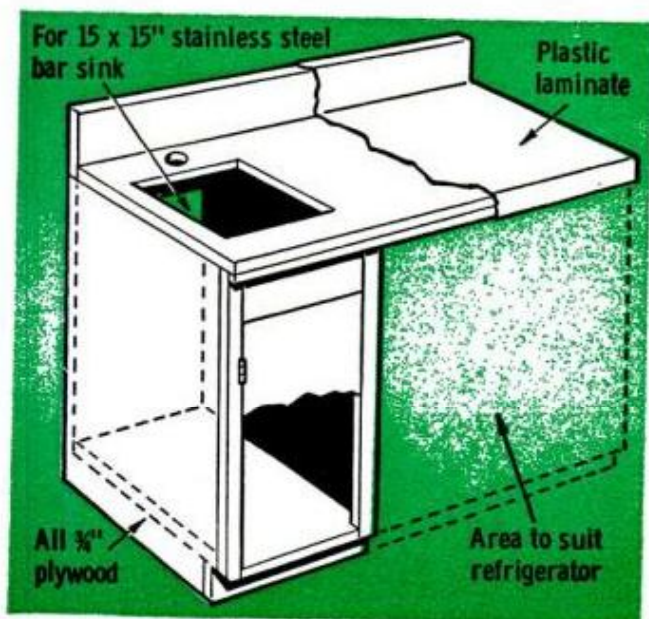
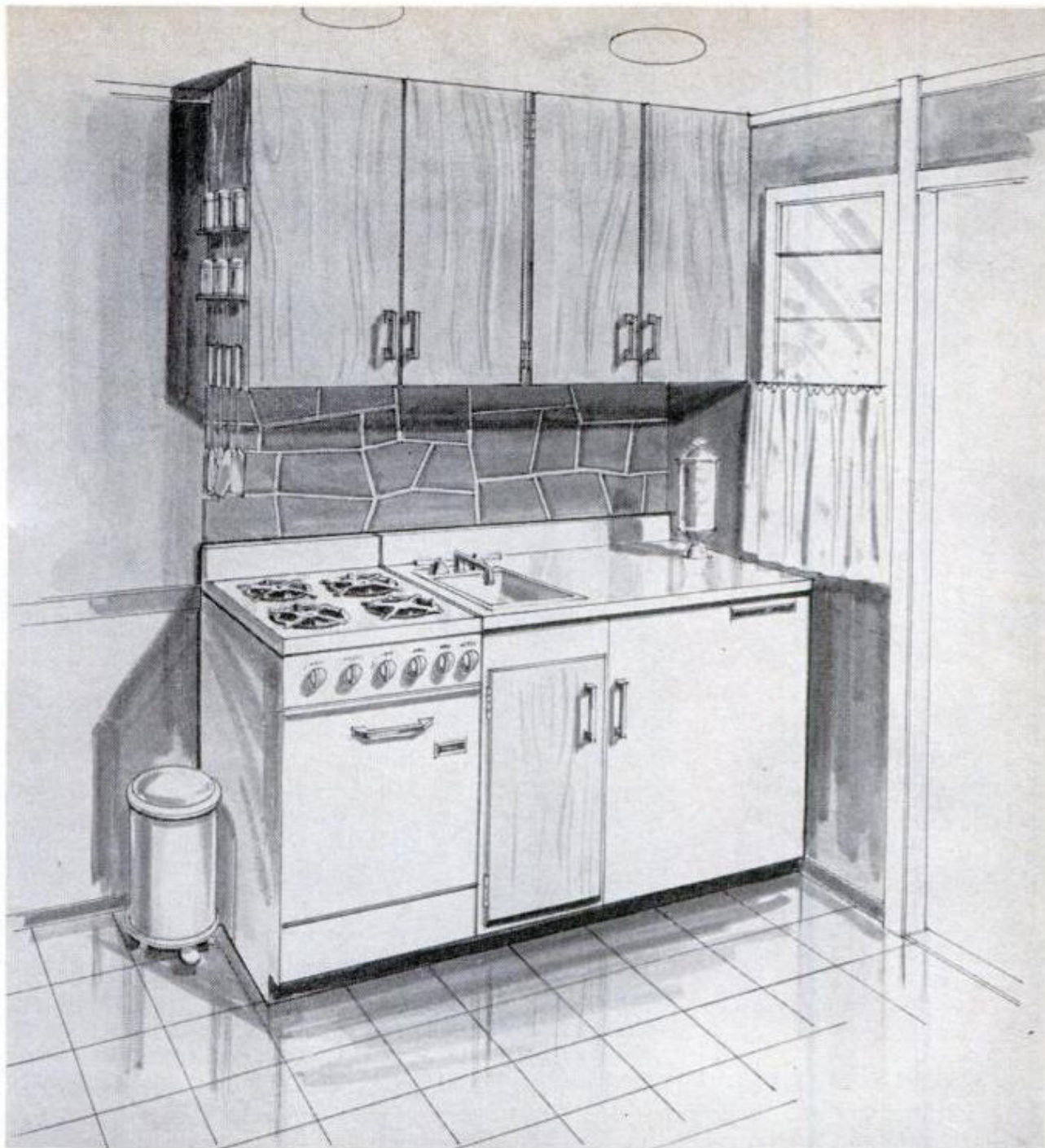
No reason why your No. 2 home at the lake can't be as convenient as your No. 1 home in town. These five build-'em-yourself ideas will help make it so

FLOOR-TO-CEILING shelves like these are easy to knock together, and do a great job of sharpening the appearance of a room while delivering more stow-away space. Shelves are mounted flush against the wall and attached at the ceiling and

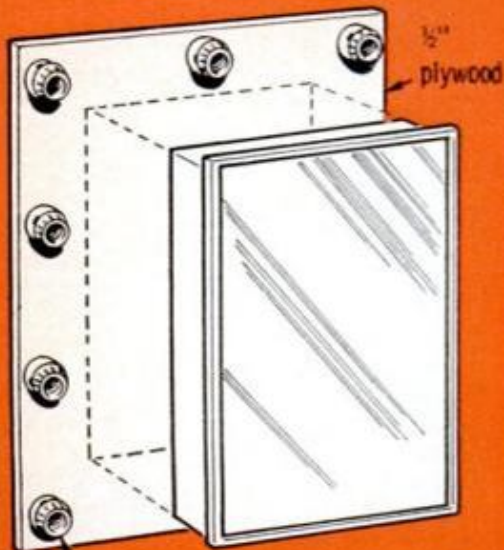
floor. Metal clips set into notched metal runners support the shelves. When you want to shift the position of a shelf, just move the clips. If your weekend home has a big picture window, these shelves could flank it. They're endlessly adaptable.

Western Wood Products Assn. photo





TYPICALLY, a weekend home is designed for plenty of living, and allots the minimum for a kitchen work center. And why not? You go there to unwind, not spend hours over a hot stove. Curious to know the absolute minimum-sized kitchen using separate appliances, we asked the designers at Hotpoint to give us the answer, based on measurements of their smallest units (roughly the same throughout the industry). What you see is a 19½-in.-wide range and oven combination, and a 6.6 cu. ft. undercounter refrigerator. You simply add the wood-frame surround, cabinet door, counter top, and drop in a bar-sized sink—in this case a unit made by Just Mfg. Co. It fits a 9x12-in. opening.



Surface sign sockets

3/4" cleat



To switch and 110-v. line



Sears, Roebuck and Co. photo

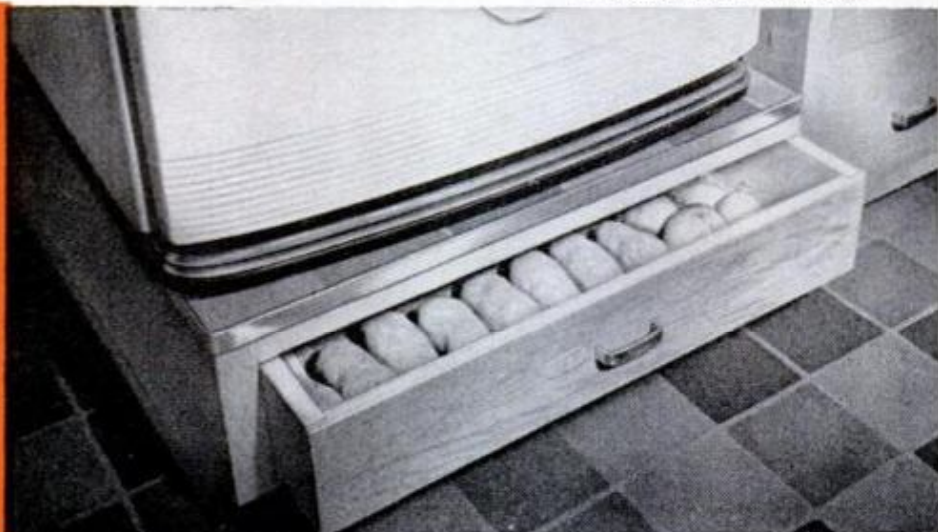
➤ **BACKSTAGE MAKEUP MIRROR** will do a lot to glamorize a cottage bath. To make it, simply attach a medicine cabinet to a plywood panel and surround it with ten 25-w. bulbs wired to a single switch.

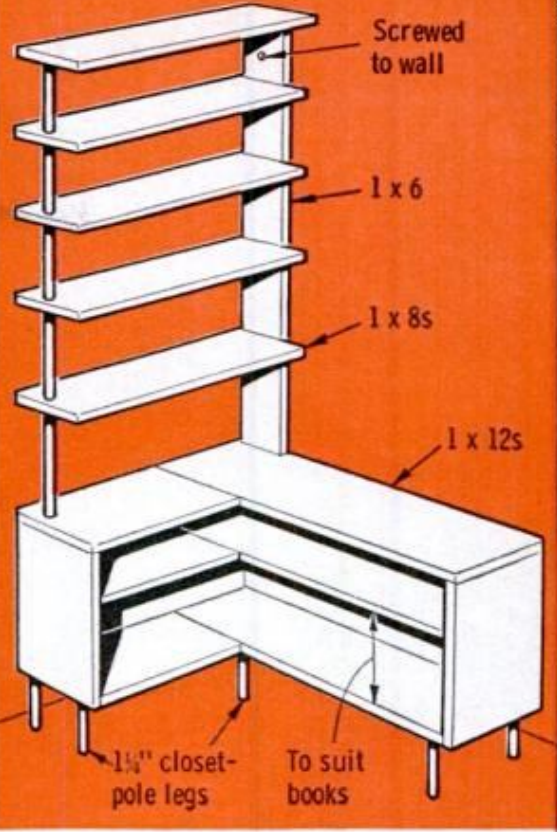
POTATO AND ONION STORAGE always seems to be a problem. You might try this handy solution—even in your year-round home. Frame for the drawer has 2x6 sides to support the weight of the refrigerator. ➤

Photo by Robert Cleveland



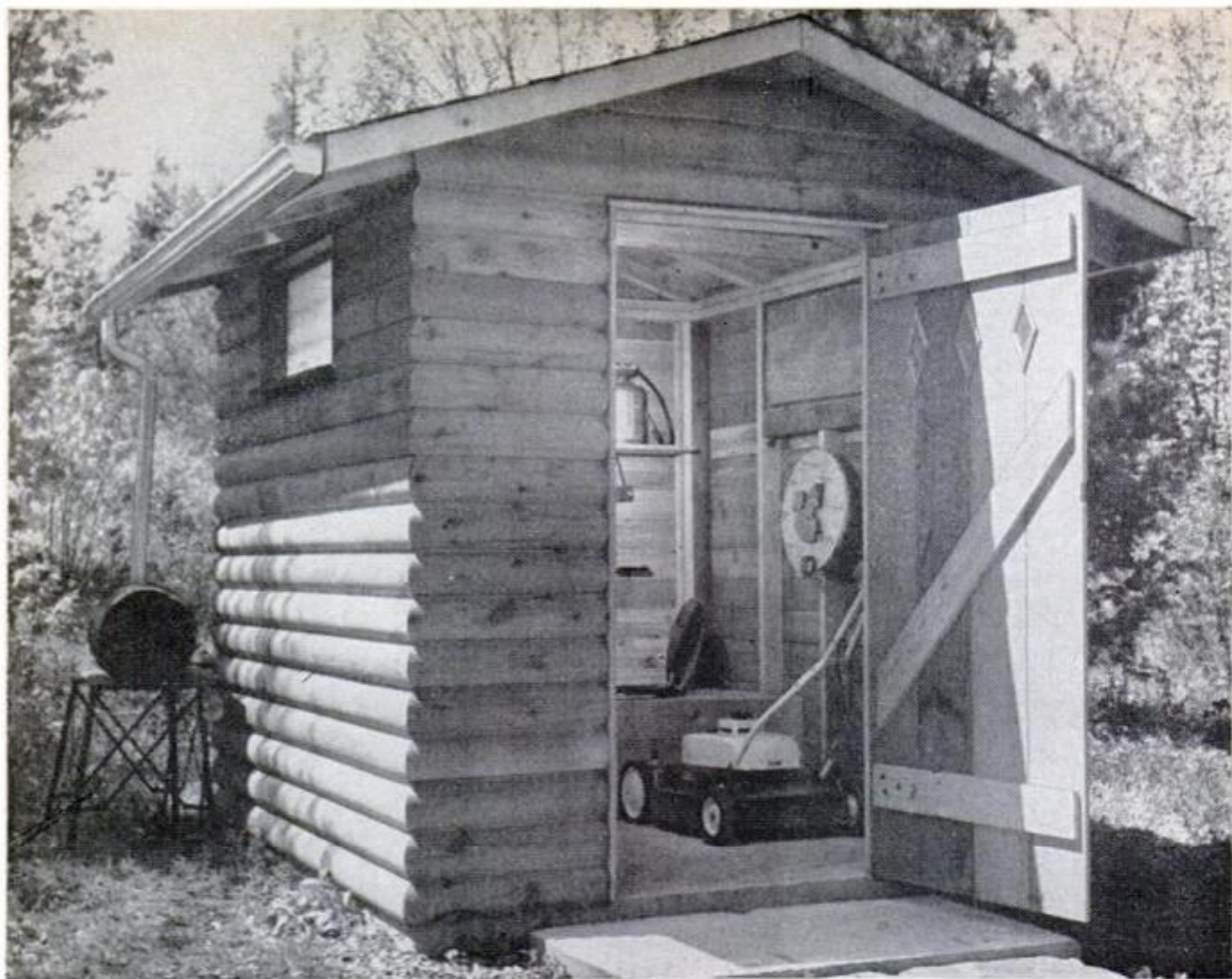
2 x 6





GOT A CORNER that's not working? This shelf and storage unit packs away a surprising amount of stuff; yet doesn't clutter the corner. Shelving above is supported by a wall cleat and a closet-pole "dowel" which passes through the shelves.

Photo by Robert Cleveland



Build a Pretty Little Privy For Your Weekend Retreat

Just what you've needed to add civilized convenience to your vacation cabin—and it can double as a generous storage shed

By DON SHINER

Technical art by Donald J. Evans

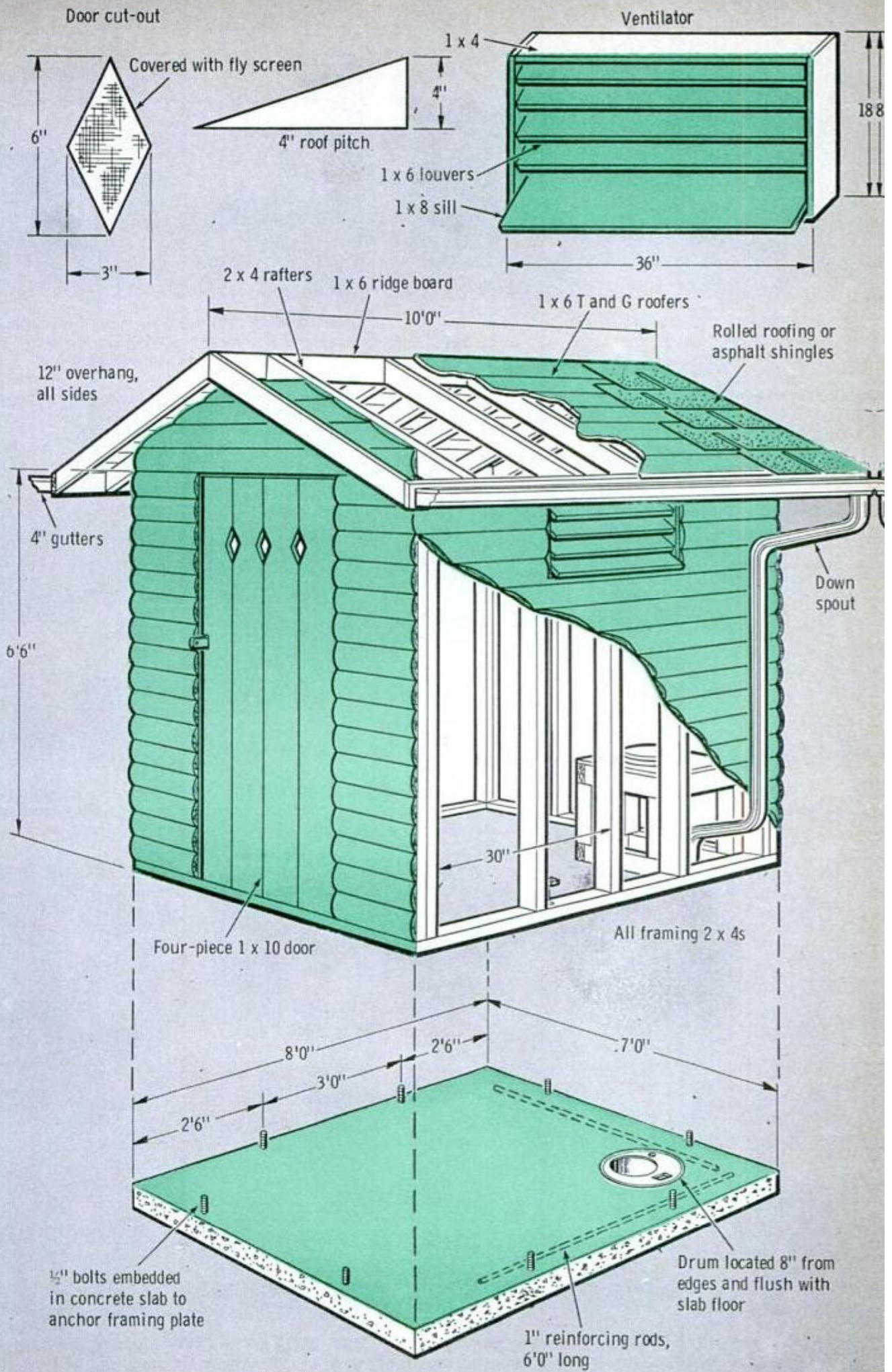
WHEN ALL ELSE IS PERFECT about that vacation home or cottage you've spotted far beyond the city mains, don't let a lack of modern plumbing stop you from buying it.

You can build a vastly improved version of the old, unlamented outhouse, complete with running water, washbasin and flushable latrine, for \$75 to \$135. Rainwater runoff from a low-pitch gable roof is piped to a storage barrel for the

basin, as well as to the latrine. The building is of simple 2x4 frame construction and bolted to a 7x8-ft. concrete slab.

Besides beating the sanitation problem without an elaborate plumbing installation, you get lots of spare room in this *Pretty Privy* for bikes, folding chairs, tools, mowers and other articles that accumulate at a cottage "way out" in the country.

Build it over a couple of weekends this





PREPARED OIL DRUM is sunk into the soil within 4 in. of the lip so that latter will come flush with top of concrete slab. Build 7x8-ft. frame for slab



OPENINGS IN DRUM LID are cut for attachment of drain and downspout elbow and for slide fit with a length of 12-in.-dia. galvanized pipe hung from box



FINISHED SLAB, showing drum located a few inches away from edges at a back corner. Small depressed slab at opposite end serves as shallow step for entry



PLASTIC TUBING is fitted to washbasin drain and extended along base of wall to the drum, providing an additional water supply for flushing of the toilet



SCREENED LOUVERS are built into 2x4 framing at top of each sidewall. Siding in this installation matches that of cabin, but any handy material can be used



BOX BUILT OVER DRUM supports conventional toilet seat, under which the flanged top of the galvanized pipe is attached to a 2-ft.-square board platform

spring in time for the full summer season. It will continue to serve until you're ready to put in a modern system.

Pretty Privy is designed around a 55-gal. steel drum used for oil and other liquids and often available as surplus at service stations, fuel-oil dealers, hardware stores and food distributors. To prepare the drum, punch a dozen or more 1½ to 2-in.-dia. holes through it about 12 to 14 in. above the bottom. You can do this with a heavy hammer and large cold chisel, but the job will be less tedious and noisy if you have a local welder burn in the holes. It will pay also to have him cut off an end to form a lid unless your drum has a detachable lid.

After painting the drum inside and out to prevent rusting, sink it into the soil, preferably in a sand or gravel bed and at least 100 feet away and on a downslope from your fresh-water drinking supply. Stake the form for the slab in place around the drum and position it so its lid will align with the slab, as shown on page 158, upper left.

If your area is not convenient for delivery of ready-mix concrete, you can use a packaged concrete mix. Since each 90-lb. bag will fill an area of 2 sq. ft. 4 in. deep, you'll need 28 bags of the mix to make the slab and another 4 to 5 bags for the adjoining step at the entry. At \$1.60 per bag, this would bring the slab cost to about \$50—worth it to save the trouble of mixing 1½ cubic yards of concrete.

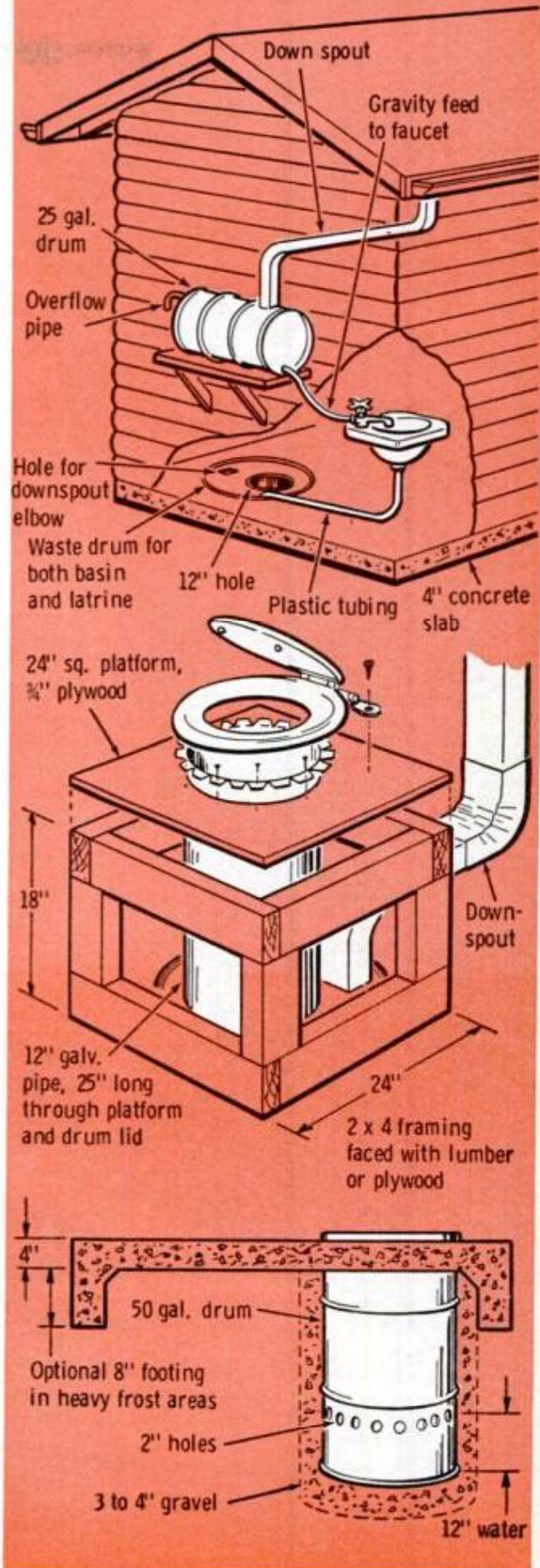
When pouring the concrete, be sure to lay in reinforcing rods near the drum and embed two ½-in. bolts near each edge of the slab to anchor the building framing, as shown on page 157. This would be a good stopping point at the end of a weekend to give the slab plenty of time to harden and cure.

Conventional frame construction of the building is shown in the cutaway drawing on page 157. You have a wide latitude as to type and size of building, but the main idea is to provide at least 100 sq. ft. of roof area. To obtain this with our 7x8-framework, we erected a gable roof with a 4-in-12 pitch and a 12-in. overhang all around. The roof is made up of 1x6 tongue-and-groove boards, roofing felt and asphalt shingles.

Two screened louvers for light and ventilation are made from 1-in. stock, as detailed, and centered high up on the side

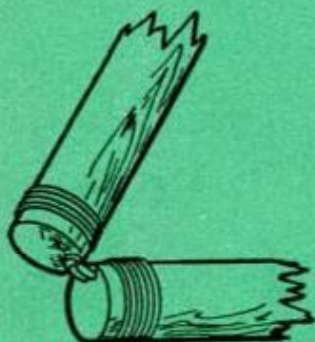
(Please turn to page 216)

HOW THE PLUMBING WORKS



2 1/4"-dia. mast
measures 11' 7"
above step. Use
spruce, if available

OUTHHAUL
Drill 3/8" holes
1 3/4" and 2 1/4" from
end of boom



BOOM-YARD JUNCTION
Gouge 3/8" x 1 1/2" groove
in each to receive 1/2"
rope. Fasten rope in
groove with 3/4" copper
nails, then compress
by serving with
twine. Varnish
when completed

1 3/4"-dia.
douglas fir yard

BOATING

Build PM's 'Jumper' Sailboard

It's small and easy to build, but
this 13 1/2 footer is a giant of a
boat in the fun department.
Two weekends and you'll be all
set for summer sailing.

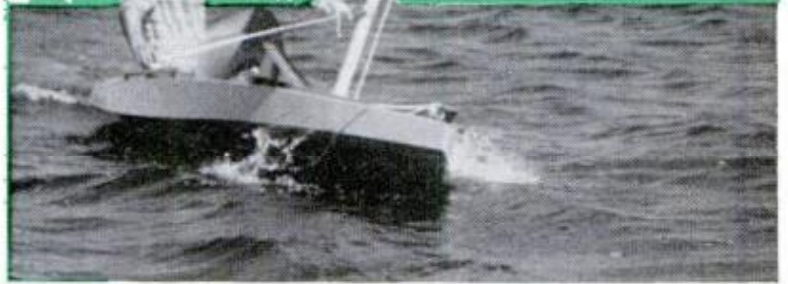
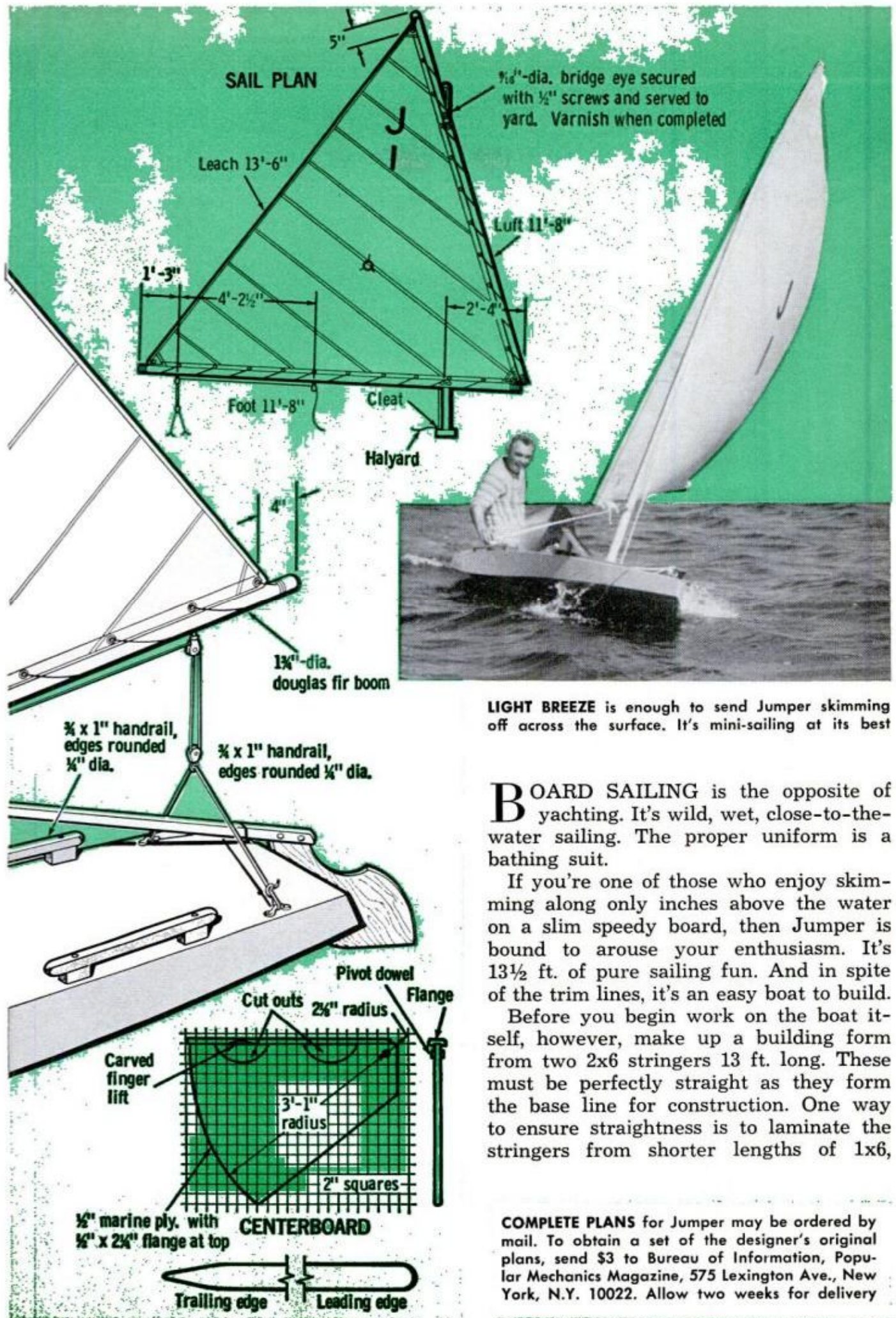
by **G. K. BRANNEN**
Technical Art by Donald Evans

3/8"-dia. bridge eye

HANDRAIL

Use no. 12 x 3" R. H.
brass screws
Drill 3/8" hole through rail
support and 1/8" pilot
hole through plywood into
sheet stringer





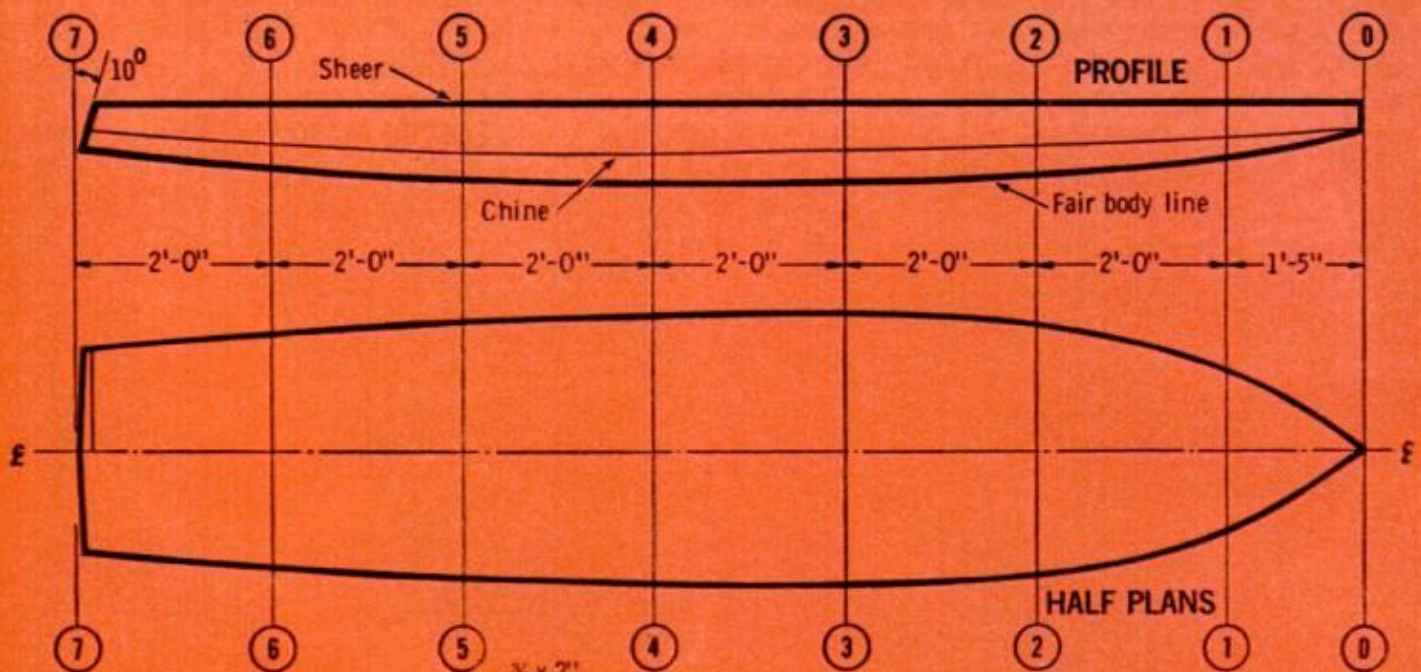
LIGHT BREEZE is enough to send Jumper skimming off across the surface. It's mini-sailing at its best

BOARD SAILING is the opposite of yachting. It's wild, wet, close-to-the-water sailing. The proper uniform is a bathing suit.

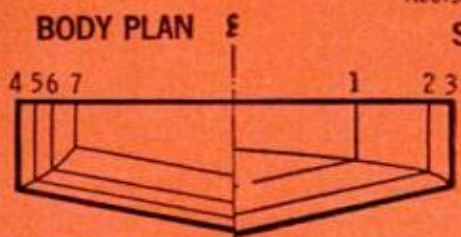
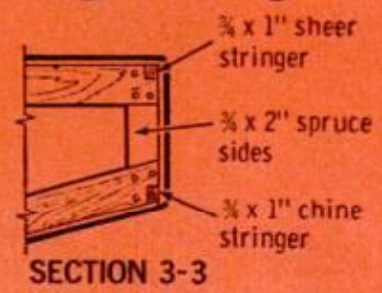
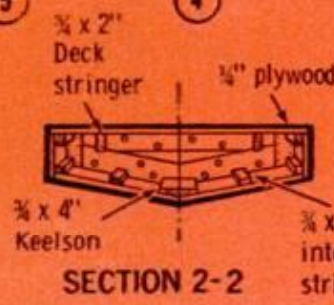
If you're one of those who enjoy skimming along only inches above the water on a slim speedy board, then Jumper is bound to arouse your enthusiasm. It's 13 $\frac{1}{2}$ ft. of pure sailing fun. And in spite of the trim lines, it's an easy boat to build.

Before you begin work on the boat itself, however, make up a building form from two 2x6 stringers 13 ft. long. These must be perfectly straight as they form the base line for construction. One way to ensure straightness is to laminate the stringers from shorter lengths of 1x6,

COMPLETE PLANS for Jumper may be ordered by mail. To obtain a set of the designer's original plans, send \$3 to Bureau of Information, Popular Mechanics Magazine, 575 Lexington Ave., New York, N.Y. 10022. Allow two weeks for delivery



CUT FOLD TAPE
"JUMPER" SAILBOARD



HEIGHTS ABOVE BASELINE								
STATION	0	1	2	3	4	5	6	7
CHINE	3-2	4-2	5-2	6-0	6-2	6-0	5-0	3-2
FAIRBODY	3-2	6-3	8-4	9-4	9-2	8-5	7-4	5-2
HALF BREADTHS FROM CENTER LINE								
CHINE	0	9-4	15-2	16-5	16-4	15-5	14-2	12-4
SHEER -	SAME AS CHINE							

NOTE:
 Sheer line serves as base line in building hull upside down.
 Offsets given in inches and eighths of inches. All measurements to outside surface of frame

staggering the butt joints and nailing the boards securely together.

