

ANC



# POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERST

REG'D. TRADE MARK, GREAT BRITAIN, No. 410426

REG. U.S. PAT. OFF.

**HEAVYWEIGHT  
CHAMPION LOGGER**

*Page 130*



HOW 'YA TRADE  
COUSIN?

NOT FOR A  
DOZEN!

# MONTA MOWER

*Mows and Trims*

# LAWNS

## IN ONE EASY OPERATION

I wouldn't trade my MontaMower for a dozen ordinary lawn mowers!"

The above statement is a direct quotation from one of thousands of unsolicited testimonial letters received from MontaMower owners every year.

And little wonder MontaMower owners are so enthusiastic! MontaMower represents the first basic advancement in lawn mowing devices during the past half century. It is a new and different kind of lawn mower that mows and trims in one easy operation.

Actually, the MontaMower is a live, 8 1/4 lb. precision machine that smoothly and quietly cuts a full 16" swath through grass, dandelions, spike grass and tall lawn weeds (including the ones that ordinarily pop back-up to cause you extra work).

**AND WHAT'S MORE** — MontaMower does what no conventional mower can do! It cuts right up to walls, fences, trees and posts — practically eliminates hand trimming. It cuts under foliage, around flower gardens and close-quarter borders which cannot be mowed successfully with conventional hand or power mowers.

The MontaMower is so light, so sturdy and responsive, that even women and children can operate it easily and efficiently. Owners tell us that with their new MontaMowers they cut their lawns in half the time — with less than half the effort.

Learn these facts about the MontaMower from actual experience... it's sold under a liberal "Written Guarantee" which permits you to try it on your own lawn... makes you the sole judge of its merits. Get the complete facts about the moderately priced MontaMower. **AT ONCE!** Just fill out the coupon below and mail it today.

ONLY MONTA MOWER  
TRIMS AS IT CUTS

## SAVE TIME AND LABOR WITH A MONTA MOWER



Weight  
only 8 1/4 lbs

## SOLD DIRECT — ON APPROVAL

MONTA MOWER DISTRIBUTING CO.

Sales and General Offices

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Gentlemen: Without obligation, kindly send me complete descriptive literature, price, guarantee information, and full details of Approval Offer.

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ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

## Here's HOW IT WORKS

The new, improved MontaMower has eight pairs of sharp-edged, precision made and fitted, tool-steel cutting disks, slightly overlapping and self-sharpening, working as a unit. Each pair revolving toward each other gathers the grass and cuts it cleanly at the intersection of the disks. The new improved model is easily and quickly adjustable to cutting height! It's as modern and efficient as an electric razor!

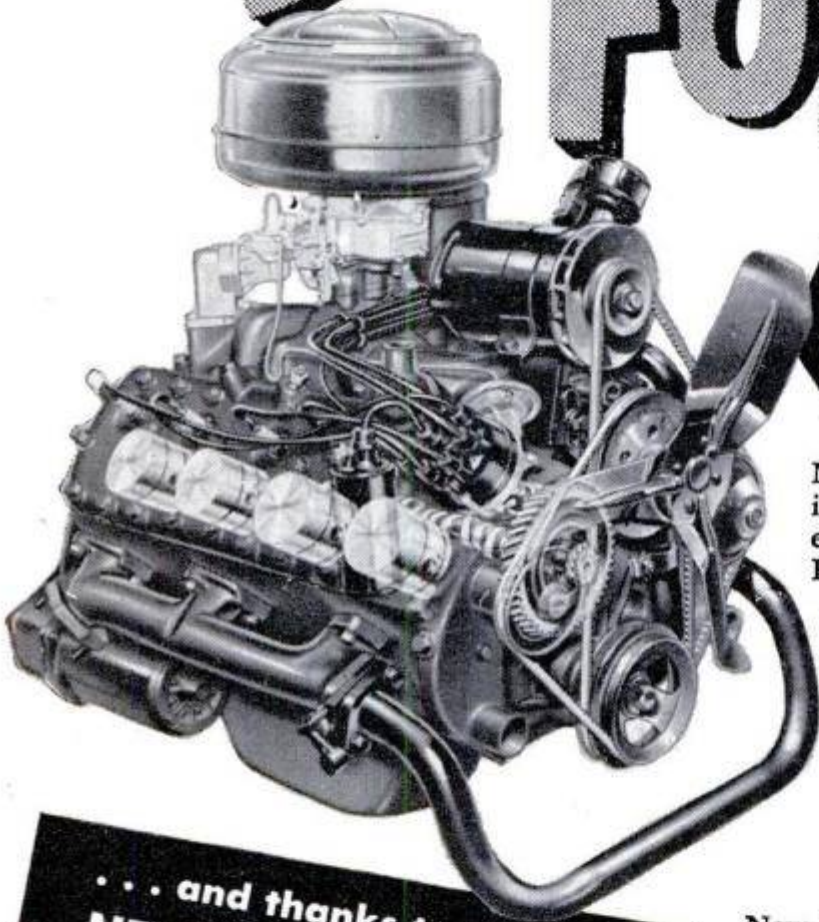
The MontaMower is sold only by direct mail to users (no agents or dealers... no foreign sales at present.)

Feels like America's  
costliest cars—



the '50 FORD

Its Quiet  
whispers  
Quality...



thanks to the super-quiet  
**100-h.p. V-8 ENGINE**

New "super-fitted" pistons with steel struts in cam-ground skirts to control expansion, permit closer clearances. Result—longer life, extra quiet.

New "hushed" laminated composition timing gear meshes with metal gear on crankshaft for practically noiseless operation.

New "quiet-contoured" camshaft lobes soft-pedal valve action.

Perma-quiet valve assemblies with one-piece valve guides and shot-peened valve springs require no adjustment, operate more quietly.

New 3-blade, silent-spin fan cools with maximum efficiency and minimum sound.

... and thanks to the  
**NEW "HUSHED" RIDE**

... a "Mid Ship" Ride away from the wheels, in the 13-ways stronger "Life-guard" Body that's "sound-conditioned" against road noise, and cradled on "Hydra-Coil" and "Para-Flex" Springs that soak up the bumps.



**"Test Drive" the '50 FORD**

**AT YOUR FORD DEALER'S**

Enjoy the World's Finest

# TECHNICAL TRAINING IN AVIATION

and Earn While You Prepare for a Career in the U.S. Air Force



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Scientific aptitude tests help direct you to use your talents most effectively. Earn good pay right on the job as you learn under skilled experts. If you can qualify you may go to an Air Force technical school for training in one of the many great career fields. Enjoy new opportunities for education, experience, advancement. Ask about the new Airman Career Program today.



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AIR TRAFFIC CONTROL AND WARNING

WIRE MAINTENANCE

MISSILE GUIDANCE SYSTEMS

COMMUNICATIONS OPERATIONS

PHOTOMAPPING

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FABRIC LEATHER AND RUBBER

PROCUREMENT ADMINISTRATIVE

PERSONNEL EDUCATION MEDICAL

ENTERTAINMENT MANAGEMENT METHODS

BUDGETARY ACCOUNTING AND DISBURSING

STATISTICAL AND MACHINE ACCOUNTING

GROUND SAFETY MARINE FIREFIGHTING

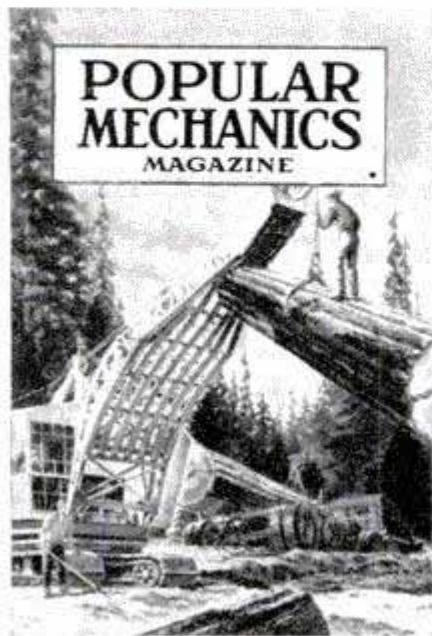
SECURITY AND LAW ENFORCEMENT

# Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, *Founder*

H. H. WINDSOR, JR., *Editor and Publisher*



## this month's cover

ONCE UPON a time the King of Sweden asked Paul Bunyan to clear all the timber off the state of North Dakota to make room for all the good Swedish farmers. Paul cut the logs out at a rate of a million feet an hour and stomped all the stumps into the ground. When the farmers came across they found a mighty clean piece o' dirt waiting for them. There never has been another lumberjack as mighty as Paul, but that big logger on our cover rates a close second. Biggest thing in the woods today, it can flip 30-ton logs through the air like matchsticks or jerk a 90,000-pound log straight up out of a crevasse. The job done, it waddles off under its own power like Paul Bunyan hiking the timber trails in search of a new task. Artist Lou Nulsen, who has studied logging operations at close range, depicted the behemoth on our cover, and you'll find more views of the logger on page 130

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BILL PLIERS.**  
No. 23, in 7" size only.



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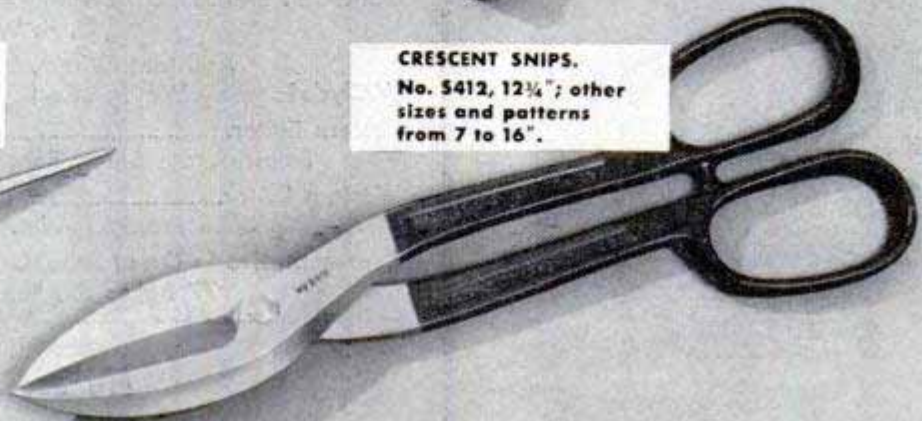
**CRESTOLOY END  
CUTTING NIPPERS.**  
No. 72, in 6 & 7" sizes.



**CRESCENT SCRATCH AWL.**  
No. 73 in 6<sup>5</sup>/<sub>8</sub>" size only.



**CRESCENT SNIPS.**  
No. 5412, 12<sup>3</sup>/<sub>4</sub>"; other  
sizes and patterns  
from 7 to 16".

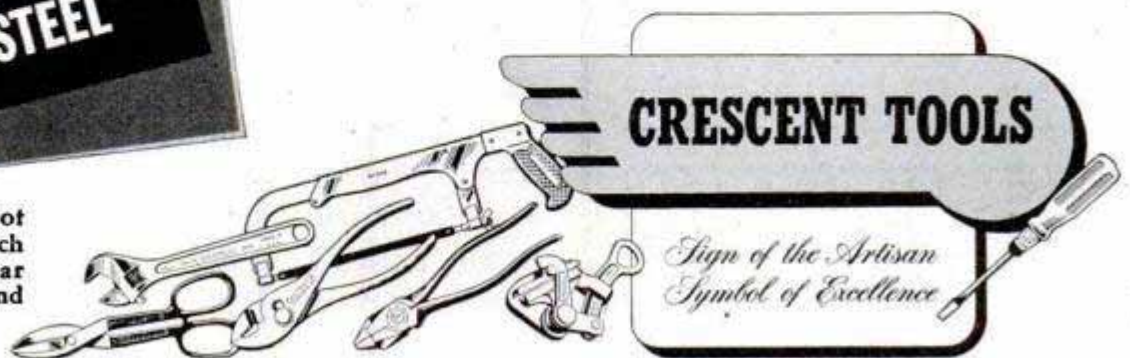


Write for your copy of  
this little folder which  
illustrates 21 popular  
patterns of Crescent and  
Crestoloy Pliers

## GOOD TOOLS

*...save time...reduce costs*

Users of Crescent and Crestoloy Tools have long since learned the economy of paying just a little more (than "cheap" tools cost) to get a whole lot more in hand tool quality. Superior tool design not only reduces worker fatigue but produces more and better output. The longer life of Crescent and Crestoloy Tools definitely reduces maintenance and replacement costs.

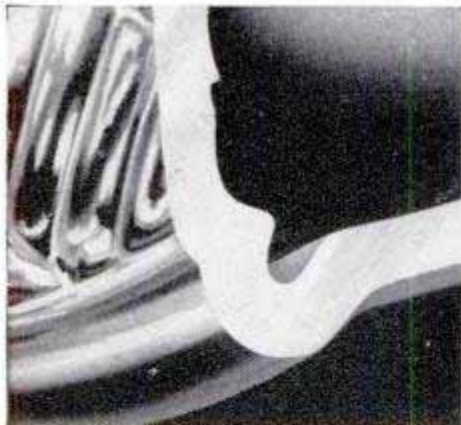


**CRESCENT TOOLS**

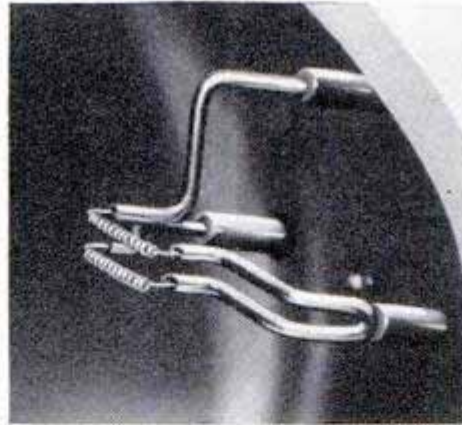
*Sign of the Artisan  
Symbol of Excellence*

THIS IS  
A G-E  
"ALL-GLASS"  
HEADLAMP

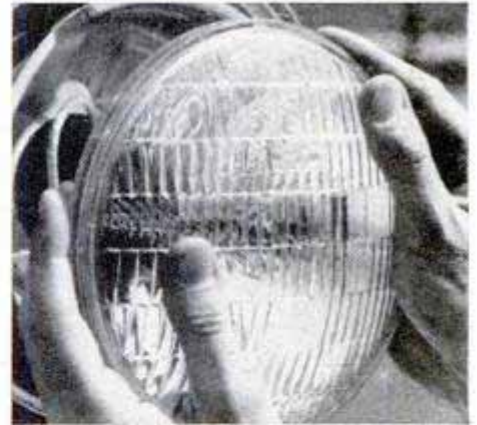
THIS CUTAWAY  
SHOWS WHY  
A G-E  
HEADLAMP  
DOES NOT  
GROW DIM!



**1. RUGGED, ONE-PIECE** construction keeps dirt and moisture from getting in to steal the light. General Electric headlamps average 99% of original light output at end of life.



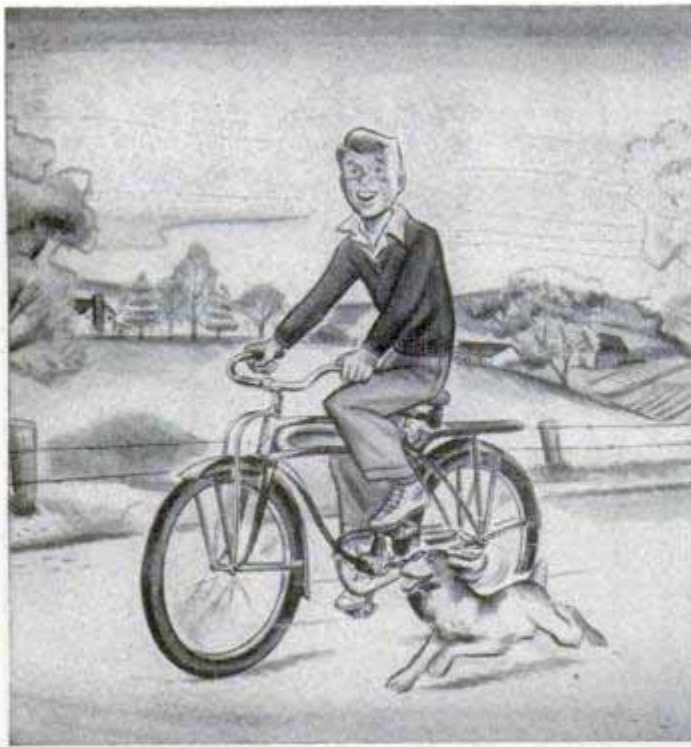
**2. IMPROVED FILAMENTS** give 12% more light on the road for driving—16% more light for passing. They're firmly anchored so they won't shake loose on bumpy roads.



**3. HARD-GLASS LENS** resists shock—is precision-built to throw maximum light on the road. Have lights checked next time your car is serviced—and insist on G-E lamps for replacement.

*You can put your confidence in—*

**GENERAL**  **ELECTRIC**



## A Boy, a Dog... and a Bike

A gleesome threesome if there ever was one! You're really going places, you're really doing things when you and your pup roll out the bike to see what's going on down the road.

Fun? You just know you'll have barrels of it, and so does Dad—good safe fun, too, because the New Departure safety brake affords constant control.

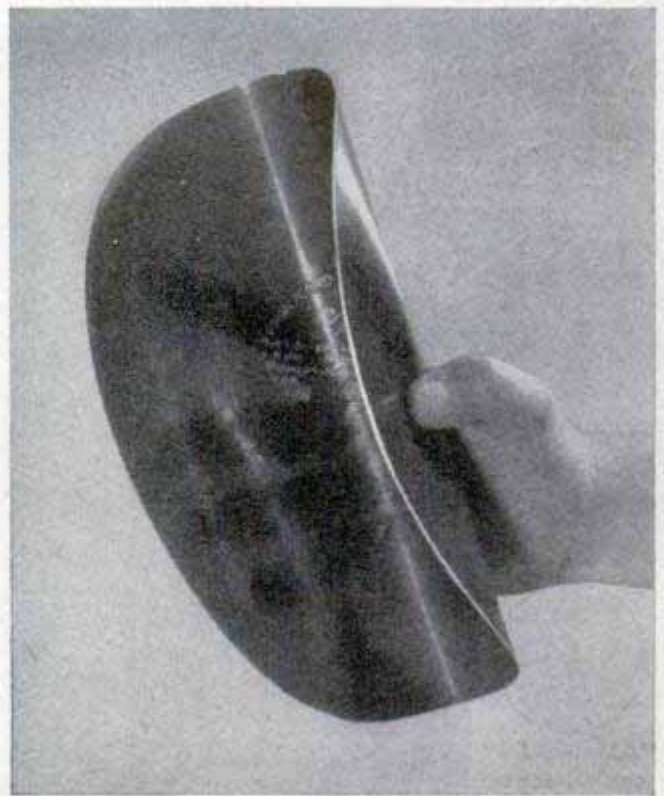
It brings any bike to a...



**New Departure**  
**SAFETY BRAKE**   
a product of  1876

New Departure • Division of General Motors • Bristol, Connecticut

in this corner.....  
**THE EDITORS**



### Letter to the Editor:

Dear Sir:

I found the attached German record in a shop here in town and, since I consider it highly interesting, I am sending it to *Mecanica Popular* for examination.

It was the last record in the shop and I had to pay 30 Patacas (about \$5) to convince the shop owner to part with it...

Daniel de Guerrero,  
Rua Sanches de Miranda #2,  
Macao, Col. Portuguesa, China.

*The flexible plastic record, imprinted "Made in Germany" and grooved with two fox trots recorded by "Missouri Jazz-Band, New York" arrived in our Chicago office in an envelope, in excellent playing condition despite its long trip from the Portuguese colony adjacent to Canton, China. The above letter was written in Portuguese to the editor of our Spanish language edition, Mecanica Popular.*

\* \* \*

### VIPs at Princeton

About the time that our Dick Dempe-wolff of New York shipped to us the story of Princeton's roomful of optical illusions (You Think You're Going Crazy, page 88),

(Continued to page 8)



# Why be a BOOKKEEPER?

... *When Accountancy offers more Money and Success...*

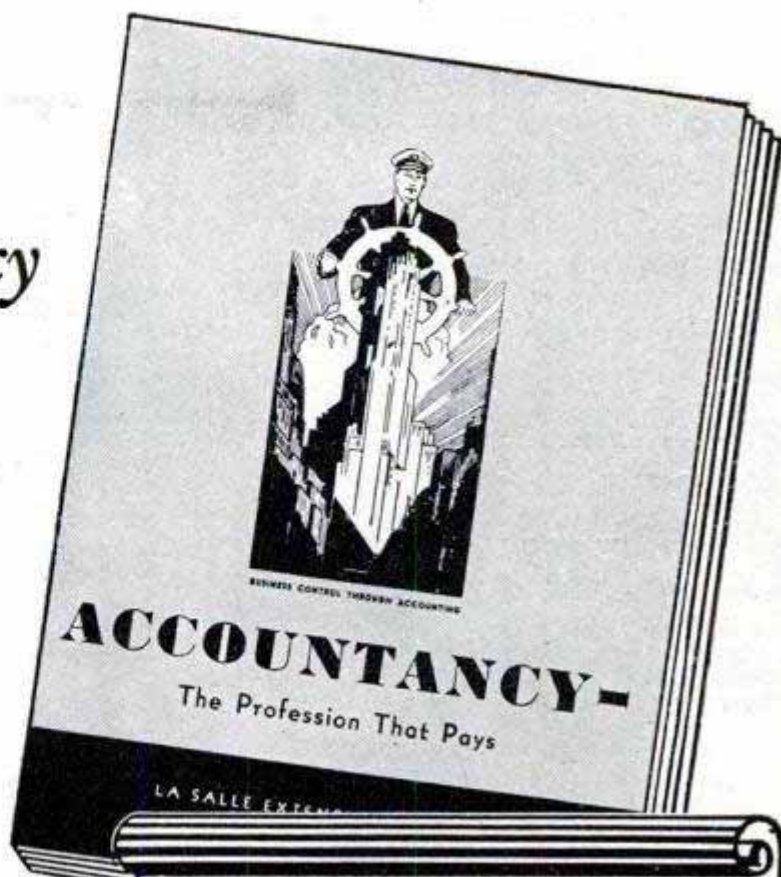
If you are a bookkeeper, you are right on the threshold of a profession that pays far above average—where there's real opportunity to get ahead and move up fast.

Why not step *UP* from bookkeeping—be an accountant—make *real* money!

You can learn Accountancy by the interesting LaSalle Problem Method—in your convenient spare time, at home, without losing a day from your work. You learn by *doing* . . . you study Accounting principles and solve Accounting problems under the clear guidance of experienced C.P.A.'s. You cover Accountancy from the basic principles right up through Accounting Systems and Income Tax Procedure—to advanced training for the C.P.A. degree if you so desire. And as you go along step-by-step, you master the principles of auditing, business law, statistical control, cost accounting, organization, management, finance, etc.

You go as fast or as slowly as you choose. And you may start "cashing in" on your new ability long before you complete the training—as thousands of others have proved. Many advance quickly to better positions, even before they are half way through. And that is only the *beginning* of a growing and continuing success for the rest of your business life.

Why remain "just a bookkeeper" when Accountancy holds so much for you? Our free 48-page booklet, "ACCOUNTANCY, THE PROFESSION THAT PAYS," tells you what you must know to be an Accountant, and how you can prepare in your



## LASALLE Extension University

*A Correspondence Institution*

Dept. 464-HR • 417 S. Dearborn • Chicago 5, Ill.

Send me your free 48-page booklet, "Accountancy, the Profession That Pays"—plus "Ten Years' Promotion in One"—a book which has helped many men.

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| <input type="checkbox"/> Bookkeeping         | <input type="checkbox"/> Foremanship                   |
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| <input type="checkbox"/> Business Management | <input type="checkbox"/> Stenotypy (Machine Shorthand) |
| <input type="checkbox"/> Salesmanship        |  |

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

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City, Zone, State.....

**LASALLE EXTENSION UNIVERSITY**

*A Correspondence Institution*

Dept. **464-HR** 417 S. Dearborn St.  
Chicago 5, Illinois

leisure time, at moderate cost and on easy terms.

Send the coupon today and we'll include "Ten Years' Promotion in One"—a book which has helped many men. Get all the facts and judge for yourself. There is no obligation. You are already started in this field . . . find out how you can rapidly go to the top! Mail coupon NOW!

**P**—is for Pyroil—lubrication's best friend

**Y**—Your car's protection, so little to spend

**R**—is for Riding with a motor that's singing

**O**—is for Oil, Pyroil helps to keep clinging

**I**—is Insurance against rust and drain

**L**—is for Long, Lasting miles you will gain

## Pyroil

—the perfect partner for lubrication, because it gives oil the property of clinging to metal surfaces at all times.

*Add Pyroil — Add miles to your car.*

### Pyroil for Aircraft Engines

Use Aircraft Pyroil B for lubricating oil, Aircraft Pyroil A for gasoline.

**GIVEN!** An attractive Pyroil metal savings bank, takes coins up to 50c pieces. **MOTORISTS**, it's yours for the asking—sent postage paid.

Manufactured and Guaranteed by Pyroil Company, 102 Pyroil Bldg., La Crosse, Wisconsin

Canadian Distributors: Central Purchasing Agencies, Ltd., Toronto, Ontario



#### PYROIL COMPANY

102 Pyroil Bldg., La Crosse, Wisconsin

I want my car to last and run properly. Please tell me more about Pyroil and how it can accomplish this for me.

Name \_\_\_\_\_

Address \_\_\_\_\_

City or Town \_\_\_\_\_ State \_\_\_\_\_



(Continued from page 6)

this letter came to us from Bill Reiche of RCA:

"Dear Sir:

"The Eastern Editor of your splendid magazine travels in fast company these days.

"In the Public Relations Department of Princeton University recently the day's agenda of visitors and activities posted on the wall read as follows:

The Shah of Iran  
Dempewolf

"Sincerely,  
"William Reiche,  
Department of Information,  
Radio Corporation of America."

\* \* \*

### Antidote for Sparrows

To the Editor:

I recently received a letter from one of your personnel telling me I was an old reader of your magazine. Quite true; perhaps 30 or 40 or more years—so long I don't remember when I began. But I like it better than any magazine I ever purchased. It never ceases to be interesting and useful. I read through the ads as well as the other material . . .

I am 73 years of age now . . . in wonderful condition . . . I am going to have a shop where I shall use many of the ideas I gleaned from the pages of your wonderful magazine.

At present I am bothered with sparrows; they have become a pest. Have you any diagrams of bird traps that I can build and put in an inconspicuous place either on my back porch or on a window sill? I do not want to use poison that might kill other birds or be picked up by small children or dogs or cats.

Sincerely,

A. J. Lillis Walkup,  
4327 W. Kamerling Ave.,  
Chicago 51.

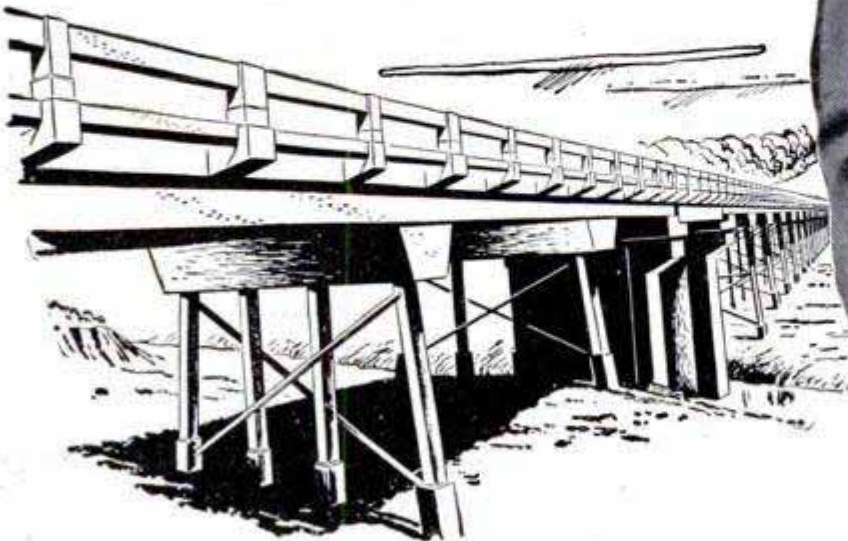
(How to get rid of sparrows is the subject of an article in the Craftsman Section next month.)

\* \* \*

### Man of the Year

James H. Rand III of Cleveland was featured in the leading article of our March issue as the "Inventor in a Carriage House." A note from Walter E. Burton of Akron, author of the article, tells us Rand has been named Cleveland's "outstanding young man of 1949" by the Junior Chamber of Commerce.

# I. C. S. training was his "BRIDGE TO SUCCESS"



**HAYDEN M. HARGETT** took his first I. C. S. course while he was still a student in high school.

He is now County Engineer of Franklin County, Alabama. Last year Mr. Hargett designed 27 homes, two theaters, a bus station and three bridges. He supervised fifty miles of highway construction and the paving of one hundred thousand square yards of city streets.

**Mr. Hargett recently enrolled for another I. C. S. course**

Listen to what he has to say about I. C. S. training: "It's more practical—more flexible than any training I've had. I can't speak highly enough of my I. C. S. training."

Mr. Hargett says his first I. C. S. course was his "bridge to success." "There might not have been much of a career," he said, "if it hadn't been for that first I. C. S. course."

**I. C. S. training can be your "bridge to success." Mail the coupon today!**

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**APPROVED**  
under the  
**G. I. BILL**

BOX 5673-K, SCRANTON 9, PENNA.

Without cost or obligation, please send me full particulars about the course BEFORE which I have marked X:

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|---|---|--|--|
| <p><b>Air Conditioning and Plumbing Courses</b></p> <p><input type="checkbox"/> Air Conditioning<br/><input type="checkbox"/> Heating<br/><input type="checkbox"/> Refrigeration<br/><input type="checkbox"/> Plumbing<br/><input type="checkbox"/> Steam Fitting</p> <p><b>Chemical Courses</b></p> <p><input type="checkbox"/> Chemical Engineering<br/><input type="checkbox"/> Chemistry, Analytical<br/><input type="checkbox"/> Chemistry, Industrial<br/><input type="checkbox"/> Chemistry, Mfg. Iron &amp; Steel<br/><input type="checkbox"/> Petroleum Refining<br/><input type="checkbox"/> Pulp and Paper Making<br/><input type="checkbox"/> Plastics</p> <p><b>Civil Engineering, Architectural and Mining Courses</b></p> <p><input type="checkbox"/> Architecture<br/><input type="checkbox"/> Architectural Drafting<br/><input type="checkbox"/> Bridge and Building Foreman<br/><input type="checkbox"/> Building Estimating<br/><input type="checkbox"/> Civil Engineering<br/><input type="checkbox"/> Coal Mining<br/><input type="checkbox"/> Contracting and Building<br/><input type="checkbox"/> Highway Engineering<br/><input type="checkbox"/> Lumber Dealer<br/><input type="checkbox"/> Reading Structural Blueprints<br/><input type="checkbox"/> Sanitary Engineering<br/><input type="checkbox"/> Structural Drafting</p> | <p><input type="checkbox"/> Structural Engineering<br/><input type="checkbox"/> Surveying and Mapping</p> <p><b>Communications Courses</b></p> <p><input type="checkbox"/> Electronics<br/><input type="checkbox"/> Practical Telephony<br/><input type="checkbox"/> Radio, General<br/><input type="checkbox"/> Radio Operating<br/><input type="checkbox"/> Radio Servicing<br/><input type="checkbox"/> Television<br/><input type="checkbox"/> Telegraph Engineering</p> <p><b>Electrical Courses</b></p> <p><input type="checkbox"/> Electrical Drafting<br/><input type="checkbox"/> Electrical Engineering<br/><input type="checkbox"/> Electric Light and Power<br/><input type="checkbox"/> Lighting Technician<br/><input type="checkbox"/> Practical Electrician</p> <p><b>Internal Combustion Engines Courses</b></p> <p><input type="checkbox"/> Auto Technician<br/><input type="checkbox"/> Diesel-Electric<br/><input type="checkbox"/> Diesel Engines<br/><input type="checkbox"/> Gas Engines<br/><input type="checkbox"/> Aviation</p> <p><b>Mechanical Courses</b></p> <p><input type="checkbox"/> Aeronautical Engineer's, Jr.<br/><input type="checkbox"/> Aircraft Drafting<br/><input type="checkbox"/> Forging<br/><input type="checkbox"/> Heat Treatment of Metals<br/><input type="checkbox"/> Industrial Engineering<br/><input type="checkbox"/> Industrial Instrumentation</p> | <p><input type="checkbox"/> Industrial Metallurgy<br/><input type="checkbox"/> Machine Shop<br/><input type="checkbox"/> Mechanical Engineering<br/><input type="checkbox"/> Mold-Loft Work<br/><input type="checkbox"/> Patternmaking—Wood, Metal<br/><input type="checkbox"/> Reading Shop Blueprints<br/><input type="checkbox"/> Sheet-Metal Drafting<br/><input type="checkbox"/> Sheet-Metal Worker<br/><input type="checkbox"/> Ship Drafting<br/><input type="checkbox"/> Tool Designing<br/><input type="checkbox"/> Welding Engineering<br/><input type="checkbox"/> Welding—Gas and Electric</p> <p><b>Railroad Courses</b></p> <p><input type="checkbox"/> Air Brake<br/><input type="checkbox"/> Diesel Locomotive<br/><input type="checkbox"/> Locomotive Engineer<br/><input type="checkbox"/> Locomotive Fireman<br/><input type="checkbox"/> Locomotive Machinist<br/><input type="checkbox"/> Railroad Section Foreman<br/><input type="checkbox"/> Steam-Diesel Loco. 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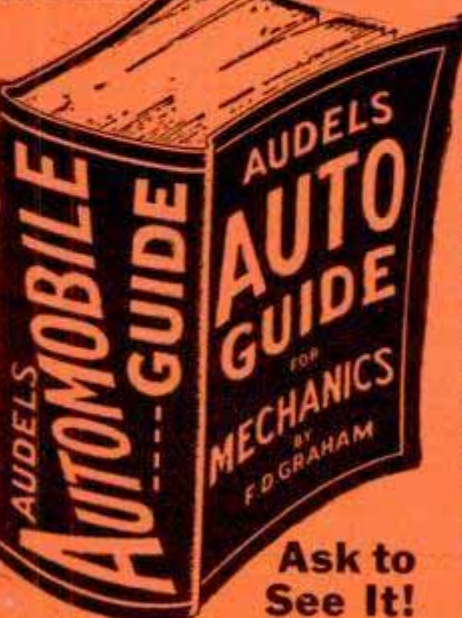
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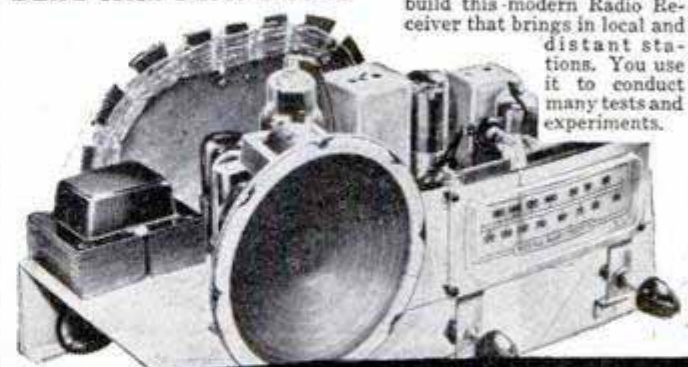


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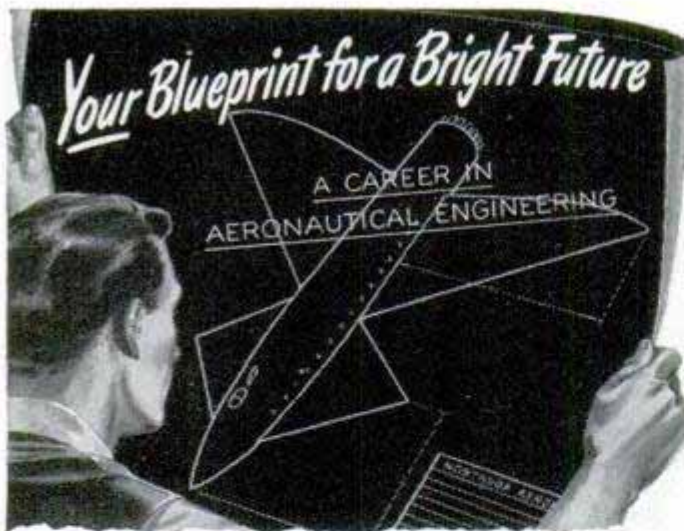
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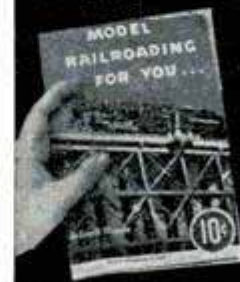
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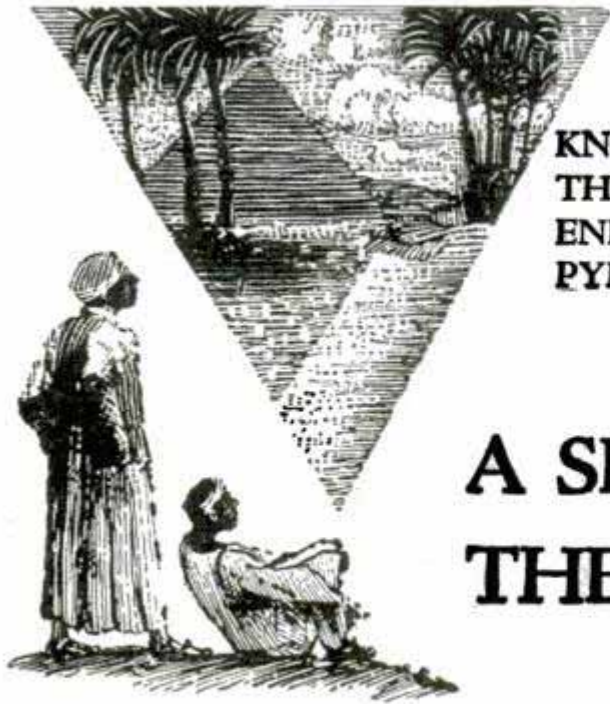
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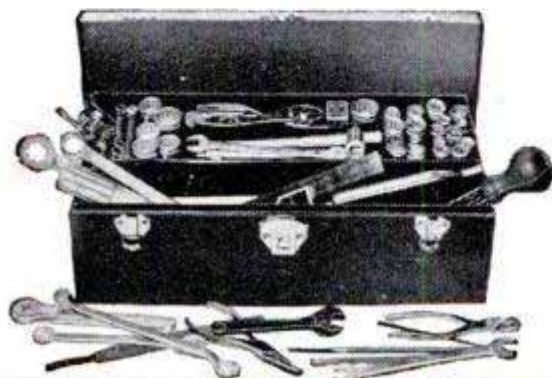
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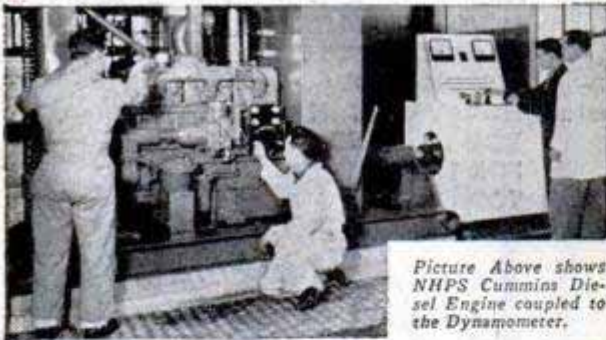
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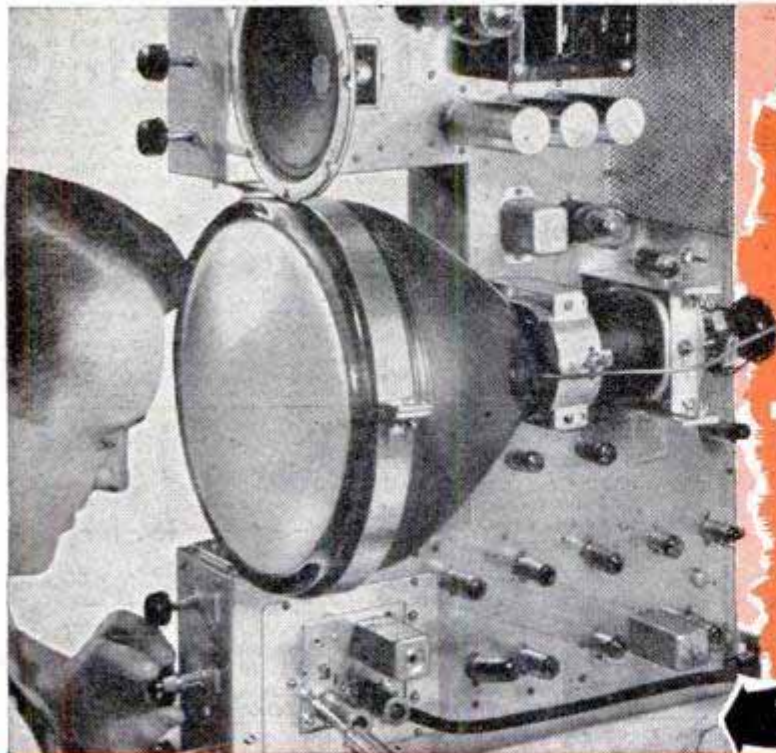
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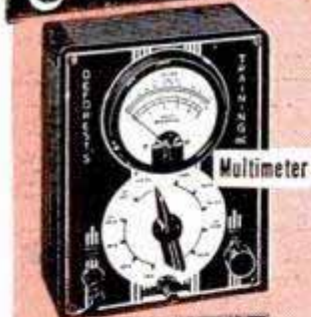
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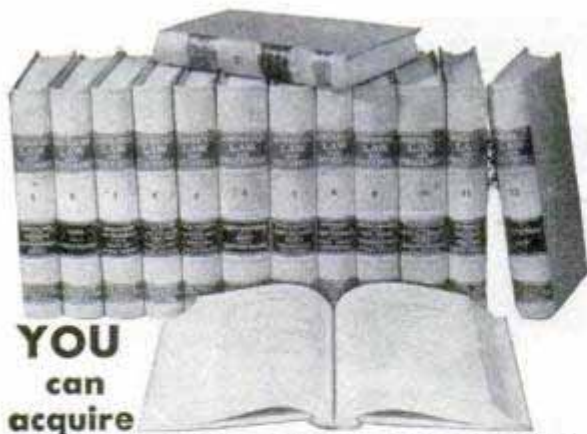
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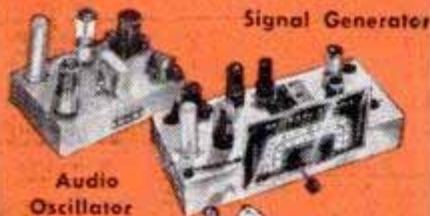
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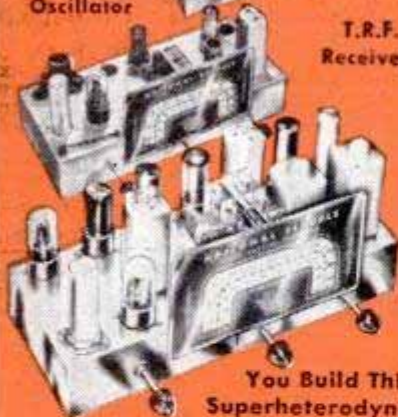


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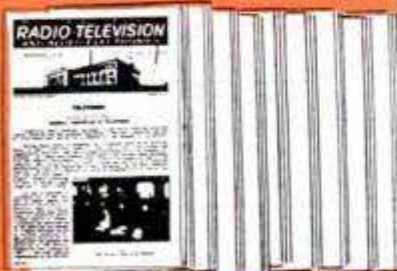
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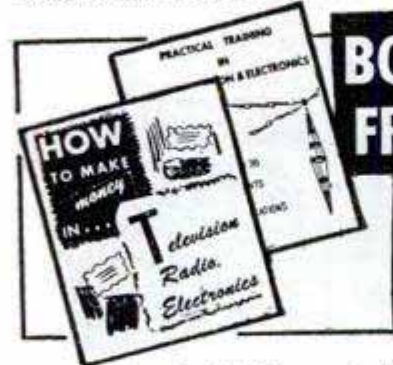
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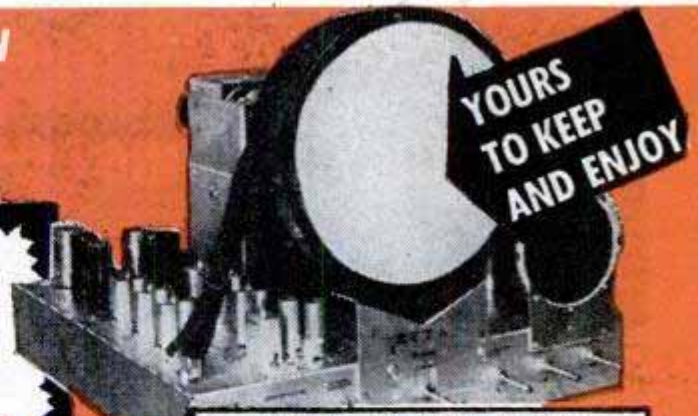
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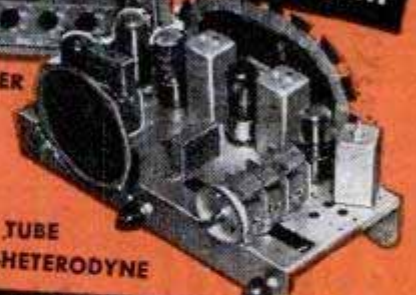
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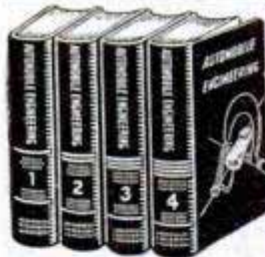
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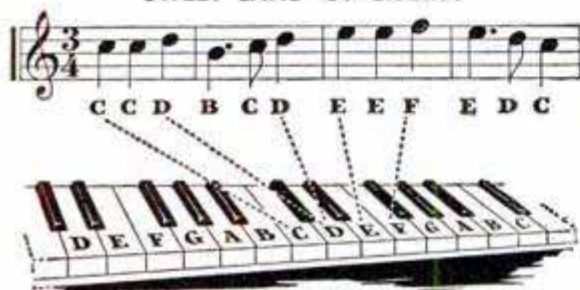
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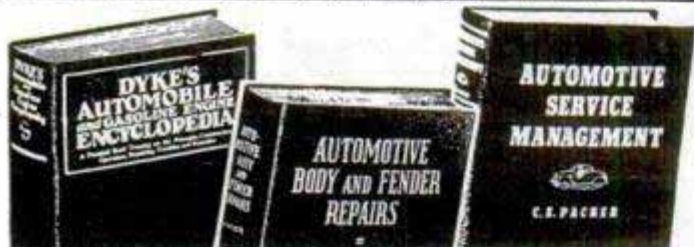
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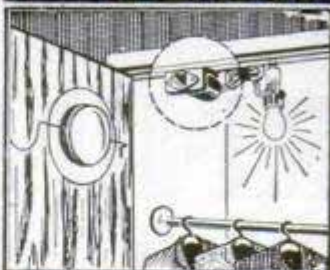
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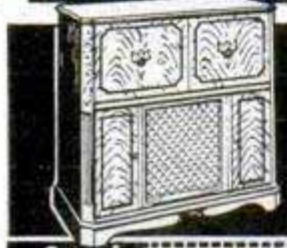
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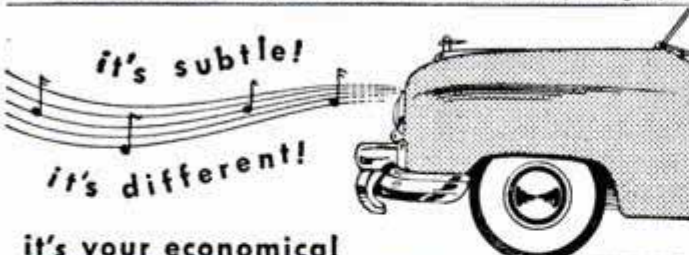
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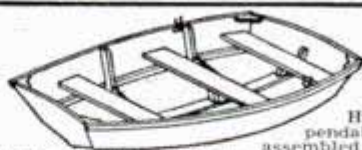
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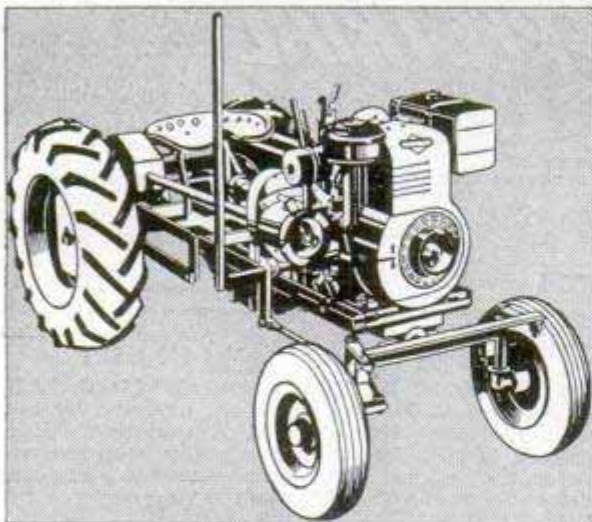
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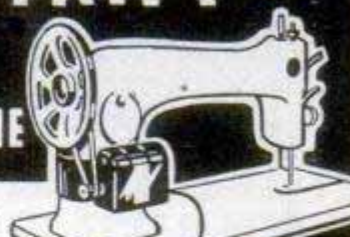
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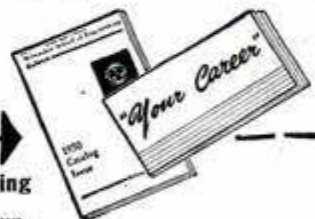


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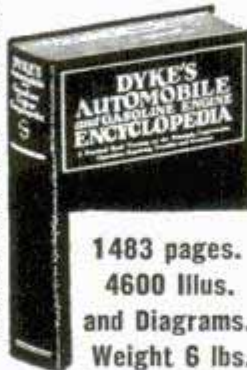
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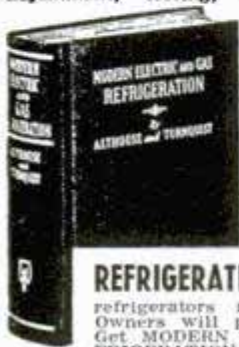


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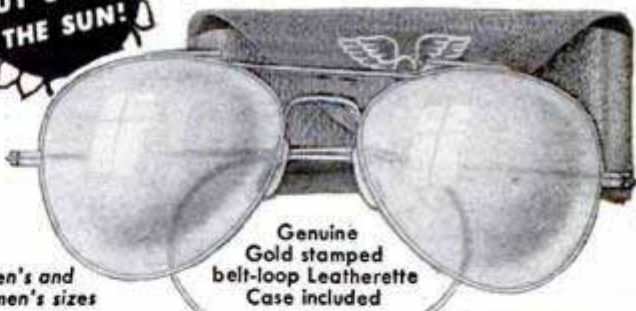
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**NEW Sensational seat cover.** Mono. 6545 Santa Monica Blvd., Hollywood, California.

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**SAVE Gasoline!** Sensational Gane needles. Free trial. See page 47.

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**1950 SUPERIGNITIONITER:** Starting, pep, mileage, \$4.50. EG Mfg., Elmsford, N. Y.

**SHATTERPROOF Glass!** Factory savings! Write requirements. Cooper's, 3124 Lawrence, Chicago 25.

**BATTERY Chargers.** \$3.95 up. L. Alexander, 780 E. 214th St., New York 67.

**WELDING Training pays.** Operating under V.A. contract. Free catalog. Box 279-M-403, Troy, Ohio.

**WELDING Bodies, frames, fenders.** Pays with Hobart arc welders. Easy terms. Free catalog. Box 279-M-402, Troy, Ohio.

**GASOLINE Expensive?** Simple device totals miles, gasoline, calculates miles per gallon as you travel. Complete \$1.00. United Manufacturing Associates, 3605 Canyon Ridge, Fort Worth 3, Texas.

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**STARTERS, Generators.** Guaranteed rebuilt original equipment, for most cars and trucks from 1928 to 1939. Abbot Auto Electric, 4215 Grand River, Detroit 8, Michigan.

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**SPEEDOMETERS.** We rebuild any make, \$4.95. Western Speedometer Rebuilders, 10452 Magnolia, No. Hollywood, Calif.

**BUICK Parts—Enjoy new-car pep and power in your old Buick.** Same day service from world's largest stock of new (not rebuilt) Buick parts and engines. Ship anywhere. Dime brings catalog. Write today. Robertson Buick Co., 1001 S. Wash Ave., Chicago 5, Ill.

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**CHEVROLET Parts.** Scarce motor, body, sheet metal parts. Grossman Chevrolet, Minneapolis, Minnesota.

**AUTOMOTIVE Surplus tool specials!** Pullers, wrenches, socket sets, reamers. Other bargains. Nationally advertised merchandise. Send dime for catalogue. Glenco Supply, 7521 Myrtle Avenue, Glendale 27, N. Y.

**AUTO And truck parts.** New and used. Lowest prices. Complete stock. Prompt replies. Babbitt Auto Parts, 2833 Chicago Ave., Chicago 22, Ill.

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**GOVERNMENT Surplus.** Low voltage circuit tester in steel box. Cost \$202.00. Our price \$27.50. Will test batteries, starters, generators, voltage regulators, grounds, short circuits. Wilt Electrical Company, 7829 S. Racine Ave., Chicago 20, Ill.

**SAVE Gasoline!** Sensational Gane Needles. Free trial. See page 47.

**"LEKTRON" Atomic coil booster saves gas!** Instant starting, smoother power. Guaranteed. \$2.00. Electronic Industries, Cleveland 11, Ohio.

### AUTO TRAILERS

**TRAIL Hut folding camp trailer is easy to build.** We have complete kits, parts. Plans \$1.00. Send for free folder, price list. Trail Hut, Dept. PM-4, 600 Sixteenth Street, Oakland 12, California.

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**NATIONAL Air Race Sketchbook.** Covers all air races 1929-1949 complete with full details, 190 sketches, charts, drawings and 14 winning airplane plans. \$2.00 postpaid. Clymer, Dept. 4-A, 1268 S. Alvarado, Los Angeles 6, Calif.

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**TRAFFIC Appliance parts, wholesale catalog and handbook, \$1.00 (refunded on \$5.00 order).** C-U's Supply, 2512-I Prevost, Ft. Worth 7, Texas.

**AMAZING Discovery, re-light "burned-out" fluorescent tubes.** Plans \$1. William Beck, 205 Hinkle St., Thomasville, N. C.

**LAMPS—Build own originals, parts wholesale, any amounts.** Catalogue 10c. Brown Lamp Co., Box 501, Wellston, St. Louis 12, Mo.

**"AUTOMATIC Closet light."** Battery powered. (Just like light in refrigerator.) \$1.25 postpaid. Akrit Industries, Inc., P.O. Box 75, Detroit 2, Michigan.

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**MAGNET Wire, insulation, transformer lamination.** Morton Electrical Service, Maywood 8, Illinois.

**32 VOLT Appliances—World's largest line.** Catalog free. Haines Corporation, Dept. N, Minneapolis, Minn.

**LAMPS—How to build lamps from vases, pitchers, etc.** Chart for top and bottom lighting, alternately or together. How to wire oil lamps, all in 56 page illustrated catalog of all lamp parts, 25c. Gyro Lamps, 5402P Clark, Chicago 40.

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**ELECTRIC Motors, free bargain list, Plenge, 9 Stuyvesant Oval, New York 9, N. Y.**

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**BUILD Your own arc welder.** Inquiries



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**RECTIFIERS** 0-4 V.D.C. \$9.50, 0-8 V.D.C. \$12.50, 0-12 V.D.C. \$18.50. All 0-100 amps. Starkweather, Ottawa, Kansas.

**RADIATOR** Repairing books, supplies, equipment, gasoline torch. Write, Curfman Co., Maryville, Mo.

**BUY** Direct from factory. Welding and cutting equipment. All makes of equipment repaired. Established 1913. Box 331, Hamilton, Ohio.

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**DRILL** Grinder for twist drills, \$2.95. See ad on page 275.

**FOUR** Brand new Onan electric plants, 3 phase, 60 cycle, 25,000 watts, driven by 6 cylinder gasoline engine. Priced one half of today's cost. The Eastern Machinery Co., Cincinnati 29, Ohio.

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**SAW** Blades—Factory prices. Free catalog on all types. Tubergen Saw Co., 1912 Jerome Ave., Grand Rapids 7, Mich.

**SURPLUS**—Electric drills, 1/4" \$16.95; 1/2" \$29.95. (Jacobs geared chucks.) 6" electric portable hand saws with case \$56.00. Send check or M.O. Money back guarantee. Send 10c for illustrated folder. Byron Tool Company, 1609 Unionport Road, New York 60, New York.

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**HOME** Lathe owners—Build your own attachments. Send for picture, sample of work and list of blueprints. Cut gears, ratchets, etc. Make neat screws easy way. The Home Shop, 415 Raymond Ave., Glendale 1, Calif.

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**REBUILT** Outboard motors—Late models. We specialize in new-used parts. Write for price quotations giving us description of parts needed. Money back guarantee. Standard and oversize outboard motor pistons. Outboard Motor Mart, 309B Atlantic Avenue, Boston 10, Mass.

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**MOTOR** Winders, free bulletins, winder and tester equipment. Motor Industries, Quincy, Illinois.

**CLOSE-OUT** Sale new 1 h.p. gasoline engines. Never unpacked. Motorize lawn mower, saw, pump, sprayer. Check, c.o.d. \$27.50. Jedway Corporation, Acton, Indiana.

**WINDING** Data, listing 225 motors, single and three phase, \$1.00. Motor Data Co., Box 7631, Kansas City 3, Mo.

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**BARBELLS,** Exercise equipment. Courses. Free booklet. Good Barbell Co., Reading, Penna.

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**SEND** 10c For list 100 used guns. Prayseth's, Willmar, Minn.

**FISHERMEN**—Make your own sinkers with our molds. Free illustrated booklet. Reading Instrument Co., Box 78, Reading, Penna.

**MOLDS** "For fishermen, sinker, squids, jigs, and lures" handled and hinged, quality fishing tackle, free catalogue. Sweets Molds, Tonawanda, New York.

**OLD** Elmer, 4422A Summit, Kansas City, Mo. want 500 fishermen to try his new "Girdle Hook." Send your name today.

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**STOP** Digging. Spray ground. Worms appear like magic. Formula 50c. Charles G. Hyde, Ballston Spa, N. Y.

**WHY** Wait? Send four bucks now for our salesmen assortment of twelve casting lures. Undersell all competitive items while doubling your money. Write Ace Specialty, 409 Elm St., Buffalo 3, N. Y.

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**FREE** Guidebook, "Top Tips For Fishermen." Send now for this fascinating, new, free, Richardson 32-page booklet containing 357 fishing tips, compiled by the expert fishermen who make Richardson rods—the fishing rods that are tagged with the "Sign of the Fish!" For your copy, sent without cost or obligation, print your name and address on a penny post card and mail to Richardson Rod & Reel Co., 3166 N. Sawyer Ave., Chicago 18, Ill.

**LEARN** Gunsmithing! Details, copy "Guns and Gunsmithing" 25c. Gunsmith, Palatine, Illinois.

**FREE** 50 Page catalog—Fly-tying, lures, spinners, rod making materials, hooks, fishing supplies. Scueilly Tackle Co., 3436 W. 5th Ave., Chicago 24, Ill.

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**BRONZE** Baby shoe instructions, supplies, custom plating and Pearlucite finishing. Schoettle, Friendship, Ohio.

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**PLASTIC**, Sheets, rods, tubes, etc. Free list. Plastics Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

**WHOLESALE** Plastics supply catalog. 10c. Lucite, clear, colored. Metallic acetate, 15 colors. Thick lucite cutoffs, polished blanks for carving. Metal findings, tools, ideas, bargains galore. Quantity prices on casting plastic. Gem-O-Lite, Box 686S, North Hollywood, Calif.

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**USEFUL** Laboratory item, catalog of chemicals, laboratory apparatus, 10c. Rex Laboratories, 2849A Birchwood, Chicago 45, Illinois.

**NEW** Idea chemical and apparatus outfits for home experimenting. Photo-scales, microscopes, chemicals, biological and laboratory supplies in small quantities. Catalog 15c. Established 1931. John H. Winn, 124A West 23rd Street, New York, N. Y.

**ILLUSTRATED** Catalog: Chemistry, mineralogy, biology, 10c. Tracey Laboratories, Evanston, Illinois.

**CHEMICALS** And apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-50, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, 20, N. Y.

**NEW** Laboratory supply catalog of chemicals and apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22, Ill.

#### AGENTS WANTED

**STAINLESS** Steel burglar-proof window guard. Sample: 25c. Free details. Artware Corporation, 11110 Ventura, North Hollywood, Calif.

**MEXICAN** Feather pictures. Big profits! No investment! Free details. Sample 10c stamps. Silvia-Pa, Apartado 9036, Mexico City.

**SEND** \$1.00. Receive six pair rayon samples mens sport Sox. Demonstrators. Yale Clothing, Meriden, Conn.

**EVERYDAY** Cards. Earn \$5.00 with every ten \$1.00 boxes of everyday cards you sell. Also new plastic cards, note paper and wrappings. Send for samples today. Howard P. Ellis, Dept. PM-4, Pitman, N. J.

**INFORMATION**—Money-making plans and wholesale supply sources will increase your income! Write, Reynard Service, Smithfield 4, Ohio.

**SELL** Ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious, "7x11" cost 6c, sells 55c. Make money. 15 samples \$1.00 postpaid. Lowy, 8 West Broadway, Dept. 532, New York.

**AGENTS**—Sell finest food products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sales plans make sales easy. Permanent repeat business. Powerful premiums and free door openers for easier sales. Samples furnished. Live territories open to dis-

**START** Your own business on credit. Always your own boss. 1554 dealers, sold \$5,000 to \$26,500 in 1948; their average \$6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful opportunity to own pleasant profitable business backed by world-wide industry. Write Rawleigh Co., Dept. D-U-PPM, Freeport, Ill.

**LOOK** Here! Wanted—Men to start in business on credit. Sell some 200 farm-home products. Thousands our dealers now make quick sales, big profits. For particulars write Rawleigh's, Dept. D-192-PPM, Freeport, Ill.

**NYLON** Uniforms. Immediate delivery, immediate profits. Sell to doctors, dentists, nurses, waitresses, beauticians, housewives. Free sales kit. Superior Fabrics, Dept. P4, 3936 Market, Philadelphia 4, Penna.

**FREE** Samples, and amazing plan, giving you gorgeous dress without penny cost. Rush name today, with dress size. Harford, Dept. B-535, Cincinnati 25, Ohio.

**ABSOLUTELY** Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 5430, Cincinnati 3, Ohio.

**DOUBLE-DUTY** Shopping bag. Zips open. Instantly changes small to large size. Samples sent on trial. Kristee 147, Akron, Ohio.

**LENS** Glo. Amazing new eye glasses cleaner. Sell individuals and wholesale to stores. Whirlwind repeat seller. Big profits. Carhoff, 9321 Buckeye, Cleveland, Ohio.

**LOOK!** Sell initialed individualized belts, buckles, cap badges, tie holders, etc., choice 2000 emblems. Write special outfit offer. Hook-Fast, Box 1425PM, Providence, R. I.

**PROFITS** To 100%. Show lovely greeting cards, plastics, metallics, personalized stationery, napkins, coasters, novelties. Approval sample. Torres, 373A Fulton St., Brooklyn 1, N. Y.

**AT** Last! Something new and sensational in everyday cards. Make extra money fast! Show gorgeous satin velour metallic cards. Get orders easy. Scented stationery, charmettes, napkins, kiddie cards. 50 other assts. retail 60c to \$1.25. Samples on approval. Puro Co., 2801 Locust, Dept. 040-D, St. Louis 3, Mo.

**AMAZING** Offer—\$40 is yours for selling only 50 boxes. Also entirely different, new deluxe all-occasion assortment with television card. Little pearls, hankie gift greetings, other surprise items. Feature boxes on approval. Free samples imprinted stationery and rose scented notes. Write today. It costs nothing to try. Cheerful Card Co, 1297 White Plains, N. Y.

**EXTRA** Money! Sell new, different greeting cards. Complete line includes Regal plastic assortment, metallics, "stand-up" and "double" cards. Free samples exclusive imprinted and engraved stationery. Sales kit on approval. Regal Greetings, Dept. PM-14, Hazel Park, Mich.

**MAKE** Money fast selling biggest line gorgeous greeting cards—21 for \$1.00 all-occasion, birthday, Mother's Day, friendship, anniversary, comics, relative, Catholic, new metal and \$1.00 plastic cards. Little pearls, twice as nice, lustre beauty, bright spots, nifty gifties, scented stationery, children's books, gift wrappings, ribbons, gifts. Plastic thread box, draperies, handkerchiefs, imported napkins, Ever-sharp pen sets. Everyone a prospective customer. Amazing profits for agents, church groups, clubs. Extra cash bonus plan. Experience unnecessary. Write today for samples on approval and special offer. Hedenkamp, 361 Broadway, Dept. PM-5, New York.

**100,000** FULL Fashioned nylons 8c up in volume. Stock list 25c. Sibert Wholesalers, Chattanooga 4, Tenn.

**HOUSE** Paint—Your name on label. Agents wanted. Experience unnecessary. Free sample. Certified Products, Louisville, Ky.

**"SOLVEX"** Cleans dirty hands quickly. Exclusive territory. Solvex, Monticello, Iowa.

**BUY** Thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save." Service Publishing, 218-A Investment Bldg., Pittsburgh 22, Penna.

**BUILDING** Maintenance, you may enjoy steady increasing life income, in your own business. Pioneer, 1828 Columbus, Cleveland 13, Ohio.

**MAKE 100% Profit!** Sell the new "Marks-All" mechanical pencil. Ten second demonstration sells on sight. Heavy duty shop pencil marks on plastics, glass, metals, tile—anything! \$1.00 retailer. 7c sample charge refundable first order or postcard for details. Studwell Products Company, Dept. A.W., 70 East 45th Street, New York 17, New York.

**I'LL Put a "shoe store business" in your pocket!** Nation's leader trains you to make big money! Fit men, women. Free sample outfit. Write today! Consolidated Shoe System, Dept. S-542, Chippewa Falls, Wis.

**DRESSES, 18c;** Coats \$1.00, blouses 35c. Free catalog. Crown, 164-P Monroe Street, New York.

**EVERY Housewife needs "300 Household Hints."** Lightning 25c seller. Sample 10c. King, 55-P Oleander, West Springfield, Mass.

**TRANSPARENT Liquid rubber coating non-slip, speed drying, for floors, walls, woodwork, linoleum.** Damp proofs base-ments. Costs 98c, sells \$2.98. Big demand. Rubber Products, Inc., Station A, New Haven, Conn.

**\$1 STARTS You in business.** Sell top quality \$1.00 ties. Now only \$7.20 dozen, your profit \$4.80 dozen. Regular \$1.50 up values. Send \$1.00 for introductory offer two ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. K-42, New York 10.

**SPARE Time, \$50,** selling top line every-day greeting, personalized stationery, napkins, coasters. Victory Studios, Mt. Vernon, N. Y.

**STEADY Profits—No investment.** Earn \$50-\$75 weekly spare time. \$100-\$250 full time. Plastic aprons, tablecloths, etc. Free catalog. Halliday Co., Dept. M-4, 347 Broadway, Passaic, New Jersey.

**NYLONS Given free if SheerKraft hosiery doesn't live up to amazing three month written guarantee enclosed with every order!** Over 570 styles, sizes, colors! Big commissions. Big bonuses. Sheer-Kraft, Box 72-E, Newark, N. J.

**NEW, Miracle household deodorizer kills offensive odors instantly.** Big profits. Amhar Industries, Plant 5G, Huntington, New York.

**JOIN Manufacturers "Products-of-the-Month Association,"** and get California's hottest selling lines. Sponsored by manufacturers. Dollar bill brings Hollywood's newest \$1.95 automotive accessory and membership. Director, Box 2470-PM, Hollywood, California.

**BIG Money selling tooth powder.** J. Walker, 633 Plymouth Co., Dept. 1, Chicago 5, Ill.

**FREE Literature—Thousands wholesale supply sources.** Money-making business ideas. Wilkin Company, Hillsboro 4, Ohio.

**AGENTS: Sell fast moving lawn mower sharpener.** Write for details. Accurate Sharpener Mfg. Co., Milwaukee 12, Wis.

**PROFIT Making novelties.** Two samples \$1.50. Folder free. Roger Enterprises, 7 Waverly, Tuckahoe, N. Y.

**ELECTRIC (1/2-Hp.) mowers—\$59.50.** Sensation. Thousands sold. Delivered. Rotacut, R-2004, Excelsior Springs, Mo.

**EXCLUSIVE Agency.** Power mowers—\$59.50. Delivered. World's cheapest. Modern, 7401-AD, North Kansas City, Mo.

**GREETING Card moneymakers.** Mother's Day, birthday, everyday. Catalog free. Greenport Art Company, Brooklyn 15, New York.

**POWER Mowers, sample \$74.50;** garden tractors \$77.00. Seasonal selling means easy sales. Power Equipment, Wakeman, Ohio.

**"BASEBALL" By Connie Mack.** New red hot seller! Thrilling inside story of America's national game by "Mr. Baseball" himself—"My 66 Years in the Big Leagues." Large book; 300 pages. Beautifully illustrated. Sells on sight! Big cash daily. Write for starting outfit! Universal House, 1012-BB Arch, Philadelphia, Penna.

**AMAZING Low-priced reflecting house numbers** sell like wildfire. 30,000 glass lenses to square inch! Self-applying, or sell complete with bracket. Low as 80c. Your profit 100%. Prospects and profits everywhere. Write Nite-Brite, 216 N. Wabash, Dept. 30, Chicago 1, Illinois.

**SENSATIONAL Earnings,** selling granite memorials. Lowest prices. Delivered. Guaranteed. Mihelik Memorials, St. Cloud, Minn.

**SENSATIONAL Nylons guaranteed** against runs. Nationally advertised. Not sold in stores. No experience or money needed. Also lingerie, robes, men's hosiery. Outfit, sample, etc. free. Wonderful opportunity earn big money spare or full time. See our full page advertisement on page 71. Kendex Co., Babylon 646, New York.

**SERIOUS Offer:** spare time, fun, excellent profits. Dollar bill brings samples. Idap, 26 Hollande, Tangier, Morocco.

**NAME Plates sell fast.** 3 designs. 100% profit. Demonstrating samples free. Barkers, 949 Greenwood, Zanesville, Ohio.

**BOYS! Earn big money easy,** spare time selling brass name plates for neighbor's doors. Write Hubstamp, 359-C Congress, Boston, Mass.

**\$85.00 WEEKLY Selling 4 pair shoes** daily direct. Free outfit. Samples. No investment. Experience unnecessary. Advance commissions, bonus. Paragon Shoes, 739 Columbus, Boston, Mass.

**BUY Nylons direct from mill.** Make good profits on fast selling nylons. Quick delivery on any quantity. Write for confidential wholesale price list. Joy Hosiery Mills, Delawanna 13, New Jersey.

**SPARETIME Profits** operating your own magazine subscription agency from home. Also handle all type greeting cards, stationery. Big confidential catalog and supplies free! It costs you nothing to try! Cassell Service, Westfield 3, N. J.

**NEW! Birthday party pack.** Be first! Sell this sensational new assortment. Contains everything but the food. The invitations, table cover, napkins, nut baskets, place cards, snapper hats, cups, plates, game booklet and six different games; a complete party for eight. Sample \$1.25. Also America's leading greeting card line featuring personalized stationery, napkins, book matches and exclusive new wedding invitations. Free samples. Elmcraft Chicago, 5930 S. Western, Chicago 36, Illinois.

**SELL New clothing.** Lowest prices. Operate from home, auto, store. Enormous profits. Big catalog free. National Mail Order, 1219-F South Jefferson, Chicago.

**SELL Balloons! Combs! Novelties!** Excellent sideline. Carleton House, Texas City, Texas.

**WHERE To buy 800,000 articles** and nationally advertised merchandise direct from manufacturers and jobbers. Sent free. "Buy direct and make bigger profits." Glass Pub. Co., Ellwood City 7, Penna.

**\$100.00 FAST—Easy.** New office necessity does it. Hudson, 934 Lakeside, Chicago 40.

**BE Renewal headquarters** for all magazines. Handle everything at home. Big profits. No experience—no capital needed. Free catalog tells how. Write: McGregor Magazine Agency, Dept. 500A, Mount Morris, Ill.

**DOUBLE Your income—Sell wool** and cotton uniforms, badges, initial buckles, belts, etc. Write Hook-Fast, Box 480PM, Roanoke, Va.

**FREE Samples.** Big profits showing amazing glow-in-the-dark specialties. House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

**JEWELRY Factory** desires salesmen, distributors, jobbers. Pickcraft, 19 Bank Street, Attleboro, Mass.

**SCHOOL Seniors!** Your postal will bring our wonder, Kwick-Sell cardalog of popular graduation name cards. Biggest profits! Only firm giving free souvenir chest and card case. Don't miss out! Hurry that postal! Craftcards, Box 235 (L), Pittsburgh 30, Pennsylvania.

**AGENTS: Stamping names** on key protectors. Sample 25c. Stamping outfits, checks, social security and name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

**SELL Big money-maker** to men and women. Easy handwork makes fast-selling useful articles. Sunmade Company, Brockton 64, Mass.

**SCHOOL Seniors—Earn 40% commission** selling classmates America's most beautiful graduation name cards. Largest selection. Outsell all others. Free sample kit. Printercraft, Dept. M, 1425 E. Elm St., Scranton 5, Penna.

**SEWING Machine electrification kit.** Nationally advertised. Has Good House-keeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least \$5 per sale. For complete details write today to Brownell Distributors, Inc.

**FREE Water and our concentrates,** make flavors, lotions, shampoos, 125 products, labels, bottles supplied. Qualco, E20030 Russell, Detroit.

**MAGIC Cleaner—Laundry soap** deal. Hotter than a firecracker. Big profits. Sample free. Bestco, 4642 No. Central, Chicago.

**GOLD Lacquered window sign letters.** Large sizes penny each. New foils. Absolutely beautiful. Free samples. Atlas, 544 W. 79th, Chicago 20.

**EXCELLENT Sideline** for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also, make money with our line of automobile initials and sign letters. Free samples. "Ralco" XL-Roxbury, Boston 19, Mass.

**PHOTO-Salesmen-agents.** Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card, for free sample kit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

**AGENTS—300% Profit** selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

### HIGH-GRADE SALESMEN

**IF You sell, you need Opportunity Magazine—the "salesman's bible,"** packed with down-to-earth ideas that boost your earnings; filled with hundreds of announcements of new, fast selling items and lines. Send your name and tell us what you're selling now for free copy of latest issue. No obligation. Opportunity, 28 E. Jackson, Dept. 32, Chicago 4, Ill.

**SALESMEN: Have you had experience** selling stocks, franchises, real estate or vending machines? Our low man earned \$750 last month. Write for free information. Fortune Enterprises, Inc., 1060 Broad, Newark, New Jersey.

**BIG Cash profits** for men and women introducing Flexiclogs, sensational new flexible footwear. Experience unnecessary. Nationally advertised styles for women, children, men. Excellent sideline, no investment. Easy to average hundreds of dollars weekly. Free sales helps and sample offer. Get details now! Flexiclogs, Dept. L-4, New Holstein, Wisconsin.

**EARN Big money fast!** Sell finest-quality advertising work uniform to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. A-40, Rochester, Ind.

**ADVERTISING Book matches—Cash** in on big demand; sell union label matches. Cuts for all businesses and political parties. Free powerhouse selling kit, low prices, protection guaranteed on repeat orders. Cash commissions. Superior Match Co., Dept. M-450, 7530 Greenwood, Chicago.

**SELL Drill saw attachments** calling on mechanics, all trades. Stackhouse, 219 N. 63 St., Philadelphia 39, Penna.

**SALESMEN—Sideline.** Earn \$3,000 next 5 months selling calendars, advertising specialties. Buyers everywhere. Big comm. advanced. Samples free. Continental Calendar, 542-A South Dearborn, Chicago.

**OVER \$500 Weekly** for several weeks for Ruffo and Maurice. \$250 weekly common, selling patented 31 to 1 power tool. Prospects everywhere. 2-min. demonstration. Palcoseal Co., Ltd., Massena P2, N. Y.

**SALESMEN—Absolutely make \$50 a day.** New sensational utility item for every food, beverage outlet, etc. Samples furnished. Johnson-Hill, 53-R West Jackson, Chicago.

**SENSATIONAL Nylons guaranteed** against runs. Nationally advertised. Not sold in stores. No experience or money needed. Also lingerie, robes, men's hosiery. Outfit, sample, etc. free. Wonderful opportunity earn big money spare or full time. See our full page advertisement on page 71. Kendex Co., Babylon 646, N. Y.

**BIG Money taking orders.** Shirts, ties, Sox, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

### EDUCATIONAL AND INSTRUCTION

**3800 LATEST Used** correspondence courses. Catalog 50c. EG, Elmsford, N. Y.

**USED Correspondence courses** and books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

**EXPORT—Import!** Big-money and world-travel opportunities. Represent buyers, sellers. International mail order without capital. Practical inexpensive course teaches you outside the home. In preparation.

"HOW To Break and Train Horses"—A book every farmer and horseman should have. It is free; no obligation. Simply address Beery School of Horsemanship, Dept. 1104, Pleasant Hill, Ohio.

LEARN The collection agency business. Highly profitable. Easily mastered. Free folder. Cole Associates, Syracuse 2, N. Y.

INVESTIGATOR—Criminology courses. Free literature. Allied Schools, 14 No. East, Indianapolis.

JOIN. Salesman's club. Educational, social. Fraternal. Application. Professor Martin, Bonners Ferry, Idaho.

MAKE Up to \$35-\$45 week as a trained practical nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. M-4, Chicago.

BE A real estate broker through home study or classroom instruction. Write for free book. Approved for veterans. Weaver School of Real Estate, 15 E. Pershing Rd., Box CP-4, Kansas City 8, Missouri.

ACCOUNTING: Become an accountant. Learn at home and have your own accounting business or a good accounting position. National Training School, 343 S. Dearborn, Chicago 4B.

HOW To make decisions logically. New! This instruction is in its first year of publication. Very few things in life are more important than being able to make sound decisions. Price \$2.00. Smith Publications, Box 184, Terre Haute, Indiana.

U. S. Civil Service jobs. Start high as \$66.35 week. Secure positions. Men, women. Qualify now for many expected openings. Experience usually unnecessary. Free 40-page book shows jobs, salaries, sample tests. Write: Franklin Institute, Dept. D-24, Rochester, N. Y.

OPERATE A collection agency. Pays big. Easily learned by mail. Free bulletin. Franklin Credit School, Roanoke 7, Virginia.

FREE: Bookkeeping lesson; particulars. Buchalter, 1280 Ocean Avenue, Brooklyn 30, N. Y.

READ With speed! New amazing method. Saves hundreds of hours yearly. Free home test. No obligation. Rush postcard. Brownson, 9109 Hoynes, Chicago 20.

SALESMANSHIP New action method. Free lesson. Garden State Industries, 684 Catalpa, Teaneck, N. J.

USED Correspondence courses and educational books bought, sold, rented. Catalog free. Educational Exchange, Summerville, Ga.

PHOTOGRAPHIC Mind with Super-memory. Write Thor Books, M-4, Box 1210, Chicago.

PRINTING Course. Thorough, complete. Send stamp for details. Director Courses, Box 941, Meriden 13, Conn.

WANT To be a television director, actor, announcer? Send for free pamphlets. Hollywood Radio Publishers, 6411 Hollywood Blvd., Hollywood 28, California.

LINGUAPHONE Makes languages easy. At home learn to speak Spanish, Portuguese, Italian, French, German, Russian, by quick, easy Linguaphone Conversational Method. Save time, work, money. Send for free book. Linguaphone Institute, 83 Radio City Bldg., New York 20, N. Y.

LEARN Railroad telegraphy by mail, spare time. Railroads need men badly. Complete course, written illustrated by practical telegraphers easily mastered. \$3.85 postpaid. Details free. American School Railroad Telegraphy, 501, Wenatchee, Wash.

STUDY To be a doctor of psychology or metaphysics. Obtain Ps.D., Ms.D., D.D. or Ph.D. degree. Chartered by state. Write for free book telling how. The Neotarian Fellowship, Dwight Building, Kansas City 6, Missouri.

MIND Asleep? Try "Thinking-Alpha-bet." Write Frank Tibolt, 17M, Philadelphia 20.

HOME Bible course. Simple, helpful, instructive. Total cost \$4.00 includes textbooks, stationery, examinations, certificate. \$1.00 starts you, or simply request prospectus. The Bible Study School, 378 Van Houten Street, Paterson 1, N. J.

HOME Study course, drugless therapy. Free literature. Institute of Drugless Therapy, Tama, Iowa.

INVESTIGATOR Training. Phillips Secret Service System, 1917-B North Kenneth, Chicago 39.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "dollar-a-week" bookkeeping and tax service. Full or spare time. Details free. No obligation.

USED Correspondence courses. Bought, Sold, Rented. Free literature. Baker, 5509-B Winthrop, Chicago 40.

PIANO Tuning pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—52nd year. G.I. approved. Write for booklet. Niles Bryant School, 78 Bryant Bldg., Washington 16, D. C.

SECRET Investigation. Experience unnecessary. Investigators particulars free. George Wagner, M 125 West 86th, New York.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-J, Austin, Texas.

REFRIGERATION—Learn to service. Big money. Self-teach full course with Follett's Guide with quizzes and the Manual. Both texts, 929 pgs. Easy, thorough, fascinating. Complete, \$7.50. Follett, Dept. PM, 1255 S. Wabash, Chicago. See ad page 76.

### PLAYS, STORIES, MANUSCRIPTS

NEW Writers wanted! Learn easiest way to write for pay. Receive checks for \$3 to \$100, offered daily. No experience necessary. Write for free details and how to get free Writer's Market Guide! Comfort Writer's Service, Dept. 2-L, 200 S. 7th St., St. Louis, Mo.

I WANT New writers to cash checks of \$1 to \$100 offered daily. The easiest way to write for pay. No previous experience necessary. Free details. Saunders M. Cummings, 468-11 Independence Bldg., Colorado Springs, Colo.

### INFORMATION

WHERE To buy most anything. We furnish supply sources. Single item, 25c. 5 for \$1.00. Service Bureau, 2624-P N. Albany, Chicago 47, Ill.

### BUSINESS SERVICE

MIAMI Postmark! Letters 25c each; \$3.00 monthly. McDowell, 504 Pacific Building, Miami 32, Florida.

LETTERS Remailed 25c (coin). James Paige, 7 Elena St., Santurce, Puerto Rico.

WE Will represent you in New York City—Buying, selling, legal, advertising, business, personal, unusual. Strictly confidential. Write Continental Research Service, 305 Seventh Avenue, New York 1, New York.

DIME Mailing list. Henderson's Directory, P.O. Box 221, Maywood, Illinois.

### SPECIAL SERVICES

CANADIAN Mailing. Kelowna, B. C. postmark. Letters received, forwarded, 25c each. Ritchie, Box 686, Kelowna, B. C., Canada.

WASHINGTON, D. C., Baltimore, Md. Letters remailed 25c each. Bernhardt, Box 4045, Baltimore 22, Md.

WHEN Others fail, have "The Watch Doctor" repair your watch. Information free. Hunter Watch Service, P.O. Box 4008, Denver 9, Colorado.

USE Your name, my address. Letters forwarded. Confidential secretarial service. Crown, Box 7041, Kansas City 2, Mo.

CHICAGO Address for your mail. Business or personal. Information free. Schultz House, 3116 Seminary, Chicago 13.

EXTRA Business! Prestige! Rent Toronto branch office \$20.00 yearly. Remailing service. Enterprises, Toronto 12, Canada.

CUBA—Letters remailed, 25c each. R. Morejon, Box 1291, Havana.

ATTENTION Manufacturers, home shop operators, hobbyist, salesmen. Let us show you where you can buy everything you want, have parts made, sources of supplies, tools, machinery, etc. This is not a mailing list. We choose reliable manufacturers, suppliers, importers that can furnish exactly what you want. Save time and money by buying direct. List of five for only \$1.00, additional 15c each. Minimum order \$1.00. Guaranteed prompt service. Tell us what you want. We'll furnish names and addresses of reliable sources or refund your money. John Allis, Box 214, Mount Clemens, Michigan.

INVESTIGATION And cash liquidation—Old or recent stock certificates, bonds, bank books, promissory notes, deeds, wills, financial documents of every description. Send us your list for appraisal. National Evaluators, P.O. Box 5852, Cleveland 1.

TANGIER Postmark! Letters reairmailed 3 for dollar bill. Idap, 26, Hollande, Tangier, Morocco.

### CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

SIGNWRITING Simplified—Ten alphabets, 7 numerals. Catalogue, \$1. Demonstrators, 639P Paulina, Chicago 12.

CARTOON Your way to success! Internationally known instructor, Raye Burns, will personally teach you to create salable, original cartoons at home. Course of 26 lessons only \$2.85. Send remittance with order or write for free details and addresses of successful students. Raye Burns School, Box 3583-M, Cleveland 18, Ohio.

"HOW To Make Money With Simple Cartoons"—A book everyone who likes to draw should have. It is free; no obligation. Simply address Cartoonists' Exchange, Dept. 94-C, Pleasant Hill, Ohio.

LEARN Professional lettering. Easy, experience unnecessary. Amazing mechanical process. Complete instructions, 75 alphabets, 250 designs \$1.00. Major-Art System, 3510-D Palmer, Chicago 47.

9 ALPHABET 3 Numeral pattern sets and catalog. \$1.00. Sign Letter Distributors, P.O. Box 101, Mineola, N. Y.

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

BARGAIN, Quick landscape painting, poster art—lettering, art lessons, catalog 10c. Art Book Shop, Arnold 8-D, Missouri.

TALENT Test, information. Give age. Art, Box 8066, Dallas 8, Texas.

SIGN Painting taught at home. Test lesson free. Ben Kerns, Box 812-T, Greenville, S. C.

CHALK Talks. Laugh producing program, \$1.00. Catalog 10c. Balda The Cartoonist, Oshkosh, Wisconsin.

### ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

ADVERTISE: 24 Words, 40 newspapers \$3.50. Lists free. Advertising Bureau, 10511-C Springfield, Chicago 43.

ADVERTISING Layouts, artwork, sales letters, folders. A complete service designed to get results. Robert James Agency, Wysor Building, Muncie, Indiana.

25-WORD Classified advertisement in "Business Guide." \$2. Business Press, Baldwinville, N. Y.

BETTER Sales letters—Stronger ads. Complete advertising service any size budget. Write fully. Monroe, Box 1002, Chicago 90.

TRADEMARKS Designed complete with cut, \$10.00. Rough sketch, \$1.00. Catalog free. Burke, 3208 McKinney, Dallas.

MAILING Lists; \$5.00-1000 up. Write Dixie Service, King, N. C.

ADVERTISERS! Reach nearly 18,000,000 readers. 25 Sunday national key newspapers, 18 words, \$51.50. "Terrific pullers." 20 popular newspapers, \$10.00. "Free booklet." Special—One inch display 2-821,198 circulation, \$48.30. Newmark's Advertising Agency, (Established 1893), 217-7th Ave., New York 11.

AVOID Costly advertising mistakes. Get enlightening Ad-Guide and Ratebook leading newspapers, magazines, mailing lists, 10c. Chicago Advertising Agency, (Established 1900), Chicago 4.

24 WORDS In 50 weeklies, \$4.96. J. Darnell, 730 Hays, Jackson, Tennessee.

REACH Spanish-speaking mail-order buyers. Great new market for your merchandise. Your classified ad in the Spanish Edition of Popular Mechanics will bring you some nice business from this new field. Rate only 25c per word. Circulation 100,000 copies. Mail a trial ad right now. Popular Mechanics Magazine (Spanish Dept.), 200 E. Ontario Street, Chicago 11, Ill.

ADS Placed in out of town newspapers and magazines. Low rates. Catalogue free. Ideas that pay. Baker Advertising Agency, Successors Ankrum Agency, 189 W. Madison, Chicago 2.

### TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

PRINTOMATIC Selffeeding post card printing duplicator \$13.50. Envelope addressing machines \$24.50. Pittsburgh Typewriter Company, 336-R Fourth Avenue, Pittsburgh 22, Penna.

**TYPEWRITERS**, Adding machines, cash registers. Ray George, 3322 South Grand, Saint Louis, Missouri.

**LOY'S Abacus**, low-cost fast adding calculator for home or office. \$3.50, \$6.50. Free details. Loy's, Dept. PM, 1317 R.I. Ave., N.E., Washington 18, D.C.

**TYPEWRITERS** \$17.50. Duplicators \$9.95; adding machines \$12.50. Typewriters, 118-N Spruce, Wichita, Kansas.

**RECONDITIONED** Typewriters, printing devices. Write Dixie Service, King, N. C.

### RUBBER STAMPS AND OFFICE SUPPLIES

**MIMEOGRAPH** Paper, 68c ream, samples. Brookman, 56-A West 24th, New York 10.

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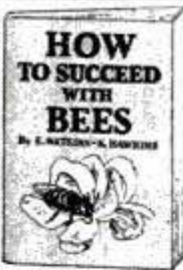


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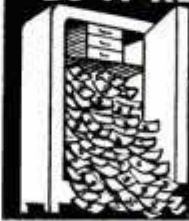
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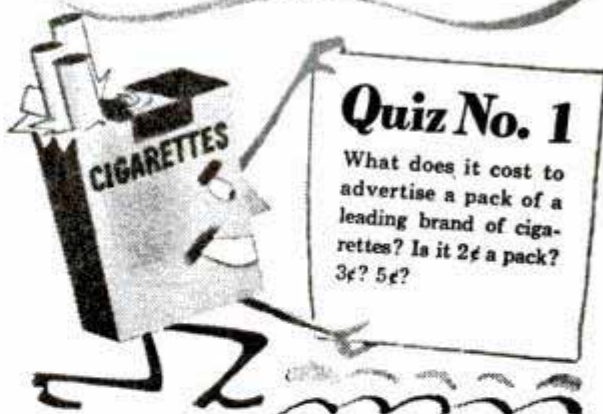
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# POPULAR MECHANICS

APRIL  
1950

WRITTEN SO YOU CAN UNDERSTAND IT  
VOL. 93 NO. 4

By A. J. Cutting

ONE EVENING back in 1903 a French chemist, Dr. Edouard Benedictus, was straightening up his laboratory. As he reached up to rearrange some bottles on a shelf, his arm hit one and sent it crashing to the floor.

When he stooped down to pick up the pieces, the scientist was amazed to find that though the glass radiated cracks, the bottle was intact with not a splinter detached. Chemicals which the bottle had contained had dried to form a film inside, holding the fragments together.

Benedictus made a note of the chemicals and promptly forgot about the incident. Then, within a short space of time, he witnessed two automobile accidents in which victims were badly cut by flying glass. He remembered the falling bottle.

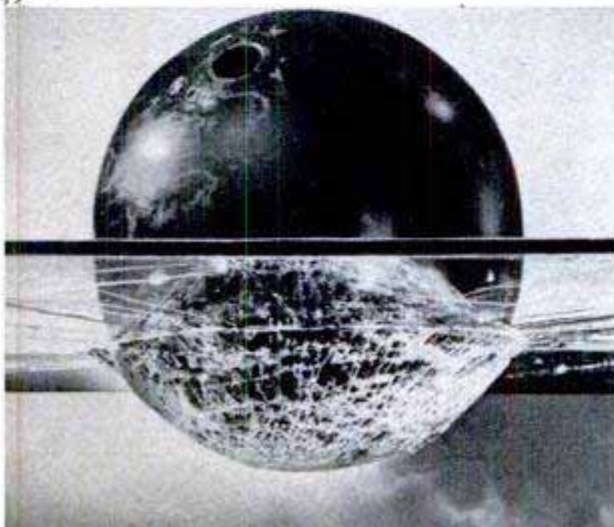
"I realized the possibilities the incident opened up and dashed to my laboratory," he said later. "The creation of the first

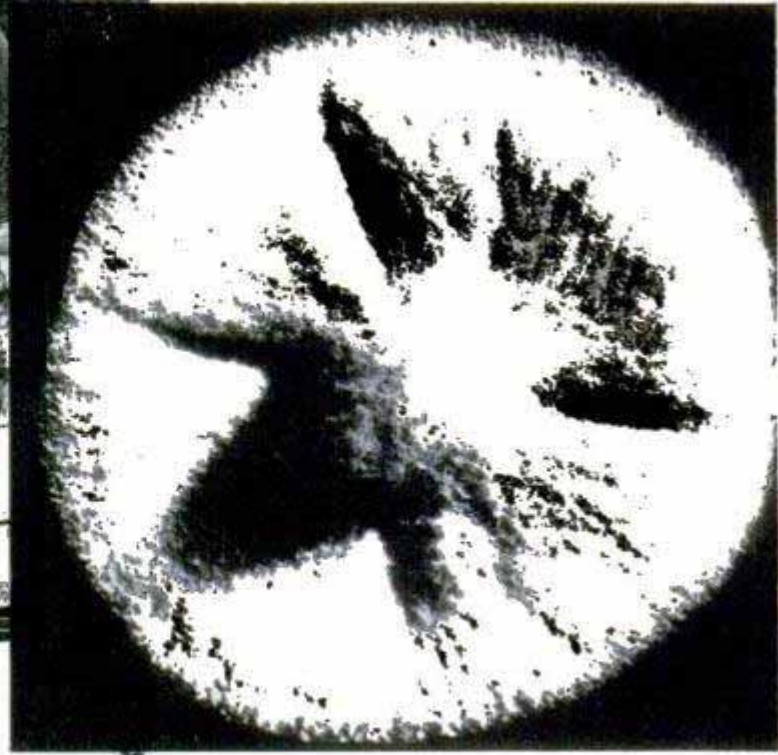
A flask of chemicals that fell to the floor without shattering led to development of modern safety glass

## THEY STUMBLED ON SUCCESS

Here is the "fruit" of Dr. Benedictus' laboratory accident: a bowling ball dropped on a pane of shatterproof glass is held by its plastic "sandwich," the safety factor that has saved the lives of countless motorists

Libby-Owens-Ford Glass Co. photo





Lady Luck placed a speck of mold in a bacteria culture which Dr. Alexander Fleming later examined. The mold, which is shown above, prohibited the growth of bacteria. This led to the discovery of the wonder drug, penicillin

piece of laminated glass was the result."

His crude piece of "sandwiched" glass, with transparent binder between two sheets of glass, was the forerunner of safety glass, which since its introduction in 1926 has saved countless thousands of lives.

A surprising number of the world's most important inventions and discoveries came about because of accidents, or because Lady Luck was looking over the shoulder of an inventor or scientist.

In 1929 an eminent English bacteriologist at the University of London, Dr. Alexander Fleming, set aside a culture of bacteria with which he had been working and went on to other duties. When he examined the

plate several hours later under a microscope, he noticed that part of the culture was contaminated by a blue-green mold.

Many researchers would have tossed the plate away to the accompaniment of a few harsh words. Doctor Fleming didn't. He studied the culture and noted that the germs had not grown for some distance around the mold, and guessed that the mold contained something that held back their development. Further experiments showed that the mold offered protection against bacterial infection.

The doctor named the drug penicillin, but did little with it because it was difficult to get pure cultures of the substance.

**DDT has killed billions of insects. Chemical formula discovered accidentally was filed away for 65 years**



Ten years later, when the war created an acute need for a better antiseptic, penicillin's great possibilities were realized. The miracles worked by this wonder drug both among war casualties and sick and injured civilians are well known. And they were made possible because a scientist happened to notice the accidental contamination of a bacteria culture.

The list of helping hands doled out by Fate goes on almost endlessly. For example, take the electric generator or dynamo that produces electricity for mills and factories, radio and telephones and so many other purposes. We have it because a Danish professor, Hans Christian Oersted, accidentally pushed a compass under a wire connected to a battery and noticed that the needle swung at right angles to the wire instead of pointing north. It proved to him that electricity and magnetism were intimately related, and led to the principle of the electric generator.

A formula, filed away and forgotten for 65 years, gave the world one of its most useful chemicals. Back in 1874 a young student of chemistry, Othmar Zeidler, was working in a laboratory in Strasbourg. During his experiments he produced a new chemical which he labeled "dichloro diphenyl trichloroethane." Seeing no use for his discovery he made a few notes on the formula and filed them away.

In 1939 Swiss farmers were having great trouble with huge swarms of insects at a time when there was a severe shortage of the normally used insecticides. In their desperation to find something to combat the destructive pests, Swiss scientists looked into every possibility. Finally, a young chemist, Paul Mueller, came across Zeidler's old formula. Small quantities of the chemical were produced and tried. To the amazement of researchers, it mowed pests down upon the slightest contact.

We know that chemical as DDT, the insecticide that has been so potent in killing mosquito larvae, disease-bearing flies and other insects.

The line-up of famous inventions that owe a vote of thanks to Fate is an imposing one. A shirt drying over an open fire tipped off Joseph Montgolfier to the principle which led to the first balloon. He was relaxed in front of the fire idly watching the flames when the shirt, inflated by the heated air, swelled up and began to rise.

Montgolfier and his brother, Etienne, tested the discovery by building fires under small paper bags. Not long after, in 1783, they sent their first great balloon skyward.

Because of an accident, we ride on rubber tires, wear rubberized raincoats and use thousands of other articles in which rubber



Oersted accidentally pushed a compass near a wire connected to an early battery. The needle didn't behave as a good compass should. Discovery of principle behind this behavior led to giant generators

Bureau of Reclamation photo





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Galvani's wife noticed frog muscles twitch when they were touched by scalpel which had been in contact with electrical machine. This led to galvanic battery

is a material. Charles Goodyear tried for years to find a way of treating the gummy material so it would withstand heat and would not deteriorate.

One day in 1839 he was sitting in front of a stove. Goodyear was thoughtfully fondling a piece of rubber treated with sulphur when it slipped from his hand and fell on the hot metal. When he examined the lump he found that the rubber had become hard and tough and that the stickiness was gone. This was the clue he needed, and the accident guided him to experiments that produced his vulcanization process.

The legs of a dissected frog led Luigi Galvani to the principle of the galvanic battery. Galvani's wife noticed that the muscles twitched when she touched the frog leg with a scalpel that had been in contact with an electrical machine. Professor Galvani started experimenting, and discovered that contact with two metals such as iron and copper would produce the convulsive movement of the frog legs.

George Westinghouse hit upon the principle of his revolutionary railway air brake through reading an article in a magazine he did not want to buy.

One day while sitting in his father's shop eating his lunch, a young lady asked him to buy a subscription to a magazine.

"I never read magazines," Westinghouse told her.

As he talked with the girl he casually flipped through the pages of one of her samples. Suddenly he saw an article that stopped him. It described how compressed air had been used to operate drills for cutting through rock.

Out of that chance reading of the article came the inspiration for his great contribution to safe rail travel, patented in 1869.

Dame Chance can take credit also for the

versatile photoelectric cell which opens and closes doors, starts alarms ringing and does a hundred-and-one other jobs.

In 1873 an Englishman, Willoughby Smith, discovered quite by accident that the electrical resistance of the metal selenium was lowered when light fell on it. Further experiments proved that it was possible to hook up a selenium cell with a relay and an electric motor so light falling on it would start the motor.

While there have been great improvements in photoelectric cells, and newer principles have since been applied, this accident brought about the development of the first such device.

The great Galileo Galilei discovered the value of the pendulum for measurement of time because he chanced to watch the swinging motion of a lamp hung from a cathedral roof. And no less an authority than Voltaire tells us that Sir Isaac Newton really did hit upon the law of gravitation because an apple fell on his head.

Keep your eyes open and your mind alert. Entirely by accident you may stumble upon some history-making development. For, if Lady Luck has a mind to do so, she can drop fame right smack in anyone's lap.





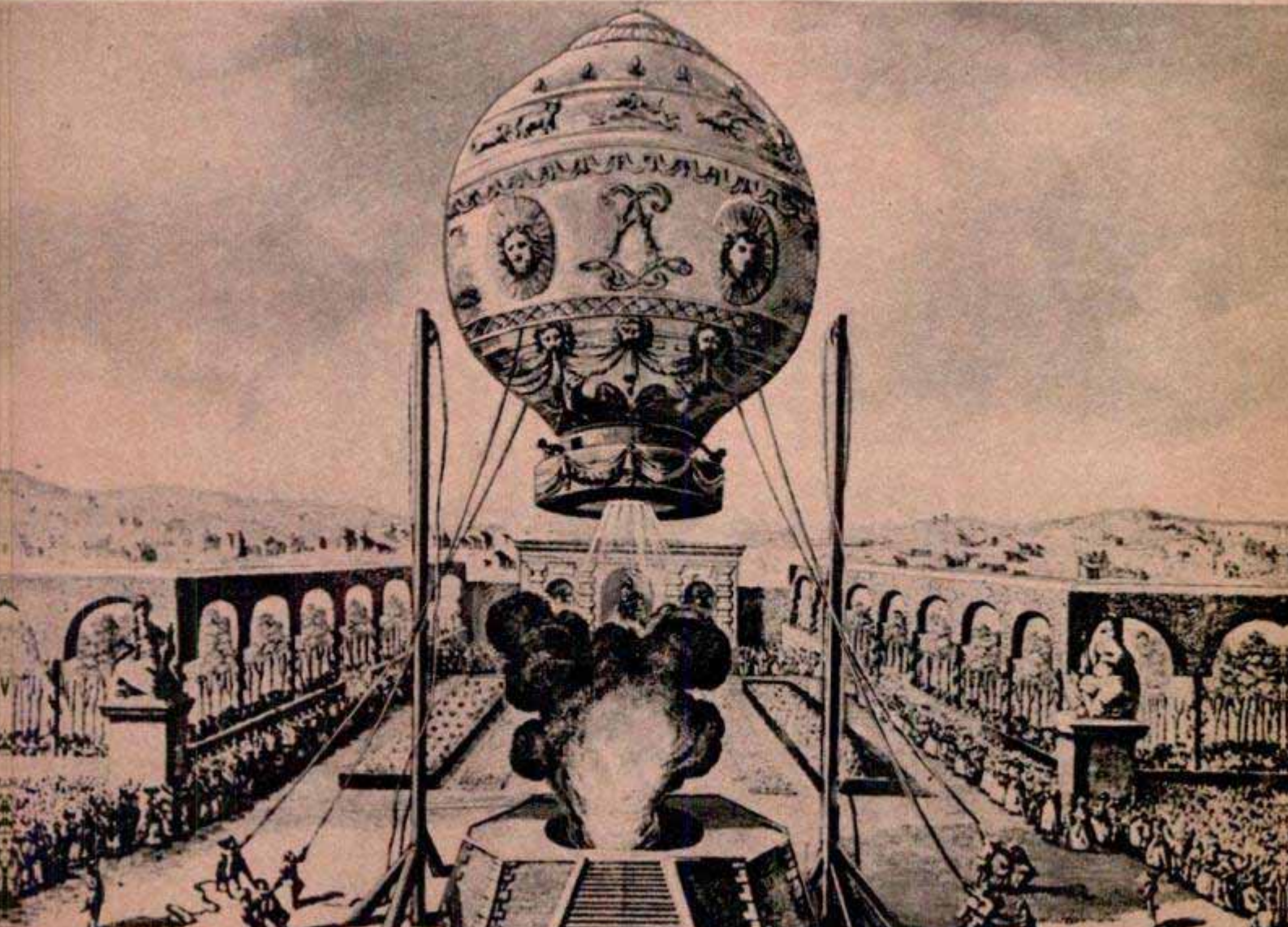
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Goodyear Tire & Rubber Company photo

Goodyear chanced to drop a piece of sulphur-treated rubber on a hot stove. When he picked it up it was fused into a tough, flexible chunk. This discovery of vulcanization gave rise to the huge rubber industry

Montgolfier was drying a shirt in front of a fire when the hot air carried it toward the ceiling. Why, then, couldn't hot air carry a man aloft? Early Montgolfier balloon, shown below, was the result of his observation

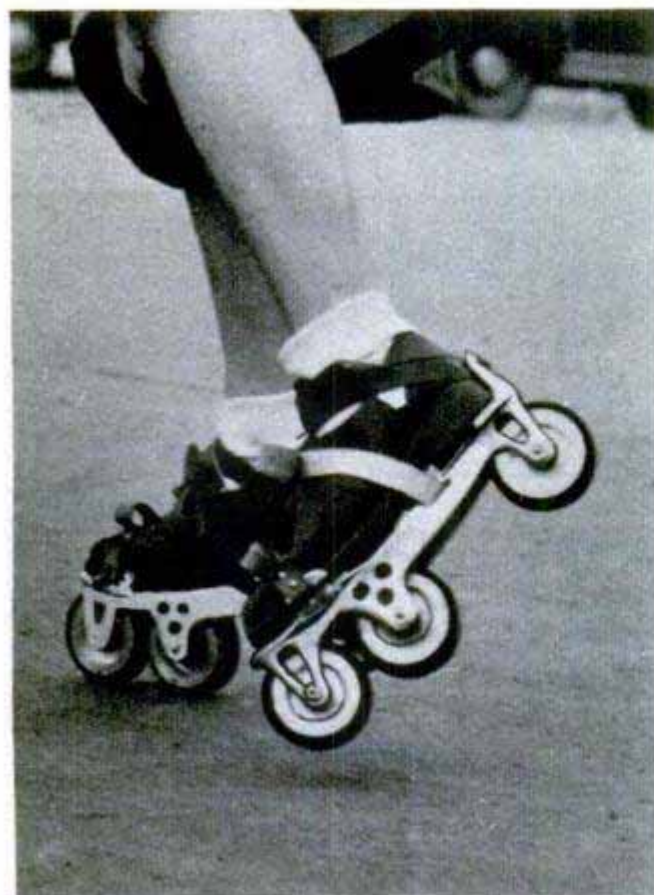
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### Radio in a Bottle

Building ship models inside bottles is old-fashioned now that a British company is producing a five-tube radio inside an ordinary wine bottle. Displayed at a British radio show, the receiver has its speaker in the plastic base. Tuning is accomplished by turning the "cork."



### Rubber Springs for Tractors

Taking the jerks and bumps out of tractor-riding, a newly developed rubber-spring system works on the torsional-shear principle. A thick layer of rubber is sandwiched between two metal plates. As the tractor rides over rough ground, the rubber twists and turns with each jolt, cushioning initial shock and leveling out the sharp rebound. Mounted in two cylinders under the tractor seat, the springs can be adjusted for various weights from a 100-pound farm girl to a 275-pound husky.

### Figure Skating With Roller Skates

Figure skating on roller skates is possible with a new product on the market in Japan. The new skate has three wheels in line, instead of two wheels in parallel. Only the middle and rear wheels are used for ordinary skating; if a skater wishes to do figures, he uses the middle and front wheels. A ratchet gear prevents the front wheel from turning backward so that quick turns are possible.

☞ For servicing vehicles in the field, the Air Force has developed a knockdown grease rack which can be easily moved to any area where permanent greasing facilities aren't available.

Popular Mechanics provides two sources of further information concerning articles published in each issue: the WHERE-TO-BUY-IT INDEX, starting on page 10, and the WHERE-TO-FIND-IT INDEX, which is available to readers without charge. Just address your request for a copy of the latter index to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill.



# FLYING GAME WARDEN

**T**HREE hunters, stalking ducks and geese out of season, recently were the amazed victims of a three-way blitz. An automobile laden with game wardens rolled up to seize them, while a boat circled just offshore to prevent their escape by river and overhead a plane dipped down with another warden inside.

The game violators were apprehended by a three-way assault which is producing real results for the Illinois Department of Conservation. Key to the successful operations is a reconnaissance plane which spots suspected violators, then radios the information to the ground forces in boats and autos.

In the case of the three hunters, the pilot of the plane dipped down to investigate the trio, hunting in an area thick with ducks. The suspects, unaware that the warden was breathing down their necks, waved a greeting and went on hunting.

The pilot relayed the information to investigators in an automobile marked with a huge cross so the pilot can keep track of it at all times. The warden in the radio-equipped boat also picked up the news.

In one test, nearly 100 investigators participated in a three-day maneuver. Illegal hunters swept up in the dragnet didn't have a chance.

The three-way blitz is especially successful because the investigators are unknown in the areas in which they operate. And the chief inspector, when asked about the present location of the enforcement group, tags it a "military secret."

