

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

REG. U.S. PAT. OFF.

*Launching Ramp
for Skiers—Page 156*

10 Best Boating Vacations

BUILD YOUR OWN PONTOON BOAT

Owners Report on the

BUICK

**I Teach Kids to Swim
in One Lesson**



WIN!

THE FABULOUS EVINRUDE DREAMBOAT

Hit of the New York and Chicago boat shows
... powered by two 35 hp Evinrude Larks!

**ENTER THE EVINRUDE DREAMBOAT
CONTEST—FEB. 21-MARCH 22**

Here's a prize to stir your Gypsy blood! A gay and glamorous "houseboat-of-the-future" by noted designer Brooks Stevens. Custom built and luxuriously fitted to accommodate your entire family. Powered to perfection with two famed Evinrude Larks. This answer to your dreams may be as close as your Evinrude dealer. Drop in and pick up a contest entry form.

A visit will reward you in other ways—it's Evinrude Dealer Boat Show time! A wonderful time to see the latest boats on display and the finest motors in 50 years. See these remarkable new Evinrudes with *sound-sealed cushioned power*... and *thermostat temperature control*... most efficient boat power yet produced!

Take the family to visit "dreamboat land" at your Evinrude dealer. They'll share the fun—and can help you win!

A Division of Outboard Marine Corporation
In Canada: Mtd. by Evinrude Motors, Peterborough



EVINRUDE

QUIET OUTBOARD MOTORS

HOW TO ENTER!

1. Go to your nearest Evinrude dealer (look for his name under "Outboard Motors" in the yellow pages).
2. Pick up rules and entry blank.
3. Complete this statement in 50 words or less: "People who own an Evinrude get more fun out of life. I'd like to own a '59 Evinrude because."
4. Mail official entry blank to "Evinrude Contest."

33 PRIZES... FOUR WEEKLY CONTESTS!

FIRST PRIZE: Fabulous Evinrude "Dreamboat" houseboat... hit of the New York and Chicago Boat Shows... powered by two Evinrude 35 hp Larks.

4 SECOND PRIZES—one each week for 4 weeks: Evinrude V-4 50 hp Starflite motor plus \$1,500 in credit at your dealer for the family boat of your choice and accessories up to that amount.

NEXT 28 PRIZES—7 each week for 4 weeks: 3rd Prize: 50 hp Evinrude Four-Fifty motor; 4th Prize: 35 hp Lark; 5th Prize: 35 hp Big Twin; 6th Prize: 18 hp Fastwin; 7th Prize: 10 hp Sportwin; 8th Prize: 5½ hp Fisherman; 9th Prize: 3 hp Lightwin

SPECIAL BONUS PRIZE: If you buy a 1959 Evinrude motor during the contest period and become a winner—we'll pay you the full value of the motor you bought in addition to the prize.

"MIRACLE MILD" PHILLIES

Now - The Best Selling Blunts in the U.S.A.

The advertisement features a central image of a pack of Phillie Blunts. The pack is white with a black spine that says "PHILLIES" vertically. The top of the pack says "BLUNT" in large black letters. A circular window shows four blunts with "PHILLIES BLUNT" labels. A black price tag in the upper right corner of the pack says "NOW 39¢". Below the window is a large orange oval with "PHILLIES" in white. At the bottom of the pack, it says "MIRACLE MILD" and "Blended with Havana" in a cursive font. A large, detailed image of a single blunt is positioned horizontally across the bottom of the pack. To the right of the pack is a black and white photograph of a man in a suit holding a large trophy.

"MIRACLE MILD" Phillies Blunts — the first cigar mild enough for all smokers. Never before has smoking offered so much pleasure for so little cost. Pick up a pack today!

NEW LOW PRICE!

5 for 39¢

Other Phillies sizes . . .

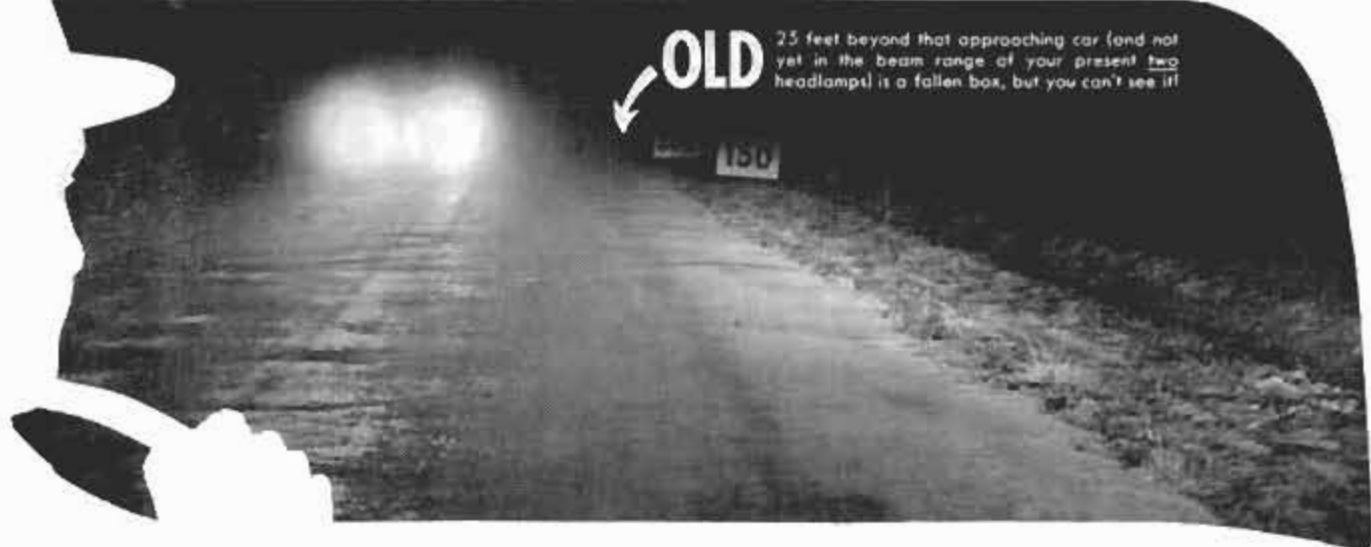
IMPERIALS—DOUBLE PERFECTOS—KING SIZE—2 for 25c • PERFECTOS—10c • PANATELLAS—5 for 39c • JUNIOR PHILLIES 5c

MARCH 1959

This One



1



OLD

25 feet beyond that approaching car (and not yet in the beam range of your present two headlamps) is a fallen box, but you can't see it!

See better in spite of the other car's lights!



NEW

There's the box 200 ft. ahead! This is how a pair of new G-E SUBURBAN Headlamps helps you see better against oncoming cars' lights!

Get NEW G-E SUBURBAN Headlamps with the "built-in spotlight" effect in the low beam

... especially designed for all cars with two headlamps

Only the new General Electric SUBURBAN Headlamps have the low beam filament *optically centered* in the reflector. Because this filament is on focus, it provides *twice* as much light in the "spotlight" area—with ample light to the sides of the road—and with no added drain on the battery.

The additional light enables you to see better beyond the oncoming car in

spite of *its* lights—when both cars are from 75 to 200 feet apart. And it helps you recover your vision more quickly after the other car goes by.

See the dramatic difference; get G-E SUBURBAN Headlamps. Have a pair installed and aimed now. General Electric Co., Miniature Lamp Dept., Nela Park, Cleveland 12, Ohio.



Special low beam filament shield lets you see better in fog, rain or snow. The upper beam reaches far and wide for safer driving on the open road.

Get a pair today

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Advertising Offices
Chicago: 200 E. Ontario St., Whitehall 4-0100;
New York: Empire State Bldg., 350 Fifth Ave.,
Longacre 5-7580; Detroit: General Motors
Bldg., TRinity 5-8711; Cleveland: Hanna
Bldg., 1422 Euclid Ave., PRospect 1-0456; Los
Angeles: 3460 Wilshire, DUmkirk 2-8458; San
Francisco: Russ Bldg., 235 Montgomery St.,
Yukon 2-0823.

Published monthly by Popular Mechanics Company,
200 E. Ontario St., Chicago 11, Ill. Richard E.
Berlin, President; Richard E. Deems, Executive
Vice-President; Fred Lewis, Vice-President and
General Manager; John R. Miller, Vice-President;
G. Harry Chamberlaine, Vice-President; G. G. Mar-
kison, Treasurer; R. F. McCauley, Secretary;
Joseph R. Buell, Jr., Advertising Manager. Single
copy in the United States and Canada, 35 cents;
subscription rates in the United States and pos-
sessions, Canada and countries of the Pan Amer-
ican Postal Union, 1 year \$3.50; 2 years, \$6.00;
3 years, \$8.00. To all other countries add \$1.00
a year over United States prices for overseas
postage. If you plan to move, notify us at least
30 days in advance so you will not miss an
issue. Give both your old and new addresses.
Entered as Second Class Matter, September 15,
1903, at the Post Office at Chicago, Illinois, under
Act of March 3, 1879. Entered as Second Class
Matter at Post Office Dept., Canada, Registered
as Second Class Matter at the Post Office at
Mexico, D.F., Mexico, June 20, 1950.
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MARCH 1959

FOREIGN EDITIONS: MECANIQUE POPULAIRE (French) MECANICA POPULAR (Spanish) POPULAER MEKANIK (Danish) POPULAR MEKANIK (Swedish) POPULARE MECHANIK (German)

Volume 111

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Next Month...

You'll find OUTDOOR LIVING featured on 16 pages, including four in full color, with intriguing do-it-yourself projects that range from a barrel-type Dutch oven to a swank lawn cabana with full entertainment facilities. Other highlights are a redwood patio with a cantilever roof and, for the boating family, a foldup "house." . . . Now that the experts have had their say about the new cars, read the owners' verdicts on the '59 CHEVROLET, FORD, PLYMOUTH



THERE'S A BIG DIFFERENCE IN PERFORMANCE TODAY

and Plymouth's got it!... let these experts tell you how!

"MAY PROVE TO BE THE ONLY '59 CAR WHICH HAS ACTUALLY IMPROVED PERFORMANCE... BEST CAR OF THE LOW-PRICED 3... A GREAT PERFORMANCE CAR... I DROVE THIS PLYMOUTH FLAT-OUT... AND THERE WASN'T THE SLIGHTEST SIGN OF OVERHEATING OR BREAKDOWN."

Tom McCahill, Mechanix Illustrated.

"... PROBABLY THE HOTTEST OF THE STANDARD PASSENGER SEDANS... TO BE FULLY APPRECIATED, MUST BE DRIVEN... QUICKEST CAR ON

THE ROAD IN FURY FORM WITH THE BIG ENGINE... GREAT HANDLING... MAY EVEN SURPASS SOME SPORTS CARS..."

Motor Life.

"IT'S QUITE A PACKAGE... CORNERING QUALITIES... DESERVE AN 'EXCELLENT' RATING WHEN COMPARED TO ANYTHING OTHER THAN A FULL-FLEDGED SPORTS CAR."

Ray Brock, Hot Rod Magazine.

"THIS YEAR'S 'HOT ONE' MAY BE THE 1959 PLYMOUTH."

Arthur R. Railton, Popular Mechanics.

And these are only a few of the raves! See your Plymouth dealer for FREE "Experts Folder" with more enthusiastic quotes. See and try the optional *New Golden Commando 395 V-8*... biggest engine in the low-price field. Discover all the news about the **BIG DIFFERENCE IN PERFORMANCE** among low-price cars for 1959!

So much the same in price... so different on the road

Plymouth

As a former serviceman, your skill could be valuable to the U.S. Air Force. If so, the Air Force has an important job and a guaranteed future waiting for you in this new Age of Space. You'll work with the most modern equipment and learn the newest techniques of your specialty. And don't forget: your previous service counts toward rank, pay and retirement income. Talk it over with your local Air Force Recruiter, or mail the coupon.

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IN THE
NEW AGE OF SPACE**



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ACROSS THE DESK



spot after his sensational solo drive from Paris to Bordeaux and return in 1895. The huge monument, with a fine bas-relief showing Levassor's arrival, is still there, though few guide books mention it. There's a bus stop nearby and a vast number of motor vehicles buzz past it every 24 hours, but few of the hurrying drivers and riders ever seem to pause to acknowledge their debt to Levassor.

"I, for one, believe you have put the credit finally where it belongs when you have credited Levassor with 'inventing' the automobile. True, Benz and Daimler merit all the honors that have been accorded them for pioneering in the installation of internal-combustion engines in road and rail vehicles and in boats, but it was Daimler's good friend Levassor who spent month after month with various arrangements of the several component parts of the motor vehicle until he found the one which worked best. That combination—engine in front, gearbox and clutch next in line, then drive-shaft and differential, and finally the driving-axles—introduced the automobile as we know it.

"The publication, *Paris Match*, reported the other day that the French equivalent of our Society of Automotive Engineers has just proposed that an automobile museum

(Continued to page 8)

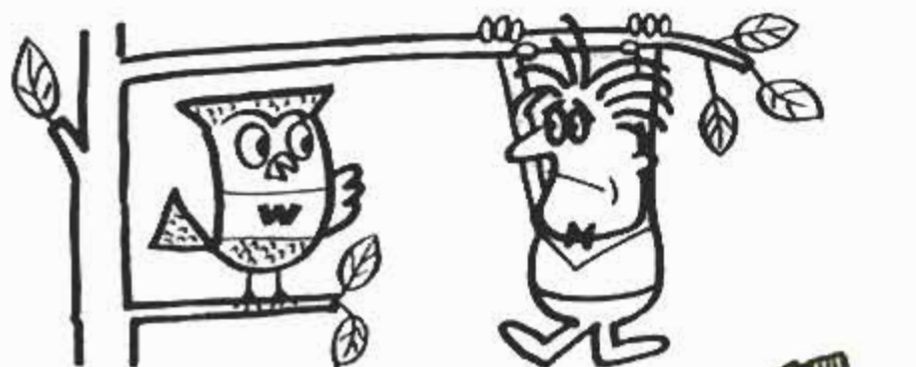
"Heroic Years"

The color paintings that highlighted our annual Automobile Section in January under the title "Heroic Years of the Automobile" have brought flattering comments and many requests for the "pin-up" reprints. One of the interesting letters came from Christy Borth of the Automobile Manufacturers Association, who helped uncover the historical material with Art Railton, Automotive Editor. From Borth's letter to Railton we quote:

"Congratulations! Your handling of 'Heroic Years of the Automobile' in the January, 1959, edition of *PM* leaves nothing to be desired. Orchids, too, to Robert Korta for excellence in capturing the spirit of the four great events of the automobile's infancy in his paintings.

"I suppose you know that around 1907 the people of Paris subscribed to a monument at the Porte Maillot commemorating that exciting moment when Emile Constant Levassor arrived at the finish line at that

Hair problem got you out on a limb?



Get Wildroot Cream-Oil Charlie!



Just a little bit of Wildroot and... WOW!





YOU Can Prepare Rapidly as an EXPERT BOOKKEEPER



FREE SAMPLE LESSON

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Of course, you need something more than just the desire. So, wouldn't it be well worth your while to use some of your leisure time in interesting home study—over a comparatively brief period? Always provided that the rewards were good and thousands upon thousands have found it so.

A Bookkeeper's or Accountant's duties are interesting, varied and of real worth to his employer. He has important standing with his employer.

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The success of LaSalle graduates has resulted from their knowledge and application of the principles acquired through Basic and Practical Accounting. Principles of Accounting and Cost Accounting training, offered in our step-by-step accounting plan. Federal Income Tax is included to qualify you for the many opportunities available to bookkeepers and accountants with this valuable knowledge.

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Please send me, free of all cost or obligation, a sample lesson in Accounting...also, your latest illustrated book, "Opportunities in Accounting."

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WHY NOT
BE ONE?



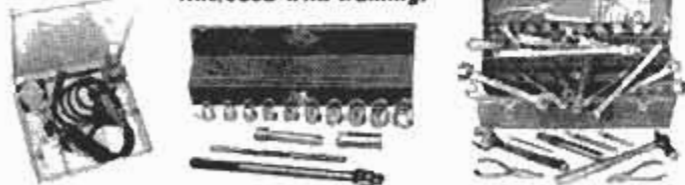
**It's easy to train at home for a
TOP-PAY JOB with a BIG FUTURE!**

Stop worrying because you need a better job—or because you need more pay! Over 100,000 jobs are waiting right now for newly-trained auto mechanics. Here's why: There are 60 million cars and trucks on the road—and one-third need heavy repairs. Over 7 million new vehicles are made annually—also need service. No wonder the demand is big for auto mechanics—why pay is tops, work is steady!

YOU CAN LEARN AUTO MECHANICS in months, at home in spare time. Let CTI train you with its famous Shop Method. It's easy. It's fast. *Mail coupon for free details.*

You Practice with Tune-Up Kit and Tools

(Included with training)



CTI training is practical. You get a valuable Tune-Up Kit, the kind that experienced mechanics use to locate engine troubles. You receive a Compression Tester; Vacuum Gauge & Fuel Pump Tester; Ignition Timing Light; portable steel case. You also get a set of professional mechanic's tools, including socket set with extension. You'll use instruments and tools to practice, to make repairs, to earn money as you train. (Note: Diesel Mechanics or Body-Fender Repair instruction too—at no extra cost.)

Many Students Make Money as They Train

Soon after they begin training, many students fix cars for others. They not only acquire useful experience—they also earn money. Their earnings help pay tuition, buy shop equipment, start many in business. *Mail coupon for details.*

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CHICAGO 26, ILLINOIS

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and *Sample Lesson*. BOTH FREE.

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City _____ Zone _____ State _____



(Continued from page 6)
be established in Paris. The *Conseil Municipal de Paris* and the French Republic both promised support. The sponsors point out that Paris is the proper place for such a museum, not only because of Levassor's pioneering, but also because it was there. In 1768, that Captain Nicolas Joseph Cugnot, ordnance officer under Louis XV, successfully ran his invention, the steam-powered artillery tractor which was the grandsire of all self-propelled vehicles.

"I hope that your article and Korta's paintings may play important parts in augmenting the plan to get this museum created in Paris. Nothing, in my opinion, would be more fitting and proper than for a groundswell of American public opinion to manifest itself in favor of this plan, for surely no other people on this earth have reaped greater rewards from the widespread use of motor vehicles than have we here in the United States.

Christy Borth,
Assistant to the
Managing Director,
Automobile Manufacturers
Association,
Detroit, Mich."

☆

Your 1959 Parade of Cars (January PM), which I thought was fine generally, specifically put the Rambler in a bad light price-wise.

It showed the price of a Super Rambler V8 as \$2398 with a footnote stating "for Sixes subtract about \$120."

This is correct, but your readers may not know that Rambler also offers, in the six-cylinder line only, a Deluxe model that sells for \$2098.

Russell Martin,
Miner Motor Sales,
Willimantic, Conn.

☆

There are also the dissenters. Roy Ferrer, Los Angeles, writes:

"I wish to take exception to a statement in the section '1895—Paris-Bordeaux-Paris: Levassor's Triumph.' Mr. Railton writes: 'This first speed event of all time proved the superiority of the gasoline engine.'

"This statement in my opinion is both erroneous and ambiguous. It did not prove the superiority of anything. I think it did prove that Monsieur Levassor was either a very good mechanic or machinist, or that he had good men working for him.

"All down the line before and since in automotive history, steam cars have time and time again proved their superiority. If

(Continued to page 10)

Learn Radio-Television

Servicing or Communications by Practicing at Home in Spare Time

N.R.I. SENDS kits with which you practice building circuits common to Radio and TV sets. You LEARN-BY-DOING to locate Radio-TV troubles. As part of N.R.I. Servicing Course, you build Vacuum Tube Voltmeter and AC-DC receiver. Use VTVM to conduct experiments, earn extra money fixing sets in spare time.



RADIO-TV BROADCASTING (see above) offers important positions as Operators and Technicians. **RADIO-TV SERVICING Technicians** (see below) needed in every community. Their services are respected, their skill appreciated.



Fast Growing Field Offers You Good Pay, Success, Bright Future



J. I. SMITH
founder

Bigger than ever and still growing fast. That's why Radio-TV has special appeal to ambitious men not satisfied with their job and earnings. More than 4,000 Radio and TV stations. More than 150 million home and auto Radios, 40 million TV sets. Color TV promises added opportunities. For the trained man, there are good jobs, bright futures in Radio-TV Servicing or Broadcasting. Training PLUS opportunity is the ideal combination for success. So plan now to get into Radio-TV. The technical man is looked up to. He does important work, gets good pay for it. Radio-Television offers that kind of work. NRI can supply training quickly, without expense of going away to school. Keep your job while training. You learn at home in your spare time. NRI is the **OLDEST** and **LARGEST** home study Radio-TV school. Its methods have proved successful for more than 40 years.

Added Income Soon - \$10, \$15 a Week in Spare Time

Soon after enrolling, many NRI students start to earn \$10, \$15 a week in spare time fixing sets. Some pay for their training and enjoy extra luxuries this way. Some make enough to start their own Radio-TV shops. NRI training is *practical*—gets quick results. Easy to understand, well illustrated lessons teach you basic principles. And you LEARN-BY-DOING by practicing with kits of equipment which "bring to life" things you study.

Find Out What NRI Offers

NRI has trained thousands for successful careers in Radio-TV. Study fast or slow—as you like. Diploma when you graduate. Mail coupon now. Paste it on a postcard or mail in envelope. **ACTUAL LESSON FREE.** Also 64 page catalog that shows opportunities, shows equipment you get. Cost of NRI courses low. Easy terms. **NATIONAL RADIO INSTITUTE, Dept. 9CA, Washington 16, D.C.**

N.R.I. TRAINED THESE MEN FOR SUCCESS



"I was repairing Radios by 10th lesson. Now I'm Engineer for WHPE." **M. R. LINDEMUTH, Fort Wayne, Ind.**



"Doing spare time repairs on Radio and TV. Soon servicing full time." **CLYDE HIGGINS, Waltham, Mass.**

"I had a successful Radio repair shop. Now I'm Engineer for WHPE." **V. W. WORKMAN, High Point, N.C.**



"There are a number of NRI graduates here. I can thank NRI for this job." **JACK WAGNER, Lexington, N.C.**



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M. Lyons (Chgo.): 3rd year should hit \$100,000; 2nd was \$60,000; 1st \$40,000. Hdqtrs help make it possible.

D. Chilcott (N. Platte): Duraclean says you can gross \$9.00 per hour. I gross up to \$12.00. Many dealers do much better.



E. Roddey (Hamp-ton, Va.): Have earned as much as \$485 in one day. My 9th year and business keeps growing.



You, too, can enjoy the financial Independence of your own business

Join the thousands of opportunity-minded men like those pictured above who are sharing in the profits that Duraclean and this remarkable home-furnishings cleaning field make possible. We can help you to make more money in one of the fastest-growing industries today . . . one which the Dept. of Commerce estimates as having a \$750 million dollar a year potential. Every building houses a customer!

We will train you to become a cleaning specialist, show you the proven methods for building business, and then back you with over 27 continuous services to help assure your growth.



Arlis Wilson of Tulsa says: "As a Duraclean Dealer, I have the ideal setup. I am operating my own business, yet have at my disposal a staff of experienced men at headquarters who will gladly help me on a moment's notice."

Start Part-Time if now employed and build it into a full-time operation as thousands of Duraclean Dealers have done. No shop needed. We help finance reliable men.

FIVE WAYS TO MAKE MONEY:

You provide 5 different services, thereby multiplying profits on most jobs. **Duraclean:** unique absorption method of cleaning rugs, carpets and upholstery which eliminates harmful scrubbing, soaking and shrinkage. This process is so safe it has been awarded the Parents' Magazine Seal. Other vital services are **soil retarding, mothproofing, flameproofing, and spotting.** Just 2 average jobs a day nets \$8,750 first year.



WE HELP YOU GROW: Duraclean's growth depends on your success; thus, Headquarters provides all the help possible to assure your success. When you phone or write, our staff of specialists give you prompt, expert counsel. What's more, you're kept up-to-date, first hand, on all phases of your business through our comprehensive 5-day training school, national conventions and regional conferences. We back you with National Advertising in leading consumer and trade magazines, provide newspaper ads, direct mail materials, copyright and trademark protection, a monthly sales-building magazine plus a host of others.

Mail coupon for free booklets and complete details on a dealership in your town.

DURACLEAN CO., 9-163 Duraclean Bldg., Deerfield, Ill.

"OWN A BUSINESS" COUPON

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Without obligation, please rush me free booklets giving me full details of how I may OWN a growing, lifetime business.

Name.....

Address..... County.....

City..... State.....

(Continued from page 8)

they had had the concentrated engineering spent on them that the internal-combustion cars had, there probably would be very few i.c. cars in use today."

No fan is more devoted than the steam-engine fan. Nevertheless, Mr. Railton comments, "historical fact is that in 1895 steam cars which had been built for years were trounced by a whole raft of primitive, imperfect gasoline cars. From that day until this the steam car has never been a threat. It may be some day, but at the moment it is not."

☆ ☆ ☆

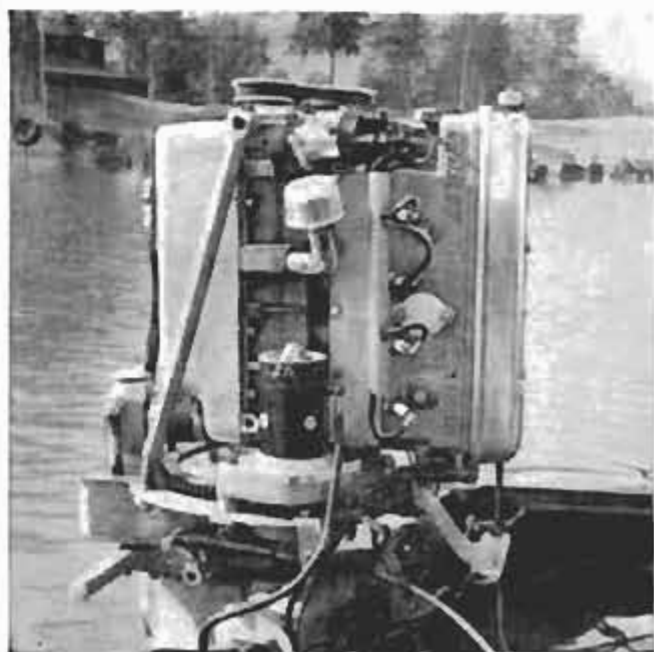
To the Editor:

I have been reading your magazine for a good many years, and have found some good ideas in it.

I am enclosing a snapshot of an outboard motor I built from a Crosley car engine.

It was put on an Evinrude lower-end unit, it has a dry oil sump under the motor and two U.S. carburetors.

It does about 30 m.p.h. on a 15-foot boat.
Chas. Wells,
London, Ontario



☆ ☆ ☆

Next time a tornado heads for your town—and we hope you never have this opportunity—get out your camera before you duck for cover. Weather bureau scientists are making a study of tornadoes and applying photogrammetric methods (aerial mapping). They will welcome as many photographs of a single tornado as possible, taken from all angles, whether by professional or

(Continued to page 14)

INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

CLARENCE A. O'BRIEN & HARVEY JACOBSON

Registered Patent Attorneys

91-C DISTRICT NATIONAL BUILDING

WASHINGTON 5, D. C.

Obviously, We Didn't Know This Old-Timer!

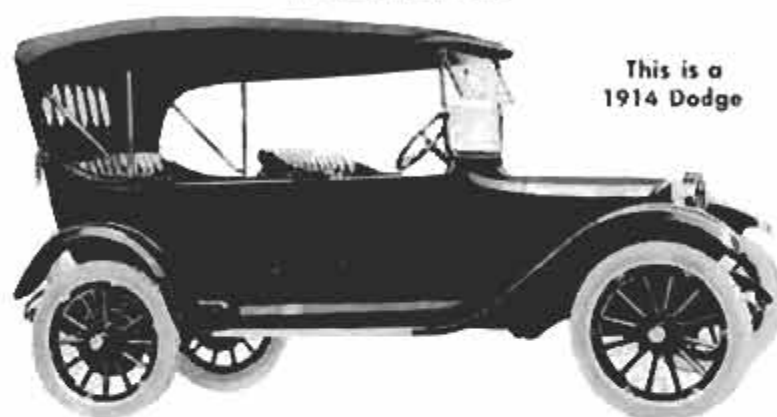
On page 44 of our January 1959 issue we ran the photograph of an old car loaded down with camping gear shown below and asked: "Do you know this old-timer?" On another page we identified it as a 1919 Ford. Readers from all over the country wrote to tell us how wrong we were. Here are some of the letters:



We said it was a 1919 Ford, but it's a 1917 Chevrolet 490



This is a 1919 Ford



This is a
1914 Dodge

This is a
1915 Chevrolet
490



The old-timer on page 44 is certainly not a 1919 Ford. It is a 1917 Chevrolet 490. I, as a boy of 15, drove this car over hill and dale and am well acquainted with its details.

A. G. Bussey,
Los Angeles, Calif.

He is absolutely right—ED.

You say the old-timer is a 1919 Ford but that it's not a Ford top. The reason for the top not being a Ford top is because the car is a 1918 Chevrolet 490.

Delbert D. Daniel,
San Jose, Calif.

I don't know the exact year, but I believe it was one of the first cars built by Dodge.

C. F. Grazioso,
Clifton, N. J.

Compare the photograph with any 1916 Dodge stock touring car. Also compare with any 1916 to 1922 Ford. You will readily agree that it is a 1916 stock Dodge. I should know, I owned one.

William B. Baker,
Council Bluffs, Iowa

Body resembles a Ford but the front fenders, lights and radiator are those of a Dodge. The wheel size is also that of a Dodge with demountable rims. If the Ranger was not standing in front of the steering wheel and windshield I would have more clues.

T. A. Parker,
Brady, Tex.

Just to keep the record straight, this couldn't be a Ford, even a highly rebuilt one. It most probably is a model 490 Chevrolet, about a 1917. And the top is okay.

Cornelius W. Hauck,
Cincinnati, Ohio

The headlights are set up too high and are mounted on U-brackets. The visors on the front of the fenders are rather long. My guess is that the car is a Chevrolet. I hope you continue these old photos.

Henry A. Parker, Jr.,
Johnson, Vt.

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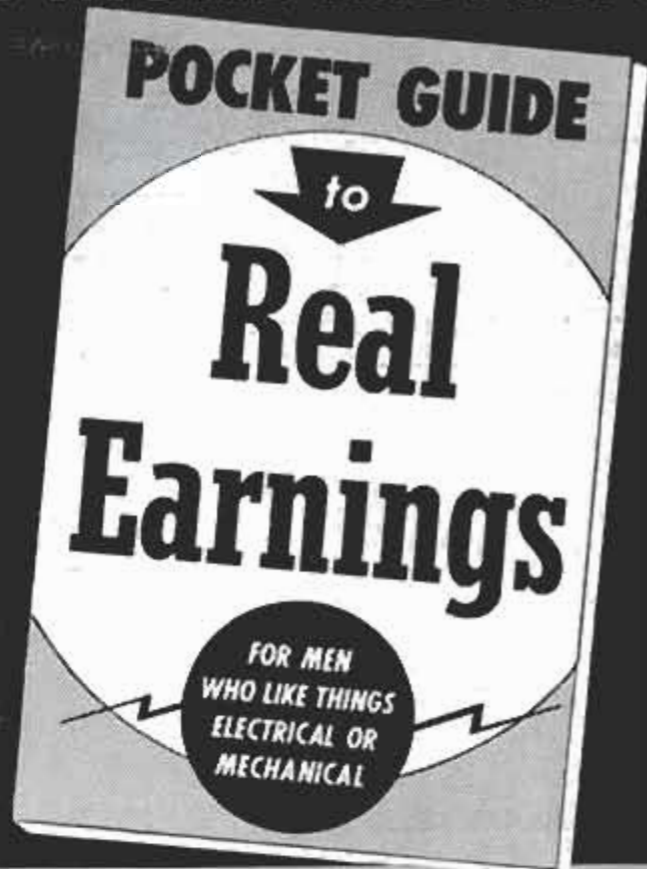
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amateur photographers. With enough different views they can measure the storm in three dimensions. Prints may be mailed to Severe Local Storm Research Unit, Office of Meteorological Research, Weather Bureau, Washington 25, D.C. Mark pictures as to date, time and place, and indicate if you wish them returned.



To the Editor:

One of the top attention-getters at Paradise Airport, just outside Phoenix, Ariz., is the single-seat monoplane constructed by Ken Bowser and Gailord Barker, of Phoenix.

Using no plans, but improvising as they went along, the amateur fliers built a plane which has passed CAA specifications. They introduced many new ideas and managed to buy and salvage pieces from other planes and remodel them.

The plane has a length of 16 feet, modified Luscombe wings which were 35 feet long originally and now are 23.7 feet.

Designed by the two fliers, the throttle is ball-jointed with swivel, which results in no binding. The straps are mounted in the frame and the stick is a push rod with ball-bearing operation, making it easy to handle.



The tubular steel for the fuselage ranges from 3/8 to 1 1/4 inch and was put together by welder Barker. The gasoline tank mounted ahead of the pilot can haul 16 gallons. The plane burns about 4 1/2 gallons to the hour and is powered by a 65 horsepower Continental.

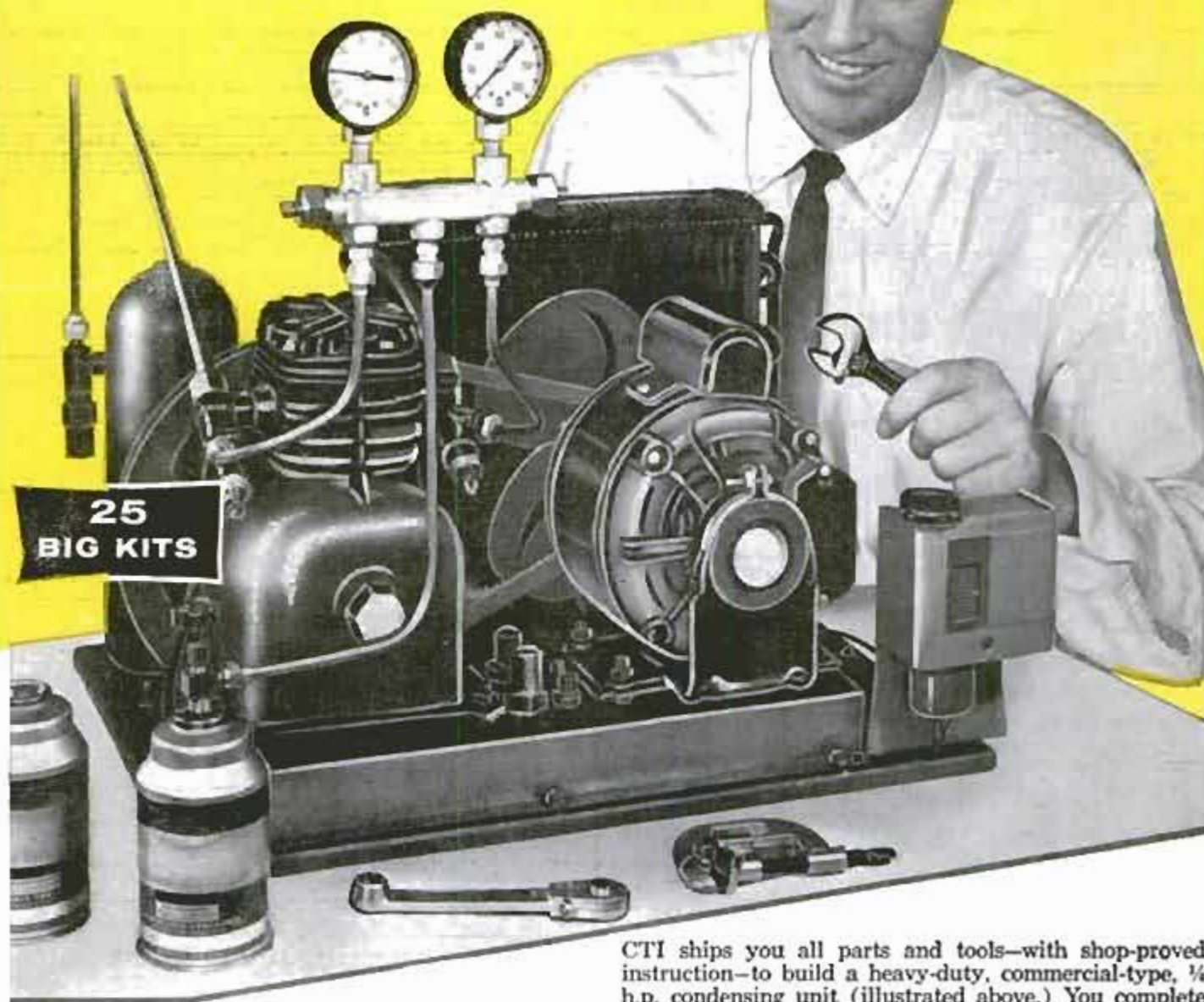
The gear is a Cessna type but cut down, and the heater system was built by the flying team.

Capable of flying at a top speed of 100 miles per hour, the plane can land and take off at around 60 miles per hour and it has gone over 13,000 feet.

Henry F. Unger,
Phoenix, Ariz.

(Continued to page 78)

**THIS is how you train at home
to become a SERVICE ENGINEER
in the Air Conditioning and
Refrigeration industry...**



An old industry offers bright new opportunities

Almost any industry has jobs for men with special skills. In many cases, good pay and steady work are the rule. Yet—would you be happy in being a repairman all your life? Wouldn't you rather have a job that presents a *challenge*—still *bigger money*—an opportunity to *grow*?

Listen, if you are ambitious to *keep climbing*: The air conditioning and refrigeration industry is growing so fast that 20,000 newly-trained technicians are needed each year. They can come only from the technical schools. Because installation and repair work is important, graduates may expect high pay and security right from the start. That's not all. *A well-trained technician has a great opportunity to develop into a Service Engineer.* As a matter of fact, 90 percent of all refrigeration engineers are former repairmen!

If you seek a *career*, not just a job, get into air conditioning and refrigeration. Your first step is to gain skill and knowledge. Learn at home by practicing with 25 big kits that CTI sends. Acquire experience as you train.

CTI ships you all parts and tools—with shop-proved instruction—to build a heavy-duty, commercial-type, 1/4 h.p. condensing unit (illustrated above.) You complete 23 field-type projects—do 10 trouble-shooting jobs. You make home a training center!

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Great Pioneers in Science Do You Know Them?

—By James S. Thistle—

VULCANIZATION of rubber came about by accident. Its developer accidentally spilled some crude rubber and sulphur on a hot stove. The rubber became smooth, elastic and temperature-resistant. At last he had discovered the process that led to the founding of the American rubber industry.

His road to success, however, was not a smooth one. He was unable to get anyone to invest in his experiment. He was also involved in many patent suits, which drained him financially. Finally, in 1852, his legal claim to his discovery was upheld in the famous India Rubber Case.

Daniel Webster represented him in court, but his fee of \$250,000 was more than our scientist ever earned from his researches in science. He went to England and France, established a manufacturing firm that shortly failed. In spite of all his efforts, he died in debt, but others made fortunes from his patents.

*These letters, unscrambled,
spell the name of this
month's Great Pioneer
in Science:*

SHALERODCOYRAGE

(First and Last Names)

Write the correct name here:

Now turn to page 236 for the answer.

POPULAR MECHANICS

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

McMORROW, BERMAN & DAVIDSON

Registered Patent Attorneys

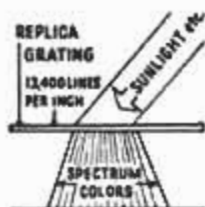
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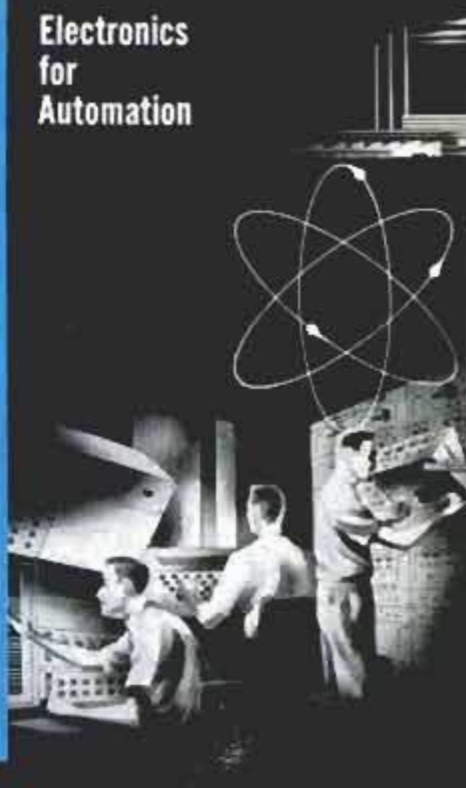
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Sketch and describe your invention. (For convenience in starting action on your invention, use "Evidence of Invention" form offered below.)

Sign, date and have this invention disclosure witnessed by two people capable of understanding your invention.

Have us make a preliminary search among U. S. patents already granted for similar types of invention.

We then prepare a report for you on the probable patentability of your invention and recommend your further course of action.

This firm is registered to practice before the U. S. Patent Office. We are available to assist you in the preparation and prosecution of your application for patent.

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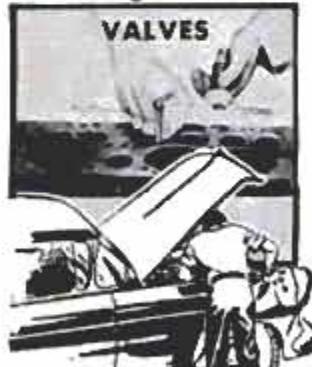
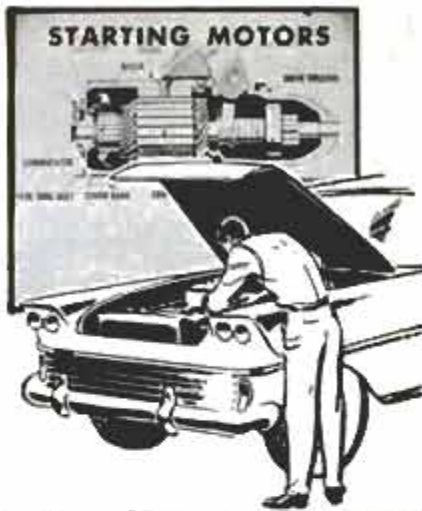
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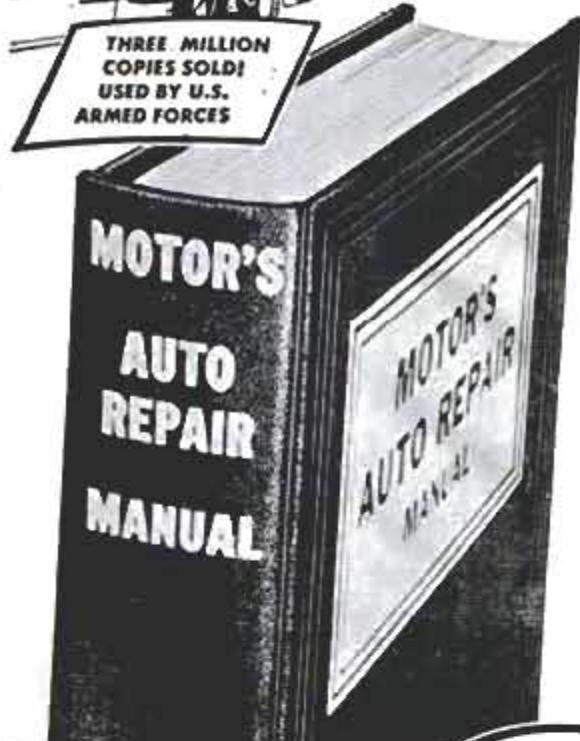


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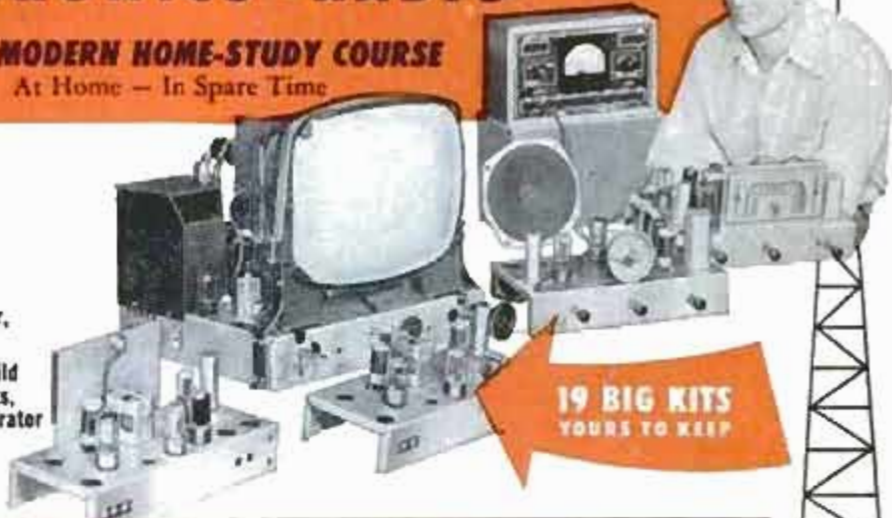
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All over the country it's happening. You may even know some of the men who already have started home operated businesses of their own in their spare hours. They keep their jobs. The "boss" doesn't know they are planning for independence. They do not have any heavy investments in equipment or inventory, because they buy their raw materials as they are needed. They have no overhead expense because they operate their businesses from their homes.

Yet hundreds are quietly developing a second source of income—an extra income right now for their spare hours; and a business that can be quickly expanded if it were ever necessary to look to it for complete support.

These "little" home businesses are little only in the sense that they require little capital to start and run, and they require little time on the part of the owner. The margins of profit in some of them are so fantastic as to be almost unbelievable—far greater than those usually enjoyed by big investment manufacturing.

And, there are many kinds and types. For the man who is mechanically inclined there are businesses in which he can use his hands as well as his head. For those who have no aptitude with tools there are small manufacturing operations that are almost automatic in their production methods.

One of the features found in many of these businesses is a wide and ready market for the product. Usually it is a product too small in total national market to attract the attention or envy of the big investors. So, the danger of competition from big operators is absent. Usually it is a product that enjoys a neighborhood demand so that good markets are found in any size community from the small town to the neighborhoods of the big city. Usually the cost of the raw materials is only about one tenth the selling price. One such product costs 11c for raw materials, yet sells readily for \$1.00. Another sells for \$6.50, yet the raw materials cost only 55c. Still another returns \$1.80 for each 27c worth of raw materials.

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(ALARM DIVISION)

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New York 16, N. Y.

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850x14	7.52	760x15	4.72	640x15	5.32	700x16(r)	8.72
750x14	7.52	800x14	8.72	1100x29	19.52	1100x22	20.32
700x18(6)	\$9.92	700x20	\$10.92	750x17	\$13.72	825x20	\$19.52
750x18(8)	11.62	750x20(10)	15.22	600x20	9.92	900x20	19.72
700x17	10.92	750x20(8)	13.32	650x20	11.32	1000x20	19.92

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G-5

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How To Stumble Upon A Fortune in GEMS

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Next time you trip on a rock—examine it carefully. You may have "walked into" a real fortune—unexpectedly.

In a single year, over half a MILLION dollars worth of stones were found by week-end gem hunters. A youth pitching horseshoes in an open lot picked up a stone and kept it in his pocket for 15 years before he discovered it was the largest alluvial diamond ever found in the U.S.A. ... 84.46 carats in weight.

Two salesmen went gem-hunting on vacation and found a small pocket of "Tourmaline," a semi-precious, crystal gemstone, worth \$13,500.

Are You "Passing Up" Real GEMS Near Your Home?

Valuable gems are all around us—half hidden by surface dirt and other rock. Perhaps in an abandoned quarry near your home, a river bottom, a rocky hillside, a beach, or an old cave. If you know WHERE to look and how to RECOGNIZE the more precious stones—you can enjoy an educational hobby that can pay off BIG.

Now you can enjoy and profit by gem-hunting—no matter where you live in

the U.S.! Brand-new book, "Gem Hunter's Guide" tells all you need to know. Exactly where

to find scores of precious and semi-precious gems. Where to find rich PEARL-bearing mussels. Complete town-by-town and county-by-county index helps you plan week-end and one-day gem hunting. How to recognize each variety.

53 Gem Stones Shown in Natural Color

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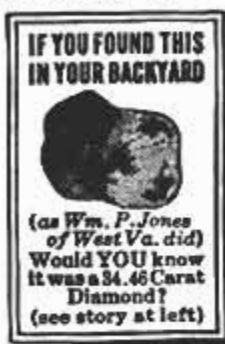
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Science & Mechanics Magazine
450 East Ohio Street, Chicago 11, Illinois



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- 48,000 Diamonds have been found in Arkansas alone?
- A Diamond weighing over 20 carats was found in Va.?
- A vast region surrounding the Great Lakes holds the greatest store of Diamonds yet to be found in the U.S.?
- Gem sapphires are found in Colorado, Idaho, Montana, and North Carolina?
- For every diamond already found in this country, there are thousands more yet to be found?
- A cowboy found an Opal worth \$280,000.00?
- Mid-west streams have produced as much as half a million dollars worth of pearls in a single year?
- 10-pound Turquoise nugget, believed largest ever found, discovered recently in one of our western states?
- Valuable Gems are discovered in all parts of the U.S.—even in New York City area?



tells you:

MANY WAYS to test rocks to see how valuable they are; the color tests, hardness and specific gravity tests

HOW to plan a week-end gem-hunting trip

LOCATIONS where gem materials are found in EACH State—complete town and county index; with 81 detailed road maps giving gem-material locations

WHERE rubies are found in Georgia, Idaho, New Jersey and No. Carolina

How to make the drab rocks glisten like

magic with "black light"

HOW TO IDENTIFY over 75 different gem materials by hardness, composition, color, luster, cleavage, associated rocks, etc.

METHODS for classifying gems by families.

WHERE big diamonds, pearls and rubies have been found in the U.S.

A SIMPLE PLAN for finding and harvesting pearl-bearing mussels

THAT GEM QUALITY emeralds may be found in Maine, Massachusetts, New Mexico, Nevada, and North Carolina

... ALSO special full-color portfolio shows 53 gem materials in their natural state.

Science & Mechanics Magazine, Dept. 196 450 EAST OHIO STREET, CHICAGO 11, ILL.

Please send me—for 5 days' FREE EXAMINATION—a copy of the "Gem Hunter's Guide" packed with pictures, maps, charts, expert advice telling where gems may be found. Unless completely satisfied with the book at the end of 5 days' examination I may return it and owe nothing. Otherwise, I will keep it and send you only \$3.95, plus 50c to cover postage and handling charges.

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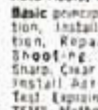
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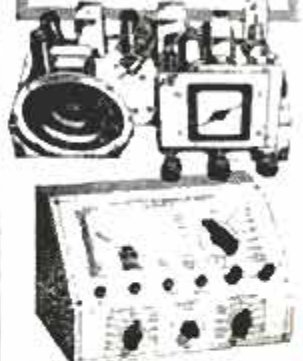
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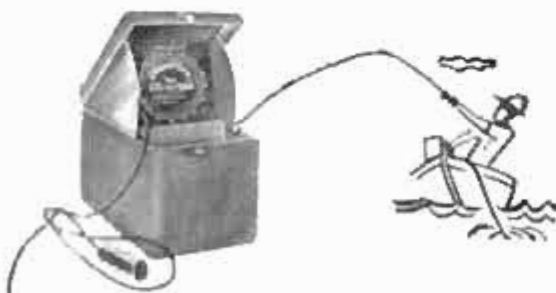
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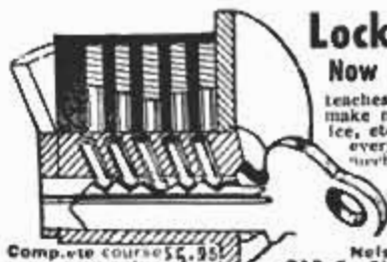
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However, to the average person, manufacturing brings up pictures of huge industrial plants with smoking stacks and with thousands of employees. Yet, recent figures from the Department of Labor and the U. S. Chamber of Commerce reveal that the total amount of small manufacturers, with limited facilities, still makes them the dominant factor on the American Industrial Scene.

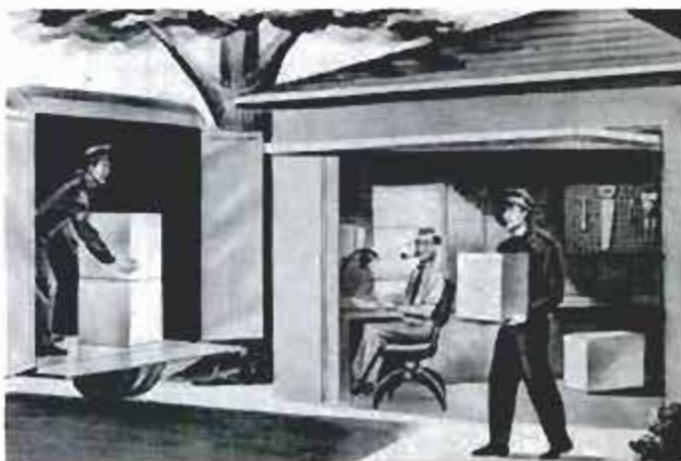
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YOUR Own successful business can bring you \$20,000 a year regularly, by mail at home. Know-how is important, investment isn't. Get free details, then decide. DeLang Research, Box 52-D, Burlington, Iowa.

\$1 PAYS \$16.00. Enclose \$1 bill, receive charges prepaid materials for making \$16.00 worth sensational new tire cleaning discovery. Lifetime opportunity. Money-back guarantee. Watts Products, 4809 Poplar Level Rd., Louisville 13, Ky.

BOSS Your own home business. Profits 1200% to 3000%! Make, distribute stunning Shellcraft jewelry. Sells itself wherever displayed. Big repeat demand. Details free! Shellcraft, Dept. A, Box 804, Panama City, Florida.

LEARN Upholstering. Supply sources. Free information. Write Shelton, Box 5101, Nashville, Tenn.

MAIL Order opportunities galore! Details free! Write: Mail Order Publications, 5204 37th Street North, St. Petersburg 14, Florida.

MONEYMAKING OPPORTUNITIES

MAKE Big easy profits making costume jewelry at home in spare time! Quick, easy to make; easier to sell! Details free! Don-Bar, 3511 W. Armitage, Dept. C-192, Chicago 47, Ill.

MAILORDER Beginners. Sell our manual. Million prospects. Free guidance. Thayer Products Co., Bath, Maine.

MAKE And save money. Beautiful, imported "Black Forest" cuckoo clocks. Hand carved wood case. Price \$23.77 each. \$30.00 up retail. Cash or money order. Mauzy, 2915 Clairmont Ave., Birmingham 5, Ala.

AMAZING Money making mail order opportunity. Experience unnecessary. Free details. Write Richton, 231 Wyoming, Maplewood 22, New Jersey.

INVISIBLE Reweaving: \$5 in one hour possible reweaving burns, tears, moth-holes. Spare-full time. Free details. Skill-Weave, Dept. SC-163-A, 335 W. Madison, Chicago 6.

BE Appointed state notary public now. Details. Stationers, 515 East 33rd, Kansas City 9, Missouri.

\$340.00 MONTHLY With jigsaw. Details. Elkman, 346F North Summit, Sioux Falls, So. Dak.

AMAZING Magazine with moneymaking suggestions. Sample 10¢. Pinkerton, 1738-B North West 12th, Oklahoma City 6.

BIG Profits making flowers. Beginner's outfit, \$1.10. Hauser House, Box 6524-P, Phoenix, Arizona.

ASTOUNDING Profit raising earthworms. Details free. Raising instructions 25¢. C. Barnes, Box 135, Pulaski, Tenn.

FREE Imports from overseas. Particulars free. Henry Bassen, Importer, 828 Fullerton, Chicago 14, Ill.

EASY To start rubber stamp business at home in spare time. Make up to \$9.80 an hour without experience. Facts free. Write to Roberts, 1512 Jarvis, Room CR-2-A, Chicago 26.

SELL The new \$29.95 Regina adding machine. Everyone a prospect. Write for free information. Holes-Webway Co., St. Cloud, Minnesota.

FREE Plan and help. Start home mail order business. In 1952 I was almost broke. Today I own \$18,000 home, drive Cadillac, have bank account. Anyone can do this. Norris Cole, 217 West 49th, Bradenton, Florida.

SNAKES Are worth up to \$25.00 each, lizards \$8.00, turtles \$25.00, toads and frogs \$1.75. We buy all kinds, sizes. Full details and collectors brochure 25¢. Biological Exchange, 1211L Wagner Lane, El Paso, Texas.

MAKE Money writing short paragraphs! No tedious study. I tell you what to write, where and how to sell; and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell, right away. Send for free facts. Benson Barrett, Dept. C-27-A, 7464 Clark, Chicago 26.

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

START Big-pay business at home in spare time. No experience needed to operate little table-top machine for bronzing baby shoes. Make \$5.46 profit on every pair. Full particulars free. Send postcard to Mason, 1512 Jarvis, Room CM-2-A, Chicago 26, Ill.

MEN—Women! Start money-making plastic laminating business at home in spare time. Material that costs 11¢ brings back \$2.50. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars free. Rush name on postcard to Warner, Room CL-2-A, 1512 Jarvis, Chicago 26, Ill.

EARN Cash at once, sending us easy orders for magazines your friends, neighbors want. Instant profits! We show how. For free kit, everything you need, write McGregor Magazine Agency, Dept. 321, Mount Morris, Ill.

HOW To make money—Over 150 plans \$1. Catlin, 68 North Ellsworth, San Mateo 8, California.

AMAZING Successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, MP-528, 333 North Michigan, Chicago 1.

WIN Contests. Complete information, 10¢. Spence, Box 11569, St. Petersburg, Fla.

MUSHROOMS Quicker, easier, cheaper. "Magic" preplanted trays. Newest facts free. Spawn \$1.00. Luxur, 641 South 19th, Newark 3, N. J.

JOIN The prosperity parade with a mail order bookshop in your own home. Valuable information free. Practical Publications, 3974-F Milwaukee, Chicago 41, Ill.

SELL Titania gems. Far more brilliant than diamonds. Catalog 10¢. Diamonite, 2420-M 77th, Oakland 5, California.

SELL Information by mail. 10-to-1 profit ratio. Valuable suggestions free. Rawson F. Wood, 3974 Milwaukee, Chicago 41.

EARN Money evenings copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

BOOKS: Hundreds of subjects. Big 1958 book catalog—10¢. Popular Mechanics Press, 200-BC East Ontario St., Chicago 11.

WIN Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests, rules. Sample magazine 25¢. General Contests, 1609½ East 5th, Duluth 12, Minnesota.

FREE Folio "\$5,000-\$45,000. Unlimited vacations." No merchandise. Unknown! Work home, sparetime! Haylings, Carlsbad, Calif.

MAKE Money, operating mail order business, selling business cards. Vosacek Printing, 4444A Ute, San Diego 17, Calif.

CIGARETTES—Improved roller makes 20 for 9¢. Facts free. Moberly, Box 821, Owensboro, Kentucky.

READ Progressive Mailtrade, the magazine that tells how to make money by mail. Dime brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

WE Pay \$3.50 lb. dried. Grow mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We pay \$3.50 lb. Free book, Mushrooms, Dept. 173, 2954 Admiral Way, Seattle, Wash.

OPPORTUNITIES. Unlimited. 100 selected, small manufacturing opportunities. Exciting details, free. Alpha-Midwest, LaPorte, Indiana.

HAMMER? Saw? Drill? \$100 weekly. Jet, Box 422, Escondido, California.

\$3.00 HOURLY, Sparetime. Typewriter required. Confidential home-setup 35¢. Interstate, 37 Besch, Albany 9, N. Y.

A Store of your own. How to obtain and operate without capital told in revealing booklet. \$2.00 postpaid. 10 day money back guarantee. Charles Cammer, 2711 De LaVine, Santa Barbara, Calif.

LONGINES, Hamilton, Benrus, Gruen, Bulova, and Elgin. One of the world's largest suppliers of new and rebuilt watches. Lowest prices. Ladies' and men's. \$6.95 up. Write for catalog. Mars Watch Co., Dept. 11-C, 421 S. Los Angeles St., Los Angeles 13, Calif.

"COLLECTIONS Unlimited" offers fascinating agency proposition! Extraordinary. Box 1346-PM, Denver 1.

PROFITABLE Unique coin jewelry. Easily made. Instructions \$1.00. Albert, 809 San Luis Rey, San Diego 8, Calif.

FREE Gift 5 money making plans. Discount catalogue. Coupons worth \$10.00. All \$1.00. Edith's Service, Box 984, Globe, Ariz.

BIG Money in imported paintings. Buy direct at low low prices. Free details. Hrebenyar Company, 4436-C Hamilton Scipio Road, Hamilton, Ohio.

SELL Books by mail. 400% profit. Royal, Box 388-X, Cleveland 27, Ohio.

LEARN Managing money-raising campaigns for churches, hospitals. Handsome fees. Free proof. John Arbogast, 229 East Mason Avenue, Alexandria, Virginia.

FABULOUS Opportunities still exist. Learn to buy and sell real estate for profit. Egan, 17579 Ohio, Detroit 21, Michigan.

\$20 DAILY Spare time plating baby shoes, jewelry, novelties. Free details. Jo-Ca Electroplater, 7840-D Northwest Sixth Court, Miami 50, Florida.

MAILORDER Success secrets revealed by new magazine. Free details. Mailorder Income, 2639-23 Howard, Chicago 45, Ill.

RECEIVE Magazines, samples, mail, catalogs, offers, from everywhere. Get listed. \$1.00. Helen T. Todd, 107-A Pardee St., San Antonio 10, Texas.

RAISE Earthworms for health and profit. Free literature. Edith, Terra-Vermis, Allegan, Michigan.

MONEY Maker—A travel business you can run from your home. Practically no investment. No experience required. W. Anderson, 3933-PM No. Clarendon, Chicago 13, Ill.

\$200.00 DAILY Potential guaranteed! Sawdust product, demanded everywhere! Retraining, sacrificing formula at \$1.00. Starduster, Hendersonville, Tennessee.

MAKE Money gathering herbs, roots, barks, moss, cones, flowers, leaves, etc. Free folder. Kelley, B-10-M, Looneyville, West Virginia.

HOME Mail order sales. We love money, do you? Sell my booklet, "Successful Job Interviewing" 100% profit each. Take advantage of present unemployment. Sample, instructions, \$1.00, satisfaction guaranteed. Box 717, Endicott, N. Y.

START A profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions on all subscriptions. Supplies free. No experience needed. Send this ad with your name and address to: Popular Mechanics, Room 3-0, 250 West 55th St., New York 19, N. Y.

BEGIN Immediately. Make money from empty cigarette packs. Complete instructions. \$1.00. Kokinda, Simpson Avenue, Duryea, Pennsylvania.

FORMULAS, PLANS, ETC.

4 PROFITABLE And useful formulas \$1.00. John Palmer, Box 294, Sacramento Calif.

CAST Plastic opaque. Guaranteed. Write Plastic, 2875 N. Elston Ave., Chicago 18, Illinois.

FORMULAS: All kinds, latest, best. Literature free. Kemixal, Park Ridge, Ill.

LATE, Modern manufacturing formulas. List free. Moon Chemical, Martville, New York.

FORMULAS For latest money-making discoveries. New! Good! Valuable literature free! Miller, Chemist, 1517-D, Tampa, Florida.

PLASTICS

LAMINATING Plastics. All types plastic sheets, vinylite, acetate, plexiglas. Free catalogue. Arthur Blank & Co., 44 Cummington, Boston 15, Mass.

NEW Liquid casting plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks "How to Cast Liquid Plastics" and "How to Make Extra Money at Home." Castolite, Dept. C-101, Woodstock, Illinois.

PHOTO-Seal. Complete electric laminating kit for wallet size photos, cards. \$14.95. Refills available. Therm Appliance, St. Charles, Illinois.

LAMINATING Supplies. Free price list. Solomson, 46 Cornhill, Boston 8, Mass.

BOXES. Plastic. Free list. Althor, 170 Bay 23 Street, Brooklyn, N. Y.

LEARN Plastics fabrication for spare time income. Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-3, Portland 13, Ore.

NOW — Electric plastic laminating kit. Burr, 330 East Center, Kalamazoo, Mich.

NEW Do-it-yourself casting and molding plastics! No experience or machinery necessary. Send 25¢ for big 64 page catalogue. Castacraft Corp., Dept. C-22, P.O. Box 555, Palo Alto, California.

PLEXIGLAS. Square foot cost. 1/16", \$1.20; 1/8", \$1.52; 3/16", \$1.86; 1/4", \$2.21; 3/8", \$3.23; 1/2", \$4.36. Colors add 10%. Send 15¢ for postage. Aristocrat Plastics, 23 Sussex Avenue, Newark, N. J.

CHEMISTRY

MICROSCOPE Slides, anatomical. Free list. Bay, 409 Roosevelt, San Francisco 14, California.

EXPERIMENTERS: Bargains galore catalogue, 25¢ (refundable). Hagenow Laboratories, Manitowoc, Wisconsin.

CHEMICALS And apparatus for industrial, analytical, and private laboratories. Catalog 25c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 25¢. Tracey Laboratories, Evanston, Illinois.

AMAZING New book of science experiments, formulas, and catalogue of laboratory supplies. Only 25¢. National Scientific Co., Dept. PM-3, 11 E. St. Charles Road, Lombard, Illinois.

350 SCIENCE Pocket-books! Comprehensive catalog, 25¢. Details. Fabian's, 4370-P Clark, Montreal 18, Canada.

CHEMISTRY Catalog, 25¢. Experiment book, 25¢. Laboratory Sales, Box 161-A, Brighton, Mass.

VISUALIZED Chemistry-science books! Information free. Franks, 3121 South Racine, Chicago 8.

AGENTS WANTED

FREE Sample! Beautiful feather pictures. Send 14¢ stamps mailing. Sylviak, Apartado 9036, Mexico 1, D. F.

BUY Wholesale — Shoes, shirts, pants, underwear, etc. Complete catalog. Bostonian, 14-C Dock Square, Boston 8, Mass.

WHOLESALE Jewelry closeouts! Catalogue! A&S Distributors, 677 Washington, Norwood, Mass.

MAKE Money selling bumper signs, decals. Box 2223, Paterson, New Jersey.

SALON Reducing tables, rollers, belts, cushions, slant boards. Coin timers factory. Mary-Mac, 1012 Powhattan St., Dallas 2, Tex.

EARN \$12,000 Yearly Only two sales daily. World's best seller, The Holy Bible. Illustrated. Protestant or Catholic. Margaret's, P.O. Box 92, Hazleton 7, Penna.

EASY Handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Massachusetts.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics Magazine, Room 305M, 200 E. Ontario St., Chicago 11.

GOLDMINE Of 600 money makers. Free copy. Specialty Salesman Magazine, Desk 5B, 307 North Michigan, Chicago 1, Ill.

PRINTING, Advertising salesmen—Excellent moneymaking sideline selling decalcomania name plates, small quantities. Automobile initials, sign letters. Free samples. Ralco, XL, Boston 19, Mass.

GOLD Or silver letters, numbers. Windows, doors, trucks, 1" to 6". 500% profits. Free samples. Atlas-T, 544 West 79th, Chicago 20.

AGENTS — 300% Profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 1217-D West Newport, Chicago.

YOUR Ad in this space will get some good agents for you. Yes, I'll prove it. Write for Folder "A" right now. F. W. Johnson, Classified Advertising Manager, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

YOUR Own business — Used suits \$1.50, overcoats 65¢, mackinaws 35¢, shoes 12 1/2¢, ladies coats 30¢, dresses 15¢. Enormous profits. Catalog free. Nathan Portnoy Associates, 2109-AA Roosevelt Road, Chicago 8.

CASH Commissions at once, taking orders for magazines every family wants! No experience needed. For free money-making kit, with everything you need, write McGregor Magazine Agency, Dept. 301, Mount Morris, Ill.

RUN A spare-time greeting card and gift shop at home. Show friends samples of our wonderful new 1959 all-occasion greeting cards and gifts. Take their orders and earn up to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 31, Ferndale, Michigan.

MAKE \$50-\$300 Quickly, easily, showing outstanding all occasion, Easter cards, costume jewelry, gifts, imprinted stationery, household items. Costs nothing to try. Bonus to 7%. Special plan for churches, organizations. Write for best-sellers on approval. Free surprise gift offer, money-making details. Hedenkamp, 361 Broadway, Dept. PM-55, New York City.

SHINE Cars without polish. New invention. Lightning seller. Cars gleam like mirror. Samples sent on trial. Kristee 61, Akron, Ohio.

SELL Miculite coatings or lubricants. Guaranteed. Some commissions 50%. Miculite, Box 8335, Fort Worth, Texas.

NEW Car thief signal. Lightning seller. Samples sent on trial. Northwest Electric, 108, Mitchell, S. Dak.

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto fire extinguisher. New chemical used by airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E.32nd, Dept. P-66W, New York City 16.

\$10.80 PUTS You in business. Take in \$24.00. Get 24 8-oz. bottles guaranteed vanilla flavoring. Repeat orders. F.o.b. Betty Cunningham Co., Box 1, New London, Ohio.

FLYING Outboard. \$1500, car needed. Box 291, Dana Point, California.

TURN Your spare time into cash! No "selling" needed with items like these; you just sit back and take orders during your spare time! Over 700 fascinating items: Gifts, gadgets, toys, greeting cards, and novelties that sell themselves on sight. Write today for details and free, colorful catalog. Samples on approval. Greetings Unlimited, 9-311 Park Square, St. Paul 1, Minnesota.

60% PROFIT On cosmetics — Famous nationally advertised Hollywood cosmetics get 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, Calif. Dept. 1293G.

SEEKING New products? Get my outfit 47 money-making specialties. Latest conveniences for home, car. Send no money. Just your name. Kristee 60, Akron, Ohio.

IMPORT Dropship franchise. Personalized and advertising cigaret lighter line. Nice profit. Details \$1.00 (credited towards first order.) Write Cooke & Co., 3, 1-PM, Chome Yurakucho Chiyodaku, Tokyo, Japan.

SELL. Profitable imports. Literature free. Dale, 1959 Clays Mill Rd., Lexington, Ky.

SELL Champion, AC, Autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles, 100% profit. Free sample. Lee Plugs, 1608-E Roberts, Houston 3, Texas.

"BEST-Gro" plant food is a necessity that brings repeat business, generous profits! Mail \$2.00, refundable, for sales pack. Dealer's prices. Best's Nursery, Kissimmee, Florida.

DAMASCENE Earrings! Exotic orientalism. Huge profit. OHGA, PM141, Sigakenkusatu, Japan.

GET Into toys! Gunsmoke—Matt Dillon cowboy vest, top seller. Many other products. Styleco, Dept. 889, Cincinnati 10, Ohio.

WANTED Fire extinguisher salesman. Huge profits. Out-o-Matic, 1737 W. E. 31st, Denver 5, Colo. ☐

BUY IT WHOLESALE

ILLUSTRATED Wholesale merchandise catalog 25¢. Staffords, 806 N. Emerson, Indianapolis 91.

FREE! Beautiful sample doll, authentic sleeping eyes, with wholesale discount catalogue, 50¢. Refunded \$5 order. Amazing savings. Thousands of items. Pecks, 501 South 8th, Independence, Kansas.

DIAMOND Rings! Below wholesale, catalogue. Distributors, Box 106Z, Hudson, New York.

HANDMADE Western boots. Free catalogue. Hall Boots, Box 7074, El Paso, Texas.

AMAZING Savings. Wholesale catalogue \$1.00, refundable. Coleman's Personal Shopping Service, Wayland, N. Y.

ACCORDIONS Wholesale! Save 1/2. Home trial. Free catalog. Accordion Warehouse, Dept. 39-RW, 2003 Chicago, Chicago 22.

TREMENDOUS Savings. Large wholesale catalog. \$1.00 (refundable). Robert Barcker, Dewey Rd., Amherst, Ohio.

BUY Wholesale: 100,000 nationally advertised products. Appliances, cameras, sporting goods, housewares, watches, typewriters, tools, clothing, etc. Discounts to 80%. Buy-Rite, Box 258, Hawthorne 104, New Jersey.

USED And new watches \$2 up. Free list. Southern Watches, 5-PM So. Wabash, Chicago 3.

MOST Unusual catalog—Gift included. 25¢ (refundable). Seegay, Box 10126, San Antonio 21, Texas.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin PMW, Covina, Calif.

LARGEST Wholesale supply source in U.S.! Furniture, clothing, appliances, housewares, automobiles and accessories, tools, sporting goods, hobby supplies, farm equipment, imports, new products, bargain merchandise. Free details. Associated Wholesalers, Box 2068-DD, Sioux City 4, Iowa.

PLYWOOD Wholesale. Fir or hardwoods. Send 20¢ for price lists. Lewis, Box 172, Medford, Oregon.

I Can get it for you wholesale! Clothing, appliances, household goods. Even automobiles. Free information on our service. Frank's, Box 547, Paducah, Kentucky.

RONSON And Zippo type lighters. \$5.50 dozen postpaid. Midwest Imports, 430 South, Springfield, Missouri.

BIG Multicolor wholesale catalog! Housewares, appliances, clothing, silverware, cookware, luggage, binoculars, shavers, radios, phonographs, cameras, projectors, recorders, typewriters, sewing machines, furniture, power tools, toys, sporting goods, watches, diamonds, jewelry, automobiles, etc. Name brands. Huge discounts. Postcard: Selbyco, Decatur 154, Illinois.

SELLING Out many items less than wholesale. Catalog 10¢. Cewaco, 5921 Lowell Road, Everett, Wash.

JEWELRY. Watches, perfume, pricelist 25¢. 3208 Oriole, San Jose, California.

BUY Wholesale! Tremendous discounts available! United Wholesalers, 1265-M Broadway, New York 1, N. Y.

SALESMEN—DISTRIBUTORS

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto fire extinguisher. New chemical used by airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd, Dept. P-66W, New York City 16.

GET New shirt outfit free! Make \$90.00 weekly on 5 average orders a day. Famous quality made-to-measure dress and sport shirts at \$3.95 up sell fast to all men. No experience needed. Full or part time. Write: Packard Shirt Co., Dept. 841, Terre Haute, Ind.

AD Match sales! Your own business, without investment! Sell for world's largest direct selling manufacturer of advertising matchbooks. Big spot cash commission. Start without experience. Our tested sales kit tells you where and how to get orders. Men, women, part or fulltime. Match Corporation of America, Dept. PM-39, Chicago 32.

AMAZING Opportunity. New low priced fire alarm protects homes, farms, offices, factories, etc. No wiring, hangs like picture. Pays up to \$1,100 a month. Free kit. Merlite (Alarm Div.), 114 E. 32nd St., Dept. F-66W, New York 16, N. Y.

MAKE Big profits calling on business men. Free details. Box 77A, Flat River, Mo.

SELL New 49 star flag. Wales Manufacturing, 47 W. 63, New York City 23.

SELL Utility jeeps, wagons. Big demand, high profit. Send 10¢ for folder and prices. Custom Car Company, Rockford, Illinois.

\$6.73 PROFIT On every sale of lightning portable adding machines, retail \$14.95. Wide market. Full details, actual size. Color photo free. Lightning Adding Machine Sales Company, 2306A West Slauson Avenue, Los Angeles 43, California.

MAKE Extra money—Big cash commissions plus premiums for you and your customers. Sell advertising book matches. Sensational new tenoramas, gamon, girls, hillbillies; dozens others. All sizes. Quick daily sales; big repeat business. Free master kit makes selling easy. No experience necessary. Superior Match, Dept. M-359, 7530 Greenwood, Chicago 19.

MY Free outfit puts you in a fine business! Just 8 easy orders a day brings you up to \$960 extra a month in big money shoe business! Complete line air cushion shoes for men, women. Rush postcard for powerful free selling outfit! Mason, Chippewa Falls K-136, Wisconsin.

WILL You wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to \$30.00 in a day even in spare time, without canvassing. J. C. Field & Son, Inc., Dept. L-1826, Harrison & Throop Sts., Chicago 7, Ill.

I'LL Send you free stocking sample newest advancement in hosiery since nylon. Patented, full-length. Stays up over-the-knee without supporters, without girdle! Nationally advertised price \$1.95. Make money introducing to friends at \$1.00 pair. American Mills, Dept. 674, Indianapolis, Ind.

CALENDARS. Advertising novelties, matches. All styles, including religious, varnished. 12 sheet, girls. Hundreds of advertising novelties, book matches, etc. Fleming Calendar Co., Sales Division, 6539 Cottage Grove, Chicago 37, Ill.

BIG Money making opportunity. Exclusive line uniforms, jackets, pants, shirts, coveralls, sportwear. Advertising embroidered. Every business prospect. Get selling outfit free! Master Co., Dept. K-21, Ligonier, Indiana.

ANYONE Can sell famous Hoover uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics: Nylon, dacron. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. C-100, New York 11, N. Y.

SALESMEN—Big money every day showing nationally known drain cleaner. No chemicals. Nothing like it. Minute demonstration. Commissions paid daily. Sample furnished. Campbell Co., (Est. 1928), Rochelle 604, Illinois.

IF You're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine. Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 17, Chicago 10, Illinois.

TAKE Over your area—Agents, dealers, farmers, make \$125 up weekly selling nationally advertised Campbell's Go-Green liquid fertilizer concentrates. No investment. Everything free. Campbell Co., (Est. 1928), Rochelle 5, Illinois.

INCREASE Your earnings by applying time proven sales methods. The selling plan in "The Magic Key to Selling" has greatly increased the earnings of thousands of salesmen. Send \$4.98 today for this effective selling plan. Satisfaction guaranteed. Specialty Sales Consultants, P.O. Box 222, Muncie, Indiana.

"SPIRITUAL Birth certificates." It's new, marvelous, unique, exclusive, fascinating, beautiful, copyrighted. Market goal 125,000,000 certificates. Possibly \$70.-000,000 retail sales. Franchise available to qualified jobbers, distributors, salesmen, etc. Write Spiritual Birth Certificates, Red Springs, North Carolina.

SELL Australian boomerang. Information and sample \$2.00. Far Horizons Imports, Box 252, Felton, Calif.

\$10,000 A Year selling steel shelving, parts bins-cabinets-shop equipment. Sold everywhere! Terrific commissions. Free 32-page catalog. Jobber discounts. BFC Corporation, 2800 E. Hedley, Philadelphia 37, Penna.

IT Ain't sellin'—Just servicing! Take over your area as our service distributor keeping retail stores supplied. Nationally advertised 29-year-old line pays you 66 2/3% mark-up. For samples and highly successful plan, write Novo, Inc., 1166-T Milwaukee, Chicago 22, Illinois.

100% PROFIT. Fast easy money! Take orders for Sweet Georgia Brown cosmetics. Colored people buy quick. Free sample. Valmor, Dept. TD, 2451 Michigan, Chicago 16.

EMPLOYMENT INFORMATION

MIAMI Opportunities. \$1 for ads. Maco, 864 W. 73rd Pl., Hialeah, Fla.

AMERICAN Overseas jobs. High pay, men, women. Transportation paid. Free information. Write Transworld, Dept. 12D, 200 West 34th St., New York City.

JOBS On ships. Write for free information. World Wide Seamens Service, Box 1445-PM, New York 1, N. Y.

LOS Angeles employment, housing, business opportunities \$1.00. Hall, Box 4011, N. Hollywood, Calif.

WANT A good job? High pay? Overseas—U.S.A.? Free information. Employment Headquarters, 79 Wall Street, Dept. 340, New York City 5.

500 NAMES, Addresses of U. S. firms operating overseas. Send \$2.00. Fileco, 1456 Jones, San Francisco 9.

RUN Profitable advertising business. Particulars free. Industrial, 82 Pioneer, Dayton, Ohio.

MEN, Women. U. S. A., foreign jobs. High pay. Construction, clerical, supervisory, shipping, aviation, oilfields, etc. Skilled, unskilled. Free transportation, adventure, promotions. Unusual opportunities. Complete information plus worldwide project listings. Only \$2.00 (\$2.25 airmail). Satisfaction guaranteed. International Reports, Dept. E, P.O. Box 621, San Jose, California.

CALIFORNIA Jobs and pay rates. New 48-page book lists firms, jobs, wage and salary information. Valuable sample employment tests, essential job-getting information. Send \$1. Periday Co., Box 331, Inglewood, California.

MERCHANT Marine jobs. Top wages. Ship's captain reveals how to join. Beginners book \$2.00. Details free. Captain, Box 501-P, Reading, Massachusetts.

JOB Hunters—Procedure booklet, secrets; \$1.00. Counseleers, 514 Forest, Collinsville, Illinois.

ALASKA Hourly scale: Laborers \$4.16; truck drivers \$4.45; carpenters \$4.38; plumbers \$5.00; electricians \$5.00. Construction projects awarded over \$335,000, -000.00. Names and addresses of companies hiring; total contract awarded; location; wage scale; also information regarding homesteading. Send \$1.00 to Alaska Employment Opportunities, Box 1032, Anchorage, Alaska.

JOBS Overseas! Write Janecek Development Co., 109 Hub Station, New York 55, N. Y.

INFORMATION—U.S.A. overseas jobs. High pay, transportation. Futures, Dept. M, 215 West 34th Street, New York City 1.

FOREIGN Jobs—Latin America, Alaska, Canada, up to \$1500 monthly. Up-to-date 1959 foreign service directory gives complete information; hot list of firms hiring for military and civilian construction, aircraft, oil, exporters-importers, mining. How-when-where to apply. 11th successful year. \$1.00. Global Reports, Box 8873-S, Los Angeles 8, Calif.

JOIN The merchant marine. For information write Box 4092, Jacksonville 1, Fla.

ALASKA Information. Unlimited opportunities. Homesteading, employment. 25¢. Haase, De Forest, Wisconsin.

JOBS \$400 Month. Merchant marine. Write: Box 1804-T, Paterson, N. J. Beginners only.

FOREIGN Employment information. Make big money in Europe, Africa, South America, Canada, Alaska, Far East. Transportation paid. Construction workers, clerks, truck drivers, etc. Travel, adventure. Complete information application blanks, sent by return mail. Send \$2.00 to Foreign Bureau, P.O. Box 512, New Orleans, Louisiana.

WHY Worry about work? Escape jobs forever! Retire securely now. Lead leisurely life. Unusual new book shows how. Postcard brings details free. Belmont, Wyckoff 157, New Jersey.

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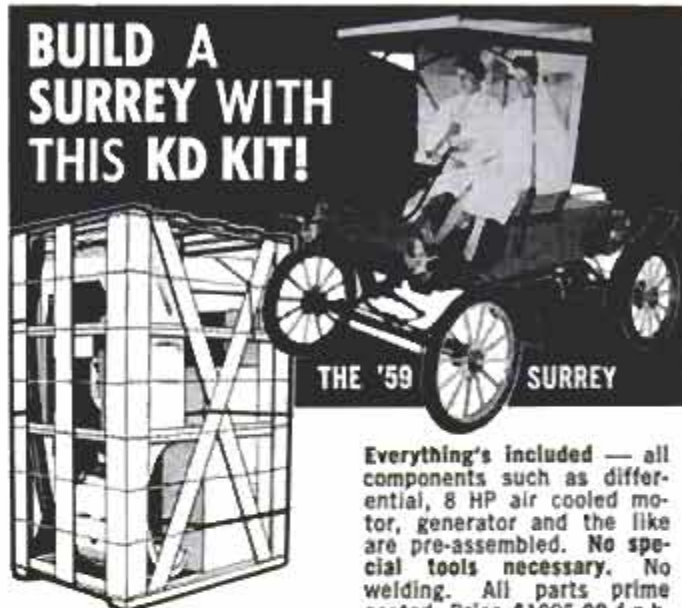
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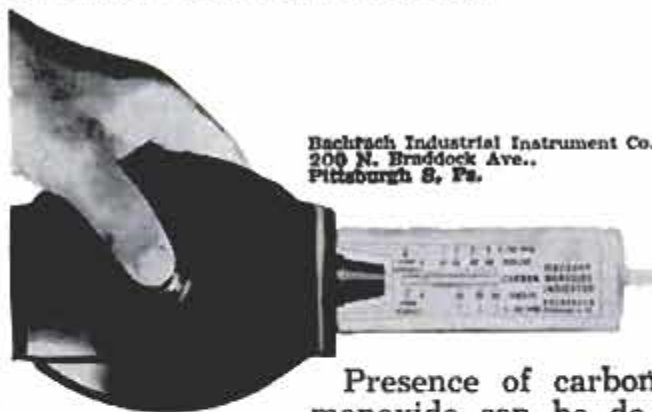
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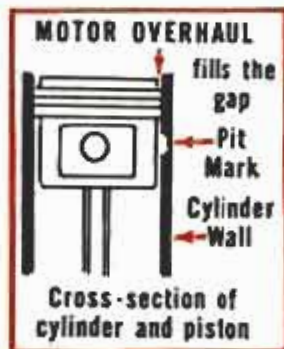


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MOTOR OVERHAUL is a magnetized metallic liquid, which, when added to your crankcase oil, travels with it into the cylinders. It fills pits, scratches and cracks in the cylinder wall and, because MOTOR OVERHAUL is magnetized it clings there, creating a glass-smooth surface that re-seals the gap between cylinder wall and piston ring. Engine is "tight" again . . . oil no longer enters combustion chamber (where it would be burned away) . . . compression, power and peppy response increase dramatically . . . in mere minutes!

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- 1. INCREASES MOTOR COMPRESSION UP TO 58%.** In minutes, the Laboratory Test Car delivered 58.26% more compression. Motors 100,000-miles-old regain new-car power like magic.
- 2. INCREASES GAS MILEAGE UP TO 54%.** The Laboratory Test Car ran 54.12% more miles per gallon. Savings on gas can run to hundreds of dollars a year.
- 3. INCREASES OIL-SAVING EFFICIENCY UP TO 900%.** No more oil needed between oil changes. Laboratory Test Car "burned" a quart every 300 miles before MOTOR OVERHAUL . . . now never needs oil added . . . saves 67 quarts a year.
- 4. MAKES ENGINES RUN SMOOTHER AT ONCE.** Immediately, rings and cylinders fit tightly again, friction-drag reduced. Motor "knock" disappears while car is driven — at once.
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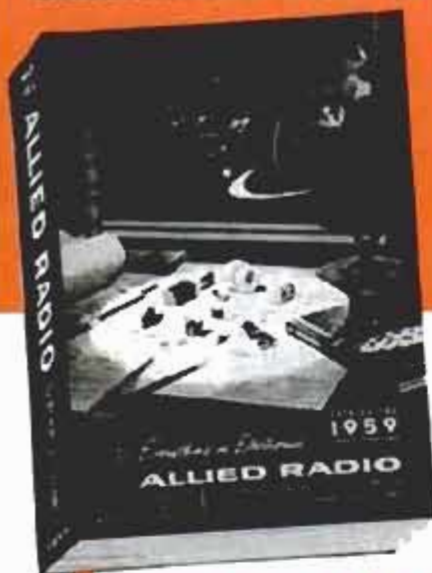
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What's New for Your Home

Table listing home-related articles and their page numbers, including 'Floor flusher washes away dust, litter', 'Bowl holder handy with electric mixer', etc.

Radio-Television, Electronics

Table listing radio and television related articles and their page numbers, including 'Go behind the scenes to look ahead in electronics'.

Craftsman and Shop Notes Index

Automotive

Table listing automotive-related articles and their page numbers, including 'Vacuum tests wiper motor', 'Using antifreeze second season can damage cooling system', etc.

Boating

Table listing boating-related articles and their page numbers, including 'Outboard can't slip off boat when chained to transom', 'Grease fittings on wheel hubs ease boat-trailer servicing', etc.

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House and Home

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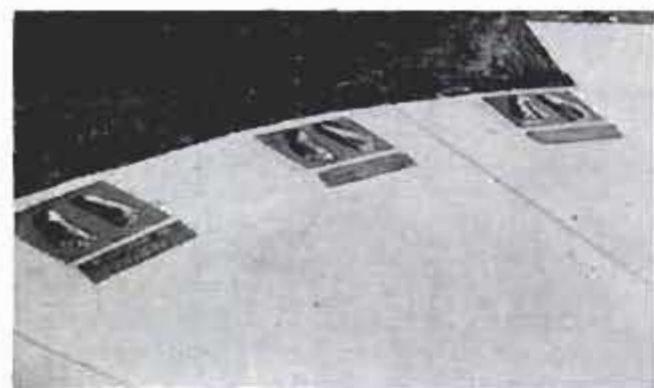
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To the Editor:

What are probably the world's only naked footprints in bronze are embedded in concrete in the Plains Indian Sign Language Memorial at the small prairie settlement of Browning, Montana, agency for the Blackfeet Indian Reservation.

In 1930 the last of the Indian sign talkers of the West met in council. For days they talked, never uttering a word. Almost every Indian tribe of the West had its own



language; communication between the many tribes was achieved by means of signs, something like the white man's deaf-and-dumb talk of today.

The red men sign-talkers were all old then. They are dead now, and the sign language has disappeared. The only complete record available was taken at the council, on film, for the Smithsonian Institution in Washington, D. C.

After the council was over, the sign talkers, most of them chiefs, had their footprints taken, cast in bronze, and set in a concrete circle which stands today before

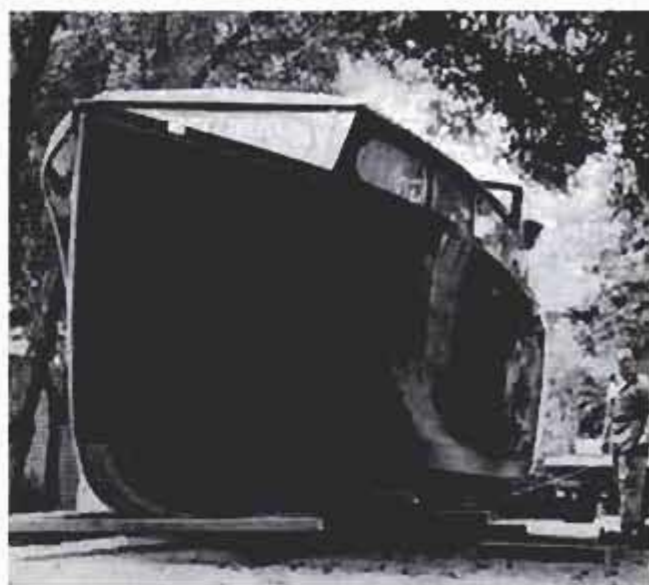
the Museum of the Plains Indian on the outskirts of Browning.

Eric Thane,
Helena, Mont.

☆ ☆ ☆

Dane Builds PM Cruiser

It appears to be literally true that a good man can build a *Popular Mechanics* boat with one hand. The feat was accomplished at Copenhagen, Denmark, by Kaj Niels Andreasen, a lithographer, who has only one hand. From plans for the 25-foot cruiser *Sea Craft*, published in our March 1948 issue and later appearing in our Danish-Norwegian edition published at Copenhagen, Mr. Andreasen built "the most beautiful ship you can imagine" of mahogany. The task took seven years, and every part was handmade. The ship has a six-cylinder engine capable of cruising at 13 knots.



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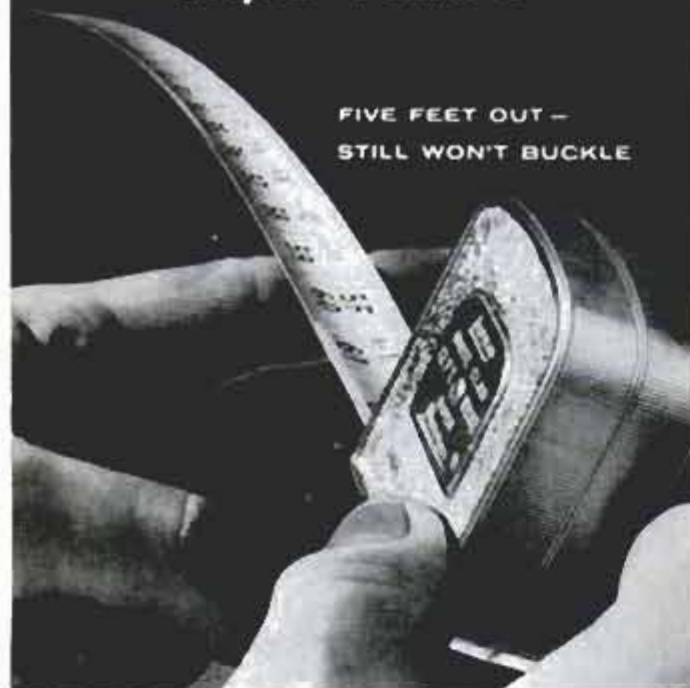
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Glass-Fiber Hubcaps for Autos

Automobile hubcaps made of glass fiber have now been perfected. They are said to be resistant to rust. Lightweight and striking in appearance, the hubcaps have a layer of gold or silver glitter just below the outside surface. They will fit all cars.

Ever wanted to design your own car? Chevrolet lets you come awfully close—with a choice of nine engines, five transmissions, two suspension systems, regular or Positraction rear axles, special cams, solid or hydraulic valve lifters, two air-conditioning systems, even Fuel Injection. You name it, chances are Chevy has it. Here's an example of what we mean:

“I ‘built’ my Chevy to handle like
a sports car . . . for five!”



“Take a young architect (that’s me) with a Corvette appetite, a one-car budget and a family of wife, three kids and a puppy, and you’ve got *frustration*.

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“Here’s how I ‘designed’ the sweetest handling five-seater that ever came down the pike: First, an Impala two-door sport coupe. Then the 290-h.p. Fuel Injection V8* and, buttoned on right behind it, that *great* four-speed box. (That’s the Corvette transmission, you know, with synchro on all *four* gears and that solid, direct floor shift.) The driveline ends up with Chevy’s limited-slip Posi-

traction* rear axle to give me real glued-to-the-road traction on gravel, mud or whatever.