The stringers should be mounted parallel about 20 in. apart, so cut spreaders this length from 2x4 stock and nail them at 18-in. intervals between the 2x6s. To avoid unnecessary bending, elevate this base assembly roughly 2 ft. above the floor by adding 2x2 legs. Nail them to the inside of each stringer at 4-ft. intervals.

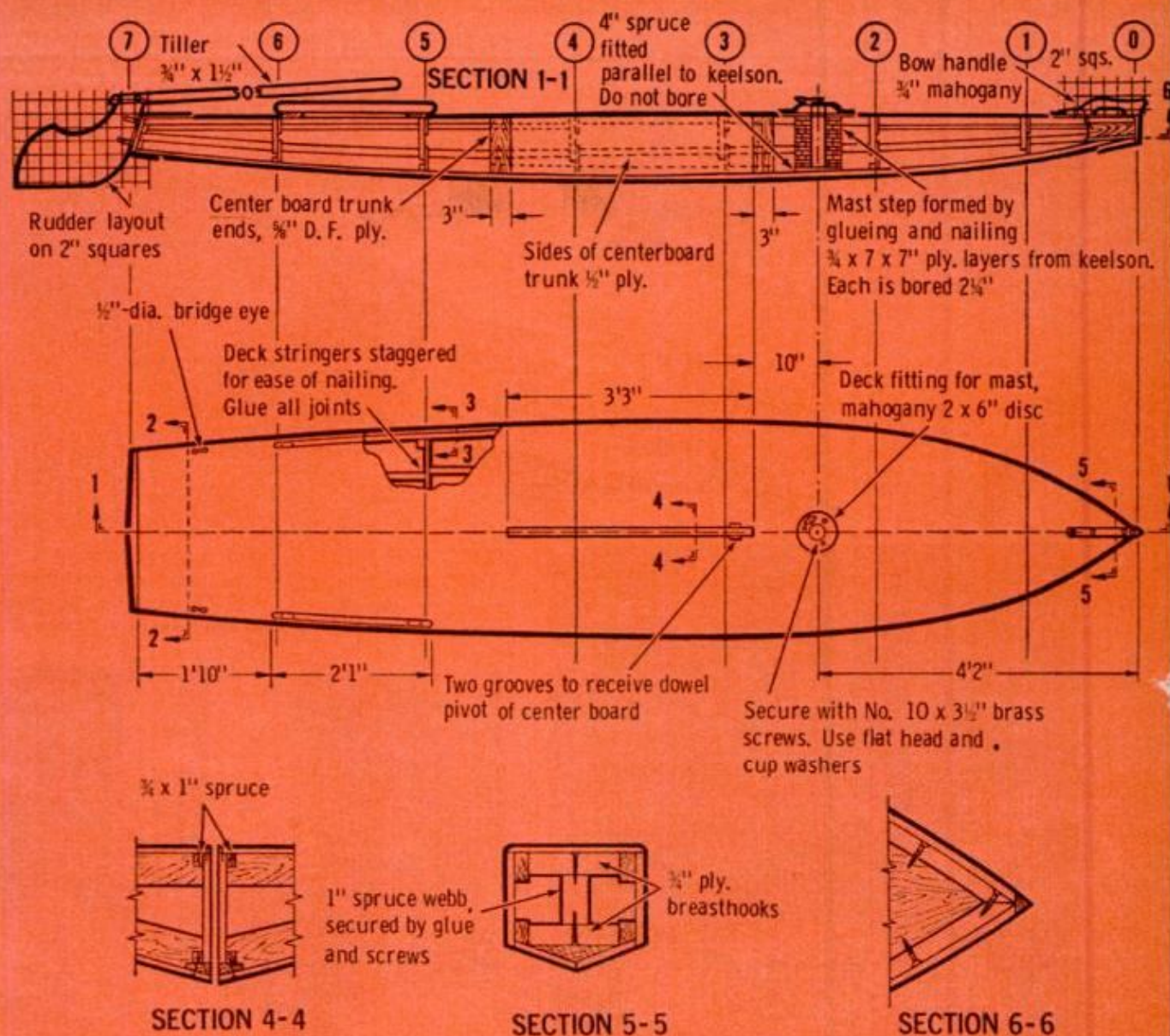
Remember, a basement or garage floor is almost never perfectly level. Your two stringers must be, however, so scribe the legs to the floor and check your work with line and level. When you're satisfied, add two or three extra braces, both longitudinally and transversely, to prevent the assembly from twisting out of line. Once this building base is complete, you're ready to go to work on the boat.

Begin by making up the frames. Using the table of offsets shown above, lay out full-size patterns on a large sheet of heavy brown wrapping paper. Use a common center line and base line for all of them. Frame members can then be placed on the drawing and all cuts marked out on the stock.

Assembling the frames

When fabricating the frames, use waterproof glue at all joints with the exception of those in Frame Nos. 3 and 4 which will have to be dismantled later to install the centerboard. Secure them with 3/4-in. 15-ga. silica-bronze nails having annular threads. Allow plenty of time for the glue to set before assembling the frames on the building base.

Construction is conventional through-



EARLIER VERSION of Jumper featured different deck layout which was later refined after sailing tests

out. Mount the frames on the building base by nailing short 1x1 uprights to the stringers and clamping (or temporarily nailing) the frames to these. Use one of the chine stringers as a bending batten to lay out the notches in the frames. All of

APRIL 1967

these should be cut at the proper angle to provide full contact between both surfaces of each joint.

The bow of the boat will extend slightly beyond the building base, enabling you to work on the bow assembly more easily. When reference to the center line is required at this point, tack a short straightedge to the building base to extend the center line.

To obtain the proper cutting lines where stringers intersect at the bow, just bend one over the other and mark the cut. All fore-and-aft members are secured with one $1\frac{1}{4}$ -in. No. 9 flathead brass screw per frame. Countersink these to prepare for fairing.

The breasthooks should be patterned from the chines to obtain a tight fit. Both

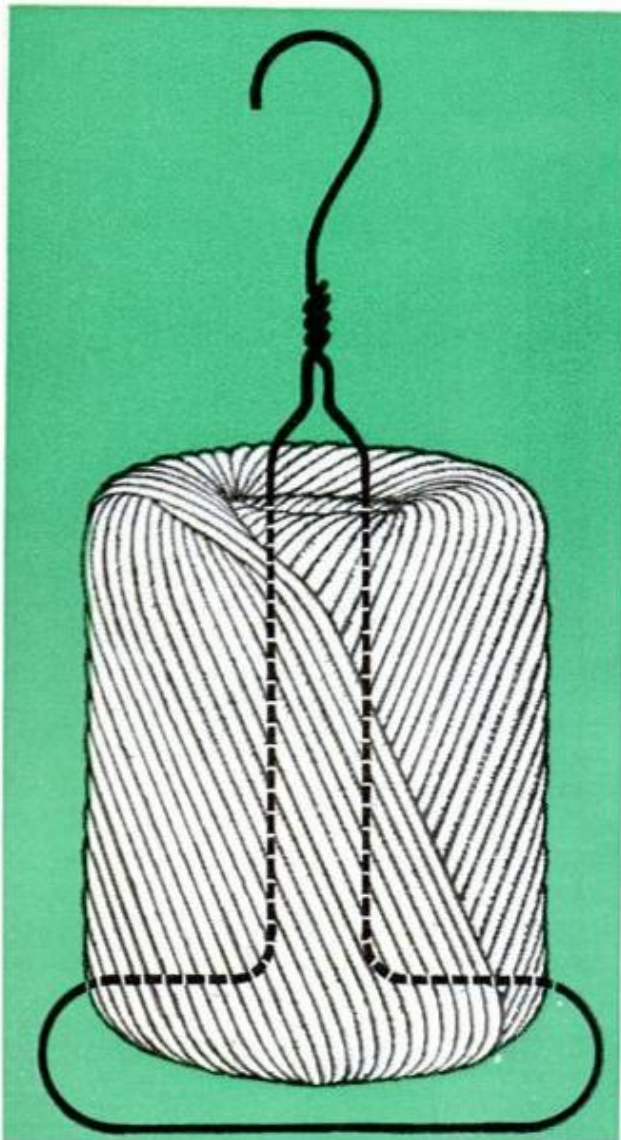
(Please turn to page 204)

163

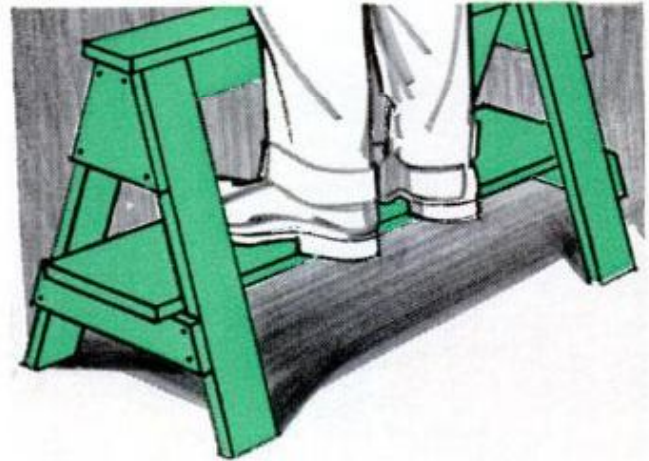
Solve home problems



NEED NAME TAGS to label luggage and other personal gear? Just snip your name and address from envelopes you receive in the mail. With transparent tape, you can use these on toolboxes and other things



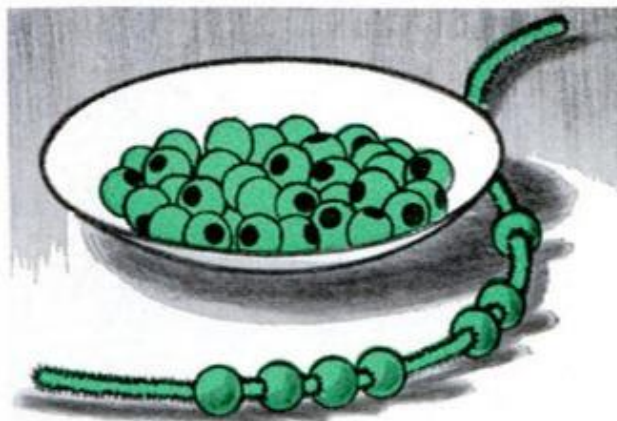
BIG BALL OF TWINE can be hung on the wall handy to where it's used if you bend a wire coat hanger as shown so that the hook slips up through the opening in the center and ball rests on the projections



ONE-STEP LADDER will give you that extra few inches of height required on many jobs. To make one, add brackets between the legs of your sawhorse to support a sturdy shelf. You can use it from either side



STIFF RUBBER HOSE becomes easier to force over a tight connection if you place the ends in a pail of hot water for 10 minutes or so. This not only makes the hose more flexible, but assures a tighter fit



WHEN YOUR WIFE'S NECKLACE breaks, pipe cleaners are perfect as temporary holders for the loose beads until they can be restrung. This not only keeps the beads in proper order, but prevents your losing them



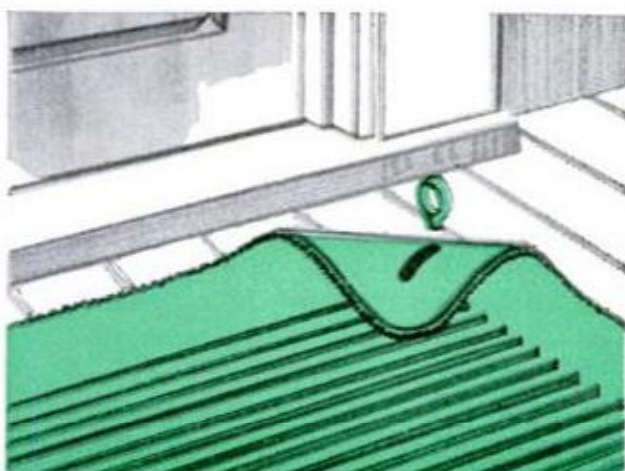
WHEN JOGGING a number of sheets of paper to align the edges before cutting or stapling, sandwich them between two pieces of cardboard the same size. This protects the ends and the corners from battering



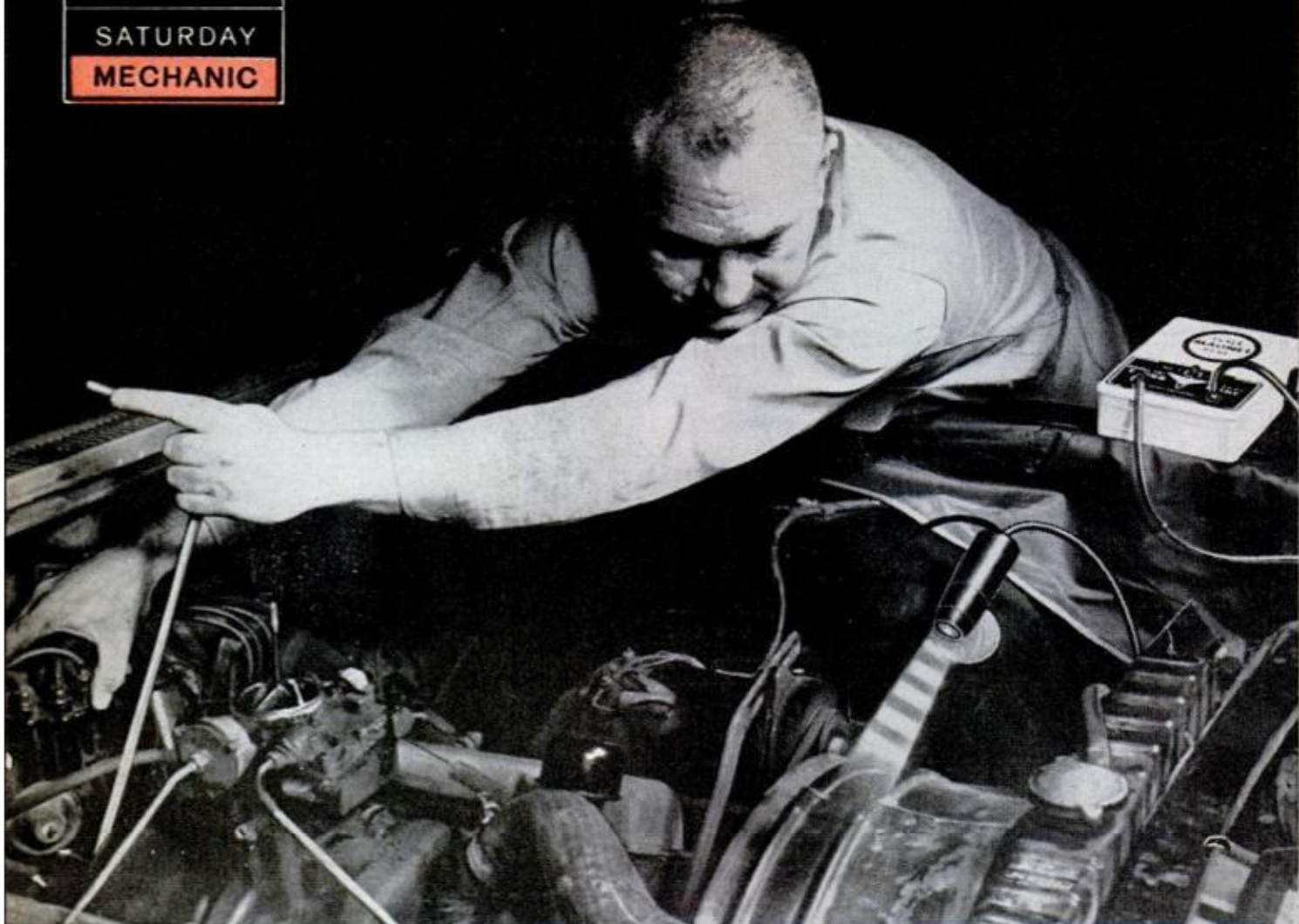
IF YOU DON'T HAVE a whetstone handy when a knife has to be sharpened, try using the rim of a clay flower pot. With this "emergency stone," you can hone the edge of a paring knife to razor sharpness



CLOTHESPIN CLAMPED to rim of a pail when you're cleaning gutters supports the bail and makes it easy to engage the hoisting hook. The bail rests in the open end of pin and swings in or out with no difficulty



TO HOLD DOORMAT in place on a wood porch floor, cut buttonhole slots in the corners near the door and use screw eyes as turnbuttons. Mat can't get kicked about, yet can be removed quickly for cleaning



DYNAMIC TIMING ADJUSTMENTS are made with engine running at specified rpm by loosening distributor and turning until timing marks line up. Timing mark on pulley appears to stand still when illuminated by stroboscopic pulses of light (emphasized above) from timing light connected to battery and ignition voltage

ENGINE POWER, MILEAGE AND LIFE DEPEND ON YOUR

TIMING TECHNIQUES

By MORT SCHULTZ

I GET ANNOYED, and I'm sure you do, too, when faced with simple-minded instructions that say do such-and-such according to the manufacturer's specifications. Nevertheless, I have to say, when it comes to timing the ignition of your car, *do it according to the manufacturer's specifications!* Some theory will reveal the importance of ignition timing and why manufacturer's specs should be followed without deviation.

There's nothing mysterious about ignition timing. Timing simply refers to *when* the fuel-air igniting sparks are delivered to the cylinder to provide the pistons with the explosive force they need for their

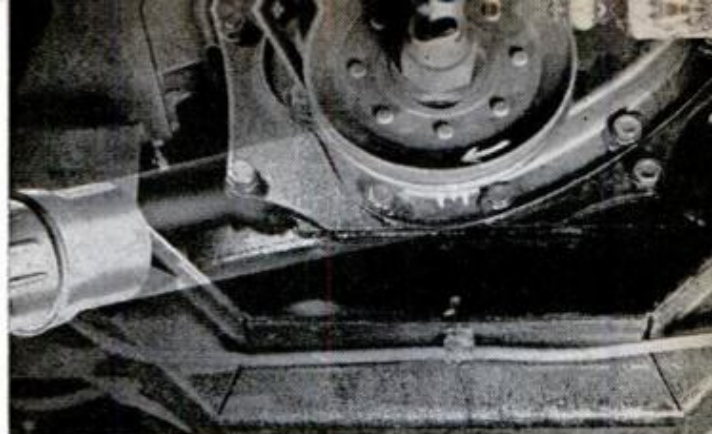
power strokes. It's as simple as that. But the importance of the spark being at the right place at the right time is too frequently overlooked.

According to a survey made by the Champion Spark Plug Co. and another made by *PM's Auto Clinic*, many people seem to take ignition timing for granted. In Champion's survey, the repair histories of hundreds of vehicles operated by 189 fleet owners were checked.

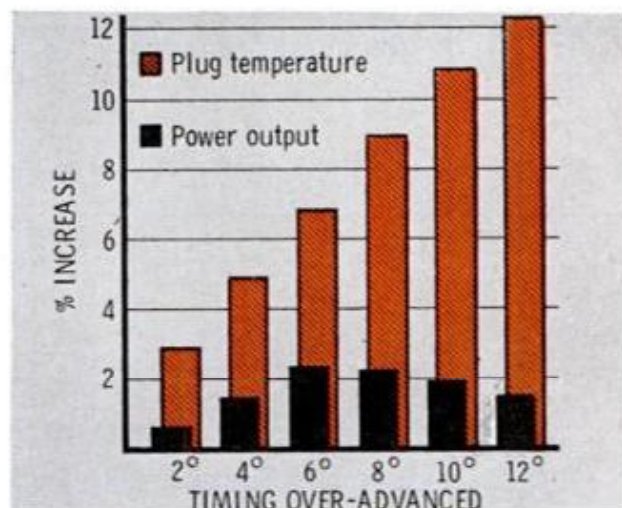
It was found that second on a list of 18 prevalent conditions contributing to operational problems with these *professionally* driven and maintained vehicles was incorrect ignition timing.



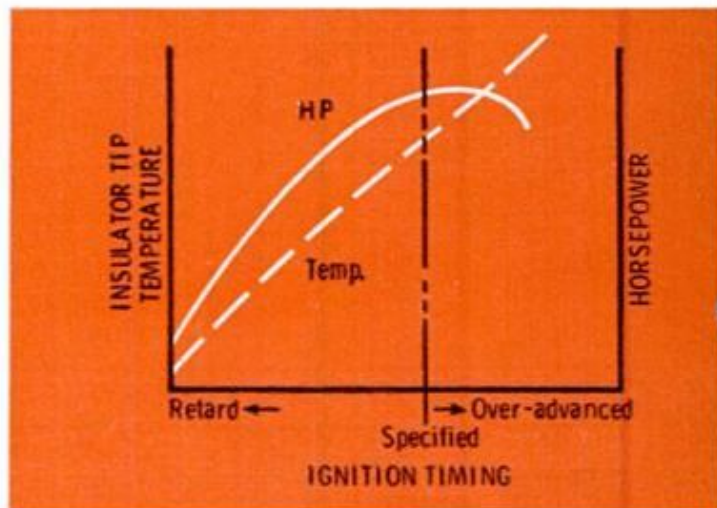
ADVANCED TIMING causes plug overheating, which breaks down porcelain insulation and greatly shortens plug life. This is only one effect of mistiming



TIMING MARK on crankshaft pulley is illuminated by stroboscopic timing light. Mark is aligned with reference marks on engine for idle and higher rpm



SMALL INCREASE IN POWER gained by over-advancing timing is paid for in decreased sparkplug life and can result in engine damage caused by preignition



RETARDING OR ADVANCING engine timing from manufacturer's spec affects available horse power and sparkplug temperature as shown in these curves

Is the average family car in any better shape than these fleet vehicles? When was the last time you had your car's ignition timed? If it's been a while, lend an ear to the basic approach for the correction of ignition timing.

Although the piston-compressed fuel mixture in your cylinders burns rapidly—almost explosively—it takes time for it to burn completely. The ignition system (specifically, the distributor) has to be set (or timed) to produce the spark at an exact moment. With most manufacturers, this moment is just before the piston reaches top dead center in its compression stroke. At this point, the mixture has sufficient time to ignite, burn and exert the pressure that sends the piston on its downward stroke with a punch.

The point before top dead center (BTDC) at which manufacturers tell you to set the timing is usually not the point that provides *maximum* power. In determining a timing point, most manufacturers

allow for a "cushion" to eliminate vibration and increased sparkplug temperature. Timing for maximum power doesn't allow for this built-in safety cushion.

What happens if your timing isn't set to the manufacturer's specifications? The spark occurs either early (advanced) or late (retarded) in respect to the manufacturer's requirements for his engine. In either case, the peak at which adequate power occurs *with the greatest degree of safety* is missed.

What happens when you over-advance your timing in the interest of more power is dramatically shown in the bar graph of timing advance versus percent of increase of plug temperature and power. You do get more power, but look what happens to sparkplug temperature. This graph was plotted by Champion Spark Plug engineers during experiments in which an engine was outfitted with conventional sparkplugs with tiny "thermometers" in the form of thermocouples installed in the

TROUBLE	CAUSE	CORRECTION
Timing mark doesn't align with reference pointer	Distributor not properly timed in relation to engine	Loosen distributor housing, rotate until timing mark and pointer are aligned
Timing mark wavers	Bad bearings in distributor	Repair or replace distributor
Timing mark remains stationary beyond speed at which automatic advance should operate	Frozen automatic advance mechanism	Repair if you can, but replacement in today's cars is usually called for
Timing mark jumps suddenly as engine rpm is increased beyond speed at which automatic advance should operate	Sticking automatic advance mechanism	Repair or replace
Double firing of timing light	Plug gap extremely wide or defective cable, requiring extremely high voltage to fire plug	Repair or replace plug and/or cable
Timing flash misses	Fouled plug	Clean or replace plug

CUT
FOLD
TAPE**IGNITION
TIMING**

firing-tip temperatures immediately.

Advancing ignition timing—a thing that many “power boys” do—means that you allow the distributor to produce the spark in advance of the piston position where manufacturers recommend it should be produced. The piston begins its compression stroke and, if timing is advanced, the spark occurs on this upstroke at a point where maximum burning of fuel takes place. This squeezes every drop of energy out of the fuel and allows for a more powerful piston power stroke.

But this timing advance lowers sparkplug voltage requirements since the plug fires at a lower compression pressure. The spark electrodes get hotter because a higher burning temperature is created in the cylinder and because a plug cools better when it can expend its full spark. If the timing is set to lower voltage requirements, you don't get a full spark and plug temperature rises.

Under these conditions, several things can occur:

insulator tips. By connecting them to sensitive meters, the thermocouples indicate sparkplug

1. If timing is only moderately advanced, plugs overheat and will fail short of their specified life expectancy.

2. If timing is well-advanced, plugs get even hotter and preignition is likely—that is, firing of the fuel mixture before the spark occurs, which leads to extreme heat and pressure inside the cylinder. Cylinder temperature can get so high that piston and valves begin to roast. In fact, it has been demonstrated that under a sustained preignition condition, a piston can have a hole burned in it.

3. If the timing is advanced too far from recommended specs, the spark occurs so far in advance of the piston's top dead center that the explosion in the cylinder could stop the piston's upward travel. It may even run the engine “backward,” jamming the starter and breaking the starter drive housing.

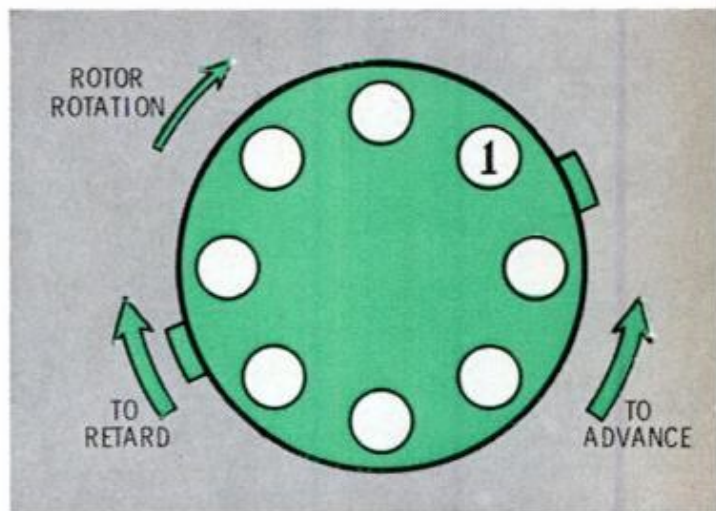
Retarded timing—having the spark occur after the manufacturer's recommended point—does not cause results as violent as advanced timing, but it is equally detrimental to engine efficiency. You don't get all the power the manufacturer intended you to get from your engine. Fuel isn't fully burned because of lower sparkplug temperature, and the engine,



TIMING LIGHT ABOVE is Lincoln Engineering Co.'s Model 387. This light, priced around \$35, is in two parts: Circuits are in case, and light is enclosed separately with magnet base for attaching to car

TIMING LIGHT AT TOP RIGHT is a Knight-Kit Model KG-371 available from Allied Radio. The \$19.95 kit is easily assembled and can be used with 6 or 12 volts. All cables, clips and adapters are included

TURN DISTRIBUTOR as shown at right to advance or retard ignition timing and always double check timing after retightening the distributor. As a final step, check your vacuum advance, using a timing light



as a result, will consume more gas.

In the extremely retarded condition, unburned residue builds up and carbons the top of the pistons. Engine temperatures cause this carbon to reach a temperature hot enough to ignite the fuel mixture in advance of the spark. This preignition knocks the devil out of pistons and other engine parts.

There's no disagreement on how often timing should be checked: after every 5000 miles of running and whenever distributor points or sparkplugs are replaced. Timing an engine can be done in two ways: statically or dynamically.

Static timing is done under an engine-off condition. It consists of adjusting distributor breaker points to open precisely in relation to a specified distance between the top of the piston and top dead center. It's done by connecting a continuity meter or test light into the ignition circuit.

The points are adjusted to break at a specific time during the piston's reciprocal movement. When the continuity meter or test light registers open circuit, point opening is indicated.

For example, suppose the timing is specified at 10° BTDC. With marks on the crankshaft pulley lined up as called

for in the manufacturer's instructions, one lead of a test lamp is connected to the distributor terminal of the ignition coil, and the other lead is connected to ground. The ignition is switched on without starting the engine. The distributor body is rotated until the contact points are closed and the test lamp lights. It is then rotated in the opposite direction until the points just begin to open and the test lamp goes out. The distributor is then tightened.

Most foreign-car manufacturers explicitly specify static timing for their cars, claiming that static timing provides the best timing adjustment. Timing engines that put out a scant 30, 40 or 50 horses is a critical job. If your timing is inaccurate to the tune of 10 or 15 percent of available horsepower, you're down to a not-too-mighty few horsepower. With a 200, 300 or 400-hp Detroit engine, on the other hand, 10 or 15 percent inaccuracy still leaves plenty of power.

Dynamic timing—done with the engine running—is performed with the use of a stroboscopic timing light that flashes each instant the sparkplug fires. The number one sparkplug is usually used as the reference. When the beam is aimed at the

(Please turn to page 220)

Magazine-Go-Round End Table

Four-sided rack spins around to serve you your favorite magazine on a platter. Even provides end table to boot

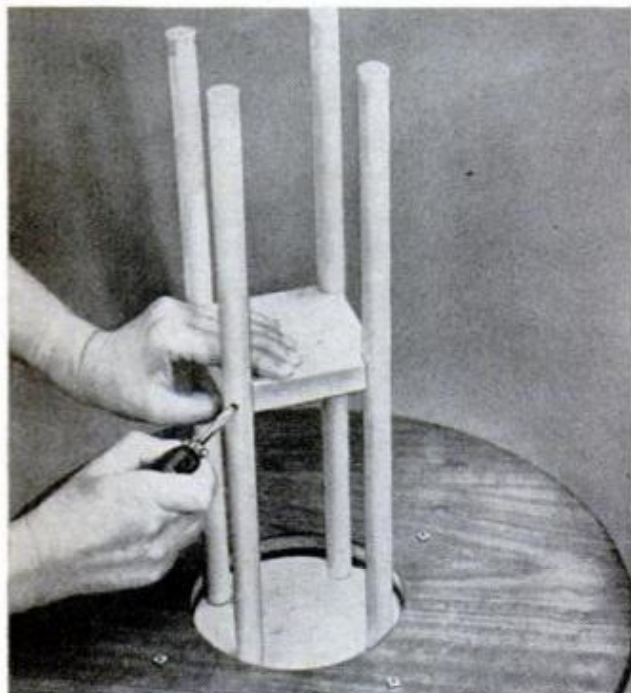
By **ELMA and WILLARD WALTNER**
Technical art by Barry A. Wiedenkiller

YOU WON'T HAVE TO STIR from your easy chair to reach a magazine from this novel four-sided end table. It spins around with a touch of the hand to bring all four racks within convenient reach. It rotates freely on a lazy-Susan bearing which is sandwiched between a double circular base. Two slanting racks are provided for large-format magazines; two recessed ones hold medium and small-size periodicals.

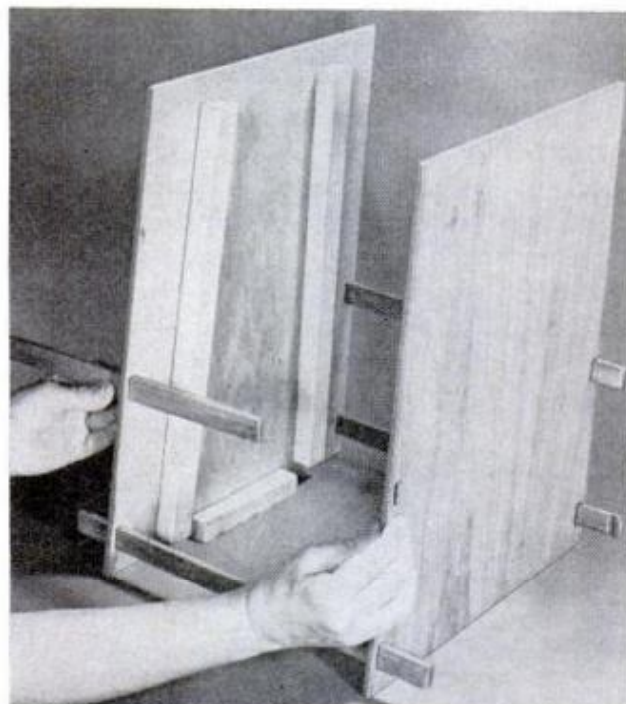
You can make it of any wood you like. We used walnut-faced plywood for the

top, turntable and magazine racks; fir plywood for the base and leg spreader.

The table consists of two separate sections: the base, which is nothing more than a low four-legged stool to which the lower



CENTRAL CORE of dowels, which join the base to tabletop, is braced midway with plywood spreader



RETAINING RAILS are slipped through slots in the widest rack panels to join with adjacent end rails

half of the lazy Susan is screwed, and the four-sided top section, which is fastened to the upper half of the lazy Susan.

Both the tabletop and the lazy Susan base are 17 in. in diameter, while the turntable is a 20-in. disc with a 6-in. hole cut in the center. Dowel holes in the base and the underside of the top are laid out in an identical pattern by striking a 5½-in. circle and spotting the four holes inside. Make the leg spreader at this time, laying it out the same way, but boring the holes before cutting it out. Drill the ¾-in. dowel holes only part way through the top and base.

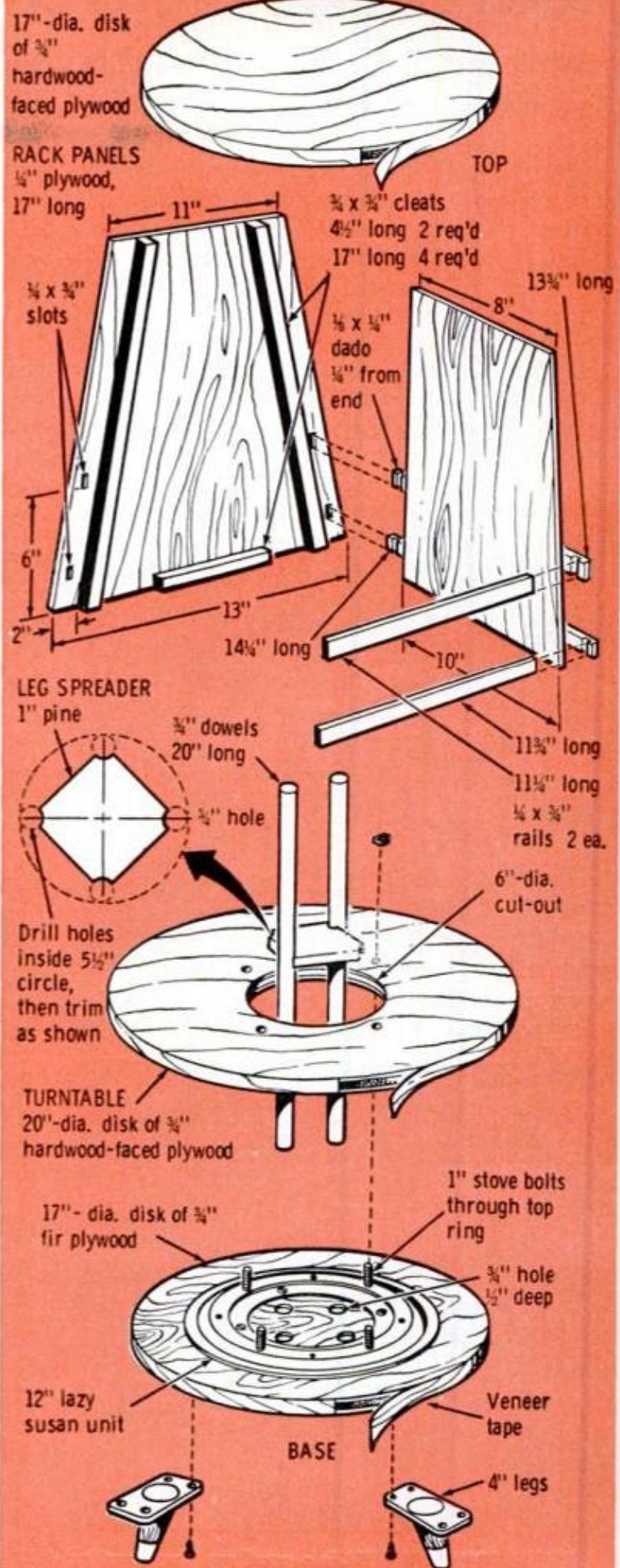
Now fasten the lower half of the lazy Susan to the base with screws and bolt the upper half to the turntable, with nuts on top. The bolts will have to be in place in the bearing plate before it is screwed to the base.