Another officer cruises along the river in a boat which also has radio equipment. He closes in on signal to prevent escape of game violators by water



Pilot of the plane spots hunters suspected of game violations, transmits instructions to ground forces

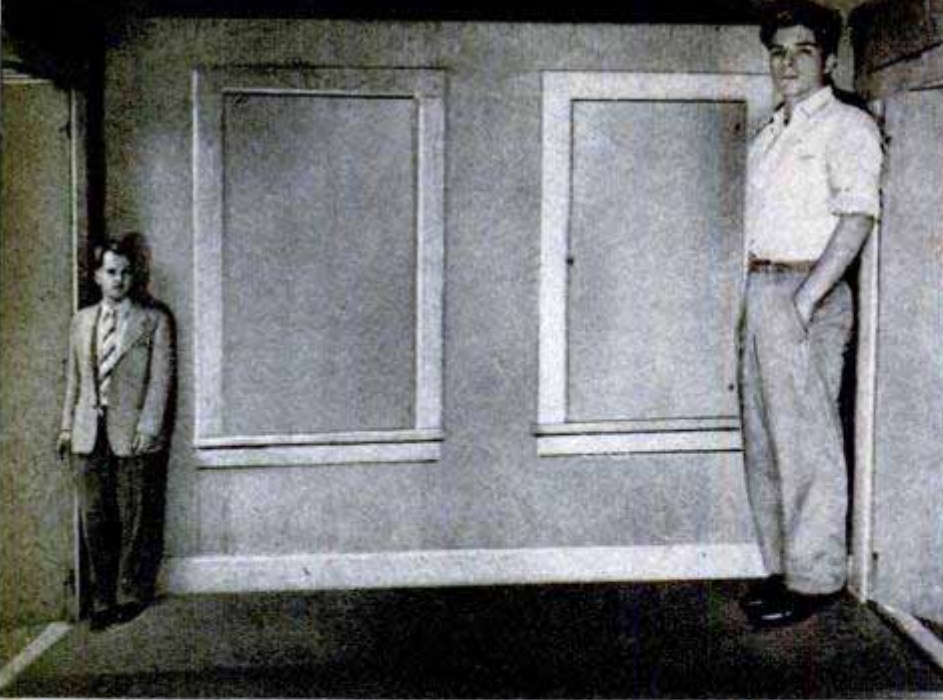


Airborne warden has instructed men in marked car to investigate truck. They apprehended hunters near by. Below, wardens receive another radio tip from plane

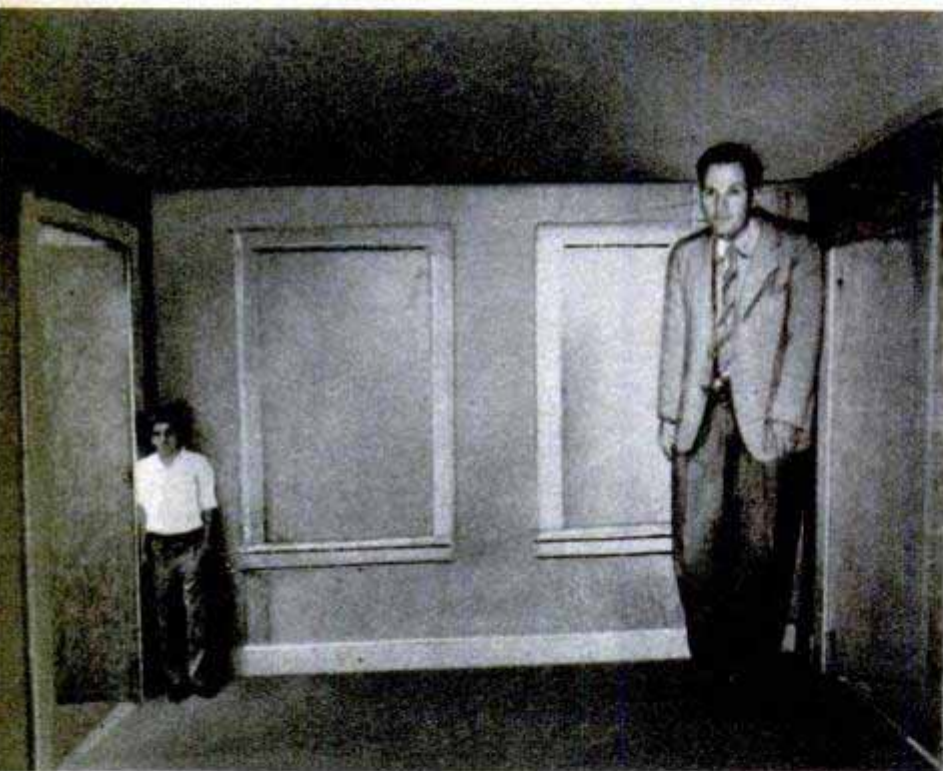


# You Think

By Richard F. Dempewolf



Above, illusion room puts man at right eight feet from lens, makes him seem a giant. Man at left is 16 feet from lens, appears a midget. Below, giant becomes a midget as men change places



**I**N A DARKENED basement room, appropriately dubbed "the dungeon," beneath Princeton University's ivy-covered Laughlin Hall, there's a whole world of confusion which completely blasts the old theory that "seeing is believing."

Here, in a strange Alice-in-Wonderland laboratory of mental hocus-pocus, people can trick themselves into seeing a two-foot midget grow into a 10-foot giant while crossing a room. Hideously distorted rooms look absolutely square. Stationary balloons can be seen swiftly moving back and forth. Close objects seem far away, and distant objects seem close. In utterly square rooms, you can watch the floor fall away at an angle as frighteningly precipi-

tous as the walls of the Grand Canyon. Marbles roll uphill at an alarming rate. Firmly anchored ceilings descend on your head, and you stagger out into the comfortably familiar world wondering if it's really there and if you'll ever trust your eyes again.

The optical-illusion laboratory, originally conceived by an optical physicist, Adelbert Ames of Hanover Institute, New Hampshire, was not designed just to confound people like a Coney Island House of Horrors. Its purpose is as deadly serious as the atom bomb. It represents a pioneering expedition into the nether regions of the mind, headed up by a group of scientists, among them Prof. Merle Lawrence, a tall, husky young Princeton psychologist whose fame in the field is growing by leaps and bounds. The way we interpret and act upon what we see, these scientists believe, may furnish information about the brain mechanisms behind human behavior.

Doctor Lawrence explains it this way: "The experiments show that what you see when you look at something depends not so much on 'what is there' as on the assumptions you make when you look."

Take the giants and midgets, for instance. Anyone knows a man can't walk across a square room and grow a foot with every step he takes—not outside of Hollywood, anyway. Yet, in that Princeton room it seems to happen. There are no mirrors involved; you see it in a full-size room through a peephole with your naked eye. The experiment has variety, too. Sometimes two normal-size men will enter the room, standing against opposite walls. The man on the left has suddenly become the size of a peanut. The other is a grotesque monster. When they swap sides, the giant becomes a midget and vice versa.

In a smaller edition of the same room in the Laughlin Hall "dungeon," you can see the identical thing happen with a pair of rubber mice that creep across the floor

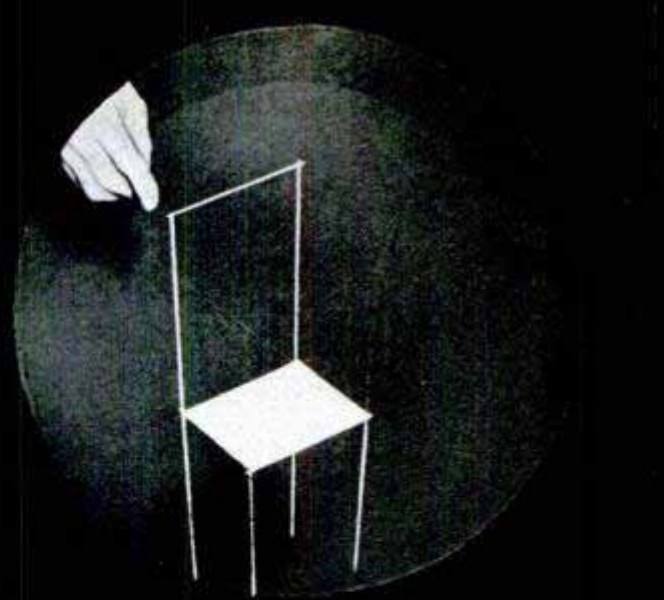
# You're Going Crazy...

but it's merely an optical illusion. What the scientists at Princeton have concocted to confuse you outdoes any Coney Island House of Horrors

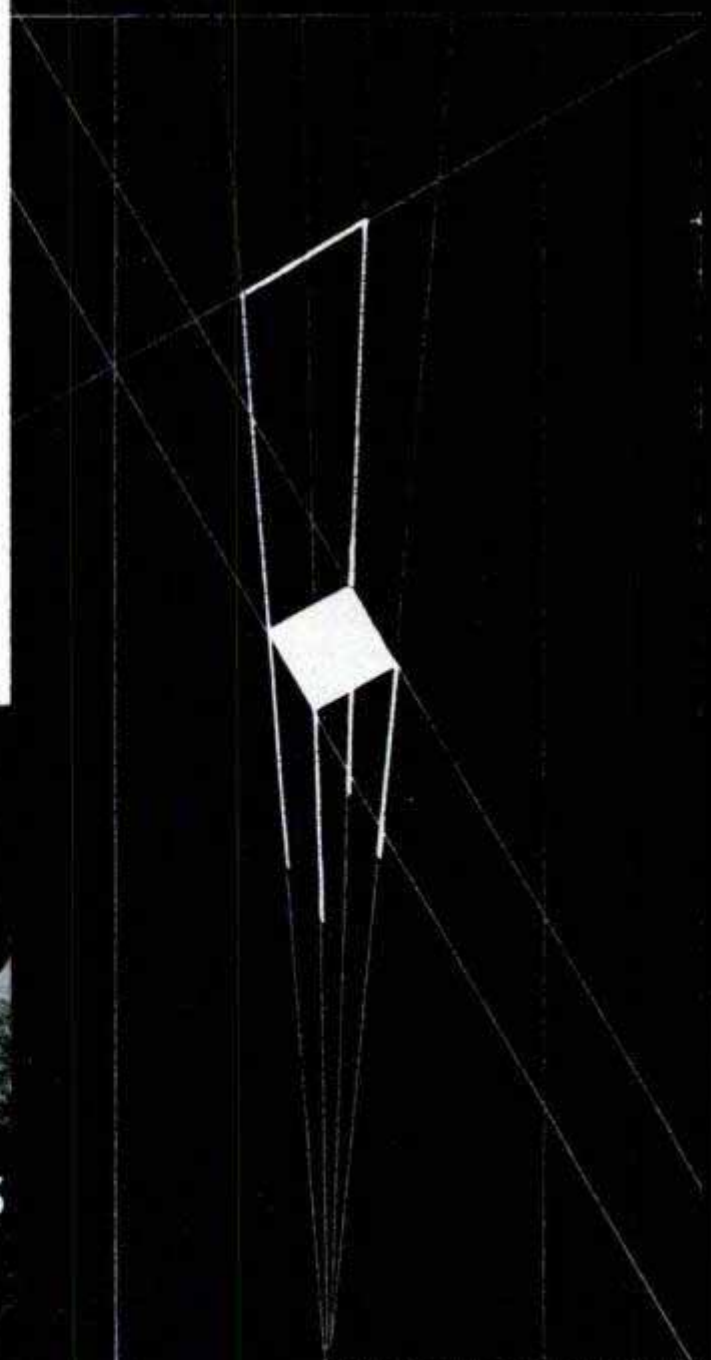
growing and shrinking. Meanwhile, an attendant psychologist is casually dropping marbles in a chute which traverses the room at a steep pitch. It would be fine if the man were dropping the "immies" into the high side and letting them roll down. But he's not. He's dropping them into the low side and they're rolling up! Or are they?

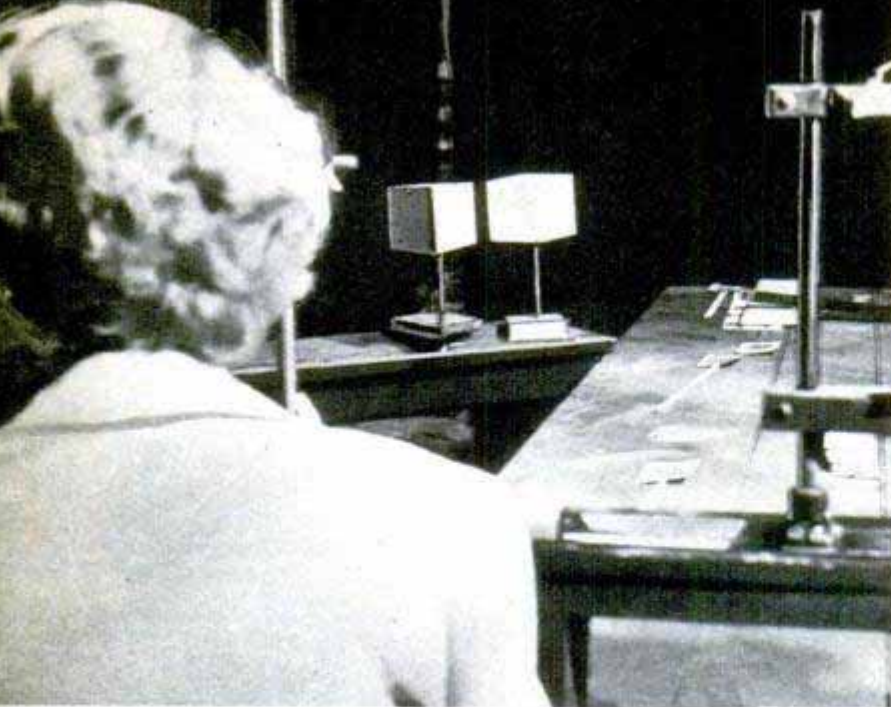
Of course not. No more than people and mice are growing and shrinking. The answer is, despite what your eyes tell you, that neat little room is about as square as a 10-sided barn on the verge of collapse. It is constructed somewhat like a pyramid laid on its side, with the peak cut off. The floor and ceiling fan out to the left at sharp angles so that the left side is about twice as high as the right. The left side goes back about twice as far, too. Windows, moldings—all appurtenances—increase in size as they approach the high side. Normally, of course, if a room recedes on one side, you get a distance perspective. Things farther away approach a "vanishing point." But Professor Lawrence's room has been fiendishly designed to eliminate this clue. Everything about the room gets bigger as it gets farther away, thus

White painted areas of wires merge in three-dimensional perspective to form object that the eye sees as a chair identical to the real chair viewed through peephole No. 1

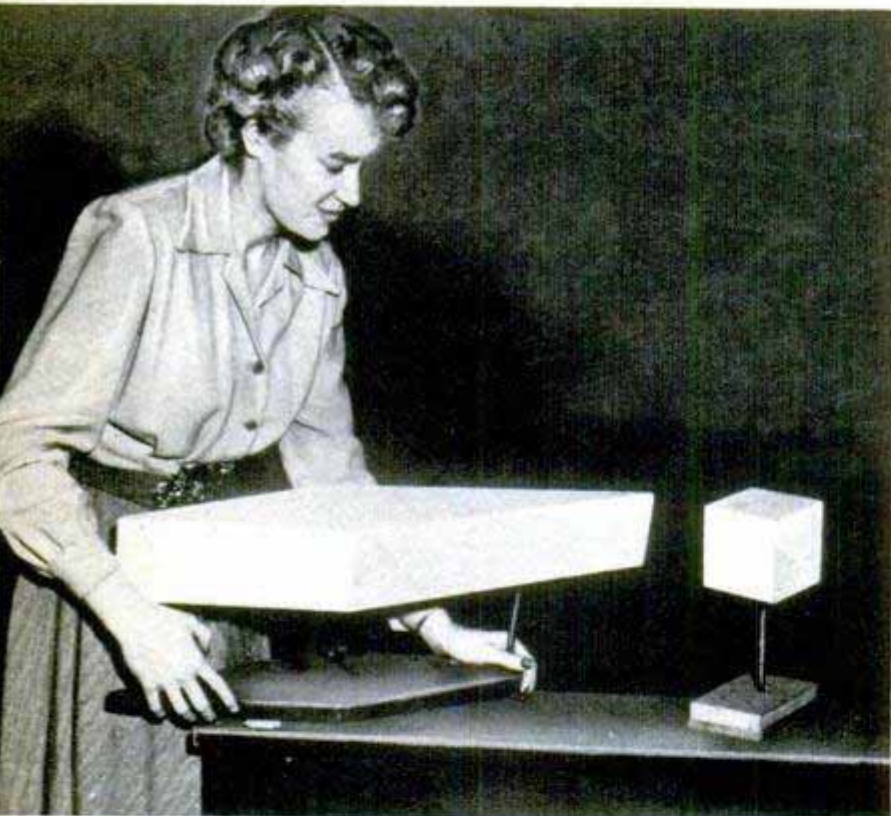


Above, through peephole an observer sees a three-dimensional chair. Below, what he really "sees" is a group of wires painted white in spots to form a two-dimensional chair in distorted perspective. Readers can get same effect with this drawing by punching small hole one inch from edge of blotter, placing blotter on end, with hole right above point A, and peeping through





Is seeing believing? Here, a student looks through an eye-piece at a pair of cubes—at least she thinks they are cubes and so does the camera. Below, the "cubes" as they really are



neutralizing perspective. So, when the room is viewed through the peephole or by a projected image on a camera film it looks square. Normal objects—like people and mice—on the far side, therefore, look tiny, although we know they can't be. "But," says Professor Lawrence, "from all our experience we are so accustomed to a square or rectangular room, that our minds insist on making the room square rather than let us see people in their true proportions."

In other words, as Doctor Lawrence explains it, a person builds up a storehouse of past experiences, which tell his brain what he is seeing, hearing and feeling right now. According to the professor, what he perceives is no more than a guess at what's really there, based on what his past experience tells him it should be. Psychologists call this the assumptive world. So, when this poor fellow (you and I) is confronted with Professor Lawrence's distorted rooms and deceptive distances, his assumptive world goes all to pot. Things he sees with his own eyes don't "jell"; facts he has established (he thinks) contradict each other all over the place, and he winds up with midgets, giants, gravity in reverse and a host of things he knows should be impossible. But there they are. Occasionally, people see through the deceptions, but always with good reason.

The professor cites the case of a woman who watched her husband in the room. She was so familiar

Below, left, furniture in the illusion room, while somewhat crude, looks natural. In photo at right, however, the same furnishings in a room of normal proportions, unaccustomed to a flat floor, look weird





Special "aniseikonic" glasses (left) create a confusing world for wearer—floors slope away and ceilings are at crazy angle. Above, student wears glasses in "leaf room" which becomes place of peril. Thick S-shaped lenses (right), give student feeling he faces downhill



with his size that she actually saw him properly, and consequently saw the true distortions in the room. When a strange man went in a moment later, however, she got the illusion.

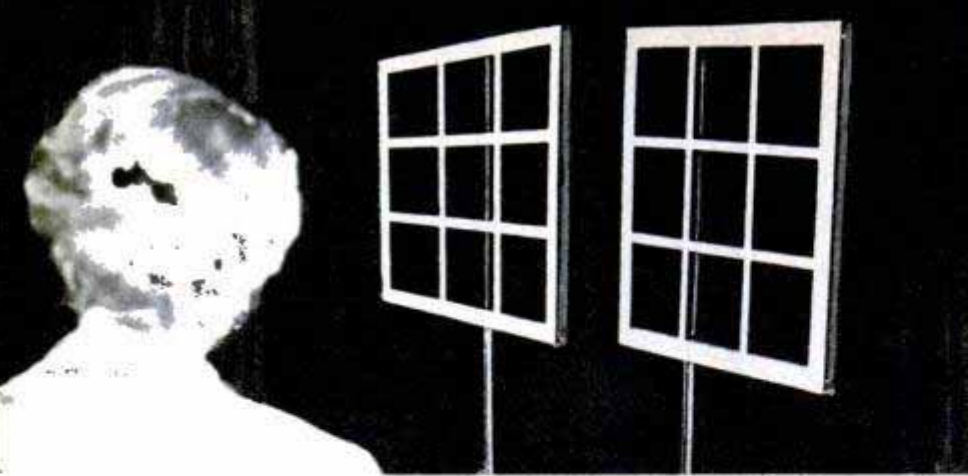
What about those uphill marbles? They really go downhill, of course. The strange angles of the room simply make the chute appear to be pitching in a direction opposite to the way it is really slanted.

Some people have accused the Hanover and Princeton group of trickery. "Since you make victims squint at the room with one eye, you're denying them the three-dimensional effect they would normally have with binocular vision," they claim. Lawrence and his confreres say nonsense. To prove it, they are now building a weird thing up in Hanover, which will be known as the Hyperbolic House. It's made up of complicated curves. If it comes out as the scientists hope it will, a person will be able to look into it with both eyes wide open and get the same odd effects. Walls, floors and ceilings curve inward, with all the proper varying molding and window sizes to destroy normal perspective. The builder, who wasn't told the purpose of the house, completed one section a few weeks ago and walked into Ames' office with a worried

frown. "Something aww-fully funny about that place," he told the professor. "We made it just like you said—all curves. There's not a straight line in the whole thing. But we just stood back to look at the work a minute ago and, darn if it didn't come out square as a crackerbox."

Normal objects moving across the Hyperbolic room will appear to observers to start out pint-size, grow to twice their size in the center, then shrink again as they approach the opposite wall. "According to all known mathematical calculations, this can't happen," says Lawrence, "but it does."

Maladjusted people show up quickly when exposed to the distorted room illusions. One man, given a stick, was told to strike at the rubber mouse on the right, or small side of the illusion room. He took a swipe and, as everyone does on the first try, hit the back wall, which came in toward the mouse at a sharp angle. He tried again, without making any allowances. He did it again and again until finally, in a rage, he climbed right in on top of the poor rubber



Window at right is square and stationary; window at the left, shaped like a trapezoid, is mounted on a vertical rod and is moved with strings operated by the victim. Problem is to make edges parallel



mouse and beat it to a pulp. "That man," says Lawrence. "was not well adjusted. Obviously, it wasn't the mouse's fault."

There are many other illusions in old Laughlin Hall, which help to prove that what we see may have absolutely no resemblance to the thing we are looking at. In one big closetlike affair, there are three peepholes. In each hole, the observer sees a small, three-dimensional wire chair with a white seat. The chairs are identical. Then, he goes around back to find out that he hasn't been looking at any such thing. The first is a true chair, all right, made of wires and a white paper seat. But the second is the greatest crisscross of floating wires in three dimensional Dali pattern that you ever saw, with a trapezoidal-shaped patch of white paint on the backboard. When viewed from the angle of the peephole, however, all those wires fall into a pattern and the splotch of paint becomes the seat of a chair that seems identical to the first one. So does the third one, which is an ordinary two-dimensional pattern of wires.

Again, proof that previous experience determines what the viewer sees is borne out by the fact that, although nearly everyone sees three-dimensional chairs, an architect recently stopped at number 3, and

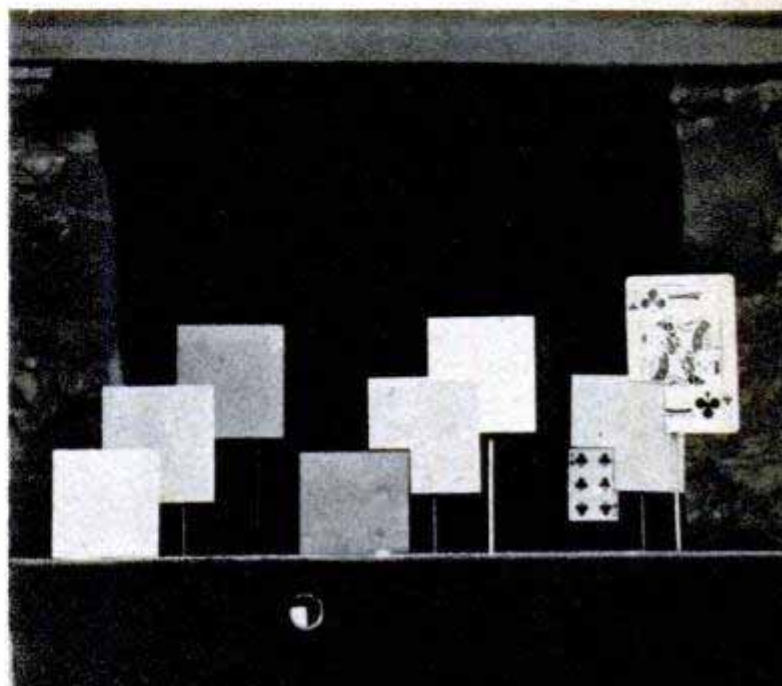
said: "That's a two dimensional chair in perspective."

"Architects," explains Lawrence, "spend all of their work hours using two-dimensional lines to give a three-dimensional effect. Hence, this man was not taken in by an illusion that will fool practically anyone else. His storehouse of experience told him exactly what he should be looking at. And he was."

Another interesting experiment is the "leaf room," a perfectly square room completely lined with red oak leaves to make it unfamiliar. While developing queer S-shaped lenses to correct an eye abnormality known as "aniseikonia," in which each eye records a different image on the brain, Hanover scientists discovered that the glasses also worked in reverse. They could give a normal person aniseikonic vision. These aniseikonic glasses are worn in the leaf room, and do weird things, depending on the type lens used. In some cases, the ground rises up at a rugged 45-degree angle, and the victim feels nine feet tall. Walls

slope up and away. The ceiling soars off into the firmament. With others, the man feels a midget, the ground slopes away like a coal chute, walls rise up in a peak and crowd in around his head. The ceiling tilts crazily. The wearer finds himself crouching and dodging to avoid a collapsing world.

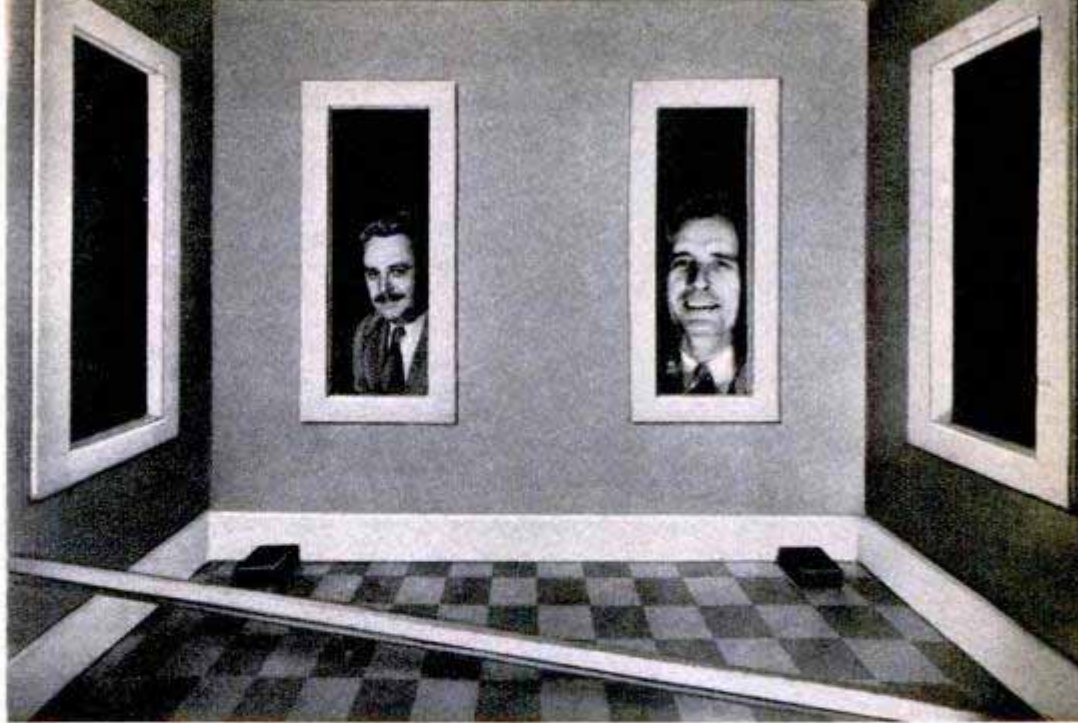
Worn outdoors, the glasses do even stranger things which are mightily signifi-



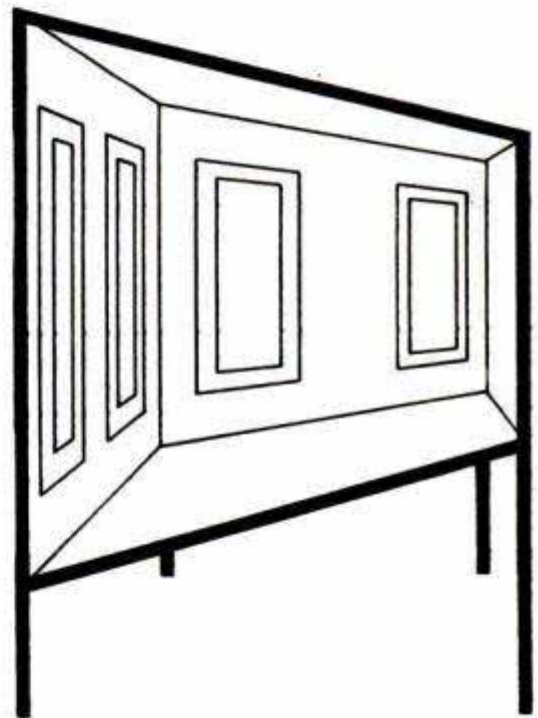
cant. Similar objects may look entirely different. A level lawn, for instance, will tilt away like a tip table, while a lake in the same scene, just as flat and expansive, will not tilt at all. Why? That storehouse of experience is working again, Professor Lawrence explains. Land might possibly tip away, so the mind accepts the evidence given by the lensed eyes. But, experience says, you can't tip water without spilling it, and that water isn't spilling. So the lake stays flat. To compensate for that, tiny ripples on the lake may look like monstrous waves through these glasses. Something has to give when the facts don't add up. With some of the lenses, to make the rest of the world stand up the way it should, the poor aniseikonicized mind will make a woodland stream rush madly uphill.

In all these experiments, the thing we are most sure must be so is the one that wins out when the mind is being fooled. These are known as the "dominant cues." In the dungeon there are the yellow spheres to illustrate this. The viewer, sitting in a darkened

(Continued to page 266)

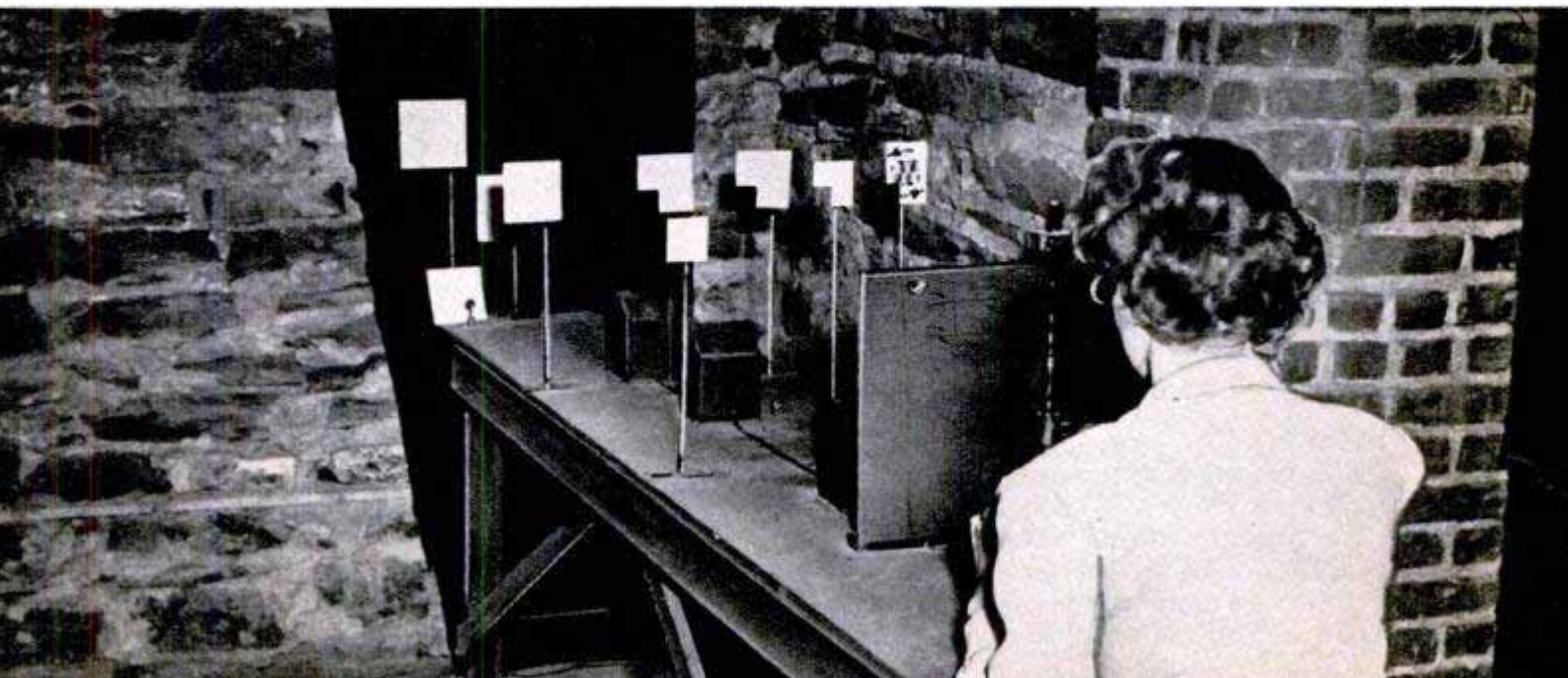


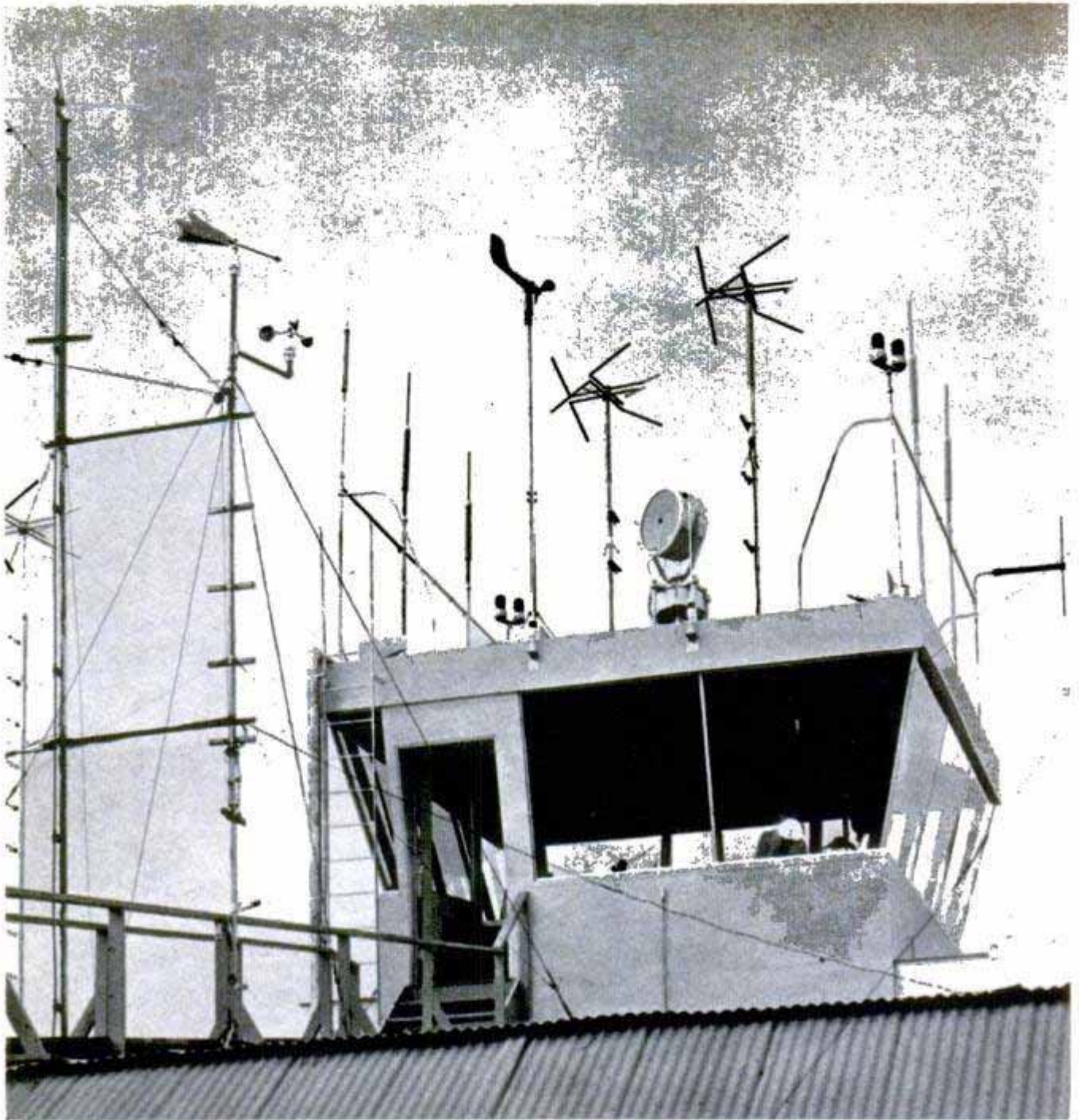
Marbles seem to roll uphill along metal trough in illusion room. Actually, trough is sloping the other way and they move from right to left by gravity. This is eye-level view of room



Sketch shows actual shape of an illusion room. The left side is about twice as deep as the right side and floor and ceiling fan away from the right side at a wide angle to kill perspective

Viewer looks through peephole at overlapping cards which are notched to give illusions both as to their order, according to color, and size. Opposite page, camera view through peephole





United Air Lines photo

## Tomorrow's Control Tower

Previews of tomorrow's correctly equipped airport can be had at Reno, Nev. There, the Civil Aeronautics Administration is operating complete electronic equipment that is expected to set the pattern for future installations of similar size and scope. The tower has polarized angled windows to eliminate glare, air conditioning, soundproofing, and very-high-frequency

receivers and transmitters on all frequencies for contact with private, military and commercial aircraft. A counter device keeps daily totals on all air traffic. Telephone links the tower directly or through relays with all others in the CAA's western circuit, keeping it advised of all aircraft en route to Reno. Built by United Air Lines, which uses the field, the compact tower's floor measures 16 feet square and its ceiling 20 feet square.

## "Tracer" Atoms Used to Study Formation of Rust

Radioactivity may teach science how to control common rust, according to General Electric engineers. In experiments they are using "tracer" atoms to photograph rust. A solution holding radioactive iron is electroplated on the surface of the metal to be studied. A photographic plate is placed

against this surface and left for several days. During this time, the radioactive material exposes the plate, and as the metal rusts, a decrease in radiation results, showing up as light areas on the plate. Through these pictures the engineers can study the formation of the rust.

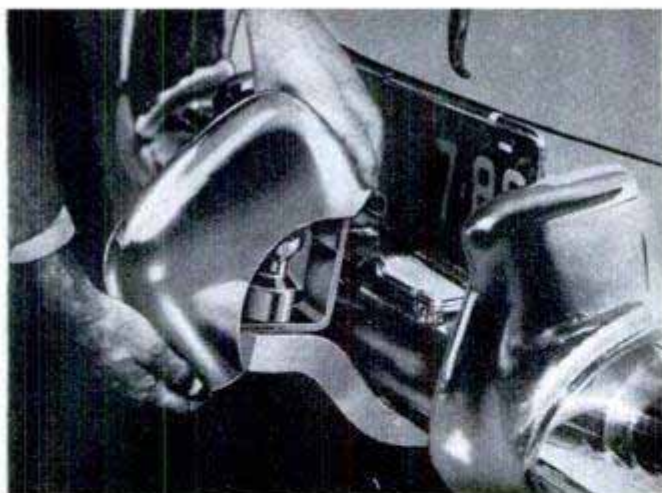




## "Banana" Lifesaver

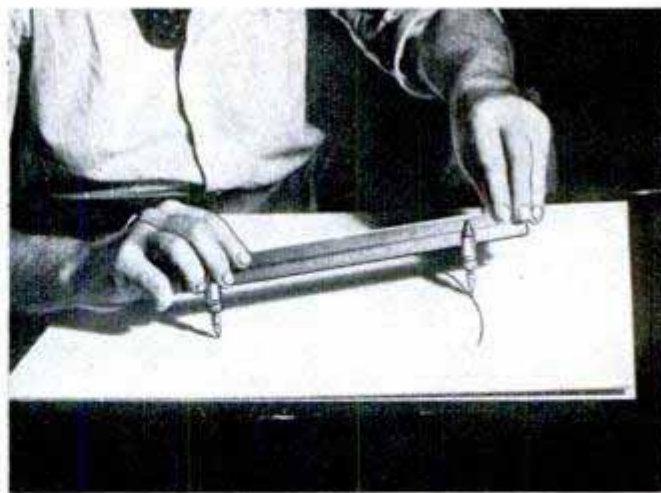
Increased stability as a midair rescue platform is achieved by the new HRP-2 helicopter, built by the Piasecki Corp. It is the prototype of a higher-powered craft intended for rescues of entire bomber crews

that have crash landed on water or in the Arctic wastes. The banana-shaped craft in emergencies could carry up to 27 on the floor of its central, 20-foot-long cabin. A tandem arrangement of rotors makes it better balanced so large loads can be added or dropped while in hovering flight.



## Trailer-Hitch Guard

Trailer hitches, often grease-coated and ugly on the rear bumper of a shiny automobile, can now be covered with a shiny chrome guard that will fit almost any car on the road. Large enough to cover the entire hitch assembly, the guard also serves as an additional bumper guard and prevents hooked bumpers that result when the hitch locks under another car's bumper. Spring tension holds the cover in place.



## Trammelheads Make 4-in-1 Tool

Used with any combination square or scale, a set of trammelheads provides an accurate compass, height gauge, inside or outside calipers or scribe. The sets come complete with scribe points, pencil tips and caliper points.

☐ Heat output of a typical jet airplane engine is equivalent to that of steam plants needed to heat a 4000-room office building.

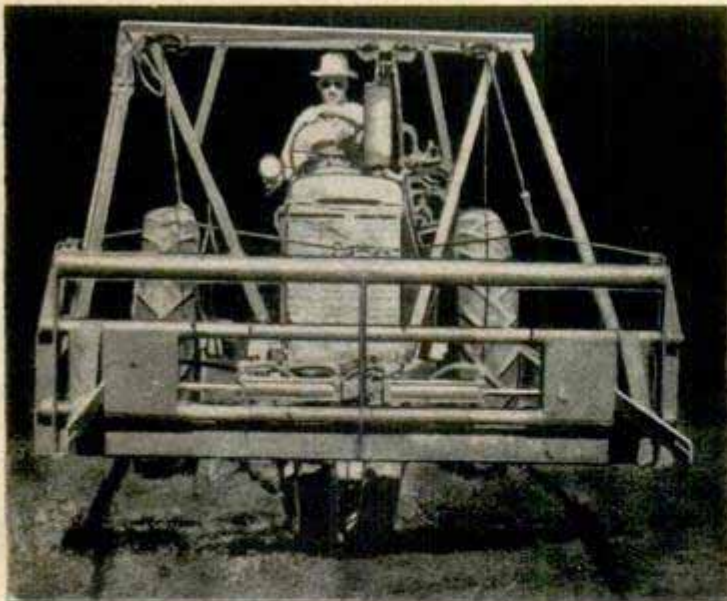


## Electric Dishwasher Rolls on Casters

Apartment dwellers as well as homeowners can now have an electric dishwasher that requires no installation and can be rolled around the kitchen on casters. All the housewife has to do is connect the rub-

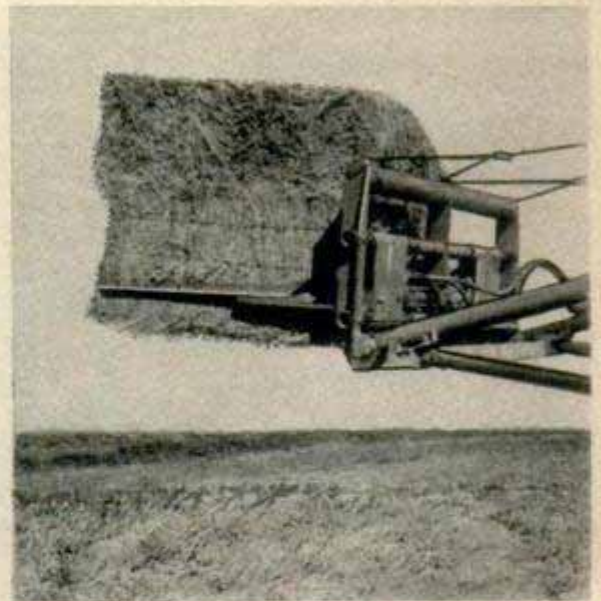


ber inlet hose to the faucet and plug in the electric cord. The drain hose is attached to the inlet hose and centers over the sink when the inlet is attached. Less than five gallons of hot water are used in the entire cycle, consisting of a five-minute wash and two short rinses. A detergent dispenser automatically adds the proper amount of cleaner during the wash process.



## Baled-Hay Loader

As many as seven bales of hay at a time are loaded by a homemade lift that stacks them as high as 21 feet. Developed by Frank and Erwin Billeter of Ellensburg, Wash., the lift consists of a tubular frame attached to the front end of the tractor. A fork on the face of the frame holds the bales



securely by squeezing them between two hydraulically operated arms. Two double-acting hydraulic cylinders are used to power the squeeze fork.

Edible wrappings for bars of food are under development by the Army Quartermaster Corps for use in cold climates where removal of foil wrappings is difficult.



This fireworks display in Radio City Music Hall cost \$50,000, took two years to build and required 24,000 incandescent bulbs

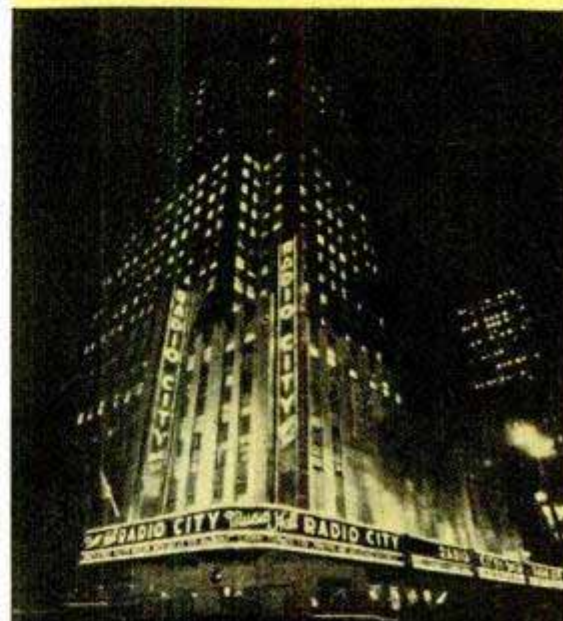
By *Richard F. Dempewolff*

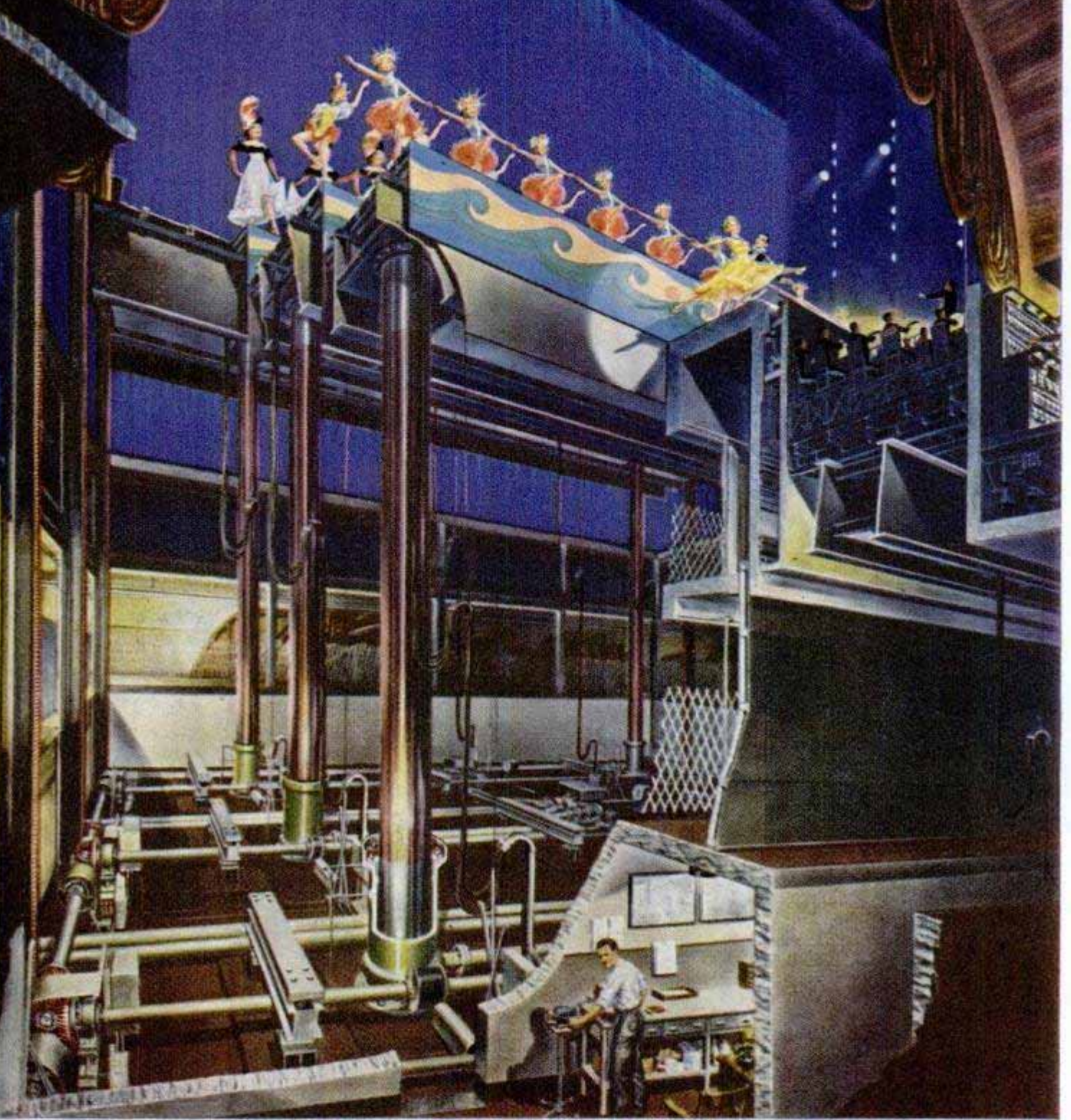
HIGH ABOVE a revolving carrousel, studded with gaudy incandescent bulbs, skyrockets burst in star-spangled glory. Staccato explosions banged a tympanic din over a musical background provided by a 65-piece orchestra, a 30-voice chorus and the rumble of the biggest organ in existence. Showers of colored light twinkled over the dazzling face of a whizzing pinwheel. Aerial bombs let go a barrage of fiery streamers. Then, with one great boom, a hundred-foot wall of colored light cascaded over everything, as the applause of 6000 spectators joined the tidal wave of sound tumbling across the gold-plated dome of light overhead.

This was no outdoor Coney Island fireworks display. It was one of the outstanding indoor spectacles produced by the largest and most incredible theater in the world: Radio City Music Hall.

Because it is even more grandiose than the grandeur it produces, the famous theater must always outdo itself in the extravaganza department. Any ordinary show would be lost in the cavernous maw of its 60 by 100-foot proscenium arch, which backs off over the heads of the audience in a series of concentric golden coves depicting a vast stylized sunset. From auditorium doors to curtain is a city block's distance; its massive stage is nearly half the size of a

## Hall of a Thousand Illusions





Courtesy Socony Vacuum Corp.

Some of the magic of Music Hall staging is made possible by the three stage elevators which operate on 57-foot pistons. The famous dancing Rockettes are shown above performing on three different levels (also below across the two pages). The 65-piece orchestra rides a separate elevator and sits in sort of a band wagon on wheels that moves across the stage elevators to front or rear sections much to the surprise of the audience. To the right of the orchestra is part of the light console which has 4305 switches for presetting any of 20 different light combinations on any of the units in the huge theater. There are 25,000 bulbs in the place





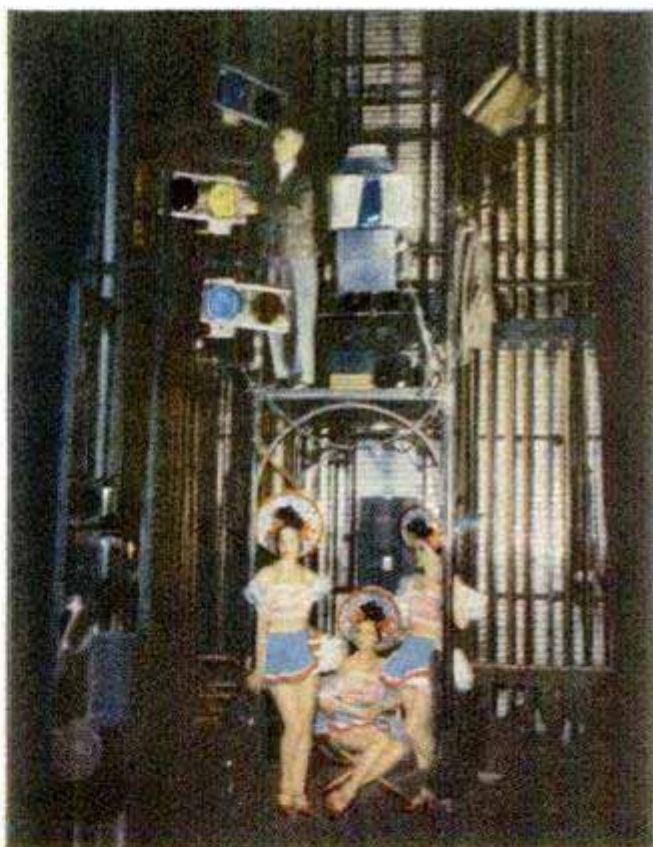
Audience gasped when an observation car appeared on the stage. Below, light technician rides mobile stand

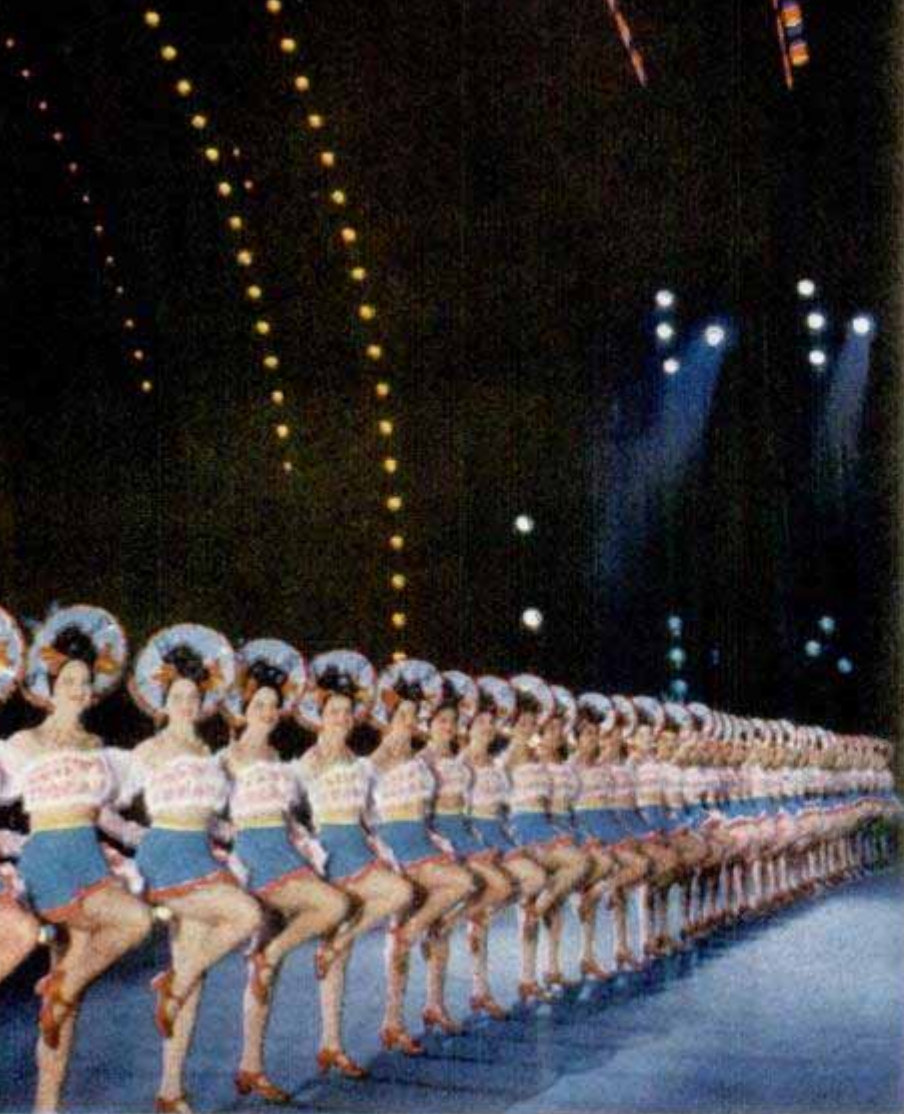
football field. More than 2000 lights illuminate that stage, and its contour curtain weighs three tons.

Eight million people a year, half from out of town, pour through the Music Hall's air-conditioned five-story foyer to fill its 6200 seats daily, and it takes miracles like the recent fireworks to keep them coming.

To stage such gaudy displays, the theater's producers: Leon Leonidoff, Russell Markert, Florence Rogge and an army of some 60 technical assistants, don't spare the horses. Those fabulous rockets and bombs could not have been the genuine "made-in-China" variety, or there'd have been a few scorched patrons. So, for two years and at a cost of \$50,000, the stage-lighting director, Eugene Braun, and his men worked over a maze of bewildering blueprints in the hall's own shops to construct twelve 600-pound lighting panels. When finished, they towered 42 feet against the back wall of the stage, filling it from side to side.

The dazzling 3½-minute display called for 24,000 incandescent bulbs in eight





Spotlights from booth on third mezzanine throw beam 190 feet to stage where the beautiful Rockettes are doing precision dance

colors, 300,000 feet of copper wiring, a nightmare of automatic relays run on a battery of electric motors, thousands of blank cartridges and an automatic synchronized firing device that would chal-

the wings. The water is trapped in a tarpaulin over a slightly lowered elevator and drained off. A phony but impressive Niagara Falls has disgorged itself into a monstrous hidden drain from huge tanks of an

Behind railing at stage level is a full-size swimming pool. Divers operated from boards at left end of pool



lenge an Einstein. The whole thing had to go through its automatic routine at the touch of a single button.

For 17 years, Leonidoff, Braun and other Music Hall geniuses have been staggering a goggle-eyed public with stage trickery that beggars description. Daily, the orchestra pit containing its quota of Maestro Alexander Smallens and 65 artists is swallowed up by the floor. It may reappear a few minutes later, slowly rising out of the back of the stage—or the front. Once, without dropping the curtain, an entire scene depicting outdoor circus grounds suddenly changed to an interior of the big top, with cages of wild animals, while the baffled audience blinked 12,000 eyes during a brief five-second blackout.

Regularly, the famous Rockettes, whirling in gorgeous costume, rise out of the stage floor and silently disappear beneath it, while other acts replace them as mysteriously. Whole sets rotate and change before your eyes.

Hurricanes, with drenching rain (from perforated pipes high above the stage), have swept across the place, blown by a 10-foot propeller-type fan located in

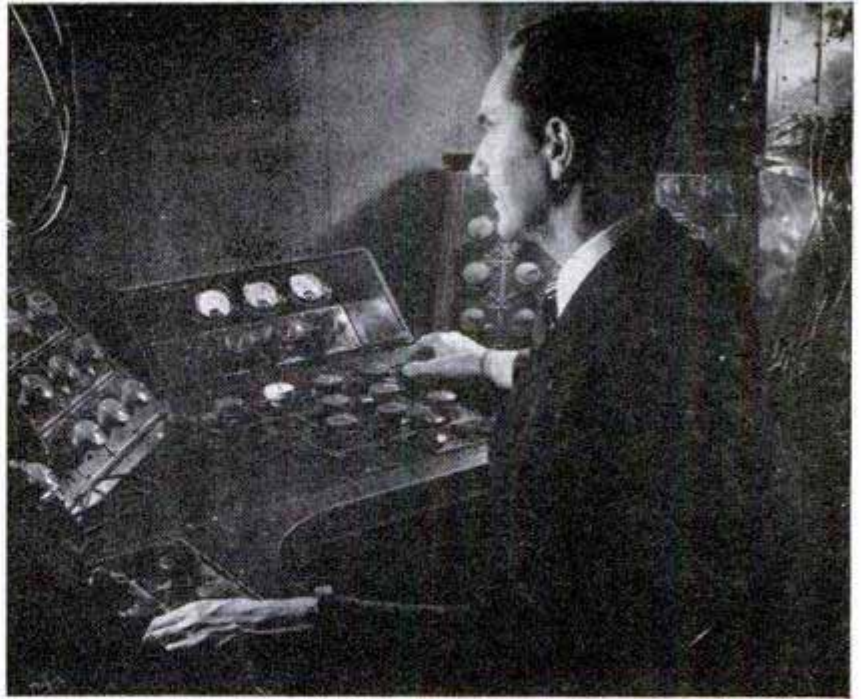
agitated soap solution. An ocean-going ship was once torpedoed on the stage, broke in two and sank beneath the waves as pretty as you please. Another time, a life-size observation car of a train was hauled off the stage by a chugging locomotive, and a moment later the whole train was seen winding its way across the rolling hills in the background. Elephants, helicopters, a troupe of 30 horses and a full-size swimming pool—all have been accommodated from time to time.

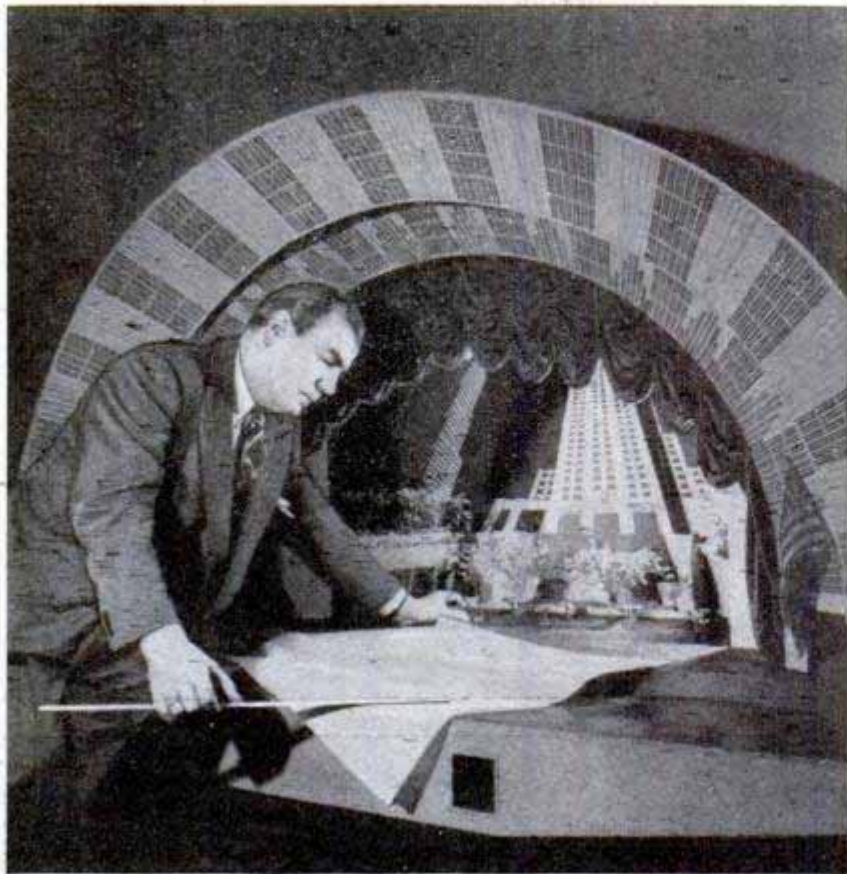
Much of the magic of the Music Hall can be laid to the hydraulic mammoths beneath its stage. There, in the dungeonlike subcellar where footsteps of Rockettes dancing overhead are never heard, and blaring music comes as a muffled thrum, a hydraulic engineer keeps an eye on the real magicians—eight gigantic pistons, whose shiny steel sides glisten with oil in the gloom. Each piston, almost two feet in diameter, and 57 feet high, fits into a cylinder whose casing plunges 67 feet down into bedrock. The ponderous shafts can move the stage in whole or in part, from 27 feet below stage level to 13 feet above it, at the touch of buttons on the master control board located behind the wings upstairs.

The stage itself really consists of three hydraulic elevators which divide it lengthwise into 70-foot strips, about 15 feet wide. There are two pistons per elevator. The fourth pair is for the elevator on which the orchestra sits in front of the apron. Any one of the elevators can be raised or lowered independently—or all three stage elevators can be locked together and moved. That way, a whole show can disappear from sight.

And how does the orchestra

**Top, sound-board operator in booth on third mezzanine sets dials as he watches show. Center, light-control console directly in front of orchestra. Right, Leon Leonidoff, producer, directs show rehearsal. Board enables him to talk to anyone in the theater**





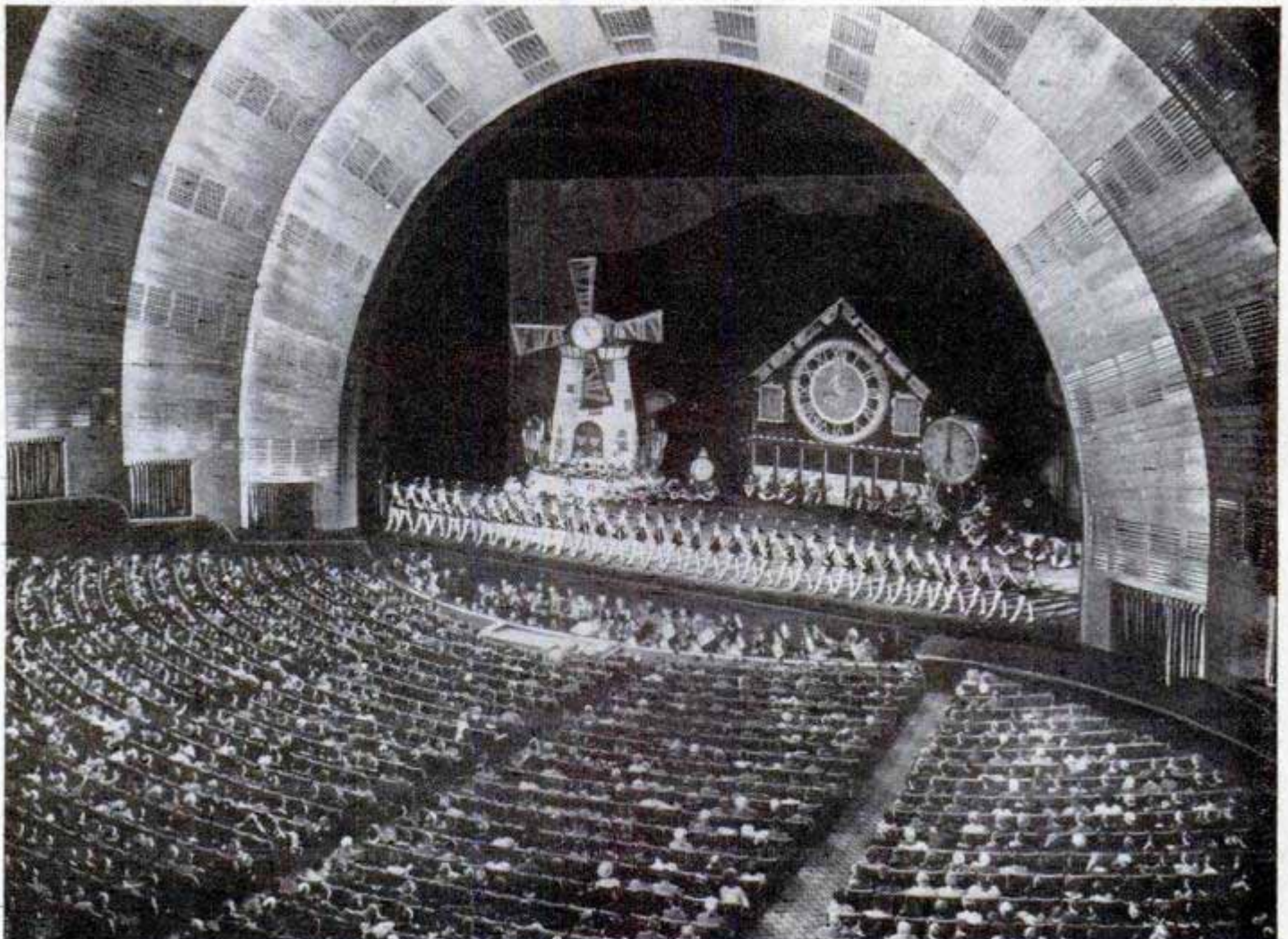
All scenes are worked out on a model stage. Here Bruno Maine, art director, works out a skyscraper scene. Stage even has elevators

Proscenium arch, 60 feet high and 100 feet long, frames theater's renowned 36 Rockettes. Sunburst coves of ceiling extend to the back

get moved around so eerily? Atop the orchestra elevator sits something known as the "band wagon," a sort of self-propelled boat on wheels. While the overture is going on, the whole stage is lowered to basement level. When it's over, the orchestra subsides to the same depth. An electric motor on the band wagon sends the whole shebang scuttling across the lowered stage elevators to the desired position on the front or rear section (the middle one is too narrow to take it), and up goes the stage. The whole operation only takes a minute or so and, when the curtain goes up, there's the orchestra blithely sawing away where no one ever expected to see it.

The band wagon can also be raised to stage level and go gliding across the elevators in stage position.

That's not all the acrobatics the stage can perform. Cut into the top of the three stage elevators, like a freshly cut cookie waiting to be lifted







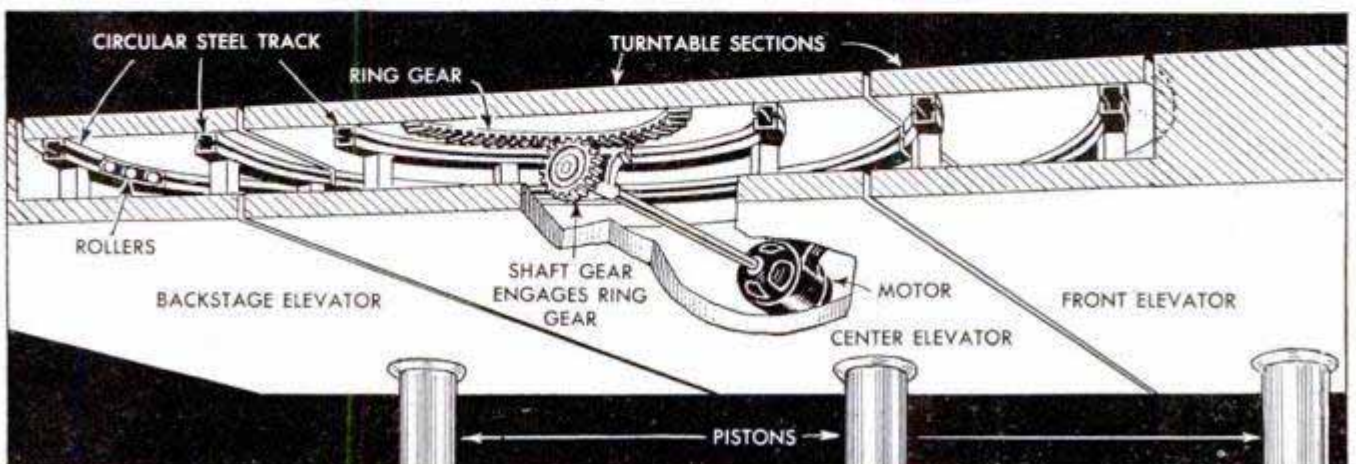
Central panel on stage-manager's control board regulates giant curtain; sliding buttons show preset pattern

from a sheet of dough, is a 43-foot turntable. Of course, the elevators must be at the same level before it can operate, since it is made up of sections from all three elevators. Fastened to the underside of the center stage section, off to one side of the turntable, is an electric motor that turns a shaft, which, in turn, meshes into a ring gear beneath the turntable. A hundred and two little rollers on three guide tracks under the turntable carry the big circle of stage around like a pie tin twirling in water.

It was by using the turntable that the circus exterior became an interior so quickly. On one side of the circle sat the tents; on the other side, the animal cages.

The audience takes all this magic machinery pretty much for granted. But not the producers or the stage manager, Irving Evans, who must keep the magic within the limitations of the Music Hall machinery. Every show is worked out in detail beforehand on a working model of the complicated stage in the office of Bruno

Ingenious turntable is made in three sections extending over the three stage elevators; it is 43 feet wide





**Giant Music Hall stage easily takes in entire East Side dead-end street on full scale including washlines**

Maine, art director. The model is scaled 1½ inches to the foot and will do everything the big stage does. Its tiny pistons work by air pressure, send the elevators up and down at a lively clip. It has an electrically controlled curtain, lights and all. Every set is built in miniature and tested

on the model before it goes into production.

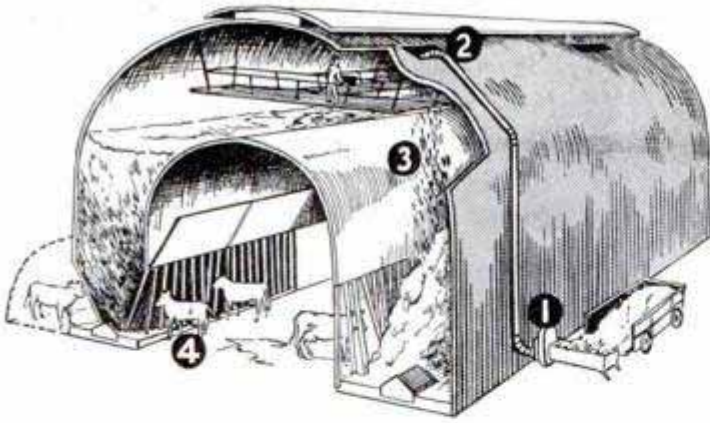
After that, the problem falls on the hydraulic engineers down in their jungle of pipes and pistons. The show must not be too heavy for this equipment. Special water, treated against bacteria, is pumped through a spaghetti maze of pipe at 400 pounds pressure per square inch by a pair of humming 250-horsepower pumps. The huge system, including the great 20,000-gallon pressure tank, is built to raise or lower 190 tons of stage. Above that, the elevators can hoist a weight of 96,000 more pounds. Any more, and somebody might get wet. Twice, the head of one pump has blown with a crack like a cannon and the deluge was something fearful.

The hydraulic engineer watches his show weights carefully. When Leonidoff and Maine planned the swimming pool for an Eleanor Holm (Rose) exhibition, they wanted a realistic set. The scene was the foredeck of a ship; the back elevator lifted to represent the bridge, the center section lowered to take the big steel swimming pool so it would be flush with the deck. Mirrors at an angle along the ship's bridge would give everyone in the audience a bird's-eye view of what Eleanor did in the pool.

(Continued to page 238)



**Through the big projection machines run 5000 miles of movie film a year; booth is 190 feet from screen**

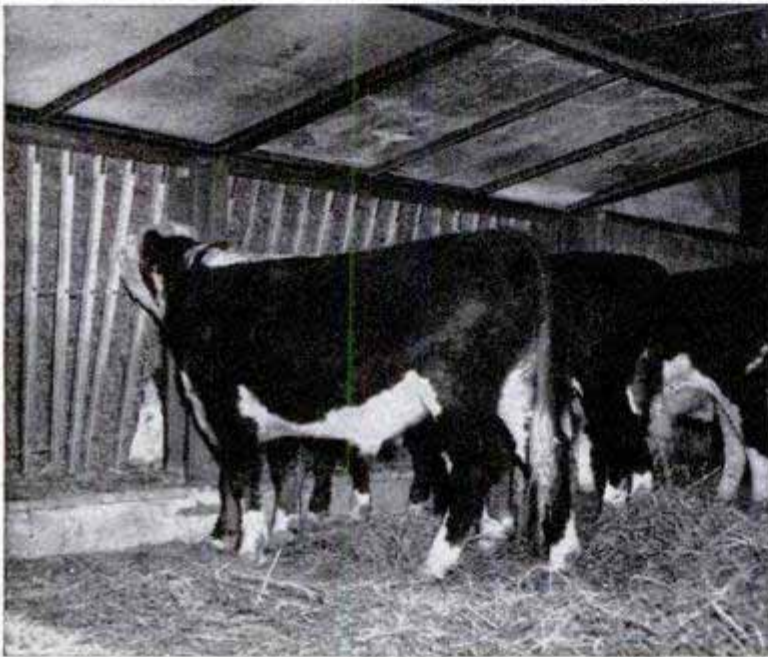


Above, blower (1) forces cut grass to top of barn (2) where it is distributed in storage space (3), allowing cattle (4) to feed themselves. Right, barn exterior. Below, cattle at feeding gates



## "Cowfeteria"

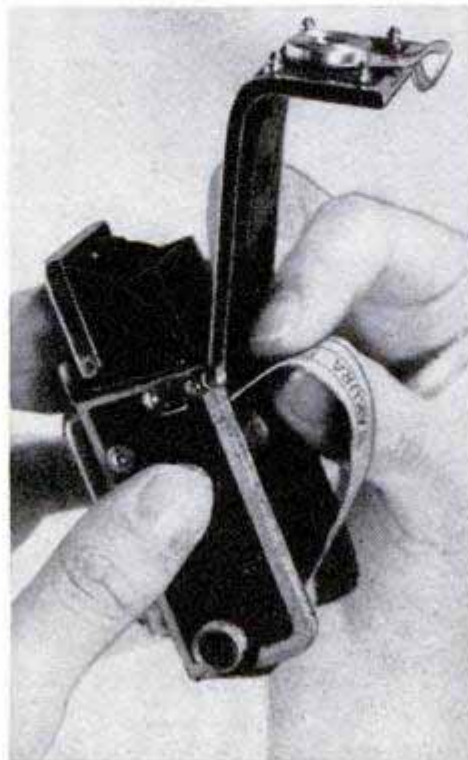
Cattle serve themselves in a scientifically designed barn that saves hundreds of man-hours of labor each year and permits them to satisfy their hunger at will just as they do in the pasture. A winter's supply of hay is stored in the top of the barn, which is essentially a small Quonset building placed inside a larger one. The cattle feed at the bottom through gates and the weight of the hay keeps the feeding racks filled. There is enough play in the vertical gates to dislodge small amounts of hay when a cow nudges them with her head. A duct system, built into the barn, dries the hay in the barn, taking only three or four days. In a test, it took only four man-hours of labor to feed 70 tons of dry hay to 44 steers.



## Miniature Reflex Fits in Palm of Hand

Operated like a full-size model, a midget reflex camera that fits in the palm of your hand lets you focus and compose the picture on the ground glass right up to the moment of exposure. Made in Japan, the camera is only 1 inch wide and 2½ inches tall. It has shutter speeds up to 1/100 second and uses 10-exposure roll-type film.

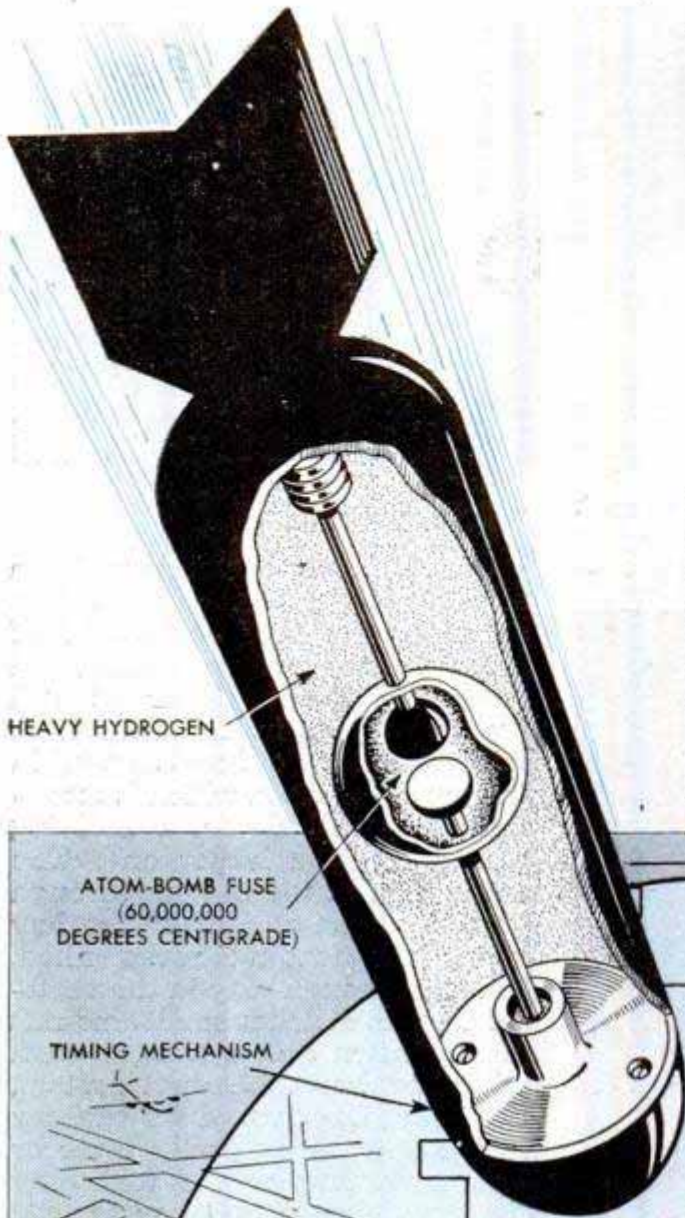
Information not listed on articles in the index, starting on page 10, frequently is listed in the WHERE-TO-FIND-IT INDEX, available without charge from Bureau of Information, 200 E. Ontario St., Chicago 11, Illinois



# HYDROGEN BOMB

WHERE does the hydrogen bomb get its kick? Its potential destructive energy has shocked the world with its possibilities. Scientists tell us the action of the bomb is similar to the atomic reaction that takes place in the sun and that makes life on earth possible; also, that the action is just the opposite of that of the "old fashioned" plutonium or atom bomb. In the atom

Artist's conception of an H-bomb with an atom-bomb fuse; map below shows comparative destruction areas



HEAVY HYDROGEN

ATOM-BOMB FUSE  
(60,000,000  
DEGREES CENTIGRADE)

TIMING MECHANISM

OAK PARK

CICERO

CHICAGO

EVANSTON

COMPARATIVE AREAS  
OF DESTRUCTION

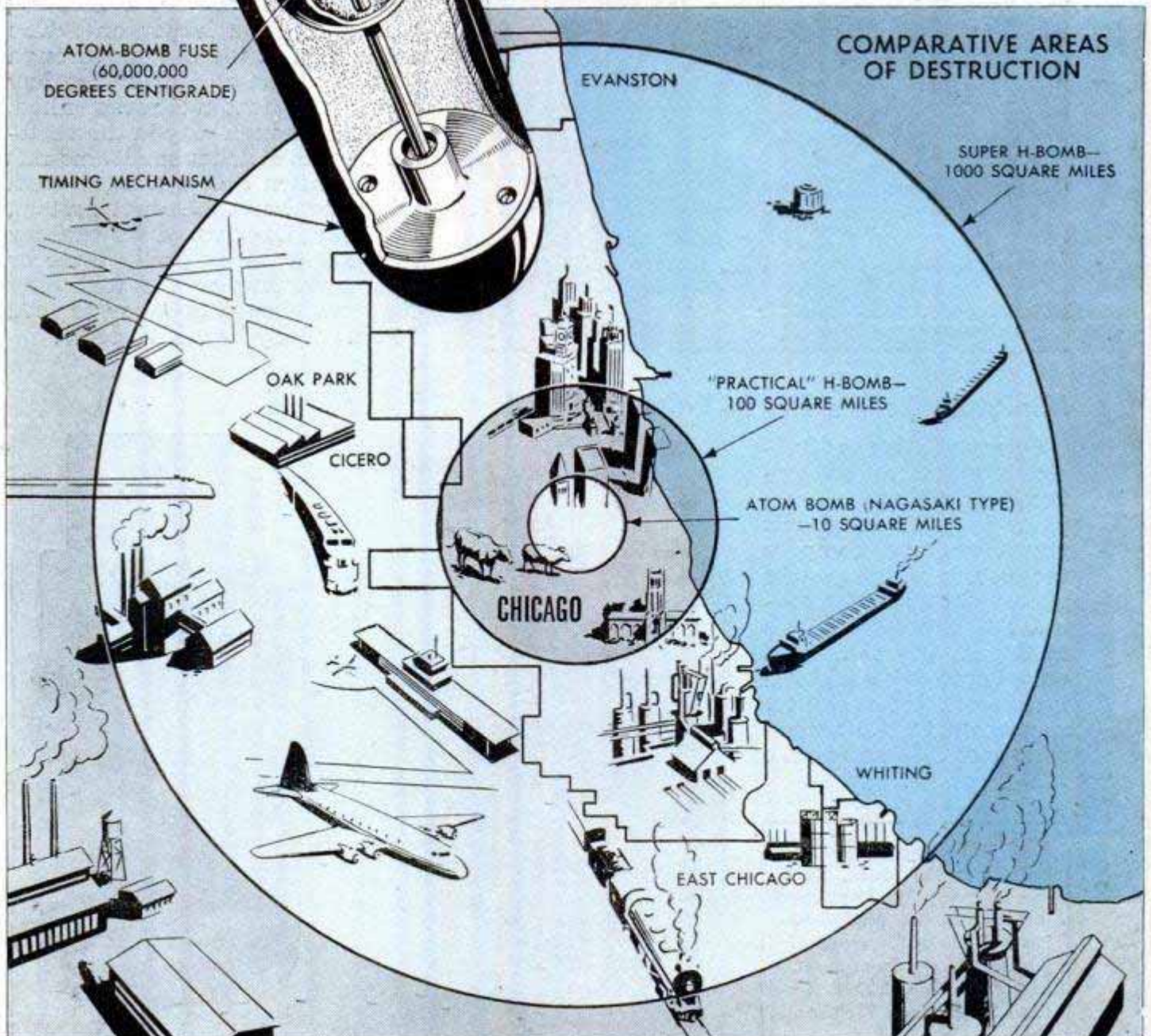
SUPER H-BOMB—  
1000 SQUARE MILES

"PRACTICAL" H-BOMB—  
100 SQUARE MILES

ATOM BOMB (NAGASAKI TYPE)  
—10 SQUARE MILES

WHITING

EAST CHICAGO



bomb, fission (splitting of atoms) takes place to produce energy; in the hydrogen bomb, fusion (joining of atoms) is the basic principle.

Scientists of the Los Alamos Energy Commission Laboratory have made public a finding known as the hydrogen-tritium reaction. There are three kinds of hydrogen atoms: ordinary hydrogen, an atom twice as heavy called deuterium, and an atom three times as heavy known as tritium. Whether the super bomb will be composed of deuterium or tritium has not been announced, but the chances are it will be the latter due to the excessive costs mentioned in connection with the project. Tons of deuterium have been manufactured and it is comparatively plentiful, while tritium is very rare and is produced today only in a few uranium piles in minute amounts.

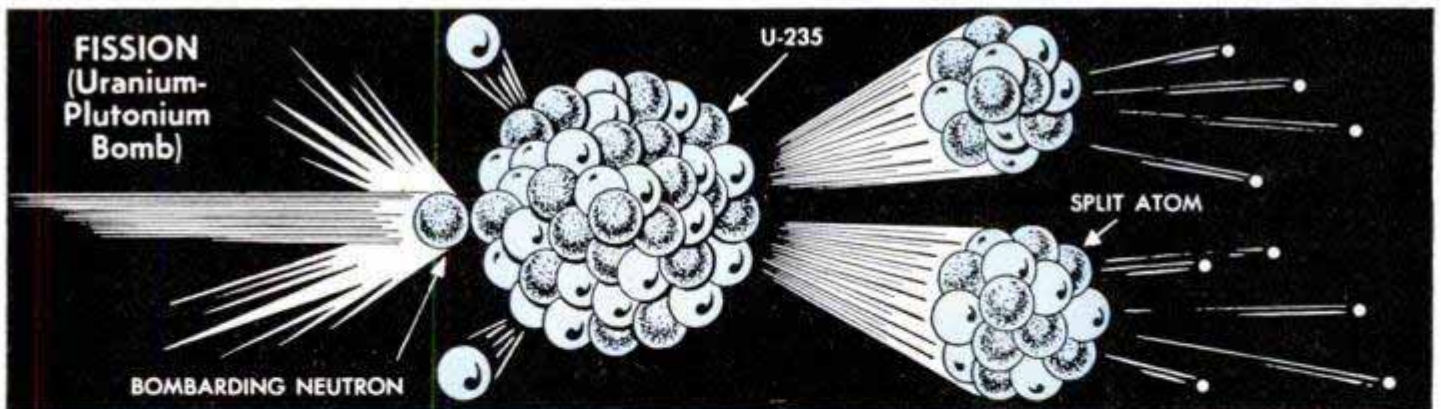
Tritium packs the big wallop of the heavy hydrogens. When tritium is bombarded with hydrogen protons, fusion takes place and an upset tritium atom becomes an atom of helium, and from a single atom gamma rays shoot out carrying 20,000,000 electron volts of energy. It is this punch multiplied millions of times and limited only by the size of the H-bomb that has stunned the world.

Although scientists have known the theory of the hydrogen bomb for years, it wasn't until the atom bomb was built that it became a real possibility. There was no known source of heat great enough to ex-

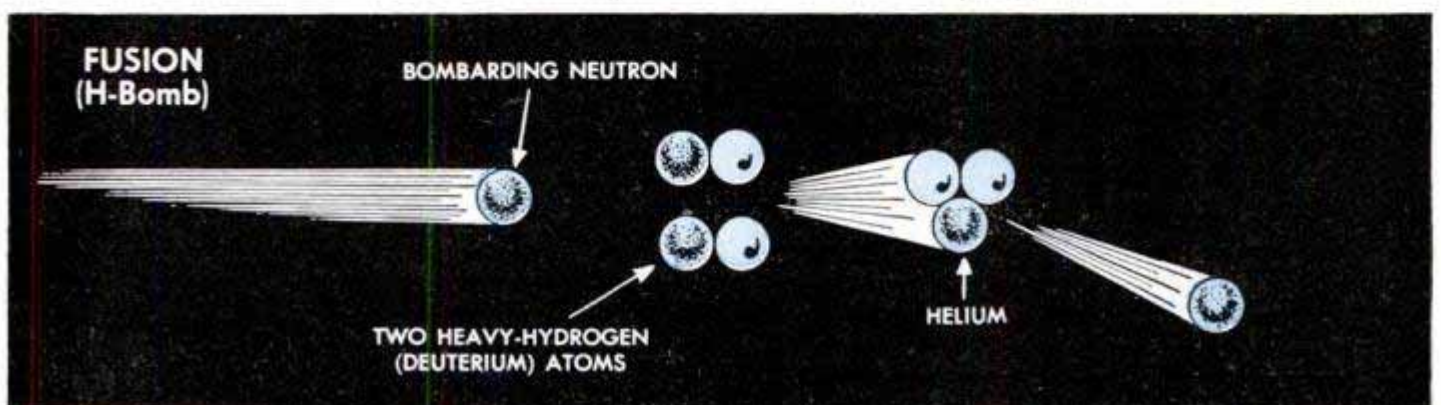
plode a hydrogen bomb. On the sun where hydrogen fusion takes place constantly, the temperature is 20,000,000 degrees Centigrade. No such heat had ever been generated on the earth until the atom bomb was exploded with an estimated temperature at the center of the explosion of 60,000,000 degrees Centigrade. What makes the H-bomb possible is that an atom bomb will serve as its fuse!

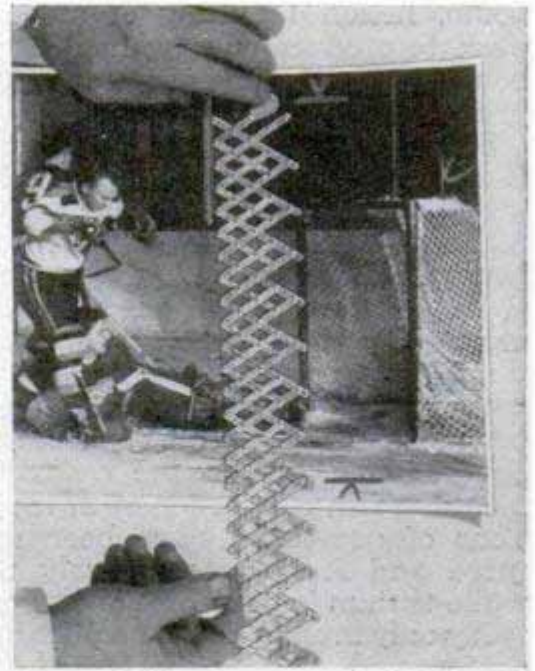
The power of the H-bomb, made of either deuterium or tritium, runs into astronomical figures and many scientists believe that such a bomb can be built which may be 100 to 1000 times more destructive than the atom bomb. This is based on the fact that 2.2 pounds of hydrogen when transmuted into helium would yield about 200,000,000 kilowatt-hours of energy. This would set off an explosion about the same as 160,000 tons of TNT. Using only 10 times as much hydrogen—22 pounds—would result in an explosion equivalent to 1,600,000 tons of TNT or 80 times the power of the first atom bomb dropped on Japan. This can be extended within reason to a hydrogen bomb weighing one ton which would equal 20,000,000 tons of TNT.

Leading scientists differ on the after effects of an H-bomb explosion. Some say that after the blast the radiation would die out quickly. Dr. Albert Einstein warns that "radioactive poisoning of the atmosphere and hence annihilation of any life on earth has been brought within the range of technical possibilities."



Both fission (above) and fusion (below) release tremendous energy but in different ways. The fusion reaction of the H-bomb is similar to constant explosions in the sun where hydrogen atoms are changed to helium

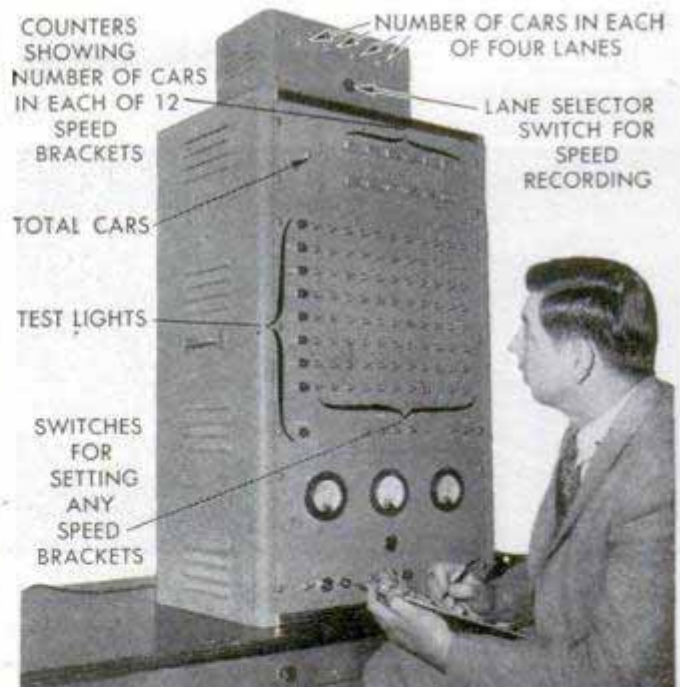
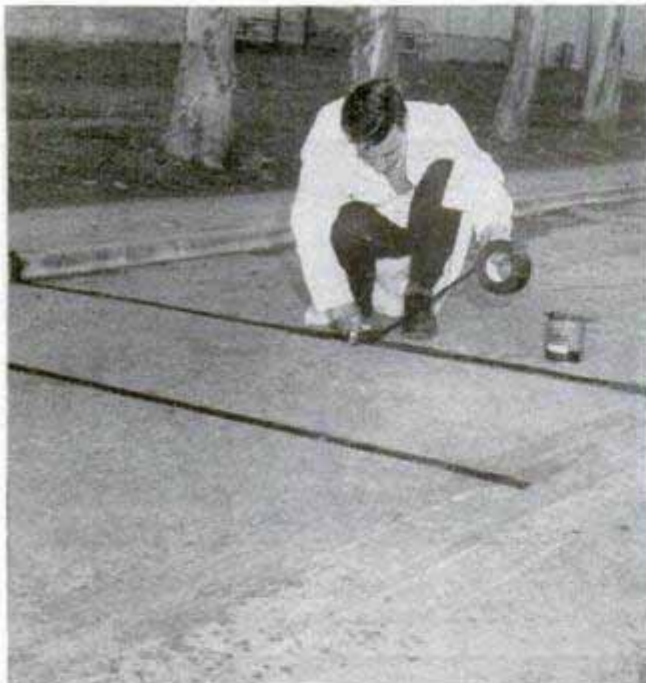




## Link Ruler

Picture editors can measure art work in proportion for reduction or enlargement with a new link-type ruler invented by Paul E. Broner, layout man for the Detroit Times. By extending the ruler across the width of a photograph so that its scale shows the desired width for printing in a magazine or newspaper, then turning the

extended ruler across the picture vertically, the exact depth of the finished engraving can be measured in advance. The Linkruler is six inches long when contracted and extends to slightly over two feet, with its three sets of measuring scales always remaining proportionate. One scale gauges reductions up to half size, another is for extreme reductions and the third is for all enlargements.



Detector wires, left, are cemented in place across each lane and are connected by wires to computer, right

## Traffic's "Private Eye"

Cars have everything but their "fingerprints" taken by an electronic robot that counts cars according to lane position and speed levels, as well as computing total traffic. Two parallel tapes, consisting of a pair of metal conductors that are forced together by the car's weight, are placed

across each lane. Impulses, triggered when the pressure of a car closes the circuit, go into an electronic computer which analyzes the information, recording it on dials to show the number of cars in each lane, the total number using the highway and the number moving in each of 12 speed brackets. The device was built by the engineering staff of the University of California.



## Low-Priced Model Featured by Kaiser

All new from bumper to bumper, the 1951 Kaiser-Frazer line includes 20 body styles and the small low-priced Kaiser. The small car, scheduled for the assembly line late in June, will first appear as a five-passenger, two-door sedan with either a four or six-cylinder engine. All trimmings and gadgets will be eliminated and the rear trunk has no outside opening. Hydra-Matic transmissions will be available on all the Kaiser-Frazer line with the exception of the small model. Later this year, the company has announced, plans have been made to switch to a Borg-Warner automatic transmission.

Thirty to 35 miles per gallon is promised for Kaiser's new low-priced model which is 60 inches high and powered with a new Supersonic engine. Rear seat folds for more trunk space. Below, "tuck away" tire well in K-F line has floor for cover



1951 Frazer Manhattan has "airplane" styling on front end, fancy glass pillar posts and "hop-up" fenders

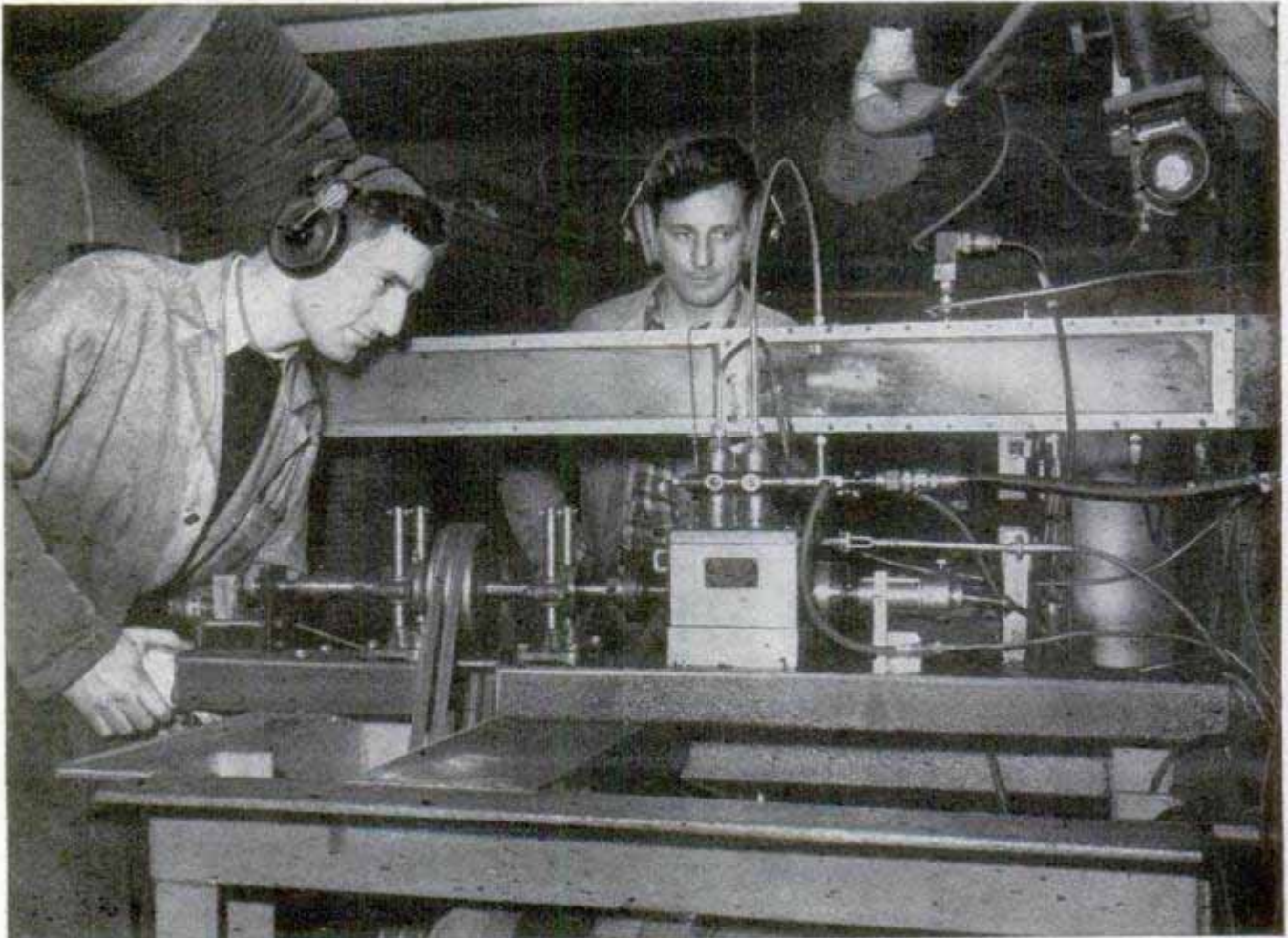


# THUNDER

## IN A NEW PACKAGE

Gas rocket at Princeton looks like a super blowtorch, which is really what it is. It is used to test exact scale performance. When the fuel doesn't mix properly, it shatters with the crack of a 16-inch naval gun

Below, though earmuffs help deaden the roar of the intermittent ramjet, an exclusive Princeton development, it is still loud enough to cause headaches. Injecting the fuel in spurts provides much higher compression





**I T STARTED QUIETLY**—like a hundred motorcycles running at the same time. Two miles away Princetonians coming out of the village post office stopped and gazed apprehensively at the sky. “We thought,” said one villager, “that any minute a crippled B-36 would fly by at about 500 feet and crash into the street.”

That was a few months ago. Today, townspeople in Princeton, N. J., are familiar with the big thunder that shatters the air for miles around the university campus. It's coming from an assortment of brand new experimental rockets and jets that poke hot, vicious exhaust stacks through two-foot concrete walls. In one cold dungeon there's a wicked-looking “ram rocket” stabbing its pointed metal nose from a stovepipe sleeve that flares out like a stainless-steel lily at one end. There's nothing lilylike about its performance.

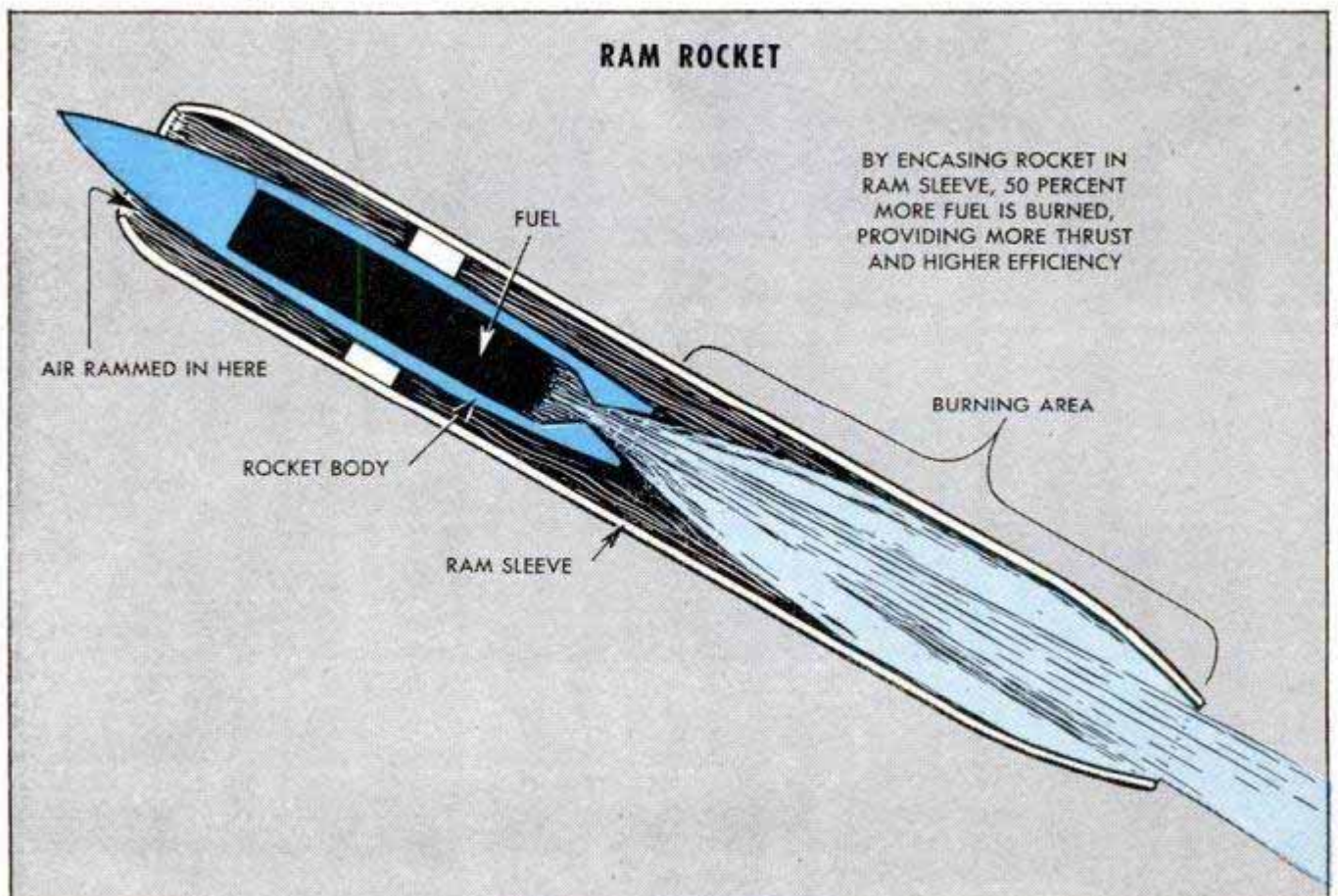
By applying the ram principle to rockets, Princeton has come up with a device that may increase rocket efficiency by 50 percent. Unlike the ramjet, the ram rocket can start from zero speed under its own steam like any rocket. “The difference is,” explains one of the scientists, “that at 350 miles per hour, the air ramming through the sleeve makes the rocket think it's a ramjet. That extra oxygen compressing into the sleeve burns up fuel that would be blown away in an ordinary rocket.

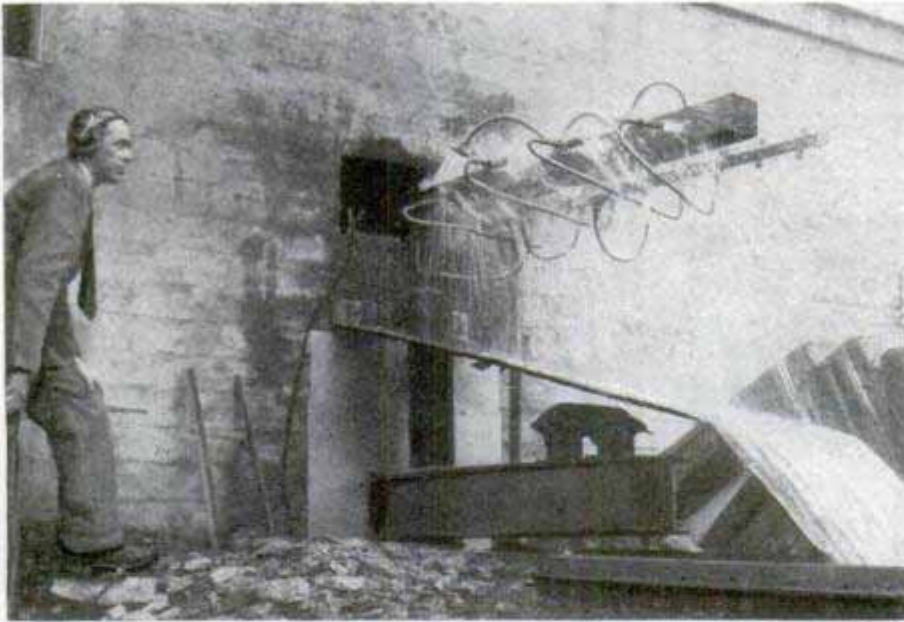
In another building sits a second contribution to supersonic engines—the intermittent ramjet. Stretching 10 feet across



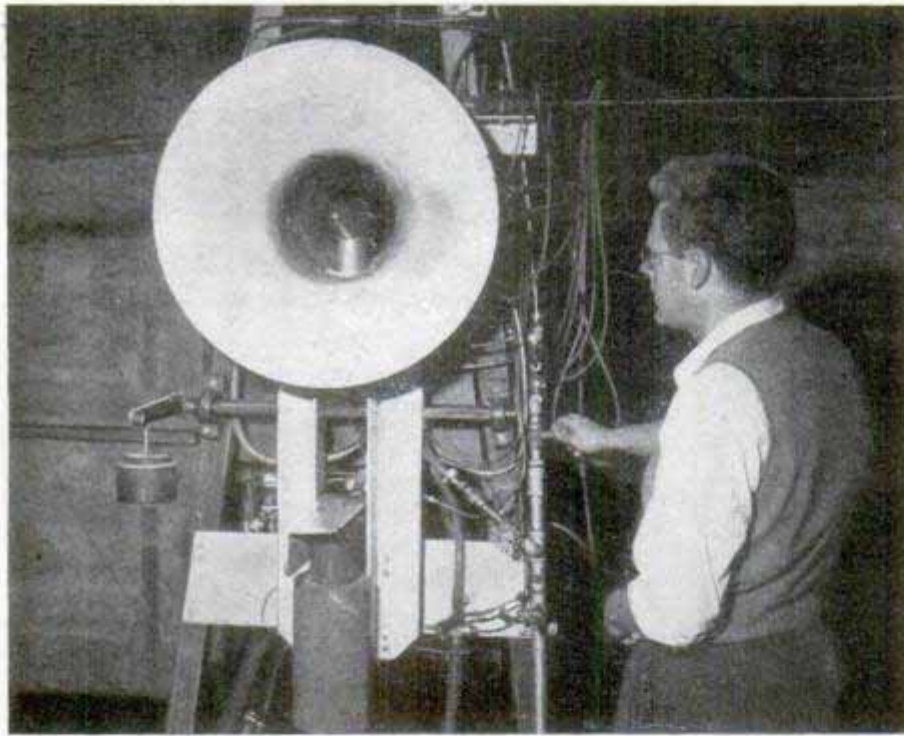
Rocket fabricator John Ashworth holds in his hands examples of steel shells before and after blowouts

Below, in addition to utilizing its fuel more efficiently, the ram rocket can start operating from a standstill, instead of at 350 m.p.h., as ramjets must





Above, ingenious scientists have rigged up an octopuslike water sprinkling system, using garden spray nozzles, to cool exhaust stack of ramjet



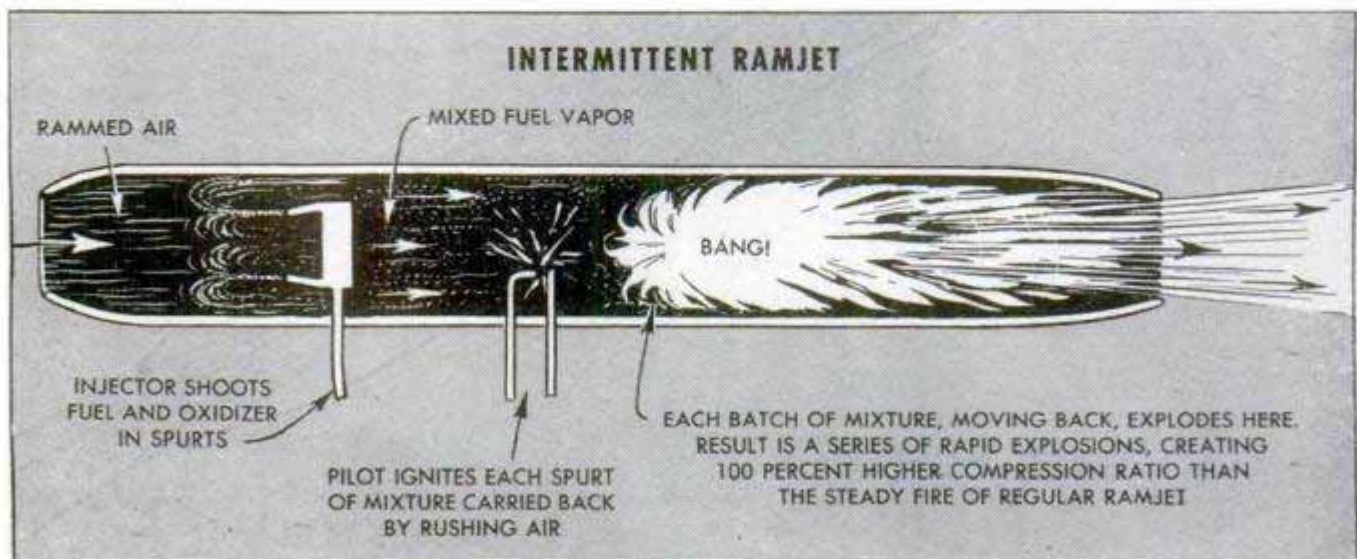
Above, bell-like front of stationary ram rocket, being readied for test. Below, cutaway of intermittent ramjet, illustrating sequence of operation

the room, it resembles a misplaced I-beam with thick glass and bolted steel sides. Instead of breathing a steady spurt of flame, the ramjet builds up twice the oomph of its more ordinary cousin by firing a series of rapid explosions. A complicated fuel-injection system sends the mixture into the tube in spurts—3600 every minute.