“Seat belts, of course, and those optional nylon tires. But I wouldn’t add a thing to the genuine road car feeling of Chevy’s Full Coil suspension and Ball-Race steering. I’ve let a lot of my sports car friends drive the Impala and you ought to see the look on their faces after a couple of blocks. Man, I never thought a sedan could feel like *this!*”

It’s a fact; here’s a car you really can tailor to your measure. Why don’t you sit down now and make an outline of what your “ideal” car would be like—we’ll bet there’s a Chevy that fits the specifications like a glove! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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Honest taste is the true, full, generous taste of fine tobacco. And you get it every time in a Lucky Strike.

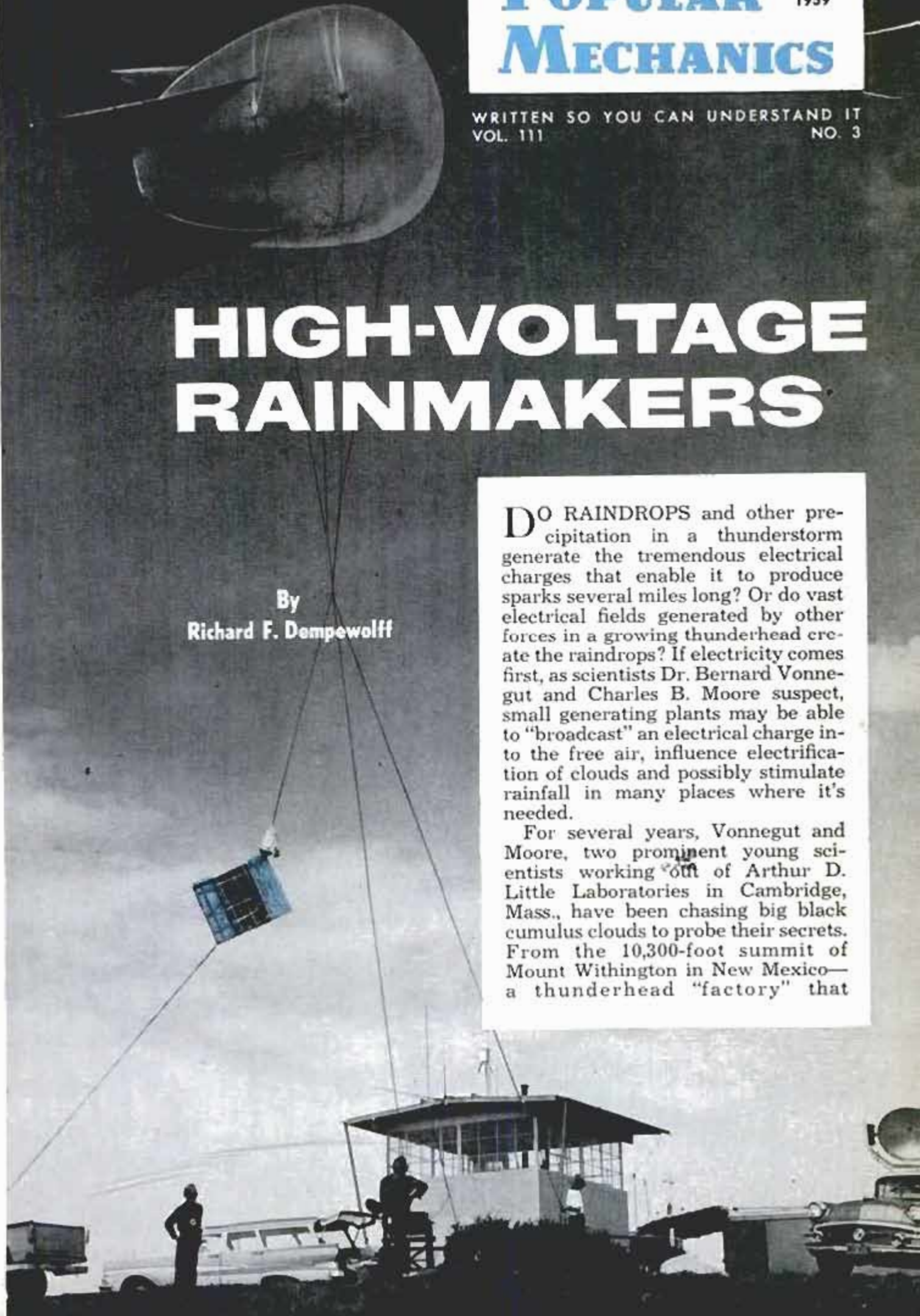


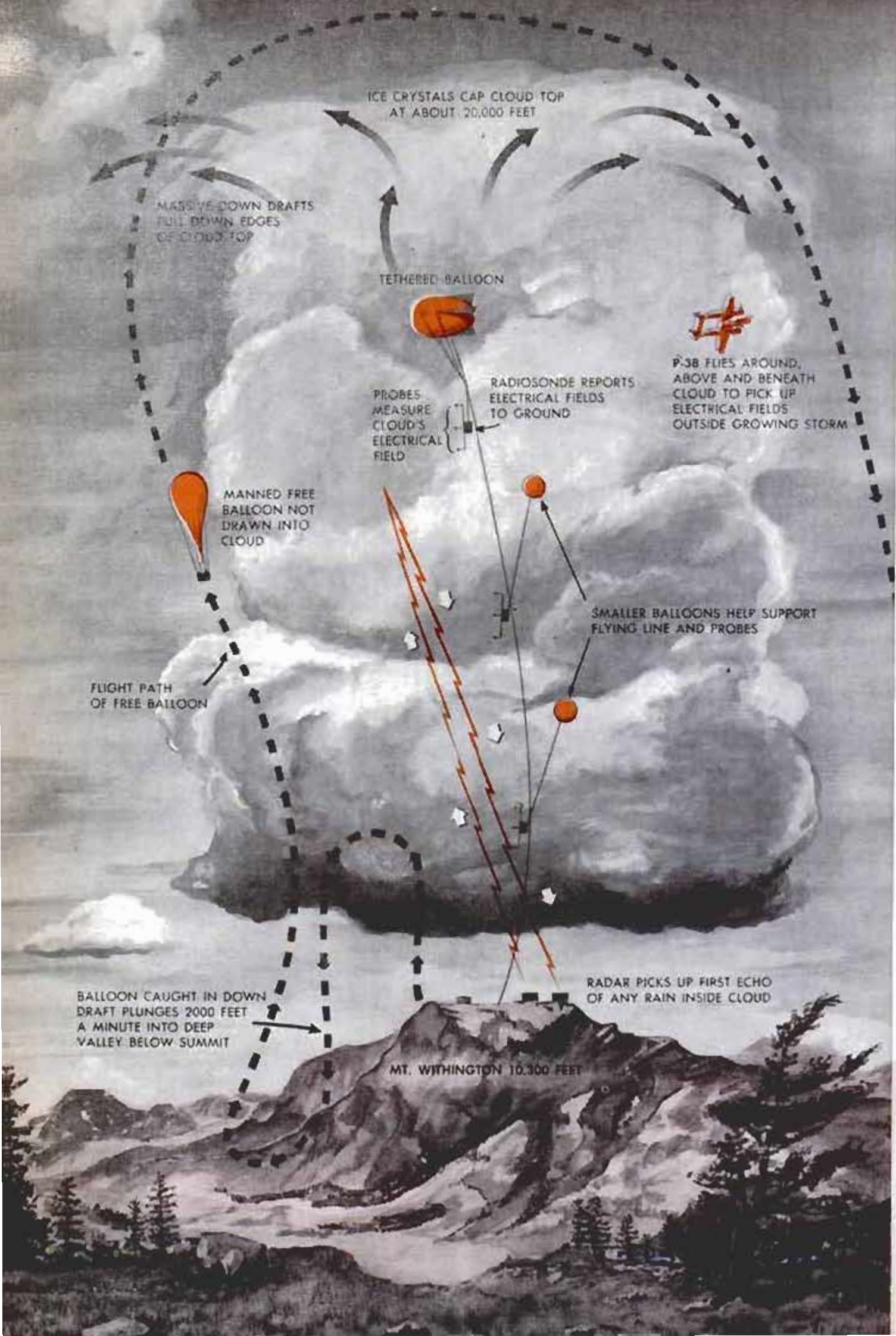
HIGH-VOLTAGE RAINMAKERS

By
Richard F. Dempewolff

DO RAINDROPS and other precipitation in a thunderstorm generate the tremendous electrical charges that enable it to produce sparks several miles long? Or do vast electrical fields generated by other forces in a growing thunderhead create the raindrops? If electricity comes first, as scientists Dr. Bernard Vonnegut and Charles B. Moore suspect, small generating plants may be able to "broadcast" an electrical charge into the free air, influence electrification of clouds and possibly stimulate rainfall in many places where it's needed.

For several years, Vonnegut and Moore, two prominent young scientists working out of Arthur D. Little Laboratories in Cambridge, Mass., have been chasing big black cumulus clouds to probe their secrets. From the 10,300-foot summit of Mount Withington in New Mexico—a thunderhead "factory" that





ICE CRYSTALS CAP CLOUD TOP AT ABOUT 20,000 FEET

MASSIVE DOWN DRAFTS FILL DOWN EDGES OF CLOUD TOP

TETHERED BALLOON

P-38 FLIES AROUND, ABOVE AND BENEATH CLOUD TO PICK UP ELECTRICAL FIELDS OUTSIDE GROWING STORM

PROBES MEASURE CLOUD'S ELECTRICAL FIELD

RADIOSONDE REPORTS ELECTRICAL FIELDS TO GROUND

MANNED FREE BALLOON NOT DRAWN INTO CLOUD

SMALLER BALLOONS HELP SUPPORT FLYING LINE AND PROBES

FLIGHT PATH OF FREE BALLOON

BALLOON CAUGHT IN DOWN DRAFT PLUNGES 2000 FEET A MINUTE INTO DEEP VALLEY BELOW SUMMIT

RADAR PICKS UP FIRST ECHO OF ANY RAIN INSIDE CLOUD

MT. WITHINGTON 10,300 FEET



P-38 airplane, with special weather instruments mounted on probe, is used in studies of thunderstorms

produces walloping rumpers nine out of every ten days in summer—their tethered balloons, trailing pigtailed instruments to measure electrical fields, soar through the vitals of developing storms. Their radar, perched on the mountain, sweeps the cloud curtain above it for an "X ray" glimpse of the first sign of rain formation. Meanwhile, an airplane, bristling with probes, roars above, through and beneath the towering cumulus columns to measure the horizontal and vertical electrical fields inside and around the storm cloud.

Twice, on a flimsy plywood platform slung beneath a giant free balloon, Moore and two other scientists have sailed through the frightening up-and-down drafts of growing black thunderheads to observe first-hand the machinery of developing storms.

Last summer, as a result of what they discovered, the meteorologists set out across the prairie with a truckload of innocuous-looking equipment. At a ranch near Jacksboro, Tex., they quietly set about rigging a simple experiment with startling implications. On 30-foot telescoping TV masts, they strung a slender wire four miles across the prairie. Using a portable generator, they shot a high-voltage direct-

current charge through their "aerial." At night, faintly visible coronas glowed along the length of the wire as fast ions sprayed out into the atmosphere and were carried off downwind. "We found," says Vonnegut, "that the negative space-charge we were introducing reversed the normal fair-weather field for four or five miles downwind. When low cumulus clouds were growing above this region of artificially electrified air, we found that the electrical fields beneath such clouds were far more strongly reversed than elsewhere. There appears little doubt that our artificially produced charge was entering these small clouds."

Even more interesting is the fact that during April and May of last year, while the experiment was in full swing, vast areas of east Texas, downwind of the unique power line, experienced unusual torrential downpours. Vonnegut cautions that those rains probably bear no relation to the space-charge experiment, but, he admits, "we are presently so ignorant of the process governing rainfall distributions that we should not entirely dismiss the possibility of a relationship."

Since 1953, when he wrote a paper on his thunderstorm ideas, Vonnegut has been in

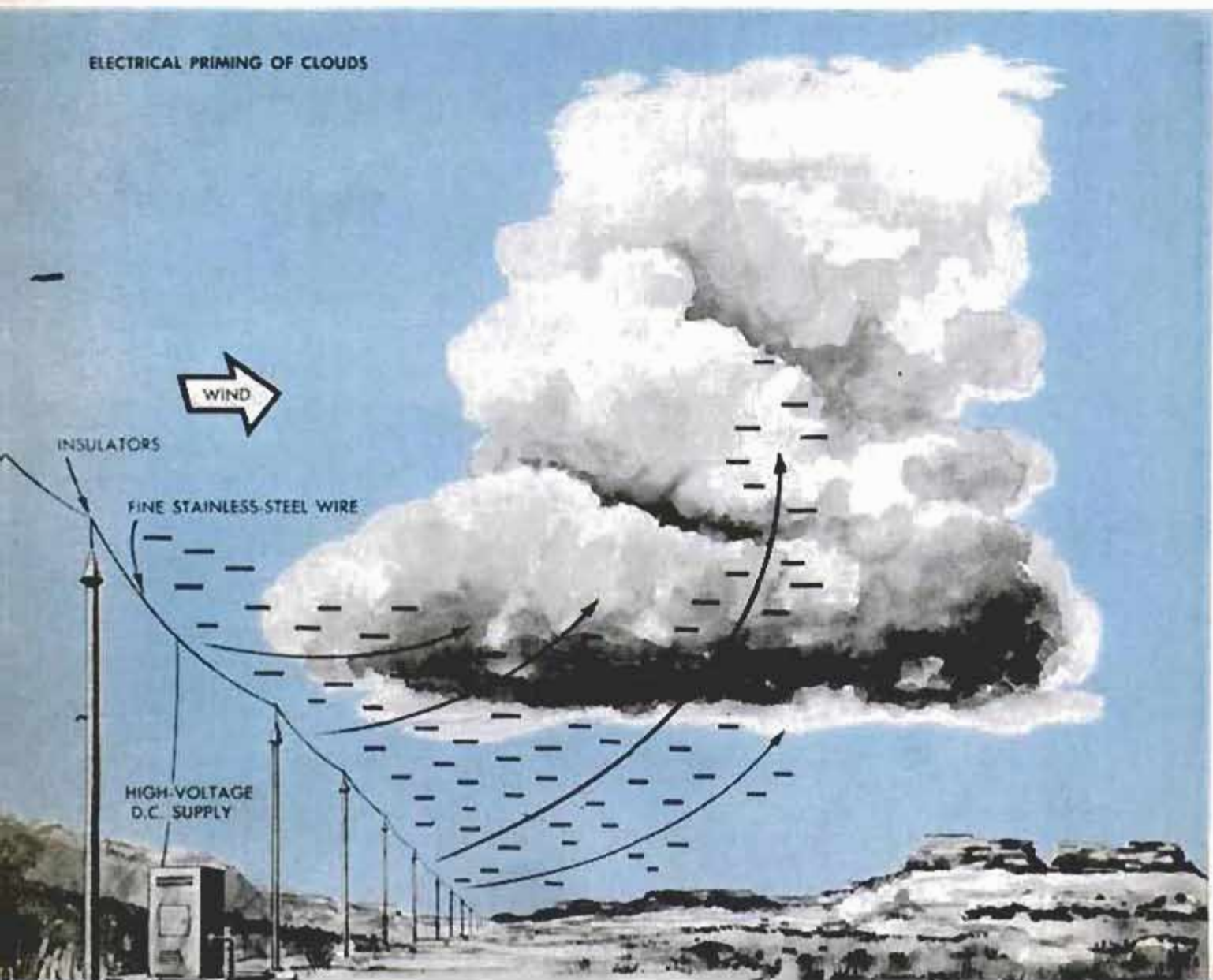


Silvered hemisphere is used as wide-angle lens for pictures of sky. Camera records cloud conditions

what he calls "an amiable scientific controversy" with most of his fellow scientists. Nearly all of them hew to half a dozen generally accepted, though unproven, theories. "One of these ideas," Vonnegut explains, "is that falling raindrops capture ions, become charged themselves and electrify the cloud. Another popular theory is that the storm becomes electrified by the collision of ice particles and snowflakes rubbing together. The shattering of ice crystals, break-up of raindrops in updrafts, the riming process on hail particles, and voltages produced in the freezing process itself—all these have been given credit for doing the job." In each case, he points out, rain or other precipitation is assumed to come first, and electrification of the storm afterward. What might happen inside a cloud if things happened to work the other way around?

In his laboratory, Vonnegut has set up a simple gadget, first devised in 1879, to show visitors just that. He turns a petcock on a fine nozzle, and a vertical fountain of almost misty droplets sprays upward. He rubs a pocket comb on his sleeve, then holds it a few inches from the spray. Instantly,

ELECTRICAL PRIMING OF CLOUDS





Unable to stay close to thunderhead top, balloonists soared 29,000 feet before they could start earthward

the fine moisture particles, brought under the influence of the tiny static field set up by the comb, coalesce into big drops, and the fountain becomes a short column of water spattering "rain" around itself.

Vonnegut's hunch is that a similar phenomenon probably is what makes a thunderstorm "rain." But if so, then how does the cloud become electrified to start with? The lower atmosphere blanketing the earth, he explains, always carries what physicists know as a "fair-weather space charge" of positive electricity. Dr. Vonnegut thinks that air containing this charge may rise into a small cumulus cloud on convection currents, weakly electrifying it. This weak field, he says, would cause a conduction current to flow around the cloud, bringing an opposite charge to the cloud surface. Downdrafts on the cloud's surface would carry these negative particles into the lower part of the cloud, and a continuous current would begin to flow from the upper atmosphere into the lower reaches of the cloud. As the cloud grows, so do the charges, and the developing storm becomes a sort of snowballing, mammoth Van de Graaff generator. Finally, masses of cloud particles, caught in the vast electrical field, coalesce into sheets of rain and fall earthward. Meanwhile the charges continue to build on roaring convection currents until they sizzle themselves away in lightning strokes.

To prove beyond doubt whether electricity or precipitation occurs first in a moving, growing cloud isn't easy. However, betting

that they'd come up with some answers if they could measure the field in and around a developing thunderhead, and watch for the first sign of rain with radar, Vonnegut and Moore went cloud-chasing. While their radar sets, perched on top of Mount Withington, peered into the hearts of passing cumulus clouds, the two meteorologists explored the electrical mysteries of the clouds with a wide assortment of ingenious equipment.

From Airplane to Balloon

One of the first tools was a little Beechcraft Bonanza that sprouted glass-fiber fishing rods from its wingtips, belly and back. On the rod tips, radioactive probes picked up the faintest space-charge variations as the plane flew along, registering the "tickle" on an electrometer in the cabin. "We got some interesting readings," Vonnegut says, "but the plane was too light. It finally lost its engine and landed on the desert. So we went to tethered balloons, on which we rigged radiosondes."

Designed by Moore, these polyethylene teardrop-shaped balloons sporting fins, carried measuring devices 20,000 feet above sea level, up into the cores of developing thunderheads. A P-38 Weather Bureau plane flew over each guinea-pig cloud at the same time, measuring the electrical field above the growing storm. Down on the mountain peak, a screen-walled "Faraday Cage," resembling somebody's back porch, measured the constantly changing

(Continued to page 252)



Ezra Stoller photos



Prefab House Has Aluminum Exterior

Buyers of prefabricated homes can now look at houses featuring bake-finished aluminum siding and roofing. It is estimated that the owner of one of these houses can save \$4000 in maintenance and repairs over a span of 20 years. The aluminum exterior is backed with gypsum, which is fastened to a conventional wall with insulation, interior sheathing and two by four-inch studs.

Transmitter in Scanning System Weighs 2½ Oz.

Tiny and compact, the transmitter in a television-type scanning system designed by Navy scientists to picture the moon weighs just 2½ ounces. The crystal-stabilized transmitter is capable of a 50-watt output, to transmit a television picture 240,000 miles. The scanning system itself weighs eight pounds.



Here's Convair's 880—the Fastest Jet Transport in the World?

At 615 miles per hour, Convair's 880 is said to be the world's fastest jet transport. It carries 88 first-class passengers in a two-abreast seating arrangement. Basically a medium-range airplane, the gold-striped

880 is able to operate from nearly every airport in the world that has been accommodating four-engine transports. Seven international airlines have placed orders for the new jet airliner.

Tiny Projection Lamp Produces Top Screen Brilliance

Your eight-millimeter movie projector can now be equipped with a 150-watt lamp that is said to produce screen brilliance surpassing that of 750-watt lamps. Only $3\frac{3}{8}$ inches tall, it supplements a curved, built-in reflector with a low-voltage operation and rugged filament structure.

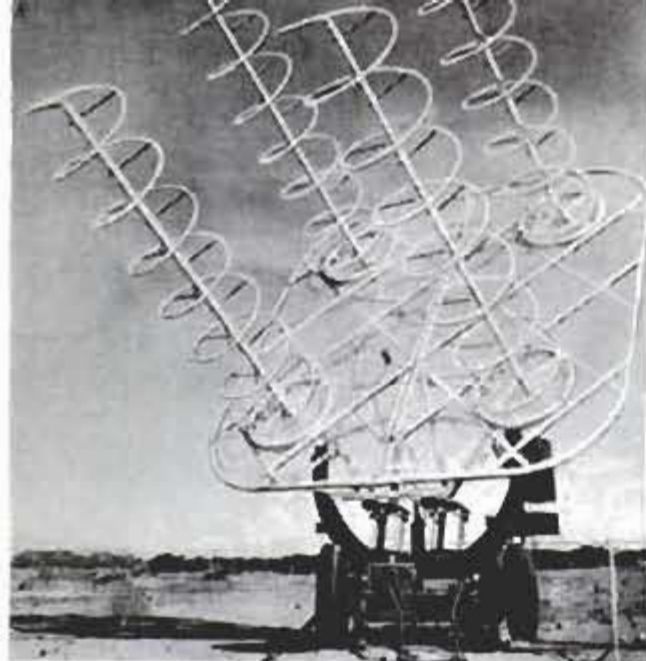


Glass-Fiber Heater Made of Thin Sheet

Ability to generate nonincandescent heat evenly over any area is the feature of a new heating element developed by a British manufacturing firm. Made of glass fiber, the material is in thin-sheet form and can be shaped and laminated for many uses. It can be used in portable heaters, hot plates, ovens, and can also be incorporated in room baseboards to replace radiators.

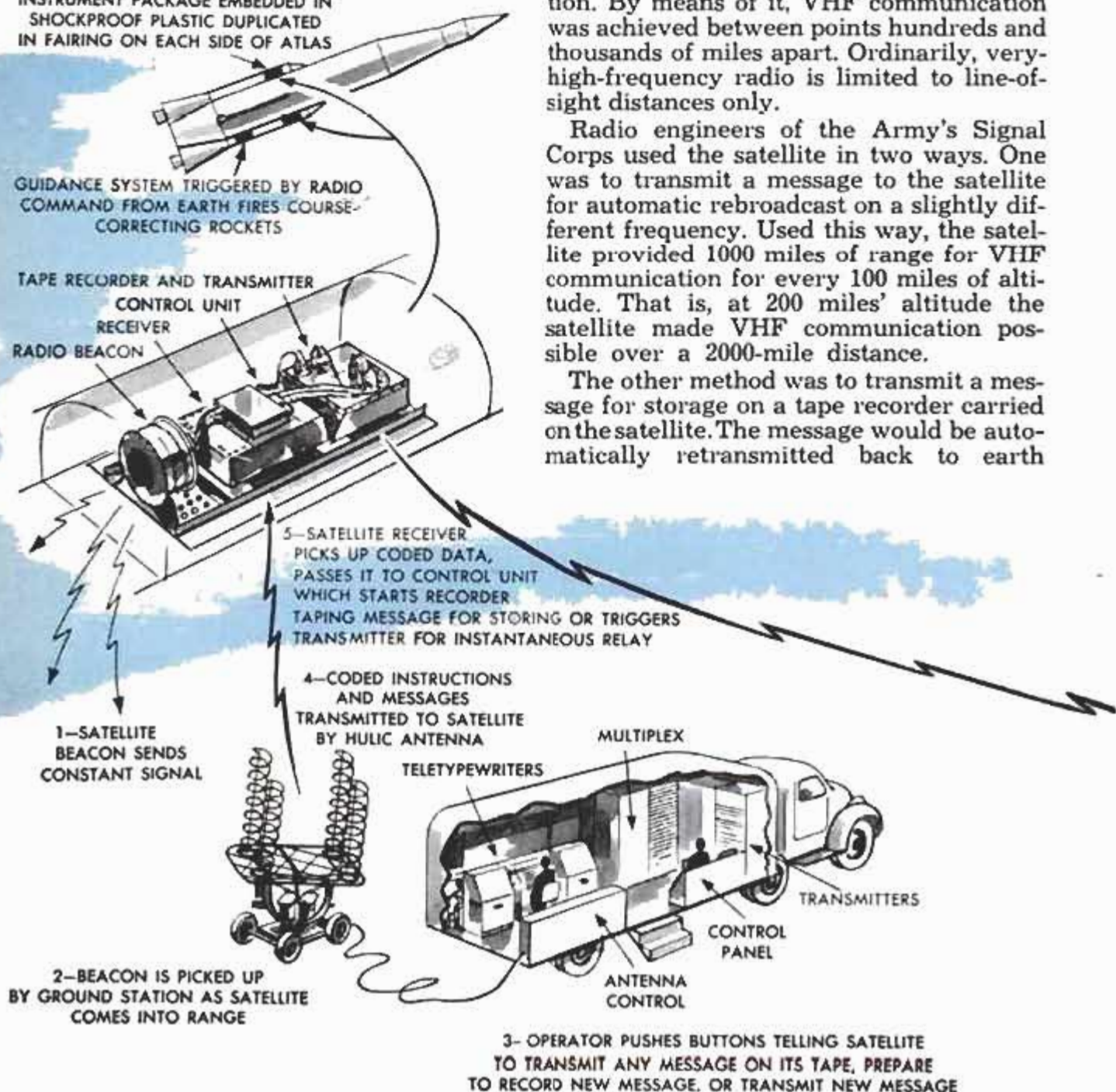


From Outer



Spiral antenna transmits messages to space vehicle

INSTRUMENT PACKAGE EMBEDDED IN SHOCKPROOF PLASTIC DUPLICATED IN FAIRING ON EACH SIDE OF ATLAS



WHEN OUR "talking" Atlas satellite of December rammed its 8750-pound shell into a looping orbit around the earth, like a ball on the end of a string, its greatest significance to rocketeers lay in its tiny package of "brains." Not only did the 85-foot rocket's tricky communications system receive, remember, and return verbal messages from space to earth, but it was steered en route by radio signals from the ground.

Known as SCORE (for Signal Communications by Orbiting Relay Equipment) this satellite was a high-flying radio-relay station. By means of it, VHF communication was achieved between points hundreds and thousands of miles apart. Ordinarily, very-high-frequency radio is limited to line-of-sight distances only.

Radio engineers of the Army's Signal Corps used the satellite in two ways. One was to transmit a message to the satellite for automatic rebroadcast on a slightly different frequency. Used this way, the satellite provided 1000 miles of range for VHF communication for every 100 miles of altitude. That is, at 200 miles' altitude the satellite made VHF communication possible over a 2000-mile distance.

The other method was to transmit a message for storage on a tape recorder carried on the satellite. The message would be automatically retransmitted back to earth

Space— Voices Today, TV Tomorrow

whenever a ground station interrogated the satellite. Messages on seven teletypewriter channels in addition to voice could be stored this way. Sometimes a stored message would be "unloaded" to another ground station on the same pass around the earth, sometimes it would be held for a number of revolutions before a ground station interrogated the satellite and caused the message to be transmitted from it. All the Signal Corps experiments worked perfectly.

Clustered before their complex instrument panels, Air Force ballistic-missile experts watched as the Atlas roared out of this world. Each time the rocket veered from the trajectory that would send it into orbit, a series of coded orders, radioed skyward by earthbound human monitors, flashed through a miniature receiver aboard the space vehicle. They were relayed instantly to a decoder that translated the electronic beeps to course commands. Switches closed, valves opened, and small rockets burst into flame, nudging the nose of Atlas back toward its globe-circling course. According to the Air Force's ballistic-missile chief, Gen. Bernard Schriever, it was the first time any satellite rocket was steered into orbital trajectory by radio guidance. Until now, all our space vehicles have had built-in gyro-electronic guidance. Once off the pad, they were on their own.

The unique communications system carried by Atlas points the way to space relay networks that may soon make it possible to send microwave-radio and TV signals to any point on earth from a single ground station. It proved the feasibility of reconnaissance satellites (now a-building) that will gather and store pictures and data as they hurtle along, and transmit their coded information to ground stations at radioed command.

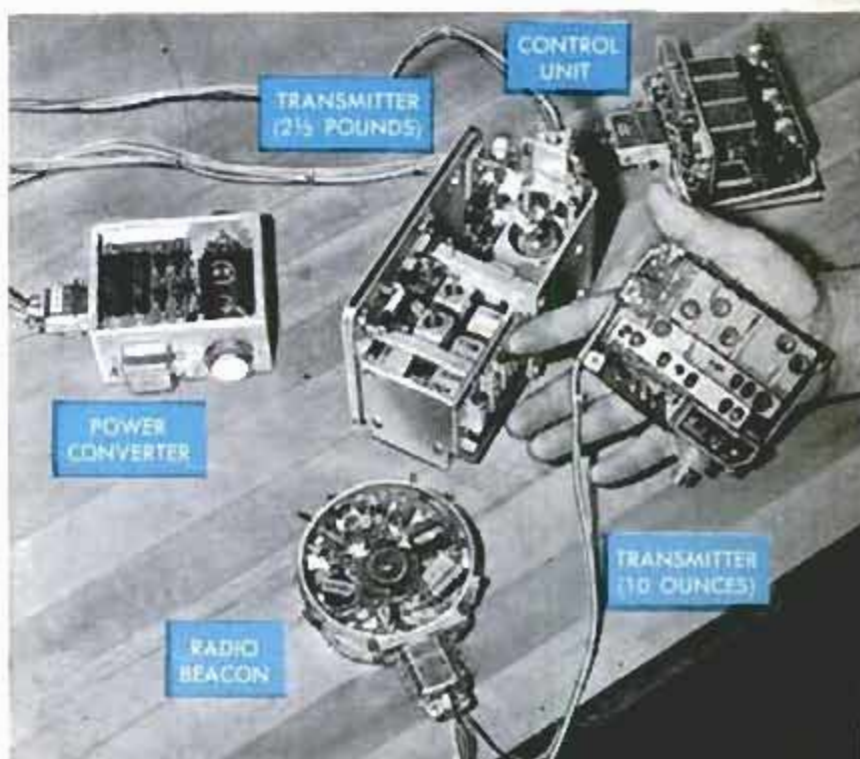
Heart of Atlas' big secret was a 150-pound communications payload consisting of two identical miniature radio stations. Fitted snugly in faired housings on each side of the big rocket, the briefcase-size units included flush-mounted flat antenna, receiver, control unit, tape recorder and transmitter. Each set could pick up, store and relay messages from ground stations.

Why two? "If one failed, the other could take over," explains S. W. Spaulding, engineer at RCA's Astro-Electronic Laboratories where many of the components were designed and built in conjunction with U. S. Army Signal Corps scientists. Wisdom of the twin units was proven when one of the two sets went dead shortly after the Atlas took off. President Eisenhower's famous Christmas message from space was handled by the alternate set.

Here's how the tricky system worked:

(Continued to page 244)

6—AS SATELLITE COMES WITHIN RANGE OF NEXT STATION, OPERATOR INSTRUCTS IT TO PLAY BACK RECORDING, ALSO FEEDS IT NEW DATA FOR RELAY.





Buick's straight-line speedometer is probably the longest in the industry



Trunk is ample, but deck slants so sharply to rear that two-suiter case must be placed in extreme forward position to allow lid to close



Tunnel under center of rear seat allows about one inch of padding

MARGINAL COMMENTS
BY ART RAILTON
PM'S AUTO EDITOR

There must have been a big bumptiousness market a few years ago when Buick was in third place in sales. Public taste apparently changed sharply in '57.

In all cars, the center seat is to this generation what the rumble seat was to the '20s—the mother-in-law seat.

BUICK HAS NEW PERSONALITY; HERE'S HOW OWNERS LIKE IT

WHEN BUICK says it's new, it means it. The all-newness includes the way it drives, the way it sits and the way you feel inside it.

It's a whole new personality.

How does this new personality appeal to long-time Buick owners? To find out, *PM* surveyed 1000 owners of 1959 Buicks, asking them what they think about the new car. The answer: They like the big change.

"Both my husband's family and mine have had Buicks for years. We deferred getting a new car for two years as we didn't care for the previous Buick styling. This year's is just right. Sweeping lines, but not too severe. It certainly has eye appeal. Some have told us it looks like a plane taking off as we drive away."—Wyoming housewife.

And the new look seems to appeal to the "conquest" buyer—the man who traded a different make:

"I traded a 1956 Mercury. This is the first good-looking Buick I have ever seen. In previous years, Buick was too bumptious, too heavy looking, poor taste in general."—Rhode Island retired owner.

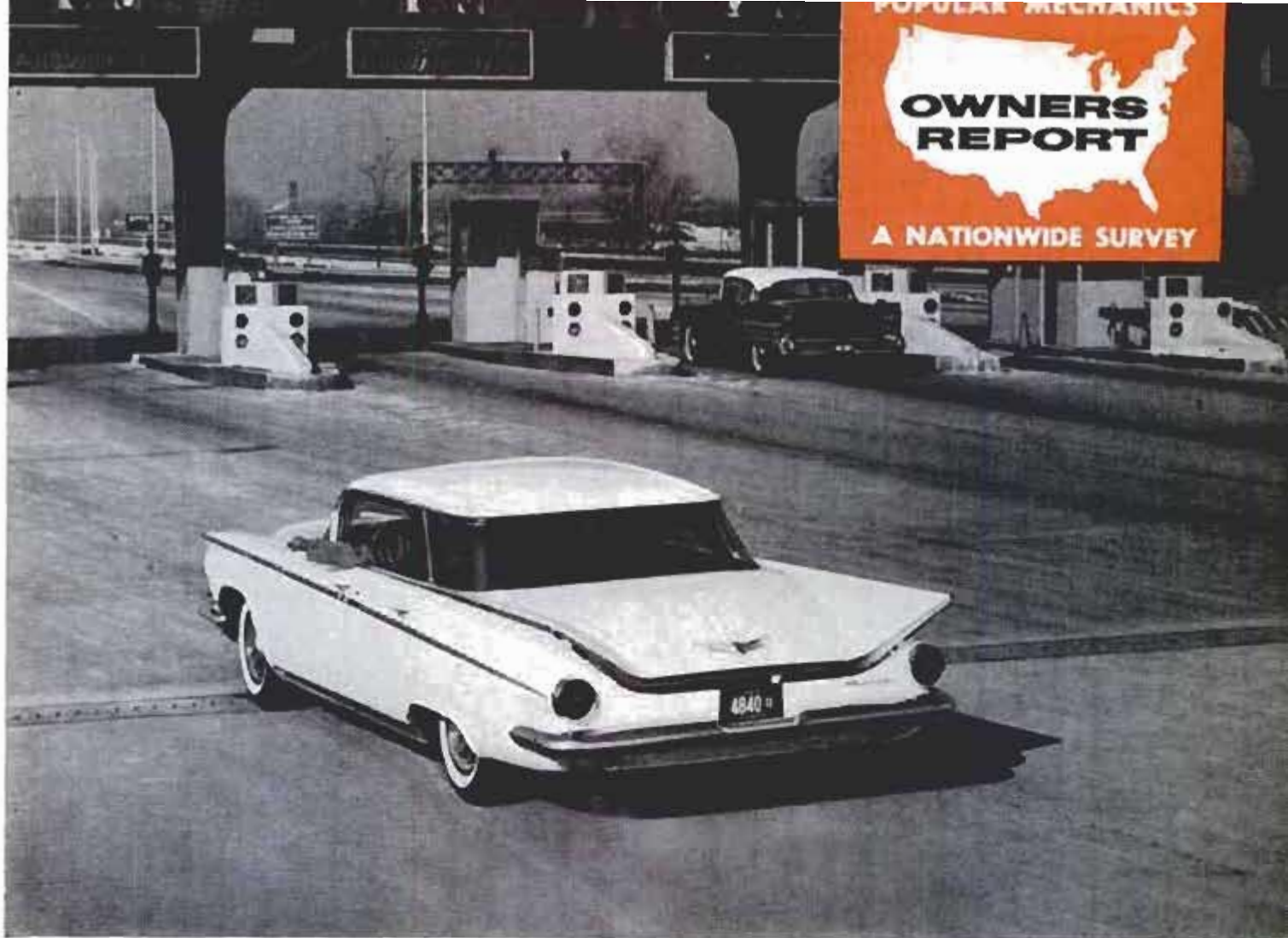
What single feature do the owners like most? Surprisingly, it is not styling. The most often mentioned feature is Buick's handling ease, next comes riding comfort and third is the new styling.

But there are some complaints also. Topping the list of don't-likes is the high center hump in both front and rear floors which makes the center of the seats uninhabitable for any long period. Second most frequent complaint is the difficulty of getting in and out of the low-slung



Sure, I love my Buick's

- Ease of handling, say 49.5% of the owners
- Comfortable ride, say 47.1% of the owners
- Beautiful styling, say 41.9% of the owners
- Power and performance, say 28.9% of the owners
- Excellent brakes, say 14.6% of the owners



body. Third is a bothersome and, some owners say, dangerous reflection on the inner surface of the windshield when the sun shines on the shelf over the dashboard.

Best-liked Features

Here, in order of frequency of mention, are the Buick's best features as described by the owners:

"Handles lightly in the city and performs like a heavy car on the highway."—Kansas government worker.

"Steering improved to the point that it feels like power-assisted equipment although it isn't in my car."—California wholesale clerk.

"New power steering is exceptional. Good handling. Hardly know it is a Buick, so different is it."—California aircraft inspector.

"Comfortable, buoyant ride."—Maryland accountant.

← *It's good news that poor workmanship (usually a major complaint in an all-new year) is far down on the list in 8th place.*

← *If you think Buicks still drive the way they used to, you're in for a surprise. Gone is the ponderosity of the past. Now you can aim it into the eye of a needle.*

But, I don't like

Driveshaft tunnel, say 25.2% of the owners

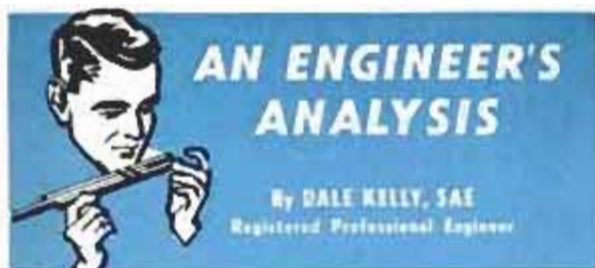
Getting in and out, say 15.2% of the owners

Sun glare on top of dash, say 12.8% of the owners

Low front seat, say 8.8% of the owners

Its length, width, lowness, say 7.3% of the owners





1959 BUICK INVICTA TEST

MODEL TESTED: Four-door hardtop with four-barrel carburetor, dual exhaust, Twin Turbine transmission, power brakes and steering.

Rear-axle ratio: 3.23 to 1. Wheelbase: 123.5 inches. Tires: 7.60 by 15. Weight: 4546 pounds with gas tank half full (54 percent on the front wheels, 46 percent on the rear).

Mileage on car at time of test: 450 miles. Barometer: 29.1 inches. Temperature: 73 deg. F. Payload: 200 lbs.

ACCELERATION TIME FROM STANDING START (in seconds)



Ignition timed for:	0 to 20	0 to 40	0 to 60	0 to 80	1/4 mile
Regular gasoline	2.2	6.3	11.2	17.5	18.3
Premium gasoline	2.1	5.8	10.3	17.0	17.7
Super-premium gasoline.....	No improvement				

(Gasoline used had following octane ratings by Research method: Regular 90, Premium 99; Super-premium 105.)

FUEL ECONOMY (miles per gallon)



Ignition timed for:	Steady 30 m.p.h.	Steady 50 m.p.h.	Steady 70 m.p.h.	Traffic Route
Regular gasoline.....	16.0	15.8	13.3	9.0
Premium gasoline	16.5	15.4	13.5	9.3
Super-premium gasoline.....	Not tested			

(In traffic test, car makes 10 full stops per mile and is driven fast enough to average 15 miles per hour.)

ESTIMATED AVERAGE ANNUAL GASOLINE BILL: \$237 for 10,000 miles

(Based on use of premium gasoline at 33 cents a gallon.)

SPEEDOMETER ERROR (miles per hour)



Speedometer reading.....	20	30	40	50	60	70	80
True Speed.....	19	29	38	47	56	65	73

ODOMETER ERROR (miles traveled)

Odometer registered 105 miles for an actual distance of 100 miles.



DRIVER'S VISION

Driver could see part of road 18 feet in front of car, full width of road 24.5 feet in front of car.



GROUND CLEARANCE (unloaded car)

Worst dip that could be crossed.....26-ft. radius
Worst hump that could be crossed.....18-ft. radius
Deepest rut that could be negotiated.....7.5 in.
Curb clearance for door opening.....14.8 in.

STEERING

Steering wheel turns for 50-ft. circle...1.5 turns
Curb-to-curb turn-circle diameter.....44.0 feet
Wall-to-wall turn-circle diameter.....46.5 feet
Steering-wheel turns, lock-to-lock.....3.6 turns

CENTER OF GRAVITY: 21.0 inches

TRUNK CAPACITY

12 cartons (one cubic foot each)

WATER RESISTANCE: Fair

Splash-pan test: No leaks
High-pressure test: Leaks under both front doors

OBSERVATIONS

Speedometer has an open, legible scale, but the one in the test car was not particularly accurate. Gasoline gauge monitored a dwindling supply of fuel accurately down to almost the last gallon (1.5 gallons, to be exact). Excessive chrome around instruments seriously interferes with legibility.

Engine had an oil-wetted air cleaner, which

is standard equipment on this engine. Optional at extra cost is the more modern, more efficient dry paper filter (an item which is standard on many cars).

Transmission is very smooth, going from standstill to top speed with no jerk or apparent shifts.

Dale Kelly, SAE



Owners like Buick's handling ease most. Its power steering is light and the big car is surprisingly nimble

"My job takes me all over New England. I average between 800 and 1000 miles per week. I travel over the roughest roads, taking short cuts between towns. Buick takes these back-country roads like they were superhighways. Most comfortable car I have ever driven."—Rhode Island salesman.

"I especially like the styling better than the 1958 design because of the lack of so much chrome and gingerbread."—New York secretary.

"It will last stylewise, it's so new. I had a 1954 Buick and never felt my car was outmoded until I saw the 1959 Buick."—California Navy man.

"A complete departure in styling. Rakish and very sporty looking."—New York salesman.

Now the Complaints

Buick owners are enthusiastic, but most of them admit the car has a fault or two (however, 24.3 percent of them register no complaints at all).

Here, in order of frequency, are the top five complaints as described by the owners:

"Where the drive shaft goes under the seat cushions, it is like sitting on a rail."—Wisconsin salesman.

"If more than four persons are in the car, the center passengers must sit on the drive-shaft housing which can be felt under the padding."—Wisconsin clerk.

"This is really a four-passenger car although it is a four-door hardtop. Center of seats very uncomfortable."—Missouri salesman.

"Difficult to get out of back seat of this four-door hardtop. Especially for ladies. Legs hit the rocker panels on outside and dirt rubs off on stockings. Not too difficult for men."—Minnesota retired owner.

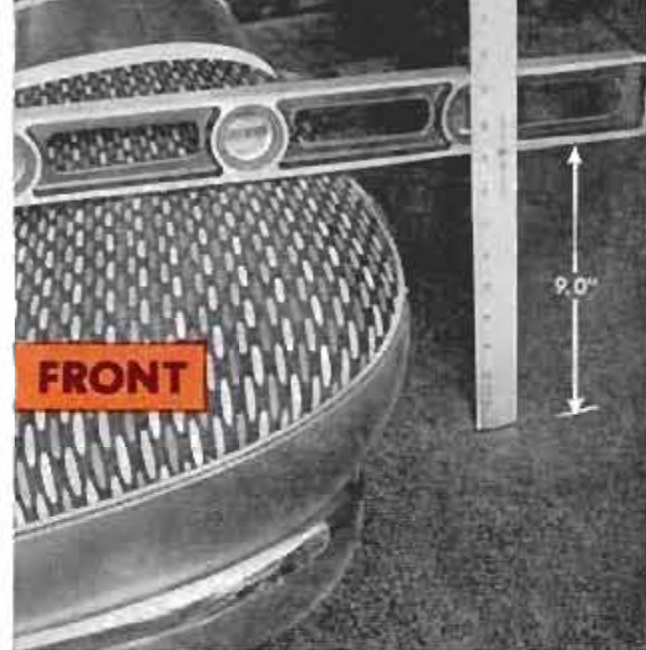
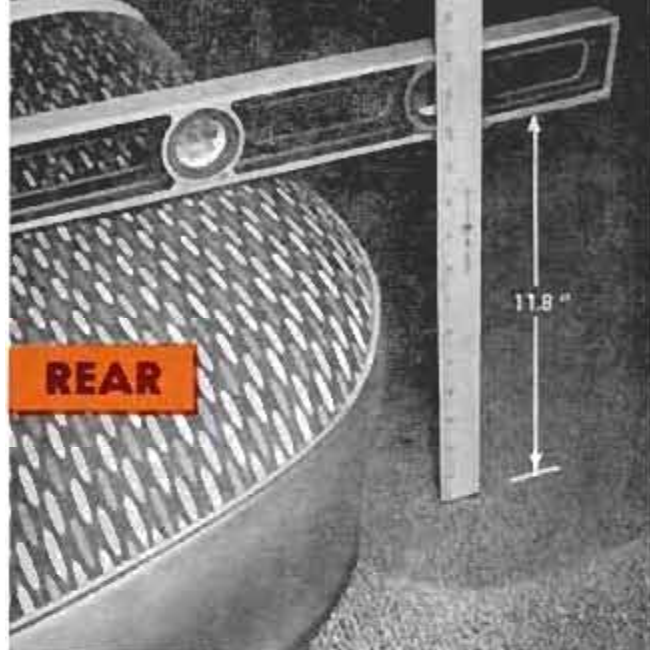
"It is so hard to get in and out of the station wagon."—Ohio housewife.

← Over smooth roads, test car almost floated. On washboard, considerable rear-wheel hop and chatter. Crossing railroad tracks, reaction is sharp and noisy, but not at all unpleasant.

← What about the guy who had just bought a '58 Buick?

← How much more would you pay for a car without a center hump? \$100? It could be done for that, say engineers, but they doubt that you'd pay that much.

← Apparently, in the back seat of a car at least, it's a man's world!



Rear-seat riders (if no more than two of them) have best seat in house. Deep stepdown in floor gives them a high cushion and toe space under front seat. Those in front have no stepdown and sit almost on floor

One auto company released a series of photos showing how to get into its cars gracefully. The secret: Stern first.



"There must be a more ladylike way of entering the car. It seems awfully awkward to enter the front seat, especially with a tight skirt."—Ohio Fisher Body employee.

Everybody from eye doctors to filling-station men dislikes wrap windshields, yet they get bigger, curvier and more horizontal. Sun glare is just one more reason why they are a mistake.



"Windshield gives back a terrible reflection in sunshine. Dash lights at night also reflect on windshield unless practically turned off. I consider this a safety hazard."—Wisconsin manufacturer's representative.

"Dashboard shelf is of a leatherette which reflects in driver's eyes when sun shines on it. It gives the effect of a dirty windshield and could hamper vision on a bright day."—Wisconsin soldier.

Front seat is so low a short driver can't see right-front fender. We're being forced into buying power-seat options.



"Driving into sun, the high blue cowl and slanted windshield reflects a blue haze on glass, cutting visibility."—Illinois owner.

"Front seat seems too low. Right leg gets tired on long trips."—Georgia tugboat captain.

"It's like sitting on the floor."—North Dakota businessman.

"Low front seat and high front fender limit visibility on right-hand turns."—Illinois clerk.

"A low car has many road advantages, but they are far offset by the discomfort of such low seats. Legs tire much quicker on long trips."—West Virginia retailer.

Turn circle is larger by two feet than in 1957. This is progress?



"Too big! Too long, wide and low. Hard to find parking area large enough. It takes up most of my garage. Hard to make U-turn."—Illinois salesman.

"Extreme width at fins and long rear overhang make sharp turns out of narrow garage difficult."—Illinois sales manager.

If men were as critical of clothing as they are of cars, they wouldn't wear the anachronistic felt hat. It makes even less sense than lower cars.



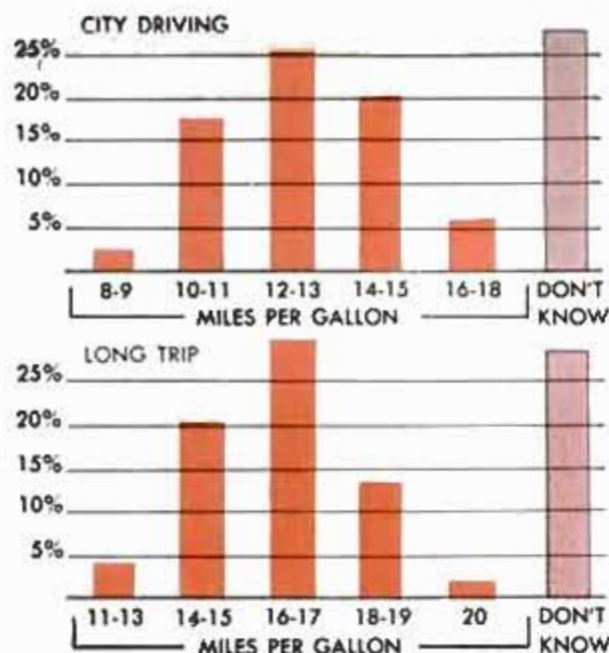
Suggestions for Industry

Each owner is asked to make one suggestion to the whole industry (not simply to Buick). The one most frequently suggested is, as you might expect, to provide increased gas economy. Second is to lower horsepower, third is to make cars shorter, narrower.

"Increase gas mileage and lower horsepower. Small cars are going to take over if this isn't done, I believe."—West Virginia branch manager.

"Raise the roof. My hat is worn and torn."—New York insurance salesman.

"Too much fins, too much glass, too long and too wide. Give us a car that is more durable."—Georgia tire retailer.



Bars in charts above show what Buick owners claim to be getting in gasoline mileage. Over-all average is probably between 13 and 15 miles per gallon. Right, extended fin can hit the vertical post before rear bumper when car is on a slant as at curbing



"What would be wrong with making a Chevrolet of about 100 horsepower, as big as a Rambler, but almost identical in styling to the Impala? They will never do this, but it would be nice."—Georgia businessman.

"The auto companies must sample teen-agers rather than the people who can afford to buy new cars when they ask about styling. I have no sympathy for the dilemma of the auto companies. I have been in business for nearly 30 years. At least 90 percent of my friends feel as I do. Why are cars so long and so low? The whole thing is ridiculous."—Illinois corporation president.

"Not enough attention is paid to the comfort of seats."—California general contractor.

(Continued to page 258)

← Don't ever say "never," my teacher used to say. And this fellow is in for a pleasant surprise come autumn.

← Why? Because they sell, that's why. Did you ever see a corporation president in a small car?

SUMMARY OF BUICK OWNERS' OPINIONS:

OVER-ALL RATING: Excellent 79.5% Average 18.8% Poor 1.7%

Best-liked features

Handling ease	49.5%
Riding comfort	47.1%
Exterior styling	41.9%
Power, performance	28.9%
Excellent brakes	14.6%
Good visibility	14.3%

Most-frequent complaints

None at all	24.3%
Center hump in floor	25.2%
Hard to get in, out	15.2%
Sun reflection dash	12.8%
Seats too low	8.8%
Too wide, too low, too long	7.3%
Heater-blower arrangement	6.1%

Had trouble with engine?

No trouble	87.9%
Some trouble	11.2%
Considerable trouble	0.9%

What was trouble?

Pings, knocks	5.8%
Carburetor, poor idle	3.0%
All others less than	1.0%

How is dealer service?

Excellent	53.1%
Average	29.4%
Poor	7.5%

Would buy from him again?

Yes, would	51.7%
No, would not	6.4%
Don't know, no answer	41.9%

What make was traded?

Buick	67.9%
Another GM make	14.6%
Ford Motor make	10.0%
Chrysler Corp. make	4.8%
All other makes	1.2%
No trade, no answer	4.5%

What other car owned?

Another Buick	4.3%
Another GM make	12.8%

Ford Motor make	8.5%
Chrysler Corp. make	4.5%
Independent make	4.3%
Foreign make	1.5%
No other car, no answer	64.1%

What make will buy next time?

Another Buick	68.7%
Another GM make	3.3%
Ford Motor make	2.1%
Chrysler Corp. make	1.2%
All other makes	1.0%
No answer, don't know	23.7%

Approve of industry styling?

Yes, approve	86.9%
No, disapprove	1.5%
No answer	11.6%

One suggestion for industry?

More gas economy	18.5%
Less horsepower, speed	11.6%
Smaller cars	9.1%
Better workmanship	5.2%
Easier in and out	3.3%

AN EYE ON SPACE

By Dr. Dan Q. Posin

PROFESSOR OF PHYSICS, DEPAUL UNIVERSITY
SCIENTIFIC CONSULTANT AND ADVISOR, COLUMBIA BROADCASTING SYSTEM



THE UNITED STATES has a plan to put a man into orbit. According to plan, the man will go around the earth 15 times or more before he comes down again, safely. McDonnell Aircraft Company now is designing and will build the capsule which is to carry the space adventurer around the world—not in 80 days, but in little more than 80 minutes.

The capsule with occupant will be launched by an Atlas ICBM. This rocket, using two booster engines and one sustaining engine, has been able in the past to develop more than 350,000 pounds of thrust. To increase the total thrust to more than 1,000,000 pounds, more booster rockets will be clustered around the main shell, thus permitting a substantial payload to go into orbit—a capsule containing a Daniel Boone of space.

The capsule will be guided into the chosen orbit by ground-radio equipment. If, by any chance, a mishap occurs on the way up, it will be possible to separate the capsule and bring it back by parachute.

After a series of successful orbitings, the spaceman will be able to fire a braking rocket in the direction of flight, the recoil destroying most of his forward speed. After a period of free fall, a series of parachutes will bring the traveler down to the surface, where radio signals will reveal his position. The capsule will be buoyant, should it land in the water.

The flight path, at about 125 miles above the earth's surface, will lead through the atmospheric fringe, and could permit orbiting for several weeks, should the spaceman begin to like his work and decide to remain aloft. Sufficient medical data will have been gathered, however, in the course of merely 15 or 30 orbital trips (a day or two).

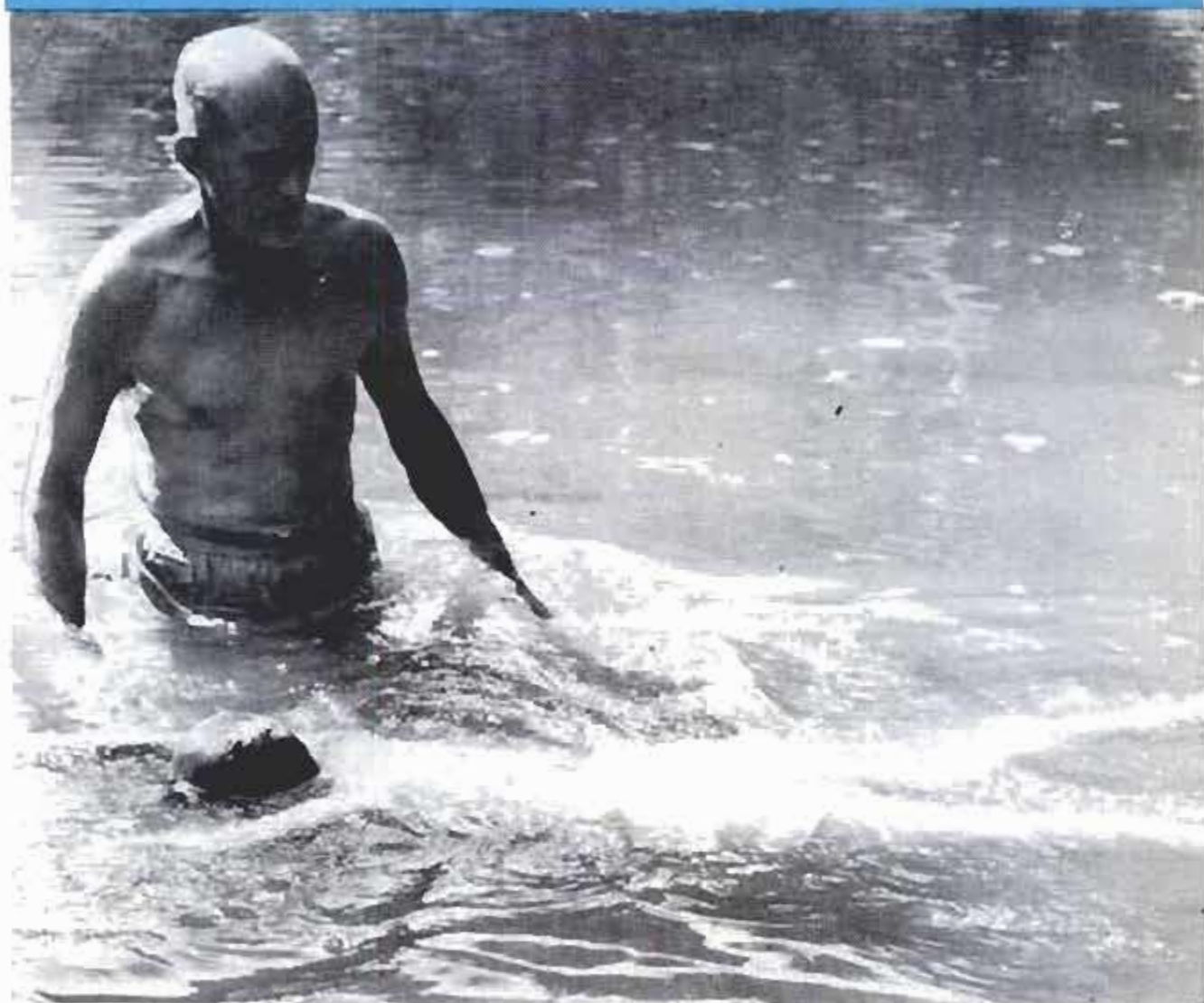
The speed in orbit will be something like the 18,000 miles per hour we've heard and read so much about. But this 18,000 is not a magic or absolute number. At a greater distance from the earth, the speed can be less. Obviously this is so because the earth's gravitational pull is less at greater distances, and the satellite can laze along, experiencing only a relatively mild curving effect. At the distance of the moon, a satellite can lope along at a mere 2000 miles per hour. And, in fact, the moon does just that.

It is not difficult to calculate the speed which any satellite must have in order to orbit at any distance from the earth. For example, at 4000 miles from the earth's center (that is, a little above the earth's surface), the speed for orbiting is about 18,000 miles per hour; at 16,000 miles from the earth's center, the orbiting speed would be 9000 miles per hour, and at 36,000 miles the orbiting speed would be 6000 miles per hour.

In this connection, our spaceman could have a very interesting capsule journey around the equator at a distance of about 22,000 miles from the earth's surface (26,000 miles from the earth's center). At this distance the orbiting speed would be about 7000 miles per hour. And at this speed, the orbiting capsule would be turning in space at *exactly the same rate as the surface of the earth below*. Thus an orbiting spaceman at 22,000 miles above the equator would be constantly poised above the same spot on earth. It might even be the spaceman's house. It would be as though a man sat on a flagpole 22,000 miles tall—with the minor difference that there would be no flagpole!

Teach the Kids to Swim in One Lesson

By
Emmett Gowen



The author starts a 10-year-old nephew out with his first step in learning to swim, the dead-man's float

IT IS POSSIBLE to teach almost any non-swimmer to swim in one lesson. There are but three basic ideas to put across, three things for the pupil to do. When he does the three together, he's swimming.

First, have your pupil do the dead-man's float. Chances are he can already do this, for it is nothing but lying in the water, face downward. Small children often learn this in the bathtub. When asked to do it in a pool or lake, though, many kids are horrified at the idea of putting their faces in

the water. So if you want to see how quickly you can teach someone to swim, I'd suggest you choose a boy about 10 years old who has decided he *wants* to learn. It helps if your word has authority with him. He must believe that if he does as you say, he will be able to swim as soon as he has gone through the three steps. These steps shouldn't take longer than a half hour.

Have him do the dead-man's float a few times. Then, step two, instruct him to make swimming motions with his arms. Do this a



Still doing "dead-man's float," Coleman advances to second step—making swimming motions with his arms

few times, and make sure that the motions strike downward so that there will be a lifting effect. It is best to keep the whole thing as simple as possible, so say nothing, yet, about kicking the feet. That can come later. Just convince the pupil that (1) if he does the dead-man's float and (2) pulls with his arms, he will move through the water.

Now you add the third step. Do the dead-man's float, pull forward and down with the arms, and try while doing this to peep up out of the water. Anyone who has not swum before will tend to exaggerate this motion. The thing that can hold any beginner back is the impulse to get as much of himself as possible above water—with the result that he loses the flotation he had when lying barely awash. In trying to get too high out of the water, he sinks

himself. So your advice to just peep out is a trick to get only the nose and mouth out of the water.

Once he is floating, propelling himself, and has his face up high enough to breathe, he's swimming.

Good swimming instructors use these three basic steps in their teachings, but they don't put it all into one lesson or half an hour. I noticed this many years ago when I used to go swimming in a hotel pool. A woman was taking swimming lessons there, and I noticed that the instructor used several lessons on nothing but the dead-man's float, then spent several more having the woman swim with her face underwater. Finally he had her raise her face, and she was swimming.

I applied the observation to teaching six of my seven nieces and nephews to swim.



Still floating, and propelling self with arms, Coleman raises nose, mouth above water—but not too high

But I didn't see any reason to string out the lessons. I proceeded quickly.

There were, I found, variations in the aptitude of individuals. Iris was never fond of playing in water, had no desire to learn to swim, and when pressed asserted positively that she did not want to learn to swim. She has not learned to this day. Nona, strong-willed and inclined from earliest childhood to test everything with her own intelligence, would not listen. She asserted she would learn by herself, so she went into the water and fought it until she half-drowned herself and was weak with exhaustion, and getting nowhere. Finally she considered trying my method. She did the dead-man's float, pulled her hands against the water, raised her face and was swimming.

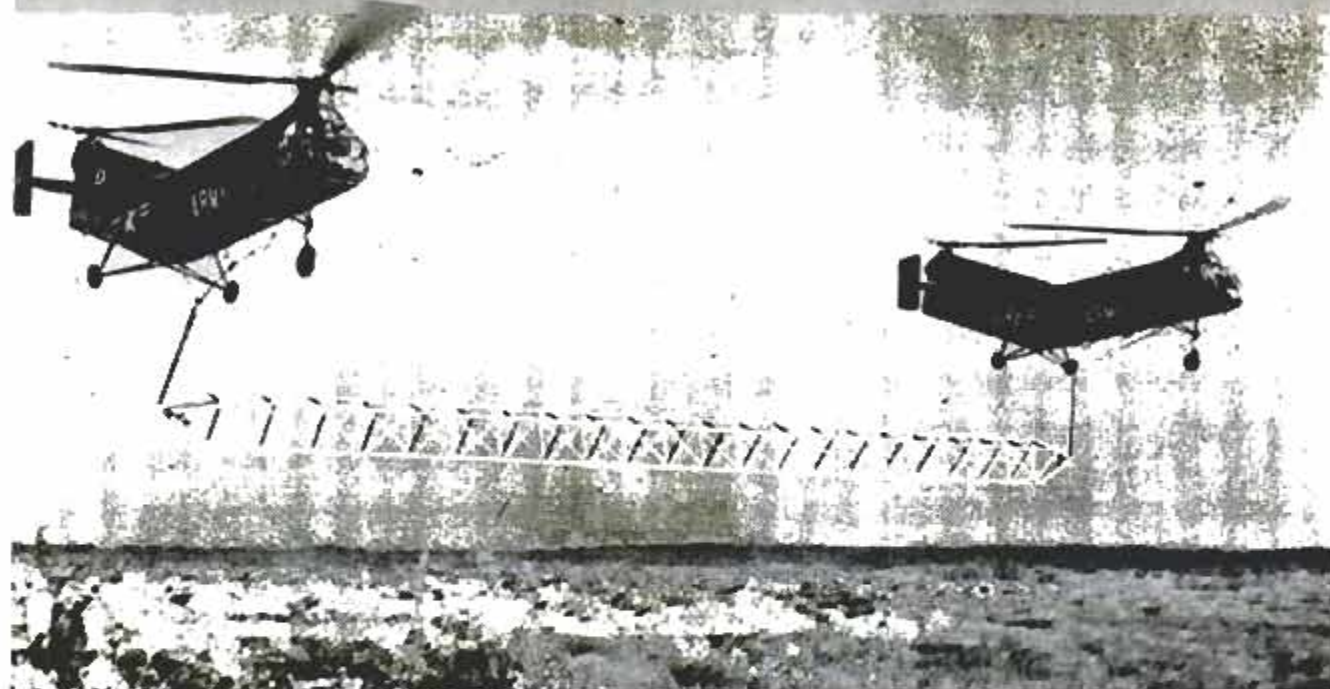
Travis and Jeanine were impressed, al-

most hypnotically. It took no more than half an hour to teach them to start swimming. It was in salt water, which is more buoyant than fresh water, and neither of them will ever believe that there is anything difficult to learn about swimming.

Sandra learned by herself. Three children older than she already knew how to swim, and wanted to go to the deep hole in the creek. She was only about five, and I had not yet tried to teach her. We just put a kapok life preserver on her and let her paddle along while we swam. One day, when the life preserver had become waterlogged, Sandra unconsciously began swimming against its dead weight. After we threw the life preserver away, she paddled around the deep water much faster.

Karen would not do the dead-man's float.

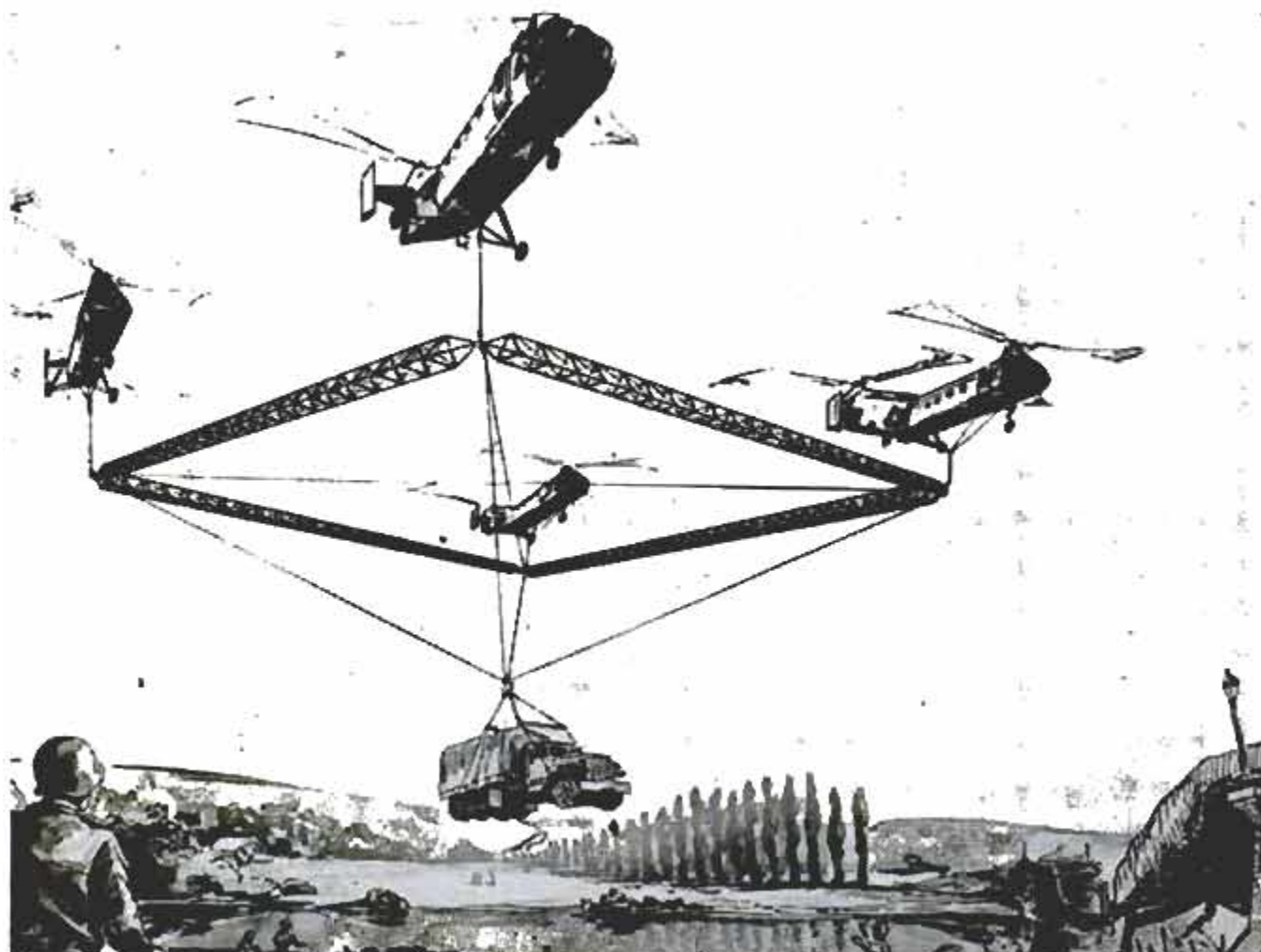
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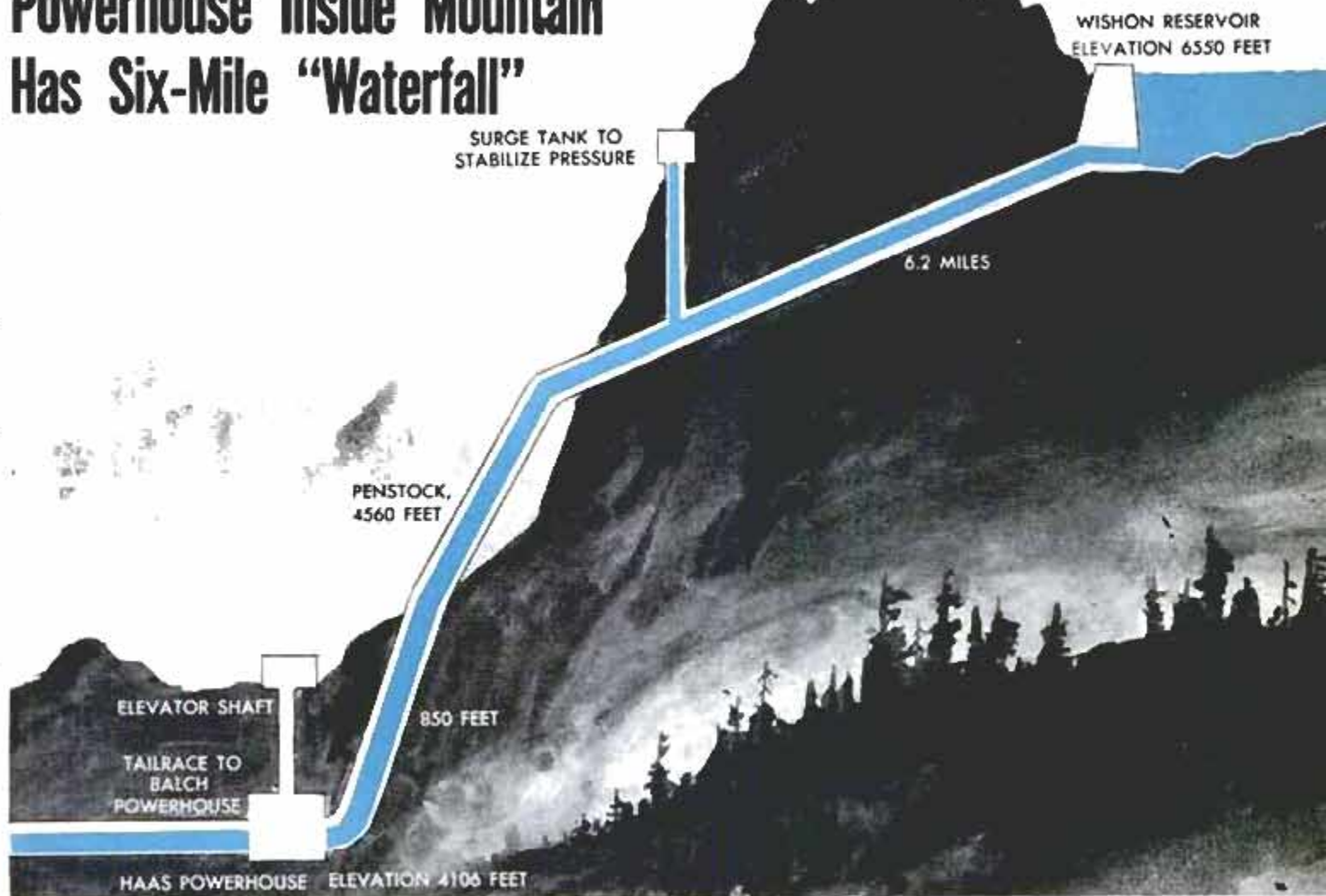
Workhorses of the Air

HELICOPTERS can be harnessed in teams of aerial workhorses, providing tremendous lifting power for short-haul delivery of heavy military vehicles and materiel to advanced combat areas. The copters can be harnessed in teams of two, three, four, five or six. Their heavy cargo, such as a 13,000-

pound truck, is attached by cables to aluminum-alloy spreader-frames. Ends of the frames are fastened together and the copters are attached to the frames by suspension cables. Each frame is 113 feet long and weighs 400 pounds. Vertol Aircraft developed the method for the Army.



Powerhouse Inside Mountain Has Six-Mile "Waterfall"



Profile sketch illustrates the flow of water to underground Haas powerhouse from High Sierra reservoir

BURIED 427 FEET in the solid granite of the Sierra Nevada Mountains of California is a hydroelectric installation as big as a 10-story building. The huge underground Haas powerhouse contains two generators with a capacity of 128,000 kilowatts. The installation is part of the Kings River hydroelectric system of the Pacific Gas and Electric Company. Water to operate the turbines comes from the Wishon Reservoir, which is over a mile high in the Sierras. The water flows six miles through a 13-foot horseshoe tunnel cut in the rock. The end of the tunnel connects with a steel penstock that carries the water 4560 feet above ground to another granite tunnel through which the water plunges 850 feet, almost straight down, to the turbines. After falling 14 times the height of Niagara Falls, the water rifles into the turbines with a pressure measuring 72 tons per square foot. The nozzle speed of the water jets hitting the turbine cups is 261 miles per hour. Then the water flows through a tailrace to produce more power in other generators downstream. Granite that was cut from where the tunnels and the powerhouse are now located was used in construction of the Wishon Reservoir Dam.

Interior view of underground powerhouse during installation of generators. Walls are solid granite



They're Testing

Walls without studs, roofs without rafters and windows without sashes are among construction ideas for houses of the future that should give you more for your money

By Kenneth Anderson

WHEN YOU SHOP for a new home in the rapidly approaching "space age," the real-estate salesman might mention the advantages of wiring trees, slotted splines or expandable polystyrene in stress skins. But he won't be using doubletalk. The words already are part of the vocabulary of home builders who are experimenting with revolutionary techniques and materials that should result in better houses for less money in the next few years.

Right now the National Association of Home Builders Research Institute is conducting tests with the first two of a planned series of houses incorporating new developments in aluminum, gypsum, plastics, plywood, steel, concrete and other building products.

The research houses which have been built so far, at South Bend, Ind., and Knoxville, Tenn., would not appear out of place in any neighborhood of inexpensive new homes. They are attractive three-bedroom, basementless houses. Both were erected by prominent home builders—Martin L. Bartling, Jr., constructed the Knoxville research house and Andrew S. Place built the South Bend home. Both have modern floor plans and might carry a price tag of around \$13,500, if you could buy them.

The most startling feature of the South Bend research house is a steep-pitched shelter over the driveway. This structure, linked to the family room-kitchen area by a breezeway, is called a "garport, since it is a cross between a carport and garage." A "traffic stopper" on the Knoxville research house might be the wind-sheltered patio. It extends in an L-shape around the exterior of the kitchen and family room. The patio receives additional sunlight through an exposed portion of the ribbed-aluminum roof.

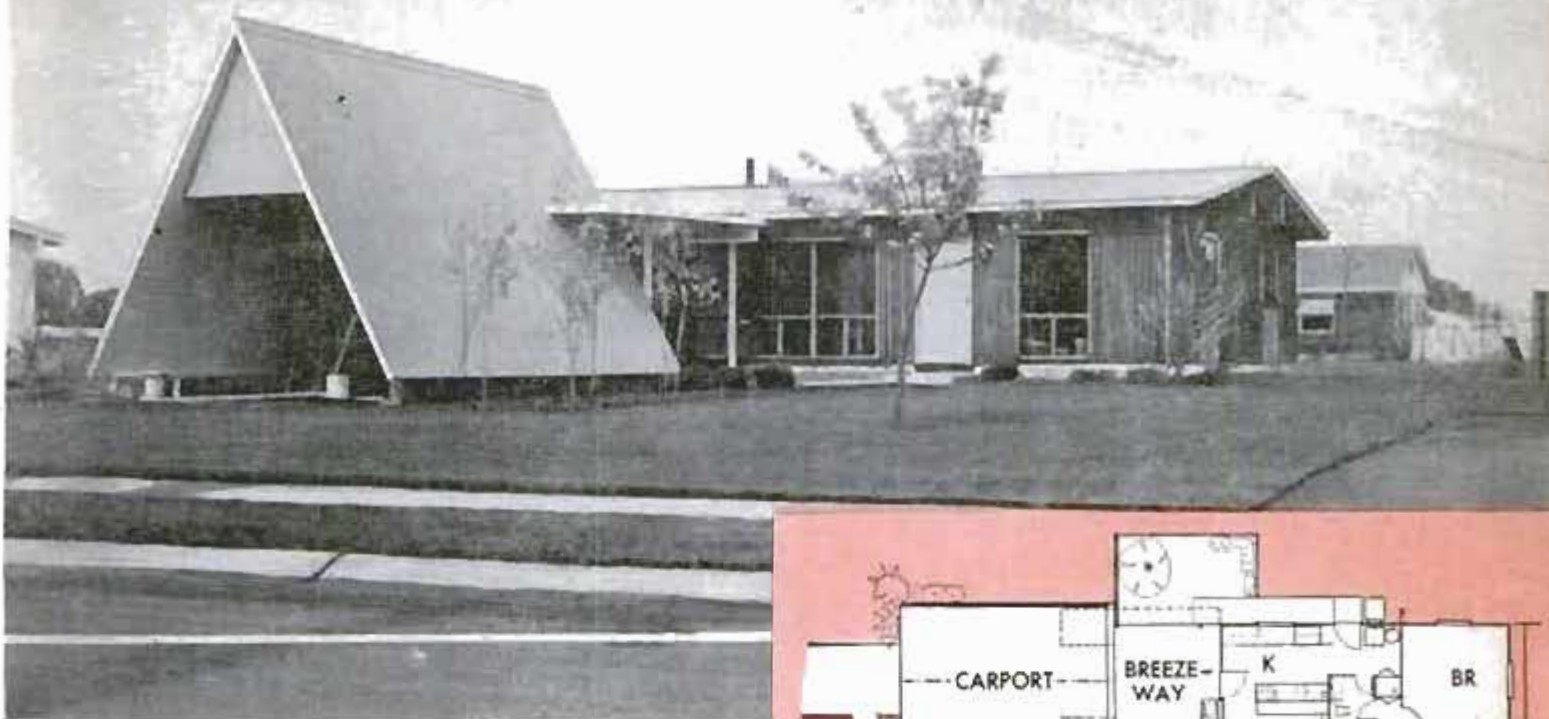
More significant, probably, are some of the features that are not discernible in a view from the street. Even from inside the South Bend research house, for example, you are not aware that the six-room structure, with approximately 1200 square feet of floor space, was assembled without a single stud, joist or rafter. The outside walls, interior walls and roof are made of sandwich panels with a "filling," or core, of foamed plastic.

The panels, also known as stress skins, have never been used before in building a house. They are made by placing two sheets of conventional building material, such as gypsum board or plywood, in a form and filling the 2¼-inch space between the sheets with expandable polystyrene. The polystyrene, which bears the trade name of Dylite, foams

Interior doors of NAHB research house at South Bend, top left, are eight feet high and close on hardware mounted on wall, beneath electric switch plate. Center photo shows cross-sections of a gypsum interior wall panel and a plywood roof panel, both filled with foamed plastic. Left, workmen at Knoxville site install hardboard wall panel on sill plate



Tomorrow's Homes

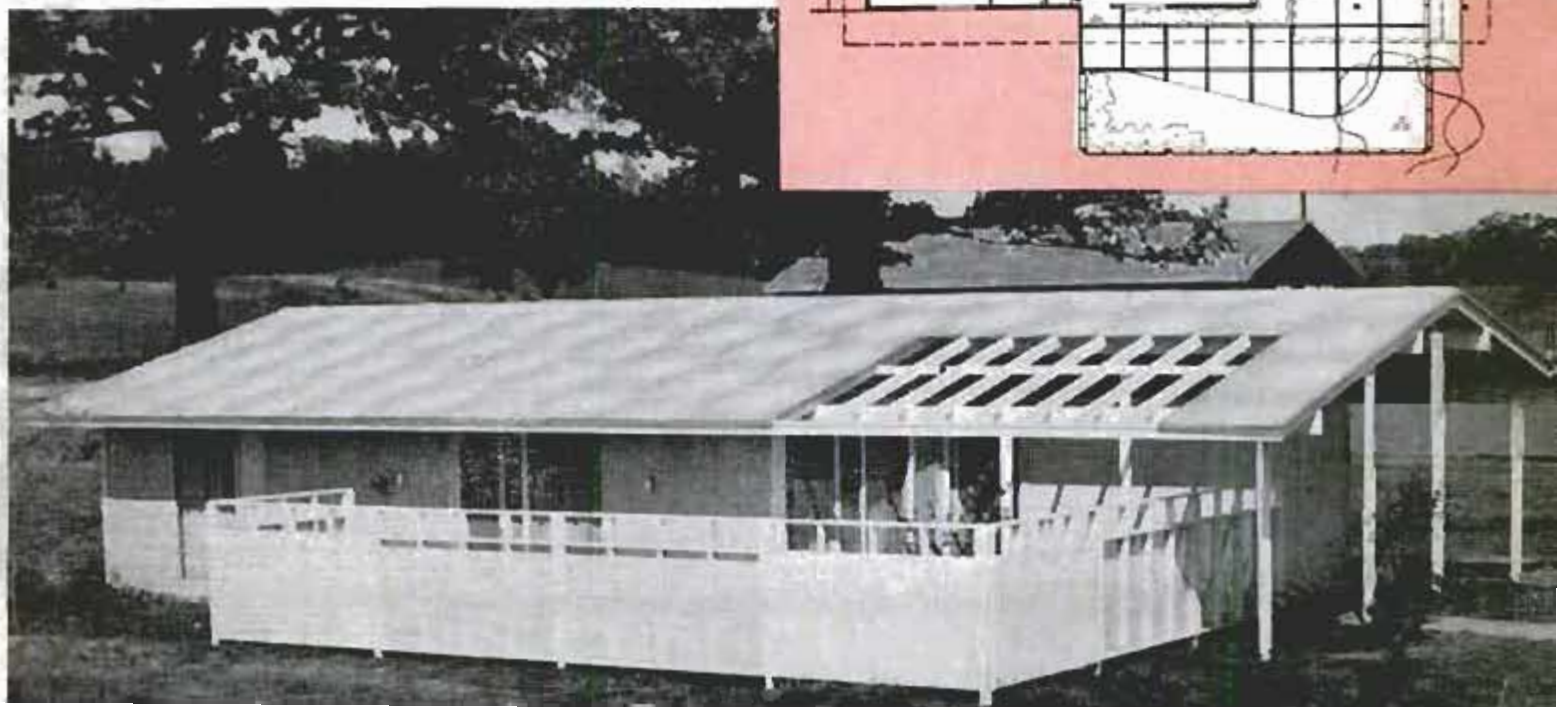
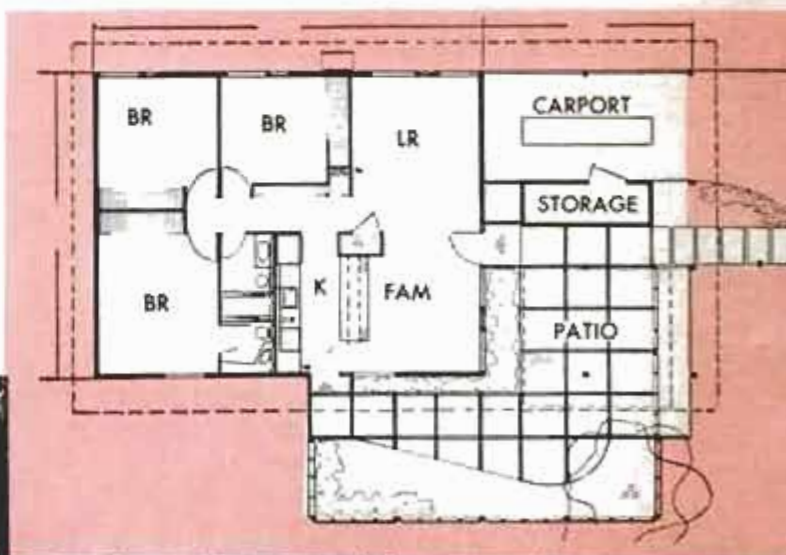
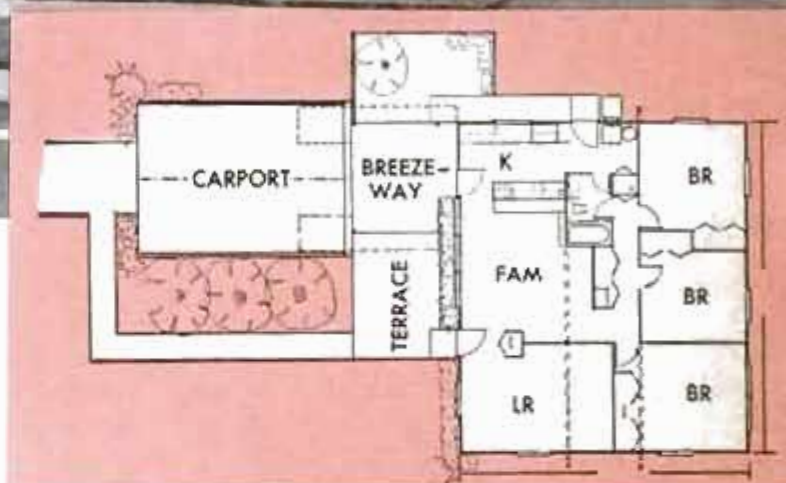


South Bend research house is 36½ feet by 32½ feet, features steep-pitched "garport" of sandwich panels

in the space and forms a bond with the surface material, which in the case of exterior wall panels may be Douglas Fir plywood on one side and "combed" redwood plywood on the other.

The tiny beads of Dylite feel like pieces of popcorn if you squeeze them between your fingers. As insulating material, the plastic is rated excellent. Heat loss through the sandwich panels is about half that of walls built with conventional framing methods. And the panels have a tremendous load-bearing capacity. Builders of the home estimate the studless walls could

Knoxville research house is 36 feet 8 inches long by 28 feet 8 inches wide and has sheltered patio





First of plastic-core roof panels is put on South Bend house, which five men erected in one working day

support a roof covered with wet snow 40 feet deep, if the roof weren't deflected by the weight.

The panels for the South Bend research house were produced in four-foot modules. But, eventually, they may be produced in any length that can be shipped. And when the homeowner of the future wants to add a room to his house, he may simply order sandwich panels to match the dimensions of the room and cut out holes for the doors and windows.

The stress-skin panels with foamed plastic cores are lightweight. The 4-inch thick roof panels, 18 feet long and 4 feet wide, weigh 190 pounds and can be handled by two men.

Exterior and interior walls of the Knoxville research house were assembled from factory-built panels of hardboard. The inside surfaces of the wall sections are plastic-coated and the exterior surfaces are finished with a new kind of outside paint which may not have to be renewed for 20 years. The hardboard wall panels also have built-in insulation, are lightweight and can be erected quickly by a small crew of workmen. (The entire research house at South Bend was erected by five men in one working day.)

Both the South Bend and Knoxville houses make use of aluminum as roof coating and fascia strip. On the Knoxville project, ribbed aluminum sheets, measuring 4 by 18 feet, were fastened to plywood sheathing. The aluminum is expected to help insulate the house and to eliminate periodic replacement of shingles, as is nec-

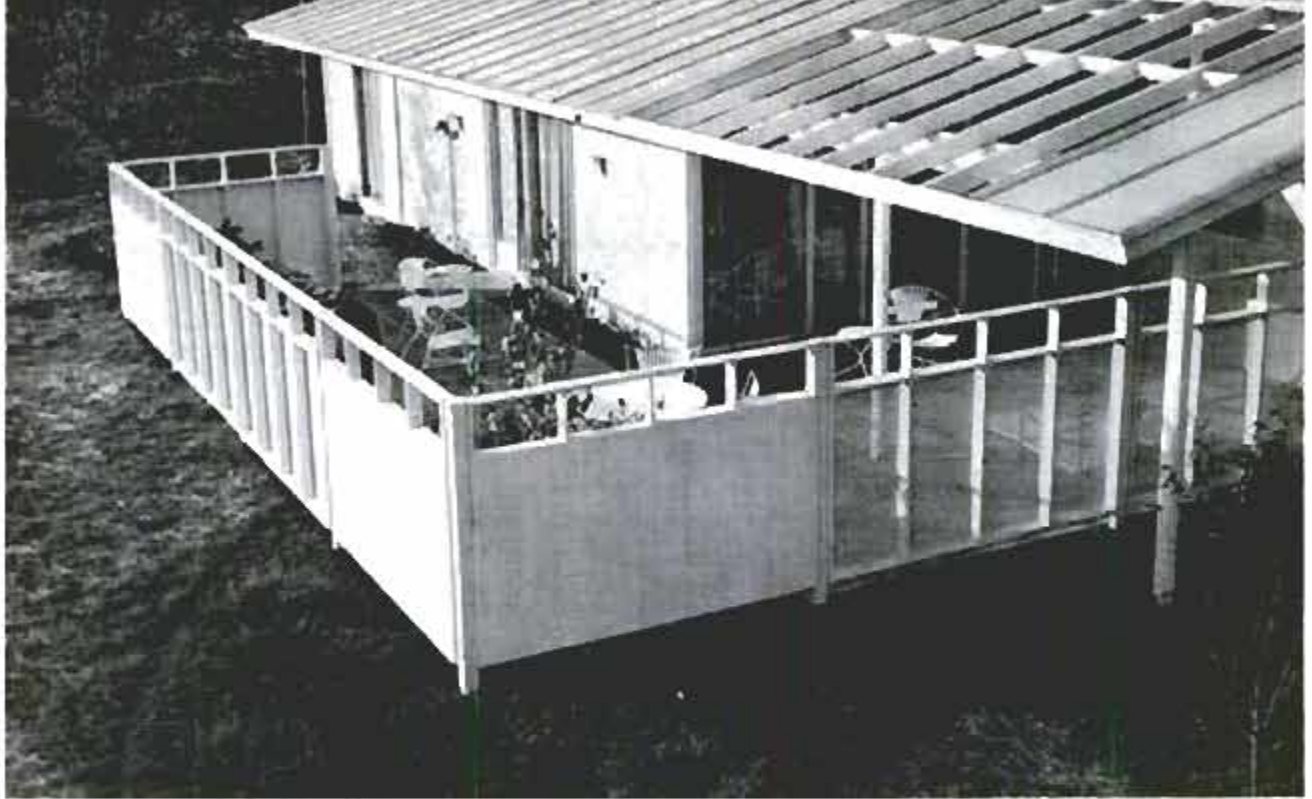
essary with today's conventional houses.

Some new ideas in plumbing also are getting a practical test in the two research homes. At Knoxville, all-plastic plumbing was installed, along with a new type of toilet and a garbage disposer that greatly reduce the amount of water consumed. In the South Bend research house, the plumbing is a simplified package of pipes concealed under the kitchen sink. Since the bathroom adjoins the kitchen, all the sewage and water-supply pipes are located next to the common wall. Even the stack is one solid pipe that can be disconnected under the sink counter and pulled up through the roof. Copper tubing was used in the South Bend house, with the explanation that copper will bend if the structure settles and plumbing failures caused by sagging walls and floors will be eliminated. The copper tubing is four times lighter than the type usually recommended for home plumbing.

The bathtub was installed on a platform six inches above the floor. This idea, it is hoped, will prove attractive to a mother of small children. She won't have to bend over so far to scrub the toddlers.

Many of the ideas being tested by the NAHB are simple cost-cutting methods. For example, hiding the seams between wall and ceiling panels is expensive. In the South Bend house little or no effort is made to conceal the seams. The builder explains, "there's no heat loss through them and they don't leak, so let them show."

The interior walls are plastic coated and the interior doors are eight feet high. For people who have spent most of their lives



Close-up of house at Knoxville shows use of 18-foot aluminum roofing sheets combined with fascia strip

opening and closing six-foot eight-inch doors, the eight-foot doors may seem unnecessarily large. But the oversize door reduces the cost of framing doorways; the conventional door casing is eliminated. There is, instead, a vinyl closing strip along the edge of the wall.