Next cut four ¾-in. dowels 20 in. long and glue them in the base holes. Slide the dowel spreader halfway down inside the dowels and fasten in place with glue and countersunk screws.

Cut tapered panels for the magazine racks in pairs from ¼-in. walnut-faced plywood, following the sizes given. Note that ¼ x ¾-in. slots are made only in the larger panels, and that ¾-in.-sq. cleats are glued to the rear sides 2 in. in from the edges. A third cleat, glued even with the bottom edge, is predrilled and used later to attach the racks to the turntable. Glue the four panels together like a pyramid, then cut and dado the ends of the walnut rails, insert them through the slots and glue the connecting end rails in the dadoes.

Now you're ready to slip the assembly down over the dowels and fasten it to the turntable with screws through the cleats provided. Finally, glue the tabletop to the dowels and attach 4-in. ready-made tapered furniture legs to the base. Band edges of the discs with matching wood tape; finish the table as desired. ★★★

PULL-APART CONSTRUCTION DRAWING



Convert your outboard

While kits don't provide the full breakerless package found on the big

By HENRY B. NOTROM *Drawing by Bruce Aldridge*

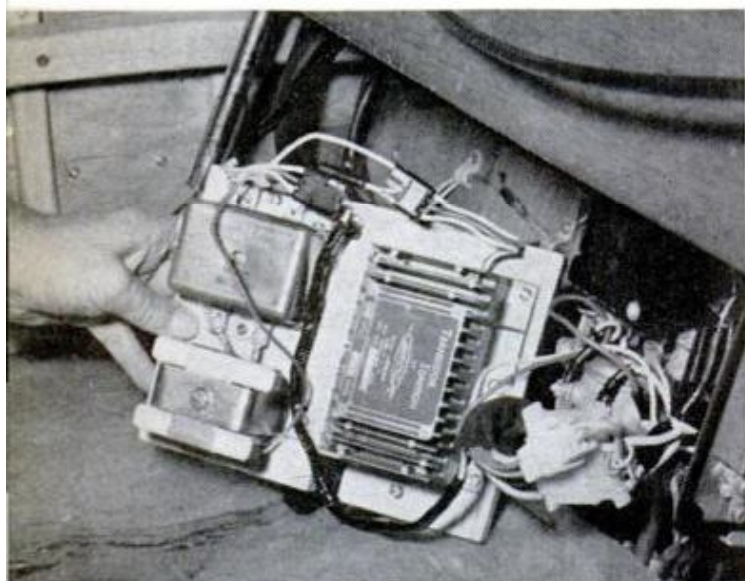
IF YOUR OUTBOARD has a battery, a generator or alternator and a distributor, you can convert to electronic ignition with a relatively inexpensive kit.

Of course, such kits have been around for a number of years, but they were designed primarily for the automotive market and haven't made much of a dent in the outboard field. However, with Mercury, Johnson and Evinrude lining up solidly behind electronic ignition this

year, there is bound to be renewed interest in these conversion kits.

Let's make it clear at the outset, though, that the only similarity between any of these kits and the electronic ignitions found on many of this year's large outboards is the fact that both use electronic components to control current flow to the sparkplugs. But, more later.

You'll find that all conversion kits are advertised either as transistorized igni-



KIT COMPONENTS won't fit under shroud so they must be mounted on board and located inside boat



UNDER TRANSOM WELL is a good spot for mounting kit board, since it provides protection from spray



SPECIAL COIL fits under the shroud easily. A high-tension lead included in kit is used to connect it

to electronic ignition

'67 motors, you still get super spark and a solid boost in performance

tion (TI) or capacitor discharge (CD) ignition. What's the difference?

The main one is that CD ignition employs a silicon-controlled rectifier (SCR), while transistorized ignition uses transistors. Both solid-state components are switching devices—that is, they turn current going to the sparkplugs on and off.

The SCR, though, is a newer development and is characterized by a higher rise time, which allows for delivery of a

greater amount of voltage at faster intervals. Some manufacturers tell me that voltage available with their CD systems is as much as 80,000 v. This is made possible by the inclusion of a more powerful coil with windings of up to 400 to 1. (The standard coil in your engine probably has windings of only 75 to 1 or 90 to 1.)

The output of transistorized ignition, however, is in the 40,000-v. range.

Transistorized ignition will fire plugs which are dirty, something conventional ignition won't do. CD ignition will fire plugs that are downright filthy, something neither of the other two can do.

However, don't confuse a CD conversion kit with the CD ignition used as original equipment by Mercury, Johnson and Evinrude. As I mentioned earlier, they are decidedly different.

The latter is a contactless system that uses surface-gap sparkplugs. With a CD (or TI) conversion kit, breaker points in the distributor play an important role and regular sparkplugs are used.

It is this primary difference between original-equipment CD and conversion-kit CD which has prompted one major manufacturer to hold off, at least temporarily, packaging components in conversion kit form. The Prestolite Co., which makes the electronic components for both the Johnson and Evinrude breakerless systems, told us that no plans are afoot to offer the system in kit form to the public.

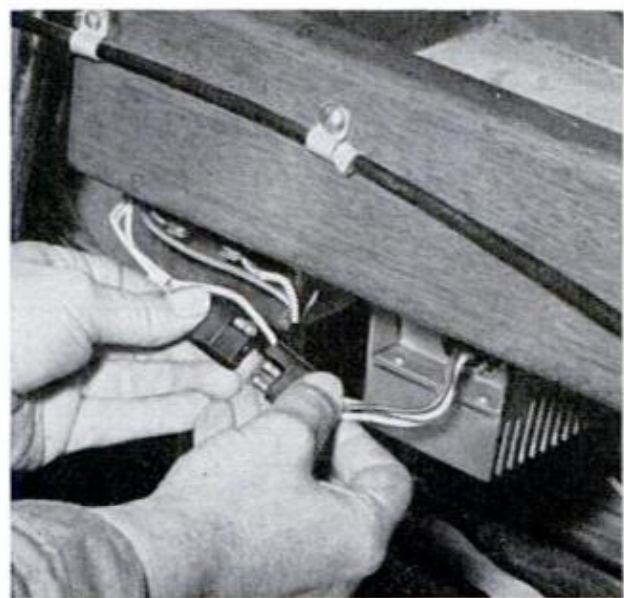
A spokesman indicated that the CD system presently used as original equipment in new engines would probably be prohibitive in price anyway, since installation of a new distributor without contact points would be necessary.

Another big difference between original-equipment capacitor-discharge ignition and that in conversion kit form is that the former is specifically made for outboard engines. Components and wiring are beneath the cowl on the engine.

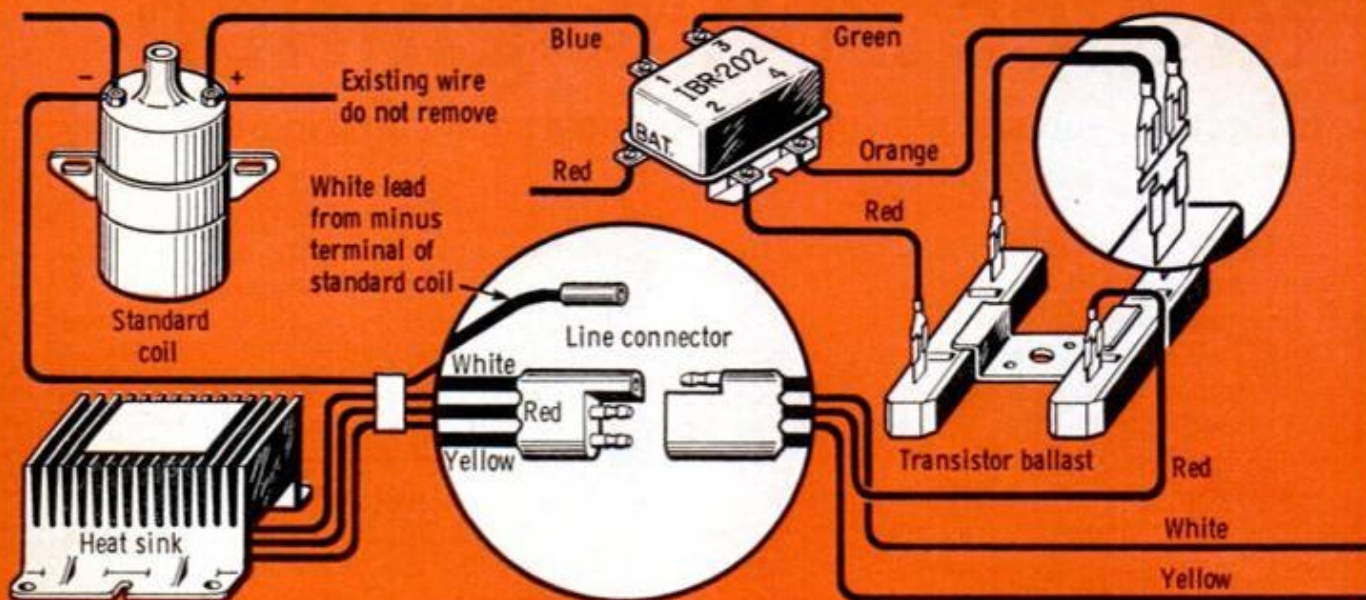
Manufacturers of CD conversion kits (and TI kits, too) produce them primarily with the large automotive buying public in mind. Those little black boxes aren't so



INSTALLATION instruction may not call for soldering connections, but it's a good idea to do this



TO CONVERT BACK to conventional ignition, unplug the kit components and reconnect the standard coil



TYPICAL LAYOUT of either TI or CD electronic ignition kit shows how components are hooked into the

WHO MAKES WHAT				
Name and Address Of Manufacturer	Model Number Of System	Type of System	Number of Components	List Price
Wagner Electric Corp. Tung-Sol Division 630 West Mt. Pleasant Ave. Livingston, N. J.	EI-5	CD	Two: special coil and main unit	\$89.50
Delta Products 630 South 7th St. Grand Junction, Colo.	Mark 10	CD	One: all components arranged in one box	\$44.95 (factory assembled unit); \$29.95 (put it together yourself kit)
Wico Division Globe Union, Inc. West Springfield, Mass.	TI 296M	TI	Four: transistor unit, special coil, ballast and relay	\$65.70
Slep Electronics Co. P.O. Box 178 Ellenton, Fla.	TS-30 with F-250T coil	TI	Three: transistor unit, special coil and ballast	\$39.95
W. F. Palmer Electronics Carlisle, Mass.	TM (single transistor); TM-2 (dual transistor)	TI	Three: transistor unit, special coil and ballast	\$59.95 (model TM); \$69.95 (model TM-2)
All systems are available in either negative or positive-grounded electrical systems. If you've got an old-fashioned 6-volt system, you can get electronic ignition for that, too.				

little when you go to put them on an out-board. Some, for example, measure 10x6 inches, much too large for placement beneath the cowl. Thus, they have to be positioned on the transom, with wires running to the engine to make the hookup.

No matter what the layout of your engine's electrical components may be, the hookup involved in installing a CD or TI

kit is basically the same. If everything is under the cowl, for instance, making it necessary to run wires back to the engine, these can be fed through the holes in the side of the transom well which take the steering cables. Then you can push them through the grommets battery-cable holes in the cowl.

Both transistorized ignition and capaci-

Outboard Clinic

Q. My 30-hp Elgin jerks on acceleration. The faster you go, the harder it jerks. Other than this, the motor runs fine. Why?—R.D.C., Ky.

A. It's tough getting a clear picture of what you mean by "jerk." However, if everything checks out from a tuneup standpoint, don't overlook the possibility that the dog clutch is jumping out of gear, or that there might be a bad hub in the prop.

Q. My brand new 9½ keeps heating up. The dealer has tried to cure it, but without success. Any ideas?—J.T.C., S.C.

A. There is always the possibility of an internal flaw in a new engine, no matter how good the manufacturer's quality control may be. A sand hole in a part inside the engine, for example, could cause overheating. Tell the dealer to get the company working on this. Every outboard manufacturer I know of will bend over backward to rectify a problem of this sort, even to the extent of taking the engine back to the factory and ripping it apart from cowl to prop.

Q. Trolling, even for eight straight hours, presents no problem for my 1964 3½-hp McCulloch. When I advance the throttle, though, the engine runs well for 30 seconds, then starts to die. What's wrong?—V.H., Ohio.

A. I'd say your high-speed carburetor needle or carburetor float is out of whack.

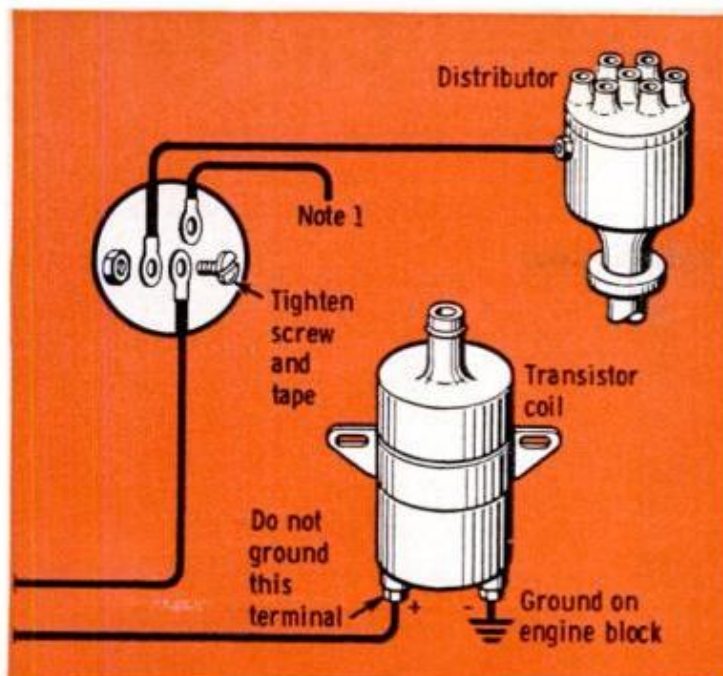
Q. What would cause erratic tachometer operation at high speeds with a '62 Johnson 40-hp motor?—F.P.S., Ill.

A. Probably lack of a ground or a poor connection between the movable magneto plate and ground. If you don't have a ground wire, get one. If you do, make sure connections are clean and tight.

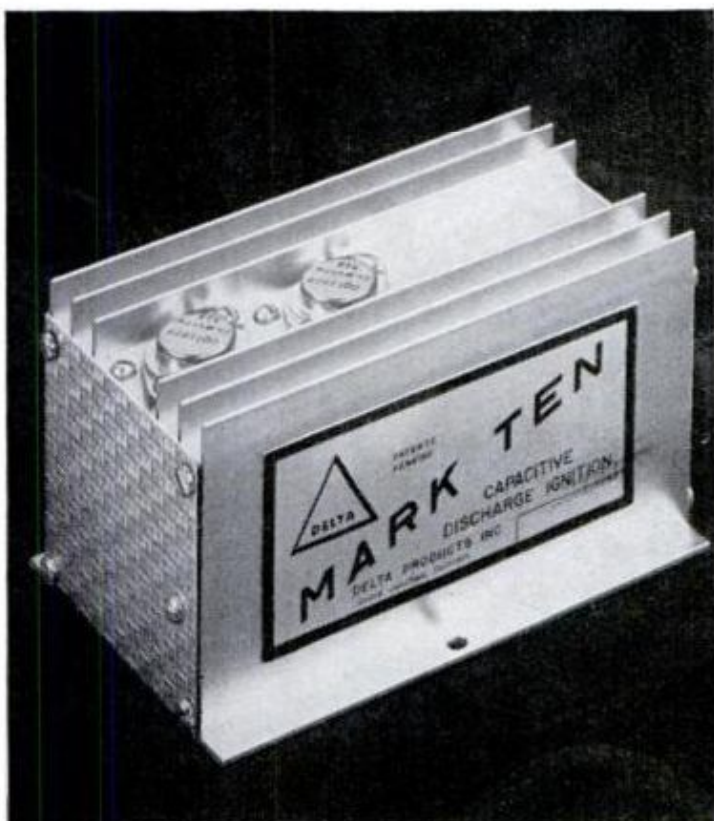
Q. Carburetor cleaning and replacing some old parts seems to have caused my Evinrude Sportwin to start coughing and dying on acceleration. The spark is there, but the zip is gone. What happened?—K.F., Mich.

A. I would start by checking the fuel line for a kink or break. Assuming you're running the right fuel mixture and you've adjusted the carburetor by the book, I'd check the fuel-tank cap. If this isn't tight, pressure drop can result that keeps a good amount of fuel from getting to your engine. Just for good measure, go over the carburetor carefully and concentrate on high-speed adjustment.

FOR PERSONAL REPLY to questions concerning your outboard motor, write to *Outboard Clinic*, *Popular Mechanics*, 575 Lexington Ave., New York, N.Y. 10022. Enclose 25 cents in coin.



electrical system. Same principles apply to all kits



UNLIKE MOST KITS, Delta Products single-package CD Mark 10 has the coil built right into black box

tor-discharge conversion kits work much the same way and offer the same general advantages over conventional ignition. The difference is more one of degree.

In conventional ignition, the contact points act as a switch to send current to sparkplugs. As points make and break, switching and deswitching the primary
(Please turn to page 214)

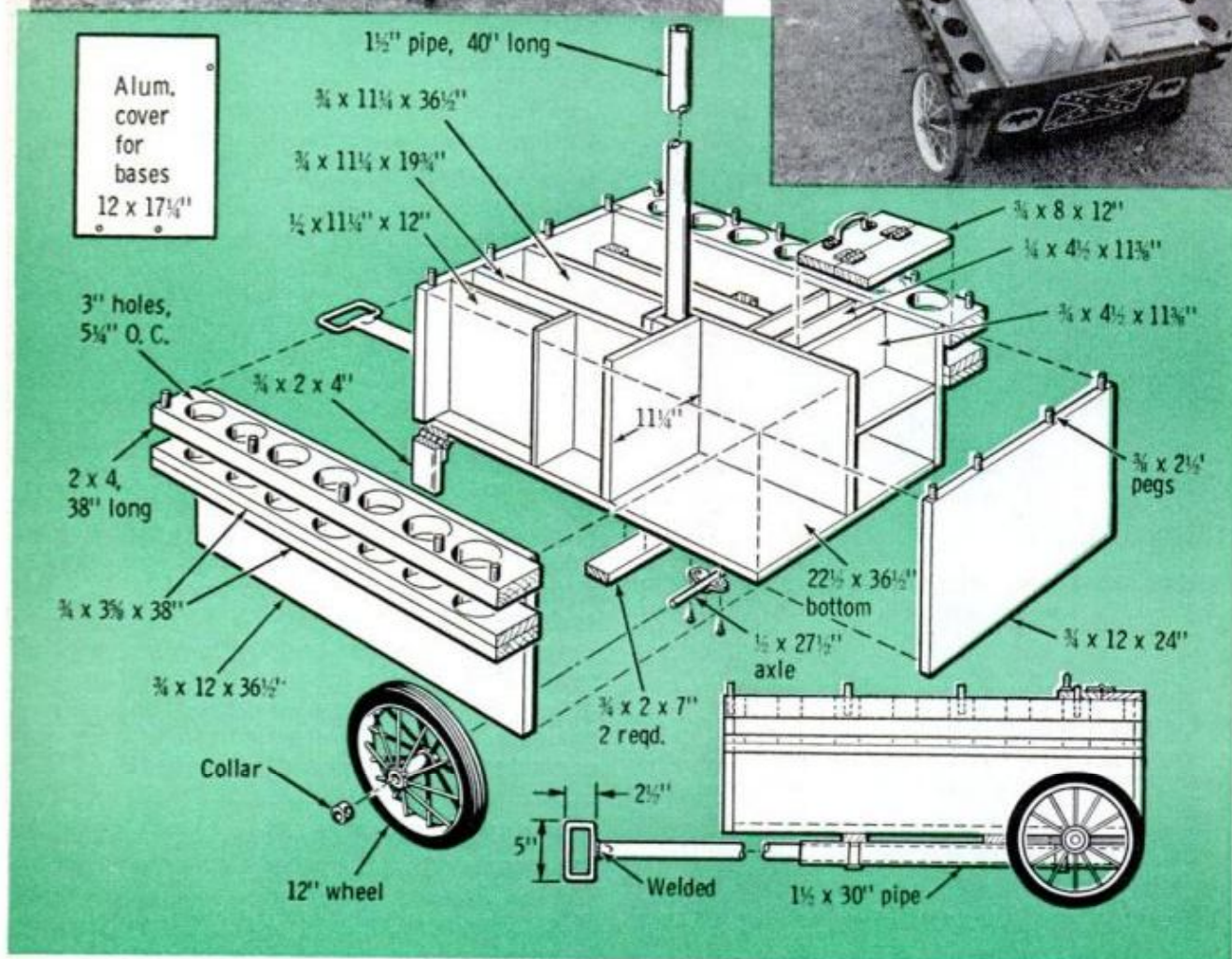
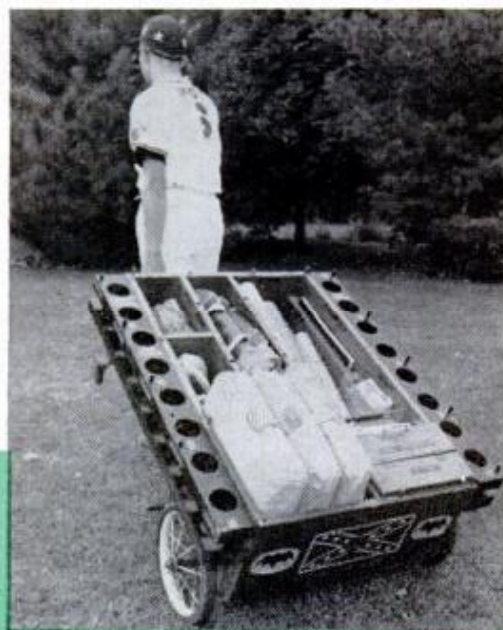
Little League Baseball Caddy



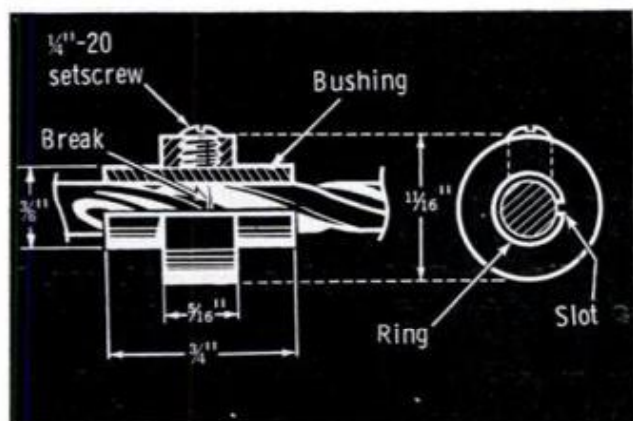
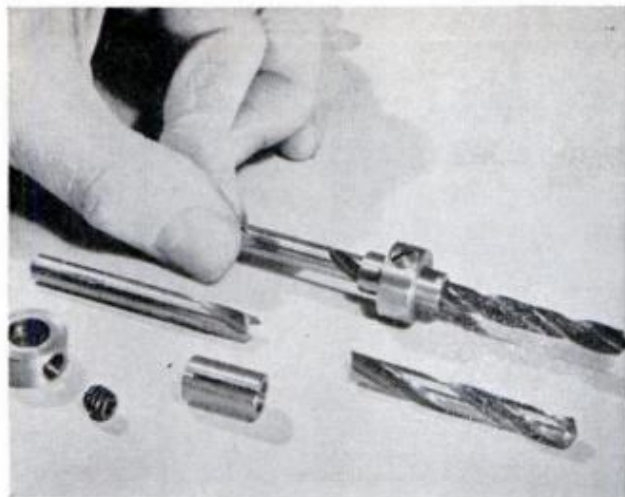
WHEN BRUCE IMHOFF's little leaguers head for the ball park there's nothing left behind, thanks to a two-wheel caddy which has everything, including a thirst-quenching water cooler!

As manager of the National Data Processing Class A team in the Millcreek Valley Traveling Baseball League of Cincinnati, Ohio, Bruce and his son, Steve, put their heads together and

(Please turn to page 229)



Split sleeve forms splint for broken drills



YOU CAN SALVAGE a twist drill that breaks some distance from the point by encasing the fracture in a two-part steel "splint." This consists of a split bushing inside a ring provided with a setscrew to compress the bushing against the drill.

To make the bushing, drill an axial hole

the size of the bit in a piece of cold-rolled or tool-steel rod. Machine the outside to produce a wall thickness of at least $\frac{1}{16}$ in. for bits in the $\frac{1}{4}$ -in. range. Saw a slot lengthwise to make bushing compressible.

For the average drill sizes, a $\frac{1}{4}$ -in. No. 20 setscrew in the ring will furnish enough pressure to cause the bushing to grip the drill segments tightly. Insert the two pieces so that the break comes snugly together at the midpoint of bushing and ring. While drilling depth is limited, most drilling operations use only the first inch or so of a twist drill anyway.—*Walter E. Burton*

Household carryall from an old dish drainer

WHEN MY WIFE bought a new dish drainer, she was all set to throw the old one into the trash barrel. Before she had a chance, though, I took it down to my shop and attached a handle of $\frac{1}{4}$ -in. soft iron rod by wiring it to the frame. With the addition of the handle it became a colorful lightweight carryall which comes in handy for both of us.

Now I can use it to lug around all sorts of tools and materials when taking care of those little repair jobs around the house. She finds that it's great for carrying furniture polish and dust cloths when cleaning the house, or for gathering flowers and vegetables from the garden.

—*Eric E. Swanson*



Stupid Questions about

They'll seem stupid once you have the answers. Yet few homeowners know what to use in concrete patching and construction jobs, where and how to buy it, or how to handle it. PM asked 50 homeowners what they would use to repair a crack in a concrete walk. Eight said mortar, 11 concrete and 26 mentioned the brand name of a packaged mix. Only 5 of the 50 had the right answer: sand mix. Study the following questions and answers and raise your cement IQ to that of a real construction buff

By Steven J. Howard

Illustrations by Adolph Brotman, Worman Associates

What is a packaged mix and why should I use it?

It's a dry mixture of the ingredients for concrete, mortar or patching which saves you a messy, time-consuming mixing job and prevents you from guessing wrong on the proportions to use. While it will cost a bit more than a comparable batch you mix yourself or have delivered by a bulk ready-mix company, the saving in time and trouble is worth the difference. And it is cheaper for small jobs.

What's different about these mixes?

Sand mix is just cement and sand. Concrete mix has these plus gravel or stone. Mortar mix contains cement, sand and lime.

What's sand mix for?

Patching cracks, primarily, in concrete walls, sidewalks, floors and stucco walls; also as a thin base (less than 2 in.) for flag or stepping stones, or as a top coat.

What's a top coat?

It's a layer spread over an older installation to reinforce it. Applying a top coat over a beat-up concrete walk, for example, allows you to renew it without having to rip it up and lay a new one. A top coat less than 2 in. thick can be spread with a sand mix; concrete mix should be used where a thicker topping is required.

What dictates top-coat thickness?

The amount of old material that has to be

removed and replaced. Sidewalks are usually 4 in. thick; concrete driveways, 6 in. If only a surface layer has crumbled, you can replace it with a sand-mix top, but if you have to chip away to a depth of two or more inches, it would be better to use a ready-mixed concrete.

How would I apply a top coat, say, to a bad sidewalk?

First, make sure the old surface is absolutely clean. This is vitally important, and we're not kidding. Use a stiff brush to remove all loose particles and dirt (below), and keep brushing until you have a clean, solid base for the top coat. If you don't, the top coat will not bond properly to the base and soon fail.

Next, spread a bonding agent on the solid concrete before troweling on the sand or



concrete mix. Available in the same outlets that sell the mix, the bonding agent holds the top coat to the old surface. Use a paintbrush or roller to apply it in a thin film over the old surface. Let dry for about 45 minutes—when it becomes tacky, it's ready for the top coat.

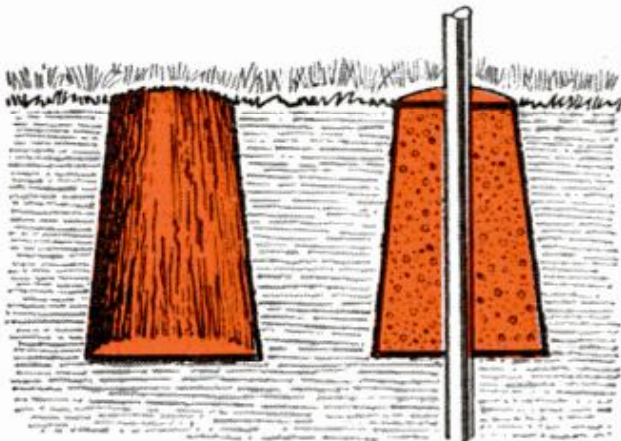
BAG MIXES

Since sand mix is concrete mix without the gravel, can't I use it all the time?

The gravel in concrete mix adds strength to the end result and allows you to use less material to fill a larger area. Use of sand mix to fill a cavity 2 in. deep, or more requires nearly twice as much material—and you don't get the strength needed to bond a large mass adequately. Sand mix used to cover a large area would fail in no time.

Where would you use concrete mix?

Laying sidewalks, base slabs and footings; setting posts into the ground (below),



and forming steps; also in such projects as building fishponds, wading pools, swimming pools and birdbaths.

How much area can I cover with a bag of sand mix?

It depends on bag size. Keep in mind that an 80-lb. bag will cover 8 sq. ft., 1 in. thick, or 4 sq. ft., 2 in. thick.

If packaged ready-mix is dry, how do you prepare it for use?

This is awfully important, because its strength and durability, plus its ability to resist moisture, depend on how you do the job. First, dry-mix the material . . .

Dry mix? What's that?

Before adding any water, empty the bag



into a wheelbarrow or box of similar size and mix the aggregates with a shovel or hoe. If you don't need the bagful, empty it anyway, mix, then return that portion of don't need to the bag. When the aggregates are mixed well, you are assured of maximum strength in the final result.

How much water do I add?

Look at it this way: You get the strongest mixture using the least amount of water possible. The final mixture should be stiff and strong, but one in which the cement is wetted and covers all aggregates. There should be no water puddles. A proportion you can use as a guide is this: Mix one gal. of water to 90 lbs. of packaged ready-mix; add water a little at a time and mix aggregates together; test for firmness. If too stiff or powdery, add a little more water.

What's curing?

It's the process whereby you assure that water in the ready-mix doesn't evaporate too fast. Curing lengthens and intensifies the hardening process.

Is curing always necessary?

Yes, especially in warm weather (80° F. or above) during maximum evaporation.

How do you do it?

Cover newly-laid cement with burlap, canvas or an old blanket and wet this daily for five days. If covering isn't possible, such as on a vertical surface, substitute fine spraying from a water hose daily.

What about mortar mix? What sets it apart from the others?

Lime. Without lime, it would be ordinary sand mix. Lime adds plasticity and makes

troweling easier. Ever watch a mason work? He scoops up mortar and throws it over a surface. This is what we mean by plasticity.

No. It's also used as a bed for stone, cinder or concrete block, and to repair joints between brick, stone or what have you—a job called tuckpointing.

In four easy steps: 1. Clean out loose and eroded mortar by chipping away at the joint with a cold chisel or old screwdriver. Stop when you contact firm mortar.

2. Make sure the cavity is clean. Brush out all loose particles, then flush with water from a hose.

3. With joint wet, place a trowel full of mortar mix on a hawk, or float. Hold this beneath the joint and push mortar into the cavity with the edge of a pointing trowel or slicker (see sketch).



Pack tightly, then scrape off excess mortar flush with face of the brick.

4. Strike joint with the slicker (pointing tool) for a smooth, concave joint. Rather than merely looking pretty, the slope produced allows the joint to shed water.

Lumberyards, building supply dealers and most hardware stores offer concrete mix in 45 and 90-lb. bags; mortar mix in 25, 45 and 80-lb. bags and sand mix in 11, 25, 45

and 80-lb. bags. Among brands are Sakrete, Redi-Crete, Home-Crete and Watta-Crete.

They're as different as cake flour and the cake batter it helps to make. Ready-mixed cement is a generic term covering a whole family of ready-mixed products because all contain cement. Ready-mixed concrete is a specific member of the family, as are sand mix and mortar mix.

Figure a 90-lb. bag of concrete mix will make $2/3$ cu. ft. of concrete, enough to cover a 8x12x12-in. or 2x24x24-in. area. An 80-lb. bag of mortar mix accommodates 50 bricks, or 20 concrete or cinder blocks if a $3/8$ -in. mortar joint is used.

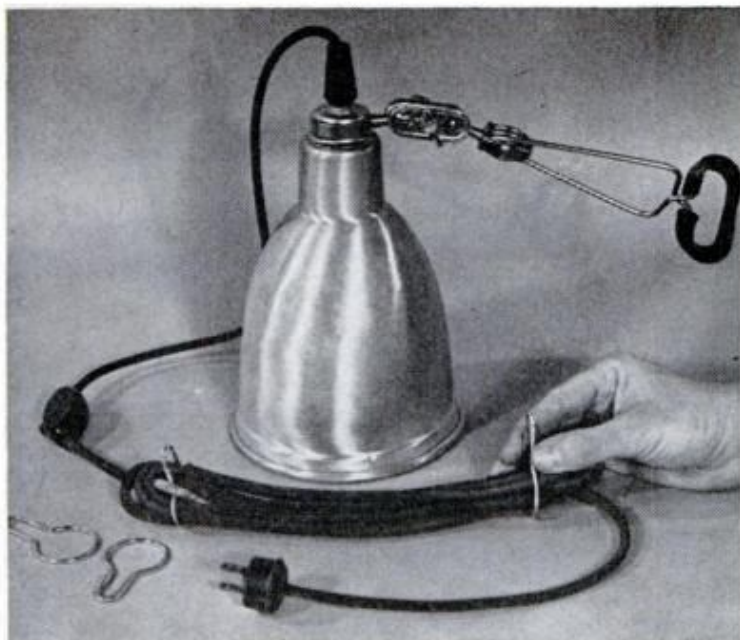
The packaged ready-mix is your best bet for smaller repairs and projects that require only a few bags of the material. If you have several small jobs calling for the same kind of mix or plan a new section of sidewalk or driveway, you'll save by ordering a bulk pre-mix delivered by truck.

It's sold by the cubic yard. You can be sure that either way beats mixing a ton of concrete yourself.

When the temperature is between 50° and 70° F. Other times are okay, too, but never do the job when the temperature is 40° or below, or 90° or above.