There's another concrete-bound midget known as a gas rocket whose fiery exhaust will drill a hole through a brick in less than a second. There's a brand new wind tunnel, too, capable of simulating flow conditions over airfoil shapes at speeds from 1000 to 3500 miles per hour and at altitudes from sea level to 20 miles above the earth's surface—a range of conditions greater than that of any other supersonic tunnel.

All these new projects are sponsored by the Office of Naval Research, located at Princeton's Guggenheim Jet Propulsion Center, and spearheaded by Dr. Daniel Sayre, chief of the university's aeronautical engineering department. Most interesting is the rocket program, under the title "Project Squid."

"It started in 1948," says Sayre, "when a few



Princeton scientists decided something might be done about rocket and jet efficiency." Ordinary rockets are only about five percent efficient. The supersonic flame at the tail blows much of the fuel out into the air unburned. "We knew that a few people," he recalls, "had tried putting a sleeve over the rocket to confine and burn the gases—with some success. It seemed like a good idea."

Professor Larry Poole, a man with an imagination as long as his six-foot-six-inch frame, scouted the Army and Navy surplus stores in New York. He chugged back with sections of old B-29 exhaust stacks for the rocket sleeve. Tin stovepipe, flared six to eight inches, became the sleeve ends.

Before going to the expense of actual powered rockets, Poole simply formed a hollow miniature, bottle-shaped rocket shell of stainless-steel tubing, about a foot long and one inch in diameter. Then he got some compressed-air tanks. He set the rocket shell inside the B-29 exhaust stacks and ran a pipe from the air tank into the front of the rocket shell. The air would simulate rocket exhaust.

He opened the valve. Whish! a blast of air rocketed through the rear nozzle of the shell at about 3000 miles per hour. The most important result was that for every pound of air shooting out of that nozzle, the thin stream was "entraining," or pulling with it, 15 pounds of air through the big sleeve—enough oxidizer to burn practically all the fuel any rocket might squirt from its tail. The rush of entrained air crushed the flared stovepipe against the rocket.

"Now we knew that our ducted ram rocket would work," says Sayre. "It was time to invest in powered rockets. It was tough. Nobody in the department had even seen a rocket. We couldn't afford a big one, and even if we could, the noise would be frightful. So, they went scouting for miniatures. One company had six tiny rockets for sale at \$30,000. "We couldn't afford even one," says Poole.

Once again Poole started shopping. Surplus stores yielded stainless-steel tubing. A shop, made up of surplus machine tools, was built on the campus. On these machines, engineers now press-form their own rocket shells for \$5 to \$10 apiece. Cheap brass tubing forms the water jacket. Other parts of the fuel-injection system are machined from scrap steel. Today \$25 buys a whole Princeton rocket, made up of several parts bolted together—another advantage over the welded one-piece commercial jobs. Burned parts can be replaced.

Last winter Poole was ready for his first run. The ram rocket sat proudly in its concrete chamber. Behind two-foot concrete walls, scientists watched instruments

which would measure heat along the sleeve, fuel consumption, combustion and a host of other things. The men peered through a periscope into the chamber. "Then," says Poole with a wry smile, "we sat around scratching our professorial pates, wondering how we were going to start the thing."

Finally, he got a blowtorch and tied it with bailing wire to the tail of the sleeve, lit it, and pointed the flame up toward the rocket nozzle. Then he went back and threw the switch. The flame caught with a roar like a subway train. But it caught halfway across the room, in mid-air. The force of the fuel blast wouldn't let the flame back to the rocket nozzle. "We leaned the mixture, tried two blowtorches, and the flame jumped back and forth," says Poole. "Then we leaned the mixture some more and the whole shebang blew up with a high pitched crack, like the wallop of a 75-mm. cannon."

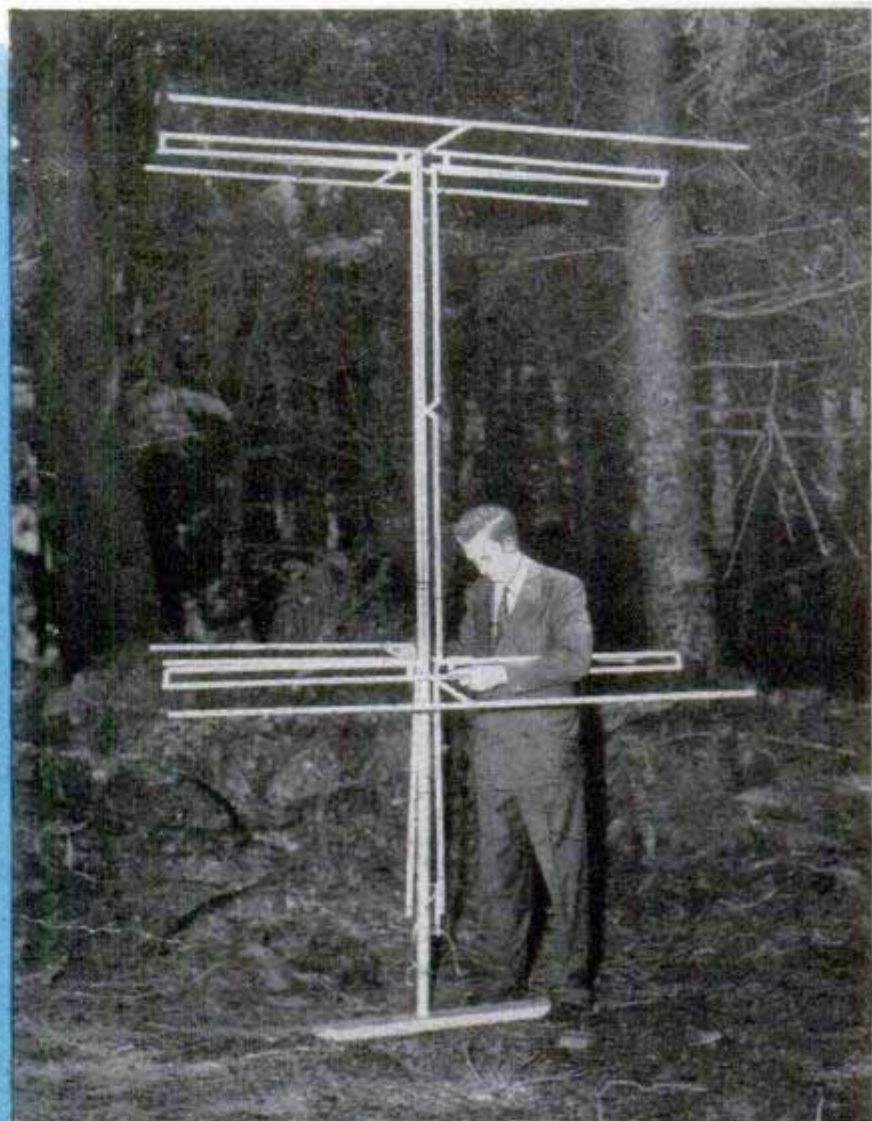
On a new rocket, Poole tried a different ignition trick. He took welding rod, stuck it down through the rocket nozzle, and touched off a spark actuated by a Model-T ignition coil.

The rocket lit like a charm. The only trouble was that the 3000-degree temperature melted the welding rod and blew it out the rear like a shot. Today, the ram rocket is fired by model-airplane spark plugs, and more than 200 successful runs have been logged. The rugged little engine, with its secondary stream of air whipping through the ram sleeve, burns ethyl alcohol, gasoline or diesel fuel, along with its liquid oxygen, at a highly efficient rate. The tiny rocket motor itself, only a foot long, produces a 50-pound thrust. By converting to full scale, rocketeers may be able to turn that efficiency into higher speeds, or longer flights, for supersonic missiles.

The same ingenuity and abandon accompanied the development of the intermittent ramjet—a brand new idea in jets exclusive with Princeton. In 1947 Professors Lester Lees and Abraham Kahane looked at the V-1 pulsating rocket which, though it threw a steady stream of fuel, gained better compression by use of flutter valves which let in the air in spurts. Result was a series of explosions, each one building up a high peak of compression, rather than one long roar of fire. Why not get the same advantages—plus fuel saving and efficiency—by making the fuel spurt instead of the air?

Since their jet would be stationary they had to blow air into the ram tube to simulate flight. From War Assets they got two big blowers, connected them and fed the air stream through a pipe to the front of the ramjet. They whipped up a 350-mile-an-hour breeze, and the blowers proved so

(Continued to page 280)



## SMALL TOWN

By Rafe Gibbs

When Ed Parsons decided to bring TV from Seattle to Astoria, he didn't let 140 miles of mountainous terrain (see map, left) discourage him. Above, he sets up a test antenna on one of the pine-covered hills near his home town

TELEVISION is going to town—your town. Never mind if your town is only hamlet-size, or more than 100 miles from a metropolis with a television station, or is hemmed in by some first-rate mountains. Television now looms as a distinct possibility for that corner by your fireplace.

What is the basis for such statements? It is the fishing port of Astoria, Ore. Astoria is located at the mouth of the Columbia River, just a couple of jumps above sea level. It is 140 air miles from Seattle, which has the nearest television station. Pine-covered mountains between Astoria and Seattle stand 4000 feet high, but folk in Astoria are enjoying telecasts from Seattle. And reception is good!

Who is responsible for bringing TV to Astoria? Some Astorians give credit to Ed Parsons; some to his wife. Here is why:

Mrs. Parsons, an attractive, dark-haired and dark-eyed former Canadian newspa-

perwoman, remarked to her husband one day at breakfast in the summer of 1948, "Ed, I wish we had pictures with our radio."

Parsons frowned.

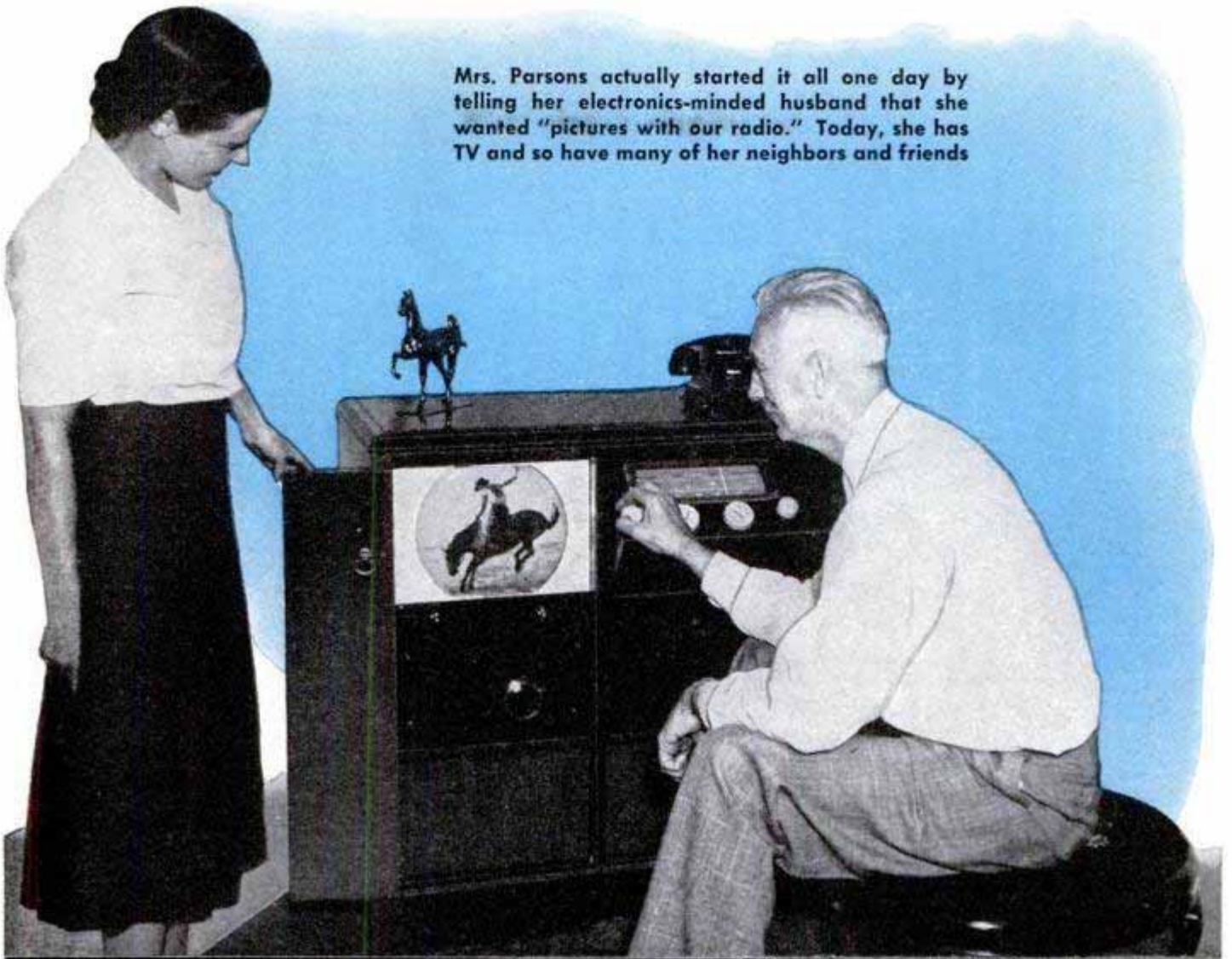
"We live in Astoria, you know. It just isn't being done here this season."

"But I still say I'd like television—and I know someone who could bring it to Astoria if anyone could."

Mrs. Parsons' eyes were on her husband.

As a youth, Parsons was a ham radio operator. As a man with prematurely gray hair that has difficulty staying in place, he still is—W7FKZ. He is best known as the owner and manager of Astoria's commercial radio station, KAST. But to some 1500 Astoria fishing-boat skippers, he is the man who sees that their radar, depth finders, automatic pilots and direction finders keep working. He also provides maintenance for aircraft and air-navigation aids. Owner and operator of Radio and Electronics

Mrs. Parsons actually started it all one day by telling her electronics-minded husband that she wanted "pictures with our radio." Today, she has TV and so have many of her neighbors and friends



## TELEVISION

Company in Astoria, he is one of the West Coast's top electronics engineers.

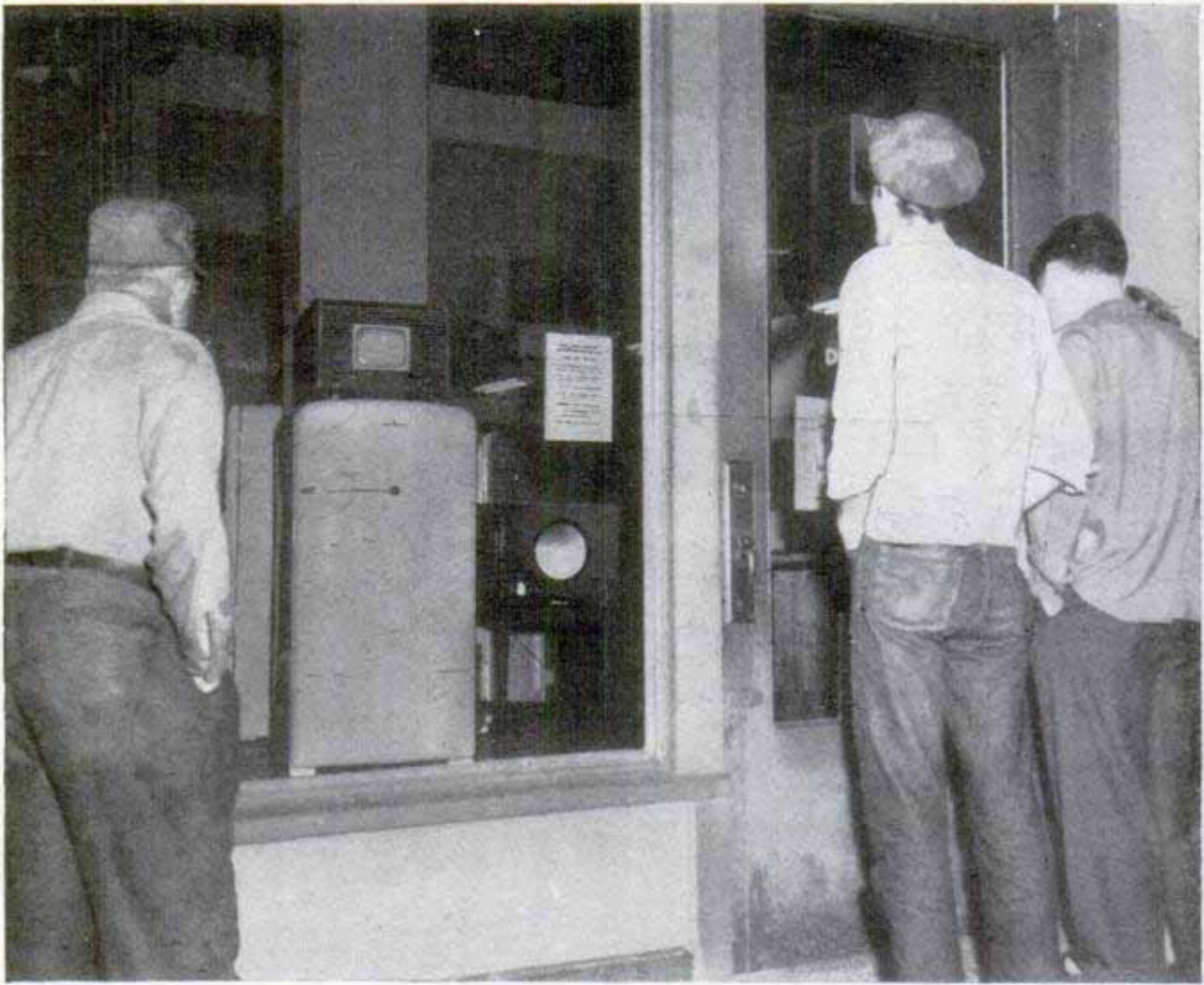
If anyone could bring television to Astoria, Parsons was the man. But could it be done? Fifty miles over fairly level terrain was generally considered as the maximum radius for consistent television transmission. There have been receptions in different parts of the United States from as far away as England, but they were freaks that flickered briefly in the night.

Nevertheless, to please his wife, Parsons decided to look into the matter. Television Station KRSC in Seattle was then about to go on the air and was making test telecasts. Parsons began to conduct some experiments of his own.

First, he had to find out whether there were any usable signals in Astoria from the Seattle station. Loading his car with frequency-survey equipment, Parsons prowled the streets of Astoria with all the sleuthing patience of a patrolman. Matter of fact, before he was through, Parsons covered all of Clatsop County.

With this compact eight-tube receiver-sender of his own design, Parsons picks up TV signals from Seattle and sends them out over coaxial cable to other sets





Stores in Astoria now sell TV sets and, just as in the big towns, passers-by stand outside, watching the show. Below, Parsons is well known among fishermen who bring their radio equipment to him for repair



The most logical place to pick up signals would seem to be hilltops, but it just wasn't that way. Parsons found signals on the sides of hills, in valleys and in other assorted spots. The KRSC signals seemed to come to Astoria in fingerlike bands. These bands were one to two city blocks wide. Within each band, the signal was constant from street level to building tops, but the signal in some bands was stronger than in others.

Invariably, the signals were in awkward places for experiments. But, finally, after testing the whole county, Parsons got around one day to working with his survey equipment at his own home, a penthouse atop a two-story building right in the center of Astoria. He picked up a signal, which meant a television "finger" was pointing right at his roof top. The signal was weaker than some of the others he had found, but for experimental purposes it would do and now he had a handy place to work.

To his home "laboratory," Parsons brought a standard television set and a variety of television aerials. He tried one aerial after another, but got no television. Most men would have given up at this point, but not Parsons. He is slow to quit. Ask the Astoria fishermen. When a skipper

comes into his shop with an electronics problem that can't be solved on land, Parsons goes to sea himself for the answer.

He kept on with his television experiments. He began to devise his own aerials, his own booster equipment. Then he installed telephone service from the roof of the penthouse to the living room where the television set stood, its screen as blank as a wall.

While Parsons experimented with aerials on the roof, his wife sat in front of the set. Making an adjustment, Parsons would telephone his wife:

"See anything?"

"Not a shadow."

This went on for weeks. The Parsons house became a clutter of aerials and other equipment. Then one day, Parsons called down to his wife and got the answer:

"A flicker."

The flicker progressed into faint images, into pictures, into consistently good reception with the touch of a dial. Mrs. Parsons, who had asked for pictures with her radio, had them from Station KRSC, now regularly on the air in Seattle, 140 miles away over the mountains.

The word got around town and its echo was the steady ringing of the doorbell at the Parsons' penthouse. Both friend and stranger came to hear, to see and to believe.

At first, Mrs. Parsons served refreshments to the guests—invited and uninvited—but soon their numbers made this impractical. It got so that when the doorbell rang, the Parsons would just call, "Come in, and have a seat," without even going to the door.

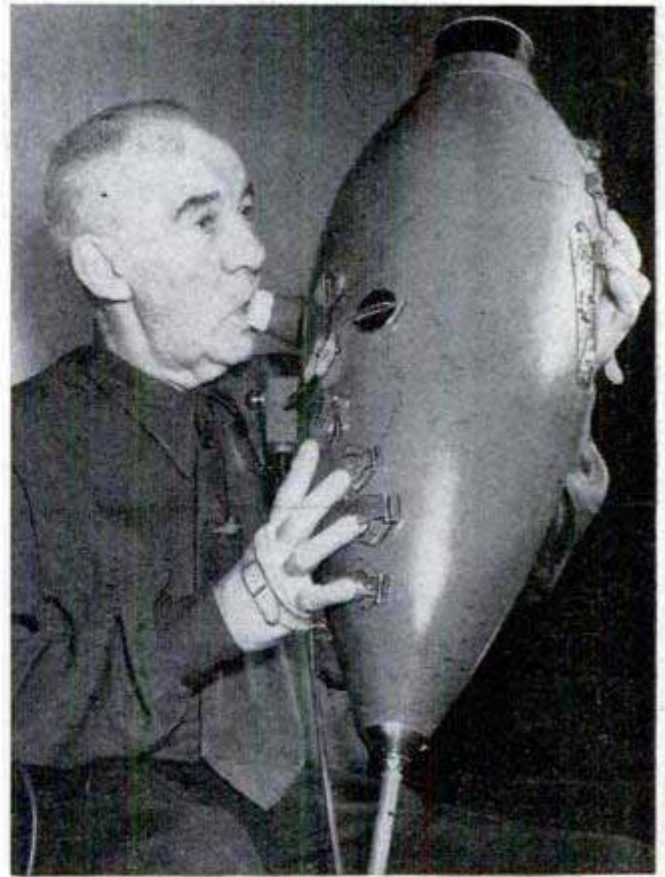
"You asked for it," Parsons told his wife, then added: "Something will have to be done."

Parsons had proved that television could be picked up efficiently over a considerable distance that traversed mountains. But now, somewhat in self-defense, he decided to try another experiment—to see if he couldn't send out what he picked up in Astoria to other residents of the town.

He began development of a receiving-sending unit. Starting with a three-tube system, he worked his way up to one with eight tubes. The unit was kept relatively simple. Relatively small, too, with a 12 by 14-inch chassis. And Parsons made it work.

He had no FCC license to resend a telecast, but there was no law against piping KRSC programs by coaxial cable to other residents of Astoria. He strung cable up buildings, down elevator shafts, through underground tunnels carrying utility lines. The cable went into private homes, taverns, stores. About 2000 feet is the limit of transmitting for Parsons' present equipment,

(Continued to page 268)



### Biggest "Sweet Potato" in World

Resembling a Navy blimp in form, an ocarina designed and built by Charles Lindsay of Washington, D. C., is made of wood and weighs 11 pounds. Lindsay says it is the largest ocarina in the world, and with it he can play any sort of tune. The instrument took about 500 hours to build.

### Mushrooming TV

With television antennas springing up like mushrooms on the nation's roof tops, there are over three million TV receivers in use today and 42 cities have video broadcasting stations, according to the annual report of the Federal Communications Commission. TV network facilities link 24 cities. Using microwave, 136 relay stations send programs between cities and from studios or remote pickups to transmitters. Biggest advance during the year covered by the report was the linking of eastern and midwestern coaxial-cable systems. Simultaneous networking of programs could make possible the viewing of a program by about one-third of the nation's population. Frequency-modulation stations have also increased in number and now more than 100 million persons are within range of broadcasts from FM transmitters.

Our spinning earth is about 3,350,000,000 years old according to the estimate of Dr. Arthur Holmes of the University of Edinburgh, who used the rate of decay of uranium for working out the figure.

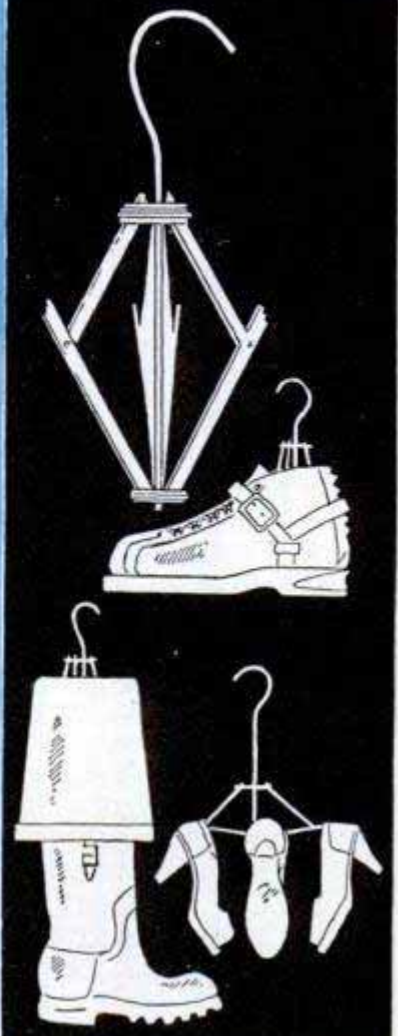
# WHAT'S NEW *For Your Home*



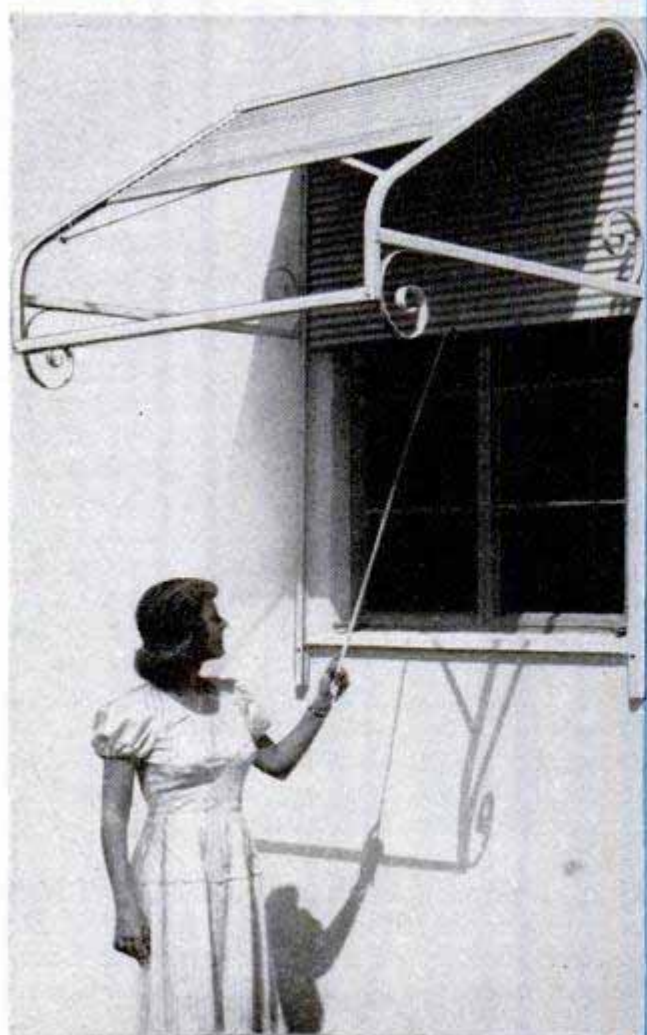
**SELF-OPENING LID** on garbage pail permits use of both hands for scraping dishes. Mounted high on cabinet-sink door, it eliminates stooping. The lid closes automatically as the door swings shut



**BOOT DRIER**, made of a rustproof metal, holds the boot upright so the moisture escapes freely. It is useful for hanging up any type of footwear



**CEILING WASHER** is nondripping. You don't even have to cover the furniture when you are using it! A rubber bulb near the end of the adjustable handle forces cleaning fluid up into the head when squeezed



**AWNING-SHUTTER** has a double life. Pulled up, it is an attractive and serviceable awning. If a big storm threatens, a quick downward pull converts it into a shutter. Made of aluminum, it is available in many colors

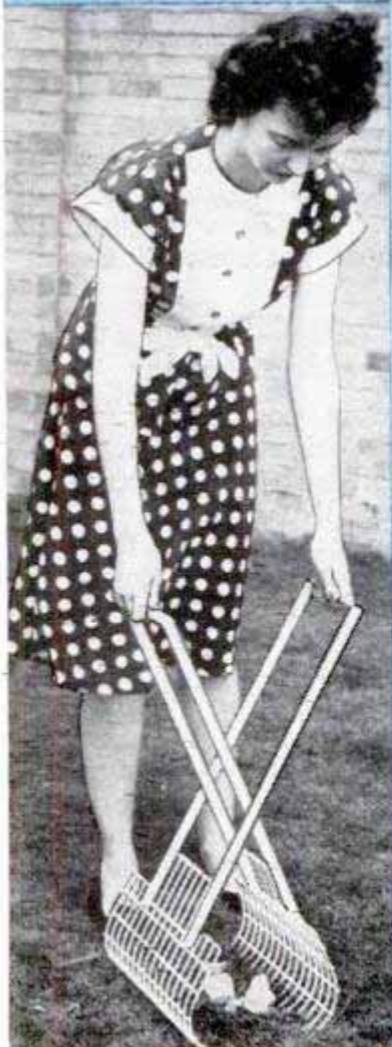




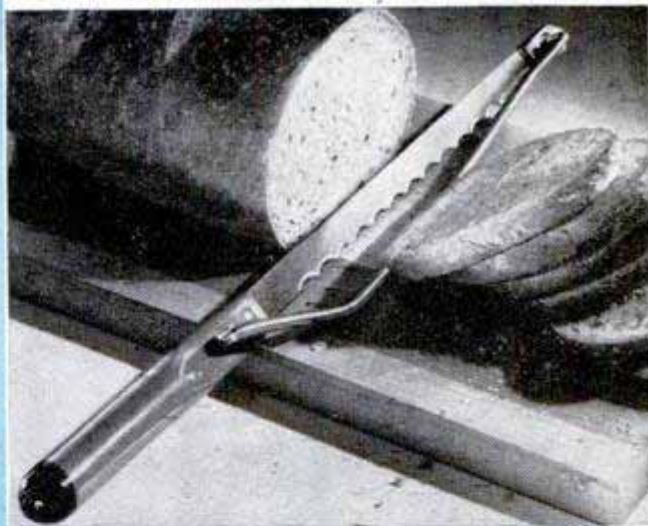
→  
**CLOTHES BUCKET** for washdays is carried by a shoulder strap. It holds a washing-machine load of clothes and has a clip-on clothespin tray. It is made of a lightweight metal



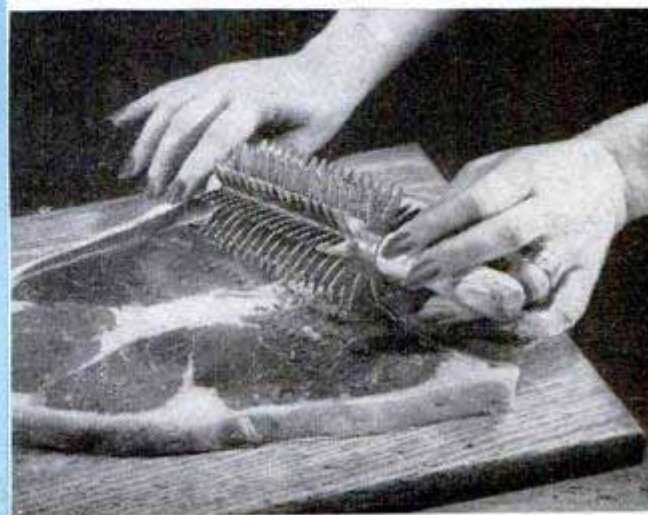
↓  
**NO-STOOP RAKE** makes cleaning up the yard easy on the back! It picks up leaves, sticks and paper a half bushel at a time

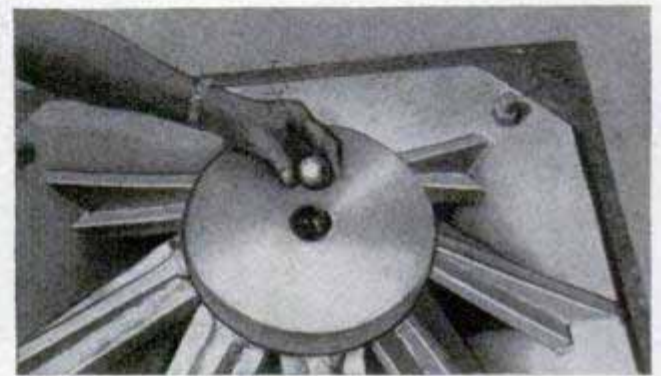
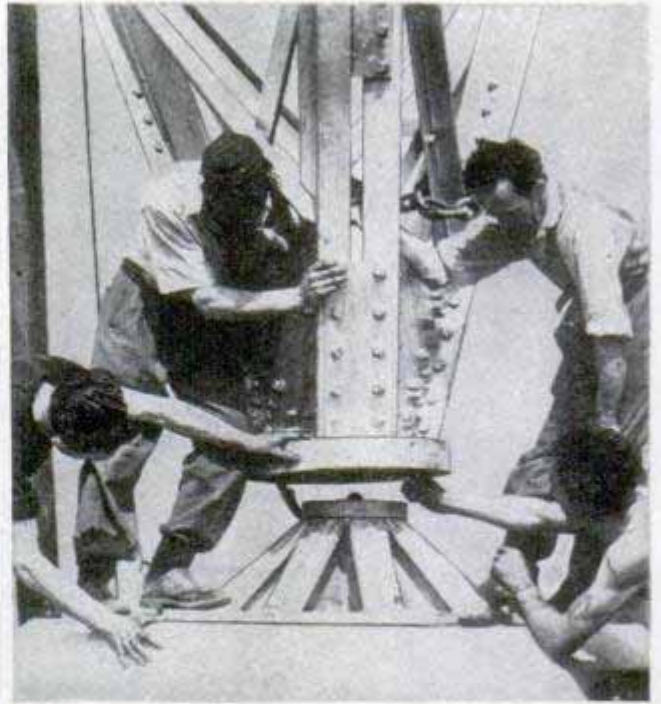
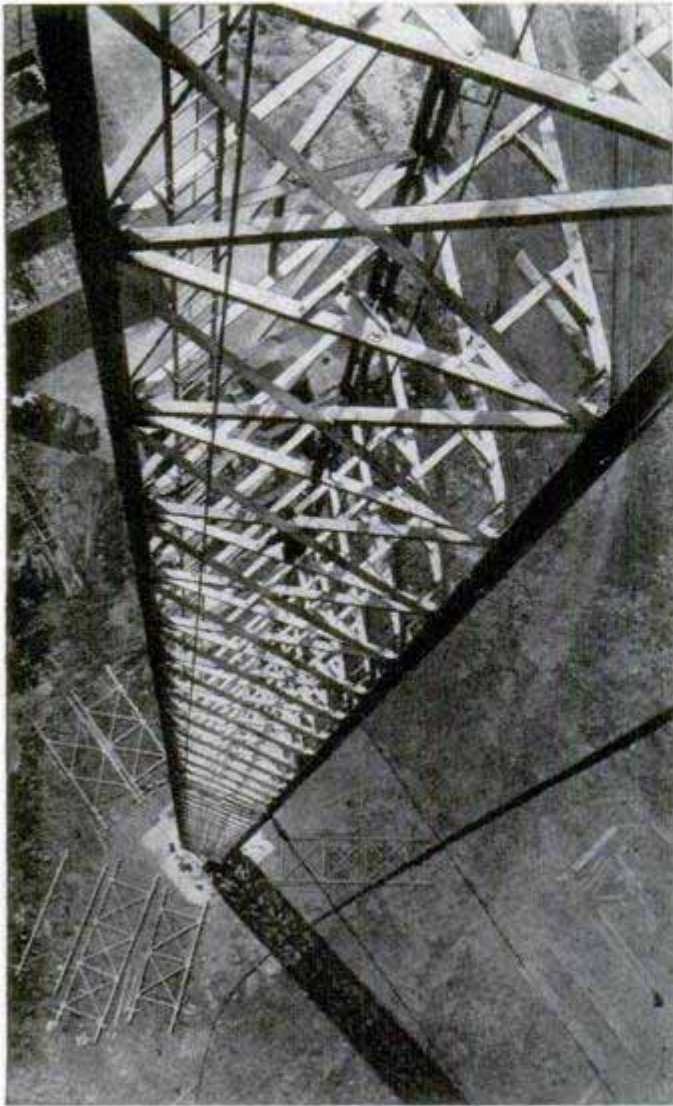


→  
**FOOD SLICER** with an adjustable guide rod is designed so even the man of the house can slice a loaf of bread neatly. It has a sturdy Tenite plastic handle. The very thin blade always stays sharp



→  
**STEAK ROLLER** makes tough steaks tender, but does it without any loss of juices. Used like the rolling pin, it cuts the fibers without smashing them. It works fine for breaded meat dishes, too

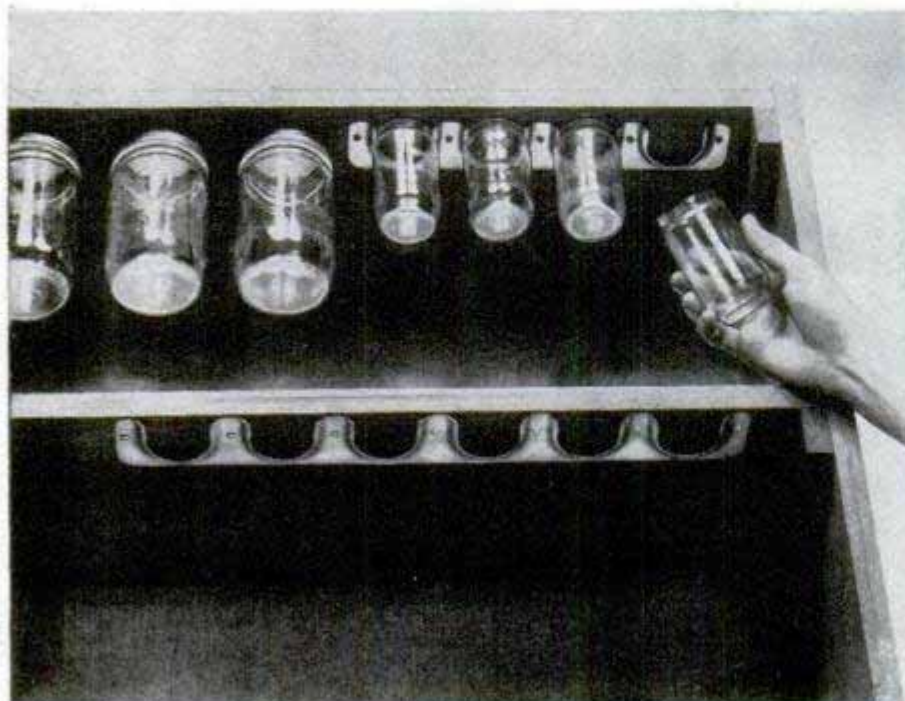




## 750-Foot TV Antenna Mast Balances on Ball Bearing

Pivoting on a ball bearing only two inches in diameter, a 750-foot television mast, erected in England, is designed to allow it to sway in strong winds without damage. Programs originating in London will

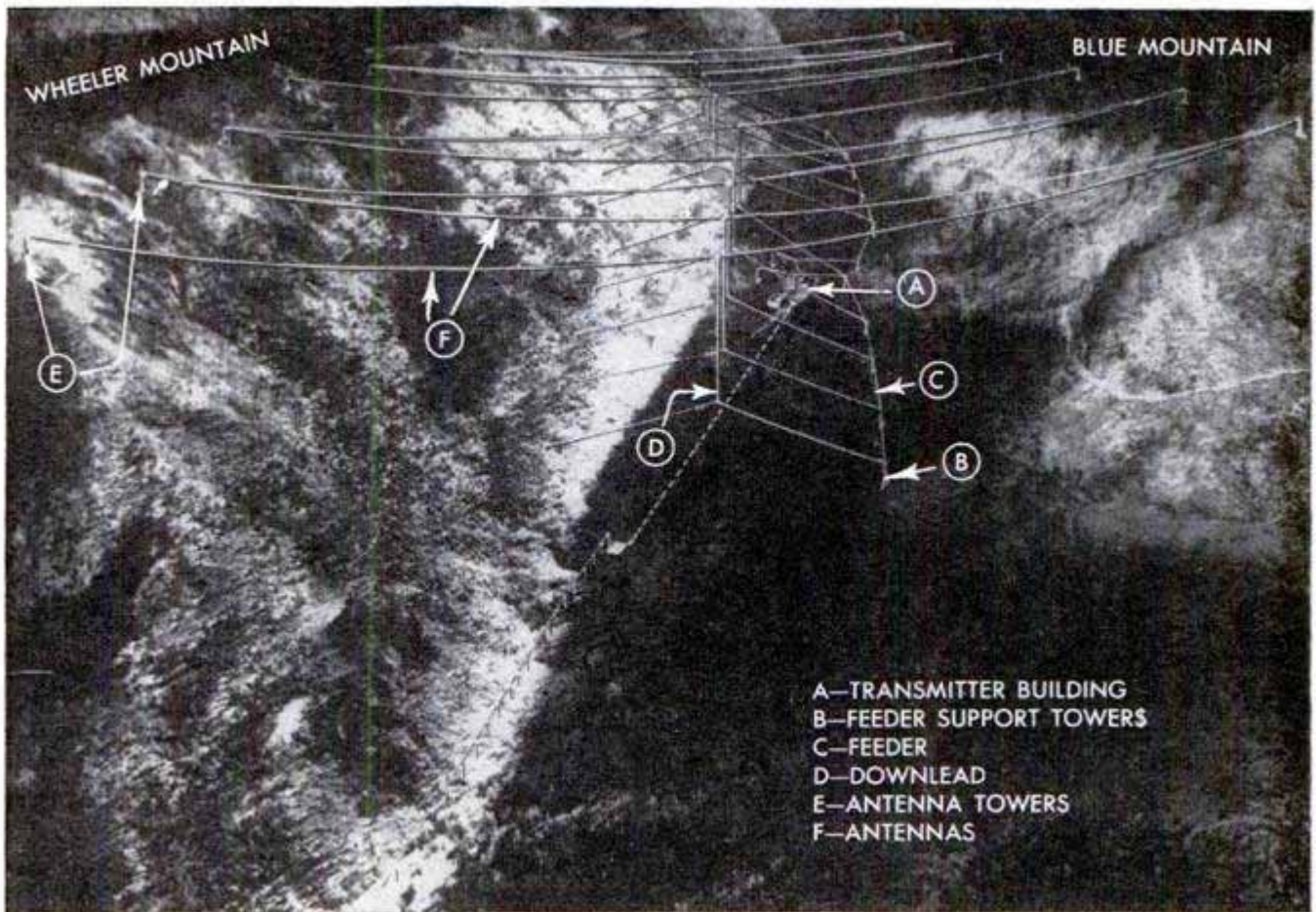
be relayed from the antenna, located near Birmingham, to a potential audience of over six million. The mast, which weighs about 100 tons, is the tallest television antenna in England.



## Storage-Jar Holder

Held in position by a newly designed bracket, strained baby-food jars are excellent containers for small parts in the home workshop, factory or garage. The jars can be removed or replaced in a single motion and are locked in position against vibration and shock. Made in either steel or a chrome-plated brushed brass, the brackets come in four or six-jar sizes.

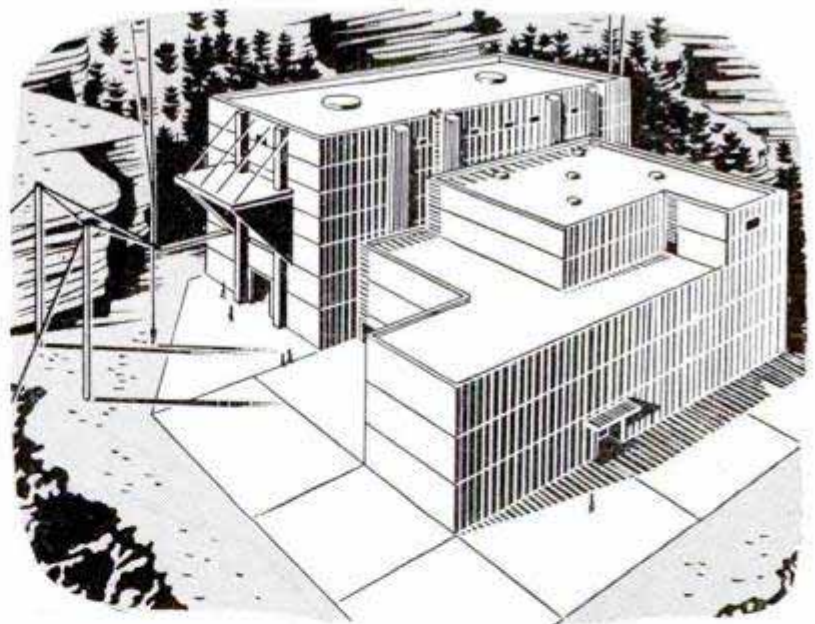
☛The oil in your car should be changed only when the engine is thoroughly warm.



Artist's conception of how the Navy's million-watt radio station will use two mountains to support antennas

## Powerful Radio Station Uses Mountains as Antenna Masts

Mountains are used as "masts" to hold up a series of antennas that will transmit low-frequency radio waves for the Navy at Jim Creek, Snohomish County, Wash. Two mountains, each about 2000 feet high, form a valley in which the station will be built. Said to be the most powerful in the world, the station will develop over a million watts to provide effective all-weather communications throughout the Pacific area. Relatively short towers, only 200 feet high, will be constructed on the mountain ridges. Stretched across the valley will be a network of antennas ranging up to  $1\frac{3}{4}$  miles long. Vertical down-leads will be suspended from the midpoint of each span.



Above, the transmitter building. Because of the remote location, living quarters will have to be provided for operating personnel

## Dip Process Produces "Mirror" Finish on Aluminum

Mirror finishes and protective coatings are added to aluminum and its alloys by immersing the metal in certain chemical solutions. In addition to the mirror-type finish, a further treatment involving anodizing and coloring produces the brilliant effects of gold, silver, chromium and other

colors. This process gives the metal a corrosion resistance which is said to be much greater than the best plated metals and requires no after-lacquer. The operation, which is relatively simple, is available to industry as well as for private use and does not require a chemist.



Photo by Colin McAllister

When wells go dry around Danbury, Conn., they call the fire department's new tank truck to replenish them

# ARE WE RUNNING DRY?

By **Wayne Whittaker**

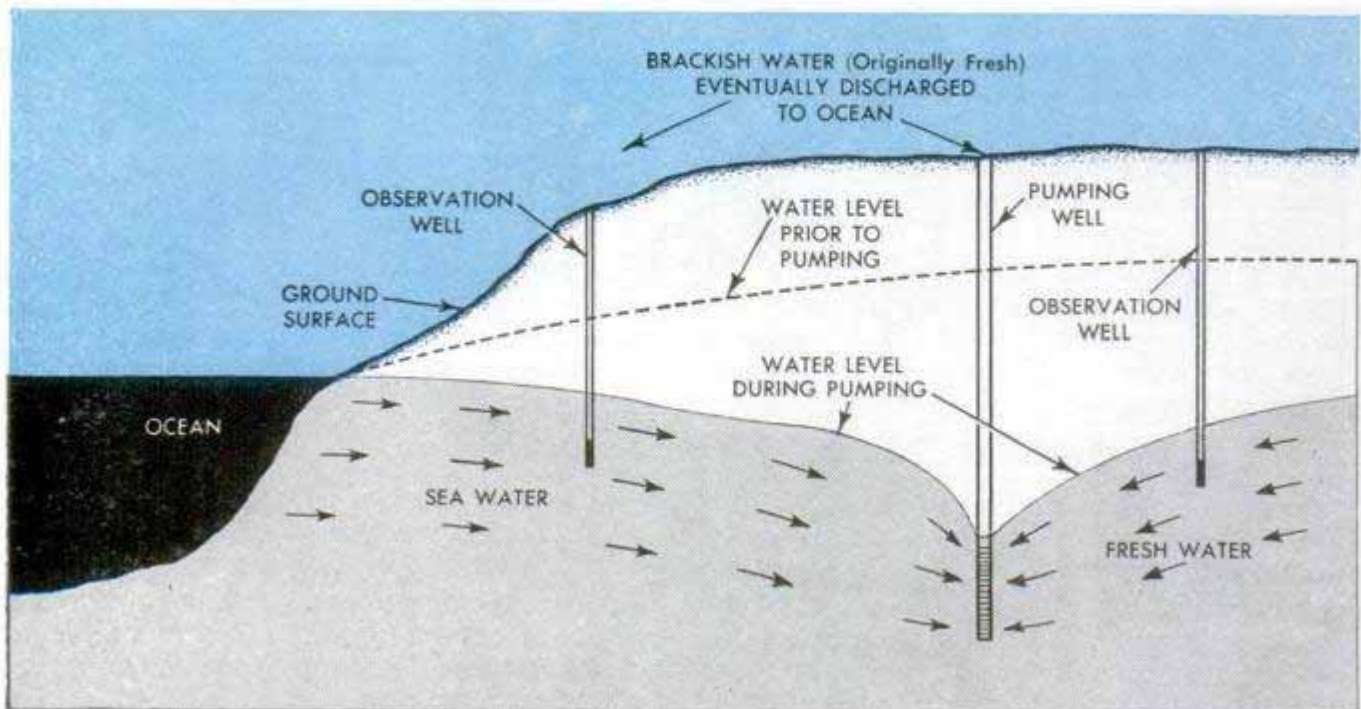
**R**ECENTLY an exploring party in a remote section of western India discovered a ghost city. It had once had a population of about 200,000, but several centuries ago its springs and wells had gone dry. The inhabitants moved away and the city died and was forgotten.

This could happen to any American city,

industrial area or farm region that is wholly dependent on underground water. Only in recent years has America awakened with a shock to the fact that in certain districts ground water is being used with an abandon comparable only to the ravage of our great forests in the latter part of the 19th century.

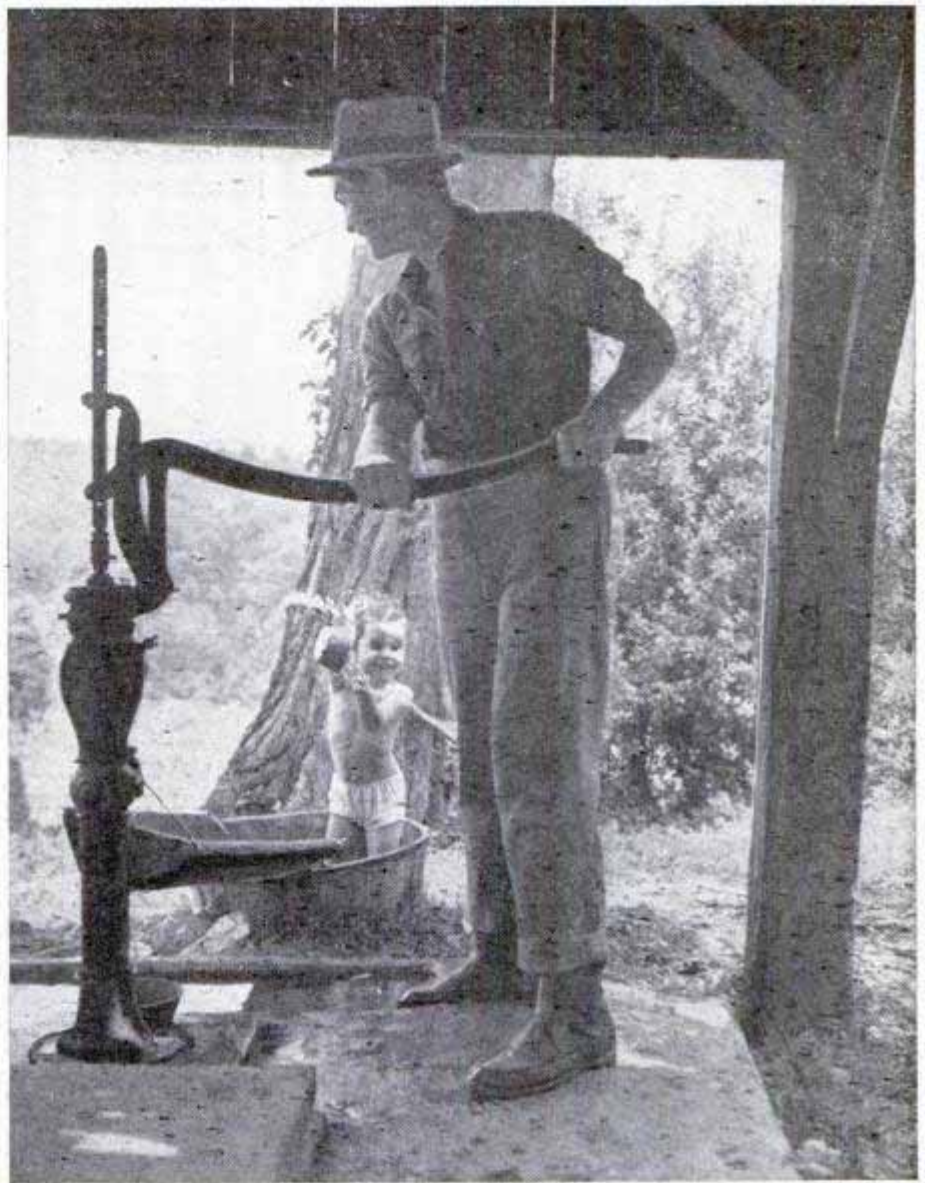
Sketch shows how sea water seeped into wells on Long Island before pumping was corrected (opposite page)

U. S. Geological Survey



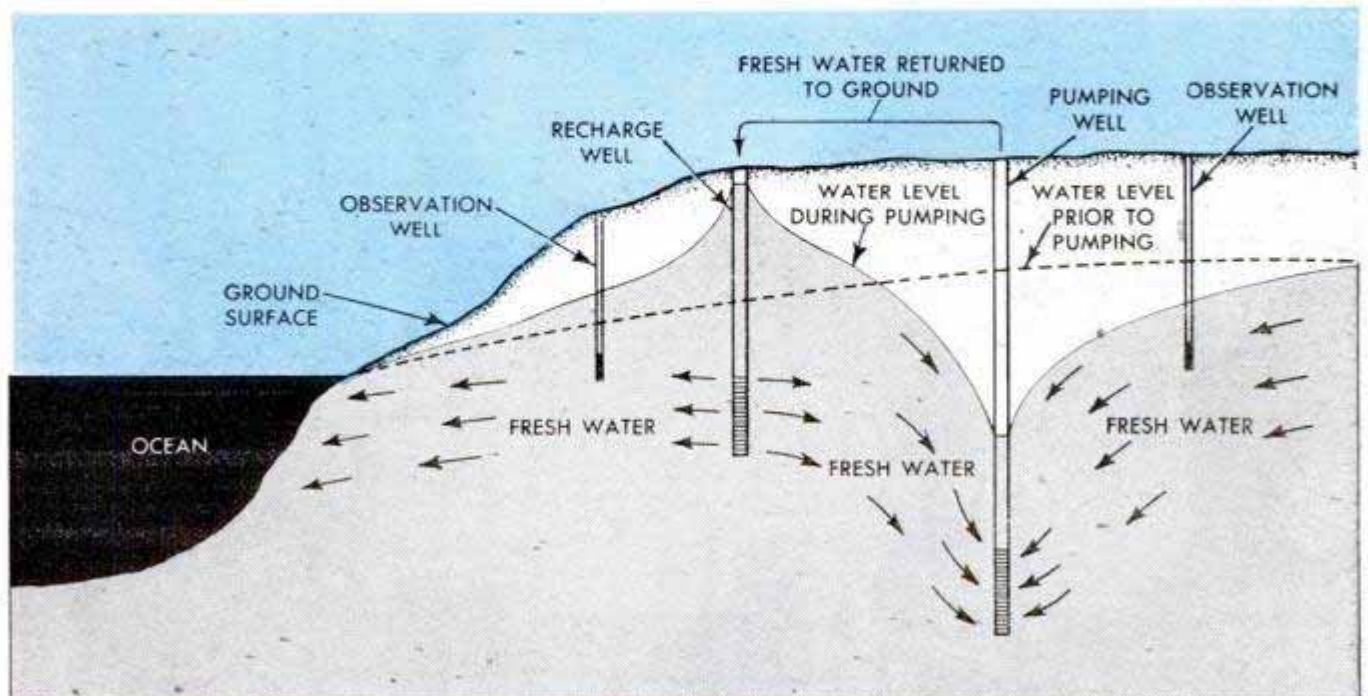
Tremendous underground storehouses of water have been built up over many years. In some areas, the level of this water is being lowered day by day with the withdrawals far in excess of the natural replacement. This can lead only to ultimate disaster — unless drastic steps are taken. The alert United States Geological Survey, an agency of the Interior Department that investigates water supplies, is on the job to help regions that will heed its warnings and follow suggestions. Expert geologists say that America's water problems, in many instances, are the result of poor planning and reflect the old adage of "famine in the midst of plenty."

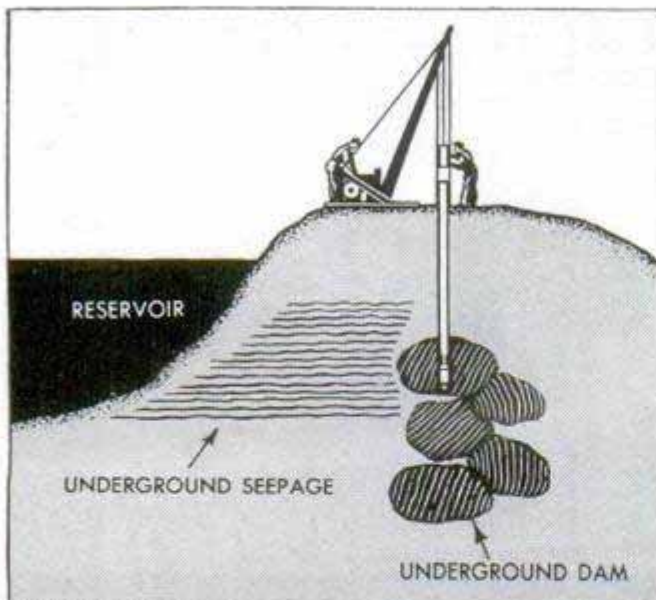
There is the case of Louisville, Ky., where war industries mushroomed during the early '40s, particularly synthetic-rubber plants. At one period 75 million gallons a day were being pumped from the ground — more than double the pumpage of the '30s. The water level dropped at an alarming rate in the rubber-manufacturing district. It was discovered in 1943 that there was only a two-year



The old hand pump may be a stranger to city dwellers, but it's still in use in rural areas. This one is on an old estate near Howardsville, Va.

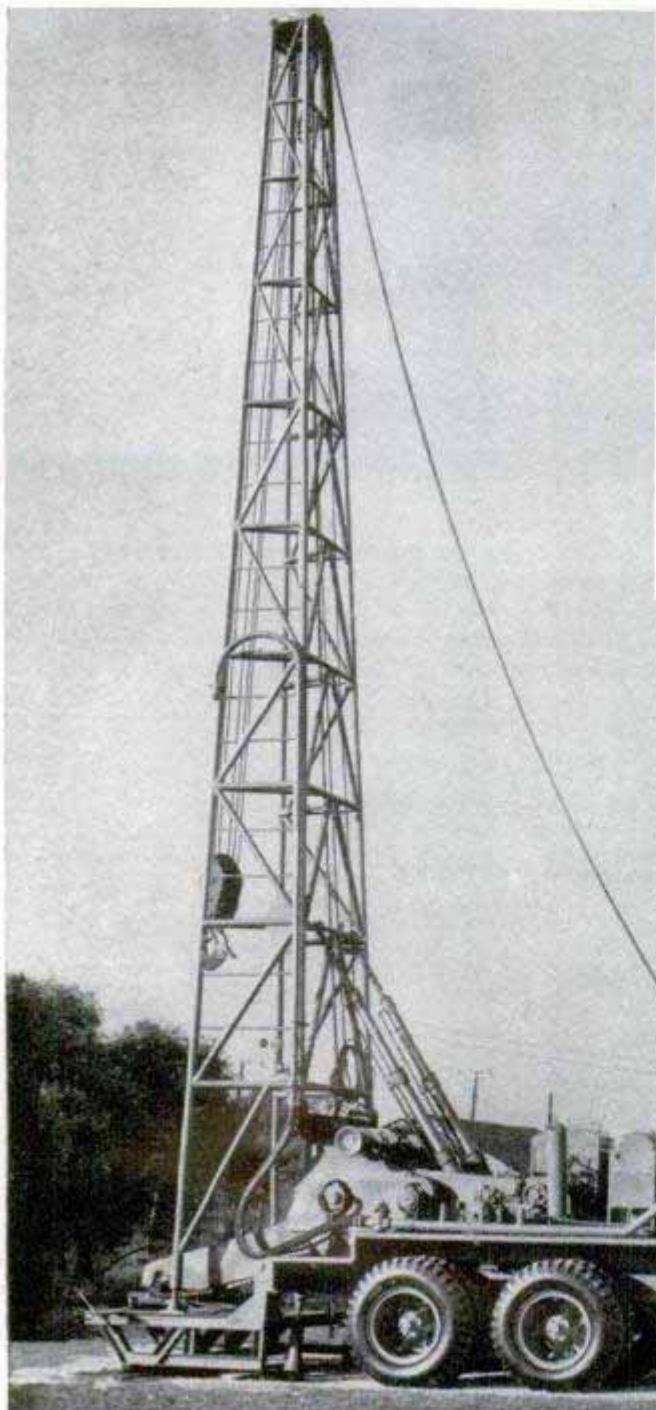
Sketch below shows how recharging of wells corrected encroachment of salt water from ocean as shown on opposite page. The water level in this Long Island district has been raised so fresh water moves toward sea





Courtesy Shell Oil Co.

**To stop water seepage from reservoir an asphalt mix is injected by pipe into earth without excavation**



supply of water left in the underground reservoirs. The Geological Survey was called in and discovered that the recharge of the reservoirs was only 40 million gallons a day. The industries took expensive action in a hurry. Water-saving measures were introduced in the form of cooling towers and recirculation; new wells were drilled closer to the Ohio River; surface water (from the river) was purchased from the city and some wells were recharged with the city water. In two years the industrial pumpage was reduced to 45 million gallons a day (at a cost of \$5,000,000) and today it is less than 40 million daily. The irony of the Louisville situation is that had the industrial region been located a few miles north or south of the city with the wells close to the river there would have been several hundred million gallons of cool water available every day. Manufacturers all over the U. S. learned a valuable lesson from the Louisville area.

Across the nation there are hundreds of glaring examples of high-priced bad planning. Near Chicago a big manufacturing plant was built that required thousands of gallons of cool ground water every day. The water level dropped quickly and farmers and others in the vicinity found their wells drying up. In the Texas Panhandle today irrigation farmers are pumping water from the ground 15 times faster than it is being replenished. In 14 years the water level has dropped 40 feet. The story is similar in Arizona and California where

**This portable 48-foot-high well-digging rig operates around Corpus Christi, Tex., and is mounted on a 10-ton diesel truck. The rig drills to 3000 feet**

great quantities of water are used for irrigation. It takes nearly a million gallons of water a year to irrigate a single acre of orange trees.

Twenty billion gallons—more than half our daily water supply—comes from the ground. The use of ground water which is naturally cool (60 degrees) and bacteria free has doubled since 1935. The U. S. Geological Survey reports that 10 billion gallons a day are used for irrigation, five for industry, three for municipalities (66 percent of our cities depend on it exclusively) and two billion gallons a day are consumed in rural areas, excluding irrigation.

The ground water of the subterranean reservoirs should not be confused with the surface water of our lakes and streams. Both have the same origin—rainfall (including snow). The average annual rainfall of 30 inches would cover our entire three million square miles to a depth of 30 inches—or 15 million billion gallons. In some parts of the South where rainfall is heaviest (seven states of the Tennessee Valley), some 6000 tons of water fall on each acre of land in one year. These figures make a water shortage anywhere in the U. S. seem almost incredible. However, the National Water Well Association reports that 50 years ago a good municipal supply of water could be had 150 to 200 feet down; today the common depth for drilling is 600 feet.

Ask the average man how much water it takes to keep him going for 24 hours and he will probably answer: "Five or ten gal-

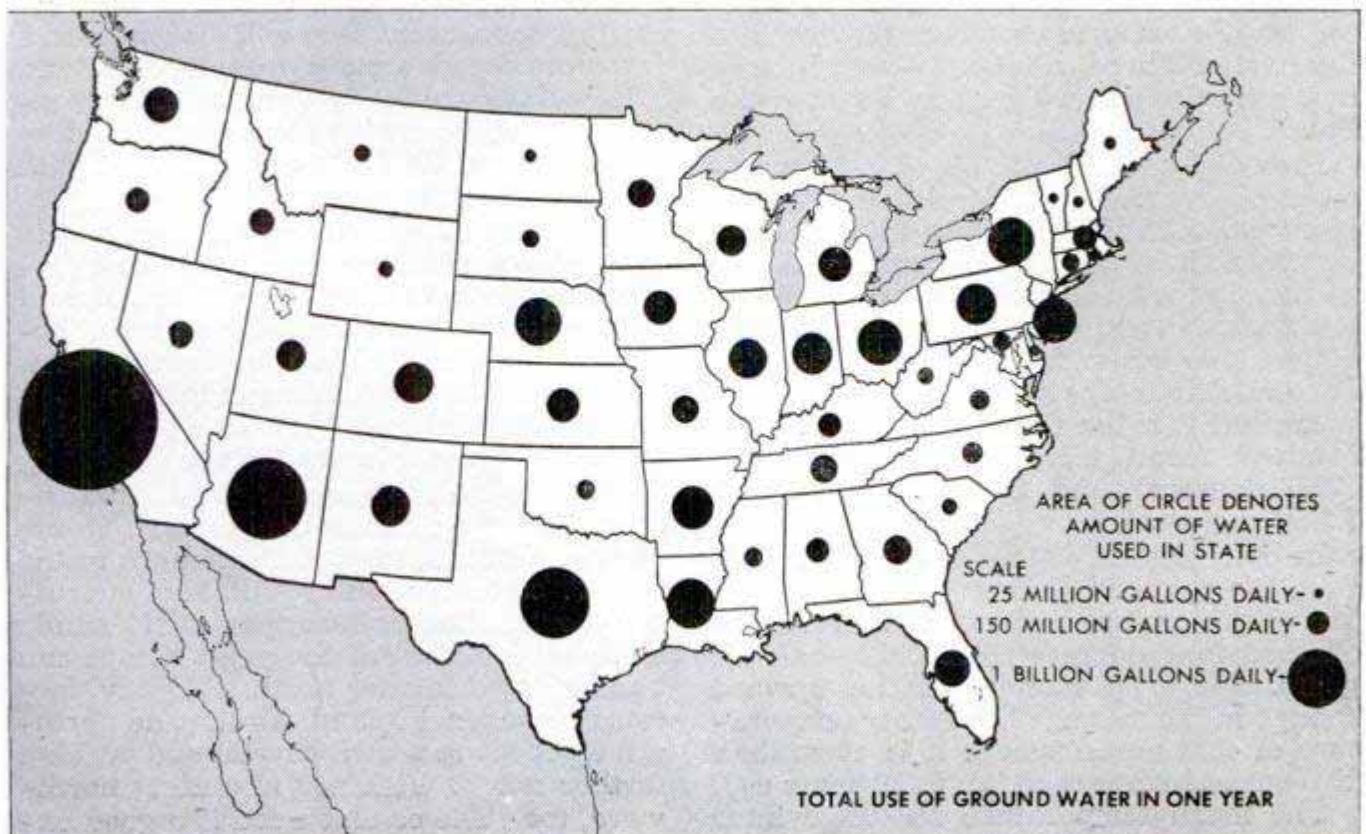


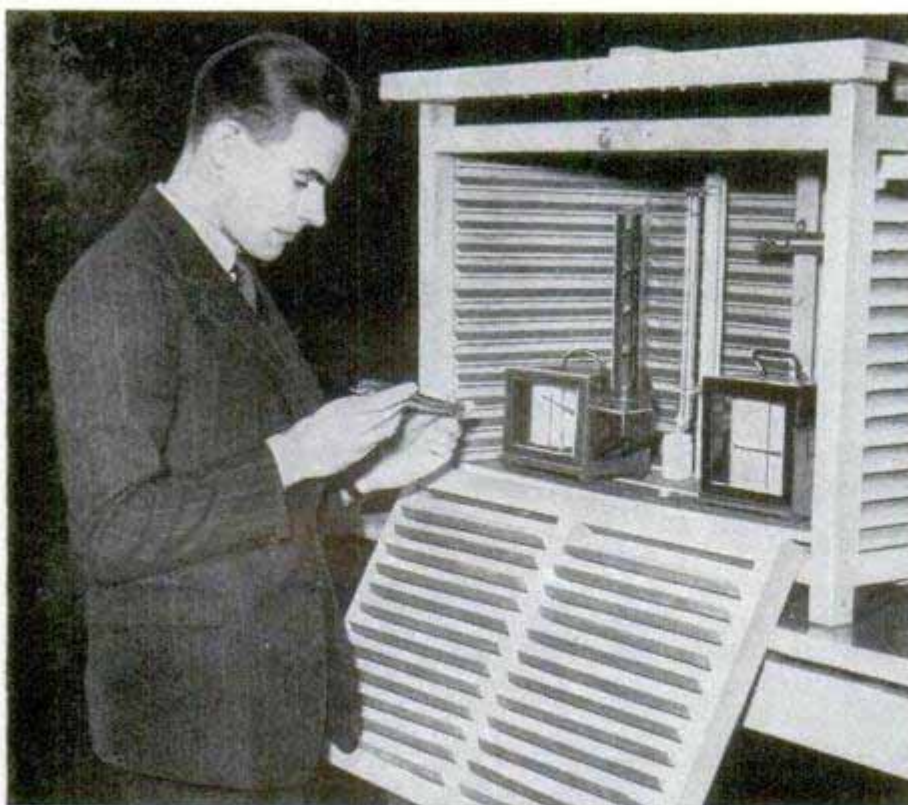
Pumping unit on raft behind Gibraltar Dam supplied water to local residents during California drought

lons." The actual figure set by waterworks engineers is 100 gallons a day per person. This includes industrial and farm uses for any area. After all, every use of water is to support needs of man, directly or indirectly. The industries which use the most ground water are oil refining, chemical

(Continued to page 272)

Dots on map explain why places like California and Arizona—big ground-water users—face water trouble





## GRANDMA'S RIGHT ABOUT THE WEATHER

Prof. George Kimble of McGill University, shown here at one of his weather recording stations, says Grandma's memories can be substantiated by facts

**M**ILD WINTER, EH? Things aren't like they were when you were a kid? Skating isn't what it used to be, there isn't half the fun of tobogganing and sleigh rides, nothing like the blizzards and sub-zero spells you remember.

Maybe you're right. And maybe Grandma is right when she tells you winters aren't what they were in her day.

Weather-Bureau records do indicate that we're in a warm-up cycle. The harbor of Spitzbergen, once frozen nine months of the year, is now open to shipping nine months instead of three. Glaciers are receding. Forests and crops are moving into the Arctic. Where will it end—with Siberia in the tropics and wheat growing near the Poles?

Prof. George E. T. Kimble of the Department of Geography at McGill University, Montreal, tells of the upward trend of temperatures in a book being published this spring. In the last hundred years, he points out, the mean annual temperature in Philadelphia has risen from 52 degrees to 56 degrees. A four-degree rise may not appear great, but it is the difference between the January mean temperature in Chicago (25.0 degrees) and Santa Fe, N. Mex., (29.2) degrees.

In Spitzbergen, 400 miles north of Norway, the change has been more dramatic. There the annual mean temperature has climbed four degrees since 1912—only 38 years. More spectacular is the upward change in the average December temperature of that arctic island; it is more than 10 degrees higher than it was 30 years ago.

The mean temperature for the winter

months in Oslo, Norway, is up four degrees since 1850. Montreal has only half as many sub-zero days as it did 75 years ago and the mean temperature for March is up more than six degrees. During the 20 years ending with 1892, Washington, D. C., had a total of 354 days with freezing temperatures from March to June, but in the 20 years ending with 1933, the number had dropped to 237.

All over the world, with one or two exceptions (most notable of which is southeastern Alaska), glaciers are receding. Professor Kimble points out that some are melting so fast that they will disappear in a few more decades under present conditions.

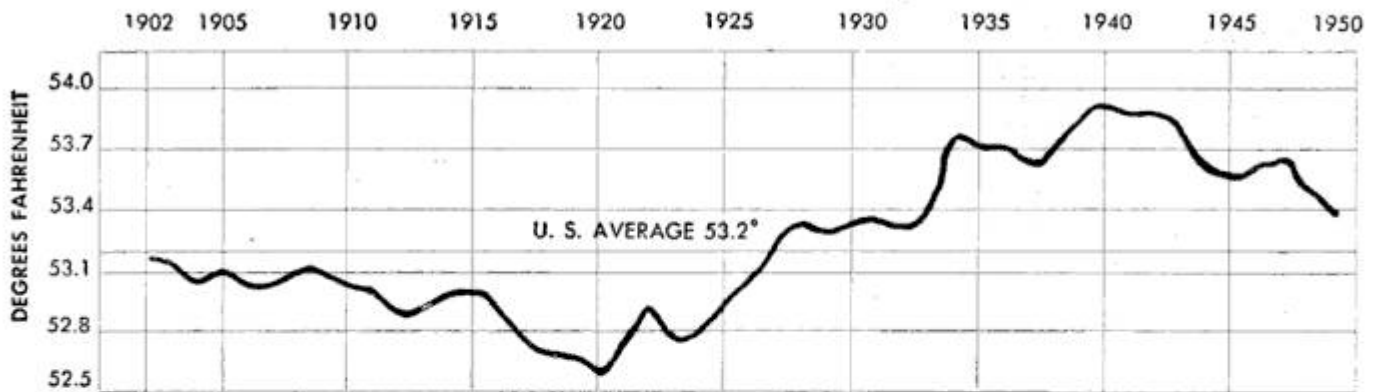
Snowfalls are less severe, also. In Montreal, the winter's average is now considerably less than 100 inches as compared with 130 inches in the 1880s.

However, there are some exceptions to the rule of rising temperatures and decreasing precipitation. The tropical and subtropical zones have, if anything, become a little cooler in the past 50 years. Large parts of the Arctic and the monsoon regions of southeast Asia have shown increases in annual precipitation.

What does all this mean? It has tremendous economic consequences and, if the trend continues, important changes in the world's commerce will result. Many northern ports, like Spitzbergen, will handle shipping for most of the year. Crops can be cultivated farther north. Already, forests in Sweden, Finland, Alaska and northern Quebec are growing faster and pushing farther north. Fish are migrating northward, too. The common cod is a good ex-



10-YEAR MOVING-AVERAGE ANNUAL TEMPERATURES FOR THE U. S.



Charts from J. B. Kincer, Washington, D. C.

This chart, based on thousands of records from all over the country, shows that the temperature has been above the U. S. average since the late '20s. The winter of 1948-49 caused the sharp drop at extreme right

ample. At the beginning of the 20th Century, the cod was found at only a few places in the waters off southwest Greenland and then only in small numbers. By 1920, it was beginning to frequent the waters off the island as far north as Godthaab (64 degrees north latitude) and by 1930 it had reached 70 degrees north. Today, it is found as far north as 73 degrees. The cod catch of west Greenland totaled only 5 tons in 1913; in 1946, the catch was 13,000 tons.

According to Dr. Clarence A. Mills of the University of Cincinnati, the period of rising temperatures may result in smaller adults in the U. S., reversing a trend that has continued for centuries. There may also be a retardation of mental keenness and the rate of development. The trend will mean that northern countries such as Canada, Russia, Alaska and those in Scandinavia will be opened up to greater trade with the world. The vast resources of the Arctic and Antarctic will become accessible as temperatures rise.

However, there is a note of caution in Professor Kimble's book. Some portion of these changes may be due to man-made conditions. To some extent, higher tem-

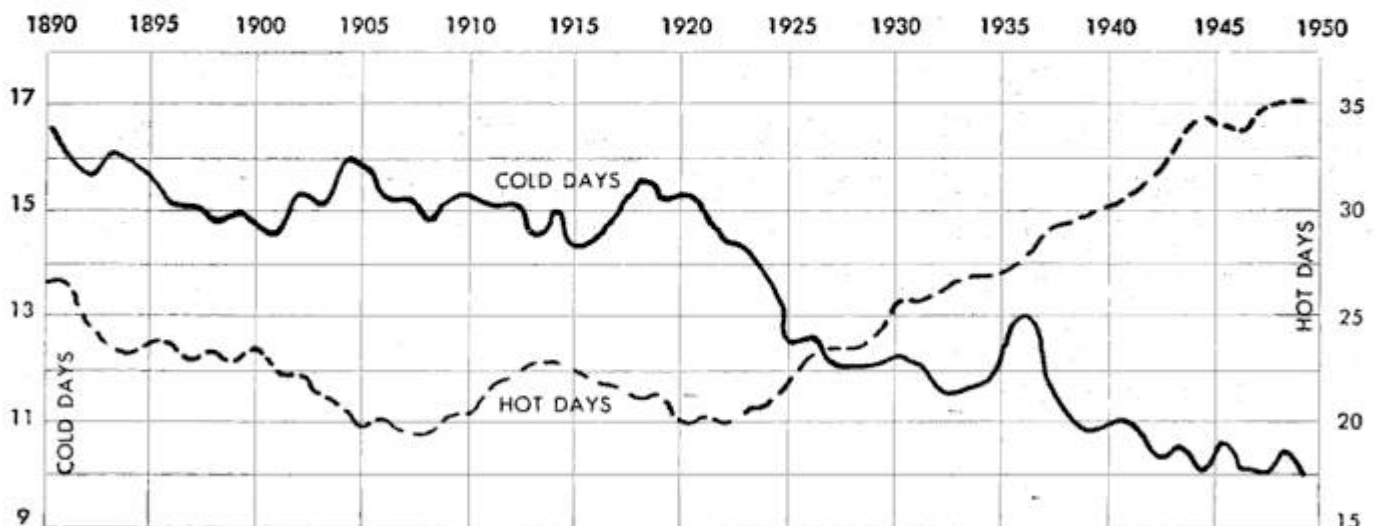
peratures in towns and cities may result from the loss of heat by buildings. Heat engineers estimate that in a city the size of Montreal the amount of man-made heat escaping into the lower atmosphere on a day when there is good inversion could raise temperatures three or four degrees.

The Canadian geographer hastens to add that our weather records go back only a short distance into history—actually only seconds on the clock of the earth's life span.

Whether next year, the year after or 10 years hence will bring cooler days is anybody's guess. The severe winter of 1948-49, which will probably be remembered in some parts of the United States as the year of the Great Blizzard, provides some evidence of an impending temperature recession. However, one year's evidence is not enough to support a prediction of a reversal in the generation-old trend toward warmer weather.

Grandma is right about the weather and she has plenty of proof in the files of the Weather Bureau. But don't get rid of your overshoes and snow shovel—there's still a lot of fight in Mother Nature, even though she may be calming down in her old age!

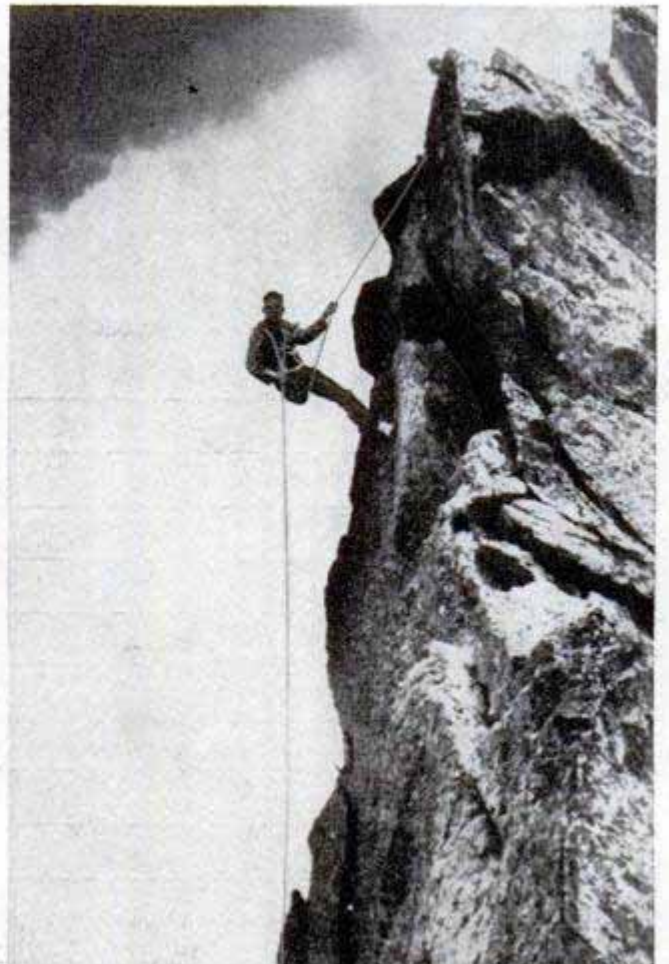
20-YEAR MOVING-AVERAGES HOT AND COLD DAYS IN WASHINGTON, D.C.



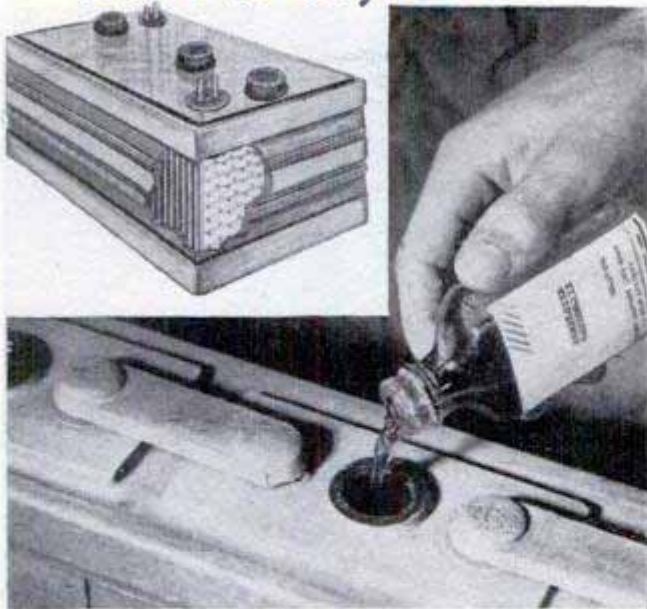
Moving average of hot days (maximum temperature of 90 degrees or above) increased from 20 in 1905 to 35 in 1949. Moving average of cold days (continuously below 32 degrees) dropped from 16 to 10 in the same period



**ONE-LEGGED MOUNTAIN CLIMBER**, Roger Tschumi, of Switzerland, is proof that you can't keep a good man down. Tschumi recently fulfilled a dream he has cherished for years—he made the difficult Mont Blanc climb in the Alps. To top off his achievement, he did acrobatics on top of the "needles"—Alpine spires rising almost vertically from the mountains. Tschumi does his climbing on special crutches he made himself. He skied most of the way to the mountaintop on one long ski, with two shorter skis attached to his crutches. Then he made the final hazardous ascent to the top by crutch and rope, aided by a mountain-climbing friend



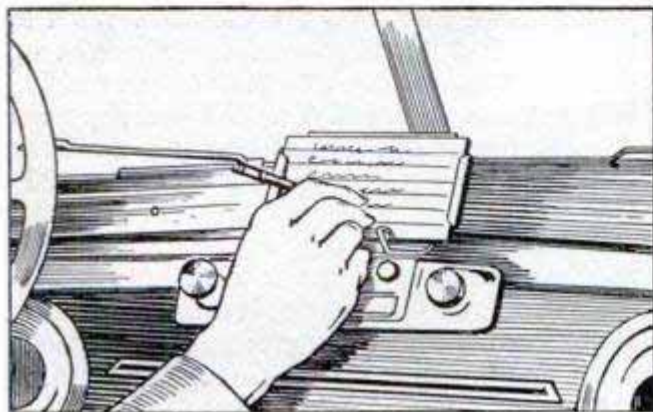
148 West 2nd South St.  
Salt Lake City, Utah



### Nonacid Storage Battery May Last 25 Years

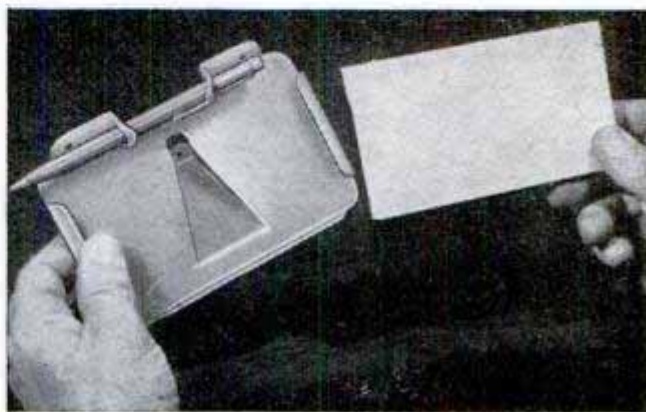
Storage batteries using plates of copper-lead alloy are said to give continuous service up to 25 years. The copper-lead battery uses a vanadium electrolyte which does not eat away the plates as the conventional acid solution does in the lead-plate battery. It has nonconducting plastic separators and a lined aluminum case. Corrosion is entirely eliminated on terminals and holders. The battery can be quick-charged at rates up to 100 amperes for an hour without damage and it can be stored for long periods without loss of charge. The manufacturer is also producing a vanadium electrolyte that can be used in conventional acid-type storage batteries. The regular electrolyte is poured out and one ounce of the vanadium electrolyte is poured in each cell. Distilled water is then added to bring the level up to the full mark. After a five-minute charge from the generator, the battery is ready for service. The new electrolyte is said to add life to any battery because it does not destroy the lead plates and it completely eliminates corrosion.

**MEMO PAD FOR CARS** enables salesmen and others who spend a great deal of time on the road to jot down ideas as they drive along. Fastened to the dashboard by three self-tapping screws, the steel-backed pad provides a firm writing surface and holds a pencil. The pad also can be installed in the home near the telephone



### Ladder-Leg Equalizer

Adding a level-equalizer attachment permits ladders to be solidly based on hill-sides, stairways or other uneven surfaces. Consisting of two interconnected hydraulic units, it allows oil to flow from one leg to the other to compensate for height differences. A valve, easily operated by foot, locks the ladder into any desired position. The steel attachment, weighing only six pounds, supports 500 pounds and can be installed on any type ladder, wood or metal. A ball-and-socket shoe that can be tipped on end for ice, slippery asphalt or soft ground also helps conform to irregularities.





Effortlessly, the new champion holds a huge log above a tractor and arch, once biggest of logging machinery

No fleet-footed mountain goat, the Trakloader moves its 135,000 pounds slowly but surely along the trail



## HEAVYWEIGHT CHAMPION LOGGER

**E**VEN rough-and-ready lumberjacks, accustomed to superhuman exploits in fact and legend, stand in awe of a heavy-weight champion logger that tosses 30-ton logs around like matchsticks. Shaped vaguely like a prehistoric dinosaur, this giant loader is the biggest thing in the woods today that moves under its own power.

One man operates the Goliath. With it, he can lift a 90,000-pound log straight up out of a crevasse in low gear or juggle 70,000 pounds in high. The 200-horsepower diesel engine can't stall because speed is automatically adjusted to loads up to 96,000 pounds.

Eliminating the rigging of booms, the mechanical strongman does in hours what once required days to do. It crawls through Washington forests, loading huge trucks with mammoth Douglas-fir logs and amazing lumbermen with its power.



**Husky logger looks almost puny as he rides aloft with his spikes dug into this three-foot Douglas-fir log, a mere morsel for the powerful jaws of the hoist. Its 28-foot gooseneck boom is made of railroad steel**

**There's enough lumber in these two logs to build a house! It takes only a few minutes to load a big logging truck with the Trakloader. The operator, in the windowed cab, has complete control of the log at all times**





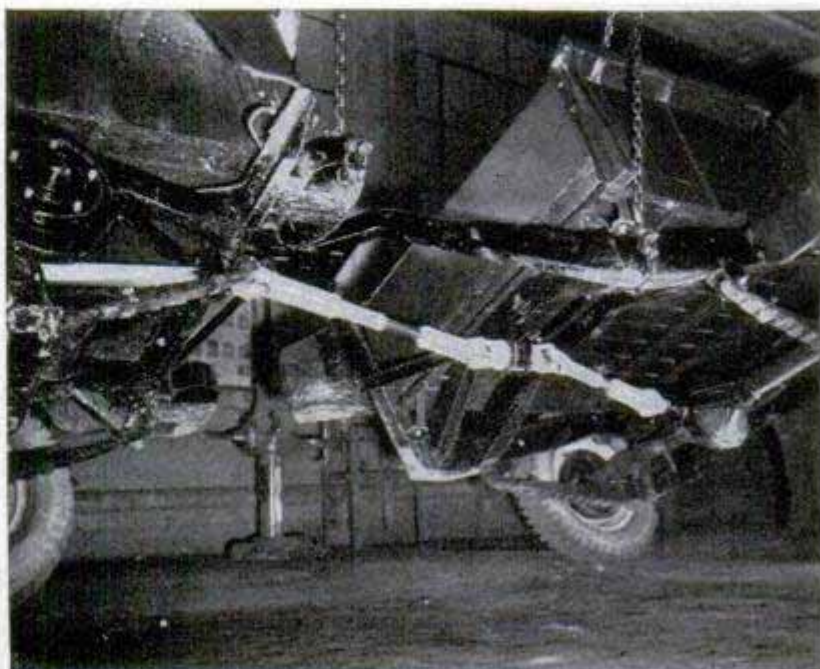
## Dental "Sandblasting" Makes Drilling Painless

Patients scarcely realize their teeth are being "drilled" with a technique that uses a high-pressure stream of abrasive particles instead of the rotary drill. The abrasive powder, aluminum oxide, is mixed in a stream of carbon-dioxide gas and "fired" against the tooth to cut away the decayed portion. Almost no pressure is exerted on the tooth by the stream of particles. Vibration and bone-conducted noise are completely overcome and heat generated by friction is almost entirely eliminated. Although it cuts teeth readily, the abrasive does not damage the soft tissue of the mouth. Invented by Dr. Robert B. Black of Corpus Christi, Tex., the technique was recently demonstrated at the University of Michigan. To prevent the abrasive from entering the patient's mouth, a rubber guard is placed behind the tooth. A suction tube, held near the mouth by the dentist's assistant, removes the particles while the "drill" is operating. By substituting dolomite for the aluminum oxide, the dentist can use the "drill" to clean the teeth.

## Powered Trailer Gives Jeep Six-Wheel Drive

Linked to a Jeep engine by a special drive shaft, a small trailer provides its own traction when the going gets rough. Designed by Willys-Overland to be pulled by the Jeep, the trailer mounts a 52-percent grade

when loaded to its one-ton capacity. The drive shaft runs from the Jeep's power take-off to the trailer wheels, making possible six-wheel traction. The trailer drive can be disengaged for highway use.





# RADIO up your SLEEVE

Dr. Brunetti holds tiny receiver to ear and transmits with a "large" five-tube set

By Thomas E. Stimson, Jr.

**WHEN DETECTIVE** Dick Tracy introduced his famous "wrist radio" to his fans a few years ago, everyone wondered if tiny personal radios actually would be available someday.

The fact is that Tracy's useful two-way voice set was based on techniques already perfected. The little radios are not on the market, but all the tiny components are available.

Depending on how many ounces of battery the operator wants to carry in his pocket, he can hold conversations with a companion up to a mile away. For communicating over a few hundred feet he can come up with a set hidden entirely in his fist.

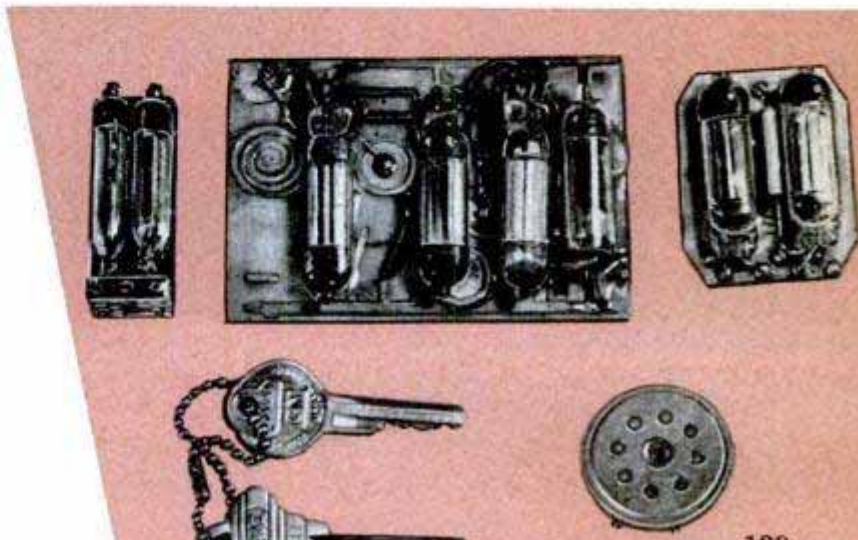
The vacuum tubes are thinner than a lead pencil and weigh  $\frac{1}{10}$  ounce each. Condensers are  $\frac{1}{4}$ -inch disks, almost paper thin. Resistors and connecting wires are lines of a conductive paint on a ceramic or other insulating surface. "A" cells are of the mercuric-oxide type, each the size of a lima bean. Layer-built B-batteries deliver about 30 volts.

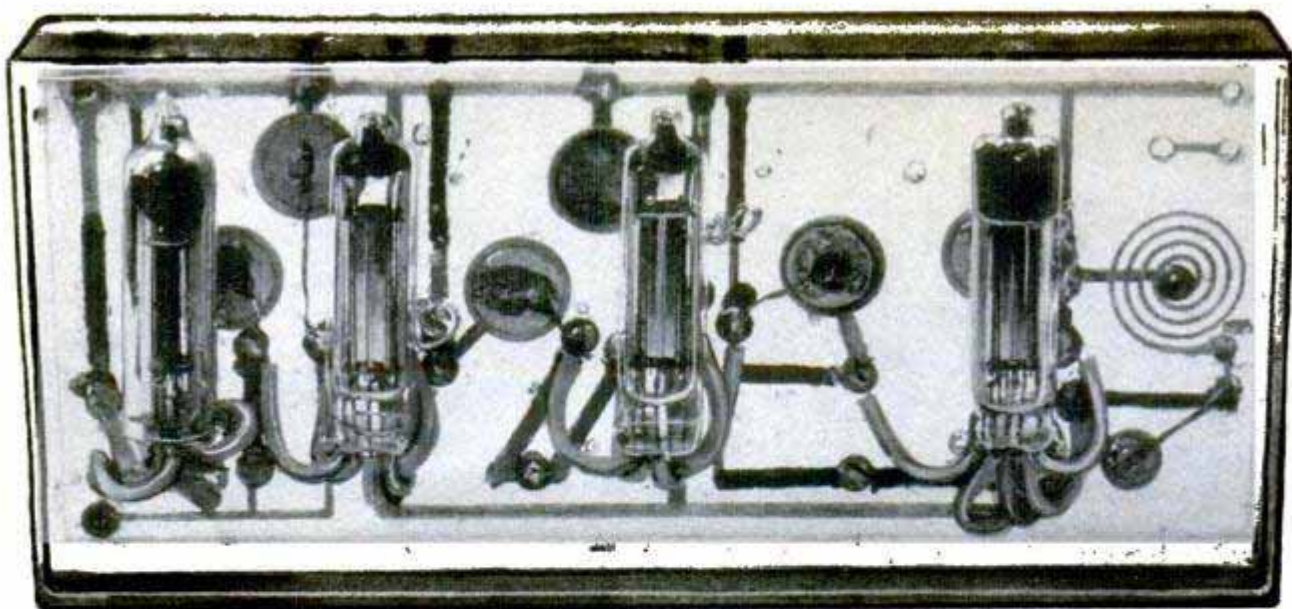
Even though it is subminiature, a walkie-talkie must conform to the radio laws. Information on frequencies available, such as the 465-

megacycle citizen's radio band, can be obtained from the Federal Communications Commission, Washington, D. C.

Subminiature electronic circuits were developed during the war and they made possible, among other things, the tiny radio apparatus that is carried in the nose of a proximity shell and that detonates it when close to the target. Proximity-fuse development was conducted at the National Bureau of Standards by a group of scientists of which Dr. Cleo Brunetti was a leading member. Often called the world's leading genius in reducing the size and

Here are midget amplifier, receiver, transmitter and microphone





Four-tube receiver is embedded in block of plastic only five inches long. Spiral at right is the tuning coil

weight of electronic equipment, Doctor Brunetti is now an associate director of Stanford Research Institute in California where more research in subminiaturization is being conducted in a new laboratory.

When Doctor Brunetti lectures on small-scale radio equipment, he often carries an entire network of transmitters and receivers in his pockets. To illustrate a point in his talk he may hold up, between his fingers, a thumb-size chunk of plastic which

contains a complete two-stage amplifier. It does the same work as equipment that may measure four by five by six inches. Because it is buried in plastic it is protected against moisture and accidental breakage. It is fitted with a plug-in base so that it may be removed from a set and replaced in a couple of seconds.

From the same pocket Doctor Brunetti pulls a cigarette package that contains a complete three-tube transmitter including microphone, collapsible antenna and power supply. It has a clear and reliable service range of three blocks. A four-tube receiver is even smaller, about the size of a calling card.

Next, he displays a true "sub-subminiature," a one-tube transmitter with its connectors, resistors and capacitances printed on the glass envelope of the vacuum tube. Without microphone, antenna or power, it is mounted inside an ordinary lipstick container. With one exception, Doctor Brunetti remarks, it is probably the smallest practical transmitter ever built. Then with a grin he produces the exception from between his fingers, a still smaller vacuum tube and circuit that rests inside a tinier lipstick container.

Subminiature transmitters and receivers are of short range when paired together, Doctor Brunetti explains, but range is multiplied many times when a more powerful unit is used at one end. That is, a pocket transmitter can be picked up at a considerable distance by a receiving set of good sensitivity. Similarly, good reception of an ordinary broadcast station a number of miles away can be obtained

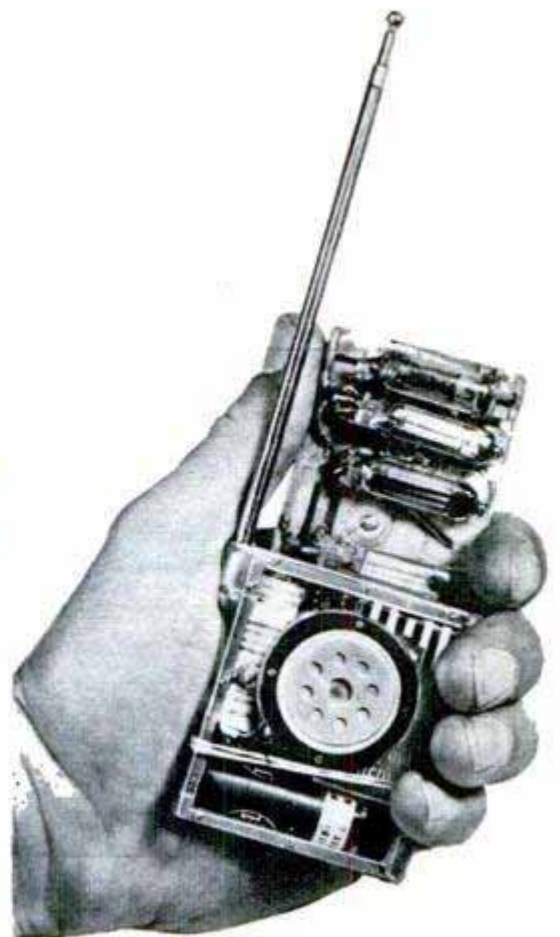
Hunter of the future? He wears a tiny radio in his helmet for communication with the other members of the hunting party







With the help of a laboratory magnifying glass a technician checks the internal structure of a subminiature radio tube. It will be fastened directly to the material upon which the circuit is printed



Combination transmitter and receiver, including batteries, can be held in one hand. Below, that's not a radio tube in his fingers, but a control circuit that does work of all standard components on table

with a subminiature receiver.

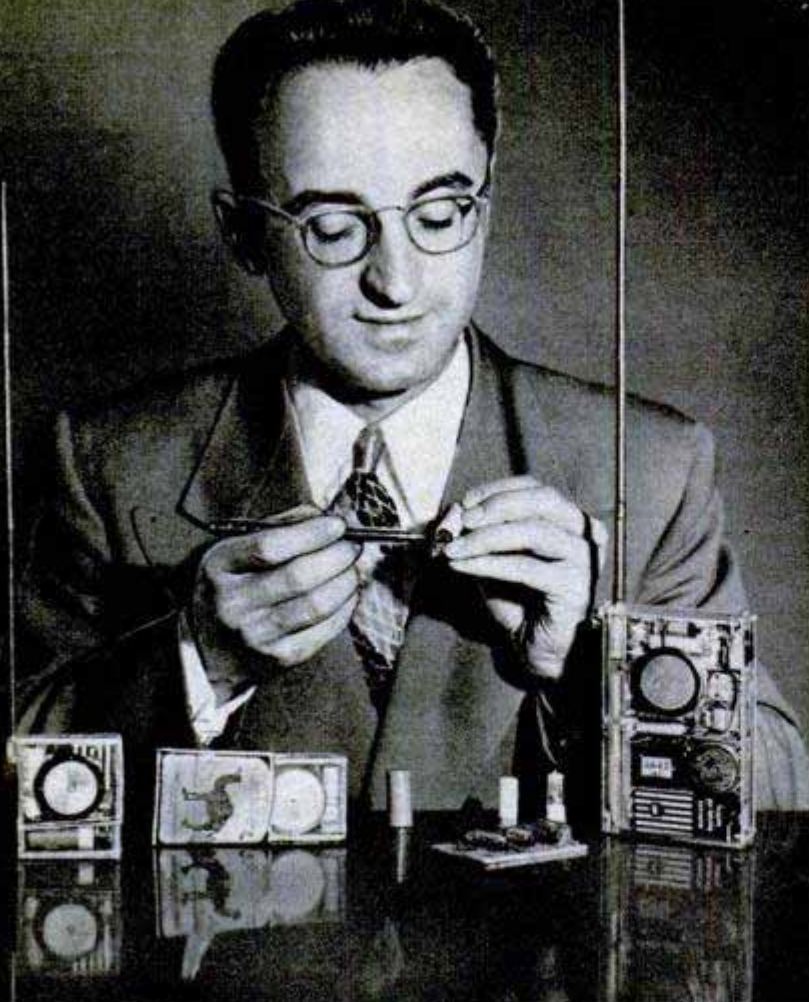
Sometimes a member of an audience suggests that the diminutive radios are interesting but, he asks, have they practical value?

Doctor Brunetti can give half a dozen or more practical applications with hardly a pause for breath. Beside being suited for short-range communication on the new citizen's radio frequency, he says, they could be employed for many special purposes. Waitresses could use them for relaying orders direct to the kitchen. Tuned to the frequency of an aircraft's communication circuit, a hand-size radio could be used by a ground crew member in advising the pilot where to park. Deer hunters in the field could use them to check on the whereabouts of each member of the party.

Doctors could make electrocardiographs of a person's heart action while the patient exercised instead of lying at rest on a table. People in adjacent offices could use their transmitters to dictate to a common recording machine.

Eventually, Doctor Brunetti



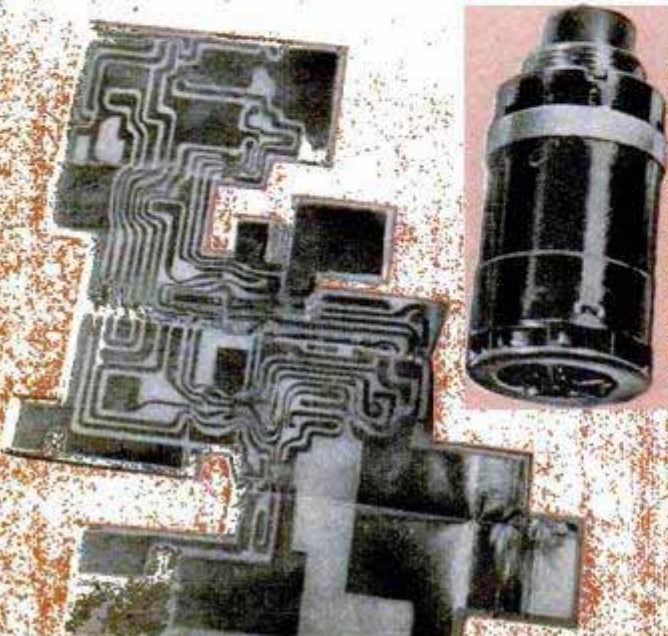


↑ Flashlight powered by mercuric-oxide cells in black case will glow several hours  
 ← Brunetti's subminiatures include cigarette-pack receivers, lipstick transmitters

suggests, a "universal" subminiature set that weighs no more than a pound will serve as a broadcast receiver, a two-way radiotelephone, a hearing aid and a remote control for such tasks as opening or closing the windows at home or opening the garage doors.

Another application may be a cordless hearing aid for the hard-of-hearing. At present a deaf person's earplug is connected by a cord to an amplifier box that is usually carried in a pocket. Sometime it

**Complicated electronic circuit is made of silver foil on piece of paper. Beside it is proximity fuse for mortar**



may be possible to broadcast from the pocket to a complete but tiny receiver contained in the earplug, without the nuisance of the connecting wire.

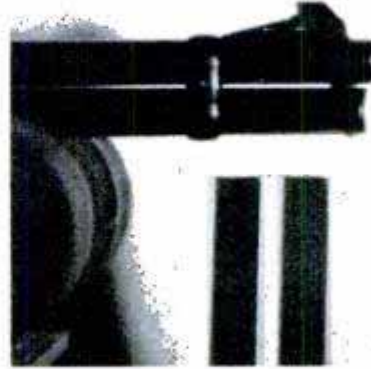
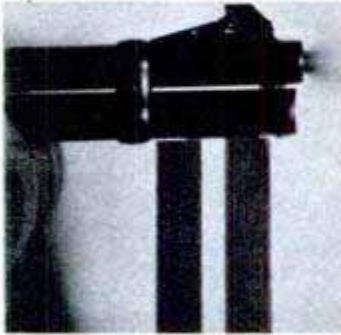
There is a possibility, too, that batteries can be eliminated completely for some portable sets, although this is not in the true field of subminiaturization. Doctor Brunetti and Robert Eichberg, a former colleague, have done some exploratory work on the principle of "powerless wireless." Instead of requiring battery power, receivers and possibly transmitters would be energized by the heat of an ordinary stove or campfire.