Windows in the South Bend house are sashless. They are simply plates of glass that slide in the grooves of a wood casing. Hardware mounted directly on the glass permits the windows to be locked shut or partly open. The heat loss through the sashless window reportedly is 72 percent less than through awning-type windows.

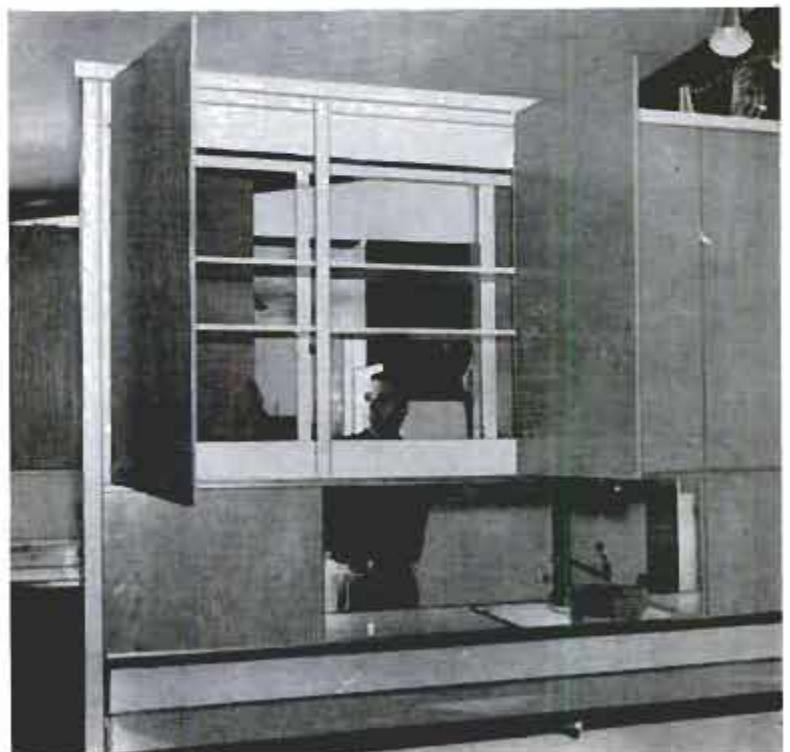
Still other ideas being tested for the homes of tomorrow are very thin hardwood flooring—African oak $\frac{3}{16}$ inch thick—and a pre-assembled electrical wiring system called a “wiring tree.”

Kitchen cabinets in the Knoxville house are made of hardboard and mounted on slotted splines. Cabinets in the South Bend house can be opened either from the kitchen or from the family room.

These aren't just demonstration houses. They actually serve as laboratories for the NAHB Research Institute. And from these laboratories will come tomorrow's houses—with better materials, methods and values. ★ ★ ★



Sashless windows lock closed or partly open with twist of wrist. Kitchen cabinets, below, can be opened from family room



L around. The next three years will be the most exciting since they stopped putting flower vases in sedans.

By 1962 the three top-selling cars will be makes that aren't even on the street today (except as prototype test cars in deep disguise).

The Big Three's upcoming smaller cars could account for at least 40 percent of all domestic cars sold in 1962. If so, drastic changes are certain. At least one and, quite possibly, two medium-price makes in each family of cars will vanish. Do your own forecasting as to which will be first to go.

"Nothing in the past three months has occurred to discourage GM's move toward small cars," is the way Frederic G. Donner, top man at General Motors carefully understated it at the Chicago Auto Show.

The bold plan of the automobile industry is to produce a durable, dependable automobile of such simple mechanical design that you can work on it yourself. This will bring the do-it-yourself movement back into the home garage. (Hurray! shout millions of enthusiasts to whom tinkering with the car is not only money saving, but relaxing.)

Of course, there will always be the bigger, luxury-type car for those who demand it and can afford it. This may even become the second car in the family. The mass market is expected to be for a transportation vehicle.

Must Be Exciting

These smaller cars must not fail to be exciting, say the planners. They must provide the same fun-to-drive that foreigners have taught Americans to expect in small cars. They must provide a pride of ownership based on exciting engineering, exciting handling instead of the rapidly disappearing size-prestige symbol.

If reports are right, the GM small car does all this and more. Test drivers say that the rear-engine machine (rumored to be disguised under a foreign-car body) goes up and down winding mountain roads faster than any mass-produced car in the world. Weight distribution is the key to its fine handling. The supposedly inherent oversteer of the rear-engine design has apparently been licked by GM's lightweight power package. The car is expected to clip the tart tongues of the "Detroit iron" cult of critics.

There may be three shades of small-car opinion. GM is emphasizing engineering innovations. Ford seems to be betting on conventionality, reliability and miles per gallon. Chrysler is rumored to feel that visual excitement or styling is as important (perhaps even more so) as mechanical ex-



By Art Railton

citement. These are far too generalized statements to be taken literally; no company puts all its efforts in one area. However, they do describe the over-all impression one gets.

Chevrolet dealers apparently are not going to market the GM small car. Best bet is that the choice plum fell into Pontiac's lap, with a possibility that Buick will be cut in also. If so, this explains why Pontiac and Buick dealers were given the Vauxhall and Opel. Their two-year experience with the imports gives them an advance feeling of the small-car business. Once the new GM car is out, these two "naturalized" imports are expected to return quietly home.

If you want to speculate on what the rear of the 1960 Cadillac will look like, study the \$13,000 Italian-built Cadillac Brougham. Its tailfins are subdued, but stylish. And in good taste—no rocketry there. The 1960 Cadillac will copy them.

Exciting Truck Engine

Big news for truckers will break this fall. Here also, GM will make a bold advance. It will introduce a spectacular V6 engine for its truck line. The shorter, more powerful engine will fit neatly under the floor of the close-coupled tractor cars. It is an attempt (and a successful one, say insiders) to make the gasoline engine as long-lived and as cheap to maintain as the diesel, without the diesel's initial higher cost. It will run 200,000 miles without an overhaul.

Is it suitable for passenger cars? Experts say it is not. A V6 takes up more vertical space than a V8 because of its 60-degree configuration. It is also longer for the same reason. These are two dimensions that are critical in cars. The big virtue of the V6 shape is its narrowness. In an under-cab-engine design, width is a critical item, but not in today's automobiles.

Anyway, the new V6 is water-cooled and cast iron, much too old-fashioned to be exciting in the years ahead. GM has the upcoming air-cooled aluminum flat six to power its passenger cars until the turbine takes over. ★ ★ ★



Hiller's Tilt-Wing Transport Is Largest VTOL Aircraft

At 16½ tons, Hiller Aircraft Corporation's X-18 "Propelloplane" is the largest VTOL (vertical take-off and landing) craft yet built. The tilt-wing transport can also operate as an STOL (short take-off and landing) or a conventional airplane, depending on the length of runway. The X-18 is an intermediate-range transport.

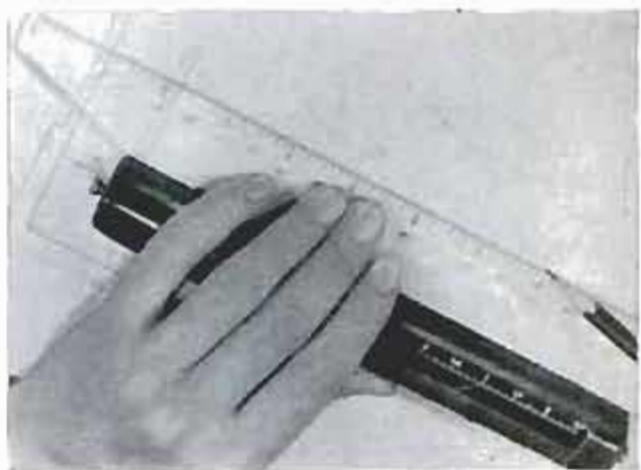
Sensitive Tube "Sniffs" Smoke To Set Off Warning

Prevention of fire and explosion disasters was given an assist by the development of an ultraviolet-sensitive tube that responds simultaneously to flame, smoke and combustible vapors. The four-inch, black tube, developed by the Minneapolis-Honeywell Regulator Company, is shown here at the center of an experimental detector. As a demonstrating scientist lights his pipe, the tube illuminates the "fire" and "smoke" indicators. The "vapor" indicator notes the presence of gases in the beaker.



Ruler Rolls on Drawing Paper To Make Parallel Lines

Introduced recently in England is an instrument designed to aid draftsmen and artists in drawing horizontal or vertical lines. The device consists of a ruler that is attached to a roller housing. The roller housing contains a scale for measuring the distances between horizontal and vertical lines. By inserting the pencil point in holes in the ruler, the instrument can be used to draw parallel vertical lines. The roller has serrated metal ends to prevent slipping.



Keeping up with the ATOM

NOW THE TINY ATOM has been put to work weighing the contents of loaded freight cars. The photo at right shows an experimental "atomic scale" developed by the New York Central.

Between the freight car's wheels is a lead-shielded box containing Cobalt 60, a material which emits gamma rays. Suspended above the car is a scintillation counter which measures the gamma rays reaching it.

As a freight train passes over the box, the gamma rays penetrate each car. The car absorbs a certain amount of the rays depending upon the weight of its contents. The measurements are fed into an electronic computer which then calculates the weight of the car and records the answer on a graph or printed tape.

The atomic scales can be used to weigh entire trains without uncoupling the cars, as present systems require. Although the system is not yet accurate to within two tenths of one percent, as required for billing purposes, additional improvements may permit such pinpoint accuracy.

☆☆☆

ARE THERE ATOMIC particles with negative mass? The discovery of such strange particles would be fascinating, for it would be akin to the discovery of an object that would fall up instead of down!

There is evidence that "falling up" electrons exist. Experiments in this field have been performed at the Princeton Laboratories of the Radio Corporation of America. The experiments uncovered evidence that some electrons inside crystals of germanium rotate in a direction just opposite to that of positive-mass electrons.

The negative-mass electron might be compared to an object that would move the wrong way when pushed. If such strange electrons could be attained in quantity, they would signal a major breakthrough in solid-state physics.

☆☆☆

DEER ANTLERS can offer mute testimony to the increase in fallout.

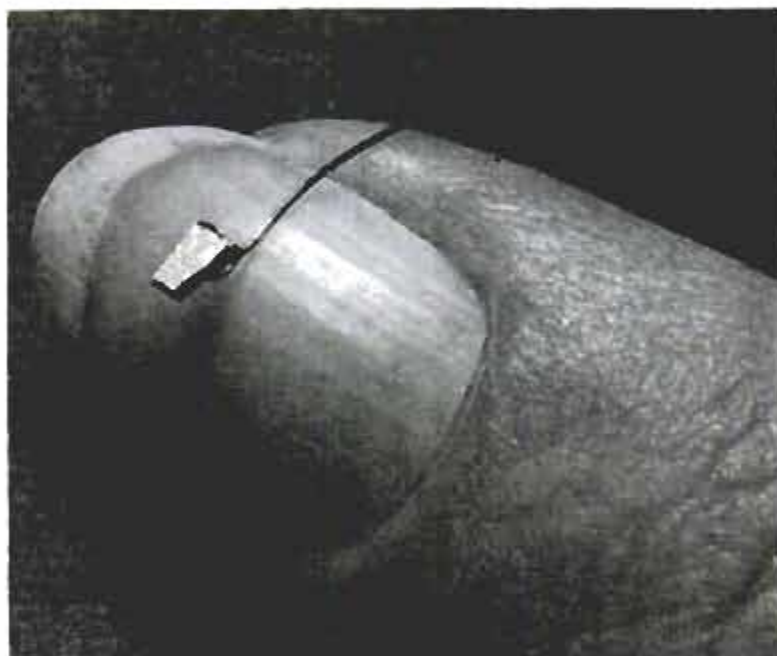


Studies have been made of deer that normally graze on upland pastures which are known to contain relatively high levels of fallout. This analysis indicates that there has been about a tenfold increase in radioactivity since 1952.

Also, British scientists are undertaking a study of the effects that fallout may have on wildlife. Recent reports indicate some mysterious changes. For example, migratory birds have arrived to winter in Africa wearing the next season's breeding plumage, and some birds arriving in Britain, also with unseasonal plumage, have been found to be more radioactive than normal birds. British scientists suspect that radioactivity may have upset the birds' sexual cycle.

☆☆☆

THE TOM THUMB instrument below is said to be the world's smallest neutron detector. Developed by Westinghouse, its function is to map the pattern of neutrons inside the core of a nuclear reactor.





Rotating Chute Reduces Glide And Drops to Ground Vertically

Safer and more accurate parachuting may result from a chute equipped with four cloth blades that spin like a helicopter's rotor. Still being tested, the chute greatly reduces shock on opening, and all but eliminates glide, thus making it possible to drop personnel or cargo vertically. The chute is also intended for missile recovery and braking of high-speed aircraft. Rotation of the blades creates a vortex of air around the tips, increasing the drag area and enlarging the chute's size. The corners of the blades are attached to nylon suspension lines drawn together at a swivel, which has an attachment for personnel, cargo, missiles or aircraft.



Brrr! Magnet Helps Approach Absolute Zero

Temperatures within a thousandth of a degree of absolute zero can be maintained with the help of an electromagnet. A substance to be tested is placed in a container inside a helium bath and the whole apparatus lowered into the magnet's core. Liquid helium lowers the temperature of the

substance and most of the random motions of its molecules cease. Meanwhile, the magnetic field has aligned the molecules in orderly fashion. When the magnet is turned off, the molecules try to return to a disordered state. Expending energy, they become colder still.

On floor above giant magnet, scientist places test apparatus in container holding liquid-helium bath

Scientists inspect magnet. Tubes, left, keep magnet cool with 2200 gallons of kerosene per minute



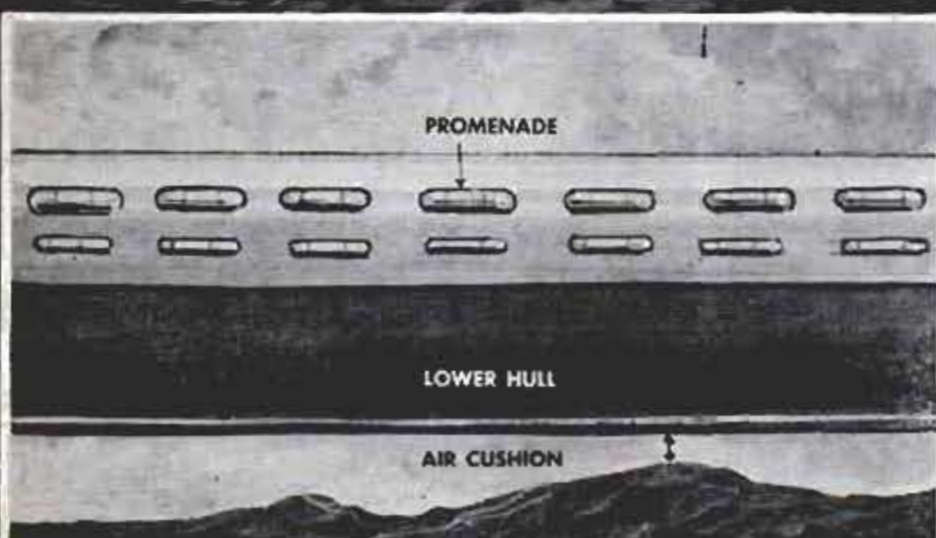
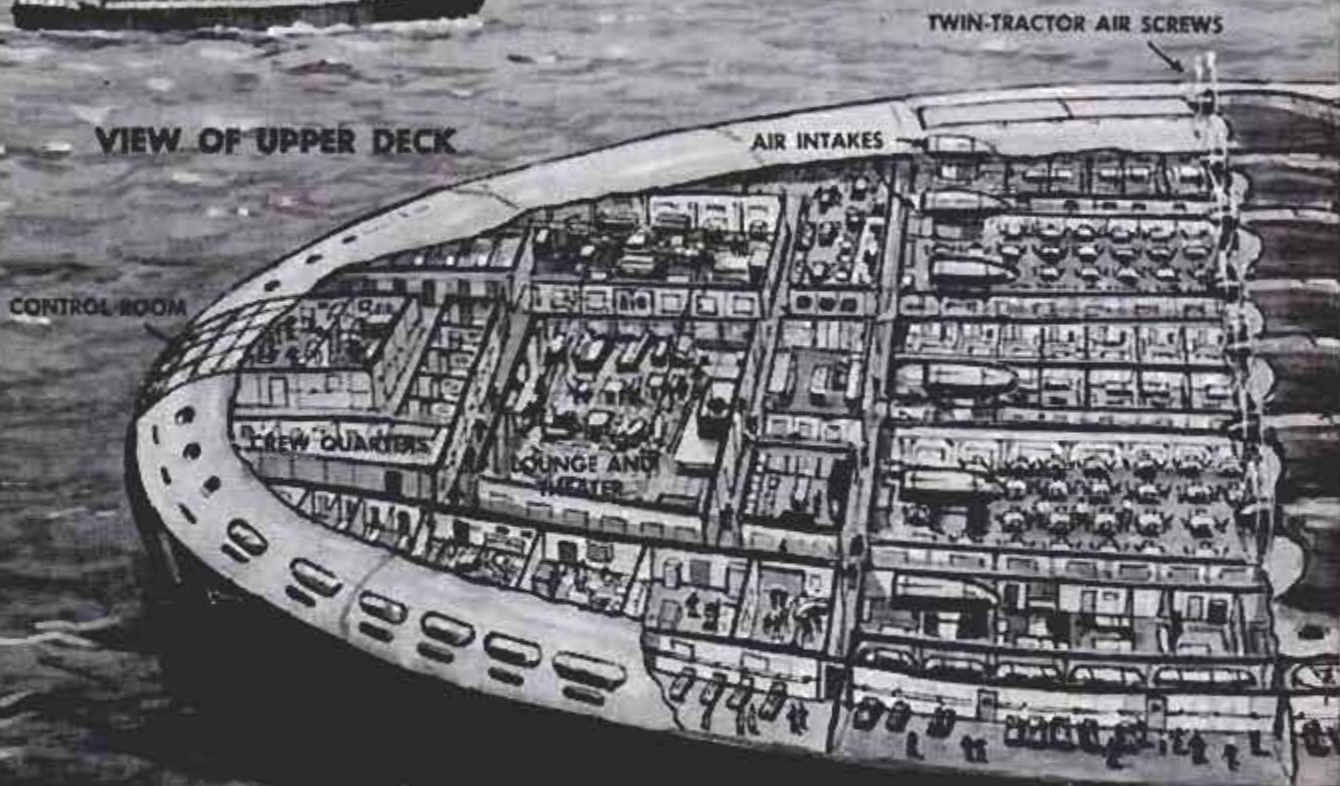
SIDE VIEW OF "MARINE FLYING SAUCER"



GREATEST CUSHION PRESSURE IS IN CENTER OF SHIP. IT IS RETAINED THERE BY FORE-AND-AFT BLASTS FROM FANS



VIEW OF UPPER DECK



AVERAGE HEIGHT OF ATLANTIC WAVES: 8 FT. AVERAGE HEIGHT OF ATLANTIC WAVES IN GALE: 18 FT. SHIP WOULD BE HELD APPROXIMATELY 8 FEET ABOVE ALL CRESTS. BECAUSE SHIP HAS NO DIRECT CONTACT WITH SEA, IT REMAINS STABLE IN ALL WIND AND SEA CONDITIONS

OCEAN VOYAGERS may some day travel on a vessel that rides a few feet above water and crosses the sea at 100 knots. Such a vessel would look like the marine "flying saucer" shown on these pages, which was designed by Swiss engineer Carl Weiland and drawn for *Popular*

PROPULSION UNITS

AIR INTAKE

CABINS

AIR CUSHION DUCTS

FUEL

SEAGOING SAUCERS AHEAD?

AIR INTAKES

CABINS

FINS AND RUDDERS

SWIMMING POOL

CABINS

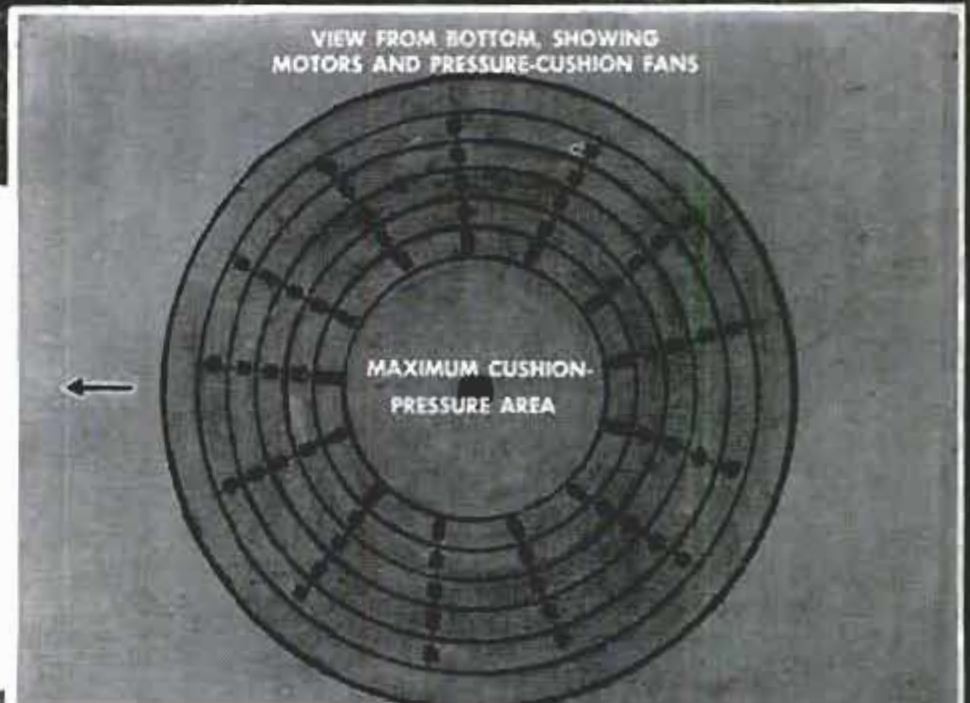
PROMENADE

WEIGHT OF SHIP: 40,000 TONS
PASSENGER ACCOMMODATIONS: 1000
DIAMETER: 330 FT.
SPEED: 100 KNOTS

VIEW FROM BOTTOM, SHOWING
MOTORS AND PRESSURE-CUSHION FANS

MAXIMUM CUSHION-
PRESSURE AREA

Mechanics by the British artist, G. H. Davis. Skimming the surface as a hydroplane does, the vessel would ride on a cushion of high-pressure air created by huge fans fore and aft. The vessel's circular design would reduce to a minimum the escape of air from the cushion. ★ ★ ★





Orbiting "Satellite"



Model plane enthusiasts can fly a new "satellite" either in free flight or on a tether in "controlled orbit." The model consists of whirling vanes mounted around a gas engine. In free flight on a calm day the model will rise more than 1000 feet straight up. On a control line it can be made to "orbit" above the head of the flier.



Cadets Read Signal Lights To Learn What to Wear

Combinations of colored lights tell Air Force Academy cadets which uniform to wear at the next formation. From a control room, the signals are flashed on electronic panels located on hall ceilings throughout cadet quarters. The system replaces the traditional flag-and-yardarm method used at other service academies.

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Basketball Goal Can Be Adjusted to Suit Boy's Height

Fathers may now buy a basketball goal that can "grow" with their sons. It can be adjusted from seven feet up to ten—regulation height. Designed for garages and other

buildings, the goal is extended far enough out so that a player can dribble in for an under-the-basket shot without bumping into the building.





All photos by Canadian National Defence

HMCS *Restigouche* pauses at gun wharf in her home port, Halifax. Rounded edges of deck shed atomic fallout

Canada's Fabulous Submarine Killer... HMCS *Restigouche*

By Wayne Whittaker

WHEN YOU STEP ABOARD Her Majesty's Canadian Ship *Restigouche*—regarded by Navy men on a couple of continents as the hottest thing in antisubmarine warfare—you are immediately impressed with the ship's resemblance to her enemy. The rounded decks and sleekly contoured hull make the ship look like a cross between a high-riding submarine and a destroyer.

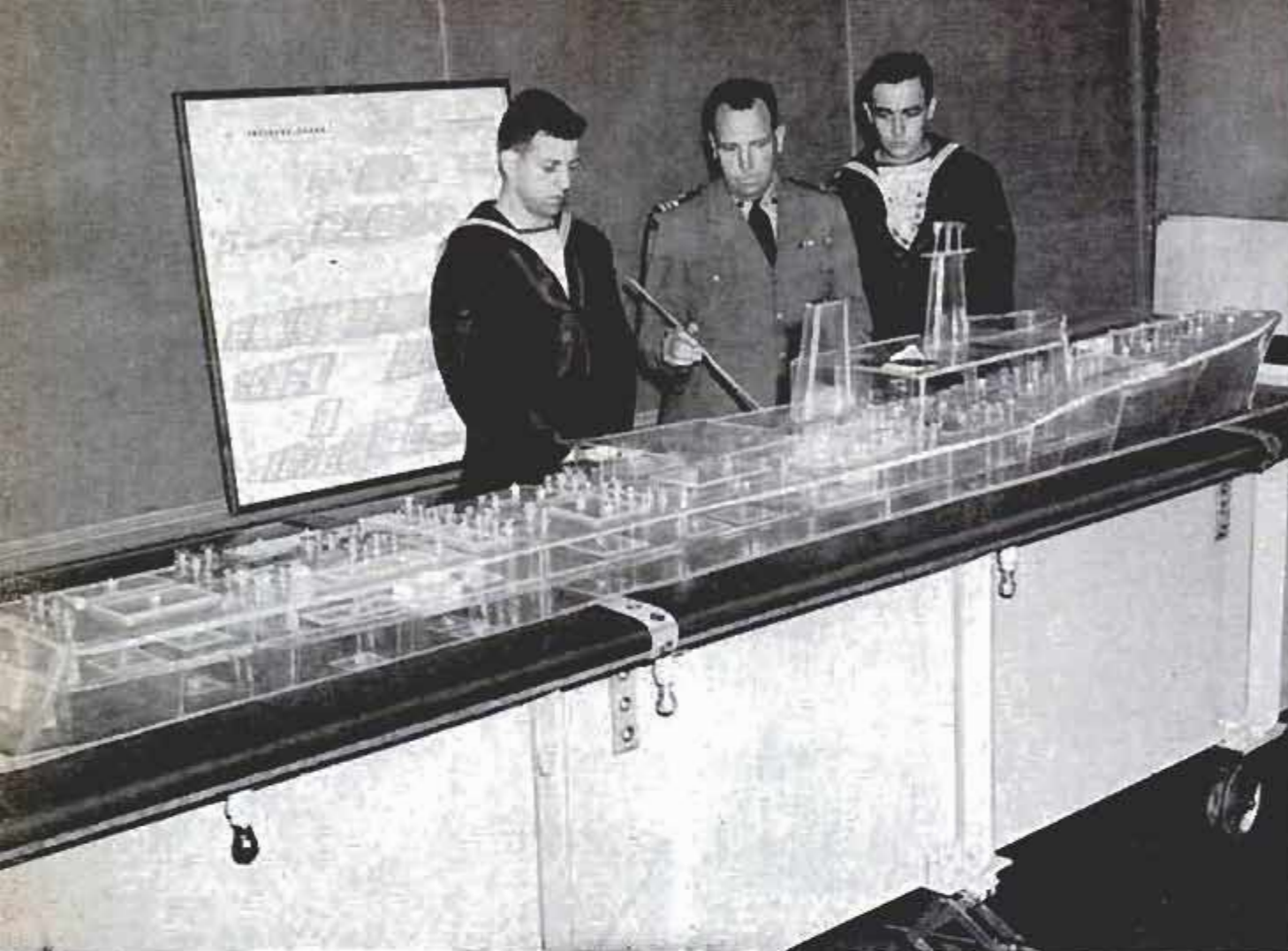
When I boarded this new destroyer escort at Halifax, Nova Scotia, she had just come in from her first trials in the North Atlantic. The captain of the ship, Comdr. John W. McDowall, and his ordnance officer, Lt. Comdr. Richard J. F. Donnithorne, pointed out that this vessel, and others of its class, would be in the first line of defense against missile-launching enemy sub-

marines—even in areas of atomic fallout.

"The *Restigouche* can proceed for days if necessary through radioactive fallout," said Comdr. McDowall as he led the way

Crew is proud of this new twin-mounted 3-inch .70-caliber antiaircraft gun; it can be fired remotely





Lt. Comdr. Ian C. Martin uses \$50,000 transparent model of *Restigouche* in tank to show ship's stability

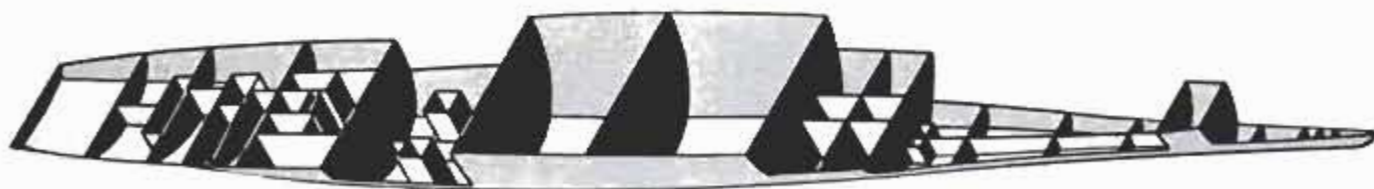
along the spotless decks of the 366-foot ship. "The ship can be sealed airtight and the air recirculated as in a submarine."

A gesture by Lt. Comdr. Donnithorne included the radar masts and aft guns. "We also have the latest equipment in sonar, as well as electronically controlled mortars and homing torpedoes," he said. "You know, it's only proper that the home port of the *Restigouche* should be Halifax." He pointed to the harbor bustling with naval craft and ocean liners. At one end of the long inlet that forms the harbor is a protected basin and at the other a widening blue expanse to the open sea. "Many of the biggest convoys of World War II were made

up here at Halifax. This place is antisubmarine minded."

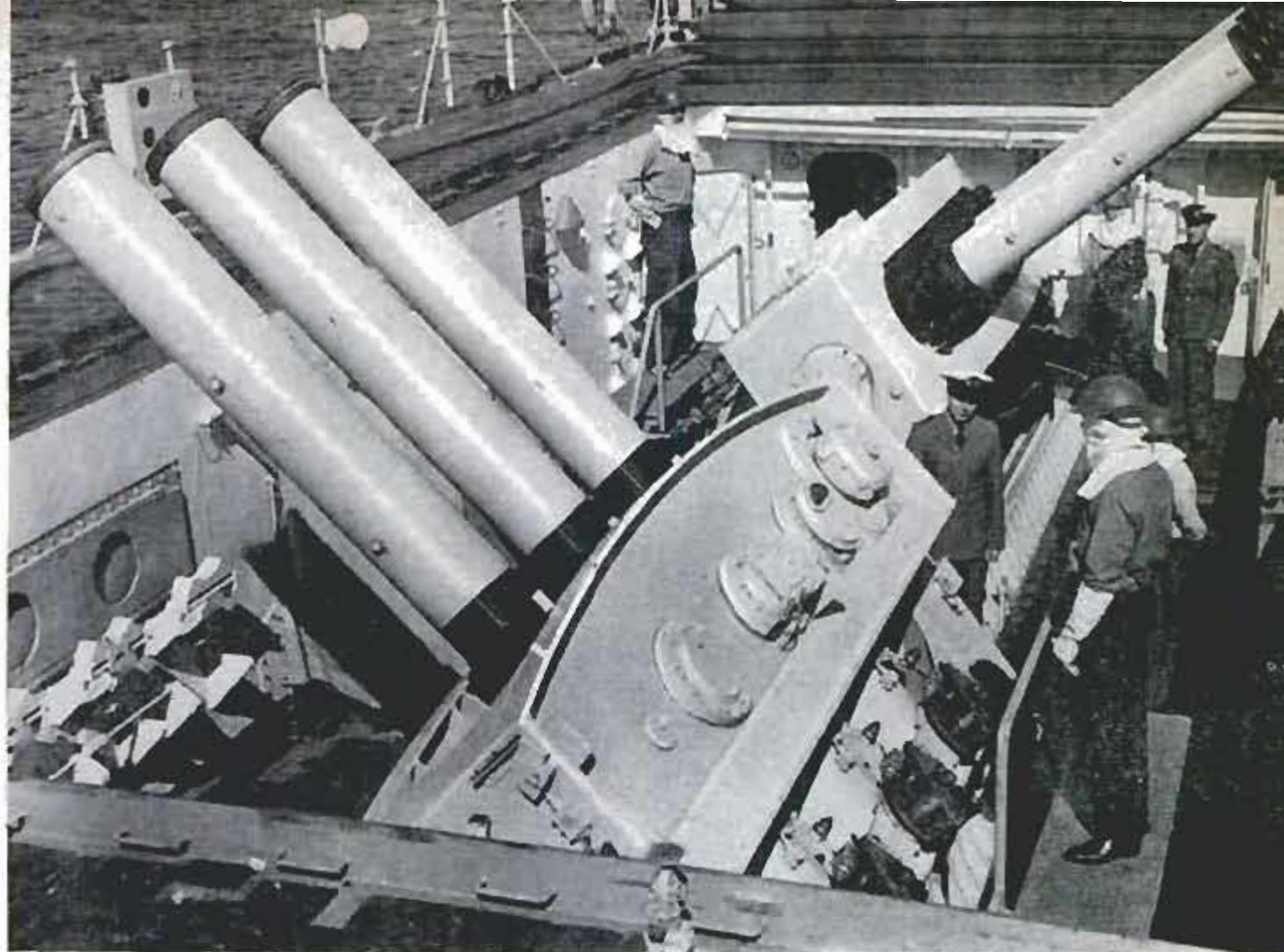
Comdr. McDowall chuckled. "I guess some people have been surprised that the Canadian Navy has developed such a lethal ship as HMCS *Restigouche*. It was a case of our sitting back in the weeds and taking the best ideas from the British and United States navies. Then, with some of our own Canadian gadgets, we put together the finest submarine killer afloat. This little ship has \$6,000,000 worth of special equipment."

As we proceeded across decks, down passageways and up ladders, we were joined by Lt. Comdr. Jacques P. Coté, the ship's executive officer, who filled us in on the



Drawing shows crosswise bulkheads that add greatly to ship's stability if struck by torpedo. The *Restigouche* will not list more than 18 degrees either way. Below, colored area can be flooded before sinking plus section just aft of diagonal lines in center; when critical center section is flooded the ship rolls over and sinks





Two triple-mounted 12-inch mortars that replace "ashcans" of World War II are housed in the aft hatch

history of HMCS *Restigouche* and her place in the St. Laurent class of postwar destroyer escorts. Built by Canadian Vickers Limited in Montreal, there were to be 14 ships in the class which took its name from the first ship, HMCS *St. Laurent*. The *Restigouche* (named for a river in the maritime province of New Brunswick) is No. 8, but so many improvements have been incorporated in her design and armament that the other six ships now nearing completion will be known as members of a special *Restigouche* class. All 14 destroyer escorts have a displacement of 2900 tons and the same geared steam turbines and twin propellers which provide a speed of "over 25 knots." How much faster than that



Right, crew handles a deadly homing torpedo. Below, ship gives itself shower to wash off atomic fallout

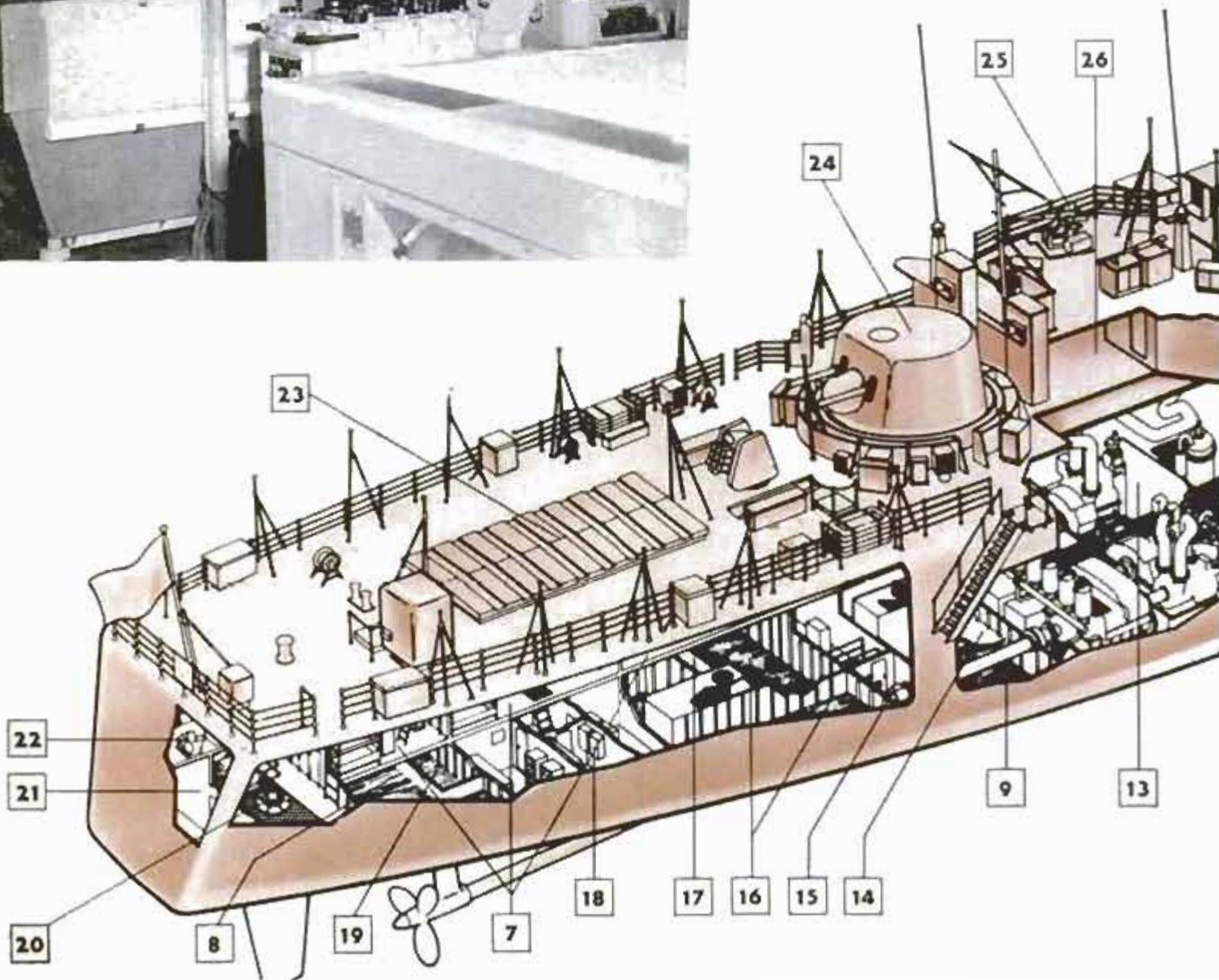




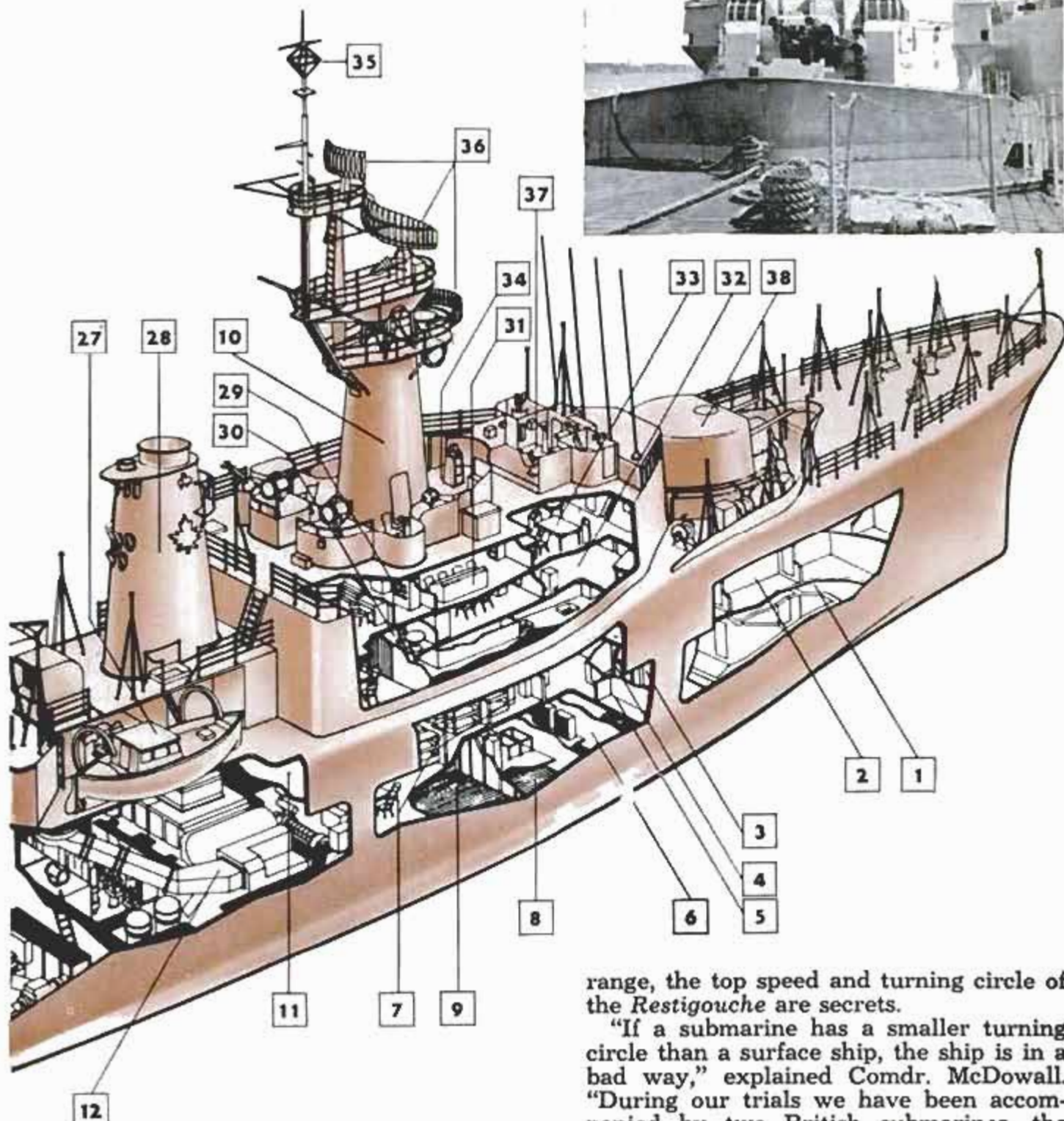
Left to right, Lt. Comdr. Coté, member of crew and Comdr. McDowall on the bridge



Cutaway shows: 1. Food storage and refrigeration; 2. Gunner's store; 3. Diving-gear store; 4. Naval store; 5. Water ballast tank; 6. Fresh-water tank; 7. Mess; 8. Water-ballast tank; 9. Fuel tank; 10. Foremast; 11. Electrical workshop; 12. Boiler room; 13. Engine room; 14. 3"/50 magazine; 15. Pump; 16. Fuel tanks; 17. Cofferdam; 18. Small-arms magazine; 19. Fog-oil tank; 20. Steering-gear compartment; 21. Provision room; 22. Refrigeration units; 23. Mortar hatch; 24. 3"/50 twin gun; 25. Single Bofors; 26. Torpedo house; 27. 27-foot motor boat; 28. Funnel; 29. Radar room; 30. Ward room; 31. Sonar room; 32. Radio rooms; 33. Operations room (C.I.C.); 34. Gunnery remote control; 35. HF/DF loop; 36. Radar; 37. Bridge; 38. 3"/70 twin gun



Right, view from forward deck shows .70-caliber guns and officer leaning from remote visual-control post



the ships will travel is anybody's guess, but when an earlier ship of the St. Laurent class worked out with the speedy United States atomic submarine *Nautilus* she was reported to have done "very well." Along with other such items as radar and sonar

range, the top speed and turning circle of the *Restigouche* are secrets.

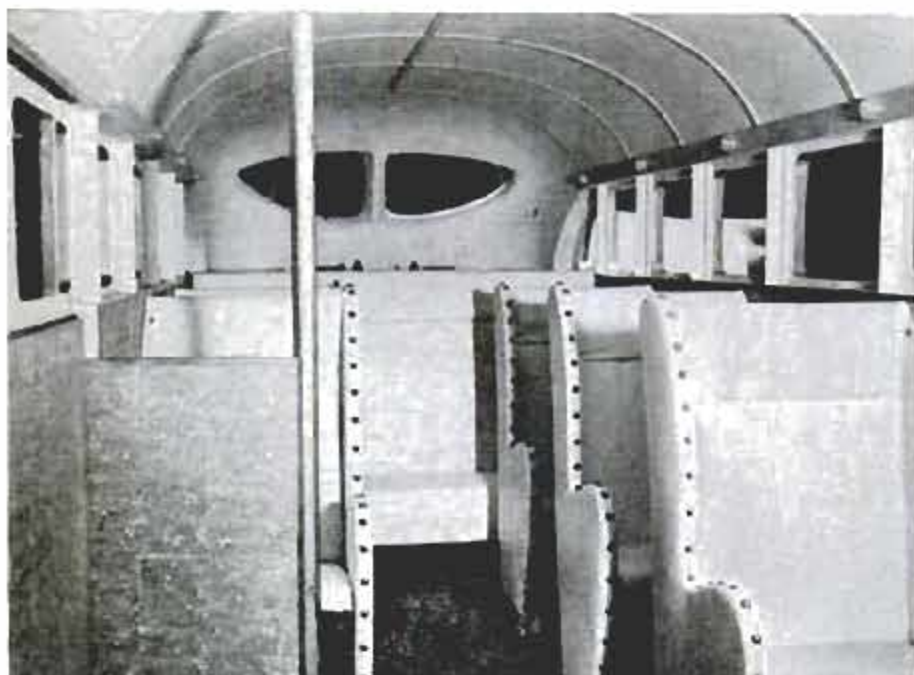
"If a submarine has a smaller turning circle than a surface ship, the ship is in a bad way," explained Comdr. McDowall. "During our trials we have been accompanied by two British submarines, the *Alcide* and the *Ambush*. These subs are manned partially by Canadians."

"Our playmate subs have plenty of respect for the *Restigouche*," said Lt. Comdr. Donnithorne. "We can hunt down a submarine whether it's submerged, on the

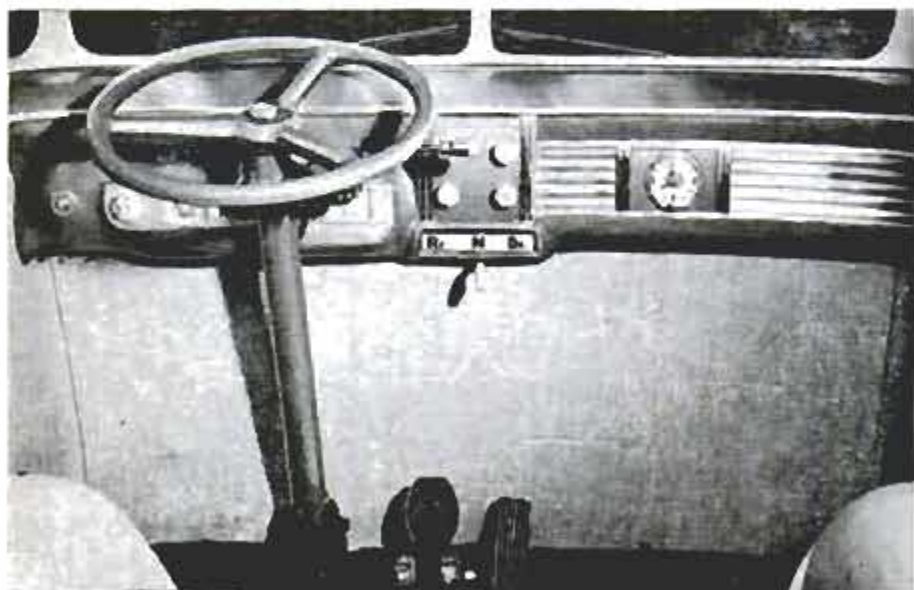
(Continued to page 230)



Dubbed the "Little Hound Line," this scale-model bus is 3 feet 5 inches wide and 4 feet 4 inches high

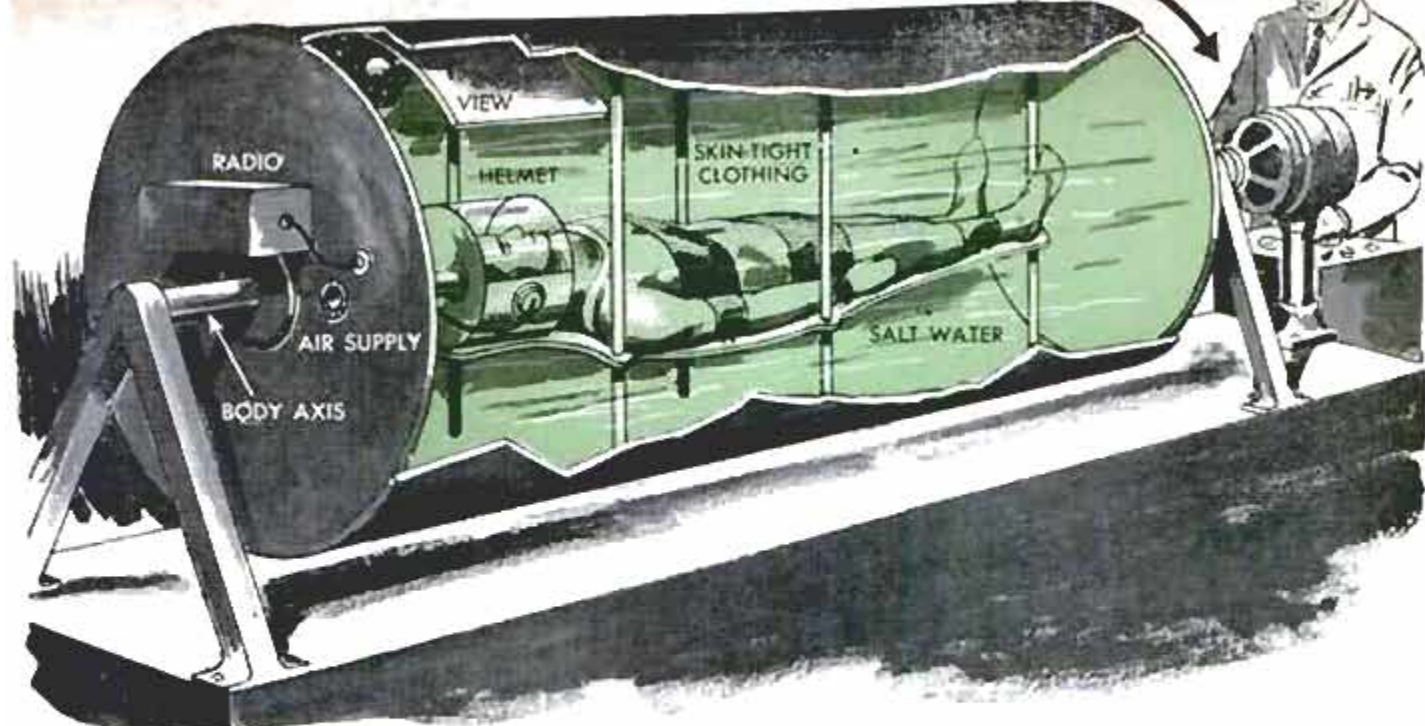


Interior of bus shows five single seats and one wide seat at the rear. There are six dome lights above the windows on each side. Photo below shows Crosley steering assembly, transmission lever and other controls



Miniature Bus For Small Riders

EIGHT CHILDREN and one adult, the driver, can ride in a miniature bus constructed by L. A. Beretta of Lexington, Mo., from sheet aluminum and parts of cars and farm machinery. The tiny bus, a scale model of the type used by one of the cross-country buslines, has a top speed of 25 miles per hour. It's powered by an eight-horsepower engine and has an automatic transmission that works through a centrifugal clutch. The midget bus is 4 feet 4 inches high, has a wheelbase of 83 inches and weighs 1280 pounds. Beretta spent three years of his spare time on the project, plus \$475 for materials. He did all work himself, except for welding the frame. The springs came from a hay baler and from a mower. The bus has tractor headlights, fender parking lights from a 1941 Ford and directional lights converted from the parking lights of a 1941 Chevrolet. License-plate holders serve as side windows.



Tank Could Produce Weightless Sensation

Scientists could experience the feeling of weightlessness with inexpensive equipment in an earthbound laboratory, according to Dr. H. J. Muller of Indiana University. Dr. Muller, a Nobel Prize-winning zoologist, said an apparatus could be constructed similar to a mechanism used for nullifying gravity in studies on plants. The subject, in skin-tight clothing, would be immersed in a tank in a salt solution having the same specific gravity as the body. The tank would spin around a horizontal axis to "disengage" the balancing apparatus in the subject's ears. A transparent helmet would provide a means for breathing and talking, and a fixed "view" in relation to the subject would prevent any sensation of motion.

Portable Shortwave Radio Transmitter Controls Tower Crane

With portable equipment carried by an operator on the ground, all of the operations of a giant tower crane can be handled by remote control. The portable equipment includes a set of controls and a transmitter that emits ultrashort radio waves. The unit broadcasts 36 separate frequencies, each of which controls some action of the 200-foot crane. The frequencies are tuned so they do not interfere with each other and up to 12 of the control frequencies can be transmitted at the same time. A radio receiver on the crane contains 36 relays, each tuned to one of the frequencies. So-called dead-man controls automatically stop the crane if the load is too heavy or the crane travels too far. Both the crane and remote-control unit were developed in Germany.

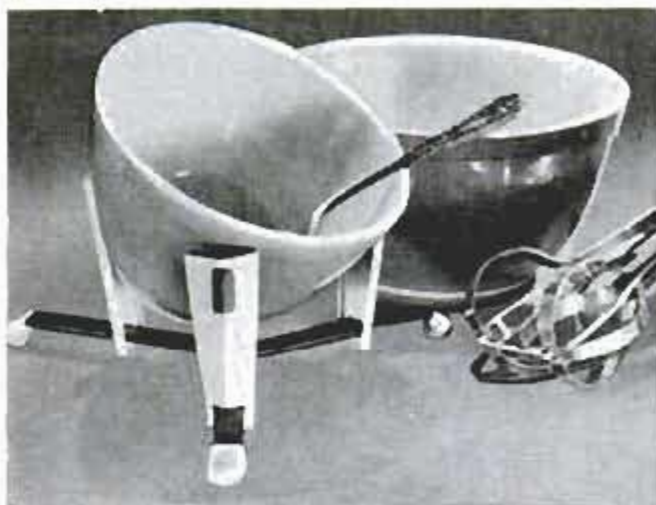


WHAT'S NEW FOR Your Home



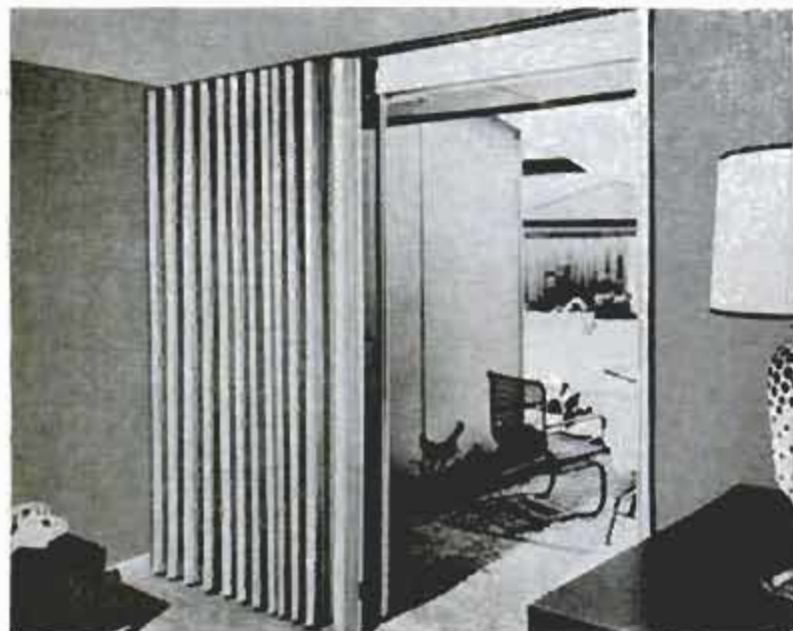
FLOOR FLUSHER washes away dust, litter and leaves. The nozzle is mounted on a wheel and rides an inch above ground. Its tiny opening provides forceful stream and cuts down on water bills. Handle is four feet high
Magie Hostess Corp., 36th and Bennington, Kansas City 29, Mo.

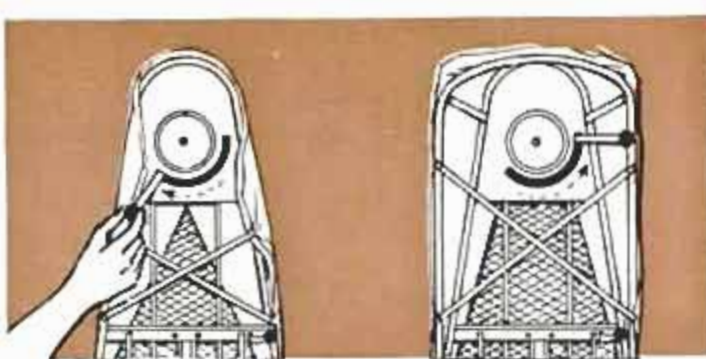
BOWL HOLDER gives housewives "third hand." Especially handy when electric mixer is being used, it permits tilting of bowl. Holder adjusts to fit any size bowl and has three-point legs tipped with rubber cushions. It can hold potted plants, hot dishes
Milwaukee File Co., 1567 W. Pierce St., Milwaukee 4, Wis.



WOVEN WOODEN SHADE, used with sliding glass doors, provides privacy and blocks harsh sunlight and glare. Combination folding door and drapery can be opened from either side with fingertip action. Even when fully drawn, shade permits air to circulate through door into room, at the same time softly diffusing outdoor light. Easily cleaned, it comes in 12 colors
Consolidated General Products, Inc., 24th and Nicholson, Houston 8, Tex.

DRINKING BUBBLER can be attached to kitchen and bathroom faucets and outdoor outlets. A flip of the lever sends gentle stream of water upward. Easily installed to aerator-type faucets, fountain attachment does not interfere with use of sink
Hawa Drinking Faucet Co.,
Fourth and Page, Berkeley 10, Calif.





IRONING BOARD has adjustable tapered, squared-off ends—the latter for such items as bedspreads, sheets and curtains. Board has mesh top for cooler, drier ironing and is equipped with wheels that lock into place. It also has 12 different positions in height—from 23 to 36 inches—to permit sit-down ironing

The J. R. Clark Company, Reading, Pa.

PLASTIC DIFFUSERS take glare away from fluorescent light fixtures. Made of rigid vinyl, diffusers are snapped into aluminum tracks that are screwed to cornices or ceilings. Designed for one-man installation, they resist flame and can be cleaned with soap and water. Diffusers come in several different types

Lam, Inc., Wakefield, Mass.

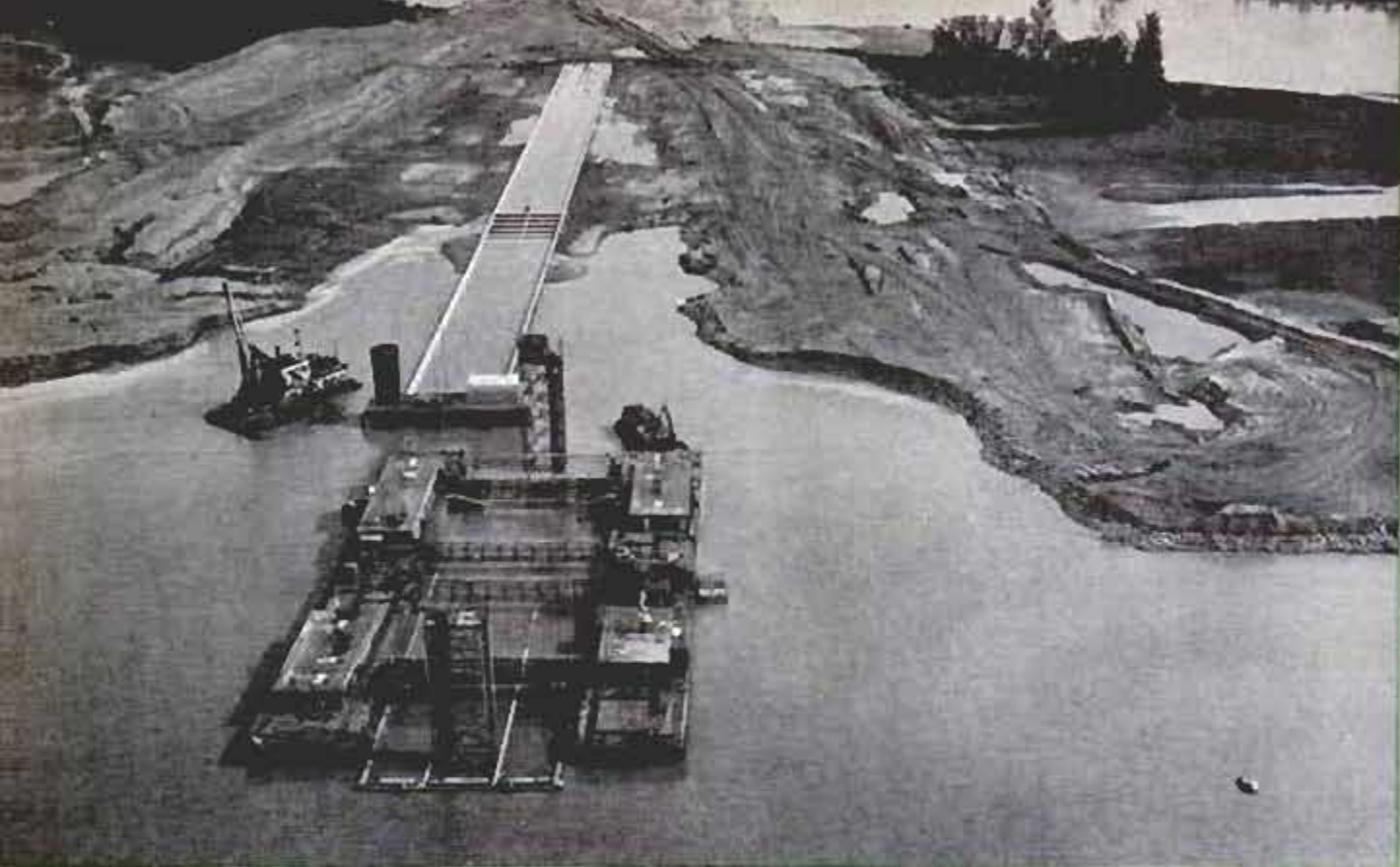
WINDOW GREENHOUSE enhances beauty of home inside and out and enables gardener to grow plants and flowers throughout year. Thin but sturdy aluminum framing provides big glass area. Top panel is hinged for ventilation. Framing will not rust, rot, warp, shrink or swell. Unit available for any size window

Emerson Industries, Inc., 122 Adams Ave., Hempstead, Long Island, N. Y.

WALL FIXTURES can be adjusted six ways: up and down, in and out, and from side to side. Designed in wide variety of styles, fixtures have inner glass plate that prevents shades from discoloring because of heat. "Tableless lamps" are especially suitable in room where added table would crowd other furniture

Globe Lighting Products, Inc., 10 East 40th St., New York City

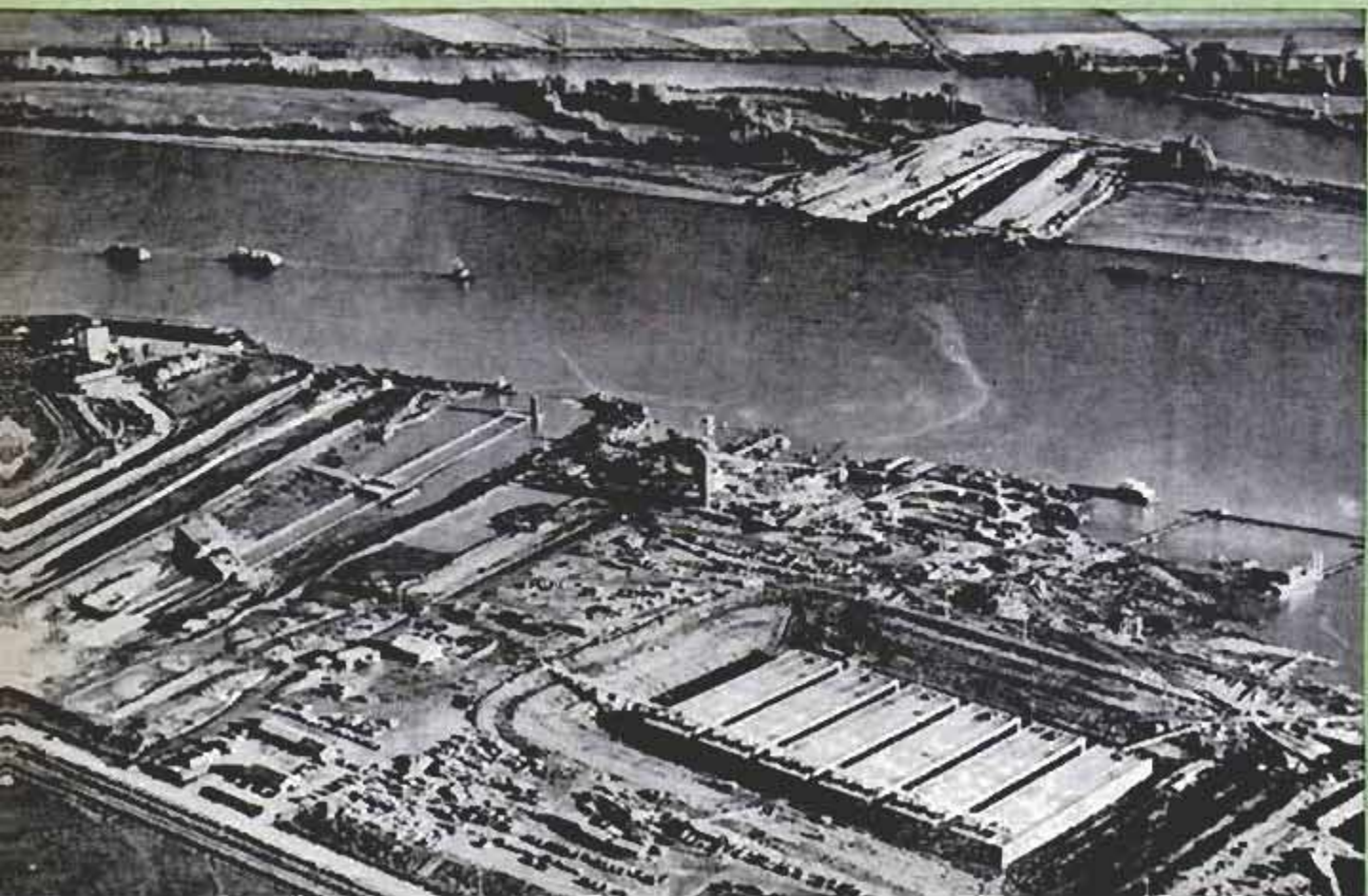




Four steel scows ease a prefab section of the tunnel into position for sinking—six inches per second

A Prefab Tunnel Conquers a Tough River

Six sections of tunnel (lower right) were prefabricated in 40-foot drydock; then floated to positions





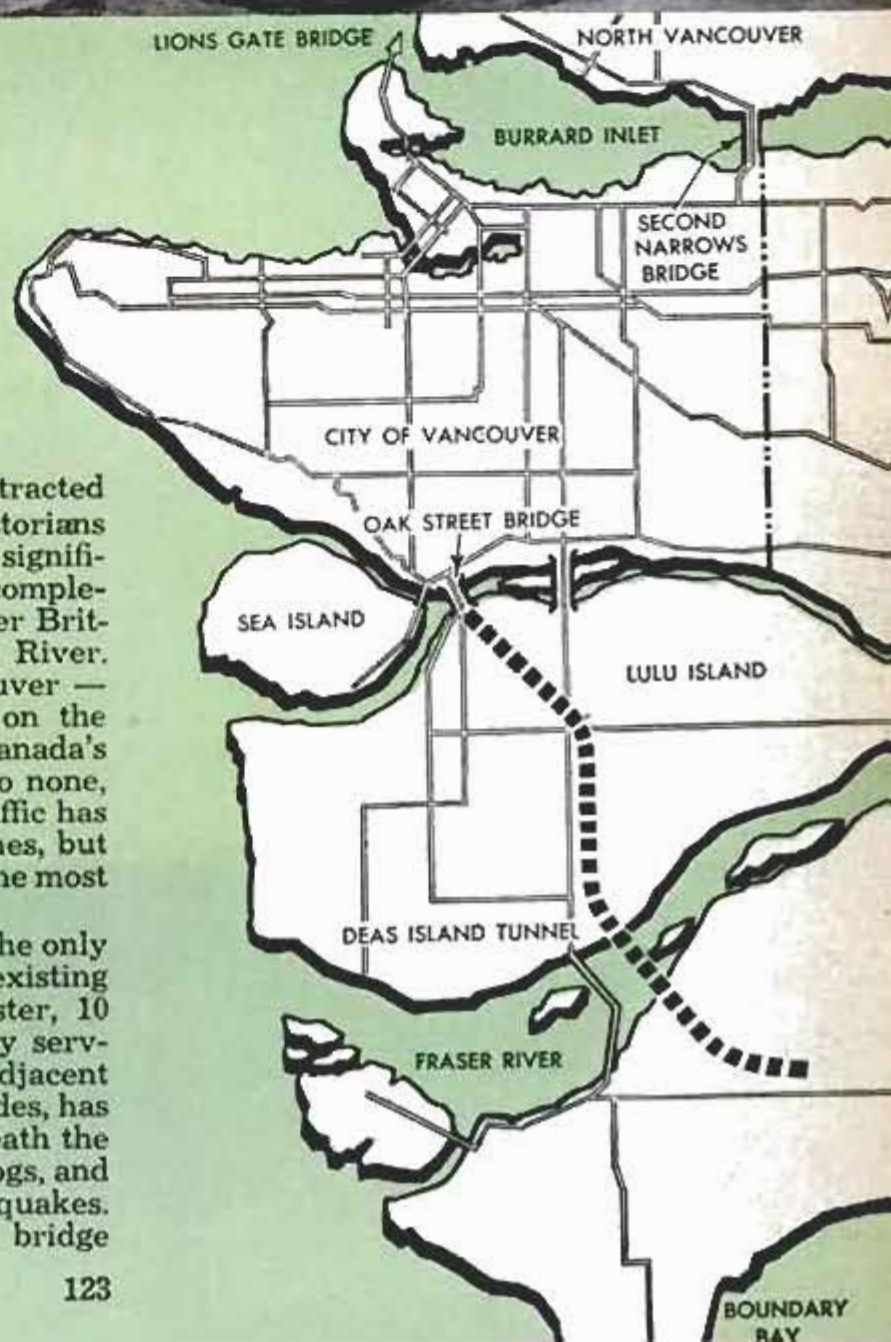
Shafts 70 feet high were fitted to the sections before sinking. Right, dotted lines show main traffic route via tunnel

By Carson Kerr

THE BIG RIPPLE ROCK blast attracted more attention, but future historians will probably attach much more significance to the comparatively quiet completion of the Deas Island Tunnel under British Columbia's treacherous Fraser River. The scenic surroundings of Vancouver — mountains north and east, ocean on the west and river to the south—give Canada's third largest city a setting second to none, but also complicate access to it. Traffic has demanded more southerly approaches, but the scenic features have presented the most problems.

For years, experts have felt that the only possible supplement to the one existing highway bridge at New Westminster, 10 miles up-river, was additional ferry service. At any feasible crossing point adjacent to the city the Fraser is subject to tides, has constantly shifting sand dunes beneath the surface, is bordered by large peat bogs, and frequently feels the force of earthquakes.

After decades of deliberation, a bridge

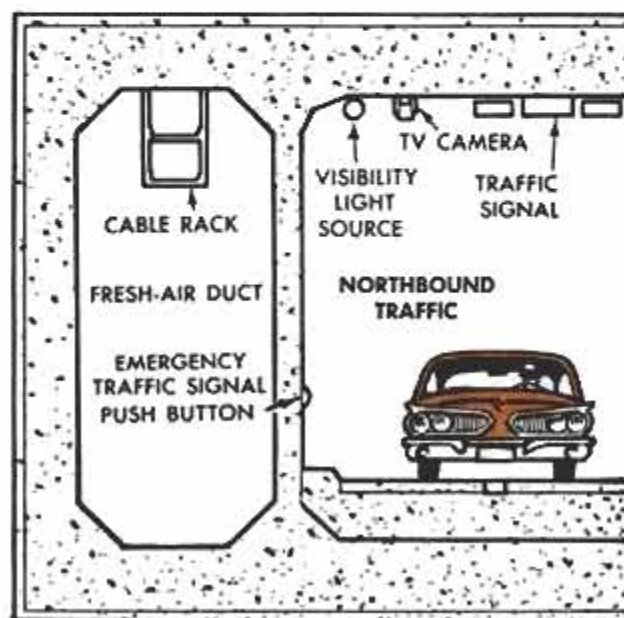
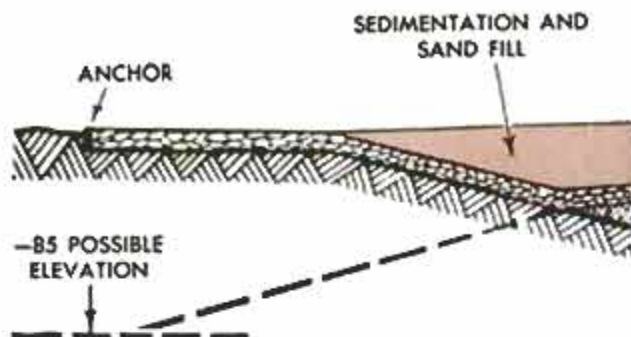
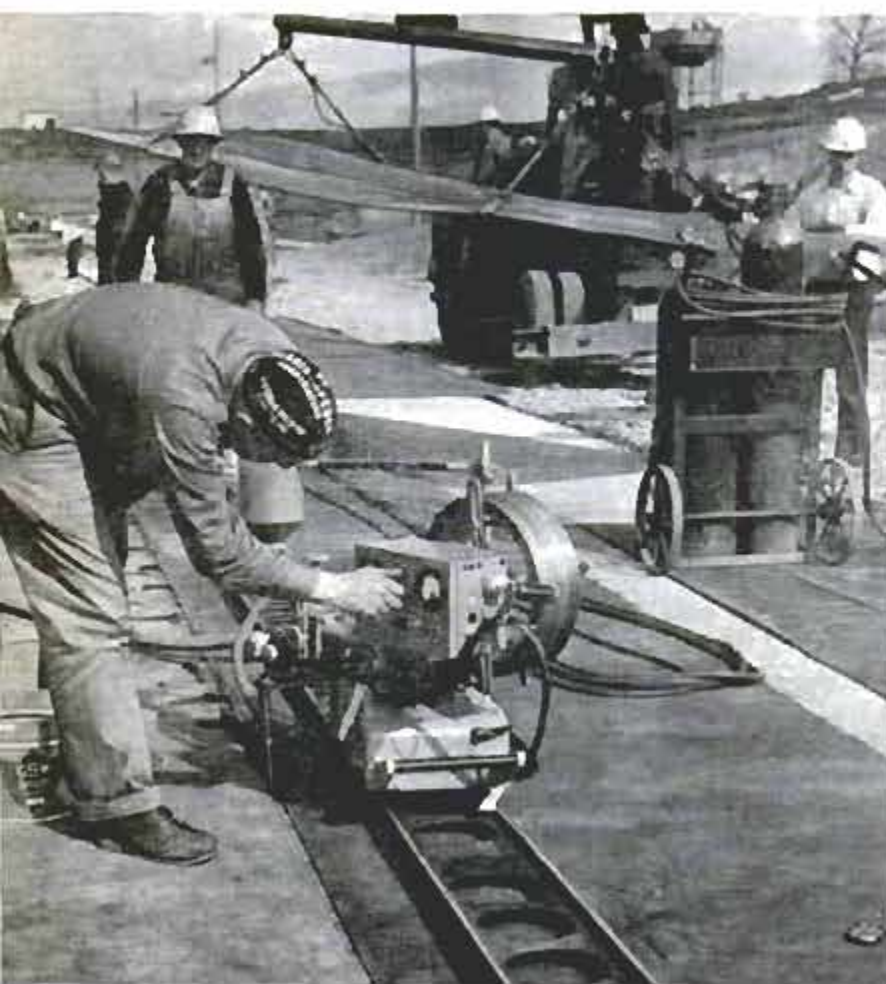




Divers played important part in helping position the sections

had been ruled out, for two reasons: It was almost impossible to find firm foundation for one lofty enough to provide clearance for the ocean-going freighters that frequent the river route; also, a high bridge would create a hazard to aircraft using Vancouver Airport on nearby Sea Island. A solution to the problems was finally found in going under, instead of over, the river. But it was by no means a simple one. History was made last year with a unique prefabricated tunnel, first of its kind in

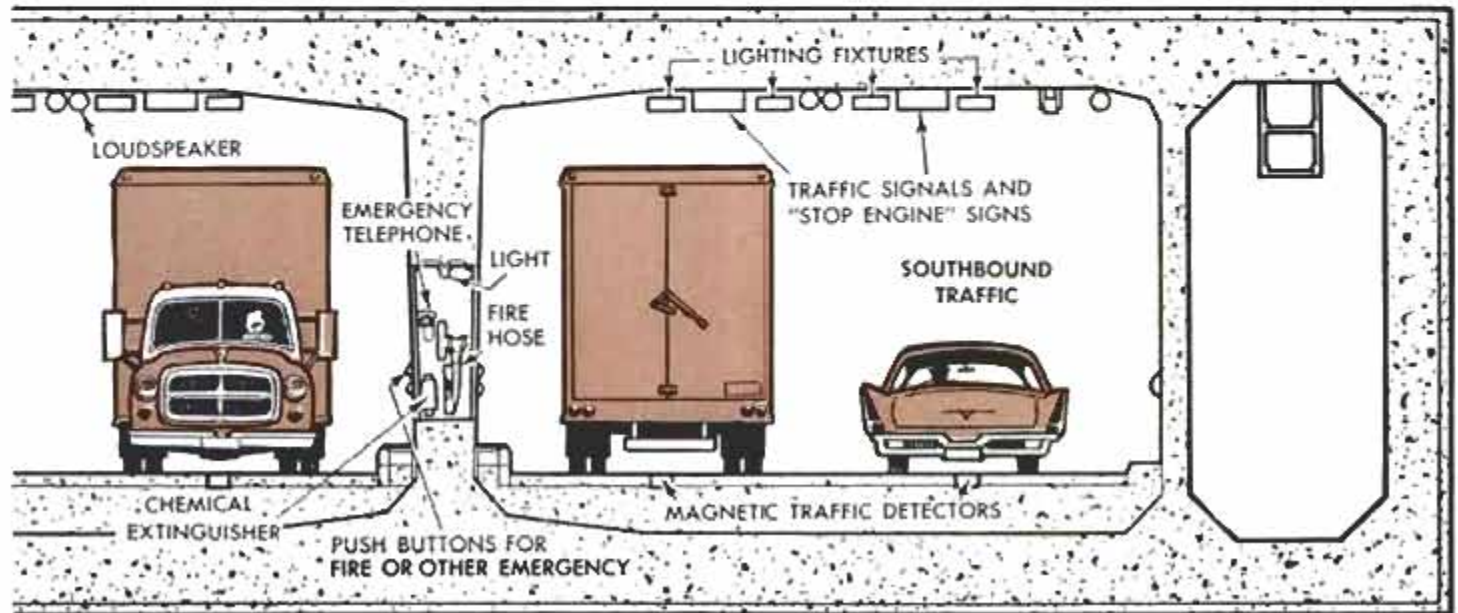
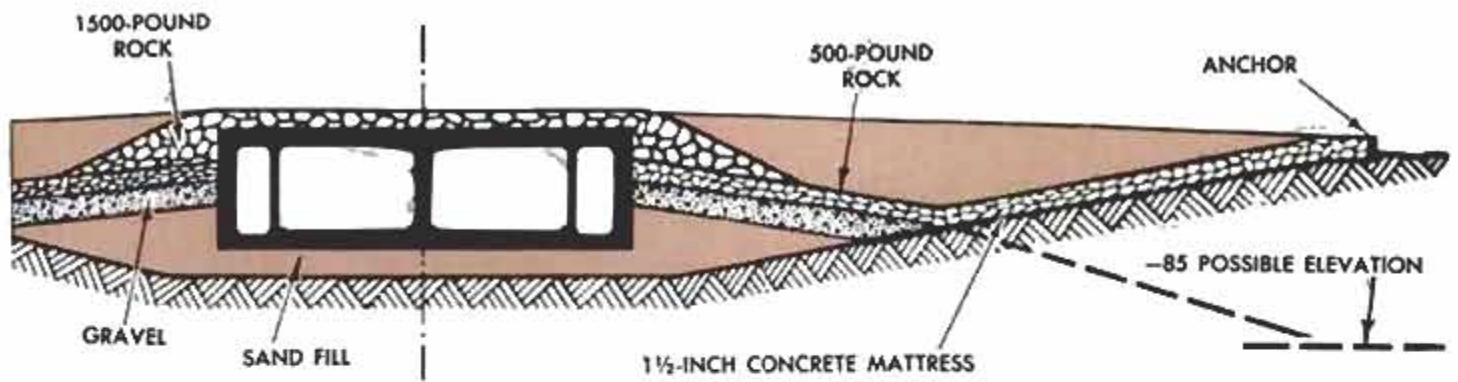
Strips of bituminous material are sealed for waterproof cover



North America and second in the world, and the mighty Fraser met its match in the combined engineering and construction skills of man.

The tunnel was one of the most complex construction jobs ever undertaken, according to project manager Ole H. Bentzen. A Danish engineer, Bentzen represents the Foundation of Canada Engineering Corporation, which shared credit for the project with Christiani & Neilsen of Canada, designers of the famous Maas Tunnel under Rotterdam Harbor.

"The Fraser River is under the double influence of tides and mountain freshets," Ole observes. "The flow varies from 12 feet per second to almost-still water. Work had to be done at extreme low tide and when velocity dropped below two feet per second. We were limited to a period from the beginning of winter to mid-April, because at any other time the river was unmanageable. Most of the critical work was done 'blind,' in heavy rain, high winds or dense fog. The river was so muddy that contractors had to rely on instru-



ments and the verbal reports of divers. We'd hoped to achieve accuracy within one quarter of an inch; we actually made it plus or minus one eighth. Before the last section was sealed in place, I'd almost worn out my knuckles knocking on wood."

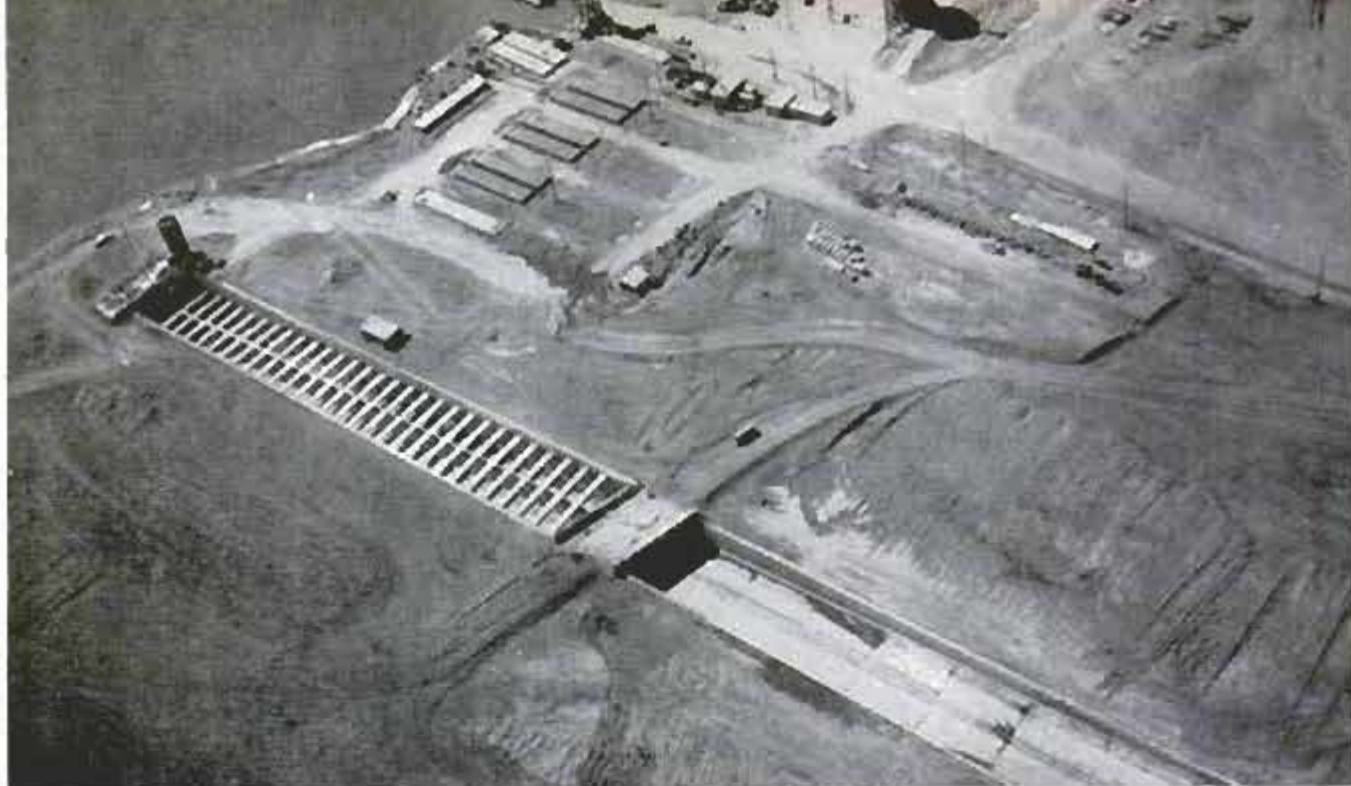
Crossing only a short distance from where the river pours into the Pacific, the new tunnel is 25 miles from the Canada-U.S. border, and is linked to Highway 99 to the south and the Trans-Canada High-

way to the east. It connects Lulu Island (from which two bridges lead to Vancouver) with the mainland, and cuts across the end of Deas Island, after which it has been named. Together with its approaches, it is 8000 feet in length with 2100 feet of tunnel. The two 24-foot roadway tubes are 60 feet beneath the surface at the lowest point, allowing navigable water with a depth of more than 40 feet above.

Although it was patterned after the Maas

Concrete sections nearing completion in drydock; each is 344 feet long, 24 feet high and weighs 18,500 tons





Sun screens over approach prepare drivers' eyes for dimmer interior; dark stack is from ventilation building

Tunnel, the Deas Island Tunnel is of vastly improved design and has many modern features usually associated only with freeways of the future. The maximum flow of 7000 cars per hour is controlled by attendants aided by a maze of safety systems, including magnetic traffic detectors in the roadbed, loudspeakers every 50 feet, and 14 TV cameras placed at strategic points. Emergency telephones are located at 177-foot intervals; there's a sprinkler for every 120 square feet of interior surface, and a number of emergency traffic-signal and fire-alarm push buttons.

Long, troughlike approaches, rather than a continuation of the tunnel, were originally designed mainly to simplify ventilation, but they also make possible one of the more important traffic safeguards. Each has a system of huge sun screens that cause a gradual transition in light intensity from exterior to interior. These serve a double purpose in that they prevent re-entry of vitiated air.

Ventilation buildings at each end are independently founded on slabs and almost completely below ground level; soil pressure around them is the same as that under the approaches. Power for ventilation is provided in both buildings, but each can handle the full load. There is also an emergency storage-battery unit. Variable-speed fans are controlled by time clocks set to suit the traffic pattern, but can be overridden automatically by

carbon-monoxide meters, visibility meters or the fire-alarm system. The fans can also be operated manually.

Throughout the tunnel there are STOP ENGINE signs, which will flash on when the amount of oxygen in the air begins to drop toward the danger point. Abnormal conditions with any degree of frequency are not anticipated, because tests have shown that the ventilation system will normally renew tunnel air every two minutes.

The prefabricated underpass was
(Continued to page 226)

Workman inspects rubber pneumatic seal at the end of section





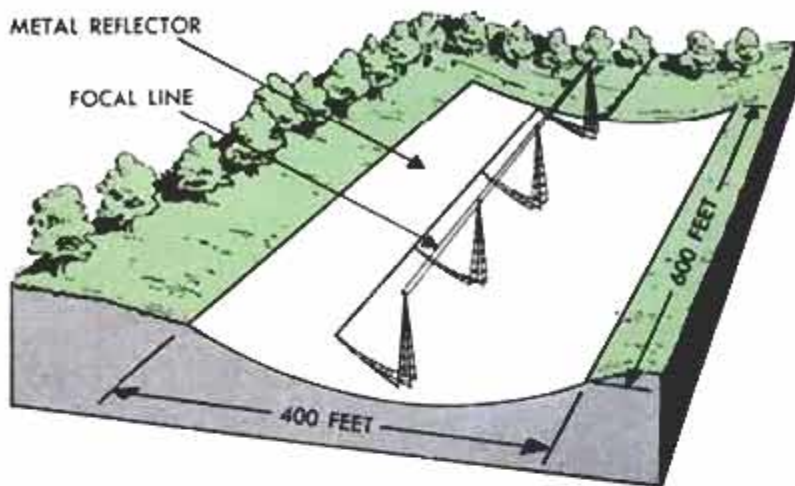
Goliath Goes Anywhere

It can cover 7 miles per hour on water and 13 on land. It can climb over barriers, cross beaches and travel over lakes, swamps, tundras and muskegs. Goliath is its name, inspired by the 46-foot length, 14½-foot height and 100-ton weight of this Navy amphibious craft. With a 63-ton cargo limit, the vehicle can carry any tank now in use. Two 500-horsepower engines provide the drive for its versatility.



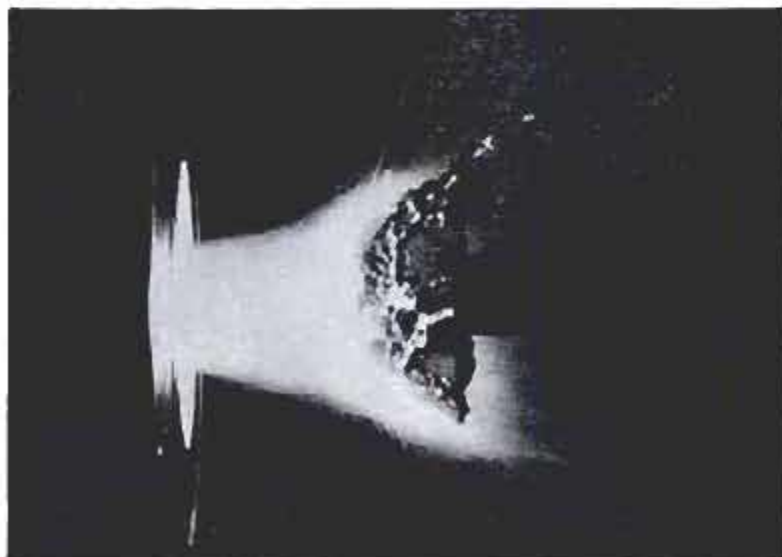
Radio Telescope in Ravine

One of the world's largest radio telescopes will be constructed by the University of Illinois in a ravine 65 feet deep. The sides and bottom of the ravine will be covered with metal, making a giant reflector. The reflector will concentrate radio signals from objects in space on a north-south line of receiving elements supported by towers. The site, near Danville, Ill., was selected because of its freedom from radio interference.



Superhot Jet Tests Missile Materials

Carbon arcs, through a new technique, are developing temperatures so high that no existing thermometers can measure them. The arcs produce a jet of intense flame about six inches long, creating temperatures up to 20,000 degrees Fahrenheit. Such jets are used by Avco Manufacturing Corporation to test small models of missile shapes and materials. Missiles are subjected to intense blasts of heat during their re-entry into the earth's atmosphere.