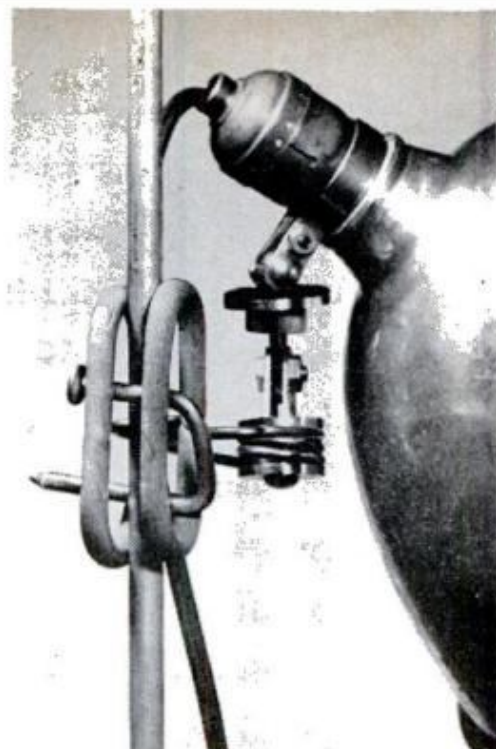
Indefinitely, they say, but you had better make sure that no moisture hits it. If you store it in a basement or garage, get it on a shelf—up off the floor. However, I wouldn't want to store it more than a year. ***

Photo Hints

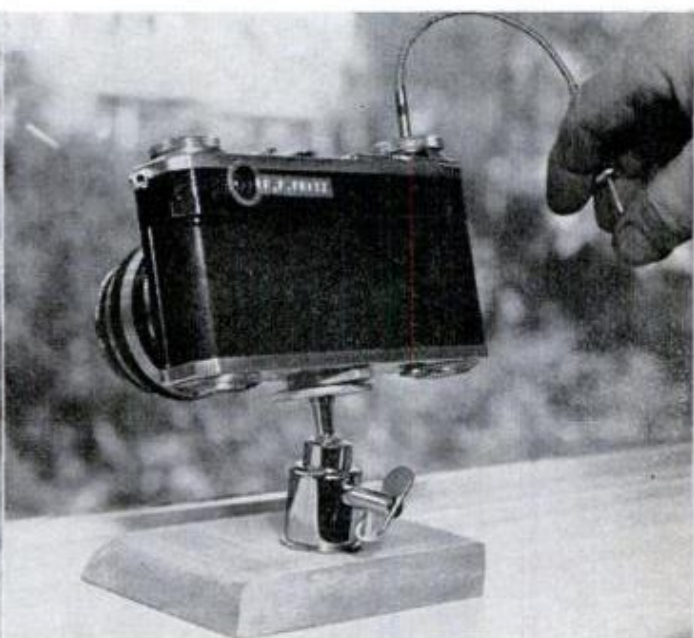


A FINE POWER-CORD SHORTENER can be fashioned in a jiffy with a pair of ordinary shower-curtain rings. Just fold the cord to the most convenient size while still plugged in, then fasten one of the rings near each end. They work best with round cable, but will also handle lamp cords.—Ken Patterson

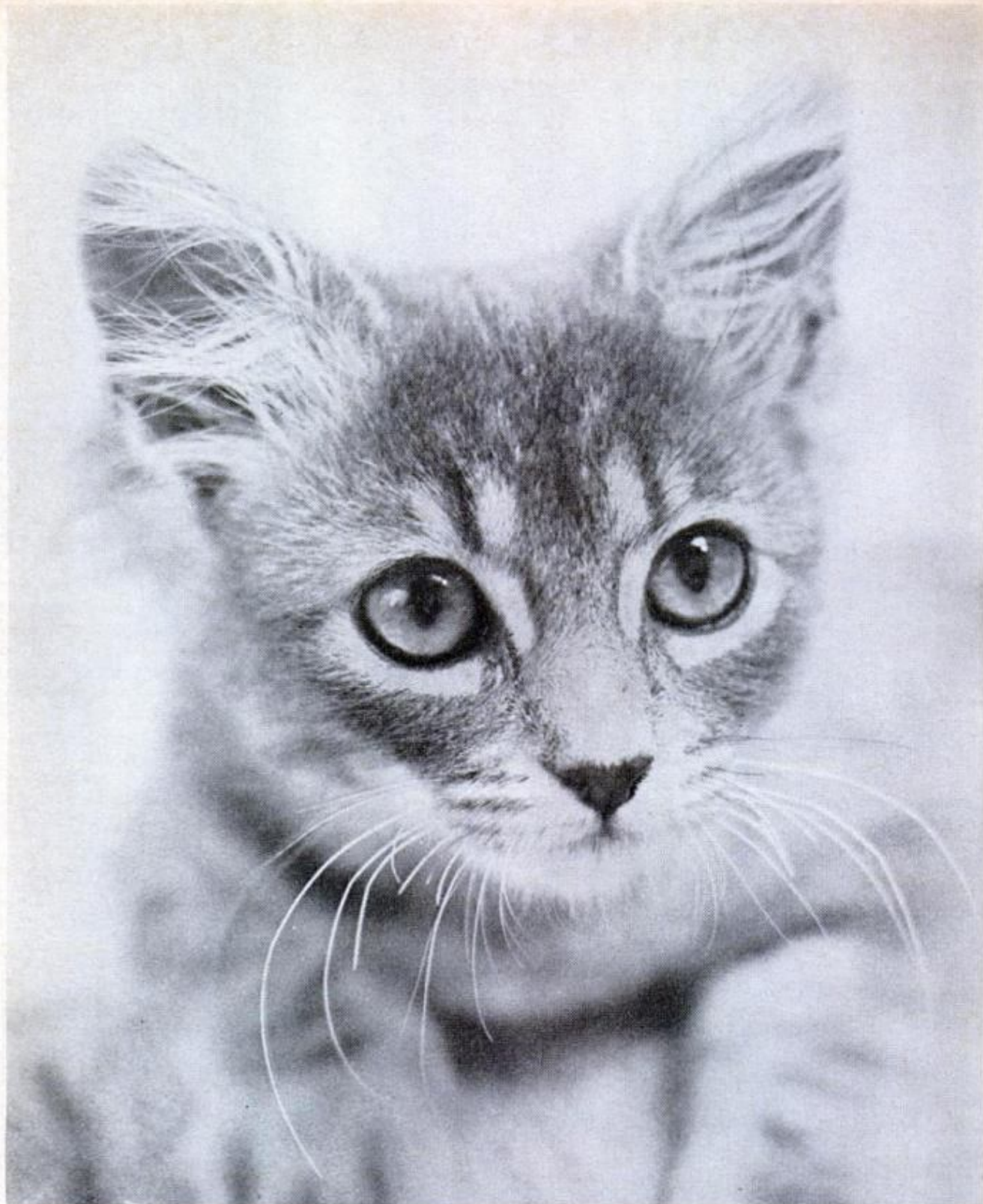
COMMON PHOTO CHEMICAL DOUBLES IN BRASS. A film processor has discovered that Edwal Water Conditioner can be added to the final rinse in color-film processing to prevent water spotting that causes a color change. Try this in your home processing work to prevent damage caused by hard water



REFLECTOR SLIPPING is a very common complaint whenever you may be using the spring-clamp type of floodlights in photography. Among the numerous techniques that have been tried with varied success for holding a reflector to your pole lamp or portable light stand is this effective solution: Bend a 20d or larger spike into the shape of a U, then pass this spike through the clamp in such a way that one of its legs will wrap around each side of the pole or stand.—Glen F. Stillwell



MAKE AN EMERGENCY SUPPORT for your camera when a tripod is not available or where its use may be impracticable, such as a position on a narrow window sill. One easy way is to mount a ball-and-socket swivel head on a cartop carrier suction cup fitted with a $\frac{1}{4}$ -20 screw. In place of the cup you can also use a length of 1-in. board fitted with a similar screw.—Paul Burch



How to **SNAP** A CAT

By MICHAEL M. HERRON

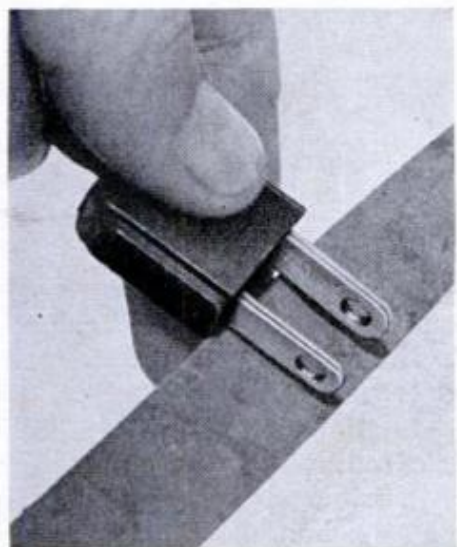
STOPPING THE ACTION is the name of the game when you're trying to photograph young pets.

My two-month-old kitten could move faster than I could focus and change settings on my camera. Several rolls of wasted film taught me that young animals keep moving, explore half a room at a time, are afraid of floodlights and have absolutely no patience with a photographer

POPULAR MECHANICS



CLOSE-UPS OF KITTY may require half-stop increase in exposure or be compensated for by placing the strobe closer (2 to 3 ft.) to the ceiling (below). Lamp-to-ceiling-to-subject distance is used to compute aperture. When kitty walks into pre-focus zone, shoot. Many strobes will accept a regular extension cord in their a.c. outlets. File plug's prongs to fit, especially if it should be polarized (below left)



when he's trying to focus his camera.

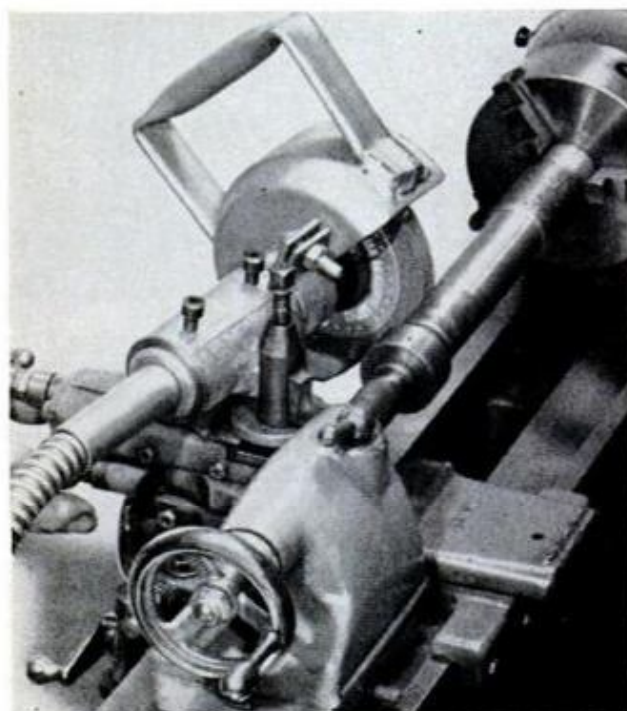
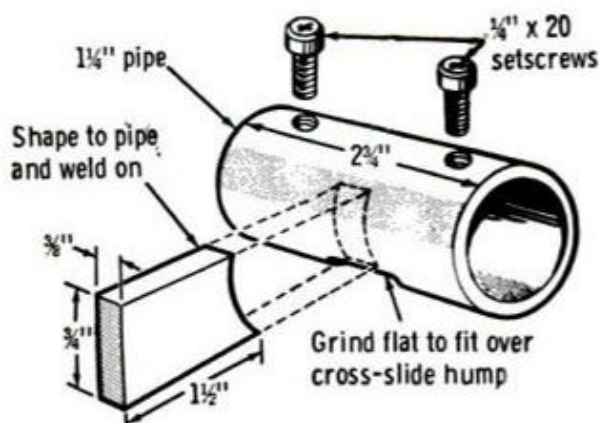
What is needed is a large area for the cat to gambol in, plus even, natural-looking illumination with enough intensity to permit you to prefocus your camera at a medium f-stop and still stop the action dead. So, with the camera preset you can try to catch the animal when she's at her whimsical best.

For the lighting, bounce strobe mounted on a light stand is the answer. Keep

it low for general illumination. If you can keep the cat near the stand or catch her napping, however, you'll increase your bounce light by placing it closer to the ceiling.

For these shots, I used Plus-X Pan at f/5.6, adding a half stop of exposure for the extreme close-up. Rating the film at 200 ASA, I developed it for nine minutes in D-76, which I diluted 1 part developer in 1 part water. ★★★

EASY-TO-MAKE ADAPTER for your flexible shaft



IN MOST SHOPS, the cost of making this flexible-shaft adapter for toolpost grinding should approach absolute zero, as it consists only of a short length of 1 1/4-in. pipe, a small piece of steel and two setscrews—all junk-box materials.

As dimensioned, the adapter is made to fit a 3/8-in.-core flexible shaft having a handpiece 1 1/4 in. in diameter, and is designed to clamp in the toolpost. If your flexible shaft has a handpiece of a different diameter, select pipe of the nearest size. The fit needn't be tight, as the setscrews will hold the handpiece firmly. Still, you may need to vary dimensions of the tang to fit the toolpost of your lathe.

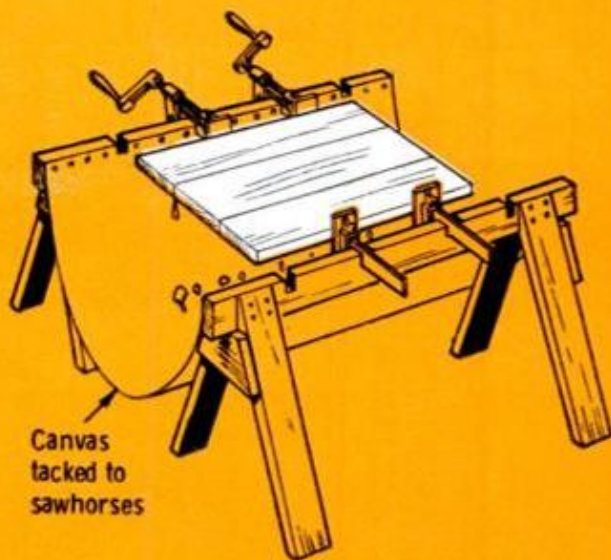
In the setup shown, my flexible shaft is attached to the shaft of a 1/2-hp, 3450-rpm electric motor. The grinding wheel rotates in a clockwise direction when viewed from the handpiece side. For external grinding, the work is rotated backward in the lathe (the motor must have a reversing switch, of course). For internal grinding operations, the lathe rotates normally—toward the operator.

High-speed toolpost grinders produce a fine finish with a 60-grit wheel, but this is too coarse a grit for the relatively slow speed of the setup shown. A wheel of 100 or 200 grit, however, gives a fine finish. Polish with an oil-soaked emery cloth of medium grit.—*Manly Banister*

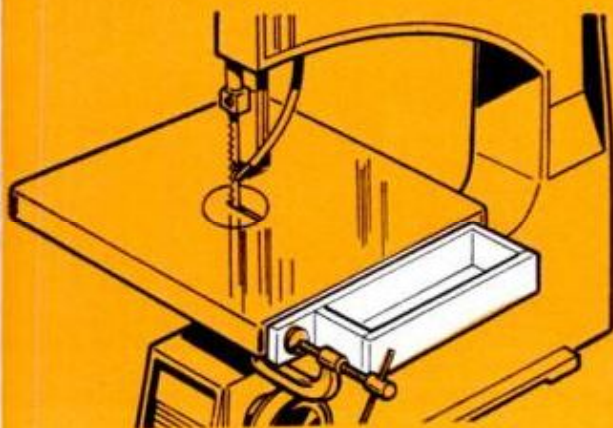
Glue-drip catcher

After having glue drip to the floor from edge-glued lumber, I took two regular sawhorses and made them into "glue horses" to catch the drips.

I first cut notches across the horses to hold the clamps upright and then I tacked a piece of canvas from one horse to the other, leaving enough slack to accommodate large or small glue jobs. Now I can forget about spreading papers.—*Vernard B. Butler*

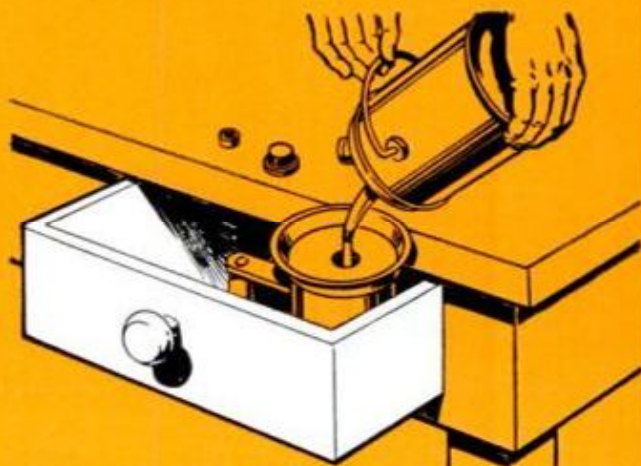


Canvas tacked to sawhorses



Power-tool parts caddy

Clamped to your jigsaw or drill-press table, a shallow box with one side extended is handy tray for extra blade or drills.—*G.E. Hendrickson*



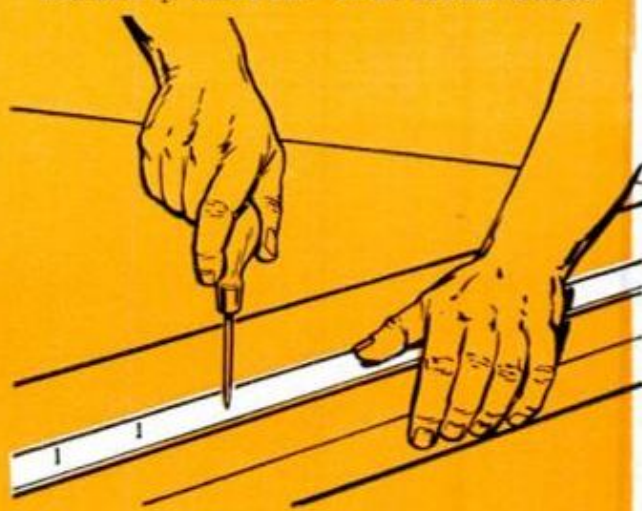
Blowtorch filling station

The nuisance of holding a blowtorch inverted to refuel it can be overcome by wedging it in place in a workshop drawer.—*G.E. Hendrickson*



Cutting dowel tenons

No lathe? You can "turn" a tenon on a dowel on your saw. Raise blade a little at a time and rotate dowel against miter gauge and rip fence.



Brad-driving aid

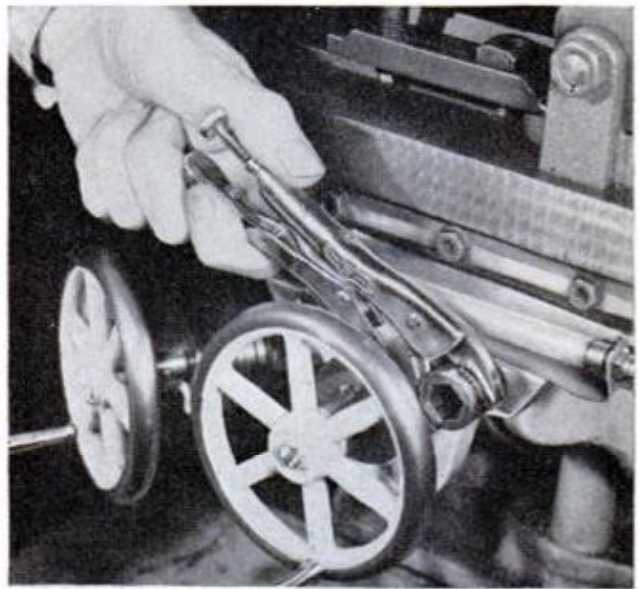
If you fear splitting narrow moldings when driving brads, make pilot holes with an awl. It goes much faster than with a drill.—*Michael Ligocki*

HOW TO SQUEEZE MORE FROM

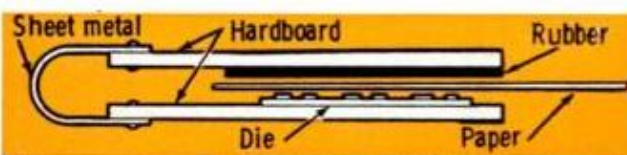
They transform your grasp into a ton of gripping power—or take a bite
The many types—examples of which are shown here—will do hundreds



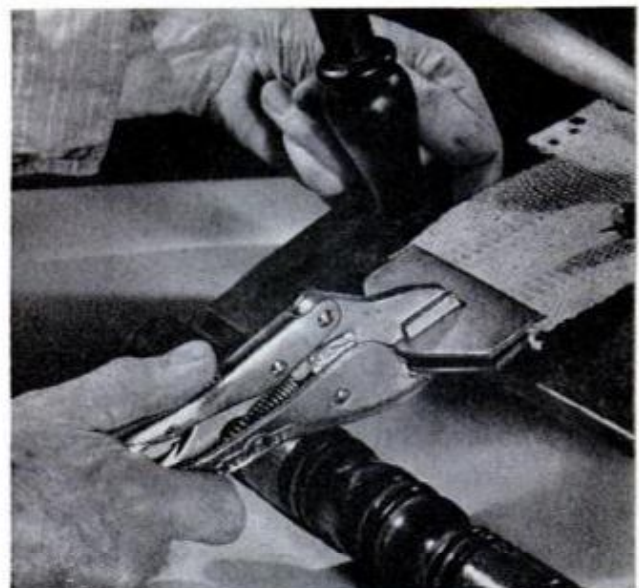
STANDARD WRENCH—here, a straight-jaw 10-incher—does better job than hammer of driving brads in critical spots. Since jaw limit is regulated by screw at end of handle, all nails will project same amount. Note how padded jaw protects the frame's finish



SOCKET WRENCH for spots too tight to permit use of regular handle is what you get when you adjust jaws to grip hex socket. New 5-in. wrench is particularly compact for this purpose, when it's awkward to grip the bolt head directly with the jaws



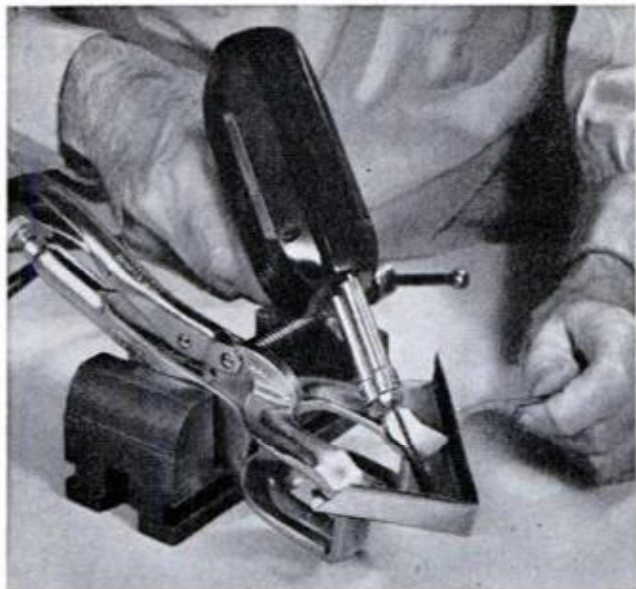
EMBOSSED PRESS—for personalized stationery—is easily made. Die is nameplate snipped from plastic credit card. Adjust jaws for enough pressure to emboss the raised letters, but not the die outline, then squeeze the nameplate in two places for uniformity



SHEET-METAL TOOL has wide jaws that make it handy for stretching upholstery webbing and fabric or window screening. Contour of tool often lets you use it as lever, over a corner or edge as shown, to provide maximum tension while tacking or stapling

YOUR PLIER WRENCH

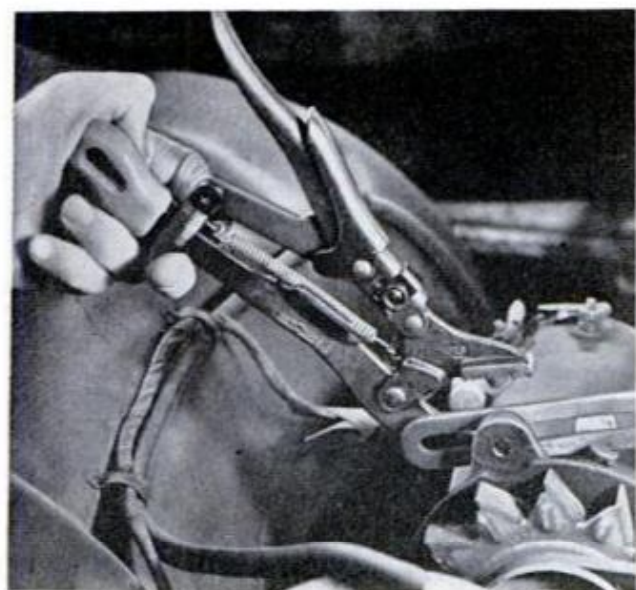
as gentle and controlled as a playful pooch.
of unexpected jobs By Walter E. Burton



WELDING-CLAMP version has all features of standard plier wrench—adjustable jaws hold workpieces in alignment for soldering, and release lever permits easy removal when job's done. In photo above, clamp is firmly supported in a drill-press vise

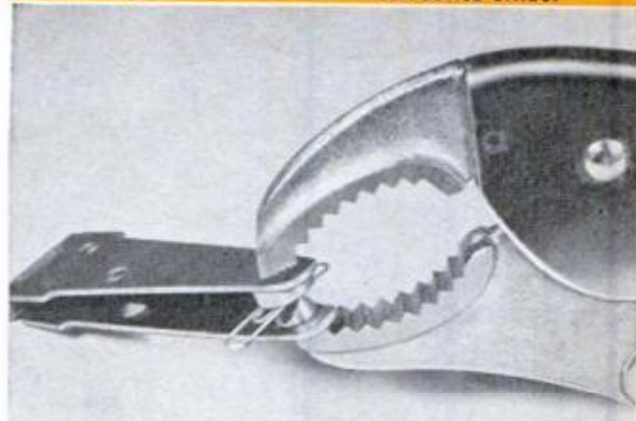


SMALL-PARTS HANDLE saves fingers in such jobs as grinding. Tool shown here—called a LeverWrench—has automatic size-sensing action, which lets you grip a variety of sizes and shapes without adjusting jaws for each. Grip is released by spreading handles



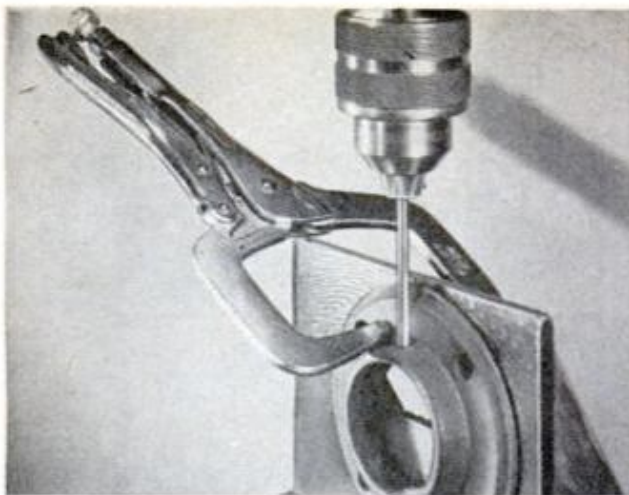
ONE-HAND VERSION—above, the 910 GripLock—is fine for jobs that need one free hand, as for holding flashlight when doing emergency work on car. When spring-loaded jaw operator is released, jaws close on bolt head, are locked with a squeeze of handle

APRIL 1967

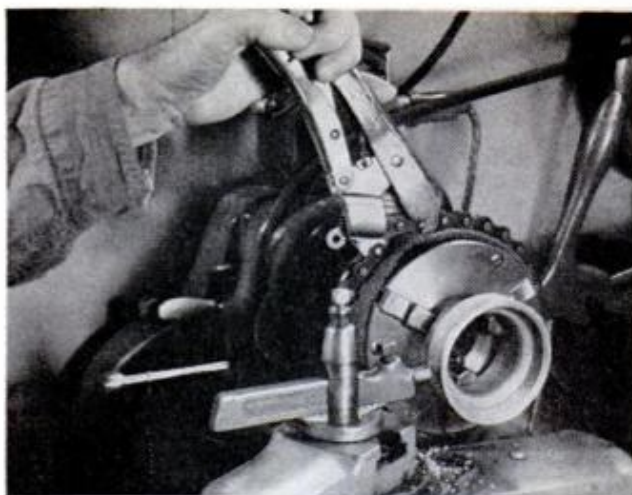


HINGED CUTTER snips paper clip into three sizes of wire staples with single squeeze of 12-in. Lever Jaw wrench (one shown has jaws contoured to grip round stock and offer four points of contact on nuts). Many wrenches have built-in wire cutters

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C-CLAMP VERSION—Vise-Grip's 11R—has jaws that adjust from zero to $3\frac{3}{4}$ in., shaped to grip objects other clamps can't. In photo above floor flange is anchored in order to drill a setscrew hole. The instant release feature speeds up production work



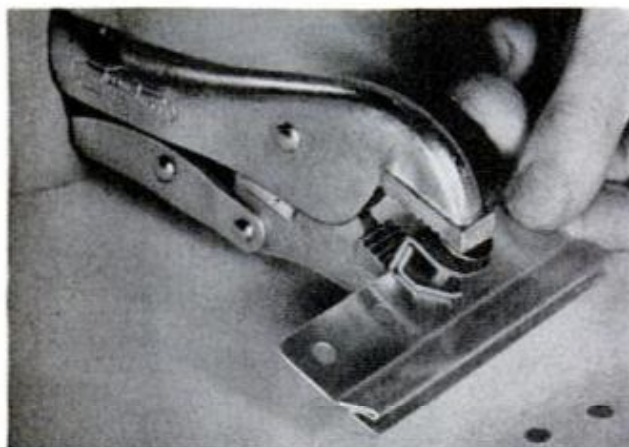
CHAIN WRENCH has bonus uses. Here, it grips (with pad of belting) a lathe chuck to serve as lever for slotting operation. Slot, extending 115° around the sleeve, is made by feeding in the cutoff tool after each forward-and-back swing made by the chuck



GENTLE BUT FIRM grip is needed for many chores—such as loosening stubborn caps on tubes of paint or cement. With ordinary pliers, you're likely to strip threads or twist off neck. This 5-in. wrench has curved jaws and wire cutter, is easily pocketed



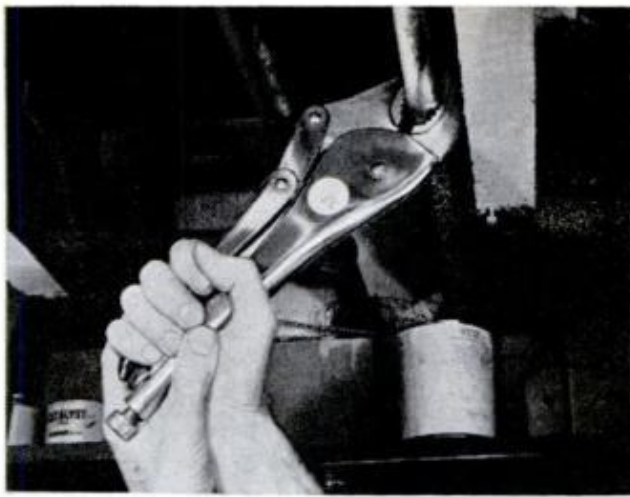
NUT CRACKER? A plier wrench makes the best kind. Jaws can be set to fracture a hickory or other tough nut without crushing the kernel. With curved jaws shown, you can also vary pressure by changing the nut's position. And there's no chance of hand strain



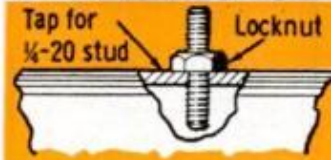
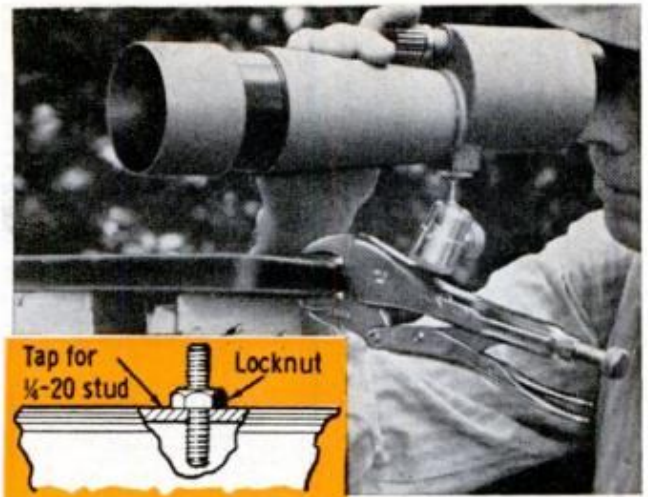
PAPER PUNCH will stamp through thin aluminum when you "power" it with a plier wrench. Just set jaws to take uncompressed punch and a squeeze of the handles gives you a clean hole. Washer between punch and lower jaw provides ejection space for discs



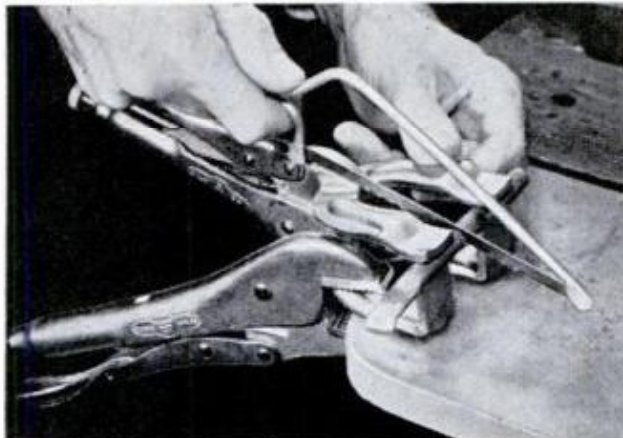
HANDLE FOR SCRAPER—or cold chisel, punch and rivet sets or even campsite cookpans—is yours with a locking-jaw wrench. Above, piece of tungsten carbide (of type used for lathe bits) becomes scraper for removing rust and old paint from lawnmower housing



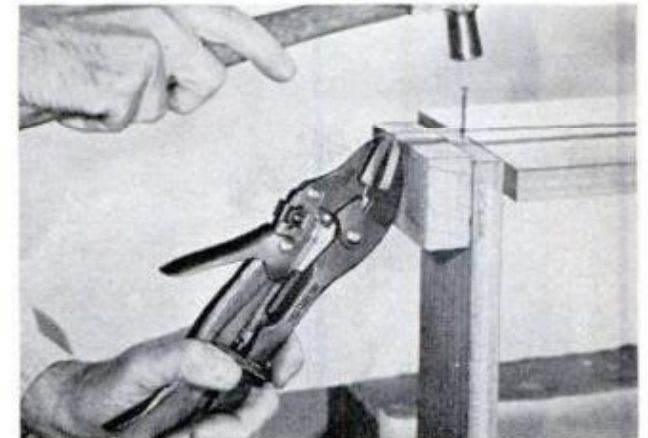
LOCKING WRENCH is handy for holding or turning pipe when clearance is limited. Jaws of this 12-in. lever-jaw wrench can be controlled to produce a ratchet action, making it unnecessary to release grip at end of swing. This job needs curved jaws



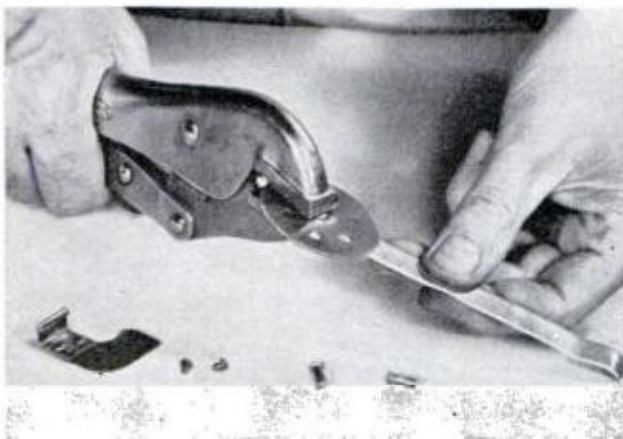
ADD THREADED STUD to backbone of wrench and you've a versatile clamp support. Above, clamp is applied to stepladder to steady telescope; ball-and-socket tripod head allows adjustment. Use this instead of bulky tripod for camera, flash or floodlight



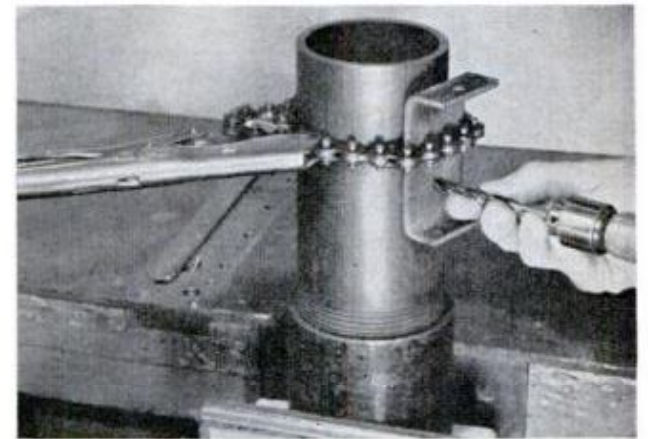
MULTIPLE CLAMPING is best for special jobs, such as hacksawing setup shown, or critical filing. Two regular wrenches anchor welding clamp to solid surface, for gripping both sides of cut, limiting vibration and keeping pieces from falling after cut is made