A broadcast receiver of this sort might look something like a kettle and would begin to play as soon as it warmed up. The vacuum tubes would have special "combustion heated" filaments that would operate efficiently when heated to several hundred degrees. B-batteries would be replaced by tiny thermocouples that would generate B-voltage when heated. No such radio has actually been built, but the underlying principles seem feasible.

Not all portions of some electronic circuits can be subminiaturized, as yet. For instance, heat dissipation from a subminiature tube that must carry high wattage is such a problem that tubes of ordinary size commonly are used in the final stage of any powerful system.

Too, some of the components are not

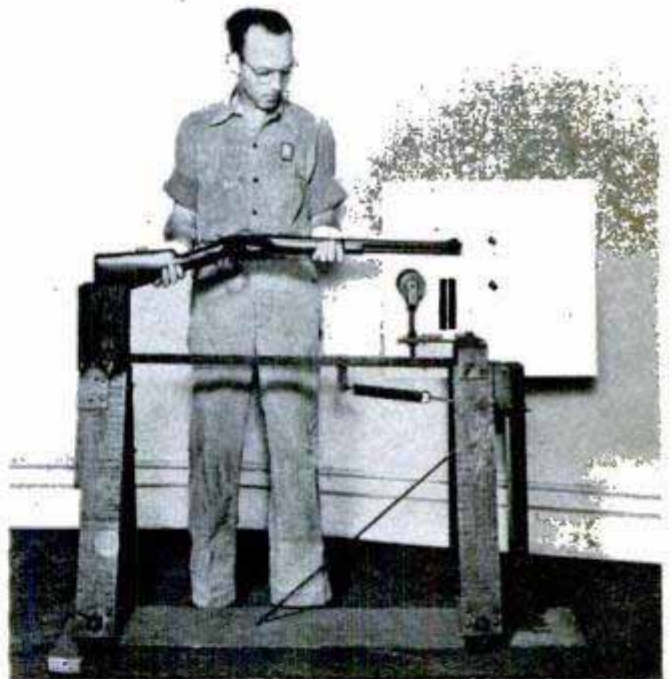
(Continued to page 248)



Left, bullet is shown leaving muzzle of gun with no visible recoil as muzzle rests firmly on the support. Photo at right shows recoil of gun after bullet is 30 feet away. Below, recoil testing device in laboratory

## Tests Settle Recoil Controversy

Does the visible recoil of a gun occur before a bullet leaves the muzzle and spoil the aim or after the bullet is well on its way to the target? A Winchester carbine, a camera of the type used by newspaper photographers and a photographic light that makes camera shots at three millionths of a second were used in recent tests to settle the old controversy over recoil. The carbine was mounted in a recoil rest to simulate the conditions under which a rifle is fired from a man's shoulder. The stock of the rifle rested in a steel pocket lined with sponge rubber, and the muzzle was supported on a hard-rubber cylinder and a block of wood. A thin copper wire was stretched vertically before the gun,  $2\frac{1}{2}$  inches from its muzzle, directly in the path of the bullet. The wire was connected electrically with the photo light. A picture was made of the gun at rest in this position, and then the gun was loaded with a 30-30 cartridge of 2200-feet-per-second muzzle velocity and a shot fired. Another picture was taken as the bullet cut the wire. This photo showed the bullet more than two inches away from the muzzle and no recoil in the gun. The gun was reloaded and a third picture made when the bullet severed a second wire 30 feet in front of the rifle. This



picture showed that visible recoil had raised the muzzle approximately  $\frac{3}{4}$  inch above the wood block. It is explained, however, that a gun reaches maximum recoil in about sixteen thousandths of a second. Since everything happens in such a short space of time, it is no wonder some shooters will blame recoil for a miss. The tests were made in the laboratory of the Western Cartridge Co., division of Olin Industries.

## Music Is Newest Instrument in the Doctor's Black Bag

Doctors are using music in operating rooms and in treating patients with mental illness, heart disease and a number of other ailments. Handled by a trained therapist, the musical "treatments" have shown important successes. If the patient likes

music, he is given earphones when he enters the operating room and he goes to sleep to music. In mental treatments, music is used to calm violent patients. Cardiac patients who require relaxation are given soothing music in their rooms.



## Ultramodern Desk

Hidden elevators and pivoting drawers give Allen B. Gellman fingertip control over everything in his desk. Gellman, president of the Elgin American Company, designed the desk himself. The large, curved top is uncluttered and attractive. At one

end is a telephone shelf which pivots toward the executive when he wants to place a call. Similarly, a filing drawer twists out for accessibility. When Gellman presses a button, the front section of the desk rises to reveal pigeon holes for correspondence. The secretary slides back panels to find her work already sorted.



## ← Cultivator Fits in Car

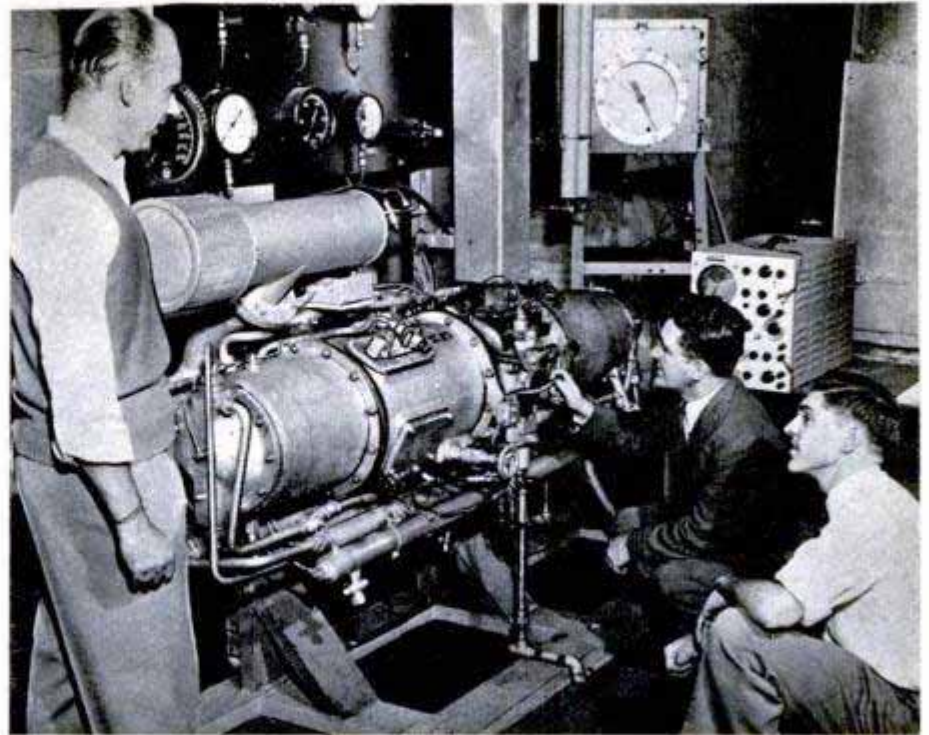
Weighing only about 100 pounds, a power garden cultivator fits inside the trunk of most automobiles. The cultivator is designed for use on city and farm gardens too small to require full-size tractor equipment. It is powered by a four-cycle gasoline engine which operates a chain drive.

## Heating Ducts of Aluminum Prove Best in Lab Tests

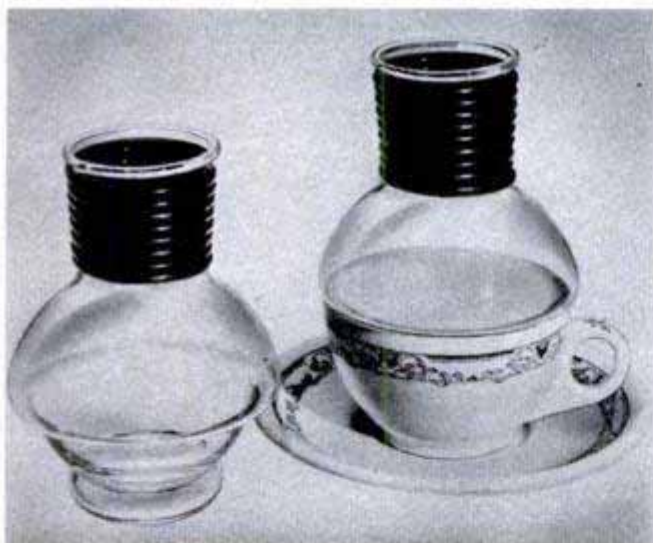
Aluminum ducts to carry heat from furnace to rooms are superior to those of other materials, according to comparative tests made at the University of California. They are also cheaper because they need no insulation and actually function more efficiently without it. The tests also showed that asbestos-paper-covered ducts can be raised to a level comparable with that of bare aluminum ducts by adding an additional wrapping of aluminum foil, sealed at the joints with aluminum tape.

## Sub's Compressor May Power Auto

Cheap to build and operate, a free-piston engine, formerly used as an air compressor in a German submarine, may lead to a new type of automobile or truck engine. Tests being conducted on the captured engine at Stanford University show that engines can be made in any size from that of a passenger car to the largest diesel, using the same principle. Besides being inexpensive to build and operate, the engine is lightweight and runs almost without vibration. So smoothly does it operate that a coin can be balanced on the engine while it is running. For use in a car, the engine would produce hot exhaust gases at a pressure of 100 pounds per square inch and these gases would drive a turbine to power the ve-



hicle. Used as a compressor, the engine takes 70 cubic feet of free air a minute and compresses it to 3000 pounds per square inch. In the submarine, it was used to produce compressed air for torpedo launching.



## Glass Bottle That Fits in Cup Keeps Coffee Hot Until Drunk

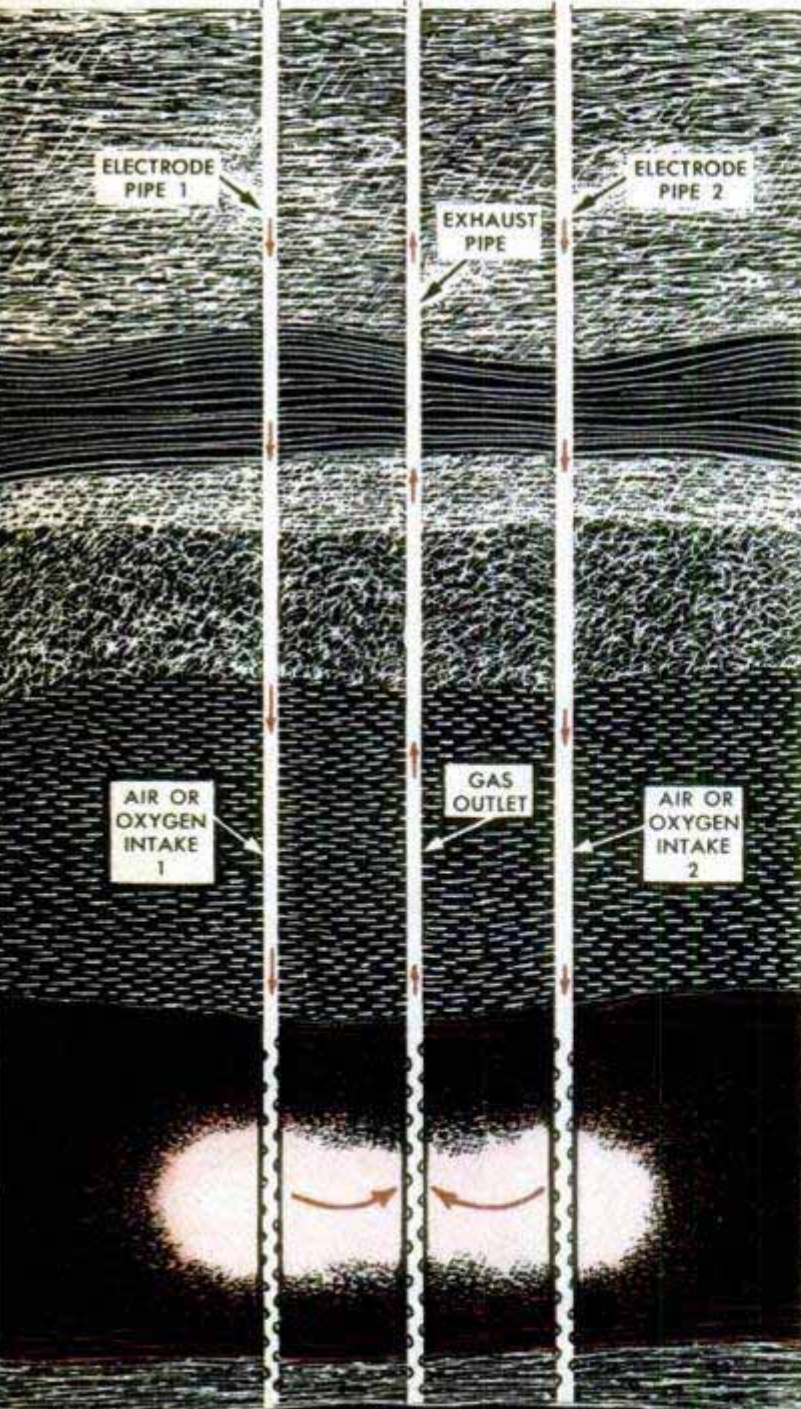
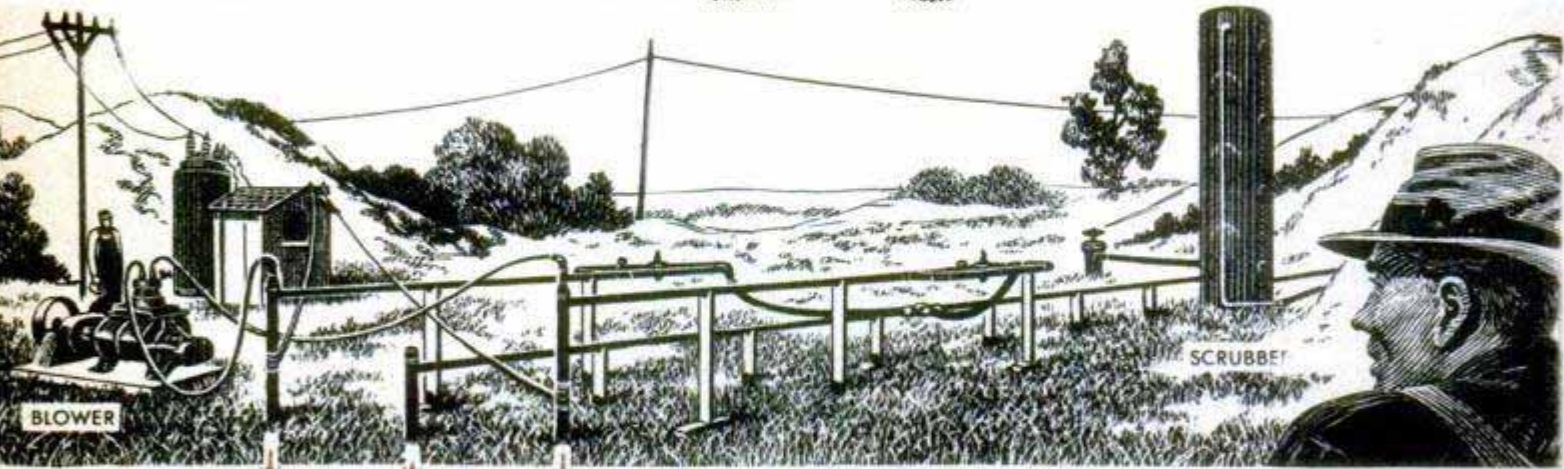
Diners pour their coffee hot—and when they want it—from a glass bottle that fits in the cup. It also keeps the cup warm until the first coffee is poured. The Hottle (coined from "hot bottle") holds 10 ounces, enough for two cups. Plastic insulation around the neck gives protection in handling when filled with hot liquid. On trains, ships and planes, where the motion of the carrier often slops coffee into the saucer, it has the added advantage of allowing a traveler to pour out only half a cup at a time and yet have sufficient hot coffee on hand when more is needed.

## Four-Position Tee Rests Atop Ground

Four different cups at varying heights are provided in a single golf tee which rests on top of the ground. The plastic tee consists of four prongs joined together with a cup at the end of each one. The three prongs not occupied by the golf ball form a tripod for the tee. Thus, the golfer can always tee his ball at the same height.



# "MINING" COAL WITH FIRE



Two electrode pipes, sunk into the Hume coal seam, carry the current which heats the coal. Then, air is pumped down them to support combustion. The gas which is released is forced up through a third pipe

**T**OMORROW'S coal miner may never go underground. He'll probably work on the surface, turning over the dirty and dangerous underground task to his subterranean "slave," a controlled fire, that will bring up the coal in the form of gas.

Two important experiments now being conducted may lead to this revolution in mining. Instead of burrowing into the earth, chipping the coal loose and hauling it up for distribution to the nation's furnaces, we may convert the coal into fuel gas underground, burn the gas at the mine-head to produce electricity which can be "shipped" at a fraction of the cost of hauling coal.

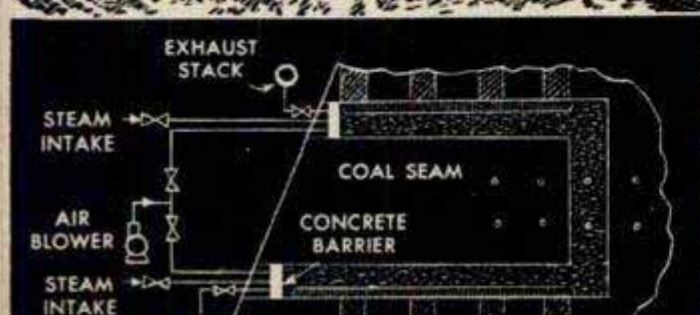
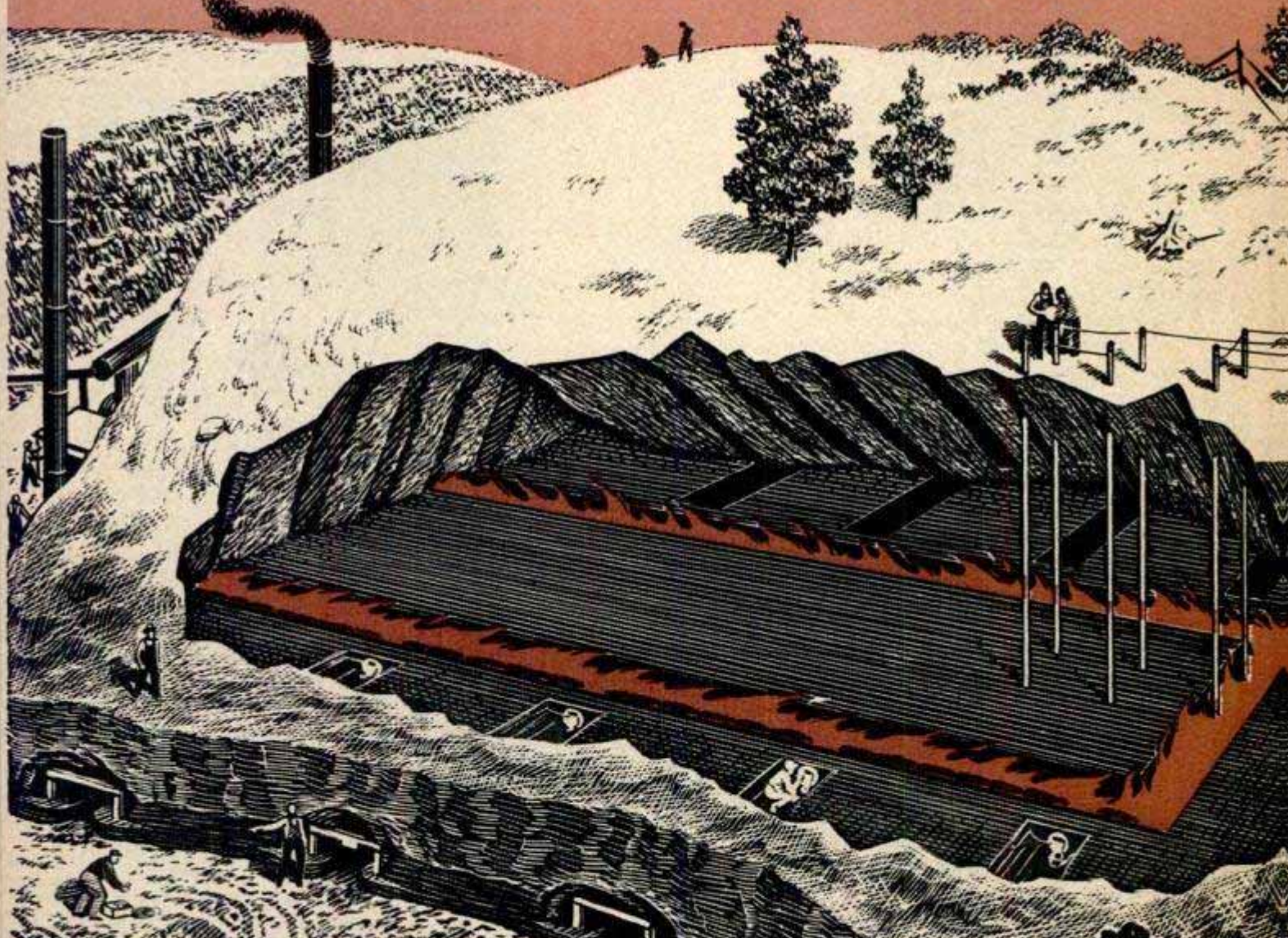
At Hume, Mo., the University of Missouri is gasifying coal by forcing a high-voltage electric current through the seam, heating the coal until it is ready to ignite. Then, air or oxygen is pumped into the seam through iron pipes, which also serve as electrodes for the current, causing the coal to burn. The gases released by this incomplete combustion are forced upward through an exhaust pipe and converted into a heating fuel similar to coke-furnace gas manufactured in commercial plants.

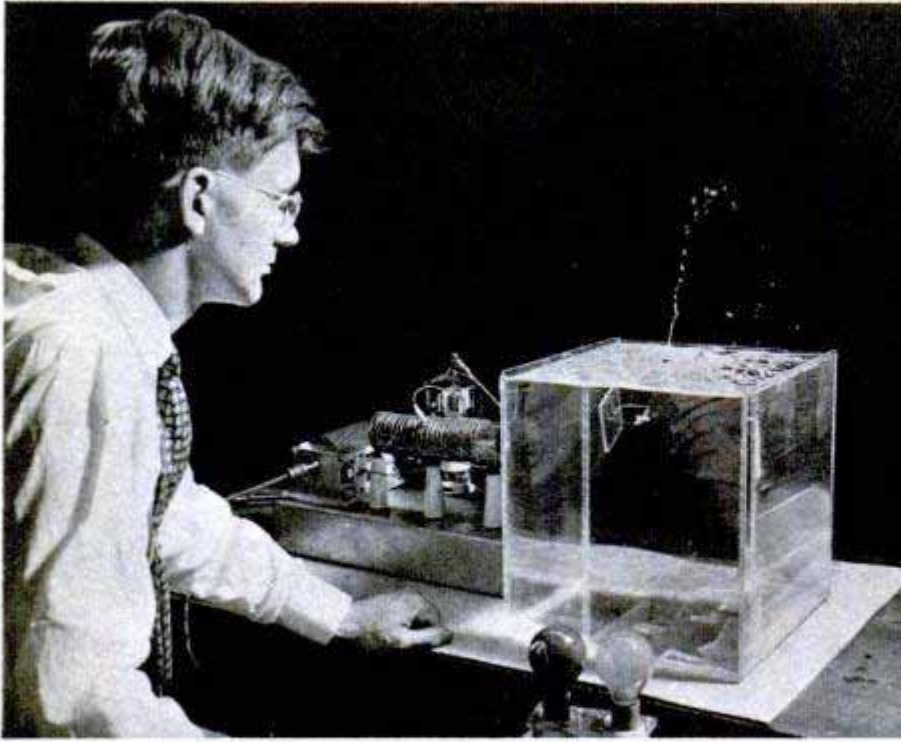
In a similar experiment at Gorgas, Ala., the Bureau of Mines has been producing fuel gas by underground gasification of coal. There, electricity is not used, the combustion being started by an incendiary bomb dropped into a tunnel in the coal seam. Air under pressure is forced into the tunnel to feed and spread the fire, forcing the gases out an exhaust stack where they can be captured and processed.



Left, at the Gorgas experiment, a miner checks the fire's progress through a vision slot. Right, dropping a fire bomb into the coal seam to start combustion

Below, cutaway drawing of the Gorgas test. Air and steam are forced in, first from one end then the other, to produce an even combustion of the coal seam.



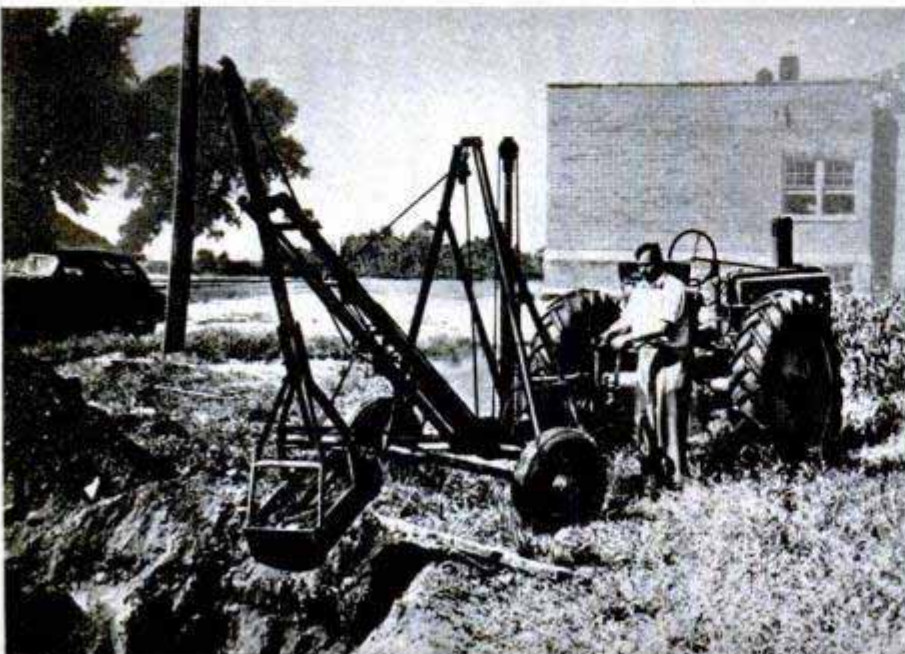
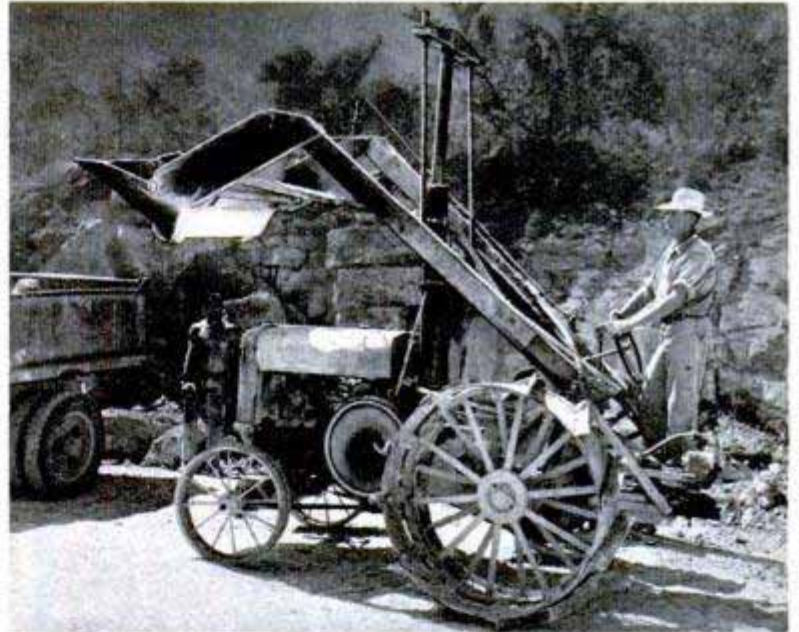


### Ultrasonic Fountain

Sound waves, pitched so high the human ear can't hear them, operate a miniature fountain, throwing a jet of water several inches into the air. The apparatus was designed by General Electric engineers to study ultrasonics. Heart of the fountain is a dime-size disk of barium titanate suspended in the tank. When voltage is applied, it vibrates at almost 3,000,000 cycles per second. As the disk is slightly concave, the waves are focused upward, producing the water jet. The sound waves manufacture fog unless soap is placed in the water. According to engineers, soap forms a film, which prevents fog droplets from forming.

### Homemade Power Shovel

There's a little of almost everything from a B-24 bomber to a broken-down bridge in a power shovel made by a Missouri farmer who runs a rock-crushing business on the side. Using an old farm tractor as a base, he mounted the hydraulic-lift cylinder from a worn-out dump truck just behind the motor and hooked it to a fuel pump from a war-surplus B-24. The bucket came from a discarded scraper and the arms of the shovel were once girders on an old iron bridge. Double steel wheels on the rear axle provide the extra traction necessary for digging into the broken rock.

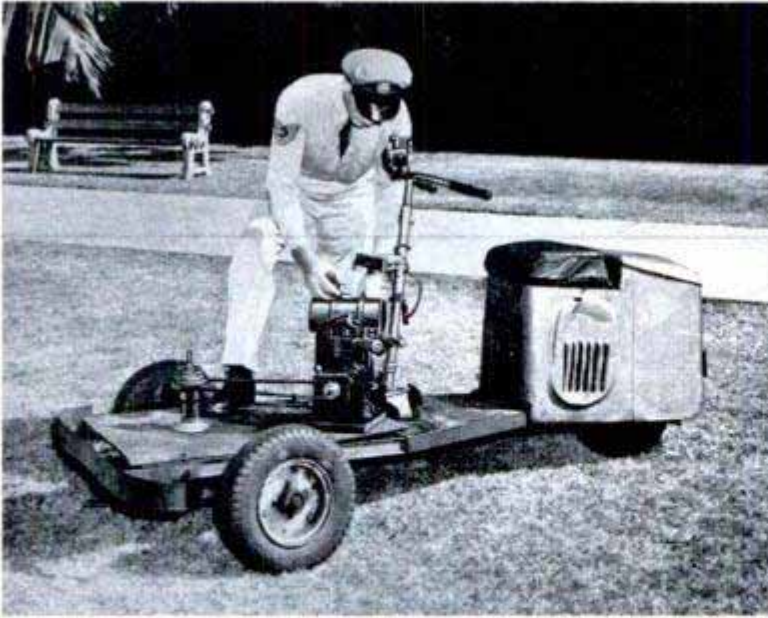


### Light-Duty Ditcher

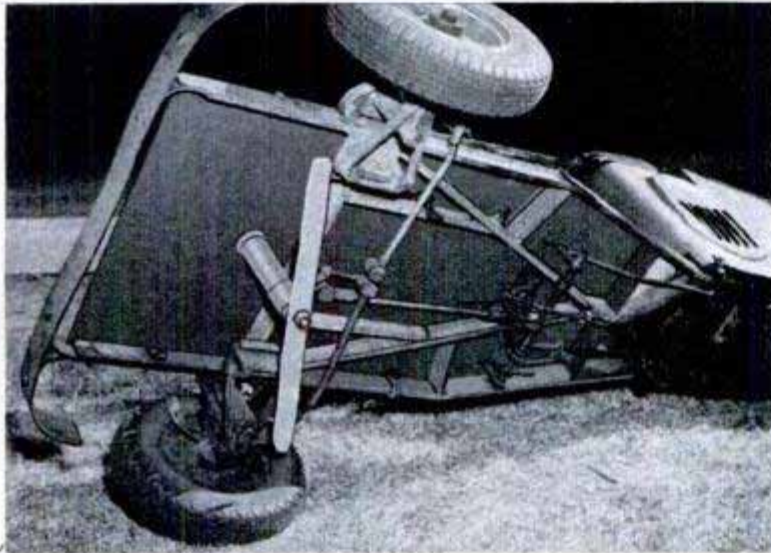
Completely hydraulic, a new ditcher can be operated with any tractor, truck or Jeep with a power take-off. Digging at its maximum depth of nine feet, it can work 25 feet in an hour. By changing the depth to four feet the ditcher can be made to dig 100 feet an hour. The machine carries a bucket 17 inches wide and has a reach of 17 feet 9 inches. It has a swing of 180 degrees, is 8 feet 6 inches long and weighs 1850 pounds.

☞ In 1949, an airliner took off or landed every five seconds, night and day, in the world network of scheduled airlines.





Above, left, Sergeant Chew fills gas tank preparatory to cutting lawn. Belt goes from motor to rotary spinner and sharpened spring. Right, the scooter operating as a lawn mower. Below, underside view of the machine  
U. S. Air Force photos

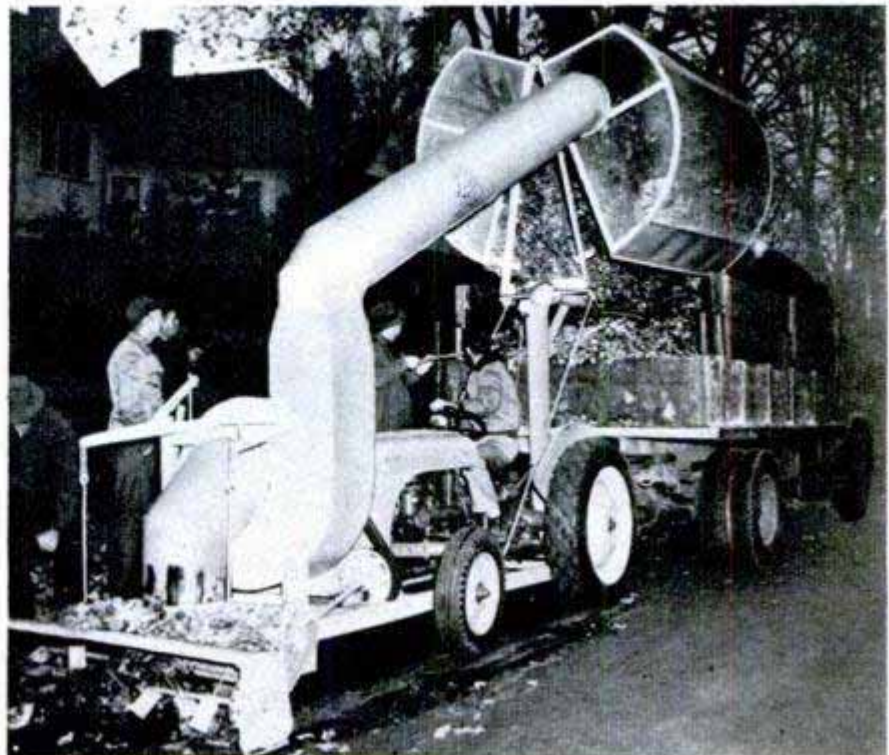


## Lawn-Mowing Scooter

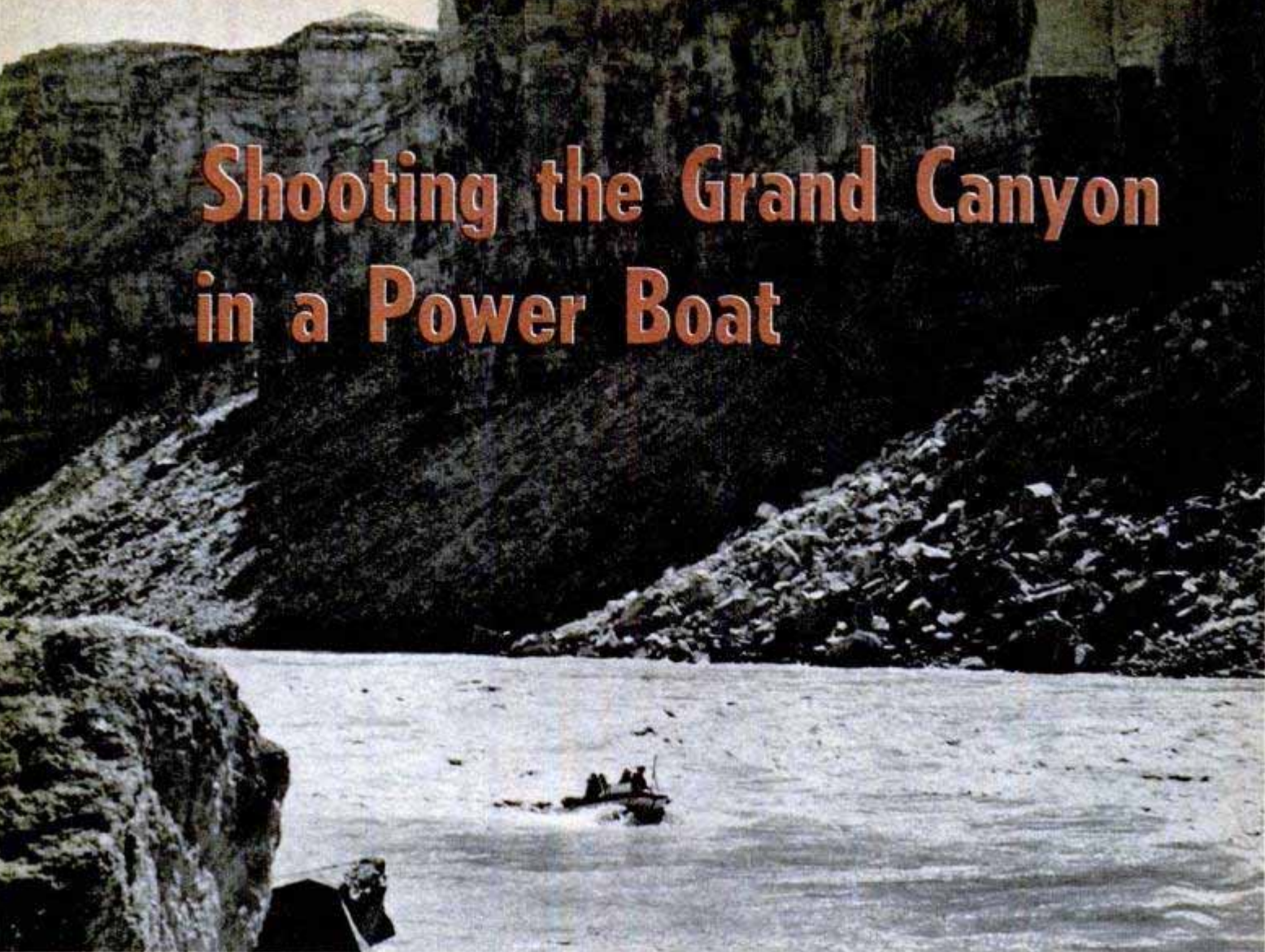
With a model-T spring, some surplus parts, one dollar in cash and four hours work, Sgt. Robert Chew of Hickam Air Force Base, Honolulu, built a motor scooter which mows lawns or supplies transportation. He made a forward section with two wheels and attached it to the front of the scooter. In the center of the platform he built a rotary spinner and attached it to a sharpened spring on the underside of the platform. To cut the lawn, he attaches a belt from the motor to the spinner.

## Leaf Eliminator

Over 1000 pounds of leaves or street debris can be sucked up in a single load by a giant "vacuum cleaner" developed by Harry Clemens of La Porte, Ind. It can be installed on any Ford tractor and operated by one man. An agitator at the front breaks up all packed debris before the vacuum picks it up. A fine wire mesh, covering the hopper, permits the air to be dissipated so that the leaves, which are being blown out a tube at the rate of 6000 feet a minute, won't be scattered back into the street.



# Shooting the Grand Canyon in a Power Boat



By Gene Segerblom

**F**OR THE first time the descent of the treacherous Colorado River has been mastered by a power-driven boat. The craft not only set a new record for the 290-mile run, but proved that motorboats were practicable for negotiating the world's deepest gorge.

The *Esmeralda II*, with five adventurers, made the trip in only five days. The course started at Lee's Ferry in the Grand Canyon and ended at Pierce Ferry, at the mouth of the canyon where the Colorado enters Lake Mead.

The sportsmen making the voyage, all Californians, were Ed Hudson, Paso Robles druggist, and his son, Ed, Jr.; Otis Marston, Berkeley investment counselor, making his fourth trip down this portion of the Colorado; Wilson Taylor, Berkeley businessman and Bestor Robinson, Oakland attorney. Hudson was the pilot and Marston did the navigating.

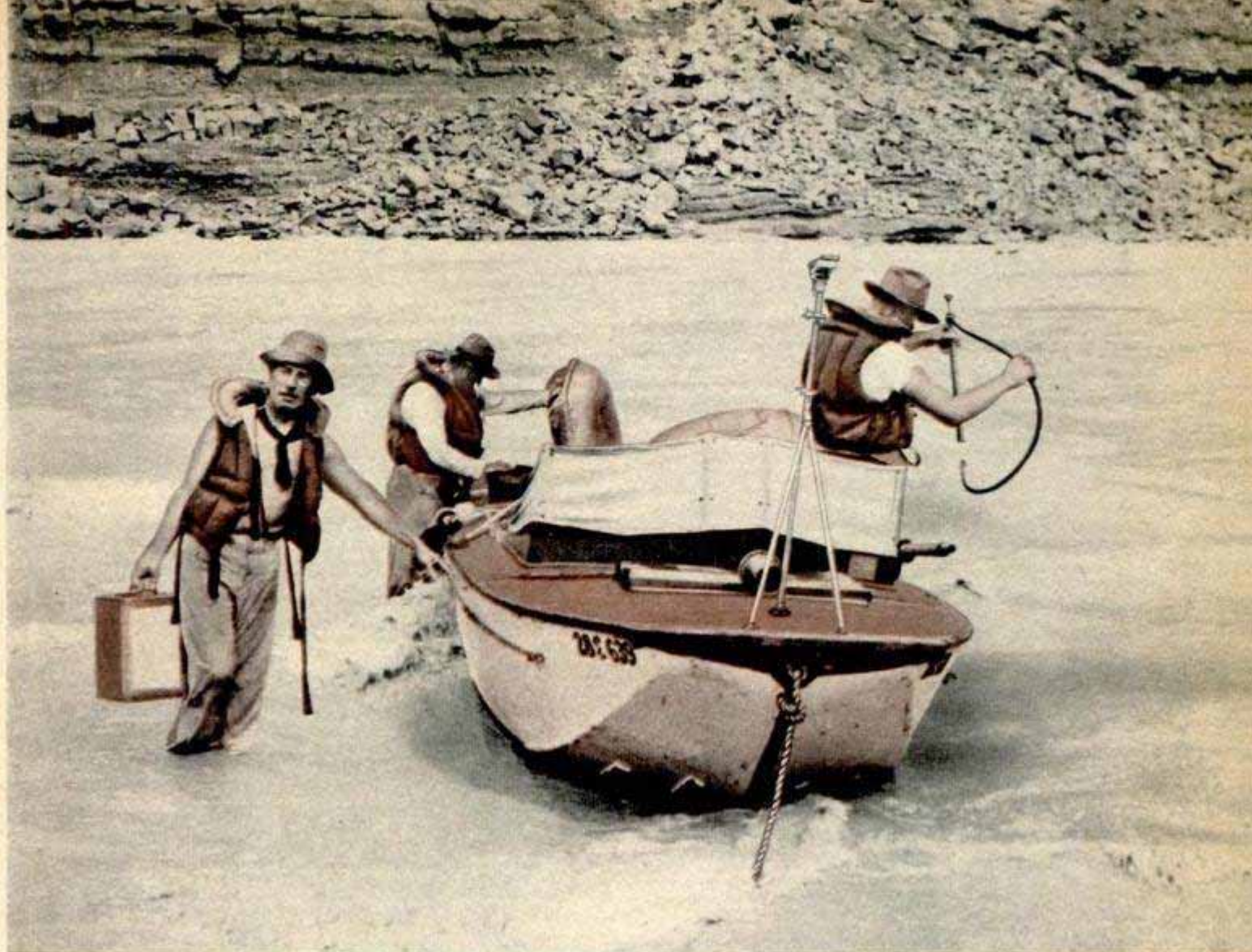
Since Maj. J. W. Powell made the first expedition 80 years ago, only 100 persons have come down safely. Many daredevils have been lost and neither boat nor crew found. The Hudson-Marston party's completion of the course raised the total to 105 lucky or skillful boatmen to reach safety.

The 19-foot plywood boat was especially designed and built for the trip by Hudson, enabling it to take the rapids without serious damage. It has a Gray marine 125-horsepower motor and a two-layer bottom for added protection. According to Marston, who has had considerable experience with river boats, it is the finest boat ever built for such trips.

Although battered by huge waves, the craft suffered only minor damage. The propeller was bent from contact with sharp rocks in the rapids, but the worst damage was done to the propeller shaft. It had been worn down  $\frac{1}{16}$  inch by the silt from the Colorado penetrating the bearings.

The engine, although encased, drowned out several times. By the time they reached Pierce Ferry, they had it so well wrapped that it took Hudson 10 minutes to get the engine uncovered. A small hand pump, as well as buckets and rags, were kept going almost continuously to keep the boat from swamping.

The party had originally planned the downstream run only to leave caches of food and gasoline for a proposed trip back up—a fete unaccomplished as yet. However, the trip down posed more obstacles



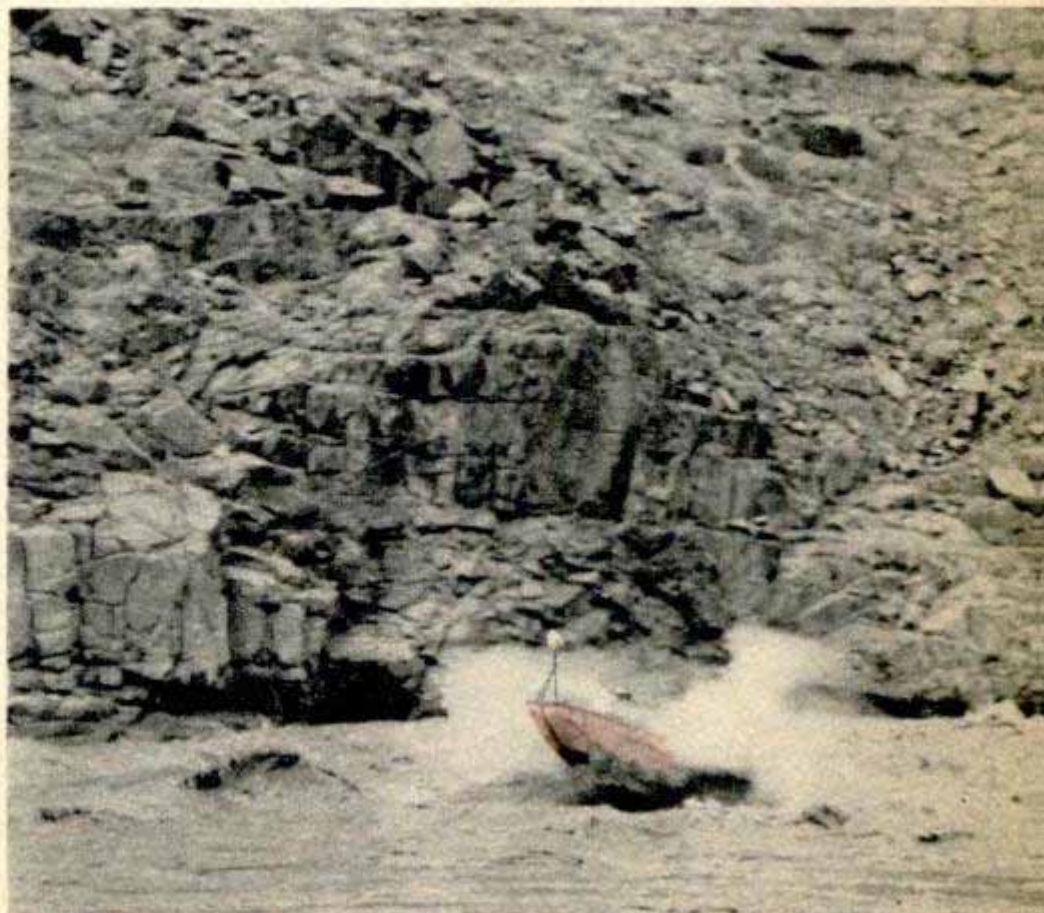
Above, the river runners pause in the Grand Canyon to replenish gasoline from supply hauled in by mule-pack train. The sides of the cockpit were lined with shelves for five-gallon cans. Below, billows as high as 15 feet were encountered, but the boat came through with only minor damage

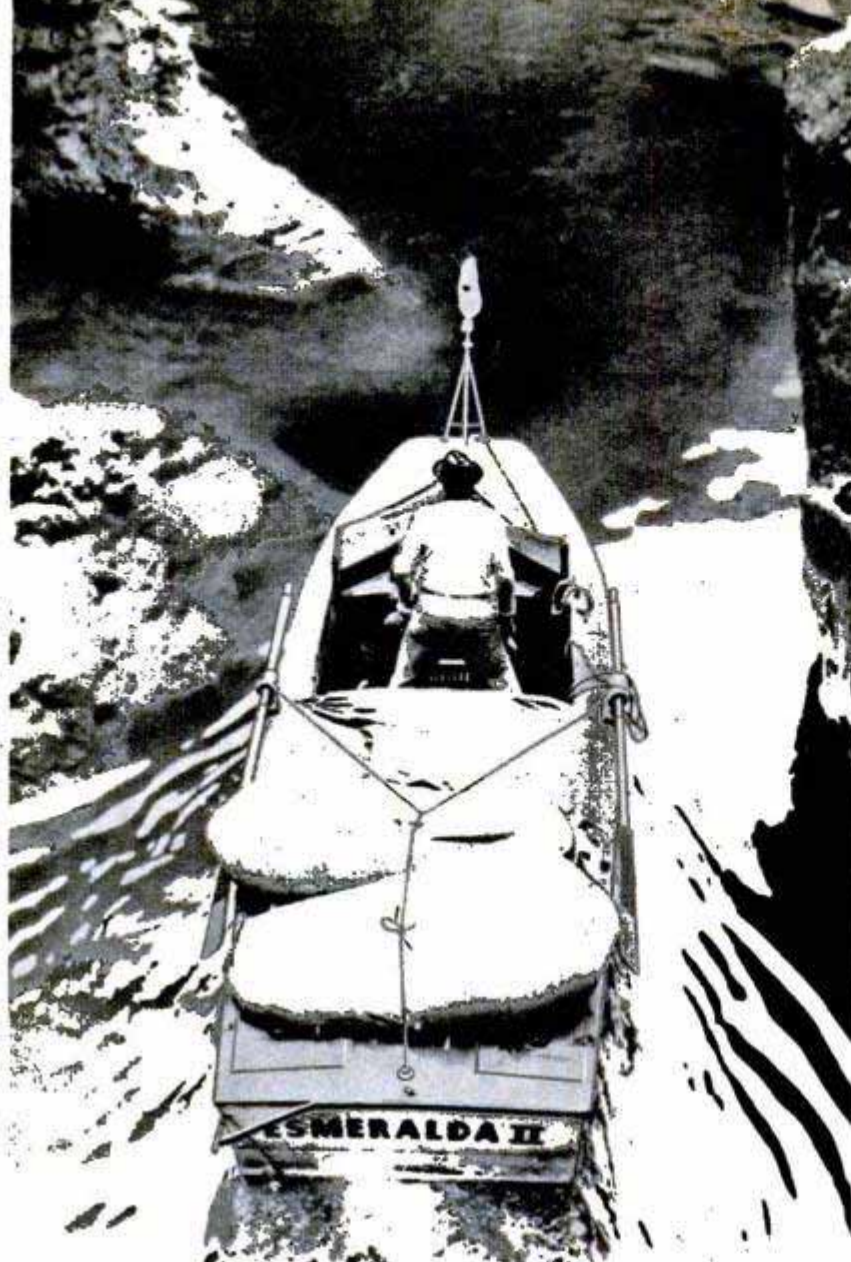
than had been prepared for. When they set out from Lee's Ferry, the river runoff was 55,000 cubic feet. By the time they were halfway down the gorge, it had increased to more than 88,000 feet.

The increased runoff also added the hazard of masses of dislodged driftwood. Many pieces were larger than the 19-foot vessel itself and could have sunk it with a blow.

Although the power craft was easier to handle in the rapids than other boats, and its speed was greater, it had the disadvantage of needing gasoline to run. The gas mileage was extremely poor, averaging about 1½ to 2 miles per gallon.

"What we need in the canyon for a motorboat trip," declared "Doc" Marston, who knows the river well, "are a few well-spaced gas stations."





Above, narrow going into a side canyon at the mouth of Havasu Creek. Marston, the navigator, has made four trips down the Colorado River. Below, almost hidden by billows, the Esmeralda II battles the first major rapids on the descent. There were nearly 300 rapids en route

The sides of the cockpits were lined with shelves to hold five-gallon cans of gasoline. On one billow, the boat hit with such a thud the shelf in the front cockpit was knocked down. Fortunately, the gas didn't spill.

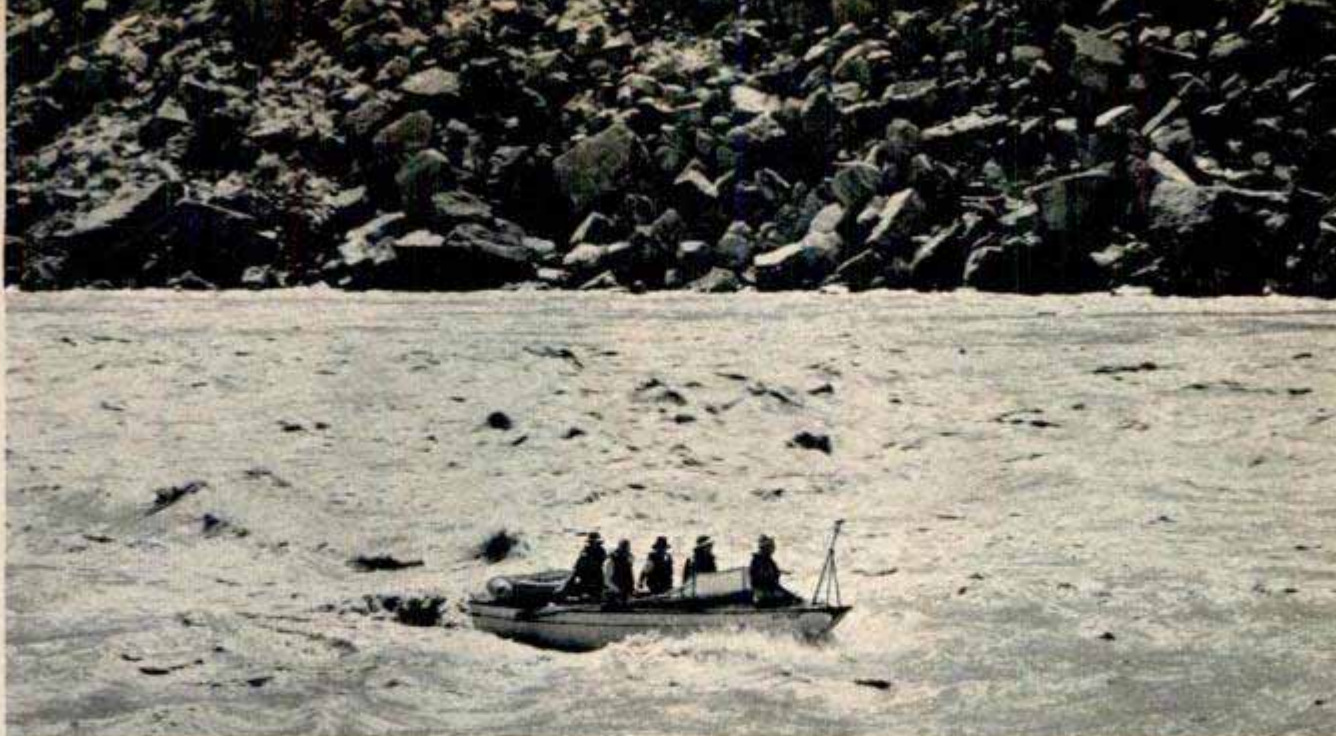
Gas was packed in by mules at several strategic points along the course for the downstream trip. At that they just got through, using nearly 50 percent more gas than had been anticipated.

The only serious mishap of the adventure occurred to one of the mule trains hauling gasoline down the side of Grand Canyon for the boat party. Gasoline evidently leaked from one of the cans strapped on a mule, burning his back. The mule went berserk on the narrow trail leading from the top of Grand Canyon to the river.

Before the excitement subsided, every can in the mule train had been punctured on the sharp rocks. It was necessary for a plane to fly to Phoenix for new cans to send down the needed gasoline before the party reached that point of their trip.

The series of nearly 300 rapids in the river course consists of tumultuous swells





In Marble Canyon, the first motorboat to conquer perilous Grand Canyon churns along the 290-mile course

capable of smashing the sturdiest of craft to fragments. Anything under five feet in height is considered by river runners as a mere riffle. This year's flow of water made the Lava Falls rapid—the toughest stretch of the run—churn up billows nearly 15 feet high.

As soon as they reached Pierce Ferry, the expedition made minor repairs and started back up. However, the runoff had by then reached 101,000 cubic second feet, causing them to call a halt at Mile 242.

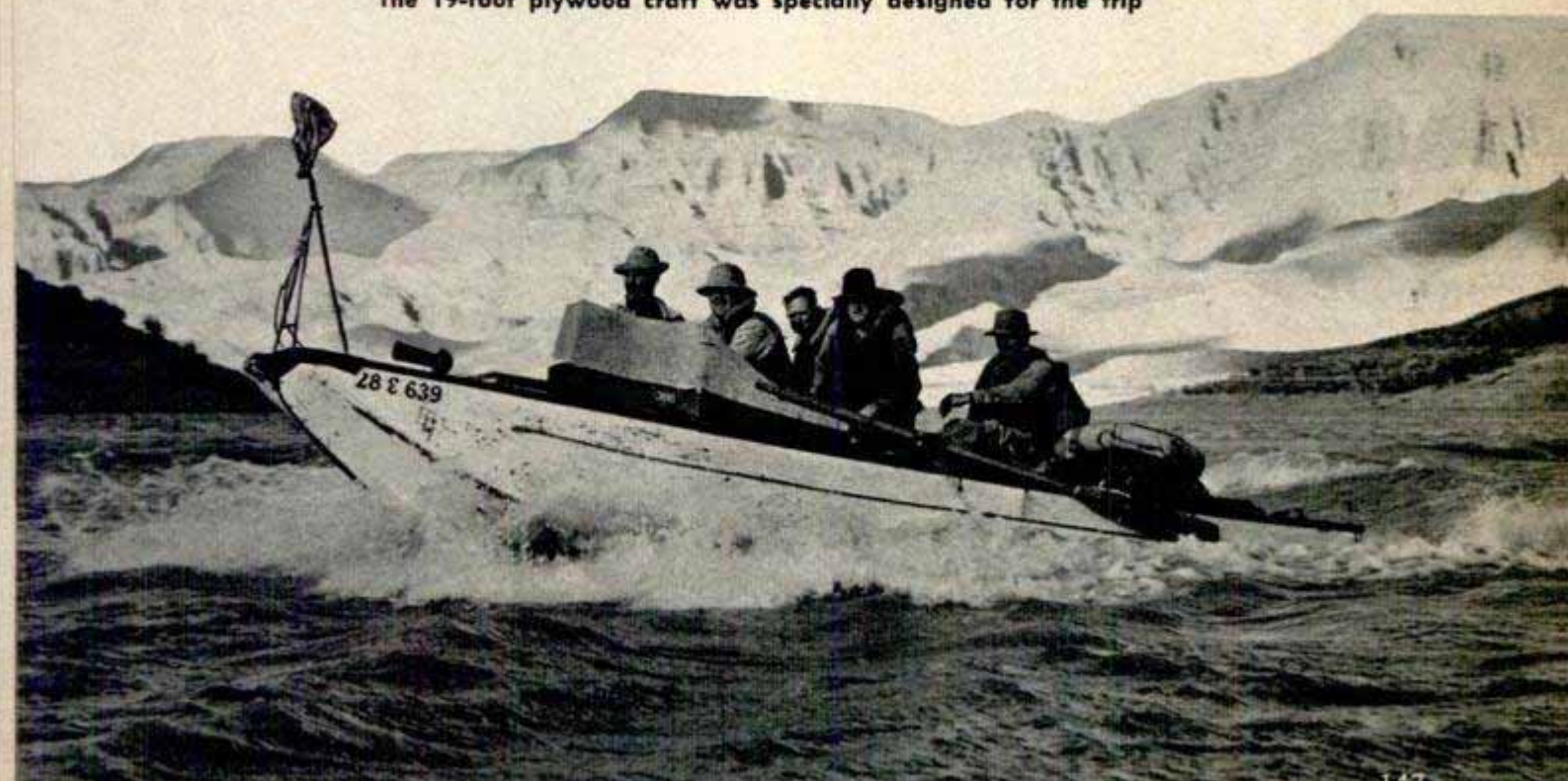
Running upstream the 125-horsepower motor took three times as much gasoline as they had made provisions for. Last year, the same men, with the exception of Robinson, were able to get to Mile 217 in the

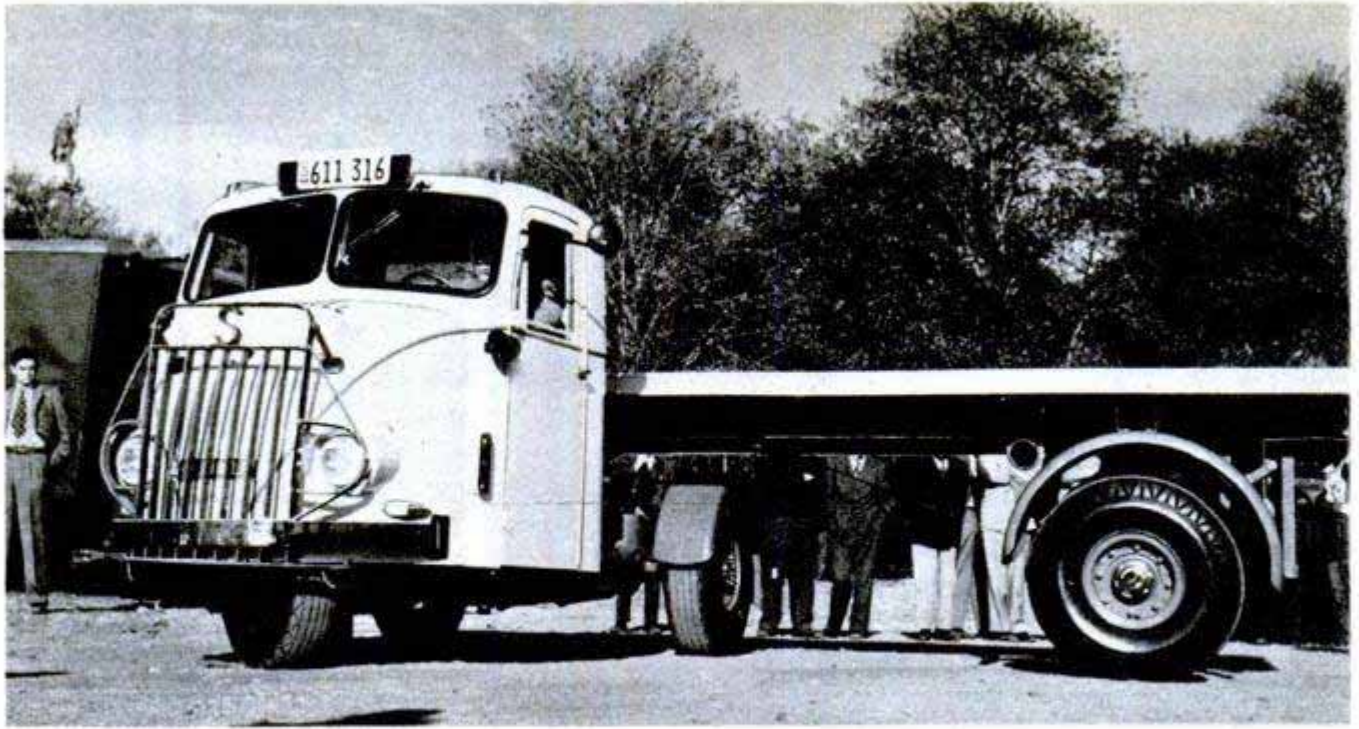
same boat, before being halted by lack of power. This time the 75-horsepower engine had been replaced by a 125-horsepower motor. They had tested the boat's power at Lava Falls rapid on the way down and had made it easily.

The five dauntless men were not discouraged over the failure of this second attempt to go up the Colorado River. They all plan to return shortly for a third try.

Although their down-river record stands at 5 days and 10 minutes, they actually spent only 4½ days on the water, having spent half a day and a night at Bright Angel. And they could have done even better if they had not stopped now and then to leave supplies for the upstream trip.

On placid Lake Mead, after completing perilous canyon descent. The 19-foot plywood craft was specially designed for the trip





## Trailer Truck Pivots on One Front Wheel

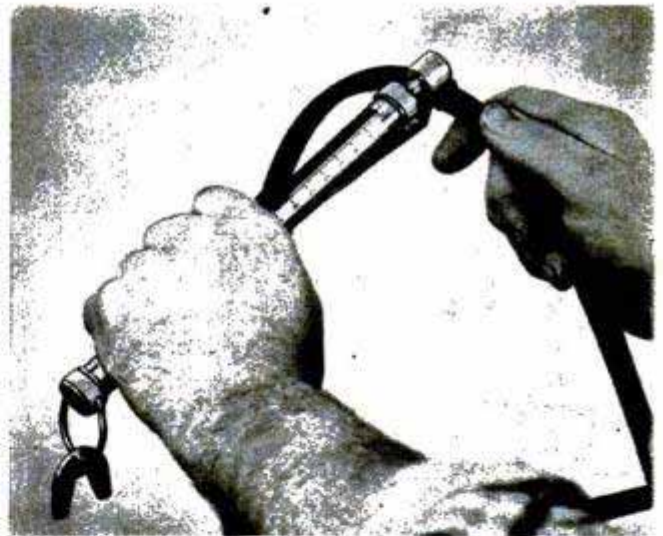
Agile as a motor car is a British semi-trailer truck with only one front wheel. The truck is small in size and has a trailer measuring only 15 feet. The single front wheel and the short length of the tractor

and trailer permit the truck to be maneuvered easily into a parking space or unloading dock. By cramping the single wheel in one direction, the driver can make a U-turn in a space only 19 feet wide.



## Pocket Ray Detector

Radioactivity is detected and measured by a British instrument about the size of a fountain pen. The detector is used in radium-treatment rooms and research laboratories. Instead of a Geiger counter, the instrument has a quartz fiber electrometer which moves up a scale according to the degree of radioactivity. The fiber is tough enough to withstand heavy shocks.



## V-Belt Measurer

Operating on the same principle as an automobile-mileage indicator, a meter measures the length of V-belts. Any light-duty V-belt is clipped against a wheel and pulled through its cycle. As the belt moves through, the wheel rotates and indicates the length on an easily read gauge.

Sources of available products described in this issue are listed on pages 10, 12 and 14. Sources of further information on other articles are listed in the WHERE-TO-FIND-IT INDEX, which is available without charge from Bureau of Information, 200 East Ontario Street, Chicago 11, Ill.

Artist's impression of jet B-47 as an airliner. Boeing may add fuel tanks under the wings and convert 600-m.p.h. bomber into a transport



# Commute by Jet

By Aubrey O. Cookman, Jr.

**I** WONDER WHAT it's like?" How many airline passengers, looking out the window at jet fighters and bombers "whooshing" by in the distance, have asked that question? And, in the same breath, "how soon will I be doing it?"

Those jets, many with wings swept back like wild geese in flight, are lifting the curtain on new and almost staggering vistas of speed in transportation. A generation of travelers, just becoming accustomed to the time schedules of conventional planes, have a jolt in store for them. Not tomorrow, but unquestionably jets will begin scheduled operations by 1952.

Every major advance in transportation has changed man's life by telescoping time and distance. Ox cart—horse and buggy—locomotive—automobile—piston-engine planes—and now, jets. Everything points toward as big a change from today's airplanes to tomorrow's jets, and perhaps rockets, too, as from the horse and buggy to the automobile.

At already-achieved jet-propulsion speeds any corner of the world will be accessible in a matter of hours. Before this century ends, an air traveler leaving London to spend a week end in New York may be able to say: "Well, goodbye. I'll

arrive in New York City 25 minutes ago."

Confusing? Yes, but perfectly possible with jet speeds. Racing with the sun he actually will arrive in New York 25 minutes earlier than he left London. Breakfast and dinner at places 5000 miles apart, like Istanbul and Brooklyn, won't be an exciting enough travel event to warrant space in the newspaper.

Today's air-traffic rules will be obsolete. Jets, with their terrific rate of fuel consumption, can't waste valuable time being stacked over airports waiting until there is space for them to come in and land. A jet-engine transport the size of the DC-6 would burn four times as much fuel per hour in a holding stack as does the DC-6.

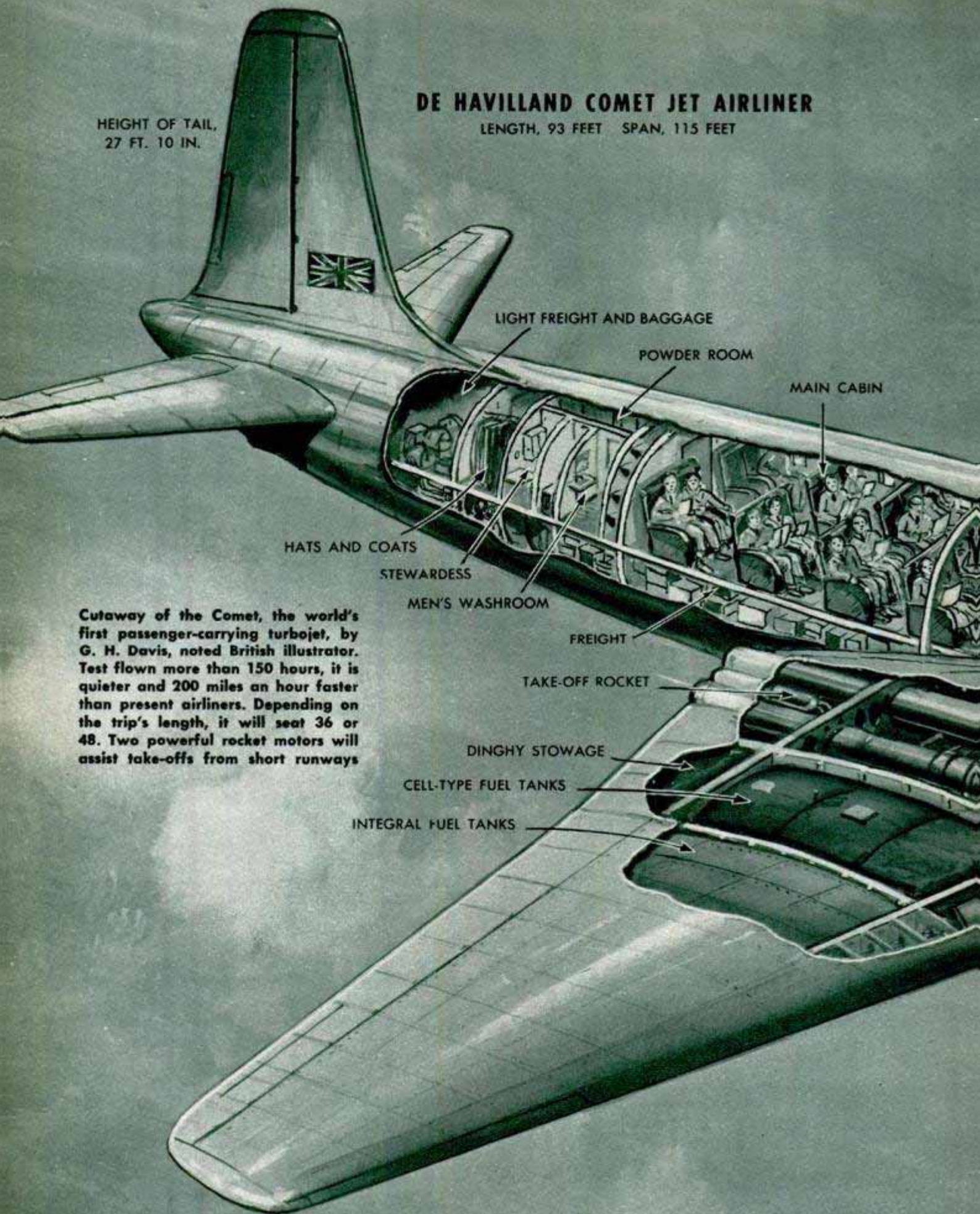
They'll be quieter than today's piston-engine airliners, will vibrate much less and fly much higher. There will be many difficulties to overcome, too, before this high-speed newcomer can be absorbed into the world's transportation system, but we're not talking of fantasy. Two pure jet liners are already here, and flying.

Heading the parade, as the world's first passenger-carrying turbojet, is Britain's de Havilland Comet. Still experimental, it whipped from London to North Africa and back, nearly 3000 miles, at an average speed

# DE HAVILLAND COMET JET AIRLINER

LENGTH, 93 FEET SPAN, 115 FEET

HEIGHT OF TAIL,  
27 FT. 10 IN.



LIGHT FREIGHT AND BAGGAGE

POWDER ROOM

MAIN CABIN

HATS AND COATS

STEWARDESS

MEN'S WASHROOM

FREIGHT

TAKE-OFF ROCKET

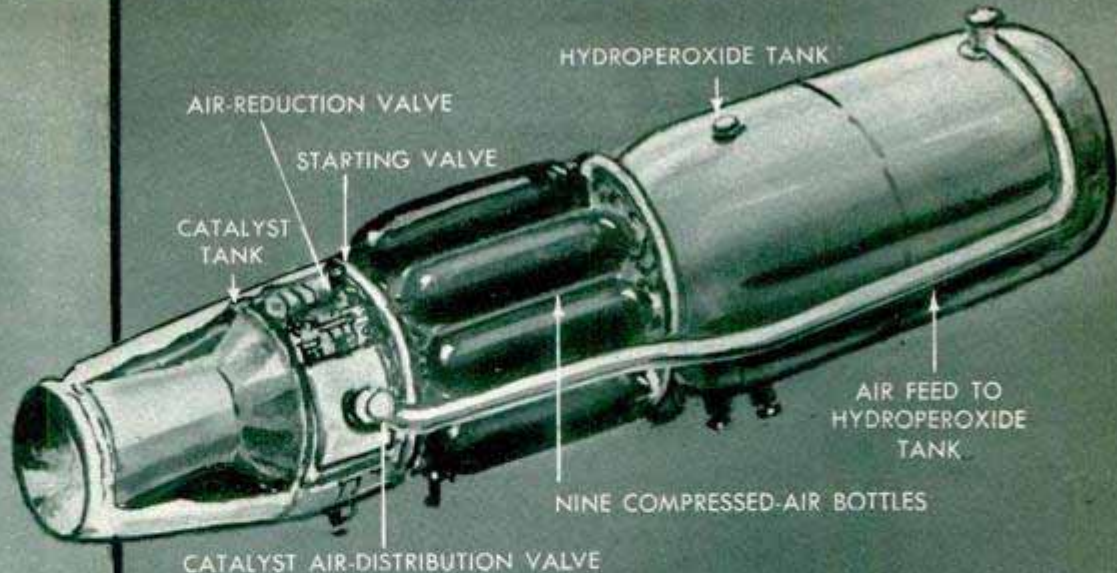
DINGHY STOWAGE

CELL-TYPE FUEL TANKS

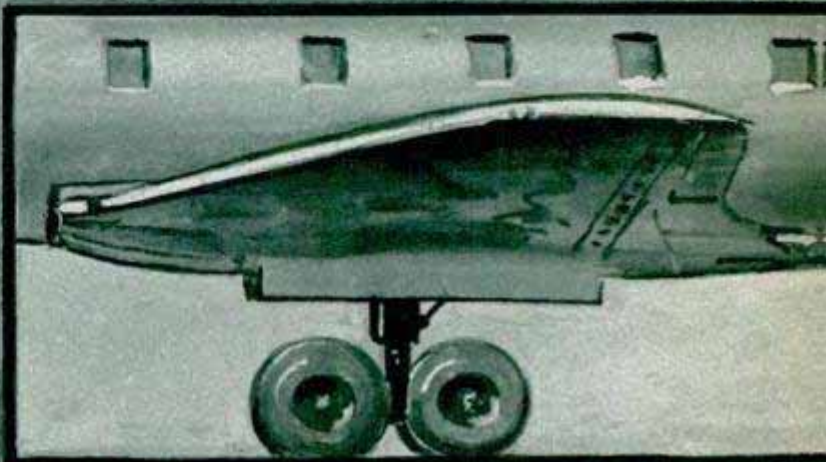
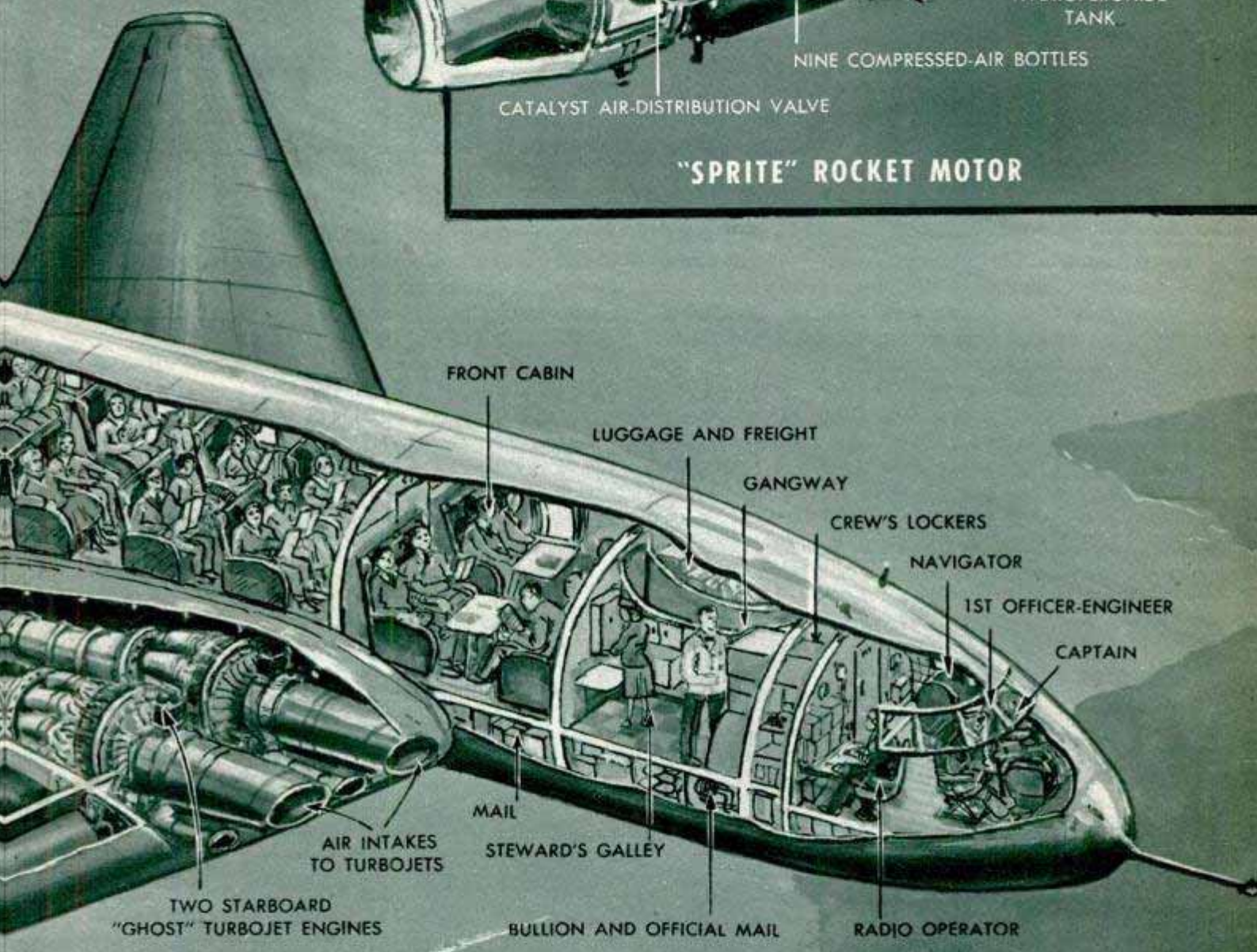
INTEGRAL FUEL TANKS

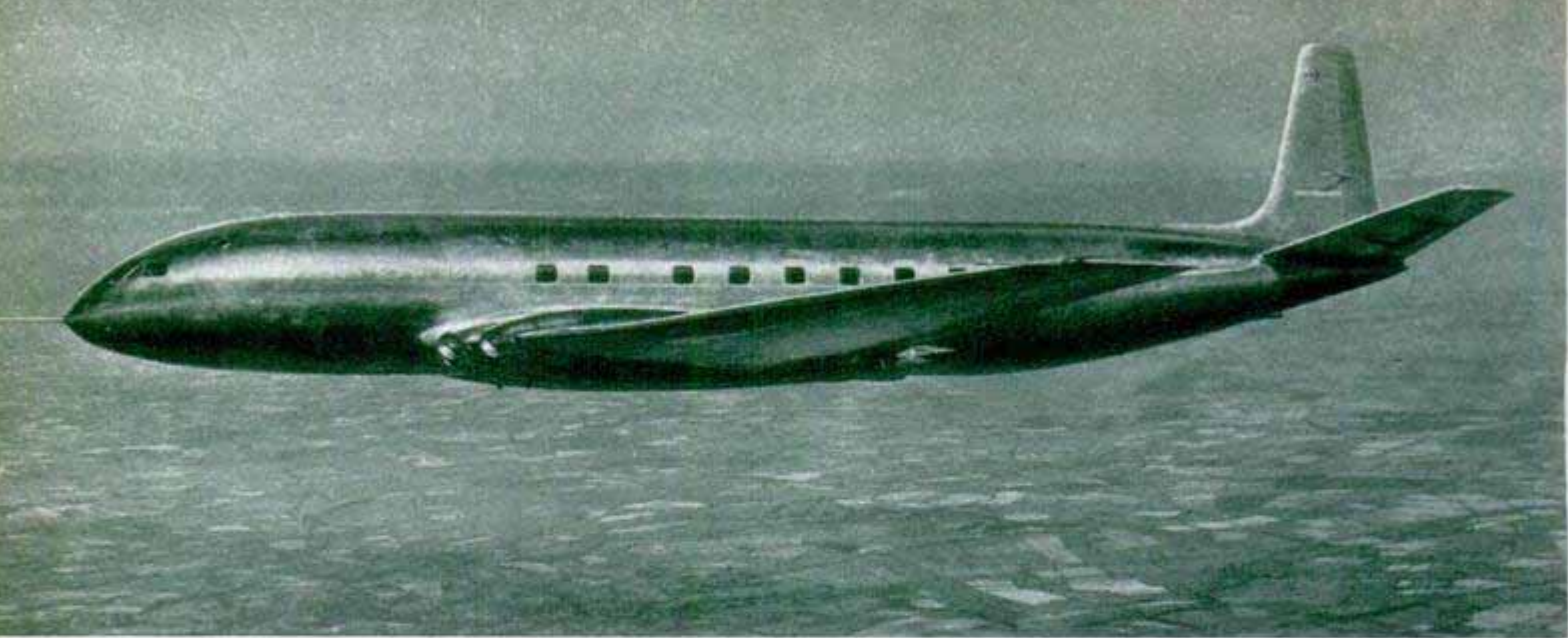
Cutaway of the Comet, the world's first passenger-carrying turbojet, by G. H. Davis, noted British illustrator. Test flown more than 150 hours, it is quieter and 200 miles an hour faster than present airliners. Depending on the trip's length, it will seat 36 or 48. Two powerful rocket motors will assist take-offs from short runways





**"SPRITE" ROCKET MOTOR**





de Havilland Aircraft Co. photo

**Engines only 53 inches in diameter are almost completely buried within the Comet's relatively thin wing**

above 450 miles an hour. Since then it has cruised at nearly 500 miles an hour, approximately 200 miles an hour faster than today's fastest commercial planes.

Just as the first motor cars looked much like the buggies they were to replace, the Comet has few radical "body" changes. Not revolutionary in appearance, the plane is beautifully streamlined. An American Air Force officer, watching it execute a tight 60-degree bank, said, "We haven't a fighter any cleaner than that baby!"

The four power plants are buried in a thin wing, only moderately swept back. A stubby undercarriage, made possible by the absence of propellers, allows the plane to be closer to the ground—simplifying loading and unloading.

Jets operate most economically at great altitude, so the Comet will fly as much as possible at 40,000 feet—nearly twice as high as present air travel. This meant building a

fuselage for a pressure differential of over eight pounds per square inch. Instead of rivets, surfaces are bonded together with a resin-and-plastic combination, applied with great heat and pressure.

The 105,000-pound de Havilland liner will be able to operate from present, average-size airports. For fuel it is using a 99-percent kerosene and one-percent oil combination, used safely in British fighter craft for several years. The plane's "Ghost" engines, the first jets approved for public transportation, set the present world's altitude record of 59,446 feet in a fighter. Comets will normally operate with a crew of four and 36 passengers.

The world's other flying turbojet transport, Canada's Avro jetliner, is lighter than the Comet and intended for shorter, 200 to 800-mile routes. In rate of climb and at level speed the 50-passenger Avro outdoes two

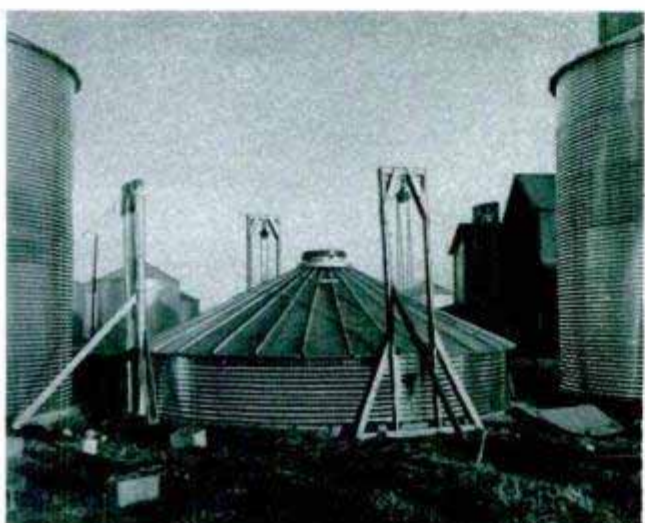
(Continued to page 262)

**Built for trips up to 800 miles, Canada's Jetliner cruises at 450 m.p.h. It is expected to be in service in 1952**





Workmen in photo at left install roof of grain bin while in picture at right conveyors fill bins as soon as they are finished. Below, roof of bin is built first and tiers are added below it to form structure



## Aluminum Grain Bins

Some 83,000,000 bushels of grain of the 1949 harvest were saved from possible loss by the construction of nearly 26,000 aluminum grain bins, each with a capacity of 3250 bushels. The bins were formed in the fabricating plants of strong corrugated aluminum, light enough to be shipped and constructed with ease. It is anticipated that the aluminum with its capacity to reflect heat will protect the grain from deterioration. Since aluminum does not rust, maintenance costs should be at a minimum. The bins are filled by portable conveyors which empty into a center roof opening.

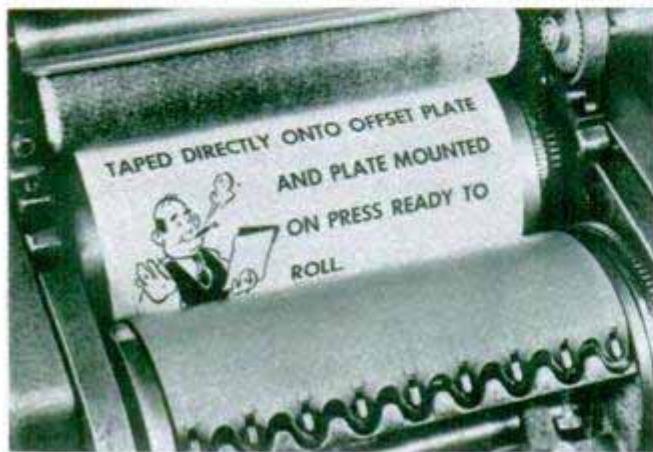
## Single-Engine Amphibian Stresses Safety Features

Seats built into the plane's structure and a control stick that bends forward with body impact are crash-safety features of the new Colonial Skimmer. Location of the single-engine amphibian's wings behind the cockpit also helps by affording better visibility. Cruising at 110 miles an hour and landing at slightly over 50, the Skimmer has a range of 600 miles.



Length of the new all-metal amphibian is 23 feet and the wingspan is 34 feet. Its three landing wheels are retractable

When taxiing into sun, the hinged canopy can be pushed aside to avoid glint from sun reflecting off water onto the Plexiglas



### Printing With Cardboard "Type"

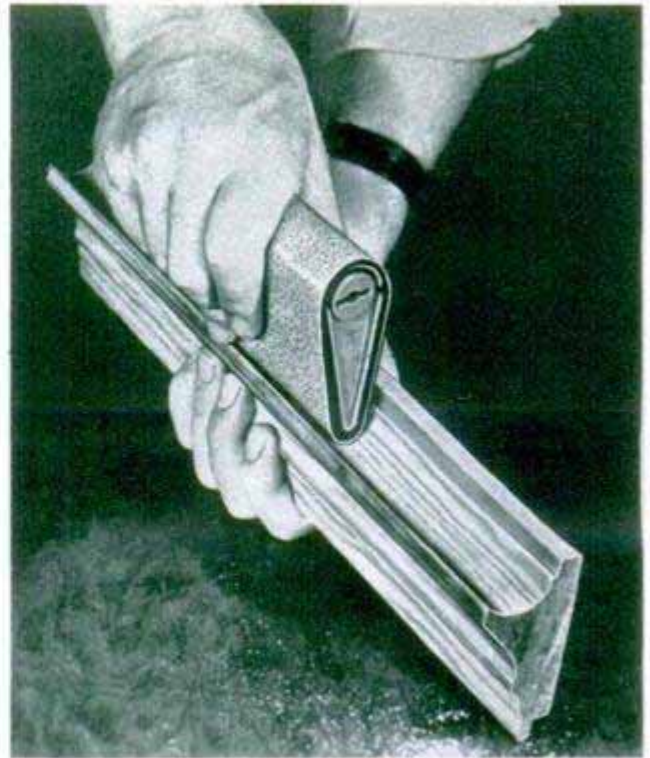
Offset printing can be done quicker and cheaper by a phototype process that requires no photography. Individual letters and numerals, printed on cardboard, are set in a composing stick to form words. A double-coated tape holds the type on the direct-image plate and printing, by offset, is done directly from the cardboard letters. Art work can be attached and printed in the same manner.

### Bicycle Coach →

Latest bicycling novelty in France is a coach which fits over the bike to protect the rider from the weather. Made of oilcloth, the coach is held in place by a metal framework. It has a swinging door on one side and windows all around which give the cyclist a view in every direction.

### "Painting" Lake Ice Black Lengthens Shipping Season

By coating the ice-covered Great Lakes with black powder or liquid, scientists at Armour Research Foundation hope to open them to shipping weeks earlier each year. The black "paint" increases the absorption of the sun's heat. Still being sought is a cheap material that will accomplish this without causing water pollution.



### Hand Sander Smooths Contours

Home craftsmen can smooth irregular surfaces by hand with a new sanding block which is adjustable in shape. Made of plastic, the sander has a wedge-shaped body. It is covered with a rubber sleeve, ranging in thickness from  $\frac{1}{16}$  to  $\frac{3}{16}$  inch, which cushions the sandpaper. When the rubber sleeve is rotated, the radius at each end of the sander is changed from a minimum of  $\frac{1}{8}$  inch at the narrow end to  $\frac{3}{4}$  inch at the wide end. Thus the curve of the sanding surface can be adjusted to the curve of the work surface.



## Elevator "Pilot" Rides in Cockpit

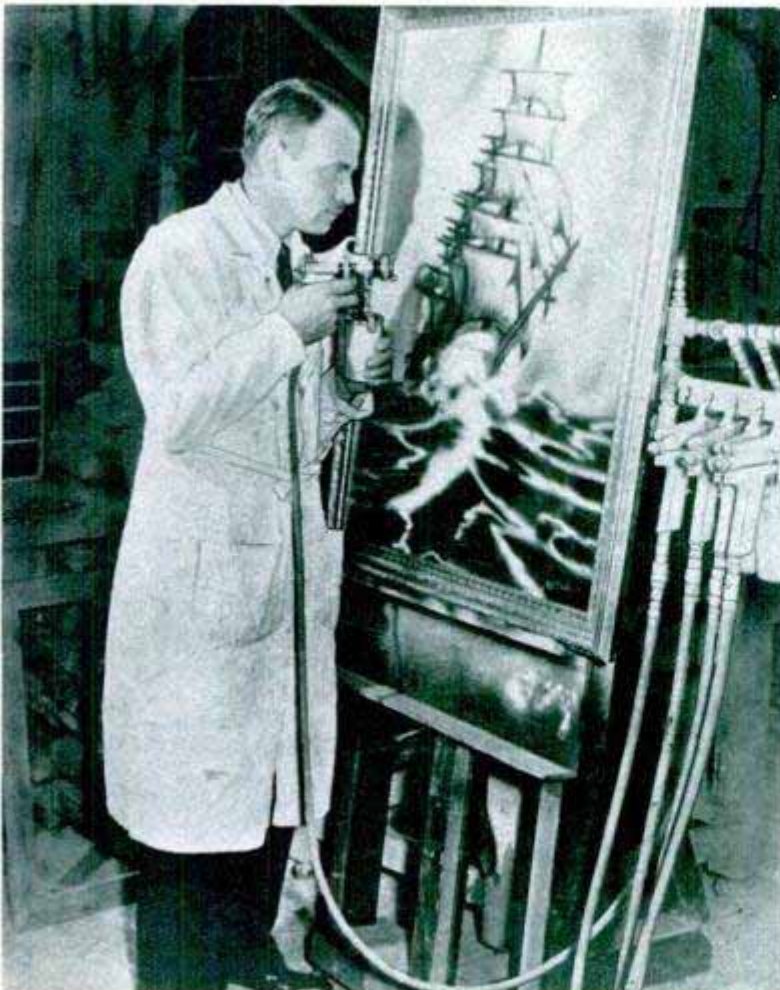
Elevator operators can see better and don't interfere with passenger traffic in a new elevator that has a control compartment built into one side. The compartment is a foot above the floor level to provide better visibility. Door openings on the new elevators are seven feet wide, two feet wider than standard doors in store elevators. The elevators have been installed in Jordan Marsh's new department store in Boston.

## Electronic Warning Protects Boom Operators

Boom operators have an extra pair of "eyes" that keeps constant watch for power lines and sends out a shrill warning when the boom swings dangerously close to the wires. Easily set for any distance by the operator, the warning device is sensitive enough to operate at 50 feet from a 10,000-volt power line. If desired, the actuating distance can be lessened when circumstances require. A sensitive trigger is mounted on the end of the boom and picks up signals from the power line.



When the boom moves within the danger area, the trigger sends a signal to the control unit in the cab, setting off a loud warning horn that blows as long as the boom remains inside the danger area. The device can be set to protect against any voltage from 110 to 110,000.

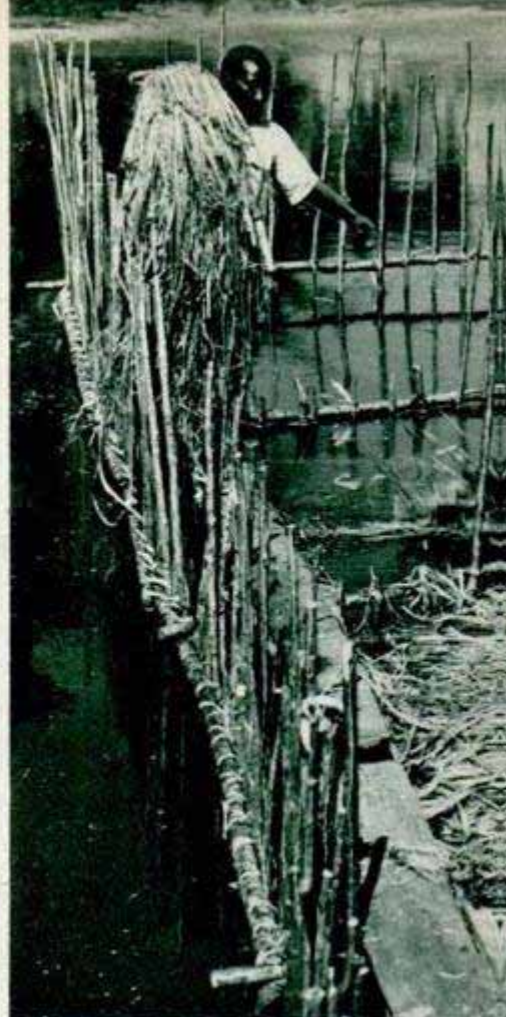
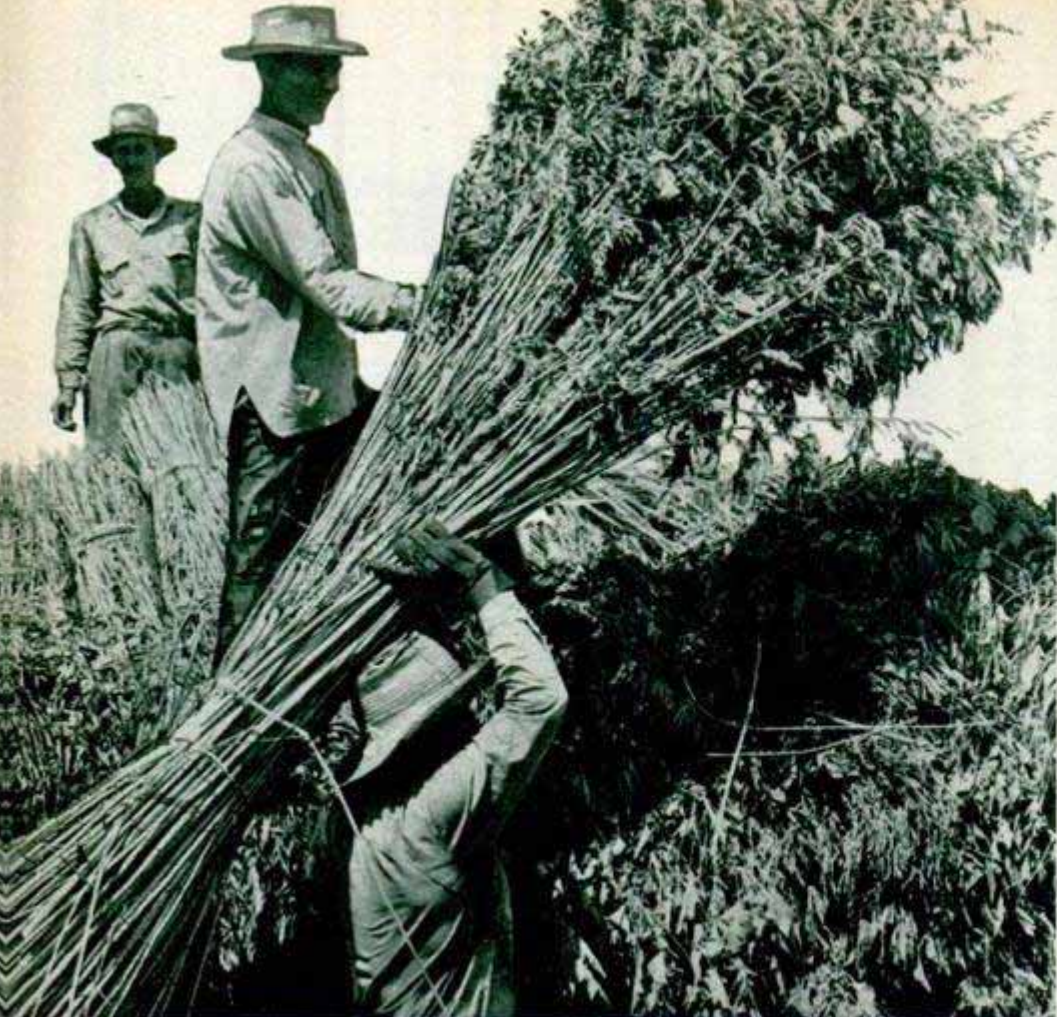


## Spray-Gun Artist

Conventional spray guns — the kind found in auto repair shops — serve as brushes for Ralph DeGayner, an artist of Silver Lake, Mich. With fine control over the gun's trigger, DeGayner sprays his pictures on canvas. Very small air guns frequently are used in art work, but DeGayner uses a bank of conventional guns that are not modified in any way. He uses no stencils or other equipment. His paints are the standard automotive enamels, and he obtains sharp details by controlling the trigger and not by reducing pressure on the gun.

## Ocean Travelers Take to Air

Overseas airlines are cutting deeply into steamship trade. Over half of the travelers going overseas to and from the U. S. went by plane in 1948. Most popular are flights between here and Latin America which carried 78 percent of all passengers in 1949.



# KENAF.

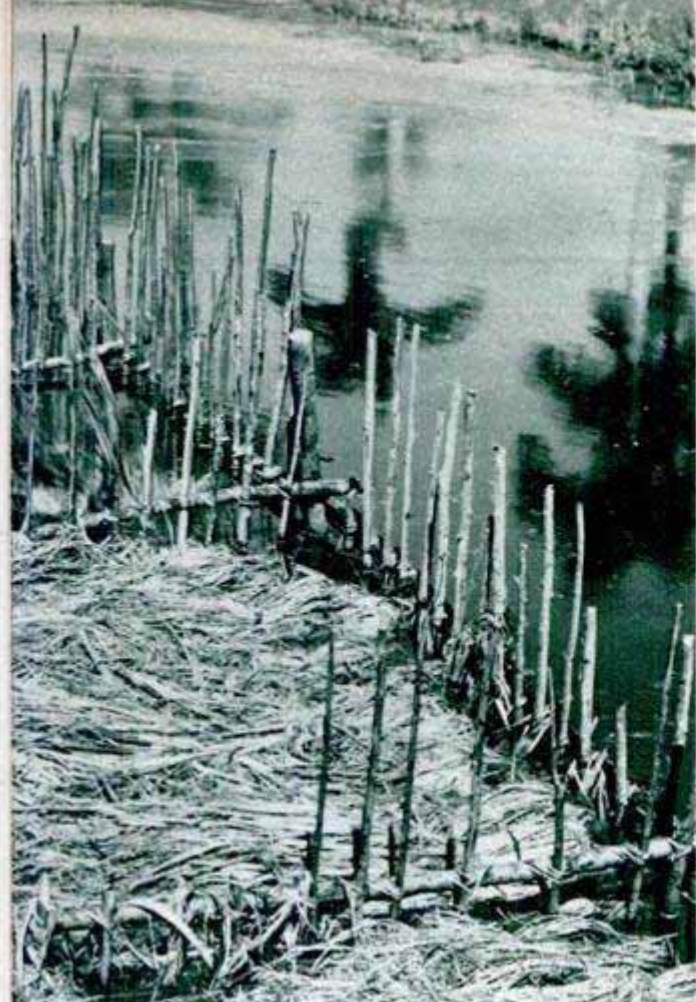
Top, left, only 100 days old, these 10-foot kenaf stalks are on their way to processing

Above, bark ribbons, in retting stalls in a river, are the fiber-bearing parts of stalk

Left, a modified hemp harvester and binder cuts a crop of kenaf, jute's new competitor

Below, experimental plantings like this one provide data on best method of growing crop





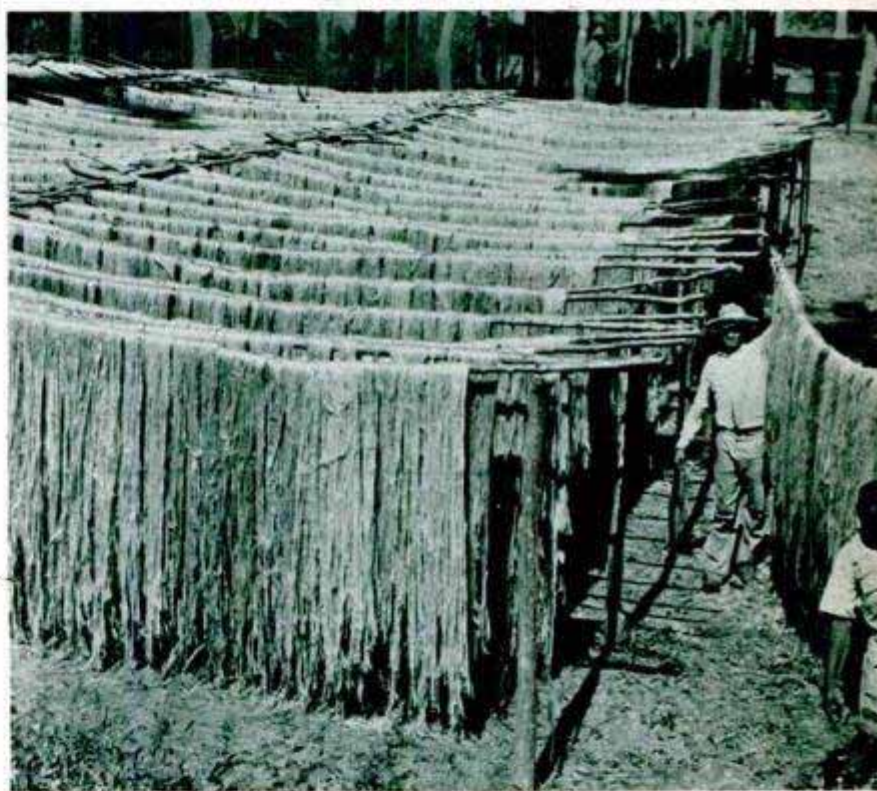
Above, the stalks are first crushed and then this beater removes woody centers, leaving fiber-bearing bark ribbons

## THE NEW FIBER CROP

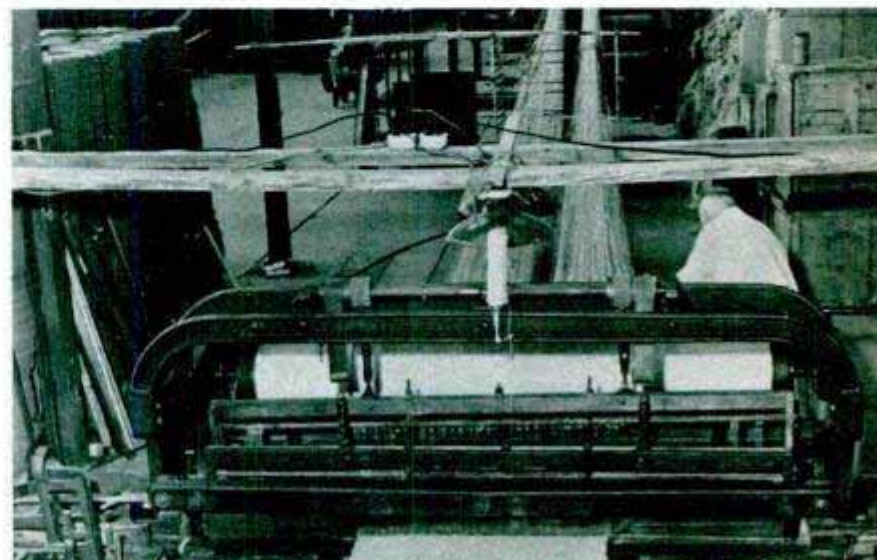
**D**OWN in Cuba, there's a revolution brewing — happily, it will be peaceful! Leading the revolt is kenaf, a fiber crop that is bidding to replace jute as the source of cordage and bagging material.

Demand for jute fiber is tremendous. The U. S. alone needs 165 million pounds annually for rugs, matting, sacks, electric cables and other uses. Cuba needs 40 million jute sacks a year for its sugar crop. Latin America uses 300 million sacks. About 98 percent of the world's jute is grown in India and Pakistan but, as jute fields are converted to food crops, the supply is dropping.

Fast-growing kenaf is competitive to jute in yield, cost and strength. Yields in Cuba are expected to be about one ton of fiber per acre. Its seed yields an oil comparable to cottonseed oil. Drop tests show it withstands falls that split open jute sacks. With new machinery being developed, kenaf may soon bring about a desirable revolution in the fiber world.



Long strands of kenaf hang on racks for drying in the sun. The fiber crop grows during the off season for sugar, thus will give new opportunities for employment in Cuba. Below, this loom is weaving kenaf yarn into a strong sack material





## Round-the-Town Car Has Air-Cooled Engine

Remember the Hall flying automobile? Its inventor, T. P. Hall of San Diego, Calif., has designed and built a lightweight rear-engine car for about-town transportation. It is powered by a 10-horsepower air-cooled aluminum engine and the transmission is connected to the engine through a fluid drive. Both rear wheels are chain driven. Not yet being manufactured, the car travels 45 miles on a gallon of fuel and will go 45 miles an hour. It is 158 inches long and 58 inches wide, carries two or three persons and has compartments for storage behind the cushioned seat and in the forward section. Aluminum-alloy and plastic materials kept the weight of the car down to 775 pounds. Excellent visibility is afforded through a big safety-glass windshield.