Greeting to American Librarian Association delegates was written in red begonias and featured open book



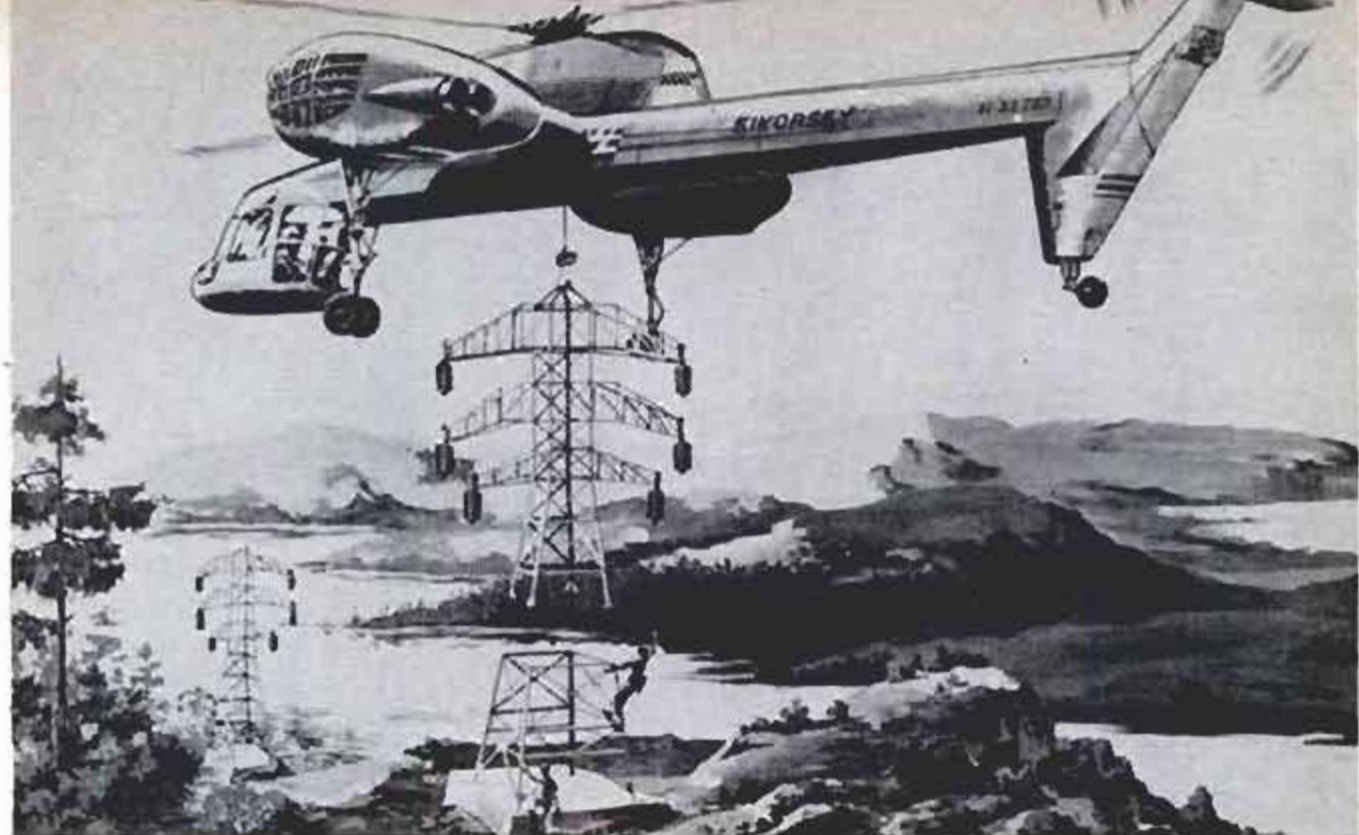
This close-up shows the method of laying out the letters within an outline formed by pegs and string

Flower layouts are first prepared on the drawing board. About five hours are required to work out details

San Francisco Says "Welcome" With Billboard of Flowers

GOLDEN GATE PARK in San Francisco welcomes convention delegates with a billboard of flowers. On a plot 30 by 15 feet, special greetings are spelled out in colorful blooms. The technique, known in Europe as "carpet bedding," requires about 10 days' preparation. Landscape-gardening foreman Otto Miller first works out a design on paper. The letters and patterns are carefully measured, then outlined on the ground with pegs and string. Small, round, gray-green succulents and grass form the background. Begonias, of the small red variety, frequently are used to make the words of the message. A crew of gardeners may spend a full week at moving plants and transplanting them for a greeting.





Huge Flying Crane Can Haul Power-Line Towers — or Houses

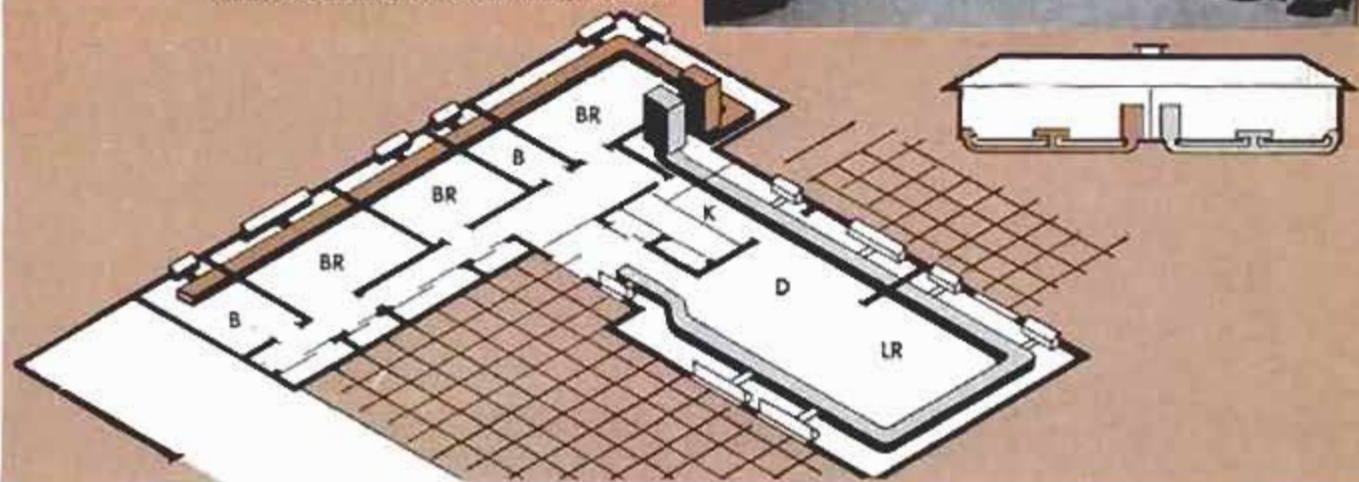
Sikorsky's new flying crane can carry six tons of cargo. This equips it for hauling prefabricated houses or sections of power-transmission towers. The crane helicopter may be a boon to construction work in remote areas.

Double-Furnace System Gives Better Zone Control

Rambling ranch houses and multilevel dwellings sometimes can be heated more economically with two small furnaces than with one big unit, according to heating engineers. Cost of a twin-furnace system may run up to \$150 more to install than a single furnace, but the work load of each is lessened and they require less servicing. Air conditioning can be added to either furnace.



American-Standard, Air-Conditioning Division





Beehives should be located in the shade of trees and near crops that produce an abundance of nectar



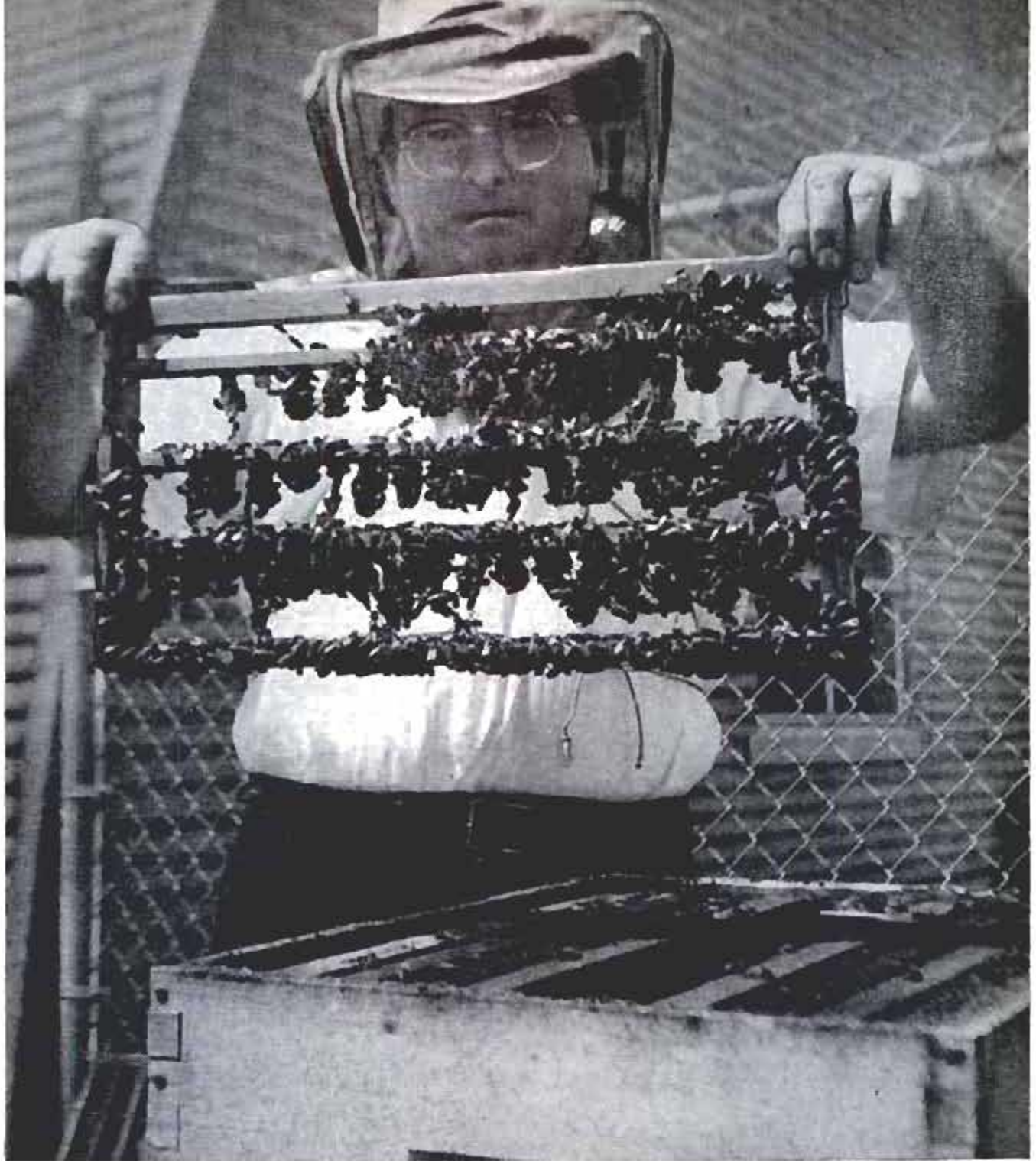
By
A. B. Kennerly

BEEKEEPING is one of the few remaining agricultural pursuits that can be started on a small scale at little expense with a good possibility of its growing large enough to bring in a substantial income. In fact, a \$20 bill and a little spare time can start you in beekeeping. Any of the manufacturers of beekeeping supplies have beginners' outfits that sell for around this figure. The possibilities are as big as you want to make them—a few colonies as a sideline or a full-time business.

Unless you're one of the rare individuals who is allergic to bee stings, you can become accustomed to having the little creatures nip you once in a while. If it's any consolation, remember that while you may be uncomfortable for a short while, the bee pays with its life.

What are the possibilities in beekeeping for the amateur? Claud Burgin, state en-

If you have only a few colonies of bees, the cell caps can be removed from the comb with a kitchen knife



Worker bees will raise queens when given start of queen-size cells with eggs inside and some royal jelly

tomologist at Texas A. & M., says, "The number of beginner beekeepers has increased rapidly in the last year or two. It's a good time to grow into the business."

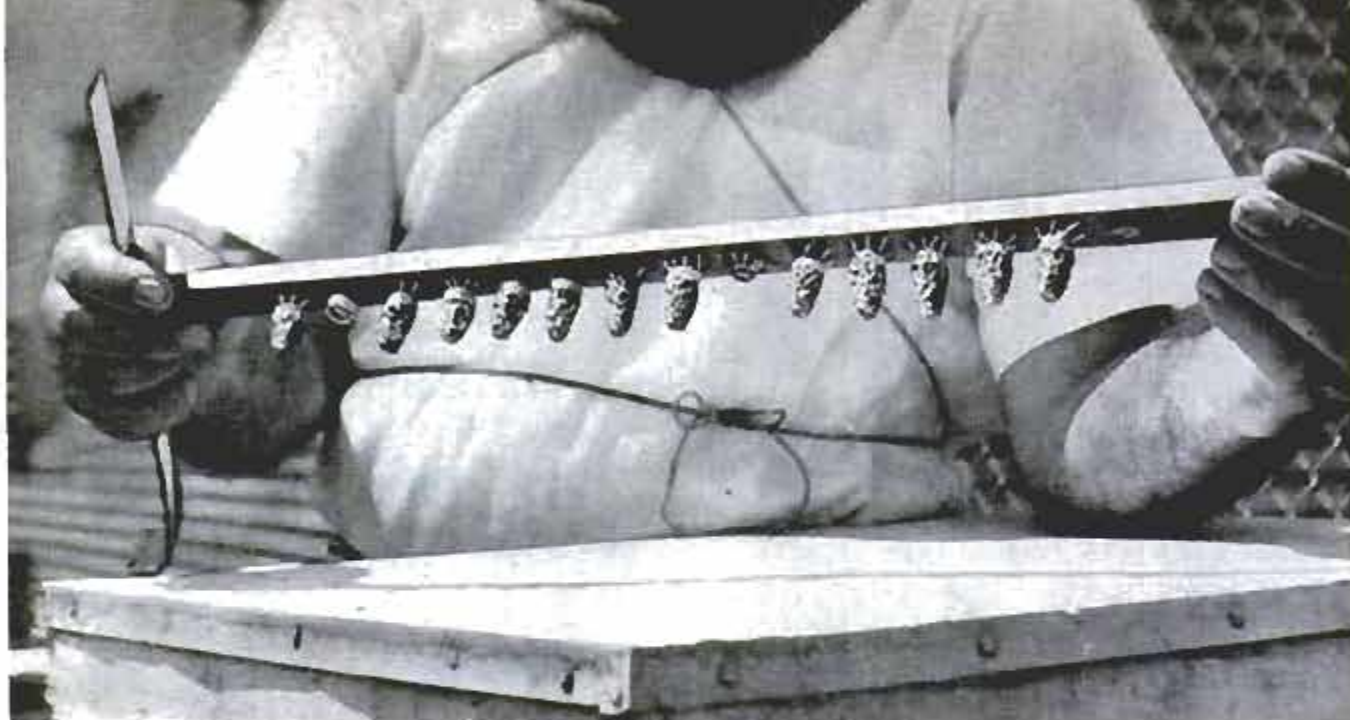
With good beekeeping management, which can be learned from books and bulletins on the subject, the number of colonies can be rapidly increased. Anyone starting with three to five colonies will have from a dozen to 30 colonies in a few years' time if he wishes. In fact, it's easier to increase colonies than to hold them at a certain number. The bees will help you increase when they swarm in the spring.

The best market for your honey is your own table. One colony that produces a nice surplus of honey, say around 60 or more

pounds, can save you from 35 to 40 cents on each pound of honey the family will eat. And the family will be eating one of the most nearly perfect foods.

As your colonies increase, friends will be wanting to buy honey from you, so your next step will be to purchase a few bottles from the beekeeping supply house and bottle the delicious sweet for sale. By this time you probably will have become a true, beekeeping enthusiast. You will be interested in reading more about what other beginners are doing and how they are handling their little sideline businesses.

If you grow beyond four or five colonies, you will looking toward production of 100 pounds or more surplus a year from each



Queens can be successfully grown by the beekeeper. The queens will emerge in a few days from these cells

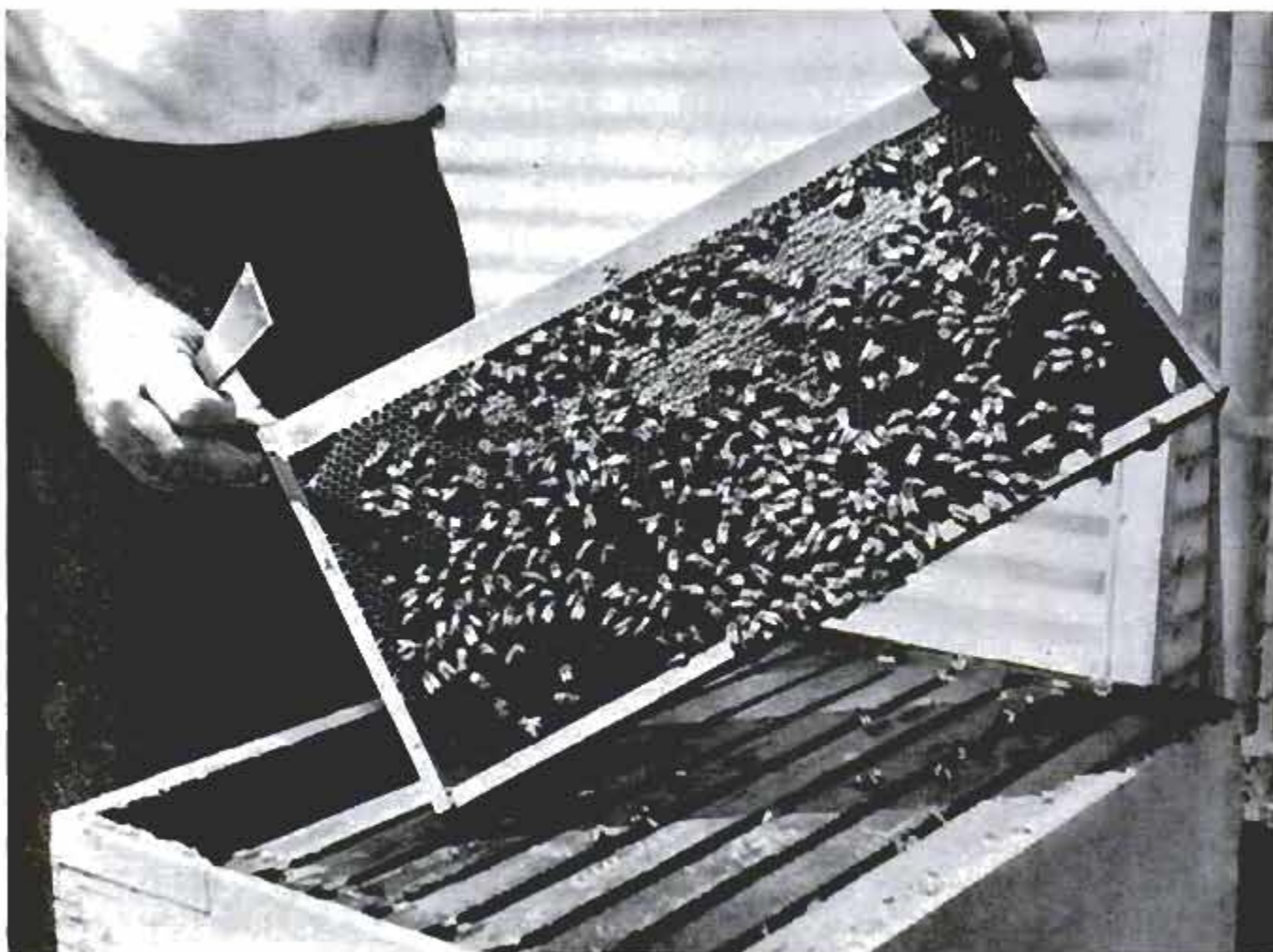
of your colonies. This will depend upon the location of the yard and the surrounding bee range. But more about that later. Let's look at the marketing situation a little more.

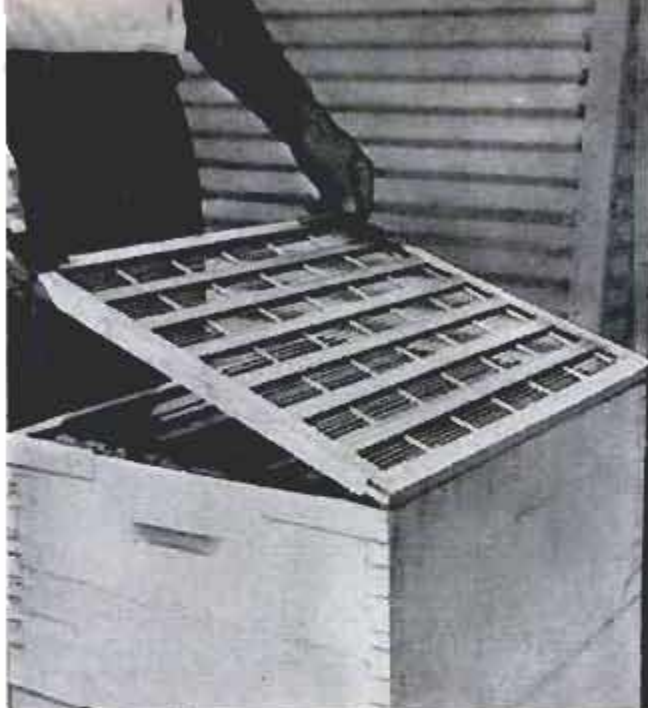
As beekeepers increase their number of colonies, they eventually face the decision as to which route they follow in marketing.

There are two that offer the most promising possibilities: Bottle and sell under your label or sell in bulk to honey processors. Either route makes a good sideline business for small producers and can help the hobby to pay for itself.

Least troublesome is to sell extracted honey in bulk in 60-pound cans. This can be

Worker bees busily store their honey in the comb cells. When the honey is ripened the bees cap the cells





To keep the queen from laying eggs where honey is stored, an excluder is placed over brood chamber

done through an association of beekeepers or individually to a processor. Processors pay lower prices for honey in bulk since they must grade the honey, blend it for bottling and take on the job of bottling and selling it under their own labels. If the beekeeper prefers to spend most of his time working with the bees, leaving the job of bottling and selling to someone else, this is the ideal course.

Your Own Labels

On the other hand, there's a great deal of satisfaction in pasting labels on bottles of crystal-pure honey with your own name printed on the pretty labels that can be obtained from beekeeping supply houses. It's satisfying, too, to watch the business grow from a few customers to as many as you can handle in your spare time.

One of your early decisions will involve the location of your bees. If you live in the suburbs or in the country, you will have little trouble finding a good place to keep the bees. If your home is located where bees may become a nuisance to neighbors you will want to arrange for a location in the country. Bees can go along for two or three weeks at a time without attention so your location is not a major problem. Some beekeepers with a large number of colonies drive 25 to 30 miles to their bees.

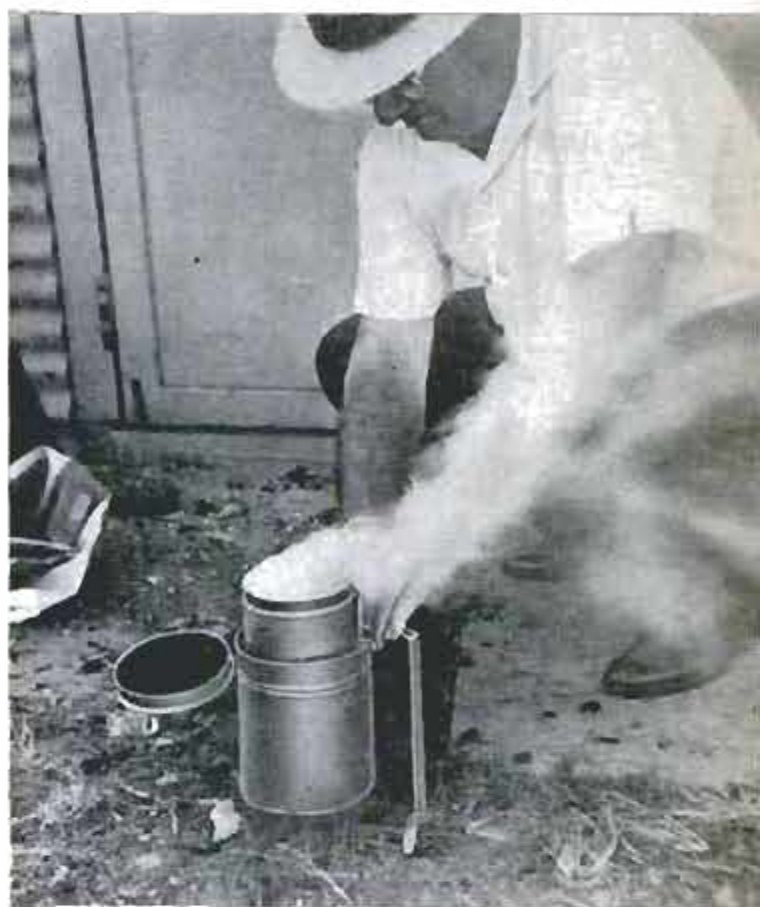
The ideal location is on a farm close to clover fields where the bees can bring in pounds and pounds of richly flavored honey. Sometimes the growers are glad to have bees near for pollinating their crops. Otherwise, a gallon or so of honey is considered ample pay for a location.

Bees will fly as far as five miles to gather

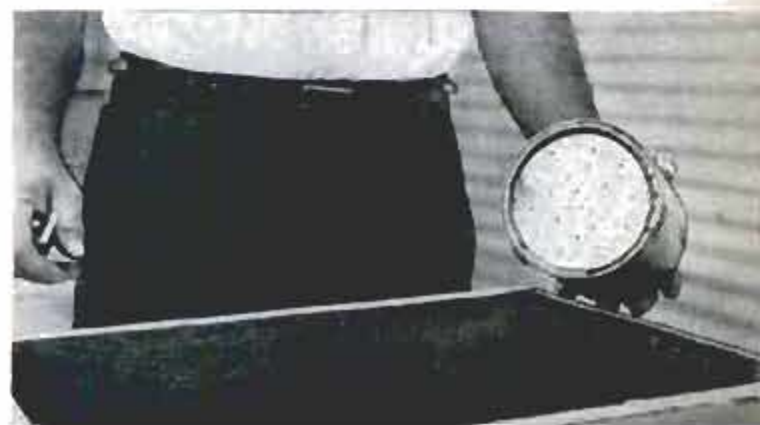
(Continued to page 222)



Electric machinery that uncaps combs and extracts honey is available for large beekeeping operations



Smoke protects beekeeper from stings. A can filled with sugar water, below, feeds bees in dry seasons



MAN WITH A HIGH HE'S A TV



CHARLIE SOWDERS of Dayton, Ohio, is a "doctor" on 24-hour call—and one of his patients is 1104 feet tall.

As service-maintenance man to a string of television, radio and long-distance-telephone towers, Charlie is the "high man" called by engineers to replace burned-out airplane-warning lights, to repair transmission lines and mount reflectors. Jobs like the latter require that the high man stay aloft, following radioed directions from the engineer below who is watching a monitor, until the reflector has been maneuvered into its exact position for best reception. In a recent installation, this meant 17 hours on the tower without coming down.

Good weather or bad, when there's trouble the TV steplejack goes up. Sudden wind and rainstorms are two of the biggest hazards.

TV transmission lines, whose inner and

Steeplejack Charlie Sowders takes a coffee break 1000 feet up. Since the advent of TV, steplejacks have been rigging towers five times higher than the smokestacks and water towers of former days

Left, Sowders gets his meals from a supply line. Right, a 75-year-old church steeple is dismantled



CALLING— STEEPLEJACK

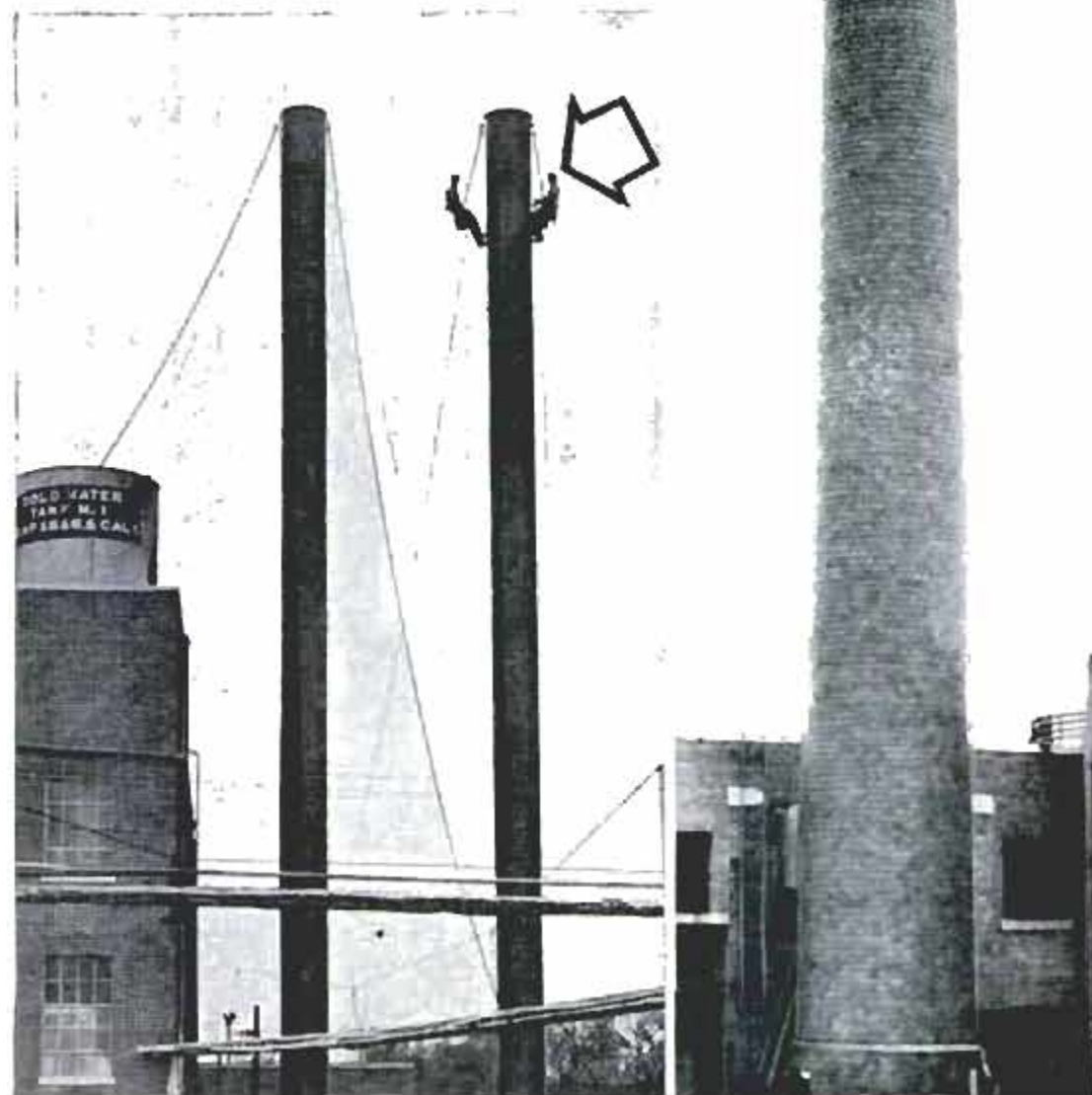
By
Kirk Polking

outer cables are separated by nitrogen gas to help keep them absolutely dry, present a problem when the lines are opened for repair. Should a rainstorm come up suddenly and dampen the inner cable, the TV equipment could be irreparably damaged.

Such rainstorms can be even more dangerous for the man on the tower, as one serviceman discovered recently. Lightning accompanied the rain, and a streak of electricity that normally strikes the tower and is deflected harmlessly to the ground, followed the lines of least resistance and shot out from the open end of the transmission line.

But this freakish accident is the exception. Most TV high men are sensible, able men who watch weather reports carefully and have a well-founded knowledge of construction, weights and balances, ropes and rigging. This is vital. Their lives depend on it. ★ ★ ★

Below, stack gets painting. Right, Sowders tuckpoints. Far right, he replaces light on 1104-ft. TV tower





AP/WIDE WORLD

Tilting Operating Table Aids Veterinary Surgeons

Because of new techniques in veterinary medicine, many injured farm animals now can be saved. At Cornell University, an in-

jured horse is given a tranquilizer and placed upright against a table which is then tilted to a horizontal position.

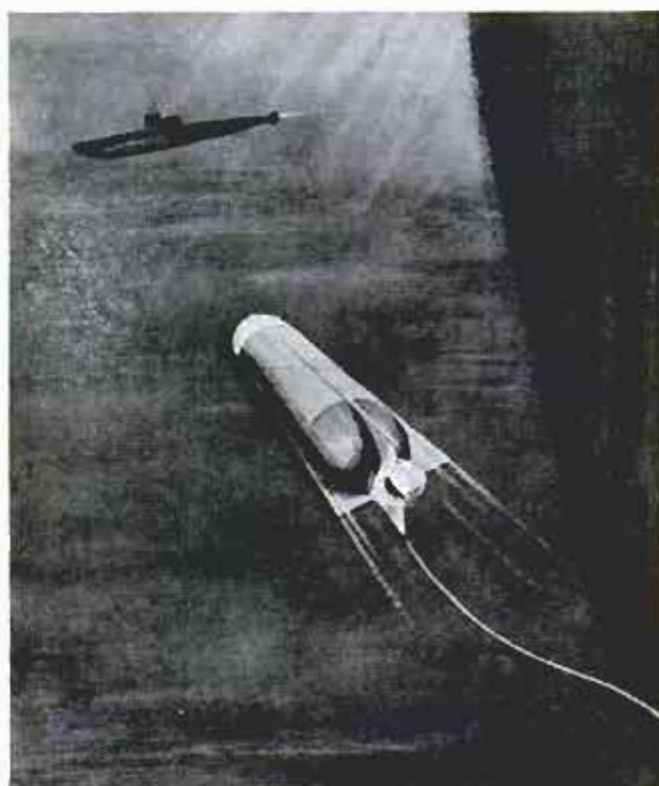
Paper Sailboat

They proved their point! To demonstrate the moisture-resistant properties of a corrugated board (ordinarily used for shipping cartons), one manufacturer recently built a little sailboat of the material. With a paper sail on the mast, the boat carried a young lady for several hours.



Torpedo Resists Jamming

Submarines now have a wire-guided torpedo that can destroy a target despite countermeasures. It is connected to the sub by wire reeled from the torpedo as it shoots through the water. Operators aboard the sub guide the torpedo to a kill by sending electrical signals over the wire.





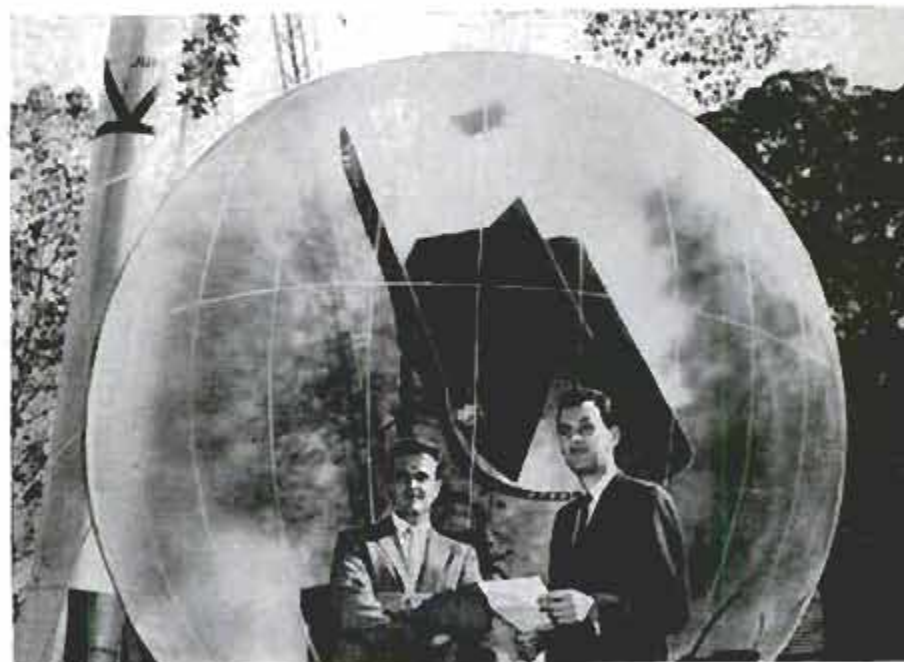
Prefab Panels Make "Dome" Cabin

Geodesic-dome shelters suitable for vacation cabins can be assembled by two men from factory-assembled panels. No special equipment is required to build with the plywood-surface panels. The finished weatherproof structure is 13 feet high, has 458 square feet of floor space.



Radar Antenna In Plastic Bubble

Housed in a plastic sphere, a new radar antenna pinpoints targets in three dimensions — distance, bearing and altitude. It is a single antenna, rather than the two or more antennas required to obtain the same data with conventional radar. Information from the 3-D antenna is transmitted to missile batteries. The radar system, called Frescanar, was developed by Hughes Aircraft Company for the U. S. Army Signal Corps.





Hidden Ice Crevasses Revealed by Infrared

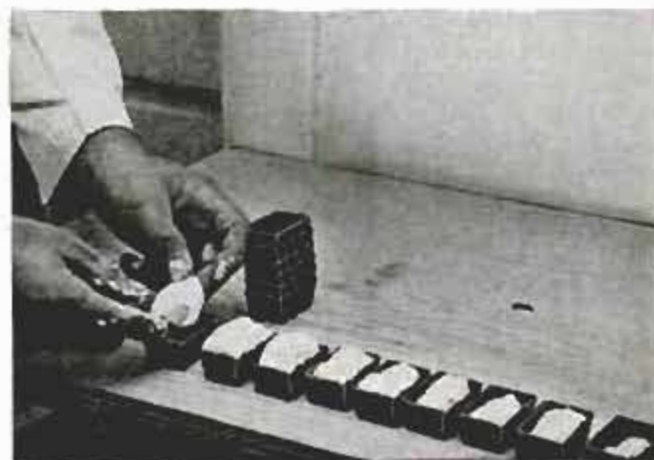
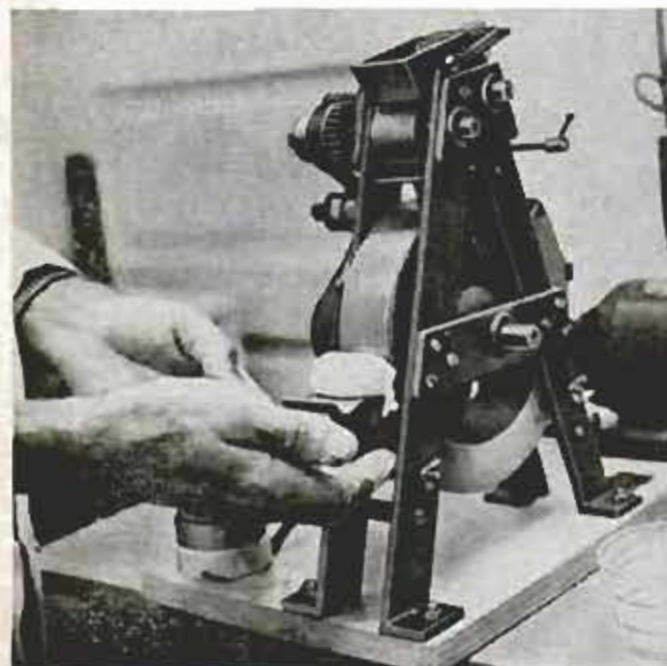
Because the temperature above a snow bridge over a hidden crevasse is either warmer or colder than the surrounding area, Army Engineers in the Arctic and Antarctic regions can locate the treacherous ice cracks with infrared devices. One of the infrared "boxes" is mounted on the roof of a weasel in the photograph above.



Bread From Miniature Bakery Tests New Varieties of Wheat

Probably the smallest bakery in the world is located at Kansas State College where tiny loaves of bread are made to test new strains of wheat. The reason for baking such small loaves is that there isn't enough wheat of a particular experimental strain to bake standard loaves. In fact, it takes four years to produce enough wheat of a new strain to make the miniature loaves.

Miniature equipment used to produce tiny loaves of bread includes an electric mixer, dough molder made in college machine shop and inch-size pans





Hydrophone in aquarium detects fish chatter, which Dr. James Moulton, above, amplifies and records on tape

Scientists Lure Fish by Feeding Them a Line—of Chatter

BENEATH THE SURFACE of the sea is a noisy world where fish apparently talk to each other with grunts, groans, rasps, barks and other distinctive sounds. During World War II, it was discovered that the "voice" of a toadfish could explode an acoustical mine. And electronic gear designed to pick up the sounds of submarines frequently detected "enemy craft" that didn't exist. It had been tricked by the sounds of undersea life. Scientists, like Dr. James M. Moulton of Bowdoin College, now are making an intensive study of the conversations of marine animals. At the Bermuda Biological Station, Dr. Moulton makes tape recordings of fish sounds by lowering a hydrophone into the water from a small boat. He also eavesdrops on fish in tanks to learn what effect captivity has on their sound production. And he dissects the fish to learn more about their sound-producing mechanisms and ears. The object of the research is to improve methods of commercial fishing. Eventually, fishing crews may introduce sounds into the oceans to lure certain kinds of fish to their nets. Valuable fish populations might be conserved by introducing sounds that would drive them away from danger areas. Scientists have found several species that respond to imitations of their voices.

The spiny lobster not only talks but it has a voice which gets deeper as it grows older



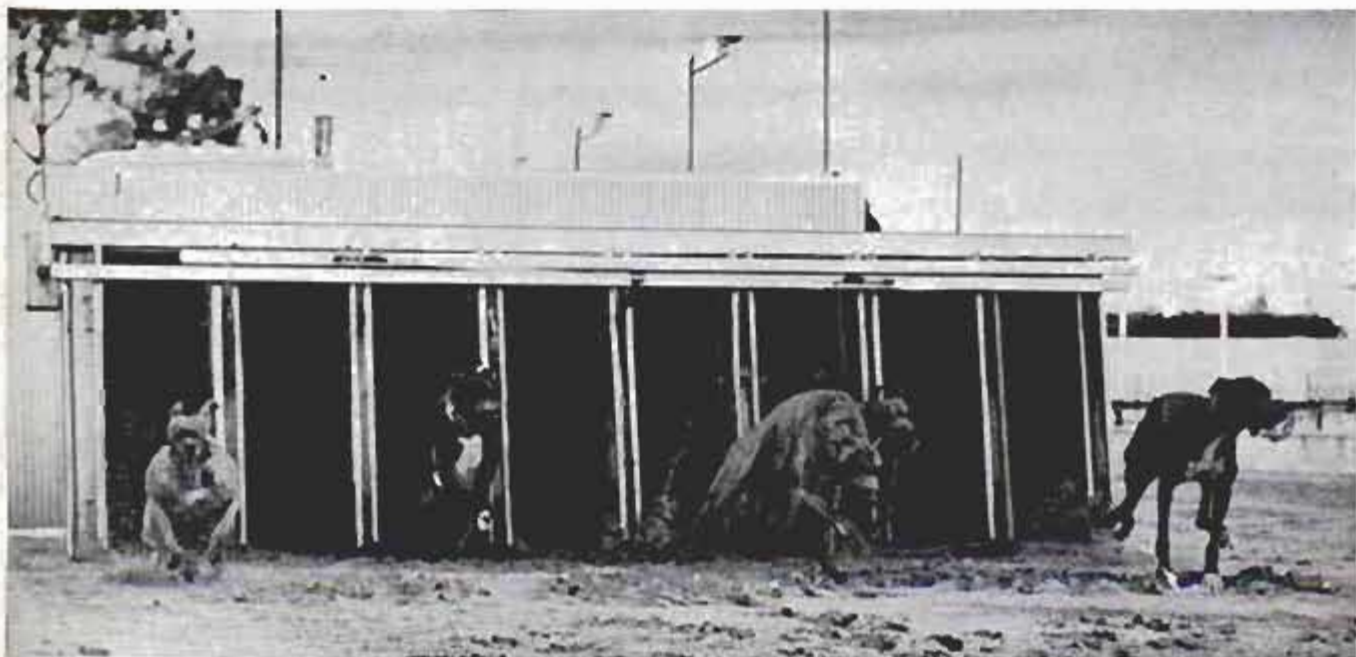


Eugene Braddock and daughter, Pat, adjust artificial bunny for a race on their training oval near Miami

FOOLMASTER TO THE HOUNDS

By Max Hunn and Edward Dickson

Young greyhounds bound out of the starting box; most of them need 10 or 12 training races before "debut"





On Braddock's training track, greyhounds chase the mechanical rabbit propelled by motor between rails

EUGENE "SKIPPY" BRADDOCK'S business is foolin' — not people, but greyhounds.

He's engaged in one of the world's most unusual occupations which concerns fooling the speedy greyhounds—both in training and on the race tracks.

During six months of the year he operates a private schooling track, a full-size, quarter-mile oval on his 10-acre estate in the outskirts of Miami. He often trains as many as 400 dogs in one day.

The rest of the year he works as an electrical maintenance man for a greyhound track near Boston. His duties include acting as lure operator (the man who makes sure the bunny always wins) as well as general maintenance chief for the electrically operated track. In his spare time, he builds and installs the gimmicks that fool and train the greyhounds. These include automatic starting boxes, special tracks on which the electrically powered bunny runs, and the ingenious machines that haul the stuffed versions of Br'er Rabbit. Br'er Fox, indeed, would have a tough time catching this Br'er Rabbit no matter how hard he tried.

Braddock, who has been operating his private training track for eight years, begins training shortly before sunrise during the winter months. Dog owners, who are either schooling new dogs or conditioning veteran dogs that need exercise, prefer to train in the cool

early morning hours to avoid overheating their dogs. So Skippy goes to work early, and calls it a day by 10 a. m. Occasionally, if there are too many dogs, he holds another training session late in the afternoon. Most young dogs require 10 to 12 training races before they are ready to compete on regular tracks.

Braddock's training oval is a duplicate of the public tracks, minus, of course, the grandstands and the crowds. He makes all of his mechanical hares, a special type with a two-wheeled motor which runs along the inside of the track; the artificial bunny projects onto the track on a steel pole. His hare will travel 65 miles per hour, the speed governed from a control tower. His

Small four-horsepower electric motor with projecting steel rod speeds the mechanical bunny around the track at 65 m.p.h.





These greyhounds are in hot pursuit of the hare they'll never catch; training track duplicates public oval



two-wheeled hare rolls on a low rail, but gets electricity for its four-horsepower motor from a "hot" upper rail much as an electric trolley car.

He believes he was the first designer of this type of equipment to devise an electrical brake to stop the lure, and the first to add an electrical device for opening the starting boxes with a remote switch in the control tower.

Stop Hounds With Trick

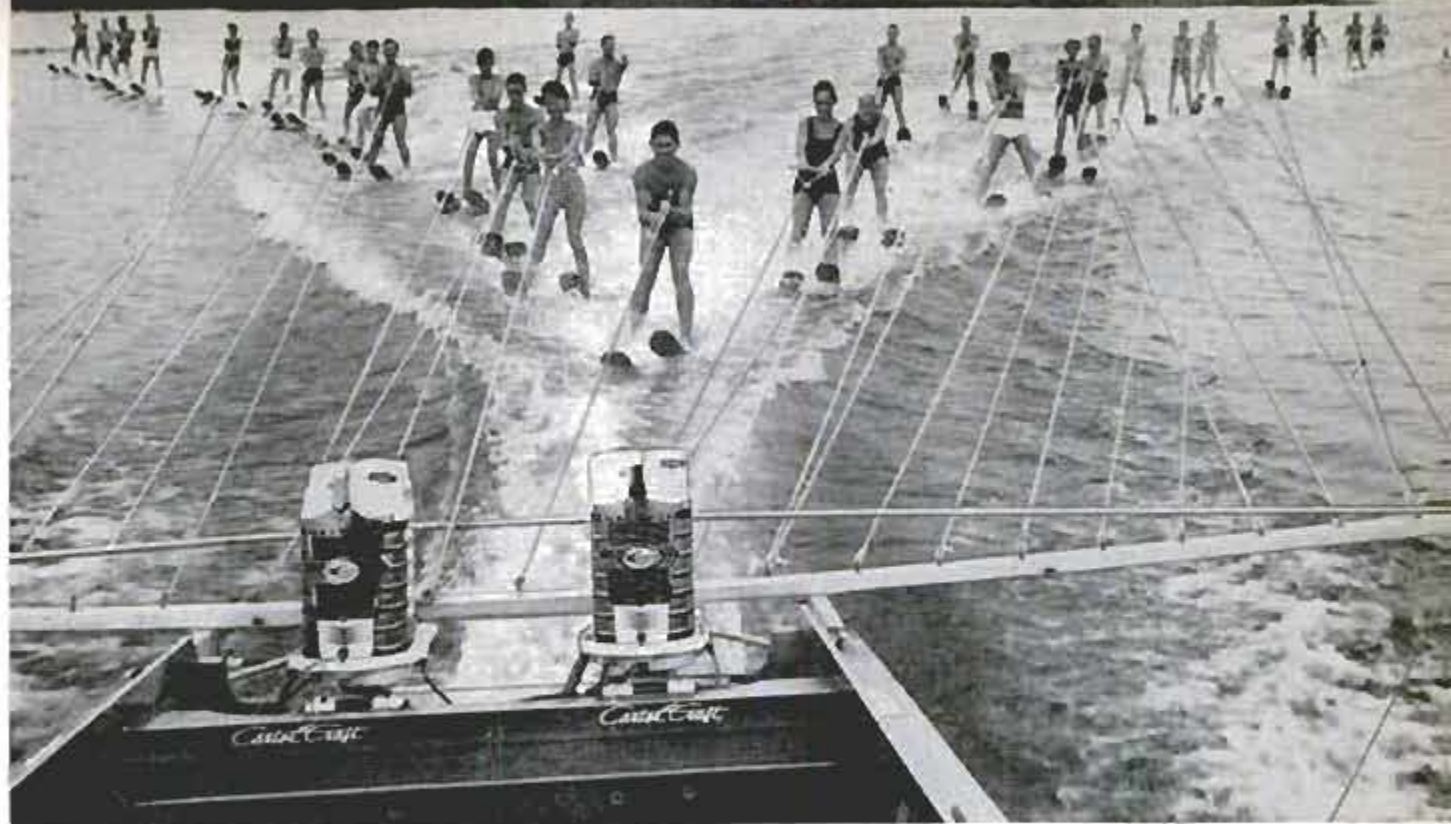
Stopping the greyhounds is as much of a trick as getting them started. Once they've passed the halfway post on the oval, an assistant draws a canvas curtain across the track. When the mechanical rabbit zips around the second time, he ducks behind the canvas. The befuddled greyhounds, who run strictly by sight, lose visual contact with their quarry and come to an abrupt stop to be quickly leashed by their handlers.

Foolin' the hounds is a family project with the Braddocks. Mrs. Braddock helps by making the white, stuffed bunnies which serve as lures. Now she makes a very lifelike bunny, but she recalls "the first rabbit I made looked more like a pig." Another member of the family, 17-year-old Pat Braddock, likes to lend a hand by helping her dad or the dog handlers.

The Braddock family is in the foolin' business all the way, with Skippy the acclaimed "Foolmaster of the Hounds." ★ ★ ★

Pat holds a pair of muzzled young greyhounds ready to race. Below, greyhounds keep running as long as they see bunny





One Small Boat Tows 5146 Pounds of Skiers

Thirty-one water skiers recently skimmed along behind one boat in an impressive demonstration of the power of a small boat equipped with outboard motors.

The 31 skiers, who averaged 166 pounds each, were brought to a simultaneous start from a pier by the unassisted boat. Two 70-horsepower motors pulled the skiers.

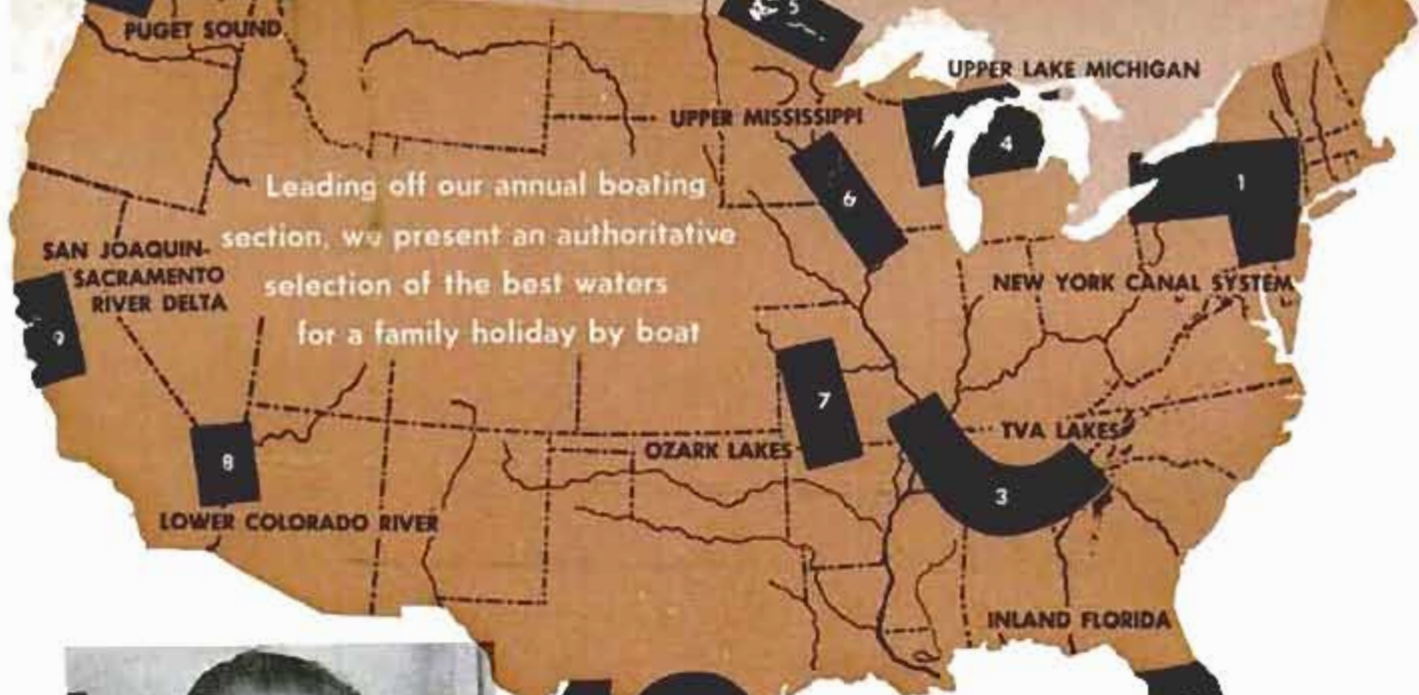
Slide Rule for Doctors Helps Diagnose Diseases

Invented by a British physician, a two-foot slide rule is expected to help doctors make diagnoses. "Symptom strips" are inserted under a window on the front, where 340 disease categories are listed. It's called a Nash Grouped Symbol Associator.

Air-Conditioned Cab Cools Combine Operator

Farmers today can work in comfort regardless of weather. An enclosed cab for self-propelled harvesters can be air-conditioned on hot days and heated on raw, cold days. There's even an automatic washer and wiper to clean the tinted windshield.





Leading off our annual boating section, we present an authoritative selection of the best waters for a family holiday by boat



By Edward S. Spanke

10 BEST BOATING VACATIONS

The author, a Staff Director of the Outboard Boating Club of America, coordinates OBC's waterways information service and its local boating club program

Reprinted "Fun with Boats"

ADVISING BOATERS on where to take their vacations is as thankless a job as suggesting whom they should marry or how much money to invest in a new business.

But I must admit it's a fascinating subject. At the Outboard Boating Club of America we receive more queries on this subject than on any other.

To select the 10 best boating vacations I consulted the top authorities on our recreational waterways—the organized boatmen, members of local boating clubs. They spend week ends as well as vacations on the water. For more than a year I carefully checked the cruising and vacationing activities of some 1000 clubs. Then I surveyed the 300 most active clubs by mail.

The results of this study appear on the map above, and on the following pages. In these 10 areas, stretching from Florida to Puget Sound, I'm confident you'll find perfect waters for your own vacation.

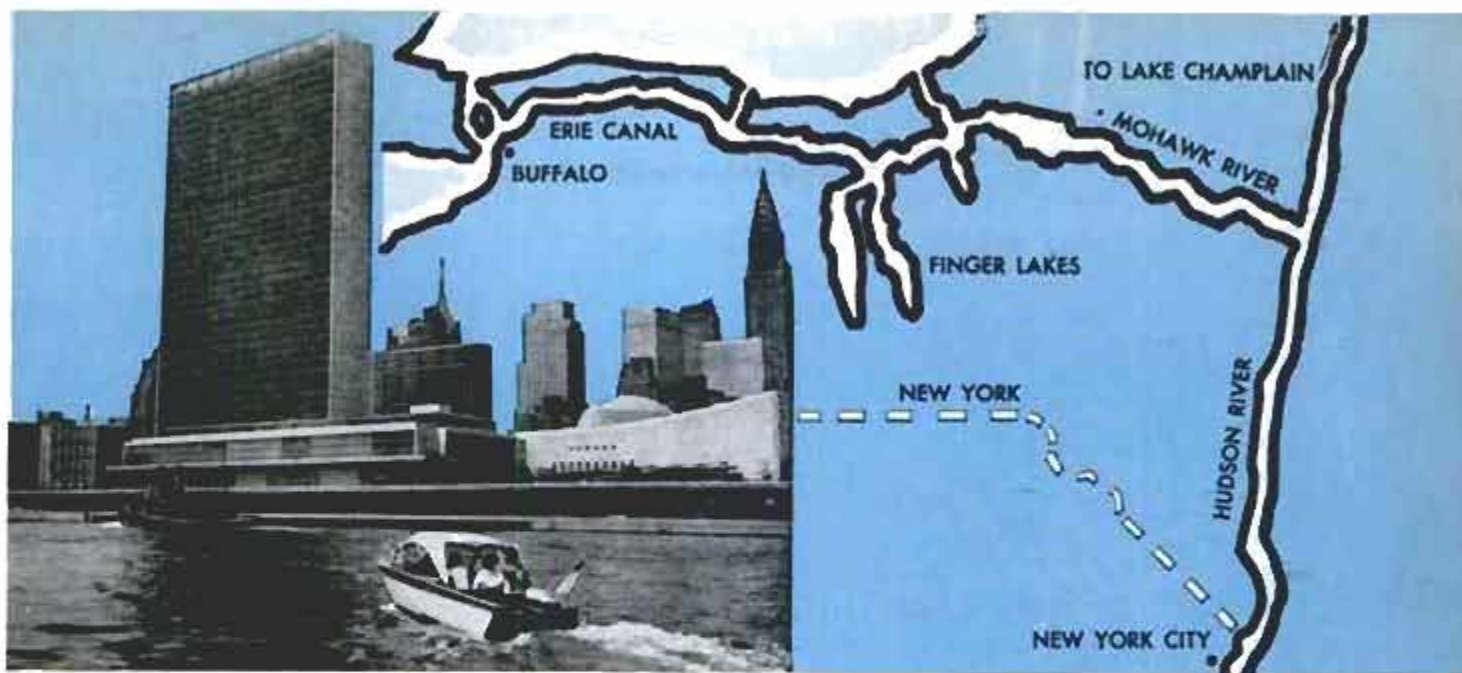
I have a personal acquaintance with most of the 10 areas. Though boating clubs made the selections, I fully agree with their choices for several reasons:

- The areas are well charted and mapped.
- All the areas offer a variety of interest.

- They are readily accessible to major population centers.
- Most (though not all) of these waters can be easily navigated by novice skippers.
- All the areas lend themselves to boating by boats of nearly every category.
- They are well spread from north to south. Thus you can find a good vacation area any time of year.
- Most of the areas lend themselves to short or long cruises. You can set up a headquarters, or camp as you go.

The areas, as noted above, are well charted and mapped. From two free catalogues you can choose government charts of the areas. One of these free lists is the *Catalogue of the Great Lakes and Connecting Waters*. You can obtain it from the U.S. Army Engineer District, Lake Survey, 630 Federal Building, Detroit 26, Mich. On the following pages, this will be referred to as "Catalogue A." For coastal water charts, write the Coast and Geodetic Survey, U. S. Department of Commerce, Washington 25, D. C. Ask for the *Catalogue of Nautical Charts—Serial 66S*. In this article, it will be referred to as "Catalogue B." You can obtain other maps and charts from oil companies.

Happy cruising!



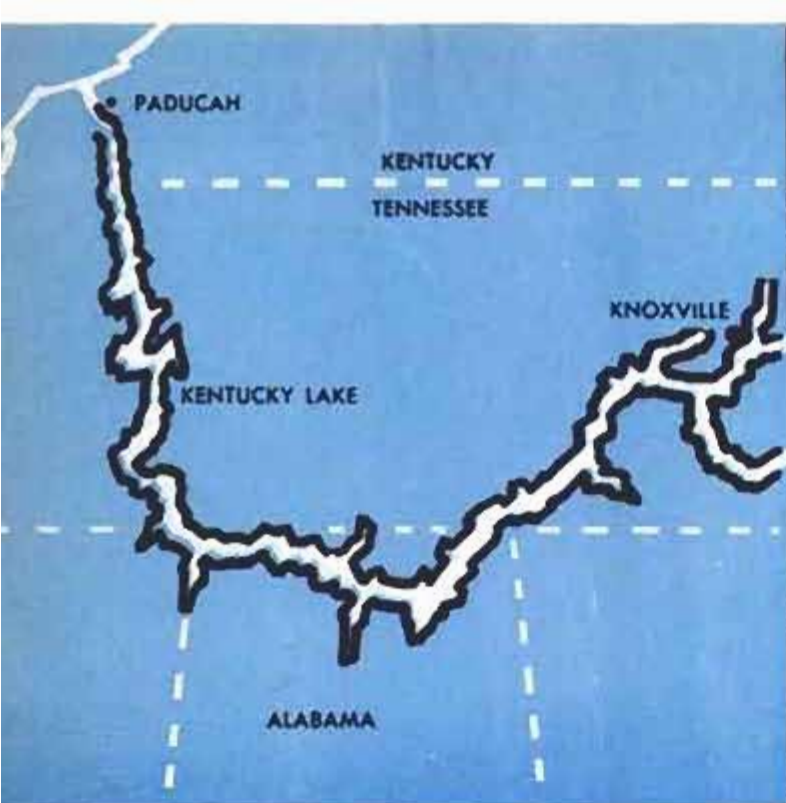
1. NEW YORK CANAL SYSTEM

The canal system links the Atlantic with the Great Lakes. From any point on the system you can embark on a fascinating cruise of days or weeks. You can cover the Erie Canal, the historic Mohawk River, some of the Finger Lakes, Lake Champlain, the St. Lawrence and—via the Hudson River—New York City itself. Good cruises: Tonawanda to New York City, Rome to Watkins Glen, Oneida Lake to Rochester. Pleasure boaters need a permit (free) in these waters. Basic charts: **Catalogue A** and oil-company maps.

2. INLAND FLORIDA

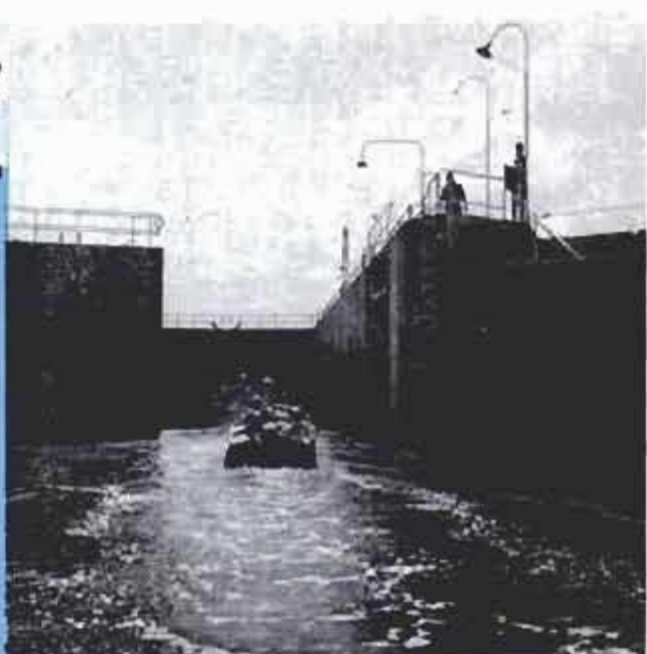
Here's a fine bet for early spring or late fall. Inland Florida is dotted with lakes, interconnected by streams and canals. Or you can cruise along the Intracoastal Waterway. According to the survey, this was the favorite of all vacation areas. Top appeals: Bass fishing, quiet waters, solitude. Best boating routes: The Oklawaha River between Eureka and Leesburg; the Kissimmee River and connecting lakes between Kissimmee and Stuart; Stuart to Fort Myers via canal, lake and river. Basic charts: **Catalogue B**.





3. TVA LAKES The Tennessee River and its lakes extend some 650 miles between Knoxville, Tenn., and Paducah, Ky., winding through four states. Top appeals: A year-round boating area; magnificent scenery, from mountains to meadows; easy access from other waterways; easy navigation; fine lodging and launching facilities. The fish are big, and include bass, walleye, crappie, bluegill and rainbow trout. Here's everything for a one-day or a two-week cruise. Write Tennessee Valley Authority, Knoxville, Tenn., for charts and maps.

4. UPPER LAKE MICHIGAN AREA Lake Michigan is one of the most treacherous waterways in the country. Yet two offshoots (circled) offer sheltered boating: A complex of lakes and rivers at the southern end of Green Bay; and an inland waterway that cuts across Michigan, from Lake Michigan to Lake Huron. Fish: Northern, walleye, sturgeon, white bass, largemouth black bass and panfish. Both offshoots have fine accommodations and public camp sites. They are top areas for family boating. Basic charts: Catalogue A and oil-company charts.





5. LAKE OF THE WOODS This lake on the Minnesota-Canada border is said to have more islands than any other lake in the world —14,000 of them. The islands and channels provide a series of sheltered waterways. The north-woods scenery is spectacular, and there are thousands of miles of shoreline to explore. Top attraction: Fishing for walleye, northern, pickerel, sauger, bass, lake trout, lake perch and that king of the fresh water, the musky. *Caution:* Gas pumps are widely spaced. Plan your fuel stops in advance. Basic chart source: **Catalogue A**.

6. THE UPPER MISSISSIPPI This stretch of the Mississippi, above Lock and Dam No. 13 near Clinton, Iowa, is by far the best section of the river for boating. Scenery ranges from rolling hills to magnificent bluffs. Features: Riverside state parks, friendly lock tenders, generally calm waters, and clean, mosquito-free sandbars. On week ends you'll meet one or more boating clubs cruising these waters. Try the trip from St. Paul downstream, then up the St. Croix River to Taylors Falls. Basic chart sources: **Catalogue A** and oil-company maps.





LAKE OF THE OZARKS

MISSOURI

• SPRINGFIELD



LAKE TANEYCOMO

BULL SHOALS LAKE

NORFORK LAKE

TABLE ROCK LAKE

ARKANSAS



7. LAKES OF THE OZARKS

Five manmade lakes within a 60-mile radius of Springfield, Mo., rated high in the survey. They are: Lake of the Ozarks, Table Rock Lake, Lake Taneycomo, Bull Shoals Lake and Norfolk Lake. Most boaters prefer to spend their nights ashore rather than roughing it, and accommodations are excellent. Fine fishing. Watch your navigation or you'll become lost in the numerous arms of these lakes. Basic chart sources: Write District Corps of Engineers, Little Rock, Ark., and state tourist agencies.

8. LOWER COLORADO RIVER

The 375-mile stretch from the northern end of Lake Mead to the Gulf of California offers top opportunities for trailer sailors. There are four great lakes formed by huge dams. The area abounds in desert canyons of monumental depths and lush mountain-rimmed valleys. Fishing is good, with no closed season, and hunting is excellent. Game includes ducks, geese, doves, quail and deer. With spectacular scenery, what more could a boating family want? *Caution:* Launching ramps are scarce. **Catalogue B.**



• LAS VEGAS

LAKE MEAD

COLORADO RIVER

LAKE MOHAVE

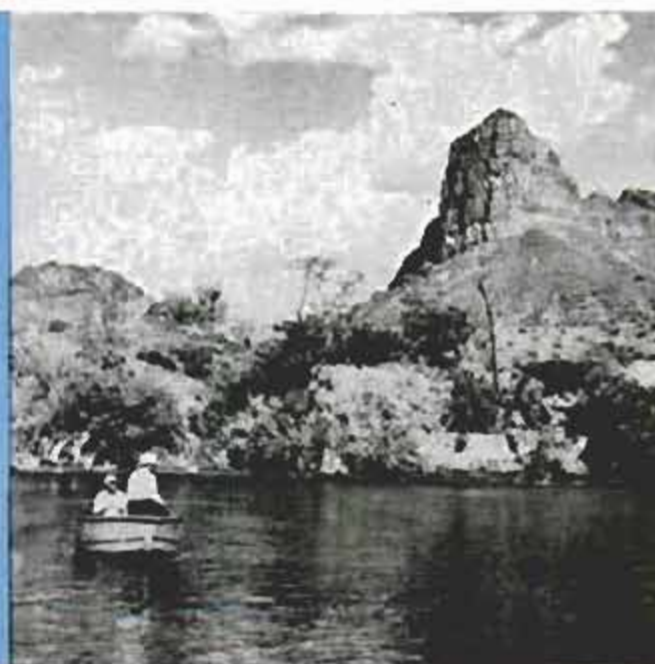
LAKE HAVASU

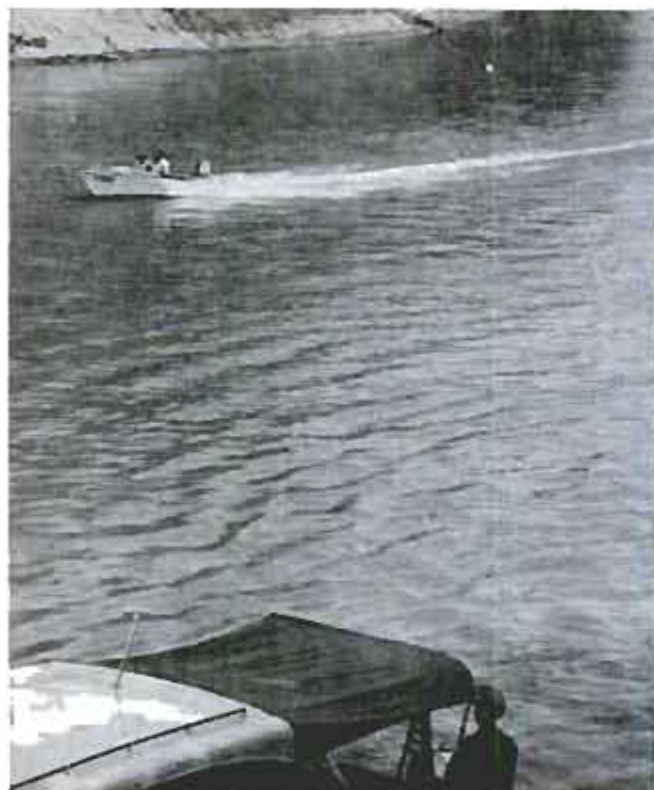
CALIFORNIA

ARIZONA

IMPERIAL RESERVOIR

• YUMA



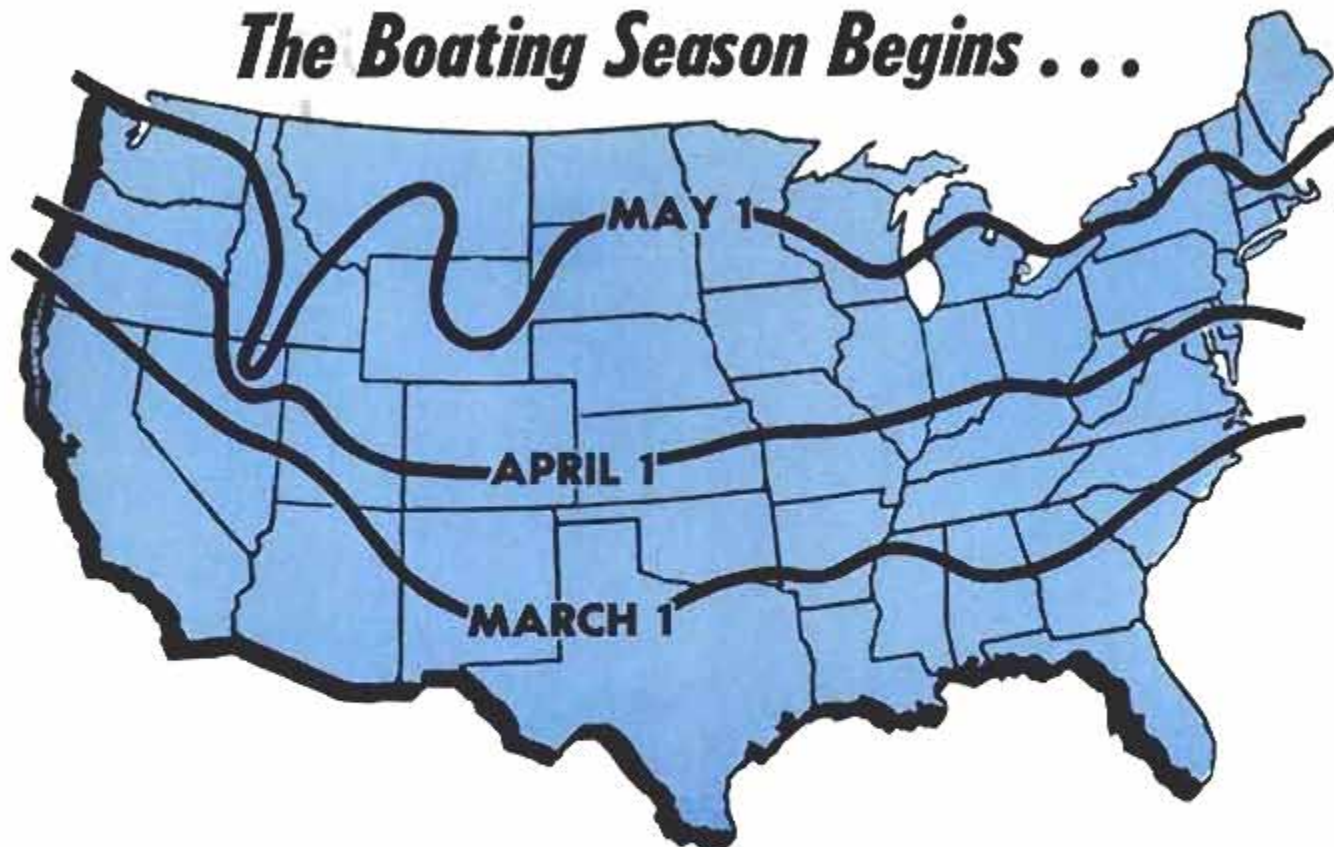


9. SAN JOAQUIN-SACRAMENTO RIVER DELTA On a map, this area extends 65 miles from San Francisco to Stockton, yet if you followed every turn of the rivers, sloughs, cuts and canals you'd log more than 1000 miles. Despite the proximity of big cities, there are few habitations and a minimum of roads. Fish and game are abundant. It's a fine area for a family to study wildlife, and one of the top boating areas of the West. Chart sources: **Catalogue B**, oil-company maps and a map available from Stockton Chamber of Commerce.

10. PUGET SOUND This is a magnificent network of waterways that would take several lifetimes to explore fully. For vacation purposes, consider Puget Sound to extend 110 miles from Orcas Island on the north to Olympia on the south. With snow-capped peaks in the background and wooded shores up close, you are hardly aware of civilization. Salmon are king, but there are many other species. You can boat for years without dropping anchor in the same cove twice. Basic charts: **Catalogue B** and oil-company maps.



The Boating Season Begins . . .



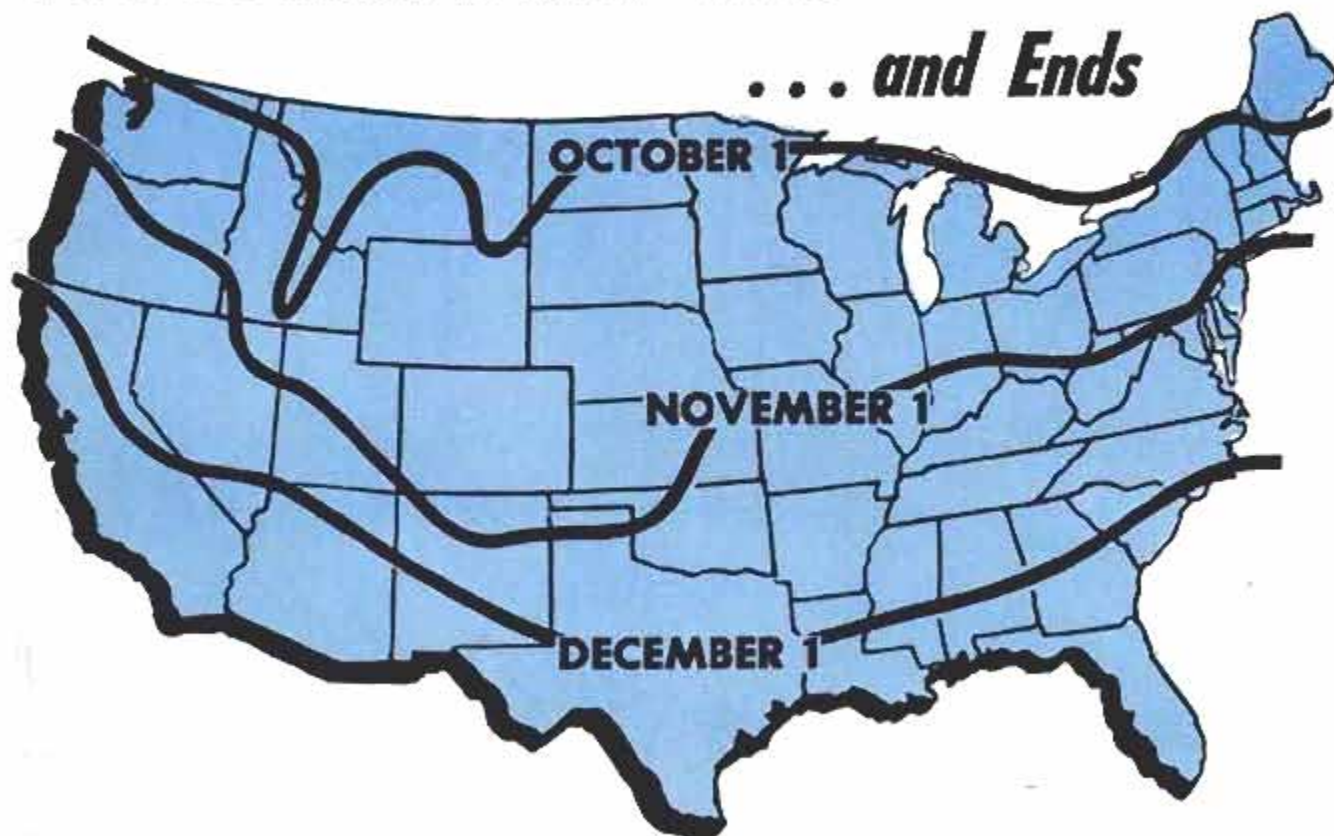
INFORMATION ON the top 10 vacation areas for boaters may help you decide *where* to go. The maps on this page may help you decide *when* to go.

No one can guarantee the vacationer perfect weather, but here's a "guesstimate." These maps, based on U. S. Weather Bureau records going as far back as 100 years, indicate the boating season—the span of time when the weather should be warm enough for fine days on the water.

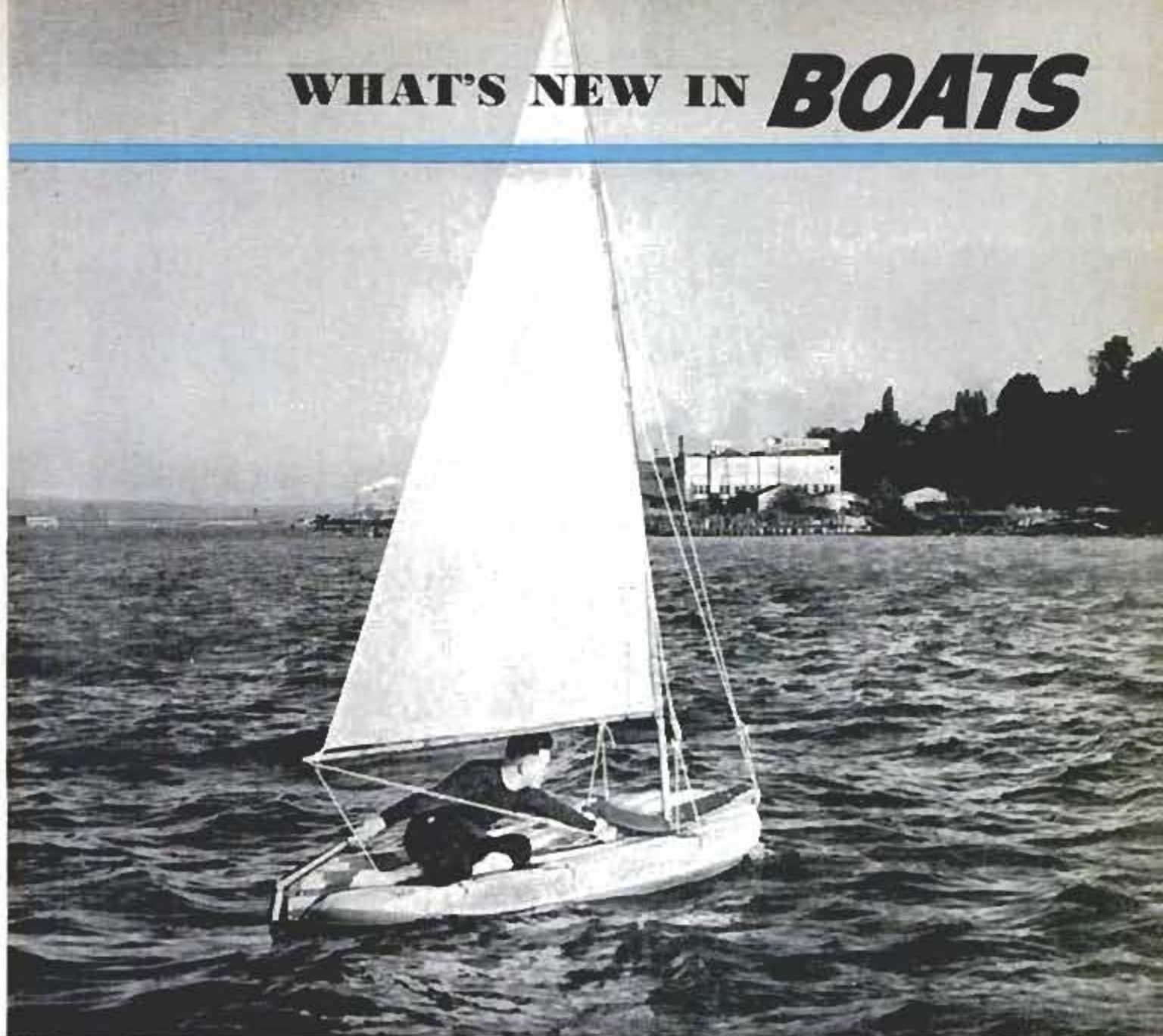
It is the lines that show the Weather

Bureau records. Each line above shows the date in the spring when the average mean temperature, all along the line, reaches 50 degrees or better, and when afternoon temperatures are likely to reach at least 60 degrees. The lines on the map below show the last dates these temperatures are reached in the fall, indicating the end of the boating season. With a little guesswork you can estimate the beginning and end of the season for any point between the lines. ★★★

. . . and Ends



WHAT'S NEW IN **BOATS**



SAILING SAUCER, above and left, is basically an inflatable play raft that can be rigged as a sailboat. Hull consists of two fabric sections in a mahogany frame. Bamboo mast is stepped into the framework.
Yogi Yachts, Midway, Wash.

POWER SKIS, right, combine the fun of skiing and boating. The skis, 10 feet long, will support 300 pounds. Powered by a 25-horsepower motor, they give the skier a fast run in calm waters.
Martin-E-Products, 3030 Bridgeway, Sausalito, Calif.





MICROBOAT provides thrills for small-fry boaters. Only seven feet long, it is made of glass-reinforced plastic and weighs 60 pounds. Thus it can be man-handled by young boaters themselves. Motors up to five horsepower are recommended for the little craft

F. K. Howe Co., Muskegon, Mich.



MORE FUN FOR KIDS is a tiny craft shaped like a bathtub. Made of expanded plastic, it weighs only 15 pounds. Completely filled with water, it still will support a 250-pound man. Ashore, it becomes a wading pool, a windbreaker or even a sunshade

Jay V. Zimmerman Co., 7933 Clayton Rd., St. Louis 17, Mo.

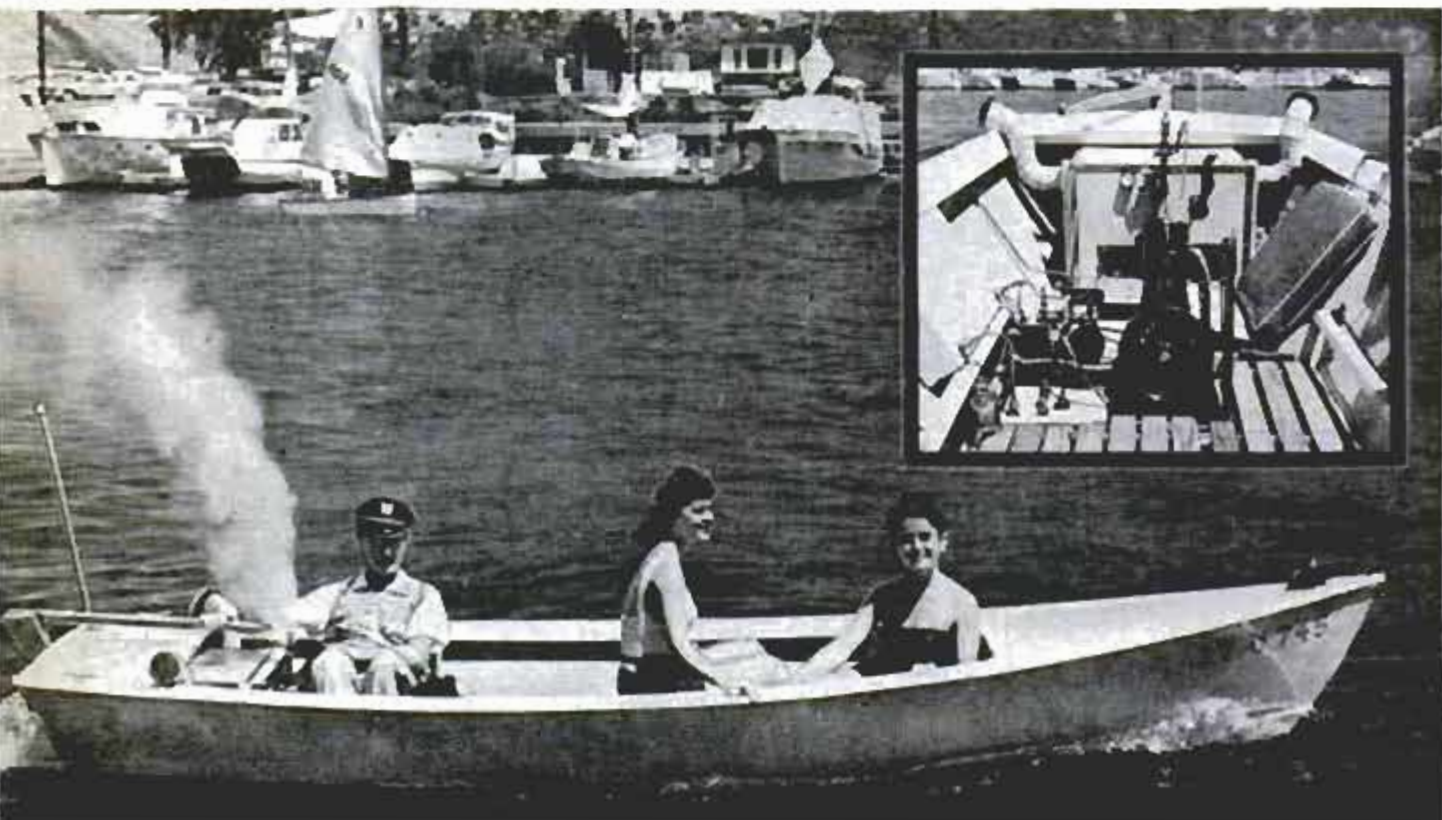


INFLATED RUBBER BOAT is only 83 inches long, has a transom framework to hold a small outboard motor. It seats two, has a total capacity of 400 pounds, is readily collapsed and easy to carry

Little Normie Mfg. Co., 5 E. 1st St., Atlantic, Iowa

STEAM-PROPELLED DORY will carry old-timers back to the quiet days of hissing steam and the odor of hot oil. Boat glides along under the power of the single-cylinder, double-acting, reversible steam engine, shown in the inset, which burns butane

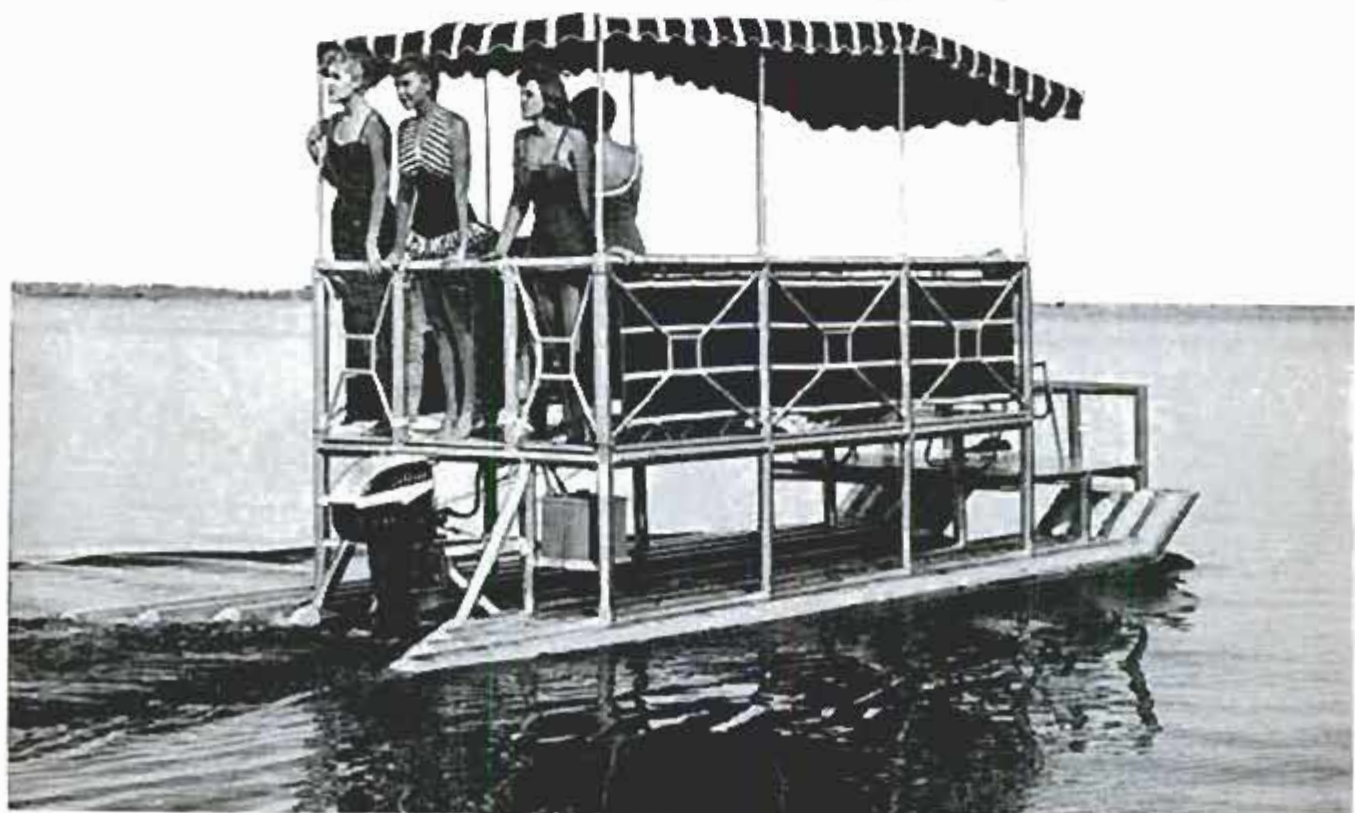
Frostline, 1272 Wellwood Ave., Beaumont, Calif.





AMPHIBIAN provides a mobile home afloat or on the highway. Built-in wheels are lowered when the craft is converted into a house trailer. The 25-footer sleeps four, has a refrigerator and stove. Steel hull is divided into five compartments
 Har-Mac, Inc., Stratford, Wis.

FUN FOR LOAFERS is this high-platform craft designed for slow cruising, swimming or just plain relaxing. The "hull" and superstructure are both made of aluminum tubing. The unique craft is 21½ feet long, can handle motors up to 30 hp.
 Rain Chief Irrigation Co., Inc.,
 P.O. Box 587, Grand Island, Neb.





BOARDING STAGES—platforms hinged to the transom—long have been a common sight on Australian boats. Now they are becoming popular in this country. You can swim and dive from the stage (above), use it for gaffing and cleaning fish, or as a boarding platform for swimmers and skiers. A small-size stage, left, permits outboarders to work on propellers

Carpeo Marine, Inc., P. O. Box 3272, Jacksonville 6, Fla.



GASOLINE CADDIE, below, makes it possible for you to wheel fuel to the boat, then pump it into the tank. It rolls easily on large rubber tires, has a hand pump for filling the aboard-boat tanks

Handling Equipment Mfg. Co., Wixom, Mich.

VARIABLE-PITCH PROP permits you to "dial" best propeller pitch for trolling, skiing, cruising or racing. The prop, 10½ inches in diameter, can be varied in pitch from 9 to 15 inches. It can be installed on 25, 30 and 35-horsepower motors of various makes

Lesnor Maehr Marine Co., 118 Cherry Lane, Floral Park, N. Y.

TRANSOM WHEEL gives you a big lift in moving your boat. Clamped to the transom, it permits one man to wheel a small boat along the shore or pier on an easy-rolling semi-pneumatic tire. There are several sizes available to fit transoms of various heights

L. and R. Products, 52 Lake Rd., Framingham, Mass.



OUTFITTING YOUR BOAT?

ROLL-OUT CARRIER takes much of the work out of loading or unloading a boat. Steel rails are held above car top by four brackets. Rails slide out to support the boat well beyond the side of the car during the loading or unloading operation

Plantico Co., 1405 Spring St., Manitowoc, Wis.



BOARDING LADDER folds to the size of a shoe box for easy storage. To install the ladder you simply drop the bottom end over the side, slide steel knobs on the top end into sockets secured to the hull. Rubber tips prevent scratches on hull

Marine Products Div., Detroit Stamping Co., Detroit, Mich.