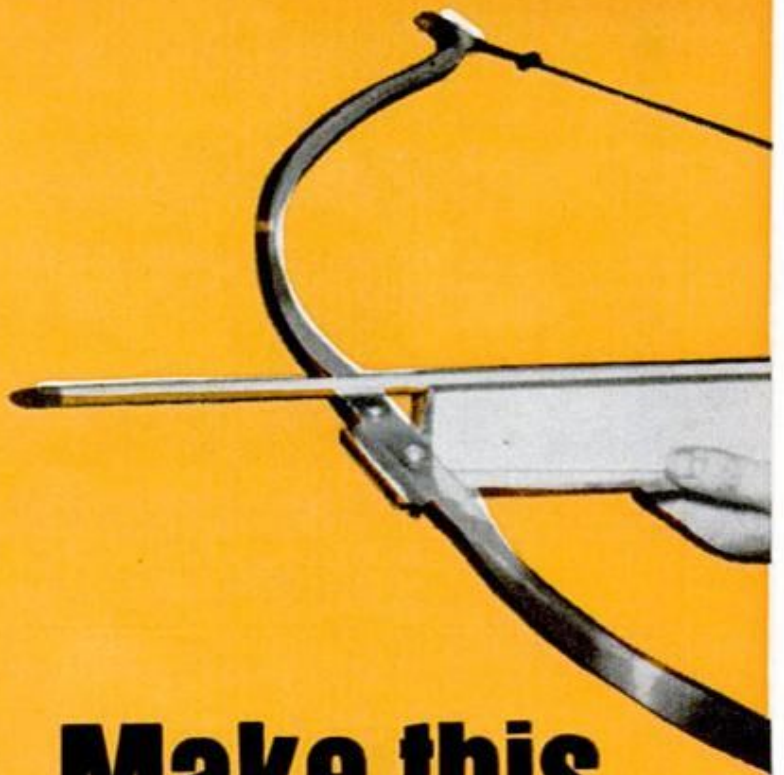
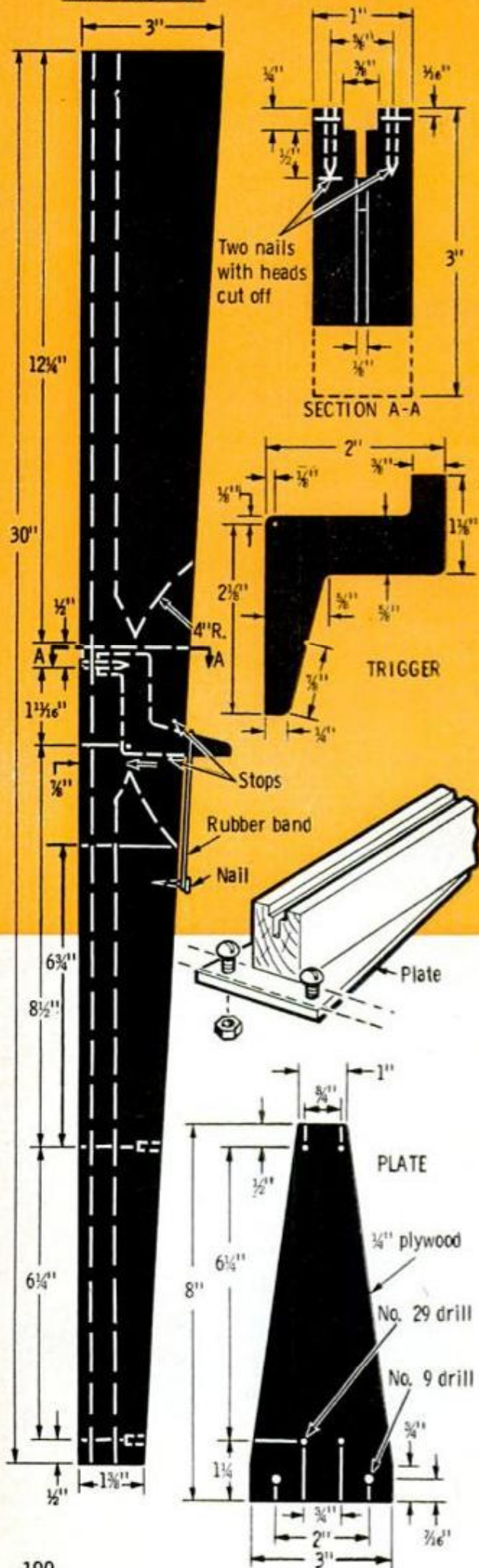
LEVERING ACTION of this 10-in. GripLock is especially handy for pulling a steel strap taut when reinforcing a nailed corner of a box frame. Wood block acts as fulcrum, and prestarted nail is driven into end grain to anchor strap as wrench is pressed



RIVET SQUEEZING is possible with the "ton grip" of larger wrenches. Small, soft rivets can be set with single squeeze, though larger, harder ones may take several partial bites, as shown. Jaws are easily adjusted to limit extent of squeeze to avoid marring



DON'T FORGET versatility of all types of toggle tools. Using this bracket as a template for spotting matching holes in an iron pipe is simple with a chain clamp. It leaves both hands free, and clamp prevents slipping as almost no other method could do

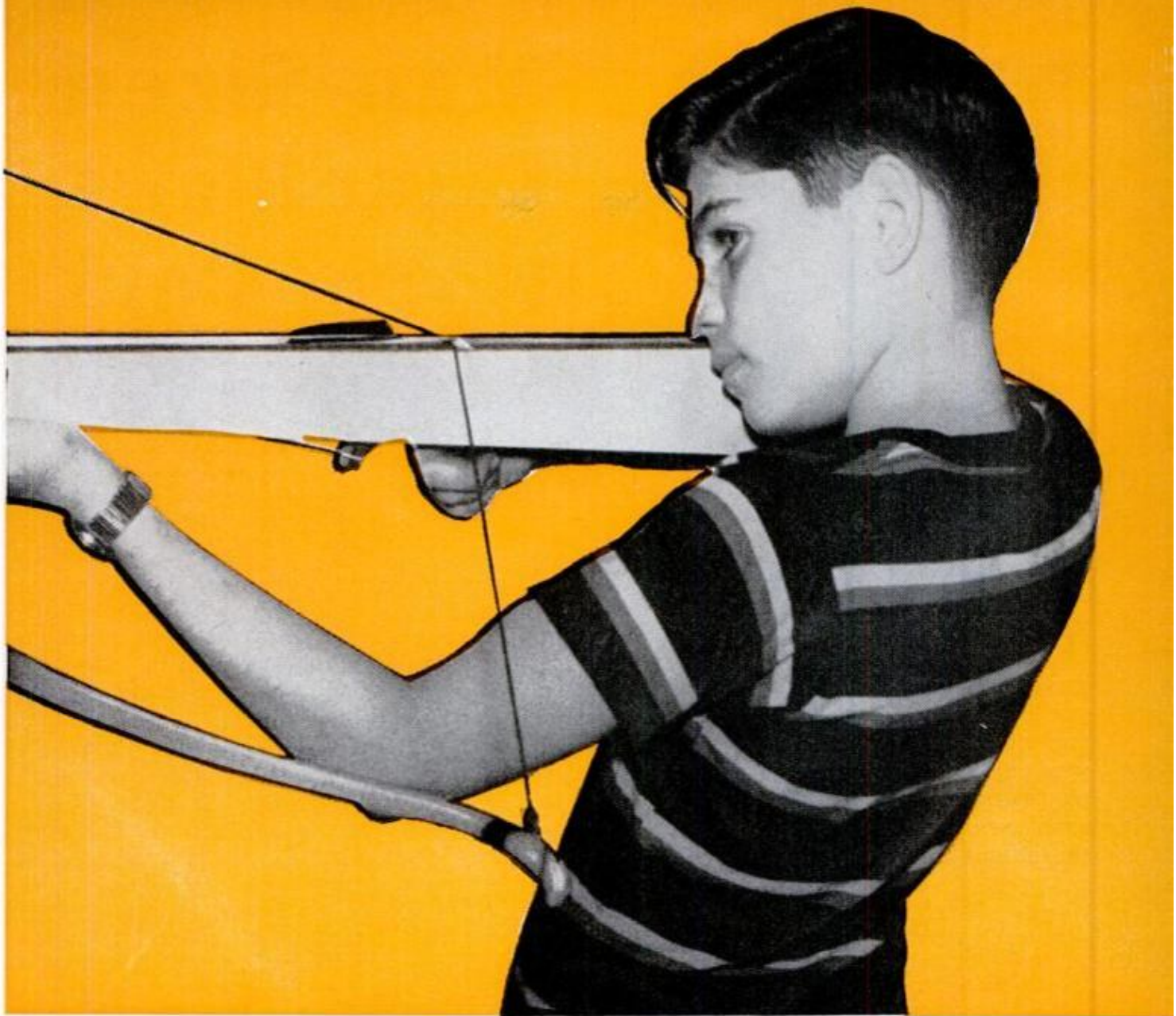


Make this deadeye crossbow

FIRED LIKE A RIFLE, this fun-packed target crossbow will make a sharpshooter of any young Robin Hood. You buy the bow and make the stock, the bow being a child-size 4-ft. fiberglass one which is bolted to the end of the stock. It's cocked by drawing the bowstring over two headless nails. The arrow, which lies in a channel in the top of the stock, is fired by a trigger that forces the taut string up over the nails.

The cavity for the trigger is easily formed on a table saw by slowly raising the blade up through the center of the stock, top and bottom. If you use the same bow as shown, you simply remove its plastic hand grip and use the same screw holes to bolt it to the plywood end plate.

Be sure to check with your local police before making the crossbow, though. In some states it is illegal.—Ronald Seelig



NEXT MONTH IN SHOP AND CRAFTS

HOW TO CHOOSE THE RIGHT BOAT CAULK. The bewildering array of new wonder materials crowding your dealer's shelves is enough to confuse anyone without a BS in chemistry. To help guide you through this maze, next month's PM includes a down-to-earth article on these modern miracle materials, plus a simple product-vs.-problem chart you'll want to clip and save.

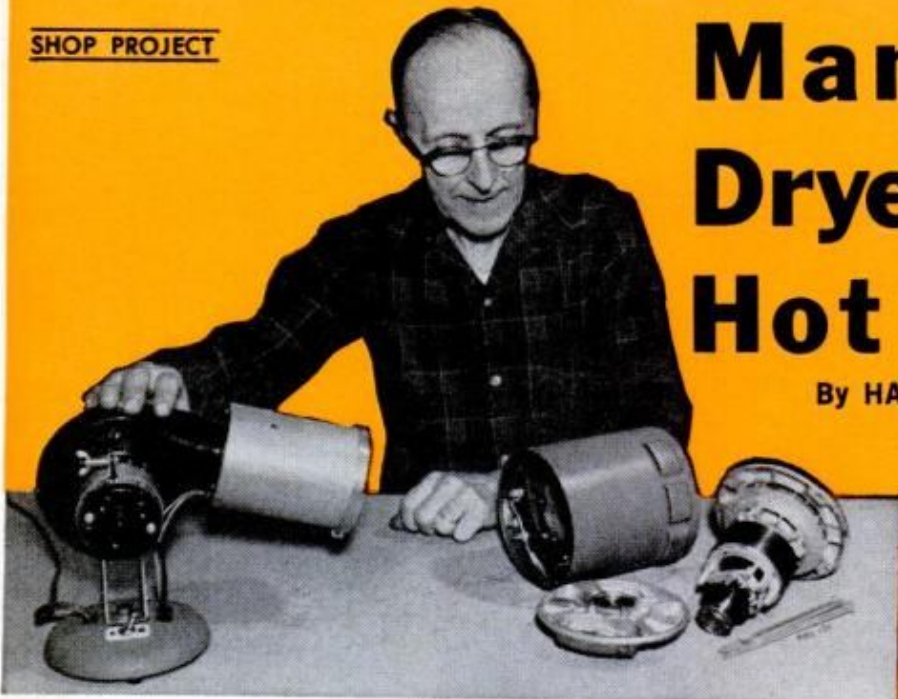
DRILL-PRESS KNOW-HOW. Your drill press is going to waste if you use it only to drill holes. This highly versatile workshop machine can perform a bagful of tricks when given a chance. Next month's Toollesson will make you a master of your drill press through the use of simple jigs and fixtures.

TWO-IN-ONE CHEST-CRIB. It's a crib and a chest all in one which makes it a real space saver. It's junior size and designed to take over when Johnny outgrows his infant's crib. An ideal project to shorten the waiting period for young fathers-to-be.

GREENHOUSE KITS MAKE THEM EASY TO BUILD. Garden buffs who can hardly wait for each spring to roll around can enjoy their hobby the year round when their gardens are under glass. Whether you build a lean-to or free-standing unit, framing members of these structures bolt together like a toy construction set to make them a simple job for the homeowner to tackle.

Man-Sized Dryer Blows Hot or Cold

By HAROLD P. STRAND

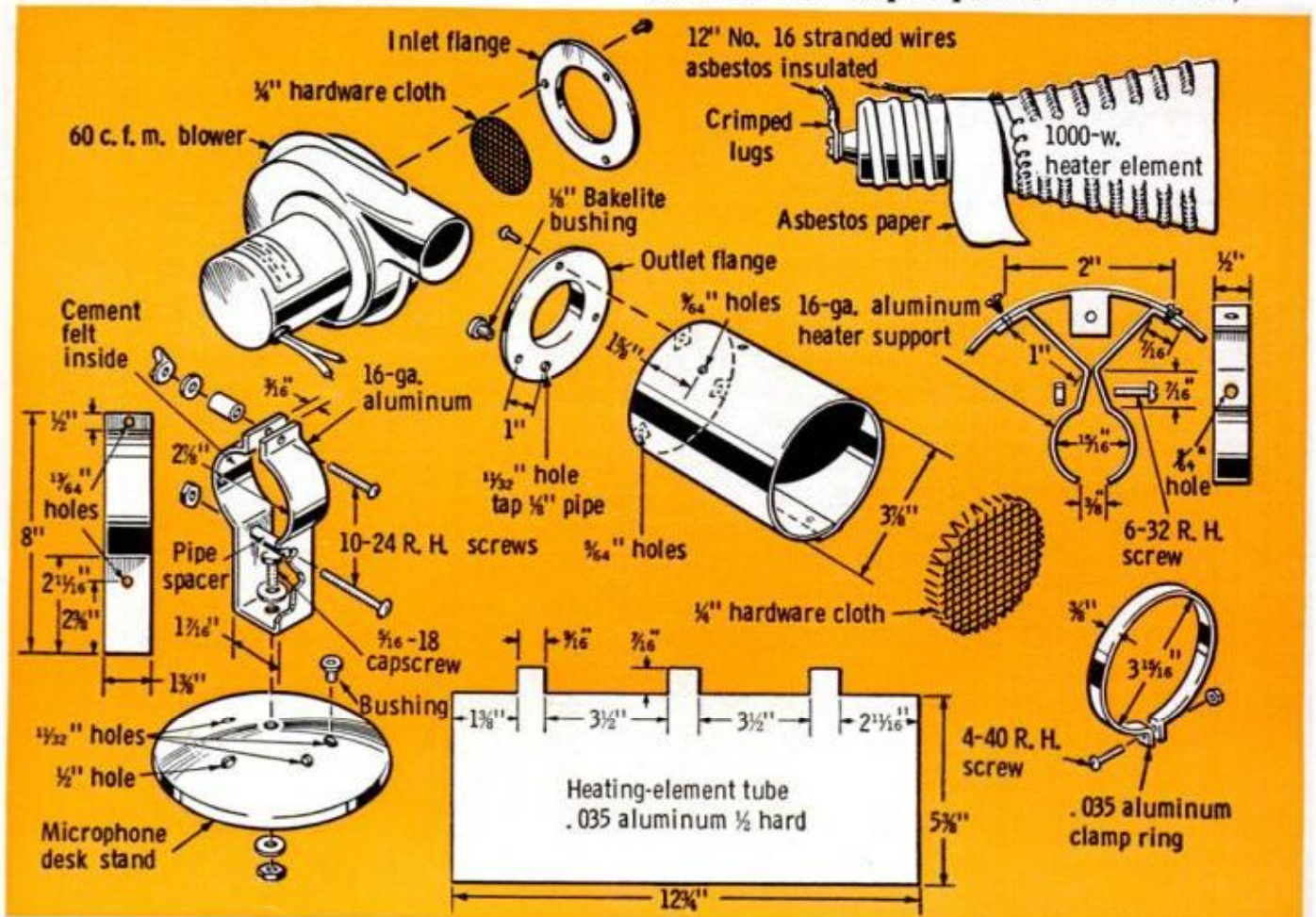


WHEN THE HEAT'S ON, the blower can make short work of drying out a soggy motor. To speed the job, author has removed end bell and rotor to reach motor windings

VERSATILITY IS THE NAME of this blower-heater dryer, a real handy-andy for your home and shop. With it you can rapidly dry photographic prints and negatives, cameras, paint jobs, motors or other electrical equipment; it will circulate air, blow fumes away, heat a small room and even be taken over by the missus for drying hair.

The ventilating blower, rated at 60 cu. ft. per minute, has a flange on its output port. The heating element is a 1000-w. sunbowl type that you mount in a bracket support centered in an aluminum tube.

The pattern for the tube allows about $\frac{1}{16}$ -in. overlap for riveting. Bend the tabs and drill to match the spacing of the flange holes in the output port of the blower,



keeping the riveted seam at the bottom.

Crimp screw lugs to one end of a pair of No. 16 stranded wires that are asbestos or glass insulated. One wire goes to the screw at the end of the heating element's base; the other connects to a screw at the side for the screw-base shell. Drill an $1\frac{1}{32}$ -in. hole near the lower edge of the output flange and tap it for $\frac{1}{8}$ -in. pipe threads to accept a Bakelite bushing through which to pass these leads.

Before mounting the heating element in the bracket shown, wrap three turns of asbestos paper around the neck of the element to insulate it from the bracket.

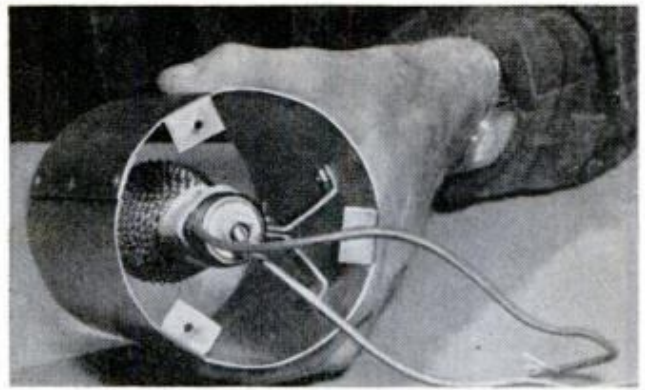
Then mount the tube on the flange with sheet-metal screws and cover the other end of the tube with a disc of $\frac{1}{4}$ -in.-mesh hardware cloth. An aluminum ring clamps the bent-over edges of the screening. I fitted the intake port with similar screening under its flange.

Both the element bracket and the motor support are made from 16-ga. aluminum for rigidity. The latter is attached to the microphone desk stand I used for a base with a $\frac{3}{16}$ -18 capscrew fitted with a washer and nut on the underside. But first, file a flat over this center hole to provide a better seat for the support. Instead of the microphone stand, you could make a base with a pipe flange attached to a board large enough to be stable.

Next drill three holes in the base for Bakelite bushings and a $\frac{1}{2}$ -in. hole for the switch. All connections are made in the base. Make certain to buy at least a 10-amp.-rated switch to handle the high current. Since the base is not very deep, look for a switch body that will fit the space. The base feet can be extended to install a slightly larger switch. ★ ★ ★

MATERIALS LIST

Quantity	Size, Description, Use
1	60 c.f.m., 120-v. ventilating blower, with output flange
1	1000-w. sunbowl-type cone heater element with screw base
1	Microphone deskstand base
1	10-amp. (at least), 125-v. d.p.d.t. center-off toggle switch
1	5/16-18 capscrew and nut (base)
1	Plug cap (line cord)
1	7" square $\frac{1}{4}$ -in.-mesh hardware cloth (port screening)
2	Small wirenuts
4	$\frac{1}{8}$ " pipe-threaded Bakelite bushings (outlet flange, base)
1'	No. 16 stranded asbestos-covered wire (heating element)
6'	No. 16 lamp cord (motor, switch, line cord)
Misc.	Machine screws, nuts and washers



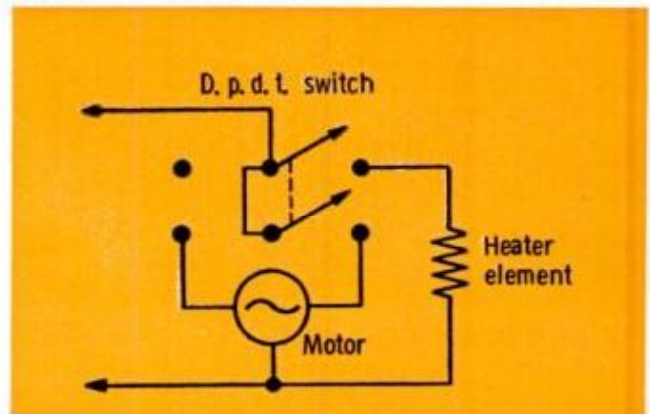
STANDOFF BRACKET centers heating element in aluminum tube. Asbestos paper covers heater terminals to insulate them from the supporting bracket



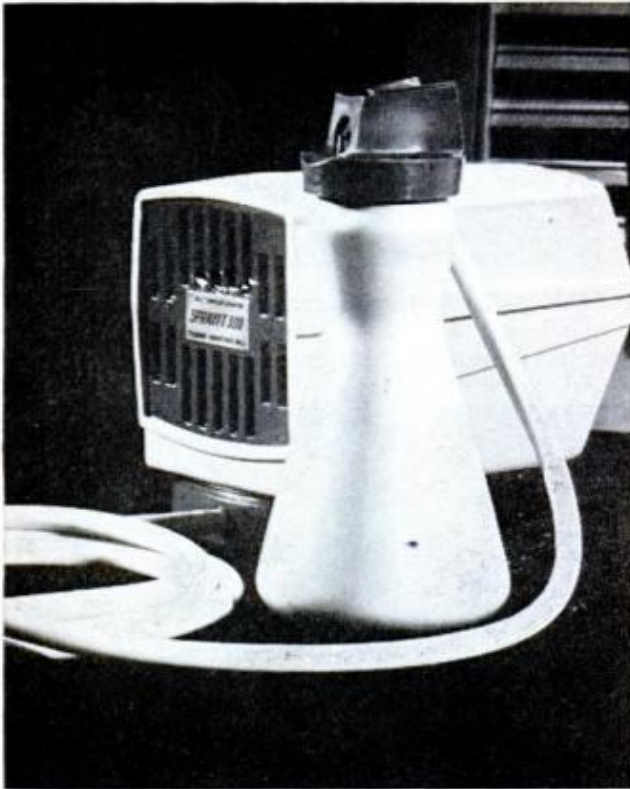
DIRECT THE AIR SUPPLY up, down or where you want it by loosening a wingnut on the motor clamp, turning blower unit to position and retightening nut



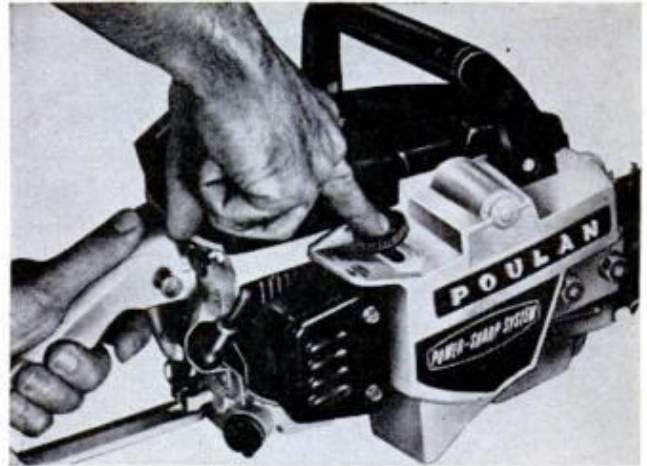
ALL WIRING CONNECTIONS are made near body of a center-off toggle switch and concealed on underside of the microphone stand that forms the base



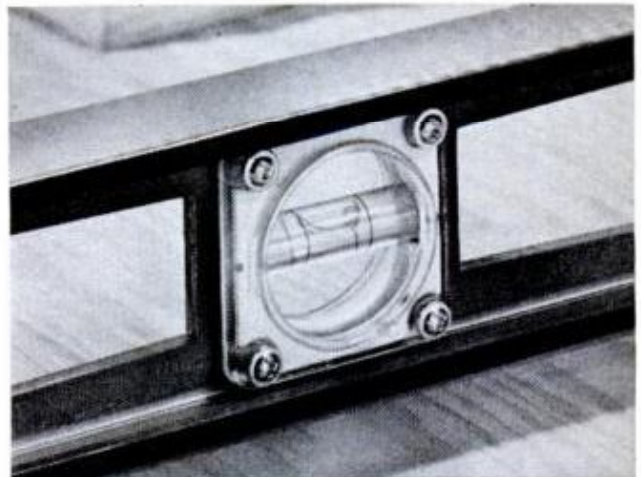
These new tools will



YOU CAN SPRAY almost any liquid, inflate toys or air-dry things with Sprayit 300, an integral-diaphragm compressor. Made by Thomas Industries, Louisville, Ky. \$24.95.



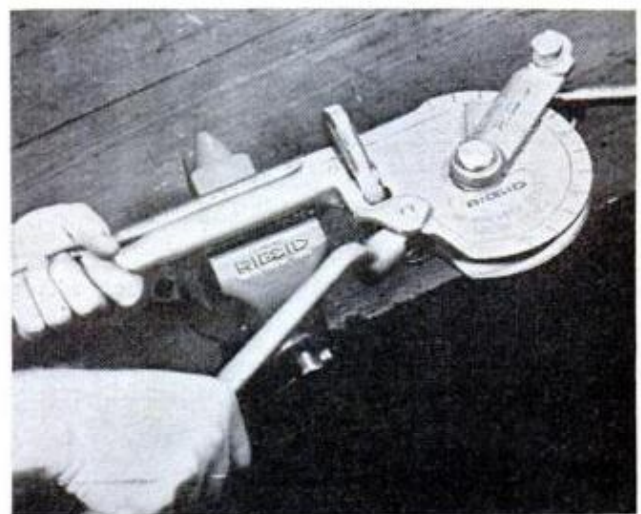
BUILT-IN CHAIN-SAW SHARPENER has been added to the Poulan lightweight line. Knob on the stone is loosened and slid toward the blade. By Beard-Poulan, Shreveport, La.



ANY WHICH WAY—The Craftsman Mono-Vial Level reads through 360°, cross-tests and plumbs. Three plastic vials are in 24-in. frame. Sears, Roebuck & Co., Chicago, Ill. \$6.99.

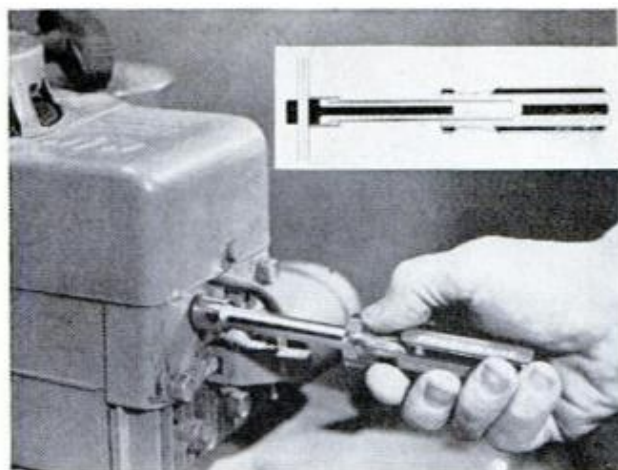


DIAL-A-DRILL is a plastic dispenser with 12 high-speed drills and a center punch. The dial permits release of a single bit only. Made by Century Drill and Tool Company, Chicago, Ill.

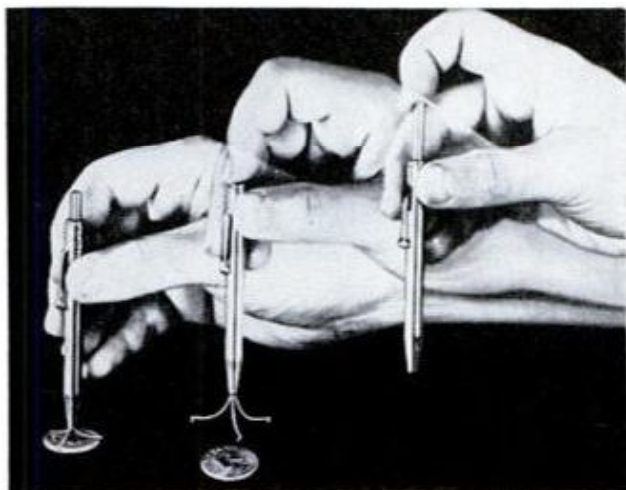


HEAVY-WALL TUBE BENDING is made easy with portable Ridgid Ratchet Tube Benders for $\frac{5}{8}$ and $\frac{7}{8}$ -in. O.D. tubes. Made by the Ridge Tool Co., Elyria, Ohio. \$24.50 and \$39.

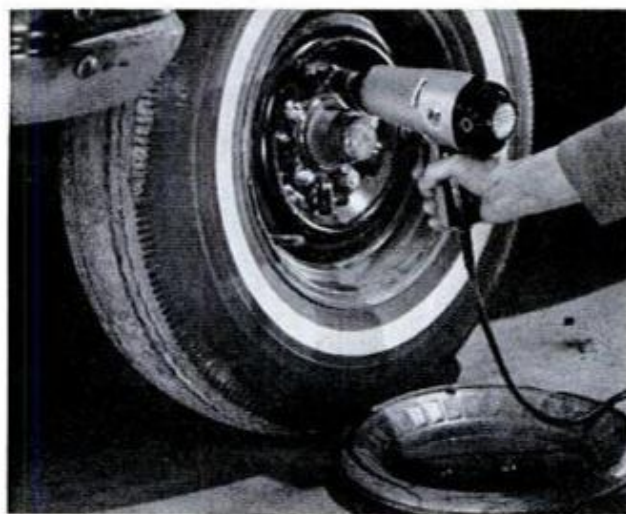
make shopwork easier



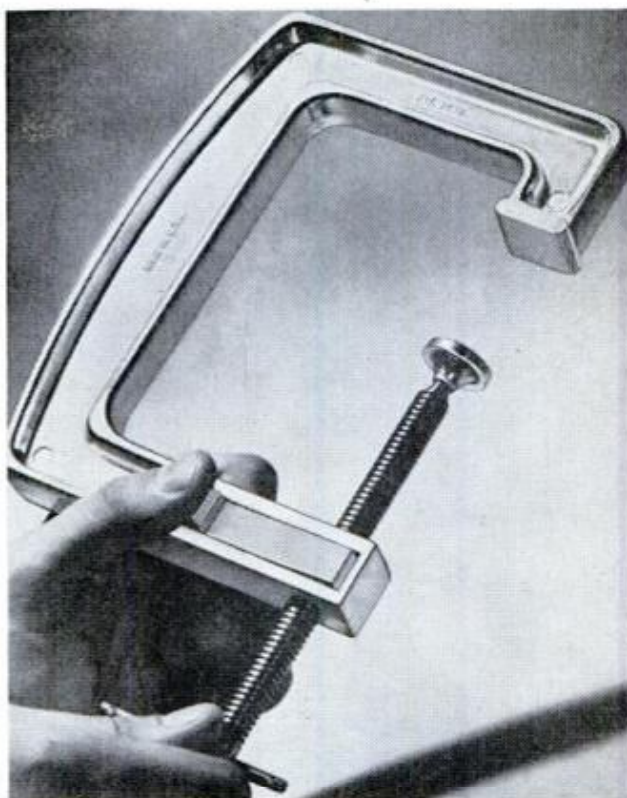
THE LONGEST BOLT IS NO MATCH for these color-coded, hollow-shaft nut drivers. Seven sizes range from 3/16 to 1/2 in. The Stanley Works, New Britain, Conn. Set costs \$8.86.



TINY FINGERS are what you have with one of the six models of Triceps, plunger-operated, stainless grasping tools. Universal Technical Products, Inc., Forest Hills, N.Y.



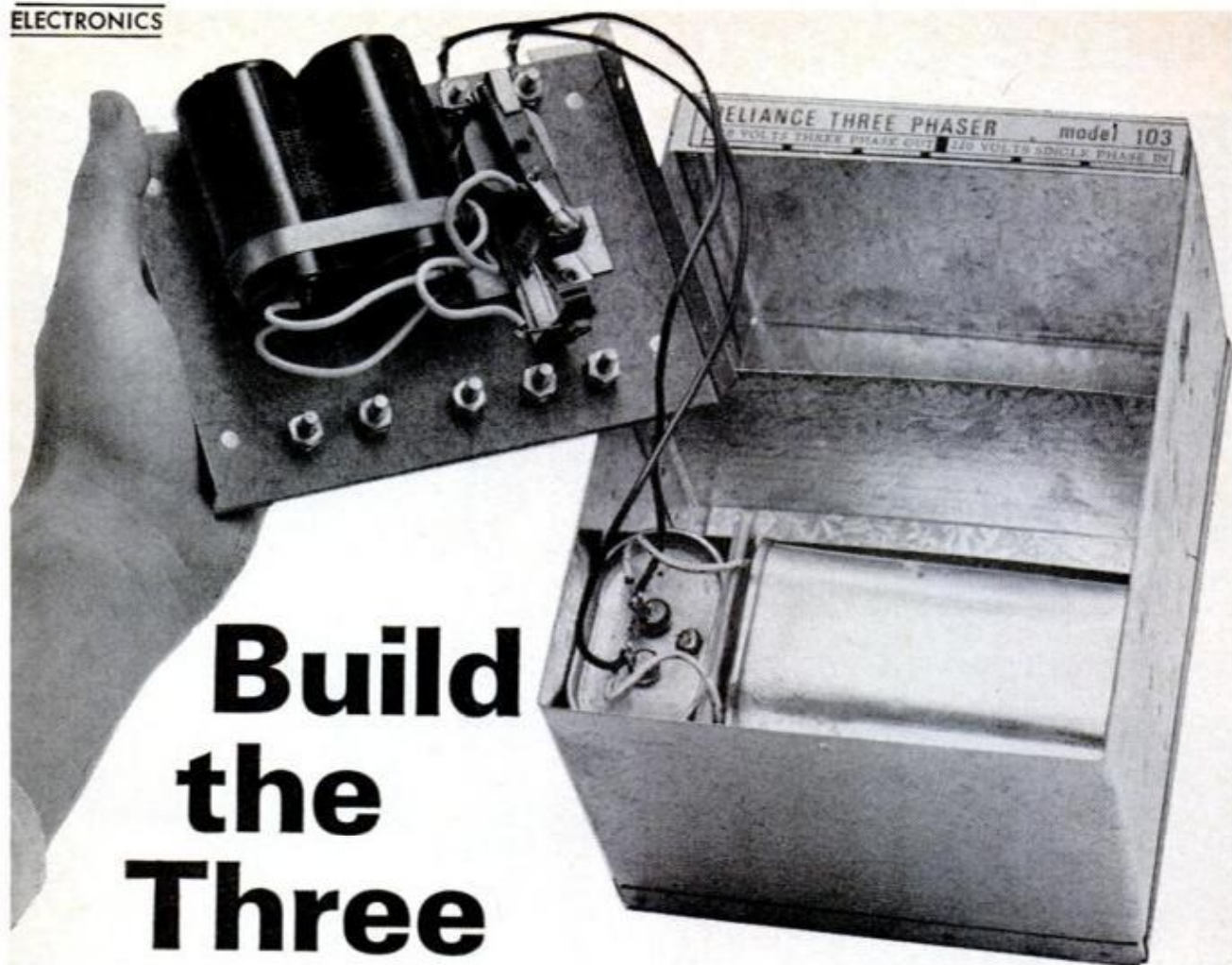
ONE-HAND OPERATION is the boast of this 1/2-in. impact wrench with a split-direction trigger, plus options for screwdriving and drilling. By Black & Decker, Towson, Md. \$75.



CLAMP IN JIG TIME because you don't have to thread the shaft's length. The new Quick-Set Clamp has a shaft grip that's released by a trigger. Wing Products Co., Tempe, Ariz.