## Automobile Heater-Cooker Operates From Manifold

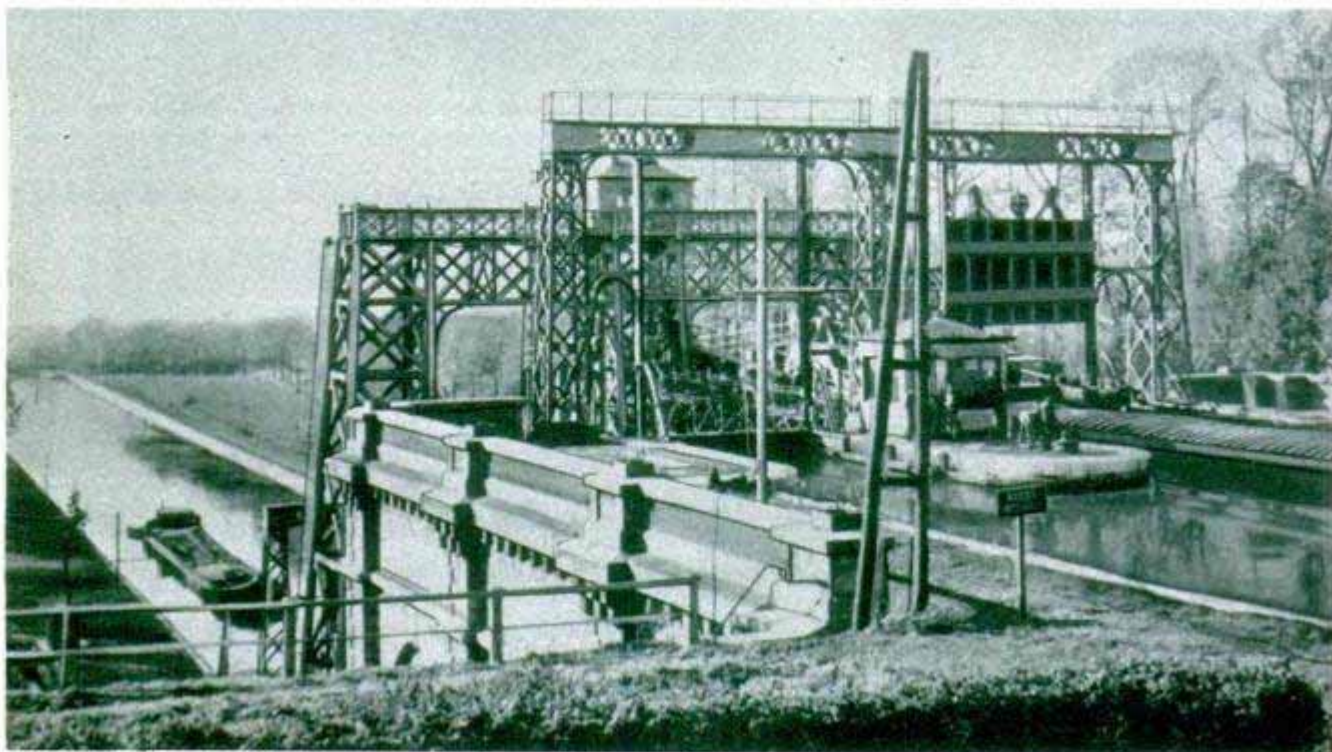
Manifold gas operates a heater-cooker which will serve four persons a complete meal. Designed for use in automobiles, the cooker is adaptable by sizes to airplanes, busses, trucks or boats, and is said to be safe. A cooking tube is inserted into a larger

tube, resembling a rural mailbox, which is equipped with coils through which the manifold gas circulates to produce intense heat. Dashboard controls operate valves which increase or decrease the degree of heat as desired.

## Floor Please? Barges Ride Elevator on Canal Trip

Barges now are lifted by elevator during their trip up a southern Belgium canal. The elevators hoist the 300-ton barges 48

feet from the lower to the upper level of the canal. The elevator ride requires only 20 minutes.

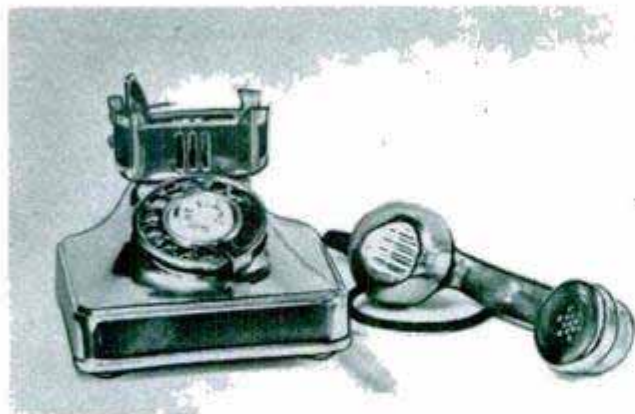






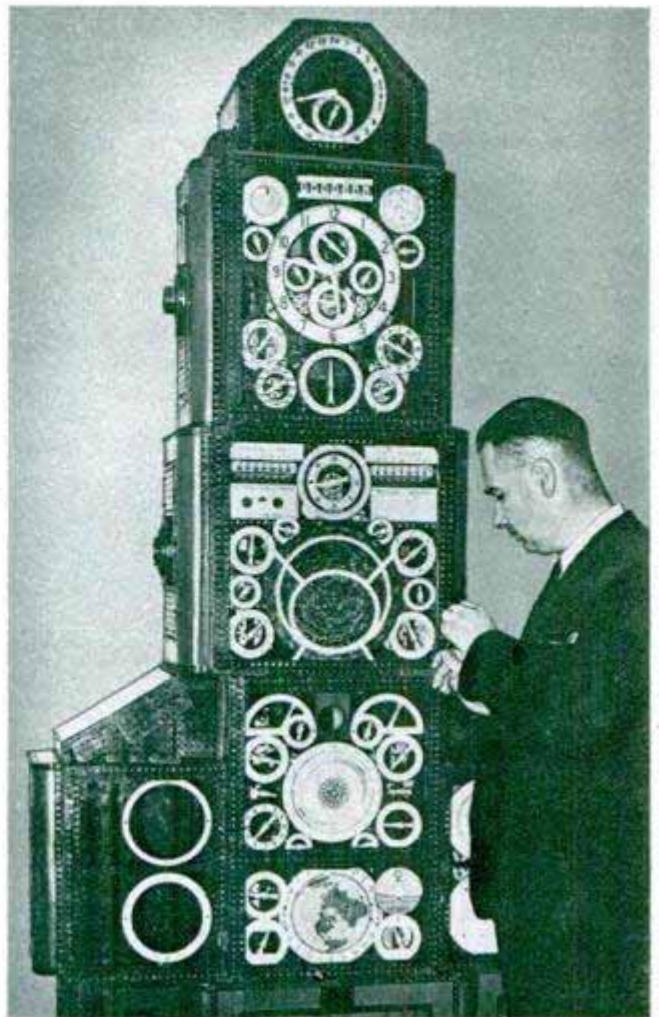
### Remote Radiation Detector

Shaped like a long-barreled pistol, a new radiation detector has a probe that is four feet long to permit detection of radiation from a distance. Developed by General Electric engineers, the detector has an electronic tube at the tip of the long probe. Attached to the tube is a phosphor, a material which gives off light in the presence of radioactivity, and this light is converted into electrical energy to activate a meter mounted above the pistol-type grip. The detector is powered by batteries carried in a box fitted with a strap so it can be slung over the operator's shoulder.



### Dial a Light

From Japan comes a novel smoking accessory—a cigarette lighter that looks like a telephone. Measuring only 2½ inches long and 2½ inches high, the little telephone has a miniature receiver and a dial. The smoker lifts the receiver off the hook and spins the dial, which releases a spring-type lid and ignites the wick. The lighter is chromium plated.



### Clock That Tells All

Almanacs are unnecessary in the house of John Nowlan, a British chemist, who has built a clock that tells just about anything you would find in those handy reference books. It took him four years to build the giant machine that stands in his living room. Among the data provided by the multidialed clock are the time, day, date, season, times of sunset, sunrise, moonset and moonrise, phases of the moon, dates of next eclipse and known comets. It also gives the state of the tides in any important coastal town in England and shows what stars and planets are visible overhead at any given moment. The clock also shows what time it is anywhere in the world as well as the correct time for Nowlan's town of Becontree, Essex.

¶ Termites come from a big family, according to the Smithsonian Institution, which has issued a catalogue listing a total of 1932 species of these wood-eating insects.

Popular Mechanics provides two sources of further information concerning articles published in each issue: the WHERE-TO-BUY-IT INDEX, starting on page 10, and the WHERE-TO-FIND-IT INDEX, available without charge from our Bureau of Information, 200 East Ontario Street, Chicago 11



## Awning "Garage"

Ventilated aluminum awnings are doubling as car port and patio coverings in areas where winters are not severe. They are fireproof and have a baked-enamel finish that can easily be cleaned with a damp cloth. A patented design feature keeps summer temperatures under the awning 10 to 20 degrees cooler. Custom-made, they also serve as canopies and as protection for windows, porches and store fronts.

## Color-Film Processor Is Fully Automatic

Inconsistent reproduction, one of the chief bugaboos of color photography, is believed solved by a new electrically controlled processor. Racks of film are automatically "dunked" in a series of 12 tanks, each holding 3½ gallons of solution that is automatically agitated for prescribed lengths of time. Duration of immersion is fixed by presetting individual timers above each tank, and the temperature of the contents is held constant at the ideal 68 degrees Fahrenheit.



U. S. Air Force photo

## Folding Trailer Is Its Own Ramp

Providing its own loading ramp, a new heavy-duty trailer eliminates the need for cumbersome cribbing and planking. The "gooseneck" front end of the trailer unfolds to provide a smooth, gradual ramp for unloading. The trailer is available in capacities up to 100 tons and only one man is needed to operate it.

☛ There were 15,478,570 licensed fishermen in the United States in 1949 with Michigan and California in the lead.





Relaxing after a day's tramp are the author, right, and a companion. Their two-man tent weighs only 3½ lbs.

## BACK-PACKING in the MOUNTAINS

**E**VERY YEAR the army of back-packing vacationers is growing and the recruiting — all unintentional — goes something like this.

"Joe, how about telling us about your pack trip last summer and that little trout lake you found where you caught your limit in 10 minutes."

Joe grins and his eyes shine with fond recollection. "You mean the place where we filed the barbs off the hooks and caught 'em just for fun and tossed them back? Oh, I'll never forget that day. It was the same morning the bears almost got our bacon."

By this time Joe has the attention of everyone in the group and they lean forward eagerly to hear a good yarn. Back-packing is another word for guaranteed good vacation stories. It is adventure with an old-fashioned dash of something close to nature and is a far

cry from resort hotels, summer cottages by a lake or 5000-mile automobile trips.

After Joe has reported on the fisherman's paradise he discovered and how the bear almost—but not quite—got the bacon out of a tree, someone wants to know:

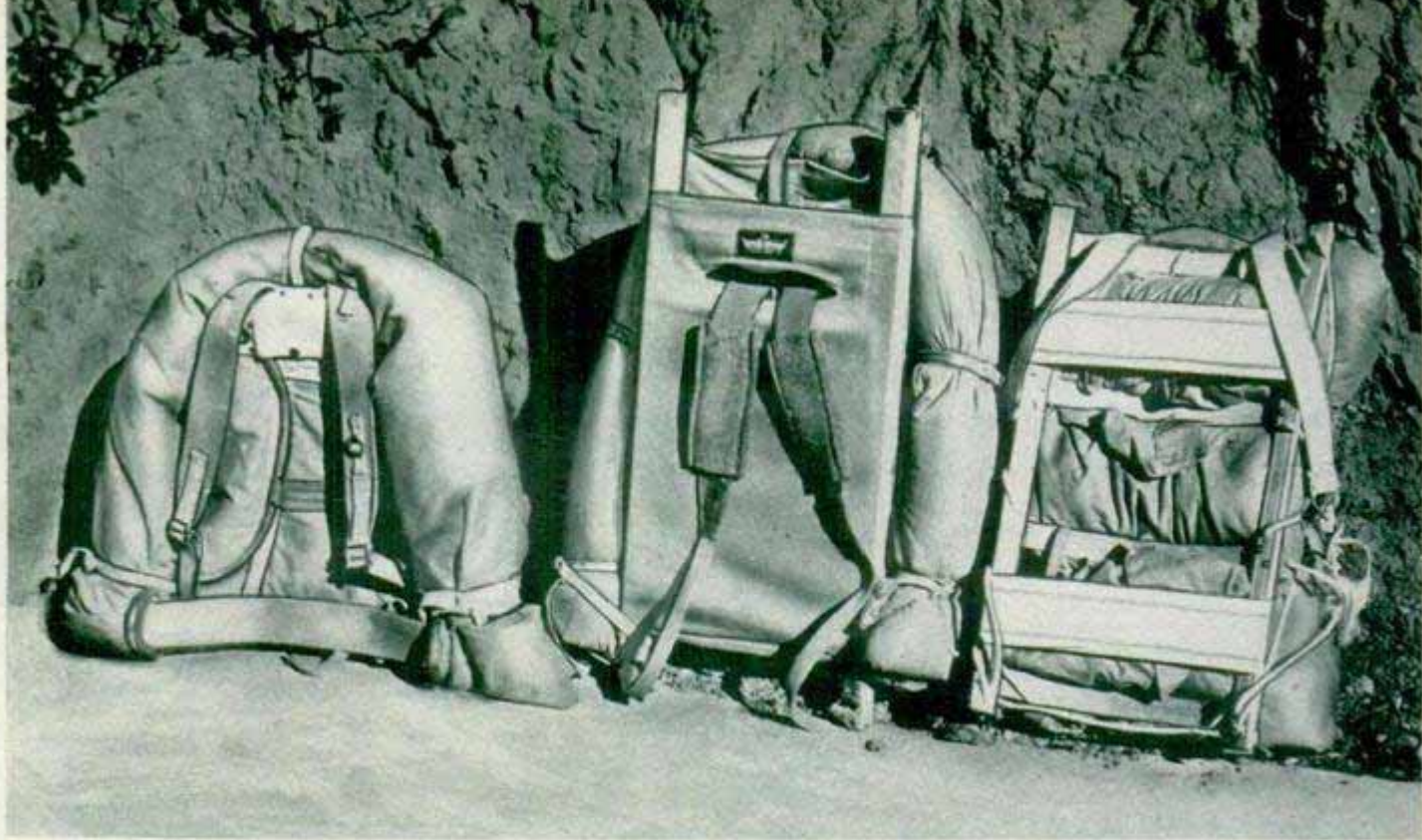
"You mean you and your friend walked on this trip and carried all your stuff on your back?"

"Sure," Joe says. "We were gone 10 days. Both of us carried 28 pounds of gear in addition to 20 pounds of food. We figure two pounds of food per day per man. If you have a good pack your back isn't nearly as tired at night as sitting behind a steering wheel for 10 hours."

Later in the evening you will see Joe cornered by two or three converts who are taking notes on the backs of envelopes. They are smart because back-packing into the mountains is not just a case of slinging a lot of miscellaneous food

By Charles McDermind





Left to right, Army rucksack, Trapper Nelson pack described in this article, and Boy Scout type pack board

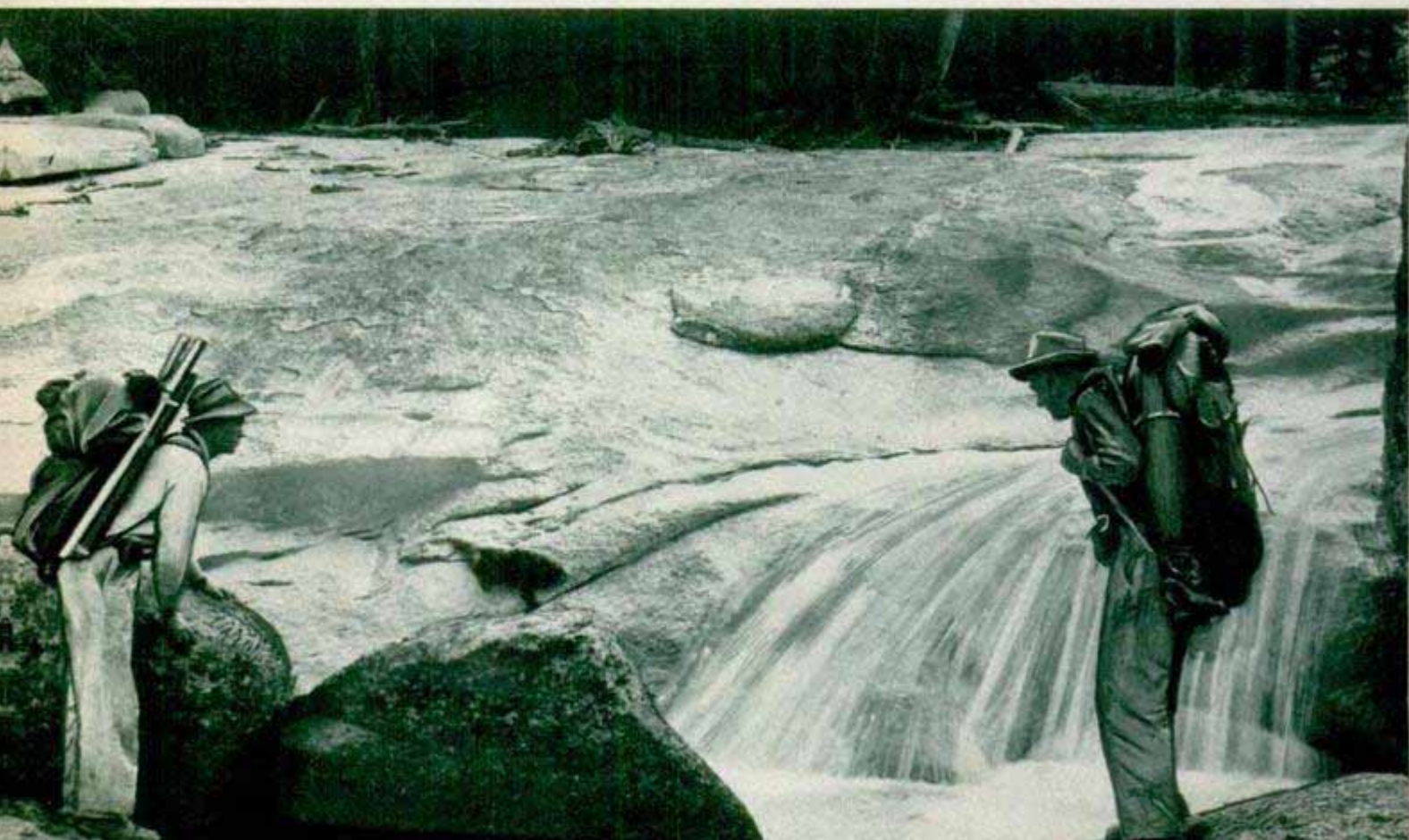
and equipment over one's shoulder. If you have taken the wrong stuff, or forgotten salt or a raincoat or any one of a hundred necessary items, it's just too bad.

First thing you'll need is a pack board. One of the most practical and comfortable consists simply of a pair of wooden uprights connected by three curved horizontal ribs, like rungs on a ladder. Canvas is drawn

over the wooden frame and tightened by a lacing. The curved ribs, arching away from your spine, keep tin cans, skillets and other hard objects from digging into you. Equipped with broad pack straps and a waterproof sack, the board handles loads up to 60 pounds comfortably.

War-surplus rucksacks, designed for ski troops, are not recommended. They keep

Back-packing takes you to virgin trout streams. Trout rods in cases are taped to uprights of the pack board





**Left, here's what one man can carry comfortably with a pack board. The load includes a 3½-pound tent and a 5-pound sleeping bag. Right, on cold nights you heat rocks around the fire and take them to bed with you**

the weight low to help the skier balance, but when you're tramping you'll want the weight high for comfort.

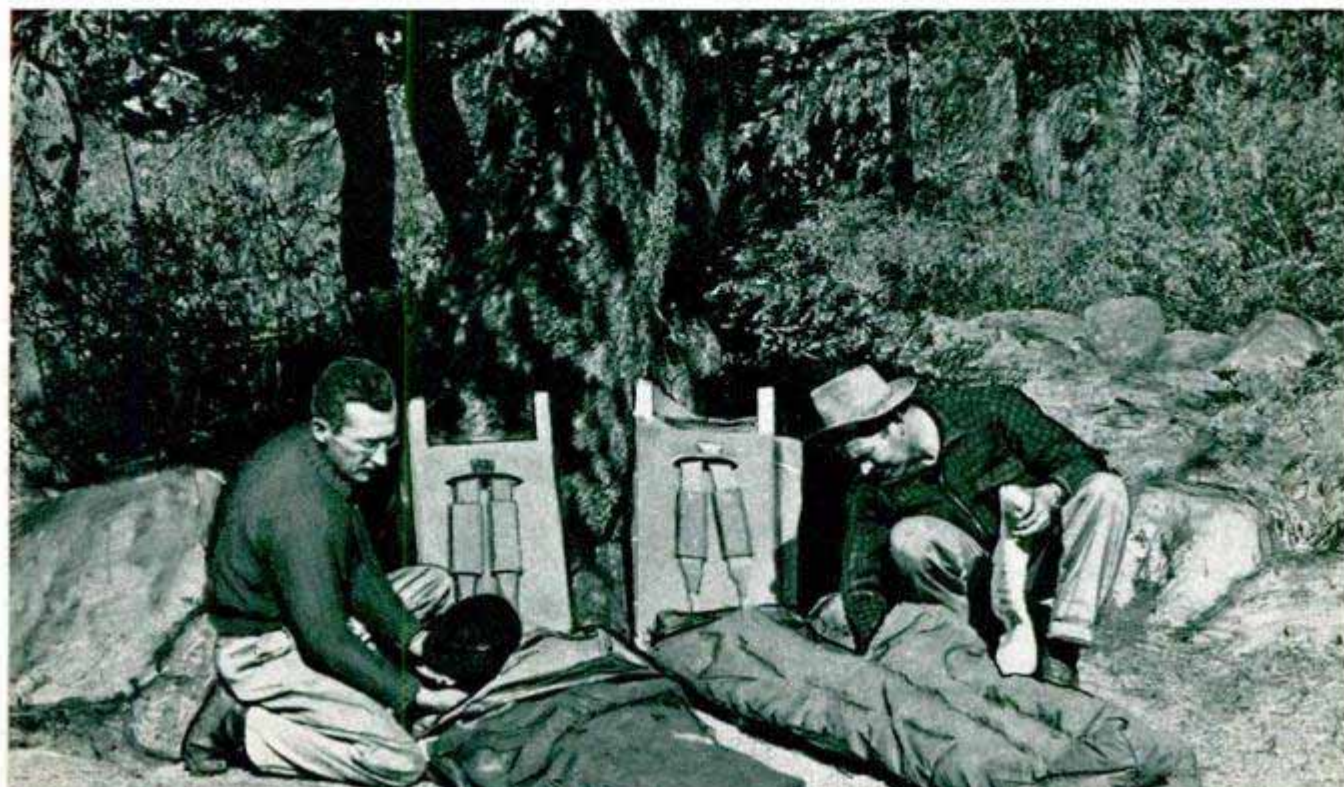
Next on the list is a light tent or tarpaulin. Surprise storms frequently develop in mountain country and you can't risk being caught shelterless. Army ponchos, being light and waterproof, are fine for this. Nylon tarps are also good and are available in many surplus stores. Light tents are available—some weighing as little as 3½ pounds. Don't forget that you'll need a lightweight raincoat if you carry a tent instead of a poncho.

Your sleeping bag should be of the streamlined, mummy shape to eliminate unnecessary weight. Make sure its filling is down, or a mixture of down and ordinary duck feathers, to keep its weight below six pounds. Wool and kapok bags are too heavy for back-packing. On cold nights you can keep warm by heating a couple of rocks for an hour or so and wrapping them in a towel before slipping them into your "sack."

Be careful with clothing selection. At altitudes above 7000 feet, even on bright days, winds are cutting and it's always cold

(Continued to page 250)

**Warmed and wrapped in towels, the rocks keep you warm through the night. Pack boards are seen in rear**



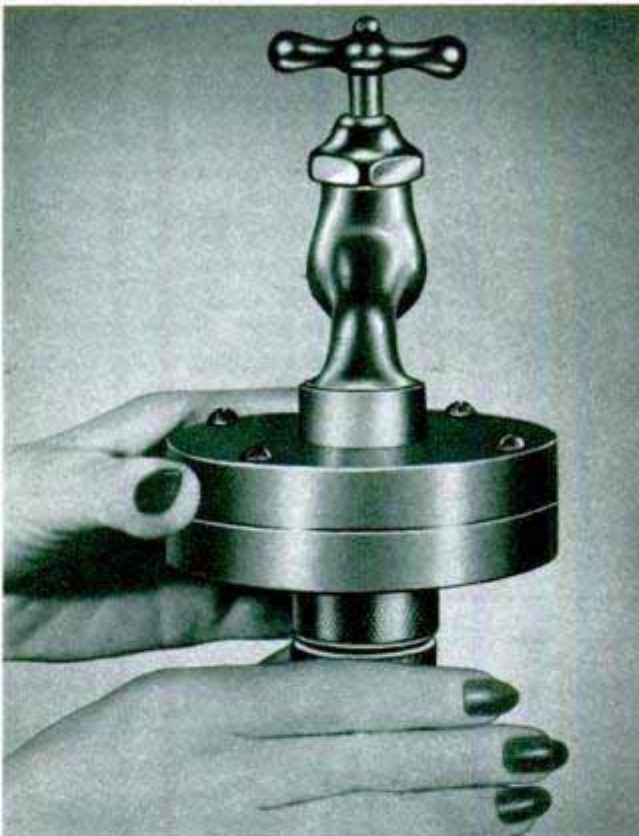


## Student's Home Is a Bus

College student David McNair of Winnetka, Ill., moves his room to and from the University of Illinois campus every day. His home is a 23-foot discarded bus which he bought for \$350, overhauled and remodeled. Inside the bus are a bed, stove,

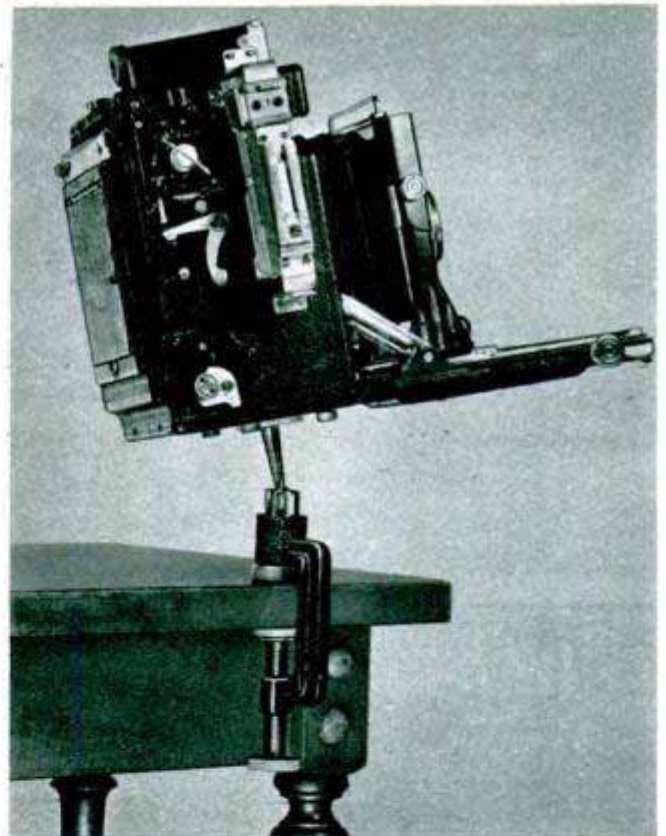


desk, bookcases, sink and storage facilities. But the feature is a full-size piano which the young music student uses in his studies each day. At night McNair parks on a farm outside the university town. In the morning he drives to the campus where he can study, practice on the piano, eat or sleep only a few steps from the classroom.



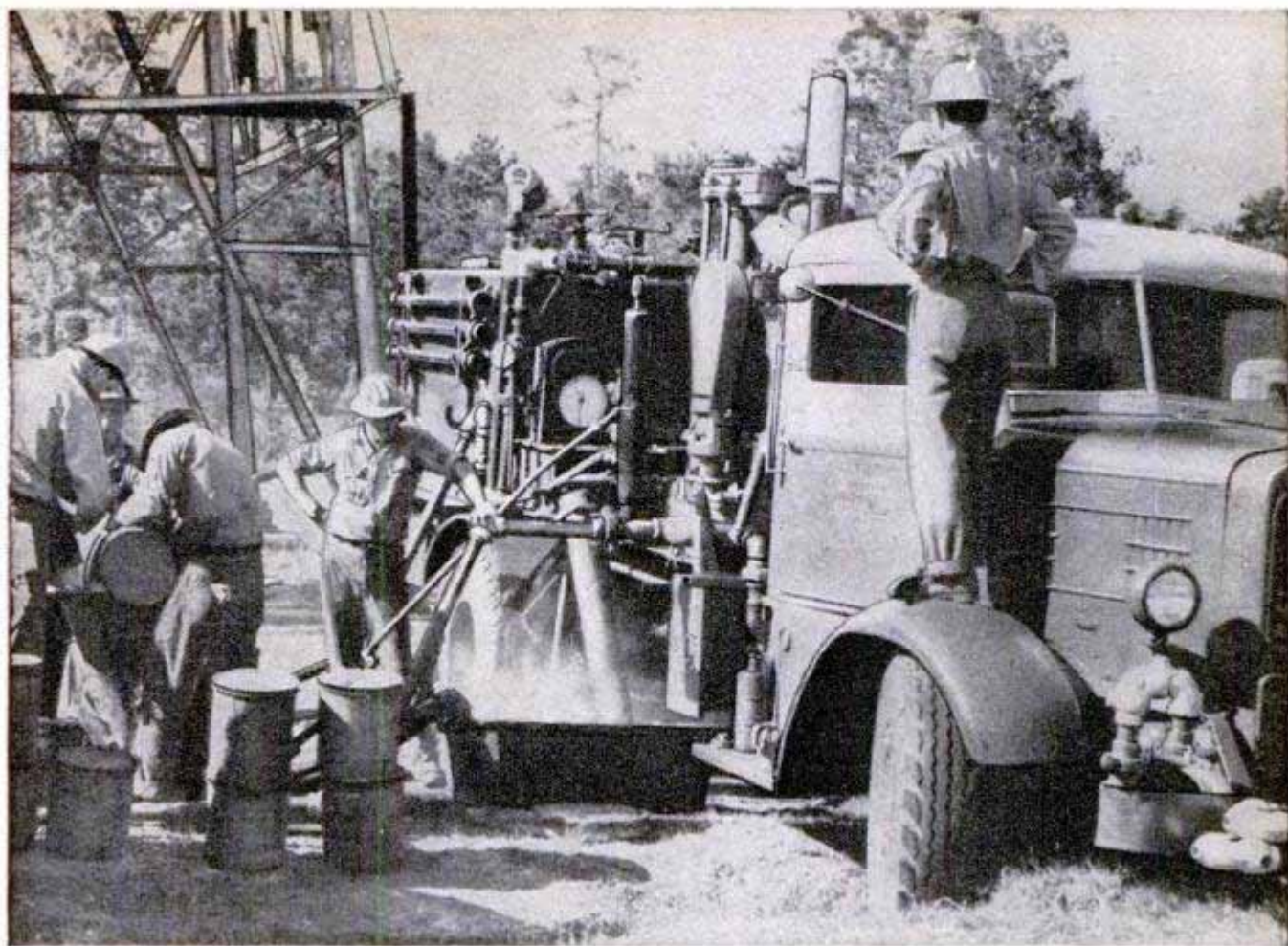
## Darkroom Filter

Photographic negatives are protected from grit damage by a simple filtering device that screws on the faucet. Filter pads, which can be replaced in two minutes, will efficiently filter the wash water for as much as six weeks, depending upon the amount of use. By using the filter, the photographer does not have to swab his negatives before drying and is assured of crystal-clear water at all times.



## C-Clamp "Tripod" Has Swivel Head

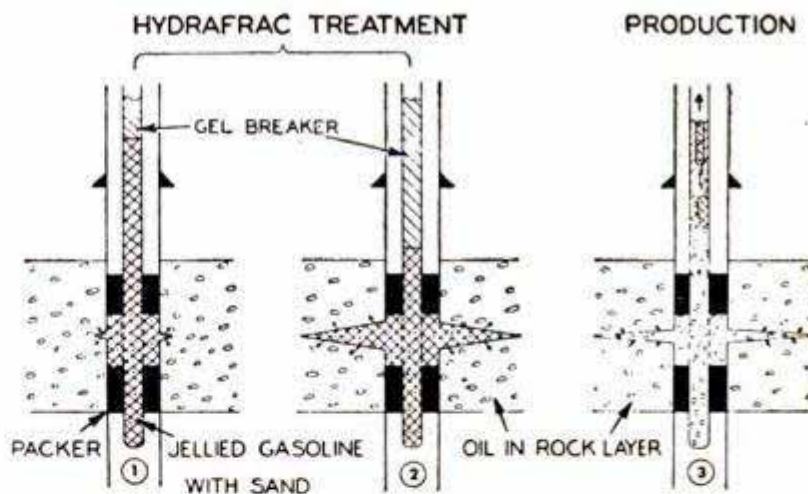
Clamped to a table, chair or car window, a swivel-head camera support provides a means of taking pictures at a variety of angles and frequently eliminates the need for carrying a tripod. The grippers on the C-clamp support are padded with rubber to prevent scratches. It also can be used as a swivel top for any standard tripod as there is a threaded socket in the knob end of the take-up screw.



## Jellied Gasoline Gets Peacetime Job

Jellied gasoline—which looks like thick mush and was used to make terrifying incendiary bombs in World War II—has been put to work in the oil fields. It is used to “crack” rocks thousands of feet underground and make the oil flow into the hole being pumped. This system, known as Hydrafrac, was developed by the Stanolind Oil and Gas Company and may substantially increase the amount of oil recovered from many formations. Jellied gasoline is pumped into a well under high pressure which splits the rock formations. The sand suspended in the mush keeps the cracks from closing after a liquid chemical breaks the mush up into a liquid again. The gasoline that was used in the gel flows out with the oil. Engineers in Stanolind’s Tulsa

Workers mix powder with gasoline to form the thick mush which is pumped into the well. Drawing shows: (1) jellied gas under high pressure; (2) it opens a big crack in the rock layer; (3) gel breaker liquefies mixture. Gas and oil flow out together

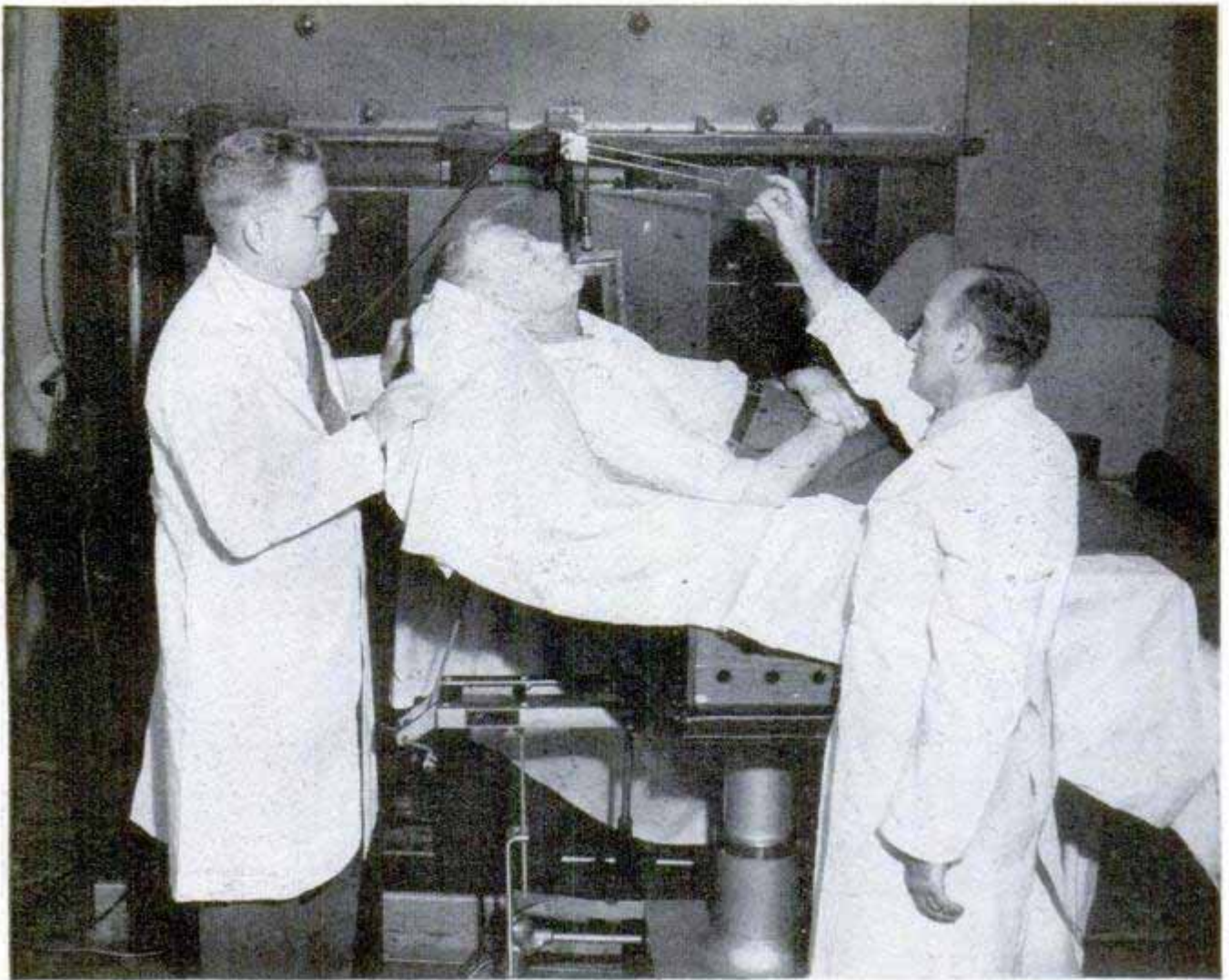


research laboratories report field tests with excellent results. At Frannie, Wyo., the Hydrafrac treatment increased production on one well from 60 to 160 barrels per day. This well has kept up the higher production for the last year.

## Plastic Envelopes Help Plot Water Currents in Lake Erie

Waterproof envelopes made of polyethylene are helping investigators study the water currents in Lake Erie. The envelopes, six inches long, won't break and don't blow in the wind. More than 1500 of

them have been stuffed with self-addressed cards and set adrift. Finders have mailed 600 of the cards to the investigators, who compute water currents by noting the place of release and recovery of each of them.



Positioning a throat-cancer patient for treatment by 25-million-volt betatron at the University of Illinois

## NEW MACHINES FIGHT for

By Aubrey O. Cookman, Jr.

**T**HROUGH a narrow slit in a thick barrier, I watched the first treatment of a cancer patient with a betatron. Three feet of concrete and four inches of lead shielded me from the dangers of scattered radiation.

A few short bursts of noise from the super X-ray machine—less than 10 minutes and the treatment was over. More were to follow, every other day, if he lived.

The patient was old, 72, and illness had piled the marks of even more years on a thin body. He had an inoperable throat cancer, doctors said, that would soon suffocate him if left untreated. The big machine at his side dwarfed the frail old man.

His eyes and those of his wife, a small woman who had led him into the room, mirrored the long odds against recovery for advanced-cancer cases. This experiment, on the University of Illinois' vast Chicago medical campus, was a desperate last-ditch effort.

Fourteen weeks later that man's ulcer-

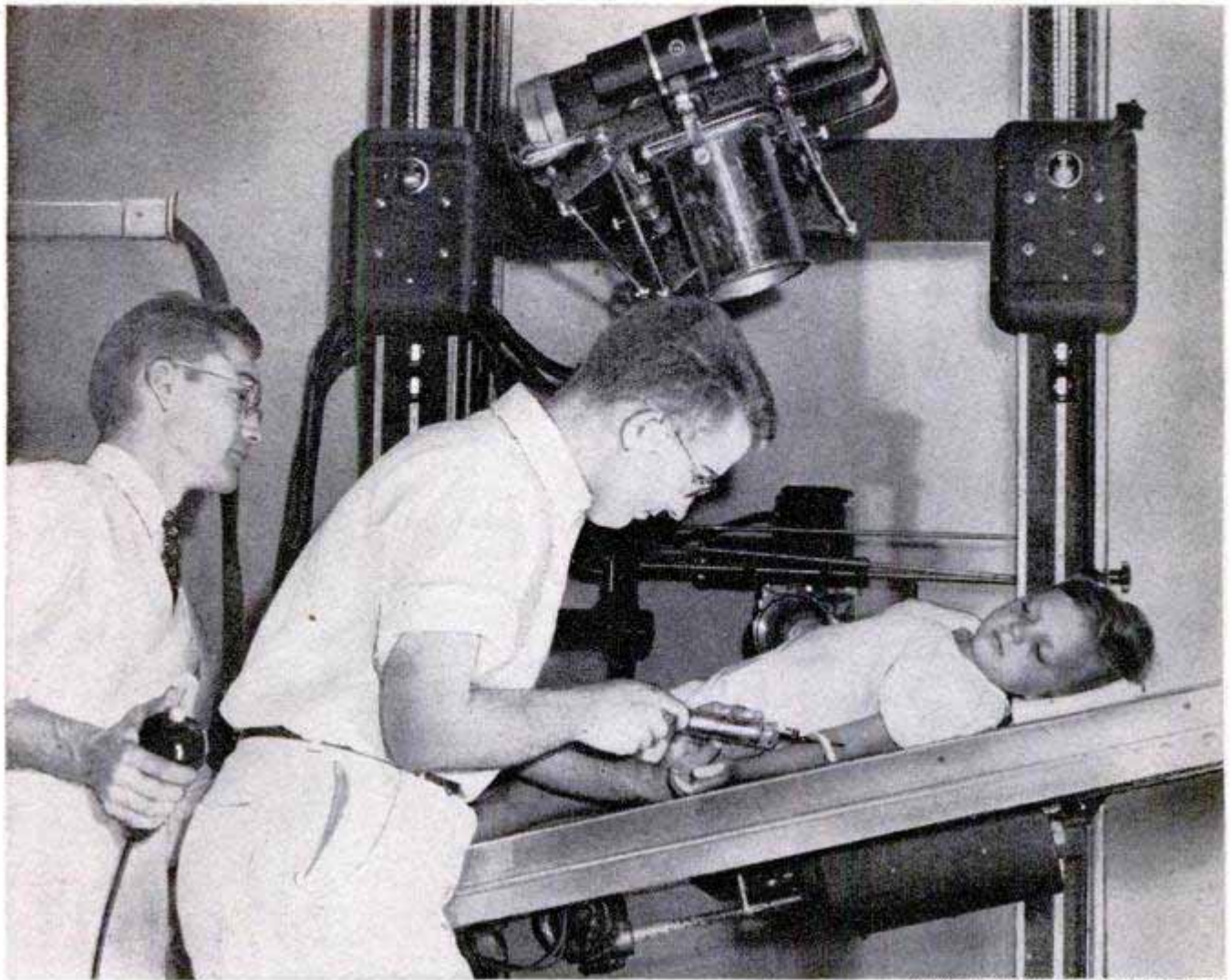
ated throat was healed. The betatron—a giant machine with a 25-million-volt wallop—has scored in the great world fight against cancer.

Dr. Roger A. Harvey, head of the radiology department at the university, won't say he's cured—yet. The medical profession acknowledges a "cure" only after five years of no recurrence. Doctor Harvey admits the results are encouraging, but hastens to point out that the university has had too few cases to properly evaluate the betatron in cancer therapy.

Three other cancer patients using the betatron give additional reason for hope. With afflictions centered in the jaw, throat and brain respectively, their condition ranges from arrested to uncertain.

Betatron rays are superior to X rays because they project their greatest intensity—and curative powers—well into the body, at the point actually being treated. The Illinois instrument, with the most powerful





American Medical Association photo

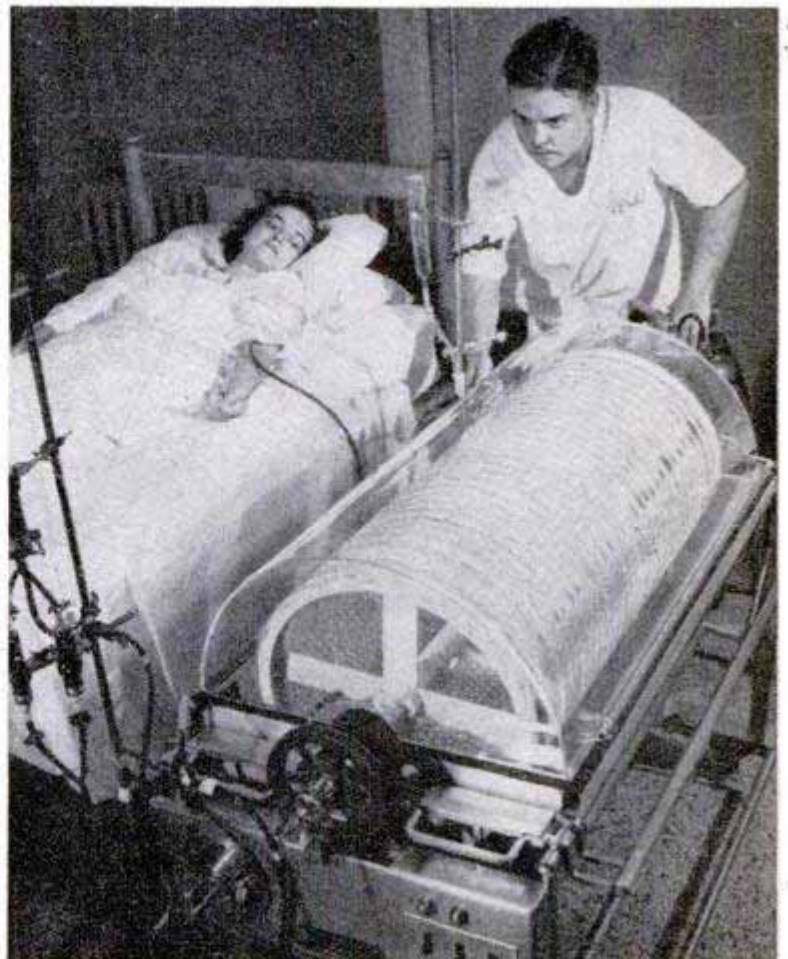
To detect defective hearts in children, wartime aerial camera (beneath table) makes 20 X-rays in 10 seconds

## your HEALTH

medically used voltage in the world, can be utilized with complete safety. Conventional X-ray, which develops its maximum intensity at the surface of the skin, can damage healthy tissue when used at high voltage.

A long list of electrical and mechanical newcomers, like the betatron, are helping man's fight for better health. Every year the equipment exhibits at the American Medical Association's convention attract more attention and use more space. The campaigns against cancer, heart ailments and polio — all widespread killers — have been among those benefiting most from the new aids.

An electrical detection method, taking only about 25 minutes, has been found to be about 85 percent



Allis-Chalmers photo

When the real ones aren't working, mechanical "kidney" removes wastes from the blood



Above, diagnoses of heart ailments can be made by measuring flow of blood in the fingers and toes. Below, a child hears for the first time over a new auditory training unit built especially for schools

accurate in discovering cancer in the female genital tract. The originators, Dr. Harold S. Burr of Yale University and Dr. Louis Langman of New York University, believe it will apply to all forms of the disease.

It is based on the same principle used in making electrocardiograms of the heart and brain waves in the head, that the body has electrical activity. Burr and Langman reasoned that healthy, nonmalignant tissue must have different electrical activity from cancerous, malignant tissue, and the contrast would show in instrument readings.

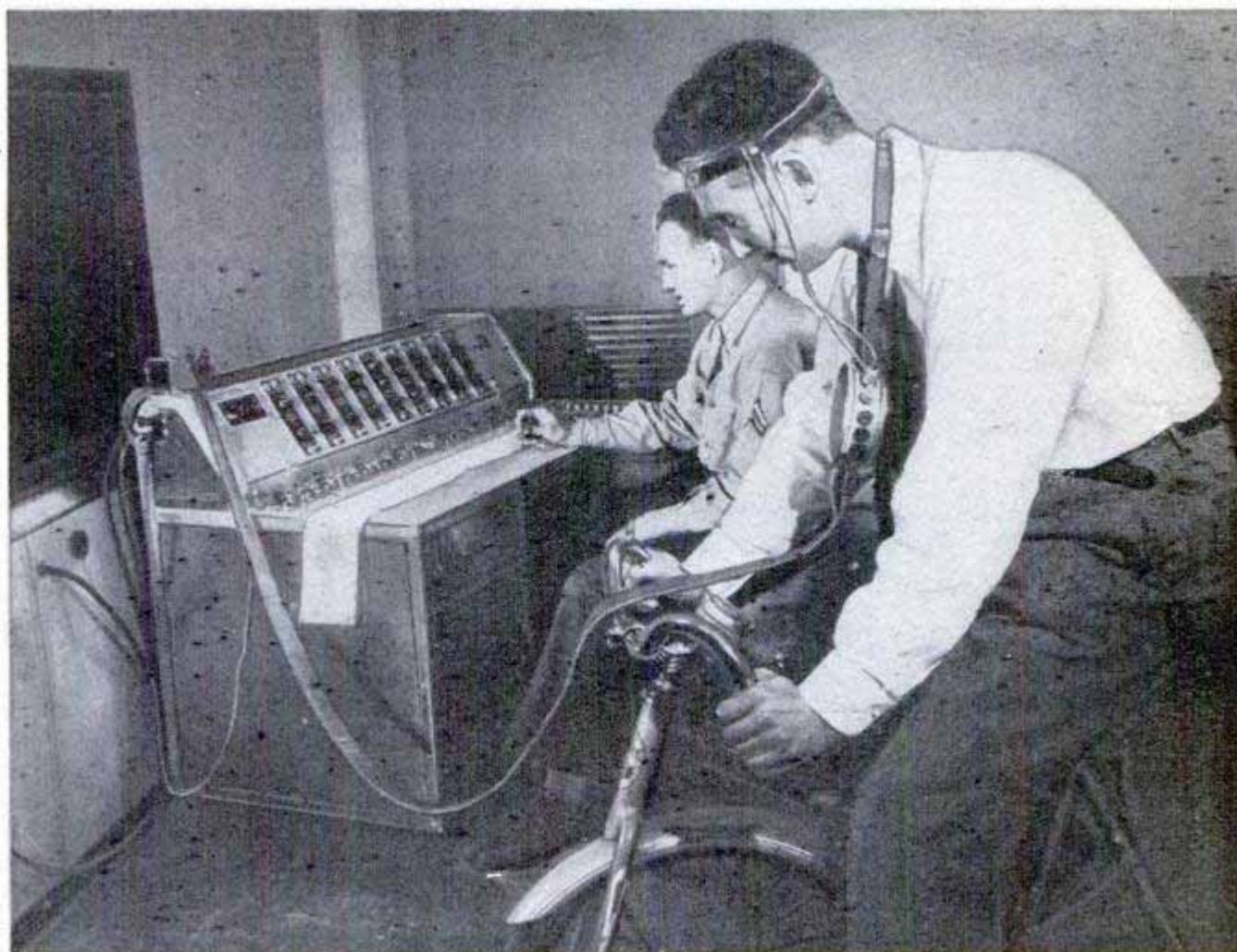
An associate aided the next step by designing equipment to take such readings, using a microvoltmeter. On one side are electrodes, which are attached to the patient's abdominal regions, and on the other side is a photoelectric recorder. Used on 616 patients, the simple test proved correct 611 times.

A mechanical "substitute kidney" prevents death from uremic poisoning when the human kidneys aren't able to carry poisonous wastes from the body. Its main part is a large cylindrical drum, around which 140 feet of cellophane tubing are wound spirally. The drum revolves constantly in a bath of rinsing fluid.

A small tube in the patient's forearm carries blood to the cellophane tubing. As



*W. H. H. Co.*



the blood moves along, tiny particles of poison seep through the tubing into the rinsing fluid. As much as a pound of poison may be removed by the time the blood re-enters a vein in the patient's leg or arm. The first "kidney," donated by its builders — the Allis Chalmers Manufacturing Company — to Milwaukee, Wis., is expected to save 20 lives yearly in that city alone.

Harvard's School of Public Health, where the "iron lung" was born 20 years ago, has come up with another remarkable breathing aid. Called an electrophrenic respirator, it is about the size of a portable radio and operates on ordinary house current. It induces breathing by sending an electric current through a nerve in the neck to the breath-controlling muscles of the diaphragm. Smaller and simpler to operate than other respirators, it is not intended to replace the iron lung, but is useful in some cases where the lung is ineffective. In bulbar polio, for

**Above, cardiac conditions and epilepsy can be diagnosed over the telephone with the aid of a sensitive device that is hung around patient's neck while he exercises**

**Below, a new camera that develops, fixes, washes and dries can turn out accurate cardiograms in approximately four seconds**

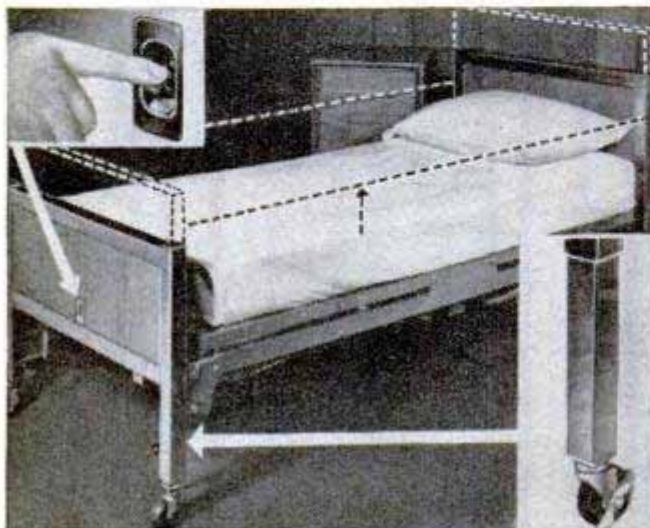




Above, a "baby lung" is helping doctors learn why premature infants breathe in short, irregular gasps



Above, screen shows path of tube being inserted in heart to detect abnormalities. Below, the flick of a switch smoothly hoists an electric bed, in use at Chicago's Passavant Hospital, to examination height



— example, it suspends irregular breathing—something the iron lung cannot always do—and starts regular, controlled respiration. Compact and light, it can also be rushed to the scene of accidents, to revive victims of drownings, asphyxia and electrocution.

Researchers at the University of Michigan are using a miniature iron lung to learn why premature babies breathe in gasps or jerks. It apparently is caused by oxygen not reaching the brain tissue which controls respiration. In the school's lung, with an atmosphere up to 80 percent oxygen, 9 out of 10 early babies quickly develop normal, "adult type" breathing.

Even normally born babies of the future may not have to put up with the resounding slap usually administered in the delivery room to start breathing. A "resuscinette," operating on the simple mechanical process of expanding oxygen, will start the lungs operating. The machine adjusts itself to any size lung and also provides the correct heat and humidity for the tiny infants.

Almost positive diagnoses of heart disease can be made from supersensitive electronic measurement of blood flow through the fingers and toes. Dozens of wires, sprawling out from a machine called a pneumo-plethysmograph to plastic cups on the fingers and toes, detect the changes. A recorder used with it, for complete analysis, correlates data on the heart rate, pulse volume, blood pressure, skin temperature and perspiration. This combination helps doctors decide when amputation is necessary by indicating whether or not the blood flow is sufficient to nourish the limb.

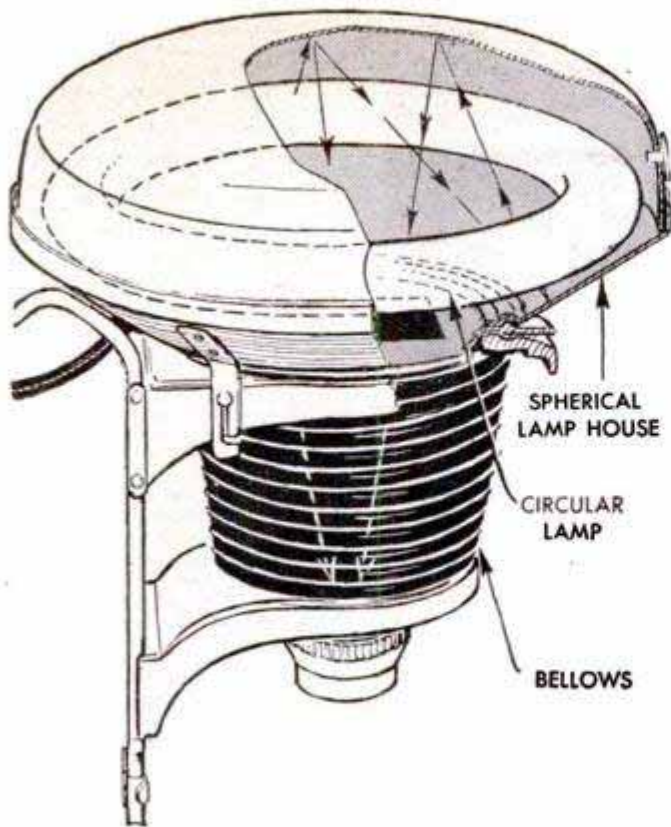
Both cardiac conditions and epilepsy can be diagnosed over the telephone with an electroencephalograph used at the U. S. Air Force School of Aviation Medicine. Hung around the neck of a patient while exercising, it permits transmission of heart waves by telephone. Patients had to be motionless with the bulky, older machines.

At Chicago's Presbyterian Hospital physicians are detecting and treating abnormalities that used to be discovered only by autopsy—too late to do the patient any good. The surgeon inserts a flexible tube into the patient's arm, watches its progress on a fluoroscope, and gradually works it through a vein into the heart. Blood samples taken there tell the exact location of the trouble. The procedure, done under local anesthesia only, is safe and painless.

Cameras are getting wider use as heart-trouble detectives. One turns out completely developed cardiograms in four seconds. The entire process—developing, fixing, washing and drying—takes place within the camera.

For children born with defective hearts,

(Continued to page 258)



### Cold-Light Enlarger Uses Circular Lamp

Using a circular fluorescent lamp inside a spherical lamp house, a new photographic enlarger combines the advantages of both condenser and diffusion-type enlargers. The lamp house, shaped like a hollow sphere, completely diffuses the light rays without ground glass or condensing lenses. Highly reflective paint inside the lamp

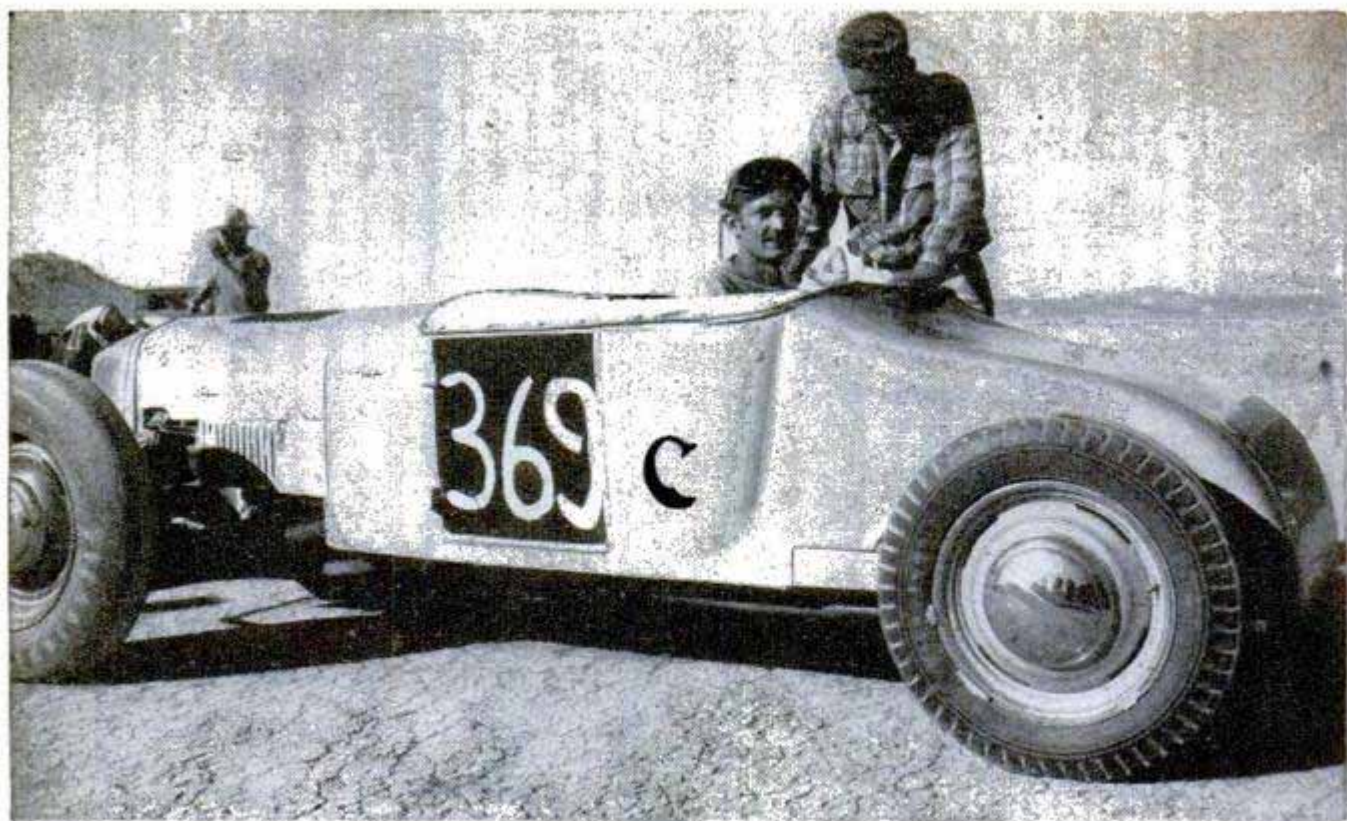
house reflects and re-reflects the light rays for even distribution. No direct rays from the lamp hit the negative because of the position of the nonflicker tube. The enlarger has approximately the same speed and contrast as the condenser type plus the ability of the diffusion type to minimize specks and defects.

### Nose Doors Simplify Work on Helicopter Engine

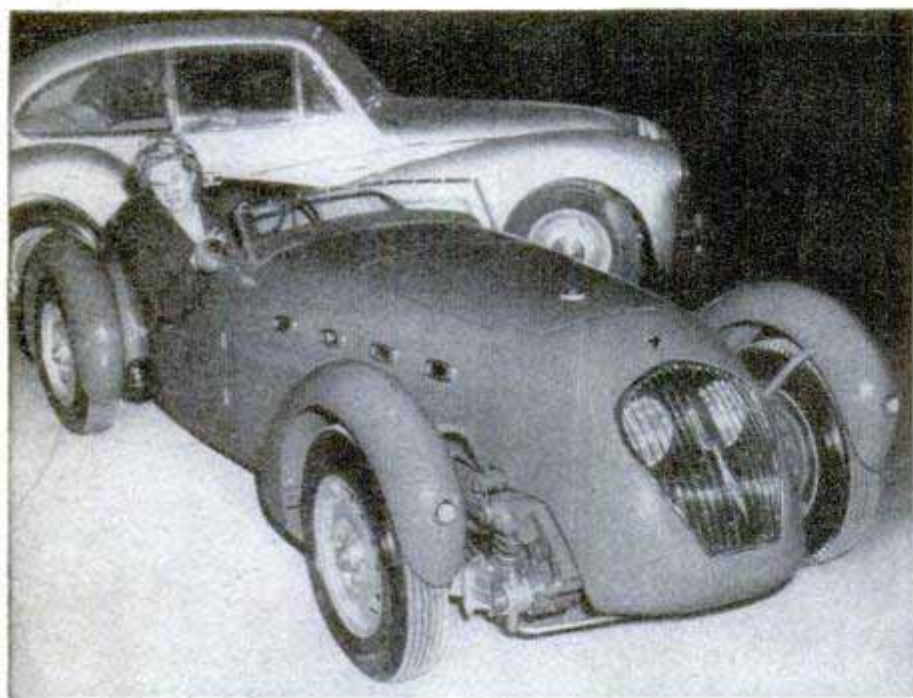
Clamshell nose doors simplify access to the engine of a new helicopter and permit maintenance work to be done from the ground. Location of the passenger-cargo

cabin in the 12-place Sikorsky is directly below the main rotor, at the center of gravity, allowing loads to be added or removed without affecting the craft's balance.





**REVERSE HOT ROD** races backward. By turning the body of his car around for better streamlining the driver made 148.51 miles per hour, 11 miles faster than his best time previously. Car is now a rear-engine job



← **SPORTS CAR**, low-slung and racy in appearance, is one of the latest autos to appear in England. It zips along British highways at 100 miles an hour

**OCEAN AUTO** designed by a Berlin man makes 40 miles an hour in the water and more than 80 when driven on the highway. After testing it in the Havel River in Germany, the designer told of plans to cross ocean in motor car



the

POPULAR  
MECHANICS



# CRAFTSMAN

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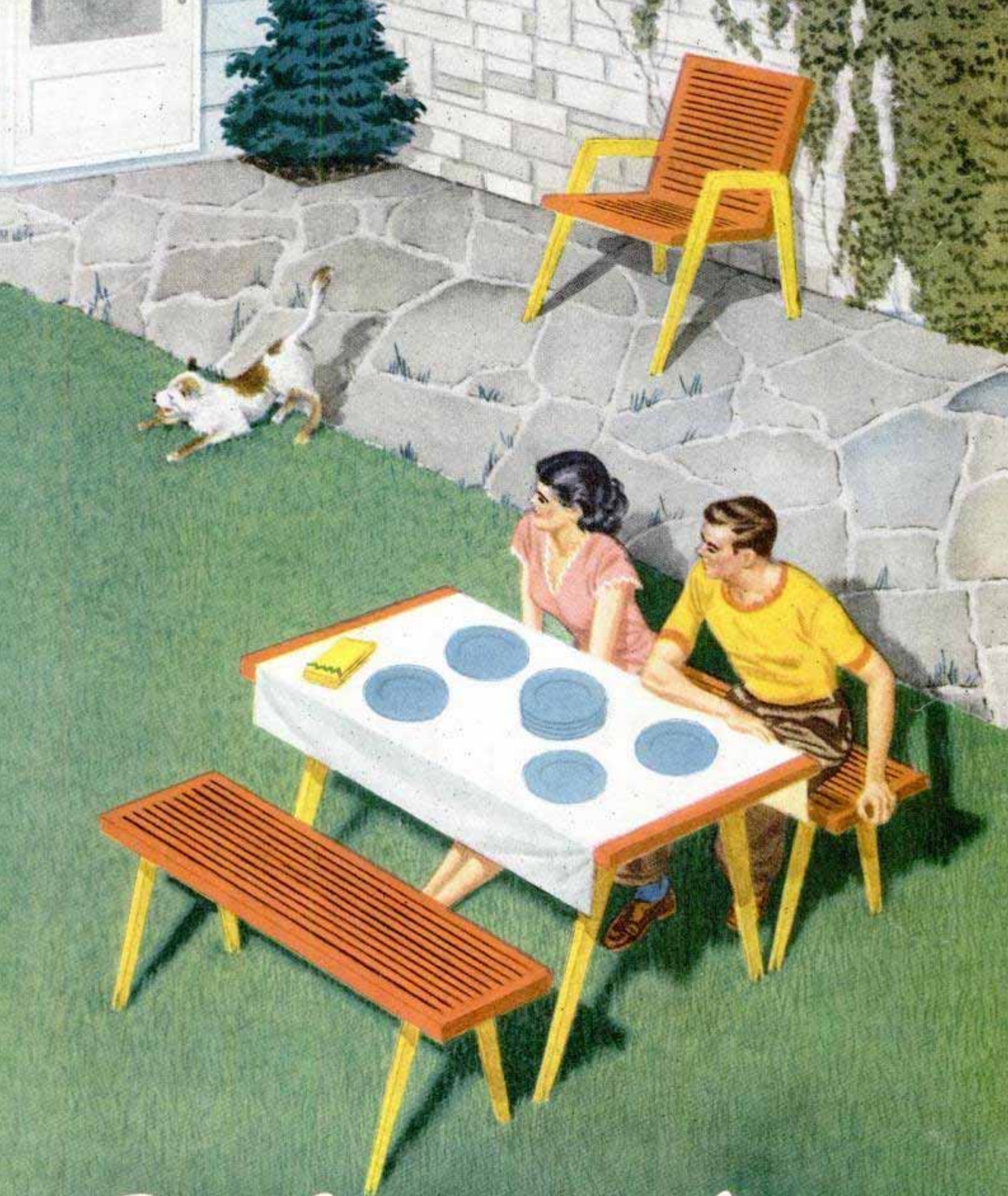


The "new look" in lawn furniture—see following pages for complete group



Korda





# *For Outdoor Living*

Here's real living-room comfort—a smart  
6-piece lawn ensemble, designed for stock lumber  
and ready-made cushions of weatherproof plastic

Blueprint # 1120 - 2.00  
 6 pieces of lawn furn.

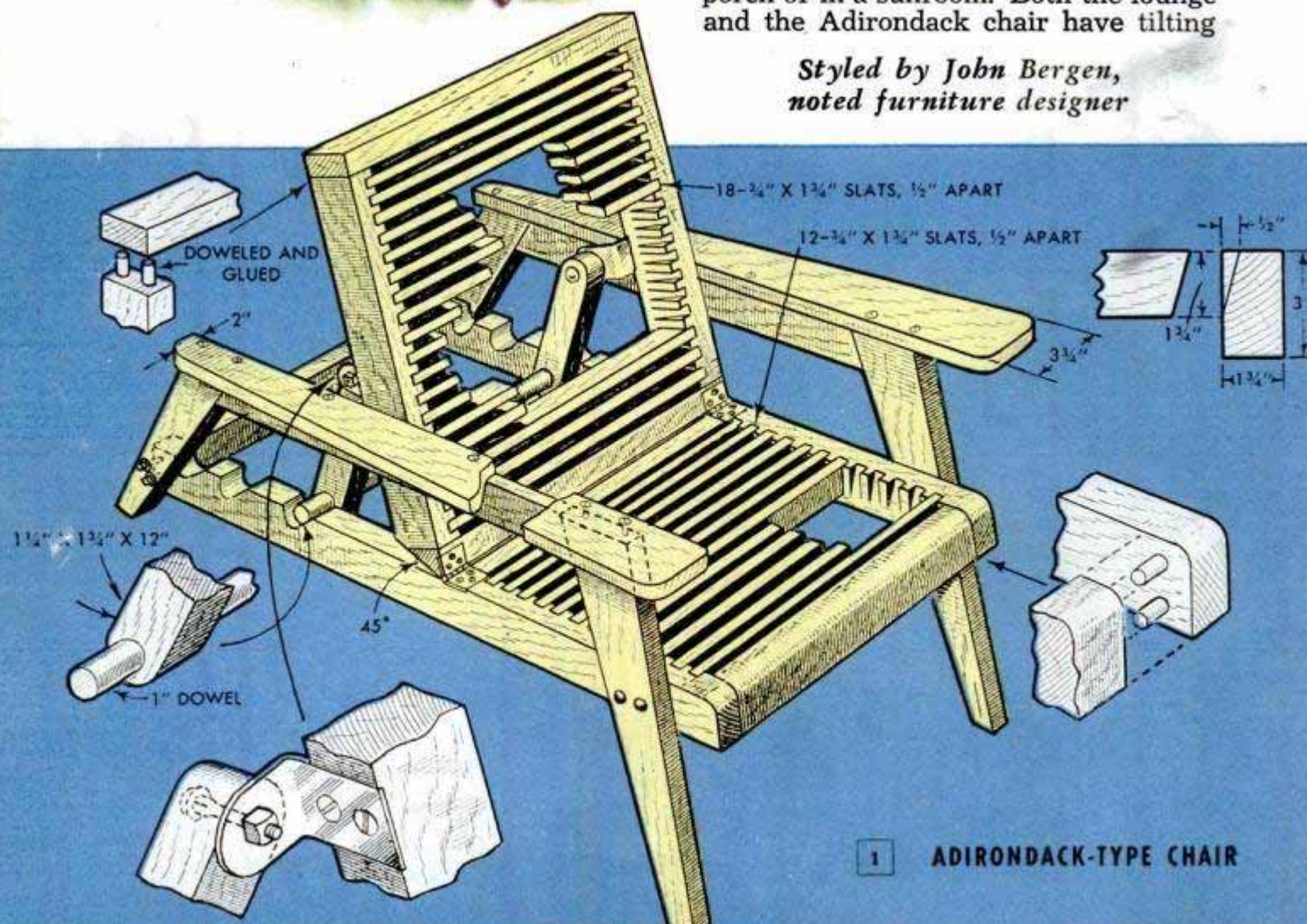
# "New Look" in LAWN FURNITURE

By Wayne C. Leckey

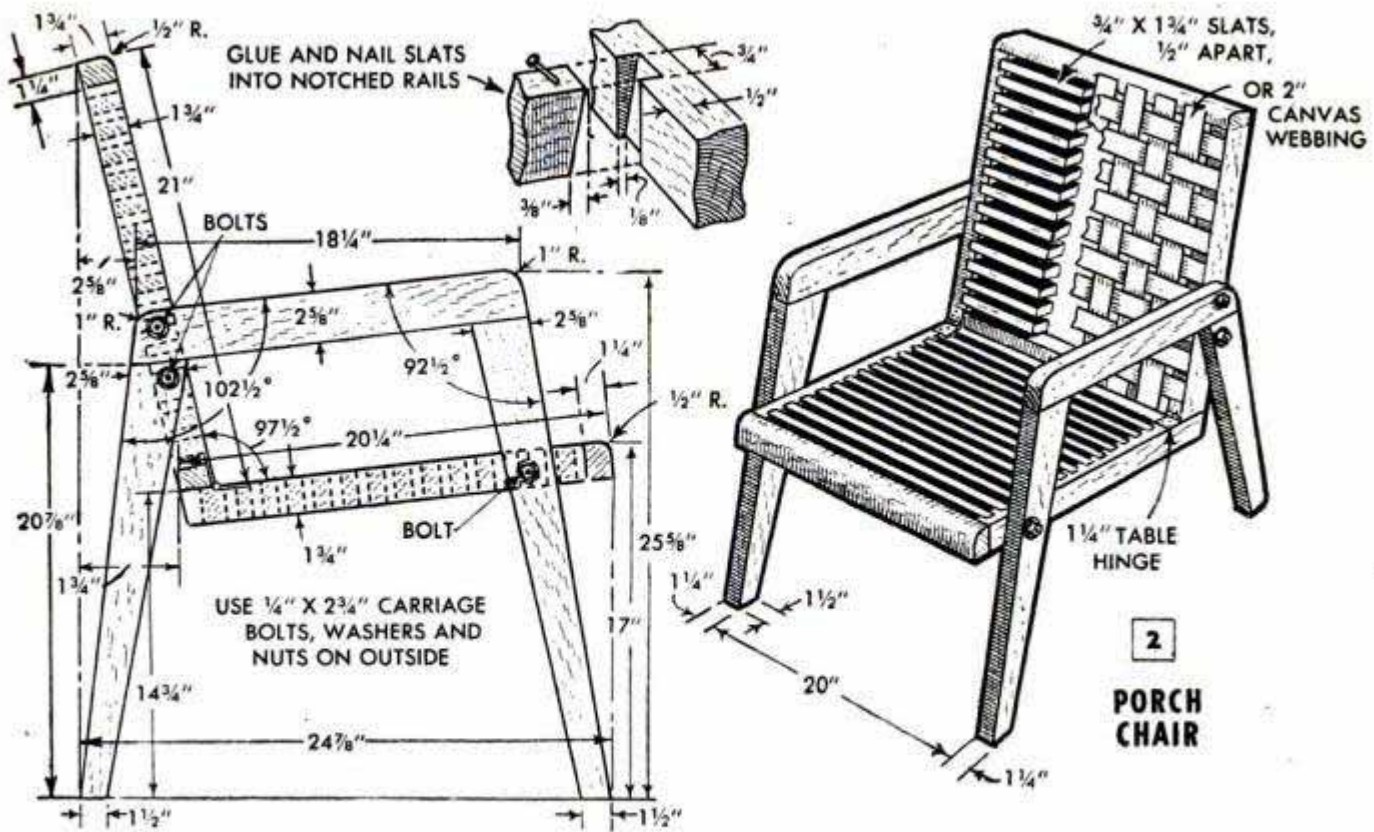


NOT SATISFIED with presenting the commonplace in outdoor furniture, the craft editors of *Popular Mechanics* commissioned a well-known furniture stylist to come up with something new and exciting which would feature knockdown construction to lick the problem of winter storage. Gay, comfortable and easy to dismantle, this striking lawn furniture incorporates the use of ready-made waterproof cushions. These can be purchased from department stores in sizes to fit the various pieces of the group. Shown in full color on this and the preceding pages, the complete ensemble features six pieces, including an Adirondack-type chair, porch chair, serving cart, garden lounge, porch glider and a table-and-bench set. Several of the pieces, such as the porch chair, lounge and glider, also can be used during the winter on an enclosed porch or in a sunroom. Both the lounge and the Adirondack chair have tilting

Styled by John Bergen,  
noted furniture designer



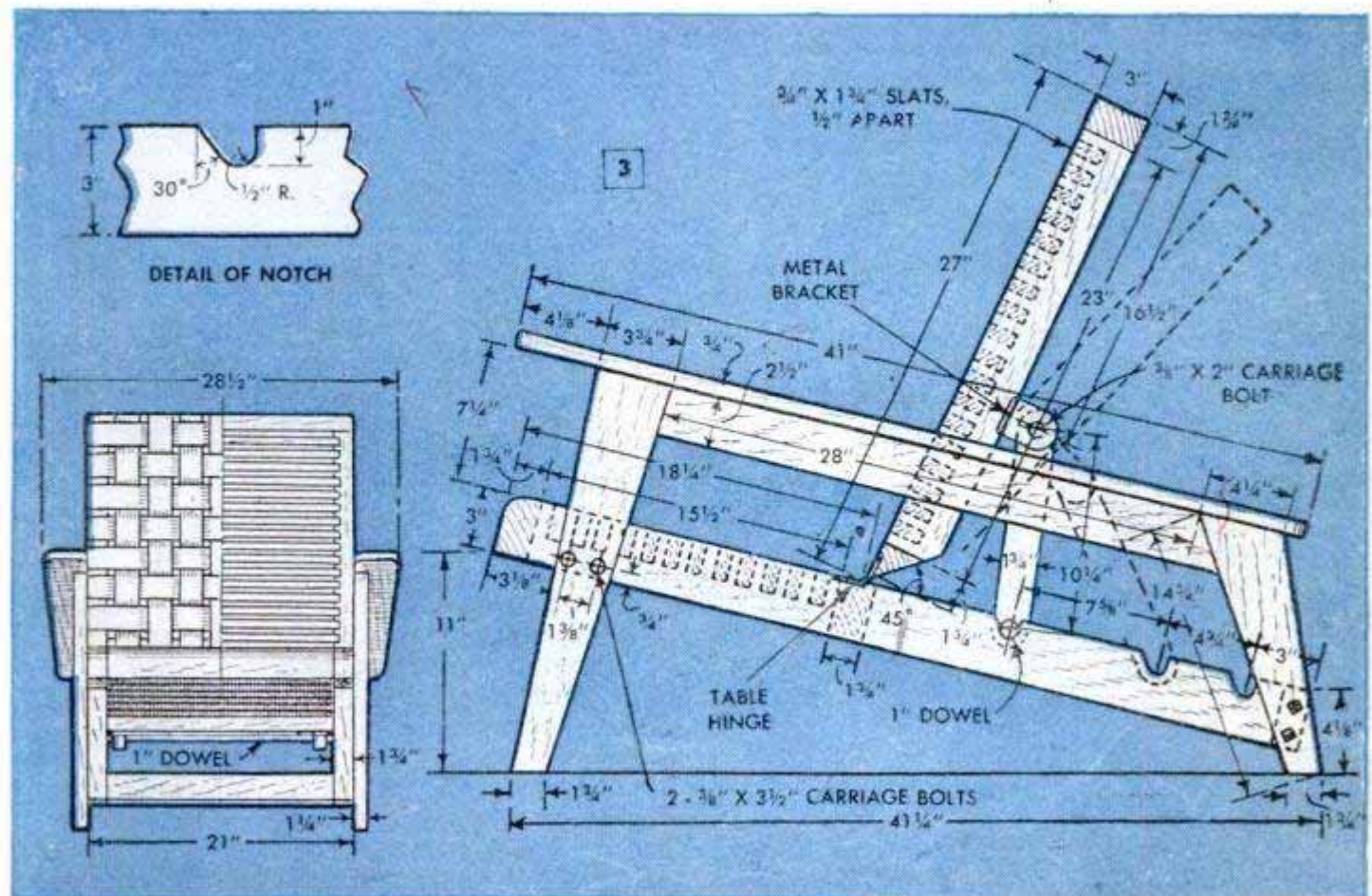
1 ADIRONDACK-TYPE CHAIR

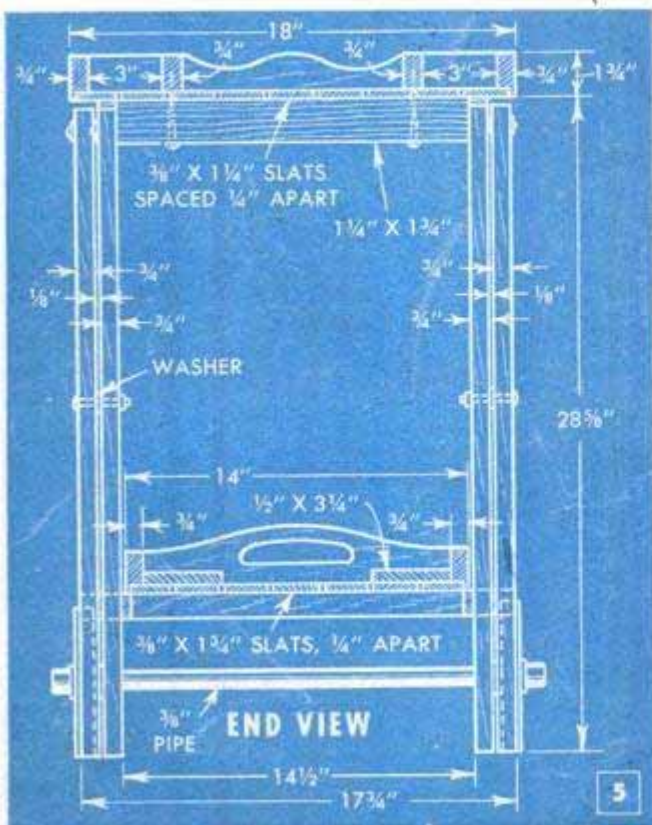
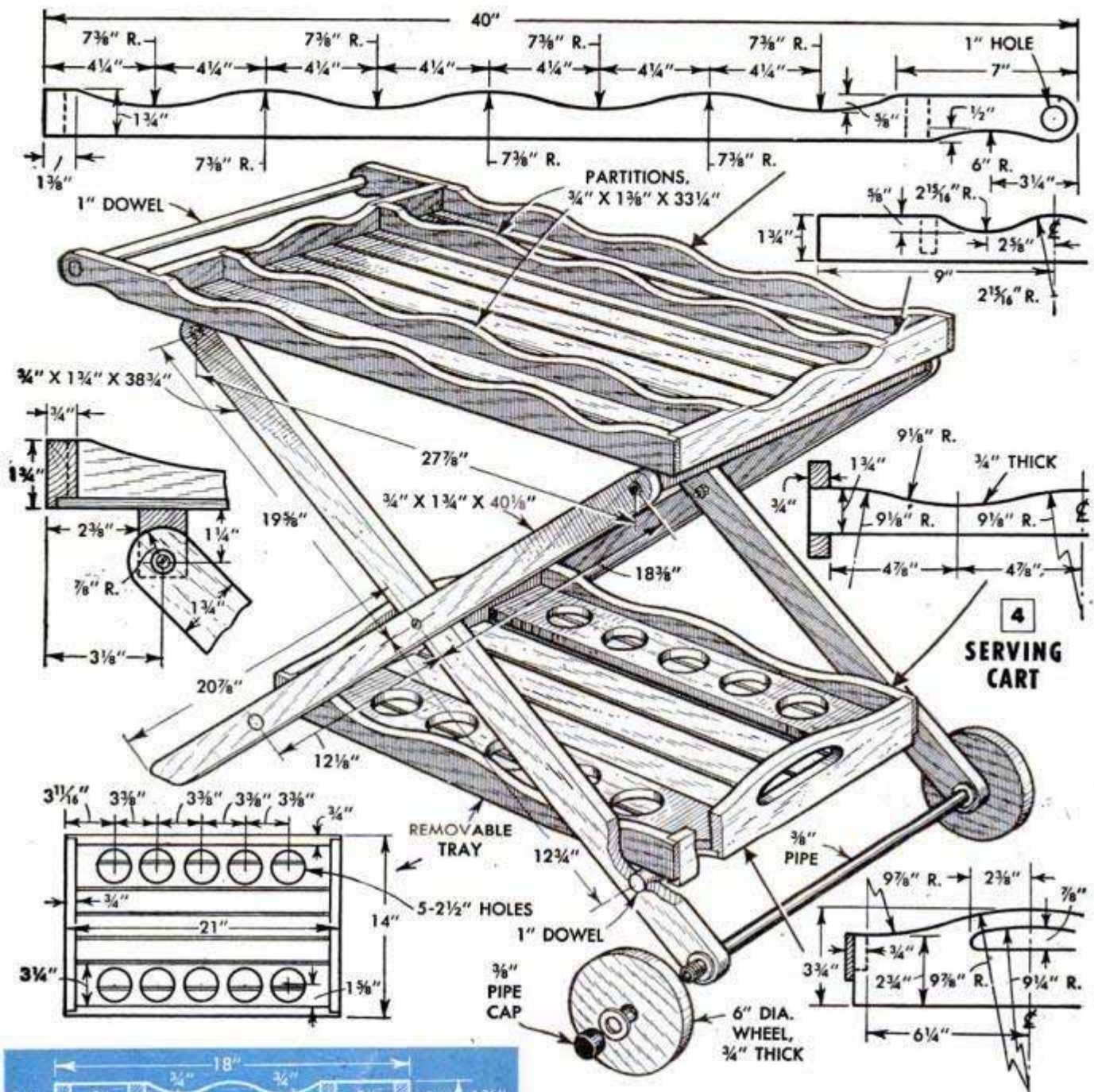


backs that can be adjusted to suit the comfort of the individual. Except in the case of the garden table-and-bench set, a choice of slats or webbing is given in constructing the seats and backs of the furniture. Both types are partially indicated in most of the drawings, and this should not be confused with actual construction details.

While redwood or cypress are two of the

most durable woods, especially suitable for outdoor furniture, common lumberyard stock, such as yellow pine or fir, is perfectly satisfactory if the pieces are kept well painted. The material list on page 182 itemizes the amount of lumber needed for each piece, and, for those who prefer to work from plans larger than magazine size, large black-and-white prints are available.





The Adirondack chair, detailed in Figs. 1 and 3, has a tilting back which can be adjusted to three reclining positions. The framework for both the seat and the back of the chair is made from 2 x 4 material, while the legs, and the rails which support the arms, can be of 1 1/8 or 1 1/4-in. stock. Each framework is made as a separate unit and the back is hinged to the seat with 1 1/4-in. table hinges, set flush. If slats are used instead of webbing, the slanting notches for them must be made before the frames are doweled and glued together. These can be cut with a 3/4-in. dado head on a circular saw by utilizing a narrow strip tacked temporarily to the face of the work along the rear edge. The strip is positioned to tilt the work at an angle that will produce a notch 1 3/4 in. long. The slats are cut from common 1 x 2 lumber, the ends being sawed off at an angle to fit the slanting notches and then nailed in place, flush with the surface. The support for the tilting back

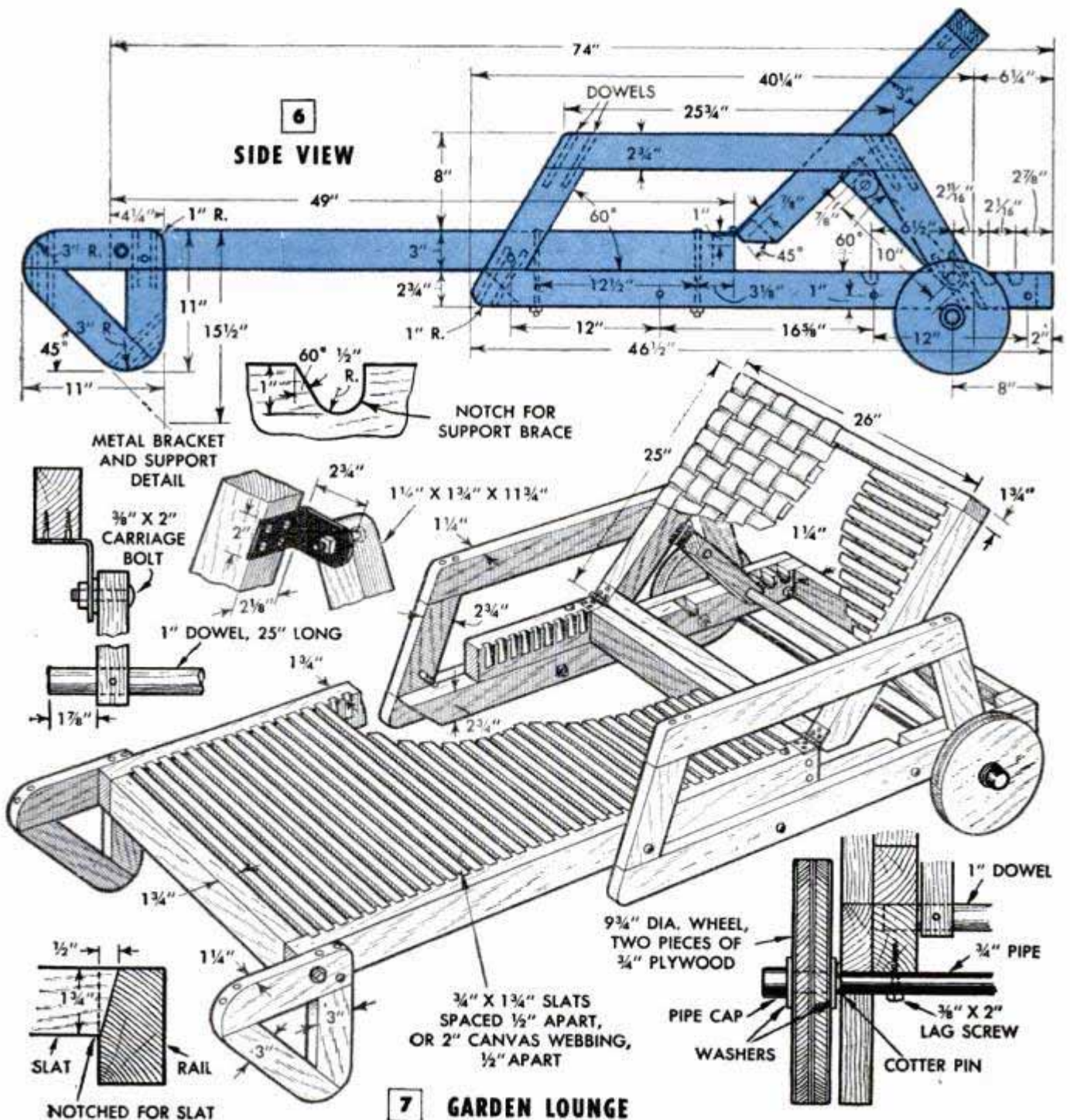
is pivoted to it with sheet-metal brackets in the manner shown in Fig. 1. If webbing is preferred to the slats, use either nylon parachute webbing or common canvas webbing and interlace it as shown. The ready-made cushions will hide the tacks used in fastening webbing to the frames.

**The porch chair, Fig. 2,** is somewhat similar in construction. The seat and back are hinged together to fold flat for storing, while the legs and arms can be taken off as single units by removing only six nuts and washers. Frames for the seat and back are assembled from  $1\frac{1}{4}$  x  $1\frac{3}{4}$ -in. stock, notched if slats are used, before doweling and gluing together.

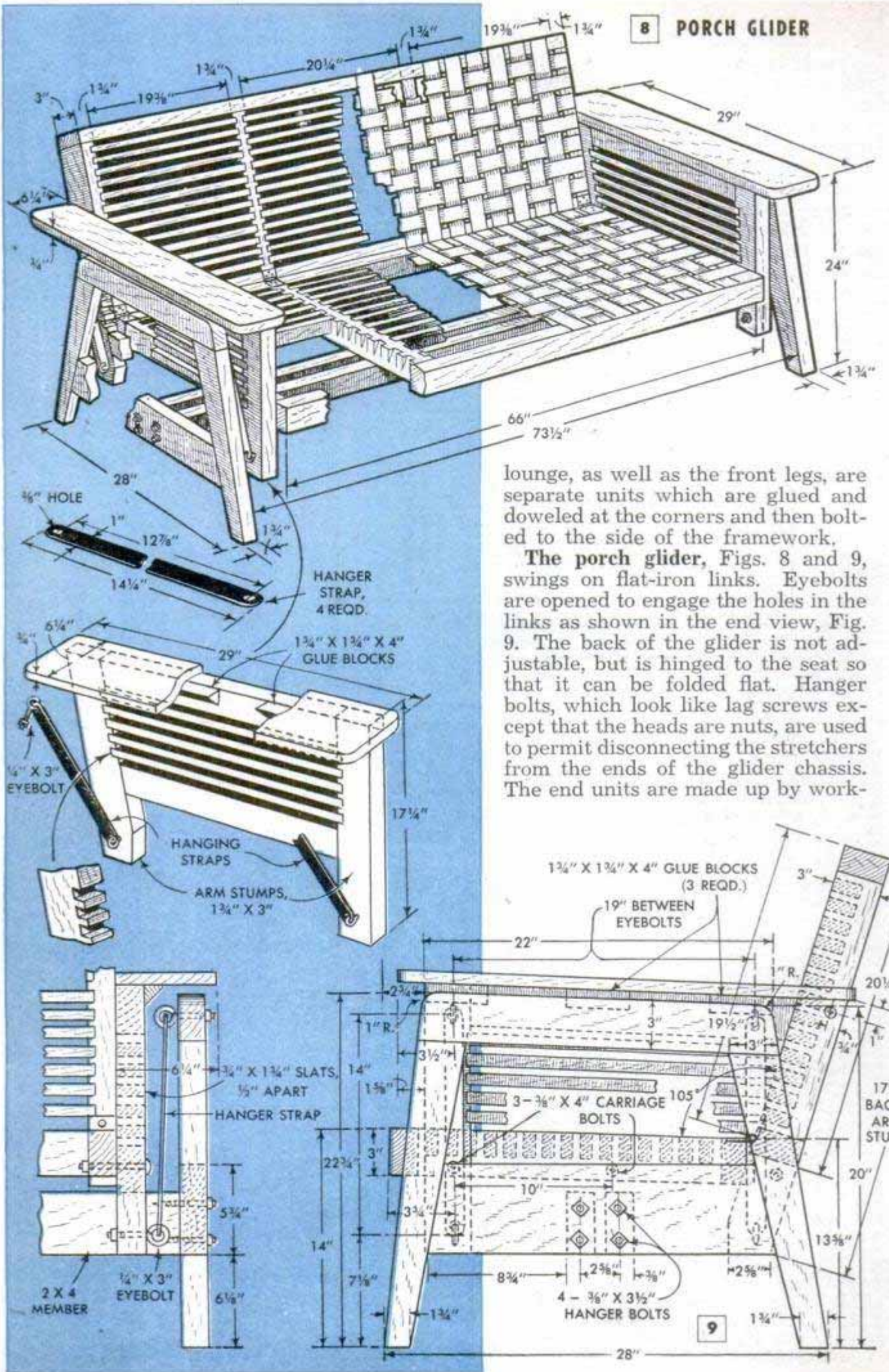
**The serving cart, Figs. 4 and 5,** can be wheeled about and features a removable beverage tray which rides on two rungs

fitted between the crossed legs. Each pair of legs are duplicates and registering holes for the pipe axle, dowel rungs and screw fastenings are bored at one time through each set. The upper ends of the legs are pivoted with wood screws to  $1\frac{1}{4}$  x  $1\frac{3}{4}$ -in. cleats which support the upper tray.

**The garden lounge, Figs. 6 and 7,** like the Adirondack chair, has a tilting back which is supported in the same manner except that it is adjustable to four positions. The bed frame of the lounge, including the tilting back, is made of 2 x 4 material, with a second frame of lighter stock being bolted to the underside. This second frame carries the wheel axle and also the notches which engage the tilting back support. The end-view detail shows how the pipe axle is bolted in place with lag screws. The arms of the

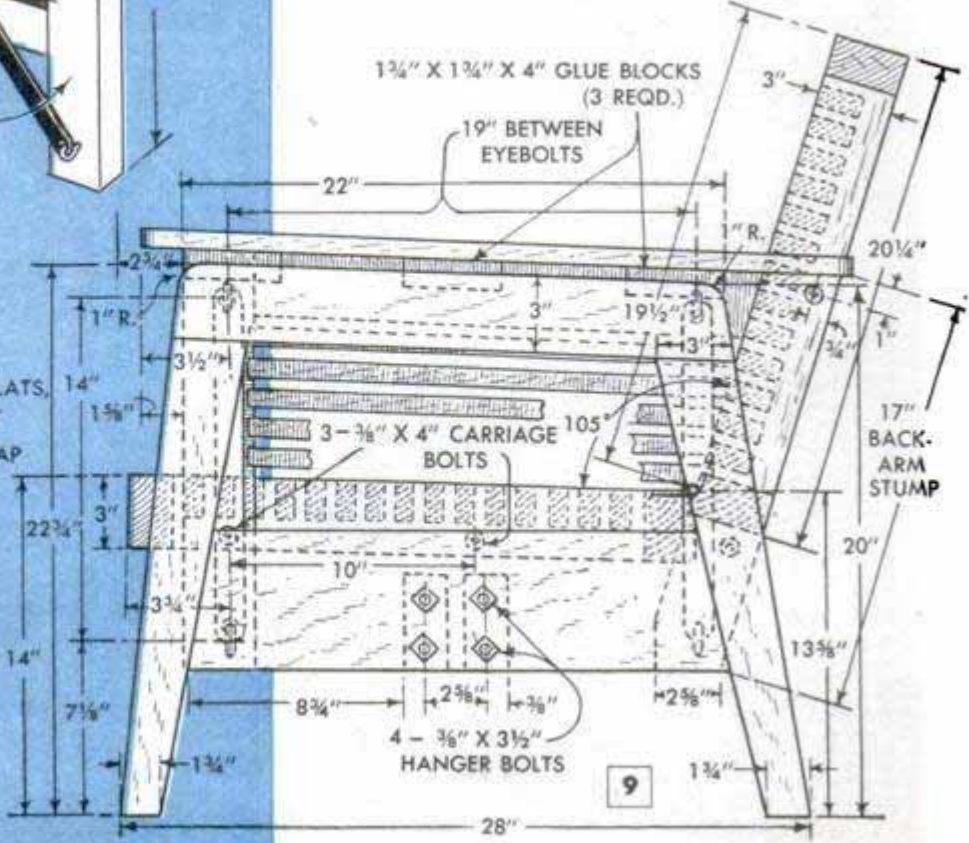
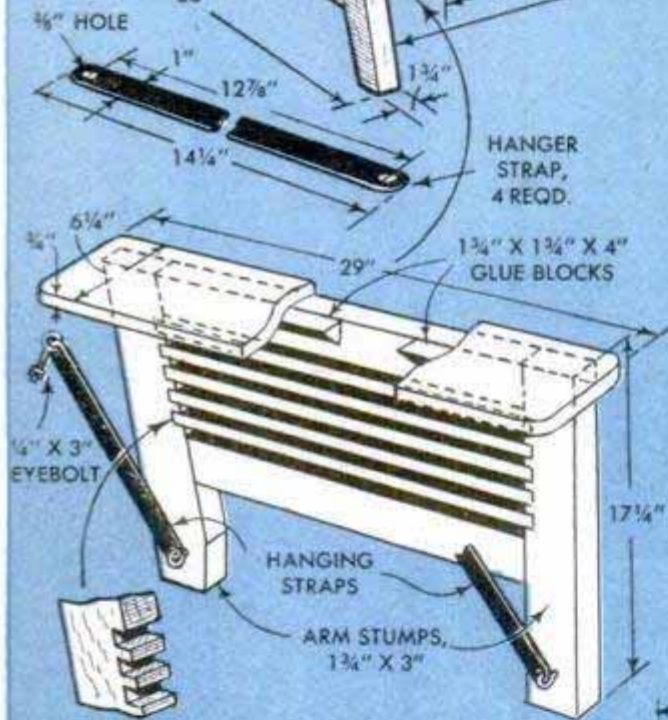


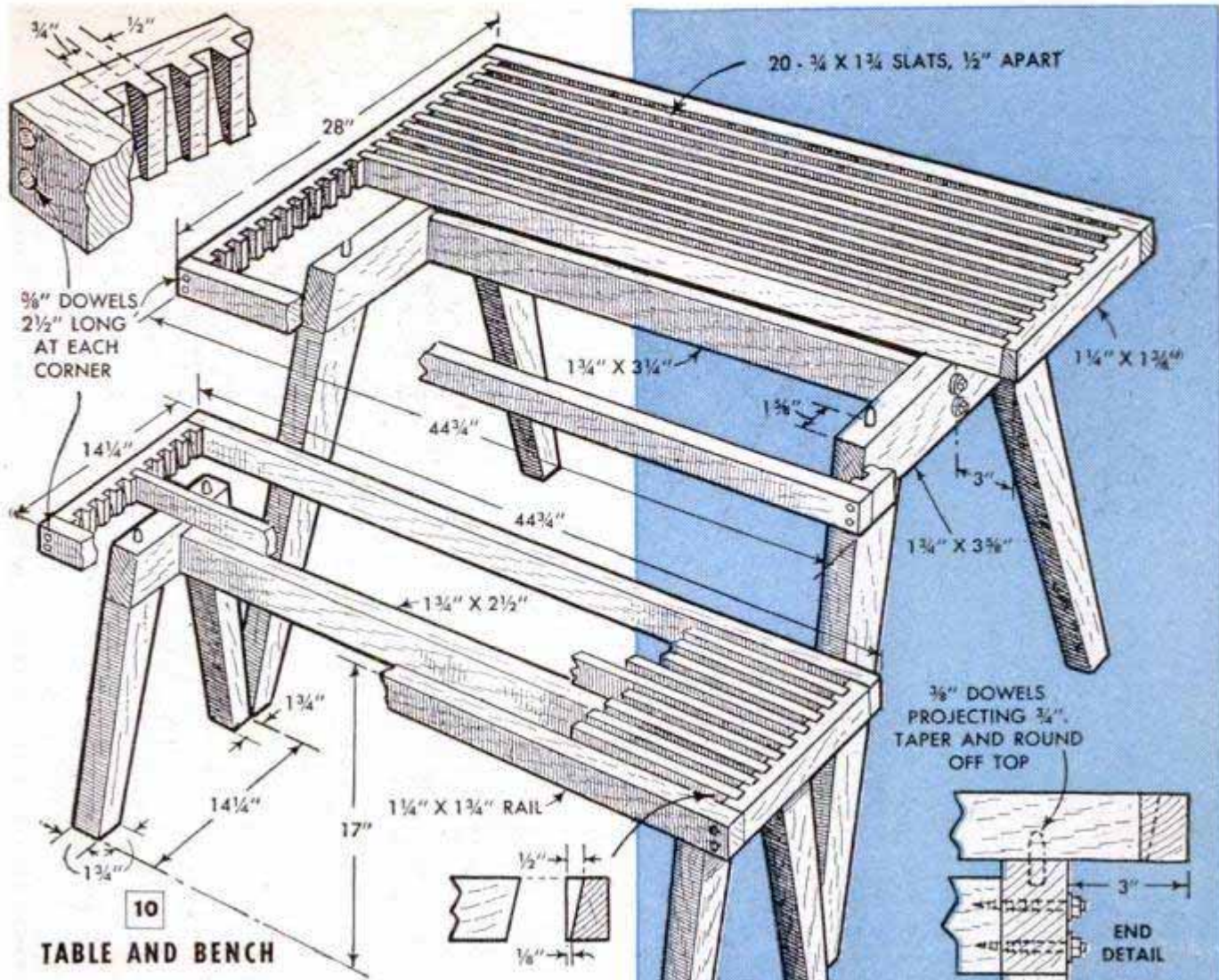
**8 PORCH GLIDER**



lounge, as well as the front legs, are separate units which are glued and doweled at the corners and then bolted to the side of the framework.

The porch glider, Figs. 8 and 9, swings on flat-iron links. Eyebolts are opened to engage the holes in the links as shown in the end view, Fig. 9. The back of the glider is not adjustable, but is hinged to the seat so that it can be folded flat. Hanger bolts, which look like lag screws except that the heads are nuts, are used to permit disconnecting the stretchers from the ends of the glider chassis. The end units are made up by work-

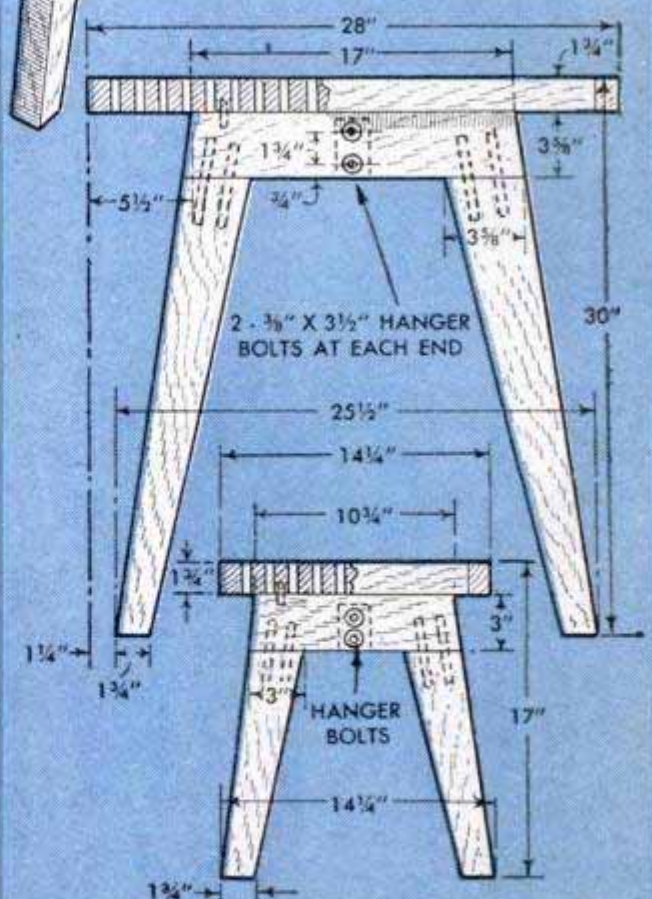




10  
TABLE AND BENCH

ing from a full-size paper pattern laid out according to Fig. 9 and placing the pieces right over the pattern to obtain the correct slant for the legs and top arm rails.

The picnic table-and-bench set, Fig. 10, also can be taken completely apart for storing. The tops of both the table and benches lift off, being held in place merely by stub pins which engage registering holes. Hanger bolts in the ends of the center stretchers permit the U-shaped legs to be removed in a jiffy. Except for size, the construction of the three pieces is exactly alike. As the slats are spaced 1/2 in. apart, it is best to paint them before they are nailed in place. Note that here the tapering notches are cut the full width of the end rails. This can be done with a small dado head by gluing a strip of beveled siding temporarily to the inside face of the work to bring the line of cut parallel with the saw table. The siding strip is glued with paper between it and the work so that it can be pried off easily when all the notches have been cut. However, to simplify the job, the notches can be cut straight through and the 1 x 2 slats glued in place and nailed from the outside face. The legs are cut from 2 x 4 material and glued and doweled to the apron pieces. Screws can be used instead of dowels at the corners of the bench tops.