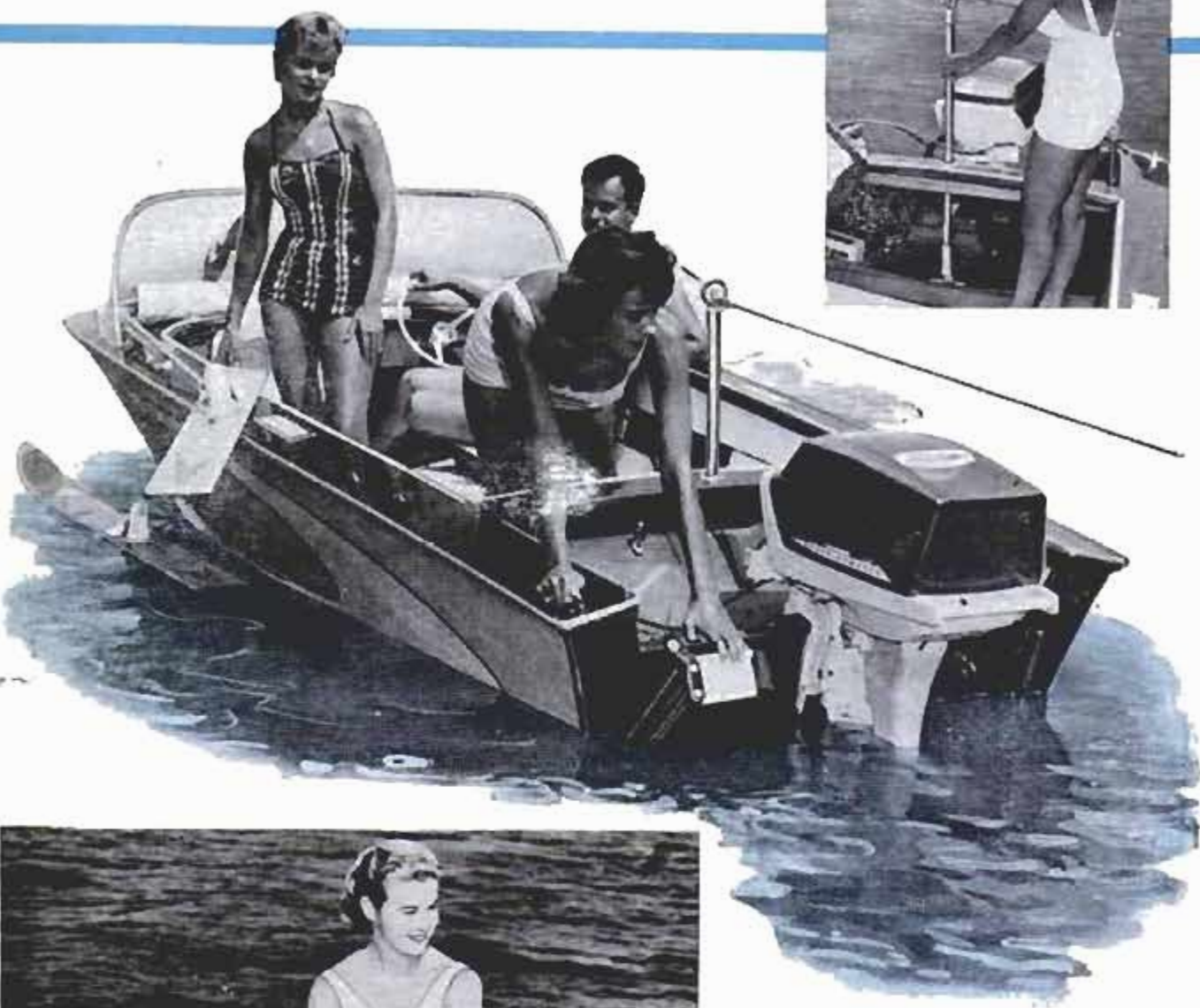


CAR RACK permits one person to load or unload boat. Axle with two wheels clamps to transom for easy handling ashore. To load the boat, bow simply is placed on rollers and boat is rolled onto top of automobile

Mayville Boat Carriers, Inc., Mayville 10, Mich.

WATER-SKI BOAT has special built-ins to aid the skier. Ski mast, right, fits into a socket near transom, holds line high to eliminate fouling. The 15-foot craft also sports a hinged ladder for boarding, a reversible front seat for watching skier's signals, compartments for storing gear

Switzer-Craft, Inc., Crystal Lake, Ill.



←**LAUNCHER** (also shown on the cover) eases skier into the water after boat has attained skiing speed, eliminating beach or dock starts. Skis are parallel with surface until skier trips a hydraulic mechanism which lowers skis into the water in the proper position. Launcher mounts on any boat over 16 feet and is easily removed for storage by releasing lockpin. Launchercraft Co., Inc., Box 1584, Yakima, Wash.

TOW BAR around motor, right, has an electronic "eye" that "watches" skiers for safety. Tow ropes are attached to the eyebolt, and a switch is flipped on. As long as there is drag on the rope, the signal is inactive, but as soon as the skier lets go or falls, a buzzer sounds an alarm. Thomas Die and Stamping Co., 2170 Walton Blvd., Pontiac, Mich.

WHAT'S NEW IN

WATER SKIING

BUOYANT SKIS, right, enable most skiers to start on top of the water. Made of glass-fiber plastic, the skis are hollow. Because of their buoyancy, they permit skiing with low horsepower. An added safety feature is that they will support a dunked skier in the water indefinitely.

E-Z Plastics, Inc., Blue Earth, Minn.

TOW TRIANGLE floating behind the boat below eliminates the slack that a regular V-rope creates just as the skier starts to come out of the water. The triangle, made of aluminum, floats and has a connecting swivel to prevent rope twists.

Thompson Skis, Inc., Crivitz, Wis.

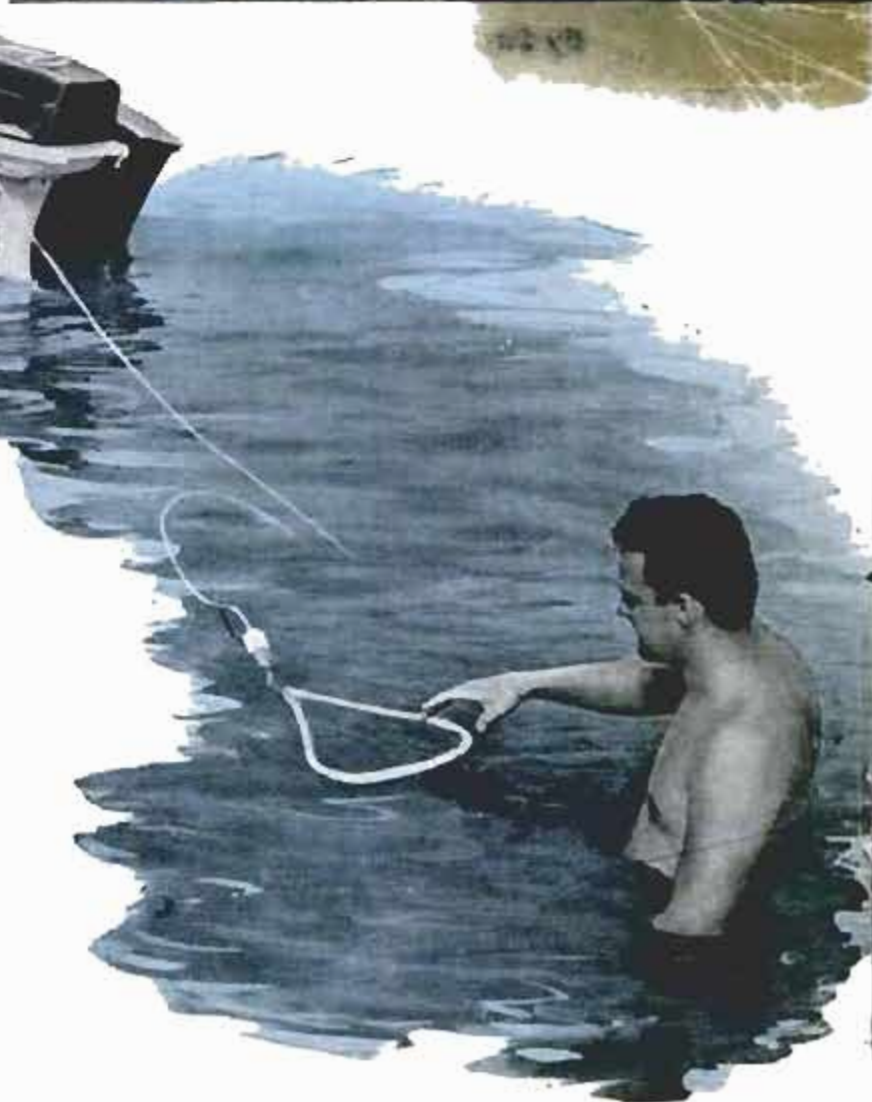




Photo courtesy Mercury Outboard Motors

Small pontoon boat powered by 60-hp. outboard motor demonstrates its versatility by towing water skiers

VERSATILE PONTOON BOATS

*can be fitted with a variety of superstructures
for comfortable camping, hunting or fishing
and even for summer living on lake or river*

X77

By Earl Wobeck

PART I

ONE OF THE LATEST trends in outboard boating is the pontoon boat. Due to its large amount of deck space, it can be a seagoing patio, camping tent, summer cottage or whatever the owner chooses to add to the basic unit. The latter generally consists of two pontoons and a deck and railing, which can be purchased in a number of sizes from several companies at about the cost of a good 15-ft. runabout. For those who wish to build their own boat, construction plans for a 23½-ft. model are included in this article. The completed boat is shown in Figs. 3 and 5.

To the basic unit of any pontoon boat

you can add an awning for protection from the rain and sun as in Fig. 1. There is enough room on board for a chaise longue or cot, or for a card game around a table large enough to accommodate at least six people. For a family that desires cruising accommodations, a cabin complete with head and galley can be built on the deck as in Figs. 2 and 11. In some cases, an extra pontoon may be required to provide proper flotation for the added weight of cabin and furnishings.

For the hunter or fisherman who wishes to trail the boat frequently, such as on week ends, a cabin-type tent may be set

Photo courtesy Gennett & Sons, Inc.



up on deck at the launching place. Manufactured boats are launched from a trailer in the same manner as runabouts and outboard cruisers are handled. The PM boat is built in units that can be loaded easily in a box trailer, Fig. 4, for transporting to a lake, where it can be unloaded and quickly assembled on the water.

These craft can be outfitted to provide safe boating for the entire family. Because of their sturdy construction and extremely shallow draft they can be run up on a beach or tied to a tree on a riverbank. The motor will pull the boat off the beach when shoving off. Speeds range from 10 to 20 m.p.h., depending upon the size of boat and motor.

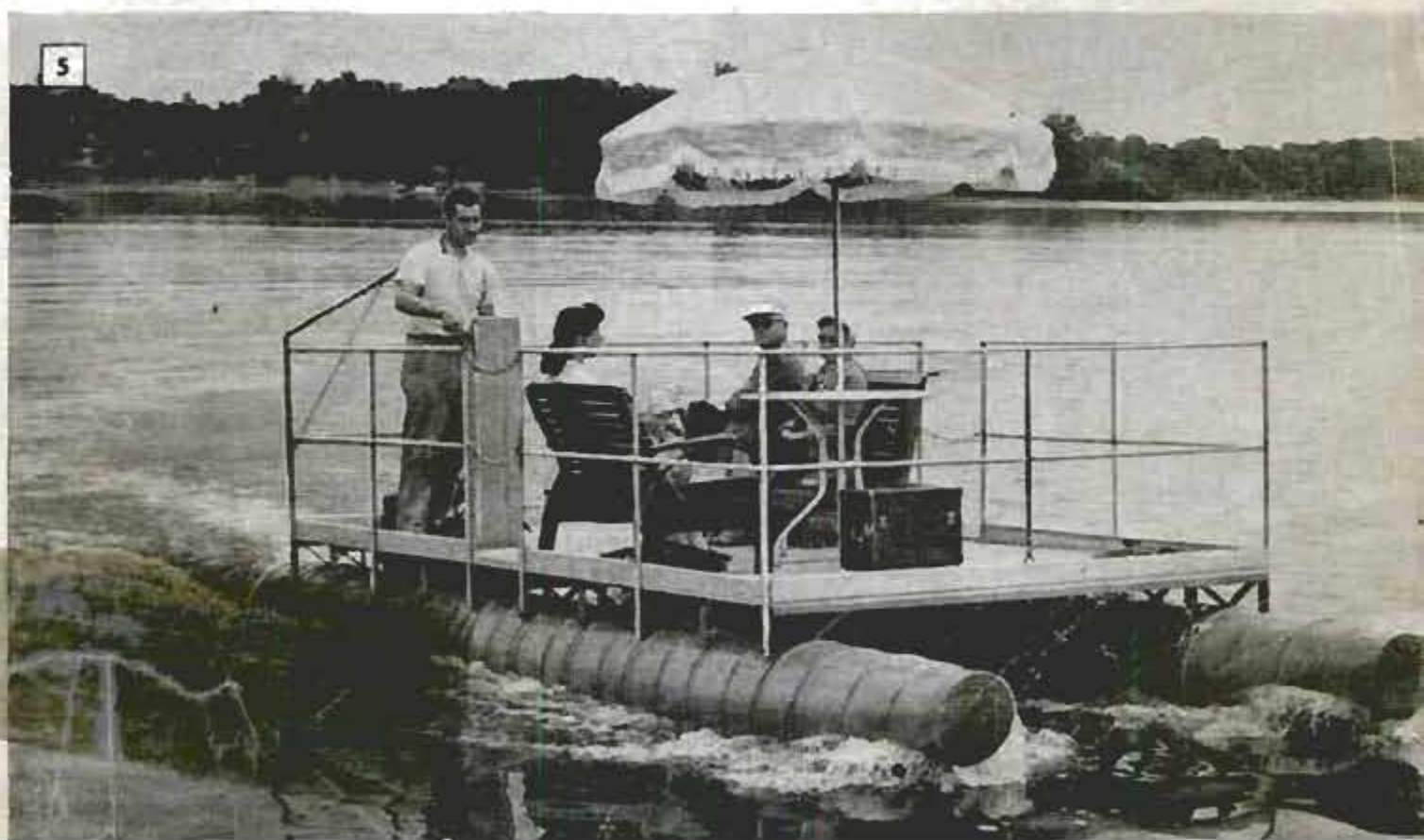
The PM boat can be made for about the price of a good boat trailer. Construction is simple but strong, using inexpensive, readily obtainable materials. Except for an arc welder, no special tools are needed, although a saber saw will save a great deal of time and effort. A 110-v. a.c. welder in a 40 to 100-amp. size is adequate for this project since none of the welds requires electrodes that are



Above, typical of pontoon boats, PM boat appeals to all ages and is easily handled by means of remote controls mounted on steering station

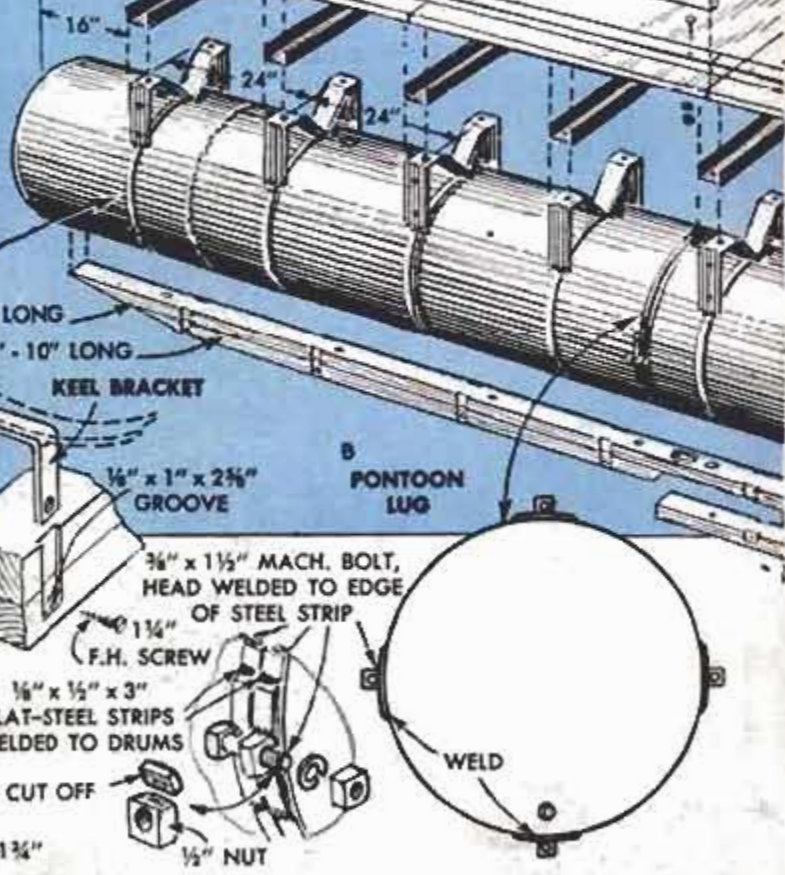
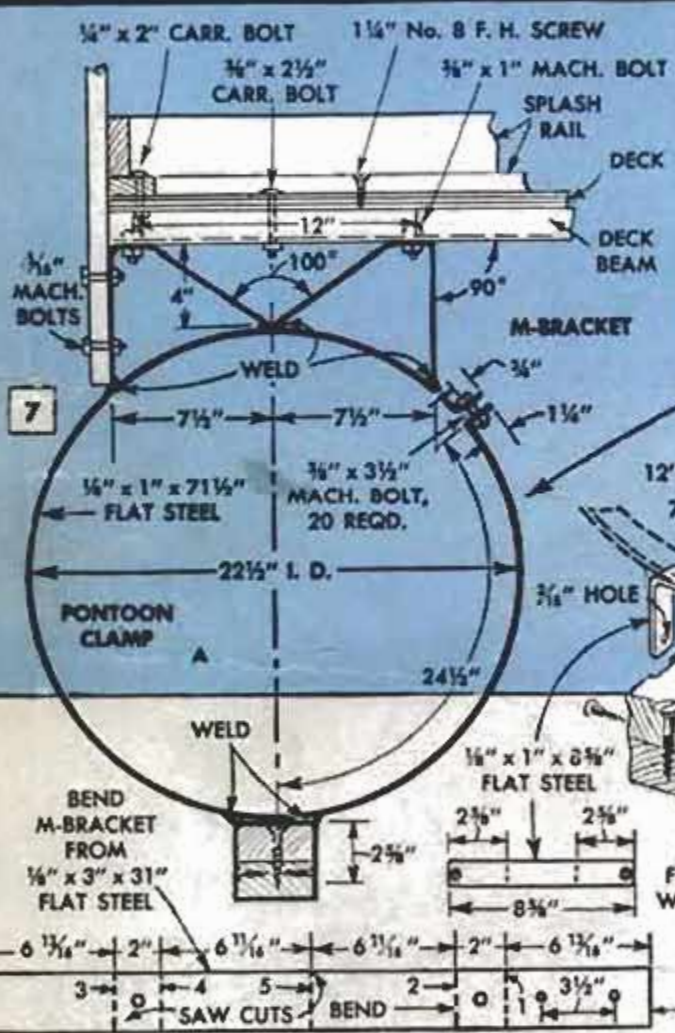
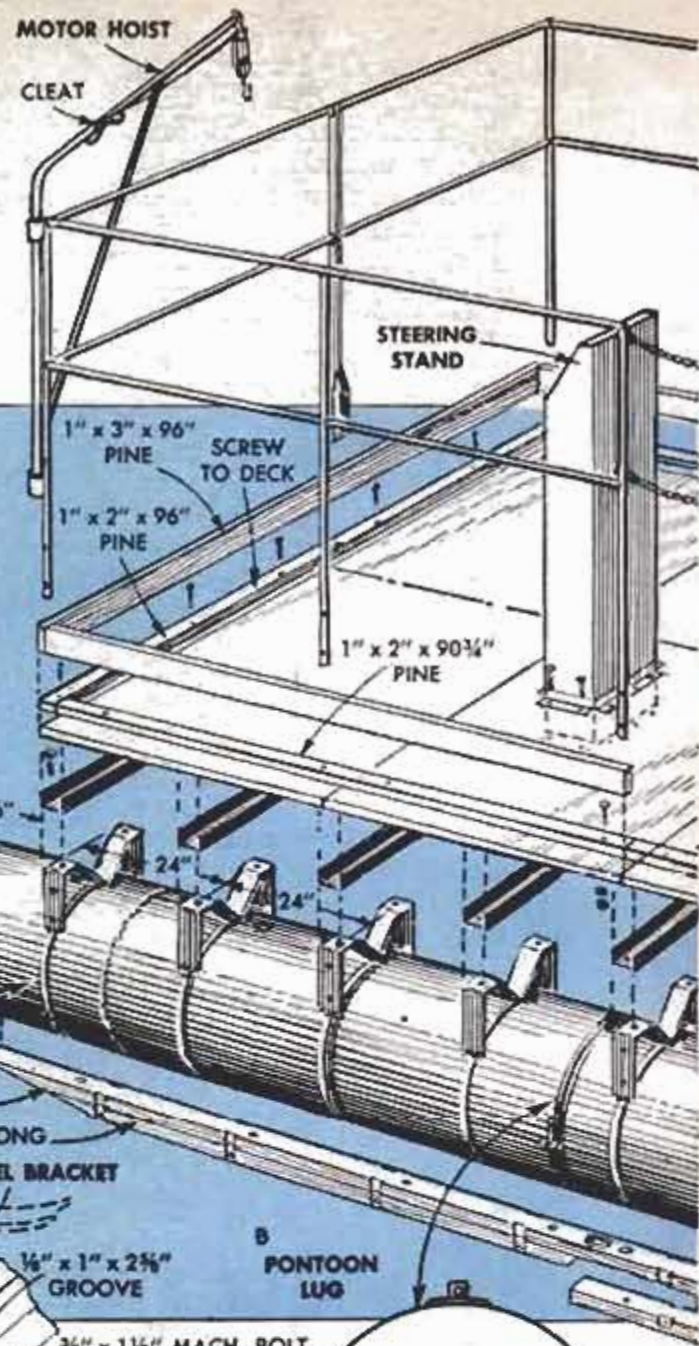


Above, PM boat disassembles into easily handled sections for hauling in rented box trailer. Fig. 5, 35-hp. motor pushes boat at 12 m.p.h.





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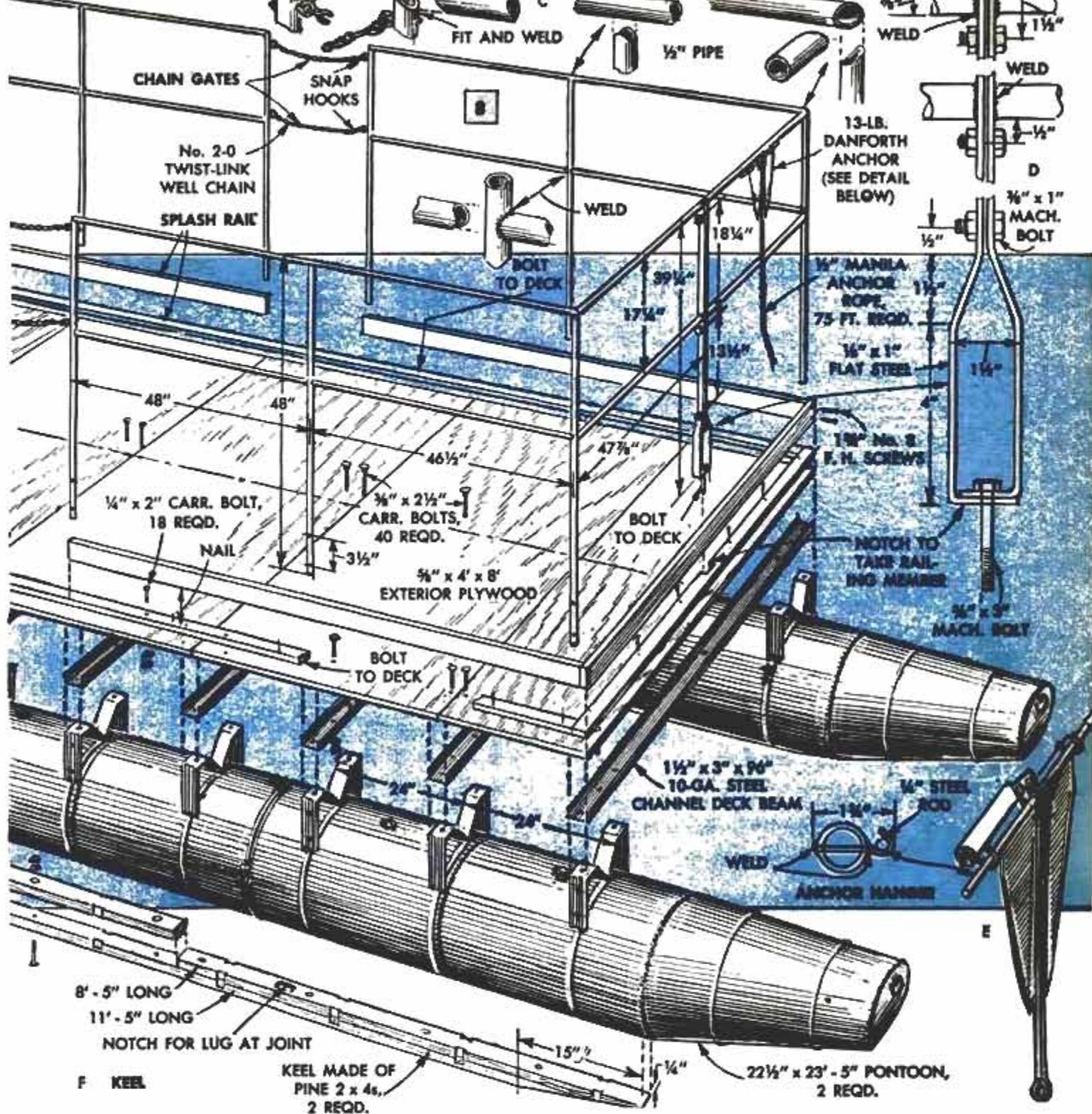


larger than $\frac{3}{16}$ -in. dia. Mild-steel-coated electrodes (Hobart "13") produce strong welds and are easiest to work with for this purpose. If you have never operated an arc welder, make practice welds on metal of the same thickness as that which is used in construction of the boat. An hour's practice is about all you need to make passable welds.

Making the pontoons

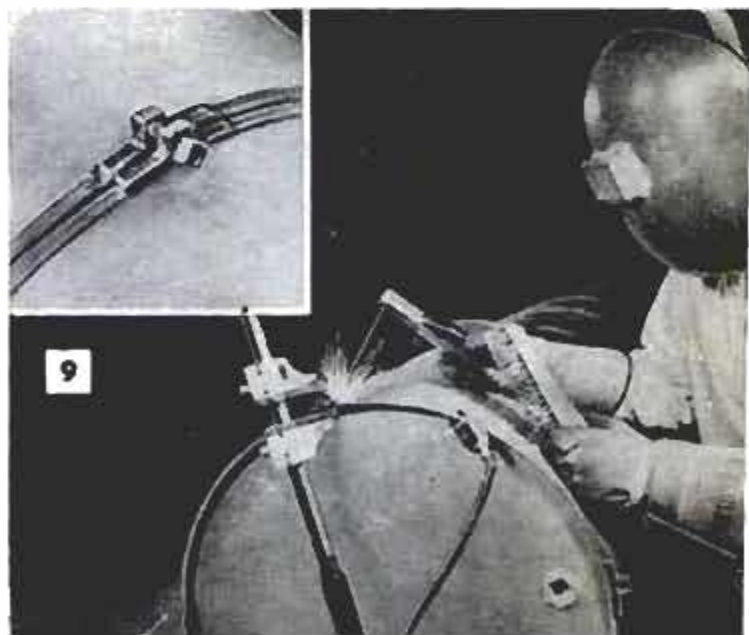
Each pontoon is made from 55-gal. steel drums welded together end to end to form three sections. Three drums are used for the stern section, three for the bow section

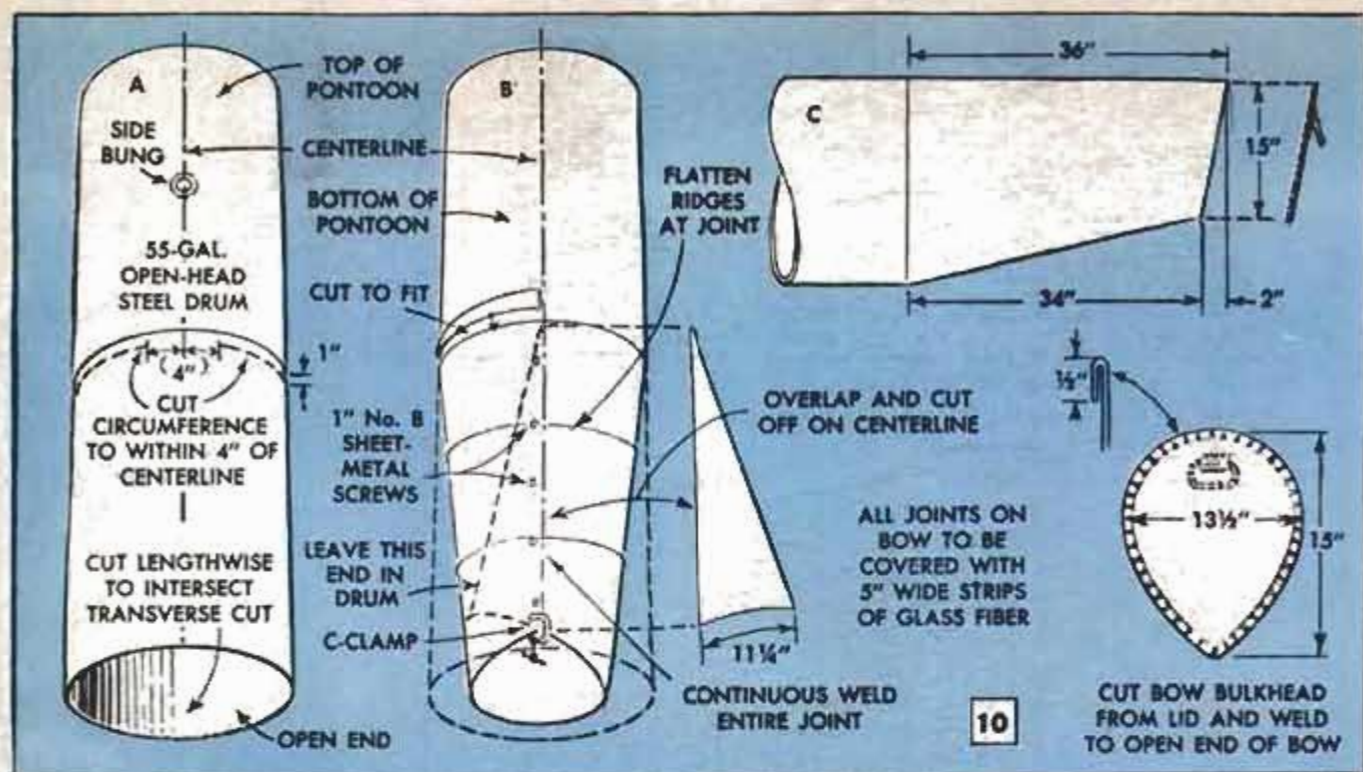
and two for the center section. All are closed-head drums, except for the one that is used to form the bow which is open at one end. The sections are bolted together by means of lugs welded to section ends that butt together to form a rigid pontoon as shown in Fig. 9, and detail B of Fig. 7. Most used 18-ga. steel drums are suitable for this purpose. They do not require cleaning or reconditioning, but should not have been used as containers of flammable liquids. However, it is important that all drums be of the same diameter and length so that the flanges at the side match when bolted together, also to ensure that the over-all



lengths of both pontoons will be the same. Drums of slightly different lengths may be used as long as they are paired off opposite each other in the pontoons according to length. Drums having bungs on the side should be used so that air pressure built up inside when welding can be released. Position the drums so that the filler caps are located on top of the pontoon on the centerline as shown. Before welding the drums together, be sure end caps are turned tight to prevent them from leaking. It is only necessary to make butt welds about 4 in. long where drums are joined together, spaced to match the lug locations.

The angled portion of each bow section is





formed from an open-head drum, one having a removable lid as shown in Fig. 10. Before cutting the drum for shaping, weld the closed end to the drum that is next in line on the pontoon to avoid distorting the bottom flange, detail A. Note that the uncut portion of the drum's circumference is located so that the pontoon centerline bisects it and the side bung on the drum is aft of it. The finished dimensions of the bow are given in detail C. Shaping is done simply by compressing the open end and holding it in position with a C-clamp as in detail B. The metal that overlaps the centerline and circumference cut is cut away and the metal at the centerline joint

is drawn together with sheet-metal screws for welding as in Fig. 6. It is not necessary to make these joints watertight by welding since they are to be covered with glass fiber.

The bulkhead that covers the open end of the bow is cut from the drum lid. Before doing this, make a template by holding a piece of cardboard against the bow opening and tracing around it. Add 1/2 in. on all sides of the template to permit bending over the edges of the bulkhead to provide two layers of metal as detailed in Fig. 10. The doubled metal dissipates more heat from the welding arc than when a single thickness is used, thus lessening the

Lightweight cabin built on pontoon deck provides inexpensive summer living afloat for entire family

Photo courtesy Holland Pontoon Boats



chances of melting holes in the metal. When outlining the bulkhead on the lid, position the template to locate the lid handle at the top as indicated. After cutting and fitting the bulkhead, tack-weld it in place and then run a continuous bead around the joint. The latter is covered with glass fiber to make it watertight.

Next make the pontoon clamps and M-brackets as shown in Fig. 7, detail A. The M-brackets are welded to clamps, rather than directly to the pontoons. This results in a stronger boat and also makes it easier when it comes to assembling the deck beams and deck. After the M-brackets and clamps are completed, they are welded together and placed roughly in position on the pontoons in readiness to be drawn up tightly after the deck is assembled on them and properly aligned. Once the latter is done, the clamps need never be moved. Note that pontoon clamps are spaced 24 in. on centers, except for the end ones which are 22½ in. on centers. All holes should be drilled in these parts before bending, using a jig for accuracy and to save work.

The M-brackets are easy to form. Carefully mark the points at which bends are to occur and make ¾-in.-deep saw cuts in each edge of the material at these points for accurate, small-radius bends. Saw cuts are welded shut after the brackets are formed.

Wooden keels protect the bottom of the pontoons and cover the lugs at the bottom. They are made from pine 2 x 4s screwed together and assembled in two parts as shown in detail F, so that no member is too long for hauling when disassembled.

Deck and Railing

The 8 x 18-ft. deck consists of four 4 x 8-ft. and one 2 x 8-ft. panels of 5/8-in. exterior plywood that are bolted to steel-channel deck beams as shown in Fig. 8. The splash rail consists of 1 x 2 and 1 x 3-in. furring strips nailed together to form six sections. Bow and stern sections are screwed to the deck, while side sections are bolted to the deck. The four-piece railing is made of galvanized pipe and lengths of 1/8 x 1-in. flat steel. The latter is welded to facing ends of the railing at the bow and stern for clamping the sections together, detail D. All uprights are 3/4-in. pipe, horizontals are 1/2-in. pipe. Joints must be properly cut and fitted for strong welds, detail C. A 13-lb. Danforth anchor will provide ample holding for most bottoms. The anchor can be hung on the railing by providing two hangers for it as in detail E. Construction of the motor hoist, outboard mounting board, steering stand and installation of controls will be explained in part II next month.

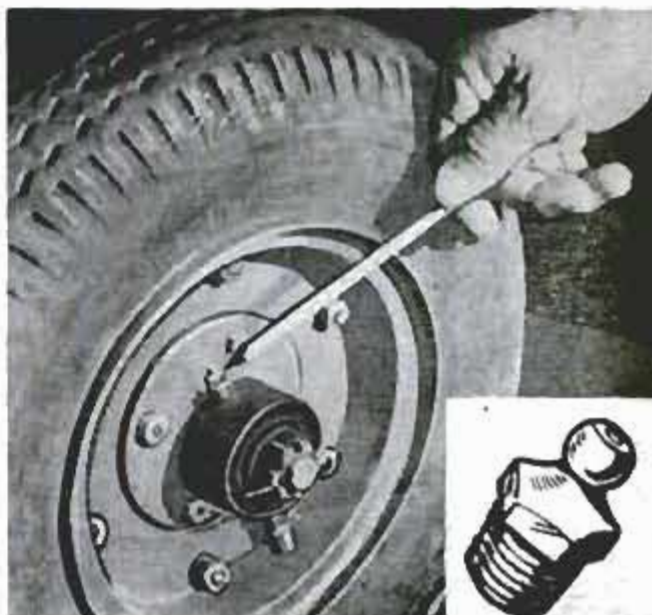


Outboard Can't Slip off Boat When Chained to Transom

To prevent your outboard from accidentally slipping off the transom when under way, Johnson Motors recommends chaining it to the boat. The best way of doing this is to bolt one end of a length of chain to the transom and secure the other end to the motor clamp screw by means of a snap-hook linked to it as shown. For motors that do not have a hole in the clamp screw, drill one in the latter to take the snap.

Grease Fittings on Wheel Hubs Ease Boat-Trailer Servicing

Keeping the wheels greased on a frequently used boat trailer no longer presents a servicing problem for one outboarder who installed a grease fitting on each of the hubs as shown in the photo and inset. Since the fitting must be located as far inboard as possible for proper lubrication, the wheel must be removed before tapping the hub to take it.—Lee H. Schrimpf, Tulsa, Okla.





Photos courtesy Michigan Wheel Co.

In race between two identical boats and motors, one equipped with stock propeller and other having propeller recommended for boat and motor. Latter has big lead at end of the measured half-mile course

THE RIGHT PROPELLER WINS

Boating Annual, 1961

By Earl Wobeck

WHETHER YOU WANT to win races, or travel to a favorite fishing spot and back in the quickest possible time, your outboard should be equipped with a type and size of propeller that will permit the rig (boat and motor) to develop its maximum speed. A propeller that is too large for the rig prevents the motor from running within close range of the maximum rated r.p.m. recommended by the manufacturer, so that full power is not developed. A propeller that is too small permits the motor to exceed its maximum r.p.m. to waste power and damage the motor. Underdeveloped or wasted power means less speed, which is graphically illustrated by the finish of a comparative test between two identical boats and motors as shown in Fig. 1. The winning boat differs from the loser in only one respect—the propeller that came with it was replaced with one better suited to the rig.

To make available a good selection of propellers for many specific boat and motor combinations, propeller manufacturers design and test new ones each year as soon as motor manufacturers place their new models on the market. Shown in Fig. 2 are seven propellers, each having slightly different design characteristics, that were tested by Michigan Wheel Company's field

staff to determine the one that would afford maximum effectiveness for a given rig. When satisfied with test results on a propeller, it is placed in production and kept in stock, as are similarly tested propellers for most popular motors. To obtain a propeller that best suits your needs, consult one of the propeller-selector lists that are available from the manufacturers. Then, to further improve the performance of your rig, some testing will have to be done on your own, since the replacement propeller you order undoubtedly was tested on a rig that differed to some degree from your own.

Testing the efficiency of a propeller is easy when you have an understanding of the way in which it moves the boat through the water. It does this very much like a propeller on an airplane, except that the medium in which it is operated is water instead of air. The blades of a propeller are set at an angle on the hub so that when rotated they bear against the water, which forces the propeller forward to the extent forward thrust is developed by the speed of rotation. Since the propeller is connected to the motor and the latter to the boat, the entire unit is driven through the water.

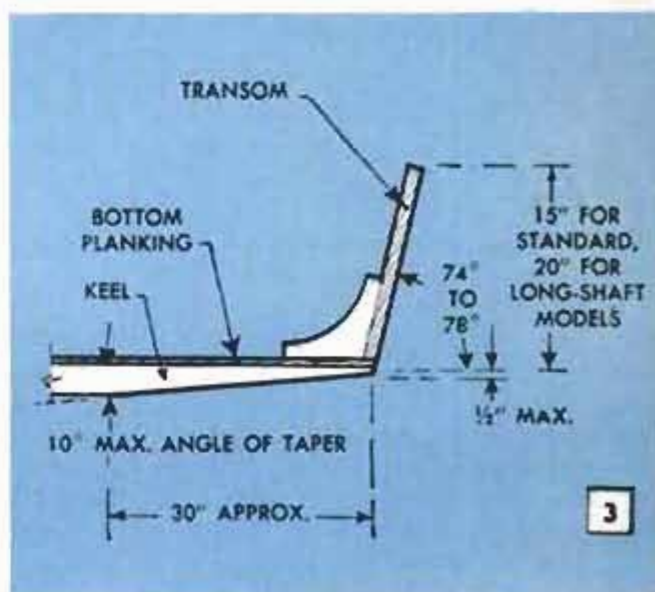
The size of a propeller is always referred to by pitch and diameter. To find the diameter of a propeller, double the distance



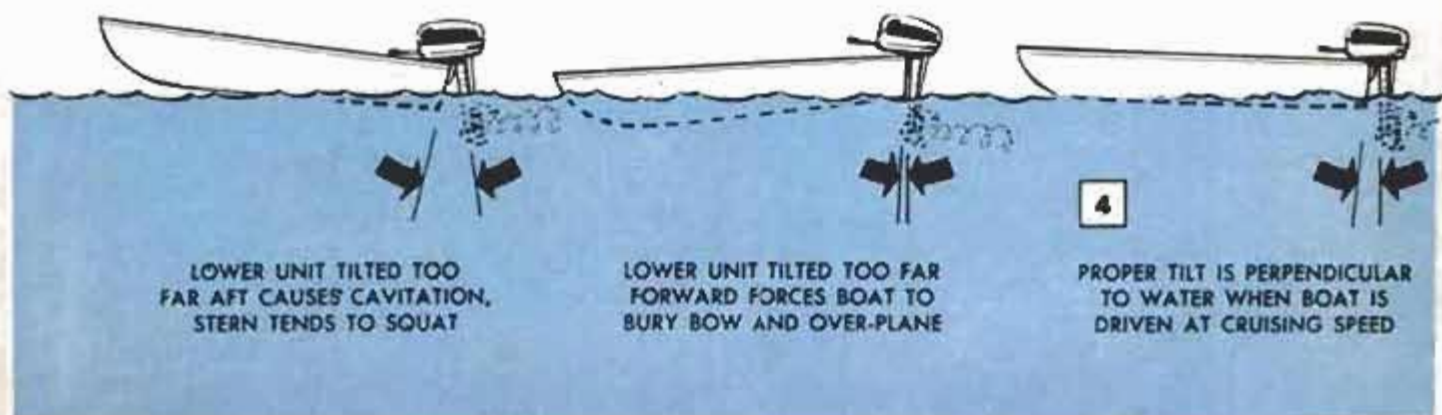
Several propellers, each having slightly different pitch, diameter or blade characteristics, are test-driven to determine the one that will give best over-all performance for given motor, hull, type of service and load

in inches from the tip of one blade to the hub center. Pitch is determined by the number of inches the propeller would move forward through a solid in one revolution, Fig. 7. Since it never travels this far in water, the speed the boat would attain if it did is the rig's theoretical speed. The difference between the latter and the actual boat speed is referred to as propeller slip. Slip should be from 15 to 30 percent, depending upon the type of hull being driven.

Here is the way you check propeller slip: An accurate speedometer and a tachometer are needed, the former to check boat speed and the latter to determine propeller shaft r.p.m. First note the r.p.m. and boat speed when moving at a constant speed as indicated by the tachometer and speedometer. Divide the r.p.m. figure by the first number of the motor's gear ratio (for a ratio of 2:1, divide by 2) and multiply the result by the propeller pitch number



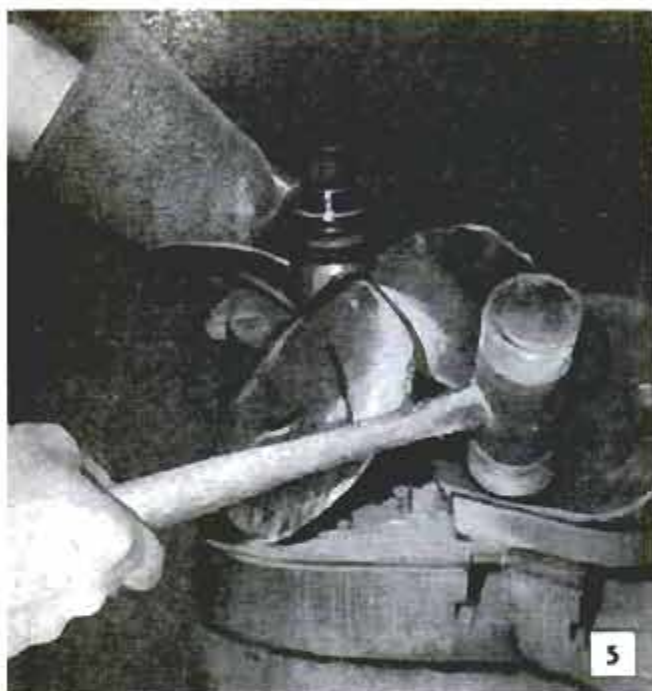
Above, sufficient submergence of lower unit of motor is necessary to prevent cavitation and power loss. Below, tilting motor to correct angle in relation to water surface is important for optimum performance



LOWER UNIT TILTED TOO FAR AFT CAUSES CAVITATION, STERN TENDS TO SQUAT

LOWER UNIT TILTED TOO FAR FORWARD FORCES BOAT TO BURY BOW AND OVER-PLANE

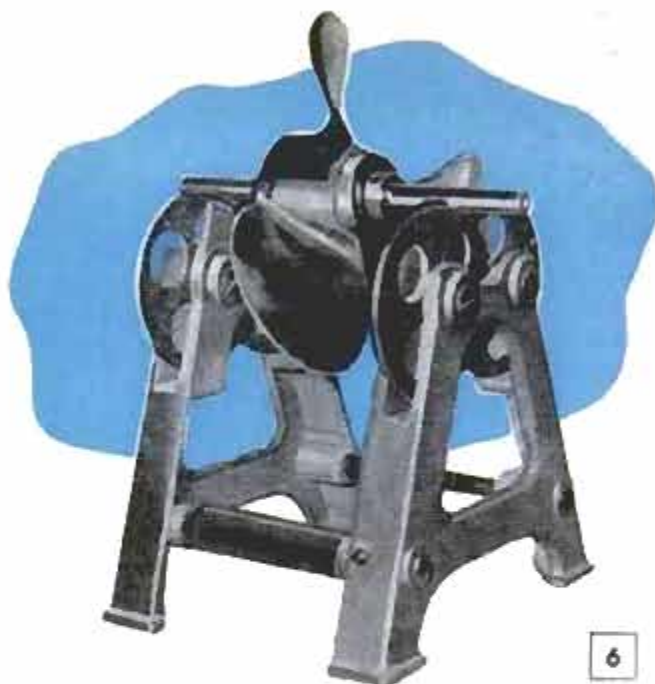
PROPER TILT IS PERPENDICULAR TO WATER WHEN BOAT IS DRIVEN AT CRUISING SPEED



Damaged propeller blades are straightened and trued on pitch block, a job for the professional repairman

for the theoretical forward speed rated in i.p.m. After converting this to m.p.h., subtract the boat speed for the slip in m.p.h. Divide the slip figure by the theoretical speed for the percentage of slip. If slip is excessive, try a propeller having proportionately less pitch than diameter, keeping in mind that a propeller having two blades has less blade area than one having three blades when the given diameter is the same for both. If slip is less than normal, less blade area and more pitch usually are required. To get the right combination of pitch and blade area, it may be necessary to change from a two-blade to a three-blade propeller, Fig. 9, details A and B. Normally, four-blade propellers should be used only for heavy-duty applications, detail C.

When selecting a propeller consider the advantages of having one that is equipped with a cushion hub, Fig. 8. The rubber in-



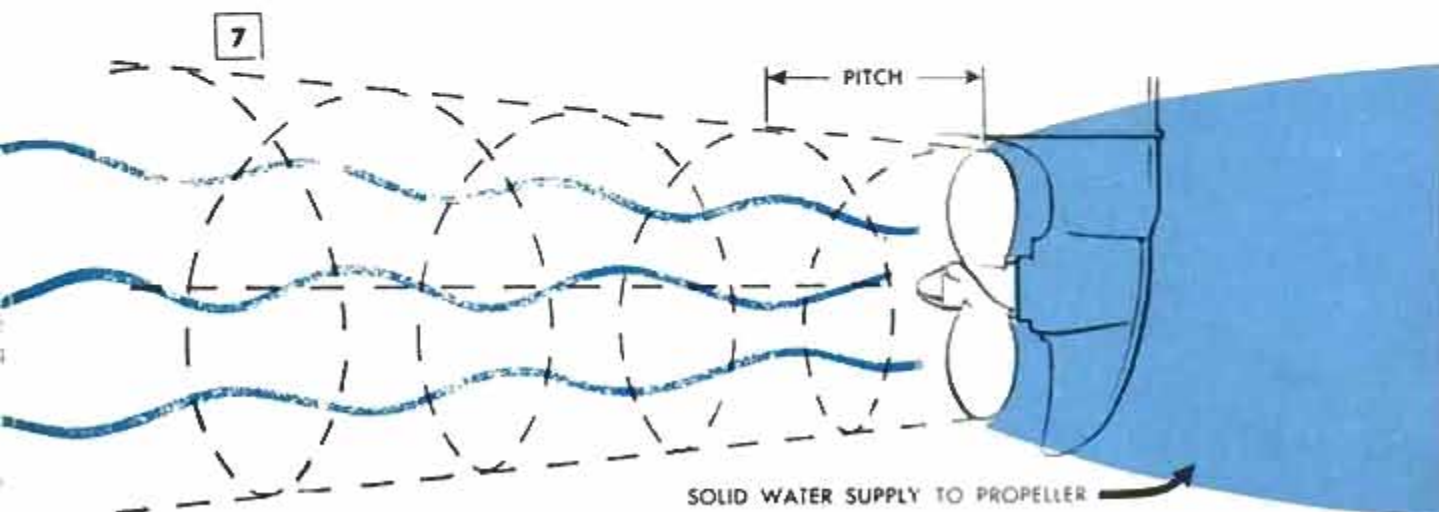
Repaired propeller is statically checked for balance to be sure it will not vibrate at high speed

sert rotates in the propeller hub only at the instant rotation is reversed, relieving strain on the gear assembly in gear-shift models, and reducing strain on the shear pin when an obstruction is encountered.

Propellers with damaged blades should be repaired by a competent workman using proper tools. To assure that a repaired propeller has its original pitch and blade contours, it must be straightened on a pitch block having the same surface design as the propeller blades, Fig. 5. A propeller that has lost metal from nicks must have the metal replaced by welding and then be checked for proper balance, Fig. 6. The balancing procedure is much the same as balancing a car wheel, except that metal is ground from the hub instead of being added to achieve balance.

Most important for obtaining full power from your motor is mounting it on the

Propeller pitch indicates distance in inches propeller would move forward through solid in one revolution



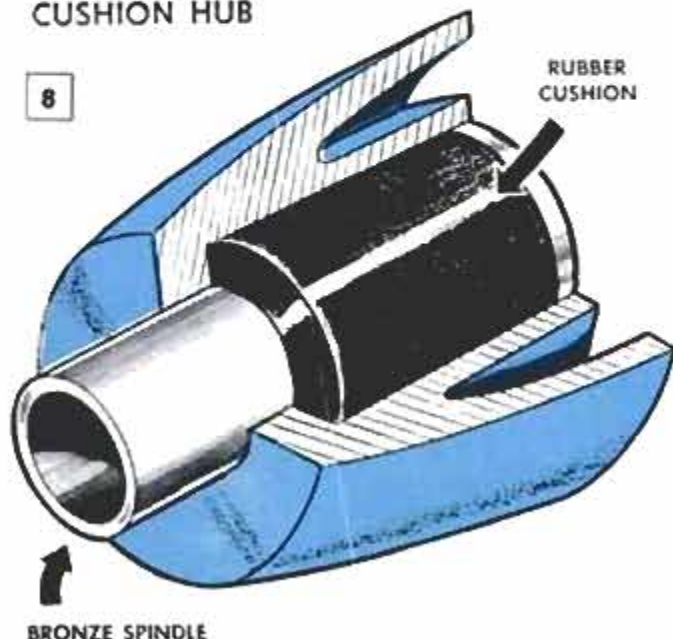
transom so that the lower unit is submerged sufficiently as indicated in Fig. 3. For most runabouts a good rule is to run the anticavitation plate slightly below the boat bottom. But avoid mounting the motor so that the lower unit is overly submerged which would cause drag to reduce boat speed. Also keep in mind that the deeper the motor exhaust outlet is submerged the greater is the build-up of back pressure.

Motor tilt is another important factor. When the lower unit is tilted too far forward, the bow will tend to bury itself and cut speed. Proper tilt for most rigs is with the drive shaft perpendicular to the water surface when the boat is at full speed. For maximum racing speeds the best motor angle is with the lower unit tilted back as far as possible without causing cavitation, a condition wherein the propeller draws air or motor exhaust gases and runs free. Most cavitation is caused by the motor being tilted too far aft or located too high on the transom. Other causes are a bent propeller, wrong propeller size and weeds on the lower unit.

If full speed is to be attained, the bottom of the hull should be straight from the transom to the point at which the bow begins its curve. When there is a substantial keel extending from the hull, the after end should be tapered from full size at a point about 30 in. forward to $\frac{1}{4}$ in. at the transom to reduce turbulence at the propeller, Fig. 3. Some rigs are so sensitive to weight distribution that inside ballast (unattached equipment) must be moved well forward to permit planing when medium to large motors are used. Design, power and type of rig vary so much that weight distribution is an individual problem. ★ ★ ★

Rubber cushion in propeller hub absorbs shock to protect shift gears and reduce shearing of pins

CUSHION HUB



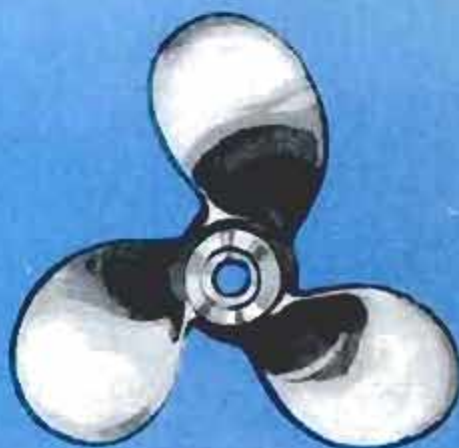
MARCH 1959

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Above, most two-blade propellers are designed for service on motors used in racing craft and small runabouts where light loads are involved and high speed is of major importance

B



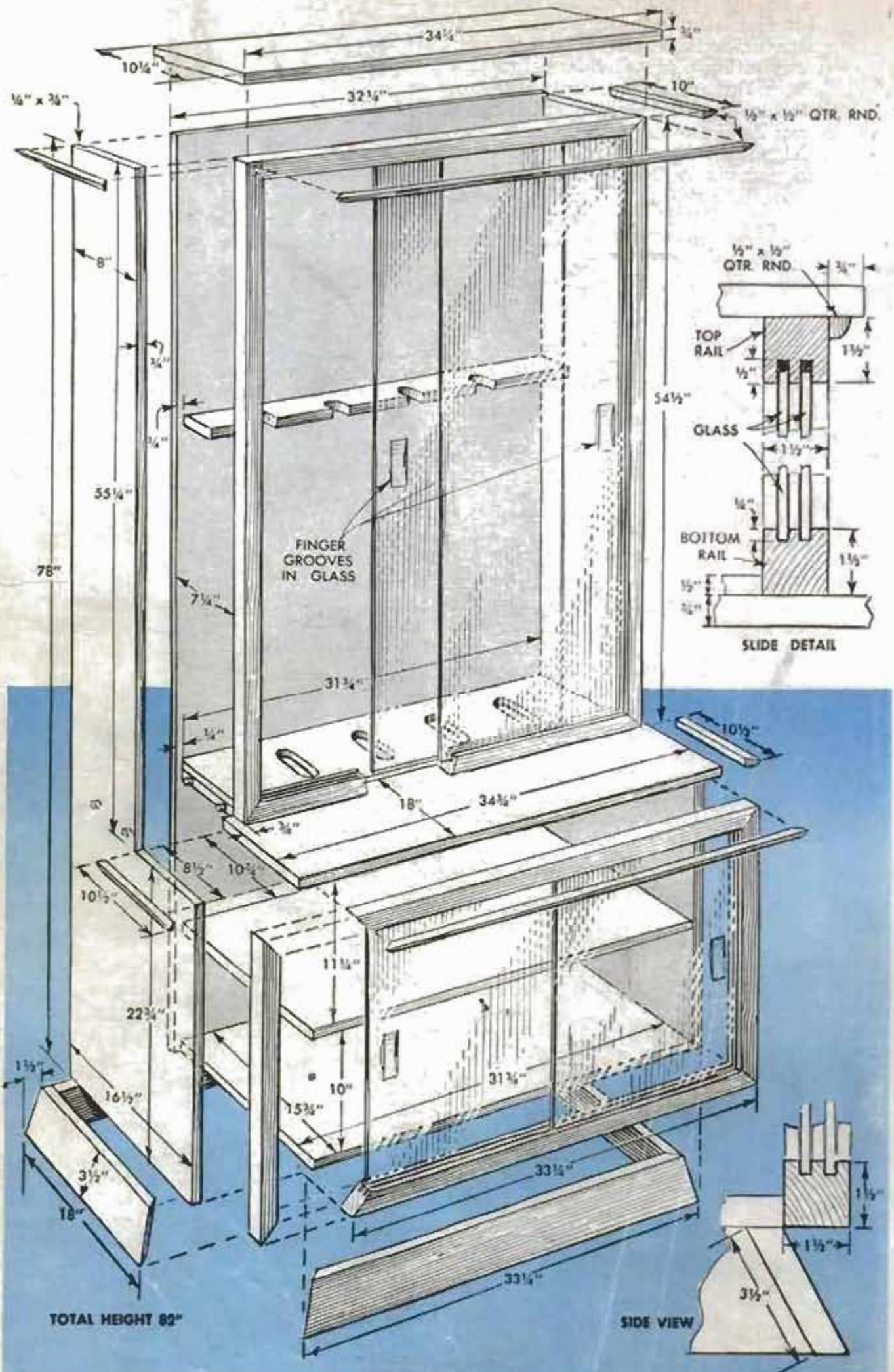
Above, three-blade propellers afford quicker acceleration and have better load-carrying ability than two-blade ones, which makes them ideal for family cruisers and water-skiing

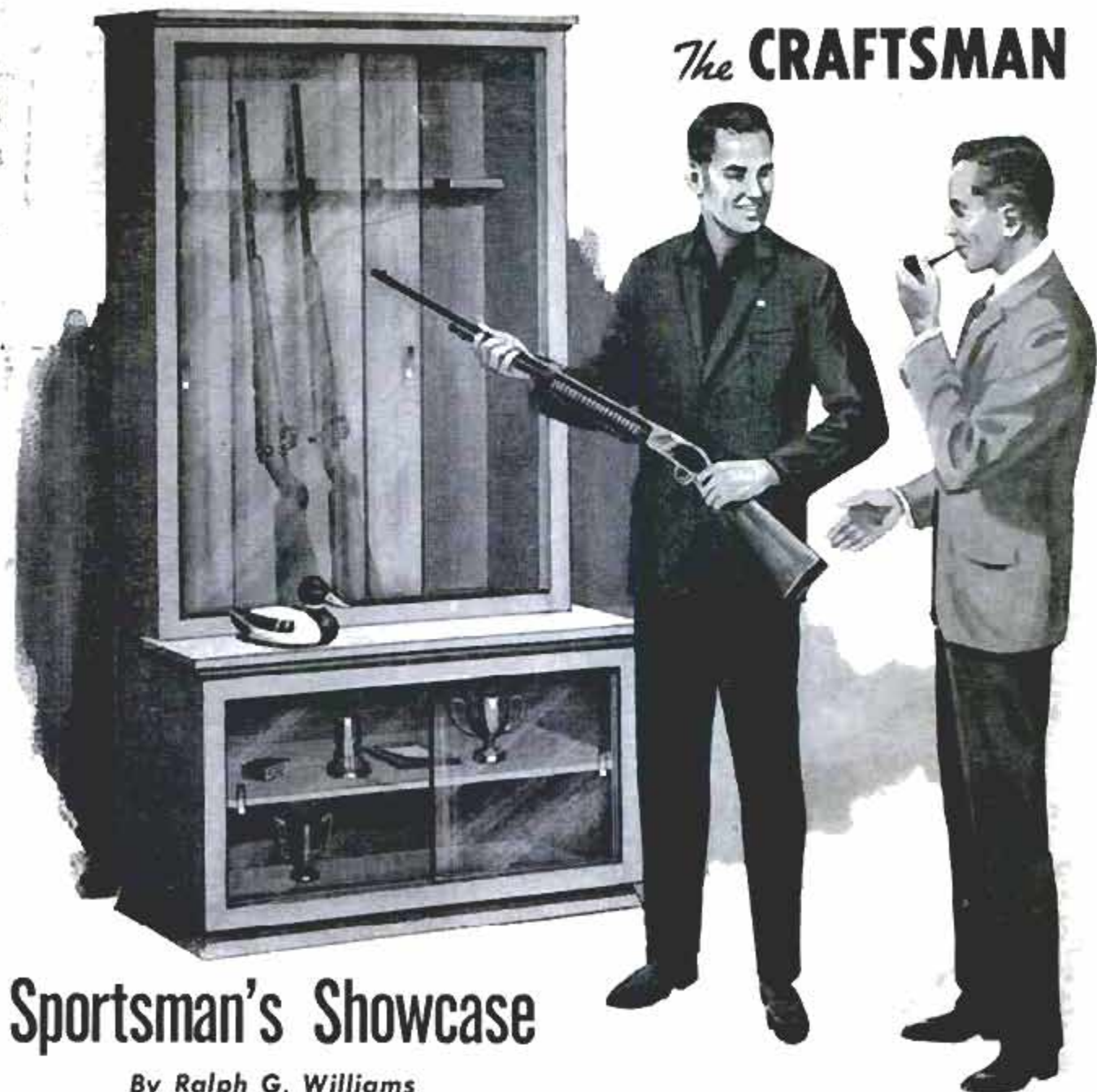
C



Four-blade propellers provide more blade area in limited diameter to improve thrust, maneuverability, starting and stopping. Designed for use on motors of 15 hp. and larger, they are ideal for large cruisers and houseboats

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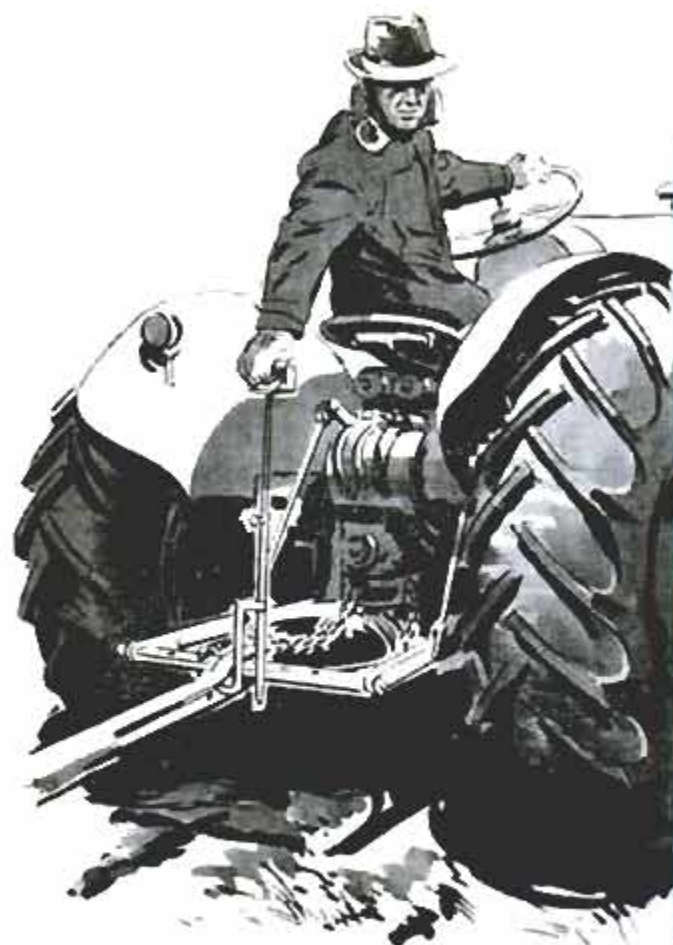


Sportsman's Showcase

By Ralph G. Williams

EVERY SPORTSMAN needs a place to display his equipment and trophies, and this cabinet fills that function in an attractive and practical manner. The upper portion of the cabinet, with slight modifications, can be used for shotguns, rifles and bows and arrows. The lower shelf of the cabinet is ideal for cups and trophies. Sliding glass doors protect the equipment and trophies, yet permit them to be seen easily. If there are toddlers in the household, it is suggested that a metal-mesh cover be fitted over the doors of the lower shelf, to prevent children from being injured should they fall against the cabinet. The original cabinet was made of solid mahogany, separate planks being edge-finished and glued together to form sheets wide enough for the required panels. However, $\frac{3}{4}$ -in. hardwood-faced plywood would do as well, especially as the design of the cabinet results in all exposed edges at the front

of the cabinet being covered with trim. After all the parts of the cabinet have been cut to the dimensions given, the two sides and the top are rabbeted to receive the back panel. This panel must be cut square and true, as the assembled cabinet is clamped and glued around it. Blind holes are drilled in the cabinet sides and the ends of the shelves to receive short lengths of dowels. When the cabinet is assembled, the dowels and shelves are glued in place with the other pieces. Each of the glass doors is $\frac{1}{2}$ in. wider than one-half the width of the opening into which it fits, and $\frac{7}{16}$ in. longer than the height of the opening (after the slides are in place). When the glass doors are ordered, have finger grooves ground in them as indicated. Each groove is located 4 in. below the center of each door, and 2 in. from the edge. The edges of the glass doors should be polished, so they slide easily in the grooves. ★ ★ ★



Tractor Hitch Pin Has Hook To Lift Towing Tongue



This hitch pin permits a tractor operator to couple and uncouple machinery without getting off the tractor seat. The tongue of the wagon or machine to be towed is lifted with the hook on the hitch pin, and the tractor backed into it, after which the tongue is locked to the tractor drawbar with a pin. As indicated in the detail, a telescoping handle allows the pin to be adjusted for tractors of various heights. A set-screw in the handle holds the adjustment. When the hitch pin is in continuous use, the handle may be removed. — A. M. Wettach, Mt. Pleasant, Iowa.

☐ Before painting over a knot in a wooden surface be sure to fill any cavities with wood putty, then apply sealer to prevent the resin in the knot from "bleeding" through the new coat of paint.

☐ Before nailing down boards on a porch floor, the underside of which is exposed to changing temperature and humidity, paint the boards so moisture will not enter and loosen paint on the upper surfaces.

Deburring Tool From Can-Opener

To quickly remove the burrs from the edges of sheet metal and plastic, use this simple tool. It is made by cutting or grinding a V-notch in the end of an opener of the type used on metal beverage containers. After the notch is formed, sharpen the edges with a file. To use the tool, simply draw it along the edges of the material as shown, pressing down firmly.

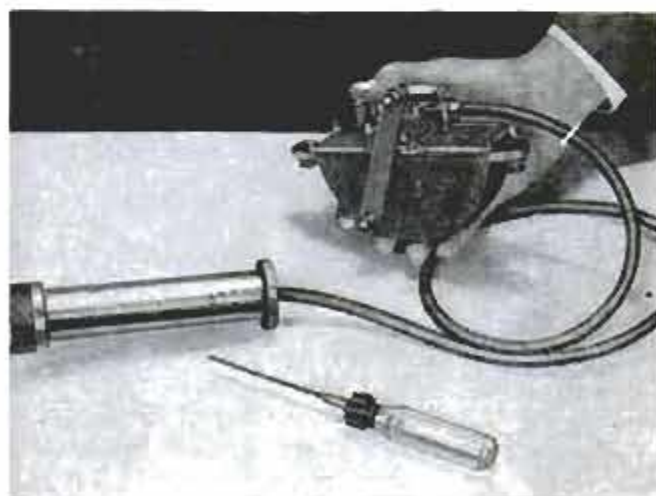
Frank A. Javor, Newark, N. J.



Vacuum Tests Wiper Motor

After repairing windshield-wiper motors of the vacuum-operated type, one mechanic tests them by using a household vacuum cleaner as a power source. Regular wiper-motor hose connects each motor to a length of tubing fitted in a wooden disk. During testing the disk is held against the end of the vacuum-cleaner hose by suction and requires no method of fastening.

R. Hanscom, Elmhurst, Ill.



Two-Height Table

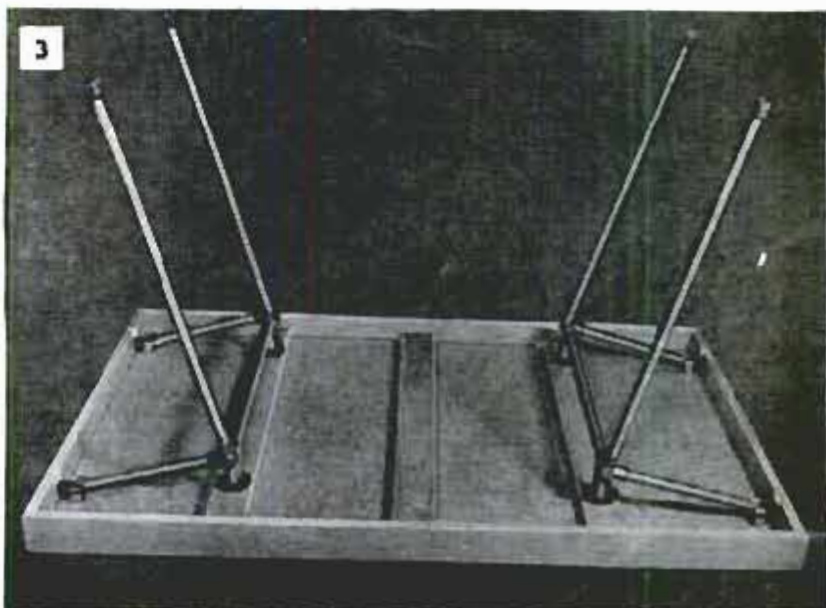
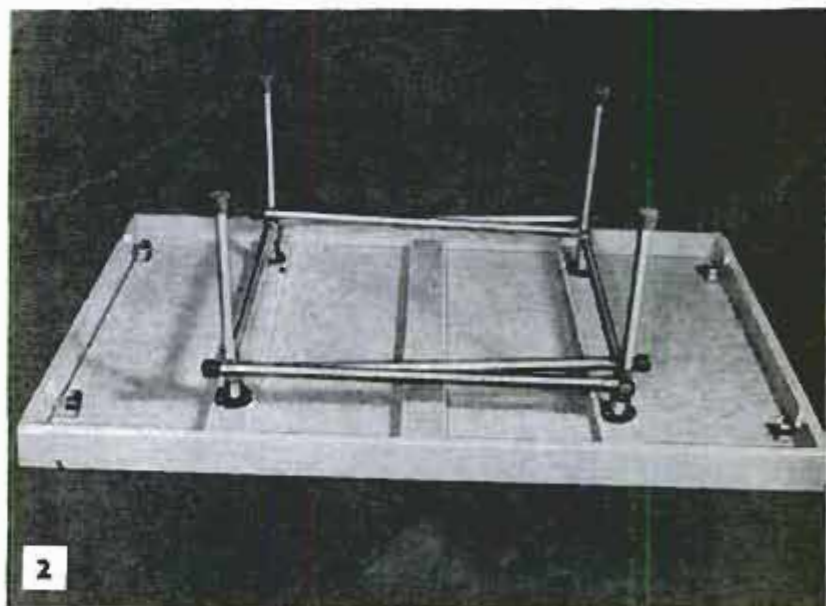
By Paul Corey

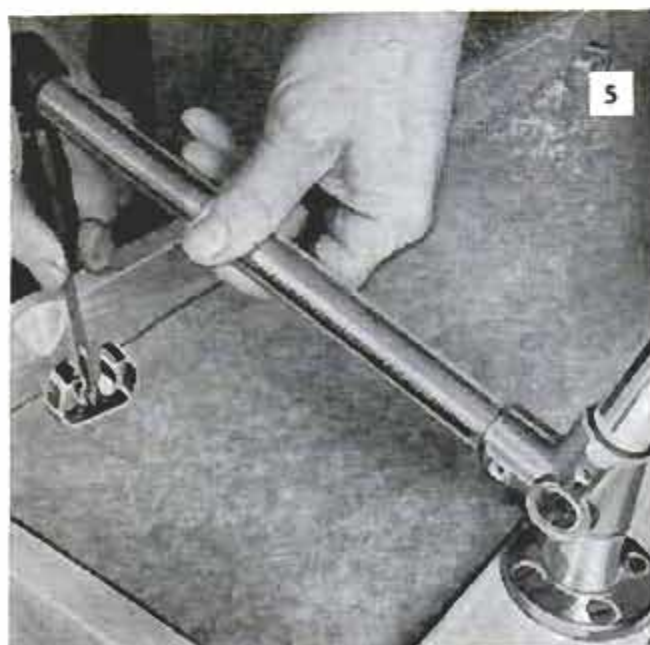
ESPECIALLY ideal for a small apartment where space is at a premium, this ingeniously designed two-height table is equally useful in a family room, on a patio, or any area utilized for both living and dining. Most of the time, as in Fig. 4, the unit is a coffee table, then at mealtimes it "steps up" to become a standard-height dining table, as in Fig. 1.

The "dual personality" is a result of two sets of pivoting legs. Each of the sets contains two L-shaped legs; one side of each set measures 11 in., the other 25 in. When the table is dining height, the short legs of the L-shapes are locked in broom clamps on the underside of the table as in Fig. 3 and Fig. 5. When the unit is coffee-table height, the longer legs are forced together, each set being slightly offset, as in Fig. 2. The latter arrangement will work for a table of the dimensions given in the details. Should a larger table be built, the longer legs also would require clamps to hold them in the "up" position.

Start by making the top of $\frac{3}{4}$ -in. material. Particle board or plywood is suggested, although strips of 1-in. stock could be glued together to form the surface. If the table is to be covered with a plastic veneer, the table apron can be butt-joined at the corners and the top butt-joined to it, as in Fig. 6, detail B. If the top is to be left natural, it is recommended that the corners be mitered and the top fitted in a rabbet as in detail A.

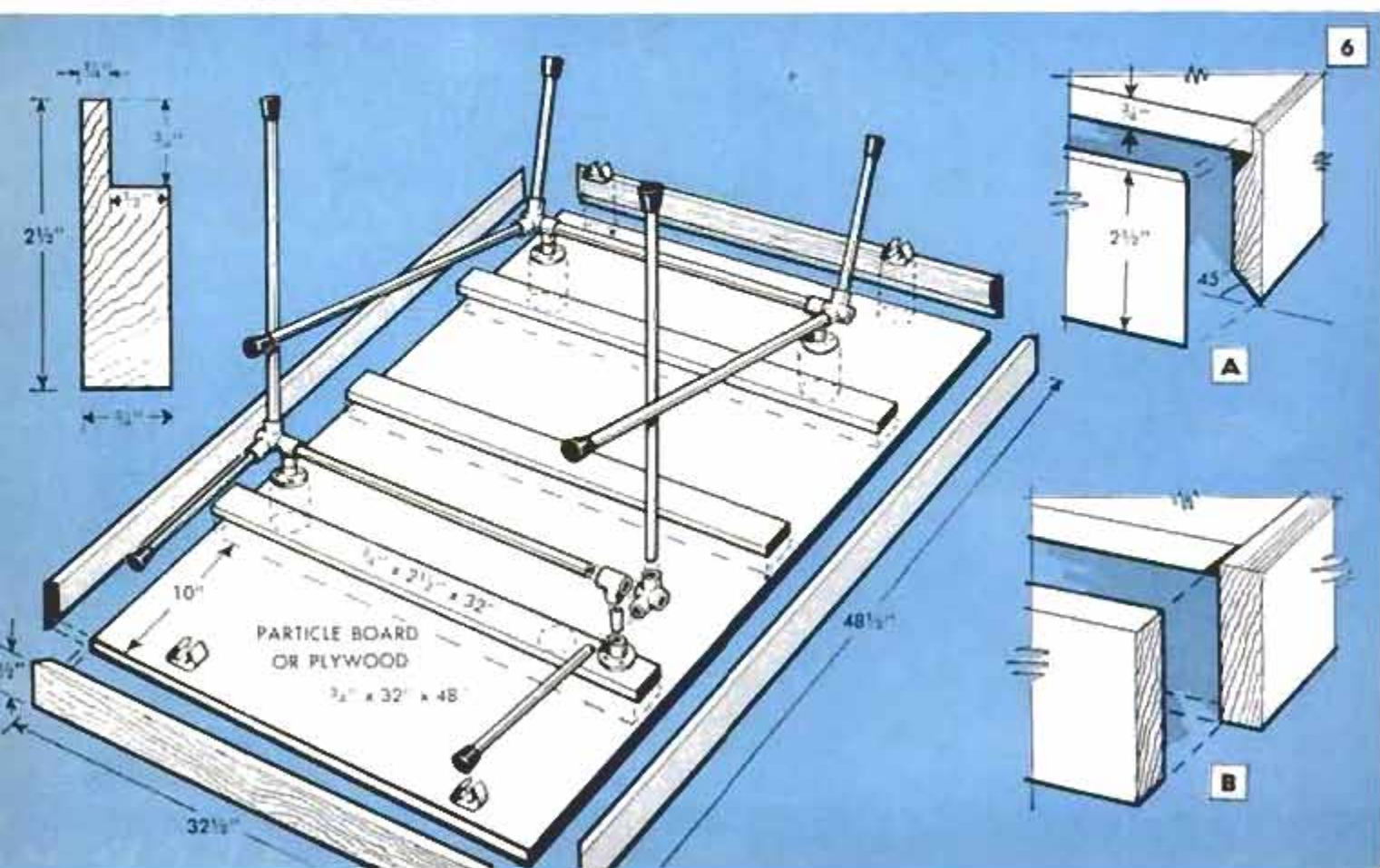
Legs for the table can be $\frac{3}{4}$ or 1-in. aluminum tubing, with fittings to match. Fittings for both sizes, called "Nu-Rail," are





available, while another type, called "Slip-On," fits only 1-in. tubing. Pipe and fittings also could be used, but some fittings would have to be reamed for a slip fit. Regular slip-type fittings are held on the tubing by means of setscrews. Eliminating these screws in the four T-fittings required permits the leg assemblies to pivot in the T-fittings. After the four flanges have been screwed to the cross pieces on the underside of the table top, a 2 $\frac{3}{8}$ -in. length of tubing is fitted in each one. A T-fitting then is slipped on the end of each length of tube. Into the tees are slipped two 24-in. lengths of tubing, one for each set of legs. A side-outlet tee then is clamped on each end of the two cross pieces. Into one side of each side-outlet tee is fitted an 11-in. length of tubing, while a 25-in. length is fitted in the other side of the tee, providing the two lengths of legs. On the end of each of the legs, fit a rubber crutch tip. Check the clearance of the legs in the folded position. It may be necessary, as in Fig. 5, to notch the apron, when the short legs are folded against the underside of the table. Four plugs, or caps, now are snapped into the open ends of the two tubing cross pieces to provide a finished appearance.

For extremely heavy-duty service, such as a 2-height workbench, $\frac{3}{4}$ or 1-in. pipe and fittings could be used. In this case it would be necessary to ream out two pipe tees for a slip fit for the cross pieces. Pipe caps could be used instead of crutch tips for the leg ends. ★ ★ ★



High-Lift Jack Handles Farm Jobs

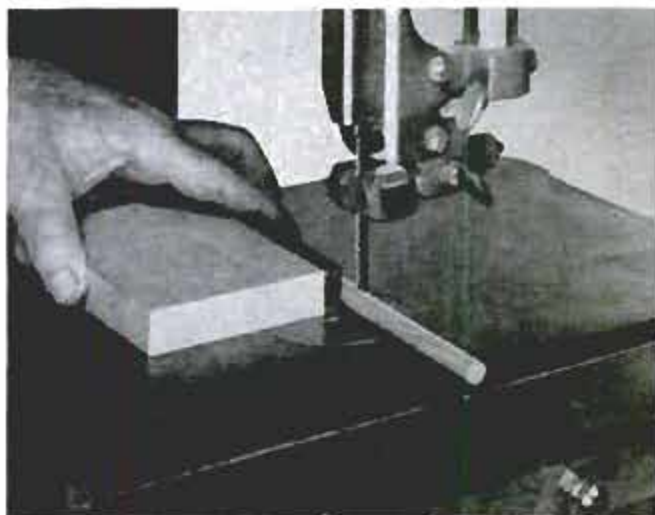
Greater utility from a mechanical jack is obtained by one farmer who mounted it on an A-frame welded together from lengths of 1½-in. steel pipe and pieces of 1½-in. steel angle. To prevent the pipe legs of the frame from sinking into soft ground, squares of steel plate are welded to the lower ends. The base of the jack is bolted to the lower angle-member of the frame, the upper end is bolted between two steel flats welded to the frame top crosspiece. On the frame, the jack is ideal for lifting bodies of dump wagons. — C. F. Marley, Nokomis, Ill.



Dowels Bandsawed Accurately With Rubber-Faced Guide

When cutting dowels on a bandsaw, you can prevent them from rolling, which binds the blade and results in an inaccurate cut, by using a "guide block." The latter is a block of wood of convenient size to which a strip of sponge rubber is cemented. In use, the dowel to be cut is gripped against the sponge-rubber strip and both block and dowel are pushed past the blade. The rubber acts as a nonslip facing, and the block itself serves as a guide for dowels up to 1 in. in diameter.

G. E. Hendrickson, Argyle, Wis.



Coating Inside of Metal Planters Prevents Corrosion

Metal containers that are used as planters will last much longer if they are protected on the inside with automobile undercoating or asphaltum paint. Even copper and brass containers should be protected in this way, as corrosion may be caused by chemicals in the soil.

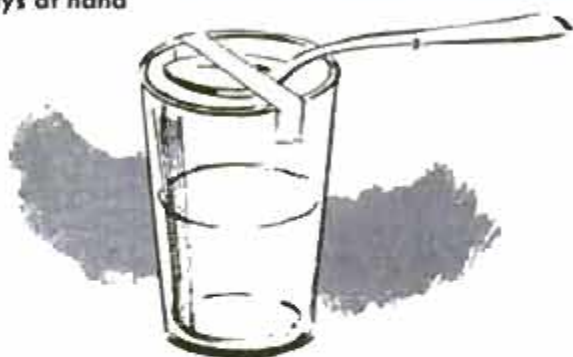
Smoke stains on brick fireplace can be removed by rubbing with a paste consisting of baking soda, 2 oz.; pumice stone, 1 oz.; and salt, 1 oz., mixed with just enough water to form a paste. After rubbing it on the bricks, allow it to stand a few minutes, then brush off.—Charles V. Mathis, Wildwood-by-the-Sea, N. J.





WHAT TO DO with those pan lids, pie tins? Just buy an extra wire draining rack, drop it in a drawer or make space for it on a shelf and there you are, a filing system that keeps the lids and tins in order, always at hand

Solving



A STRIP OF TAPE across top of tumbler keeps medicine spoon off night stand or dresser. Adhesive on tape keeps spoon in place; it can't fall to floor



CAKE CANDLES won't tip at that critical moment if you insert each one in a chocolate cream before placing on cake. Later the creams serve as an extra treat

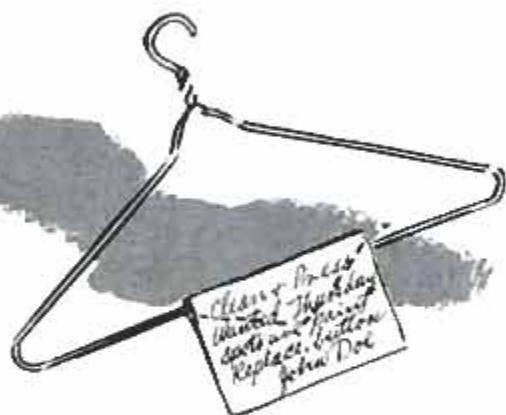
INVERTED ASHTRAY of colored glass makes an appropriate base for a figurine. Select tray of shape pictured. A drop of cement holds figure in place



THREADING A CURTAIN ROD through the hem can try your temper, unless, of course, you cut a finger from an old leather glove and slip it over end of rod



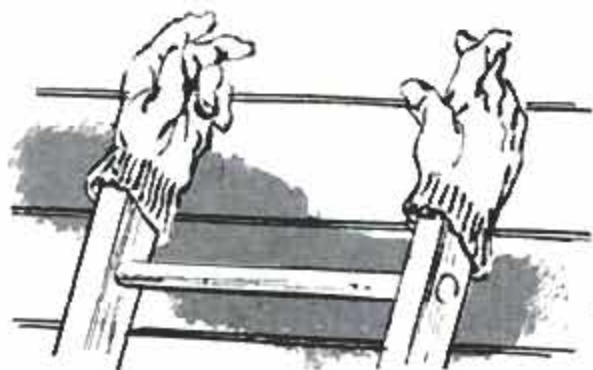
HOME PROBLEMS



YOUR LOCAL CLEANER will be glad to follow instructions to the letter if you write them on a plain envelope and seal envelope over crossbar of hanger

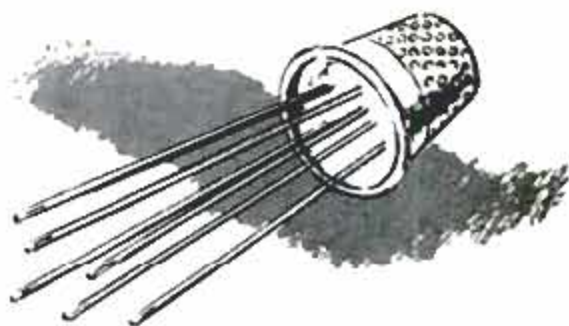
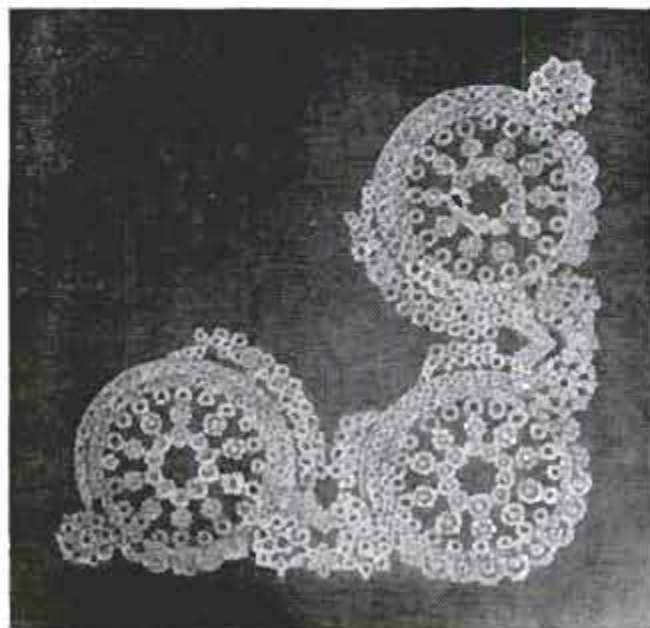


SCORE A WOODEN RULER with an awl, place ruler under magazine page you wish to clip and then utilize the groove to guide razor blade when making cut



COTTON GLOVES make good pads for the top ends of the ladder rails. They prevent scratches on paint or masonry when ladder is put up, moved, taken down

PAPER DOILIES in metallic gold or silver make attractive ornaments. As an example, clip to the shape pictured, cement at corners of kitchen-cabinet doors



THIMBLE FILLED WITH BEESWAX keeps those straying needles together. Otherwise you may find them on floor, in drapes or sofa cushions, no telling where

GLYCERIN will stickproof a glass stopper if you take time to rub a drop or two of it on the ground portion of the stopper before inserting in bottle



Rubber-Band Tension on Handle Keeps Boat Winch From Slipping



If there is a worksaving hand winch on your boat trailer, you may have noticed that the locking ratchet sometimes bounces loose when the trailer is pulled over rough back roads. If you want to keep the line from the winch drum to the boat tight, no matter what the condition of the roads, fit a couple of heavy rubber bands cut from an inner tube over the winch handle and down to some solid projection on the trailer frame. Tension on the handle from the rubber bands will keep the winch gear firmly against the ratchet, preventing it from jarring loose.

Lee H. Schrimpf, Tulsa, Okla.

Removing reflective tape and decalcomania from auto bodies will cause the least amount of damage to the finish if one corner of the decalcomania first is loosened with a razor blade. Cellulose tape then is pressed over the entire area. Finally, the tape is peeled back, pulling the decalcomania with it. Some spots may require a touch of the razor blade.

James M. Callan, Nipomo, Calif.



Storage Wall for Small Parts

Discarded elevator buckets, 104 of them, nailed to the workshop wall between the studs give this Michigan farmer plenty of storage space for nuts, bolts and small parts. Because the front edge of each bucket is lower than the back, the contents can be checked at a glance and, as most of the depth of each bucket is recessed in the wall, very little floor space is used.

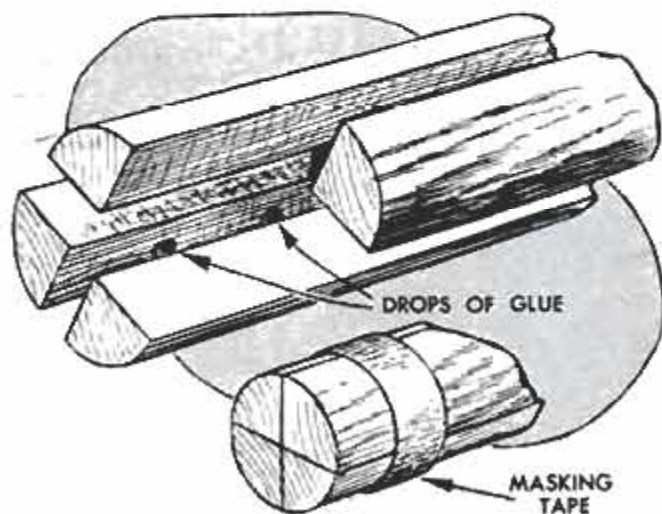
Donald K. O'Brien, Gahanna, Ohio.

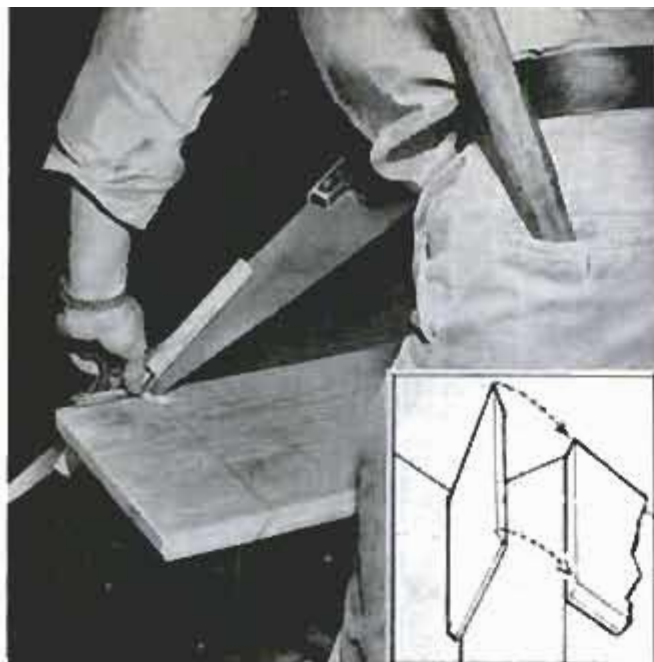
Preheating a vacuum bottle by pouring it full of hot water and allowing it to stand for several minutes will assure that the contents to be carried in the bottle will stay hot much longer.

Finishing Quarter-Round Molding

Sanding, staining and varnishing quarter-round molding before it is installed eliminates much of the time and trouble involved in doing these operations after the molding is in place. To further simplify the job, place a few spots of glue on four lengths of the molding and assemble them into a round with masking tape at 1-ft. intervals. After glue has set, remove tape, and sand. This trick prevents rounding the corners, as often happens. After staining and varnishing, pull the strips apart.

W. M. Judy, International Falls, Minn.





Square Aids in Cutting Accurate Miters With Handsaw

When you have to cut a miter on trim stock, such as ceiling cove around a soffit, and a power circular saw or a miter box is not available, try this handsaw stunt. First, hold a length of the trim stock in position and with a sharp pencil mark it, as in the right-hand photo. This line is the inside edge of the angle to be cut. Mark a 45-deg. angle on each edge of the stock, then join these marks with a line on the opposite side of the stock from the first line. Place the stock flat on two horses,

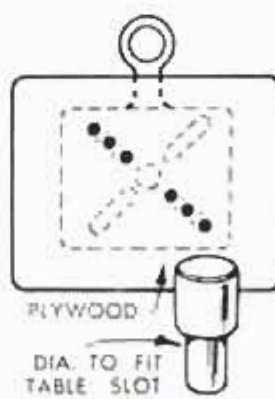
hold the square on the 45-deg. angle as shown in the left-hand photo and start the cut. Keep the square against the saw blade as long as possible to assure the accuracy of the angle. When the cut is about half through the stock, the square can be shifted to the opposite side of the work and used in the same manner. One big help for this job, and it is not a secret, is that the saw should be sharp. Even an expert craftsman cannot do an accurate job with a dull blade.

Western Pine Association.