ALL IN ONE. The Rapid Grip 10-in. ratchet wrench adjusts automatically by mere thumb pressure to fit square or hex nuts. In two sizes. Tanguy Tool Co., Glen Mills, Pa. \$9.95.

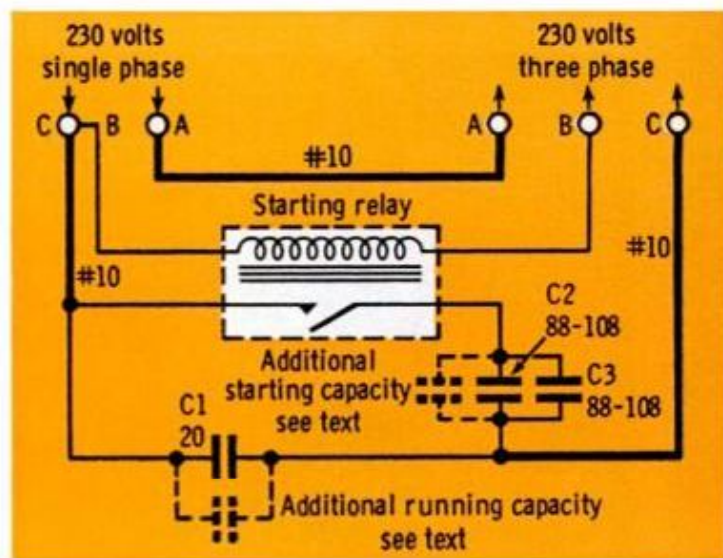


Build the Three Phaser

This ingenious device lets you put three-phase motors to work on single-phase lines

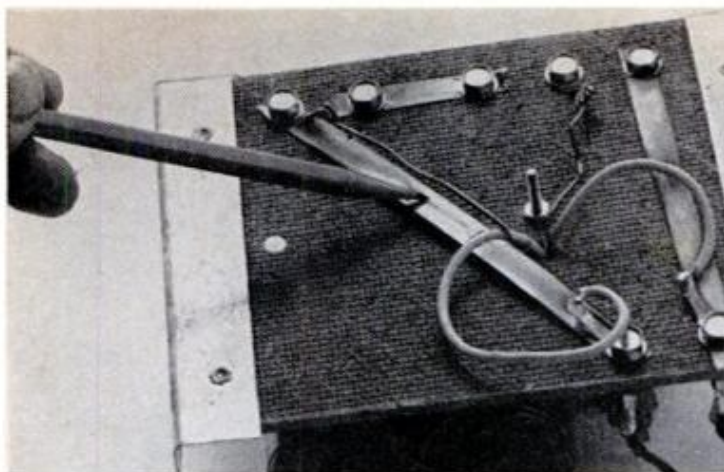
AT LAST you'll be able to put to use that three-phase motor you've had lying around the basement or one you can pick up for a half or third the price of a single-phase job. This Three Phaser makes it possible to take advantage of such three-phase motors. Although it is limited to the Y-wound type, practically all three-phase motors of 3 hp and under are Y-wound.

PM readers will recall a reference to the Three Phaser in *Fantastic Coneless Loudspeaker* (page 36, Dec. '65 PM). In that story, we did a report on its inventor—William Ashworth—and his research and development lab in New Albany, Miss. We mentioned that Ashworth's patent file included a device for converting single-phase to three-phase power, and he's been getting mail from readers ask-

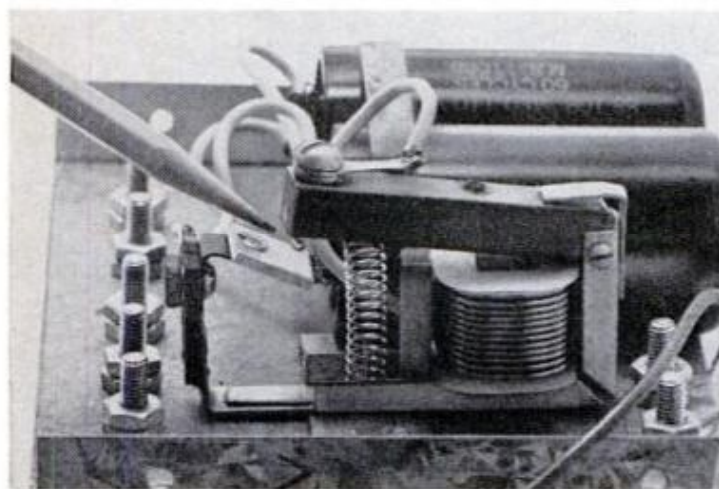


SCHEMATIC DIAGRAM of Three Phaser shows how two input terminals for single-phase power terminate in three for three-phase power. Use No. 14 gauge hookup wire except where heavy No. 10 is specified

POPULAR MECHANICS



USE NO. 10 WIRE for hookup where shown instead of metal strips as on this prototype. As shown below, heavy contacts on Ashworth's specially designed and adjusted relay carry starting current



ing for more information on the device ever since.

In our June 1966 issue, we presented plans for Ashworth's Coneless Loudspeaker (page 168) and are now able to publish instructions for building his power converter.

The Three Phaser provides power for motors from 1 to 3 hp. It approximates three-phase current wave forms (120° out of phase) by splitting the single-phase lead to form two current paths. (See current paths B and C in the schematic diagram.) Path B includes the coil of a starting relay, which is the heart of the Three Phaser and the key component in the power conversion.

Initial current surge through the winding causes the relay to close and another current path, C, is formed. Current draw through path C causes the heavy current flow through the relay winding to decrease and the spring-loaded relay contacts open. This removes the starting capacitors C2 and C3 from the circuit, but

current then flows through running capacitor C1 in the alternate leg of path C.

Approximately 200 microfarads starting capacity is specified for the Three Phaser. If greater starting torque is desired for the 3-hp motors, an additional 100 mfd can be added in parallel. Running capacity is specified at 20 mfd, but an additional increment of 20 mfd per horsepower can be added for better running efficiency. This figure is approximate; an ammeter could be used to determine the capacity required for the best current balance in the three paths of the Three Phaser.

As mentioned, the starting relay is the heart of Three Phaser operation. It is designed and adjusted to close and open within the ranges of the typical current draw of 1 to 3-hp motors. In some cases, a 1-hp motor does not draw a starting current sufficient to pull in the armature of the starting relay; the motor will only hum and won't start when power is applied. This being the case, Ashworth includes with the relay a coil form on which you can wind 60 turns of No. 20 magnet wire for an alternate coil that will close the relay.

As shown in the photographs of the Three Phaser, the starting relay, starting capacitors, and terminal screws are mounted on hardboard. The board slides into a galvanized enclosure approximately 5 x 6 x 7 inches. A chassis box of this size provides enough room for the components indicated in the schematic as well as for the additional capacity if it is required.

A single-phase power cord can be brought into the unit to connect to the input lugs through the side of the chassis box, and the three-phase cable can be brought out at the same location. If desired, provision can be made to mount a three-phase power socket on the chassis box for plugging in three-phase motors directly.—*Bill Hartford*

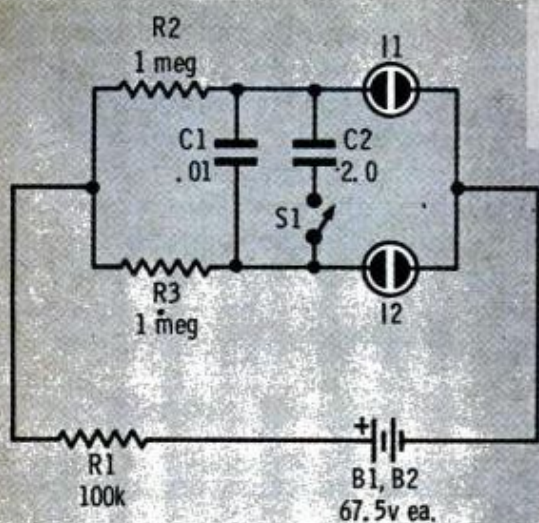
PARTS LIST

C1—20uf, 220-v. minimum, oil-filled a.c. running capacitor.
 C2,C3—Approx. 100 uf electrolytic motor starting capacitors, 100-v. rating or higher.
 Starting Relay—Ashworth relay (see below).
 Misc.—No. 10 and 14 hookup wire, terminal lugs, chassis box, heavy-duty line cord, three-conductor cable, solder.
 A complete kit of parts is available from Ashworth Research and Development Laboratory, Highway 78 East, New Albany, Miss. 38652, for \$19.95. An assembled Three Phaser is \$29.95. The relay can be ordered separately for \$5.00; 100 mfd. starting capacitors \$2.50 @; and 20 mfd. running capacitors \$5.00 @.

No amount of capacitor theory will enable you to outguess this impartial . . .

Electronic 'Coin Flipper'

By EDWARD A. MORRIS



IN THIS AGE OF PUSHBUTTONS there's no need to flip coins, call "odds" or "evens," or go through the "eeny-meeny" chant. All you have to do is press the button on this neon-tube multivibrator.

The pushbutton switch places capacitor C2 in parallel with C1, which increases the total capacitance in the circuit. This reduces the flash rate of I1 and I2 from a normal several hundred times a second to once every several seconds. The effect is to freeze one of the lamps in its lighted condition—heads or tails.

The action is completely random so no one can be accused of using a double-sided coin. Two batteries will keep the "coin flipper" nervously flashing for several years. Use it as a paperweight decision maker in your office, and you can discard your "Think" sign! ★★★

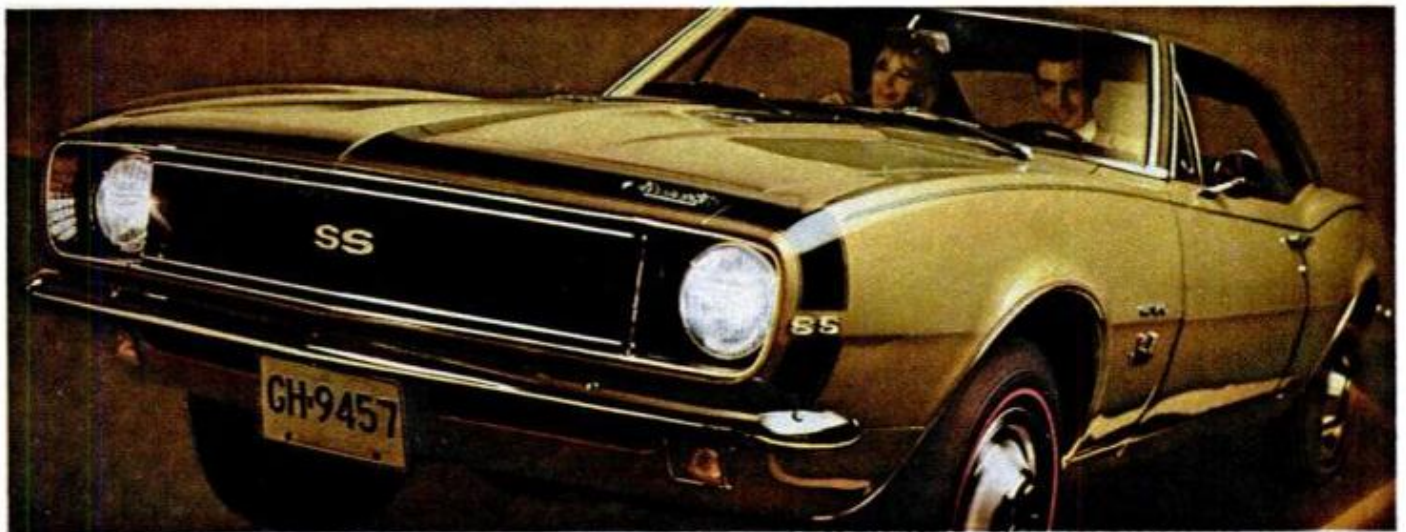
PARTS LIST

B1, B2—67.5-v., miniature batteries
 C1—.01-mfd., 200-w.v.d.c. miniature capacitor
 C2—2.0-mfd., 200-w.v.d.c. miniature capacitor
 I1, I2—NE-2 neon indicator lamps
 R1—100,000-ohm 1/2-w., 10% resistor
 R2, R3—1,000,000-ohm, 1/2-w., 5% resistor
 S1—S.p.s.t. normally open pushbutton switch
 Misc.—Enclosure, rubber feet, hookup wire, hardware, solder



SMART WOODEN ENCLOSURE for the "Coin Flipper" was adapted from a men's cologne box. You'll have to use similar packaging ingenuity

Camaro SS: the 396-cu-in version!



Camaro SS Sport Coupe with Rally Sport equipment

Camaro's free spirit was just made for a big-chested V8 like the 325-horsepower Turbo-Jet 396. So we put them together in a new package. That's the only way we know to step up from the 350-cubic-inch Camaro SS.

For show there's a stripe around the snout, SS emblems, domed hood and a black rear body panel. For go there's a special suspension with beefier springs and shocks, special lower ball joints and rear axle radius rod.

And hear this: you can order the three-speed Turbo Hydra-Matic with this one. Yeah! But don't just sit there reading about it. Hustle down to your Chevrolet dealer's and look at the sportiest setup this side of Corvette.



51 VACATION STOP-OFFS

(Continued from page 102)

graphic equipment). Hours in both locations 9:30 a.m. and 1:30 p.m., Mon. through Friday. Children over 5. George Eastman Museum, 900 East Ave., open daily 10 to 5. Pushbutton display. Free.

INDIAN POINT ATOMIC POWER PLANT, 1 mile west of Buchanan, N.Y.—Visitors can see the plant from an observation platform. Open Wed. through Sun., 1 to 5. Free.

HORSESHOE CURVE, 5 miles west of Altoona, Pa.—From a parking place, rail buffs watch trains negotiate famed arc.

PIPER AIRCRAFT CORP., Lock Haven, Pa.—Conducted tours of the plant are offered Mon. through Fri., 9 to 11 and 1:30 to 3:30. Free.

ROCK OF AGES, Graniteville, Vt.—Guided tours of the granite quarry show the drilling and blasting in the pit. Tours 8:30 to 5, May 1 to Oct. 31. Free.

South

MUSEUM OF AUTOMOBILES, Petit Jean Mountain near Morrilton, Ark.—The late Jimmy Melton's notable vintage car collection was bought by Winthrop Rockefeller and moved to a new museum here. April through Oct., 10 to 6 daily, except Mon. Adults, \$1; children, 50¢.

PIKE COUNTY DIAMOND FIELD near Murfreesboro, Ark.—Two competing diamond mines allow visitors to search for diamonds at a price. Sharp-eyed tourists have found stones up to \$75,000 in value.

POSSUM TROT LINE, Reader, Ark.—The railroad operates trains drawn by steam locomotives from Reader Depot on Mon., Wed. and Fri. at 10:30 a.m. Round trip returns from Waterloo at 4:30. June 1 through Labor Day trains operate on Sat. also. Round trip fare, adults, \$4.50; children, \$1.18; under 5, free.

KENNEDY SPACE CENTER, Cape Kennedy, Fla.—NASA bus tours of the facilities leave from Gate No. 3, 2 miles south of Titusville, east of U.S. 1. Tours start at 8:30 a.m. and end at 3:30 daily and are scheduled at 10-minute intervals.

PARADISE STEAM PLANT, Paradise Ky.—Big Brother, a stripping shovel tall as a 20-story building, can be watched digging coal for world's largest steam plant generating electricity from fossil fuels. Free.

MICHOU D ASSEMBLY FACILITY, NASA, New Orleans, La.—Tour trains take visitors through the vast buildings where technicians are building the up-rated Saturn I and Saturn V rockets designed to put the first man on the moon. Tours are scheduled at 10 and 2

each weekday and at 10 on Saturday. Reservations should be made by phoning 255-2605 in New Orleans or writing the Public Affairs Office, Michoud Assembly Facility, P.O. Box 293000, New Orleans, La. 70129. No children under 12. Free.

WATERWAYS EXPERIMENT STATION, U.S. Corps of Engineers, Vicksburg, Miss.—A tour takes visitors to working models of Niagara Falls, lower Mississippi, mouth of the Columbia River, and others. Mon. through Fri. except holidays at 10 and 2. Free.

NUCLEAR REACTOR BUILDING, North Carolina State Univ., Raleigh, N.C.—The reactor can be seen Mon. through Fri., 8:30 to 5. Free.

U.S.S. NORTH CAROLINA Battleship Memorial, Cape Fear River, 3 miles south of Wilmington, N. C.—Sound and light drama gives the story of this battleship, nightly at 8, April 2 to Labor Day. Adults, \$1.50; children under 12, 75¢. Visitors can tour the gallant warship. Open daily 8 to sunset. Adults, 50¢; children 6 to 12, 25¢.

AMERICAN MUSEUM OF ATOMIC ENERGY, Oak Ridge, Tenn.—Exhibits include a scale model of a pitchblende mine, the first atomic reactor, and uranium samples. Open Mon. through Sat., 9 to 5; Sun., 12:30 to 6:30. Free

HOMESPUN VALLEY Mountaineer Village, Gatlinburg, Tenn.—An authentic moonshiner's still operates daily for tourists, and there is square dancing. Open Mon. through Sat., 8:30 a.m. to 11 p.m., May 15 to Oct. 30. Adults, 75¢, day, \$1 evening; children under 12, free.

POCAHONTAS EXHIBITION MINE, Pocahontas, Va.—Visitors watch coal being mined. Open daily, June through Oct., 8 to 6. From Mar. 15 to June and Oct. 31 to Dec. 1, 8 to 5. Adults, 75¢; children, 25¢.

U. S. NAVAL STATION, Norfolk, Va.—Tour buses take visitors from the main gate to the Naval Air Station and submarine piers. Daily April 1 to Labor Day; from Labor Day to Mar. 31, Tues., Thurs., and Sat. at 1:30. Bus fare, 50¢.

Midwest

BORG-WARNER SCIENCE HALL, 200 S. Michigan Ave., Chicago, Ill.—In the environment chamber, visitors watch a film on climate while actually feeling and smelling the heat, cold and odors depicted. Mon. through Fri., 10 to 5:30; Sat. to 4; Sun. 1 to 4. Free.

CHICAGO POLICE HEADQUARTERS, 1121 S. State St., Chicago, Ill.—Visitors guide themselves through the electronic communications center and the crime-detection lab. Open 9 to 5 daily. Free.

(Please turn to page 202)



**This is a GM Original:
It calls signals
for the engine.**



**This is a GM Replacement:
It sparks
winning drives, too.**

You've seen one . . . you've seen them both. GM Replacements look, act and are just like GM Originals.

That's a good thing to remember, especially when it comes to a precision part like the distributor cam. That's the part that tells your spark plugs when to spark. Keeps your engine running smoothly.

So be sure of quality. Go where you know they use Genuine GM parts. They're available just about everywhere in GM and United Delco packages. Don't forget, good service starts with good parts.

GENUINE GENERAL MOTORS PARTS



CHEVROLET • PONTIAC • OLDSMOBILE • United
BUICK • OPEL • CADILLAC • GMC TRUCKS • Delco



51 VACATION STOP-OFFS

(Continued from page 200)

AUTO TOURS at Ford, Lincoln, Mercury, Cadillac, Continental, Chrysler, Dodge, Plymouth plants, Detroit, Mich.—Weekdays. Contact plants for tours. Free.

HENRY FORD MUSEUM, Greenfield Village Rd. and Oakwood Blvd., Dearborn, Mich.—The Mechanical Arts Hall contains industrial machinery, early cameras, television gear and 200 antique autos. Daily June 15 through Labor Day, 8:30 to 6:30; remainder of year, Mon. through Fri., 9 to 5. Weekends, 9 to 6. Adults, \$1.40; children, 6 through 14, 50¢; under 6, free.

HULL-RUST-MAHONING MINE, off U.S. 169, north of Hibbing, Minn.—A billion tons have been gouged from this 1600-acre, 535-foot-deep open pit iron mine. Free.

TOWER-SOUDAN STATE PARK, near Tower, Minn.—Oldest and deepest of Minnesota underground iron ore mines. Tourists travel 2400 feet beneath the earth's surface and board a skip to explore a 3000-foot tunnel.

JOHN DEERE TRACTOR WORKS, Waterloo, Iowa.—One of the biggest tractor plants and foundries in the world; pours 115,000 tons of iron a day. Tours 10 a.m. and 2 p.m. Mon. through Fri., except for holidays and July 16 to Aug. 14.

GATEWAY TO THE WEST ARCH, Jefferson National Expansion Memorial, St. Louis, Mo.—Starting this summer, five passenger capsules are scheduled to take sightseers to the 630-foot top for a view of the city and the Mississippi.

ANHEUSER-BUSCH BREWERY, St. Louis, Mo.—Tour of bottling and brewing process. Clydesdale horses. May to Oct. Tours start at 9:30 a.m. Mon. through Fri. except holidays. Free.

SS DELTA QUEEN, Green Line Steamers, foot of Main St., Cincinnati, Ohio—Steamboat days are kept alive by this last packet in the gold braid trade. She plies the Mississippi on regularly scheduled trips.

U.S. AIR FORCE MUSEUM, Building 89, Area C, Wright-Patterson Air Force Base, near Fairborn, Ohio—Early and late aircraft and missiles are on display in the world's largest collection of military planes.

Southwest

ARIZONA-SONORA DESERT MUSEUM, Tucson Mountain Park, Tucson, Ariz.—Visitors see animals from scorpions to mountain lions in their native habitat. Open daily at 9. Adults, \$1; children, 6 to 15, 25¢.

METEOR CRATER, southwest of Winslow, Ariz.—A giant meteor struck here

50,000 years ago and blasted a 4150-foot-wide crater. Adults, \$1; children, 25¢.

ASTRODOME, Houston, Tex.—The world's first airconditioned stadium can be toured daily when no event is scheduled. Tours, 11, 1 and 3. Admission, \$1.

MANNED SPACECRAFT CENTER, Nasa Road, Houston, Tex.—Space film shows plus exhibits of pressure suits, space survival gear, and spacecraft used in early flights. Open Sun., 1 to 5. Free.

Mountain States

GOLD CAMP ROAD, Colorado Springs, Colo.—Theodore Roosevelt called the route "the trip that bankrupts the English language." The gravel road runs over the roadbed of the old Cripple Creek Short Line. Check road conditions.

WASHODE SMELTER, Anaconda, Mont.—The big stack is 585 feet high with walls five feet thick. Tours of the copper smelter daily except Sun. and holidays, April through Sept. at 1:15. Free.

HOOVER DAM, near Boulder City, Nev.—The 726-foot tall dam, one of the highest ever built, is ranked among the world's great engineering accomplishments. Tours inside dam and powerplant are offered from 7 a.m. May 30 to Labor Day; 8 to 5, the rest of the year. Adults, 30¢; children under 16, free.

DINOSAUR NATIONAL MONUMENT, U.S. 40 at Utah and Colorado border—Dinosaur bones in the Dinosaur Quarry Visitor Center can be seen exactly as scientists discovered them. Open daily, 7 to 7, June 1 to Sept. 1; 8 to 5, spring and fall; 8 to 4:30 in the winter.

Pacific States

PALM SPRINGS AERIAL TRAMWAY, Palm Springs, Calif.—80 passenger cars go 13,200 feet to climb 5873 feet high in the craggy San Jacinto Mountains. Daily, 8 a.m. to 10 p.m., except Wed., 11 a.m. to 10 p.m. Round trip, adults, \$2.95; children less.

PALOMAR MOUNTAIN OBSERVATORY, northeast of San Diego, Calif.—The 200-inch Hale Telescope, largest in the world, can be seen from the visitors' gallery.

RANCHO LA BREA PITS, Wilshire Blvd. and Curson Ave., Los Angeles, Calif.—The asphalt death traps for prehistoric animals can be viewed. Free.

SCRIPPS INSTITUTE OF OCEANOGRAPHY, 8602 La Jolla Shores Dr., La Jolla, Calif.—The Oceanographic Museum is one of two in the world. Open through Fri., 9 to 5; Sat., Sun. and holidays, 10 to 6. Free.

SEATTLE CENTER, Seattle, Wash.—The soaring Space Needle, Monorail and

(Please turn to page 214)

A Scout is power to fish your own sea

Somewhere there's a surf that's never been fished. Where you never hear a highway sound. Where you can catch the big ones. And you can get there with the big power of the new V-8 INTERNATIONAL SCOUT[®] with all-wheel drive.

See the new SCOUT at your nearest INTERNATIONAL Dealer. The SCOUT is built to do anything, go anywhere with its new V-8 engine and all-wheel drive. Or you can get a SCOUT with either of two husky, economical 4-cylinder engines. Open it up, and cross the border into a man's world of driving. The new SCOUT costs less than most second cars, and your INTERNATIONAL Dealer is ready to deal. International Harvester Company, Chicago, Illinois 60611.

 **INTERNATIONAL HARVESTER CO.**



**The new
top-powered
V-8 SCOUT!**

SCOUT is the registered trademark for a vehicle manufactured exclusively by International Harvester Company.

JUMPER SAILBOARD

(Continued from page 163)

the breasthooks and web must be installed before the keelson is secured since it's scribed to the bottom breasthook. The keelson must be slotted for the centerboard before it can be secured.

Fairing is the operation of beveling the outside surfaces of the frame wherever necessary to obtain full contact between the frame and the plywood planking. Most of this can be accomplished with a straightedge and a plane.

Novel sanding block

For that final touch, however, Jumper's designer made up a novel 2-ft. sanding block by cutting through a small coarse-grit sanding belt to form one long strip and gluing this over a piece of wood the same width. Such a block cuts from keelson to chine in one straight line.

The first step in planking is adding the plywood to Frame No. 7 to form the transom. Cut the ends of the stringers flush with the rear surface of the frame. The frame itself can serve as a pattern for marking the plywood for cutting, allowing about $\frac{1}{8}$ in. all around for final fairing. Use glue and 1-in. No. 8 screws to mount it to the frame.

You don't have to order extra-long sheets of plywood for the planking. Regular 8-ft. sheets, properly butted, are quite satisfactory.

Fit each panel exactly before you nail and glue it in place. Cover the bottom first, then the sides and, after you've installed the centerboard well and mast blocking, the deck. To mount the planking, use $\frac{3}{4}$ -in. 15-ga. silica-bronze nails with annular threads, spacing them no more than $1\frac{1}{4}$ in. apart. Nails shouldn't be used in any location that can't be backed with a bucking iron. In such areas, substitute $\frac{3}{4}$ -in. No. 8 flathead screws. After the bottom and sides are in place, the hull can be removed from the building base and turned over.

After making up the centerboard well, you'll have to remove the plywood crossmembers in Frame Nos. 3 and 4 in order to install it on the keelson. The well should be heavily bedded in seam compound and secured with brass screws spaced 8 in. apart.

Once the well is in place, the frame members which you removed earlier can be cut to fit against the sides of the well and reinstalled. Glue small nailing blocks to the sides of the well to provide a surface for securing the inner ends of the frame pieces.

The centerboard itself is cut from $\frac{1}{2}$ -in.

plywood, preferably marine grade since this eliminates the possibility of voids showing up in the cut edge. The flange on the top edge is mounted with waterproof glue and three $1\frac{1}{2}$ -in. No. 9 flat-head, brass screws, one near either end and one in the center. Drill a $\frac{3}{16}$ -in. shank hole and a $\frac{1}{8}$ -in. pilot hole down into the plywood for each, but don't countersink the heads. Instead, use brass cup washers under the heads. This makes a nice looking contrast with the mahogany, so use the same method when securing the side rails and bow piece.

The little pivot dowel should be oven dry when driven into the hole in the centerboard. Once the wood takes on moisture it will swell enough to stay for good without requiring mechanical fastening.

Try the board in the well before you paint it. It should be loose enough to float upward, with a minimum of $\frac{1}{8}$ in. clearance all along the arc of the pivot. To hold it down when sailing, drill a small hole about an inch below the flange and force a $\frac{1}{8}$ x $\frac{1}{8}$ -in. leather thong through it, allowing it to protrude about $\frac{3}{4}$ in. on either side of the board. This will jam the board slightly when down, but still release easily.

Drain plug in transom

Laminate the mast step as shown in the plans and install this before decking the hull. In addition, Jumper requires a $\frac{3}{4}$ -in. i.d. flush-head drain plug in the transom, so mark a location for this clear of all nails and screws. The plug should be loosened if your boat is to lie for an extended period in the hot sun, and it should be removed entirely when the boat goes into winter storage.

Use brass pintles and gudgeons with the rudder. The other fittings are matters of personal preference. The small cleat at the base of the mast serves the halyard and can be made of mahogany, if desired.

Set all nails and screwheads slightly below the surface of the plywood and mask them with marine putty, following the manufacturer's instructions.

For top appearance, finish the boat by building up three thin coats of marine varnish, sanding lightly between, and topping this off with two finish coats.

You're sure to have fun with Jumper, but use good judgment for safety's sake. If you jibe without controlling the jibe, for instance, that long boom could knock your block off. A life preserver is a sensible accessory (nonswimmers and sailboards are a frightening combination). Finally, remember that the sailing is just as good a half mile offshore as it is half-way to Bermuda. ★ ★ ★

Scratch this page and you'll see what's been wrong with print-grain panelings ...until now.

Get out a key or coin and scratch away up there.
See? There goes the wood grain! Same sort of
thing happens when you scratch ordinary print-
grain panelings.

Sure they come at a nice low price. And they look
fine when they're new. But scratch away the inks
and all that's left is a blank panel.

You deserve something better for your money.
And now, for the same kind of money, you can get
something better.

You can get new Weldwood®
Duragard™ paneling.

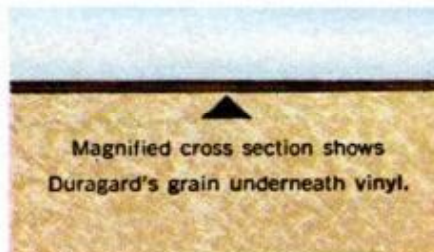
In Duragard paneling, the grain
patterns are underneath a tough,

clear vinyl film that's bonded to the panel's sur-
face. Dirt and scratches can't penetrate this barrier.
You can always restore its original luster merely by
sponging it with mild soap and water.

Like the others, Duragard costs less than \$8.00 for
a 4' x 8' panel. Like the others, it looks great when
you buy it. But unlike the others, it keeps on
looking great.

Give a look yourself, at your Weldwood Head-
quarters dealer's. He's listed in the
Yellow Pages under "Plywood."

 **U.S. Plywood Corporation**
In Canada: Weldwood of Canada, Ltd.



Magnified cross section shows
Duragard's grain underneath vinyl.

Introducing another better idea from Ford...



Ford's Model C.

The Model C is Ford's new Cortina — a great blend of basic transportation and sports car performance with razor-honed sandling at a sensible price. It has a distinguished international racing heritage built right in (winner of such events as the East African Safari, Canadian Shell 4000, European Saloon Car Championship and hundreds of others).

Car enthusiasts — their ladies, too — will admire these standard features in the Cortina GT:

- Rally-proved 1500 cc ohv 6-cylinder engine.
- Weber carburetor and tuned exhaust headers.
- Full instrumentation, including tachometer, ammeter, oil pressure gauge and temperature gauge.
- Custom-contoured, individually adjustable bucket seats.


- Four-speed gearbox with short-throw gear change lever; fully synchronized.
- Performance-grade individual front suspension.
- Front disc brakes; self-adjusting dual brake system.
- Self-adjusting diaphragm clutch.
- 83.5 bhp @ 5200 rpm; 97 lb/ft torque @ 3600 rpm.
- Cortina GT rally stripes.

And a lot of other things going for Cortina, too.

- Like award-winning Aeroflow Ventilation.
- Optional wide-based wheels with radial ply tires on GTs.
- Ford Motor Company Lifeguard Design Cortina safety features.
- Room for five adults.
- A turning circle 6' less than VW's.
- Wall-to-wall carpeting.
- All-vinyl interior.
- Ford's Model C is sold and



serviced by Ford dealers—warranted by Ford Motor Co. (check Yellow Pages for nearest Cortina dealer). □ Take a test drive and watch your sports car senses come alive! □ Shown above, the Cortina 2-door GT at \$2172.* Other Cortinas available from \$1815.

Ford Cortina 

*Prices quoted are manufacturer's suggested retail base prices at East Coast P.O.E. The prices include Federal excise tax and suggested dealer delivery and handling charges. State and local taxes and transportation charges to your local dealer are additional.

YOU 'FLY' THIS CAR

(Continued from page 89)

at a fairly high and constant speed while maintaining a minimum of headway. But, under these conditions, disturbance in one part of the flow will ripple all the way back for miles. Cars will slow down, speed up, and, if lucky, drivers will reach their destinations after a jerky and fatiguing trip.

Even barring sudden traffic disturbances, such as a driver hitting his brakes, a following driver cannot maintain a specified headway using his eyes alone. He will drift up on the car ahead and drift back, once again setting up those oscillations that limit traffic density.

Best way is automated highway

Dr. Cosgriff believes that the best way to maintain a constant headway is with a completely automated highway where variations in headway are compensated for automatically in a car that will drive itself. Headway or the distance between cars can be sensed in any of several ways, by means of a conductor embedded in the roadway or a conductive paint, for example.

But automatic controls must be able to be overridden by the driver. Only with automatic *and* manual modes of operation would the vehicle be practical and acceptable to most drivers.

Before arriving at the idea of the tactile sensor, the laboratory investigated auditory and visual methods of informing the driver that he is drifting, but none was as effective as the tactile system.

The feedback of headway information to the control system of following automobiles in a stream of traffic can be accomplished in several ways, as mentioned. But, for purposes of testing the vehicle at this stage of development, the Ohio State researchers are using the cable as one way to simulate electronic feedback. The cable is wound on a take-up drum that is mounted on the front bumper of the test vehicle. The cable, one end of which is connected to a lead car, is kept taut while the test car follows. The length of cable can be constantly monitored and used as an input to actuate the headway sensor.

With headway distance actuating the control finger and with all control functions incorporated in a single stick, I realized that there's a lot more to making this control system work than meets the eye. I went under the hood expecting to find the engine buried under a plumber's nightmare of hydraulic lines, reservoirs and pumps, and, sure enough that's what I found. The conventional but extensive

hydraulic system actuates the carburetor throttle linkages, power brakes and steering.

I also figured that there had to be a "brain" somewhere in the car to compute the rate of change of movement between the test car and the lead car to obtain the data to actuate the sensor finger. Bob Fenton smiled and pointed out that the brains were in the rear end. Lifting the trunk lid revealed the breadboarded digital computer that spread over the floor of the trunk and made it impossible to carry anything more than a few slide rules.

The computer takes up the whole trunk in this prototype design, but even at the present stage in computer art it could be designed to fit under the dashboard or in an equally small and inconspicuous spot.

The computer-actuated finger is envisioned as a driver-assist device when the car is not being guided down a highway in an automatic, hands-off mode of operation. The driver would be able to engage and disengage manual or automatic operation with a flick of the automatic control button on the head of the stick.

The automatic mode of operation is a future phase of the University's research toward the automated highway, so the automatic control button has no function on the present control stick. Automatic operation is easily envisioned, however: In the same way the computer actuates the sensor finger with variations in headway, it could be programmed to actuate brakes or throttle to maintain the headway or even bring the car to a halt in the event of an emergency.

Human factors come next

Before you can even ask the same questions about driving with the control stick that I asked, let me answer them—or, more accurately, dismiss them the way the engineers do. The answer to any question about (1) placement of the stick, (2) left-hand designs, (3) direction the stick would move to accelerate or brake, or (4) why wasn't it designed with an armrest or with such-and-such in mind, are all absentmindedly shrugged off. The answers to these questions are relegated to the human factors engineers and marketing people. They take over where Dr. Cosgriff and his associates leave off.

As the good doctor puts it, "differential equations are *our* daily bread." The people at the Communications and Control Systems Laboratory are interested in getting their ideas to *work*, not in packaging them in simulated leather with chrome trim and locating them where they won't hit your knees. That's still in the future. ★ ★ ★

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MONEY CAN BUY

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GUARANTEE

10 DAY
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or send only \$18.95 for postpaid shipment in U.S.A.

FREE Order from this ad & receive extra \$2.00 gift of rods, flux and solder. **FREE**

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TO OVERHEAD SEWER OR SEPTIC TANK.
NO DIGGING UP FLOORS. INSTALLS EASY. Write
McPHERSON, INC. BOX 15133 TAMPA, FLA.