END VIEWS OF TABLE AND BENCH

## LUMBER LIST FOR LAWN FURNITURE

### ADIRONDACK CHAIR

2 pcs.  $1\frac{3}{4}$  x 3 x 42 in.—Side seat rails  
 1 pc.  $1\frac{3}{4}$  x 3 x 21 in.—Front seat rail  
 1 pc.  $1\frac{3}{4}$  x 3 x 17 $\frac{1}{2}$  in.—Center seat rail  
 1 pc.  $1\frac{3}{4}$  x 3 x 17 $\frac{1}{2}$  in.—Back seat rail  
 2 pcs.  $1\frac{3}{4}$  x 3 x 27 in.—Side back rails  
 1 pc.  $1\frac{3}{4}$  x 3 x 21 in.—Top back rail  
 1 pc.  $1\frac{3}{4}$  x 2 $\frac{1}{4}$  x 17 $\frac{1}{2}$  in.—Bottom back rail  
 30 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 18 $\frac{1}{2}$  in.—Seat and back slats  
 2 pcs.  $1\frac{1}{4}$  x 3 $\frac{3}{4}$  x 22 in.—Front legs  
 2 pcs.  $1\frac{1}{4}$  x 3 $\frac{3}{4}$  x 14 $\frac{5}{8}$  in.—Back legs  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{1}{2}$  x 29 $\frac{3}{8}$  in.—Arm aprons  
 2 pcs.  $\frac{3}{4}$  x 3 $\frac{3}{4}$  x 41 in.—Tops of arms  
 2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 12 in.—Back stays  
 1 pc. 1-in. dia. x 20 in. long—Dowel rung  
 33 yds. 2-in. canvas webbing—Seat and back covering

### PORCH CHAIR

2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 20 $\frac{1}{4}$  in.—Side seat rails  
 1 pc.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 20 in.—Front seat rail  
 1 pc.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 17 $\frac{1}{2}$  in.—Back seat rail  
 2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 21 in.—Side back rails  
 1 pc.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 20 in.—Top back rail  
 1 pc.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 17 $\frac{1}{2}$  in.—Bottom back rail  
 27 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 18 $\frac{1}{2}$  in.—Seat and back slats  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{5}{8}$  x 23 $\frac{1}{2}$  in.—Front legs  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{5}{8}$  x 21 $\frac{3}{4}$  in.—Back legs  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{5}{8}$  x 19 in.—Arms  
 20 yds. 2-in. canvas webbing—Seat and back covering

### SERVING CART

2 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 40 in.—Top side rails  
 2 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 17 in.—Top end rails  
 2 pcs.  $\frac{3}{4}$  x  $1\frac{3}{8}$  x 33 $\frac{1}{4}$  in.—Partitions  
 7 pcs.  $\frac{3}{8}$  x  $1\frac{3}{4}$  x 33 $\frac{3}{4}$  in.—Bottom slats  
 2 pcs.  $\frac{3}{8}$  x  $1\frac{3}{8}$  x 33 $\frac{3}{4}$  in.—Bottom slats  
 1 pc.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 14 $\frac{1}{2}$  in.—Brace  
 1 pc.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 16 $\frac{1}{2}$  in.—Brace  
 2 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 38 $\frac{3}{4}$  in.—Legs  
 2 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 40 $\frac{1}{8}$  in.—Legs  
 4 pcs.  $\frac{3}{4}$  x 6 x 6 in.—Wheels  
 2 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 21 in.—Tray sides  
 2 pcs.  $\frac{3}{4}$  x 3 $\frac{3}{4}$  x 13 $\frac{1}{2}$  in.—Tray ends  
 7 pcs.  $\frac{3}{8}$  x  $1\frac{3}{4}$  x 20 in.—Tray bottom  
 2 pcs.  $\frac{1}{2}$  x 3 $\frac{1}{4}$  x 19 $\frac{1}{2}$  in.—Glass holders  
 1 pc. 1-in. dia. x 17 $\frac{1}{2}$  in.—Dowel  
 1 pc. 1-in. dia. x 17 in.—Dowel  
 1 pc. 1-in. dia. x 17 $\frac{3}{4}$  in.—Dowel

### GARDEN LOUNGE

2 pcs.  $1\frac{3}{4}$  x 3 x 49 in.—Seat side rails (front half)  
 2 pcs.  $1\frac{3}{4}$  x 3 x 22 $\frac{1}{2}$  in.—Seat end rails (front half)  
 1 pc.  $1\frac{1}{4}$  x 3 x 22 $\frac{1}{2}$  in.—Seat end rail (back half)  
 2 pcs.  $1\frac{3}{4}$  x 3 x 23 $\frac{1}{4}$  in.—Seat side rails (back half)

1 pc.  $1\frac{3}{4}$  x 3 x 26 in.—Top rail for back  
 1 pc.  $1\frac{3}{4}$  x 2 $\frac{1}{2}$  x 22 $\frac{1}{2}$  in.—Bottom rail for back  
 2 pcs.  $1\frac{3}{4}$  x 2 $\frac{3}{4}$  x 44 $\frac{3}{4}$  in.—Back side rails  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{3}{4}$  x 29 in.—Tops of arms  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{3}{4}$  x 46 $\frac{3}{8}$  in.—Bottoms of arms  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{3}{4}$  x 14 $\frac{1}{4}$  in.—Front arm stumps  
 2 pcs.  $1\frac{1}{4}$  x 2 $\frac{3}{4}$  x 11 $\frac{1}{8}$  in.—Back arm stumps  
 2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 11 $\frac{3}{4}$  in.—Back supports  
 2 pcs.  $1\frac{1}{4}$  x 3 x 15 $\frac{1}{2}$  in.—Front leg horizontals  
 2 pcs.  $1\frac{1}{4}$  x 3 x 8 in.—Front leg uprights  
 2 pcs.  $1\frac{1}{4}$  x 3 x 17 $\frac{1}{2}$  in.—Front leg diagonals  
 53 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 23 $\frac{1}{2}$  in.—Seat and back slats  
 4 pcs.  $\frac{3}{4}$  x 9 $\frac{3}{4}$  x 9 $\frac{3}{4}$  in.—Wheels  
 1 pc. 1-in. dia. x 25 in. long—Dowel rung  
 60 yds. 2-in. canvas webbing—Seat and back covering

### PORCH GLIDER

4 pcs.  $1\frac{3}{4}$  x 3 x 20 $\frac{3}{8}$  in.—Legs  
 2 pcs.  $1\frac{3}{4}$  x 3 x 22 $\frac{3}{4}$  in.—Top leg rails  
 2 pcs.  $1\frac{3}{4}$  x 5 $\frac{3}{4}$  x 22 in.—Lower leg rails  
 2 pcs. 2 x 4 x 73 $\frac{1}{2}$  in.—Leg stretchers  
 2 pcs.  $\frac{3}{4}$  x 6 $\frac{1}{4}$  x 29 in.—Arms  
 2 pcs.  $1\frac{3}{4}$  x 2 $\frac{1}{2}$  x 20 $\frac{3}{4}$  in.—Top arm rails  
 2 pcs.  $1\frac{3}{4}$  x 3 x 18 in.—Lower arm rails  
 2 pcs.  $1\frac{3}{4}$  x 3 x 17 $\frac{1}{4}$  in.—Front arm stumps  
 2 pcs.  $1\frac{3}{4}$  x 3 x 17 $\frac{3}{4}$  in.—Rear arm stumps  
 1 pc.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 108 in.—Arm slats  
 1 pc.  $1\frac{3}{4}$  x  $1\frac{3}{4}$  x 4 in.—Arm glue blocks  
 1 pc.  $1\frac{3}{4}$  x 3 x 66 in.—Front seat rail  
 1 pc.  $1\frac{3}{4}$  x 3 x 62 $\frac{1}{2}$  in.—Rear seat rail  
 2 pcs.  $1\frac{3}{4}$  x 3 x 23 in.—Side seat rails  
 2 pcs.  $1\frac{3}{4}$  x 3 x 19 $\frac{1}{2}$  in.—Center seat rails  
 1 pc.  $1\frac{3}{4}$  x 3 x 66 in.—Top rail for back  
 1 pc.  $1\frac{3}{4}$  x 3 x 62 $\frac{1}{2}$  in.—Lower rail for back  
 2 pcs.  $1\frac{3}{4}$  x 3 x 22 $\frac{3}{8}$  in.—Side rails for back  
 2 pcs.  $1\frac{3}{4}$  x 3 x 16 $\frac{3}{4}$  in.—Center rails for back  
 56 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 20 $\frac{3}{8}$  in.—Side back and seat slats  
 28 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 21 $\frac{1}{4}$  in.—Center back and seat slats  
 105 yds. 2-in. canvas webbing—Seat and back covering

### TABLE-AND-BENCH SET (table)

2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 44 $\frac{3}{4}$  in.—Top side rails  
 2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 25 $\frac{1}{2}$  in.—Top end rails  
 20 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 43 $\frac{1}{4}$  in.—Slats  
 4 pcs.  $1\frac{3}{4}$  x 3 $\frac{5}{8}$  x 25 $\frac{3}{8}$  in.—Legs  
 2 pcs.  $1\frac{3}{4}$  x 3 $\frac{5}{8}$  x 18-1/16 in.—Leg rails  
 1 pc.  $1\frac{3}{4}$  x 3 $\frac{1}{4}$  x 35 $\frac{1}{4}$  in.—Brace

### (Material per bench)

2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 44 $\frac{3}{4}$  in.—Top side rails  
 2 pcs.  $1\frac{1}{4}$  x  $1\frac{3}{4}$  x 11 $\frac{3}{4}$  in.—Top end rails  
 9 pcs.  $\frac{3}{4}$  x  $1\frac{3}{4}$  x 43 $\frac{1}{4}$  in.—Slats  
 4 pcs.  $1\frac{3}{4}$  x 3 x 11 $\frac{3}{4}$  in.—Legs  
 2 pcs.  $1\frac{3}{4}$  x 3 x 11 $\frac{1}{2}$  in.—Leg rails  
 1 pc.  $1\frac{3}{4}$  x 2 $\frac{1}{2}$  x 35 $\frac{3}{4}$  in.—Brace

## Stainless Ink for Children's Play Made From Laundry Bluing

Children can be allowed to write and draw with ink at a tender age without danger of ruining clothing and tablecloths if laundry bluing mixed with water is substituted for ordinary ink. The bluing provides a legible writing medium but, unlike the permanent stains of ink, it can be washed out easily if it is spilled.

R. F. Donovan, Jersey City, N. J.

☞ Applying wax to the heels and toes of women's stockings will reduce wear at these points, making them last longer. Rubbing with a candle will serve the purpose.

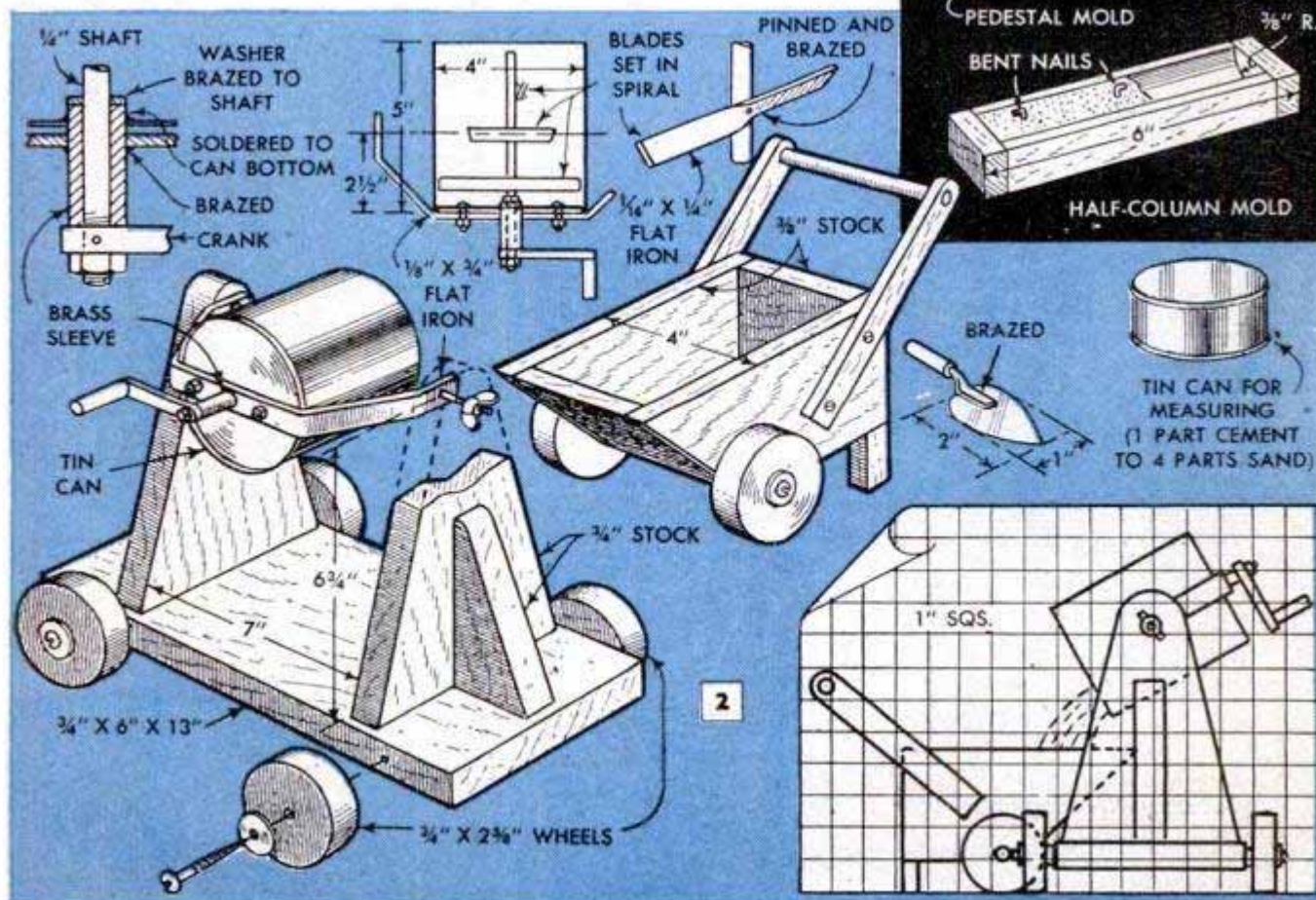
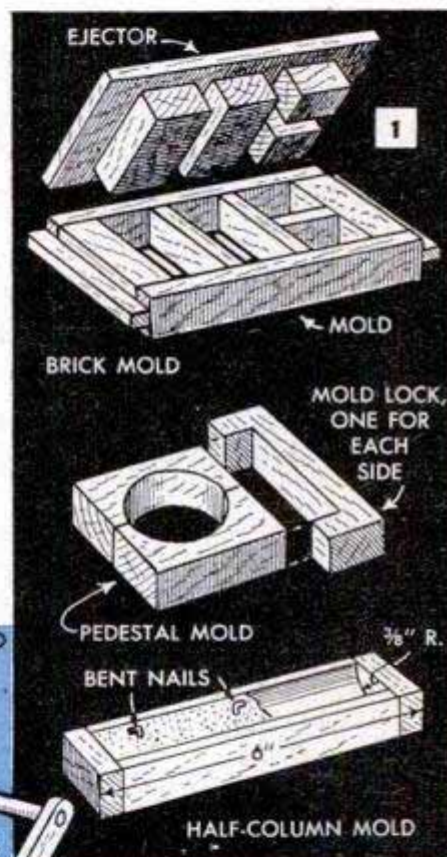




# TOY CEMENT MIXER

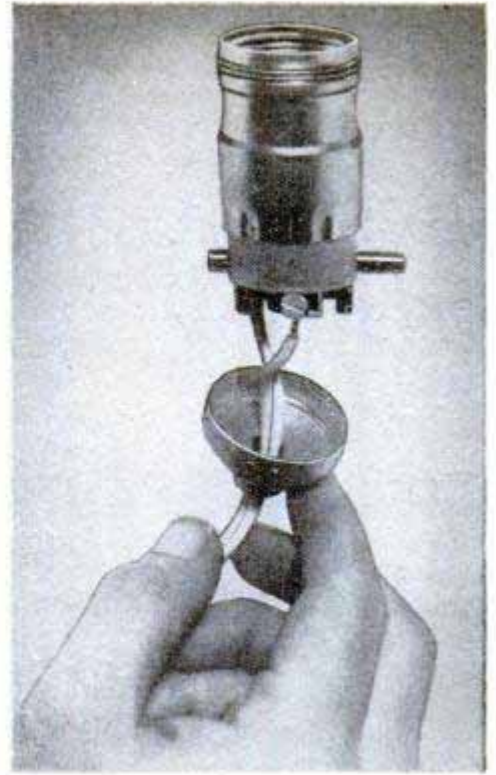
## for small-fry contractors

YOUNGSTERS with an urge to build things will have a lot of fun mixing and casting concrete with this pint-size equipment. The set consists of a hand-operated mixer of 1-qt. capacity, a cart for wheeling the grout to the "job" and several different molds for casting bricks, pedestals, columns and other miniature building material. A 1-qt. fruit-juice can is ideal for the mixer barrel. The details in Fig. 2 show how the barrel is supported and pivoted so that it can be dumped like the real thing. However, you'll notice that the barrel remains stationary, while the blades are rotated by a crank. The barrel is fastened to the flat-iron yoke with two small machine screws and the bearing for the blade shaft is soldered to both the bottom of the barrel and the yoke, as indicated in the sectional detail. A washer brazed to the shaft provides a shoulder to permit drawing the shaft up snugly in the bearing with a nut. Note that the four blades are brazed and pinned in a spiral pattern around the shaft. The wing nuts at the ends of the yoke permit the barrel to be locked in any desired position. The method of making the various casting forms is shown in Fig. 1. The brick mold is merely an open frame which has an ejector for pushing the bricks out the bottom after they have set. The mold should be soaked in oil to prevent the cement from sticking. A small trowel will come in handy, and a flat can, such as a deviled-ham can, will serve as a measure.—Hi Sibley, Nuevo, Calif.





Here's the converted lamp ready for its shade. Lamp will now give twice as much downward light and considerably more upward light



1. Separate top of socket from bottom by pressing on the sides of upper half

**E**YESIGHT is our most precious possession and yet, according to Miss Myrtle Fahsbender, the director of home lighting for Westinghouse, 60 percent of the lamps used for reading and other close work are not doing right by the eyes. However, converting these lamps from little more than purely decorative accessories

5. Replace the old harp with new wide one and rethread cord through socket

more LIGHT  
from old LAMPS

Courtesy Westinghouse Electric Corp.





**2. Remove shell from top half and pull out about 6 in. of lamp cord**



**3. With screwdriver, loosen the terminal screws and detach wires**



**4. Unscrew bottom of socket from lamp and remove the narrow harp**

to excellent reading lamps comes easy for anyone who is handy with a screwdriver. The parts are obtainable in kit form, including the new mushroom-shaped, 150-watt bulb, and their almost negligible cost pays off big dividends in saving eyesight. Of all common-type lamps, the easiest to convert is the single-socket table lamp. For best results, the base of the lamp should be at least 12 in. high and the bottom diameter of the shade should measure 14 in. or

more. Primarily, the conversion consists of replacing the old narrow harp with a wide one to take the new mushroom bulb which gives a more diffused and less glaring light. If the new harp is lower than the old one, an extension is furnished to add height to the finial. The series of photos presented here show you how it is done, step by step. This "new look" gives old lamps twice as much downward light and considerably more upward light.

**6. Reconnect the lamp cord, snap socket together; replace on lamp**

**7. If new harp is lower than old one, add finial to raise shade**

**Best illumination is had when the lamp base is at least 12 in. high**



## Inner Tube Connected to Downspout Provides Flexible Extension



Instead of allowing water from the downspout to collect in pools at the corner of the house, one homeowner uses a flexible extension made from lengths of inner tube to divert the water where desired. In this way, the water can be piped to the flower garden or it can be directed to a particular shrub or hedge that is in need of extra watering. The connector to the downspout and the couplings for joining the lengths of inner tube are made from tin cans. After both ends of the cans have been removed, the cans are inserted in the ends of the inner-tube sections. The portion of the inner tube around each can is wrapped tightly with strong cord to keep the can from slipping out.—Gordon Wilson, Myrtle Station, Ont., Can.

## Tumblers Individually Initialed With Colored Cloth Tape



To add a novel touch to your next informal party, supply each guest with a personalized drinking glass. This can be done simply by cutting the initials or first name of the guest from waterproof cloth tape and sticking the tape to the side of the tumbler. The tape, which is available in a variety of bright colors, will not wash off but may be re-

moved quickly, when desired, by pulling it from the glass. Use a pencil to outline the initials directly on the colored side of the tape and then cut them out with a scissors or razor blade, cutting slightly inside the pencil lines. If a razor blade is used, place the tape adhesive side down on a glass or china surface to provide a suitable backing.—Helen Lemberger, Chicago.

## Pin Aids Threading Drawstring

If a large needle is not available to thread ribbon through a drawstring top, fasten a safety pin to one end of the ribbon to aid in threading. Use a pin that is a little narrower than the width of the slits.

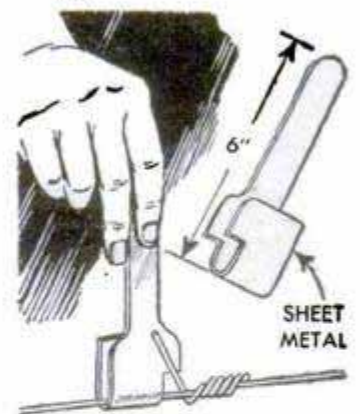


## Cleaning Equipment Kept Dust-Free

For more efficient cleaning with brooms and feather dusters, it is a good idea to protect them from accumulating dust when not in use. To do this, slip a large paper bag over the head of the broom or duster and fasten it with string or a rubber band slipped over the handle. Hang the implement from a wall hook by means of a loop of twine tied through a hole drilled near the end of the handle.

## Sheet-Metal Wire Splicer

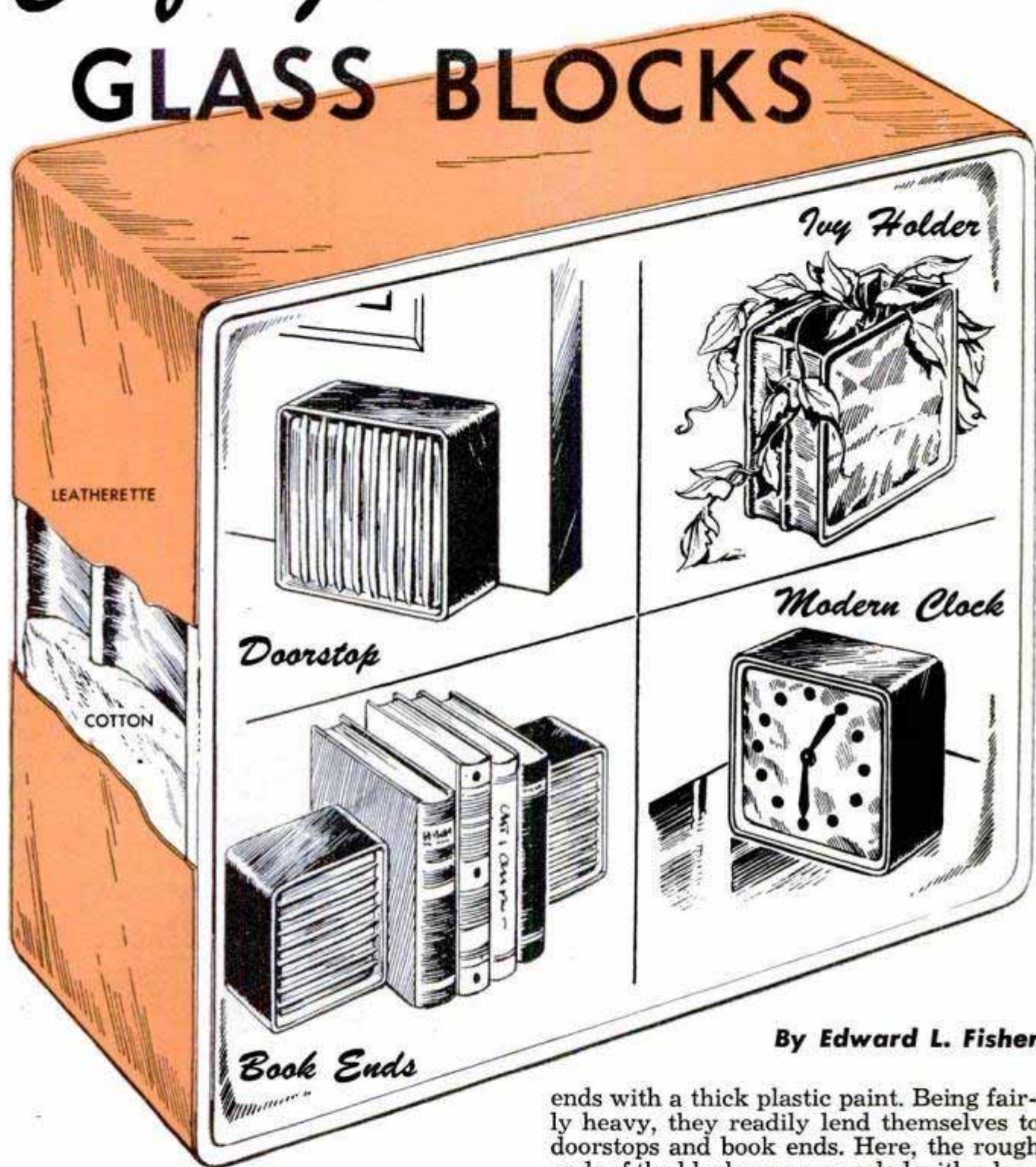
This handy tool, cut and bent from heavy sheet metal, does a fast and neat job of splicing the ends of fence wire or metal clothesline. To begin the splice, just bend the ends of the wire 90 deg. so that they engage each other, and then use the tool, as shown in the drawing, to wrap the ends spirally around the lengths of wire. The notch at the lower end of the splicer should be deep enough to clear the top of the wire as it is being wrapped.



Herbert E. Fey, New Braunfels, Tex.

☛ Stuff all-rubber galoshes with crumpled newspaper before storing them for the summer. This will help them hold their shape and prevent wrinkling and cracking.

# Crafting with GLASS BLOCKS



**A**LTHOUGH primarily used in wall construction, structural glass blocks in themselves provide the home craftsman with an unusual craft material—one which challenges his ingenuity. Being both decorative and inexpensive, the blocks can be put to many practical purposes, among which are the four suggestions shown above. Consisting of two hollow sections fused together, the blocks provide excellent and smart-looking containers for ivy, requiring nothing more than carefully breaking out the top and coating the rough

ends with a thick plastic paint. Being fairly heavy, they readily lend themselves to doorstops and book ends. Here, the rough ends of the blocks are concealed with a layer of cotton and a wrapping of leatherette. The latter is cemented to the edges of the block, pulled around firmly and lapped on the underside. The clock-case idea involves breaking out the back of a block to take a small movement and drilling a hole through the face of the block for the hands. The drilling is done with a three-cornered file which is ground to a long tapered point and rotated with an auger brace. Putty around the hole forms a well for turpentine which lubricates the file. Numerals on the clock face are dots of paint, and the edges of the block are covered with leatherette.

By Edward L. Fisher

# What to do about MECHANICAL AND CHEMICAL



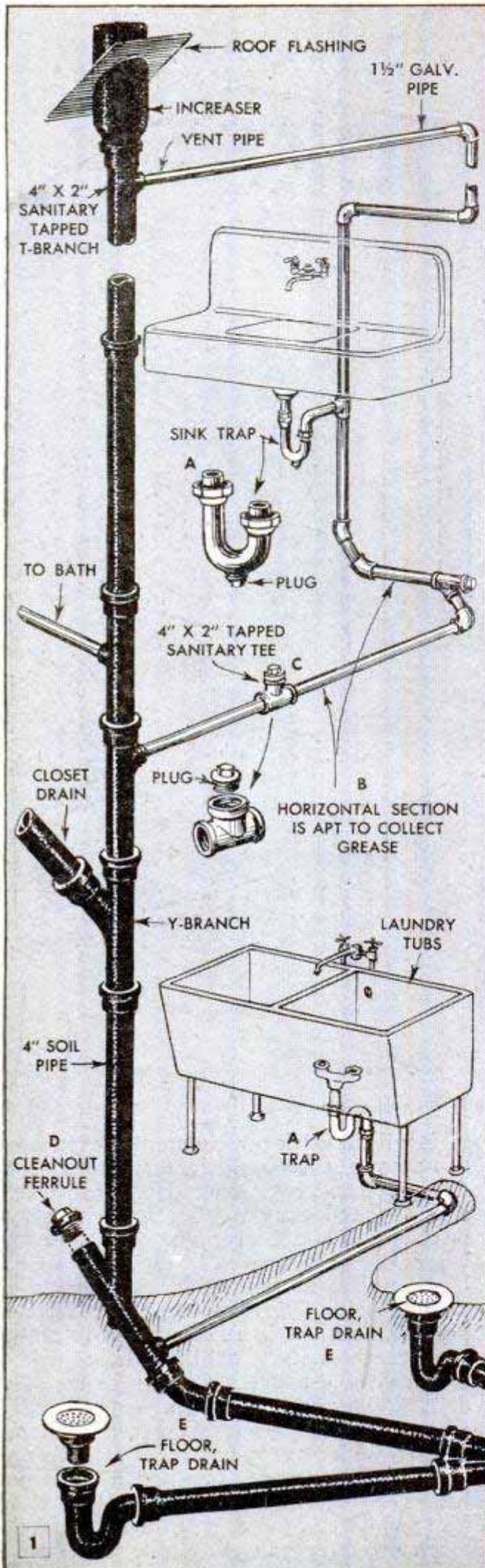
Remove all grease and residue from frying pans and discard with garbage. Don't pour it down the drain

By E. R. Haan

**F**EW EMERGENCIES in modern homes cause greater inconvenience to the entire family than clogged drains and sewers. However, in most cases, it's not necessary to call a plumber, as the average homeowner frequently can correct the trouble at a fraction of the cost of the plumber's fee. In this article, the author explains how comparatively simple it is to clean a clogged drain and also gives a number of precautions that will help prevent clogging.

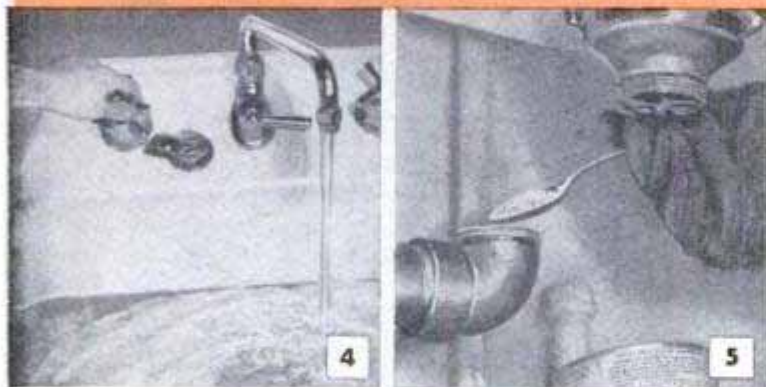
**Why sink drains clog:** Most stoppages in kitchen sinks are caused by hardened accumulations of cooking fats and oils that are washed down the drain with the dishwasher. Coffee grounds and other solid particles are caught in this grease coating and gradually build up a deposit which, in time, closes the drain completely. Generally, the trouble occurs in a horizontal length of pipe such as pictured at B, Fig. 1, which does not have sufficient drainage pitch. A sink trap, detail A, Fig. 1, seldom clogs owing to the hot water that runs through it every day. However, these frequent flushings of hot water have practically no effect in cleaning the pipe beyond the trap as the water cools rapidly and thus fails to melt the grease clinging to the pipe.

**Disposal of waste fats:** Fat and oil never should be discarded in a sink or lavatory drain. Make it a practice to pour or scrape fats from cooking utensils into cans or onto



# CLOGGED DRAINS

MEASURES THAT EVERY HOMEOWNER CAN APPLY



Flush the drain daily with plenty of hot water. Use chemical-type cleaner before drain clogs completely

paper for disposal, Fig. 2. Then wipe away remaining oil with a paper towel before washing the utensil. Also, be sure to collect and discard all food leftovers and other solids with garbage, Fig. 3. *Never wash them down the drain.*

**Flushing drain with hot water:** A kitchen sink very seldom clogs when scalding water is poured down the drain daily, Fig. 4. It's a good idea, after washing dinner dishes, to let hot water run from the faucet for 2 or 3 minutes to melt away any formation of grease. When water drains very slowly from a kitchen sink, practically an entire tankful of scalding water should be run through the drain. Set the water-temperature control at "high" about an hour or so before flushing to bring the water to the scalding point. In the case of a lavatory where the accumulation of hair helps cause stoppage, run a length of wire with a hooked end into the drain. If this does not help, remove and clean out the trap. Many lavatories have a metal pop-up drain plug which must be removed to permit cleaning the pipe from the bowl to the trap. To remove the plug, merely unscrew the short lever which is connected to the lower end of the pop-up extension, pull out the lever and lift out the plug.

**Chemical drain cleaners:** If the scalding-water treatment does not open the drain, use a strong drain-cleaning chemical. Most commercial cleaners consist of sodium hydroxide (caustic soda), with bauxite or other ingredients added to intensify action. When added to water, the chemicals effervesce violently and produce considerable heat. This, plus the caustic quality of the alkali, breaks up and eats away obstructions. Another chemical, potassium hydroxide (caustic potash), also is effective but is available only at chemical or drug-



The alternate pressure and suction of a rubber plunger frequently will open a completely clogged drain

supply houses. As these cleaners are caustic, they must be handled with extreme caution. *Avoid getting the chemicals or solution on the hands, arms and face.*

Chemical cleaners should be used only in drainpipes that are almost but not completely clogged. They are most effective when used with a small quantity of water, for when in solution form, the cleaner comes in direct contact with the obstruction. Pouring the chemical into a sink merely lets it lodge in the trap. Therefore, it is better to pour it into the pipe beyond the trap, particularly when the obstruction is in a horizontal section. To add the cleaner to the pipe, remove the trap, Fig. 7, and screw an elbow on the end of the pipe, placing it with an open end up, Fig. 5. Add the cleaner to the pipe, remove the trap, Fig. 7, and screw an elbow on the end of the pipe, placing it with an open end up, Fig. 5. Add the cleaner with an old spoon and work it into the pipe. Use about a fourth of the can of chemical and wash it down the pipe to the obstruction by slowly pouring in a



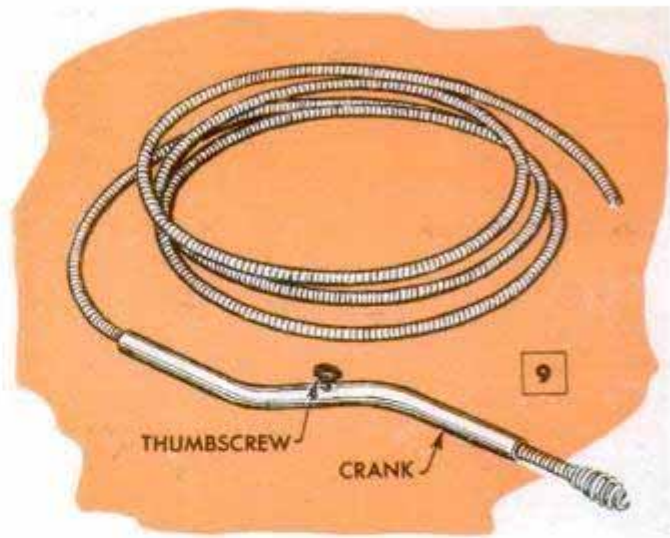
7 Removing the sink trap and pipe elbow makes it considerably easier to run a drain auger through pipe



8 Push the auger into the pipe and turn the crank. The crank is moved back as the auger is advanced

quart of water. After 15 or 20 minutes, replace the trap, (wearing gloves to prevent getting any chemical on the hands) and then test the pipe for drainage. If the pipe is still clogged, repeat the treatment as often as necessary. When good drainage starts, flush the pipe with scalding water for 5 minutes.

**Completely stopped sink drains:** When a sink or lavatory drain is completely clogged, mechanical means must be employed to force out the obstruction. First, try a suction-cup plunger, Fig. 6. In doing so, be sure that there is enough water in the sink to afford good suction. If the use of a plunger does not do the trick, examine the sink trap. If it has a drain plug, detail A, Fig. 1, place a pail under the trap to catch the water and remove the plug. Then insert a length of wire and work it around in the trap to make sure that it is clean. If so, remove the trap, Fig. 7, and insert a coiled spring-wire drain auger in the pipe, Fig. 8. When purchasing such an auger, obtain one about 15 to 25 ft. long and  $\frac{3}{8}$  in.



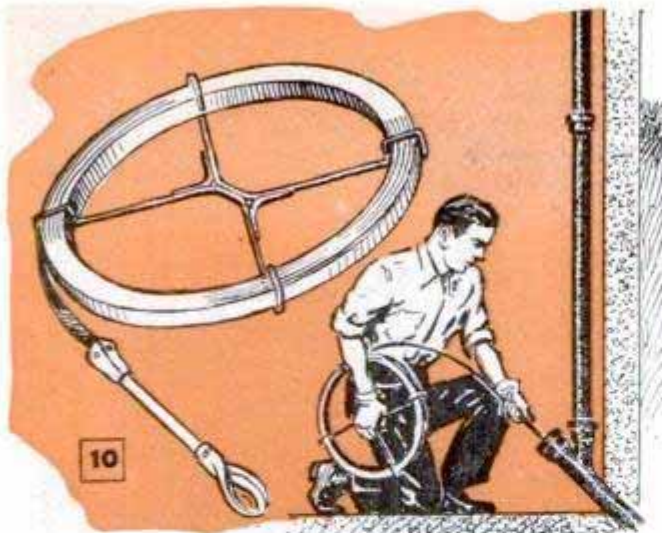
9 The drain auger consists of a coil of spring-steel wire 15 to 25 ft. long and about  $\frac{3}{8}$  in. in diameter

in diameter and select one equipped with a tubular handle crank like that shown in Fig. 9. The crank fits over the wire and can be tightened to it at any point with a thumbscrew. Start using the auger by placing the crank about 4 ft. from the working end. Then rotate the auger and, at the same time, push it slowly into the pipe. When the crank reaches the end of the pipe, loosen it and move it back a foot or so on the spring wire, and continue as before until an opening is bored through the obstruction. If you find that you are unable to reach the obstruction from the trap end of the pipe, try to reach it from the first cleanout opening in the basement, working toward the trap. A cleanout opening is usually located at a turn in the pipe as shown in Fig. 1. If such a cleanout is not provided, it may be necessary to drill a hole in the pipe to admit the auger. The hole should be at least  $\frac{5}{8}$  in. in dia. and tapped to take a standard  $\frac{3}{4}$ -in. pipe plug. Note the cleanout, detail C, which is inserted in a long horizontal run of pipe.

**Plumbing traps:** Sinks, bathtubs, shower stalls, toilets, laundry tubs and floor drains all are provided with traps. In time, water will evaporate from the traps in seldom used drains, allowing the passage of sewer gas. These traps can be kept sealed by occasionally pouring a gallon or more of water down the drain. Toilet traps are integral with the fixture and when water overflows the bowl it's an indication that there is an obstruction that must be forced out of the trap by mechanical means. A suction-cup plunger is generally effective, but sometimes a drain auger is required.

Floor-drain traps in basements and garages, detail E, Fig. 1, may become clogged with dirt and floor sweepings. When a floor drain is slow acting, first remove and clean the strainer. Then dig out the dirt with a spoon, after which use a drain auger and,





This pictures a 50-ft. flat spring-steel "snake" having a rotating spear end and a self-adjusting handle

finally, follow with a chemical flushing.

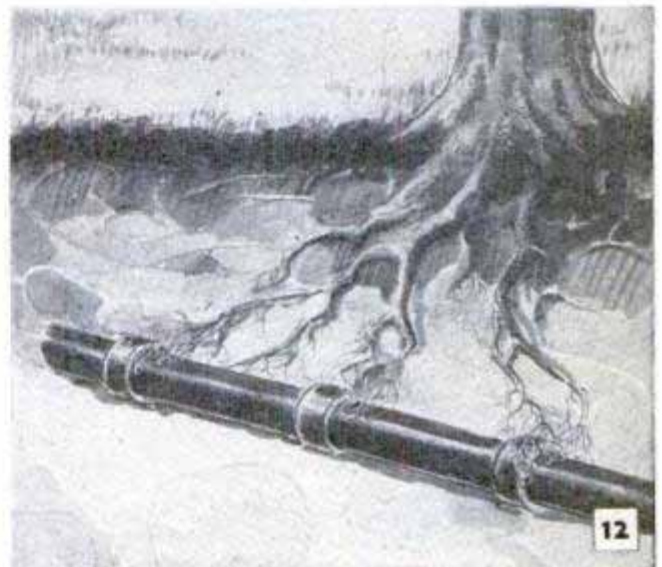
**House-to-street sewer stoppages:** Waste water backing up through the basement floor drain indicates a clogged pipe from the house to the street sewer, or to the septic tank in the case of an individual disposal system. Among the causes of such stoppages are sagged drainpipes, Fig. 13, cement left projecting inside the pipe, Fig. 14, and tree roots. Usually, there are clean-out openings in the basement as shown at detail D, Fig. 1, where a drain auger can be inserted. Another effective tool to use in clearing the soil pipe is a plumbers' "snake," Fig. 10. This is a flexible steel band which is available in various sizes, and is used by pushing it through the sewer with a back-and-forth motion. However, if the use of this tool does not start drainage, it will be necessary to have a plumber take over with larger and stronger equipment.

**Tree roots in sewers:** The majority of stoppages in vitrified clay-tile drains running from the house to the street are caused by tree roots. Some trees, particularly willows, poplars and cottonwoods, often send their roots out as far as 20 or 30 ft. A slight crack in a joint between the sections of pipe, which may have been caused by settling, permits tiny roots to work into the tile, Fig. 12. Once inside, the roots send out countless shoots, eventually filling the tile completely and often even breaking it as pictured in Fig. 11. Such root growths can be cut or torn loose with an auger or snake, but this is a laborious and time-consuming job. Here, it is recommended to have a plumber clear the pipe with a motor-driven rotary cutter.

**Root eradication with chemicals:** It is possible to prevent root growth by using chemicals, some of which are specifically prepared for this purpose. Also, repeated applications of caustic drain-cleaning chemicals, previously discussed, will be



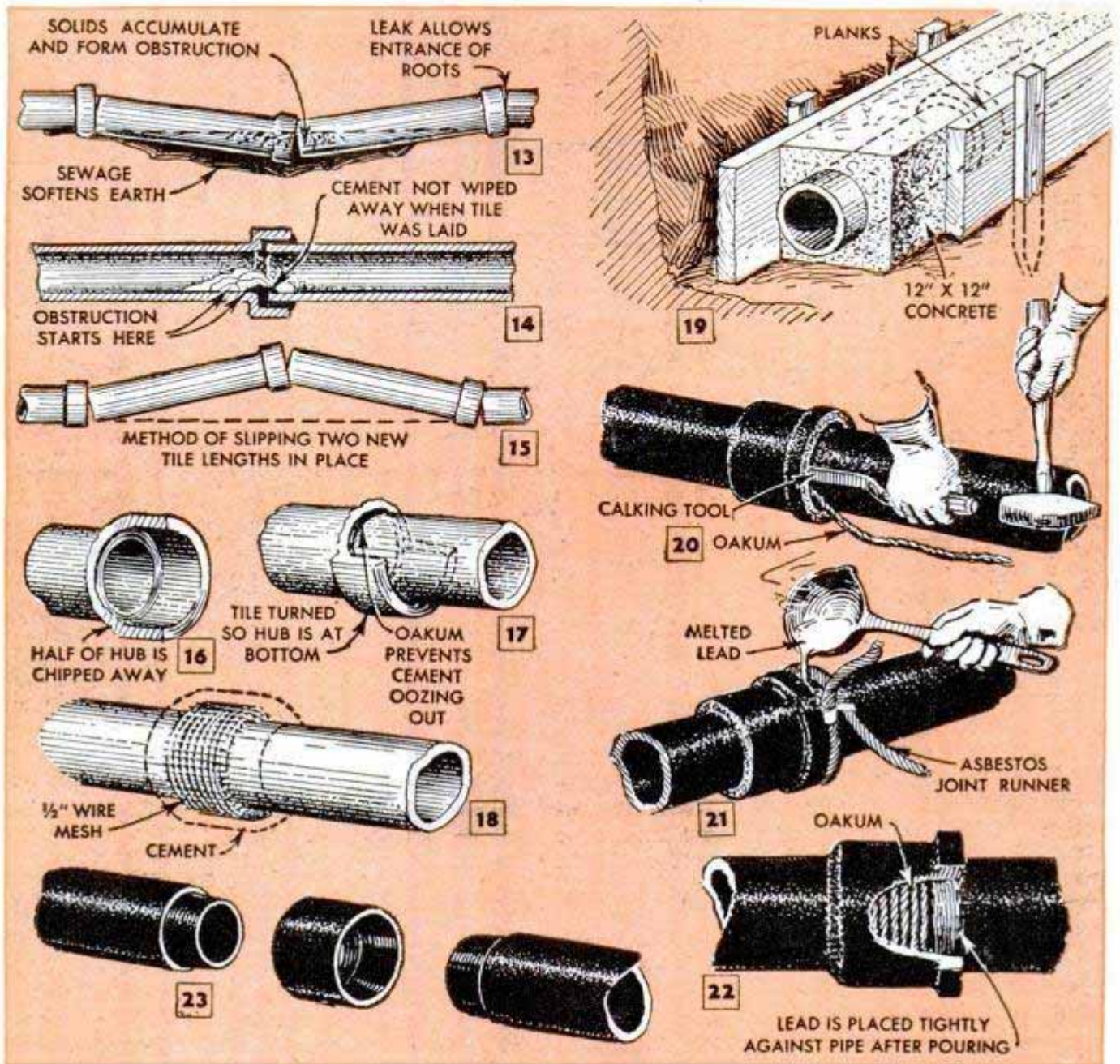
A sewer tile completely clogged and even broken by the dense growth of tree roots, some  $\frac{1}{4}$  in. thick



Hair ends of roots from trees located as far as 20 ft. from tile often work way through tiny cracks

found effective in "burning" and eating away tree roots. Copper sulphate, too, has been found effective for killing roots, after which they break off and wash away. However, copper sulphate should be used only in drains which are free from grease, as the chemical coagulates with grease and forms a nonsoluble, fatty-acid substance which can clog a drain. The chemicals can be applied at any cleanout or drain opening, and should be used regularly to keep the roots from spreading. Application should be more frequent in spring and early summer when growth is rapid.

Removing roots from pipe by either mechanical or chemical means is only a temporary measure and must be continued persistently to forestall trouble. Such measures are of value particularly during winter months when the ground is frozen and the work of digging up a pipe is a major and costly undertaking. Of course, for a permanent solution of the problem, the pipe should be repaired or replaced. If it can be located, the portion of pipe that is nearest



to the offending tree should be uncovered first, instead of digging up the entire line as is often done. The roots are cut away from the pipe which then is examined for possible damage.

#### Repairing and replacing outside pipe:

Damaged tile pipe usually must be replaced. After removing the cement from the ends of the pipe to which the new lengths are to be joined, the latter are slipped together by holding them at an angle as shown in Fig. 15. The best method of sealing the joints is to use oakum first and then cement. The oakum prevents the cement from oozing inside the pipe as shown in Fig. 14. If only one length of tile needs replacing, remove half of the hub with a cold chisel, Fig. 16, permitting the pipe to be slipped into place, after which it is turned so that the remaining portion of the hub will lie under the adjacent pipe as in Fig. 17. Then wrap the joint with wire mesh, Fig. 18, and finish by applying cement. If the pipe is not seriously damaged

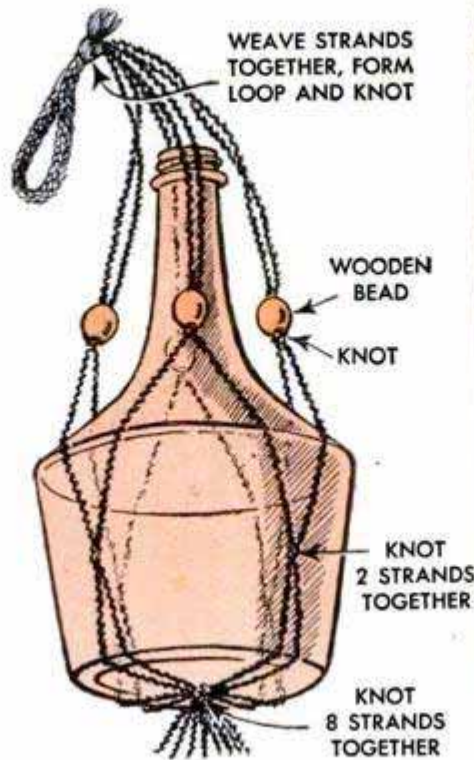
by tree roots, clean out the joint where the root entered and simply plug it with thick asphalt roofing cement before pouring a sleeve of concrete around it. This method, shown in Fig. 19, is relatively inexpensive.

A still more permanent method of eliminating all future drainage trouble caused by tree roots is to install regular soil pipe and "yarn" the joints with oakum, as shown in Fig. 20. The oakum is twisted to form a rope and about five or six turns are tamped tightly into the hub with a calking tool. This is followed by pouring melted lead over the oakum to within 1/2 in. of the end of the hub. An asbestos joint runner, Fig. 21, is needed to hold the lead in place until it solidifies. As the lead shrinks slightly in cooling, it is necessary to pack the lead tightly against the sides of the pipe with a calking tool and hammer. The finished joint is shown in Fig. 22. A hard composition pipe is sealed against the entrance of tree roots as shown in Fig. 23. The pipe ends are tapered to fit snugly into couplings.

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If you have an attractive glass decanter or a deep bowl, it can be displayed to best advantage by using it as a hanging plant holder or, if decorative enough in itself, it can be hung empty from a wall bracket. An eye-catching hanger that will conform to the shape of the container is easy to make from heavy colored wrapping cord. Using eight strands of cord, each about 1 yard long, knot them all together  $1\frac{1}{2}$  in. from one end to form a tassel at the bottom of the hanger. Then, dividing the strands into four pairs, knot each pair of strands together and knot one of the strands from each pair to the adjacent strand of the next pair. Thread colored wooden beads on the pairs of strands formed by the last knots and slip them down as far as they will go. Weave the upper 12 in. of all the strands together and bring the end of the braid

## Knotted Hangers Suspend Decorative Bottles To Hold Trailing Vines or Artificial Flowers



around, knotting or sewing with matching thread to form a loop. A large tapestry needle will be helpful in threading the beads on the strands of cord.

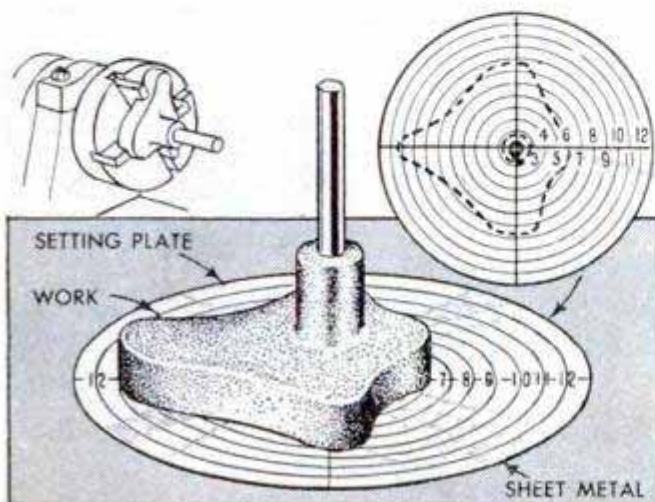
around, knotting or sewing with matching thread to form a loop. A large tapestry needle will be helpful in threading the beads on the strands of cord.

## Sheet-Metal Setting Plate Facilitates Chucking Irregularly Shaped Castings

This simple setting plate has proven to be a time and labor saver for machinists in job shops where it often is necessary to chuck a run of castings of irregular shape for machining. The problem, of course, is how to center the castings in a four-jaw chuck without resort to repeated use of the trial-and-error method. To speed up the job, cut a circular plate from heavy sheet metal to the same diameter as the chuck body. Center a light punch mark on the plate and scribe perpendicular lines using the mark as a center. Then scribe equidistant concentric lines the same distance apart as those on the face of the chuck

body. Center a hole through the plate of the same diameter as the hole in the casting. To use, place the work on the plate and center it by passing a rod or shaft through the hole in the casting and into the hole in the plate. Turn the work by hand to determine the best position for chucking. Then, by noting the position of the work with respect to the intersecting perpendicular and concentric lines on the plate, it is easy to set the chuck jaws to take the shape by simply running the jaws down to lines on the chuck body which correspond with those on the plate. Once the position of the jaws has been located to take the first casting, duplicate castings can be chucked rapidly and with sufficient accuracy for ordinary machining operations.

H. Moore, Hamilton, Ont., Can.



## Amount of Paint Left in Can Indicated by Pencil Mark

Before recapping a partially used can of paint, check the level of the contents and indicate it on the outside of the can by marking with a red pencil. Then, when you need paint in the future, you can tell at a glance whether or not there is a sufficient amount of the desired color on hand.

Ira M. Freeman, New Brunswick, N. J.

## Bench-Top Cabinet for Small Tools Has Convenient Slanted Shelves

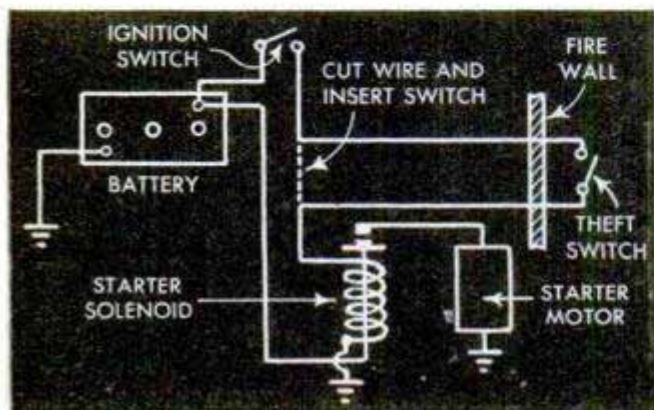


Set at a rear corner of the workbench or table top, this little tool cabinet holds screwdrivers, chisels, files and bits for immediate selection. Note that the shelves of the cabinet are slanted forward at an angle of approximately 45 deg., the tools being retained by cleats fastened along the front edges of the shelves. In addition to allowing the tools to be seen at a glance, the slanted shelves make it necessary to store the tools side by side and handle end down, thus protecting the cutting edges of chisels, gouges and similar razor-sharp tools.

Paul Will, Chicago.

## Hidden Switch Foils Car Thief

Installed in one lead wire of the solenoid starter switch, this hidden car switch differs from the usual variety in that it will prevent a thief from starting the motor by connecting a jumper wire between the battery and ignition coil. The switch is con-

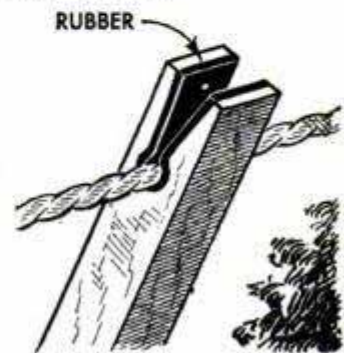


cealed in the glove compartment or under the dashboard and the leads are brought through a hole in the fire wall. The leads are taped and located under the other wiring so that they are inconspicuous. Thus, unless the potential thief is able to locate the leads or the hidden switch, he would have to push the car to move it.

H. Zave, Chicago.

## Clothes Pole Kept From Slipping By Inserting Rubber Liner

To keep a clothes pole from slipping sideways or blowing down, fit the notched end of the pole with a rubber liner. Cover the inner surfaces of the notch with inner tube, fastening it in place near the ends with stainless-steel or copper tacks. Then trim the rubber flush with the sides of the pole.



N. C. Darling, Orleans, Mass.

## Use Paraffin as a Lubricant

A block of paraffin is a handy item to keep around the house. In many cases, it can be used as a lubricant, being ideal to correct sticking window sash. Rubbed on the screw threads of a car jack, it will lubricate them and prevent rust and, also, it is an excellent lubricant for saw blades.

B. Halpern, Jackson Heights, N. Y.

## Weatherproof Order Board

Orders for the milkman, laundryman and other delivery people can be hung on the back porch without fear of their blowing away or being made illegible by rain if this plastic-covered order board is used. It consists of a plywood or hardboard backing, a sheet of plastic of the same size and a large paper clip.



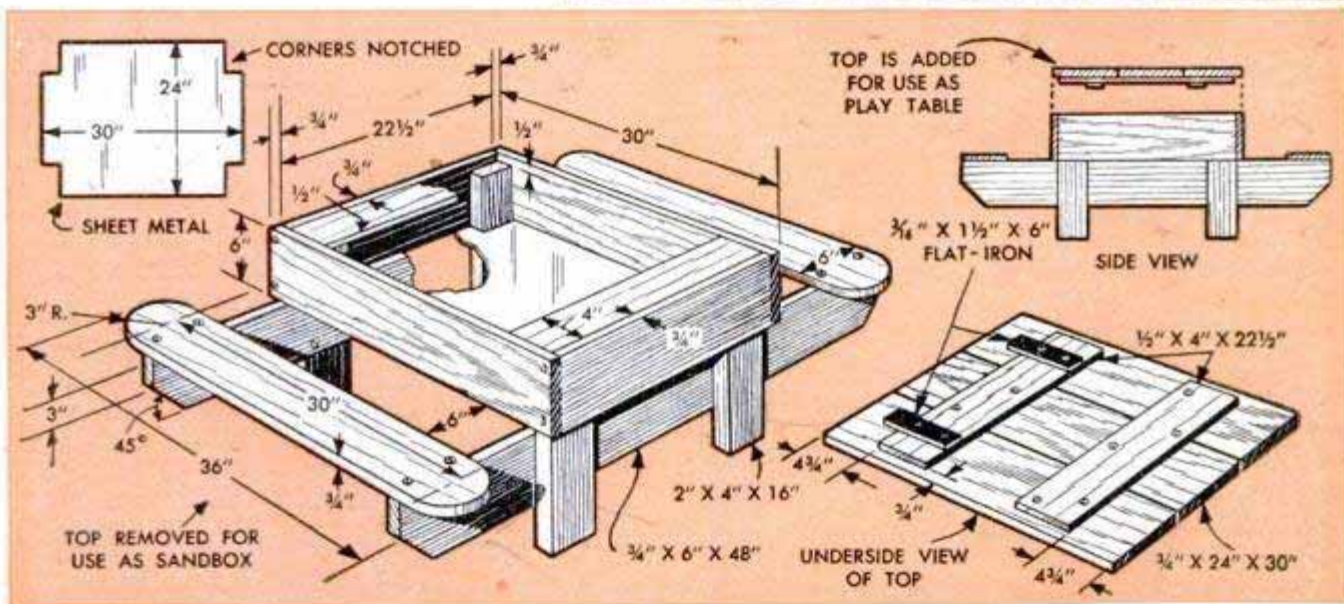
The note is sandwiched between the backing and the plastic and the parts are clamped together with the paper clip. Then the clip is hung from a screw hook turned into the door casing with a pair of pliers.

Robert Hertzberg, Jackson Heights, N. Y.

# Sandbox With Built-In Seats Doubles as Table

Resembling a miniature picnic table, this novel sandbox features a removable top which can be replaced when it rains or used to convert the box into a neat outdoor play table. Except for the bottom which is sheet metal, the entire box is constructed from common lumberyard material, the legs being pieces of 2 x 4, the ledges at the ends 1 x 4, with practically all the rest of the members being cut from 1 x 6 stock. A piece of 3/4-in. waterproof plywood will serve as a top or one can be built up from several boards. Two flat-iron cleats, fastened to the underside, serve to hook the top in place.

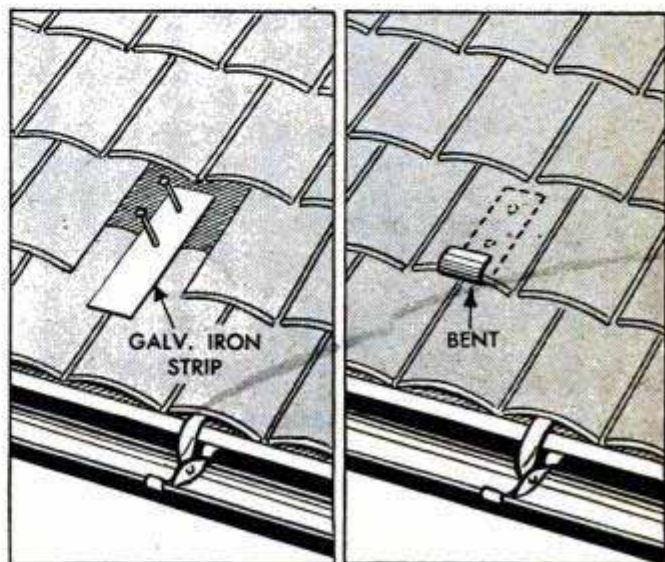
R. V. Stewart, Cleveland, Ohio.



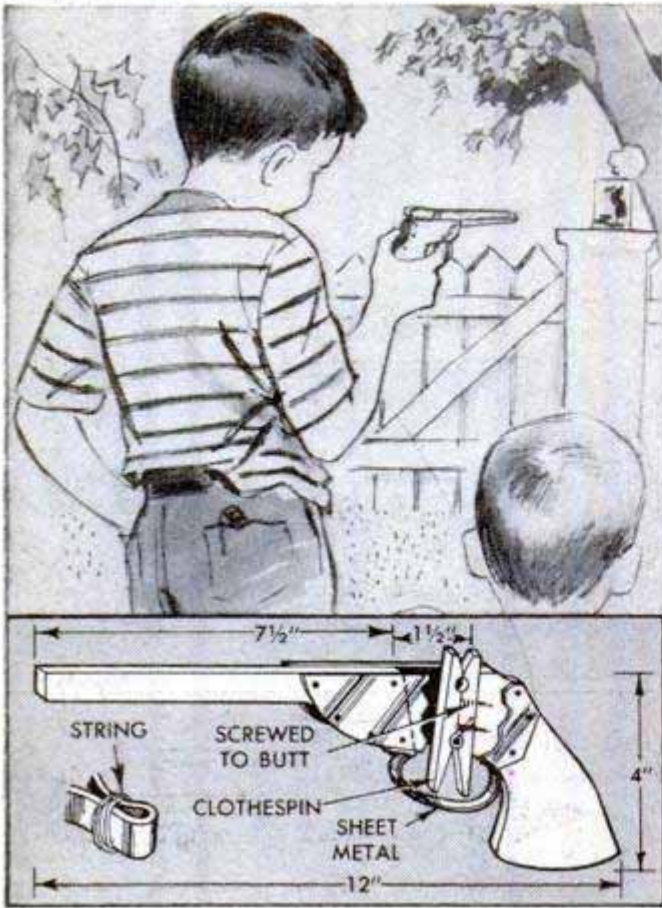
# Sheet-Metal Hanger Permits Individual Replacement of Broken Roof Tiles

It's not necessary to remove half the tiles from a roof to replace one or two broken ones if you use this easy method of attaching the new tile with a sheet-metal hanger. The first step is to remove the broken tile by sawing or cutting through the nail which holds it in place. Fitting a hacksaw blade with an improvised handle, by bolting and taping a piece of flat iron to it, provides a handy saw. The blade can be worked back and forth under the tile. A second method is to cut a notch near the end of an old hacksaw blade to form a hook. The edges of the notch are sharpened and the other end of the blade is wrapped with tape. With the notch hooked over the nail, a sharp downward pull of the blade will cut the nail in two, permitting removal of the tile. To install a new tile, nail a galvanized-iron strip to the roof, as in the left-hand detail. Then, slip the tile into position and

bend the end of the metal up and around the lower edge of the tile to clamp it tightly in place.



## Toy Pistol Shoots Rubber Bands



Made from two pieces of wood, sheet metal and a spring-type clothespin, this rubber-band pistol provides an entertaining toy. The wooden barrel and butt are joined with two sheet-metal plates fastened to the wood with brads. Before assembling the barrel and butt, the clothespin is taken apart and one arm screwed to the face of the butt. Then the clothespin is reassembled to form the trigger. A strip of sheet metal serves as a trigger guard. Note in the lower left-hand detail that the rubber bands which are cut from an old inner tube are wound with string at one end. When loading the gun, the ball formed by the string is gripped by the clothespin jaws. —Georges Normandin, Shawinigan Falls, Que., Can.

## Raise Your Own Bait Worms

WINDOW SCREEN



MIXTURE OF  
LEAF MOLD AND SOIL

knot holes, line it with window-screen wire and then fill it with a mixture consisting of equal parts of leaf mold and rich, loamy

A plentiful supply of bait worms will be available even in dry weather when they are hard to find, if you start a worm farm in a wooden box or half of a barrel. If the container has large cracks or

soil. A farm the size of a half barrel will accommodate about 300 worms. Dig them from rich garden soil, if possible, and place them on top of the earth in the barrel. The healthy worms will soon dig themselves into the soil, those that have been injured remaining on top. The latter should be removed and discarded. Keep the soil damp, but not too wet and store the barrel in a cool place. Baby-chick meal boiled for about 10 min. is an excellent food for the worm farm. When cool, this should be placed just below the surface of the soil. The worms are fed only once a week, and the uneaten food removed after 24 hours, as it otherwise will rot and cause the soil to become sour.

## Screen Disk Covers Fish Bowl

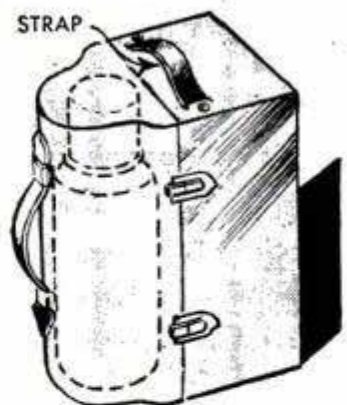
Small fish bowls can be filled almost to the top if they are covered with a screen disk to keep the fish from jumping out. Cut the disk from copper, aluminum or galvanized window screen and bend the edges down over the rim of the bowl. Then fasten a drawer knob to the center of the disk. This will serve as a handle and also as a weight to hold the lid in place.



Arthur Trauffer, Council Bluffs, Iowa.

## Handle at End of Lunch Box Aids Carrying in Crowds

If the corners of your lunch box jab fellow passengers in crowded busses or subways, attach a second strap at one end so the box can be carried vertically and, thus, take up less room. Cut two slits in the end of the box to receive a leather strap and bolt or rivet the strap securely to the sheet metal.



Harold Gould, Toronto, Ont., Can.

## Prolonging Cut-Flower Life

To get maximum life from cut flowers, keep them fresh longer by placing a couple of ice cubes in the water. Drop two or more ice cubes in the vase two or three times a day so that the water will remain cold.

Valentine Zadnik, Mantua, Ohio.

# FINGER TRAP

By Allan Carpenter

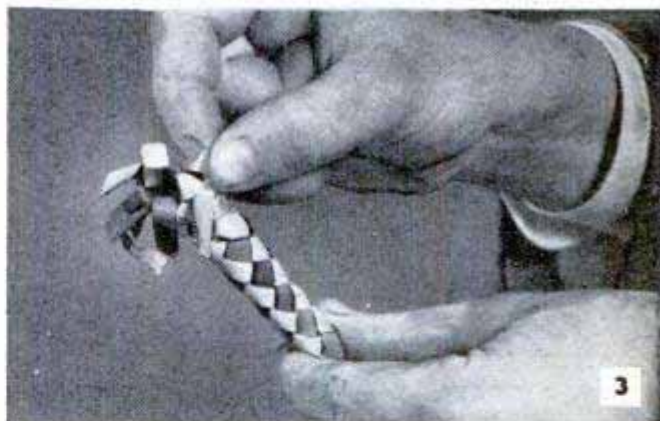
**F**UN TO PULL on your friends but difficult for them to pull off, this finger trap will provide an entertaining gadget to bring out at an informal get-together. When a finger of each hand is inserted into the ends of the trap, Fig. 4, the more the victim pulls to free his fingers, the tighter the trap grips them. The secret of getting loose, of course, is to push rather than pull and then gently ease the fingers out. To weave a trap, take eight strands of thin cane, strong paper or tape  $\frac{5}{16}$  in. wide and 36 in. long and double each strip in half. Next, insert the doubled strands through one another as in step A, Fig. 5, making four pairs, and then thumbtack them evenly around a  $\frac{1}{2}$ -in. dowel as shown in Fig. 1 and step B, Fig. 5. Now, treating each double strand as a single one, weave the right-hand strand over the top strand of the adjacent pair. This pattern of weaving is indicated in step C, which shows the four pairs stretched out. The step is repeated the full length of the trap, Fig. 2, watching to see that each "over" strand is followed on the next round of braiding by an "under" strand and vice versa. When the trap is about 6 in. long, Fig. 3, finish up the loose ends by inserting the top strand B between the strands of end A and tuck A under as shown in the right-hand detail, Fig. 5. Strands B are tucked the same way to complete the trap.



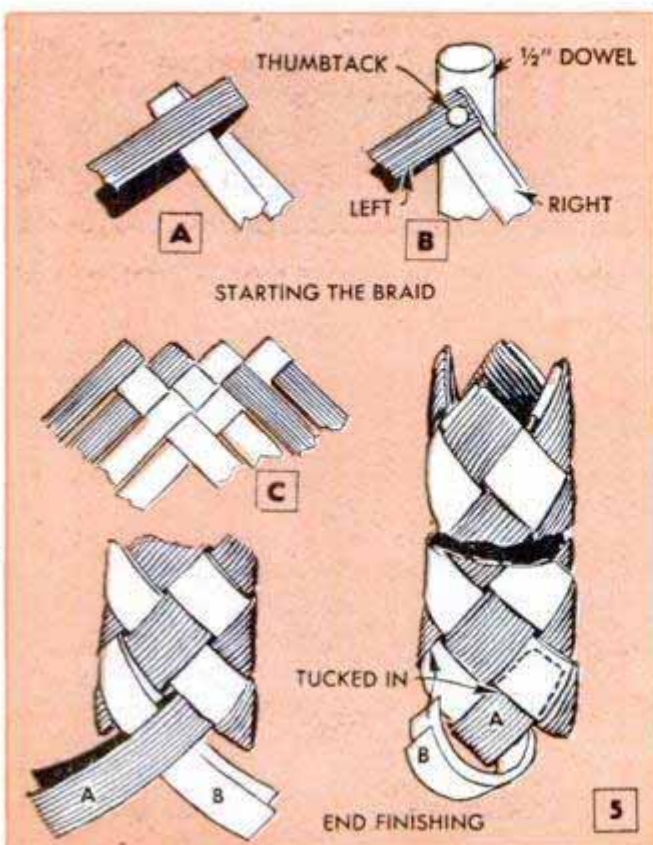
Each pair of doubled strands is laced through one another. Then pairs are spaced around a  $\frac{1}{2}$ -in. dowel and thumbtacked in place to hold them for braiding



An over-and-under weaving technique is used the full length of the trap. Four of the eight pairs of cane strands can be colored to produce a varied pattern

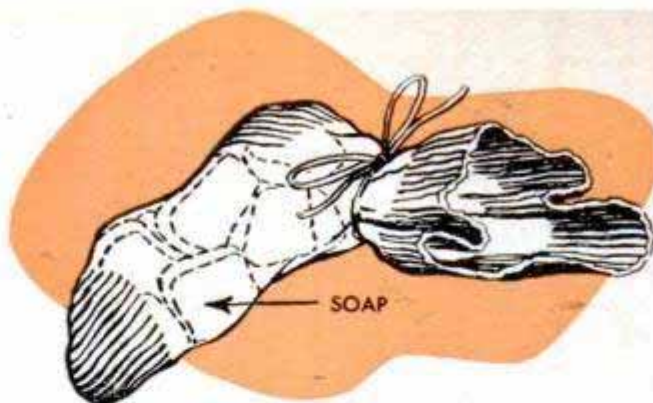


Above, when the trap is braided about 6 in. long, the loose ends are folded over and tucked under. Below, the more the fingers are pulled, the tighter the trap grips. Secret is to push and gently ease fingers out



★

# ***Solving* HOME PROBLEMS**



★

**ECONOMIZE ON LAUNDRY SOAP** by saving small scraps of toilet soap and tying them in an old sock. In this way, suds is obtained from the scraps without small pieces of soap being caught in the clothes



**FRUIT-JAR BREAKAGE** caused by jars bumping in boiling water is reduced by slipping a rubber over each jar

**FRICION-FITTING JAR COVERS** can be removed without bending out of shape if a knife blade is laid across the cover with the tip under the end of the can opener

**MOTHPROOF STORAGE** for woolens is had by placing them, along with moth balls, in tightly capped fruit jars. This is ideal for gloves, scarves and sweaters



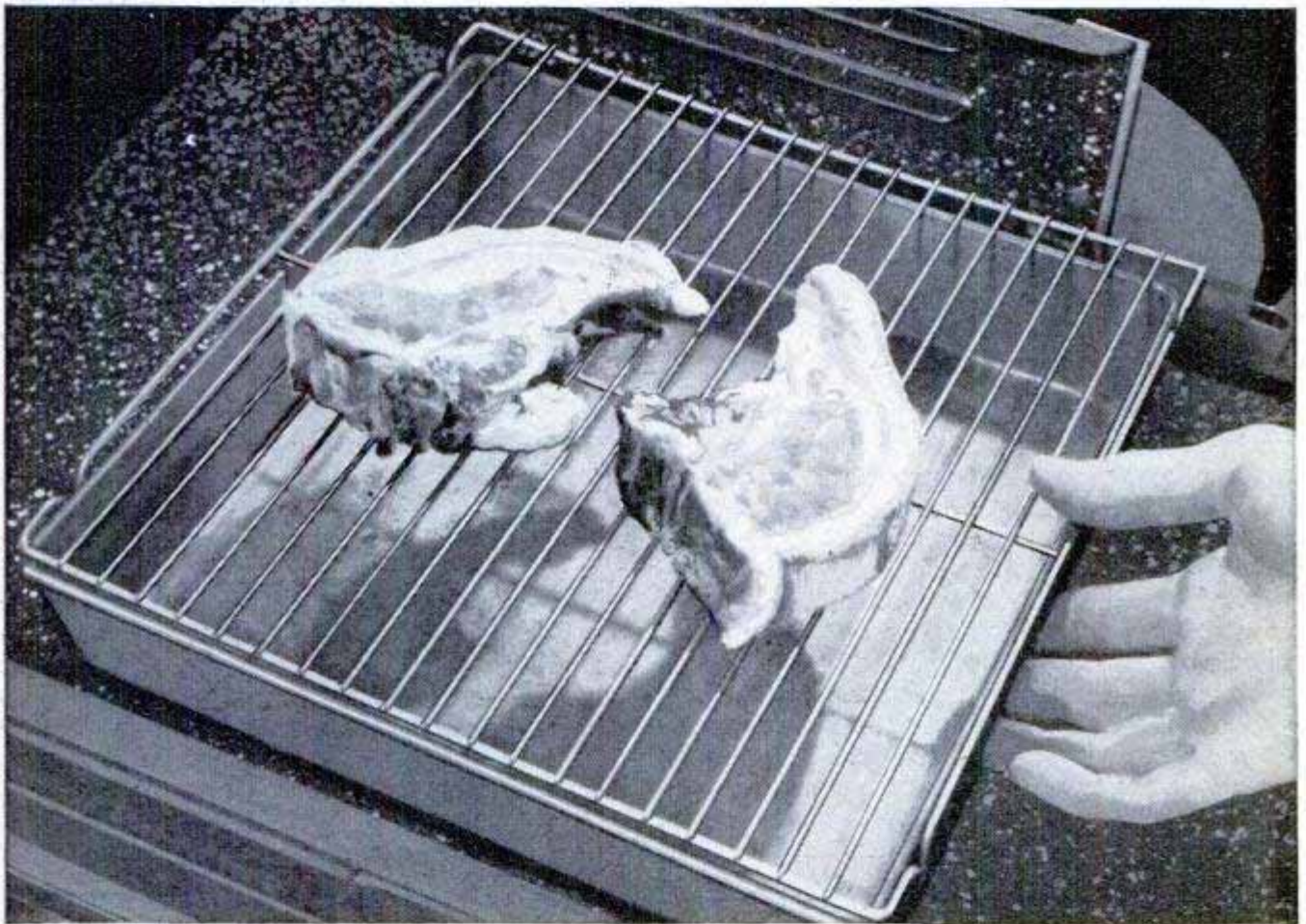




**TO RESTORE THE NATURAL COLOR** to house-plant leaves, give them an occasional shower under faucet. Slit a square of oilcloth and place it around the stems of plant to keep the soil from being washed away



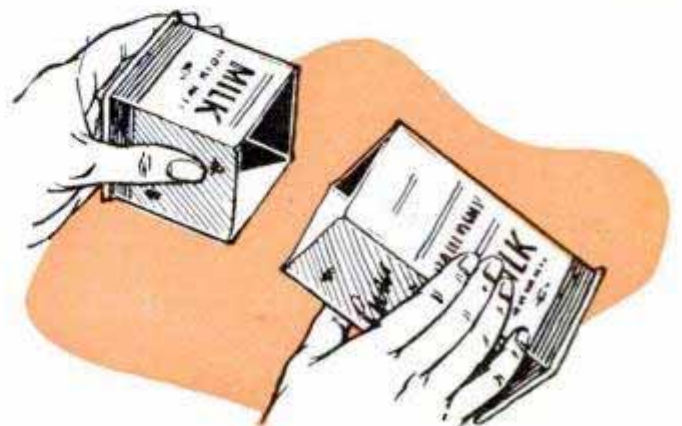
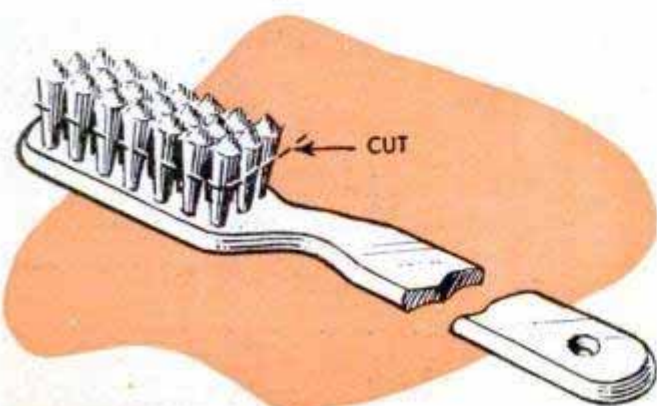
**POUNDING A CATCHUP BOTTLE** to remove obstinate contents is both hazardous and unnecessary. Next time, merely tap the neck of the bottle gently with the forefinger and watch the catchup flow out smoothly



**USING SMALL CAKE PAN** and rack to broil a couple of chops saves the trouble of cleaning out the broiler

**FOR QUICKLY REMOVING GRIME** from fingernails, try using an old toothbrush. To stiffen the bristles sufficiently, cut them down to about  $\frac{1}{4}$  in. long

**A STURDY CONTAINER** made from bottom sections of two milk cartons permits carrying salad in lunch box. Crimp corners of one section and use other as cover



## Attractively Upholstered Youth Seat Fits Dining-Room Chairs



If dinner guests frequently bring their youngsters with them or if lack of space makes it difficult to use an extra youth chair in the dining room for your own child, make this raised seat which is upholstered to match the dining-room furniture. The seat is better looking and more comfortable than the heavy books or telephone directories usually used for this purpose and also is less dangerous, as it cannot slip off the chair. The seat is upholstered over a simple hardwood frame. First, furniture webbing is drawn taut across the top of the frame and then burlap is tacked over the webbing. Layers of moss and cotton are used for padding and the cotton is covered with fabric, the corners of the latter being cut and sewn together or folded so that the laps are at the front and back of the seat. The fabric is brought completely around the frame and tacked to the lower edge. Four hardwood cleats, which hold the seat on the chair, are finished to match the chairs and are attached with screws driven from the inside of the frame.

Victor H. Lamoy, Upper Jay, N. Y.

## Set Your Watch With a Compass

Should your watch stop while out on a hunting or fishing trip, it can be set to local time fairly accurately by employing the sun and a compass. Keeping the hour hand of the watch pointed directly at the sun by moving the hands, turn the watch until a pencil or a straight twig, placed halfway

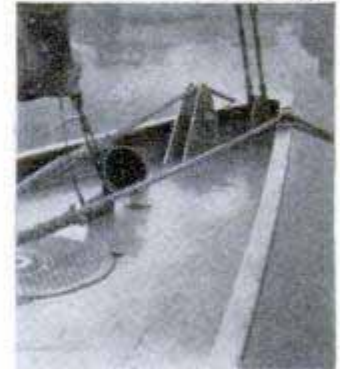
between the hour hand and 12 o'clock, points north and south. The direction of the pencil, of course, must be checked carefully with the needle of the compass.

D. E. Horn, River Forest, Ill.

## Boat Pulley Prevents Rope Chafing

When a small boat is moored to a buoy or pier where there is considerable tide, the movement of the boat causes chafing of the rope and wearing of the gunwale strip. Rope replacement and wear can be reduced to a minimum by using a pulley to replace the chock. Obtain a pulley to suit the diameter of the rope and mount it on an axle welded to two iron side plates. Then, simply bolt the pulley assembly to four galvanized corner irons mounted at the proper angle on the gunwale.

Steve Wilson, Los Angeles, Calif.

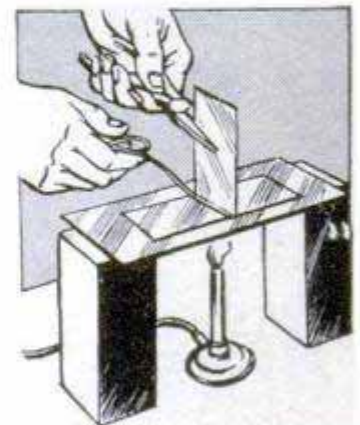


## Painting Rusted Galvanized Roof

Prior to painting a rusted galvanized roof, brush off as much of the rust as possible. Then, apply an iron-oxide or aluminum paint having a linseed-oil base, being careful to apply it very thin so that the paint completely surrounds rust or scale particles. Iron-oxide paint, which has excellent weathering properties, should last several years, while the reflective qualities of aluminum paint serve to keep the interior of the structure cooler in summer, also reducing the rate of deterioration.

## Soldering Without Distortion

By heating the work indirectly, silver-soldering or brazing small parts can be done without danger of distorting the metal. Stand a couple of bricks on end or provide some other means to support a piece of sheet metal. The work is prefluxed



and the parts are held in position on the sheet-metal plate. A Bunsen burner is used to heat the underside of the plate and, when the work has reached the proper temperature, filler rod is applied to the joint.

Ernest A. Iversen, Westchester, Ill.

# MOVING-DAY POINTERS

Accumulating a small mountain of household items is a source of satisfaction, but moving them is a real headache unless you have the know-how. If you remember these tips from the experts—the members of the National Furniture Warehousemen's Association—moving day will pass without serious mishap

By Frank N. Stephany

**M**OST OF US move from one home to another at least once during a lifetime, and the moving job usually ends in a confusion of boxes and barrels, broken china and jangled nerves. All of this is unnecessary if you plan the job carefully and take a few simple precautions to assure that even the most fragile household items can be handled with safety.

Whether you do the moving job yourself or hire a furniture warehouseman to transport the furnishings, proper packing of breakables is of primary importance. Dinnerware and glassware as well as silverware and kitchen utensils should be packed in strong barrels or drums. When packing dinnerware, pad the bottom of the drum with a thick layer of excelsior or shredded newspaper. Then wrap the pieces in excelsior and several thicknesses of paper. Heavy dishes, such as dinner and soup plates, are packed first, standing the plates on edge instead of laying them flat. After the first layer of dishes has been packed, another bedding of excelsior is laid over it and a layer of medium-sized dishes, wrapped and packed in the same way, is added. The lightest pieces of dinnerware are packed nearest the top of the drum and covered with a thick layer of excelsior and newspaper.

Glassware is packed in a separate drum, using the same general procedure as for the dinnerware. However, if space permits, the glassware



Do not pack dresser drawers with heavy items. This makes the piece difficult to handle and may result in drawer breakage

Pillows folded double and placed inside a dresser drawer are lightweight and will hold the drawer in place while moving





Electrical appliances should be wrapped separately and packed in boxes or barrels. Note pads of folded newspapers inserted between the waffle-iron grids

Securely tie handles of brooms, mops and carpet sweeper to form a neat bundle. Curtain rods can be conveniently included. A used oil mop or oily rags should not be moved with the rest of the furnishings



Inside of stemware is filled and stem is padded with a liberal amount of excelsior or shredded newspaper. Piece is then wrapped with newspaper or tissue paper



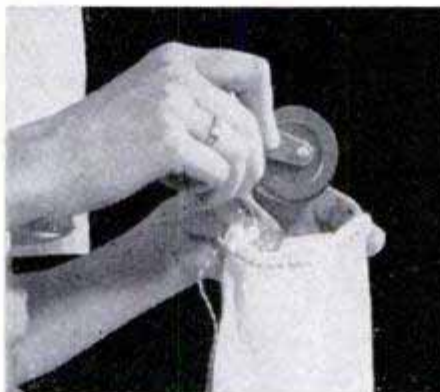
As many as six or seven plates of the same size can be stacked and wrapped in a bundle. Use heavy padding of excelsior between plates and around stack

After wrapping, plates are packed on edge in a drum or barrel. Heavy pieces are placed at bottom and progressively lighter ones are packed as drum is filled





Rolling mattress can result in damaged springs and torn fabric. Instead, insert mattress in special carton provided by warehouseman. It's also a good idea to protect the mattress with a sheet or a mattress cover



Each item which is not to be moved should be labeled accordingly. Suitable tags are supplied by the mover

Casters from each piece of furniture are removed and tied together or are placed in a special sack

Appropriate labels should be pasted to carton top and sides to insure careful handling of fragile items

For safety and ease of handling, books are packed on end and one row deep in strong cartons or boxes, left. Note bindings are placed back to back. Framed pictures may be packed between layers of linens, right





**Jewelry and cash should not be packed, but personal papers can be moved safely by locking in desk drawer**



**Above, lamp shades are wrapped individually with tissue paper and packed in a large carton. Below, a special wardrobe provided by the mover prevents wrinkled clothing and permits dustproof handling**



may be packed on the top layer of the dinnerware drum. Glassware is padded with excelsior and then wrapped with newspaper or tissue paper and, in the case of stemware, the stem of each glass is protected with a liberal padding of excelsior and wrapped with paper. Stemware is always packed on the top of the other glassware, that is, in the final layer placed in the drum.

Large framed pictures, mirrors and marble or glass furniture tops should be wrapped and crated, padding them carefully with excelsior. Linens, curtains, blankets and wearing apparel are packed in trunks or cartons, the latter being lined with brown wrapping or tissue paper to protect the contents from dust. Do not use newspaper as a liner, as the ink may soil the fabric. A dustproof wardrobe, which can be obtained from the mover, will solve the problem of packing and safely transporting suits, coats and dresses.

Cramming dresser drawers with linens or filling them with heavy objects not only makes the piece hard to handle but might result in breakage of the drawers. Instead, leave the normal amount of linens in the drawers or pack a few items of bric-a-brac in them. Placing a couple of pillows, folded double, in each drawer is the best way of utilizing the space. The extra weight is negligible and the pillows tend to keep the drawers from slipping out of the dresser. Bedding should be placed in a separate carton or bundled and wrapped in a sheet. The trick in moving your books without damage is to pack them on end in a strong box or carton. Books should be packed one row deep in each carton, with the bindings back to back. Wrap the most valuable books individually. Do not overpack cartons, baskets or barrels or they may be too heavy for the mover and will not permit stacking in the van.

Have the refrigerator serviced and the motor bolted down before moving and then have it checked and reserviced before using it at the new location. Be sure that the refrigerator has been defrosted before moving. Casters should be removed from furniture and, to avoid confusion later, each set should be tied together and labeled. Don't pack anything inflammable and do not take the chance of moving partially used containers of liquids that might spill and damage the furnishings.

Remember to give your new address to the post office, bank and newspapers and magazines to which you subscribe. Order your telephone and public utilities discontinued. Finally, inventory your household items, briefly listing the contents of boxes and barrels. Have a plan as to where the furnishings are to be placed in the new home and instruct the mover accordingly.

## Camp Foodstuffs Kept Ant-Free in Covered Cans Hung From Ceiling

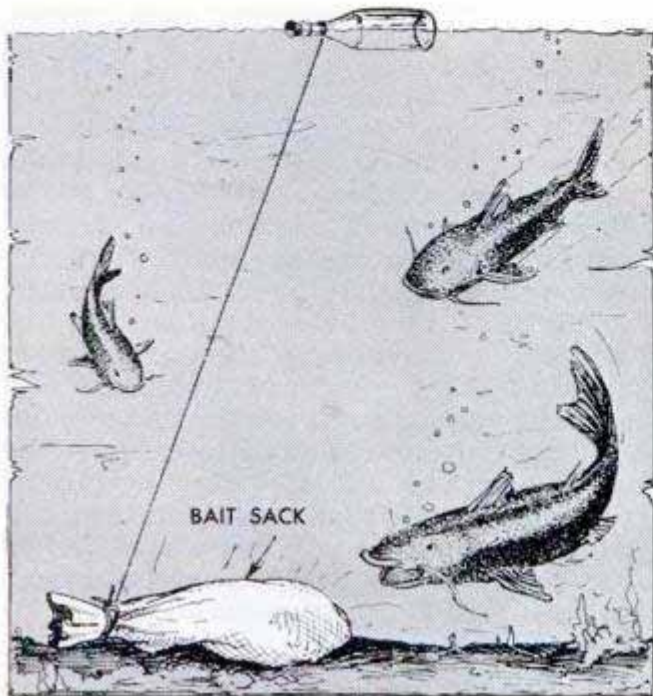
Sugar, jars of jam and small amounts of other foods used in the camp can be protected from ants by placing them in covered cans suspended from the cabin ceiling. Cut sections of dowel just long enough to fit between the sides of the cans, so that they engage the rims, and tie lengths of cord to the dowels. Slip cardboard disks over the cord to provide covers for the cans and hang the cord from hooks turned into the ceiling. To obtain the food from the cans, simply raise the covers a few inches and tilt the dowels to disengage them from under the rims of the cans.

Mrs. Alba Dias Desouza, Bombay, India.



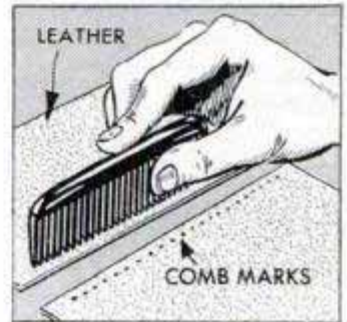
## Bait Sack Attracts Catfish

If you want to bring home your limit of channel cats or 50 to 100-lb. flatheads, don't try to do it by hunting down the fish. Instead, make them come to your bait. To do this, fill a burlap or grain sack half-full of a mixture consisting of equal parts of cottonseed meal and hog tankage. Both items ordinarily can be obtained at the local feed store. Place a heavy stone in the bag and tie it. Attach a bottle float to the sack with a long line so you can locate it easily and then drop the bag in from 10 to 25 ft. of water. The catfish, attracted by the odor of the bait, will come long distances to try to reach the contents of the sack. As the fish will be in the vicinity of the sack, just lower your baited hook and you are sure to bring in a good catch. If the stock bait mixture is not available, use chicken or fish-market refuse or bloody meat scraps. In this case, place the sack out in the sun and allow the bait to ripen before dropping it in the water.



## Comb Marks Leather for Punching

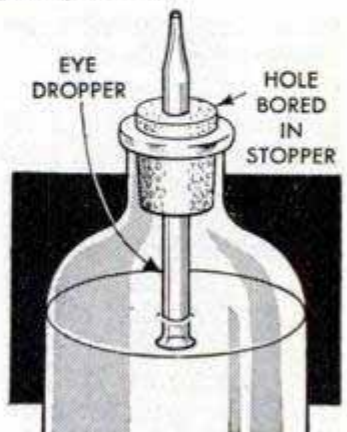
Index marks for punching leather prior to lacing two pieces together can be made quickly and evenly with a coarse-tooth comb. Press the comb on the leather so that the teeth leave a row



of clear impressions and punch through the impressions with an awl or other sharp instrument. To make sure that the holes are spaced identically in both pieces, the indented piece can be positioned over the other one before punching the holes.

## Improvised Dropping Bottle

When it is necessary to dispense a liquid one drop at a time and an ordinary dropping bottle is not available, one can be improvised quickly by using an eye dropper and a stopper. Bore a hole through the center of the cork and, after removing the bulb from the eye dropper, press the latter through the hole, as shown in the drawing. Be sure that the stopper is a tight fit in the neck of the bottle.





## *Pour Your Own*

By W. Arthur Heacock

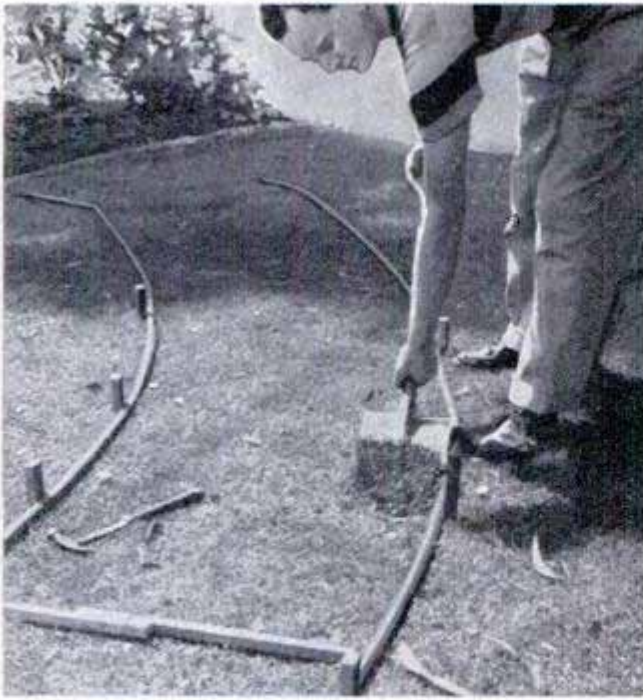
# FLAGSTONE WALK

**W**HY PAY OUT a lot of money for flagstones when you can cast them realistically in concrete? It requires no special skill. A trowel and a shovel are the principal tools needed and the work is actually fun. The series of photos on the opposite page take you through the steps involved and illustrate convincingly what a simple job it is. The "stones" are cast right in place, using metal molds resembling large cookie cutters. The molds are bands of sheet metal which are bent into irregular shapes to closely resemble actual flagstones. These are fitted together like the pieces of a puzzle, being spaced about 2 in. apart and held in position with dampened soil. After each stone has been cast and allowed to set 24 hrs., the molds are removed and reused. The first thing to do is to lay out the width and desired curve of the walk, using a garden hose to establish its outline. Small stakes are driven along the outside of the hose and used to guide the placing of the molds. If a lawn already exists where the walk is to be located, the sod is removed to a depth of about 1½ in. Take out only enough sod to accommodate the number of stones to be laid at one time. In this way, the walk can be built in stages

to suit your spare time without having the lawn torn up. The molds consist of sheet-metal strips 2½ in. wide and 5 or 6 ft. long. The ends of each mold are wired together through holes punched in the metal with a nail. Keep the molds large and varied in shape, no two being alike nor smaller than 1½ ft. across.

A 1-2-3 mix is recommended for the concrete fill, that is, one measure of portland cement, two of sand and three of pea gravel. Tamp the concrete firmly in the molds so that it puddles at the top and then rake off any surplus flush with the top of the molds, using the edge of a straight board. A little crown is preferred in troweling the stones so that they will shed water. Avoid using an edging tool around the outer edges of the molds. It is better to let the mold chip the edge of the concrete as it is removed so that it resembles a regular hand-cut flagstone. The molds usually can be removed the following day by merely cutting the wires that hold them together. After the metal bands have been pulled free, some of the dirt is scooped out from between the stones and replaced with strips of sod, keeping the latter lower than the tops of the stones.

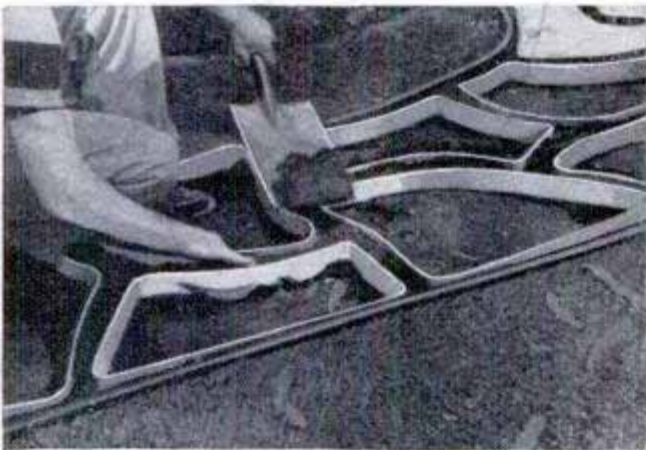




1st. A garden hose is used to establish the outline of the walk. This is staked in position and then the sod is removed, some of which is saved for filling in around the flagstones after the molds are removed



2nd. The sheet-metal bands which form the molds are made "endless" and then bent into irregular shapes, no two being alike. The ends of the bands are wired together and molds are placed as desired 2 in. apart



3rd. Wet soil is used to hold the molds in position. Part of this is later removed and replaced with sod

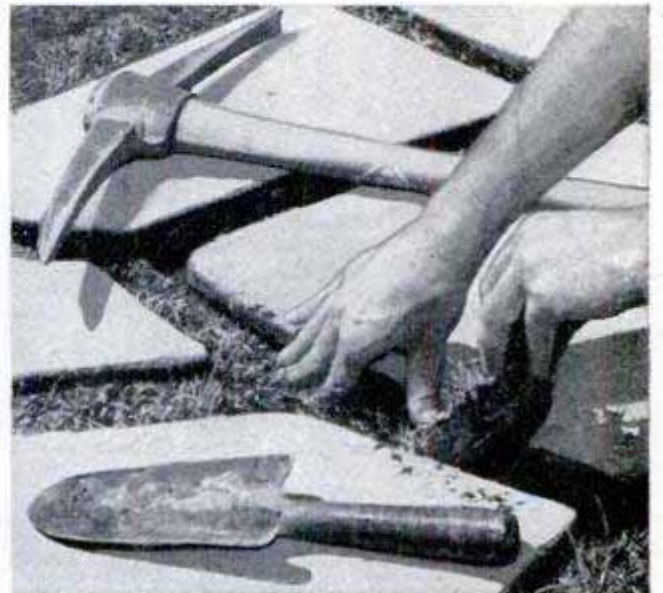


4th. Molds are filled level with concrete, tamped and troweled. Straightedge is used to rake off excess

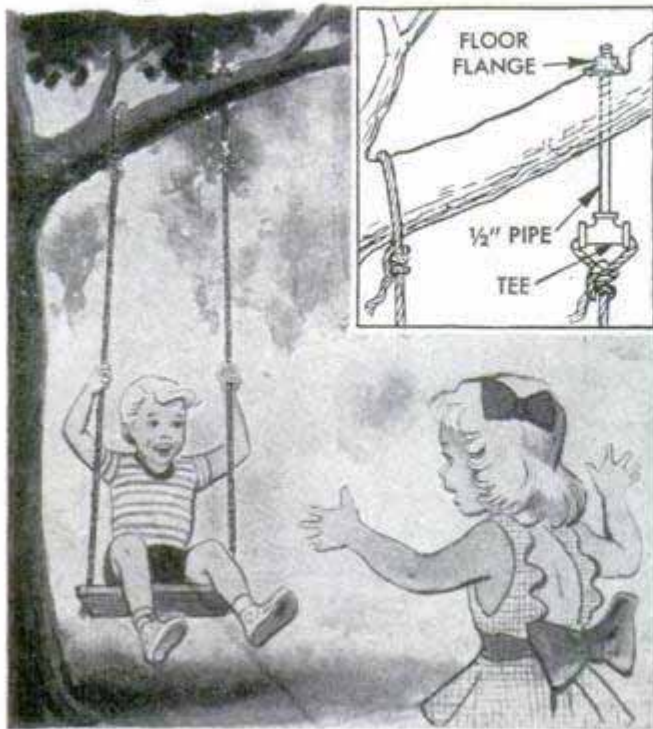
5th. Removal of the sheet-metal molds is easy. Just cut the wire holding the ends and jerk the strip free



6th. The edges of the "stones" are scraped lightly and sod is placed between them  $\frac{3}{4}$  in. below top



## Pipe Extension Lowers Swing Rope To Compensate for Slant of Limb



To make the ropes pivot at the same level when hanging a child's swing from the slanted limb of a tree, tie the outer rope to a pipe extension. Hung in this way, the swing will move in a straight arc. Cut a flat on the upper portion of the limb at the point where the outer rope is to be hung and drill down through the flat to permit inserting a length of 1/2-in. threaded pipe. Pass the pipe through the hole and fasten it with a floor flange as shown in the detail. Then turn a tee on the lower end of the pipe and tie the swing rope through the hole in the tee. The extension should lower

the outer rope so that it pivots at exactly the same level as the inner rope.

Dr. Bernard Matzen, Napa, Calif.

## Disposable Glue-Can Cover

A square of wax paper placed over the top of a glue can provides an easily removed and disposable cover. The glue left on the rim of the can will hold the paper in place tightly enough to prevent the glue inside from hardening. The paper is quickly torn off when the glue is to be used and then replaced with a new piece.



Benj. Nielsen, Aurora, Neb.

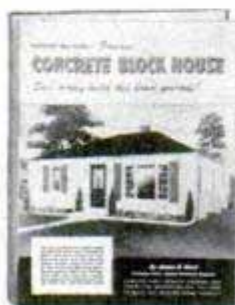
## Varnish Remover Softens Filler

When refinishing an old piece of furniture, varnish and paint remover will take off the old finish. However, the stain and filler still remaining in the wood present a hard glazed finish that quickly dulls the edge of a scraper. The surface can be scraped without difficulty if a thin coat of varnish remover is applied to the wood before scraping. When working on a large surface, apply the remover to only one section at a time so it does not dry out before scraping is begun. Be sure to clean the tool thoroughly after the job has been completed.—Earl W. Hill, London, Ont., Can.

## • Popular Mechanics Build-It-Yourself Homes •

IF YOU CAN use a hammer and saw and mix concrete, you can build one of these homes yourself and save at least 50 percent of its cost, just as other Popular Mechanics readers are doing. Enlist the aid of your friends and go to work now so that you can move into your new home next fall. You have a choice of a masonry or a frame home. Plans and a book that give step-by-step instructions on building each house are available from Popular Mechanics Press, 200 E. Ontario St., Chicago 11.

### MASONRY HOME FOR \$3650



This modest home has two bedrooms, bathroom, utility room, large living room and cabinet kitchen. It has concrete floors and is insulated. Walls and concrete floors are vapor-sealed to prevent penetration of moisture. The home was built of lightweight concrete blocks complete with kitchen cabinets and a gas-fired furnace at a cost of \$3650 for materials. It also can be built of brick or other masonry materials. The book,

\$2.00. A set of 10 blueprints, \$12.00. Book and plans ordered together, \$12.50. Extra sets of blueprints can be purchased for \$5.00 per set.

### FRAME HOME FOR \$7000



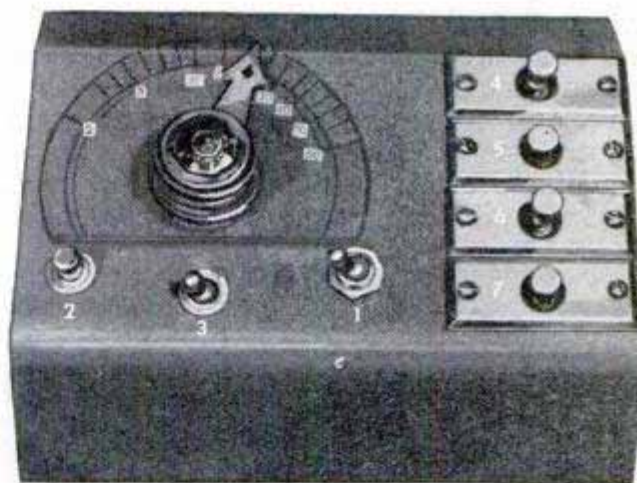
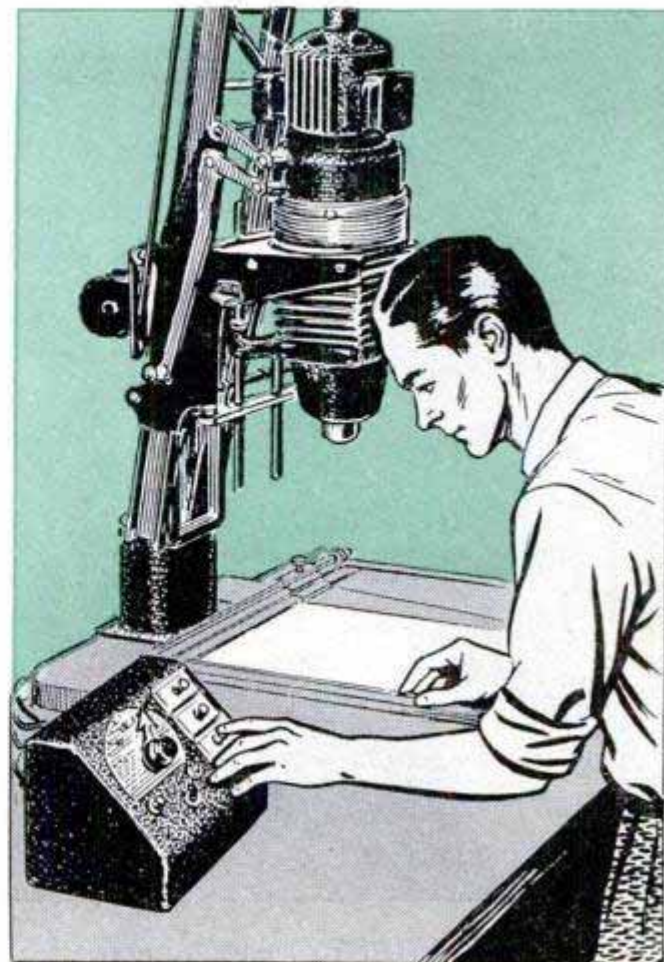
A larger and more pretentious home than our masonry home, this frame-type house was built as pictured complete with two bedrooms, living room, cabinet kitchen and dining nook, plus breezeway and garage, at a cost of approximately \$7000 for materials, including hot-air furnace. There is space upstairs for three additional rooms. This home can be built in four other styles at less cost by leaving off breezeway and garage. The book for this house is \$3.00; blueprints, \$12.50 per set. Book and plans together are \$14.00. Extra sets of plans are \$5.00 per set.

# TIMER-SWITCHBOARD

*for your darkroom*

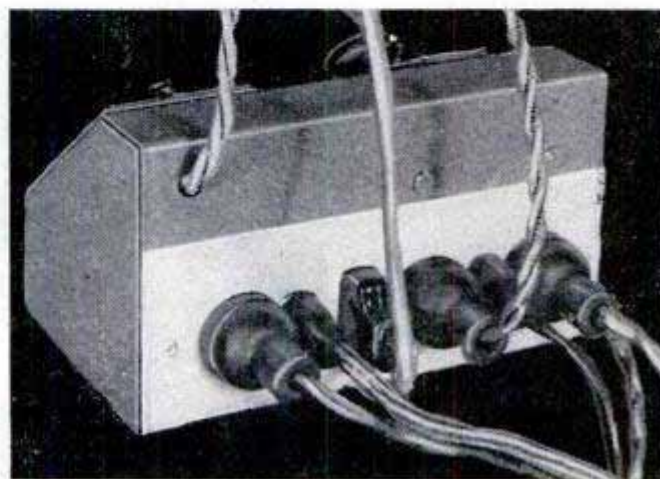
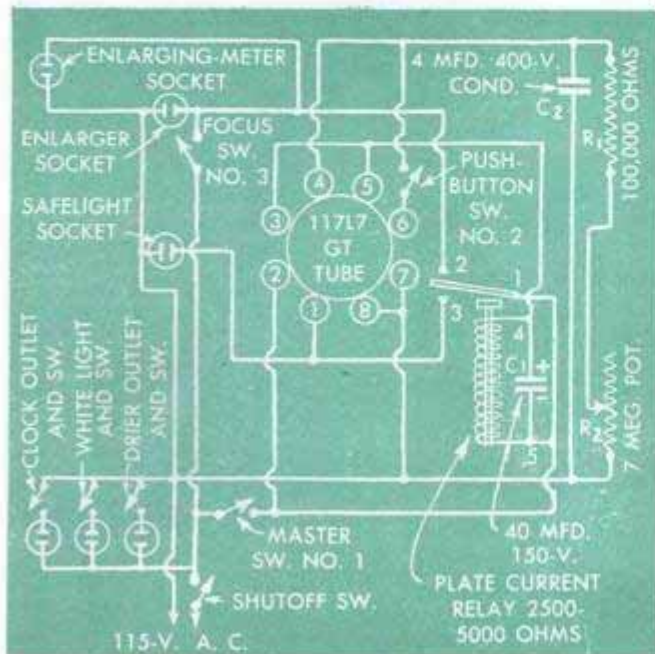
By Richard C. Collins, Jr.

**F**EATUREING finger-tip control for your various photo processing equipment, plus a built-in electronic print timer, this compact darkroom switchboard fits in a standard sloping-front instrument case measuring only  $4\frac{1}{2} \times 4\frac{1}{2} \times 7\frac{1}{2}$  in. Besides the timer, gang switches and outlets are provided for a print drier, safelight, enlarger, clock, enlarger meter and a white light, all of which plug in from the back. In addition, the switchboard has an enlarger-focusing switch, a push-button exposure switch and a master switch to turn the unit on and off. The timer, which is wired so that the safelight remains on except during the actual exposure period, requires a warm-up period of 20 to 30 min. and, when it is first turned on, the enlarger lamp will light, but shortly afterwards it will automatically turn off. The exposure period is controlled by a potentiometer which is first set by a pointer to the desired interval and then the exposure button is pushed. This causes the plate current in the grid tube to drop and the relay to cut in to light the enlarger. Actual exposure time is the time required for the plate current to build up again to the point where it actuates the relay and automatically breaks the circuit. The dial of the timer is calibrated from 2 to 60 seconds by plugging a self-starting electric clock into the enlarger outlet and setting the pointer at various positions on the dial. The elapsed time determined by the sweep second hand is marked on the timer dial.

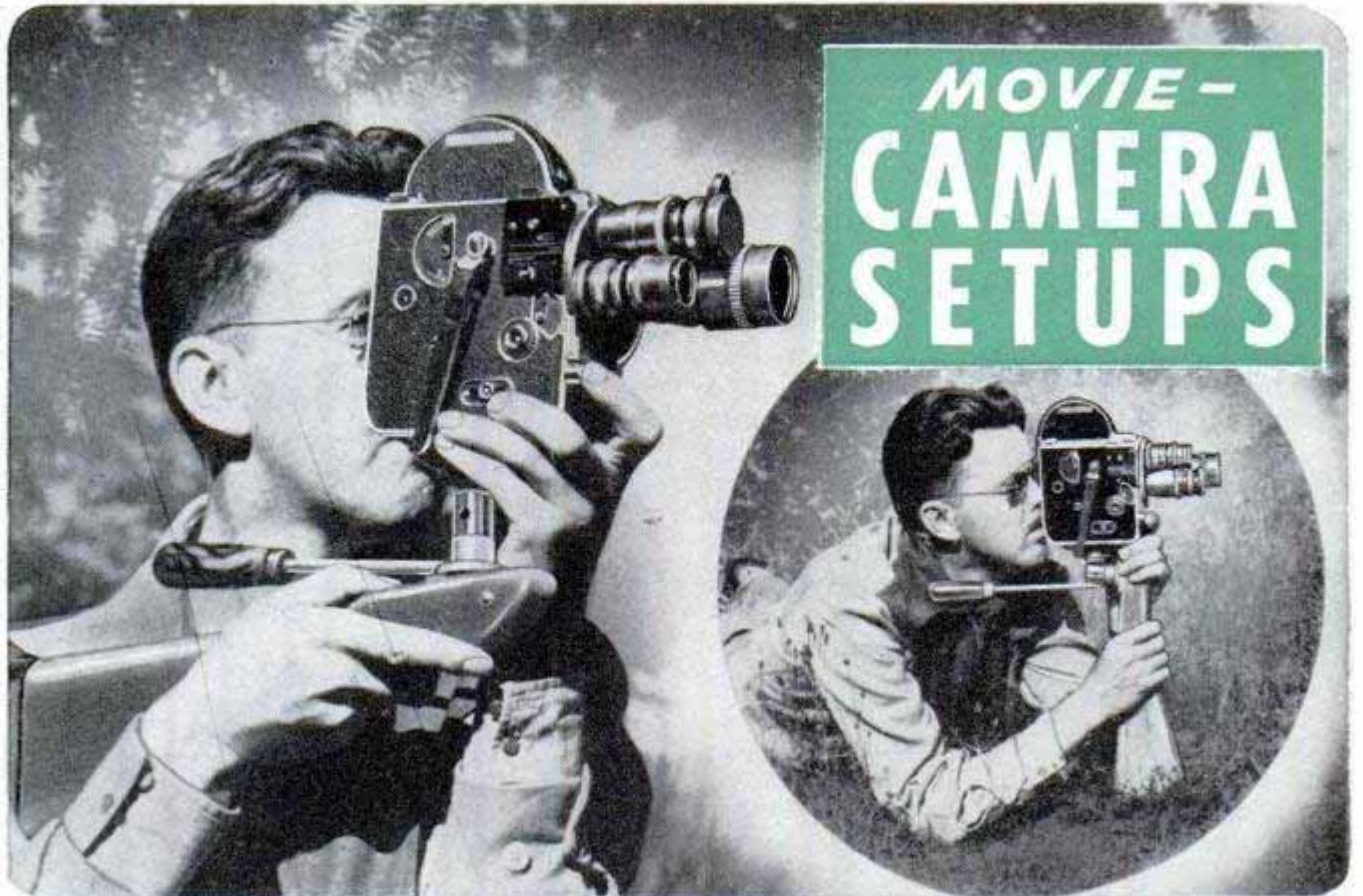


**KEY**

- 1. Timer sw. 2. Exposure sw. 3. Focusing sw. 4. Clock sw. 5. Drier sw. 6. Shut-off sw. 7. White-light sw.