Auxiliary Drill-Press Table Fitted With Stop Pins

This plywood auxiliary table for a drill press not only increases the working area, but is fitted with stop pins that prevent the work from rotating. The table is a piece of $\frac{1}{2}$ or $\frac{3}{4}$ -in. plywood cut to a convenient size. The one shown is 14 x 16 in. and has six $\frac{1}{2}$ -in. holes drilled in it over the area of the slots in the original table. Two $\frac{3}{4}$ -in. wooden or metal dowels are shouldered to $\frac{1}{2}$ -in. at one end so they fit into the holes in the wooden table. They project about $\frac{1}{2}$ in. below the table and into the slots in the original table, to hold the plywood in place.

Floor joists were kept straight during construction by one man with the aid of a length of flooring marked off for the proper spacing. After one end of each joist was nailed, the strip was moved to the center of the span for easy installation of the bridging, then to the opposite ends.





Reprinted SERVICE FILE Postlet 7-20
"Jack-in-the-Box" Trailer Becomes

YOUR VACATION HOME

in a matter of minutes. "Umbrella" top tucked inside unfolds quickly to provide shelter and sleeping for four. Tows safely at high speeds and sets up in 20 min.

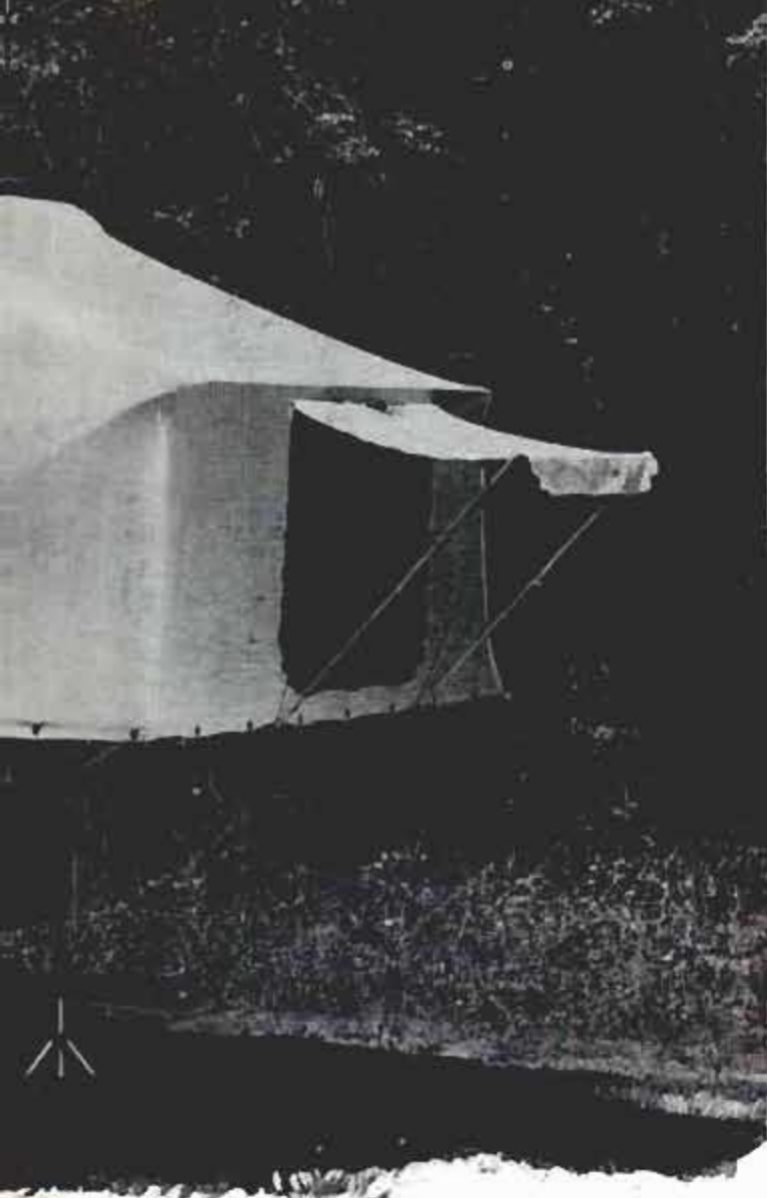
PART I

ROUGHING IT in the backwoods is almost like being at home when you hitch this box on wheels to your car. For, aside from lacking the conveniences of modern plumbing, it contains all the other comforts of home to make vacation camping a real family treat.

The Clifford De Leeuw family of Grand Rapids, Mich., builder of this unique camping trailer, found it so in exploring the primitive regions of northern Michigan. Free of the worry of finding a motel for the night, they found they could park in

undeveloped areas at no charge and be snug and as comfortable as bugs in a rug. Two full-size beds (5 x 7 ft.) supported on lids that open like the covers on a box, provide comfortable sleeping for four outside the actual living area. If necessary, two more persons can be bedded down on air mattresses placed on the floor. Dining inside is done on a folding table, with the built-in cabinets along the sides being used as seats. Headroom at the center measures 8 ft. 4 in. and the door, 6 ft., to make crouching and ducking unnecessary

V 770



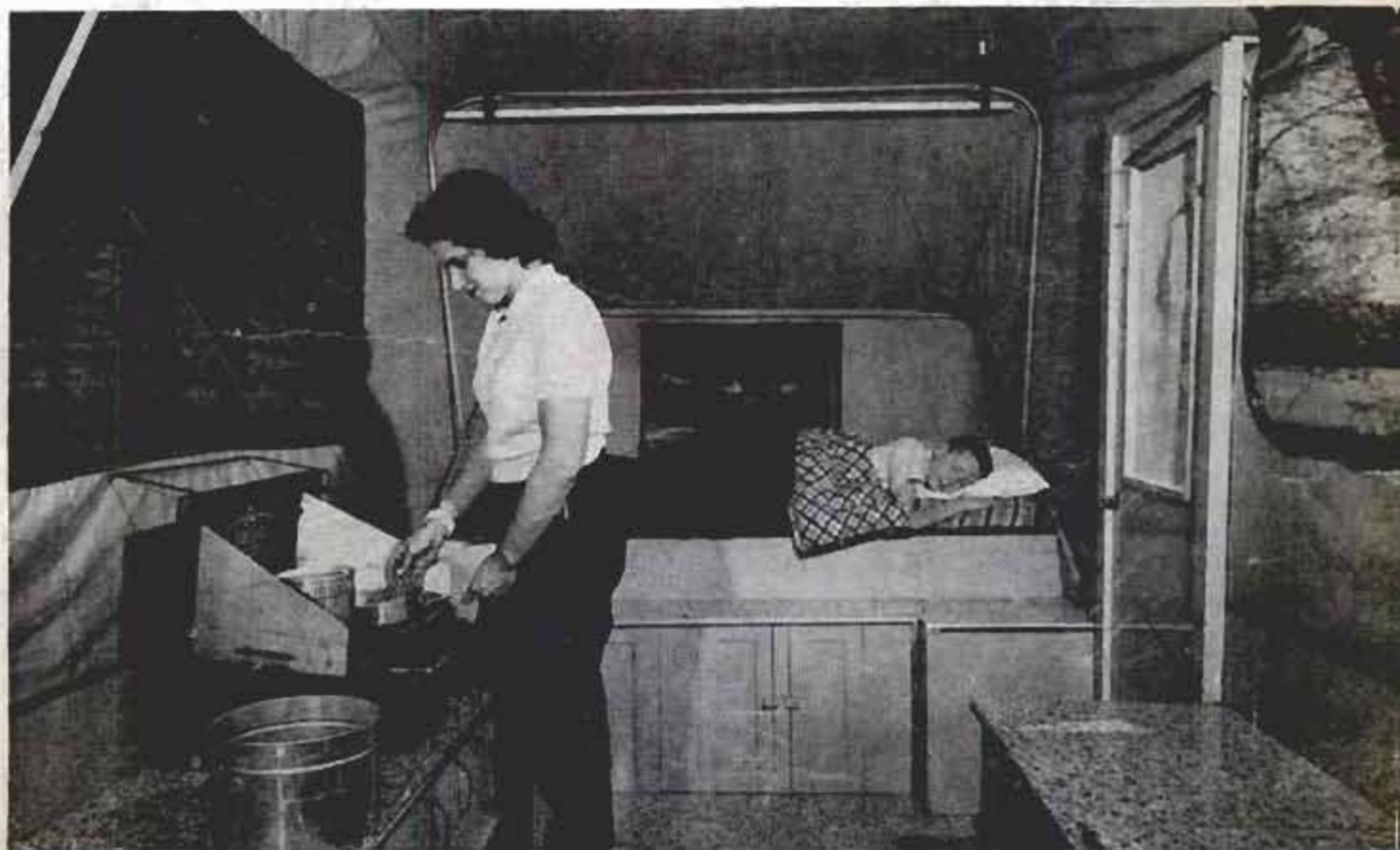
Compact as a nut in a shell, all the paraphernalia you need to camp in style and comfort is tucked away in a plywood box on wheels measuring only 7 x 10 ft.

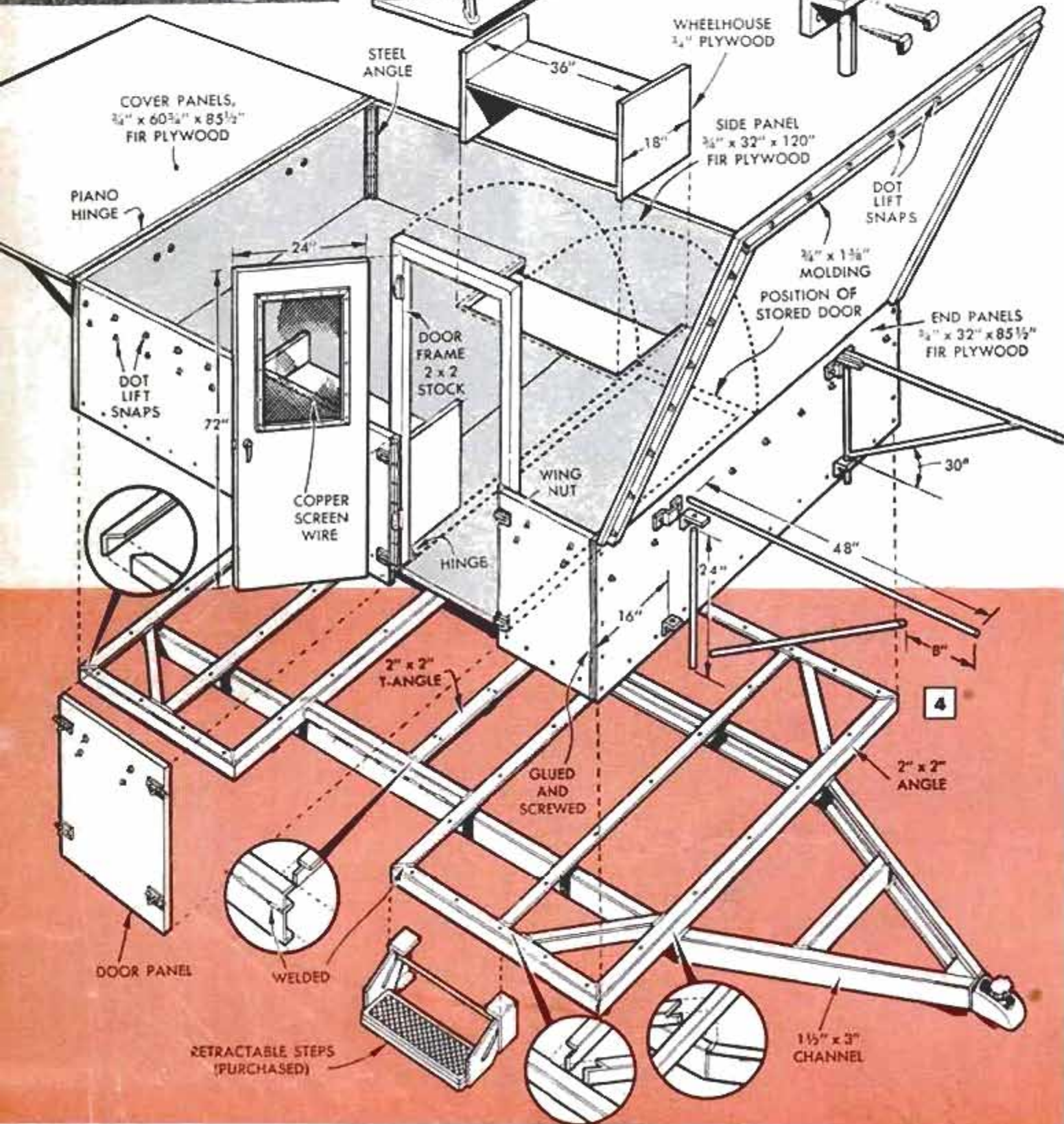
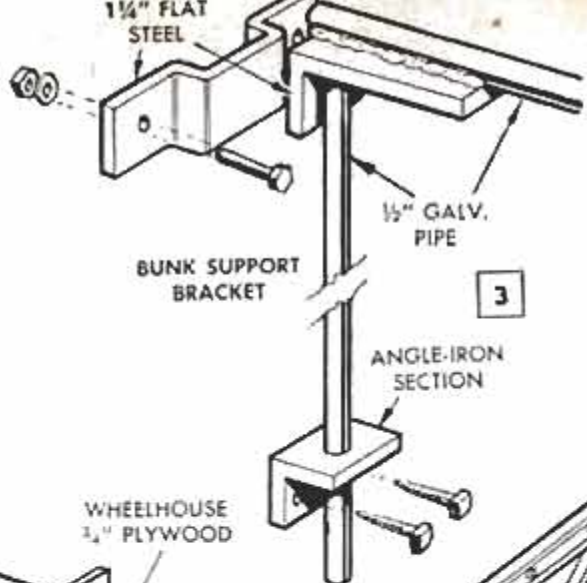
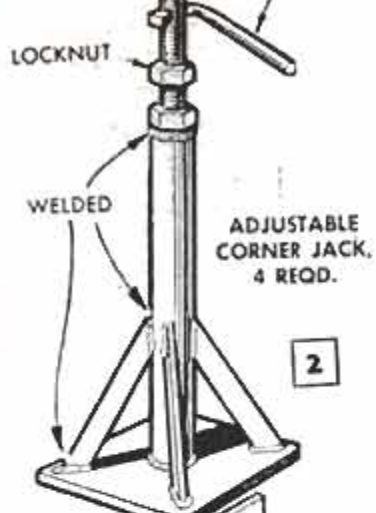


Photos by Joe Fletcher

Below, roominess and brightness of trailer interior stems from out-of-way bunks and windows on all four sides. Cabinet tops provide work surfaces, seats

Above, lids of box, when flung open and supported on removable pipe brackets, provide outboard bunks for two full-size mattresses which stow on trailer floor





in entering and standing inside.

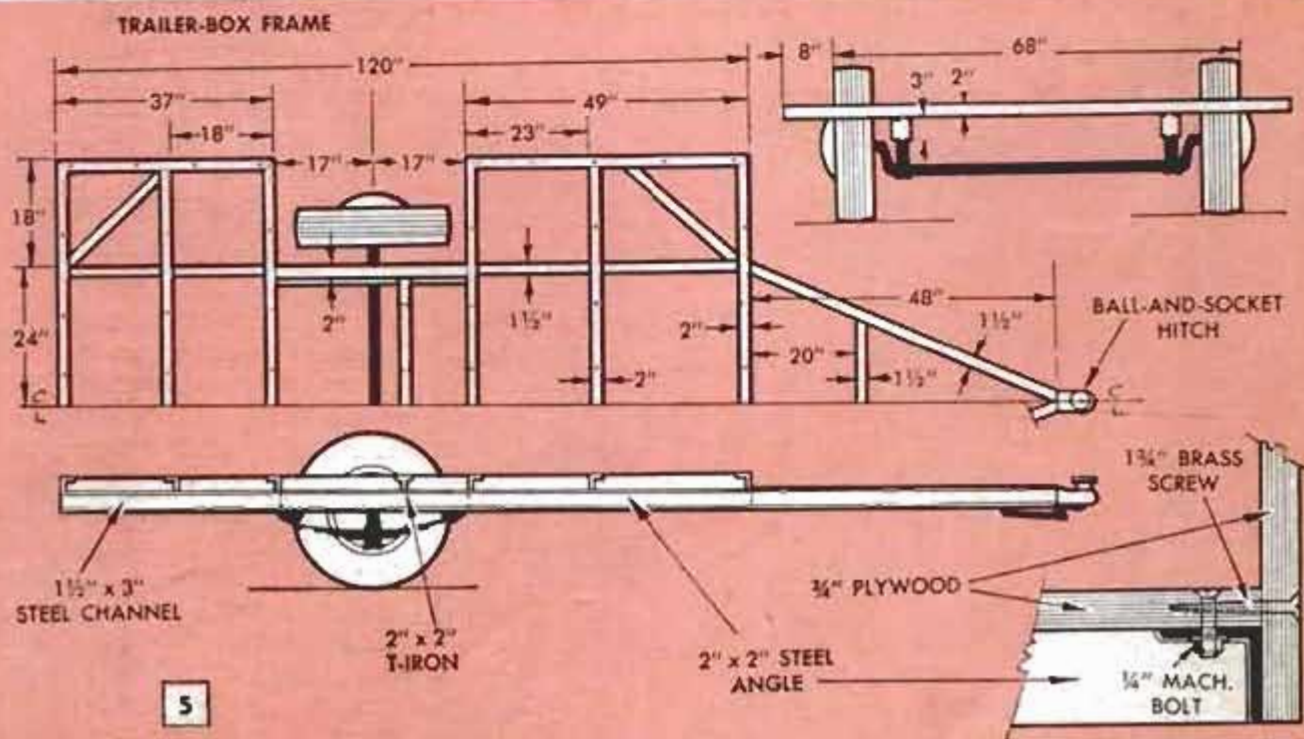
First study Figs. 4 and 5. The trailer is built on a commercial drop-type, front-axle assembly which you buy. Pick one that has wheels that match the size of those on your car so the spare tire can be used in an emergency. The bed on which the trailer body is built is welded together from lengths of steel angle and channel. This part, plus the tent top, you may have to have made for you. Outdoor fir plywood (marine grade) is used for the floor and body. The welded bed is floored first, cutting out the plywood over the wheel wells and fastening it to the bed with $\frac{1}{4}$ -in. machine bolts spaced 12 in. apart. The joint of the floor panels should center on the T-angle member of the bed. The sides and end panels of the body lap the floor and the bed, and the end panels lap the edges of the sides at the corners. Brass screws and waterproof glue are used to join the plywood, driving the ones around the bottom into the edges of the floor panels and spacing them 4 in. apart. Don't bother cutting the door opening until after the panels are in place. The four corners of the body are reinforced with steel angles placed on the inside. The swinging door is hinged to a frame which in turn is hinged to the floor so that both store flat as a unit on the trailer floor. Bolts passing through the frame and steel angles screwed to the edges of the door opening in the trailer body hold the frame upright. En route, the



Separate removable panel closes regular door opening in side of trailer body when en route. Notice retractable commercial trailer step below opening. Step can be box and stowed inside

door opening in the body is fitted with a separate panel which is held in place with four slide bolts. The bunk lids are hinged with piano hinges and are supported by removable pipe brackets, Fig. 3, that slip into fixtures permanently attached to the ends of the trailer body. The brackets store on top of the lids in wells created by strips of molding applied around three edges, $1\frac{1}{2}$ in. in. Dot lift-type snaps are later screwed to this molding for buttoning the canvas top. Adjustable leveling jacks, Figs. 1 and 2, are placed at the four corners of the trailer box to prevent rocking. The jacks are carried in the car to be available first hand.

(Continued next month)

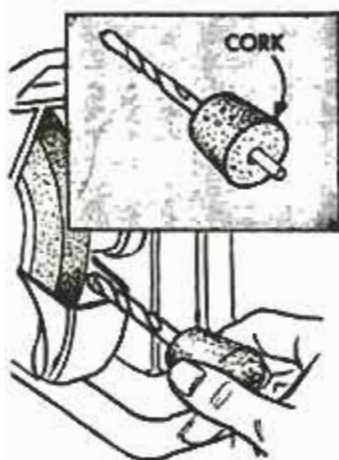


Sawhorse From Windmill Ladder

Handy as a stand for supporting long pieces of lumber that are to be sawed is this steel sawhorse formed by one farmer from a ladder section removed from a dismantled windmill. The legs are 26 in. long and have 2-in. feet bent on the ends to prevent them from sinking when placed on a soft dirt surface as shown in the drawing. If the stand is to accommodate heavy pieces, braces should be welded or bolted to the horizontal member and legs on each side.



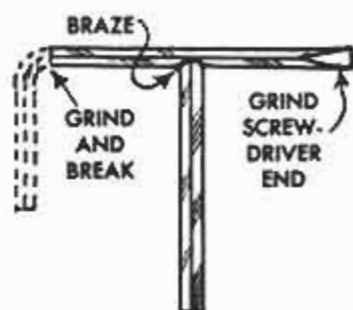
Cork "Handle" for Drill Bit



For a safe means of holding a small drill bit when sharpening it on an emery wheel, slip a bottle cork on the shank as in the detail. The cork serves as an insulated handle for a positive grip on the bit and saves the fingers from being burned.

Three-in-One T-Wrench

Two socket-head wrenches can be made into a combination T-wrench. First remove the short leg from two wrenches of the same size. Grind one end to a screwdriver point and



braze the two together as shown. You'll have a wrench that can be used as a socket-head wrench, tee-handle wrench and a screwdriver.—R. Thompson, Clinton, Iowa.



Sky Reproduced On Bedroom Wall

Now you can have imitation starlight in your bedroom nightly according to the Masonite Corp. Part of the evening sky is reproduced by perforated hardboard attached to one wall and painted black. Planets and stars are represented by phosphorescent-painted croquet balls, fishing sinkers and other objects that are pegged to the wall. BLB fluorescent lights flood the sky with black light to make the heavenly bodies appear startlingly realistic.

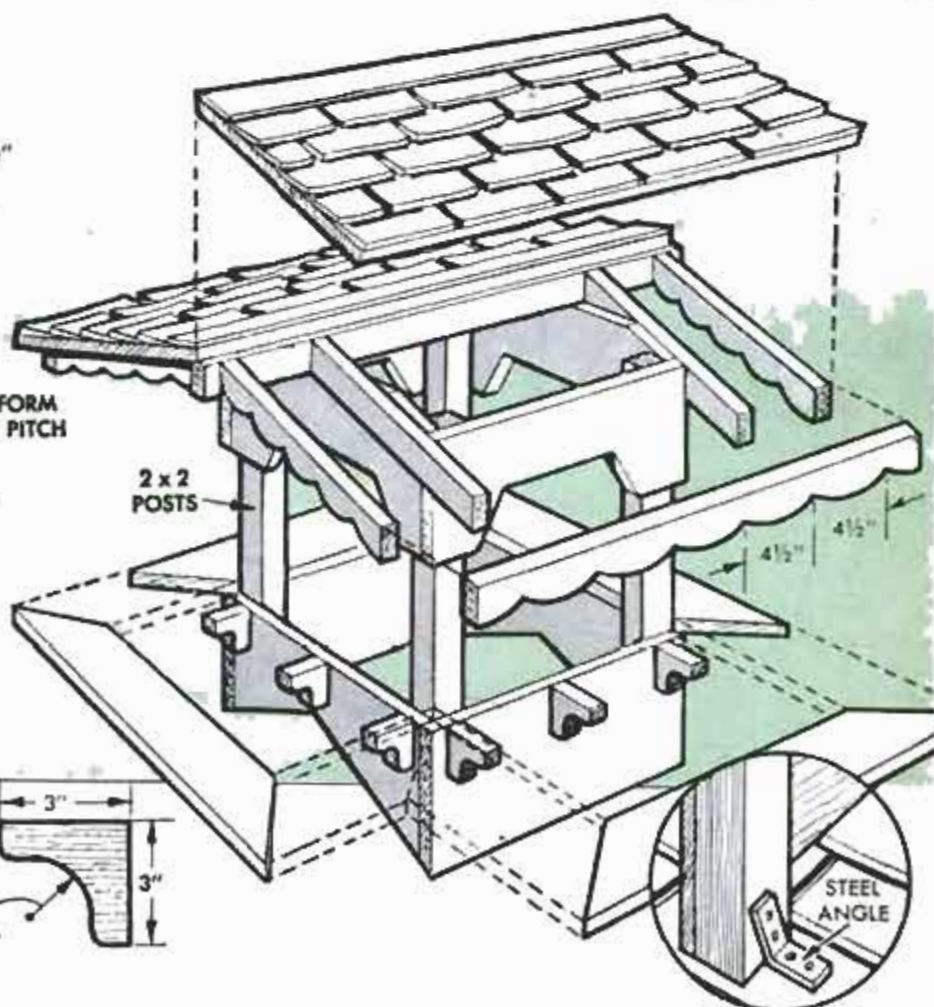
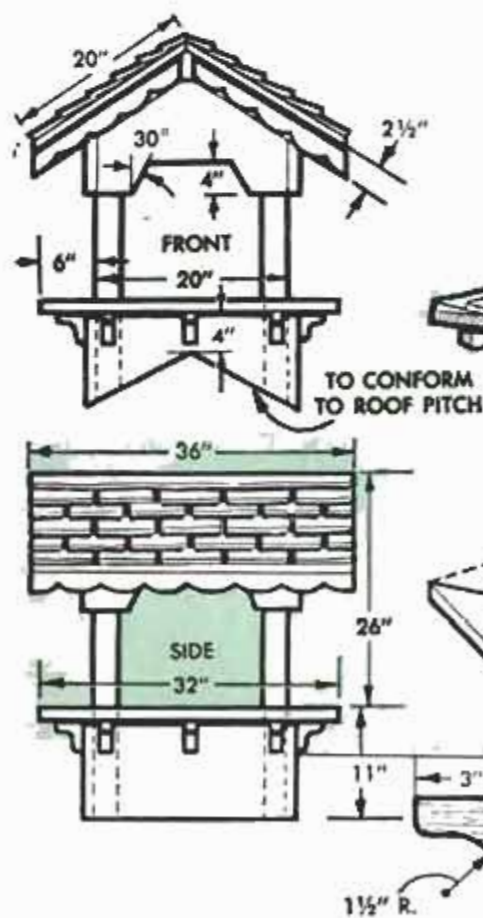
CUPOLA

With Bandstand Motif

By Hi Sibley

THIS PICTURESQUE CUPOLA, reminiscent of an old-time bandstand, will add interest to a dull roof line. The roof and decorative parts are built on four 2 x 2-in. supporting posts that are attached to the roof with angle brackets as detailed in the drawing. When screwing the brackets to a cedar-shingled roof, be sure to drill holes in the shingles to prevent splitting them, and bed the brackets in tar.

The entire project is made of stock lumber and painted to harmonize with the structure on which it is mounted. The cupola shown in the photo is all white, having shake shingles to match those on the building. The platform on the base has mitered corners that are secured on the upper side with corrugated fasteners and is supported on each side by three wooden knees. Note that the end members of the base are cut to the same angle as the roof.



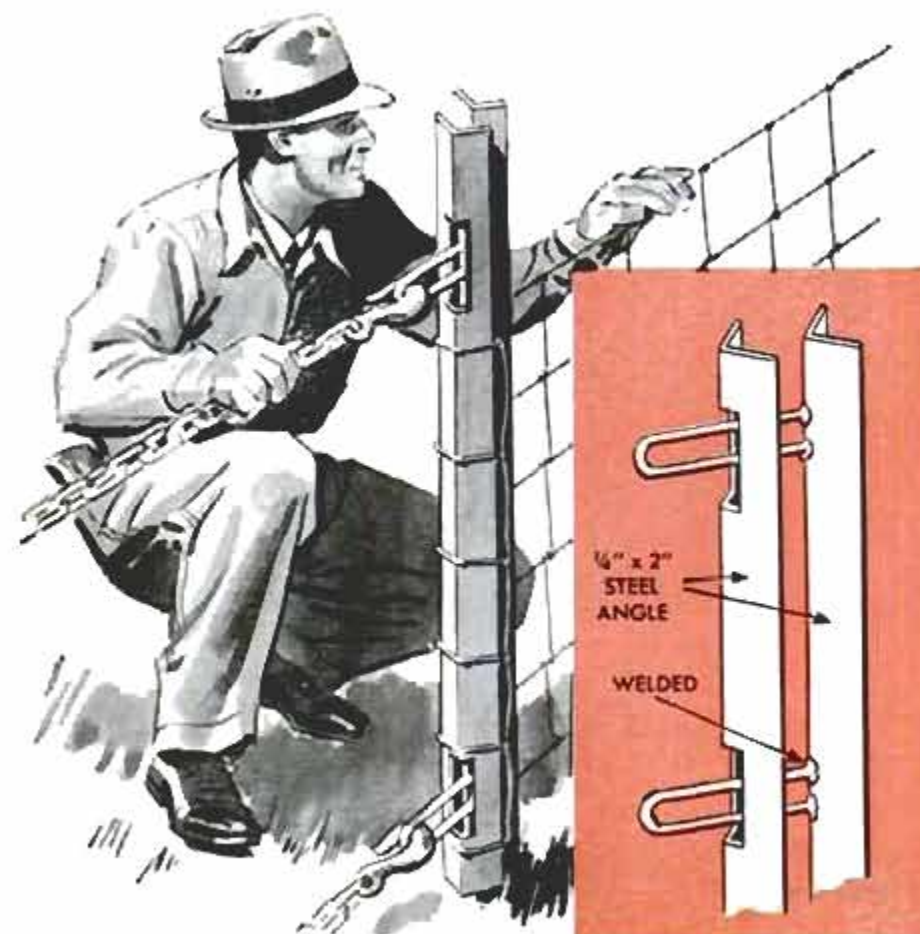


Jig for Spacing Fence Pickets

When erecting a picket fence having pickets arranged in a pattern of varying heights, you can do a better and faster job with a spacing jig like the one shown. It consists of a length of 1 x 3-in. pine in which holes are drilled to take $\frac{3}{8}$ -in. dowels spaced to coincide with the centers of the pickets in the pattern. After cutting the dowels to their required lengths, they are glued in the holes according to the pattern. In use, the jig is slid along the rail as each section is completed.—G. E. Hendrickson, Argyle, Wis.

To tighten a screw in an oversize hole, coat a short length of pipe cleaner with glue, insert it in the hole and clip it flush before driving the screw. The cleaner provides a good bite for the screw and the glue holds it fast when hardened. For a hole that is extremely enlarged, use several lengths of glue-coated pipe cleaners. M. Robert Beasley, Jackson, Mich.

Kerosene lanterns make rustic-appearing flower planters when the wick assembly is removed from each, and artificial or potted flowers or vines are placed in the oil well. Leave the globe in place. Enamel the lantern in a solid color and trim parts of it with silver or gold-colored paint as desired.—Charles V. Mathis, Wildwood-by-the-Sea, N. J.



Clamp for Stretching Woven-Wire Fencing

Easy to apply or remove, this clamp for use in stretching woven-wire fencing will pay for its cost in time saved. Just place the end of the fencing wire in the clamp, give it a half twist to bring the wire over the front member and then apply the stretcher. The pulling force of the stretcher and the pull resistance of the wire are applied in opposite directions, which causes the clamp to grip the wire. The clamp consists of two equal lengths of angle steel, one of which is slotted to slip over two U-shaped rods welded to the other length.—A. M. Wettach, Mt. Pleasant, Iowa.

Plastic Squeeze Bottles "Pump" Air and Liquid Soap

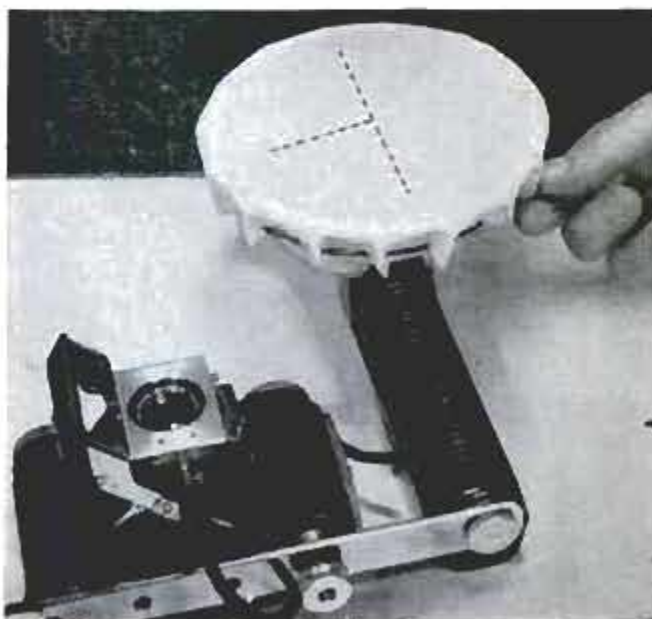


Here are two uses for plastic squeeze bottles designed as catchup dispensers: Left-hand photo shows squeeze bottle being used as a miniature bellows for cleaning dust from inside a camera. Photo at right shows bottle clamped to wall with sheet-metal strip and used as hand dispenser for liquid hand soap

Cover on Flash Reflector Reduces Light Intensity for Close-Up

This cover for a flash reflector is used in cases where photos must be taken at close range and it is necessary to reduce the intensity of light to prevent overexposure. The cover is cut from a paperlike translucent cloth (Miracloth) familiar to many housewives as a kitchen aid. One or more disks of the cloth are cut to a size about 2 in. larger in diameter than the flash reflector. Approximately $\frac{1}{4}$ in. in from the edge of each disk a series of holes is punched. Through the holes is threaded a length of light elastic or a rubber band that is pulled and tightened so it will fit snugly around the reflector. Although it was considered that the light intensity should be reduced by about one half, test exposures determine the correct light reduction for a particular situation. The number of thicknesses of the cloth, of course, determines the amount of light reduction. Cutting a T-shaped slit in the cover will permit changing flashbulbs without removing it.

R. Hanscom, Elmhurst, Ill.



To make an emergency repair in a leaking water pipe, slit a 2-in. section of garden hose lengthwise and fit it around the pipe. A hose clamp then is positioned directly over the leak and tightened as firmly as possible. Although this type of patch may hold for some time, it is recommended that the damaged section of pipe be replaced as soon as practicable.

MODELING THE FRENCH

CONCLUSION

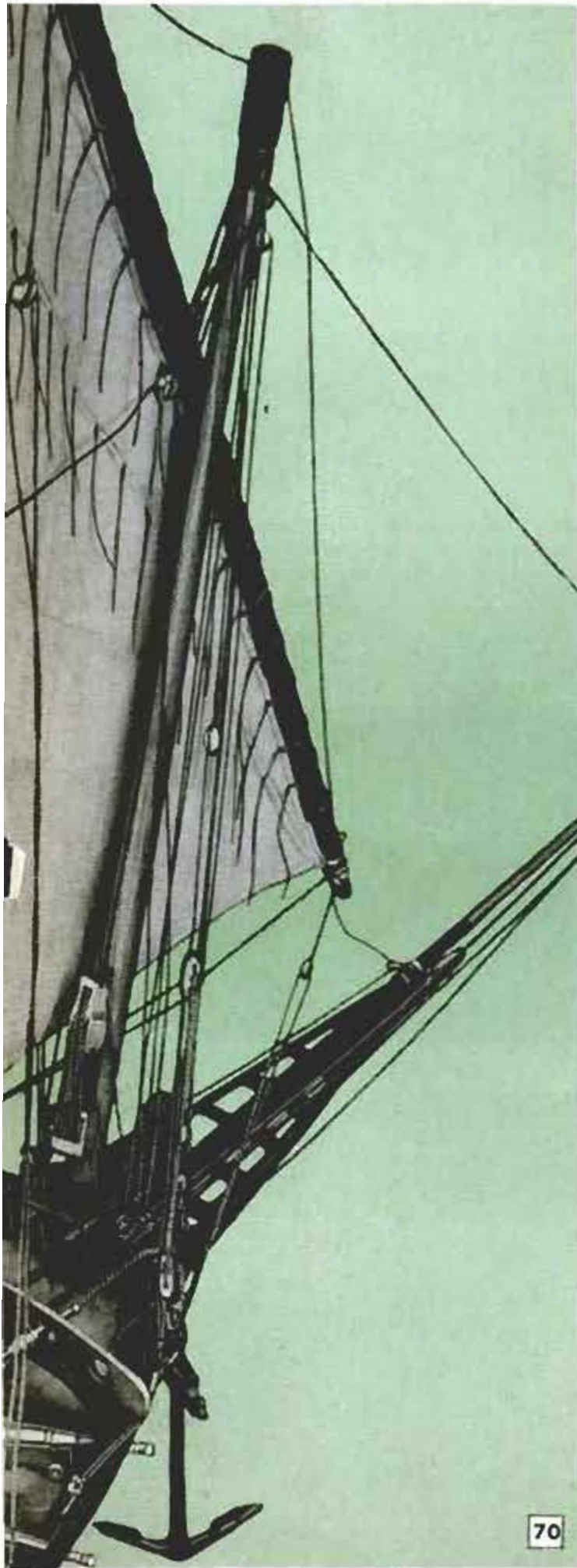
Running rigging and sail installation

THE SAILS are put aside temporarily until some of the running rigging has been installed. This is very similar at both the foremast and the mainmast, consisting of the following: (1) Tackle gear and runner ties to hold the yard. (2) One fore and one aft hoist to adjust the yard. (3) A truss line to the lower tip of the yard. (4) Two foresheets fastened to the lower tip of the yard. (5) Two aftsheets fastened to the lower clew of the leech edge of the sail. (6) Two brail lines on each side of the sail. (7) A flag-halyard line. (8) A yard stay on each side. (9) A parrel where the yard crosses the mast. The runner ties and the fore and aft hoists are installed first, then the rest of the rigging to the yard and sail. Finally the sail is hung and the remainder of the rigging completed. As mentioned in Part IV, all rigging lines are about .018 in. in diameter except where other sizes are specified.

Foremast Yard Tackle

Because of the limited work space between the masts and the shrouds, as is obvious from Fig. 70, you will find it simpler to assemble the tackle of the yard-runner ties and that of the yard hoists on an improvised jig, and then transfer the assembled tackle to the ship. The jig consists of a base block and a dummy mast. The runner-tie tackle of the foremast yard, shown in Fig. 71, consists of two multiple-sheave blocks that lie against the aftside of the mast. You will have to make these blocks. The lower one has six sheave holes in line, and a tiny cleat glued to its starboard side. The block is secured by a standing line that goes through the cross hole at its lower end. The line fastens to eyelets or staples at the base of the mast by means of tiny rings formed from 26 or 28-ga. wire.

The upper block of the tackle has two sheave holes near the top and four at its mid-point. There also is a cross hole at the top and another at the bottom. Fig. 72 shows the sizes of the blocks and also the method of threading the tackle line (.009-in.-dia.) through them. It starts at the lower end of the upper block where one end of the line is threaded through the lower cross hole, and is then glued or knotted to hold it in place. The line should be uniformly taut and the free end tied to a cleat glued to the starboard side of the lower block.



CHEBEC

The runner ties consist of a single line brought through the upper cross hole in the double block. The ends go up to the aft side of the masthead and are threaded through the lower sheave holes after which they are seized to the toggle.

Fore and Aft Yard Hoists

As also shown in Fig. 71, the tackle of the fore hoist of the yard consists of a double block (detailed in Fig. 65, Part IV), and a single block. One end of the tackle attaches to the strop of the single block, goes to the lower sheave of the double block, down to the sheave of the single block and up again to the upper sheave of the double block. Then the free end, or "fall" line, is tied under the lower block. The strop line of the block attaches to the crossrail at hole B, passing through the hole and being knotted under the crossrail. The line from the double block to the lower tip of the yard is threaded through the upper portside sheave hole from the aft side. The free end is left extending beyond this point for about 9 in., to be attached to an eyelet at the lower tip of the yard.

The aft hoist for the fore yard consists of two single blocks. The strop line of the lower one attaches to the crossrail at point C. The single line above the tackle goes up to the fore side of the masthead, then aft through the upper starboard sheave hole. It is left extending about 5 in. so it can be tied just above the lashing that holds the upper brail block. The runner ties and the two hoist lines can be held taut temporarily by means of a narrow strip of removable tape wrapped around the masthead.

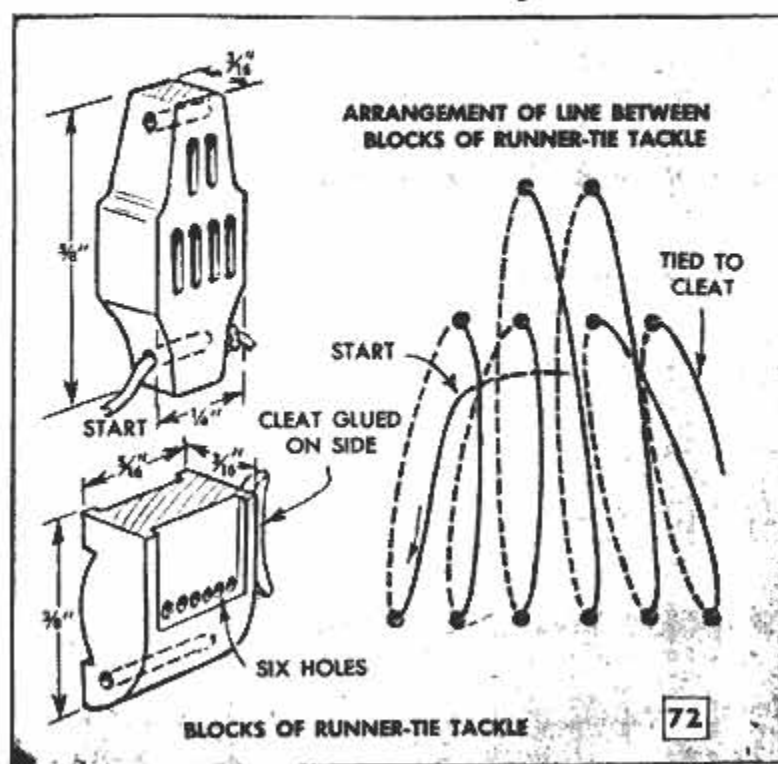
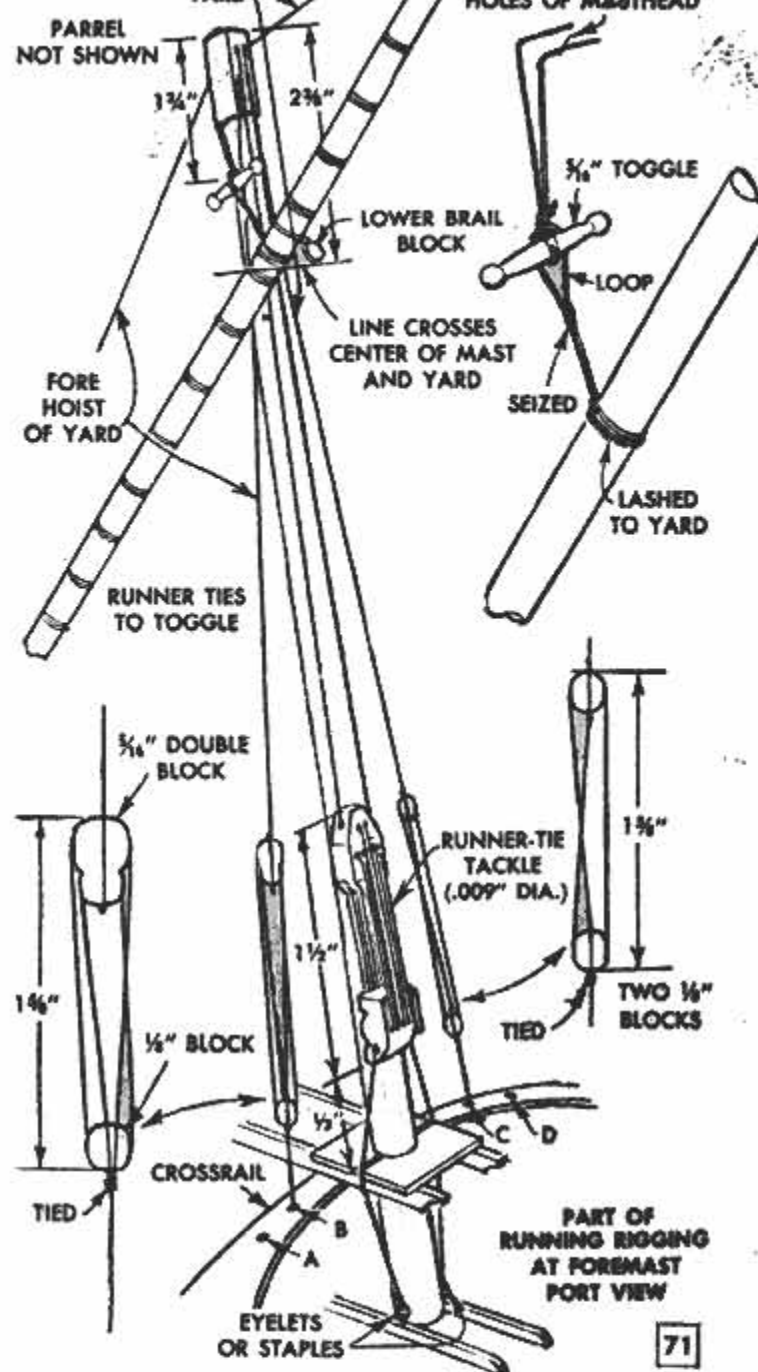
Rigging the Foresail

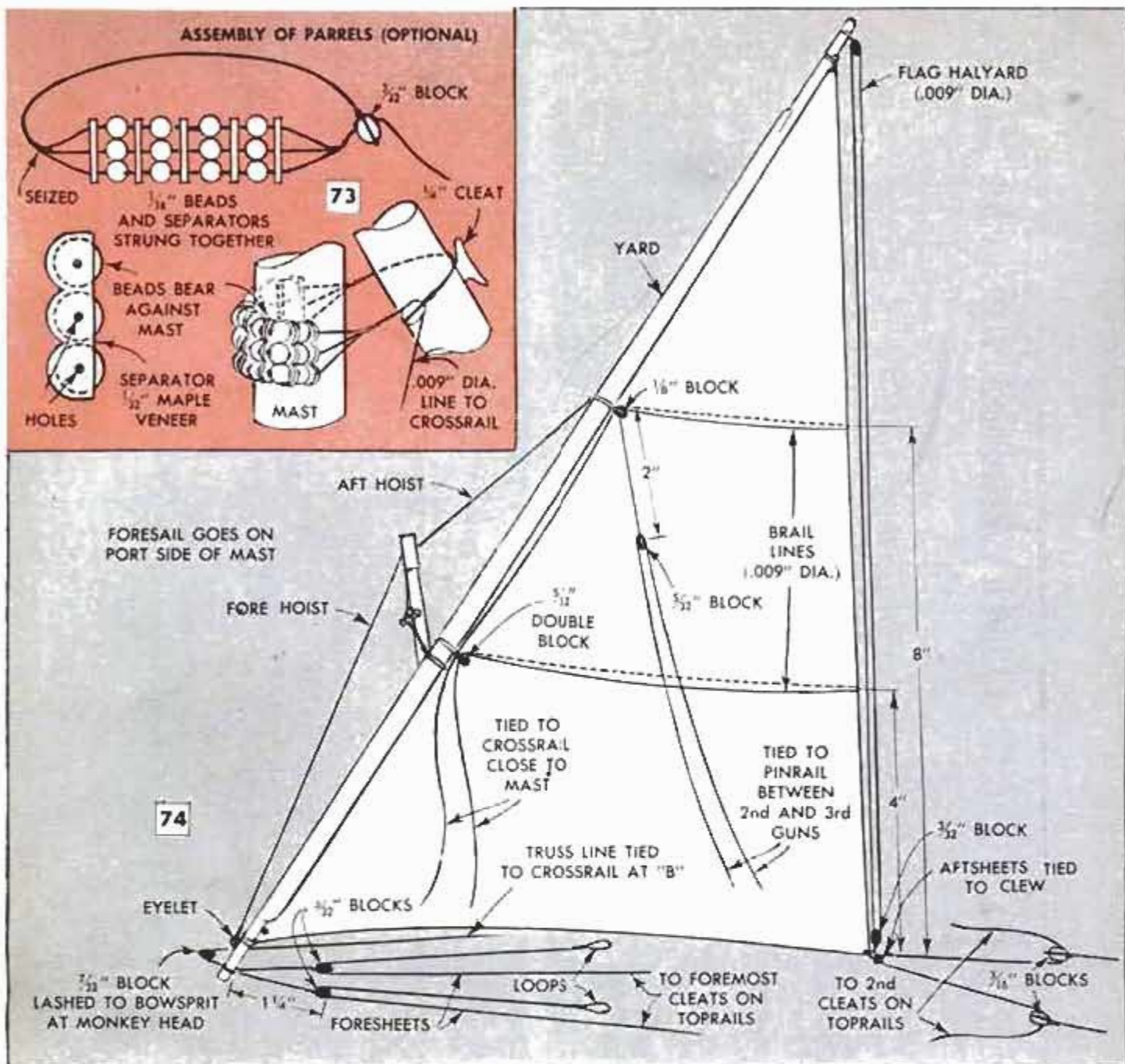
Now you prepare the foresail for mounting. Practically all the rest of the running rigging is attached to the sail and yard as in Fig. 74 before the yard is hung on the mast. This procedure is much easier than attaching the rigging after the sail has been hung. Start with the loop that slips over the toggle at the end of the runner ties, lashing this to the yard about $\frac{1}{4}$ in. below the double brail block.

Next, string the flag halyard. This is a continuous line (.009 in.) passing through the block at the yard tip and another at the lower clew of the sail. Then ends of the line are spliced together by fraying the strands and gluing. The line should be a bit slack.

Brail Lines and Yard Stays

The brail lines (.009 in.), which in the actual ship were used to gather the sail,





are attached next. A single line is used to form a pair of brails. The upper brail line is run around the leech edge of the sail and the ends brought through the upper brail blocks, then through the lower brail blocks which are double. Let the ends extend beyond the lower blocks far enough to be tied to the crossrail later, allowing for necessary slack. The doubled portion of the line is spot-glued at the leech, or aft, edge of the sail about 8 in. above the clew. Follow the same procedure for the lower brail lines, spot-gluing them to the leech edge of the sail about 4 in. above the clew.

The yard stays, one on each side, are attached at the lashing of the upper brail blocks. The line from the blocks of the yard stays must be long enough to attach to the pinrails at points about 3/8 in. apart at a location between the second and third guns. Some of the yard stays may be loosely

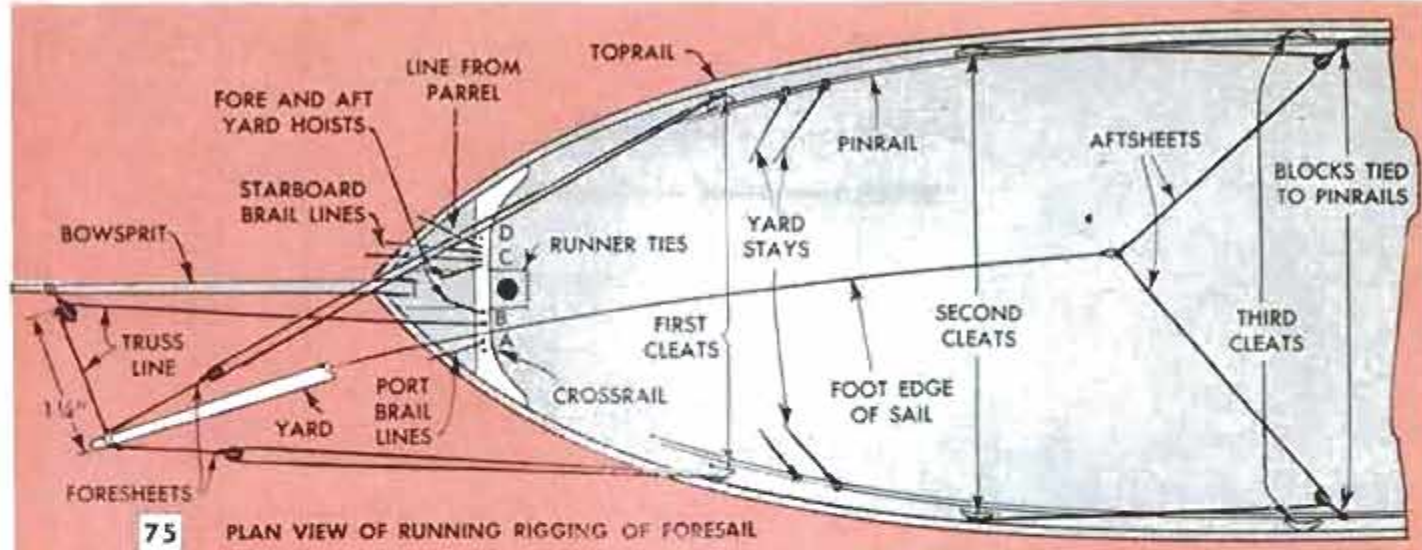
twisted together a few turns instead of letting the lines be separated.

Truss Line and Sheets

The truss line and the foresheets all attach to one lashing of three turns at the lower tip of the yard as shown in Fig. 74. The foresheets have loops at one end to hook over the first set of cleats on the top rail. The sheets are left extending long enough so that the free ends can be fastened to the same cleats. The aft sheets consist of a single line tied at its center to the sail clew. It must be long enough to pass through the blocks tied to the pinrails at points almost abreast of the mainmast, then forward to the second set of cleats.

Hanging Foresail

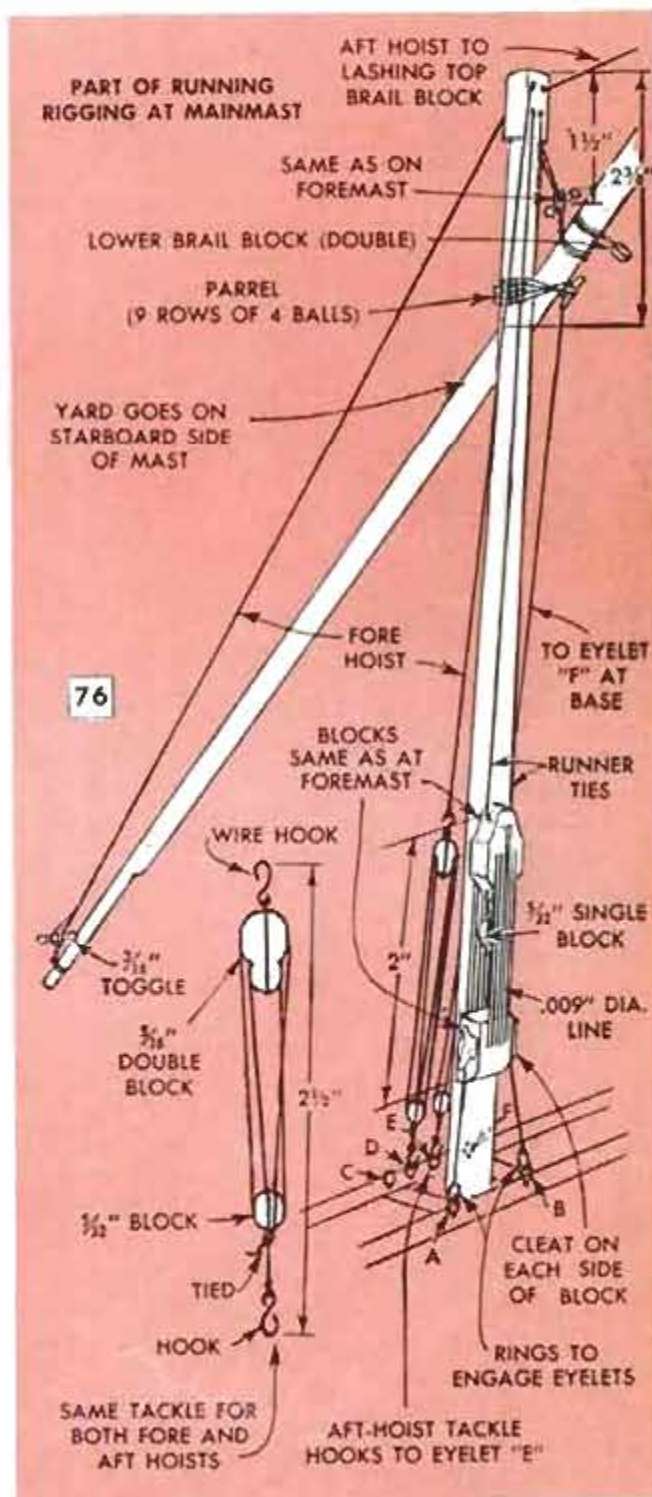
The foresail goes on the port side of the foremast. After removing the temporary

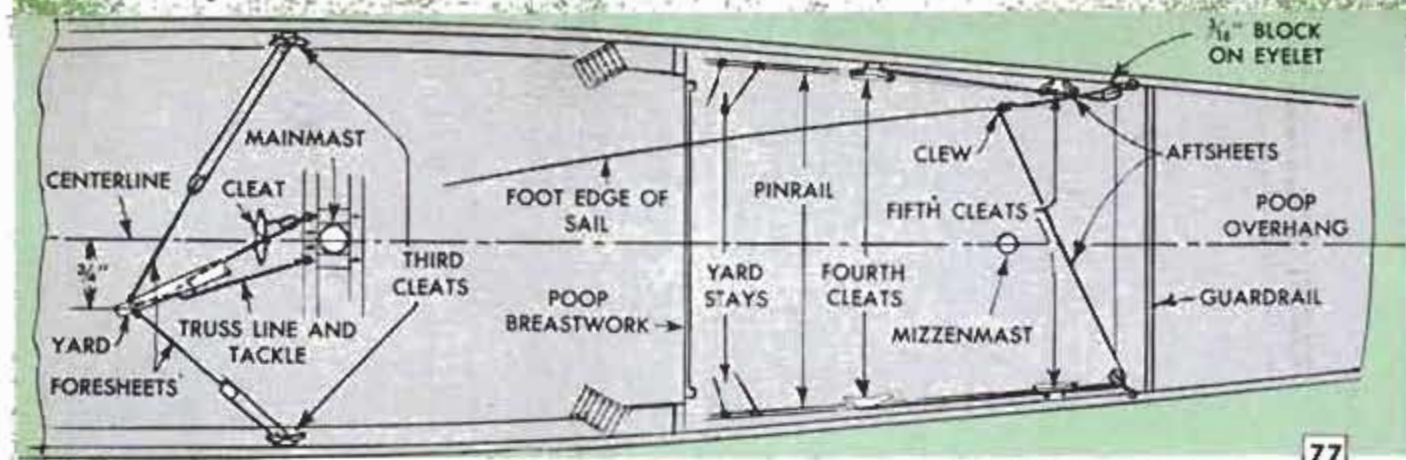


strip of tape from the masthead, place the sail between the shrouds and the running rigging already installed on the foremast. Bring the loop over the toggle and hold the yard in its approximate location. The center of the crossing point of the yard and mast comes $2\frac{3}{8}$ in. below the tip of the masthead as shown in Fig. 71. The lower tip of the yard should come just above the bowsprit. It also extends $1\frac{1}{4}$ in. on the port side of the truss block which is lashed to the bowsprit as shown in Fig. 75. The foresheet loops are hooked over the first set of cleats of the toprail, and the loose ends of the sheets are tied to these also.

Now is the time to install the foremast parrel if you want to add this authentic equipment. It consists of nine vertical rows of $\frac{1}{16}$ -in. beads, three per row, spaced with separators as shown in Fig. 73. The parrel goes directly on the mast so that no rigging lines come between it and the mast. The parrel is held up by a $\frac{1}{4}$ -in. cleat glued to the yard.

Next, the truss line is brought through the block lashed to the bowsprit, and the line is tied to the crossrail at point B, as shown in Fig. 75. Readjust all three lines (the two sheets and the truss line) to be moderately taut. The ends of the line are wrapped on the cleats in the form of a figure eight. Two turns are sufficient and a daub of glue will prevent the lines from loosening. Then fasten the ends of the fore and aft-yard hoists. The fore hoist goes to the eyelet at the lower tip of the mast and the aft hoist is looped around the yard just above the upper brail blocks. Both lines should be moderately taut. Pass the aft-sheets through the blocks attached to the pinrails and fasten the ends to the second set of cleats as shown in Fig. 75. All that now remains is tying the yard stays to the pinrails, moderately taut, and then tying the ends of the brail lines to the crossrail in pairs on corresponding sides of the mast.



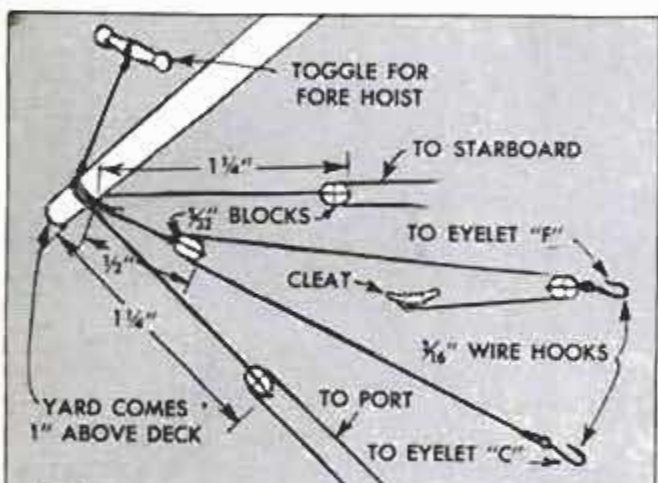


PLAN VIEW: PART OF RUNNING RIGGING OF MAINSAIL

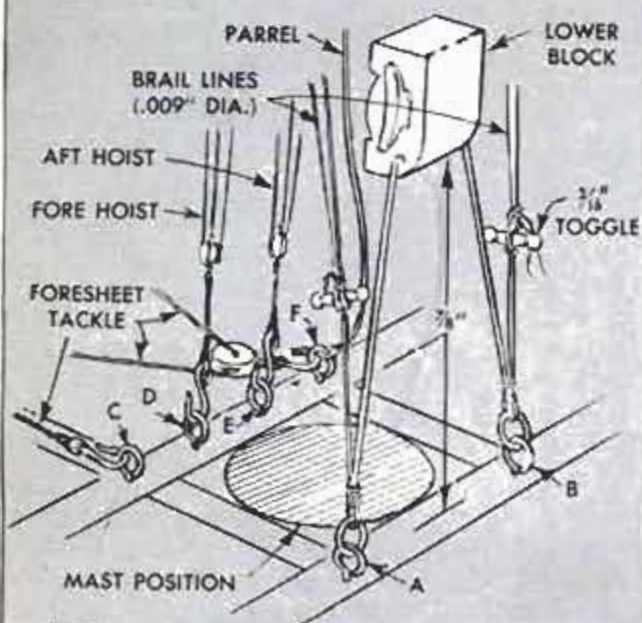
77

PORTFOLIO OF PLANS

Popular Mechanics offers the serious modelmaker plans for building four other famous French ship models, namely *La Sablaise*, a sailboat, *Jeanne D'Arc*, a training cruiser, *Marie Jeanne*, a fishing boat and *Le Terrible*, a light cruiser. For a free descriptive brochure on these plans and their prices, write to Popular Mechanics Co., Dept. 80, 200 E. Ontario, Chicago 11.



78 DETAILS OF MAINMAST FORESHEETS AND TRUSS-LINE TACKLE



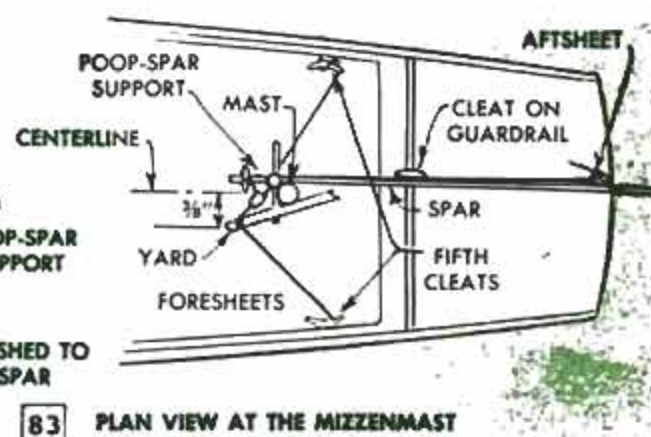
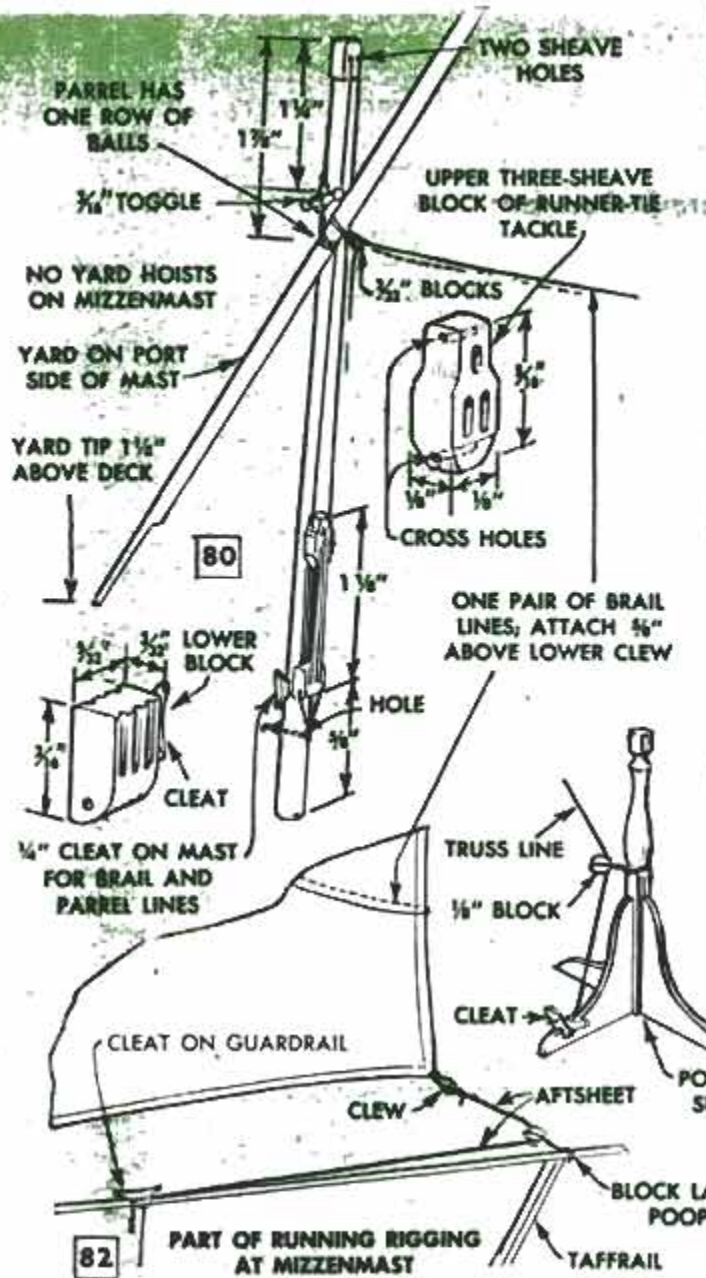
79 DETAILS AT BASE OF MAINMAST

Running Rigging of the Mainsail

To install the running rigging of the mainsail you follow the same general procedure as at the foresail. The runner ties and tackle come first and are detailed in Fig. 76. The tackle differs slightly from that of the foresail. The lower six-sheave block has a cleat on both sides. A single block hangs from the lower end of the upper block. Start the tackle (.009-in. line) on one of the cleats of the lower block, pass it through three sheaves of the blocks, through the single block, and then through the remaining three sheaves of the blocks, fastening the end to the second cleat. Follow the same procedure of assembling this tackle on a jig as before. The runner ties end at a toggle like those of the foremast. The ends of the standing line of the lower block are seized to tiny rings or hooks as at the foremast, which makes it easier to transfer the assembly to its permanent position on the ship. The rings or hooks are attached to eyelets A and B at the base of the mast. Fig. 79 shows a closeup view of the arrangement at the base of the mainmast. The tackle blocks of the fore and aft hoists of the yard are fitted with $\frac{3}{16}$ -in. hooks. The fore hoist attaches to a small toggle at the lower tip of the yard.

Again, you rig the sail before hanging it in position. Begin with the loop that engages the toggle of the runner ties and then put on the flag halyards. Fig. 78 shows how far the blocks of the foresheets and truss line are spaced from the lashing at the tip of the yard. The points of attachment of these lines are shown in Figs. 77, 78 and 79. The mainsail goes on the starboard side of the mast. The lower tip of the yard comes a trifle ahead of the leech edge of the foresail. The two pairs of brail lines (.009 in.) are spot-glued to the leech edge of the sail at points about $4\frac{1}{2}$ and 8 in. above the clew. The fall ends tie to toggles.

The yard stays are attached at the same points on the yard as they are at the fore-



sail, and the distances from the yard to the blocks of the stays are the same. Fig. 77 shows where the stays attach to the pinrails of the poop deck. The lines straddle the foremost guns on this deck and are tied about $\frac{1}{2}$ in. apart. Fig. 77 also shows the fastening points of the aftsheets. They pass through blocks held by eyelets that are driven into the toprails just ahead of the poop overhang and the guardrail, then are brought forward and are tied to the fourth set of cleats. On the poop deck the cleats are glued to pairs of adjacent timberheads just below the toprails. The cleats are larger than those along the rail of the main deck. The parrel for the mainmast has nine rows of beads, four in each row.

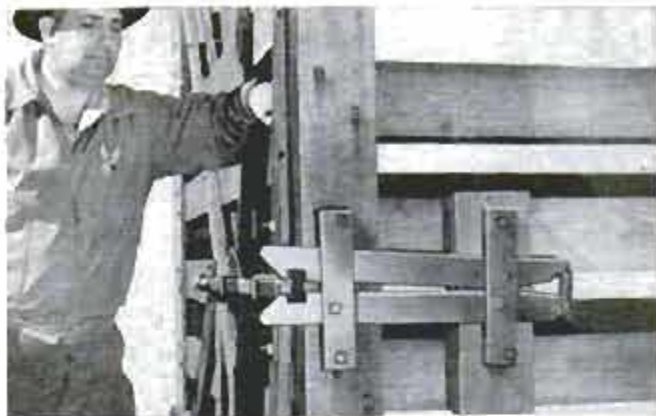
As you can see from Figs. 80 and 81, the mizzenmast has no yard hoists or yard stays. The runner-tie tackle is simpler also, consisting of two 3-sheave blocks. The standing line from the lower block goes through a hole drilled through the mast, and is knotted on the fore side. One end of

the tackle is glued or knotted at the lower cross hole of the upper block. Then it passes through the three holes of both blocks and the end of the line attaches to a cleat on the side of the lower block.

Spot-Glue the Brail Lines

The mizzen sail goes on the port side of the mast. It has only one pair of brail lines which are spot-glued to the leech edge of the sail about $\frac{3}{4}$ in. above the lower clew. The fall ends tie to a cleat glued to the port side of the mast near the lower block. As shown in the plan view in Fig. 83, the foresheets are tied to the fifth set of cleats. The truss line passes through a block lashed to the poop-spar support, and then ties to the cleat on its forward foot as detailed. The single aftsheet passes through a block lashed to the poop spar just behind the taffrail and then ties to a cleat on the guardrail. If a parrel is added, it should consist of a single row of balls, and the parrel line is tied to the brail-line cleat. ★ ★ ★

Unique Cattleproof Gate Latch Locks With Barrel Bolt

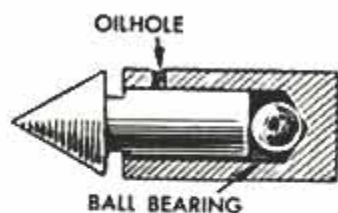


Combining the strength of a barrel-bolt lock with the operating ease of a spring-loaded latch, this cattleproof latch is installed on the gate of a stock pen. The bolt consists of a 4-ft. length of 1 x 1-in. steel bar, one end being turned to a slip fit for a compression coil spring. The bolt slides in three brackets welded from steel flat, and slips between the spring-loaded jaws of a latch mechanism fitted on the corner post and side fence. A square opening is cut in the jaws so they clamp firmly around the bolt. The jaws are pivoted at the rear bracket, so that a compression spring between the ends of the clamps keeps them together. In use, the bolt is pulled back against spring tension, to permit the gate to be opened. When the gate is to be closed, it simply is swung shut and the bolt end slips between the spring-loaded latch jaws and is held securely.

F. Leland Elam, Sacramento, Calif.

Improved Ball-Bearing Center Fits Drill Chuck or Tailstock

On some types of metal-lathe jobs a tail center that turns with the work is advantageous, especially if the operation is carried out at fairly high speeds. Such a center is made quickly by turning and blind-drilling a bronze sleeve to seat a steel ball and a rotating center, as in the detail. The sleeve can be turned to the same diameter throughout its



length for use in a drill chuck, as indicated, or machined to a taper to fit a tailstock quill.

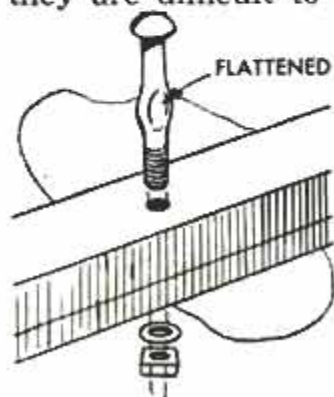
Steel-Ball Locator Removed From Machine Casting

Steel balls inserted in holes drilled in machine parts to serve as latches or locators usually are spring-loaded and are held in place by upsetting metal at the edge of the hole. When removal is necessary, one machinist drills a small hole in the casting, the drill bit centered about $\frac{1}{32}$ in. below the center line of the ball. After drilling through to the surface of the ball the latter usually can be removed with a pin punch.—Frank L. Rush, Columbus, Ohio.



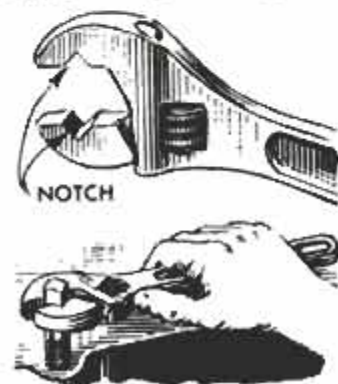
Flattened Shanks Hold Bolts

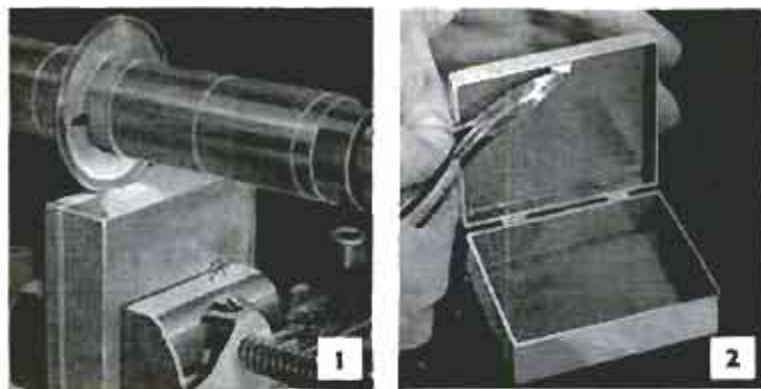
When the nuts on carriage bolts, used to assemble wooden parts, become rusted, they are difficult to remove, as the bolts simply rotate in the wood. To prevent this, one man flattened the shanks of the bolts, then drove them into the holes. When the nuts are turned the distorted shanks bind in the holes and do not turn.



Wrench for Worn-Shanked Taps

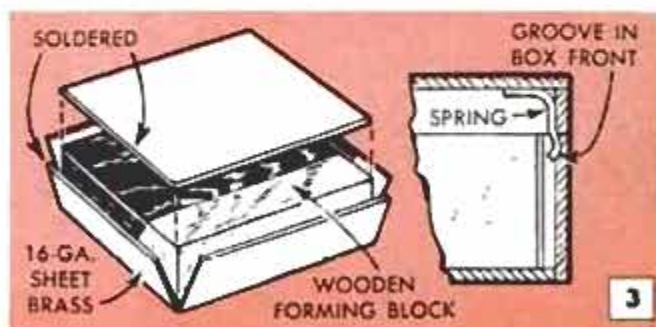
If you have some taps, the square shanks of which have become worn and rounded so they cannot be gripped by a regular tap wrench, modify an adjustable wrench for the job. Grind right-angle notches in the two jaws so a square is formed when the jaws are clamped together.—Arthur B. Farwell, Detroit, Mich.





Ornamental Brass Box For Small Parts

An ornamental metal box for paper clips, jewelry, stamps, etc., is easy to make when a wooden block of the size and shape of the box desired is used for a form as shown. The bottom, sides and ends of the box are cut in one piece from sheet brass and partly bent into position, after placing the block on the inside of the bottom as in Fig. 3. The ends and sides are then pressed together by clamping the block and cutout in a vise, after which the block is removed and the joints are soldered. The block is placed in the box again and the top, also cut from sheet brass, is soldered in place. Next the lid is cut from the upper part of the box and the block is removed. This can be done with a hacksaw, or with a slitting saw on a milling machine as in Fig. 1. In either case, the wooden block within the



box prevents distortion of the metal when it is held in a vise for cutting. Small brass hinges are soldered to the back of the box and a friction catch is soldered to the front as in Fig. 2 and the detail in Fig. 3. The completed box is polished and lacquered and a sample of its contents is cemented to the top as shown.

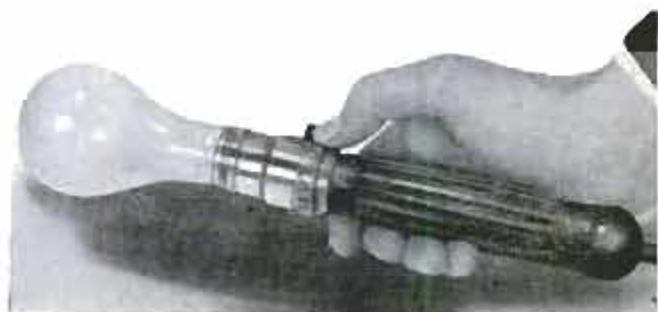
Walter E. Burton, Akron, Ohio.

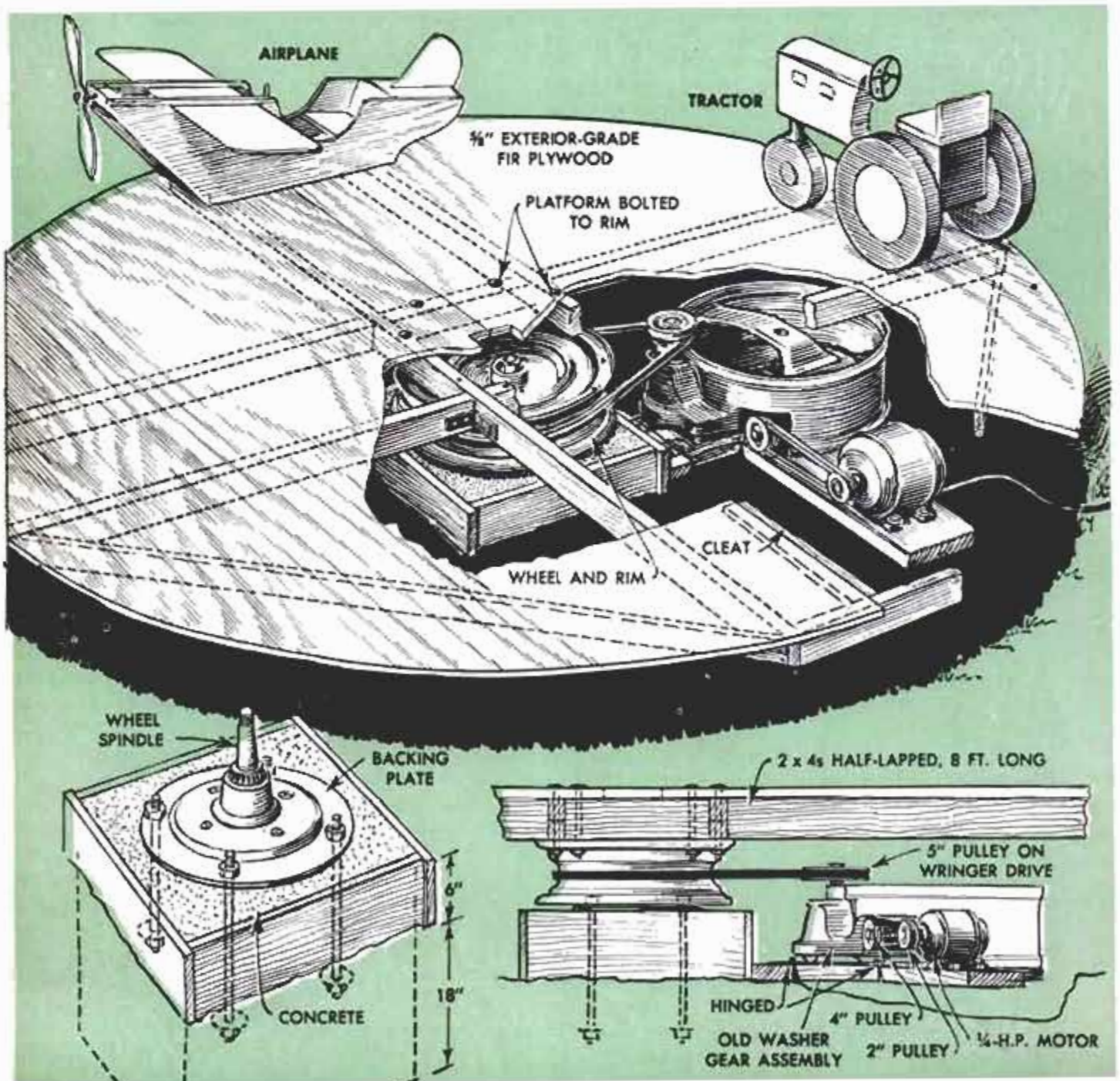
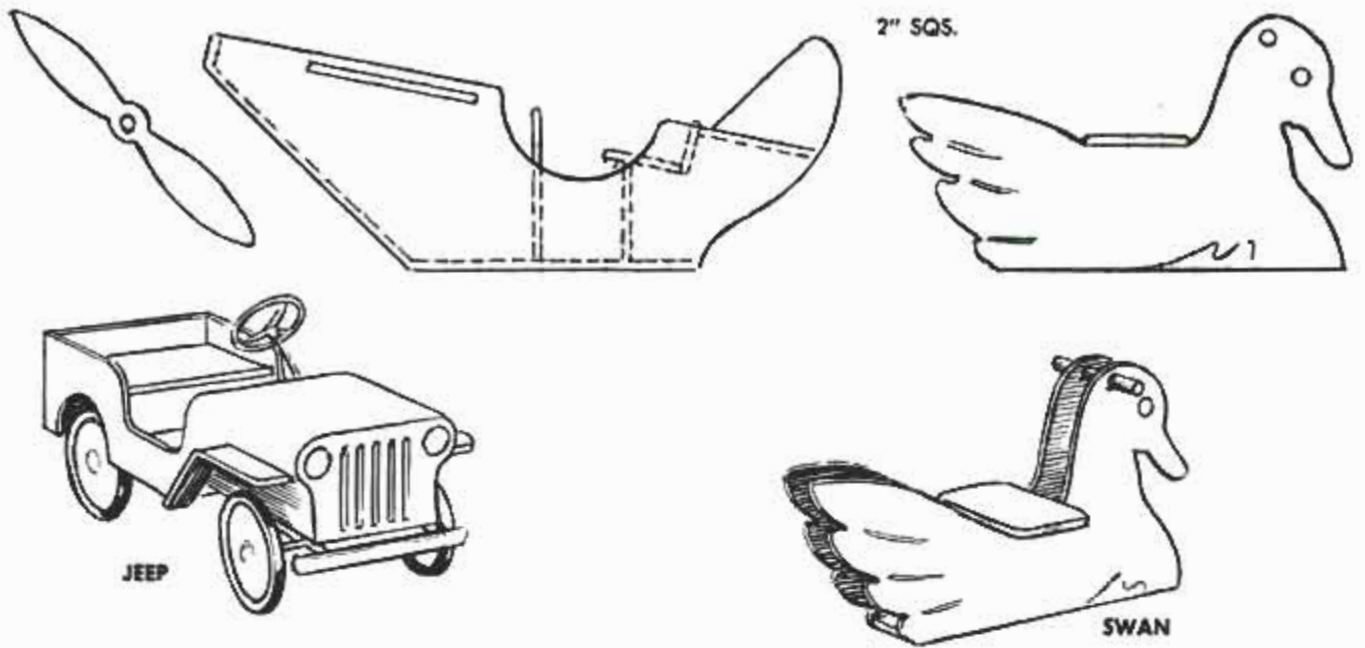
Using Antifreeze Second Season Can Damage Cooling System

Experts agree that a permanent-type antifreeze does not lose its nonfreezing quality after one season of use. They also agree that it is poor economy to reuse it, because the rust and corrosion inhibitor may be ineffective. Minerals in the water, air seeping into the system and corrosive exhaust gases leaking through gaskets can destroy the effectiveness of inhibitor in even premium-quality antifreeze. Also, salts, formed when the inhibitor neutralizes acid in the coolant, remain in solution to cause damage. If you were able to make a chemical analysis of the solution now in your cooling system, then compare it with a sample of unused antifreeze, noting the antifreeze quality, present alkalinity plus the reserve alkalinity available for future protection, you could challenge the experts. The best bet, however, is to drain and flush the cooling system and use new antifreeze.

Handle on Extension Cord Converts It to Trouble Light

An extension cord becomes more convenient to use as a trouble light when it is fitted with a handle. An ideal handle is a bicycle handle-bar grip, since it is rubber and has a hole in the end for the cord. The end of the grip is coated with bicycle-rim cement and forced against the base of the socket, after which electrician's tape is used to bind the two together. Naturally, it is first necessary to remove the wire from the socket to slip the handle over the cord.







BACKYARD MERRY-GO-ROUND

By Robert E. Wilson

PRESENTING your youngsters with their very own merry-go-round will make you a very popular father, and your children will be the envy of every child in the neighborhood.

Construction starts with digging a hole 20 in. square and 18 in. deep. In areas of severe cold, make the hole 30 in. deep. A form of 2 x 6s around the top of the excavation produces a concrete "pillar" that projects above ground level. Next obtain the front-wheel assembly from an auto-wrecking yard, including the spindle, bearings, backing plate and wheel. Be sure the bearings are in good condition. Drill four holes in the backing plate to accommodate four 1/2-in. bolts, 12 in. long. Suspend the spindle and backing plate, with the long bolts in place and nuts turned just hand-tight, over the excavation and fill it with concrete. After the concrete has seasoned several days, remove the nuts, install lock washers and tighten the nuts thoroughly so the backing plate is solid. Fit the inner bearing on the spindle, slip the brake drum in place and tighten the

large retaining nut. The wheel now is bolted to the drum.

The next step is to build the 2 x 4 framework that supports the merry-go-round platform. Two pairs of 2 x 4s, 8 ft. long, are half-lapped as shown in the detail, and all joints strengthened with steel angles. Two 4 x 8-ft. sheets of 5/8-in. exterior-grade plywood are nailed to the frame and bolted to the wheel. The intersection of diagonal lines from the corners of the platform locate the center from which is scribed an 8-ft.-dia. circle. Cut an opening at the center of the platform over the wheel nut.

Power for the ride is supplied by a 1/4-hp. electric motor. A 2-in. pulley on the motor is V-belted to a 4-in. pulley on the gearbox of an old washing-machine base. A 5-in. pulley is fitted on the vertical shaft of this gearbox that originally rotated the wringer rollers. From this pulley a 56-in. V-belt is fitted around the car wheel. The platform on which the gearbox is bolted is hinged so the weight of the box keeps tension on the belt. Speed of the ride is about 14 to 16 r.p.m. ★ ★ ★

Rustic Wagon-Wheel Garden Seat Has Removable Cushion



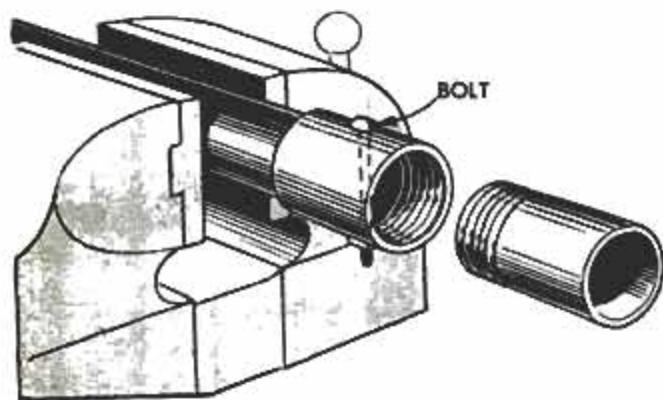
Here is a shady garden seat designed to combine rustic beauty with a practical method of storage. The seat consists of a wooden wagon wheel over which is dropped a disk of plywood. The center is cut out to accommodate the projecting hub of the wheel. The plywood is upholstered with rubberized horsehair covered with canvas-backed plastic. A wagon axle can be cut off and set in concrete to support the wheel, or if an axle is not available, a length of pipe can be used. A bolt fitted through the pipe supports the wheel. If the axle is not hollow, the column of the umbrella is fitted in a hole cut in the plywood, located between spokes. Both the plywood disk and the wheel lift off for storing.

Louise P. Bell, Tucson, Ariz.

Be certain that all the polish is absorbed when polishing wood. Otherwise, a cloudy appearance may result. A clean dry finger rubbed over the surface will not leave a trace if the wood is polished properly.

Threading Short Pipe Nipples

Threading the second end of a short pipe nipple usually is done by screwing the threaded end into a pipe coupling held in a vise. The action of the thread die forces the nipple tightly into the coupling, making it difficult to remove without damaging the threads. A bolt, inserted through the coupling as indicated, will prevent the nipple from becoming jammed.



Flat-Steel Hook on Bow Saw Increases Its Usefulness



Bolted near one end of a bow saw, as shown in the photo, a hook bent from $\frac{1}{8}$ x $\frac{1}{2}$ -in. flat steel makes a handy "accessory" when the saw is used for pruning trees. With an approximate diameter of $2\frac{1}{2}$ in., the hook can be used to pull within easy reach branches that ordinarily would require a stepladder for handling. Small, dead branches also can be broken off with the hook, eliminating the need for sawing. When not being used, the saw can be hung in the workshop by means of the hook.

R. Hanscom, Elmhurst, Ill.

If you have chairs with cane seats that have become loose and are sagging, you can clean and repair them with just one operation. Wash the chair seats with hot water and detergent, then place them outside in the sunlight to dry. In the process of drying, the cane will shrink, restoring the seats to their original tension.



“Sound Diagnosing” Engine Troubles

By M. C. Anderson

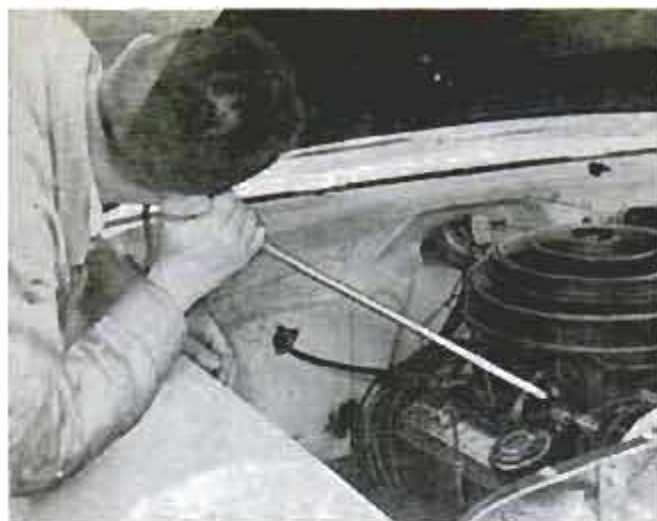
WHEN THE COMPONENTS of an automobile engine are not functioning properly, they usually sound a warning in the form of noises not common to normal operation. Every rotating or reciprocating part is a potential source of noise, and locating the actual source of engine noises and knocks can be the most puzzling of all engine trouble-shooting jobs. Fortunately, most noises possess characteristics of their own which help identify the source. Given a method of amplifying these sounds and locating their sources, coupled with some knowledge of their meaning, any car owner is equipped to make a “sound diagnosis.”

It is important to know the source of unusual noises as early and accurately as possible, because if some troubles are permitted to continue, extensive damage can occur. In other cases, a knocking engine might run safely for hundreds of miles before an overhaul becomes necessary.

Simplest of the listening devices is a sounding rod, left-hand photo, page 198. Simply rest one end of a length of broomstick or dowel against the engine, hook a thumb over the other end and rest the thumb against the lobe of the ear. Today, a professional mechanic is more likely to use an engine stethoscope, right-hand pho-

to, page 198, which is accurate and flexible in use. The photos and diagram on page 199 show the construction and use of an “electric stethoscope” which a home mechanic can build for himself. It may be used even while driving the car, an advantage when seeking hard-to-find body and running-gear noises. Parts for the stethoscope can be purchased at a radio-supply house. Needed are a set of earphones, a switch, a doorbell transformer, a .25 megohm potentiometer, 3 flashlight dry cells in a holder and a small carbon microphone. A war-surplus throat “mike” will do. These parts are assembled in a metal box, such as a child’s lunch box, and wired as shown in the diagram at the bottom of page 199. A permanent magnet taped to the microphone permits it to be placed almost anywhere on the car. The potentiometer adjusts the volume at the headset.