Sure beats smoking!



Enjoy Copenhagen: Place a small pinch between cheek and gum. No chewing.

United States Tobacco Company



\$7.50

That's all you'll pay for the PM Jet. The first do-it-yourself boat designed for turbojet propulsion. And that's one of our most expensive designs.

For three dollars you can buy the PM38, a sleek 13 foot runabout. And for \$38.00 you can build it. We don't have to tell you what a great buy that is.

And that's not all we've got to offer. We've got El Gato, a 12 foot, twin hulled catamaran. But we're not about to sell this beauty for three dollars. It will cost you four.

There are eight other models in the PM line. Some are less expensive, others will cost you more. We even sell one model that costs as much as ten dollars.

If you'd like to order the PM Jet, PM38 or El Gato just complete the coupon below and return it to us. If you want to see the rest of the fleet there's a place on the coupon for that too.

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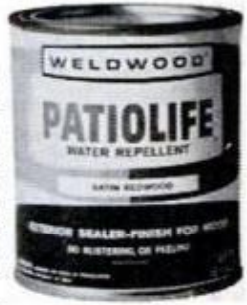
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U.S. Plywood Corporation

CHRYSLER NEWPORT

(Continued from page 95)

half the dash harness was missing."—Kansas doctor.

"Very sloppy trim installation."—North Carolina, U.S. Army.

"Body and doors fit poorly, sloppy workmanship on paint and attaching of chrome parts, chrome dented, excessive rattles, poor slide-out of the ashtray. Chrysler needs more than TV commercials promising quality. It needs the real thing built into the car."—Nebraska manager.

Next on the complaint list was gas mileage.

"With this car it would help to own a gas station or an oil company."—Wyoming engineer.

"Would like to get better mileage, if such is possible with a 4000-pound car."—North Dakota grower.

"Takes too much gas."—West Virginia housewife.

A number of owners had harsh words for the Newport's ashtray, ranking it third on the complaint list.

"Front ashtray is too small and poorly designed. It sticks and interferes with ignition key when extended."—Delaware engineer.

"Poorly placed."—Rhode Island retailer

"Cheap looking."—Massachusetts seaman.

Next on the gripe list was what many owners felt to be excessive wind noise. Typical of such comments was this one from a Kansas veterinarian:

"On a long trip, the wind noise gets a bit oppressive."

"The wind whistles in around the doors and windows."—Nebraska farmer.

"Wind roars in my ears at 50 mph."—California fruit grower.

Some of the most bluntly stated criticism regarding the Newport was saved for the glove compartment.

"It's useless."—Rhode Island manager.

"When we first got the car, we'd be riding along and the glove compartment would fly open and nearly scare us through the windshield."—Colorado housewife.

"The glove compartment is a disgrace. It's small and chintzy-looking."—New Mexico housewife.

► **You're right, Ma'm. Skilled cabinet work, it ain't. Cost-cutting, it is.**

Back on the brighter (from Chrysler's point of view, anyway) side, Newport owners passed out orchids favoring the car's performance and power, ranking these attributes sixth and seventh on the

list of things they found to praise.

"That engine's a honey!"—Idaho supervisor.

"Will outperform anything in its price class."—Wisconsin superintendent.

"Engine and transmission provide quick, smooth performance."—Georgia trucker.

"Has lots of power and plenty of passing ability."—Maine trainman.

"Has lots of power when needed or wanted."—South Carolina distributor.

Ranked eighth on the like list was what many owners thought was excellent visibility.

"Have a good view of front and rear fenders, something one doesn't always get on other makes of cars."—New Hampshire businessman.

"Passengers like the view because they sit up so high."—West Virginia businessman.

"I like the large windows for better driver vision."—Virginia scientist.

Rounding out the list of praises were kind words for the Newport's value-at-the-price, the way it steers, and its general roominess.

Back once more to complaints listed by owners of the 1967 Newport, many seemed to feel their dealer left a lot to be desired. Poor and/or indifferent dealer service was ranked sixth.

"Dealer has a customer-be-damned attitude."—Virginia businessman.

"Service is dreadful. Would never buy another car from this dealer."—Nebraska manager.

"In three months they have yet to fix the gearshift lever. No parts, they tell me."—Utah warehouse helper.

► **They're telling you something else, too. Like maybe a fib.**

Next on the dislike list were harsh sentiments about the paint job.

"Dealer had to repaint the car. Had only 100 miles on it."—Tennessee state employee.

"Paint job couldn't be worse."—Kentucky, U.S. Army.

"Paint is awful and dealer is going out of business."—South Carolina maintenance foreman.

Winding up the complaint list were owner comments about poor door fit, leaks around the windows and in the trunk, carburetor troubles (poor adjustment, usually), engine noise, poor visibility to the rear, road noise, and dissatisfaction with the Newport's standard two-ply tires.

Overall, however, PM's survey supports the view expressed by a postmaster from South Dakota, who wrote:

"The Newport is a lot of automobile at a fair price." ★★ ★

DISSTON TEFLON-COATED SAWS†

New Disston satin slide saws coated with "Teflon S"* self-lubricating finish

Bind-free cutting with minimum maintenance; same Disston quality with new added feature. Industrial-hard Du Pont "Teflon S," a breakthrough in nonstick finishes, permits a finish treatment baked on that won't wear off in normal woodcutting. You get slicker cutting, and lifelong rust protection, too!

We clamped the Teflon-coated saw blade between two wooden blocks so that only a machine could push it back and forth. After one million strokes, the Teflon showed less than 5% wear. That represents years of professional sawing, with Teflon action left for

*Du Pont T.M.

generations of easy cutting. Riding in its own kerf, as in normal woodcutting, a million strokes would produce no measurable Teflon wear, only a smoother, slicker finish.

Professional tree men found that Teflon pruning saws glided through wet or sappy wood, stayed clean and smooth. The smooth, sure action makes them safer to use where off-balance positions are required. Home gardeners proved that year-round delimiting could be easy, effortless fun. Clean, accurate cuts lessen danger of permanent tree damage and provide a finished appearance.

†Patent Pending



Teflon handsaws available in two models.
Suggested retail \$8.95 to \$12.50



Double-edge pruning saw
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Compass saw kit
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◀ **SCORCHING IS LESS LIKELY** with new electric paint remover which utilizes reradiated heat to remove single or even multiple layers of paint. It's safe for amateurs and hobbyists, since there is no flame or odor, yet powerful enough for professional use. Sold by Bridge Products Inc., 325 Pine St., Philadelphia, Pa., for \$22.95.

Special offer to pipe smokers who smoke these brands



First of all, congratulations on your good taste. They're fine tobaccos every one. But I'll bet that, like most pipe smokers, every so often you get the urge to try something different.

And so Kentucky Club Mixture makes this offer. If you're in the mood to try a remarkably mild and aromatic mixture, one of the fastest growing brands in America, send us the empty pouch you've just finished and you'll receive a fresh pouch of Kentucky Club Mixture.* Free.

It's an offer you ought to consider if you're a serious pipe smoker. Here's why.

1. Kentucky Club Mixture is probably the mildest aromatic pipe tobacco around. Most smokers can enjoy pipeful after pipeful without "bite".

2. It's a clean, easy-to-light tobacco that's cut to stay lit right down to the bottom of the bowl.

3. The aroma is pleasing to most everyone. Especially women.

4. Most important, the flavor is smooth and rewarding. The result of

the careful blending of 5 important tobaccos: White Burley, Virginia Brights, Weeds Cavendish, Turkish and Perique, plus a dash of Deer Tongue for flavor. (Deer Tongue, by the way, is a variety of wild vanilla. It's used as seasoning the way you might add salt to stew.)

So that's it. Kentucky Club Mixture is a mild aromatic blend made by people who believe it's best and are ready to prove it by sending you a supply.

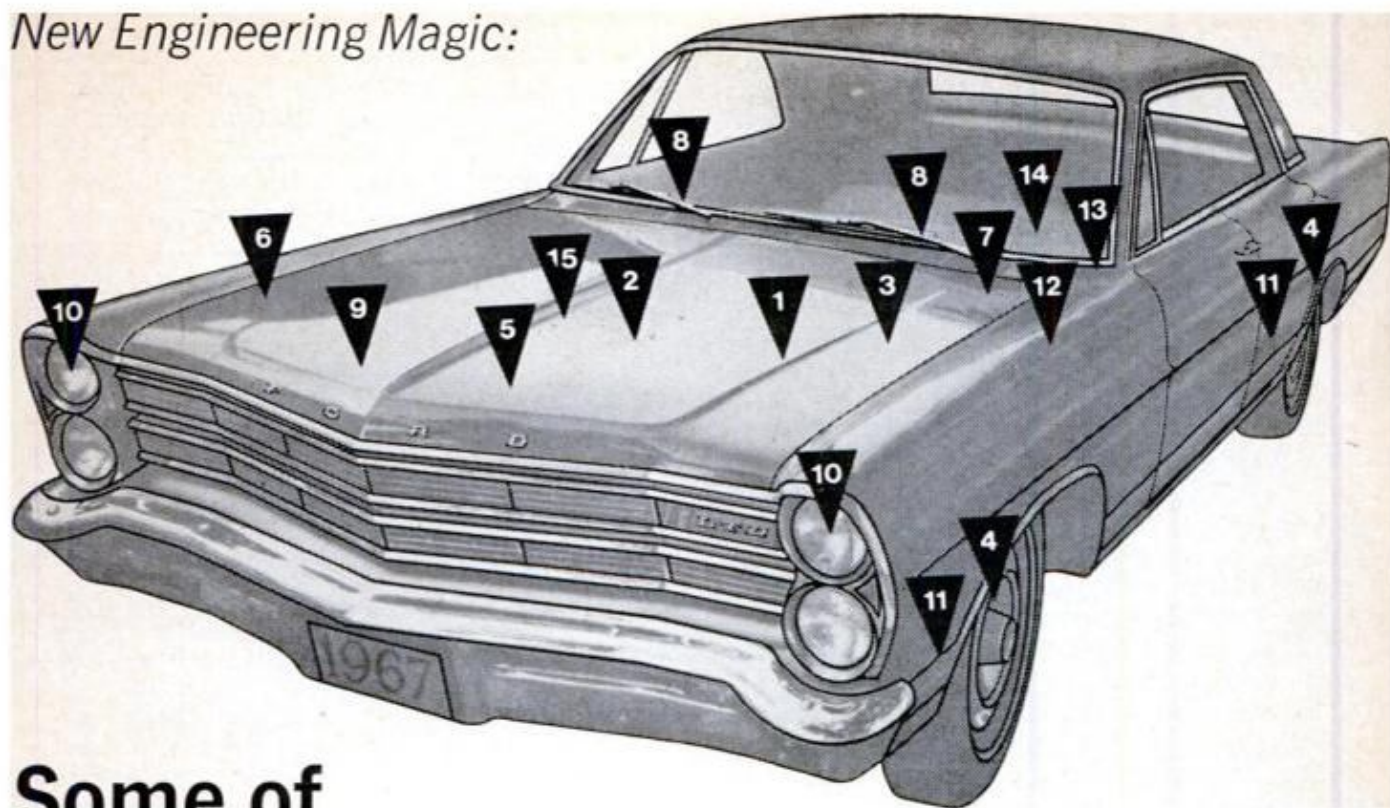
For your free pouch mail your empty to: Kentucky Club Mixture, Box 6666H, Wheeling, West Va. And when you've smoked it, write and let us know how you like it.



Kentucky Club Mixture

*Unfortunately we can't picture all tobaccos. But the offer's good on any brand (except Kentucky Club Mixture). Offer good in U.S.A. and Canada only.

New Engineering Magic:



Some of our better ideas are **INVISIBLE...**

**Here are 15 of them . . .
all designed to make
your Ford stronger and
more durable than ever.**

There are over 15,000 separate parts in each new Ford. But it's unlikely that you'll ever see more than about 5% of them.

However, it's the constant improvement of the thousands of unseen parts that concern most of Ford's 7,000 engineers. Because on the performance of these parts rests the reliability, quality and long-lived durability of every Ford.

That's why with each yearly model change—and often in between—hundreds of hidden parts in every Ford are strengthened and improved. Here are 15 typical examples of the many improvements that have been made in the '67 Ford.

- 1. Clutch**—Improved release bearing and spring seats. This change means longer life and smoother operation.
- 2. Piston Rings**—Rings filled

with moly-disulfide decrease cylinder wall wear and increase oil economy.

- 3. SelectShift Transmission**—New bands give consistently smoother and more even shift performance.

- 4. Wheel Bearings**—New seals and grease to increase long life.

- 5. Distributor**—New, pivotless-type contact points increase longevity.

- 6. Voltage Regulator**—Improved in precision of control by better calibration and a new ballast resistor.

- 7. Speedometer Cable**—Improved routing, fitting and mounting of the speedometer drive cable and a new high temperature lube for quieter action and longer life.

- 8. Defroster**—A new design gives greater reliability.

- 9. Alternator**—Molded circuit board for greater durability.

- 10. Head Lamp Mountings**—Redesigned for increased stability—longer "in focus" time.

- 11. Brakes**—Self-adjuster mechanism redesigned for

more accurate self-adjustment of the lining.

- 12. Parking Brake**—Redesigned cable mechanism for easier operation.

- 13. Turn Signals**—New, more durable switch.

- 14. Fuel Gauge**—New contact design for longer life.

- 15. Carburetor**—The float and needle valve assembly for V-8 engines has been redesigned to help prevent flooding and to aid driveability.

It's a continuous flow of improvements like these that make Fords so dependable and durable. And it's improvements like these throughout the car that enable us to say that the 1967 Ford is quieter because it's stronger, and stronger because it's better built.

You're ahead in a Ford



Mustang • Bronco • Falcon
Fairlane • Ford • Thunderbird • Cortina

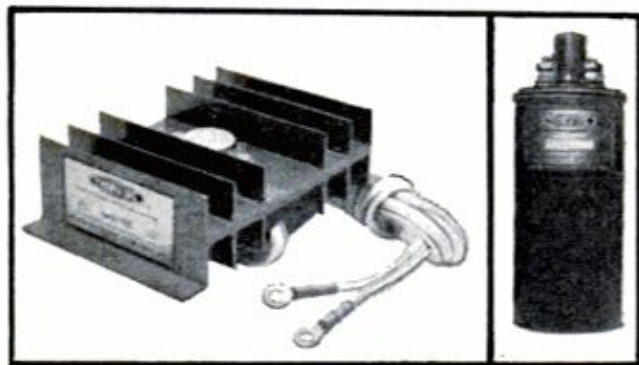
OUTBOARD ELECTRONIC IGNITION

(Continued from page 175)

current received from the coil, they carry currents of 5 to 10 amps. when closed. This isn't bad. But when points open, breaking the circuit, several hundred volts of coil kickback converge on the points. The opening and closing cycle occurs as much as 400 times in a second and is enough to literally knock hell out of points.

How rough points are treated by current in a conventional ignition system can be seen by scanning reports of on-water breakdowns. The Coast Guard at Tampa Bay, Fla., for example, claims that 80 percent of the calls for help it receives are from outboard owners who have been trolling, and whose points and plugs have fouled.

TI and CD systems take the sweat off points by relieving them of heavy current loads brought about by switching. The transistors or silicon-controlled rectifier act as the switches, with contact points being only the means of delivery to the



TYPICAL TI KIT consists of a special coil with more windings than normal, plus a transistor pack

sparkplugs. Thus, the tremendous load points get from the coil when open is reduced to practically nothing in a CD or TI system. In fact, points conduct little more than three quarters of an amp.

Longer life for points

Relieved of the load, points in CD and TI systems last a long time. I don't know if they'll last the life of the engine, as some ads say, but they certainly last a heck of a lot longer than their counterparts in standard ignition systems.

The fact that points no longer have to handle heavy loads permits pepping up of the ignition system to allow intensification of spark for better engine performance. This buildup is accomplished by adding a special induction coil.

Initial current output of at least 37,000 v. with electronic ignition is achieved, compared to only 25,000 v. with standard

ignition. This permits greater voltage to overcome the resistances of dirty plugs.

Putting an electronic ignition system in your boat is no big problem. The only consideration is where to place those boxes, and a spot under the transom well is the most likely location since it's comparatively sheltered.

Installation is easy

Anyone who can handle a screwdriver can make the installation. All these conversion kits are stuffed with detailed installation instructions, so there's no sense in going over them here. However, all terminals of the hookup should be soldered to prevent creation of high resistance.

One other fact should be emphasized. Some outboard engines—a number of Mercury models, for example—have a dual standard ignition setup. There are two distributors and two coils. One set services one line of cylinders; the other services the other bank. In this arrangement, you'll need *two* electronic ignition kits.

An incidental advantage with most of these conversion kits, though, is that you end up with a spare ignition system for emergencies. The standard ignition system is left intact on the engine.

If the amplifier of electronic ignition should fail, for instance, it is an easy job to simply disconnect the electronic setup and reconnect the standard coil to the distributor for running on conventional ignition.

The one area of electronic ignition that may raise a problem is do-it-yourself troubleshooting, especially with a CD system. Checking spark-advance curves, coil output and even ignition timing requires different equipment than that used for conventional ignition. But with the boost presently being given to electronic ignition by outboard manufacturers, you can always consult a dealer. If he's not now set up for servicing electronic systems, he soon will be. ★★★

51 VACATION STOP-OFFS

(Continued from page 202)

Science Center attract visitors as they did during the Seattle World's Fair.

U.S.S. MISSOURI, Puget Sound Naval Base, Bremerton, Wash.—Visitors may stand on the deck of the "Mighty Mo" where on Sept. 2, 1945, Japan surrendered. Conducted bus tours to the battleship leave the main gate daily from Sept. 1 through May 31 at 1; rest of the year at 10:30, 1 and 2:30. Adults, \$1; children, 6 to 12, 50¢. ★★★

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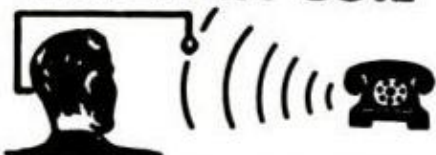


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M-500 (Wt. 13 oz.)	Has pull of 50 lbs. on steel block . . .	\$ 5.00
M-90 (Wt. 5 oz.)	Has pull of 15 lbs. on steel block . . .	\$ 3.50
M-44	Rod Magnets for Electric Guitars 1/4" DIA. x 1 1/4" 12 for \$ 4.00	
M-47	Hot pad Magnets . . . 10 for \$1.00 . . . 50 for . . .	\$ 4.87
M-35	Hobbyist Assortment of 8 small magnets	\$ 2.00

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With deluxe accessories consisting of one R 1 300 amp generator, ground clamp, welders adjustable helmet, electrode holder, 300 amp ammeter, 300 amp shunt, rheostat, toggle switch, 300 amp reactor coil arc stabilizer, voltage regulator, battery charging relay, one pair heavy duty welder's gloves. All units guaranteed pre-tested. Approx. Gov't cost \$750. Most items new—all perfect. Wt. 82 lbs. Circuit diagram included. **\$49.50**



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PRETTY LITTLE PRIVY

(Continued from page 159)

walls. Since the short roof span minimizes load-bearing problems, the side-wall studs are placed around the louvers rather than installed to the usual pattern of 16 in. on centers. In this instance, the distance from corner post to center stud of the cabin is 44 in. rather than 30 in. as indicated in the drawing.

A serviceable door can be made by joining four 1x10 boards as shown in the photo on page 156. Diamonds cut through the door and screened (detail on page 157) add to appearance and ventilation.

Aluminum gutters collect the rainwater. A downspout on one side pipes the water through the base of a wall directly to the latrine drum; the other spout leads to a storage barrel placed outside the rear wall, from which water is gravity-fed to the faucet on the washbasin (see detail on page 159). A length of plastic tubing is attached to the basin drain and run to the drum, providing still more water to flush the toilet.

To make the box supporting the seat, see the center detail on page 159. Note that a 12-in.-dia. galvanized pipe section is suspended from the seat to hang through the drum lid. However, before installing either box or the pipe, you will have to cut openings in the lid for the pipe, a downspout elbow and the drain hose, as shown on page 158, top right.

After replacing the lid with the downspout elbow attached, you can make up the box and install it. The 24-in.-sq. cover can be of 3/4-in. plywood as shown in the drawing or built up with 1-in. board stock (page 158, center right).

With the platform in place, cut a hole through it so that the galvanized pipe will slide through and into the drum directly below. Make several inch-long cuts into the top end of the pipe, then bend back the resulting tabs to form a flange. Now run the pipe through the holes in the platform and drum lid until the flange rests on the platform. Fasten it in place with short galvanized nails. Now, bolt a conventional toilet seat on the platform, then hook up the downspout and drain.

All that remains to be done is to fill the drum with water up to the side holes, then saturate this with enzymes that will digest the sewage while rainwater flushes the liquid effluent into the soil.

During dry spells, it will help to add a pail of water daily to the drum as well as the storage barrel. And, if desired, a can of disinfectant can be suspended in the latrine drum to remove a slight odor, though this is generally unnecessary. ★ ★ ★

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Largest sunlight collector

World's largest solar-tracking facility is now in service with the Air Force. It's a big dish made of aluminized plastic material, and it will be used to collect and focus energy from the sun which will be converted to other types of energy. In a demonstration, an aluminum target was set up nearby and the energy beam from the dish was focused on it. In seconds it melted out the target's center section. The Air Force's interest is in developing a system to supply continuous electrical power for future space missions.

The moon has company

The moon is not earth's only natural satellite, according to two employees of

the Lockheed Missile and Space Co., Sunnyvale, Calif. Two clouds of debris, ranging in size from thousandths of an inch to small boulders are reportedly orbiting the earth at two points where the gravitational pulls of the earth and moon are exactly balanced.

The libration points, as they are called, were first predicted in 1772 by a French mathematician, Joseph La Grange, who said there were five such points in the earth-moon system. His hypothesis was given a boost when a large asteroid was discovered in 1908 at one of these points in another two-body system, between the sun and Jupiter.

The earth-moon clouds were first observed in 1956 by a Polish astronomer, K. Kordylewski, and photographed five years later.

BACKSTAGE MAGIC

(Continued from page 109)

ing places its burial 4,500,000 years ago. When the lunar day dawns and sunlight hits it, the thing emits four powerful radio beeps.

"It's an alarm clock," explains Clarke, "set as a trap to warn some super intelligence that man has taken his first step out into the galaxy."

Scientists determine that the direction of the monolith's signal indicates life in the Saturnian system. Earth people already have plans for a deep-space ship, *Discovery*—a giant affair 600 feet long powered by fission plasma drive. The crew rides in a 50-foot sphere at one end. A 42-foot centrifuge within the sphere provides gravity for the men.

Space voyagers hibernate

Planned for nearer planets, *Discovery* has only a one-way capability for Saturn. But the decision is made to go anyway. Five volunteers are picked for the voyage. During the year-and-a-quarter trip, traveling five million miles a day, they rotate duty—two on and three off. Those off duty hibernate in cryogenic (deep freeze) "coffins."

What the explorers find is enough to make flesh creep—and so were the many problems of staging this far-out extravaganza. Kubrick and Clarke insisted that everything in the picture had to be based on known, workable principles. Controls had to be realistically accurate, and many things actually had to work.

Since no one has yet been to the moon, much less to Saturn, it wasn't easy. The team that bore the "feasibility" burden included three indefatigable wizards: Fred Ordway, scientific consultant; Harry Lange, the designer who took Ordway's technical data and drew plans for workable space gadgetry no one had ever seen; and Tony Masters, an ingenious builder who turned plans into hardware.

So precise and logical are *2001's* space vehicles that the National Air and Space Museum has requested them for permanent exhibit when the picture is finished. Detailed "specs" and drawings for an advanced fission plasma rocket capable of sending *Discovery* to Saturn were prepared by Thomas F. Widner, General Electric's manager of advanced nuclear programs. IBM development people, under Elliott Noyes, made workable plans for a fantastic red-lighted computer for the lunar module—exactly as it would have to be for a lunar computer. With Minneapolis Honeywell experts, they designed a whole new family of computer

units adapted to spaceship use, along with accurate panel displays and controls for every console shown in the film. From Bell Labs came authoritative advice on communications questions.

"The hibernation sequence was a beaut," Ordway recalls. Doctors at New York University Medical Center and Harbor General Hospital in California, familiar with work in the deep freezing of live animals, helped in the design of human cryogenic hibernators. In the movie, you'll see men climb into plexiglas containers where they are frozen to sleep.

Efforts to maintain scrupulous authenticity were endless. When detailed contour charts and maps of the moon were needed, Ordway couldn't find any good enough. He had them made at the Pic du Midi Observatory in the French Alps. They are so accurate—even down to magnetic contours extrapolated to the moon situation—that they can (and may) be used for our real moon landings.

Understandably, authenticity sometimes gets in the way of practical photography. All the expertise in the world couldn't solve the problems of filming an outer space movie in the gravitational field of earth. "Our biggest problem was weightlessness," says Masters. "How do you show people walking up walls and floating naturally in space?"

Usually, movie studios perform this kind of trickery with "matte shots"—two exposures superimposed. But Kubrick wasn't having any. Actions of people and the movement of floating objects would have looked phony. Hanging people on wires resulted in movements grotesquely unreal, and the wires glimmered.

Walks on ceiling

Solutions were highly ingenious. In one sequence on the *Discovery*, one of the crew walks down a corridor, up a wall, across the ceiling and through a doorway upside down. To get it, the camera was bolted to the deck at the near end of the corridor. The actor, walking away from the camera to the far end, turned left and started up the wall. At that instant, the entire set rotated to the right taking the camera with it. The actor, of course, remained vertical as he walked around the revolving set. But on film he appears to be hiking up the bulkhead until he is standing upside down on the ceiling.

Actors learned to simulate the slow-motion actions of a zero gravity environment by studying Langley Research findings from moon gravity simulators. "In a real spaceship you'd use magnetic floors and shoes," says Ordway. "Walking movements would be slow and jerky. We dis-

covered we could produce the same effect by walking people down an inclined plane. So that's how many of the scenes were shot. The camera was placed at the angle of plane to create the proper illusion." To heighten the effect, Velcro was used on floors and shoe soles so they'd grip each other like zippers.

There's no way to fake a spaceship centrifuge. So the giant revolving living quarters of *Discovery*, where most of the action takes place, was built full scale right in the studio. The 38-ton wheel, 42 feet across, kissed the studio girders.

"We had to find a way to shoot film inside the centrifuge, showing it revolving," says Tony Masters. "The cameras had to show people walking every way including upside down."

Upside-down shots

The men devised revolving contacts for the cables so they wouldn't knot up. All services—including airconditioning—were fed through the hub. Sixteen projectors inside the wheel provided read-outs on the consoles. The camera rode on a remote-control dolly, its power cable dangling from the hub, allowing it to move counter to the wheel and stay out in front of the actors. Anchored to the rim of the wheel, it could take "upside-down" shots.

It wasn't all ice cream. "Lights around the centrifuge were big 10Ks and 5Ks," says Masters, "and they didn't like going around. They'd blow up inside the thing while we were shooting. Glass shattered and rained down on the actors."

For weeks Stanley Kubrick and Arthur Clarke fretted about whether, in the airless lunar sky, you'd see far more stars than we do here. They finally decided that, since earth is 50 times brighter than the moon—viewed from the lunar vantage—it would wash out stars rather than make more of them visible. Surveyor proved them correct. "In fact," says Clarke, "Surveyor confirmed everything we had done."

How does this fantastic movie end? You'll have to see it to find out. As this issue went to press, Kubrick and Clarke were still kicking it around. "The space explorers reach a moon of Saturn, all right," says Clarke. "As they are passing it, they discover what appears to be a king-size version of the magnetic monolith they unearthed on our own moon. As they approach, the great block performs an optical reverse and becomes, instead, a giant slot in the Saturnian moon's surface. As *Discovery* crosses the edge, the men see lights inside. But the lights turn out to be stars, and we take it from there to a hair-raising conclusion." ★★★

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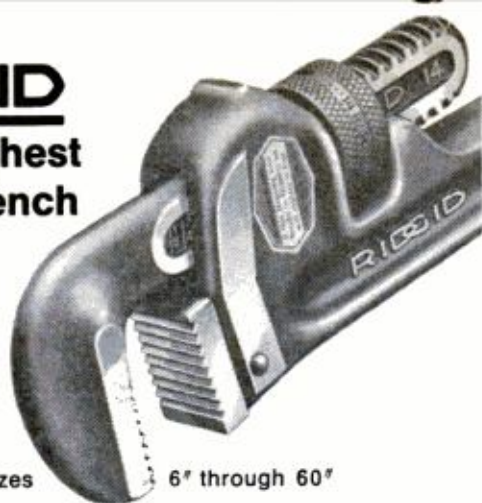
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TIMING TECHNIQUES

(Continued from page 169)

timing marks on the flywheel, vibration damper or crankshaft pulley, the marks appear to stand still in relation to a pointer or mark on the engine.

The general procedure for dynamic timing is as follows:

1. Find the timing marks on the flywheel, vibration damper, or crankshaft pulley. Clean off grease and dirt. If the marks aren't readily visible, retouch them and the pointer with paint.

2. Warm up the engine and then shut it down.

3. Connect the timing light according to the instructions provided with the light you're using. Generally, one lead is connected to the battery's hot terminal, a second lead to ground and a third lead to No. 1 sparkplug terminal. If it's tough connecting that lead to the No. 1 plug—if, for example, the lead will be dangerously close to the fan belt—you can connect it to the fourth plug in the firing order of a six-cylinder car and to the fifth plug in the firing order of an eight-cylinder. In a V8 having a firing order of 1-8-4-3-6-5-7-2, for instance, the alternate plug you can use is No. 6.

Making the test

4. Start the engine and operate it at the specified idling speed. (With many cars, the vacuum advance line is disconnected before starting the engine.) The timing mark will appear to be stationary and should align itself with the pointer.

5. Reset the timing if the timing mark appears on either side of the pointer. Reset by loosening and turning the distributor housing in its mounting. Turn the housing *against* rotor rotation to advance the timing and *with* rotor rotation to retard it. When the timing mark aligns itself with the pointer, tighten the distributor.

6. Now hook up the vacuum advance line if it was previously disconnected and test the operation of the unit by gradually increasing engine speed. Observe the movement of the timing mark. If it doesn't move in relation to the timing mark or pointer, or moves erratically as speed is increased, the unit is either sticking or jammed.

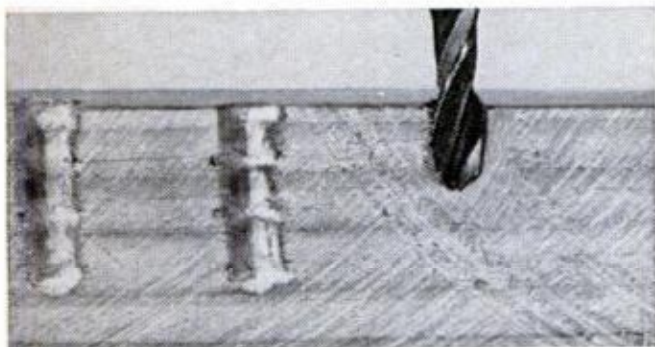
Using the timing light for troubleshooting is often an easy and accurate way of pinpointing automotive difficulties. Some of these are covered in the table on page 168. A timing light is an inexpensive tool and one of the best investments you can make—for both timing and troubleshooting. ★ ★ ★

Seven workshop headaches.

Seven Mystik Tape Cures.

1. Drilling a Finished Surface:

When you're drilling a finished wood surface, the drill can skid out of the punch and scar the finish. You can avoid this by sticking a piece of Mystik Clear Plastic Tape over the spot you want drilled. This skidproofs the surface. So you won't have to worry about damaging the finish.



2. Removing a Tap Washer Without Scratching the Chrome:

When you're changing a faucet washer, wrap the chrome packing nut with Mystik Electrical Tape. You'll avoid scratching the nut with the wrench.

3. Keeping Wood From Splintering When Sawing:

A strip of Mystik Masking Tape placed on the underside of the wood, along the cutting line, will keep the edges from splintering while you saw. (This is especially helpful when you cut plywood.)

4. Losing Small Parts:

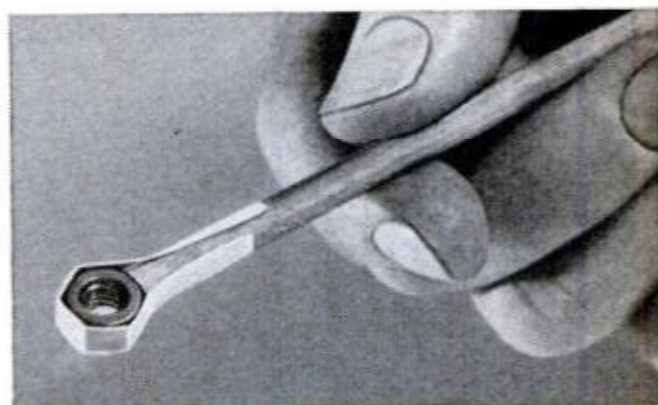
Mystik Double-Faced Tape makes a great no-spill parts rack when disassembling and reassembling a small motor. Stick a

strip of the tape on your bench and press the parts on it in the order of disassembly. This makes reassembly easy.

5. Tools Without Handles:

If you don't have handles for all your files or hacksaw blades, wrap Mystik Electrical Tape around the tangs, and you'll fashion a working handle.

6. Threading a Nut To An Inaccessible Bolt:



If you have to thread a nut and bolt in a place you can't reach with your fingers, cut a piece of Mystik Masking Tape (as wide as the nut is thick) and use it to mount the nut on the end of a pencil, butting the side of the nut to the pencil. This way, you can hold the nut in place while you turn the bolt into it.

7. Holding Tacks on Hand-Tool Heads:

If you're working with small tacks, place a piece of Mystik Double-Faced Tape over the hammer head. The tack will stick easily to the tape. You can then give the tack a firm, direct hit.

 BORDEN
CHEMICAL



REBEL OWNERS REPORT

(Continued from page 123)

"There's a lot of wind noise coming from somewhere."—U.S. Navy, Colorado.

"Air noise is terrific at highway speeds."—Indiana housewife.

Perhaps some of the complaints mentioned above are traceable to the next item on the gripe list—poor workmanship. Many owners complained of poorly fitting doors and windows, things that presumably would contribute to wind noise.

"Doors don't fit tight."—Nebraska salesman.

"Had to replace rubber around front and rear windows."—Missouri mechanic.

"Car needed more correction of factory errors than any car I've ever owned or known of."—Colorado salesman.

Next on the gripe list was poor dealer service. Many owners felt dealers did not carry a large enough inventory of parts, adding that replacement often took too much time.

"Ordered dome light switches three months ago and still am waiting."—Idaho news distributor.

"Still waiting for a new front seat."—Wisconsin manager.

"Necessary to leave car five times in order to correct things that should have been corrected the first time."—Connecticut banker.

Somewhat startling, in view of AMC's "image," are owner beefs about poor fuel economy, rated fourth on the gripe list with an FMR of 9.6 percent.

"Could be getting better gas mileage."—South Carolina trucker.

► **He's getting 18 miles per gallon out of the 290-cu.-in. V8.**

"Should get more mpg for a small car."—Wisconsin die sinker.

"Not getting the mileage I expected."—Ohio machinist.

And so on, the mileage complaints being pretty much the same. Overall, only two Rebel owners reported getting as little as 10 mpg, whereas one reported an awesome 33 mpg.

Back on the brighter side, owners reported their Rebels as being comfortable to drive and ride in, giving this attribute an FMR of 18.8 percent.

"Particularly like the increased width, the reclining seats and the softer upholstery."—California engineer.

"Seats sit 'deeper' yet solidly. Feel I'm riding in a sitting position, not on my back."—Massachusetts clergyman.

"Find the seats very comfortable."—Texas border patrol inspector.

Sixth on the praise list with an FMR of 15.9 percent are cheers for the Rebel's get-up-and-go.

"Excellent acceleration at all speeds. Beyond what you'd expect considering the fact I have a Six."—Ohio engineer.

"Has plenty of passing power."—Minnesota welder.

"Like the pickup of the 232 (cu. in.) Six."—Ohio appliance repairman.