W T M - S W

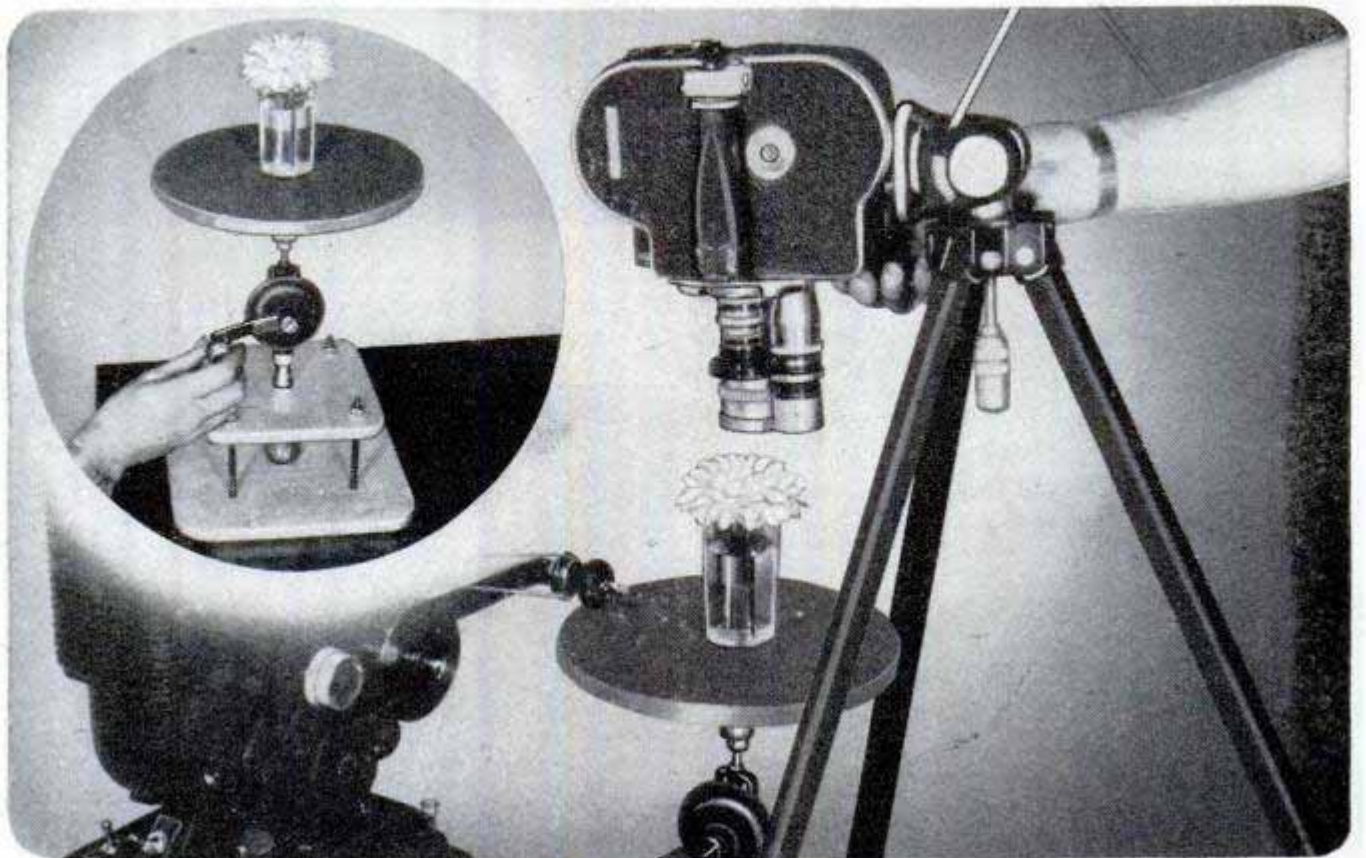


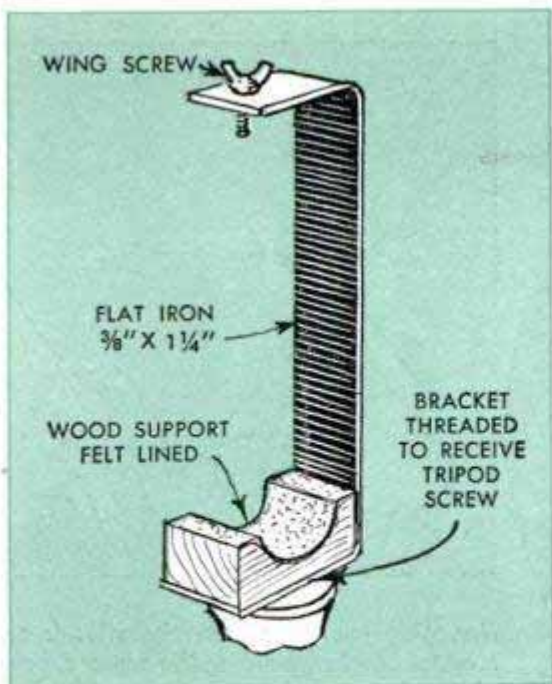
**MOVIE -  
CAMERA  
SETUPS**

**T**HE ENTHUSIASTIC cameraman who goes in for home-movie making in a big way will find these special camera setups and equipment not only helpful in filming the subject, but also a means of injecting novel and interesting effects into ordinary shooting techniques. For example, those who like to shoot close-ups of flowers, gems, mineral and insect specimens, tropical fish,

Above, fitting a pan head to the end of an old gunstock provides an excellent camera mount for stalking animal shots where instant readiness means getting the picture. The pan head makes the mount quickly adaptable to aiming the camera in a prone position

Below, to inject a bit of animation in an otherwise dead subject, this stunt will appeal to cameramen who shoot flowers, specimens, etc., close-up. Subject is filmed on disk supported by hand drill and rotated manually or by friction drive on projector





Above, right, shooting with the camera supported upside down and splicing-in the take will add considerable entertainment value to the presentation and, at the same time, eliminate the inconvenience of having to reverse the projector and then backtracking to resume showing. A simple bracket to hold the camera in an inverted position is detailed above. It's bent U-shape to fit the camera and both ends drilled and tapped, the upper one for a wing screw, the lower one for tripod screw. A padded block cushions the camera

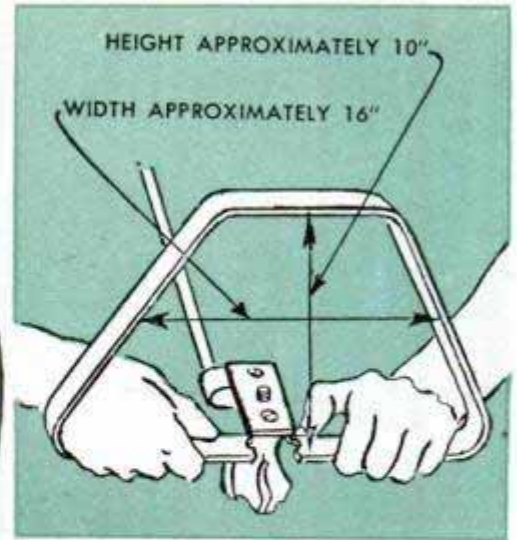


Right, set up in the conventional manner, many tubular-type tripods, even when collapsed all the way, still do not permit extreme close-up shots of subjects close to the ground, such as growing flowers. However, by utilizing the handle of the pan head as an additional leg, the camera can be practically brought right on top of the subject. This still permits regular use of the pan handle, even if the handle is partially embedded in the ground to prevent accidental tipping of the camera



Right, many excellent still pictures that otherwise would be lost while making movies, especially action shots, can be taken simultaneously by mounting a still camera alongside the movie camera. A light auxiliary-type tripod head is used to support the still camera in line with the view finder of the movie camera, and a long cable release permits snapping the picture at the critical moment. Both cameras are attached to a special plate which, in turn, is fastened directly to the top of the tripod pan head





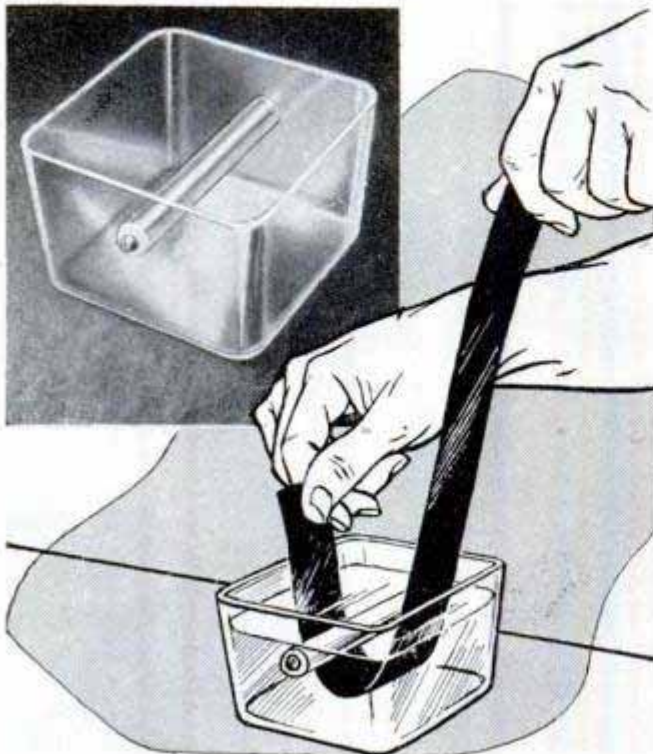
Mounting your clamp-on photofloods on a metal bracket, framing the camera, provides an extremely convenient method of following the movements of the camera with the lights. Method of attaching the bracket is determined by the camera, the one shown being held under the tripod base plate with a small machine screw

etc., will find that by shooting them on a rotating platform, as on page 210, the subject will take on animation and be exceedingly more interesting to view on the screen. Among the special equipment that can be made, the lamp holder pictured above provides an exceptionally convenient way of taking the lights with you. Tri-

angular in shape, the metal bracket frames the camera and permits three or more photofloods to be clamped to it. The holder is especially convenient when the tripod is mounted on a dolly, as the lights will travel right with the camera, eliminating the need for constantly moving lamps, as is the case when they are supported individually.

## Darkroom Tray From Plastic Dish Prevents Twisting of Roll Film

The tendency of roll film to twist when it is first immersed in the developer makes processing it in an ordinary tray a trouble-



some job. This difficulty can be eliminated by using a small plastic utility dish as a developing tray. The dish, which measures about 4 in. square and 2½ in. deep, may be purchased for a few cents. A short length of ¼-in. plastic rod is fastened between two sides of the dish to serve as a film guide. Roundheaded brass machine screws are passed through holes drilled in the sides of the dish and threaded into undersize holes bored in the ends of the plastic rod. The screws must be drawn up tightly so the solution will not leak through the holes in the dish. It is not necessary that the rod revolve, as there is little friction and the smooth surface of the plastic will not scratch the film.

## Tape Identifies Developing Tank

To minimize the danger of contaminating developer with hypo, use a separate tank for each solution and never interchange them. Stick a piece of tape to the end of the tank used for the developer. In this way, you can identify the tank even in total darkness simply by feeling for the tape.



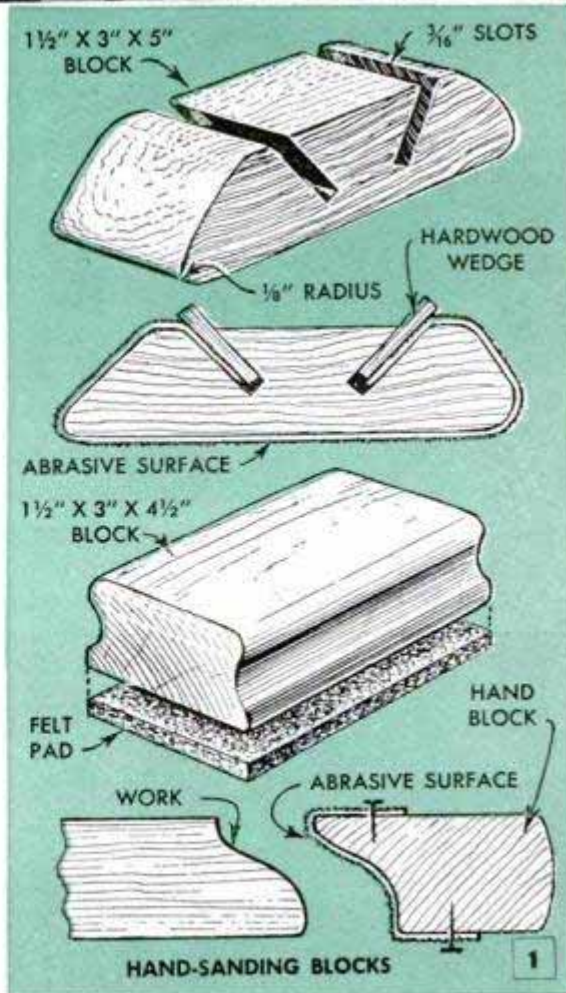
Photos and technical service courtesy "3M" Coated Abrasives Division, Minnesota Mining & Mfg. Co., St. Paul, Minn.

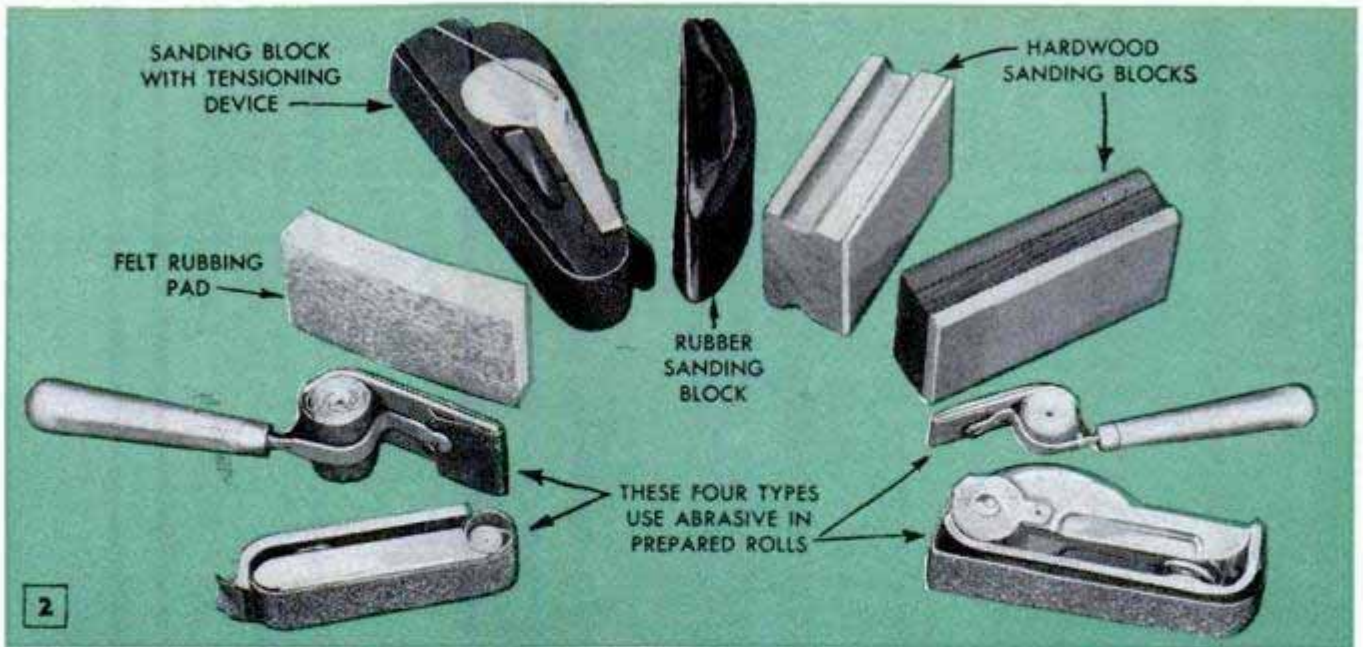
## Use The Right ABRASIVE

Part I

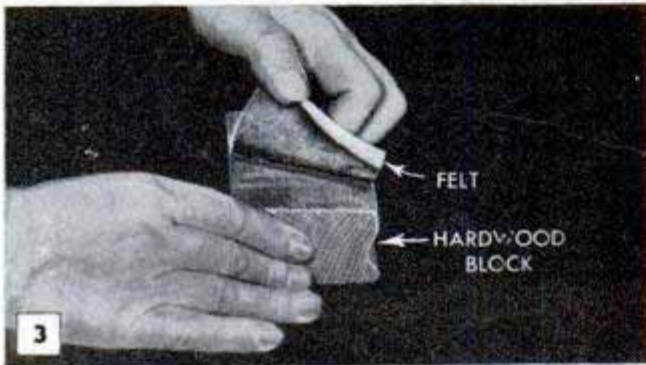
By W. Clyde Lammey

**S**ANDING the surface is one of the most important operations preparatory to finishing home-workshop projects built of wood. This must be done to remove hand-tool or machine-tool marks and also to smooth the surface of the wood so that reflective properties of the finishing materials are equalized to bring out the full beauty of the wood grain. By taking time to do a good job of sanding, using correct procedures and selected grades of abrasives, you can expect a finish of professional appearance and quality. In small home shops with limited equipment, sanding must be done entirely by hand, making selection of the abrasive and the manner of using it the most important steps in the finishing procedure. For sanding by hand on bare (unfinished) wood, there are four sandpaper grades, or grits in common use. Fig. 7 classifies these in sizes ranging from coarse to very fine. The table, Fig. 7, also gives the grit numbers by which

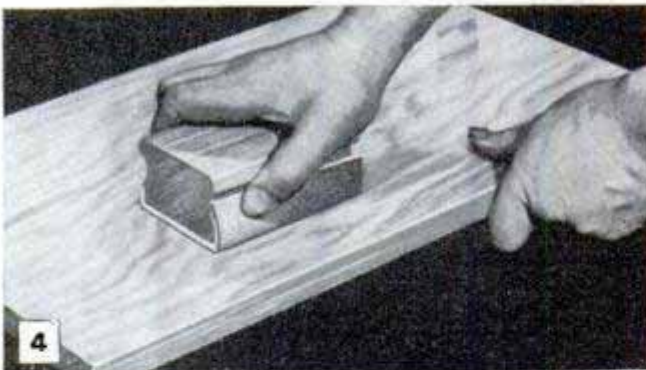




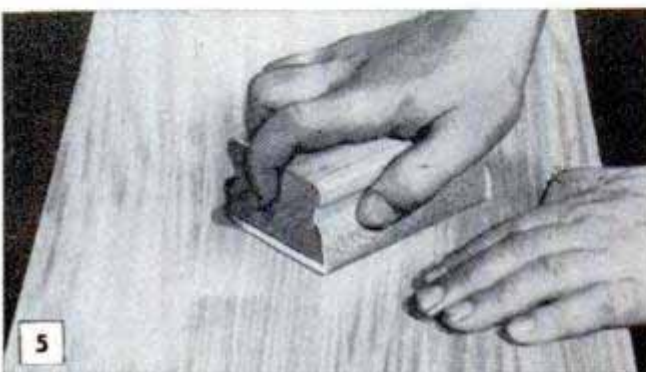
The all-rubber sanding block pictured above is especially useful for general handwork because it is flexible. Various types designed for abrasives in prepared rolls are handy for sanding corners and edges



A hardwood block fitted with a felt backing makes a very efficient hand-sanding tool. Felt backing is glued in place and can be from  $\frac{1}{8}$  to  $\frac{3}{8}$  in. thick



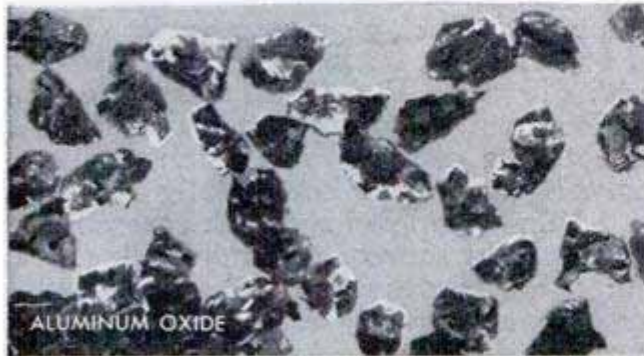
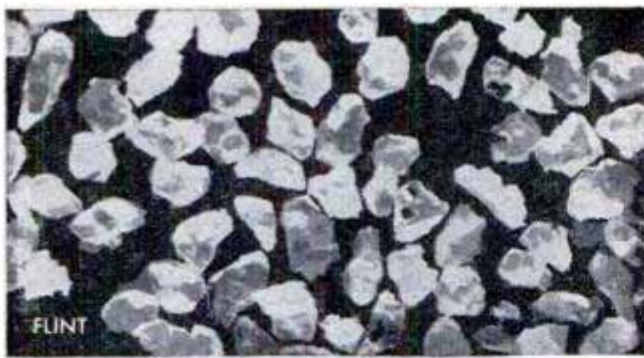
Above, except on open-grained woods, finish-sanding is done with the grain. Below, sand at an angle to the grain to remove ridges and other irregularities



these abrasives are commonly known. There also is a very coarse grade for special purposes, but this is not generally used in hand sanding because of the difficulty of removing the surface scratches with finer grades of sandpaper. Although it is still available and is listed in Fig. 7 and pictured in Fig. 6, the flint paper has been largely replaced by the faster cutting garnet and aluminum-oxide abrasives for use in hand sanding. Most of the abrasives used in handwork are paper-backed and usually are designated as A, C, D and E. The first, or A grade, is known as "finishing paper." The C and D grades are referred to as "cabinet paper" and the E grade as "roll stock." The latter is heavyweight with a stiff paper backing and is only occasionally used in handwork. The A grade is light and flexible and in the coarser grits is used for light smoothing on paint and other finish coatings. The C and D weights have a heavier and less flexible paper backing and are most commonly used on bare wood. A general classification and recommendation for grades of paper to be used on various types of work is given in Fig. 10.

To obtain a smooth and uniform action with any of these sandpapers on flat surfaces, the paper must be backed with a hand-fitting block made either of wood or metal. Two excellent types of hand-sanding blocks are shown in the three upper details in Fig. 1. One block has no felt pad and is especially suited to cutting down ridges and other irregularities on wide widths of stock. The rigid backing causes the abrasive to cut very fast with a leveling action on the whole area being sanded. The second block, also shown in Figs. 2 and 3, is fitted with a felt pad and is suitable for rough-sanding the stock at an angle with





Greatly enlarged photos show the variations in the grain characteristics of the more commonly used abrasives. Although it is still available, flint is being largely replaced by the garnet and aluminum oxide

the grain as in Fig. 5, and for finish-sanding with the grain as in Fig. 4. All the various types of hand-sanding blocks and pads shown in Fig. 2 are readily available. Four of these are designed for prepared cloth-backed rolls in narrow widths and are especially handy for working in corners, on rounded edges and on wide moldings. The rubber sanding block pictured is just the thing for sanding flat surfaces and it also works particularly well on curves of long radius. Owing to its flexibility, it readily conforms to the curve of the surface. Of course, the ordinary wooden block, fitted with a thick felt pad glued on as in Fig. 3, is equally effective for surface-sanding large work, but the sandpaper must be held in place with the thumb and fingers, as in Figs. 4 and 5. All the ready-made blocks are provided with a means of holding the sandpaper securely in place.

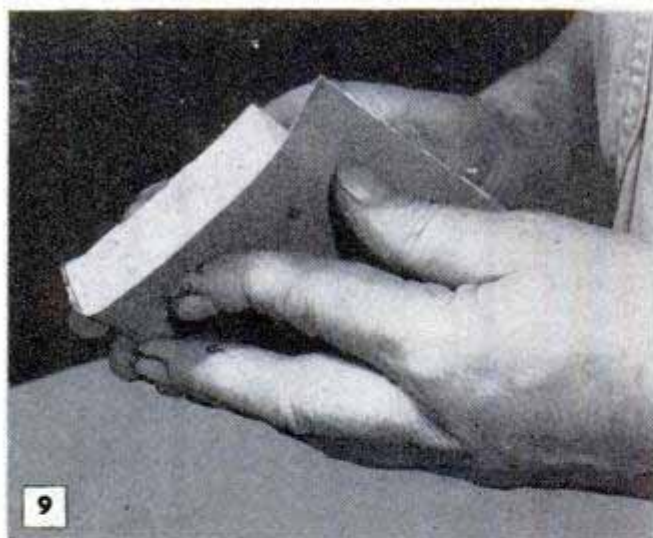
Before starting a sanding job it's a good idea to have on hand a supply of the grades of sandpaper ranging from coarse to very fine. For average work, a good selection includes No. 1 coarse garnet or aluminum oxide, 2/0 medium, 4/0 fine and 6/0 or 8/0 very fine. A typical example of hand-sanding procedure in the home shop would be that used on a small table top similar to that pictured

in Figs. 4 and 5. Usually the top has been built up by gluing together several narrow strips. There will be slight ridges at the glue joints which must be leveled and the wood sanded down to a glass-smooth surface. Begin sanding with No. 1 coarse paper at an angle with the grain as in Fig. 5. This step will level the ridges and remove the glue stains and other discolorations. Continue sanding with the coarse paper until the surface has been leveled. The coarse abrasive will leave fine scratches over the entire surface at an angle with the grain. Now, discard the coarse abrasive and follow with the medium grit, either 1/0 or 2/0, and sand with the grain as in Fig. 4. If the top is made from a coarse, open-grained wood such as chestnut or red oak, sand at a

7 GRITS	FLINT	EMERY	GARNET AND ALUMINUM OXIDE	ALUMINUM OXIDE AND SILICON CARBIDE
Very fine			10/0	500
				400
				360
				320
				280
				240
Fine	4/0		6/0	220
	3/0	3/0	5/0	180
	2/0	2/0	4/0	150
Medium			3/0	120
	1/0	1/0	2/0	100
	½	½	1/0	80
Coarse		1		
		1½	½	60
		2	1	50
	2	2½	1½	40



Above, abrasives rather than scrapers are now commonly used in preparing old work for refinishing. Below, on some types of work a felt backing is used

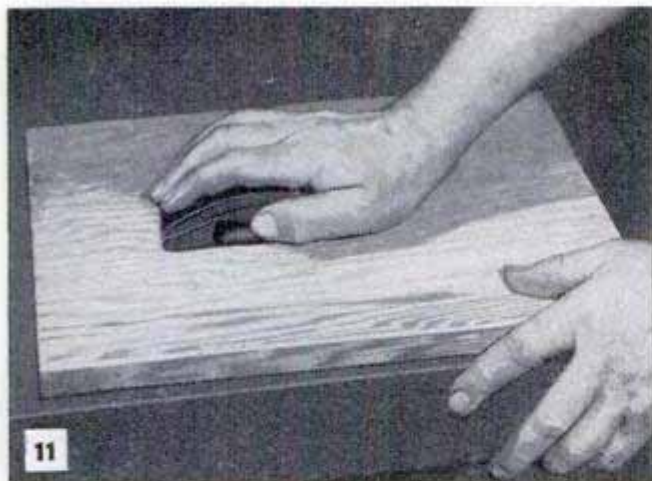


slight angle to the grain to avoid enlarging the individual pores of the wood by rounding the edges. This should be kept in mind when hand-sanding all open-grained woods, as individual grains of the abrasive passing through the tiny elongated pores parallel to their length tend to enlarge them. This leaves the surface rough and, in some cases, even changes the pattern of the grain to some extent. The second step should be continued until all fine scratches produced by the first sanding have been eliminated. Next, change to the fine grade of paper, about 4/0 grit, and sand directly with the grain, Fig. 11. At this stage, the surface will be approaching a degree of smoothness capable of reflecting oblique light. Hold the work horizontally at a point just below eye level and look across it toward a light source. Any minor ridges or other irregularities will show up quite clearly and can be pencil-marked on the outlines of the high points and then sanded down with the fine abrasive until the reflection of light is uniform over the whole surface. Before the final sanding with very fine finishing paper, some experienced craftsmen prefer to apply a thin wash of shellac or sanding sealer. Some finishers also dampen the wood with a sponge to raise the grain. After drying, the raised grain is sanded smooth and either sealed or shellacked with a very light wash coat before proceeding to the final sanding. The latter is done with either the 6/0 or 8/0 paper, depending on the degree of smoothness required. When working with open-grained woods that require staining and filling many finishers apply stain and filler, allow to dry and then finish-sand the surface. In this procedure it will be necessary to apply a few drops of rubbing oil to the sandpaper occasionally to prevent clogging. Care must be used in this method to avoid cutting through the stain and exposing bare wood. Succeeding applications of the finishing materials are sanded lightly between coats.

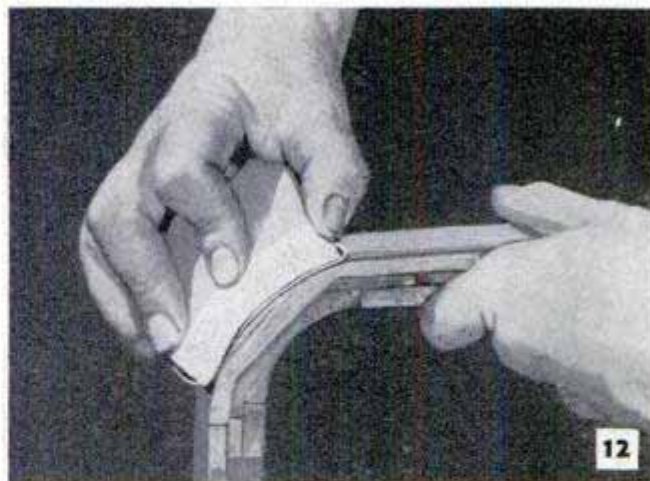
Essentially the same procedure is used when refinishing old work which has been varnished or painted, Fig. 8. After removing the old finish to the bare wood, begin

with the coarse abrasive to remove discoloration and surface irregularities, then follow with the finer grits in the same sequence as on new wood. On some types of both old and new work, the abrasive can be advantageously used with only a thick felt backing, Figs. 9, 12 and 13. Note in Fig. 13 that the craftsman is sanding a curved molding with the four fingers

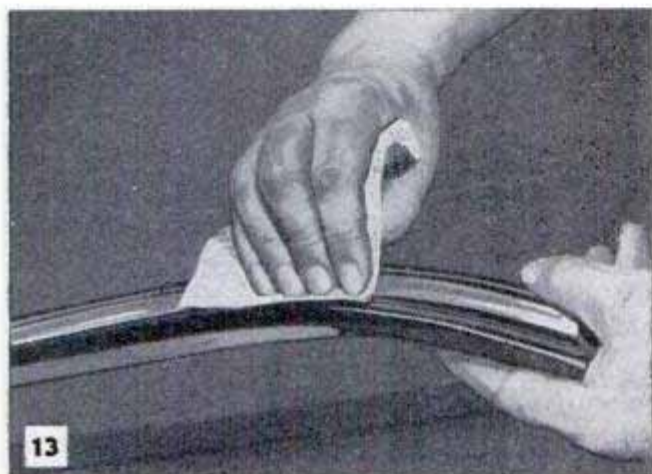
10	HANDWORK	TYPE OF PAPER	GARNET AND ALUMINUM OXIDE	SILICON CARBIDE
	First sanding, woodwork	Cabinet	Coarse or medium	
	Second sanding, woodwork	Cabinet	Medium	
	Dry sanding sealers and finishes between coats	Finishing	Medium to very fine	
	Wet sanding sealers and finishes between coats	Waterproof finishing		Very fine
	Rubbing down after finish coat	Waterproof finishing		Very fine



When finish-sanding with very fine paper, make the stroke directly with the grain of the wood. Apply uniform pressure the full length of sanding stroke



When sanding short-radius curves, the flexibility of the thick felt pad allows the abrasive paper to conform to the curved surface across its full width



By backing the sandpaper with a thin felt pad you can sand curved moldings preparatory to refinishing. Note position of fingers to maintain uniform pressure



A sanding block with one edge shaped in a reverse relief of the molded edge makes it possible to remove old varnish or enamel from the mold curves

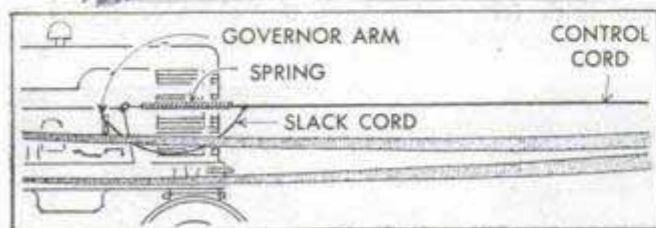
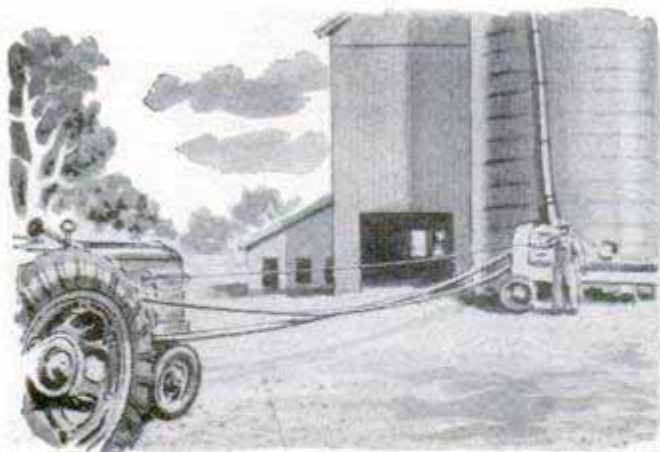
of his right hand held directly in line to equalize the pressure on the concave surface. Fig. 12 pictures another practical application of the flexible felt pad on a built-up corner having a short-radius curve. On old work it often is necessary to sand molded shapes. This is quite easily done by making a special wooden block with one edge shaped in reverse relief so that it conforms to the molded shape, Fig. 1. Usually this can be done with hand tools, such as inside and outside gouges and, if care is used to bring the shape to exact reverse relief, sandpaper wrapped around the block as in Fig. 14 will clean up a molded edge as good as new.

The trick in producing a true, flat surface by hand sanding is to adopt a sanding stroke of uniform length and equalized pressure. If you stroke the sandpaper as far as you can reach in both directions on a large surface, the pressure will fall off near the end of the individual stroke, resulting in an uneven surface. Some experienced finishers sand with short, straight strokes and, by moving back and forth along the length of the work being sanded,

the strokes are made to overlap continually. This technique produces a true, flat surface on large work, such as a table top. When sanding to an edge, the sanding block should not be allowed to extend beyond the edge more than one fourth its length on each stroke as, otherwise, a rounded edge will result. Whether sanding large or small work, the strokes should overlap about half the width of the sanding block and should progress uniformly in one direction at right angles to the direction of the stroke. On old work where it is desired merely to smooth the old finish preparatory to varnishing or enameling, finishers generally use a fine waterproof ("Wetordry") sandpaper, applying water or rubbing oil as a lubricant and also to prevent the paper from clogging with loosened particles of the old finish. In some cases, open-coated abrasives are used when hand sanding on enameled surfaces preparatory to resurfacing. The open-coated papers have the abrasive grains widely spaced to prevent clogging and also to make the abrasive cut faster on rough work where scratches will later be removed.

(To be continued)

## Remote Control for Tractor Varies Engine Speed



When tractors are belted to stationary machines, such as silo fillers and grain blowers, remote control of the engine speed often is an advantage for the operator, as it enables him to save time, fuel and steps to and from the tractor to adjust the throttle when the driven machine is running empty. To rig a simple remote control device, tie a coil spring (a screen-door spring will do) to a length of strong cord. The cord should reach from the tractor to the machine. Tie the spring to the tractor at some point back of the governor arm and tie the other end of the cord to the machine within handy reach. Then tie one end of a separate short length of cord to the governor arm and the other end to the long control cord near the end of the spring, leaving the short cord slack. When the operator pulls the control cord at the machine, the spring permits the slack cord to tighten and move the governor arm, thus slowing the engine to idling speed. This arrangement is particularly helpful when operating a silo filler, as considerable fuel can be saved by idling the tractor engine during the interval when a new load is being pulled up to the machine.

P. R. Wilson, Brooklin, Ont., Can.

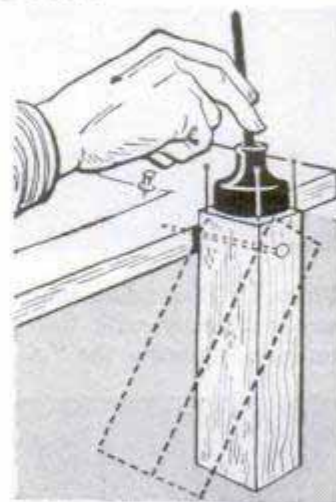
## Easily Handled Airbrush Colors Provided by Clothing Dyes

Inexpensive and easy to handle, packaged clothing dyes provide excellent colors for airbrush work. The dye solution should be mixed about ten times as strong as that used for dyeing fabric. However, the solution can be thinned as desired and the tint, of course, controlled with the airbrush. As these colors are transparent, various hues

can be obtained by using only the primary colors, white or light-colored backgrounds giving the best results.

## Pendulum Holder on Drawing Board Keeps Ink Bottle Level

If kept on top of a pivoted block attached to the edge of a drawing board, a bottle of ink is always convenient, and yet out of the way. In addition, the bottle remains level regardless of the angle of the board. The bottle holder is a length of 2 x 2 which is nailed loosely to the edge



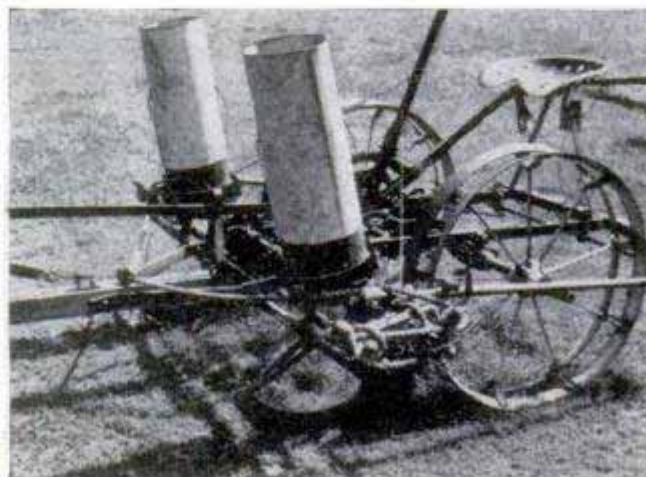
of the board so that it will always hang in the vertical position. The bottle is set on top of the holder and held in place with four finishing nails, one driven near each corner of the block.

W. R. Black, Contact, Nev.

## Sheet-Metal Planter Extensions Form Oversize Seed Hoppers

While planting exceptionally long rows in a terraced field one farmer found it necessary to refill the seed hoppers on his corn-planter before completing a single "round." To avoid the necessity of stopping in the middle of the field, often some distance from his supply of seed, he fitted the seed hoppers with sheet-metal extensions which doubled their capacity. To do this, he removed the covers of the regular hoppers and made extensions in the form of sleeves which fit snugly over the tops of the hoppers as illustrated. The extensions are held securely in place by tying them down with lengths of twisted wire.

A. M. Wettach, Mt. Pleasant, Iowa.



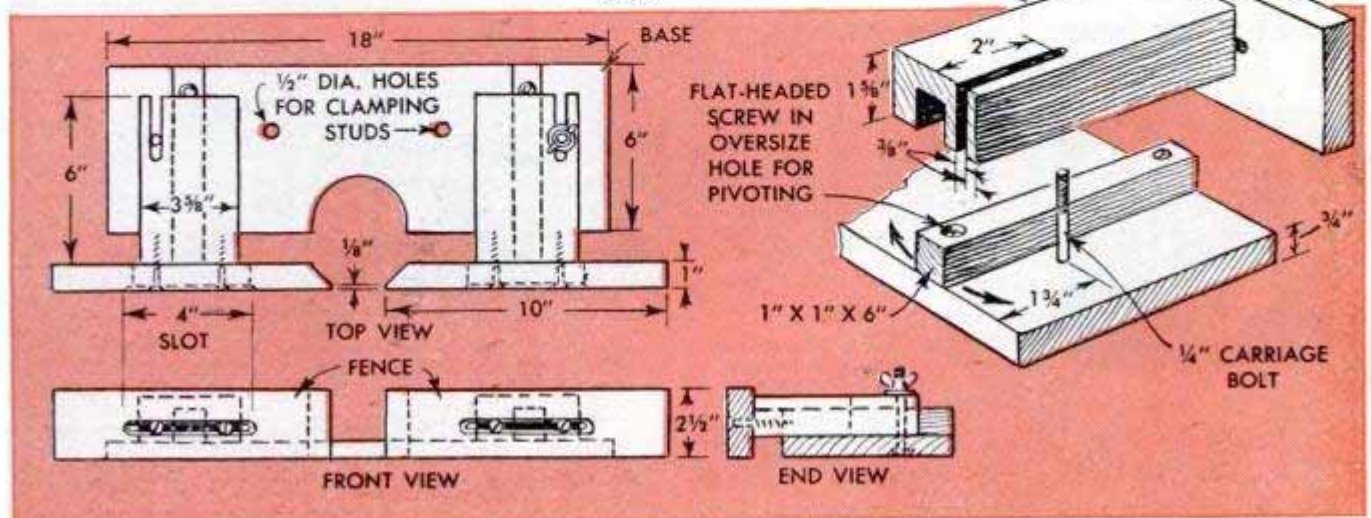
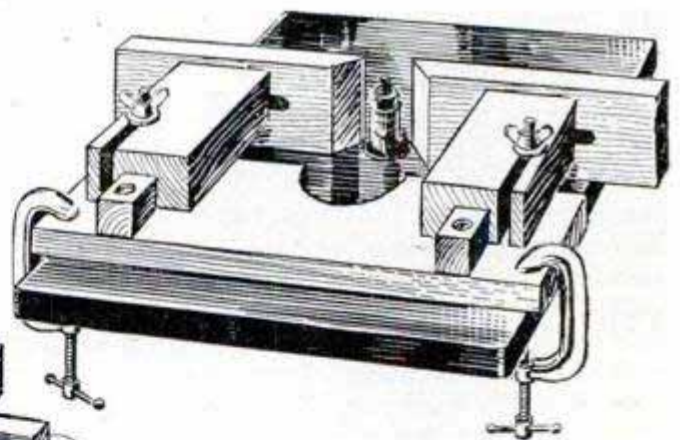
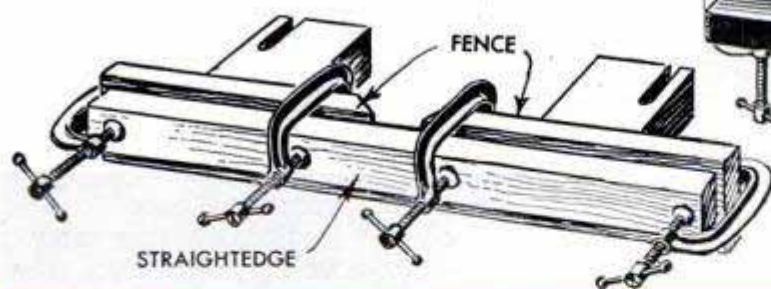
# Adjustable Fence for Homemade Shaper

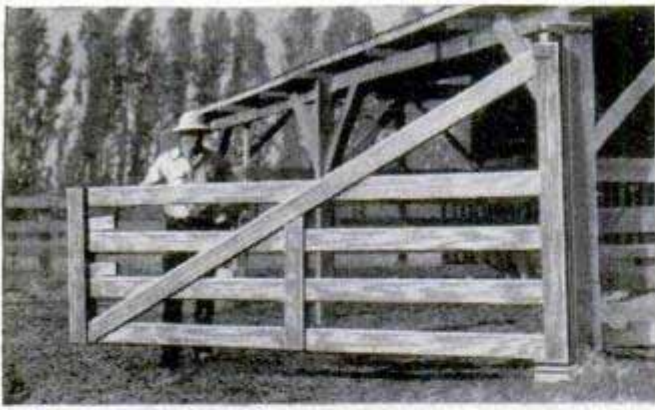
By Roy Rogers

THE FENCE on any home-built power tool usually leaves much to be desired, especially in the case of a shaper where it is almost a must that the fence be adjustable. The one detailed below is an excellent fence and provides all the essential adjustments found on commercial tools. The fence itself consists of two parts, each adjustable in two directions so that the faces either can be lined up or offset and at the same time spaced to allow clearance for shaper cutters of various sizes. Two brackets, made from short lengths of 2 x 4s, are grooved on the underside and slotted as indicated. The grooved brackets ride on guide strips attached to a base piece with screws, one screw in each strip being turned into an oversize hole so that the strip can be pivoted slightly to align the fences. The brackets are held in position by wing nuts turned onto carriage bolts which pass through the base piece as shown in the perspective details. Heads of the bolts must be countersunk flush with the bottom surface of the base. Note, below, in the top view that the ends of the fence members are cut at an angle of 45 deg. and that a semicircular section is cut out of the base piece so that it will clear the molding cutters. While the table can be fitted with clamping studs, the fence can be held in place with two C-clamps which provide a quick means of removing it when work is to be run freehand.



Above, shaper fence is adjustable in two directions for depth of cut and varying sizes of shaper cutters. Below, adjustable guide strips screwed to the base hold the two units of the fence in alignment. Brackets are locked in place with bolts and wing nuts.





## Hinged Farm-Building Ventilators

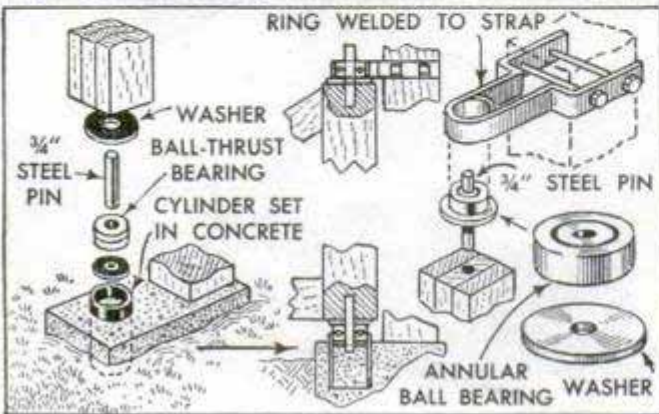
Low-cost hinged ventilators are easy to install in farm buildings having vertical siding. Remove one of the boards and cut out a short section forming a tongue at the top end. Then drill



each edge of the projecting portions of the siding for a nail which is driven through the hole and into the tongue of the ventilator to form the hinge. After renauling the siding, nail a cleat under the lower inside edge of the ventilator to provide a stop and fasten a latch on the outside to hold the ventilator closed.

## Drum-Type Feeder for Hog Lot Anchored to Concrete Platform

One successful hog raiser prefers this type of self-feeder for use in small feed lots. It takes up the minimum of space for the amount of feed dispensed, and it can be anchored to a concrete platform, thus promoting cleanliness and preventing the hogs from upsetting it. The hopper is a 55-gal. oil drum with the ends cut out. A flat-rim implement wheel having a single row of spokes forms the compartmented feed tray. Select a wheel with a rim about twice the diameter of the drum. The latter is attached to the wheel spokes by passing heavy wire around each spoke and through a hole drilled in the drum near the rim. Each length of wire is tightly twisted to hold the drum firmly in place. As the concrete platform is poured, a length of pipe is placed upright in the center of the form as shown in the detail sketch. When the feeder is set up, the wheel hub is slipped over the end of the projecting pipe. If desired, the hopper can be fitted with a sheet-metal or wooden cover to protect the dry feed in bad weather.

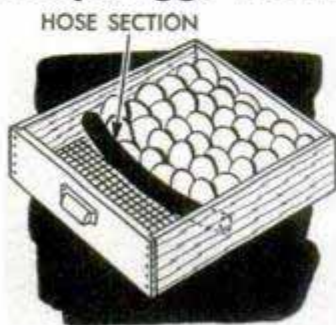


## Sagless Ball-Bearing Gate

Designed and built by George Hamerschmidt, California cattle rancher, this heavy farm gate swings on ball bearings fitted at the top and bottom of the gate stile. As detailed, the construction permits the gate to swing open in either direction. An annular ball bearing carried on a steel pin, or shaft, at the lower end of the stile, takes the thrust. It is housed in a metal sleeve embedded in concrete. A large metal washer is placed between the stile and the bearing to provide adequate support for the heavy gate. The top bearing likewise is carried on a pin inserted in a hole drilled in the top end of the stile and is housed in a yoke which is made from flat iron and bolted to the gatepost. To support a gate of this size and weight, the gatepost should be set in concrete.

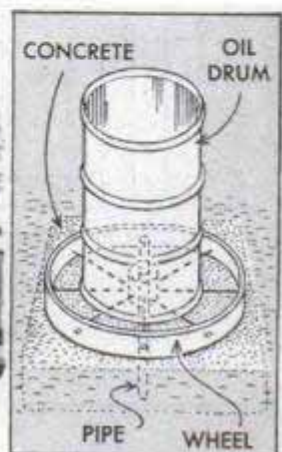
U.I. '51

## Hose Section in Incubator Tray Keeps Eggs From Rolling

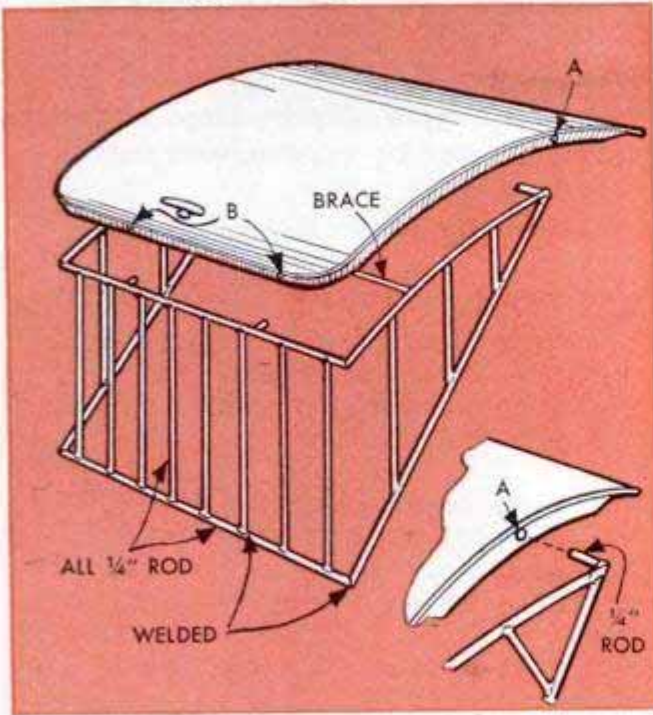


After infertile eggs are removed from an incubator tray, the remaining eggs are likely to roll and be broken if the tray is not handled with extreme care. To eliminate this danger, wedge a section of garden hose between the sides of the tray so the eggs are held snugly together.

G. E. Hendrickson, Argyle, Wis.



# Hunting Dogs Ride Safely in This Trunk Carrier



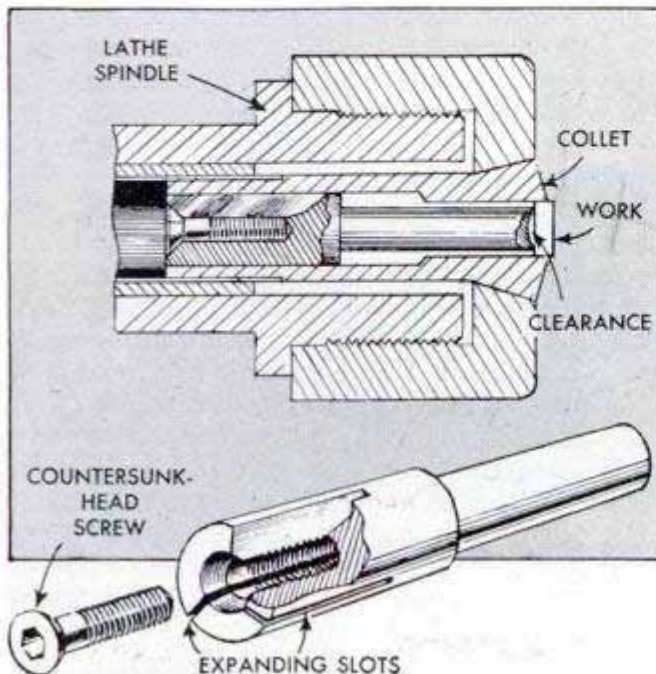
Bird hunters and others who must transport dogs for long distances will find this trunk carrier a handy accessory to the hunting equipment. It consists of a simple grille made from  $\frac{1}{4}$  or  $\frac{3}{8}$ -in. metal rods and shaped to fit inside the car trunk. The lower frame is U-shaped with straight side members welded to an endpiece as shown. The upper frame is made in the same way, except that the side members are curved to the same radius as the car-trunk deck, or lid. Holes for  $\frac{1}{4}$ -in. iron rods are drilled

through the lip of the trunk lid at points A and B. After the grille has been assembled by welding the brace and vertical bars in place, short lengths of  $\frac{1}{4}$ -in. rod are welded to the upper frame in the positions indicated. These enter the holes drilled in the trunk lid and hold the grille securely in place. The grille supports the trunk lid about 18 in. high at the back. No dimensions are given, as the grille must be made to fit the car on which it is to be used.

Wm. H. Hubbard, Modesto, Calif.

## One-Piece Depth Stop for Collet Chuck Quickly Locates Short Work

Fast, accurate facing and shouldering operations on duplicate short pieces held in a collet chuck are accomplished with this



one-piece depth stop. To determine the size of the stop, measure the length and inside diameters of the collet. Then machine and shoulder a piece of tool steel to a close, sliding fit in the large inside diameter of the collet. Machine a clearance recess in the small end of the stop. Drill, counterbore, tap and slot the large end as shown in the details. Tap with an N. C. (National Coarse) thread to take a socket setscrew with a countersunk head of the type detailed. As the final operation, slip the stop into the collet and press it forward until the recessed end projects beyond the collet. Tighten the locking screw in the stop to hold it firmly in position. Assemble the collet chuck in the lathe spindle and run a light, facing cut across the recessed end of the stop. This cut should leave a narrow, flat rim around the recess against which the work locates. To use the stop, simply locate it in the collet, tighten the locking screw and then locate the carriage stop and the tool for the desired cut.

Clifford T. Bower, Decatur, Ga.

# KEEPING HAND-

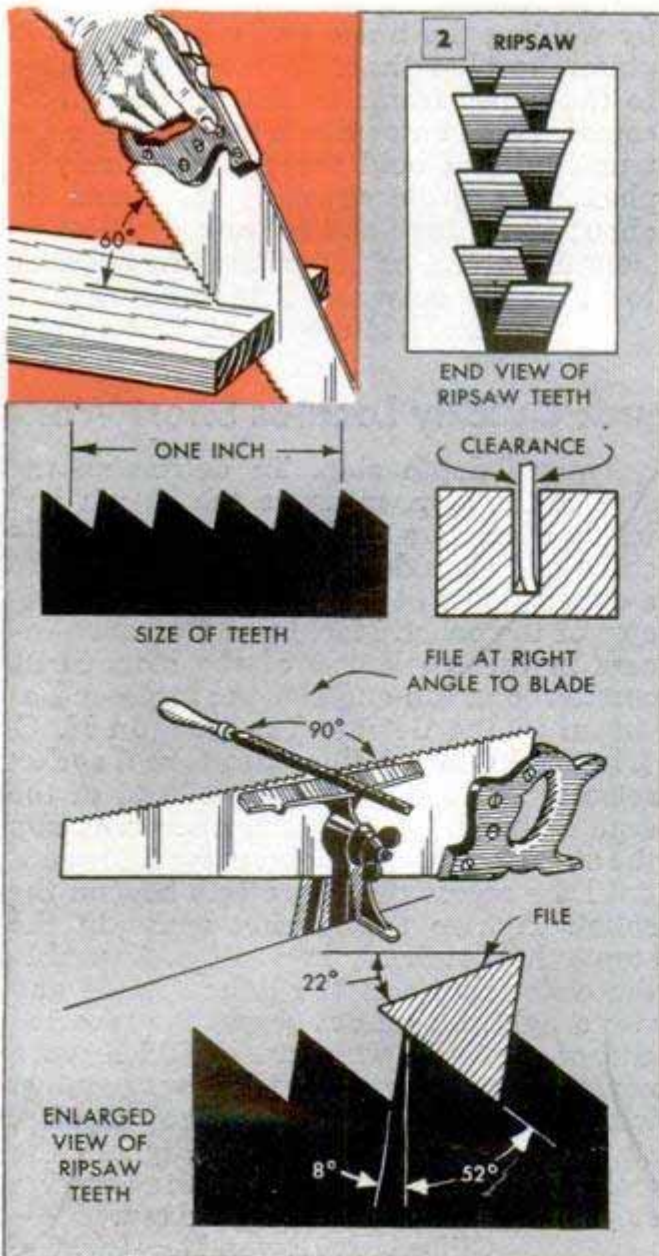
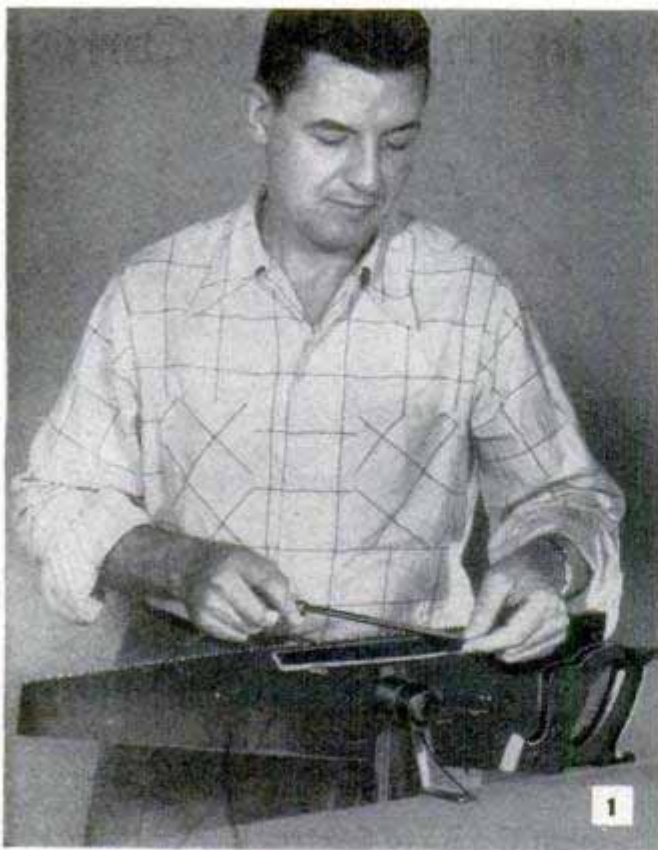
Filing a handsaw is easy to do if you follow a simple step-by-step procedure recommended by experienced craftsmen

By Nash Chandler

**S**HARP HANDSAWS cut true and fast and enable the user to turn out finished work of an accuracy and quality very nearly equal to that produced on power-driven machines. Common handsaws are of two types, one being designed for ripping stock lengthwise with the grain and the other for cutting across the grain or at an angle to it. Backsaws, dovetail saws, keyhole saws and others are simply variations of the crosscut handsaw designed for a specific purpose. On the ripping saw, each tooth cuts like a chisel, severing only the wood fibers which are directly in the path of the tooth as it is forced through the wood. Teeth of a crosscut saw cut the wood fibers at right angles to the direction of travel and for this reason they must be sharpened in such a way as to give each tooth two cutting edges or, more specifically, a leading cutting edge and a sharp, cutting point. This double-cutting edge is produced by merely changing the angle of the file.

**Jointing:** Before any handsaw can be properly filed it is necessary that the teeth be made uniform in height. This operation is known to saw filers as jointing and it is done by passing a file over the points of the teeth in one direction as in Fig. 3. Steady the file with a small block of wood, as shown, to prevent it from tipping sidewise and rounding the points. After the first few light strokes of the file it will be seen that some of the tooth points have been flattened on the top while others have been only slightly tipped by the file. Continue the jointing until all flattened points can be seen clearly. The amount of jointing necessary must be judged by the condition of the saw. If the saw has been properly filed and the teeth are regular in shape and uniform in height, jointing may be unnecessary. On a saw in this condition only light filing will be required. On the other hand, if the teeth are uneven and incorrectly shaped, it may be necessary to reshape the teeth by jointing and filing several times at short intervals during periods of use. As a rule, it is best to joint the teeth lightly each time the saw is filed.

**Setting:** Some experienced saw filers prefer to set the teeth of handsaws before jointing. Others joint the teeth lightly both

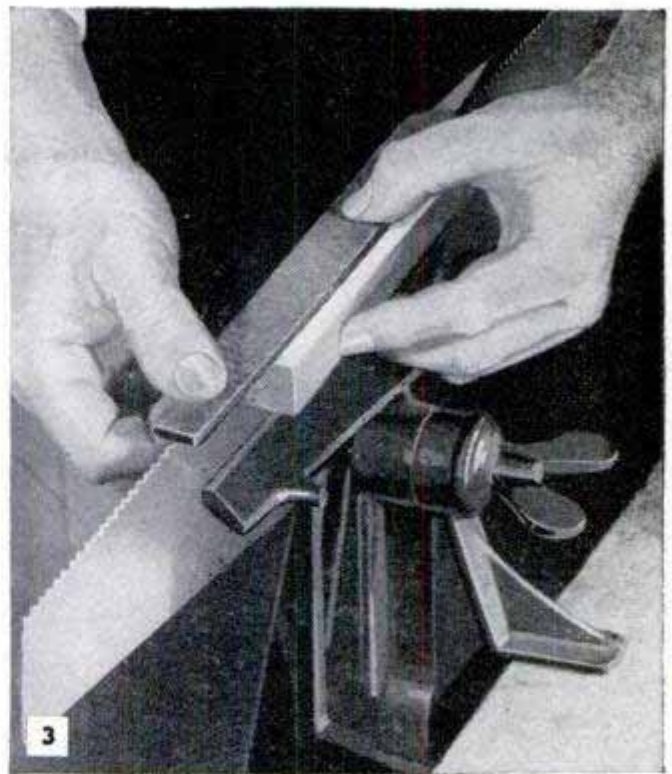




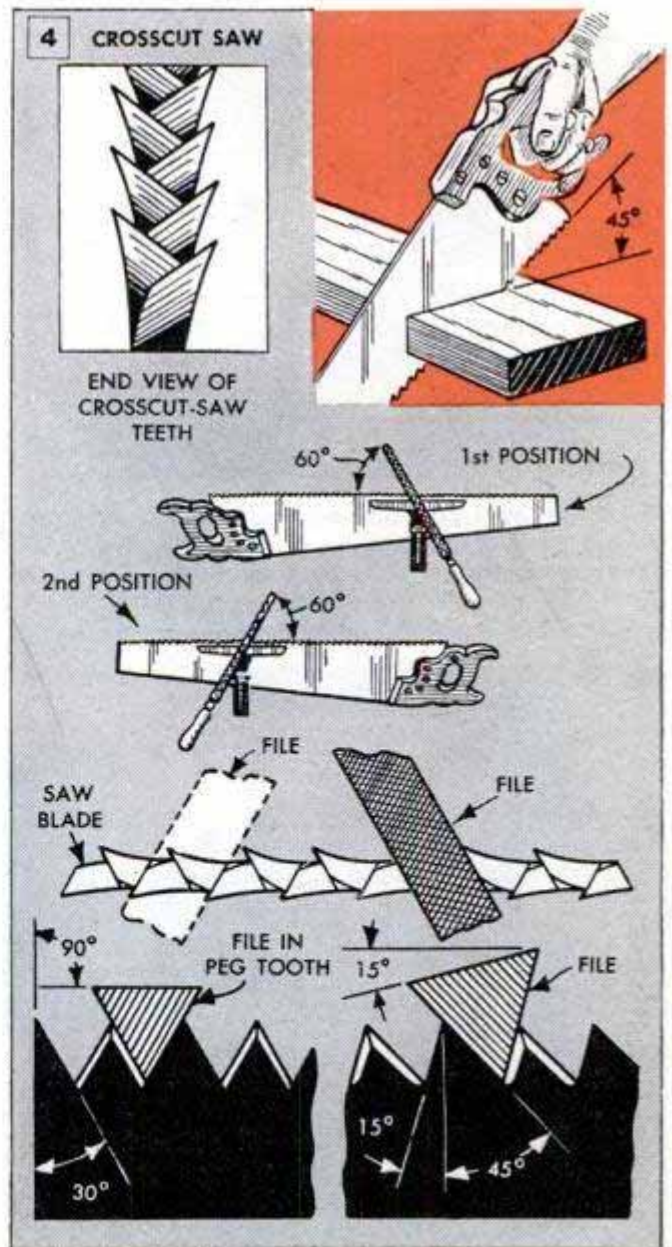
# SAWS SHARP

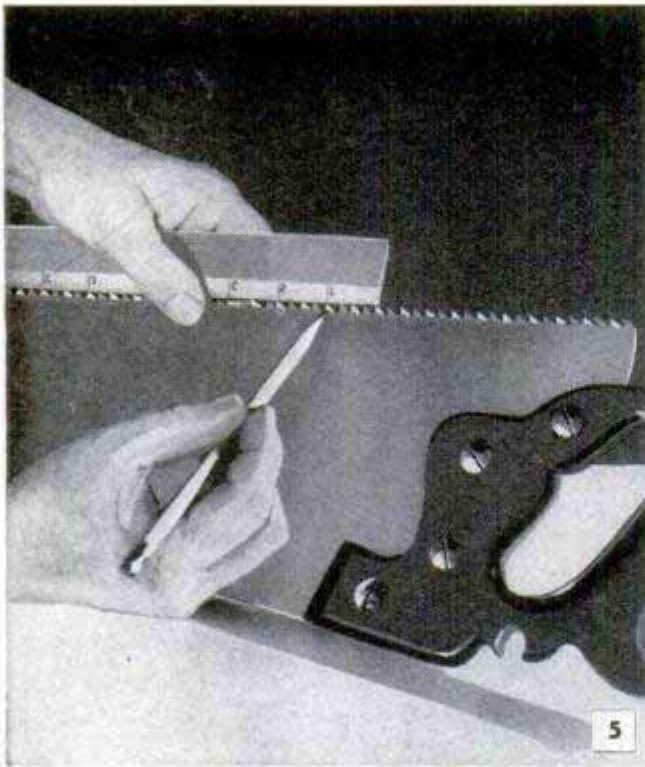
before and after setting, especially when sharpening rip saws. The reason for this is shown in Fig. 2. Note in the detail that the leading edges of the teeth are parallel, one with another. As in jointing, the necessity of setting and also the amount of the set is determined by the condition of the saw and the nature of the work which is to be done with it. For example, a rip saw used exclusively on hardwood requires less set than one which is used only on softwood, or on soft and hardwood alternately. In general, the same is true of the crosscut saw, but the width of the set will vary owing to the variations in the number of teeth per inch, and also to the purpose for which the saw is intended. Setting tools of the type shown in Fig. 6 are commonly used on handsaws. The purpose of the set is to cause the teeth to make a cut slightly wider than the thickness, or gauge, of the blade. This gives clearance and prevents friction and binding of the blade between the cut edges of the wood. In relation to the length of the tooth, the depth of the set should never be greater than half the length of the tooth measured from the point to the bottom of the space, or gullet, between alternate teeth. A deeper set may break the tooth. Saw sets of the type shown in Fig. 6 have fine adjustments for regulating the depth and width of the set on handsaws with a varying number of teeth per inch. Be sure that the setting tool is correctly adjusted to give the depth and width of set required. Begin at the heel of the blade (the end next to the handle) and place the setting tool on the first tooth bent away from you. Then, after setting the first tooth, skip one and place the setting tool on the next tooth bent away from you. Proceed in this manner to set the teeth, along the full length of the blade. Then turn the blade end for end and repeat the procedure. The trick in obtaining a uniform set is to apply equal pressure to the handles of the setter for each tooth.

**Filing crosscut saw:** Because of the variety of saw-tooth shapes, the variation in angles and bevels and the number of teeth per inch on crosscut saws designed for different purposes, a careful selection of the file is necessary as the size and type of the file determines the tooth shape. On crosscut handsaws having four, five and six points to the inch, use a 7-in. three-cornered (triangular) file of the type known as "slim taper." Use a 6-in. slim-taper file on saws having seven and eight points to the inch; and on handsaws having fine teeth running nine to twelve points to the inch, use a 5-in. file. To determine the number of teeth to

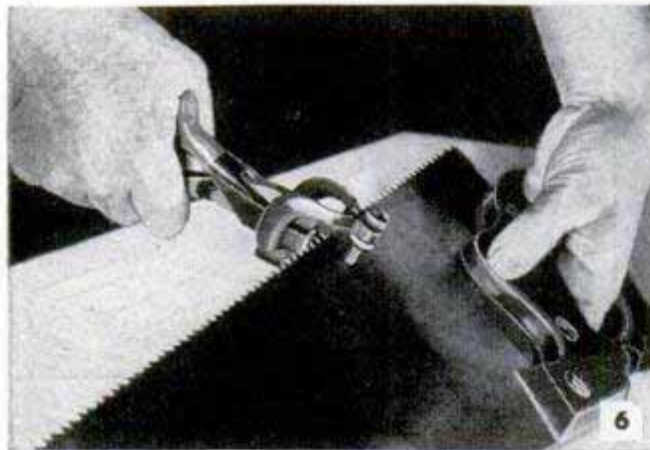


Before filing, the teeth of a handsaw are jointed with a file so that all of them are the same height

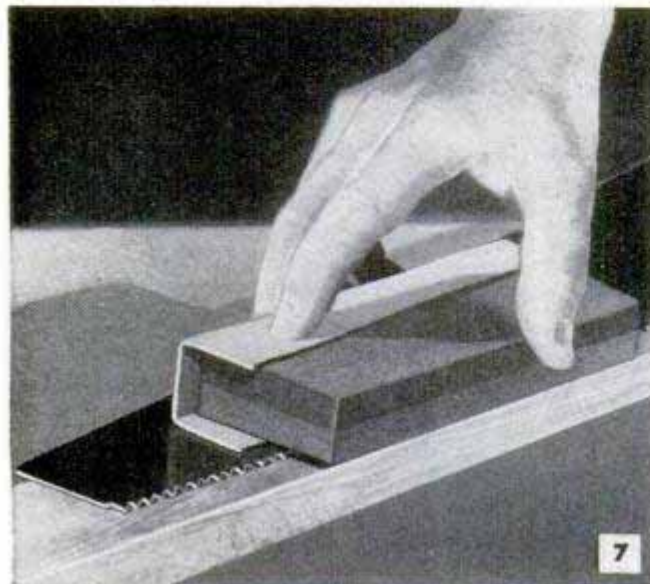




To determine the number of teeth per inch, measure 1 in. from the point of any given tooth with a ruler and count number of teeth within the 1-in. distance



Above, on both crosscut and ripsaws adjacent teeth are set, or bent, in opposite directions to give clearance for the blade. Below, as a finishing operation after filing, the teeth are side jointed with an oilstone to align points and make saw cut smoothly



the inch, measure 1 in. from the point of any tooth and count the number of teeth within the 1-in. distance, as in the left-hand center detail in Fig. 2, and also Fig. 5.

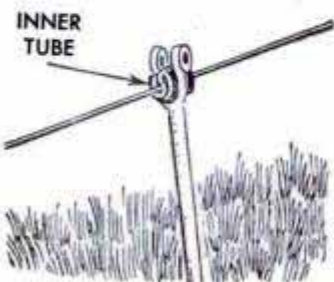
Place the saw in a filing vise of the type shown in Fig. 1, with the handle at the left as in the first position shown in Fig. 4. (A suitable vise can be improvised from C-clamps and two strips of hardwood.) The vise jaws should close on the blade at a point about  $\frac{1}{8}$  in. below the bottom of the spaces between the teeth. The tip of the blade should not extend beyond the end of the vise jaws at the first setting. Begin filing by noting the first tooth at the tip that is set, or bent, away from you. Place the file in the space to the left of this tooth and then swing the file to the right so that its angle with the blade is approximately 60 deg. Hold the file level at this angle and make the first stroke. Lift the file at the end of the stroke, return it to the original position and place it in the same space, or gullet. Make the second stroke in the same way. At this point it is important to allow the file to find its own bearing against the teeth. Do not twist the file or maintain any pressure on it except that necessary to move it on the forward stroke against the resistance of the metal being cut. Note also that the file is cutting on one face of two adjacent teeth, the points of which have been flattened by the jointing operation. The trick is to adopt at this point a uniform stroke of the file that will remove only half of the flattened portion of the tips of adjacent teeth. On saws that are in good condition with teeth of nearly uniform length, it also is necessary to use an equal number of file strokes per tooth. The exception to this is on saws having teeth in poor condition where the flattened points of adjacent teeth vary, making it necessary to reshape the teeth, at least partially, as filing progresses. Continue filing to the end of the blade, skipping a space, or gullet, after filing adjacent teeth and placing the file in the gullet to the left of the next tooth bent away from you. When one side has been finished, turn the blade end for end and proceed as before. Filing the blade from this side should bring each tooth to a sharp point. The operation on each tooth should be carefully watched to avoid the possibility of removing too much metal and getting the teeth on one side shorter than those on the other. Be sure to hold the file level and keep the length of the stroke uniform. At this stage, many filers joint the teeth lightly and again touch them up to assure perfect uniformity in length and sharpness. However, this is rarely necessary unless the teeth were in bad condition before filing. It also should be noted that some experienced filers begin filing with

the blade placed in the reverse position from that given in the center details in Fig. 4, that is, the handle is placed first at the filer's right, instead of his left, as shown. Some manufacturers recommend this position, and filers who prefer this method say that it is easier to maintain a uniform stroke of the file. In this case, start filing at the heel of the blade, placing the file in the space to the left of the first tooth bent toward you.

**Filing rip saw:** In general, the procedure in jointing, setting and filing a rip saw is the same as that used in sharpening a cross-cut saw except that the file stroke is made straight across with the file held level and exactly at right angles with the blade. This position of the file points the teeth with parallel chisel edges. The file is tilted with its top face at an angle of 22 deg. as shown in the lower detail, Fig. 2. This position of the file gives the leading edge of each tooth a negative rake of approximately 8 deg., which is commonly accepted practice on hand rip saws used for average work. Some carpenters like a rip saw with plenty of "bite" and to accomplish this they reduce the negative rake from 8 to 5 deg. or even less. This angle of the teeth makes the rip saw really take hold, but it is more difficult to control in softwood and is not suitable for use in hardwood. With the teeth filed as in the lower detail, Fig. 2, the rip saw will cut smoothly in either hard or softwood. It is easily controlled for close following of gauge lines and requires less pressure on the downward stroke.

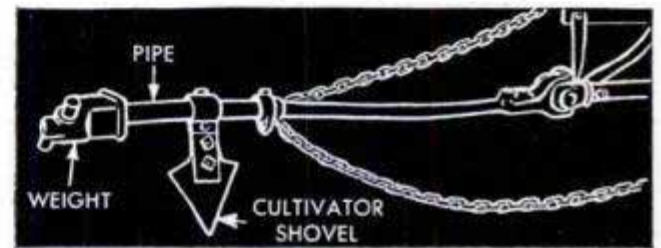
As a final operation when sharpening both crosscut and rip saws for fine work where the sawed edges must be left smooth, filers side joint the teeth with an oilstone as in Fig. 7. This operation dresses the points of the teeth to exact alignment. Use the fine side of the oilstone and wrap cloth or cardboard around one side of the stone to protect the blade from scratches. Two or three light strokes of the stone on each side of the blade usually are sufficient.

## Brake Rods Provide Posts For Electric Fence



A number of old automobile brake rods obtained from a junk yard provide easily moved posts for a temporary electric fence. Drive the rods into the ground and string the wire, wrapping it with pieces of inner tube at the points where it is inserted into the clevises of the brake rods to insulate it from the metal.

## Check Planting Four Rows With Short Markers



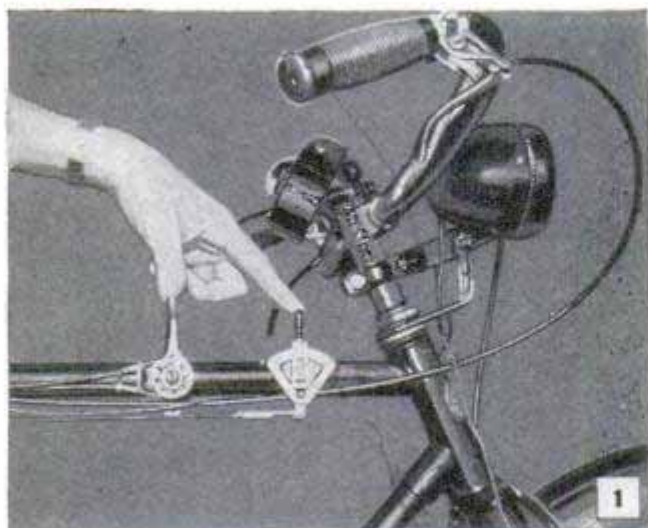
After using his four-row tractor planter several seasons with the regular row markers, one farmer decided it would be less tiring to substitute shorter markers which would enable him to guide the tractor with the drive wheel instead of the front wheels running in the planter mark, as is the regular practice. After some experimenting he came up with the arrangement detailed, which, he says, enables him to do a more accurate job of spacing the "guess" rows and at the same time permits a somewhat shorter turn at the row ends, resulting in a narrower headland. As will be seen from the sketch, the construction is quite simple. A short arm (the length will depend to some extent on the row spacing) pivots on a small universal joint attached to the planter frame. The marker is simply a cultivator sweep of the narrow-wing type attached to a flat-iron standard. The latter is welded to a clamp which fits around the arm and is clamped in place by two short bolts. This assembly permits the sweep to swing back on striking an obstruction, thus preventing breakage.

Loose-pin door hinges can be lubricated neatly by using petroleum jelly instead of oil. Remove the pins individually and give each one a light coating of the jelly.

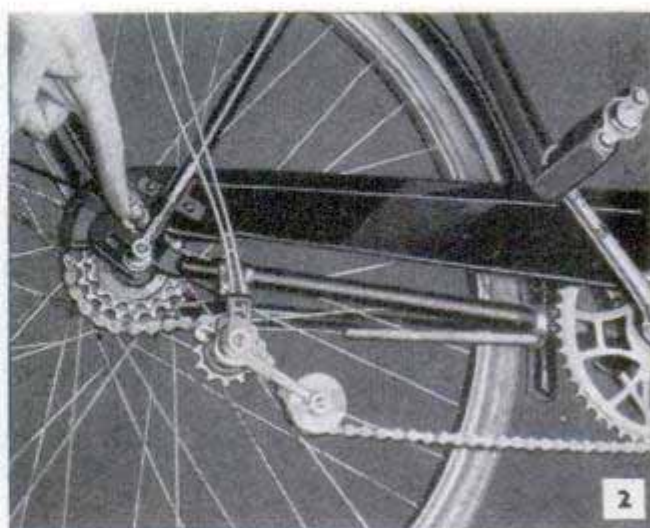
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# SPEEDS FORWARD

By M. G. Winterton



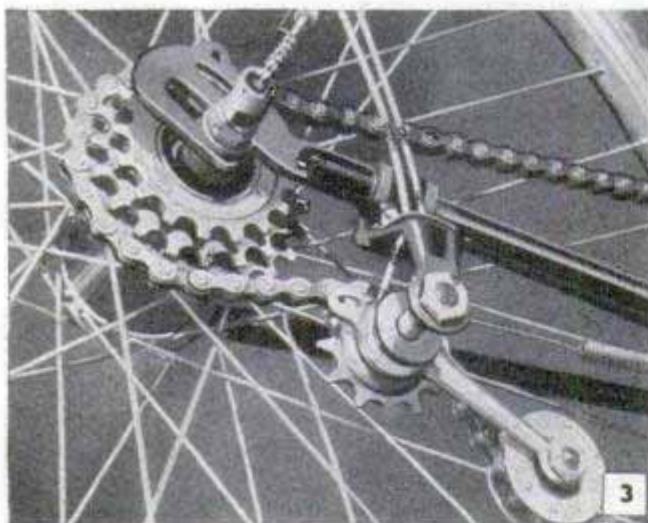
Sprocket ratio is selected by dual control levers which operate cables leading to shifts on rear wheel



Combining both 3-speed shifts gives nine speeds. The shifting requires no momentary pause in pedaling

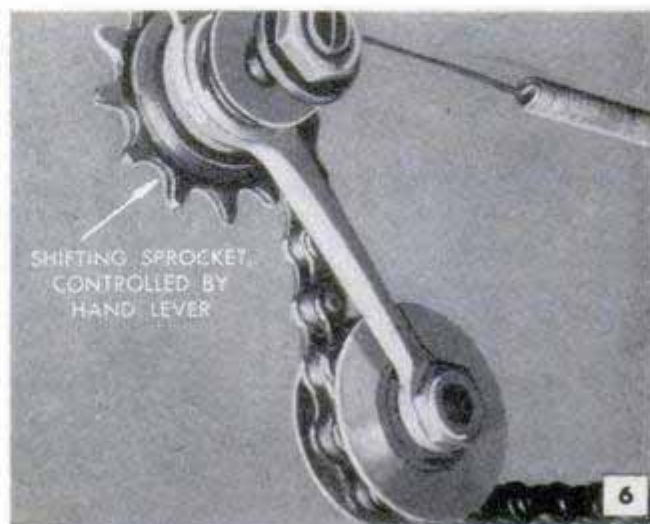
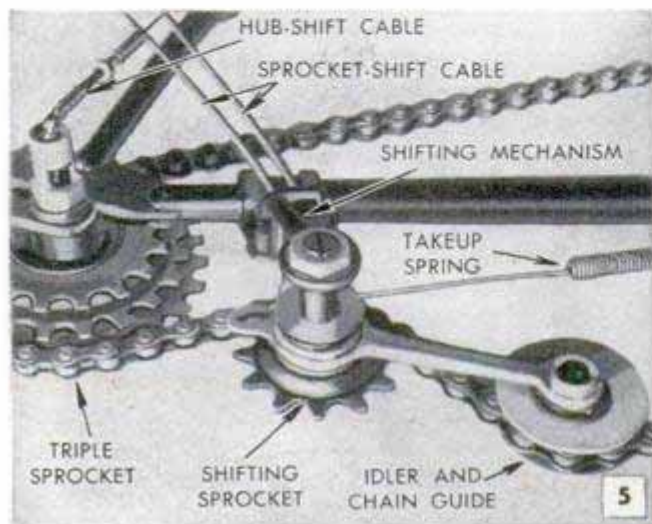
This view shows the sprocket shift in low-gear position. Note that the chain is on the inside sprocket

Here, the shift sprocket is shown in high-gear position. Note that the chain is on the outside sprocket



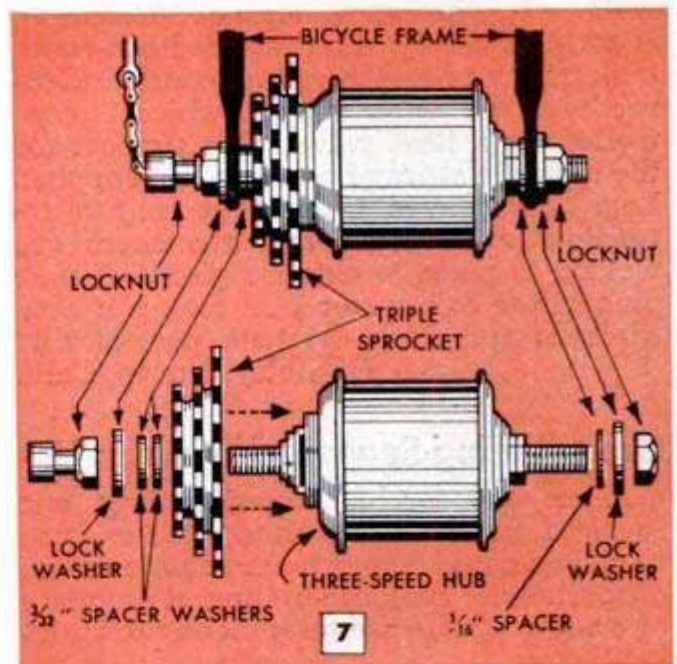
Below, close-up view identifying component parts of mechanism. The shifting sprocket and takeup idler which are integral clamp directly to bicycle frame

Below, shifting sprocket, operated by cable, travels sideways to throw chain from one sprocket to another. The idler takes up slack in chain when shifting

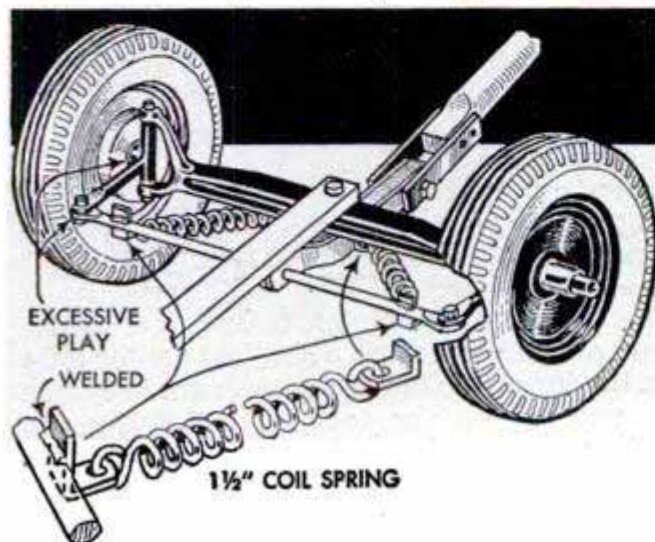


# for your bicycle

WHEN your bike is fitted with a 9-speed "transmission," that steep grade ahead becomes level ground and on a straightaway you can really make speed. A standard replacement kit, pictured in Figs. 1 to 6, can be installed on any bike to provide a total of nine forward speeds ranging from a very slow low gear to an extremely fast high gear. Installation consists of removing the coaster brake and replacing it with a three-speed hub, a triple-sprocket unit and a chain "derailer." By means of flexible cables, the rider can throw the chain from one sprocket to another as he pedals along. The cables are operated by levers clamped to the crossbar, Fig. 1, enabling the rider to select the best "gear" combination for any road condition. If the bike is already equipped with a three-speed hub, all you have to do is replace the single sprocket on the hub shift with the three-sprocket assembly. The latter is available in different diameters, 16, 18 and 24-tooth sprockets being recommended. The triple-sprocket shift affords two additional speeds to each one of the three speeds provided by the hub shift, making a total of nine speeds. Fig. 7 shows assembly of the two 3-speed shifts and how they are mounted in the bicycle frame, the spokes, tire and chain being omitted for clarity. Slight variations, such as the elimination of some of the spacer washers, may be necessary and some bikes may require using a hub axle of greater length.

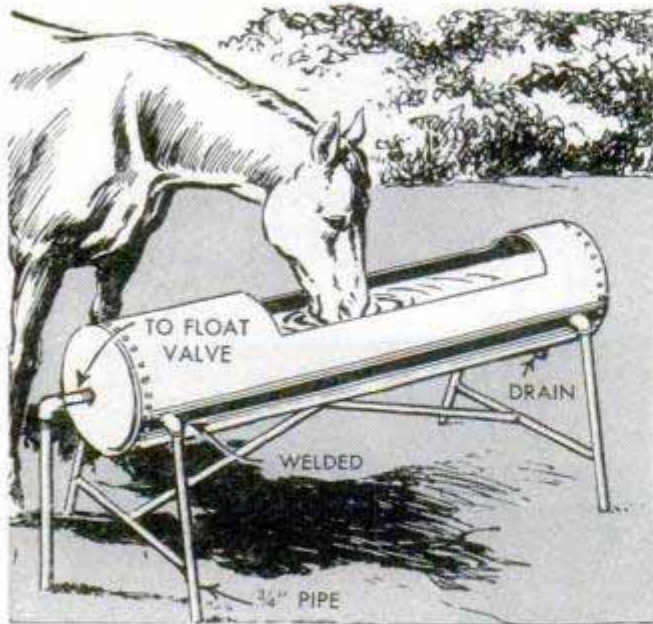


## Tie-Rod Tension Springs Correct Wandering of Four-Wheel Trailer



Four-wheel trailers made by converting old car axles often tend to wander from side to side when being towed on the highway. This generally is due to excessive play in the tie-rod yokes and in other parts of the front axle. On rough ground and in fields, the play sometimes causes whipping of the drawbar, especially when the trailer is loaded. One owner cured these troubles by installing heavy coil springs in the manner shown. Metal brackets were welded to both sides of the drawbar and also to the tie rods as closely as possible to the yokes. The brackets must be spaced to equalize the tension on the springs when the latter are hooked in place.

## Tank Fitted With Float Valve Provides Automatic Waterer

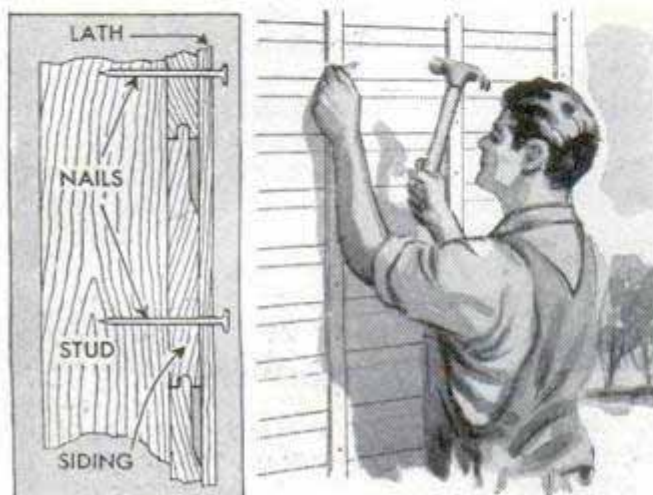


One keeper of a boarding stable for riding horses devised this simple automatic waterer for the convenience of his charges. It consists simply of a discarded hot-water tank cut away as shown and connected directly to the water supply, which is controlled by a float valve. The support for the tank is a sturdy frame made from pipe. Legs are splayed to prevent easy overturning, and braces and stretchers are welded in place to obtain rigidity. A pipe plug in the cold-water inlet makes it easy to drain and flush the tank periodically.

Hi Sibley, Nuevo, Calif.

## Green Siding Seasoned While in Use

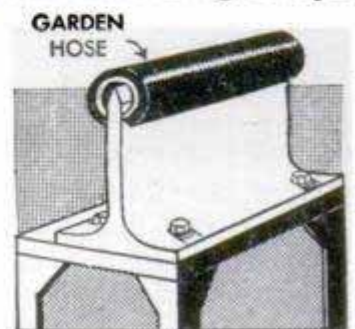
After considerable experimenting, one farmer found that unseasoned lumber, such as siding, could be put to immediate use on outbuildings by loose-nailing it in place and allowing it to season right on the building. He claims that in this way new lumber from the wood-lot sawmill or unseasoned lumber from the yard can be utilized with only the normal shrinkage and a minimum



of checking and warping. The boards are nailed to the building studding with a single nail to each stud, the nail being driven through a wooden lath as shown in the detail. The nails are driven only part way in, as indicated and scaffold nails can be used for this first nailing if desired. After the siding has seasoned sufficiently, the nails are withdrawn and the siding renailed in the regular manner. The laths, of course, are removed when the nails are withdrawn preparatory to renailing. — Ray Harrison, Fort Qu'Appelle, Sask., Can.

## Protecting Edges of Balancing Ways

When balancing ways are not in use, their sharp edges can be protected from damage by sheathing them with lengths of garden hose. Cut a piece of hose to suit the length of the ways and slit it along one side. Then, simply press the hose over the edge of the ways.



Earl R. Goddard, Denver, Colo.

## Potato Holds Parts for Welding

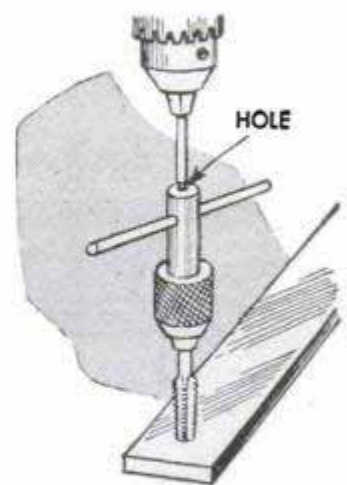
Using a large potato to hold small parts for welding, brazing or soldering provides a firm support along with efficient cooling. Cut the potato so one side forms a flat base and then press the parts into the potato at a convenient working angle.

Roy E. Bedbury, Seattle, Wash.

## Holes Tapped on Drill Press

Accurate tapping or reaming can be done quickly by clamping the work to the drill-press table and leaving it in position after the hole has been drilled. The drill is removed and a small pointed rod is chucked in the drill press. Then the tap is placed in the hole and the chuck is lowered so the end of the rod enters a shallow center hole in the top of the tap or tap wrench. Pressure is exerted on the tool by weighting the drill-press handle with a wrench or clamp, and the tap wrench is turned by hand.

E. Campbell, Edmonton, Alta., Can.



## RECTANGULAR PICTURE TUBE IN 1950 TV SETS

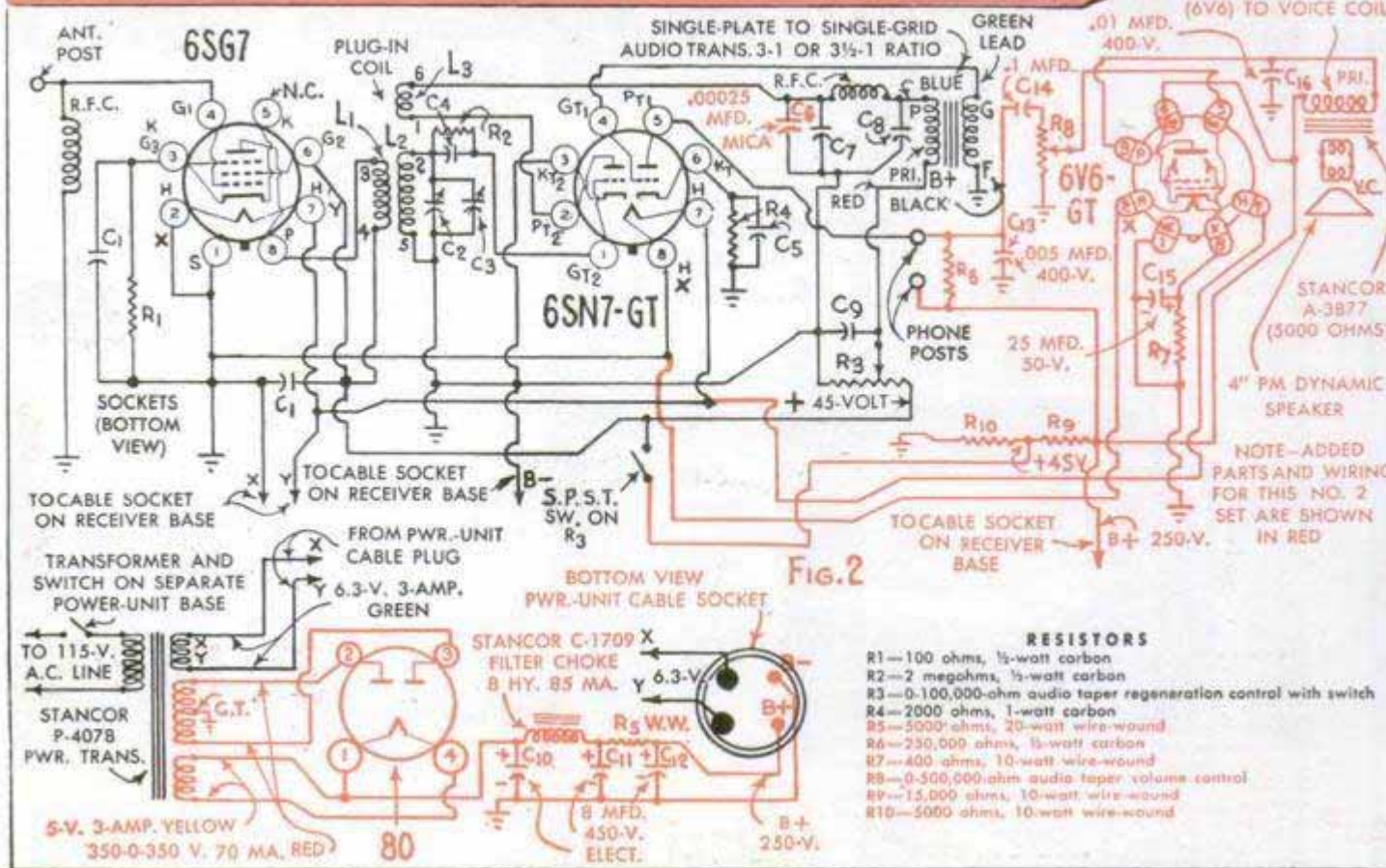
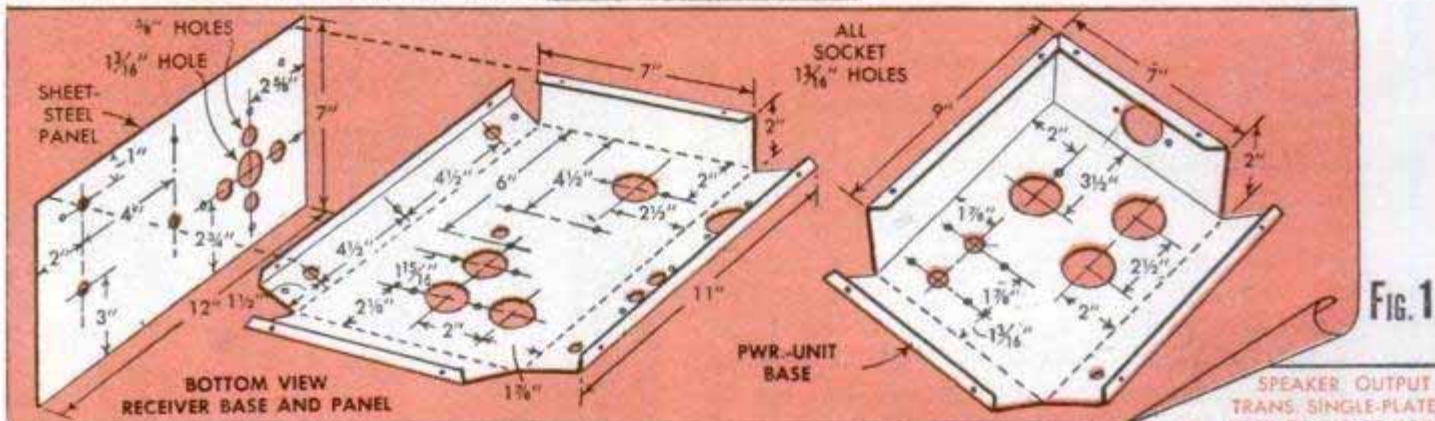
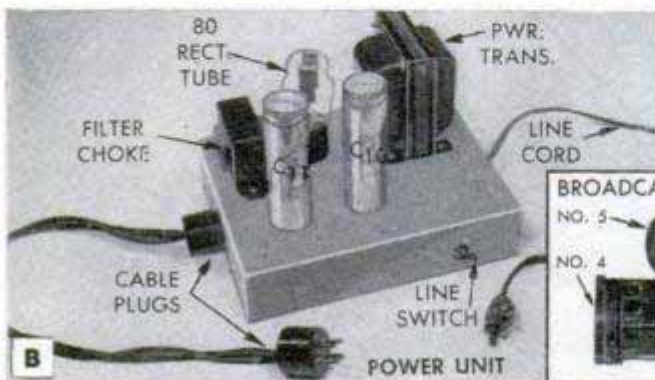
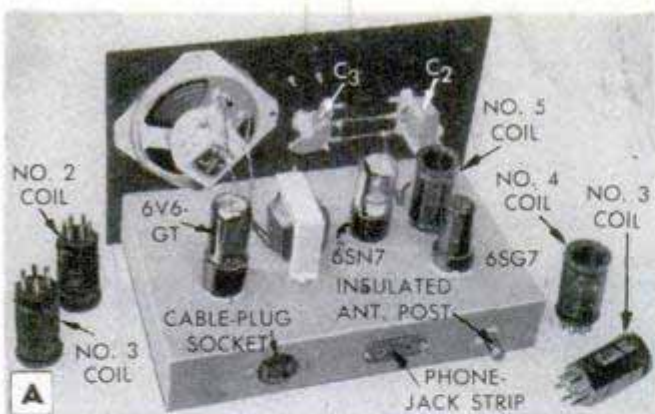
SEVERAL manufacturers are featuring the new all-glass 16-in. rectangular television picture tube in their 1950 TV receivers. It is perhaps the most outstanding feature to be found in the new sets. The rectangular tube face eliminates the formerly wasted surface which is unavoidable when a rectangular picture is presented in a round bulb. The compact new tube shown in photo D is claimed to make possible smaller TV-set cabinets without reducing the size of the picture. Made automatically, it is said to be no more costly than a round bulb of comparable size, and it is designed to receive the shape of the transmitted picture exactly as the TV camera sees it.

The television-radio-phonograph combination shown in photo A employs one of the 16-in. rectangular tubes and includes a three-speed record changer of advanced design which is illustrated in photo B. The tone arm of this changer cannot be damaged by being moved or held while in cycle. A special spindle is inserted for 45 r.p.m. records. This new combination console model sells for about \$400. The same manufacturer recently introduced the table-model TV set shown in photo C. This model features the 16-in. rectangular TV picture tube in a cabinet only 20 in. wide by 19 in. high and 18<sup>9</sup>/<sub>16</sub> in. deep. It also includes a new "fly-wheel" automatic frequency control to provide greater picture steadiness, and a built-in antenna.



# No. 2 PROGRESSIVE ALL-WAVE A.C.

DISTANT short-wave reception, commonly known as "DX" by short-wave listeners, and also standard broadcast-band programs can be tuned in with excellent quality and good loudspeaker volume with this a.c. No. 2 progressive student receiver. Those who built the No. 1 set R-385 that was described in the January 1950 issue will only have to add the few extra parts and the wiring shown in red on diagrams Figs. 2, 3 and 4. The only change in the windings on the plug-in coils is a reduction in the number of turns on the L3 winding on each coil. These are shown on the coil-winding data chart and in Fig. 5; no other coil windings are changed. If the builder is careful, it is possible to transform set No. 1 into set No. 2 without rewiring the



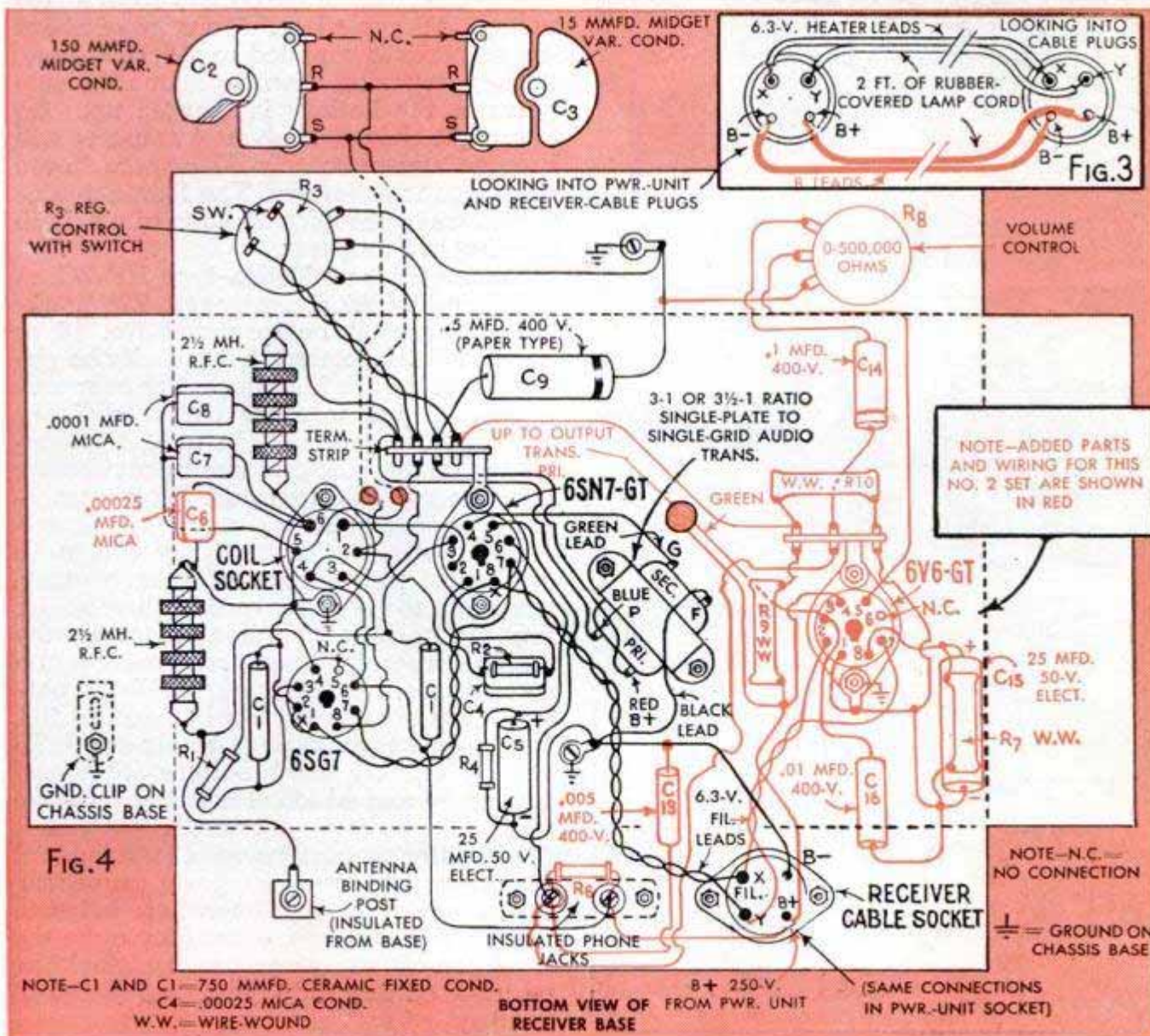
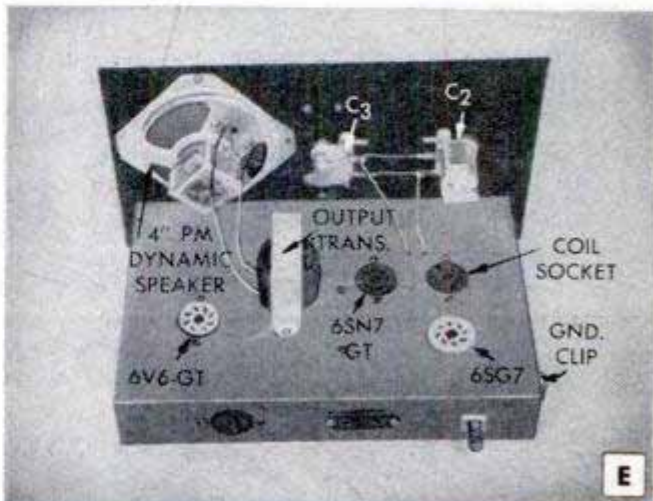
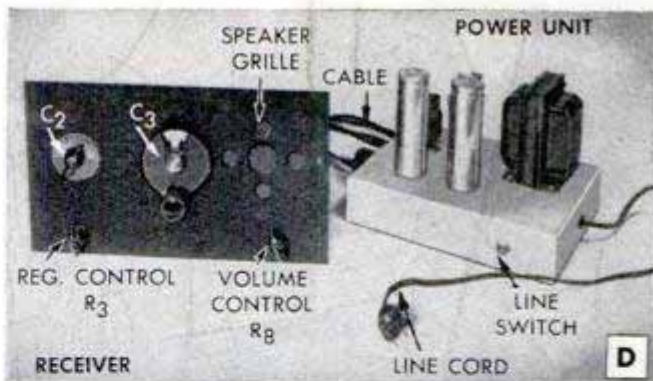


# "OVERSEAS DXER" FOR STUDENTS

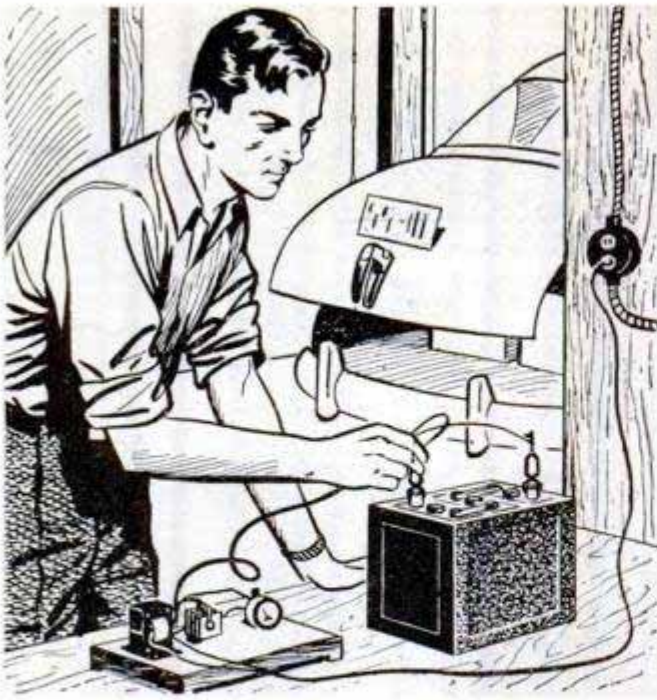
first set. By noting the added parts and wiring in red on the circuit diagrams Figs. 2 and 4, the builder will see that the amplifier stage, which is added, simply picks up the signal at the old phone terminals and boosts it for loudspeaker operation. The separate power unit now supplies both the original 45 volts for the first two tubes and approximately 250 volts of well filtered d.c. for the plate of the added 6V6-GT amplifier tube. The added resistors R9 and R10 form a voltage-divider circuit which is tapped to provide the 45 volts formerly supplied by the 45-volt B-battery. Students who did not build the first set will now follow these complete circuit diagrams. The only part that was changed in the original circuit is the fixed condenser C6.