Always make sound tests with an engine warmed to operating temperature, so that clearances are normal. Test for minor trouble first. Most clicking noises in an engine are caused by loose or worn tappets. Some engines that use hydraulic valve lifters have adjustable tappets requiring occasional adjustment to keep them running quietly. A split muffler can cause a howl identical to that produced by a bad rear-axle assembly, but is much less costly



Simplest sound-detector is dowel. One end is held on engine, other end is held against head near the ear

Engine stethoscope, similar to one used by doctors, is in toolkit of many modern automobile mechanics

NOISE	PROBABLE SOURCE	MIKE POSITION	HOW TO CHECK
Dull knock or heavy thud	Loose main bearings	Lower block near bearings	Louder on sudden acceleration or when climbing hill
Sharp, irregular rap	Excessive end play on main bearings	Flywheel housing near main bearings	Depressing clutch will stop noise. Difficult to diagnose with automatic transmission
Sharp, metallic double-knock. (If all are loose, a rattling metallic sound.)	Loose piston pins	Top of block just below head gasket	Usually loudest when idling. Shorting out plug may change tone of knock, make it more severe. Noise is sharp when engine is laboring
Light tapping, click or sharp rattle	Broken ring	Top or bottom of block near head or pan gaskets	Heard at idle and under acceleration. Cannot be eliminated by shorting spark plug
Light pounding, sometimes a clatter or series of raps	Loose connecting-rod bearings	Lower block at pan gasket or on oil pan	Bad case heard at all speeds. Slightly loose rods sound like piston slap or loose piston pins. Loose rod usually knocks loudest at 35 or 40 m.p.h.
Light knock	Bent connecting rod	Lower block at pan gasket	Light knock at idle, increases on acceleration. Reduces, is not eliminated when plug is shorted
Hollow, distinct click or rattle	Piston slap	About 3 in. below head gasket, adjacent to cylinders	Occurs at idle, shows up under load, loudest when engine is cold. Can be eliminated by shorting spark plug
Sharp clatter or knock at idle, growl at 25 to 30 m.p.h.	Loose or worn timing gears	Timing-gear cover at front of engine	Loudest at idle, particularly if idle is rough. May disappear at low speeds, come in again as growl at 25 to 30 m.p.h.
Rumble or scraping noise	Loose timing chain	Timing cover, front of engine	Rumbling noise at idle or on acceleration. A dull scraping sound if chain is striking cover
Clicking sound similar to tappet noise	Worn piston-ring grooves	Side of block, adjacent to cylinder walls	Click twice per crankshaft revolution, instead of every other revolution as for valves
Snapping sound (Engine overhauled)	Rings fitted too tightly	Top of block just below head gasket	Noise cannot be eliminated by shorting out spark plugs
Heavy click or light tapping noise	New rings striking ridge in worn cylinder, or head gasket in rebored cylinder	Side of block adjacent to top and bottom center of piston stroke	Noise is regular and changes with speed. Louder as speed increases. Cannot be shorted out with plugs
Irregular knock at idle	Worn or loose harmonic balancer	Front of block, near balancer	Noise disappears above idle. Grasp balancer at edge and rock back and forth sharply. Looseness can be detected.
Rattling sound	Bad generator bearings	Generator housing near bearings	Check with engine idling. Move mike to determine which bearing, front or rear, is bad
Irregular, heavy knock	Loose flywheel	Flywheel housing	Noise comes and goes. Cannot be eliminated by shorting plugs. Idle engine, cut switch and allow engine to slow. Turn on ignition again. A distinct knock will be heard each time switch is turned on



Electric stethoscope fits neatly inside child's metal lunch box that has handle for easy carrying



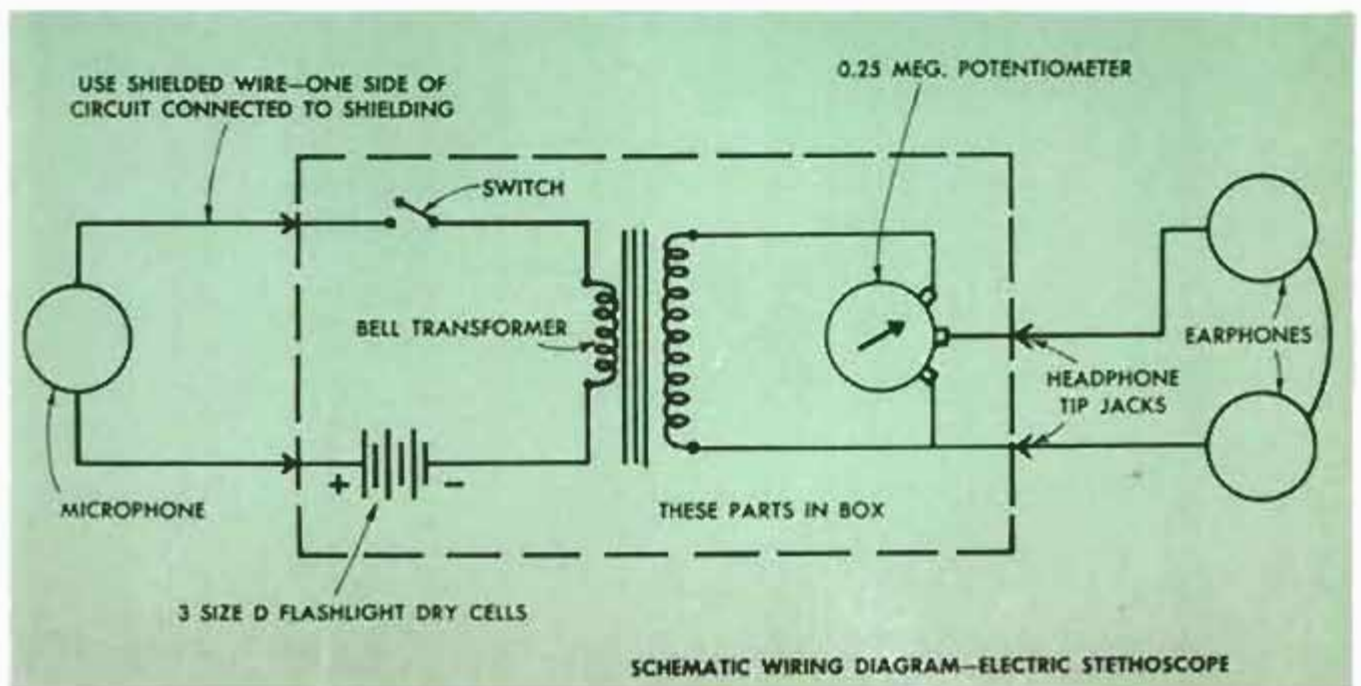
Box is placed on seat, earphones on head, microphone is held in place on car body or engine with magnet

to replace. In a similar way, other components may "telegraph" sounds to parts of the car that are not at fault. A thorough diagnosis before any work is done will prevent costly and unnecessary repair bills.

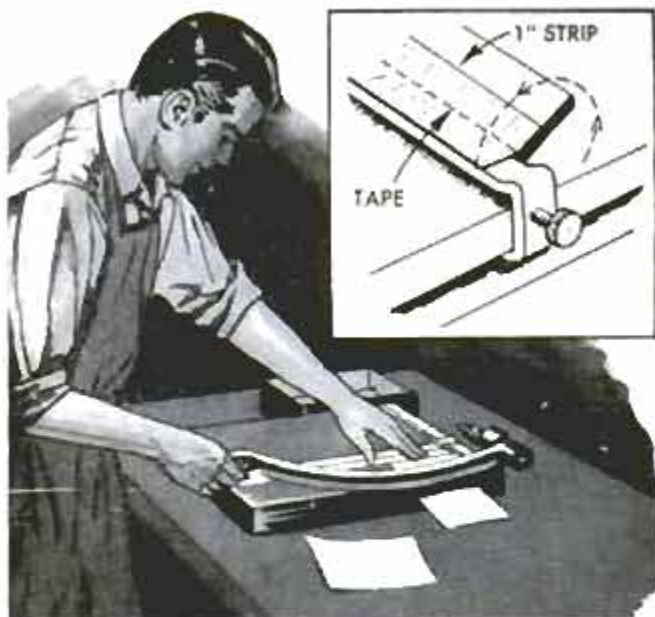
The chart on page 198 lists some of the sounds that can be heard with the electric stethoscope, where to find them and what they mean. As an example of how to use the stethoscope and chart, suppose the engine has a knock that shows up at idle speed as a hollow, distinct click or rattle. The noise is more pronounced when the engine is cold or when it is under a load. Referring to the chart, piston slap is indicated. To verify this diagnosis, place the mike on the block about 3 in. below the head gasket adjacent to the cylinders, as described in the chart. With the engine running, move the mike from one cylinder to the next un-

til the source of the noise is localized. Shorting out the spark plug will eliminate the noise, proving the correctness of the diagnosis.

If you are the type of car owner who is bothered by unusual sounds when a car is driven, the electric stethoscope will be especially valuable. For example, a rattle might sound only when the car is driven on a moderately rough road. It seems to be in the front suspension, but when the car is on a hoist none of the components of the suspension can be pulled or twisted to reveal the sound. With the stethoscope, place the microphone on various parts; the A-frames, shock-absorber links and so on, until you hear the sound loudest in the earphones as the car is driven. This procedure will reveal which component is to be repaired or replaced. ★ ★ ★



Auxiliary Stop Aids Cutting Paper in Darkroom



Hinged to the stop on a paper cutter, a 1-in.-wide strip of cardboard simplifies the job of cutting 8 x 10-in. undeveloped print paper to smaller size in the dark. The stop is set at 5 in. to permit cutting 8 x 10-in. paper to 5 x 8-in. size, which is suitable for a 5 x 7-in. print. When the cardboard strip is flipped down and held, the 5 x 8-in. paper can be cut to standard 4 x 5-in. size.

Peter G. Gordon, North Miami, Fla.

Pulls for small drawers, such as are used in small-parts cabinets in a workshop, can be obtained ready-made by cutting off the heads of conventional wooden clothespins. Holes are drilled through the drawer fronts to permit driving a screw into each pull from inside the drawer.

M. Robert Beasley, Jackson, Mich.

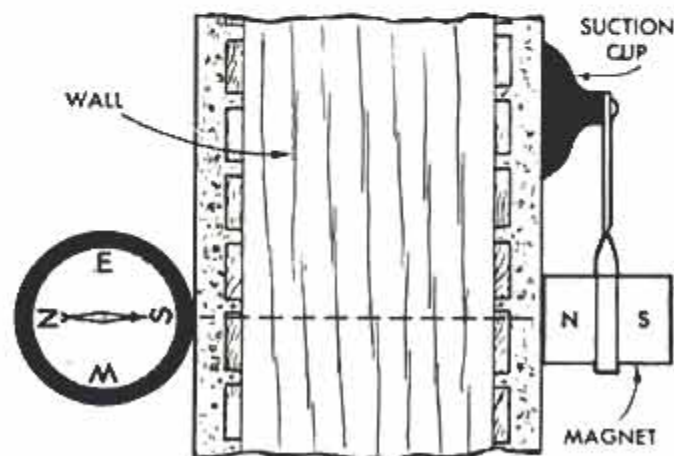
Gasket in Pouring Spout Eliminates Need for Extra Cap



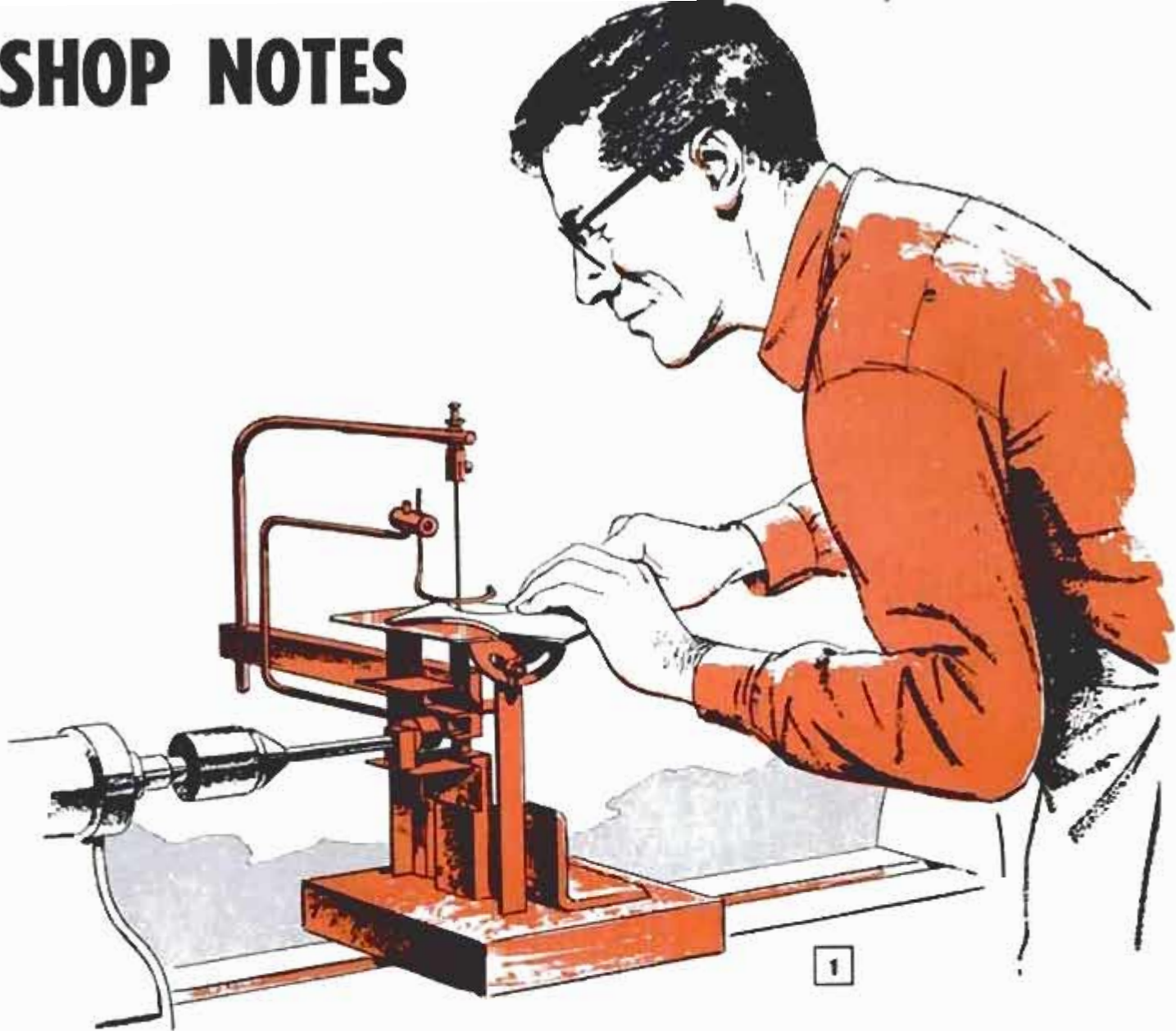
On gasoline containers that have a removable spout, the spout must be replaced with a regular cap when the container is transported in a car or boat. You can eliminate this need for carrying two items, with the chance of mislaying one, by fitting a heavy cork or leather gasket inside the cap of the pouring spout as shown. The gasket should be slightly smaller in diameter than the inside of the spout fitting, so that when the spout is removed the gasket can be lifted out easily. The spout then is replaced on the container and gasoline is poured into the tank to be filled. Keep the gasket in a pocket to prevent its loss.

ⓘ Before attempting to remove road-tar stains from clothing with cleaning fluid, rub the stains with petroleum jelly. When the jelly is dissolved with cleaning fluid it will carry the stain with it.

Positions on Opposite Sides of Wall Located With Magnet



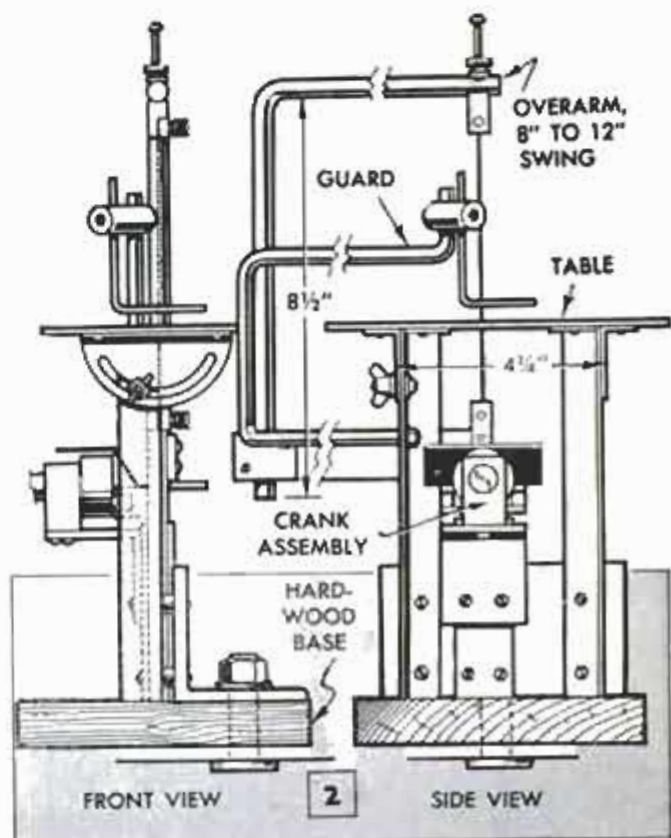
When it is necessary to locate identical positions on opposite sides of a wall, the job can be done accurately with a small bar magnet and a pocket compass. Attach the bar magnet to one side of the wall by means of a suction cup or other hanger, at the exact location. Then, on the opposite side of the wall, move the compass around until the needle points directly at right angles to the wall. If the height from the floor has been measured ahead of time with a rule, it can be double-checked by watching the compass needle as it tilts up and down, pointing to the magnet.

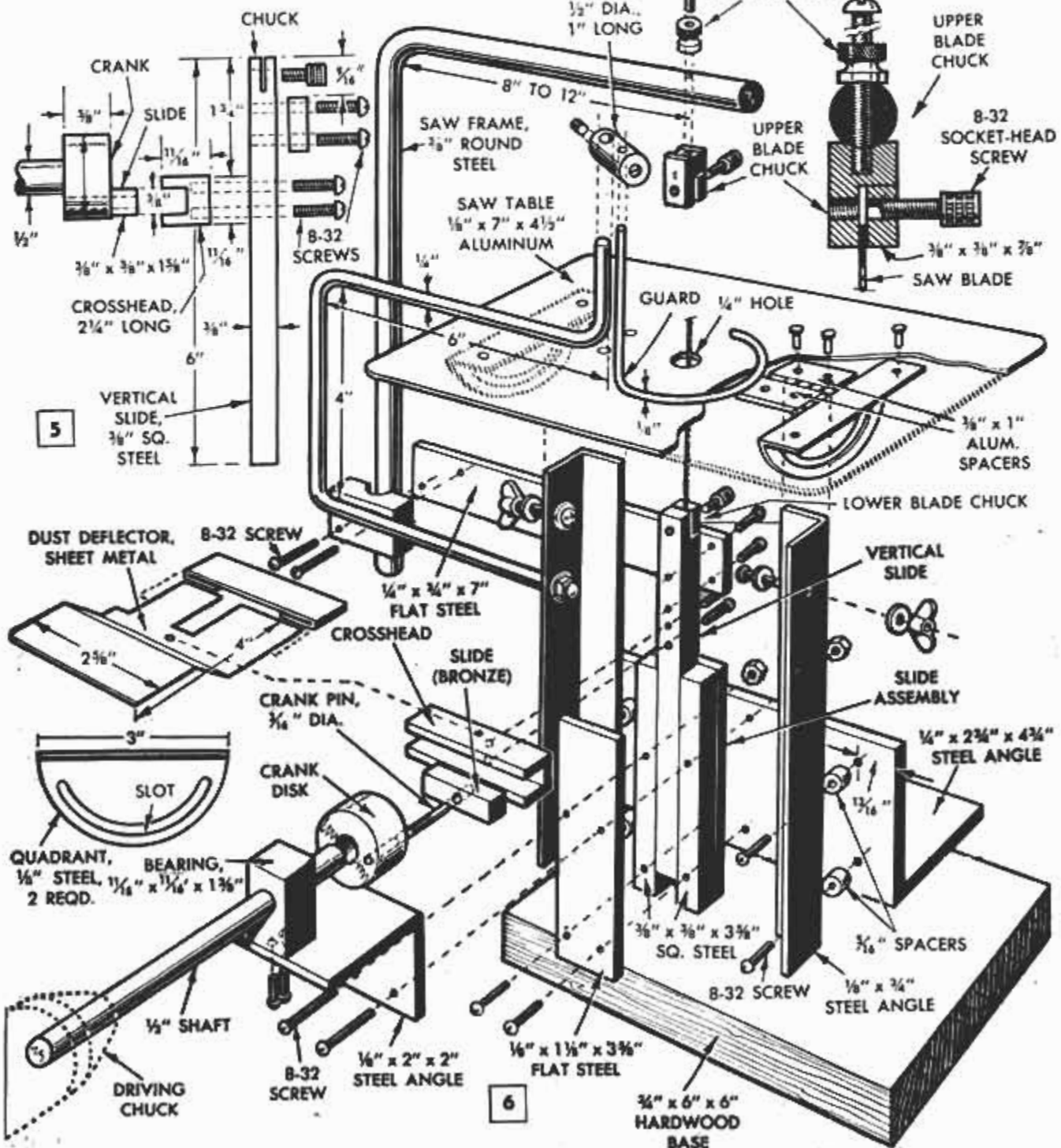
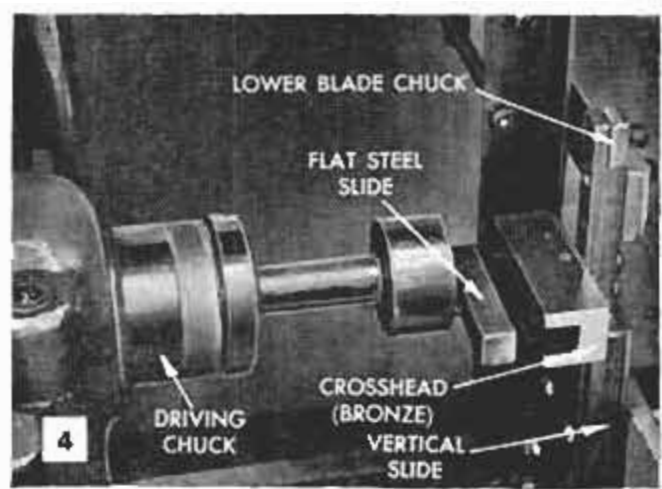
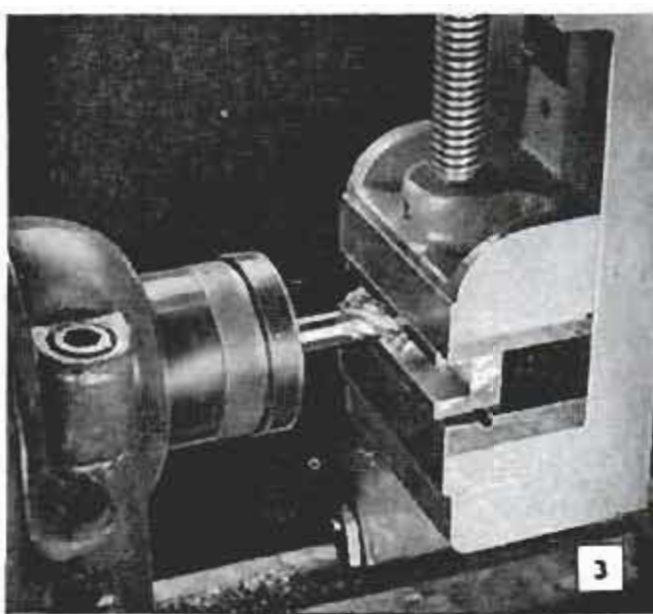


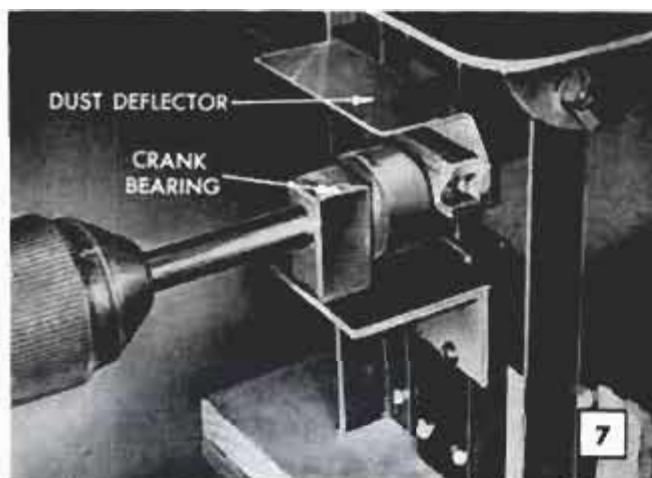
Your Lathe Drives This Jigsaw

By Walter E. Burton

ALTHOUGH designed especially for mounting on the bed of a lathe, this useful jigsaw can be altered easily for V-belt drive from a small motor, rather than from the lathe spindle. The swing, which is the capacity, can range from 8 to 12 in. This is the distance from the blade to the frame, measured at the table. The guard, which is adjustable to clear stock up to about 1 in. in thickness, is optional. The dimensions given on the principal parts adapt the unit to use on a 9-in. lathe. If the unit is used on lathes of greater or lesser capacity, dimensions of certain vertical parts must be altered accordingly. As







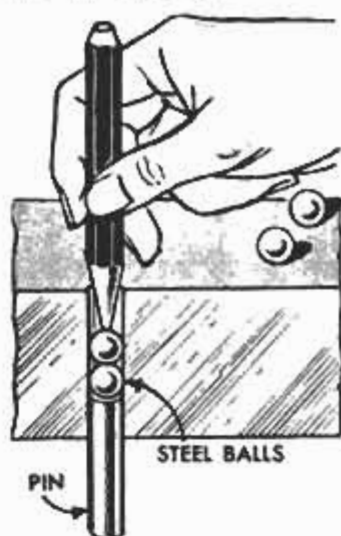
a typical example, it should be noted that the length of the $\frac{1}{8} \times \frac{3}{4}$ -in. steel angles which support the table, Figs. 2 and 6, is not given. For a 9-in. lathe these supports should be $7\frac{1}{2}$ in. long. For a 10-in. lathe they should, of course, be made 1 in. longer and a compensating increase also must be made in the length of the slide carrying the lower blade chuck. If, for example, the unit is made for use with a 12-in. wood lathe, the jigsaw can be blocked or shimmed up to align the crankshaft with the lathe spindle. For these reasons do not cut any stock to length until you have measured the swing of the lathe. Speed of the lathe spindle should not exceed 400 r.p.m.

The crank disk, Fig. 5, is turned to $\frac{5}{8}$ in. in thickness and $1\frac{1}{4}$ in. diameter, and the crank pin, which is $\frac{3}{16}$ in. in diameter, is offset $\frac{7}{16}$ in. to give the blade a stroke of $\frac{7}{8}$ in. The center hole in the crank disk is reamed to a drive fit on the shaft. The slide can be of bronze as in Fig. 6, or, if you have the material at hand, make the cross-head of bronze or brass and the slide of steel, Fig. 6. Do not use steel for both parts. Although you can groove the slide by hand methods, it is better to mill the groove as in Fig. 3, or have it milled at a local machine shop.

If you have a lathe equipped with a collet chuck, you can, in most instances, omit the crank-bearing support and drive the unit direct as in Fig. 4. But if the overhang of the shaft must be more than 2 in., then it is best to provide the bearing as detailed in Figs. 2 and 6 and pictured in Figs. 1 and 7. As detailed, the table is fitted with quadrants that permit it to tilt to the right. The guard is removed when the table is tilted. Note that the quadrant-locking screw is slightly off-center, Fig. 2, and for this reason the slot must be made wider than the diameter of the screw. If your scrollwork includes heavy cuts, then it is best to provide a blade support, or guide. This can be attached to the underside of the table so that it bears against the back of the blade.

Steel Balls Extend Pin Punch

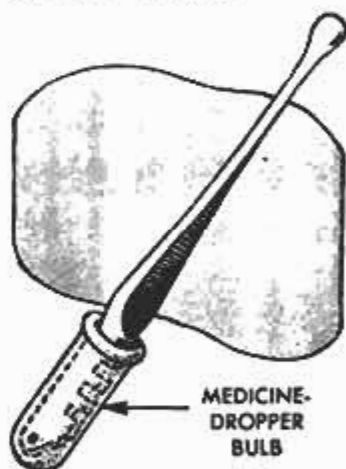
A long pin and a short punch can mean trouble, especially if the punch should wedge tightly in the hole with the pin only part way out. It does happen, so it's well to keep this trick in mind. Lacking a punch of sufficient length you can always extend the reach of the longest one at hand simply by dropping two or more steel balls into the hole after driving the pin part way out. Of course, the steel balls must be of a size to drop into the hole loosely.



E. R. Haan, Evanston, Ill.

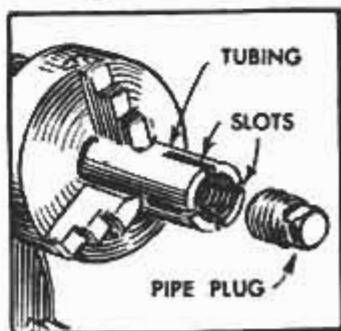
Guard for Glass-Cutter Wheel

Extend the useful life of a glass cutter by protecting the cutting wheel from being nicked or dulled by other tools in a drawer or tool chest. The rubber bulb of a medicine dropper slipped over the end of the cutter is ideal as a guard.



Shop-Made Expanding Mandrel

When you need a short, expanding mandrel in a hurry here's a way to make one quickly for use in a lathe chuck or collet. Machine a length of tubing to the diameter required, leaving a shoulder to serve as a workstop. Tap one end for a pipe plug. Slot the tapped end two ways, preferably running the slots individually on a milling machine. If the slots are cut with a hacksaw, be careful to space them equally and run to a uniform depth. In use, the work is placed over the slotted end of the mandrel and the pipe plug tightened to hold it in place.



R. B. Courtney, Whittier, Calif.

Reflective Tape on Flashlight Alerts Approaching Motorists

Strips of reflective tape wrapped around the circumference of a flashlight at both ends give it a "built in" safety factor when used on the highway as illustrated at left. Not only is it easier for approaching motorists to see such a flashlight but the reflective tape serves to warn them of the user's presence even when the light fails.

Robert V. Thompson, Clinton, Iowa.

☐ Ideal for brushing dust from silk and rayon lamp shades is the hairbrush your baby no longer needs. The soft bristles will not damage these delicate fabrics.

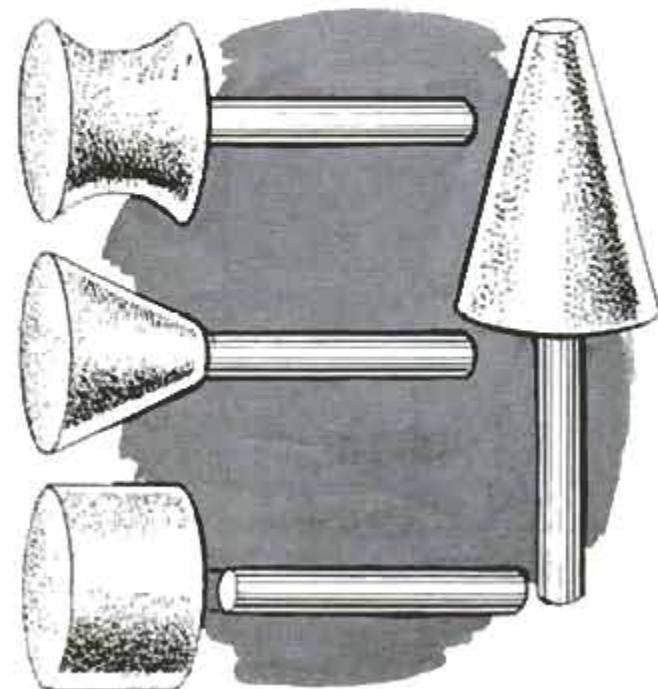
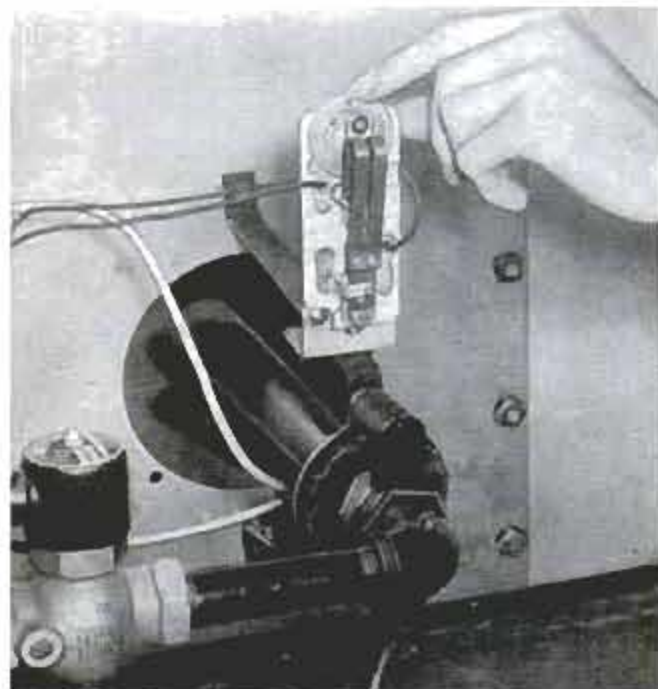
Thermostat Shuts off Gas Supply When It Burns at Mixing Valve

When there is abnormally reduced line pressure, or a "blow back" in a gas-fired furnace, gas may begin to burn at the air-mixing valve, a situation that not only is a serious fire hazard but one that may also damage the controls. To provide for automatic shutoff of gas when this occurs, mount a room-type thermostat on the furnace directly over the mixing port as shown. The thermostat is then connected to the main room thermostat circuit and adjusted to open at 90 to 100 deg. F. so that the furnace will continue to operate as before. However, presence of abnormal heat near the port will cause the circuit to break and the main gas valve to close, thereby shutting off the gas supply.

Sanding Drums Improvised With Glue and Abrasives

For fast and accurate sanding or shaping of a contoured surface, or a surface that is difficult to reach, make a sanding drum to match the contour of the work surface and fit it with a shaft for chucking in a power drill as shown in the drawing. When making the drum, turn it to the desired shape from a length of hardwood dowel and drill a hole through its axis to take a length of 1/4-in. steel rod to be used as a shaft. Then coat the surface of the drum with glue and sprinkle emery dust or other abrasive particles of the required grit on it. After the glue has set, apply another coat to prevent the abrasive from working loose too easily.

Robert L. Sargisson, Berwyn, Ill.





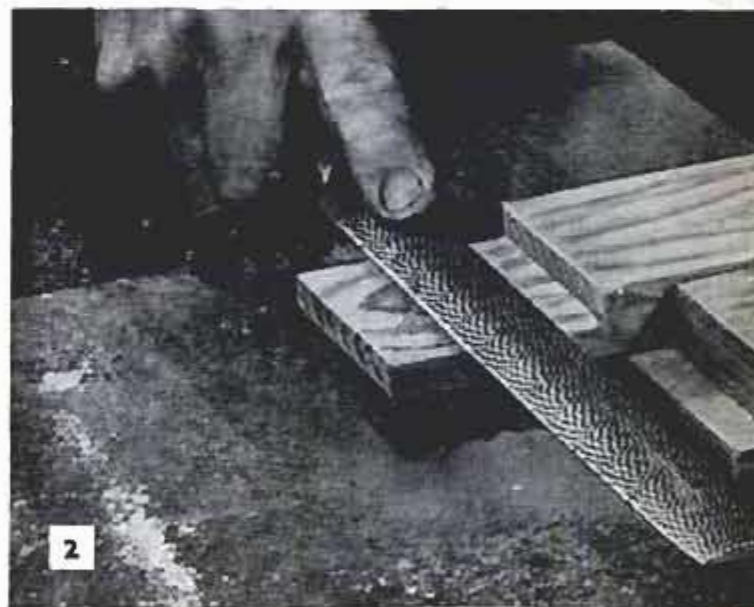
USE A WOOD RASP

for finishing scroll cuts, squaring tenons, half laps, rounding and beveling corners, squaring holes and shaping work to contour

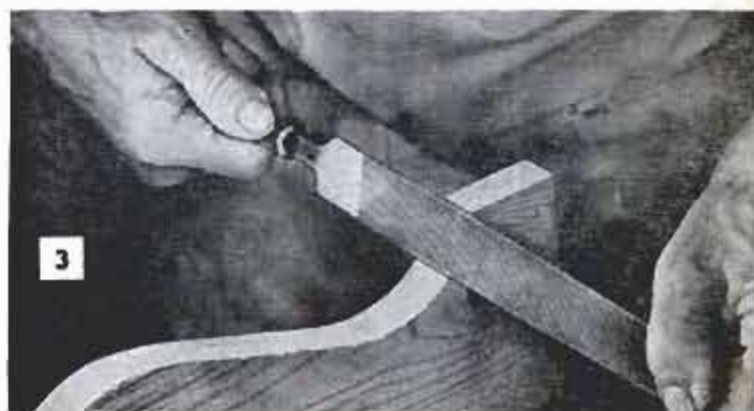
By Edwin M. Love

RASPS AND CURVED RIFFLERS are cutting tools having a number of teeth arranged in a staggered pattern on the flat and curved faces. Rasps and rifflers differ somewhat from files in that the teeth are cut individually while those of the common file are continuous, usually arranged at an angle with the blade to give a shear cut. In Fig. 1, sections A, B and E are common rasp shapes. The others are common file shapes which are useful in smoothing and shaping wood when the larger and coarser sizes are used. The combination file, or rasp-file as it is sometimes called, pictured second from the right in Fig. 1, comes in half-round cross section. The teeth on one half of the blade are rasp-cut, that is, they are individual and are formed in a staggered pattern. Those on the other half of the blade are file-cut, each forming a continuous cutting edge across the width of the blade.

In addition to common rasps and rifflers there are several variations which are coming into wide use by craftsmen who must



Above, tenons and half laps cut slightly oversize are easily reduced to required dimensions with a cabinetmaker's rasp. Below, a rasp makes short work of removing the saw marks from the edges of scrolls





No other hand tool quite equals a rasp for finishing contoured shapes of models in wood and plastic



This new tool is handled like a rasp, cuts very fast and smooth in woods, plastic, nonferrous metals



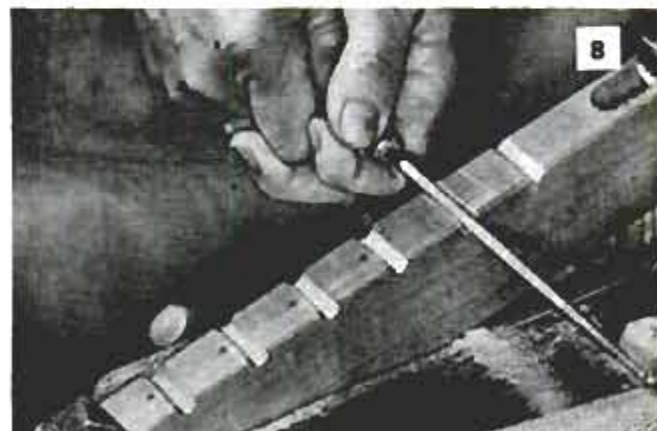
Above, tungsten-carbide grains are cutting edges of this new tool. Below, perforations in metal form cutting edges of this tool. Cuts in any direction



shape and smooth wood by hand methods. Figs. 5 and 11 picture two of these in use. Each unit consists of a handled frame and a perforated steel strip, or blade, which is replaceable. The perforations form multiple cutters, each of which is an individual beveled blade. The tool in Fig. 5 is used as a rasp. A companion unit utilizes the same blade, but is fitted with handles so that it can be used as a plane. The tool pictured in Fig. 11 can be used either as a rasp or plane by changing the position of the handle. Another variation which can be used either as a rasp or file is pictured in Fig. 6. It is simply a file-shaped piece of flat steel having tungsten-carbide grits fused to both flat faces, fine on one side, coarse on the other. Fig. 7 pictures another hand tool for smoothing wood which has the novel feature of being able to cut in all directions with equal facility. It consists of a perforated steel sheet mounted on a special holder which permits its use in much the same manner as a sandpaper block. Still another rasplike tool is shown in Fig. 13. The body of the unit is a toothed steel helix having a drill point. It will cut in any direction and can substitute for a round rasp, a drill, and a compass saw. Although the variations described are not conventional rasps, they can serve similar uses.

Figs. 2 to 13 inclusive, picture typical work with rasps, rifflers and the newly developed units that can fill in as rasps. The rifflers, Fig. 9, are toothed in a manner similar to rasps. Common sectional shapes are shown in Fig. 9, details A to E inclusive. Note that rifflers are curved, which permits them to be used on both convex and concave surfaces, Figs. 10 and 12.

Rasps are handled, or stroked, like files as they are designed to cut on the forward stroke. When smoothing a flat surface, relax pressure slightly near the end of the cutting stroke. This is especially important when using a rasp with both hands, as otherwise the surface may be rounded slightly. A shearing stroke will prevent chatter marks when it is necessary to work end grain in hardwoods. ★ ★ ★



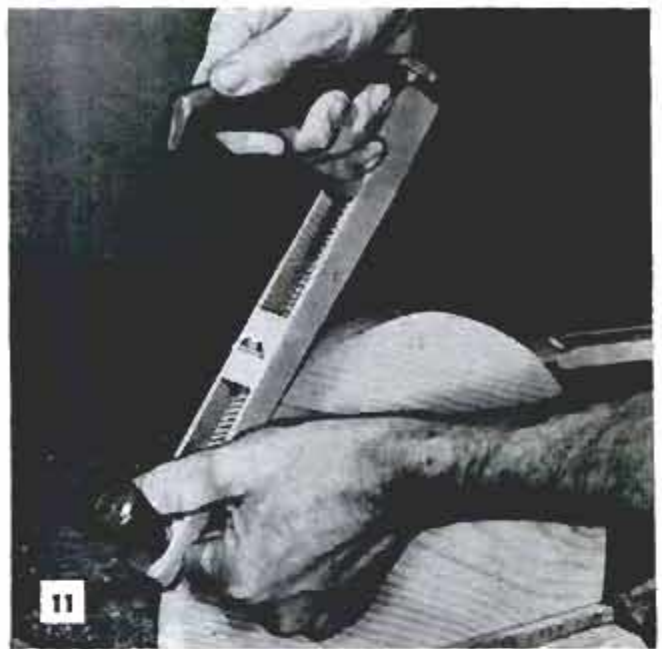


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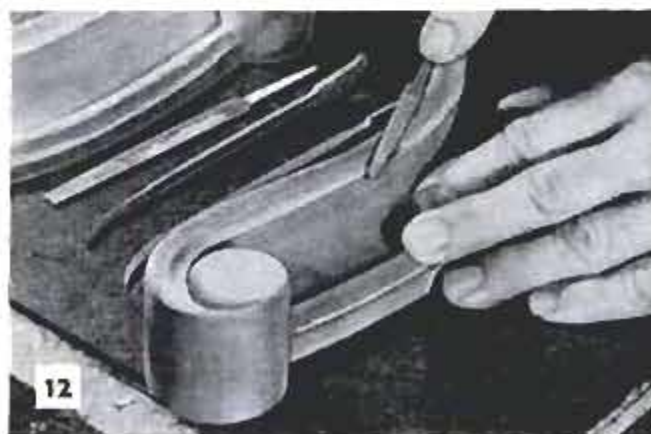
10

Above, rifflers are curved, can be used on convex or concave surfaces when shaping contours. Below, small rifflers are useful for finishing handmade moldings and for smoothing deeply relieved carvings

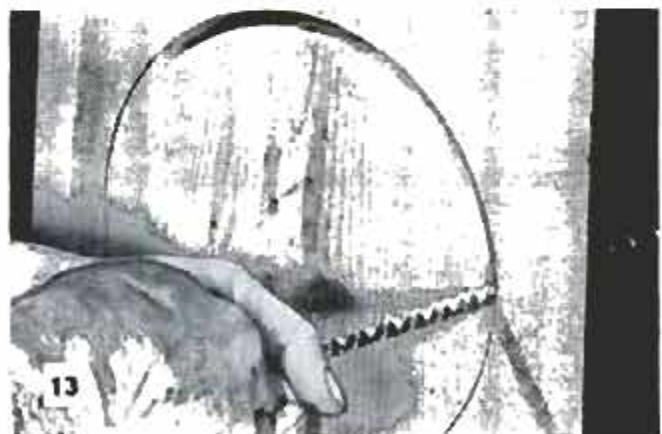


11

Above, this tool can be used either as a plane or as a rasp by changing the position of one handle. Below, this tool can serve as a round rasp, a compass saw and also as a drill. It cuts very fast

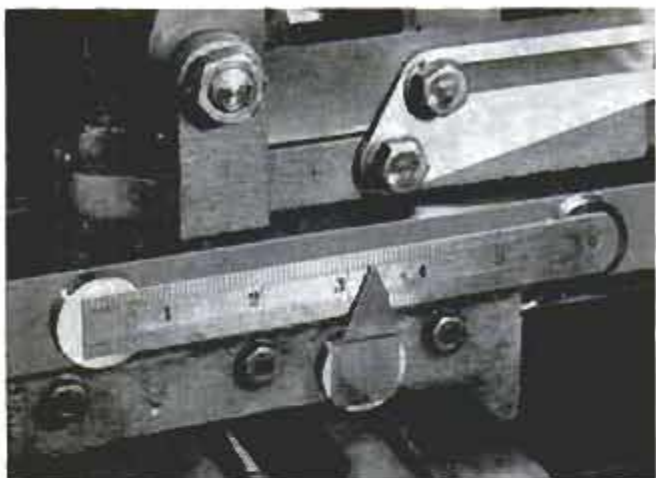


12



13

Magnets Hold Scale on Machine



Where tolerances were not critical enough to require the use of a micrometer stop, three magnets were used to attach a steel rule to the edge of a milling-machine table and a pointer to the machine saddle, for measuring table movement. One magnet held a pointer cut from light sheet metal, while the other two magnets were placed under the ends of a 6-in. rule. The magnets permit the rule and pointer to be placed in the initial position easily. This magnet-and-rule setup also could be used on other machines in the shop.

Walter E. Burton, Akron, Ohio.

Rod Gauges Planer Knives



When knives on thickness planers of the type shown are removed for sharpening, it is necessary to realign the table so it is parallel with the knives after they are replaced. This aligning can be done accurately by using a length of brass rod—which will not damage the newly sharpened knives—as a gauge. The bar is rolled across the table from side to side as the table is adjusted, so the knives barely contact the bar. Knowing the diameter of the gauge bar also permits adjusting the thickness gauge accurately after the table is aligned.

H. Hanscom, Elmhurst, Ill.

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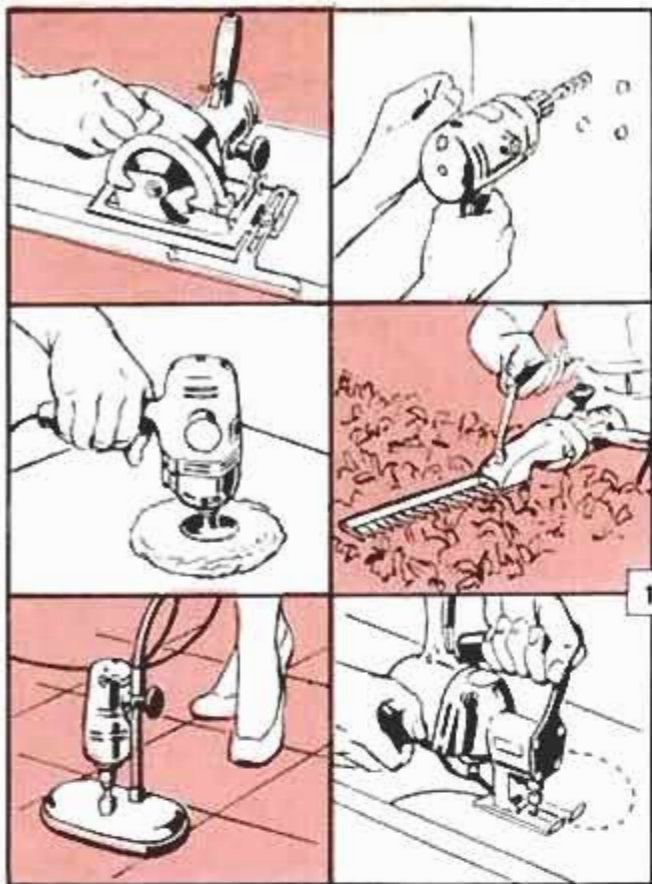
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SHOPPING FOR TOOLS

1. PORTABLE POWER UNIT does 24 different jobs in the shop and around the home. Unit alone weighs about 3¼ lb., the average weight of a ¼-in. portable drill. Special attachments, only a few of which are shown above, are designed for direct drive from power unit. This utilizes full power of motor, eliminates any loss of control due to overhang or misalignment between driving and driven units. When the geared chuck pictured is added, the unit becomes a portable drill with a side handle, or knob, for two-handed operation. Motor is controlled by trigger-type switch which can be locked in "on" position

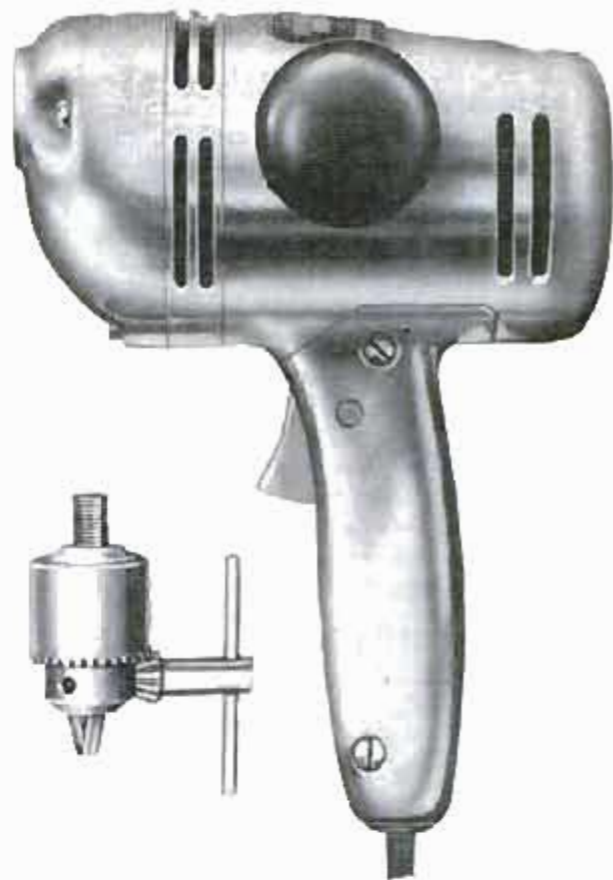
Black & Decker Mfg. Co., Towson 4, Md.

2. TAPPING ATTACHMENT is designed to fit drill press having a Morse-taper spindle. Floating spindle, which is special feature of attachment, produces a consistently perfect thread in both through holes and blind holes and reduces tap breakage and wear to the minimum. Unit is available in common sizes

Homstrand, Inc., Larchmont, N. Y.

3. LOW-VOLTAGE LIGHTER for gas-welding torch gives an instantaneous light. Eliminates less reliable flints and the hazard of open-flame lighters. Just pass the tip of the torch a few inches above the electrically heated element and you get a light, every time. Unit is 3 in. high and 3 in. in diameter

Breese Industries, Inc., Box 1704, Santa Fe, N. Mex.



4. MANDREL takes saw blades and other circular-saw accessories, such as dado and molding heads, with $\frac{1}{2}$, $\frac{3}{8}$ and $\frac{3}{4}$ -in. center holes. Ground and polished shaft turns on sealed ball bearings. Pulley takes an A-section V-belt and is 2 in. in diameter
Chicago Die Casting Mfg. Co., 2510 Monroe St., Chicago 12

5. HANDLED PAD for wide range of abrasives combines advantages of several hand tools. Makes an efficient sanding block for wood, a useful auto-body file with a metal abrasive and can serve as a finishing pad for flat surfaces of steel, softer metals, plastic
Jiffy Products Co., 31 S. Michigan Ave., Pasadena, Calif.

6. MITER GUIDE for handsaw is carried to the work, guides the handsaw blade to make accurate cuts at any angle from 90 to 45 deg. Pivoted blade guide has a graduated quadrant and is locked at any desired point by a wing nut. The base has a fixed edge guide
Chesney, Inc., 527 W. Windsor Rd., Glendale 4, Calif.

7. SPADE, OR WING, TYPE BITS for wood have non-slip hexagon shanks for use in portable electric drills. Bits are designed to bore smooth, clean holes in hard or soft wood at any angle and at average electric-drill speeds. Available in sets as shown
Greenlee Tool Co., Rockford, Ill.

8. LOCK WASHER is square, not round, and is designed to prevent loosening of nuts holding parts subjected to unusual vibration and shock. Teeth on washer not only grip surface of workpiece as nut or screw is tightened, they also engage threads of screw
American Stamped Fastener Co., P.O. Box 116, Roselawn Station, Rochester 18, N. Y.

9. SIPHON-FEED SPRAY GUN, or air brush, is designed for small-parts finishing and touchup work. Available in two models, one for light to medium materials such as dyes, other for lacquers, enamels. Spray pattern can be reduced to pencil-line width
Binks Mfg. Co., 3122 Carroll Ave., Chicago 12

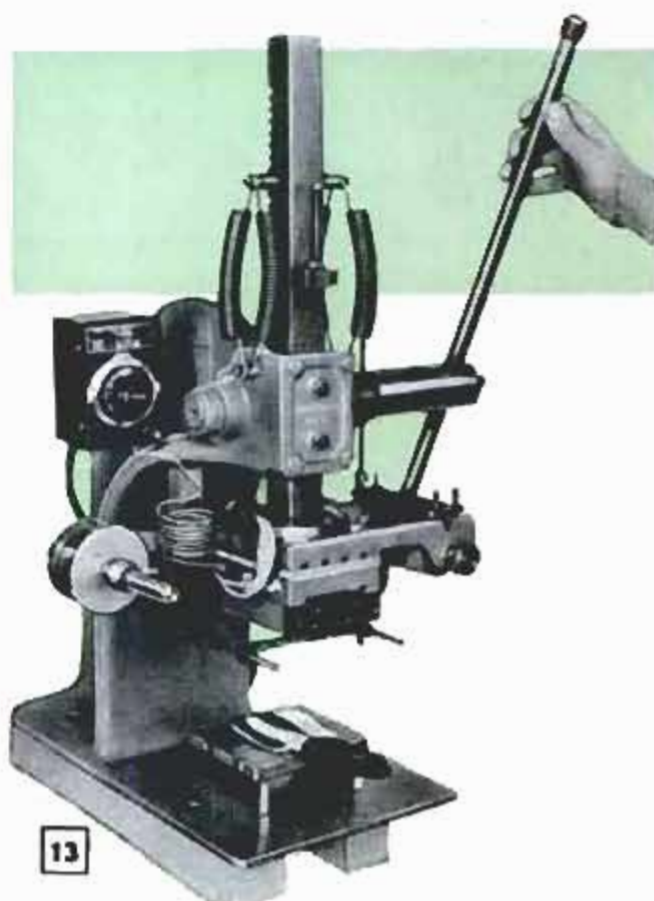
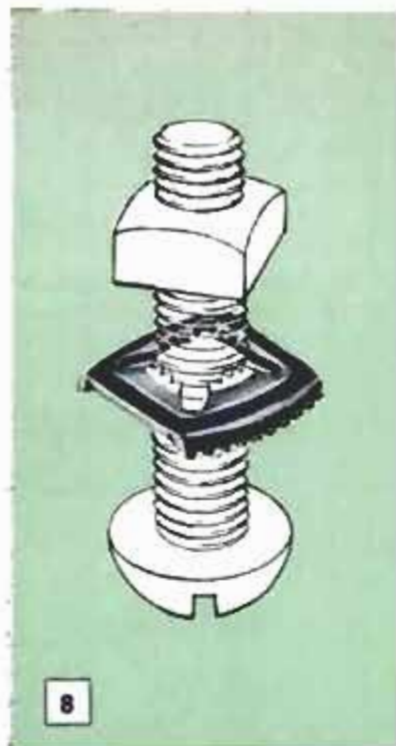
10. TOOLHOLDER has swiveling head, permits universal tool settings on lathes, planers, shapers and slotters. Rotating clamping cap, or jaw, has annular serrations that mesh with serrations on shank to provide a positive grip that prevents shifting of tool bit
Maxwell Industries, Inc., 403 E. Fifth Ave., Ashtabula, Ohio

11. STORAGE RACK for screws is made from clear plastic, can be attached to wall, or several units may be purchased and stacked to form a cabinet. Drawers that fit racks can be purchased individually, each containing a given number of screws of a single size
Elro Tool & Screw Corp., Rockford, Ill.

12. LIFTER for cinder and concrete blocks saves hands, enables mason to carry and place block on wall before releasing lifter. A U-shaped jaw grips center rib of block, holds securely. Lowering handle of lifter releases jaw from the center rib
Anchor Mfg. Co., McClure, Ohio

13. BENCH-TYPE HOT STAMPING PRESS will mark almost any shape made from plastic, fiber, wood, leather, any material that can be hot-stamped. Machine is hand-operated, uses roll-leaf in various colors. Has automatic roll feed and temperature control
Aeromark Co., 633 Morrell St., Elizabeth 4, N. J.





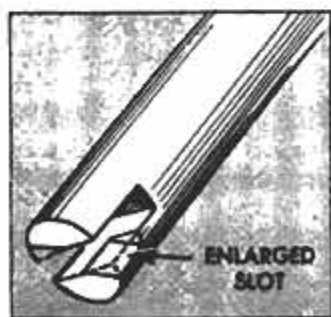
Corrugated-Steel Boat Shed



Lacking space for storing a boat and trailer in the garage, one boatowner erected this corrugated-steel shelter. Since boat and trailer can be parked easily in the shelter, the rig is stored in it when not in use during the boating season as well as in winter. The structure consists of several lengths of corrugated roofing overlapped and bolted to U-shaped frames formed from lengths of thin-wall conduit as shown. A tie rod welded to each frame near the top helps to retain the shape and to provide rigidity for the structure.

L. A. Wilke, Austin, Tex.

Diagnosing Ignition "Flutter"



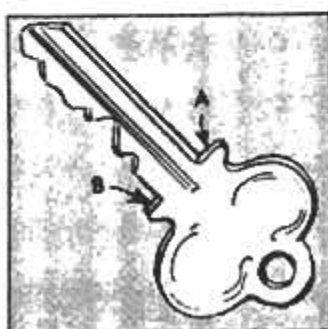
If the timing mark of an engine fluctuates from several degrees advance to several degrees retard when a timing light is used, it generally indicates a worn distributor plate or worn distributor-shaft bushings. There can be another cause, say engineers of the Champion Spark Plug Co. Check for a worn slot in the lower end of the distributor shaft. Worn as indicated, the slot will prevent accurate ignition timing.

When repairing a break in a garden hose, first rub soap on the coupler unit or inside the hose opening. This lubrication makes the coupler slip into the hose easily, and will not damage it.

When repairing a break in a garden hose, first rub soap on the coupler unit or inside the hose opening. This lubrication makes the coupler slip into the hose easily, and will not damage it.

Alter Duplicate Key to Fit Lock

When a newly made duplicate key fails to open the lock for which it is made, try removing the rough edges with emery cloth. If it still fails to work, insert the key in the lock and then withdraw it slightly before attempting to open the lock. If the latter works, remove the key, apply small beads of solder at points A and B as indicated in the detail and then file down the beads until the key operates the lock. A third remedy is to file down the key at points A and B, keeping in mind that only a very small amount of metal may need to be removed. Be sure the key is free of metal filings before inserting it in the lock.



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Frank Shore, New York City

Check Rulings Before Converting Your Gun

It has been brought to our attention by the Alcohol and Tobacco Tax Div. of the Internal Revenue Service that the rifle conversion described on page 225 of the January 1959 issue of *Popular Mechanics* is illegal. This conversion, and any similar conversion, has been ruled (1956) to be a firearm as defined by the National Firearms Act, and the manufacture (conversion) of the same without receipt of prior authority from the Alcohol and Tobacco Tax Div. of the Internal Revenue Service would constitute a felony and also would make the manufacturer liable to a \$200 manufacturer's tax on each firearm so manufactured or altered.

In Revenue Ruling No. 56-195 this conversion is ruled upon as follows:

"The Internal Revenue Service has had occasion to examine a Remington Rolling-Block Carbine of 7-mm. caliber converted into a 4¼-lb. handgun-type weapon chambered for the .257 Roberts Rifle cartridge, with a 9⅞-inch barrel. Held, this weapon is a firearm as defined in section No. 5848(1) of the Internal Revenue Code of 1954 and, accordingly, it is subject to the regulatory provisions of the National Firearms Act (Chapter 53 of the Code)."

Questions on this conversion, or any similar conversion, should be referred to your local office of the Alcohol and Tobacco Tax Div. of the Internal Revenue Service, or to the Director, Alcohol and Tobacco Tax Div., Internal Revenue Service, Washington 25, D.C.



Radio Television Electronics

Go Behind the Scenes to Look Ahead in Electronics

By Lothar Stern

WALK THROUGH the doors of a spacious research laboratory at Princeton, N. J., and you approach the world of tomorrow.

You may not live to see some of its wonders, but another generation will.

Some of the electronic marvels here in various stages of research may never be developed for practical uses.

But tomorrow is not far away for other ideas you see taking form in the famous David Sarnoff Research Center of RCA at Princeton.

- Electronic highways that will guide your car warn you by automatic signals of impending danger.

- Stereophonic transmission of programs by your regular AM radio stations.

- Reproduction of a picture or printed page on any surface — glass, cloth, paper, wood, metal—electronically.

- A typewriter that listens to your voice and automatically types out what you say.

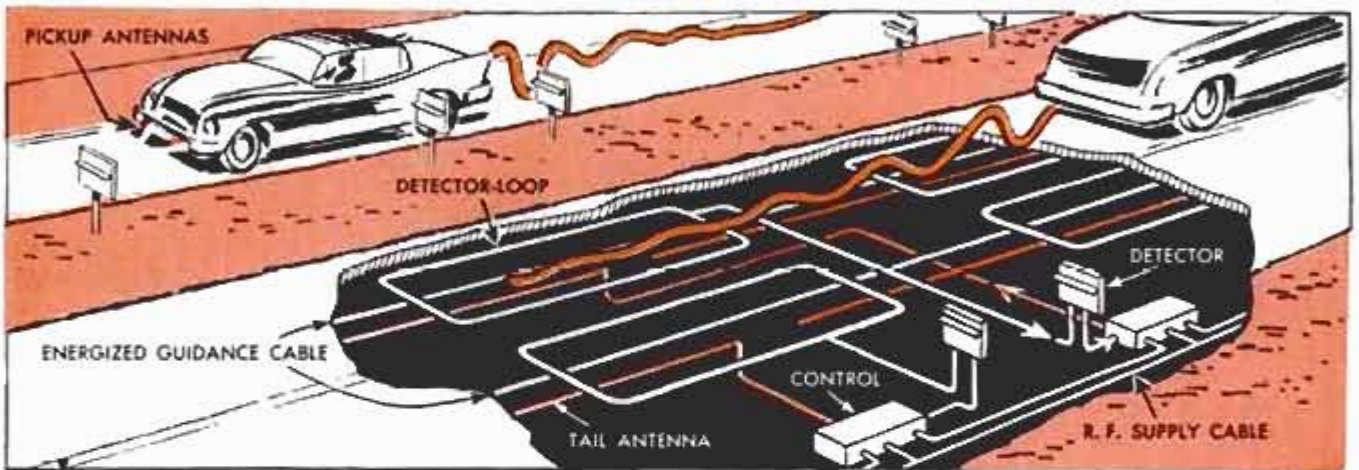
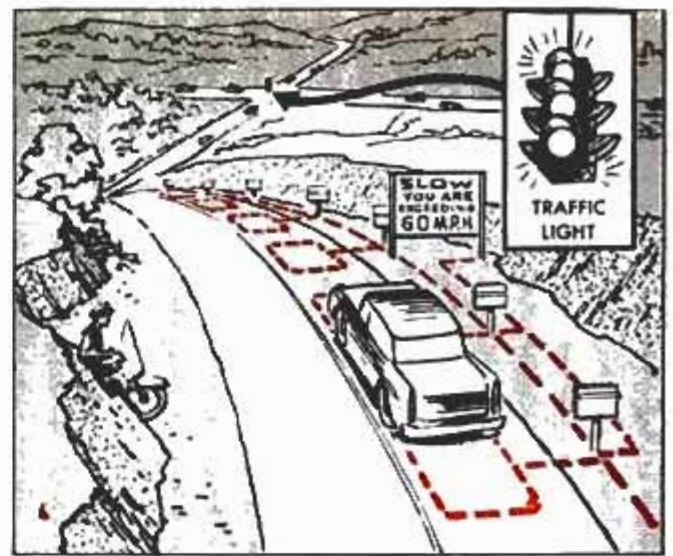
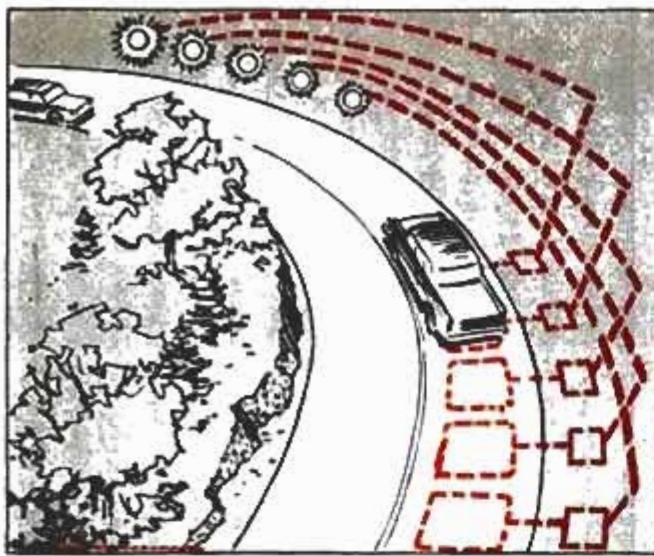
This article explains how some of these "miracles" perform their work. Others will be described in a second report next month.

TOMORROW'S HIGHWAY

At the approaches of the research center a warning sign flashes: "Slower Please." It lights up, that is, if your

car is approaching the laboratory faster than the posted rate of 20 miles per hour. Here is the first step of an automatic traffic-control-and-guidance system — a practical test of an idea envisioned as far back as 1953.

Riding on tomorrow's controlled super-highway will be as safe and carefree as today's rail transportation. In fact, predicts Dr. V. K. Zworykin who originated this particular plan, the day will come when a cross-country motorist can enter a limited-access highway on one end and reach his destination without ever touching a steering wheel or brake pedal. En route, his car is completely controlled by the road itself. Its speed is automatically regulated according to traffic and weather conditions. It will swerve around obstacles, decelerate to avoid collisions with other vehicles or objects and, in general, transform a driver



Electronic installations in tomorrow's highway can light roadside lamps (upper left) to warn approaching motorists, control traffic lights and speed-warning signs (upper right) or provide for automatic guidance and speed control. Roadside detectors and control units may be buried underground in final installation

into a passenger, free to watch television, read or just relax and enjoy the scenery.

Incredible as this may sound, research and development along these lines are far more advanced than is generally realized. In November 1957, the Nebraska Department of Roads unveiled a 320-ft. section of highway in which the RCA-proposed control system had been installed. The subsequent demonstration proved that various phases of the system could be of immediate benefit to all cars, and that complete highway control of specially equipped vehicles would present no serious obstacles.

By February 1958, General Motors had incorporated control devices in an experimental automobile which demonstrated the automatic-guidance feature of the system along a one-mile check road at the GM Technical Center.

Currently, RCA is planning the construction of a complete test track where the over-all system, including fully equipped vehicles, can be studied exhaustively.

How It Works

Basically, the automatic-control system is divided into three integral parts:

1) A sensing system which senses the location of every vehicle on the road.

2) A detection and control system which provides a variety of warning and control signals in accordance with the information obtained from the sensors.

3) A guidance method which automatically keeps a specially equipped car in the center of a traffic lane more reliably than a steady and experienced hand at the wheel.

Here's how the system works:

Embedded under the pavement of each traffic lane is a continuous series of wire loops, each one energized by a high-frequency voltage from a roadside power line. A vehicle passing over a specific loop changes its electrical characteristics and causes a variation in the current flowing through that particular loop. Here then, is the means of sensing the location of all vehicles—regardless of their speed or direction of travel.

An electronic detector—transistorized for maximum reliability and power economy—is associated with each sensing loop. It detects instantly any change in loop current and converts this information into an appropriate signal for triggering a control

unit which, in turn, can provide a variety of functions. It can, for example, energize a roadside sign if a passing car exceeds the speed limit. It can regulate a traffic light at a distant intersection in accordance with the flow of traffic. It could light a roadside lamp some distance ahead of a particular car to warn a driver on the other side of a hill or around a curve of an approaching vehicle. And, because all of the equipment is installed in the road, a vehicle need not be specially equipped to benefit from these functions.

Going a step further, each control unit could, in response to a passing car, transmit a radio signal to an antenna buried alongside the sensing loop. Every vehicle would then leave a "flying tail" radio signal trailing in its wake. If a following car were equipped with a special receiver, this radio tail would provide a visual or audible warning of a vehicle directly ahead.

As a final step, the output of such a receiver could be coupled to the car's acceleration and braking system so that the flying radio tail of a preceding vehicle would automatically govern the car's speed.

For automatic guidance, a buried cable runs along the center of each traffic lane. The cable radiates a continuous high-frequency signal which is picked up by two small antennas mounted on either side of a completely equipped car. With the car centered over the cable, each antenna picks up exactly the same amount of signal. If the car deviates from the center line, however, one or the other of the antennas will receive a stronger signal.

Inside the car, the antennas are connected to a differential receiver whose output controls the power-steering mechanism. When one antenna receives a stronger signal than the other, the receiver pro-



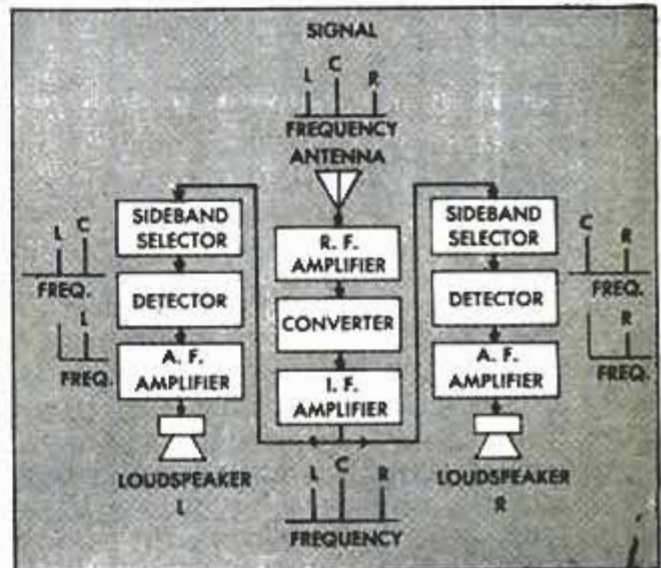
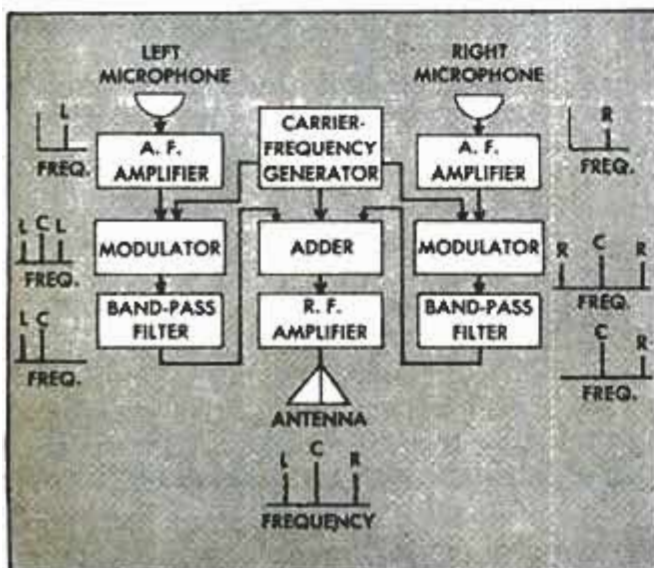
AM radio goes stereo. RCA demonstrates tested method for stereo transmission by single AM radio station

duces an output which causes the steering mechanism to bring the car back in line.

The above description only begins to tell the story of the elaborate system developed for automatic traffic control. Actually, the complete plan calls for much greater versatility and, obviously, there are numerous safety devices and safeguards which take over in case of an emergency. But the real beauty of the system lies in its compatibility which permits coexistence of conventional vehicles and specially equipped ones on the same highway—each one benefitting in direct proportion to the amount of special gear it contains. Thus automotive changes can come slowly and gradually while highway safety and motoring pleasure are increased for all.

How long before tomorrow's dream highway becomes a reality? Even Dr. Zworykin won't make a prediction. Much depends on cooperation between the electronics

Block diagrams of stereophonic AM transmitter (left) and receiver (right) illustrate underlying principles for transmitting and receiving two-channel sound via a single amplitude-modulated radio signal





Printing, engraving or reproducing visual material electronically is simple and inexpensive. Charging unit (left) deposits layer of electrons on coated sur-

face. Exposure (center) creates an electron image made visible by brushing the exposed surface with a magnetic brush dipped in a special powder (right)

industry, automobile manufacturers and highway engineers. But adoption of at least a portion of the system in some roads may not be very far away.

ADVANCES IN AM BROADCASTING

Events are moving swiftly in the home entertainment field and stereo is leading the parade of recent developments. Hi-fi fans, just recovering from the impact of the stereo record, are already anticipating stereo broadcasts via FM multiplexing. Multiplexing is a means whereby two separate audio signals are transmitted on a single channel. The advantages are that stereophonic broadcasts could be transmitted by a single station and reception would require only one receiver. This is in contrast with present stereo broadcasts which require the concerted efforts of two stations and make use of two separate receivers.

But even before FM multiplexing has had a chance to prove itself, RCA rocked the audio world by demonstrating a method for broadcasting stereo on the regular AM band—a method which, if adopted by AM stations, could bring the magic of three-dimensional sound into every home and automobile at a relatively small cost.

The principles underlying RCA's stereo-AM broadcasting system are familiar to everyone acquainted with the process of amplitude modulation. In ordinary AM, the amplitude, or strength, of a radio-frequency carrier is changed in accordance with the audio signal from a microphone. During this process, new frequencies—known as the upper and lower sidebands — are added to the original carrier.

Actually all of the audio is stored in these sidebands, and both sidebands carry identical information. To recover the original audio signal, therefore, only one sideband is needed at the detector of a radio receiver.

The block diagram of a stereo-AM transmitter shows how this principle is utilized for the simultaneous transmission of two different audio signals on a single carrier. Here, the signal from a carrier-frequency generator is applied to two separate modulators, each of which also receives the audio signal from a different microphone. The output of each modulator, therefore, contains the carrier frequency plus the upper and lower-sideband frequencies of the respective audio signals.

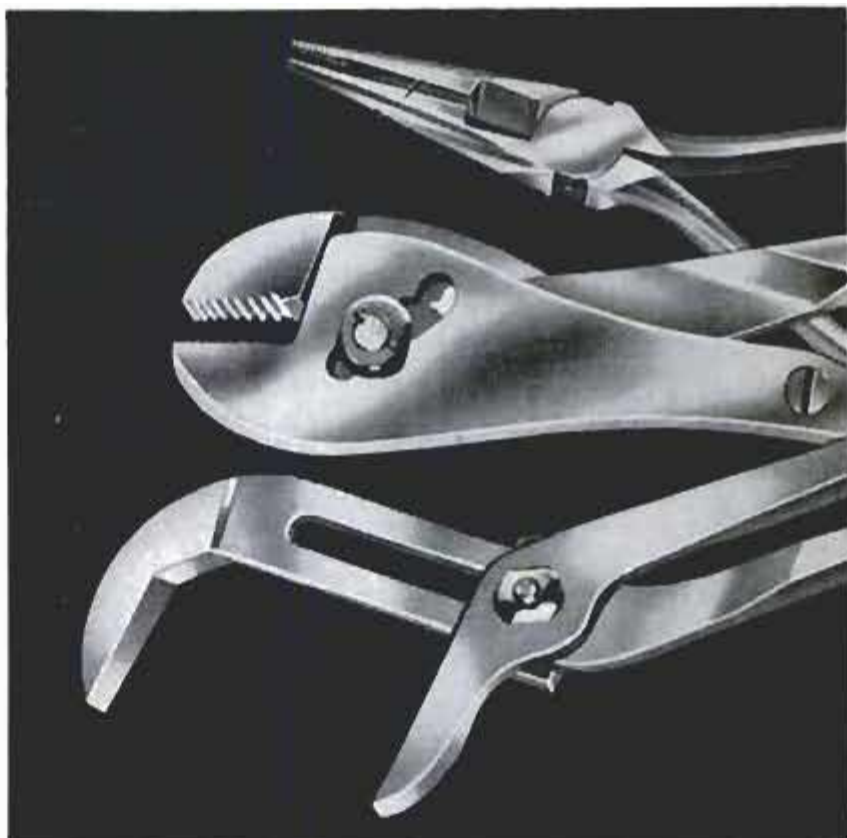
Since only one sideband is needed for faithful reproduction of the original audio signal, the modulators are followed by bandpass filters which remove the upper sideband from the left channel and the lower sideband from the right channel. The two individual AM waves are then combined in an "adder" and the resultant signal again contains an upper and lower sideband. This time, however, the upper sideband carries the information from the right microphone while the lower sideband contains the information from the left one. This combined signal is then amplified and radiated into space.

Sidebands Are Separated

In the receiver the stereo signal is picked up and amplified in the conventional manner. Before being detected, however, it is applied to two sideband selectors which separate the individual sidebands. Each selector is followed by its own detector, audio amplifier and loudspeaker so that each audio channel receives and reproduces the sounds originally picked up by a different microphone — the requirement for true stereophonic sound.

In the design of the stereo-AM system, great care was taken to preserve complete compatibility. An ordinary AM receiver, by adding the two sidebands of the stereo signal in its conventional detector circuit, provides monophonic reproduction of a stereo transmission without deterioration

(Continued to page 240)



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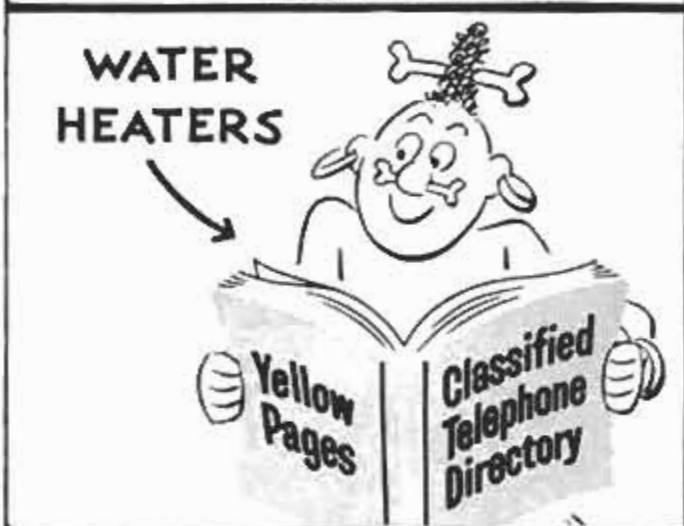


Pliers in the top photo are, from top to bottom: #226, #234, #248-S.

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Window Condensation

Q—Last fall I had my carpenter install a dual-pane window in my living room. I was told these panes do not sweat, but this one does. It clouds up along the lower edge to a height of about 18 in. or so. The moisture is on the inside. Is there any cure for this?—L. O., Miss.

A—You did not say so we will have to assume that the window you refer to is a commercial product and that it was installed in a frame built at the job site. We also will assume that the condensate forms on the room side of the inner pane and not between the panes. If these assumptions are correct, then the cause of the condensation, or sweating as it is often called, is due to a leakage of cold air through the frame at the corners and along the bottom of the pane where the condensate forms. Undoubtedly your carpenter made sure at the time of installation that the pane was correctly installed, but it should be remembered that in a new installation shrinkage of the new frame or structural members can result in openings that will admit cold air during severe winter weather. It should be a comparatively simple matter for your carpenter to locate these leaks and make repairs that prevent a recurrence of the trouble.



Leaf Curl

Q—I have two peach trees in my yard which are just coming into bearing age. Last season I noticed that many of the leaves quite suddenly curled, turned yellow and fell off. One tree lost nearly half of the original leaves. Is this a disease? What can I do to prevent it?

A. W., Mich.

A—Judging from your description we would say that the trees have been attacked by what is known to orchardists as peach-leaf curl, a fairly common fungus disease which is most serious in the northern states. The fungus spores live through the winter on the buds and become active in the spring after growth starts. Unless checked the disease will interfere with the setting of fruit and will eventually kill the tree. Perhaps the best preventive measure you can take at the present time is to spray the trees, before the buds swell, with a lime-sulphur solution in the proportion of 1 gal. of the

(Continued to page 220)



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(Continued from page 218)

concentrated lime-sulphur to 10 gal. of spray solution. Or, purchase a prepared lime-sulphur mixture and mix your own spray, following the instructions on the container. Spraying of only two trees can be done with a knapsack sprayer or a garden-hose attachment, but take pains to do a thorough job of covering the entire tree. Follow with the same spray in the fall.



Door Rattles

Q—My home faces west and when the wind blows briskly from that direction the front door rattles. I weather-stripped both the regular door and the storm door, but still the inner door rattles. I even moved the lock plate, but that did not correct the trouble. What to do now?

S. D., Kan.

A—What you have already done ordinarily cures quite persistent door rattles—unless the hinge pins are loose. Did you check them? Rust and lack of lubrication can cause rapid wear of hinge pins and in older doors this can result in appreciable play between the door and jamb, and movement between the hinge leaves when the door is closed. It also is possible that one or both hinges are loose on the jamb due to worn or otherwise enlarged screw holes. This would be a rare cause of rattling under wind pressure, but it is a possibility that should not be overlooked. Sometimes merely turning the hinge pins a quarter or half turn and tightening the screws in the jamb will cure the trouble, but the method is not entirely reliable. If, on removal and examination, the pins show undue wear, the best remedy is to replace the hinges.

Frost Injury

Q—I have been told that potted plants that have been frozen can be saved. Can this be true? And if it is, what must be done to save the plants? Also, I understand that sprinkling with a hose will prevent frost damage to tender plants. Right?

E. T., Pa.

A—Right. But sprinkling is not a common practice and neither is it considered entirely reliable or practical, although the method has been used by commercial growers as an emergency measure. Of course, sprinkling cannot be fully effective unless continued throughout the danger period, which usually means through the night or until such time as the plants can be moved or otherwise protected. As a rule a covering of newspapers or fabric will protect potted plants and annuals against damage by light frost. It is important that the paper or cloth cover the entire plant and reach the ground all around to prevent drafts of cold air under the covering. The covering should be weighted with bricks, small stones or soil. "Un-freezing" plants that have been frosted calls for quick action. They must be moved immediately, before the sun strikes the foliage and before they have a chance to thaw, to a cold room where the temperature is only slightly above freezing. This permits the foliage and the stems to thaw as slowly as possible. If freezing has not been too severe it usually is possible to save the plants.

Mold on House-Plant Soil

Q—I've noticed that the top of the soil in my house-plant pots gradually becomes covered with a mold-like coating that looks something like moss. Is there any way to prevent this?—W. G., Ind.

A—If we can judge correctly from your description this is not actually a mold, but what appears to be a coating over the top of the soil is known as algae, the term referring to tiny plants which grow as a mass. To prevent their growth, keep the soil stirred lightly and water regularly with a solution of potassium permanganate in the proportions of about 6 or 7 drops to 1 gal. of water.



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You Ought to Keep a Bee

(Continued from page 133)

nectar for making honey. But flights this long will not produce much surplus to sell. A few hundred yards' distance from the colonies to the flowers is better.

Three Acres per Hive

For good honey production, experienced beekeepers figure about three acres of heavy flowering plants are necessary for one colony of bees. This information should help the beginner in deciding upon a location and should steer him from any ideas of planting seed to grow his own nectar for the bees. He simply won't be able to plant a sufficient supply at a cost in keeping with his returns. Let others do the planting and raising of plants for the bees, or depend on nature.

The kind of flowers from which bees gather nectar will make considerable difference in the flavor and color of the honey. Some flowers, like horsemint, produce a strong-flavored, dark honey that does not sell well. It makes only a fair table honey, most of the commercial production going into the bakery trade. Clovers and alfalfa make the best honey.

Bee Dance Has Message

It is amazing how bees can locate new sources of nectar and communicate the location to others. They send out scouts to find new fields of blossoms. After discovering such fields, the scout bees hurry back to the hives and by a series of bodily "dance" movements they tell other bees the location of the field. These bees, in turn, fly to the newly discovered nectar source where they load up for the return trip to the hive.

How do the bees communicate? That's one of the many interesting things about beekeeping. Along your road of experience, you'll find out how bees communicate and many other interesting facts. Meanwhile, it takes only one colony of bees to get started in this fascinating hobby-business. Likely, you'll be glad you did. ★ ★ ★

Preserved Pollen Grains Record Prehistoric Life

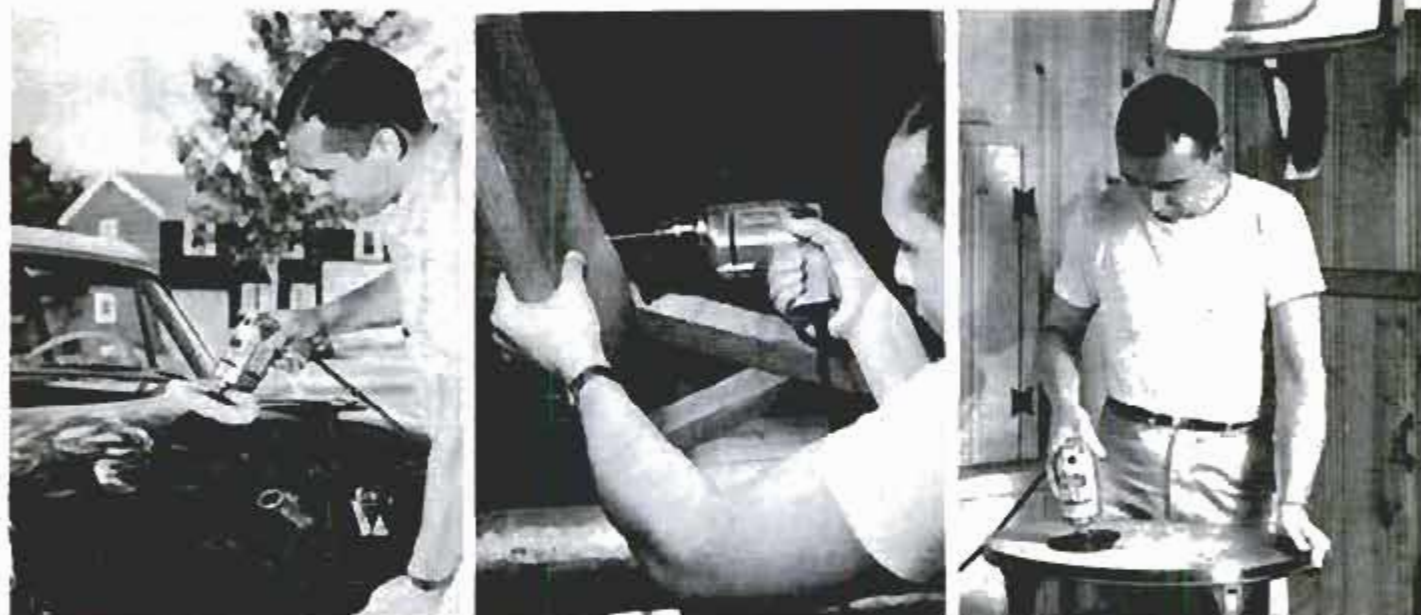
Geologists are able to reconstruct the vegetation, climate and living conditions of millions of years ago by examining thin layers of pollen preserved in sediment. The pollen grains rain invisibly from the atmosphere after they are carried from plants by the wind. They are able to resist destruction because of their wax-like walls.



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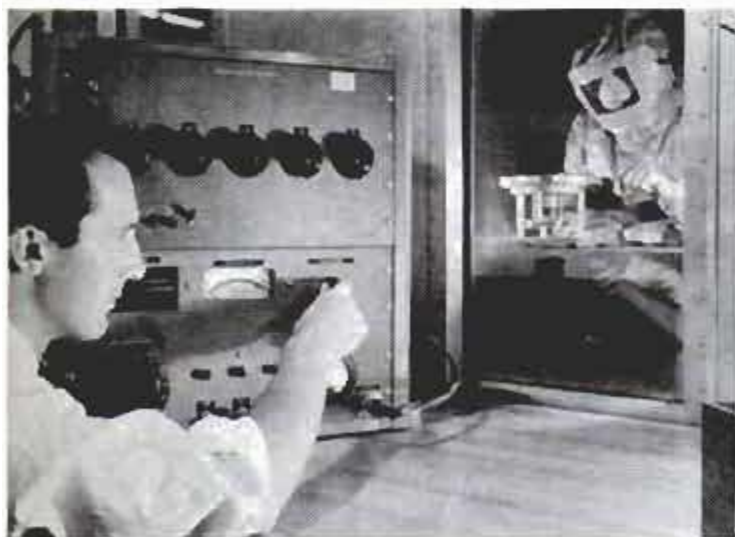
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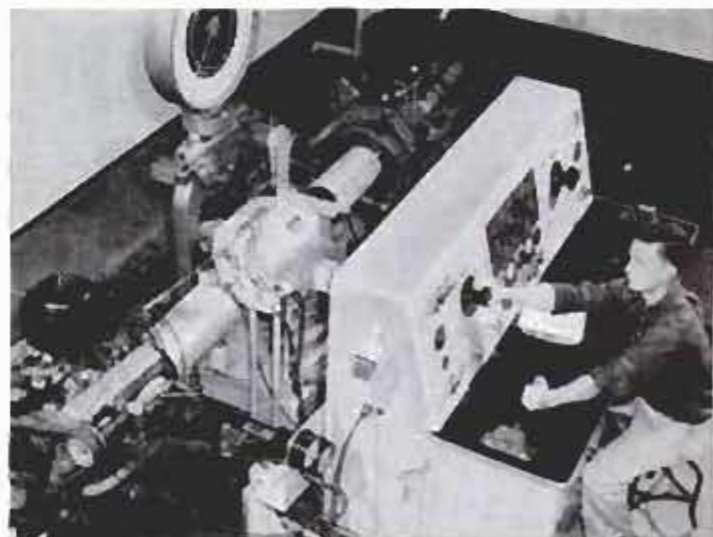
AC, sharing some of its basic patents with others, pioneered and developed the kind of

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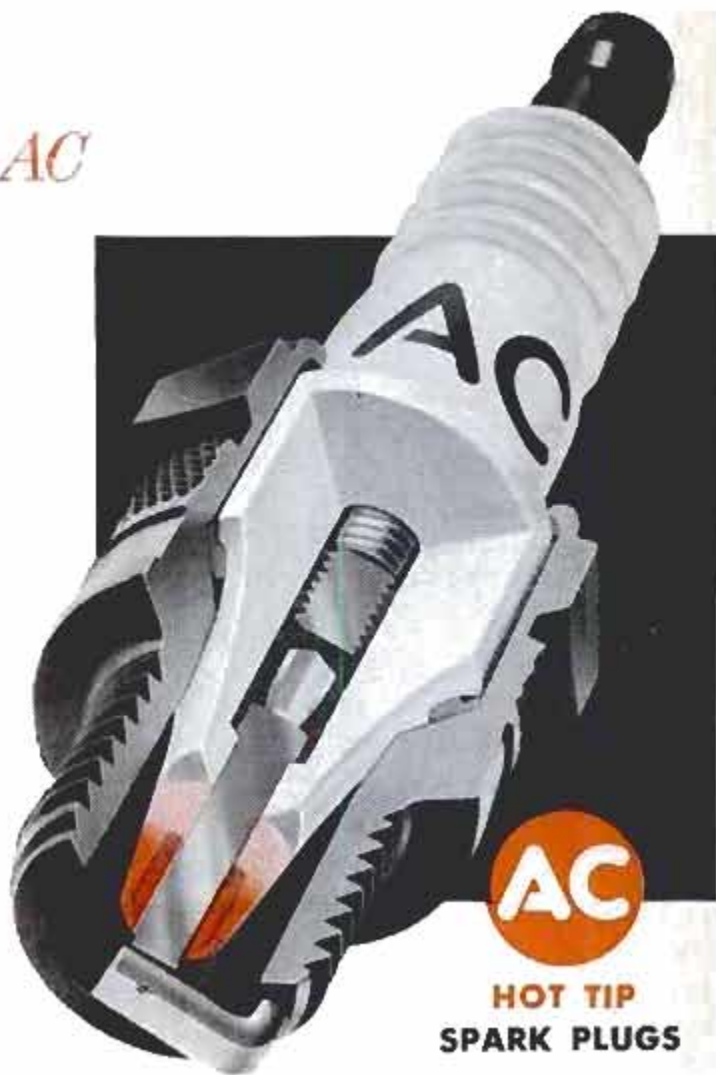
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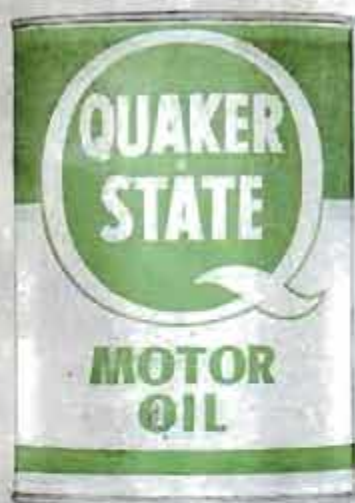


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A Prefab Tunnel Conquers A Tough River

(Continued from page 126)

constructed ashore in sections. Instead of tunneling under the river bed, a 40-foot-deep trench was sucked out and the sections were then floated into position, sunk, and sealed together on top of a padding of gravel. The first step in connecting them was the linking of a huge hook-and-eye arrangement. In the past, tunnels have been circular, because of the erroneous belief that they were easier and cheaper to build that way, but the Deas Island Tunnel was built on the square.