Part and parcel of the above, and seventh on the hit parade, is an FMR of 15.3 percent in favor of the car's performance. The comments along these lines had to do with quick acceleration, sustained high speeds, quick passing, and so on.

Ranked next on the praise list were kind words for the Rebel's room (11.4 percent). Following in order were praises citing the car's good value, its quietness of operation, the quality of its construction, the reclining seats, and the interior styling.

Turning again to the "thumbs down" list, in fifth place with an FMR of 8.9 percent were gripes about the brakes.

"Too spongy. Brakes have to be slammed on before they respond."—Massachusetts machinist.

"Brakes sound like they are dragging."—Ohio bricklayer.

"Front brakes grab."—Missouri, retired.

Following in order were gripes about excessive oil consumption (6.7 percent), poor rear visibility (5.9 percent), and difficult—binding?—window action (5.2 percent). Then, on down the list, came complaints about the heater, body rattles, water leaks (part of the poor workmanship business, I suspect), and sloppy handling.

In all, the report indicates that most Rebel owners are delighted with their purchases. ★ ★ ★

Chilling doesn't cause colds

Chilling or lowering the body temperature does not cause the common cold, three National Institutes of Health researchers discovered recently when they subjected 43 volunteers to a variety of "cold-catching" situations.

It is rhinovirus that is the major cause of colds, at least in adults, the investigators report.

Some volunteers spent up to two and a half hours in a room where the temperature hovered around 40° F., the kind of short-term chilling commonly believed to bring on a cold. Others were placed in a cool bath, which lowered their body temperatures two degrees. But unless the virus was present, little effect was noted.



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APRIL 1967

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NEWEST SEAGOING LABORATORY

(Continued from page 127)

- A magnetometer is towed about 750 feet behind the ship to provide continuous measurements of the intensity of the earth's magnetic field. The device is towed at such a great distance to keep it clear of the influence of the ship's magnetic field.
- At reduced speeds, biological nets are towed to gather samples of plankton and other organisms.
- Gravity is measured by an on-board sensor mounted on a gyro-stabilized platform. Values are automatically recorded on magnetic tape.
- Atmospheric conditions are monitored by radiosonde balloons, and sounding rockets are launched to probe the upper atmosphere and ionosphere.

The *Silas Bent* maintains position while "on station"—that is, when "hovering" at a given point in the ocean—by using its bow-propulsion unit. This is a small propeller that is lowered through an opening in the hull and swivels in all directions.

For "ultra-quiet" on-station operations, electrical power is provided by small generators that are shock-cord suspended. In other words, they are suspended by super-thick rubber bands to minimize transmitted vibrations.

On station, scientists drop Nansen bottles to get water samples and weighted hollow rods to obtain core samples from the bottom.

'Fish' on 25,000-foot cable

But the *Silas Bent* also can gather data by means of a "fish" at the end of a 25,000-foot cable. The fish is a stainless-steel cage that houses pressure-cased sensors that measure subsurface water temperature, sound velocity, salinity, level of light and pressure. Maximum operational depth is about 20,000 feet.

Sensor outputs are in FM signals that are transmitted via the cable to the electronics lab. Here they are automatically put on tape and fed into a computer.

The computer is the heart of the various scientific systems. It is a high-speed, multipurpose, digital machine that automatically corrects sensor input data and calculates true gravity and navigational information—which data can then be transmitted immediately to ships of the fleet and shore stations. The computer processes much data that previously would have required weeks or even months of work at the Oceanographic Office.

In addition to the electronics lab, other important scientific areas include: a drafting room; an electronic workshop; a "wet" lab for work with water samples and

biological specimens; a survey control center, located right behind the bridge to keep navigational scientists and ship's officers in close touch; scientific chill and freeze rooms for specimens; and a photo darkroom.

Most work rooms and all living areas are airconditioned, which makes life pleasanter on long voyages.

"This is like the *Queen Mary* compared to some oceanographic ships I've been on," Frank Anderson told me. "I was on an 80-footer a while back. After a few weeks it seemed more like a 30-footer. I shared a cabin—it was really more like a closet—with another guy. We worked 12-hour watches and every time one of us came off duty and wanted to sleep, we had to shift all our gear to the other guy's bunk. There was no other place for it."

Strong enough for ice

The *Silas Bent* has a specially strengthened hull to permit operations in floating ice and antiroll tanks to provide improved stability.

There were times during the survey of the seamount that I thought the antiroll tanks left something to be desired. Not that we hit any weather. It was just that at the slow speed used—it could have been no more than five knots—the ship tended to roll with lateral waves to a degree that made a landlubber's stomach squirm a bit.

The ship followed a pattern laid out by the navigational scientist, sweeping back and forth, at designated intervals, across an area that measured 32 by 56 miles.

The final result was good. The sharp profile produced by the graphic recorder showed a seamount that rose about 10,000 feet off the ocean floor, with its notched peak about 5000 feet below the ocean's surface.

Mission accomplished, the *Silas Bent* started to make knots again. Next target was a seamount with a few added attractions—Bermuda. ★ ★ ★

Weed killer increases protein

Light applications of a chemical weed killer have been found to increase the amount of protein in several crops 25 to 80 percent.

Dr. S. K. Ries of Michigan State University foresees application of his methods in protein-short lands. He treated rye, peas and other crops with tiny amounts of the herbicide simazine.

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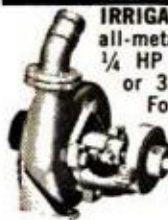
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GET MORE FOR YOUR OLD CAR

(Continued from page 132)

them. Clean and replace the windshield washer bottle and radiator cap. Remove all masking paper and clean white metal surfaces with steel wool.

The next step is to restore the interior. Start with the headliner. This area contains at least 80 percent of a used car's odor, so it behooves an owner to make sure the headliner is cleaned thoroughly.

Fabric headliners can be restored by cleaning with an upholstery cleaner or by spraying with a color tint. If you are going to scrub the headliner, start at the rear left corner and clean one section at a time. Work the suds into the fabric with a circular or back-and-forth motion. When a section is cleaned, finish by sponging the nap in one direction. This is necessary to prevent some sections from looking darker than others. Repeat the process, overlapping the sections about three inches to prevent streaking. Scrub the sun visors in the same manner. Don't let yourself be interrupted once you start as uneven drying may cause streaks.

If the headliner is stained or faded, it can be tinted. Aerosol packaged tints are available for the home craftsman. When buying the tint, make sure it is compounded for the type of material in your headliner. Natural fabrics have a nap; nylon or synthetic fabrics usually do not.

Remove sun visors, garment hooks and window moldings and mask off the beading, dome lights and windows. Start at the back left corner and spray from left to right in a continuous motion. Never let the spray stop momentarily in one spot, but keep it moving. A light coating of the tint is all that is necessary. Cross-spray the headliner with a second coating, moving from the front to the back of the automobile. Remove the masking tape and paper when the headliner is dry. Over-spray can be removed with a spot remover.

Vinyl headliners

Clean vinyl headliners with an appropriate vinyl cleaner and wipe dry. If the headliner has to be tinted, mask the area as before. Wipe the headliner with a lacquer thinner to increase the adhesion of the tint material. Spray with a vinyl tint in the same manner as for a fabric headliner. If the first coating is not even, cross-spray a second time.

The type of upholstery material will dictate the restoration method to be used. First, remove dirty spots with a spot remover. Next, use a stiff brush and scrub the upholstery with an appropriate clean-

er. If fabric, brush the nap in one direction and wipe the cleaner from the upholstery with a clean absorbent cloth.

Dirty nylon upholstery and door panels can be cleaned with an upholstery cleaner. If the nylon is faded or stained, wash the material and let it dry. Mask off the area to be tinted and spray with a nylon tint. Allow plenty of time for drying before applying a second coating. When the material is completely dry after spraying, sponge the area with an upholstery cleaner to remove any chemical odors that may remain from spraying and to impart to the material a soft, natural feel. *Do not use nylon tints on wool or cotton.*

Vinyl or leather upholstery can be cleaned by brushing with a recommended cleaner. If tinting is necessary, wipe the surfaces with a lint-free rag soaked in lacquer thinner. This will remove all oil dyes from the surface. When the material feels tacky, it is ready for coloring. Spray on a first coat and wait until it is dry before applying a second.

Spraying two colors

Keep spraying until the new color matches the old. If two different colors are required, let the first color dry overnight before masking it. Otherwise, the first color coat may be removed when the masking tape is pulled off. After the coloring is dry, sand the material lightly with No. 400 paper to restore a silky feel to the upholstery. Caution: Foreign car leathers are usually oil-tanned and will not readily accept a surface dye.

Torn, stained or warped kick panels and package shelves can be replaced by cutting new pieces from heavy cardboard or fiberboard. Use the old piece as a template. Seal the new material with clear shellac and dye it to match the original.

Wool or cotton floor coverings should be scrubbed clean with an upholstery cleaner and stiff brush. Brush the nap to lay in one direction. Tint stained or faded material. If badly worn, replace the mats.

Discolored rubber floor mats should be scrubbed with an upholstery cleaner. After cleaning spray them to restore their color.

Replace damaged door sill plates. Stained or discolored plates can be brightened with steel wool. Clean door jambs with upholstery cleaner. Cement loose weather stripping back in place.

The final step in the reconditioning process is to restore the car's exterior and touch up all nicks and scratches.

To get an exact match of the paint color and type, look for the paint identification plate on the car. Depending upon the make you own, this plate will be located

on the firewall, fan shroud, engine compartment wall, door post, or in or under the glove compartment. The paint and trim numbers can be taken to a paint supplier and translated into the information you need to purchase paint of the matching color and type.

If large areas of bare metal are exposed, sand the metal to remove all rust and dirt. Feather-edge the surrounding paint, tapering the edges with sandpaper so the paint slopes down to the bare metal. This will permit a paint job that will look better than one painted over a sharp break in the old finish. Clean the area with a cleaner to remove any grease or car polish.

Point carefully

Prime the bare metal and feather-edged area. A red oxide primer in an aerosol package is suitable. Apply two coats of primer as directed in the manufacturer's instructions. Smooth the primer with No. 400 sandpaper. Wash with clear water and let dry. Apply the paint as directed.

If you are painting with a lacquer, you will have to apply four or five coats. If you're using enamel, apply two or three coats. Apply a light coat of paint, let it dry, and then apply another. Repeat until you build the paint up to the correct thickness. Don't try to apply all the paint in one coat.

Go over the entire car with a rubbing compound to polish the paint. Small marks in the finish can be rubbed out if the paint is a lacquer. Do not use an abrasive rubbing compound on an enamel finish; a mild auto polish is all that's necessary.

Polish depends on method

If you decide to use an electric drill fitted with a wool polishing bonnet to apply the rubbing compound, be sure to use a machine-type compound. A compound designed for hand rubbing contains too harsh an abrasive for machine work, and you may spoil the car's finish by breaking through the paint. Follow the compounding with a coat of polish.

Finally, use a chrome cleaner and polish to restore the metal trim. Small rust spots around the chrome can be cleaned up by using a toothbrush and chrome cleaner or rubbing compound.

A word to the wise: *Read the instructions on the supply containers before you begin.* This will not only make the job easier, but will help keep you out of trouble and will give you the assurance you are getting a job worthy of your time and money spent. ★★★

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ANYONE CAN WELD, BRAZE, CUT, SOLDER, HEAT STEEL, BRASS, ALUMINUM, AND OTHER METALS.



Build and repair anything of metal. Save time & money with this BRAND NEW, PROFESSIONAL ARC WELDER! Rugged metal cabinet, baked Hammerloid finish. Ideal for home, shop, farm and industrial use. Expert work on FIRST job. POWERFUL glass insulated transformer welds 1/2" metals with 3/8" rods. 4 heat settings: 20 to 80 amps. Operates on 110 Volt AC line fused for 30 amps. Complete with fibre glass helmet, electrode holder, ground clamp and cables, solder, assorted rods and simplified welding manual. DOUBLE PROTECTION GUARANTEE. 10 day money back trial plus full 5-yr. warranty. If inoperative return prepaid, we will repair or replace without charge.

ORDER TODAY, ONLY \$59.50 COMPLETE (220 V. \$61.50) SEND ONLY \$6.00. Pay balance plus C.O.D. charges on delivery or write for easy "PAY AS YOU WELD" Low Down Payment Plan. Welder details FREE.

DYNAMIC WELDER CO.

1808 SO. FEDERAL ST.
Dept. D2-D
CHICAGO, ILL. 60616

New Portable LIGHT PLANTS

110-120 V. A. C. 1500 watts, 60 cycles. Weight 24 lbs. Size 10" x 5". Fanbelt driven from car, pickup or gas engine of 2 1/2 or 3 h.p. Operates 1/2" Drills, Saws, T.V. Brand new. Money back guarantee. Regular \$89.50 now \$49.50. With switch, pulley and voltmeter. Send check or money order.

VIRDEN PERMABILT CO.

Box 7066 (P.M.)

Amarillo, Texas 79109



Be Your Own Boss New Business Opportunity FILING SAWS



Start a steady repeat CASH business in your basement or garage. Earn \$3 to \$6 an hour in your spare-time! Excellent profits in saw sharpening business! Automatic Foley Saw Filer, easy to operate, files combination saws, hand, band, and circular saws. No experience needed. H. C. Deibert wrote us: "Since I got my Foley Filer 5 years ago, I have averaged 4 1/2 saws each day since I started."

Every saw you sharpen brings you more customers. "I rented a two-car garage and have all the work I can do," writes Charles H. Smith.

FREE BOOK Shows How to Start

Fact filled booklet tells you how to start a sparetime business immediately; how to get new business, how to advertise. Rush coupon now; get "Money Making Facts" and details on Easy Payment Plan. No Salesman will call.

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FOLEY MANUFACTURING CO.
443-7 Foley Bldg., Minneapolis, Minn. 55418

Send FREE BOOK—"Money Making Facts", and Time Payment Plan.

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Address _____



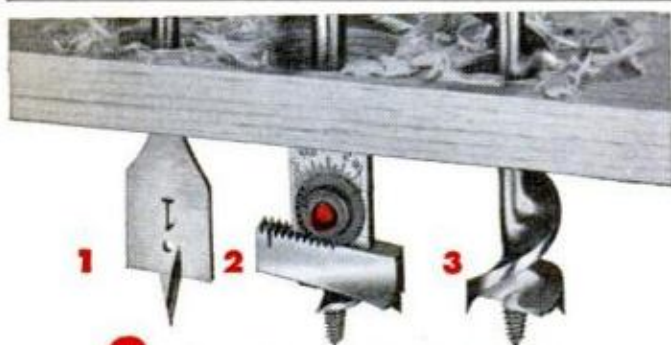


Bikes cost money.



Protecting them is still cheap.

3-IN-ONE can help keep bikes from rusting and running down. It fights rust; protects moving parts from wear; makes things last longer. You pay good money for a bike, a lawn mower, power saws, fans, etc. They're certainly worth a few cents of "insurance." Use 3-IN-ONE. Regular...electric motor oil...or this handy new spray can.



3 easy ways to bore holes faster

1. Irwin Speedbor "88" for all electric drills. Bores faster in any wood at any angle. Sizes $\frac{1}{4}$ " to $\frac{3}{16}$ ", \$.80 each. $\frac{5}{8}$ " to 1", \$.90 each. $1\frac{1}{8}$ " to $1\frac{1}{2}$ ", \$1.40 each.

2. Irwin No. 22 Micro-Dial expansive bit. Fits all hand braces. Just dial your size. Bores 35 standard holes, $\frac{7}{16}$ " to 3". Only \$4.40. No. 21 small size bores 19 standard holes, $\frac{5}{16}$ " to $1\frac{1}{4}$ ". Only \$4.00.

3. Irwin 62T Solid Center hand brace type. Only 16 turns to bore 1" holes through 1" wood. Double-cutter boring action. Sizes $\frac{1}{4}$ " to $1\frac{1}{2}$ ". As low as \$1.30 each.

EVERY IRWIN BIT made of high analysis tool steel, heat tempered, machine-sharpened and highly polished, too. Buy from your independent hardware, building supply or lumber dealer.

Straight-Line Chalk Line Reel Box
only \$1.25 for 50 ft. size

New and improved Irwin self-chalking design. Durable aluminum alloy box. Practically damage-proof. Fits pocket or hand. 50 ft. and 100 ft. sizes.

IRWIN every bit as good
as the name
at Wilmington, Ohio, since 1885

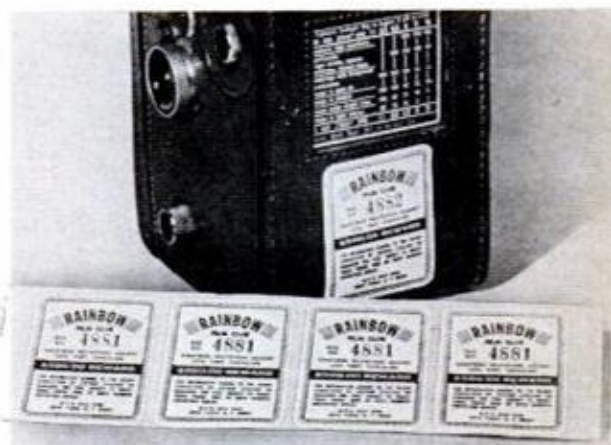


PICTURE THIS

By Leonard Samuels

SURPLUS AERIAL LENSES may not be for you, Eastman Kodak has warned. Individuals who purchase these lenses (often for space-watch photography) and leave the film in the camera for weeks may be disappointed with results. Many of these lenses are made with rare-element, radioactive glass that can fog the film, and were intended for reconnaissance photography where film remained in the camera only briefly.

CAMERAS ARE TANTALIZING to thieves, since a lot of value is often tied up in these relatively small packages. But woe to the thief who mixes with members of the Rainbow Film Club of Englewood, N.J. After hunting around for a means of protecting its members' equip-



ment, the club obtained satin pressure-sensitive labels that could be numbered in sequence to identify each member and that couldn't be removed once attached. Each label bears a \$500 reward announcement. Allen Hollander Co. of The Bronx, New York, made them up for the club.

EDWAL SCIENTIFIC PRODUCTS, the maker of a number of photo-chemical accessories, has turned up some offbeat uses for Kwik-Wet, a photographic wetting agent. If you are in a hard-water area, a drop or two in your shaving mug will put a real head of suds on your shaving cream. Put an ounce of it in a bucket of warm water when washing your car, and you can walk away after rinsing without wiping or polishing. The car will dry spot-free. Edwal advises that Kwik-Wet is not a detergent and won't do the cleaning—it's mild enough to leave the wax on your car when you're done.

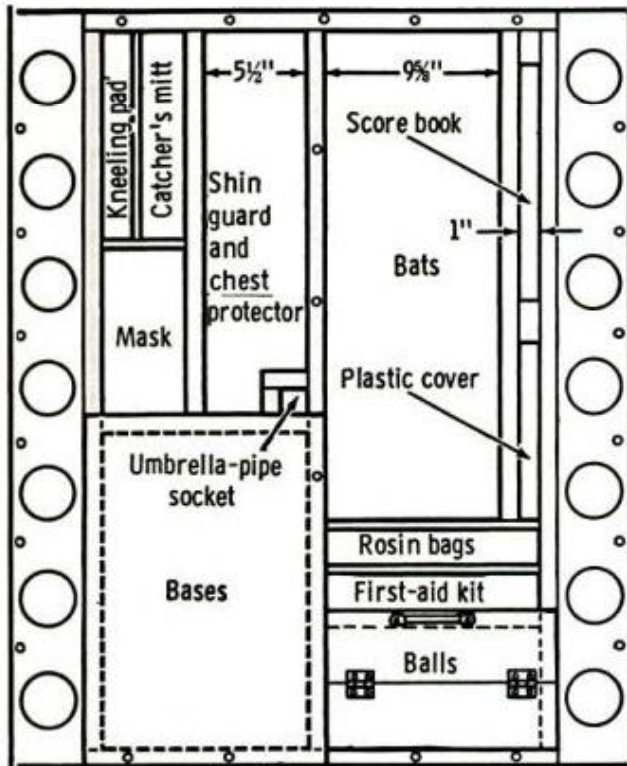
BASEBALL CADDY

(Continued from page 176)

built what they call their bat mobile. But it keeps track of far more than just bats!

There's a compartment for two dozen baseballs, a catcher's mitt and mask, shin guards, chest protector, scorebook, kneeling pad, bases, umbrella, first-aid kit, rosin bag, water cooler, plastic cover, pencils and a measuring tape—plus 14 bats. The umbrella shades the water cooler, and the plastic cover protects the equipment if it rains. Pegs along each side of the cart, labeled with the player's name, keep track of his glove while he's up to bat, and racks along each side make it handy to grab a bat when on deck. Batting helmets perch on 16-in. rods inserted in holes bored in the edge of a divider. The cart's pipe handle slips out of its pipe socket so the whole affair will fit into a car trunk.

As you see in studying the drawing, the body is little more than a box made of standard lumber and divided into com-



partments. Two wheels from an old trike are mounted on the ends of an axle anchored to the body with sheet-metal straps. Handles protruding from each side were found handy in lifting the cart in and out of the trunk.

Each bat rack consists of three members, the top one being a 2x4, the others 1x4s. Three-inch holes are bored through the 2x4, but only through one of the 1x4s, the second one being nailed to the first to form a bottom. Both sections are glued and screwed to the side of the body, leaving about a 2-in. space between. ★ ★ ★

Briggs & Stratton — Clinton New Gas Engine Sale

Never before and perhaps never again—this offer of brand new genuine Clinton and Briggs & Stratton engines including 1 yr. factory warranty at less than cost. Perfect power for go-carts, scooters, tractors, mowers, generators, pumps, sprayers, etc. We hauled out 3 big factories who needed cash and the savings are yours while quantities last. Act fast.



Clinton 21 1/2 hp. Mdl. 500—Re-coil starter Std. 3/4 shaft w. keyway—ready to go. Reg. price \$49.50 Special item 10020

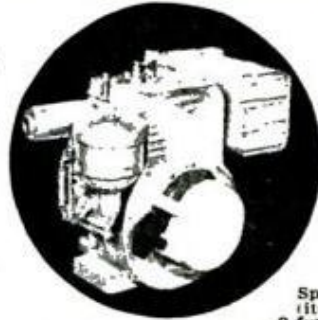
\$29.95
2 for \$59.50
6 for \$176.50



Briggs & Stratton 21 1/2 hp. Mdl. 81100 ratchet start. 3/4 shaft. Sturdy 4 cycle engine. Reg. price \$69.50 Spec Item = 1518

\$34.50
2 for \$67.50
6 for \$199.50

\$69.95
5 3/4 hp.
Briggs & Stratton



Briggs & Stratton 5 3/4 hp. Mdl. 143302. Re-coil start. Std. 1" shaft w. keyway, and adjustable governor—a rugged big engine ready to tackle any job.

Regular price .. \$92.00
Special (item 1055) .. **\$69.95**
2 for **\$135.00** 6 for **\$375.00**
\$89.95

Same engine with 12 volt start and battery charging. Item #1571

2 3/4 h.p. Clinton—34.95
Model 400, rugged 4 cycle model. Alum. Block, castiron cylinder Rope start—5/8" std. shaft.

Item 1107 34.95
2 For 69.95



3 1/2 h.p. Clinton—39.95
A big engine with big power. Model 404, 4 cycle, rope start, 3/4" std. shaft.

Item 404 39.95
2 for 77.50

Remember these engines are absolutely perfect and standard and under factory warranty. Money back guarantee. Order now while stocks are complete. Factories—we buy new engines.

STANDARD DIAL PHONES WITH BELL

Bell System late model dial phones same as used by all telephone companies. Ideal as extensions on any system. Easy to connect. Several may be connected on one line. Easily modified for private inter-com system. Cost \$10.00 new—guaranteed excellent condition.

ITEM 855 NC. Wt. 8 lbs. **\$7.45**



TRUCK OR BOAT WINCH 2000#



A powerful, compact winch which installs easily even in limited space. Works with any 12, 24 or 32 volt system. Reverses under power—positive brake holds load. Drip proof cover. Remote control if desired. Drum holds 100 ft. of 3/4" cable. Speed 30 ft. per minute. A terrific winch at an economy price.

Item 1263
Wt. 55# **\$69.50**

RECHARGE ALL BATTERIES

Only Everlite

- Charges 6 batteries
- Charges 3 times faster
- Charges all batteries

Including hearing aid, flashlight, lantern, radio, in fact any battery up to 12V. Save Money and have the convenience of fresh batteries always. Simple and 100% Safe. Plugs into any 115V. outlet. Guar. for one year. Send \$6.95 plus \$.65 for shipping

695



Model 75

Send 10c for 100 page Catalog FREE with order. Prices f. o. b. factory—Send check or **MASTER MECHANIC MFG. CO., Dept. A-47, Burlington, Wis.**
Southern Customers write Dept. A-47, Box 65, Sarasota, Florida

FANTASTIC VALUES WITH THIS COUPON

AMERICAN MACHINE & TOOL CO., Dept. PM47, Royersford, Pa. 19468
Please send me the units checked. Payment in full enclosed \$.....
or \$3 deposit each item enclosed, balance C.O.D. I MUST BE FULLY
SATISFIED OR WILL RETURN UNIT WITHIN 10 DAYS FOR FULL REFUND.
No questions asked.

<input type="checkbox"/> 8" Power Saw at \$14.95	<input type="checkbox"/> Jointer-Planer at \$19.95
<input type="checkbox"/> Standard Rip Fence #354 at \$3.50	<input type="checkbox"/> Lathe at \$9.85
<input type="checkbox"/> Long Rip Fence #354C at \$4.50	<input type="checkbox"/> Set of 3 High Speed
<input type="checkbox"/> Belt Sander at \$14.95	<input type="checkbox"/> Turning Chisels at \$4.95
<input type="checkbox"/> Mitre gage for Sander at \$1.95	<input type="checkbox"/> Drill Press at \$29.95
	<input type="checkbox"/> Disc Sander at \$7.95†

½ hp GE Motor { \$14.80 (purchased with other item)
 \$18.95 (if purchased separately)

NAME
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SAVE AS MUCH
AS...
80% WITH
QUALITY **Amco**
POWER TOOLS

DIRECT FACTORY OFFER AND REVOLUTIONARY PATENTS decrease costs, increase efficiency. Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested, packed right in our own factories shipped direct... save store profits.

ENDORSED BY AMERICA'S TOP MAGAZINES...

Here is what the editors say:
"A good bit of sound—imaginative—engineering." Popular Science; "(saw) boasts many features of bigger brothers." Popular Mechanics; "Amazingly versatile." Workbench; "Highly substantial construction, sturdy enough for production line use."

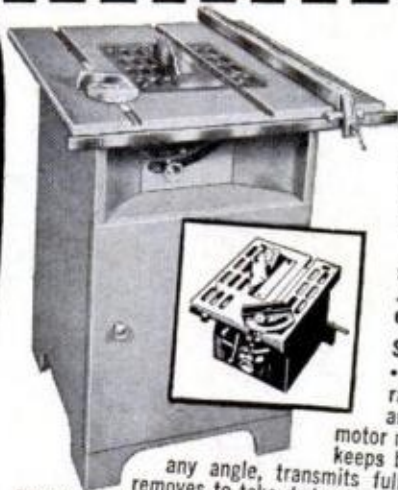
Industrial Woodworking. And Workbench awarded these tools their coveted "Work Tested" Seal.

OVER A MILLION USERS confirm their precision, versatility and rugged performance.

***10-YEAR FULL SERVICE GUARANTEE**... Any part or parts of any AMCO power tool (except motor) which may become inoperative for any reason within ten years after the purchase date will be repaired or replaced by the factory without cost to the purchaser. Your only cost: for postage.

UNCONDITIONAL MONEY BACK GUARANTEE

You must be fully satisfied. If not, return in 10 days, freight collect. Money promptly refunded in full.



8" TILT ARBOR POWER SAW

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

\$1495 f.o.b. factory. Wt. 25 lbs. Includes completely assembled cast iron and steel 8" saw with ground cast iron table... less blade. **RIP FENCE**, if desired, for easier work alignment, \$3.50 add'l.

SAW BLADE TILTS... TABLE STAYS LEVEL

Locks securely at any angle up to 50°, raises, lowers 0"-2 3/4". Patented tilt mechanism, accurate etched scale. Patented motor mount takes std. 3/4 h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power. Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.). Accurate mitre gauge assembly. Ground spindle. Enclosed steel base. "Compo" bearings. Access. Std. size (for bench saw) \$3.50; larger fence (for cabinet base, as ill'd.) \$4.50.

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

10-YEAR FULL SERVICE GUARANTEE*

6" SWING 3-FOOT LATHE



Optional faceplate for turning bowls, trays, lamp bases, rosettes, etc. \$2.50. **\$985** f.o.b. factory Wt. 14 lbs.

Set of 3 high speed turning chisels, \$4.95 add'l.

DOES THE WORK OF \$40 UNITS... with same precision and speed. Turns wood, plastic. Sturdy cast iron with tubular steel bed. Ball thrust cup center, spur center, T-rest assembly, lever action tail stock, 2-speed pulley. Fits any motor.

10-YEAR FULL SERVICE GUARANTEE*

PRECISION 4" x 36" BELT SANDER

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

\$1495 †Disc Sander attachment incl. disc bracket, ground cast table (tilts 0-45°): \$7.95 add'l.

DOES WORK OF \$50 SANDERS... The world's most talented belt sander. Heavy cast sander incl. 4" x 36" sanding belt, V-pulley drive, multi-purpose drive spindle. Changes from horizontal to vertical sanding in secs. Uses 1/2 hp or larger motor.

10-YEAR FULL SERVICE GUARANTEE*



Mitre gage: \$1.95 add'l.

FULL 22" LONG, 4 1/8" JOINTER-PLANER

\$1995

f.o.b. factory. Wt.: 19 lbs. Complete as shown.



100% precision ground cast iron and steel.

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

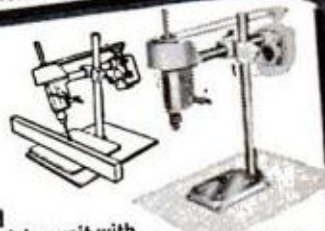
10-YEAR FULL SERVICE GUARANTEE*

32" RADIAL DRILL PRESS

All cast iron and steel f.o.b. factory **\$2995** Wt. 30 lbs. 1/2" cap.

Jacob's chuck incl.

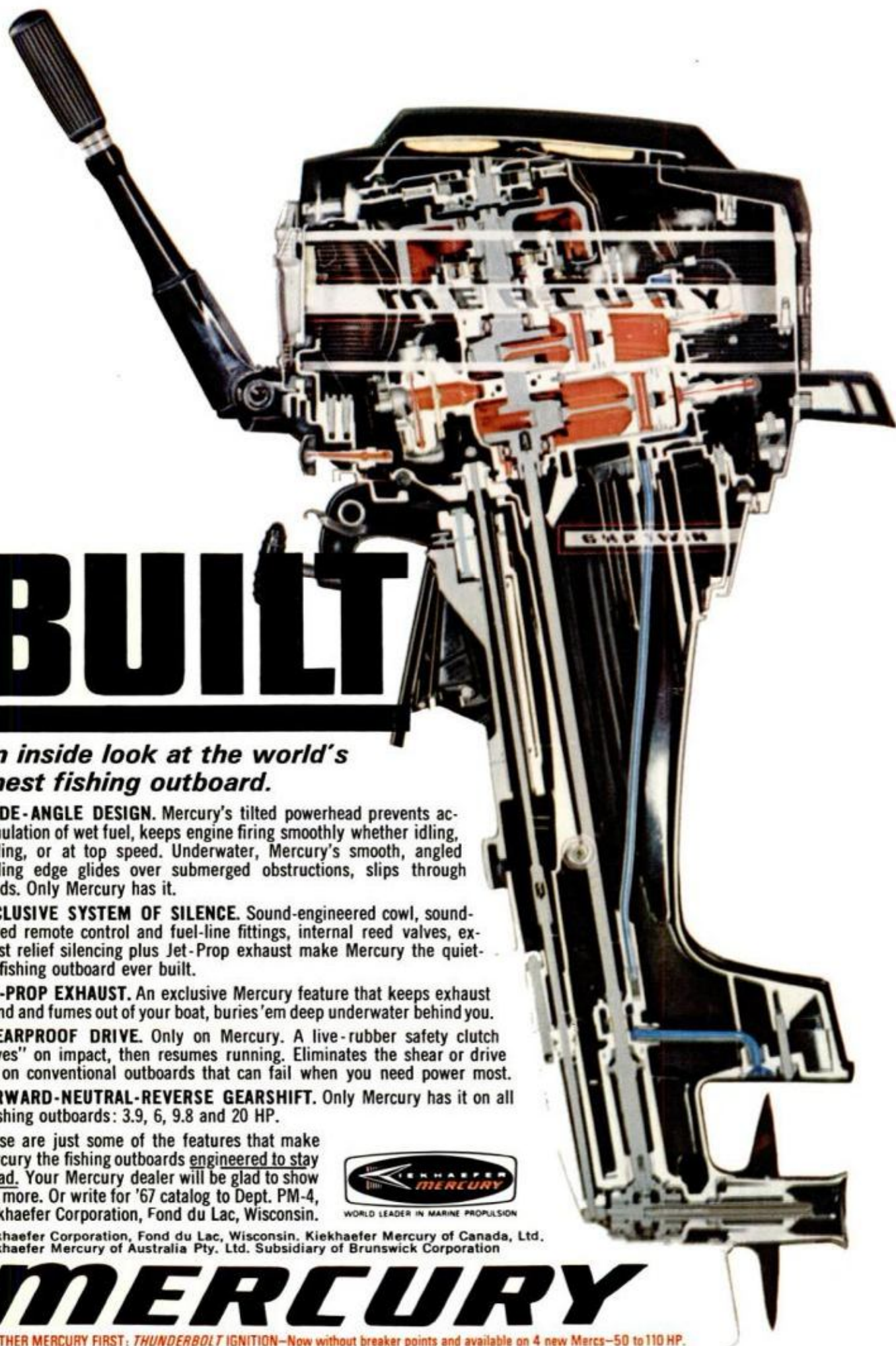
DOES WORK OF \$90 UNITS... and much more. Industrial quality precision unit with all standard features, many extras. Head raises, lowers. Depth of throat up to 16". Pre-set to any angle for on-or-off table drilling, even horizontal drilling. **10-YEAR FULL SERVICE GUARANTEE.***



BRAND NEW **1/2 H.P. MOTOR... \$14.80**

F.O.B. FACTORY

FOR ANY OF ABOVE MACHINES. WT. 17 LBS. PURCHASED SEPARATELY, \$18.95



BUILT

An inside look at the world's finest fishing outboard.

GLIDE-ANGLE DESIGN. Mercury's tilted powerhead prevents accumulation of wet fuel, keeps engine firing smoothly whether idling, trolling, or at top speed. Underwater, Mercury's smooth, angled leading edge glides over submerged obstructions, slips through weeds. Only Mercury has it.

EXCLUSIVE SYSTEM OF SILENCE. Sound-engineered cowl, sound-sealed remote control and fuel-line fittings, internal reed valves, exhaust relief silencing plus Jet-Prop exhaust make Mercury the quietest fishing outboard ever built.

JET-PROP EXHAUST. An exclusive Mercury feature that keeps exhaust sound and fumes out of your boat, buries 'em deep underwater behind you.

SHEARPROOF DRIVE. Only on Mercury. A live-rubber safety clutch "gives" on impact, then resumes running. Eliminates the shear or drive pin on conventional outboards that can fail when you need power most.

FORWARD-NEUTRAL-REVERSE GEARSHIFT. Only Mercury has it on all 4 fishing outboards: 3.9, 6, 9.8 and 20 HP.

These are just some of the features that make Mercury the fishing outboards engineered to stay ahead. Your Mercury dealer will be glad to show you more. Or write for '67 catalog to Dept. PM-4, Kiekhaefer Corporation, Fond du Lac, Wisconsin.



Kiekhaefer Corporation, Fond du Lac, Wisconsin. Kiekhaefer Mercury of Canada, Ltd. Kiekhaefer Mercury of Australia Pty. Ltd. Subsidiary of Brunswick Corporation

MERCURY

ANOTHER MERCURY FIRST: THUNDERBOLT IGNITION—Now without breaker points and available on 4 new Meracs—50 to 110 HP.



Budweiser is the best reason in the world to drink beer