"The height of a circular cross section is governed by the width required to accommodate the necessary roadway," Ole Bentzen explains. "Whereas, that of a rectangular cross section depends solely on the vertical clearance required for the traffic lanes. Also, for the same navigable depth, a circular tunnel must be carried deeper, which means longer and deeper approaches and, therefore, greater cost."

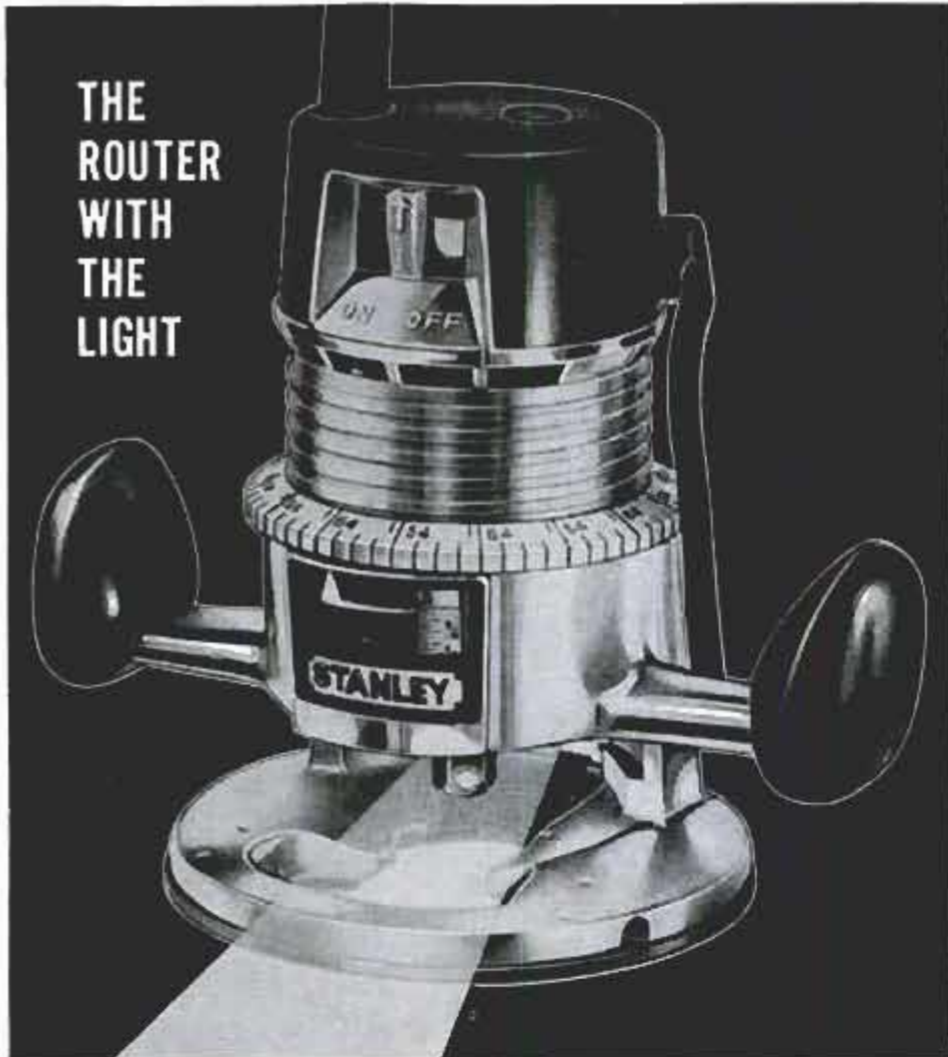
Construction, which was started in March of 1957 and was completed late last year, cost \$16,600,000. It involved the use of \$2,000,000 worth of equipment, 100,000 cubic yards of concrete and 12,000 tons of steel. Excavation and backfill totaled 2,500,000 cubic yards. As many as 800 men were employed at one time, but the crew averaged between four and five hundred. Not the least significant record established was that of safety, which resulted from the wearing of lifejackets as well as hard hats by all workmen on or near the water, plus weekly safety meetings throughout the term of the project. Although 90 percent of the work was dangerous, there was never any serious time loss and no loss of life.

This fact is brought into sharp focus when contrasted with the record of another B.C. construction job of similar magnitude, the \$16,000,000 Second Narrows Bridge, an intercity link connecting Vancouver with its main suburb, North Vancouver, across Burrard Inlet. This structure and approaches, with a total length of almost two miles, was originally scheduled to be completed about the same time as the tunnel, but was tragically delayed last June. Two 70-foot sections of the mile-long bridge gave way, workers fell 200 feet to the water and 22 men were killed.

The Deas Island Tunnel probably set a new record for attracting sight-seers, since as many as 10,000 local citizens and tourists served as sidewalk superintendents on week ends. The first act of the big show

(Continued to page 228)

**THE
ROUTER
WITH
THE
LIGHT**



NEW SAFETY SWITCH
Locks shaft automatically. Lets you change bits fast with just one wrench.



FAST DEPTH ADJUSTMENT
Unique depth gauge sets bit for cuts as fine as .004 inches — in seconds!



PERFECT VISIBILITY
Spotlight and open base let you see where you are and where you're going.

Full 7/8 hp...only \$62.50...with these exclusive new features!

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Comfortable 3-position handles give you perfect balance and control on all cuts.

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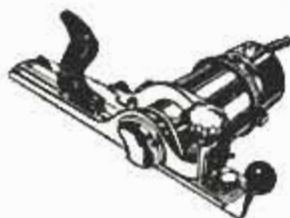
Easy handling! With it goes the power and speed (23,000 rpm) to make accurate cuts, quickly. See the H264 and the 1 1/4 hp H267 today! Stanley Electric Tools, Div. of The Stanley Works, 623 Myrtle St., New Britain, Conn.

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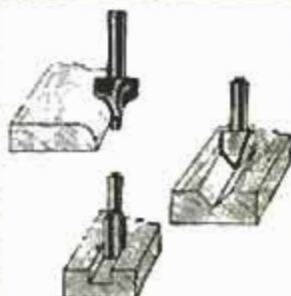
Stanley's H15 1/4 hp router. Ideal for light, delicate work. A professional tool yet only \$42



New heavy-duty H283 power plane. Perfect for fitting doors, windows. Cuts to 1/16" wide. \$89.50



H45 1/2 hp router. Another in Stanley's complete line. Powerful, rugged. Only \$49.50



Stanley offers hundreds of router bits plus the most complete line of router accessories.

was the construction of the elements by Narod, Dawson & Hall. Scene 1 was a huge excavation, 684 by 933 feet, 20 feet below the surface of the Fraser and separated from it by an earthen dike. This open cut was used as a drydock during the building of reinforced-concrete sections, each 344 feet long and 24 feet high, weighing 18,500 tons. When they were completed, it was converted to a graving dock by simply breaking through the dike. The flooded sections were then pumped out so they could be floated to the outfitting jetty where their waterproofing, a combination of built-up bituminous and light-steel mantles, was checked by an automatic leak-testing system. Each section was then fitted with a 70-foot stack supporting a shaft with a 6-foot manhole, to allow access after sinking.

Foolproof System Necessary

One of the problems was to keep the sections watertight while workmen went inside to break away temporary bulkheads and finish off the joints with concrete. The sealing system used in constructing the Maas Tunnel had been far from satisfactory, and there was no intention of undertaking the Deas Island job unless a foolproof system could be devised. Company after company turned it down, but Gutta Percha & Rubber Ltd. of Canada tackled it.

Months of exhaustive experimenting led to the development of huge rubber pneumatic seals, resembling colossal inner tubes, each 80 feet long, 26 feet high and 30 inches thick. Designed to withstand pressures up to 4000 tons, these were installed at the ends of five of the tunnel sections. The air space was filled with water and the section was sunk and moved into position near the previously positioned one. Water was then pumped out, the sections were pushed together and the seals kept workmen perfectly safe while permanent joints were secured. While the rubber will deteriorate in about 18 months, this will have no adverse effect, because all joints will have hardened.

Besides, the tunnel is well-encased by concrete "mattresses," timber lagging, sand jetting and backfilling, so that neither ocean nor river action will disturb it. Also, it should easily withstand the most severe earthquake shocks to be expected in the area. Each section is anchored in place by four 37-ton concrete blocks, interconnected in pairs with 12-inch steel pipe, and secured by cable suspension. The whole tunnel is tied to several 3100-pound Dutch anchors (looking like inverted umbrellas, with 7-foot flukes that open when a pin is pulled after they have been placed 30 feet beneath

the bed of the river) and three 7000-pound Navy anchors.

The "sinking fleet" was made up of 14 equipment carriers. Key vessel was a "floating rig" formed from four steel scows, which was used to ease the sections to location and maneuver them into position above a predetermined center line. The rig was hooked up to a complicated system of winches and land and river anchors, and movement was controlled inch by inch as engineers eyed instruments that measured river velocity, tide elevation and the stress on every cable. Typical of the extreme caution with which the sinking operations were carried out is the fact that the top recommended speed of movement was six inches per second, but the first element was moved only 12 inches per hour.

"Anything to do with the Fraser presents problems," Fred Knez, one of the project managers points out. "It's a most difficult body of water. More than anything else, the project required patience. It took three hours just to move one of the sections into the floating rig, seven more to arrange the winches and anchors preparatory to sinking. From outfitting jetty to final position, the first section kept us busy for almost 14 hours."

The actual placing operations were commanded by K.P. Kitchen, a Kiewit riverman of 50 years' experience. While four divers described underwater progress every foot of the way, Kitchen issued instructions by radio from a control room aboard the floating rig—calling for a cable to be clinched here, a pump to be started or stopped there, a jack to be operated somewhere else.

Serving over 3,000,000 residents of the Lower Fraser Valley and 650,000 in Vancouver, the tunnel was built for the Department of Highways and will be operated by the Toll Authority. Maintenance and operation are estimated at \$50,000 annually, and the toll will be 25 cents. Its effect has already been felt on Vancouver Island, where tourist trade is of great importance.

It's more than possible that the success of the tunnel will eventually lead to a similar but much more ambitious project—an underwater passage linking Vancouver Island to the mainland. In any case, the amazingly accurate engineering and almost faultless design of the Deas Island Tunnel have added to the wonders of the modern world. ★ ★ ★

☞ Floating on water that is more than 2000 feet deep, Ross Ice Shelf in the Antarctic is about 1000 feet thick and about as large as France.

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Every Johnson Sea-Horse is sold with a factory warranty—now more valuable to you than ever before. The new Johnson warranty not only covers all parts of the motor, but it also assures expert installation of warranty-covered parts by any Johnson dealer, anywhere—at no charge to you.

Wherever you go with your Sea-Horse, Johnson service stands behind it. A far-flung network of 4000 certified dealers and 1300 Master Service Stations ready to serve you. Even thousands of miles from home, you are never far from reliable Sea-Horse service—the same kind of conscientious service you'd expect from the dealer who sold you the motor. Johnson pays any Johnson dealer

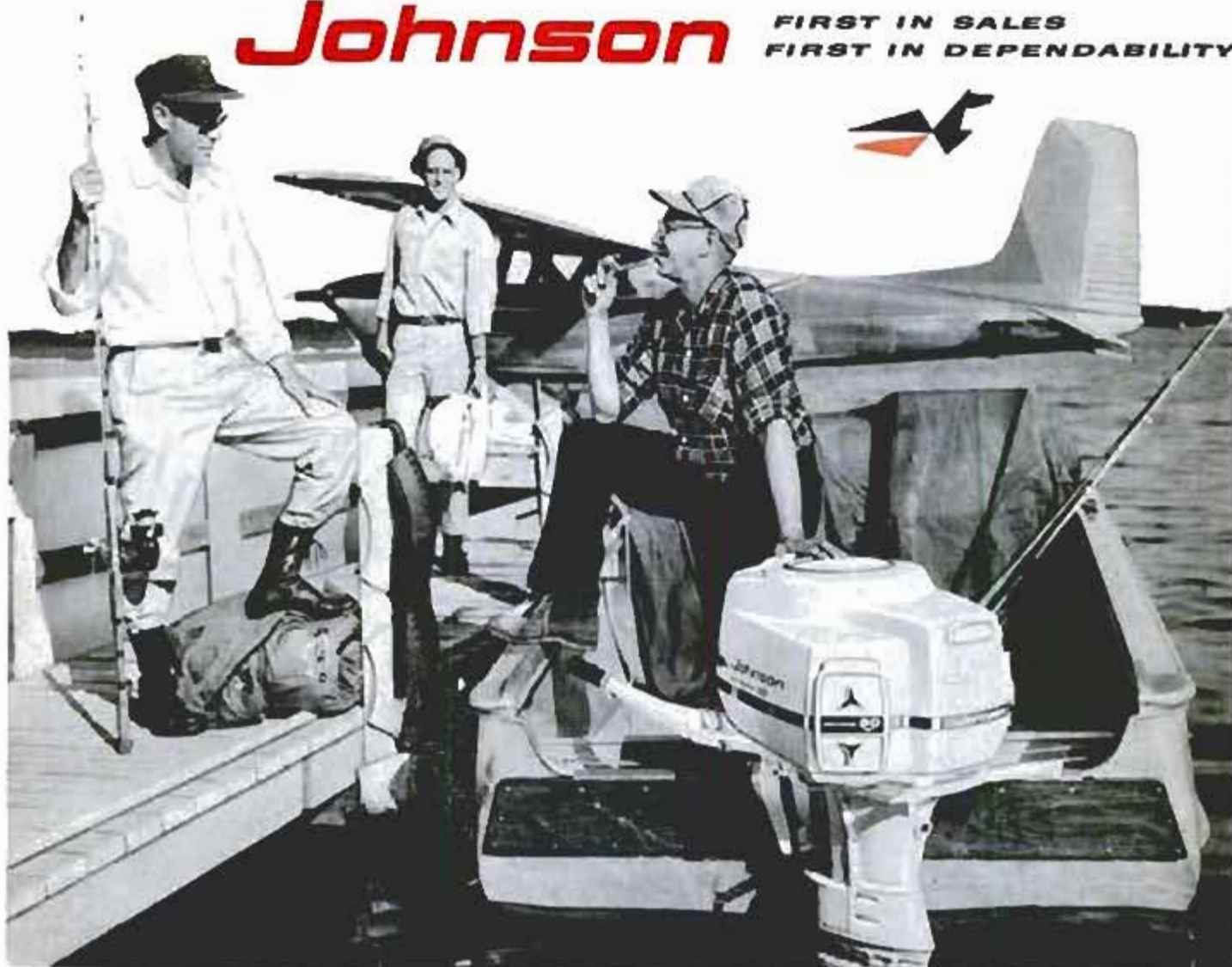
who gives your motor warranty service.

Remember—when you buy a Sea-Horse, you get an outboard that is built to be dependable. Every Sea-Horse is test-run and adjusted under running conditions before it leaves the factory. *And*—you get a motor that is serviced to stay dependable. Proof of dependability is the fact that this year Johnson will build its *two-millionth motor!*

For '59 Johnson leads with the newest and best in outboards: Dynautical Design to go better with your boat—make your boat go better. Sizes range from 3 to 50 hp. Visit your nearby Johnson dealer's All-Family Boat Show—March 6 to 15. Get the inside story from the man who knows outboards best!

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So says an expert who has been using tools and teaching with them for 50 years. Mr. Maximillian Komow knows tools. He also knows the amazing performance of Stanley SURFORM. He recommends it enthusiastically.



Pocket SURFORM
\$1.49 complete

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EXTRA! New Blades Now Available!

- Full size flat blades—98¢ each
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See Stanley SURFORM. Try Stanley SURFORM. You'll want Stanley SURFORM in your shop. On sale wherever good tools are sold.

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Division of The Stanley Works, New Britain, Conn.

Canada's Fabulous Submarine Killer . . . HMCS Restigouche

(Continued from page 117)

surface or resting on the bottom in shallow water. Then we can blast it with our torpedoes, mortars or the anti-aircraft guns if necessary."

After a tour of the *Restigouche* and an inspection of its searching, tracking and killing devices—most of them electronically guided and remotely controlled—it seems the only place a submarine would be safe from this ship would be under the Arctic ice. The *Restigouche* has three different types of radar and five types of hull-fitted sonar underwater-detection gear, the latter designed to overcome limitations of unfavorable water temperatures, salinity and other conditions.

Under a hatch on the after deck is an innovation in antisubmarine warfare—six deadly 12-inch mortars in two triple mountings. These take the place of the old "ash can" depth charges and can be fired in any direction and with variable range. Lt. Allan F. Morris, torpedo antisubmarine officer, explained that the mortars can be fired individually or all together. When the ship is tracking a submarine with her sonars the information as to speed and depth is fed into a computer that automatically relays the information into the firing station and into the fuses of the mortar bombs. As the submarine goes into evasive action the computer supplies a constant up-to-the-second reading as to its position. When the shooting is over, the hatch above the mortars is closed and serves as landing space for a helicopter.

In the torpedo room, also under remote sonar guidance, homing torpedoes are aimed in the vicinity of a submarine where the "bloodhound" apparatus takes over and relentlessly tracks down the enemy. Lt. Morris explained that there is no danger of a homing torpedo turning back on the

(Continued to page 232)



Insignia of the *Restigouche* bears a fish spear indicative of underwater hunting—fish or submarines



Beautiful wood-paneled walls that last a lifetime—go up in a weekend!

Charter Birch paneling, preserved by exclusive Weldwood lacquer finish, has the look and feel of luxury—only \$52 for a 12' x 8' wall.

Wood paneling does wonders for walls. These new Charter Birch panels, rich in swirls, burls and color variations, are cut to bring out the natural beauty of the wood. Change the style and color scheme of your rooms as often as you like—Weldwood wood paneling, guaranteed for the life of your home, flatters any color

scheme you choose and any furniture style you own.

Install in a weekend. The 4' by 8' random-plank styled panels go up fast with no on-the-job fuss with finishing. Weldwood prefinished panels come ready-made to brighten your home. If you prefer, you can buy Weldwood Paneling *unfinished* at lower cost. See more than 70 types and finishes of Weldwood paneling at your Weldwood lumber dealer's or any of our 115 branch showrooms in U. S. and Canada.



No nail holes mar your handsome wood paneling when you put it up with Weldwood Contact Cement. Gives a permanent bond to furring strips. No clamping necessary.

WELDWOOD® PANELING 
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Please send me a copy of the new full-color folder, "Presenting Weldwood Prefinished Paneling for Fine Interiors," which beautifully illustrates in color the 14 Weldwood prefinished woods and gives complete installation details. I enclose 10¢.

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RESISTOR SPARK PLUGS WITH

POWER TIP



AT LOW SPEEDS
Power Tip is hot to burn
fouling deposits away clean.

AT HIGH SPEEDS
Power Tip is cool to check
costly pre-ignition.



**"FIRE UP" AT
ALL SPEEDS
WITH
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POWER TIP!**

**Power Tip cleans itself
while you drive!**

ship because of preset depth control.

A twin 3-inch .50-caliber antiaircraft gun is mounted aft and a new twin 3-inch .70-caliber gun is mounted forward. The latter has a faster rate of fire than the .50-caliber gun and is said to be one of the most effective weapons ever mounted on a vessel of this size. Earlier destroyer escorts of the St. Laurent class carried only the .50-caliber guns. Both guns can be aimed and fired remotely from below decks, remotely from a visual-control station, or locally.

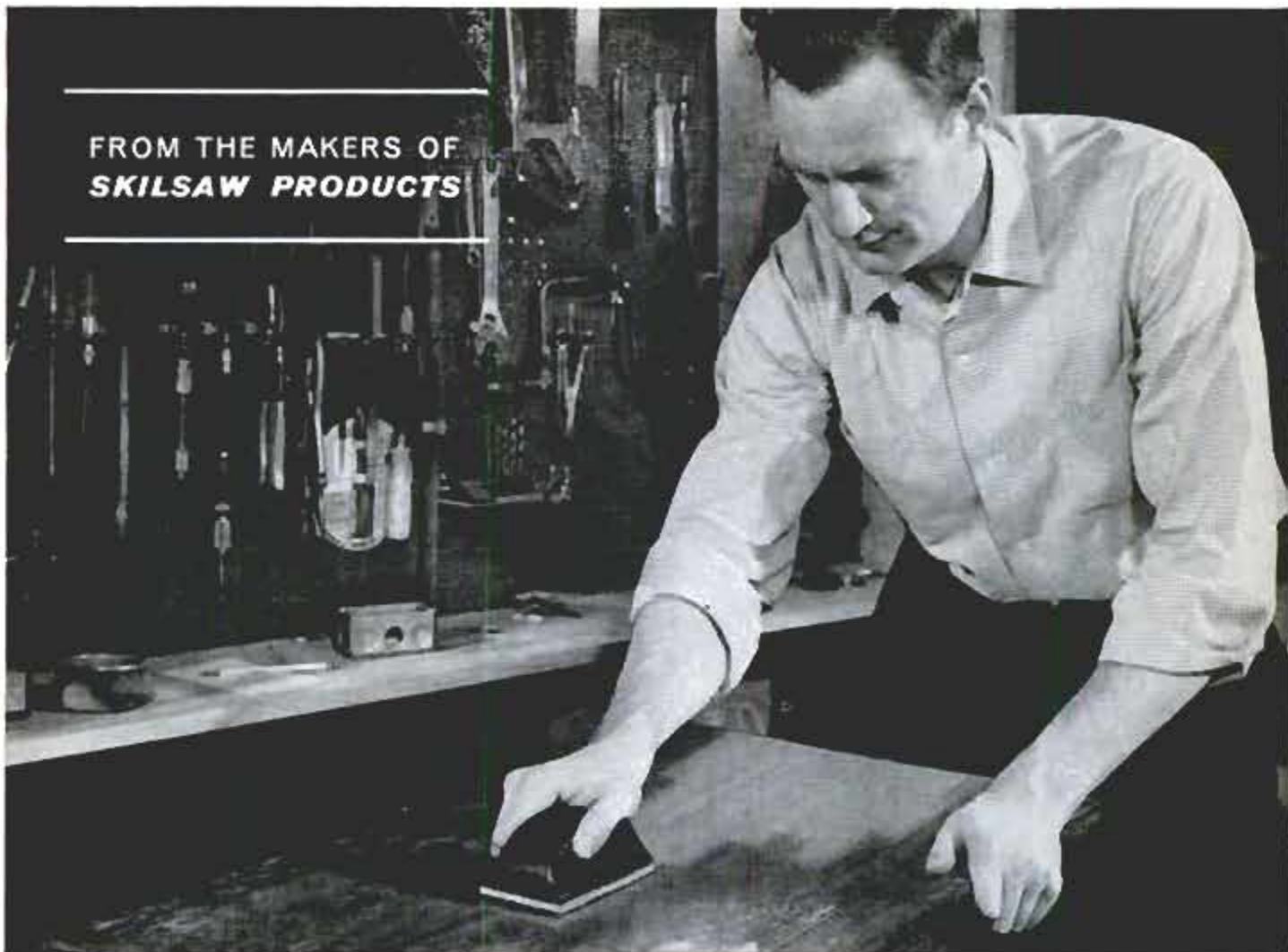
The Combat Information Center (C.I.C.) of the *Restigouche* is located convenient to the bridge and is the nerve center of the ship. Here are two big plotting tables, an array of radarscopes, a big aircraft plotting board, and an adjoining sonar room fitted with a battery of gear and computers. One of the plotting tables is used to plot the small-scale over-all scene of action and the other the large-scale immediate vicinity of the ship. All radar and sonar information is fed automatically into each table. In addition to the scopes activated by the ship's three radars are two screens that can pick up pictures from airplane radars.

The *Restigouche* can fight blind without a single man on deck. In C.I.C., lighted only by the eerie reflections from screens and plotting tables, the combat officers know the position of friend or foe in the air or on the sea—with special attention to the enemy below. With the miracle of electronics at their finger tips, mortars can be fired and torpedoes launched. A hit is recorded by the simple disappearance of a hitherto bothersome blip or streak on a radarscope. If he chose, the captain could shout: "Sub electronically sighted! Mortars electronically aimed and remotely fired! Hit electronically recorded!"

Just in case the insulated and air-conditioned *Restigouche* should be traveling sealed through an area of radioactive fallout during this action, the captain could turn to his intercom and order that all decks and superstructure be washed down. This, too, is done remotely with a spray installation that gives the ship a giant shower bath. They call this operation "pre-wetting." The rounded edges of the deck permit the fallout to be washed into the sea. There are no scuttles or vents opening onto the decks and every protrusion that might catch fallout has been eliminated. Lt. Comdr. G. H. Somers, engineer officer, pointed out that even the boiler room, not being pressurized, can be sealed off from contamination. The anchors are housed in recesses and the capstan and cable chain, usually located on the fo'c'sle, are below

(Continued to page 234)

FROM THE MAKERS OF
SKILSAW PRODUCTS



new PERMA-GRIT* hand sander cuts sanding time in half...

A wonderful, new workshop abrasive. Sands twice as fast as old-fashioned sandpaper. Can't be beat for removing old paint or enamel or for sanding wood, plastics, dry-wall, compositions.

Outlasts hundreds of sandpaper sheets—Made with tungsten carbide particles permanently bonded to steel. Always stays sharp and ready to use any time.

Deluxe Hand Sander Kit—Hand sander comes with two sanding sheets, one fine and one medium-coarse, at \$2.95. Sander with choice of either sheet, only \$1.95. Try a free demonstration at your local hardware, paint or lumber store.



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Flat or curved file,
twice as fast



Files, sands, planes,
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Safe wheels for table
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Made only by SKIL Corporation,
manufacturer of famous SKIL
and SKILSAW products, 5033
Elston Avenue, Chicago 30, Ill.

10 years

from now you too,
will be glad
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ALUMA
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"Our family has enjoyed ten years of glorious fun with our Aluma Craft. Dad does most of the fishing. The youngsters do the water skiing and the whole family goes along for week-end cruising. Our boat hasn't cost us one penny for upkeep and is still just as good as the day we bought it."

That's the kind of letters we get because every Aluma Craft is built, and guaranteed in writing, to give years and years of fun-filled, trouble-free pleasure.

The smooth, clean Aluma Craft lines instantly reveal to the experienced eye the built-in stability and the fine performance qualities of these pre-formed aluminum boats that let your motor operate at peak efficiency. Both the live-weight positive flotation and maximum horsepower are OBC certified for every model.

See new Aluma Craft now on display at your dealers or write for free, full color catalog.

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● Please send catalog
showing Aluma Craft's top-flite line for '59.

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decks. In case any members of the crew are exposed to radioactivity, there are two decontamination rooms on the ship.

In time of combat or peaceful cruising, the *Restigouche* can always keep in touch with its fighting "team" of ships and planes or the outside world. She has three radio rooms for transmitting and receiving on low, medium, high, very high and ultra-high frequencies. It's possible to broadcast or receive from 28 places on the ship. There's a message center with teletypewriter, and a cryptographic room with the latest equipment in coding and decoding devices. For internal communication, the *Restigouche* has 12 separate telephone systems including lines for fueling at sea, docking the ship, radar maintenance, and a dozen loudspeaker systems.

If the ship is crippled in action, the supply officer and engineers have a storeroom filled with 12,000 repair parts and a small but well-equipped workshop. Another storage item of interest to the crew is frozen provisions for 90 days. Back in World War II, destroyer escorts carried only enough fresh food for two weeks.

If the worst comes—an enemy torpedo ripping through the hull of the ship—the *Restigouche* is designed to give its crew a fighting chance for survival. This ship is designed to stay afloat and erect when 70 percent of it is flooded. Formerly, when the engine and boiler room of a destroyer-type ship was flooded, the vessel would capsize almost at once.

The stability of the *Restigouche* is dramatically demonstrated with a \$50,000 transparent model of the ship in the Canadian Navy's ABCD (Atomic, Biological, Chemical Warfare and Damage Control) School at Halifax. The model faithfully duplicates the volume of each compartment in the ship and the weight distribution. It is set in a large tank of water and is flooded by an intricate arrangement of valves.

"The ship has a low center of gravity," explained Lt. Comdr. Ian C. Martin of ABCD, as he proceeded to sink the model. "Even when flooding it will not list more than 18 degrees either way. As the ship fills with water it rights itself and her decks are almost horizontal to the sea until the last. There are many reasons for this ship's amazing stability and buoyancy. The designers used a lot of aluminum in its construction, particularly in the upper parts. Also, the shape of the hull is very important as is the fact that there are no longitudinal bulkheads. All bulkheads are crosswise of the ship. We all think Commodore Rowland Baker did a fine job on the design."

Although Comdr. McDowall insisted that

(Continued to page 236)




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\$5,000
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 During the past 53 years Aladdin has sold more Read-Cut Homes than any other pre-cut house manufacturer. Aladdin Read-Cut Homes have been built in all 49 states and 38 foreign countries. Today, thousands of these homes are as sound and livable as they were 50 years ago. The reason: — High Quality Material plus Sturdy Construction. You enjoy Economy, too, through Aladdin's tremendous Buying Power and Advanced Manufacturing Methods. And you can save up to 30% on labor by doing all or part of the work yourself. More than half of our customers build their own Aladdin Homes. All material is precision cut in our mill — ready to use. Easy-to-read blueprints and special instruction book simplify every step. Aladdin offers the latest designs—5 to 8 rooms—Colonial, Ranch, Cape Cod, Split Level, and 2-Story. Mail coupon today for our beautiful 72-page, full color, 1959 "Book of Homes".



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NEW...different

Dual Action
MOTOR OIL
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Short trip city driving causes "cold engine" sludge that promotes excessive wear. Long trip "hot engine" highway driving produces power-robbing piston and valve varnish. New Kendall Dual Action Motor Oil solves *both* problems... sells at the *regular* price.

Ask your favorite dealer for it

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BRADFORD, PENNA.

I view the sinking of the model in order to appreciate the stability of the *Restigouche*, he begged off attending Lt. Comdr. Martin's demonstration.

"I don't care to see even a model of the *Restigouche* go down," he said.

The commander's feeling for the ship is reflected by all 15 of his officers and the 210 men of the crew. They like the life on board, the good bunks, the same good food served to both officers and crew, and the reasonably late movies in the big dining hall in the evenings. The men even are tolerant of Lt. Comdr. Somers' avocado pear tree that grows in a wooden tub in the officers' ward room.

They are proud of the little as well as the big things on the ship, like the windshield wipers on the electrically heated windows of the bridge, the scores of luminous disks on gun protrusions and ladders that save cracked heads and shins in time of blackout. They like the idea of the intercom and lighting systems that have battery-operated auxiliaries in case the big generators are knocked out.

HMCS *Restigouche* is a combat ship of which any great navy could be proud. Men of the Royal Canadian Navy are especially proud when they recall that the entire fighting strength of the RCN at the beginning of World War II was just 13 ships—six destroyers, five minesweepers and two training vessels. ★ ★ ★

This Month's "Great Pioneer in Science"

(Page 16)



Charles Goodyear (1800-1860)

BUY **GRAVELY** FOR

MORE PERFORMANCE

MORE POWER

MORE FOR YOUR MONEY

Why tolerate equipment you have to push, pull and pamper? The Gravelly and its Rotary Mower attachment solves your toughest mowing problems!

Whether you cut and mulch heavy, tough weeds over the roughest ground, or mow the finest lawn, Gravelly does the job *better!* Because Gravelly, with its extra power (now 6.6 HP) and versatility, does more tough jobs other tractors can't!

30 Tools



SINCE 1922

UNMATCHED PERFORMANCE!

Choose the tools that fit your jobs from 30 year-round attachments. All powered by one Gravelly tractor!

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Big, 24-page illustrated booklet, "Power vs Drudgery", shows how the Gravelly solves your lawn and garden problems . . . Write for it today!



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• POWER REVERSE

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Power attachments *securely* mounted by only four bolts. Balance, easy handling, simple controls. Cutaway view shows Gravelly's clean, compact, power-engineered design — the reason for its remarkable performance. Make the wise choice — choose Gravelly!

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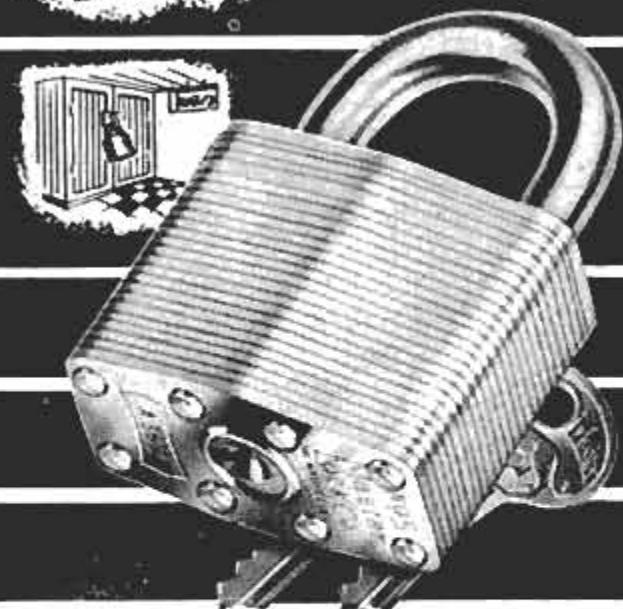
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\$1.25 to \$4.00, in a variety of sizes, at
locksmiths and hardware stores everywhere

Master Lock Company

MILWAUKEE 45, WISCONSIN

World's Largest Padlock Manufacturers

Teach the Kids to Swim In One Lesson

(Continued from page 99)

She panicked when she put her face underwater. Experience with her seemed to indicate that this simplified system of teaching a child to swim would not work. The fact was, she could not learn to swim by any method until she overcame the reluctance to put her face into the water. This didn't come about until she was in her teens.

Coleman was a baby while the older ones were learning to swim. While playing in a shallow, swift part of a creek, he fell down and drifted underwater about 10 feet before I could run and pick him up. He came up laughing and then made a game of it. He would fall down, drift along a few feet with his face underwater, then stand up.

Yet when it came to learning to swim—and trying the dead-man's float—he wouldn't do it. It frightened him to put his face down in the water. The simplified method seemed unworkable in such a case.

But later, when he was 10, he decided he wanted to learn to swim. Some other boys his age had been bragging about swimming, so Coleman got serious and practiced the dead-man's float in the bathtub. Then he came to me and said he could float with his face underwater. Would I please try again to teach him to swim? We went to the nearest creek, selected a place where the water was deep enough for him to swim, shallow enough that he always knew he could find bottom with his feet.

Under my tutelage he did the dead-man's float, next, the float with swimming motions, finally, the float with swimming motions and his face raised out of the water just enough to breathe. He was swimming. After something like half an hour, we were swimming along together, a bit splashily and with over-exertion, but swimming.

Now Coleman could learn and practice the various strokes and master the breathing rhythms. Meanwhile, if he had fallen into deep water accidentally, he would have been able to swim to safety. ★ ★ ★

Earth Gives Boost To Three Alaskan Cities

Alaska's capital, Juneau, is moving up in the world. The U.S. Coast and Geodetic Survey reports the elevation of Juneau has risen two feet in the past 50 years. Benchmarks set by the Survey a half century ago also indicate that Skagway, Alaska, has risen three feet and the neighboring city of Haines is up five feet.

15 POWER TOOLS IN ONE!

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DeWALT[®] POWER SHOP[®]

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Layout marks visible



SHAPER
50% more shapes



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Bores at any angle



ROUTER
Ideal for variety work



SURFACER
Smooths out rough stock



GRINDER
Sharpens tools, axes, etc.



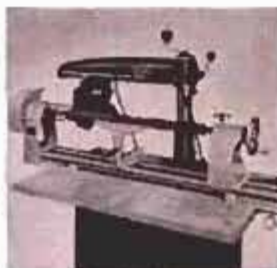
METAL CUTTER
Cuts D-I-Y aluminum



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Makes unusual jobs easy



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Anybody who enjoys woodworking falls in love with a DeWalt POWER SHOP* the moment he sees it in action and feels the precision work it does!

DeWalt brings you ultra-modern home-safety features. Compact, it fits into a work bench (free plans show how). DeWalt saves you hundreds of dollars in separate power tools. You can own a DeWalt for \$2.50 per week, two years to pay, after a small down payment.

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*T.M. DeWalt Division

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Behind the Scenes in Electronics

(Continued from page 216)

of quality. At the same time, a stereo receiver can faithfully reproduce any monophonic-AM broadcast.

Although technical development of RCA's stereo-AM system is completed, it is not yet ready for market. FCC approval must be obtained before production lines can be set up. Field tests remain to be run and station owners must be convinced that AM stereo is ready. But, with interest in stereo at an all-time high, it is quite likely that AM stereo may yet beat FM multiplexing into the average home.

ELECTRONIC PRINTING

If present developments can be used as a guide, the graphic arts fields may soon experience some drastic revisions.

The word "Electrofax," now principally a laboratory term, will become familiar to everyone engaged in the printing trades.

Electrofax is a revolutionary electronic printing process for reproducing any type of visual information on any solid surface quickly and inexpensively. In this application its uses are limited only by the imagination.

The process is as simple as it is unique.

The surface on which the material is to be reproduced is first coated with an inexpensive chemical solution which can be brushed or sprayed on like ordinary paint. This coating is made light-sensitive by passing over its surface a charging unit, consisting of an array of fine, current-carrying wires. When this is done, a dense layer of invisible electrons covers the entire surface, giving it a uniform, negative charge.

When the charged surface is subjected to light, the electrons quickly leak off in direct proportion to the amount of light striking any part of the surface. Thus, any image projected upon the surface leaves an invisible pattern of electrons whose density corresponds exactly to the light and dark portions of the projected material.

To make the electron image visible, the surface is dusted with a mixture of powdered iron and colored plastic particles by means of a magnetic brush. Tribo-electric action between the iron and the plastic causes the plastic particles to take on a strong positive charge. Therefore, when the "exposed" surface is dusted with the powder, the positive plastic particles adhere to the latent electron image, clinging most heavily to those areas which receive the

(Continued to page 242)

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Springfield engineers have combined four great performance features to give you *balanced tiller action* . . . and it's yours at no added cost.

One, you can adjust for tilling width by adding or removing tines in seconds. Two, you can adjust for tilling depth with the Springfield depth bar. Three, you can adjust for correct tilling pressure on the tines by shifting wheel position. Four, you can adjust for comfort by setting correct handlebar height.

Yes, Springfield's got it! To balanced action add the famous Quick-Lok Handlebar Clutch, your choice of fork or disc type tines (replaced free if they *ever* break), a full year warranty, and a big 3 hp engine.

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Symbol of SW Excellence INSTRUMENT DIVISION STEWART-WARNER CORPORATION

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least amount of light during the exposure. The result is a high-quality reproduction of the original image.

When heat is applied for a few seconds, the plastic particles will fuse with the coated surface, resulting in a permanent print.

The entire Electrofax process takes less than a minute, even with hand-operated techniques. With mechanized equipment this can be materially reduced. Small wonder that, in the fields of copying and photoengraving, the Electrofax process promises to render obsolete many of the techniques in use today. ***



Morning Coffee, Inc., San Diego, Calif.

Push-Button Coffee Servers For Hotel and Motel Units

Next time you check into a hotel or motel, you may find your room equipped with a hot-water dispenser for making coffee. A San Diego firm is installing push-button units in hotel and motel units throughout the country. To brew a cup of coffee at any time of the day or night, the guest presses a "heat" button that activates an electric heating element within the server. In about four minutes, the water is steaming hot and the guest pushes a second button which releases the water into a cup. A supply of packets of instant coffee, cream and sugar is provided with the room.



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your vacuum cleaner to whisk away dust as it forms, leaves a clean working surface. You can even sand and paint in the same area! Ask your B&D dealer now to demonstrate the new B&D Dust-Less Finishing Sander or send coupon below for full details.



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GREENLEE TOOL CO.
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From Outer Space— Voices Today, TV Tomorrow

(Continued from page 89)

Spotted across the country from California to Georgia were four mobile ground stations. Inside their trucks, operators manned compact teletypewriters, multiplex panels and transmitters. As the orbiting satellite circled up over the horizon into line-of-sight range of each station in turn, the continuous "beep" of a beacon aboard the rocket was picked up by the groundlings. To obtain any stored messages on the satellite's memory tape, the ground operator simply pushed a button on his transmitter console. Instantly, a radio signal shot skyward to trigger the satellite's relay transmitter, and whatever was on the tape up there was broadcast earthward.

By pushing a series of buttons, a sequence of "command" signals to the satellite could wipe the tape, and the ground operator could then broadcast a message of his own that the satellite would record for command playback at the next station that came into range.

The tiny tape loop was capable of handling seven separate teletypewriter messages plus one voice message simultaneously, at a rate of 420 words per minute. Its four-minute storage capacity could remember and rebroadcast some 1680 telegraphic words.

"If the satellite happened to be within range of two stations simultaneously," Spaulding reveals, "the operator could, by sending up a different electronic command, bypass the tape recorder, and the satellite would rebroadcast his message instantaneously."

After the successful broadcast of President Eisenhower's voice (which was secretly radioed to the Atlas' tape recorders while the missile was still on the pad, during the last seconds of countdown), Signal Corps experts gave their experimental laboratory a real workout to take full advantage of the limited time and power at their disposal. Atlas' eight-watt transmitters were powered by tiny zinc-silver oxide batteries with an estimated life of only four to six weeks; solar batteries were not installed because of the anticipated short life of the Atlas in orbit. Before the power failed, the miniature system had handled relayed messages from station to station and tapes were wiped by radio command. Direct relay through the flying transmitter was successfully tried, using the seven simultaneous voice channels and voice messages. Like the "moon signals" of several years ago, messages were even bounced off

(Continued to page 246)

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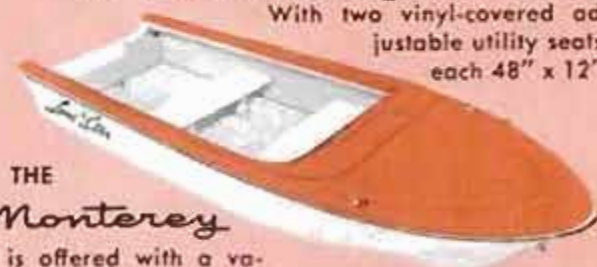
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the satellite from station to station. In nearly every case the microwave signals came through loud and clear.

Already Pentagon officials are talking about a permanent system of satellites that would relay military messages through the heavens, and relieve congested radio channels in our atmospheric envelope.

Simplest would be a few big fellows that would relay data—just as Atlas did it—picking up messages from one station and delivering them on command to another as it went its orbital rounds.

More complex would be a system of three satellites, moving in equatorial orbits at the same speed at which the earth turns. If equally spaced around the earth at about 22,000 miles' altitude, the three satellites would always be within line of sight of each other. Between them, they would be within microwave range of every inch of the world's surface. Messages could then be instantaneously relayed between any two ground stations anywhere.

"The idea of achieving precise earth speed and having the three satellites maintain their position in space isn't as tough as you'd think," Spaulding points out. "At that altitude, they could drift a thousand miles or so without spoiling the arrangement. And with radio guidance, they could be returned to position."

A third proposal envisions two dozen huge balloons with reflective surfaces, which would be shot into orbit in series, circling the globe like a string of pearls. Carrying no radio equipment at all, they would be used by ground stations to bounce signals around the world.

Since microwave signals are the same type utilized in TV broadcasts, television proponents envision the day when TV-around-the-world may well become a reality—merely by shooting the signals on a 44,000-mile journey through space over the back of a satellite. ★ ★ ★

Basketball Players Evaluated By Electronic Computer

As soon as Case Institute of Technology's basketball team leaves the floor after a game, punched cards containing notes on each player's performance are fed into an electronic computer. The computer rapidly evaluates each man and thus provides important information for the next game, including an "ideal" starting lineup. During each game, mathematicians note such items as the number of minutes a man plays, the number of his short, medium and long shots, the number of baskets for each type of shot, the number of fouls, rebounds, fumbles, bad passes, and similar items.



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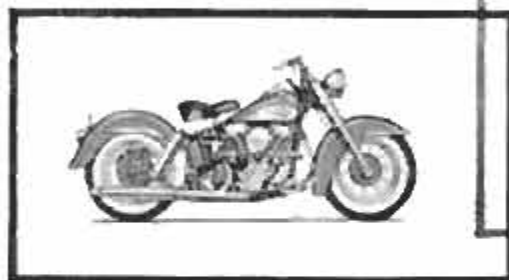
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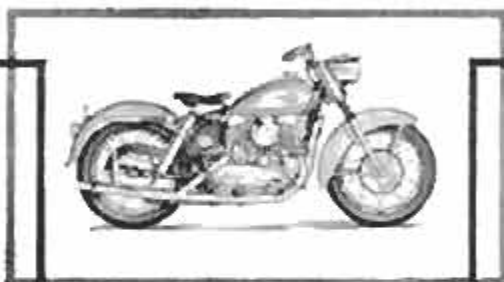


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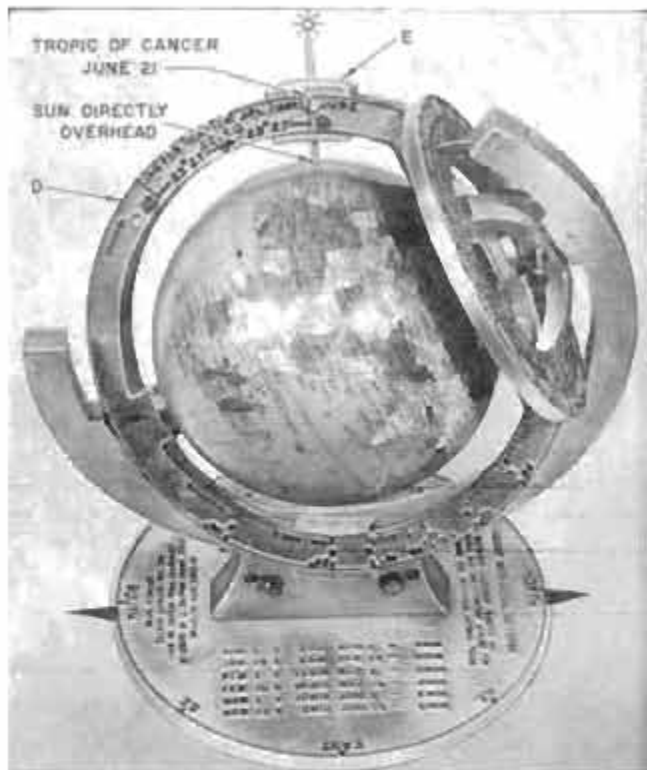
VENEER AND CABINET BLADE TWIN PACK

After April 1, the price will be \$3.98 each, but during March Sears is offering 2 Kromedge thin-rim blades in a special twin pack for only \$5.95. You save \$2! Each is designed for a specific fine-cutting job. One blade assures smooth cutting of plywood and veneers; the other is for precise cabinet work. Each blade has a built-in stabilizer and has been impregnated with hard chrome, will cut up to 5 times longer than an ordinary steel blade! Tempered under pressure, evenly tensioned to run true.

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Make Sears your saw blade headquarters. Buy Kromedge Blades at your nearest Sears Retail Store... or order with confidence from Sears Catalog in your own home by mail, phone or at your nearest Sears Catalog Sales Office.

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Mechanical Globe "Stops" Sun On Any Day of Year

As a classroom aid, teachers can use a "mechanical universe" to illustrate the earth's relationship to the heavenly bodies. A dial can be set for any latitude or longitude, and a moving slide represents the sun. The slide's position can be set for any day of the year. An indicator in the slide shows where the sun will be directly overhead. Another slide represents the path of the moon during any given month. A scale gives the relative time in the various longitudes and demonstrates at what latitudes prominent stars may be seen directly overhead.

Synchronize Yardsticks!

Beginning July 1, slight changes will be made in international length and weight units used by scientists of English-speaking nations. The new international inch will be equal to 25.4 millimeters and the international yard will be equal to 0.9144 meters. The change amounts to about two parts per million but the difference still is large enough to be significant in the precise measurements of scientists. At the same time, the international pound will become equal to 0.45359237 kilograms, or about six ten-millionths of a kilogram lighter.

By adding a bit of sodium amytal, a sedative, to the water tanks of the trucks transporting salmon from a river to a Washington state hatchery, losses of fish due to human handling have been reduced.



Power-Steering on Jet Plane Aids Pilot on Ground

Conventional steering systems were too slow to cope with the 200-mile-per-hour takeoffs and landings of the F-105 Thunderchief, so engineers designed an electronic power-steering assembly and built it into the nose wheel of the fighter-bomber. When the pilot nudges the rudder pedal, the signal is picked up by a potentiometer, amplified and fed to a servomechanism that turns the wheel. Another potentiometer measures the change and relays the information back to the servo. All this is accomplished within thousandths of a second. The new system is said to make steering the jet as "easy as steering the family car."

Automatic Nose for Alcohol Would Warn "Lit Up" Driver

If you've had too much alcohol to be a safe driver, a Danish inventor's idea would give you a sight-and-sound warning. He has developed what might be called an "automatic nose" to detect drunken drivers. Mounted on the steering wheel, it samples the driver's breath and if the reaction shows a dangerous level of alcohol in his system, a fluorescent light is activated and various relays sound the car horn and prevent turning on the ignition for a quarter hour or more. The device is not yet available.

☐ Black light, so called because its rays are barely visible to the human eye, attracts flying insects for some unknown reason.

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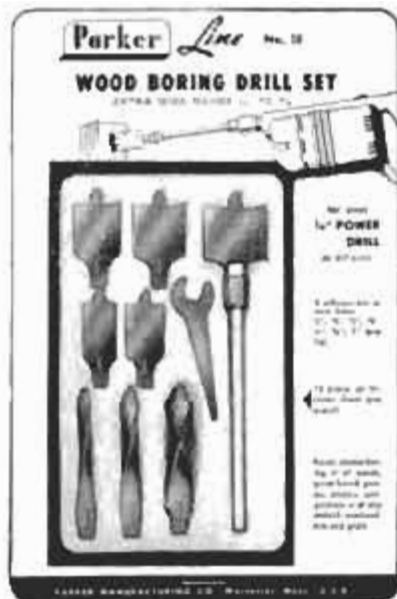


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Manufacturers of the finest forgings for fifty years.

High-Voltage Rainmakers

(Continued from page 85)

electrical charge in the air on the mountain beneath the cloud.

To learn even more about the things that were happening inside those clouds, Moore and two other scientists, M. D. Ross and Dr. Paul MacCready, set out to explore the thunderhead innards personally. Their perch was a four-by-five-foot plywood platform with nylon cloth sides, slung beneath a polyethylene free balloon 44 feet in diameter. With them went half a ton of scientific instruments, cameras and gear. They wore insulated arctic clothing and oxygen masks, and, as Moore puts it, "We were wired for sound." Instruments were rigged to measure their heartbeat, blood pressure, respiration and skin temperature as they soared skyward. Cloud explorer Moore made two hair-raising flights in this rig, both of which he will never forget.

Soar to "Cloud Nine"

On the first, June 24, 1957, Moore and Ross, a Navy expert, took off from Withington's summit into the base of a building cumulus, and were soaring nicely when suddenly their instruments told them they were dropping at the staggering rate of 2000 feet a minute. "We were in a terrific downdraft," Moore recalls. "Many people think that a free balloon, caught up in the shearing vertical winds of a thunderstorm, would be tossed and torn to ribbons. Oddly, there's no sensation of violent movement at all. The whole assembly rides with the winds, smoothly and evenly. Our first sensation of how fast we were falling came when we plummeted through the bottom of the cloud and saw bushes and trees rushing up at us at a phenomenal rate. Ross and I threw 40 percent of our ballast over the side as fast as we could. When we finally checked the plunge, we were hovering 300 feet above a valley floor, and Withington's peak towered more than 2000 feet above us."

Again they soared up, this time through the edge of the cloud, finally breaking out the side and rising through its mushrooming cap at about 22,000 feet. "An interesting thing," says Moore, "is that we were not drawn into the cloud again, which appears to negate the theory that clouds always entrain air from the sides all the way up. Another curious thing that fitted our theory nicely was the fact that a tremendous current of air pouring over the top of the cloud and down its sides was pulling the edges of the mushroom top downward like a gigantic waterfall. Something else no one

(Continued to page 254)

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had reported to our knowledge was a canopy of ice crystals that covered the entire top of the cloud and surrounded it, like icing on a cake. Inside the cloud, super-cooled water drops had formed ice on us and coated our equipment."

Heat, Overexertion Bring on Sickness

The pair soared to 29,000 feet, then devalved and coasted earthward while Moore became violently sick due to overexertion and to the suffocating heat of his clothing. And the fun wasn't over. Probably coming through the crystals, ice had lodged in the balloon's valve, and it jammed in the open position. For 10,000 feet the men plunged earthward at a rate of 1000 feet a minute before the balloon could be brought under control again. By the time they neared the desert floor, the cloud had grown into a full-fledged thunderstorm and was drifting down on them. After the first touchdown, the men cut all but two shroud lines; on the second bump the others were severed. But the gondola didn't drop off. It tipped over, strewn men and equipment across the dusty ground. They sat there dazed, while the balloon—gondola and all—soared back up into the black sky. "We'd forgotten to cut loose a couple of straps that had been rigged to prevent the gondola from rotating under the big bag," Moore recalls ruefully. "So we picked up our battered equipment and started hiking across the 110-degree desert in our underwear, carrying our arctic clothes over our arms." The balloon and gear were recovered next day, torn and smashed beyond repair.

Takeoff Clips Tree Tops

Two months later, on flight number two, Moore once more headed up into a growing thunderhead above Withington's peak—this time with Dr. Paul MacCready, weather scientist and glider champion. "First flight had made too fast a take-off," says Moore, "so this time we took it easier and nearly creamed ourselves in the woods. Rising at only 50 feet a minute, the gondola knocked the top branches off several trees before we broke away. As we did, the balloon's parachute tore loose and fell off."

This time the cloud explorers went right up through the thunderhead for 25 minutes, rode through the icy cap to 27,000 feet, released gas from the bag and drifted down toward some high-tension lines and a big barn on somebody's ranch. "We threw everything overboard that we could lay our hands on in order to gain a little altitude," says Moore. "And we did. We cleared both obstructions by a cool 3000 feet."

What came out of the New Mexico

(Continued to page 256)



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experiments was highly gratifying to both Vonnegut and Moore. "We experienced violent downdrafts in nonraining clouds," says Moore. "Previously they were not thought to exist. They indicate a possible vehicle for development of electrical fields well before rain develops in a cloud."

Rain Shows as Hollow Cup

When all the data was in, the two meteorologists could show a reversal of electrical field in their clouds and, in some cases, a build-up to 10 volts before any rain was spotted by the radarmen. "Another fascinating thing we observed, when the radar sets were moved to the top of Withington where they could get a close look at the growing storm," says Vonnegut, "was that when the first rain finally did show on the screen, it came up in the form of a hollow cup. These hollow precipitation echoes had not been observed before and pose some fascinating scientific questions. Do they conform to the shape of electrical fields in the cloud? We still don't know enough to say. Perhaps they may be the result of other phenomena as yet not understood.

"So far we've measured only the vertical components of the field," says Vonnegut. "We hope to fill in with more research this year."

They're going to string up another one of those wires again, too. This time it will be in a genuine desert area somewhere in the Western badlands. And if there's a lot of big rain where rain has never been known to fall in such quantity and such a time of year, these men may be hot on the trail of one of the most spectacular weather-control developments yet attempted by man. Being scientists, and good ones, this is not their professional goal, however.

"I prefer to think," Vonnegut points out, "that we are 'hot on the trail' not of 'spectacular weather-control developments,' but rather an understanding of some of the basic mechanisms at work in our atmosphere. Only when we have a much greater and more detailed picture of how the atmosphere works will we be able to venture into weather control with any real hope of success." ★ ★ ★

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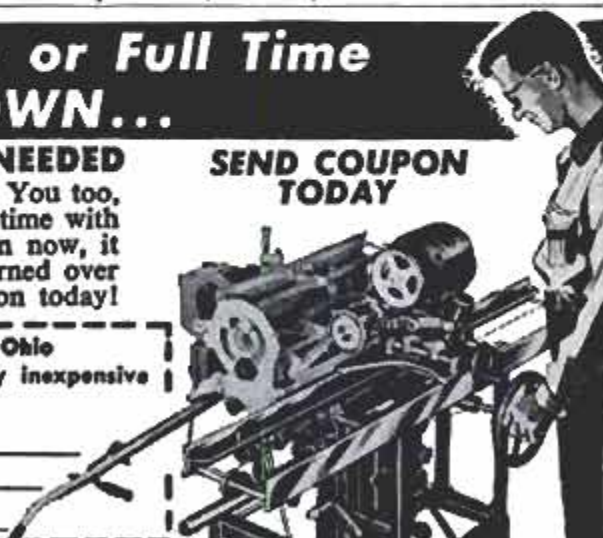
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Owners Report on the Buick

(Continued from page 95)

"Make cars look like cars. Leave airplanes and rockets for the air."—Florida display man.

Big cars appeal to many people. They must or they wouldn't sell in the volume they do. Few owners, however, seem anxious to defend bigness. Occasionally, one does:

"I cannot see this trend of going back to small European cars. It is just like going back 30 years to the old powerless, uncomfortable cars we used to have. Gasoline consumption is certainly no factor in this country. The price of gasoline is very low and it is one of the smallest expenses to be considered. The automotive industry is to be congratulated. All American cars are lovely."—Pennsylvania physician.

More Best-Liked Features

The following quotations describe, in order of frequency of mention, additional features on Buick's best-liked list:

"Good response in starting and passing. Absolutely no jerking on acceleration."—Louisiana businessman.

"I like the enlarged air-cooled brakes."—Illinois foreman.

"The best brakes I have ever used in any automobile. A soft pedal, no fade."—California security guard.

"Visibility is excellent. To date, I have noticed no blind spots."—California Air Force officer.

"First car I ever had that tracked right. It doesn't drift right or left—just runs right down the road."—Illinois restaurateur.

"Excellent roadability at high speed. Excellent control. Turns sharp without side roll."—Ohio foreman.

"I like the transmission. Smooth even power. No gear shifting so noticeable in other transmission."—Ohio construction engineer.

"Quiet. Very little wind or road noise."—Illinois Army man.

"Has better economy than the 1957 Buick I owned. Over 1000 miles of careful checking, the average was 13.6 miles per gallon."—New Jersey superintendent.

"Front seat has room to stretch your legs."—Illinois locomotive fireman.

"Luxurious interior with hardware that has a substantial solid feel."—California artist.

"New paints are nice. Beautiful colors that seem to be a little easier to keep clean."—Pennsylvania technician.

"I like the fact that there are needle meters for oil pressure and ammeter."—Illinois police officer.

"Our Buick was struck from behind while parked at the curb last week. The left rear fin acted like a can opener on the other car. Before that I was careful of those fins. Now I see that they will take care of themselves."—California auto body mechanic.

"Happy to get back to 15-inch wheels."—California maintenance man.

"Big ashtray for a change."—Illinois advertising man.

"The trunk deck comes to a narrow point and closes with the touch of your finger. Our 1957 Buick trunk lid formed an air pocket and it took both hands and much force to close it."—Missouri foreman.

The Other Complaints

Here are the other complaints, in order of frequency of mention (see page 95 for actual percentages of owners mentioning them):

(Continued to page 260)

← *The doctor has a point. If gas economy is increased 50 percent, Buick owners will save about \$100 a year. Meanwhile depreciation is about \$1000.*

← *It gets away fast all right, but so do all American cars.*

← *He overlooks the location of the rear-view mirror in the center of the windshield. Rear vision excellent.*

← *Dynaflow is smooth, quiet.*

← *Kelly's tests show otherwise. The 1957 Buick went about 1.5 miles per gallon farther than the new model.*

← *Warning: Stay away from the rear end of Buicks.*

← *Here is a place where styling brought a practical improvement. Flatter trunk lid opens and closes easily because it doesn't entrap air. Of course, there is a sill to lift bags over now.*



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GUN TACKER

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ALL-PURPOSE HEAVY DUTY STAPLE GUN

- Shoots a Staple wherever you'd drive a nail!!!
- Does 1001 do-it-yourself nailing jobs!
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Takes 6 staple sizes: 1/4", 5/16", 3/8", 1/2", 9/16" and CEILTILE staple for ceiling tile.

Price: \$12.50

Uses 6 different staple sizes up to 9/16", including

ARROW'S CEILTILE® STAPLES! ESPECIALLY DESIGNED FOR CEILING TILE STAPLING

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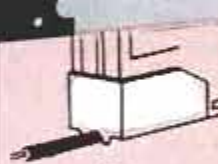
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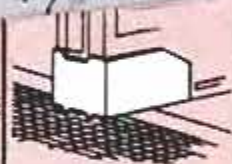
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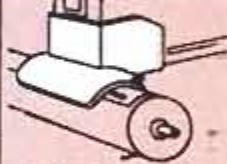
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"Levers that operate heater and vents are inconvenient. Front-seat passenger has to annoy the driver to have his vent opened."—Pennsylvania mechanic.

"Lack of headroom in rear seat. My 5-foot-4-inch daughter hit her head twice in one ride. Also question potential danger to tall people of metal piece over rear window."—New Jersey owner.

"Inside space and comfort has been reduced too much."—Virginia soldier.

"Quality control of this early model was not good. Weatherstripping on all doors not attached well."—Ohio salesman.

"No plugs placed in the many holes in the trunk floor. In wet weather the water comes up over the gas tank into the trunk. It has been corrected by undercoating."—Georgia salesman.

"Rattles in right rear section of body, also in dashboard or steering column."—New Jersey dispatcher.

"Front-end stability is very bad. No stabilizer bar at all."—New York service representative.

"On uneven roads car sways at 60 miles per hour."—Wisconsin salesman.

"My wife rode in the back seat through the mountains and complained of constant swaying. Noticeable in front also."—California court reporter.

"This is the smallest Buick and should give better gas mileage, especially on trips."—Utah farmer.

"Must use highest octane gas available or motor pings loudly. This adds greatly to cost of operating car. Mechanic at dealer's says some ping is natural. I disagree."—New York therapist.

"Front end poorest of any car I have ever owned. Hit a sudden bump or hole in road and the shock is terrible. I would also like to see something to stop the rear-end hop on a washboard road."—Ohio foreman.

"Passengers complain it's too hot in sun due to large rear window on two-door hardtop."—Colorado printer.

"Rear-seat riders get a free sunburn."—Georgia police sergeant.

"New type of paint is either improperly applied or worked. Primer is showing through black paint in several places."—South Carolina engineer.

Here are some miscellaneous complaints that only a few of the Buick owners made, but they are of general interest:

"Radiator cap can't be removed without spitting plumes of antifreeze all over yourself and the engine. Too much pressure."—Maryland owner.

"I have had trouble turning the engine off. Dealer said it was due to use of regular gas. The manual says you can use regular gas on the LeSabre, but don't try it."—Pennsylvania university executive.

"Trunk space is ruined by low dip of lid. It necessitates use of selected luggage in order to be able to close trunk."—Kansas soldier.

"Minor improvements could be made in glove compartment, wipers could be just a little longer and the trip-mileage set knob is almost impossible to work."—Illinois millwright.

That is the story of the 1959 Buick as told by the people who know the car best—the owners who use it under all types of conditions. For an engineer's analysis of the car turn to Dale Kelly's report on page 92. ★ ★ ★

← Buick has changed this in current production. Now the blower is on a separate switch.

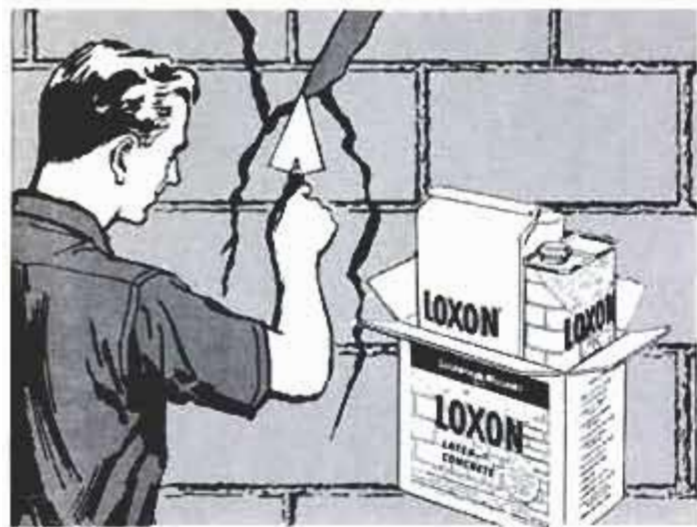
← The industry has no excuse for putting metal ribs across the car's ceiling—no excuse except styling. Those ribs are dangerous.

Buick has added a stabilizer bar to its front end in recent weeks. Owners can get one installed free if their car has none, Buick tells us. That goes for the new heater switch also.

← Kelly says all pinging is harmful, it's just a matter of degree.

Miscellaneous:
Altogether a satisfactory car. Its faults are mostly those of the industry: Lowness, bigness, too much expensive glass, no padding in center of seats, and so on. Owners report virtually no engine trouble. Only 1.7 percent rate the car poor over-all (in 1957, 7.7 percent rated it poor). Interior environment: quiet, warm and provides a secure feeling. Engine of test car guilty of embarrassing after-running. Dials (except for speedo) are arranged at difficult-to-read-at-a-glance angles and surrounded by confusing chrome. Front-seat back reclines too much for this driver, but you may like it. Brakes good, but have to be as Dynaflo is almost like freewheeling. Interior hardware feels rich and well made (except for horn ring). Glove compartment too distant and too small.

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MARCH 1959

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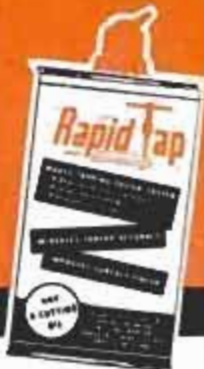
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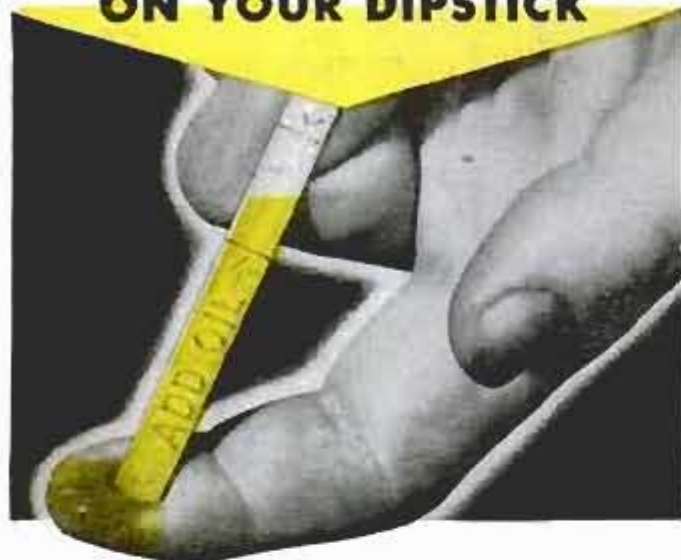
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HASTINGS KEEPS OIL CLEAN

Hastings Oil Filter Cartridges keep oil clean from filter change to filter change, when replaced as normally recommended*

That's because only Hastings has Densite filtering material, which traps and holds even the most microscopic dirt particles. The dipstick test proves it!

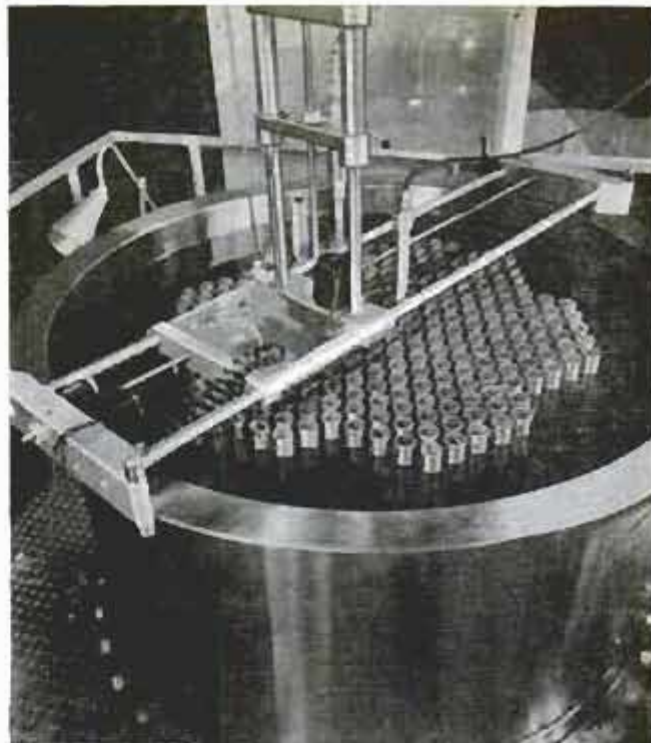
Just ask for Hastings—next filter change. Be sure of clean oil *all* the time.

* Proved by tests conducted in accordance with U. S. Bureau of Standards.

U. S. Patent Numbers 2,797,811 2,584,771



HASTINGS MANUFACTURING COMPANY
HASTINGS, MICHIGAN



Classroom-Size Reactors For Atomic Energy Students

College students will get a firsthand understanding of the design and operation of nuclear reactors by performing experiments with subcritical training units recently installed at several schools. The reactors, described as "perfectly safe" for classroom work, are five feet high, four feet in diameter and hold 435 gallons of tap water. The natural uranium fuel and a neutron source to "drive" the unit are loaned to the schools by the Atomic Energy Commission.

"Oxygen" Added to Gasoline Doubles Automobile's Power

For years, hot-rod drivers have been increasing their cars' power by adding nitro-paraffins to gasoline. But a University of California engineering professor named Ernest S. Starkman is the first man to conduct a scientific investigation into the possibilities of these chemical compounds as fuels. He has found that up to twice the power now developed by automobiles and diesel engines with conventional fuels can be provided by nitroparaffins. His experiments show that the nitroparaffins can carry oxygen from their own structure into the process of combustion. This increases the energy of the fuel-air mixture, since it allows more fuel per unit of air to reach the engine.

☐ Polyethylene-plastic tubing systems operated by one man are used to gather maple sap in New York and New England, thus eliminating the old-fashioned bucket.



Table-Model Chord Organ Can Be Played in Seconds

You don't have to be a musician to play an electric chord organ. Built on somewhat the same principle as church organs, this simplified instrument can be mastered in 90 seconds. While the left hand produces a full chord by touching a lettered button, the right hand fingers the melody on numbered keys. Music books supplied with the organ contain lettered and numbered notes. Additional books can be bought. The table-model organ weighs 18 pounds. It covers three octaves and has 37 keys and 12 chord-control buttons.

Brain Likened to Computer With 15 Billion Tubes

Your brain is comparable to a computer with about 15 billion electronic tubes. The comparison was made by Dr. Johannes P. Schädé, a research fellow in biology at the California Institute of Technology. He reports there are about 15 billion nerve cells in the brain cortex. Each cell operates at one thousandth of a millionth of a watt. The brain operates at about 10 watts. Functioning electrically and generating both direct and alternating currents, the brain operates at from 1/2000 to 1/200,000 of a volt. Dr. Schädé said that about the same prevailing electrical rhythm — approximately 8 to 14 cycles per second — is found in the brain of all vertebrates, from man through fishes.

Bacteria Warfare on Pests May Help Farmers

Bacteriological warfare against crop-eating worms will be tested in the United States, Puerto Rico, Hawaii and Australia. A species of bacillus that is fatal to insects will be applied to crops of selected growers. The bacteria do not harm warm-blooded animals.

USING TOO MUCH OIL AND GAS?



IT'S TIME FOR HASTINGS

When your oil and gas bills start growing bigger — look out! Using too much oil is your first sign of worn-out piston rings. And worn-out rings mean power drop-off — costly waste of oil and gas — and expensive repairs later on!

The sooner you act, the less it will cost. See your motor specialist the minute oil-pumping warns you there's trouble ahead. When he recommends new piston rings, ask him for Hastings. They're engineered exclusively for replacement service . . . to provide the additional lubrication worn engines need . . . to stop oil-pumping, save gasoline, restore lost performance.

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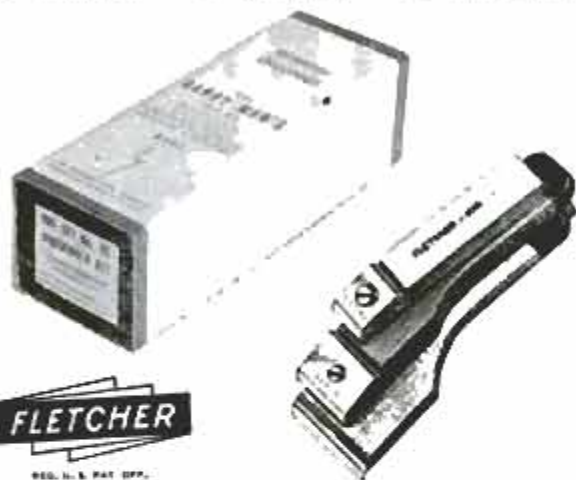
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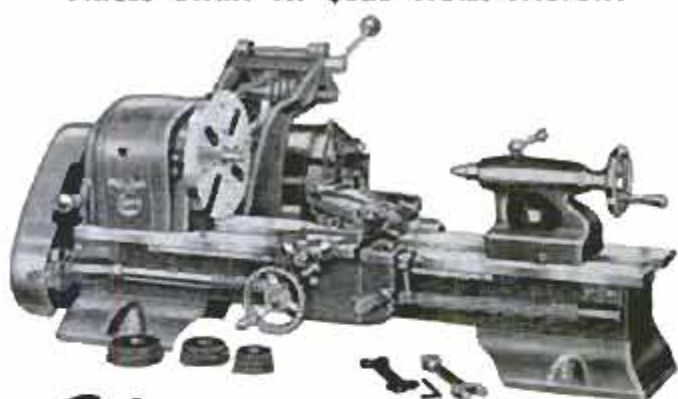


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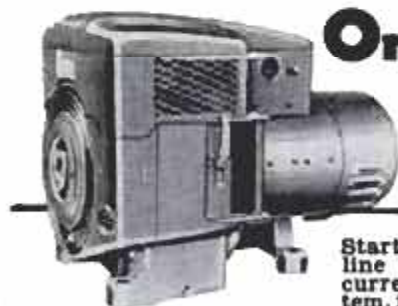
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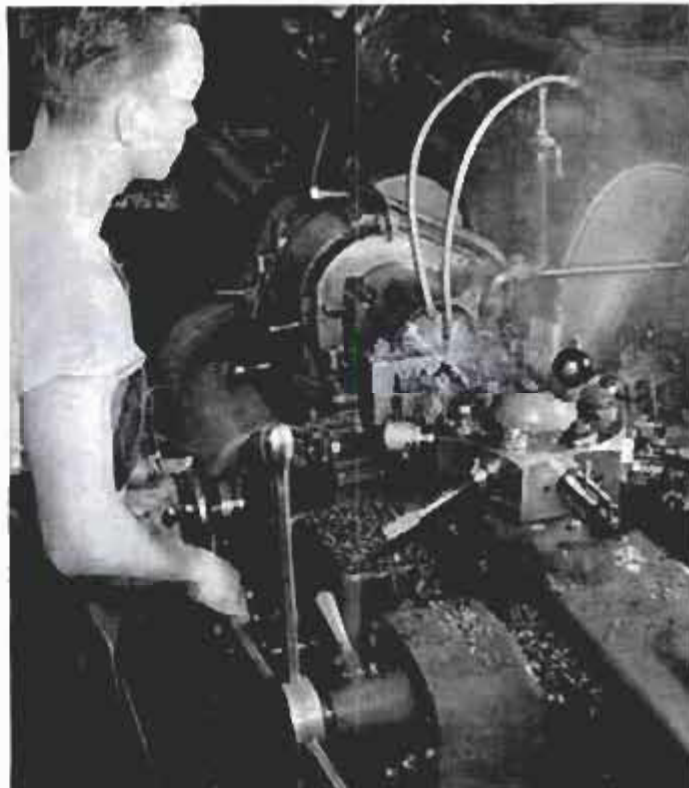
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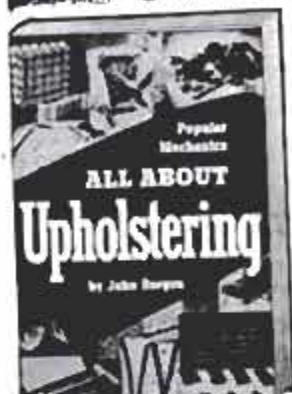
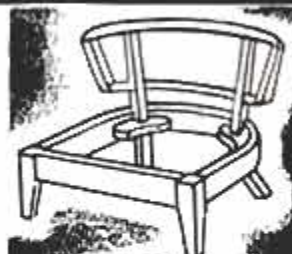
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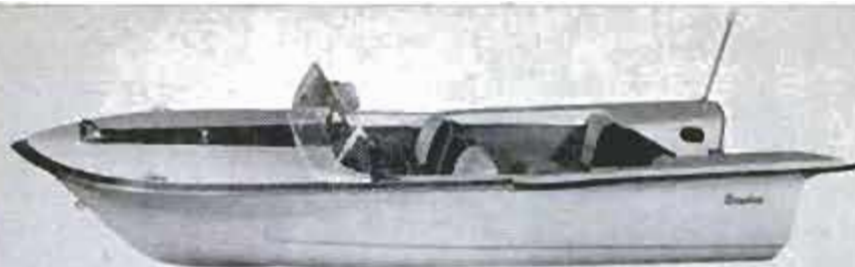
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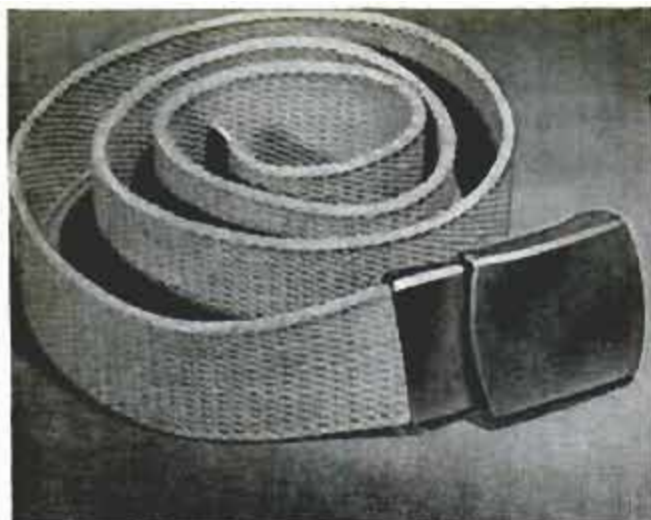
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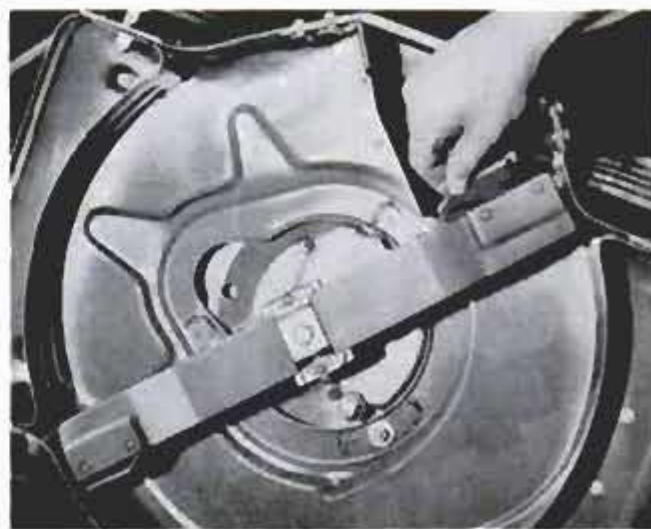
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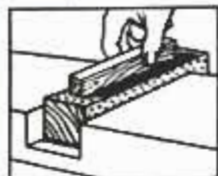
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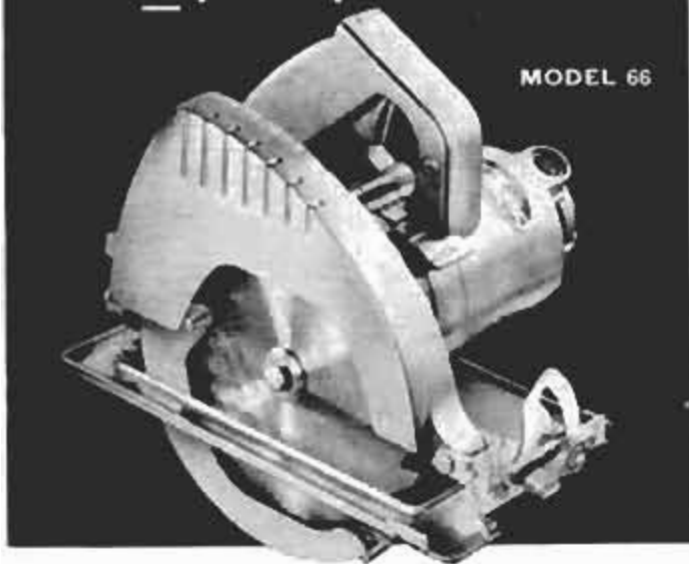
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with 14 power-plus features...



Try and beat this saw for value. Remington's new Model 66, 6½" electric saw combines optimum cutting power with today's most advanced design for safety and ease of use.

Check these features: 1) Powerful 7-amp motor. 2) Depth-adjustment thumb-lever lock nut. 3) Bevel-adjustment thumb-lever lock nut. 4) Sturdy die-cast, aluminum-alloy housing. 5) Heavy-duty, momentary-contact trigger switch. 6) Easy-access brush holders with uniform-tension springs. 7) Sawdust blower. 8) Sturdy aluminum shoe. 9) Telescoping blade guard with retracting lever. 10) Special motor ventilation for cool running. 11) Weight: only 7 lbs. 12) 6½" super-sharp combination blade. 13) Cuts full 2½" depth. 14) Cuts 2" dressed lumber at 45°.

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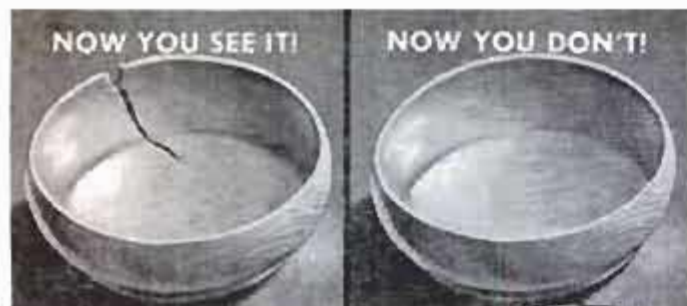
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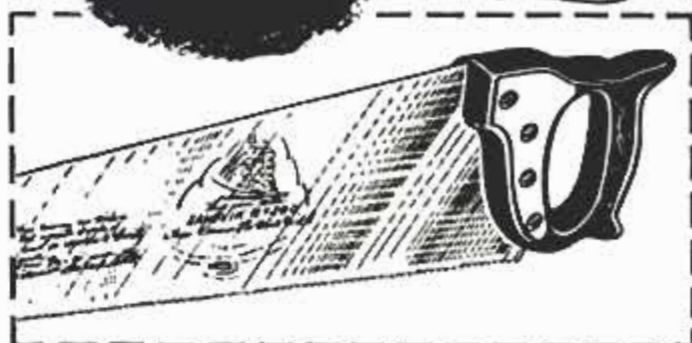
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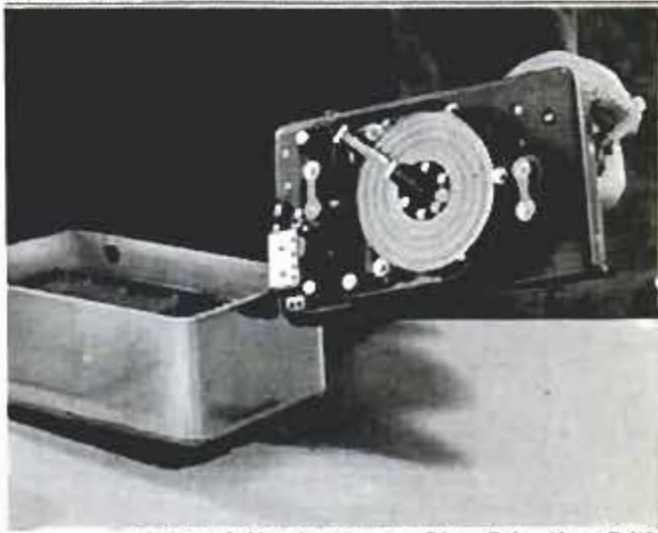


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Exclusive: *Extendable Handles for Extra Leverage*
ITEM 478 — CADMIUM PLATED. Center cut type bolt cutter for soft or medium hard rods and bolts, alloy wire, and other metals. Cutting edge has equal level on each side for extra strength. **FOLDED**—It fits into your pocket or tool box—safety latch locks closed when not in use. Capacities: medium hard bolts in thread 3/4"; medium hard metals 5/16". Length closed: 10 3/4"; extended 15 3/4".



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1 1/2 H.P. HYDRAULIC SPEED REDUCER WITH FINGERTIP CONTROL



Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of 1/4 to 1 1/2 H.P. Shaft 3/8" diam. Input rotation counter-clockwise facing shaft. Input speed 750 R.P.M. 7 1/2" x 7 1/2" x 11 1/2". Output rotation reversible. Complete with 2 qt. oil. Weight 31 lbs. F.O.B. Chicago..... **72.50**

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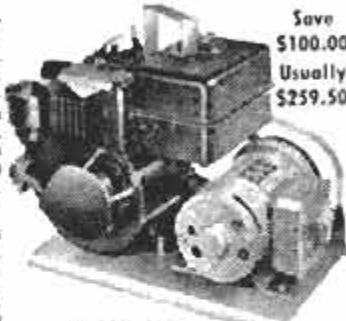
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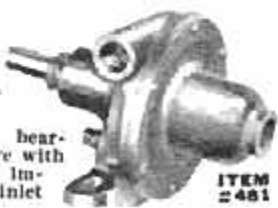
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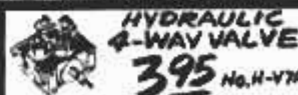
For use in opening Garage, Factory, Shop door, small boat winch, etc. Will operate from 100-115 volt AC current when using transformer (shown below) to step-down the voltage to 24 volt. Reversible motor turns at 9000 RPM. Gear box has 18 to 1 ratio. Power take-off shaft turns at 500 RPM. Limit switches set length of travel or can be inactivated for continuous use. Has magnetic clutch. SAVE! Now ONLY **5.75**

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Will step-down voltage on motor of hoist above for 110 V current **3.95**



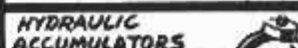
1500 PSI HYDRAULIC CYLINDER Dbl. action. Has bore of 1", shaft 5/8" stroke 4", length 9". Parts 1/4" AN. Cost gov't approx. \$35 **4.88** Catalog No. H-SASU



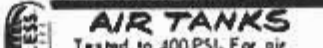
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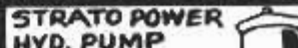
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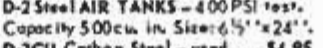


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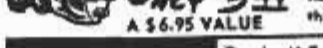
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Tank Tested up to 500 lbs. per sq. in.

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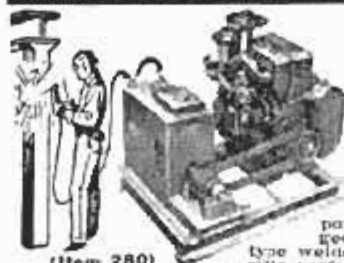
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PUSH BUTTON START
115 v. 60 cyc. AC Powered by a rugged 2.2 HP. easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. **\$143.50**
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115V. AC
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A powerful cylinder mfr'd. by Massey Harris which develops both a pushing and a pulling action. Will push 8,100 lbs., with a 1000 PSI pump pressure. Cylinder is 3 3/4" O.D. with 6 1/2" stroke—standard heavy duty cylinders on both ends. Has standard 1 1/2" pipe thread on ends. Can be used for lifting buckets or blades, raising or lowering implements, hydraulic presses, etc. Can also be used as an air cylinder. (Item 802) Wt. 17 lbs. Reg. \$68 value. Special **\$14.95**

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We have all sizes of cylinders available.

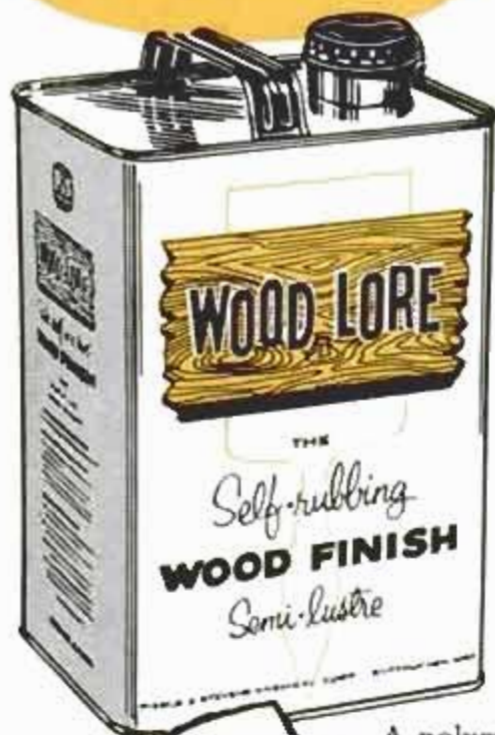
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FAME the WAXLESS wondercoat for linoleum, asphalt tile, rubber and vinyl floors. Twice the wear with half the care.

At paint, hardware and lumber dealers coast-to-coast

Send 25c in coin for comprehensive illustrated step-by-step manuals on natural wood finishing; complete data on finishing and care of all types of wood floors; modern maintenance methods for all resilient floorings.



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Dept. PM-3
710 Ohio St., Buffalo 3, N. Y.

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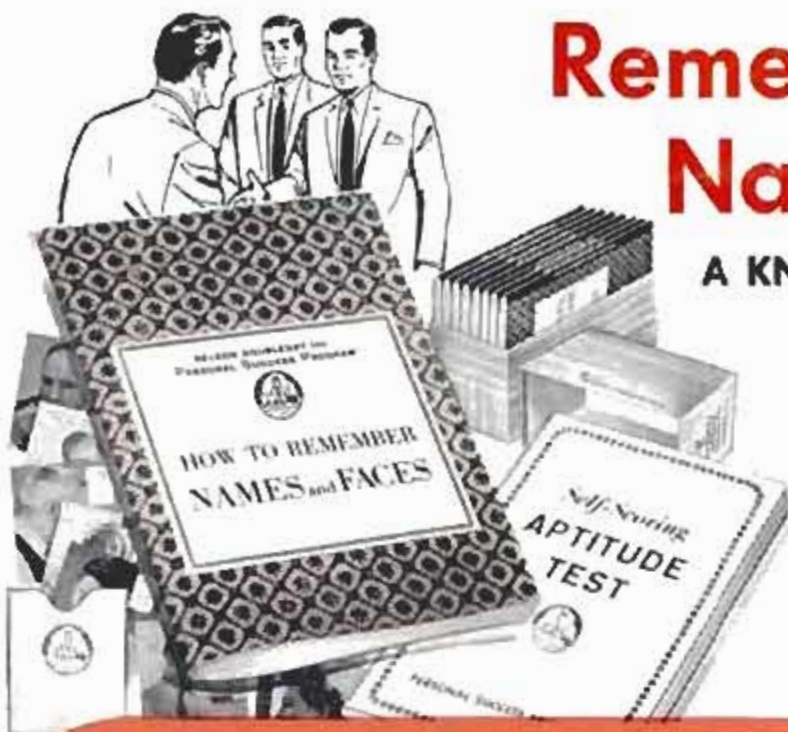
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This Complete Rapid Memory Trainer Kit yours for only

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including FREE Self-Scoring Aptitude Test and Handsome Desk File

to introduce you to the new NELSON DOUBLEDAY

PERSONAL SUCCESS PROGRAM

The Most Practical, Far Reaching Plan Ever Devised to Help Men Increase Their Earning Power and Enjoy the Good Things of Life!

MONTH by month . . . step by step . . . this brand new Nelson Doubleday Personal Success Program shows you how to develop the personal skills and techniques that pave the way to advancement . . . in any field!

Your introductory Rapid Memory Kit for 10¢ is a sample of the practical Progress Kits you receive each month — each a shortcut to mastery of an essential "success" subject. Each Kit, with instruction manual and "live" do-it-yourself material, is selected and prepared by business and psychological experts especially for this Program. There is nothing like it for completeness, authority and practical usefulness.

What Are These Success Skills?

Look at some of the highest paid men in business. They have developed the basic abilities that always pay off . . . the ability to handle people . . . to speak and write effectively . . . to create ideas and "sell" them to others . . . to organize their time efficiently and achieve more. They have learned to understand business procedures . . . what to read to keep well informed . . . how to win important new friends wherever they go. And they are just naturally sought out by others whenever a responsible job is to be done.

Few of these skills are "born knacks". They can be mastered with surprising ease by any ambitious man. Now, for the first time, the Personal Success Program offers you a tested, rapid, fascinating plan for making these "success" skills your own

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Unique "Live" Practice and Application Material

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Mail Coupon With Only 10 Cents

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"How to Remember
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2.
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I enclose 10 cents. Send me at once my introductory package consisting of handbook "How to Remember Names and Faces," set of practice and application cards and pocket card holder. Also include my free Self-Scoring Aptitude Test and the handsome Desk File for convenient storing of future Progress Kits.

After examining this package, I will decide whether or not I wish to continue. If not, I will simply let you know. If I do continue you will send me a new Progress Kit each month for only \$1 plus shipping. I am not obligated to take any minimum number of kits, and I am free to stop at any time.

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PS-1

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