The power unit makes the set completely a.c. line operated and, as it is a separate unit, hum is thus kept at a minimum. The loudspeaker is mounted on the front panel behind a grille formed by one standard

(Continued to page 234)



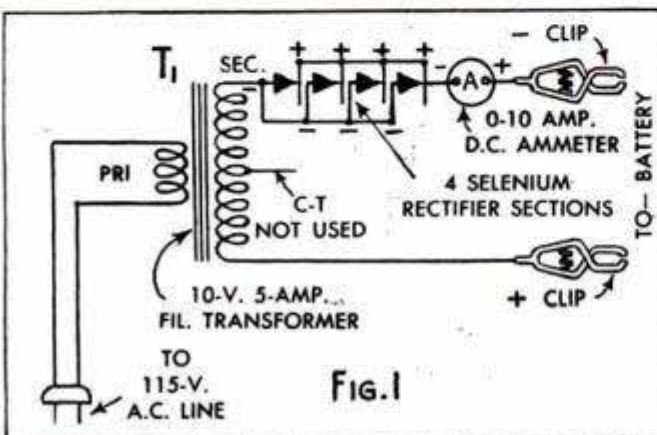
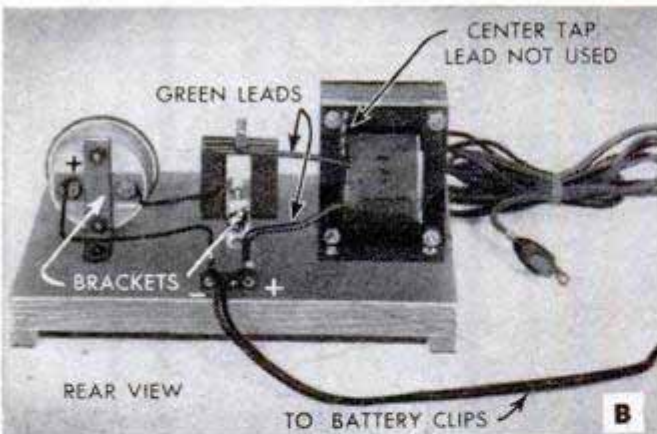
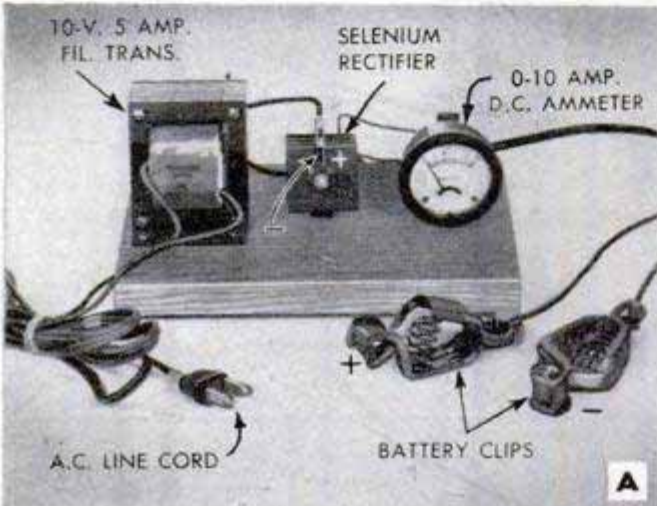
## Low-Cost Battery Charger Employs Selenium Rectifiers



THERE is nothing like a fully charged storage battery to snap over your car motor on a frosty morning. When the car generator cannot keep the battery up to par, a good charger is a handy unit to have around the garage. Many radio amateurs operating mobile transmitters have to keep auxiliary storage batteries charged without depending upon the generator in the car. The simple inexpensive battery charger illustrated will meet all requirements for such service.

Assembly is made on a  $\frac{3}{4}$ -in. wooden baseboard  $5\frac{1}{2}$  in. wide and  $8\frac{1}{2}$  in. long. This open form of mounting permits adequate ventilation. Photos A and B show front and back views of the unit, and the schematic circuit diagram appears in Fig. 1. The charger employs a rectifier consisting of four Federal-type 4D2814AS selenium cell sections connected in parallel. It will supply from  $3\frac{1}{2}$  to  $4\frac{1}{2}$  amperes of d.c. to any 6.3-volt storage battery from a 115-volt a.c. 60-cycle line. A charge of about  $4\frac{1}{2}$  amperes is supplied to a dead storage battery, tapering down to about  $3\frac{1}{2}$  amperes as the battery is charged up. An overnight charge of about 4 amperes will provide approximately 40 ampere hours of charge to a battery. The filament-type transformer provides 10 volts of a.c. with a rating of 5 amperes.

The meter is an Emico-type NF-2C, or similar 0-10 amp. d.c. ammeter. The hook-up wire should be insulated No. 18 or larger. It is important that polarity be observed on the rectifier stack. The four sections are held together by an ordinary 6-32 machine screw  $1\frac{1}{4}$  in. long; a soldering lug on this machine screw provides the common negative terminal. When assembling, be sure to file the center washers on their top surfaces so that they will make good electrical contact with each other. Assemble the sections so that their solder lugs are upright. To operate, connect the a.c. plug; there will be no current flow and no indication on the meter until the battery leads are clipped to a battery. At this point, some caution must be observed. To identify quickly which battery-cable lead is positive and which is negative, clip the leads to a battery and watch the meter. The position which draws the least amount of current is correct. Properly connected, the current will read somewhere between  $3\frac{1}{2}$  and  $4\frac{1}{2}$  amperes, depending upon the condition of the storage battery. Mark the positive battery clip with red paint to identify it for future use.



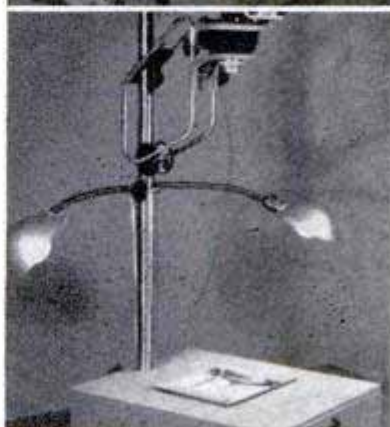
# IT'S THE NEW KODAK FLUROLITE ENLARGER

A magnificent enlarger that does many other jobs! Fluorescent circline lamp gives instant "on and off" cold light ... properly balanced for all color processes. "Integrating-sphere" type lamp-house and special inside coating give uniform light distribution; paper storage compartment in base of enlarger. Without lens, \$112.50, including Federal Tax. 7 lenses available separately. See it at your Kodak dealer's.

**EASTMAN KODAK COMPANY  
ROCHESTER 4, N. Y.**

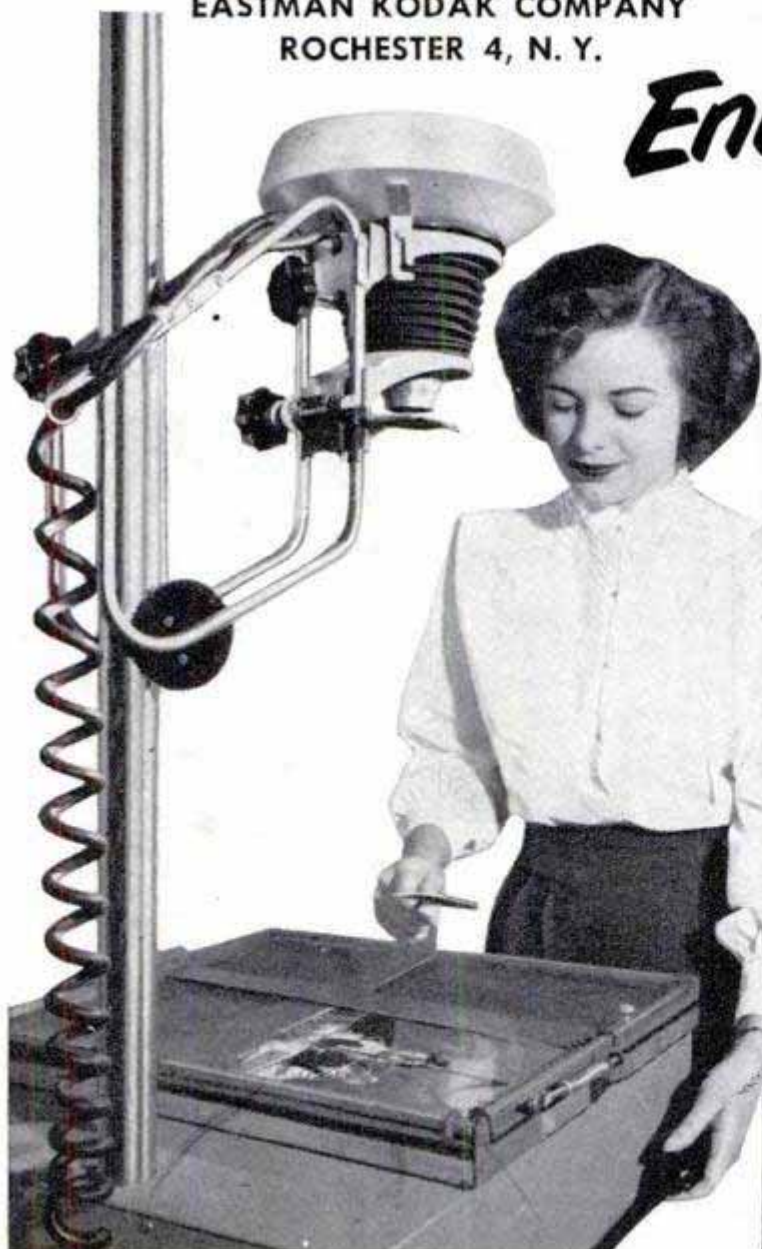


**A VIEW CAMERA ...** the Kodak Flurolite Camera Bed and Camera Back Adapter A (used as accessories) give a sturdy setup for  $2\frac{1}{4} \times 3\frac{1}{4}$  pictures. Use Kodak 35mm. Film Adapter A for miniature color photography.



**COPYING AND CLOSE-UPS ...** use the enlarger as a camera, with the accessory Kodak Copying Lights, Model 2. Fully adjustable.

## Enlarging Plus...



**PHOTOMICROGRAPHY, MICROFILMING, CLINICAL PHOTOGRAPHY ...** in this illustration, the Kodak Microscope Attachment replaces the enlarger lens and makes a light-tight connection with the microscope.



**CINE-TITLING ...** the inclined arm on the stand assembly supports a Cine-Kodak camera for making titles.

**Kodak**  
TRADE-MARK

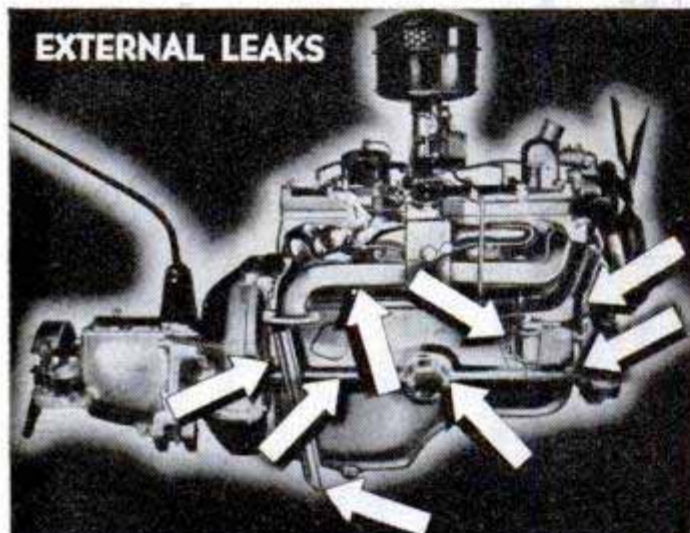


# Care and Feeding of Engines

BY S. P. CORP

## THE CASE OF THE VANISHING OIL

Fast oil consumption does not always mean worn piston rings. Rev up the engine to a 40-mile rate and take a look at the exhaust. If there is no blue smoke, look for oil leaks. Fig. 1 shows you some places where leaks can develop. If, at any of these points, you see deposits of oil and dirt, wash and dry the area.



EXTERNAL LEAKS

FIG. 1

Then hang a white cloth below the engine to show drippage. Be sure the oil level is up, otherwise leaks may not show. Then drive car a few miles, and examine cloth. Leaks will be shown up by oil drips.

## CHECK OIL GAUGE LINE

Be sure to check for a plugged oil filler breather cap, a plugged muffler, or bent tailpipe, as these can cause back pressure, forcing oil vapor out the crankcase ventilator. One of the most treacherous spots is the flexible tube in the oil gauge line, Fig. 2. Check the vacuum booster pump for a cracked diaphragm, too.

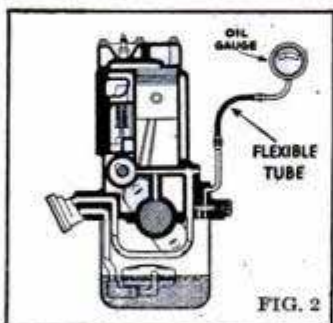


FIG. 2

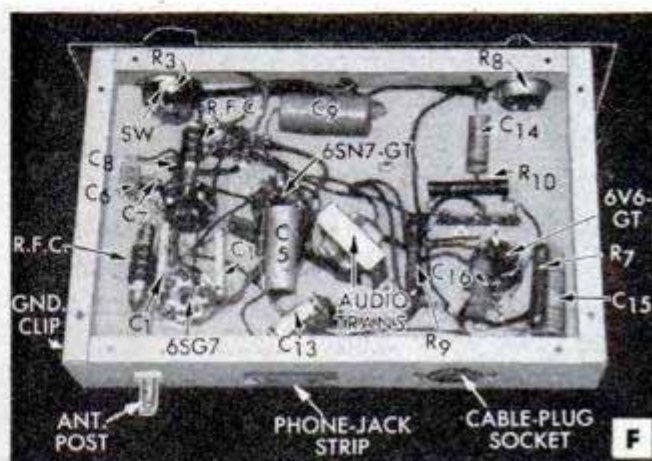
## BEST RINGS FOR RE-RINGING

When you re-ring, use the best piston rings built—use Sealed Power Piston Rings. There has never been such a ring for oil control as the Sealed Power MD-50 Steel Oil Ring—the only ring with the FULL-FLOW SPRING. This amazing ring controls oil even in badly tapered and out-of-round cylinders. There is a set specifically engineered for your car, whatever the make, model, or wear-condition. Ask your dealer.

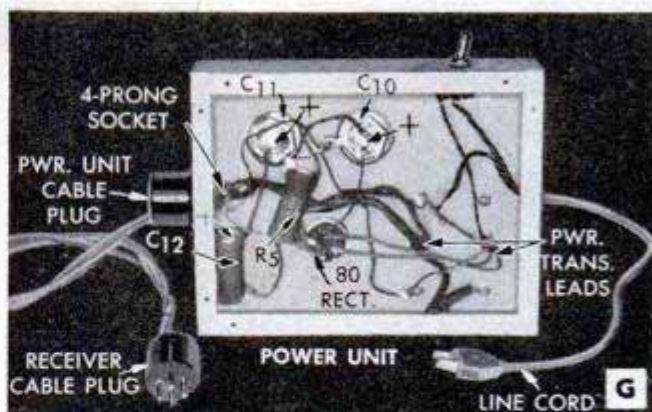
## No. 2 Progressive All-Wave A. C. "Overseas DXer" for Students

(Continued from page 231)

socket-punch hole and four holes made with a 5/8-in. drill as indicated in Fig. 1. The grille is backed up with a piece of cloth. The only additional part on the panel is volume control R8. The original volume control R3 is used as a regeneration control. Photos A, B, D and E show various views of the completed units; photos G and F are underside



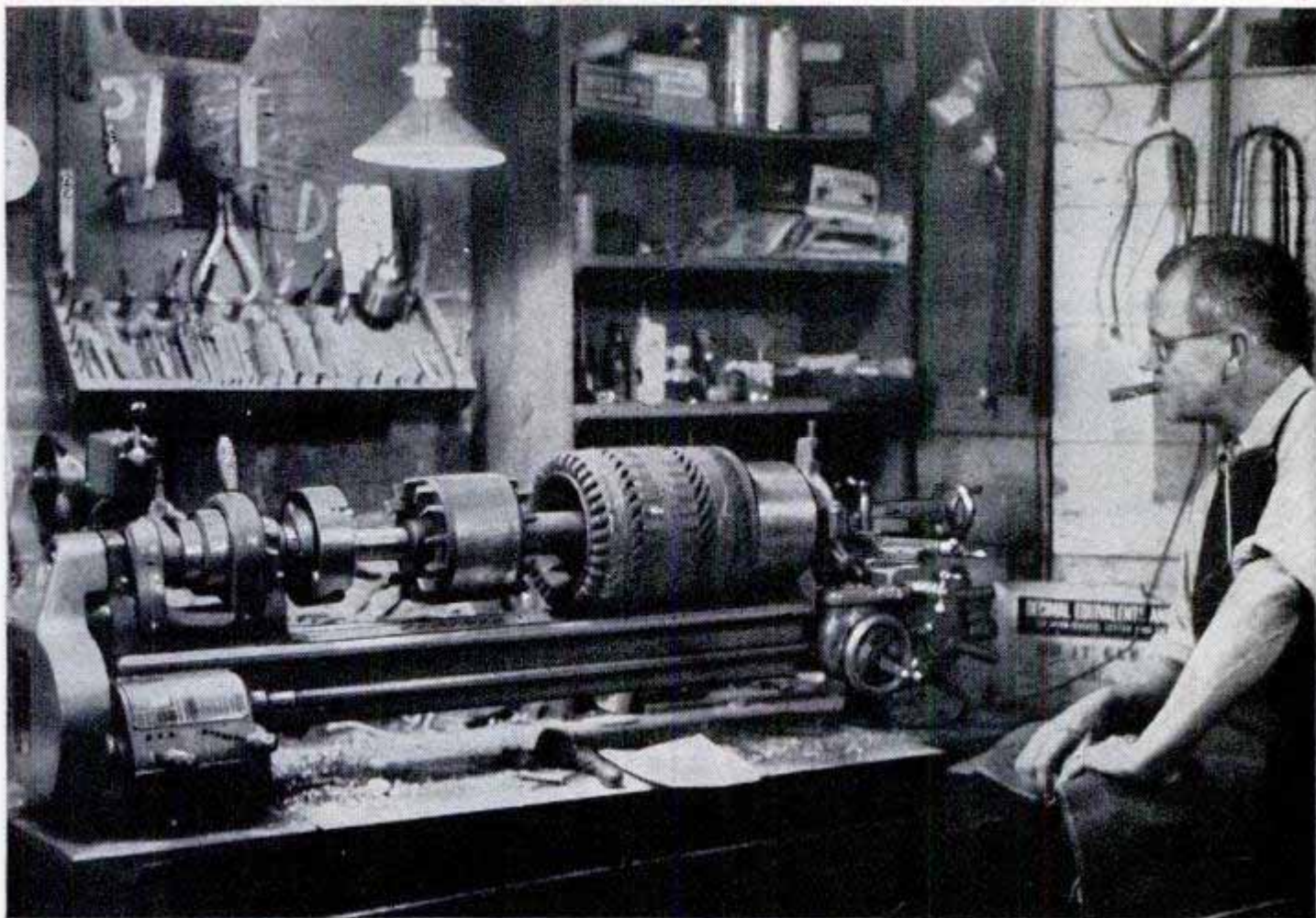
views. Three plug-in coils cover the short-wave bands from 1.6 to 15 megacycles; two coils, photo C, cover the entire broadcast band. The position of the padder condenser in coil No. 5 is indicated by the arrow. Builders of set No. 1 will note that resistor R20 is mounted directly on the headphone jack-strip terminals, and this is the logical



point to start wiring. At the same time, the 45-volt lead which ran from the power-plug socket is clipped (this is the wire that originally ran to control R3). This lead now connects to the 45-volt tap on the voltage divider mentioned previously.

For maximum selectivity on local broadcasting stations, it is important that this set be used with a very short antenna, only 5 or 6 feet being required. A 25-ft. indoor or outdoor antenna will pull in foreign stations in the short-wave bands with ease.

(Continued to page 236)



195 pound welder armature being machined in a South Bend 9" Bench Lathe

## *Small Lathe Does Big Job*

**Unusual repair job demonstrates profitable possibilities for doing maintenance work in your home workshop**

*Dewey Elmore, plant manager of the Hornaday Milk Co., Indianapolis, Indiana, recently sent us the picture reproduced above and the following letter.*

Gentlemen:

This picture was taken by my son who thought I was doing such an unusual job on a 9" South Bend Lathe. The armature I was turning weighed 195 pounds, was 34" long and 8½" in diameter. The armature was out of a direct motor drive, 300 amp. D.C. welder, which had three armatures mounted on the same shaft, the drive motor armature, the main welding generator armature and the exciter generator armature. The shaft was broken between the two generator armatures and I was unable to get parts, as the welder was obsolete. If I had made a new

shaft, it would have been necessary to have special jigs and fixtures to press armatures on and off. I supported end of armature shaft in steady rest and chamfered for welding, drilled ½" hole in ½" deep in main shaft. The stub shaft to be welded on was large enough to allow for warping. I chamfered this shaft leaving ½" nub on end to drive in to hole in old shaft. After electric welding, I turned to size.

I am real proud of this job, and the welder is back in service as good as new.

I am employed by the Hornaday Milk Company. I have a No. 644-R lathe in my hobby shop at home in my basement and for the past several years have done about all the maintenance machine work for the milk plant.

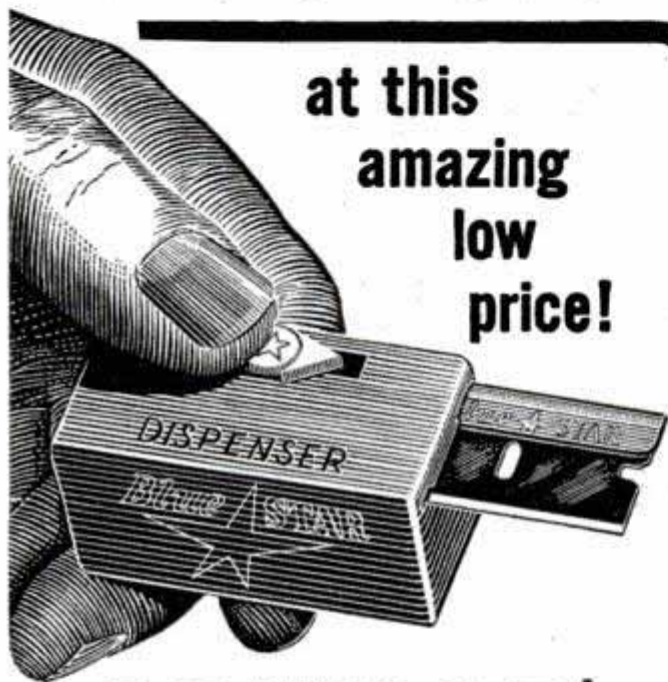
DEWEY ELMORE

*How about the equipment in your shop? If you are interested in lathes, drill presses, or shapers, write for our catalog.*

**South Bend Lathe Works  
South Bend 22, Indiana**

# NOW! this FULL WEIGHT Blade in Handy Dispenser

at this  
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price!



**10** BLADES IN  
DISPENSER **25¢**

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Try this sturdy, full-weight Blue Star on those tough, hard-to-shave spots. If any blue steel blade, at any price, gives you better shaves than Blue Star, we'll give you double your money back.

## Blue STAR

SINGLE EDGE

DOUBLE EDGE

PRECISION **ASR** PRODUCTS

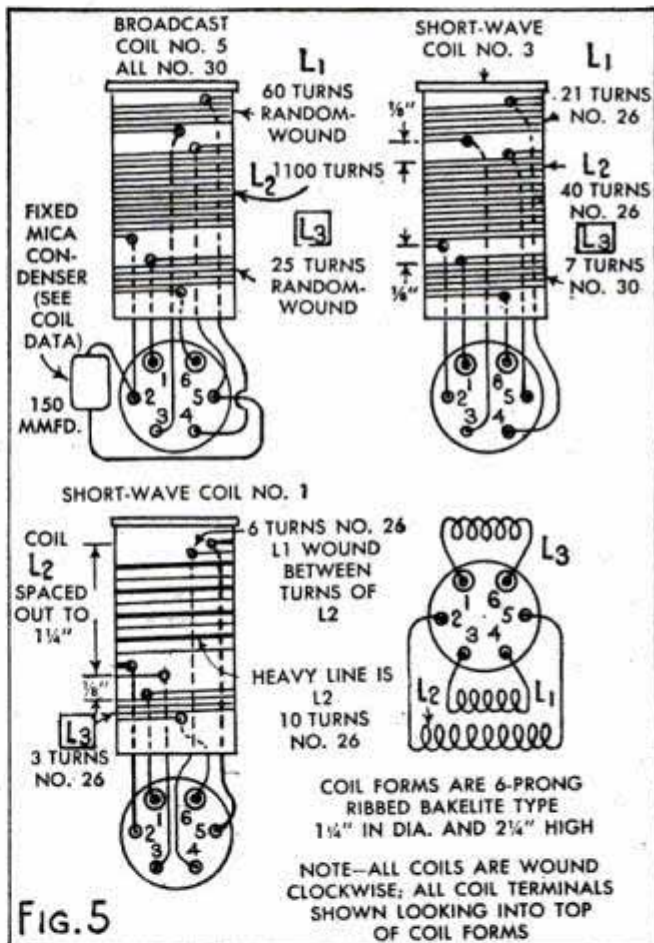
AMERICAN SAFETY RAZOR CORP. BROOKLYN 1, N. Y.

COIL-WINDING DATA				
COIL 1	L1	L2	L3	All No. 26
	6 turns	10 turns	3 turns	Enam. Wire
COIL 2	L1	L2	L3	No. 26
	8 turns	18 turns	7 turns	Enam. Wire
COIL 3	L1	L2	L3	
	21 turns	40 turns	7 turns	
COIL 4	L1	L2	L3	All No. 30
	50 turns	85 turns	20 turns	Enam. Wire
COIL 5	L1	L2	L3	All No. 30
	60 turns	100 turns	25 turns	Enam. Wire

NOTE—S.W.—space-wound

In the two high-frequency short-wave coils No. 1 and No. 2, the "grid" winding (L2) is space-wound to the length specified; the "R.F." winding (L1) is wound between the turns of L2. In the two broadcast-band coils No. 4 and No. 5, (L1) and (L3) are random-wound in order to get the specified number of turns on the standard plug-in coil forms. Coil dope is used on the random winding to hold it in place. In coils Nos. 3, 4 and 5, space L1, L2 and L3 about 1/8" apart. In the short-wave coils Nos. 1 and 2, space L3 1/8" from the combined L1 and L2 coils. Fixed padder condenser across coil L2 inside coil form No. 5 should be a silver-mica type. If 150 mmfd. is not available use a 50 mmfd. and a 100 mmfd. connected in parallel. No padder condenser is necessary in Coil No. 4.

All Coils Close-Wound Unless Otherwise Specified



If a long outdoor antenna is used, a 100 mmfd. variable condenser should be connected in series with it and adjusted for the point which gives the best signal strength without introducing interference from other stations. Test receiver both with and without an external ground for best results in your location. Detailed student material list R-388 for this No. 2 progressive set is available from Popular Mechanics Radio and Electronics department upon receipt of ordinary letter postage.

Only wide-gap Auto-Lite Resistor Spark Plugs give you

**SMOOTHER PERFORMANCE**

**DOUBLE LIFE and GREATER**

**GAS SAVINGS**

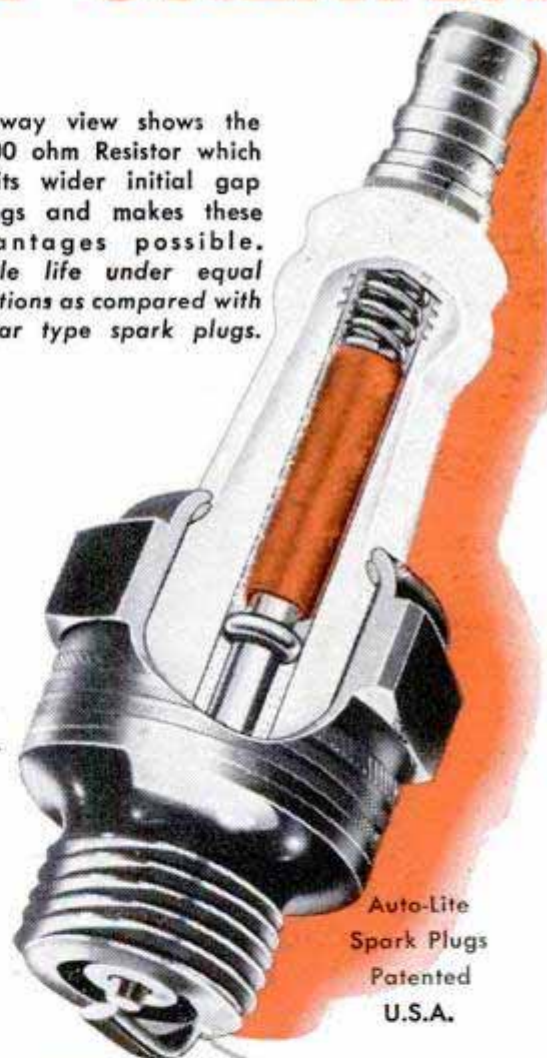
Cut-away view shows the 10,000 ohm Resistor which permits wider initial gap settings and makes these advantages possible. Double life under equal conditions as compared with regular type spark plugs.

**M**ILLIONS of car owners from coast to coast are switching from narrow-gap spark plugs to the sensational new wide-gap Auto-Lite Resistor Spark Plug. They want smoother performance—money-saving gas economy—improved starting in extreme cold weather. They want the *Built-in Resistor* that doubles spark plug life and reduces interference with radio and television reception.



To get these remarkable benefits for your car, see your Auto-Lite Spark Plug Dealer today. You're always right . . . with Auto-Lite.

Tune in "Suspense!"... CBS Radio Thursdays... CBS Television Tuesdays

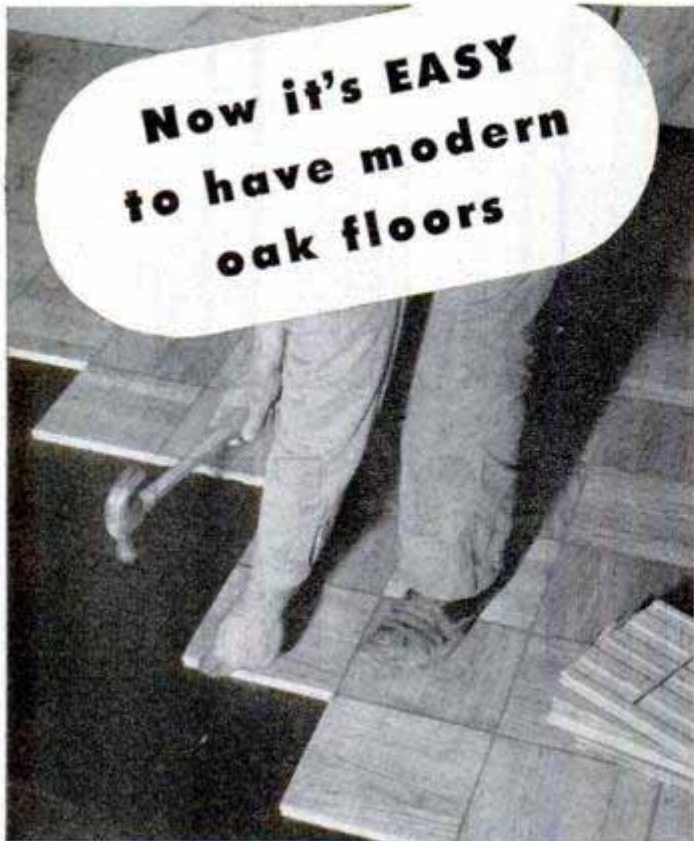


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oak floors**



*Your choice of block or strip design*

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You can give your home new beauty at low cost with a prefinished Bruce Hardwood Floor. Completely finished—even waxed—at the factory, this highest quality oak flooring can be nailed right over old floors. No sanding or finishing...no mess or smell. Ready for use as soon as laid. Made in strip or block (parquet) design.

**"Scratch Test" Finish** — The Bruce factory-applied finish is baked into the pores of the wood. The "Scratch Test" (left) will prove to you that this durable finish does not scratch or chip or mar like an ordinary floor finish.



**Moderate in cost** — A new Bruce Hardwood Floor will cost you less than a good rug or carpet. Easy to keep clean and beautiful, too. It's just the thing to use in fixing up or adding a room. Let your lumber dealer give you an estimate. Mail coupon below for colorful literature.

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**Bruce Hardwood Floors**  
Product world's largest hardwood flooring maker

**Hall of a Thousand Illusions**

*(Continued from page 104)*

The catch was that the filled pool weighed several tons too many. To handle it, the center stage had to be lowered in advance, shored up with timbers, and the pool set up on it. Temporary flooring was thrown over the gaping hole so the current show could go on uninterrupted.

Then there was the show with the elephants—six of them. They were to be taken aboard in the subbasement and raised two to an elevator, to the show level, where all they had to do was stand in formation and look like elephants. The elevators could stand their weight, but sagged somewhat. That's what the pachyderms didn't like. The first time aboard, they backed off, impelled by some instinct that told them something was hollow under that floor. They milled around, conferred a little and were coaxed to try again. Finally assured that they wouldn't plunge to Kingdom Come, they lumbered aboard like veterans and rode up and down several times a day for the duration of the show.

What the hydraulic personnel hate are the snowstorms that occur above them around Christmas time.

"They've got the biggest snow bag in the world up there in the flies," growls the engineer, "It's a hundred feet long, like a hammock, with dribble holes along the top edges. It stretches the width of the stage. They fill that thing with flameproofed confetti and work it back and forth on a counterweight frame. It might look swell from the audience, but down here it doesn't look so good. That paper sifts through the stage-section cracks, gums up the grease around the pistons, flutters into the automatic switches and insulates them so they won't make contact. We spend a week cleaning house afterward."

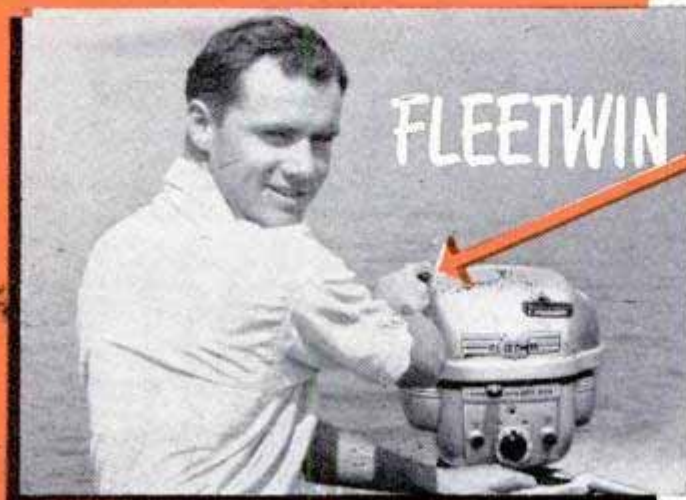
Other factors than the stage help produce Music Hall sleight-of-hand. Many quick scene shifts would be ineffective without proper lighting. To handle this the theater has the most elaborate system ever devised. A total of 25,000 bulbs from 2 to 5000 watts illuminate the place, contributing to the hall's annual 6,000,000-kilowatt-hour consumption—enough to light the entire city of Emporia, Kans.

Ten thousand of the lamps have to do with the stage or auditorium, and are remotely controlled from a 15-foot light console right in front of the orchestra pit. The console looks like a super complex telephone exchange, studded with 4305 switches for presetting any of 20 different light combinations on any of the units in the house.

*(Continued to page 244)*



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around this scientifically designed steel form which also provides circulating heat that assures perfect fireplace operation.

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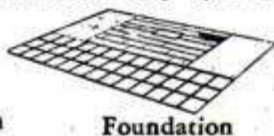
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- Steel heat-circulating form
- Cold and warm air ducts
- Chimney and flue construction
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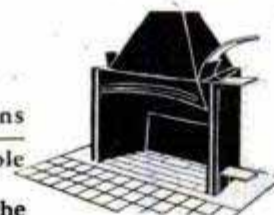
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"100 FIREPLACE IDEAS"

- Beautiful fireplace designs modern and conventional—shows artistic use of available material.

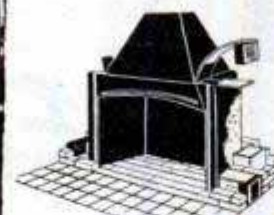
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### Inkstains on Marble

Q—I have a marble-topped table, or stand, which must be very old. There is a dark stain near the center of the marble top that I'm quite sure is an inkstain. It defies removal by any means I know of and I've tried everything I've heard about. Can you solve this one?

R.H., Centralia, Ill.

A—If you are sure the stain has been caused by ordinary writing ink, removal should be quite easy. There are several prepared ink removers available and as they are not expensive you might try one of these solutions, applying it as directed on the container and noting the results. However, we are rather doubtful about the full effectiveness of these preparations when used for this special purpose, especially if the inkstain is old. Another method which we believe would prove more satisfactory is to dissolve 1 oz. of oxalic-acid crystals in clear water (rain water is preferable) and add sufficient white flour to form a creamy paste. If it is available locally, obtain and add ½ oz. of antimony trichloride (butter of antimony) to the solution before adding the flour. **Caution:** Add both the antimony and oxalic-acid crystals to the water. Don't pour the water on the crystals. Apply the creamy mixture to the inkstain with a small brush and allow to stand for 30 minutes or so. Then wash off with clear water. It probably will be necessary to repeat this application several times in order to remove all traces of the stain and, because of the slow corrosive action of the chemicals, the marble top must be polished after this treatment. **Caution:** Dispose of all unused portions of the creamy paste, as the mixture is poisonous and the fumes from the chemicals are toxic. Wear rubber gloves.

### Moss on Terrace

Q—Our home is on a wooded lot and the lawn is terraced along the north side. Most of the terrace is covered with moss which apparently prevents grass from growing there. Does this covering of moss mean that the soil is poor? How does one get rid of the moss?—B.C., Ann Arbor, Mich.

A—Frequently moss takes over when the available plant food in the soil is depleted to the point where it will no longer support a healthy sod.

(Continued to page 242)



# CRAFTSMAN Tilting-Arbor Saw

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## Big ... accurate ... low-priced!



**CRAFTSMAN**  
8-in. Tilting-Arbor  
Bench Saw

Saw only  
**\$54<sup>50</sup>\***  
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\$5.50 Down, \$5 Monthly on Easy Terms

**\$104<sup>50</sup>\*** Complete  
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**We know of NO finer, more complete  
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A superb heavy duty CRAFTSMAN tilting-arbor saw outfit that meets the most rigid requirements of professional and amateur craftsmen! Big, accurate! New design, construction and exclusive features! Large, 20x17-inch smooth-ground table of cast semi-steel, with removable dado insert. Depth of cut up to 2½ in. 26-7/32 in. long; 17 in. wide; 14⅞ in. high. Saw has automatic leveling guard, non-kickback pawls, splitter, accurate miter gauge and rip fence; 8-in. combination blade (½-in. bore), 2-in. machine pulley, and motor mount. Complete with ½-H.P., 3450 R.P.M. ball bearing capacitor motor (110-120-volt, 60-cycle, A.C.); 2½-in. motor pulley; ½x40 in. V-belt; side-table extension; front or rear roller extension; and steel power tool bench (height adjustable, 22 to 32 in.). Saw, motor, motor pulley, V-belt, bench and extensions are available separately, if desired.

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for a paint brush,  
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**Smoothest painting**



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Nylon paint brushes are made by leading paint brush manufacturers. Sold in paint, hardware and wallpaper stores everywhere, in all popular sizes. Buy a nylon paint brush today!

**NYLON**  
**PAINT BRUSHES**  
*for smooth painting  
...easy cleanup*



Better Things for Better Living  
... through Chemistry

Usually terraces, as well as flat surfaces, infested with moss are poorly drained, and also are shaded during a part of each day by trees or buildings. The only effective remedy is to dig up the affected area either by hand or with a rotary tillage machine and once the soil has been loosened and aerated, work in quantities of humus in the form of compost, peat moss, or manure mixed with straw. Then level the soil, apply prepared lawn-grass fertilizer in accordance with the manufacturer's directions and seed the terrace. To prevent the soil and seed from washing away before germination takes place, apply a mat to the slope. Special mats are available for this purpose.



### Aged-Pine Finish

**Q**—I am finishing a room in knotty pine with the walls paneled in random widths and having two built-in bookcases. I want to color, or stain the wood in a medium-dark tone like the mellow old-pine woodwork one often sees on the walls of the older homes. What is a pickled-pine finish? How is it produced?—I.M., Cedar Rapids, Iowa.

**A**—The so-called pickled-pine finish does not mean the same thing to everyone. We gather from your letter that you are thinking of this as being a dark finish. Although there are several methods, the pickled finish generally is produced by coating the wood with ordinary white lead and oil and then wiping off the coating with a soft cloth until the desired tone results. By "walls paneled in random widths" we assume you mean you are using knotty-pine boards in random widths with one molded edge. Only good-quality white pine will take a satisfactory finish of the type you require. Probably the simplest procedure is to apply a mixture of equal parts of raw linseed oil and turpentine to which sufficient burnt umber (oil color) has been added to produce the color desired. Add the oil color and test the stain on waste stock to get just the shade you want. Apply the mixture to the boards with a soft cloth and wipe off the excess as you go along. Do not allow the coating to set even partially before wiping, and be especially careful near large knots and on areas where oblique grain runs out at the surface. On these areas the stain will "take" much faster. After the stain has thoroughly dried, sand the surface lightly and finish with paste wax.

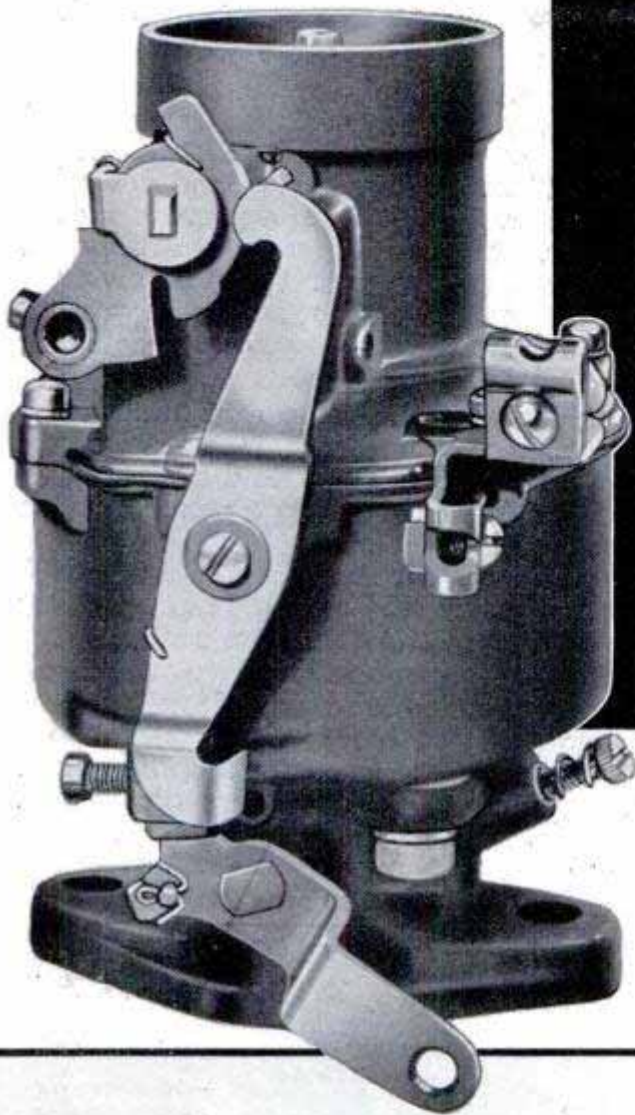
### Veneer Blister

**Q**—The veneer on our dining-table top is raised, or blistered, in two places near the edge of the top. Each blister is about 1 x 2-in. over-all size and is raised above the surface 1/4 in. or more. Is there any way to repair these defects and restore the top to its original smoothness?—C.U., Providence, R.I.



**A**—As a rule, such defects as you describe can be repaired by simply slitting the veneer, with the grain, with a sharp knife and forcing glue underneath the raised portion. Then immediately cover with two or more thicknesses of paper (newspaper will do) and place a weight over the paper to force the veneer back into place. Several bricks or a large kettle filled with sand will serve as a weight. After the glue is dry (allow at least 24 hrs.) remove the weight, wet the paper so that it can be scraped off and then sand the spot lightly with fine sandpaper, working from the center of the blistered area toward the edges. If the wood has not been badly discolored or lightened by whatever caused the blister, this simple procedure should result in a satisfactory repair.

# NEW POWER-JET CARBURETOR BOOSTS PERFORMANCE OF 1950 CHEVROLETS



Chevrolet's 1950 cars are equipped with a carburetor of new design that has many distinctive features.

Because the float bowl is concentric with the carburetor throat, the fuel level in the nozzle passages remains virtually constant, regardless of steep grades and sudden stops or turns.

Advantages gained by the new design include smooth acceleration while turning, easier hot-weather starting, continuous fuel flow, better acceleration response in hot or cold weather, and freedom from fuel loss on any incline. No metering adjustments are ever required, and the only external adjustment is for regulating the idling mixture and speed.

The new Power Jet carburetor is just one of the many features which make the 1950 Chevrolet first and finest at lowest cost.

CHEVROLET MOTOR DIVISION  
General Motors Corporation  
DETROIT 2, MICHIGAN



**On Sharp Turns**

**On Steep Hills**

The new Power-Jet with concentric float bowl design contributes importantly to smoother performance on sharp turns, on steep hills and on sudden stops.

**On Sudden Stops**

Once preset, the operator can change colors by a master switch. House lights shift to green, then dim; stage lights move into red; the prima donna gets bathed in gold—and so on for a whole show.

To control color on the 206 spotlights in the hall, a unique trick is employed. These lamps are five feet long and are equipped with a boxlike arrangement in front, holding a frame containing four gelatin color sheets. The frames are mounted on tiny geared tracks and move back and forth in front of the lens, powered by small motors. The electrician sitting at the console pre-sets for blue, throws the master switch, and all over the house tiny motors whir, color frames travel across lenses and soon the whole house is bathed in blue light.

In an ordinary theater, blackout is easy. But in the Music Hall, many of the spots are of the arc type—two sticks of carbon barely separated. When current is passed through them it jumps the gap and creates an arc of light. Eventually, the carbon gets white hot. Shut them off and they glow awhile. One isn't bad, but the 36 in the Music Hall create quite an afterglow. To squelch them, the same system is used as for the color slides. The operator simply throws a switch, and tiny motors automatically roll black slides or "blackout doublers" along the little tracks in front of each arc-

light lens. Result: No glow. Stages can go up and down unnoticed, turntables can whirl and in a few seconds when lights come on, miracles have been performed.

Dozens of other features make the Music Hall the most fantastic showplace on earth. Its three-ton curtain, with 2000 yards of fireproof lining, has nearly a mile of steel cable running through rings sewn in its seams. It can be hauled up and down by three separate motors in a predetermined pattern that is set at the same control board that runs the elevators. When a new curtain was made a year or so ago, it was too big to haul through New York streets and had to be delivered in three sections.

Besides the theater's rain and snow makers, three cloud machines send wispy billows across the stage, and a pipe along the footlights delivers up a steam curtain when desired.

Four projection machines deliver 5000 miles of movie film a year in relays over the 190-foot gap to a monster screen.

To distribute sound evenly in the theater's 1,800,000 cubic feet, the largest mixer in the world carries it from 60 microphones through a series of booster amplifiers and out through 23 loudspeakers distributed through the hall, so that sound reaches top-most seats in the balcony—a city block

(Continued to page 246)

*Don't just paint it—let's use it!*



Remember Weldwood Glue when you need dependable wood-to-wood bonds. Quick and easy to mix with cold water... tremendously strong... stain-free... rot-proof... and *permanent*. At paint, hardware, variety stores and lumber yards. 15¢, 35¢, 65¢, 95¢ and larger sizes.

**WELDWOOD** PLASTIC RESIN GLUE

United States Plywood Corporation, New York 18, N. Y.

**ALSO HANDY FOR  
WOOD HOBBYISTS!**



**Firzite**

—to give you smooth finishes on fir plywood and other soft woods.

A pre-finishing material that seals the wood pores... tames the wild grain... virtually eliminates checking and grain raising. An excellent base for stain, paint or enamel. White or clear. White Firzite provides an easy, low-cost way to achieve "blond," "bleached" or "wiped" finishes.



**Satinlac**

—to preserve the beauty of all woods.

An inexpensive coating for the proper finishing of Weldwood Hardwood Plywood and similar woods. Clear. No brush marks. Brings out all the natural beauty of wood. Does not yellow or darken with age.

FIRZITE and SATINLAC are available from paint, hardware and lumber dealers. Write for leaflet No. 4 on finishing plywood.

# BE A CHAMPION DRIVER

COOPERATE WITH THE WORLD'S SAFEST DRIVERS—THE CROSS-COUNTRY TRUCKERS



When you're not certain that it's safe to pass a truck, give him a couple of short "toots" or blink lights at night. *Stay back.* He'll signal you — **when it's safe to pass!**



If you start by a truck and the driver waves you back, he's warning you that there's danger ahead! Stay behind until he signals that all is clear. **That's the safe way!**



If you are driving slowly and a truck passes you, flick your lights as soon as the rear end is clear of your car. This signal tells the driver that he can turn back into the right lane. **He'll appreciate this courtesy!**



Whenever you are *obviously* in distress on the road, you'll find the cross-country trucker will be the first to offer you expert help. You can repay this courtesy by always cooperating with him. **Be a Champion driver! It pays!**

Commercial truckers constantly make comparative tests of spark plugs because they know that good spark plugs maintain engine efficiency, economy and dependability. The fact that the vast majority use dependable Champion Spark Plugs is positive proof that you can save money with Champions in your car.

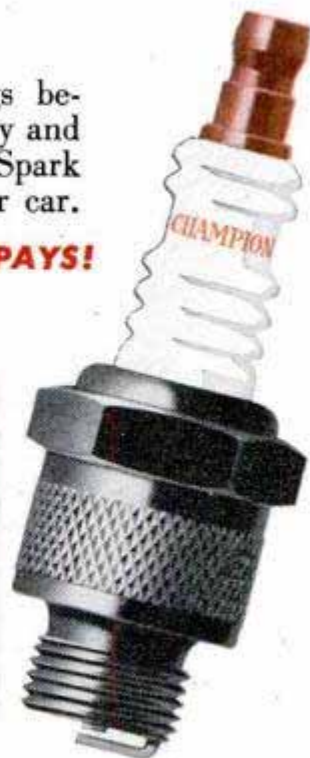
**... BE A CHAMPION DRIVER — IT PAYS!**

**FOLLOW THE EXPERTS—**

*Demand*



Mr. Jess L. Osburn, Houston Transit Company's superintendent of equipment, writes: "We use dependable Champions exclusively. They helped us win the 1948 National Bus Transportation Maintenance Award in the 501 to 750 bus group."



CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

from the stage— $\frac{1}{8}$  second after the screen image. Presiding over the mixer, in a booth over the third mezzanine, the sound engineer watching the show through binoculars, adjusts the battery of dials that control each whisper.

About the only thing that doesn't need amplifying is the organ. This mammoth, with two consoles that roll out on tracks from either side of the stage, has pipes varying from 32 feet high to the size of a pencil stub. It requires eight separate rooms to house them all. Special deodorant is sprayed through the lofts regularly to keep musty smells from wafting over the customers when it starts blowing its 60 blower fans.

The only time there was really any smell potential in the theater was when the producers moved in a cast of 30 Arabian horses, three jackasses and a camel. All had to be housed in the hall. A special ventilating system was installed over the stage. Paddocks of tanbark were built in the wings for the horses. Dressing rooms became tack rooms. The camel was relegated to the subbasement and sprayed regularly with everything from perfume to kerosene, and the donkeys won the animal room—a ceramic-tiled chamber built especially for four-legged performers—located below the stage level. Nobody in the

audience smelled a thing but pure air.

Ordinarily, the theater's own air-conditioning system takes care of odors quite adequately. Some 280,000 cubic feet of fresh air every minute is hauled into the theater by massive subbasement machinery. It drifts evenly over the audience from ceiling apertures, and is sucked out through vents under the chairs.

When the show is all over, and the house darkens, it takes a crew of 100 to clean up the day's debris—which is likely to include everything from chewing gum to diamond bracelets. Anything lost is usually found, however. All trash is sucked through 60 outlets to which cleaners attach vacuum hose. The pull, generated by a pair of 15-horsepower motors downstairs, makes a hiss like a steam engine when all the vents are closed. Everything sucked into the tubes is whipped down to a pair of 10-foot dust tanks in the cellar. Before they're dumped, the dust and dirt is sifted for valuables. One woman, who lost three  $1\frac{1}{2}$ -carat diamonds in the inch-thick pile of the luxurious rugs, got them back next day after the dust had been sifted.

"I knew this place could produce miracles," she announced. "But I still don't know how you do it." Like most Music Hall patrons, she never got a look behind the scenes.



Every Mechanic Needs a

**Snap-on\***

MIDGET

**WRENCH SET**

for small assembly work

**Set Contains These 19 Most Needed Wrenches**

When you have small nut-turning jobs, lay aside those "too-big" tools and put speed, safety, and working convenience into your hands with this 19-piece Standard Midget set. You get a Nut Spinner, 2" and 6" Extension Bars, Ratchet, Plastic Grip Handle, Sliding Bar, Universal Joint, nine hexagon sockets ( $\frac{3}{16}$ " to  $\frac{1}{2}$ ") and three square sockets ( $\frac{1}{4}$ " to  $\frac{3}{8}$ ").

\*"Snap-on" is the trade mark of Snap-on Tools Corp.

**\$17.75**

Plus Local Sales Tax



SNAP-ON TOOLS CORP., 8062-D 28th Ave., Kenosha, Wis.

Please send me the 119-TM-B Midget Standard Set

I enclose  Check,  Money Order,  
 Company Purchase Order.

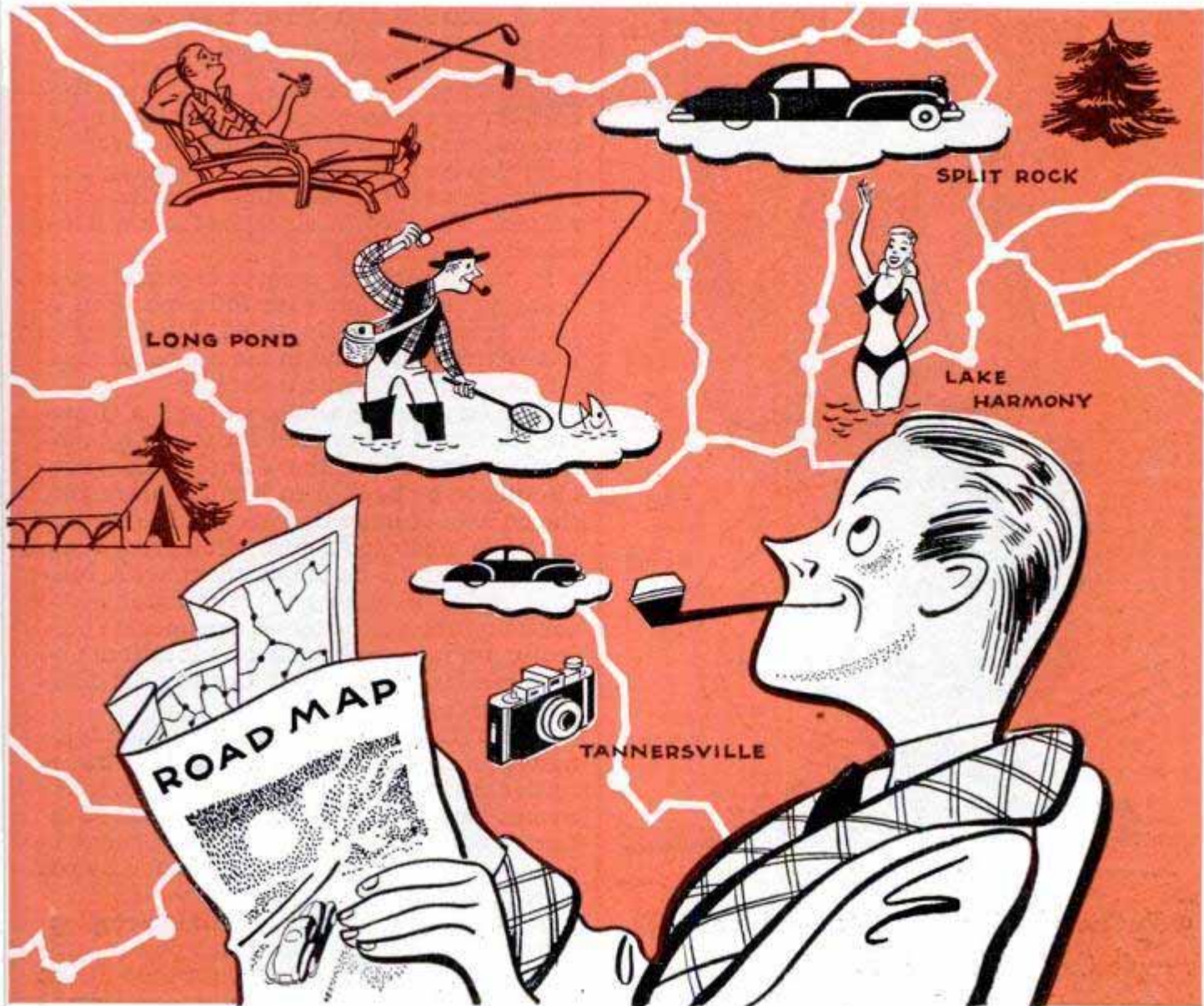
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ADDRESS .....

CITY.....STATE.....







## Whatever you plan to do this summer be sure your battery won't let you down

Time moves fast... and there's always so much to do during the last minute's rush. Give a thought to your battery now. Wait too long and it may let you down when you're far from home. Don't take a chance! Let the Exide dealer give your battery a complete check-up today. It takes but a short while... costs you nothing.

*Remember*, a single starting failure can be far more costly than the little extra you pay for a trustworthy Exide Battery.

THE ELECTRIC STORAGE BATTERY COMPANY, Phila. 32  
Exide Batteries of Canada, Limited, Toronto



"Exide" Reg. Trade-mark U. S. Pat. Off.

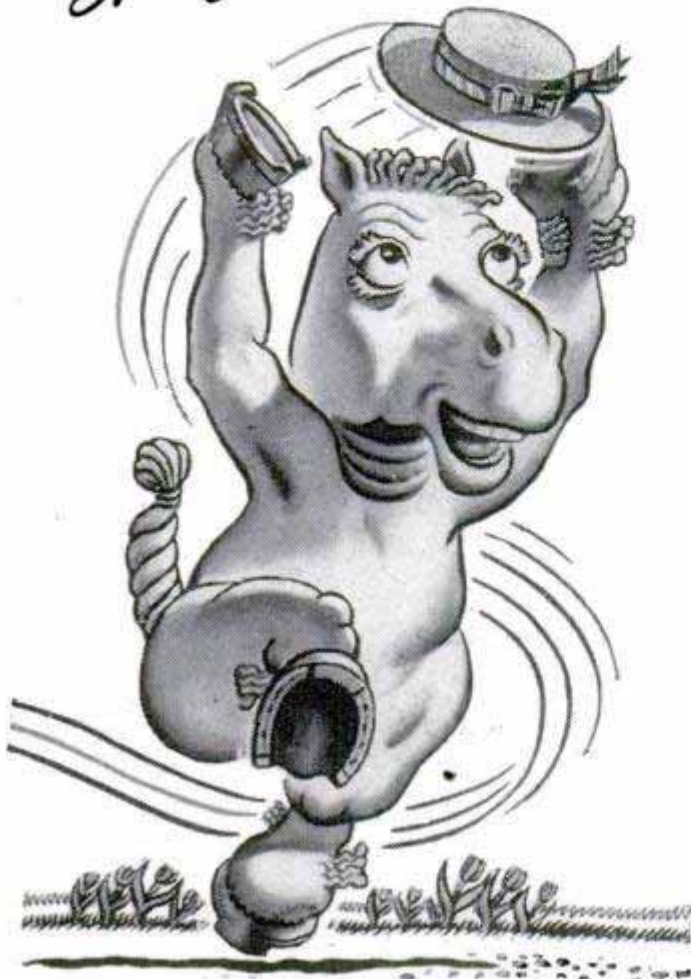
1888... DEPENDABLE BATTERIES FOR 62 YEARS... 1950

WHEN IT'S AN

**Exide**

...YOU START

## PUT *Spring* IN YOUR HORSEPOWER



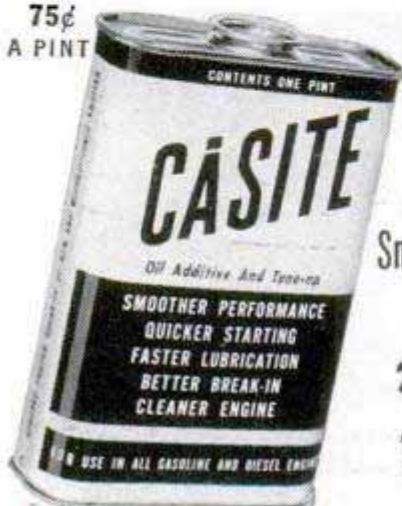
● Put new life in your motor—with a quick, simple Casite Treatment.

Casite through the carburetor air-intake frees sticky valves and rings, lets the power zoom through.

Casite in the crankcase keeps your engine clean and free-running—speeds lubrication—retards engine wear and cuts repair bills.

THE CASITE CORPORATION • HASTINGS, MICHIGAN

75¢  
A PINT



Better and  
Smoother Performance

or

Double-Your-  
Money-Back

## Radio Up Your Sleeve

(Continued from page 136)

satisfactory when reduced. A subminiature speaker can't reproduce the low notes that are emitted by a large speaker. Eventually, this may be remedied by designing a subminiature speaker that creates harmonics. These could simulate the low notes satisfactorily.

In the meantime, subminiaturization is being widely adopted for those portions of circuits for which it is suited. Hearing aids have shrunk in size with the use of subminiature parts and printed circuits.

Guided missiles would be only a futuristic dream if it were not for the new techniques that allow the complicated radio circuits to be packed in small spaces. Too, the control of huge rockets and the receiving of telemetered information from them in flight would be impractical with full-size radio equipment. A subminiature vacuum tube, for instance, can operate perfectly under conditions of vibration and acceleration that might destroy its full-size counterpart.

One of the newest developments in telemetering is a high frequency FM transmitter that weighs less than a pound, is 5½ inches long and 2 inches in diameter. Carried inside a small rocket, it has a range in excess of 50 miles. It was developed by the Pacific Division of Bendix Aviation Corporation as part of a 12½-pound telemetering package that also contains power supplies and such sensing instruments as motion and pressure pick-ups, accelerometer and altimeter gauge. A portion of the missile's air frame is used as the antenna, and as many as 48 unknowns can be measured and transmitted to the ground.

Except for the vacuum tubes, most parts needed for subminiature circuits can be bought for a few cents each. Due to the limited quantities in which they are manufactured, tubes average about \$3.50 each, list price. Few radio supply houses stock the small parts as yet and it is best to order direct from the manufacturers. A list of manufacturers can be obtained by writing to the National Bureau of Standards, Washington 25, D. C., and asking for a copy of the March 1, 1949, bulletin titled "General Information on Printed Circuits and Subminiature Radio Transmitters and Receivers."

The subminiature art is still so new that additional and important developments are occurring all the time. Eventually, it may come close to fulfilling a military request made during the war: "We want electronic equipment that takes up no space, weighs nothing, but will do everything!"

# Wonderful fun — ENDLESS GOOD TIMES



## RIDE A **HARLEY-DAVIDSON** *HYDRA-GLIDE*

**N**EW pleasures await you in motorcycling, world's greatest sport! Adventure, travel, thrills, fascinating friends! Every trip is delightfully different, every moment one to be remembered as you take in exciting races, hillclimbs, endurance runs and go on gypsy tours, sightseeing trips and other club events.

And what a difference it makes when you're riding a Harley-Davidson *Hydra-Glide*! Roughest roads smooth out like magic, hills fade away, day-long riding is really comfortable! Get your share of this exhilarating fun. You can own a Harley-Davidson on easy terms. See your dealer today.



HARLEY-DAVIDSON MOTOR CO., Dept. P, Milwaukee 1, Wis.

Send me *free* copy of ENTHUSIAST Magazine filled with motorcycle action pictures and stories, also literature on latest models.

Name.....

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**DEALERS:** Valuable franchises are now available for the full line of famous Big Twins and the 125 Model. This is your opportunity to line up with the greatest name in motorcycles. Write or wire for complete information today.

All the Difference  
in the World!



**JOHNSON**  
*Neutral  
Clutch*

**MOTOR'S RUNNING • BOAT  
IS STANDING STILL.  
YOU'RE IN NEUTRAL!**

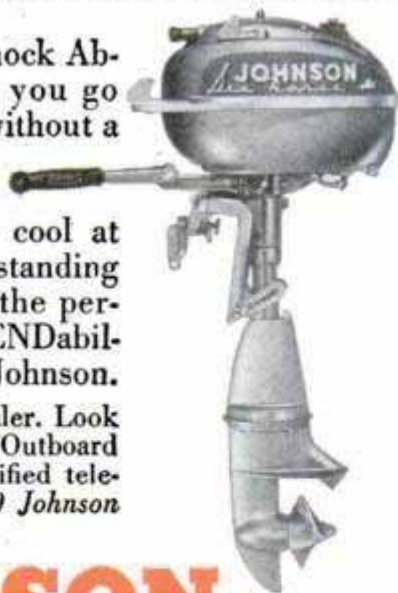
It's a new experience—running the 5 h. p.\* Johnson outboard motor with Neutral Clutch!

Start in neutral. Flip the lever, and GO! Stop, quick, with your motor running, when a big one strikes. Maneuver easily in and out of tight places.

New sure-fire Shock Absorber Drive lets you go through shallows without a care. New Vari-Volume Pump

keeps your motor cool at any speed. 32 outstanding features give you the performance and DEPENDability you expect in a Johnson.

See your Johnson dealer. Look for his name under "Outboard Motors" in your classified telephone directory. 1950 Johnson prices are lower!



**JOHNSON**  
**SEA-HORSES FOR DEPENDABILITY**



\*OBC Certified Brake H. P.  
at 4000 r. p. m.

**FREE HANDY CHART**

Complete description of all five 1950 models, including the sensational

Model QD with Gear Shift Control and Mile-Master Fuel Tank. A post card gets it. Write today!

JOHNSON MOTORS, 400 Pershing Road, Waukegan, Illinois  
Johnson Motors of Canada, Peterboro, Canada

## Back-Packing in the Mountains

(Continued from page 163)

in the shade. A lightweight woolen shirt and a down vest or loose-fitting sweater are good insurance against chills. For an outer garment, wear a windproof jacket. A stocking cap is fine to wear around camp on chilly mornings and evenings and in bed on cold nights—especially if your hair is getting thin!

You'll need the usual hiking shoes, jeans or khaki trousers, an old felt hat and four pairs of heavy wool socks. These socks are the only extra clothing you should take. Don't weight yourself down with extra trousers and shirts.

Sunglasses are an excellent "extra" for tramping high on mountains. In many cases, when well above the timber line, they are essential and it's good policy to carry an extra pair, just in case. Mosquito lotion is good insurance, too, especially in the early part of the summer.

You'll need a first-aid kit, including a snake-bite suction device, if you're in rattler country. Be sure you know how to use it before you start. Don't wait until a rattler strikes! First-aid materials should include bandages, adhesive tape, disinfectant, dental poultices, aspirin and a few sleeping pills to aid an injured person to rest. Put a couple of sturdy needles and some strong thread in the first-aid box.

Unless you're carrying a tent that requires stakes, you won't need a hand ax. It would be handy, of course, but you can pick up loose deadwood, known as squaw wood, for your fires. Don't bother with a heavy hunting knife, either. A sharp pocketknife is more useful. It's wise to carry an extra one of these, too. You can lose a knife, you know!

In addition to a stock of matches carried in waterproof packages, distributed through each pack, it's wise for each member of the party to carry a waterproof matchbox in his pocket at all times. Then, if he wanders away and gets lost, he can always build a fire to keep warm until someone spots the smoke or flames. A few candle stubs or a package of commercial fire kindler will make fire-starting easier in wet weather.

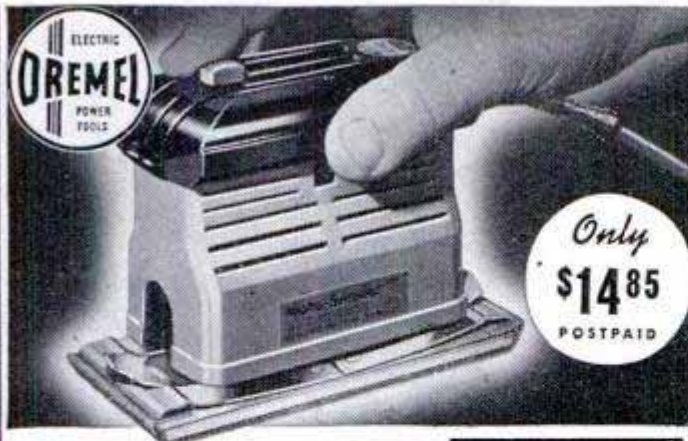
Every member of the party should have a map and compass with him at all times. And, he should know how to use them.

If you're in bear country, all food must be placed in a pack board and hung high in a tree at night and when you're away from camp. For this purpose, you should carry a light, 50-foot length of rope.

You'll probably plan to do some fishing

(Continued to page 254)

# DREMEL *Electric* SANDER-POLISHER



## SAY GOODBYE TO HAND SANDING!

This patented, miracle machine is so easy to handle, a child can use it. Craftsmen and housewives find (1) As a sander, it takes the effort out of sanding walls, woodwork, furniture, workshop projects, etc. Its straight-line (non-rotary) action will not burn or scratch surfaces. (2) As a polisher, it does a professional job on waxed surfaces of cars, furniture, etc. (3) As a massager, it's ideal for tired or sore muscles.



Works Easily in Awkward Places

## COMPARE THESE OUTSTANDING DREMEL FEATURES

Dremel Sander delivers 14,400 strokes per minute, weighs only 2½ lbs.; it's foolproof (has only two moving parts . . . never needs oiling). Dremel Sander operates on 110-120 Volt, 60 cycle, AC. Thousands and thousands of satisfied users prove its outstanding value.

**SATISFACTION GUARANTEED** —Dremel Sander comes complete with 6 sheets assorted grade Garnet Paper for sanding, plus felt pad and sheepskin for polishing. If your dealer cannot supply you, use coupon to order direct from factory. Money back if not delighted after 5 days' trial.

## USE THIS ORDER — If Your Dealer Cannot Supply You DREMEL MFG. CO., DEPT. 110-D, Racine, Wisconsin

- Enclosed find \$\_\_\_\_\_ (Check or money order) in full payment for items checked below.
- Enclosed find \$2. Ship items checked below C. O. D. I'll pay postman balance plus postage and fee.
- Dremel Sander \$14.85.  Dremel Coping Saw \$5.85. Send FREE catalog  Dremel Sander  Dremel Saw

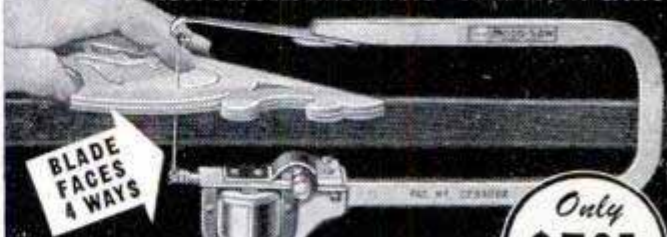
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# DREMEL *Electric* COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS



SAFE as a HANDSAW

JUST GUIDE IT!

For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute smoothly, effortlessly. Saws through ¾" medium-hard wood at foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only two moving parts, never needs oiling. Operates on 110-120 V. AC. FREE PROJECT PLANS packed with each saw. If your dealer can't supply you, use coupon to order on MONEY BACK GUARANTEE five day trial.

# GARAGEMEN, SERVICE STATION OPERATORS, CAR OWNERS!

## SAVE UP TO 50% ON THESE NATIONALLY-KNOWN AUTOMOTIVE SERVICE ITEMS



\$39.

For better than 30 years, the KRW Direct-to-User Policy has SAVED MILLIONS for THOUSANDS of Garage and Service Station Operators and Car Dealers. KRW manufactures hundreds of specialized tools and equipment which have been factory-approved by Ford and other car manufacturers. KRW Tools are used the world over. See our rating in Dun & Bradstreet. It's tops.

### KRW SIX AMPERE SLOW CHARGER

Handles 1 to 12 3-Cell Batteries or Equivalent. Complete ready to use.

This heavy-duty battery charger is ideal for safe charging of all types of car, truck and aircraft batteries. It incorporates all the latest design and construction features. Comes complete with bulb, wiring and connectors, ready to plug in and operate. Case is 11" x 13" x 6". Operation is simple and foolproof. Plug and Jack arrangement, like a telephone switchboard. You merely plug in to the jack corresponding to number of batteries on the line. Thousands now in use. Operates on 110 Volt, 60 Cycle.

\$130.

### KRW FASTCHARGER

FULLY AUTOMATIC. OPERATES ON 110 VOLTS A. C.

Simplest and most efficient on the market. Only one knob to turn, one dial to watch. New electric timer is foolproof in operation . . . it automatically discharges, fast charges, slow charges and shuts off. Customer can be shown exact condition of battery on the easily understood full-color dial. You can do this under proper load without danger of buckling plates. Use it also for "cycling" batteries that are badly sulphated. Equipped with 8" fan and heavy-duty motor. Lowest priced dependable unit on market. Money back if not satisfied after 30 days.



### KRW GARAGE JACK

3 TON CAPACITY

## SOLD WITH 30-DAY MONEY-BACK GUARANTEE

Lowest Price only \$90.

This outstanding Jack value meets every requirement of strength, fast lifting, quick spotting and dependability. Lifting capacity 3-tons. Weight 195 lbs. Length overall including handle 88". Length of chassis 53". Floor to top of rest pad 4" minimum. Raises to 24" maximum. Equipped with Self-cleaning Release Valve, Tamper Proof Safety Valve, Crowned, Roller Bearing Front Wheels and Ball Bearing Swivel Rear Wheels, Finger-tip Control Button.

### KRW AIR COMPRESSORS. TWO STAGE

Highest Quality. 4 Models—9.75 to 38.3 cu. ft. Displacement.

Why pay \$200 to \$300 Premium. For 35 years, KRW has passed these savings on to users. Every feature which can contribute to maximum efficiency and long life has been "built in". Cylinders are nickel-chrome alloy iron. Crankshafts drop-forged with integral counterweights. Timken Roller Bearings. Lynite Connecting Rods. Semi-steel Pistons with 3 compression and one oil ring. Constant level oiling system. Plate-type Valves. Automatic Air Breather. Combination Filter and Air Cleaner. Pressure Unloader for Easy Starting. Pressure Control Switch and Thermal Relay protects motor against overloading and undervoltage. 200 lbs. pressure ASME Tanks. PRICES FOLLOW:

2 H.P. 9.75 c.f.m., 80 gal. tank \$375.00 7½ H.P. 28.4 c.f.m., 80 gal. tank \$654.00  
5 H.P. 20 c.f.m., 80 gal. tank \$440.00 10 H.P. 38.3 c.f.m., 80 gal. tank \$685.00

WRITE FOR LITERATURE WITH DETAILED SPECIFICATIONS



**TERMS:** Cash with order. If C.O.D., 25% must accompany order. Concerns with established credit sold on open account. All PRICES F. O. B. Factory. (Subject to change without notice.)

**SATISFACTION OR MONEY BACK GUARANTEE** All Tools or Equipment

described in this advertisement are sold subject to your trial for 30-days after receipt. If you are then not thoroughly satisfied, return the goods to us and your money will be immediately REFUNDED.

**SERVICE AVAILABLE IN ALL PRINCIPAL CITIES**

**K·R·WILSON** 213 MAIN ST. BUFFALO 3, N. Y.  
WORLD'S LARGEST MANUFACTURER OF GARAGE TOOLS AND EQUIPMENT

# SHOPSMITH OUTPERFORMS SAWS, SANDERS, LATHES, DRILL PRESSES COSTING \$500<sup>00</sup>

It's a performance-proved fact! With SHOPSMITH you can do more jobs, actually do better work, than with any \$500 combination of single-purpose tools with motors. And here's why:

**SHOPSMITH IS VERSATILE!** It converts into five big, heavy-duty power tools. Takes all standard accessories. Can do 116 wood, plastic and metal working operations.

**SHOPSMITH IS EASY TO OPERATE!** Even without practice you can change it from tool to tool in less than sixty seconds.

**SHOPSMITH TAKES BIG WORK!** Its effective table width is so great you can saw to center of 8-foot plywood panels, sand and drill room-length pieces—with no interference from other tools. Lathe turns work bigger than a nail keg.

**SHOPSMITH IS PRECISION-BUILT!** It combines features found only in the finest tools. Grease-sealed ball-bearing action. Induction hardened spindle tip. Centerless ground steel ways. A score of precision features that assure hairline accuracy, lifetime service.

**SEE SHOPSMITH DEMONSTRATED!** At any Montgomery Ward, leading hardware or department store. And write for free 16-page, fact-packed illustrated booklet.



## \$169.50

complete except for motor. With special, 1/2-hp., capacitor type motor (shown). \$199.50

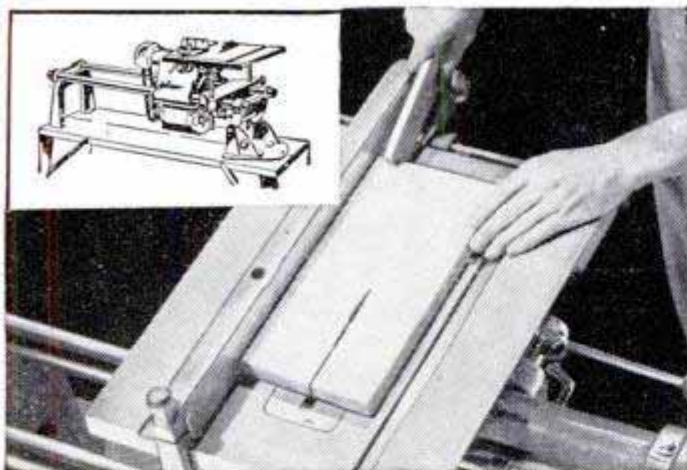
**CONVENIENT TERMS**



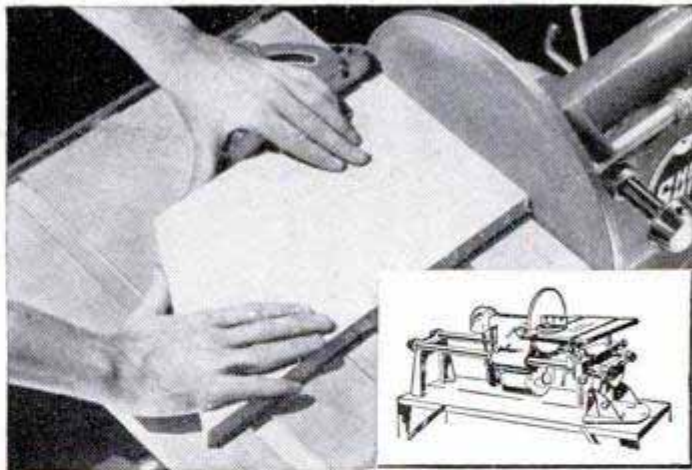
## JIGSAW FOR SHOPSMITH

*The finest precision  
jigsaw you could own*

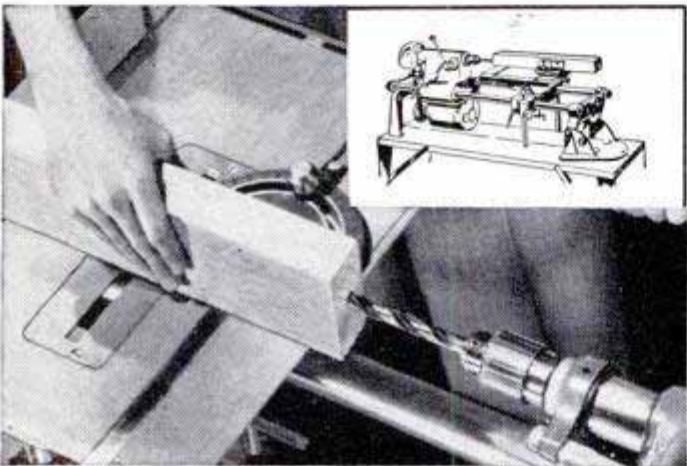
Rugged construction. 18" throat. Large tilting table. Built-in blower. Attaches quickly with one bolt. Can be used also for saber sawing, machine filing. Complete attachment, \$29.95



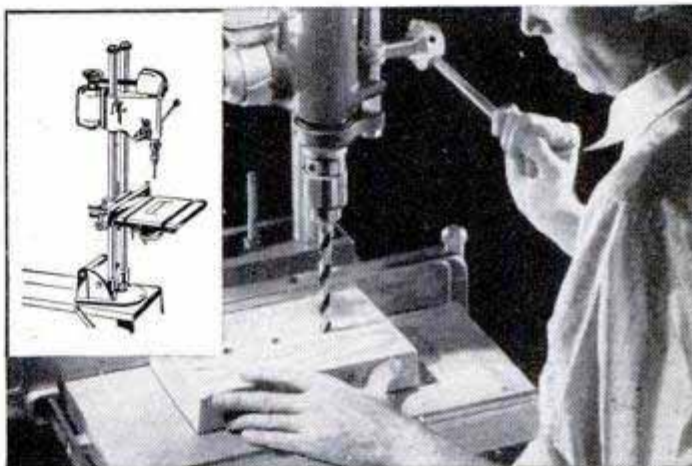
**1 8-inch Circular Saw.** You'd pay \$120 for a saw of equal quality, equal capacity. Effective table width, fence to blade, up to 48". Depth of cut 2 1/4". Sturdy tilting table with ball-crank raiser. Precision-tooled miter gauge with automatic stops. Self-aligning rip-fence.



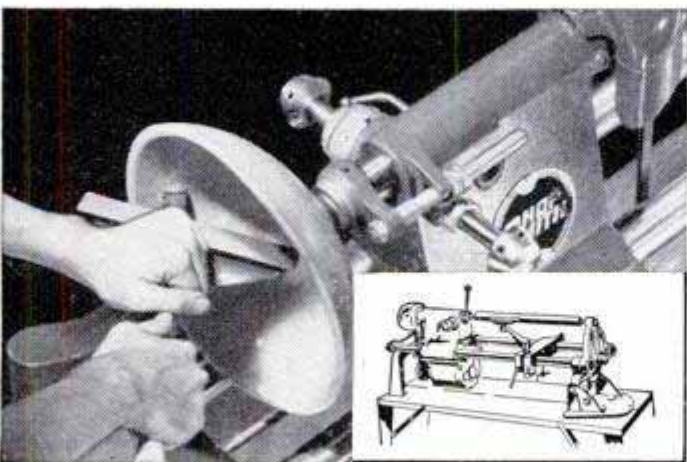
**2 12-inch Disc Sander.** No other disc sander can match it. None has 12" precision balanced disc, 14 1/2" x 17" tilting table, both miter gauge and fence. And with SHOPSMITH you can feed disc into workpiece with feed lever for greater accuracy, speed and safety.



**3 Horizontal Drill Press.** Ever try to drill the end of a table leg? Dowel stock for table tops? Mortise doors for locks? You can do it quickly and easily with SHOPSMITH. Work lies flat on table, no special jigs needed. Speeds from 875 to 3500 rpm. 4" quill feed.



**4 Vertical Drill Press.** In vertical position, SHOPSMITH is both a bench and floor-type drill press. Drills to center of 15" circle. Has 4" spindle feed with right or left hand feed lever. Jacobs key chuck takes drills from 5/64" to 1/2" in diameter. Extra-large table.



**5 33-inch Wood Lathe.** Turns stock up to 15" in diameter, 3" more than most heavy-duty lathes. Swivel-arm tool rest slides parallel to ways, lever-locks in position. Absolutely rigid lathe bed assures maximum accuracy—tubular steel ways each take over one-ton stress.



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That  
muck  
in  
my car?

In most everybody's car, Mister, this time of year  
And it can cost you an expensive overhaul. You need  
a new Purolator Refill for your oil filter—quick!

If your oil filter is to keep on keeping your oil free from engine-wrecking abrasives, you must start fresh with a new refill when you change your oil this Spring. Be sure you get a Purolator Refill. Filters more *completely*, hence saves more substantially on repair bills. \$1.38 to \$3.00, depending on make of car, inserted in a few minutes.

P. S. If your car has no oil filter, a *complete* Purolator, both housing and refill, costs only \$6.50 or a bit more, again depending on make of car. Purolator Products, Inc., Rahway, N. J. and Toronto, Ontario, Canada.



\*Reg. U. S. Pat. Off.

on the trip—both for the sport and to add delicious variety to your menu. If so, be sure to carry a repair kit for putting back into action a broken rod and reel. A spare pawl and pinion nut for a casting reel are good insurance against a fishless holiday.

Make sure the cooking utensils you get are general purpose and lightweight. Several excellent kits are available and these have the advantage of nesting together to reduce space requirements. Soap, a razor, tobacco, towel and maybe even a pair of slippers will fill out the load.

When you get these items together, you'll find that your pack already adds up to 25 or 30 pounds. And that doesn't include food. But all of it is essential and will be needed on a week-end jaunt or a two-weeks' trip. So you might as well face the fact that the back-packer's load is not light. That's why an efficient comfortable pack board is essential.

Food is a personal matter. Everyone has his likes and dislikes and what you carry won't be what the next man might want. But, roughly, two pounds of food a day is ample for the back-packer. If he augments his supply with fish, he won't need that much, but you'd better have it along.

While some men go all out for dehydrates, the lightest of foods, experience shows that staple foods are best in the long run. Even canned goods should be taken if the trip is not over a week long. A can of chicken fricassee, beef stew or tomatoes is so tasty after a few days out on a rough trail that it more than makes up for its added weight!

Dry soups weigh very little in relation to their food value. If you run out of all other food, soup will sustain you until a supply point is reached. If any excess food is carried, it should be soup and candy. Both are good tasting and provide quick energy.

Breakfasts should consist of hot cakes or biscuits, coffee, bacon and maybe some dehydrated apples stewed the night before. Lunches are simple. Dried fruits, cheese, candy, crackers and nuts provide nourishment on the march. Dinners are the choice meals. You should plan to have fish, spaghetti or biscuits, dried beef and vegetable stew. Every few days, a can of chicken, beef stew, corned beef or tomatoes will add zest to your diet.

Bacon is the backbone of the menu. Indispensable for breakfast, it is good in dehydrated stew or chowder and its fat is the all-important frying agent for hot cakes, biscuits and fish. On cold days, hot bacon fat tastes good on hot cakes and biscuits. Carry margarine instead of butter because it keeps better.

(Continued to page 256)



# OWN Your Own Business



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PORTABLE  
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Clean and Mothproof rugs and upholstery "in the home" or public buildings. Start full or part time. Gross profits up to \$15 and \$20 a day on EACH of your service men. Easy to learn . . . quickly established.

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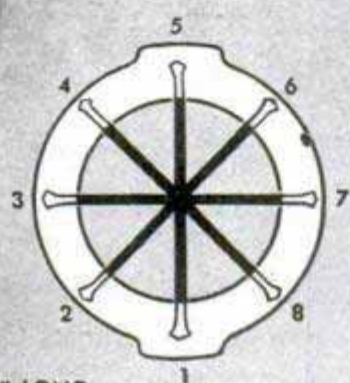
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## MILLERS FALLS TOOLS

SINCE 1868

MILLERS FALLS COMPANY

GREENFIELD MASS.

A little dehydrated milk or eggs will make your hot cakes taste better. Maybe you'll like dehydrated eggs as a breakfast dish, but you'd better try them out first before hauling a supply of them with you.

If the trip is more than a week long, most canned goods must be eliminated. In this case, increase the amount of bacon, dried beef, dehydrated vegetables and soup.

Experience teaches you many tricks, but it's good to know a few of them before you start. Dehydrated vegetables and dried beef make a good stew if presoaked well. The vegetables plus some trout and bacon provide a tasty chowder. Brown sugar is excellent on hot cakes or biscuits, either dry or made up into a syrup. For syrup, add only a tablespoon of water to three tablespoons of sugar. Bring to an easy boil. If more water is used, the syrup is too thin. Three spoons of sugar make enough syrup for one man's hot cakes.

The handiest salt and pepper shakers are ordinary pepper cans. Their tops close tightly. One ounce of black pepper is plenty for two men on a week's trip. A four-ounce pepper can filled with salt will last two men a week. Always turn the cans upside down at night so dew won't collect on the tops and clog them.

Foods and such items as camera film, tobacco and matches are carried in light waterproof bags. Bacon, margarine or butter are always carried this way to prevent the grease from working through.

Baking good biscuits without an oven is a problem for the tenderfoot back-packer. An acceptable biscuit can be baked—or rather, fried and baked—in a frying pan. Mix prepared biscuit flour with enough water to form a consistency between that of hot-cake batter and biscuit dough. After heating a little bacon grease in a frying pan, drop in four tablespoons of dough, individually, and pat until it is about twice as thick as a hot cake. When the bottoms of the biscuits are brown, flip them over and bake the other side.

All you need for a thrilling, back-packing vacation is to follow these simple rules: 1. Carry useful, lightweight equipment and use a simple pack board to distribute the load; 2. Don't overdo it the first couple of days; 3. Get an early start on the trail each morning; 4. Climb slowly on the steep stretches—slow enough so you don't puff strenuously.

Remember that with careful planning, back-packing is not another name for back-breaking! If you follow these simple rules you'll get up to the unspoiled wilderness of the rugged mountain country and come back with some first-rate adventure stories of your own.



# You're driving into the Danger Zone

## WARNING ZONE

Engine loses pep . . .

## DANGER ZONE 1

Engine begins to smoke . . .

## DANGER ZONE 2

Engine pumps oil badly . . .

## DANGER ZONE 3

Destructive wear sets in . . .



### Needs a tune-up

Clean, adjust and re-time ignition. Clean fuel supply and carburetor screens. Adjust carburetor. Adjust tappets and fan belt. Check compression and vacuum readings for symptoms of ring wear.

### Needs new piston rings and minor engine repairs

Replace piston rings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves.

Tune engine.

These repairs are comparatively inexpensive and put the engine back in peak condition for thousands of economical miles. Delay puts the engine in Danger Zone 2.

### Needs new piston rings and major engine repairs

Replace piston rings. Replace piston pins. Adjust—probably replace—main bearings. Align rods. Adjust rods or replace rod bearings. Reseat and reface valves. Tune engine.

These repairs naturally cost more than those needed in Danger Zone 1, but they put the engine back in condition for thousands of additional miles of satisfactory service. Delay leads to costly Danger Zone 3.

### Needs new piston rings and complete overhaul

Repairs cost three or four times as much as in Danger Zone 1.

Remove engine. Rebore cylinders. Replace pistons, pins, rings. Replace main bearings. Align rods, refit or replace rods, or replace rod bearings. Overhaul valve lifters, rocker arms. Replace timing chains or gears. Reseat, reface valves. Replace guides and springs. Replace camshaft bearings. Clean oil lines. Overhaul oil pump.

Clean, re-install and tune engine.

**The more you delay - the more you pay!**

**Piston rings should be replaced... *at the first sign of wear!***

You'll be money ahead if you replace your piston rings when your car first gets into the Danger Zone. But if you delay until the second or third Danger Zone, repairs cost two to four times as much.

In any Danger Zone, ask your motor service man

for Hastings Piston Rings. They *stop* oil-pumping, *check* cylinder wear and *restore* performance.

It's the best money you can spend on your car.

HASTINGS MANUFACTURING COMPANY • HASTINGS, MICH.  
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abrasives



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TROY, N. Y.

ALSO MANUFACTURERS OF COATED ABRASIVES

## New Machines Fight for Your Health

(Continued from page 170)

about two percent of all infants at birth, wartime aerial-camera magazines have been adapted to an ingenious use. It bypasses the difficulties of getting youngsters to remain perfectly still and to stop breathing, as adults do, for X-ray pictures.

The magazine is loaded with continuous-strip X-ray film, altered at the top with the addition of fluorescent radiograph screens and placed under the examination table. An opaque chemical, easily identified on film,



With a "resuscitator," there is no longer need for the traditional slap to start a newborn baby breathing

is injected into a vein in the child's arm. Even though the child fidgets and breathes, the 20 X-ray exposures the camera makes in 10 seconds give doctors enough information to determine the size and location of the abnormality.

Color television of surgery, first demonstrated last year over a closed circuit to doctors and the writer, is recognized as a potentially great tool for medical teaching. It will enable larger numbers of students to get close-up views of operations, and the color adds depth far superior to that of black-and-white equipment. The image on the receiving screen is several times larger than what the surgeon himself sees.

A machine that gets its signals from the brain and heart warns when the life of a patient on the operating table is in danger

(Continued to page 260)

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Why try to worry along with trusses that gouge your flesh—press heavily on hips and spine—enlarge opening—fail to hold rupture? You need the Cluthe. No leg-straps or cutting belts. Automatic adjustable pad holds at real opening—follows every body movement with instant increased support in case of strain. Cannot slip whether at work or play. Light. Waterproof. Can be worn in bath. Send for amazing FREE book, "Advice To Ruptured," and details of liberal truthful 60-day trial offer. Also endorsements from grateful users in your neighborhood. Write:

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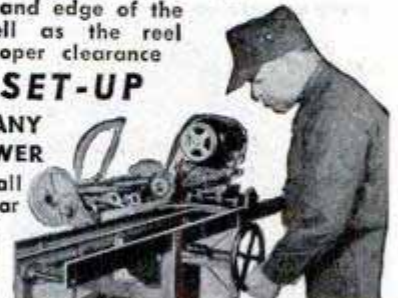
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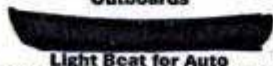
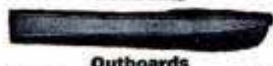
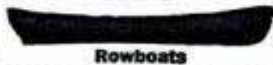
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Newman, of the Veterans Administration Hospital at Hines, Ill. One indicates to therapists how muscles are responding to treatment. It is cylindrical, with a shaft and button extending from one end and a gauge at the other. Inside is a hydraulic-pressure converter. To measure a muscle's strength the therapist applies the tester against the member it controls with sufficient force to overcome the muscle's resistance.

The other Newman device, two flexible steel tapes connected to a swivel joint, simultaneously measures the expansion of both halves of the chest. It will be helpful in tuberculosis and pleurisy, where the side of the chest affected may have considerably less movement in breathing.

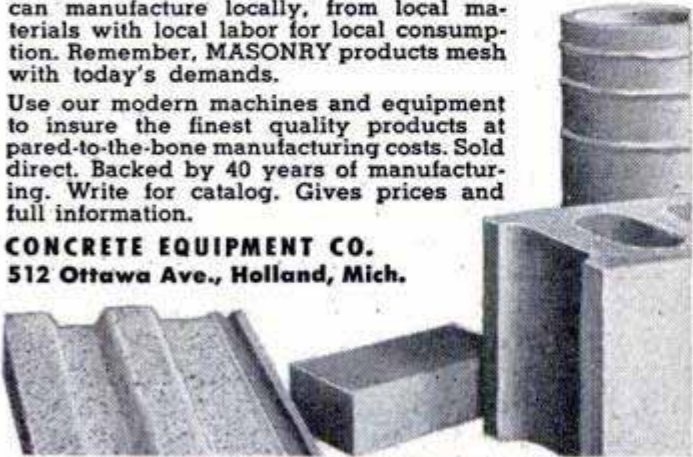
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 Gentlemen:  
 Enclosed find 25c in stamps or coin for booklet "Opportunities in Floor Surfacing," telling me how I can start my own floor sanding business.

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**Commute by Jet**

(Continued from page 152)

of the last war's outstanding fighters, the Spitfire and Hurricane. In less than a minute it can climb 6000 feet, then zoom along at a true air speed of 426 miles an hour—using only 90 percent of its available power. And the Avro's engines are about a third less powerful than those in the Comet!

On a flight like Miami to New York, the Canadian plane would be capable of 2 1/2 trips daily, because of its speed, compared with one for the present-day airliner. Fewer planes would be needed to handle the same volume of traffic, or the same number could handle two to three times today's passenger volume.

Britain has five other jet transports, four of them turbo-propeller combinations.

Where does America stand in developing a pure jet airliner? Far behind. There is talk, but not much action. An outstanding possibility for modification to fit the role is Boeing's B-47, the world's fastest jet bomber. Roughly equivalent to the B-29 in size and powered by six engines, a B-47 sped across the continent in less than four hours, at an average speed of 607.8 miles an hour. Jets 25 percent more powerful, the first of the axial-flow type approved for commercial use, have since been installed.

U. S. manufacturers are hesitant about risking the tremendous capital needed to develop a wholly new type of airplane like the jet transport. Wellwood E. Beall, chief engineer of Boeing, who says his company could build and fly a prototype of a 500-mile-an-hour jet liner in 18 months, is one of the many who believe government financial aid is essential.

Until turbojets cut their fuel appetite appreciably, Beall believes their first important airline role will be as 40 to 50 passenger, intercity planes. For the immediate future he is inclined to favor the larger piston and turbo-prop planes for long-distance, transocean flying. As a broad rule of thumb, most engineers believe now that 500 miles an hour is the point above which turbojet performance is superior to all propeller-driven planes, insofar as speed alone is concerned.

Consolidated-Vultee is building a turbo-prop version of its Convair-Liner. It may be ready for test flights this summer.

Hall Hibbard of Lockheed says that a jet transport his company now has on the drawing board will fly 600 miles an hour and cruise at 50,000 feet. He even goes so far as to estimate the cost of developing that first plane at \$25,000,000—which doesn't sound so high when the same firm admits

(Continued to page 264)



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**SCREW DRIVER**

"Palm-Grip" chucks into top of screw-driver handle. Makes screw driving and removal amazingly easy, fast. Also fits any standard  $\frac{3}{16}$ " drive socket wrench.

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BOX 416



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Includes "Palm-Grip" Ratchet and three screw drivers, 12 $\frac{1}{2}$ ", 9", 5 $\frac{1}{2}$ " with socket insert in heads. Heavy duty tool steel bits. Non-inflammable Tenite handles.

Complete Set **\$650** postpaid

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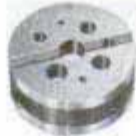
New "Satin Chrome" Micrometer No. 230, 1" capacity, Tapered Frame, Sycamore Case.



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spending \$40,000,000 on the Constellation.

The timetable of jet development is running ahead of what most experts anticipated. The first combat-type jet didn't fly until late in 1942 and Gloster Meteors that were pitted against flying bombs in 1944 had a maximum speed of only 410 miles an hour. Today's jet fighters are flirting with 700 miles an hour.

The United States already has 34 jet types, the British displayed 24 at a recent show and Russia is believed to have eight jet types flying.

Along with this astonishing progress, new problems have been created, both operational and mechanical. Pilots have been pushed along to a higher and faster world of flight, and the effects of sustained flying at high speeds and extreme altitude on humans are only partially understood.

Along with reducing fuel consumption, building engines that can better stand the extreme heats generated has been a vexing problem for jet designers. "Metal chefs" at Westinghouse—weighing, mixing and melting alloys with a precision that allows no error greater than one-tenth of one percent—have produced three promising alloys. Discaloy is being used for the heavy rotor disks, Refractaloy in the blades and K42B is being made into bolts. They have operated well at temperatures as high as 1500 degrees Fahrenheit.

Another approach, already tested on an aluminum turbine, has been to circulate a cooling fluid through the blades. It has permitted engine run-ups to 2000 degrees, 600 degrees above aluminum's melting point.

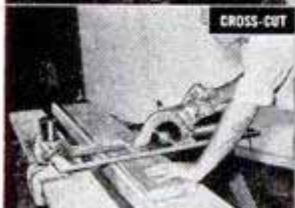
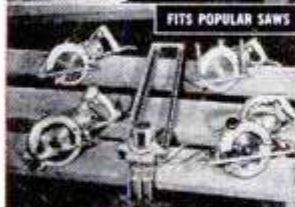
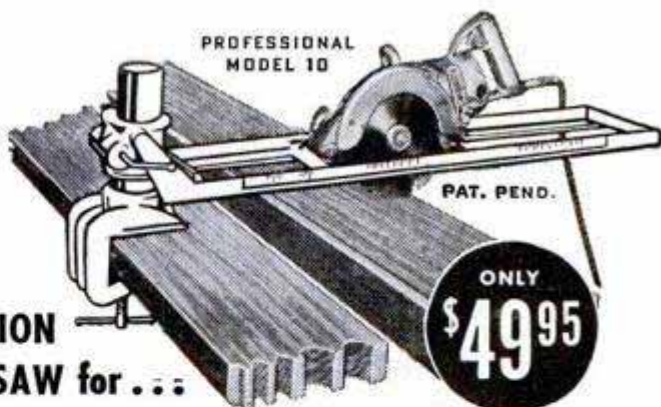
Cockpits that heated to unbearable temperatures from the friction of air pushing past the plane at high speed posed another puzzler for designers. At 600 miles an hour, that adds 60 degrees to the temperature and at 1500 miles an hour—a speed still well in the future—it is expected to make a difference of about 400 degrees Fahrenheit. Cockpits can be cooled and pressurized. That is just another problem for the engineers. But for jet transports they must be foolproof. There can be no taking of chances on sudden failures that might cook or quick-freeze the customers in a jet liner or expose them precipitately to oxygen starvation by a cabin "puncture" at 40,000 feet.

Don't start pestering the airlines for jet-plane passage when you've laid aside this magazine. Even the more optimistic agree it will be two or three years before the first officially begins service. And then there'll be relatively few.

But tomorrow's jet transports are already flying out of the dream stage and on the beam toward your local airport.

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**Converts Your Portable  
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The new Capehart SAW GIDE (story and pictures in *February Popular Mechanics*, page 96) fills the crying need for a top-quality, portable, precision "on the job" saw guide—the tool of 1001 uses that does everything you can do with the big, unwieldy, high-priced radial arm saws—plus some things you can't do with them:

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Now, for the first time, you can have the Capehart professional SAW GIDE with all the advanced features demanded by skilled craftsmen—carpenters, contractors, tile & ceramic workers, industrialists, stone masons, metal workers, etc.—at the sensational low price of only \$49.95, complete, including ripping attachment.

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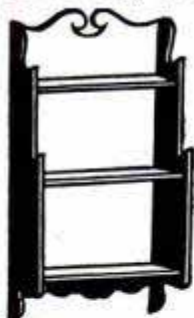
Ship My Capehart Saw Gide At Once. I enclose (check or money order) for \$49.95. If my Capehart Saw Gide does not do everything your advertisement claims—and more—it is my privilege to return in 5 days, undamaged, for complete refund of purchase price. (C. O. D. orders shipped freight collect.)

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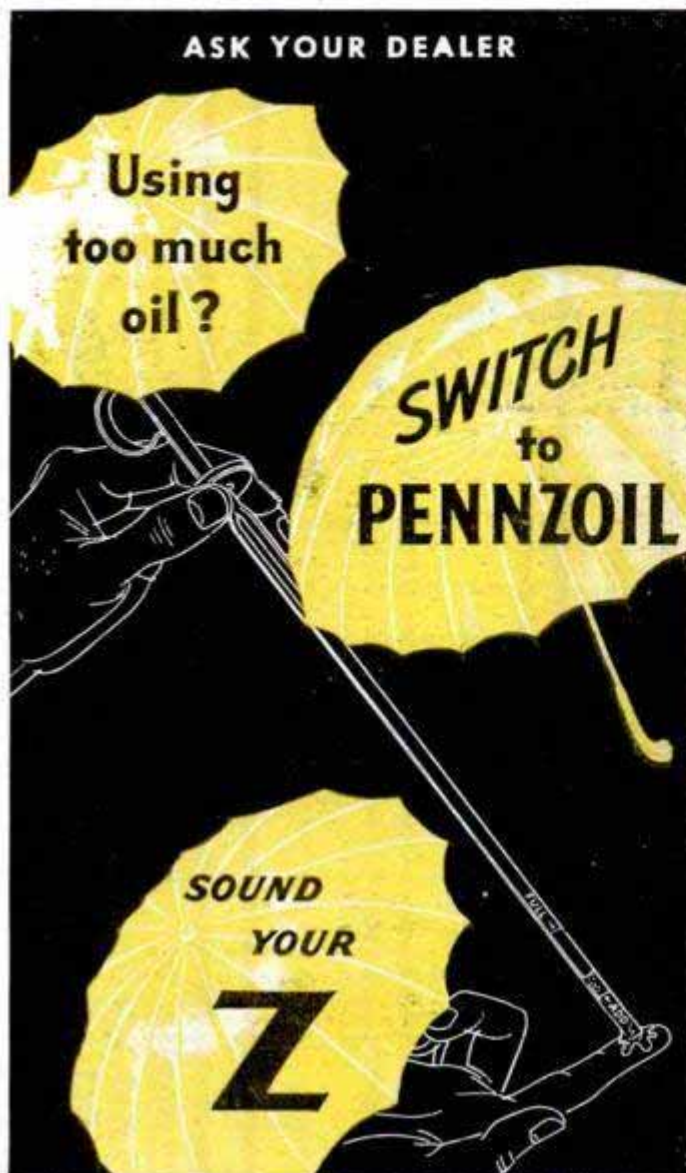
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## You Think You're Going Crazy . . .

(Continued from page 93)

room, sees a pair of identical dimly lit orbs in front of him, about 10 feet away. First thing you know those orbs are scooting back and forth like mad toward the viewer's head. One man saw them travel a full 25 feet each way, zipping like comets. The room is only 20 feet long.

The truth of the matter is that neither sphere is going anyplace. They're stationary balloons. An operator working a rheostat handle and a pump handle is simply blowing and deflating them, brightening and dimming them alternately. It's the bigness and brightness that makes one balloon seem closer than the other. Pull a switch, so that one dims as it grows, and the deflating one brightens, and the viewer gets all mixed up for a while. Soon, though, the one that's growing still seems to be approaching, dimmer or not. Why? Because bigness is a more reliable cue than brightness. A bright object might be farther away, says the old brain—but a big one? Hardly. About 90 percent of us rely on changing size rather than changing brightness to determine distance of an object.

Other weird gadgets in the dungeon room play similar tricks on the mind. There are cubes, which aren't cubes at all but great, long objects which, beside a real cube, look genuine. There's a table with two rows of cards. In one row they are orange, green and blue, in that order from the viewer. In the other, the order is reversed, and the cards grow in size toward the back. The viewer, looking through a peephole, however, sees two identical rows of even-size cards—orange, green and blue, in that order. How can this be? In the right row, remember, the near card is little, in the left row, the near card is much bigger. The viewer should at least be tipped off by the size differential, but he isn't. How come?

The gimmick is that the cards on the right are so notched that they seem to overlap exactly the same way as those on the left. So strong is this overlap "cue"—the same cue that tells us one tree is in front of another if its branches cut the other one off in spots—that the cards reverse and the sizes correspond to the sizes of the images in the eye of the cards on the left. The mind makes them all look alike, to conform with that strong overlap cue.

Probably the most frustrating of all the dungeon's tricks is the "trapezoidal window." This fiendish device, designed to test a person's assurance in what he thinks he knows, consists of one square stationary

(Continued to page 268)

Puts *Wings* on your boat!



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More than ever  
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**"Super 10" HURRICANE**

Never before such pep, power, and all around performance in a light outboard.

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**IT'S LOADED WITH NEW FEATURES:**

**NEW "HI-REV"** micro-mounted connecting rods of drop forged chrome nickel-moly steel, heat treated, hardened, tempered, precision ground and micro-honed to just the right scientific finish.

**NEW Improved Porting** to permit easier flow of fuel and gases.

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Features of Mercury outboard motors are protected by issued or pending patents.

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window. Another window, shaped like a trapezoid, is set on a vertical rod and can be swiveled by the victim, who sits about 15 feet away and tugs at strings attached to each side of the thing.

At a recent demonstration, the strings were handed to a reporter, who was told to sit down, close one eye, and adjust the trick window by pulling the strings, until it seemed parallel to its mate. He fussed for 15 minutes without success, finally gave up.

Professor Lawrence reassured him that he was entirely normal. He explained that the man was suffering a mental conflict due to his assumption that if he pulled one string one way, it would turn the window in the direction which all his past experience told him it should. The gagged-up shape of the window, however, created an optical illusion that kept him from achieving the result he wanted, gave him an un-sureness, and finally prevented him from acting.

What does it all add up to? Confusion confounded for the victims of the dungeon, for one thing. But Lawrence and his associates hope they're on the threshold of a more complete understanding of human behavior, which may help to solve some of the conflicts and neuroses that make many people miserable. "So far," he says, "many psychologists have been spending their time trying to find out what makes abnormal people abnormal. Now, for the first time, we're trying to find out what makes so-called normal people normal. In short, why do we behave like human beings?"

## Small Town Television

(Continued from page 117)

but within that distance reception is good.

Stores selling television sets are able to turn them on in their show windows and forget them. And the interest is great. Skippers of tuna clippers are now cogitating as to whether one of these days Parsons will be able to rig their craft with television. Although one old salt commented:

"My boys spend too much time at the radio now. Television would be worse."

What does Station KRSC think about this picking up of its programs and re-broadcasting them? It has cooperated—with delight. The Parsons system has simply extended the station's coverage. Astoria is only one town—the beginning—but what works in Astoria may work all over the Northwest and the nation, too.

"High-frequency signals penetrate almost everywhere," declares Parsons. "There are always some signals. It's merely

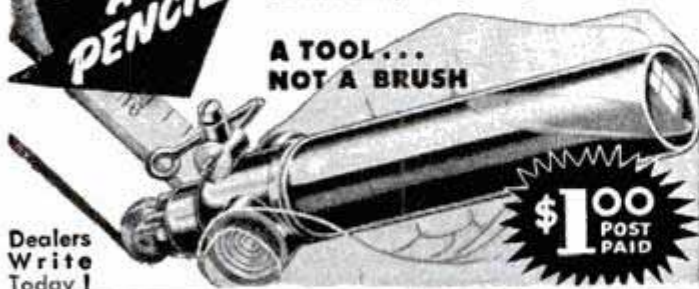
(Continued to page 270)

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a problem of finding a signal, building it up and feeding it out."

Technically, Parsons picks up KRSC telecasts on one channel (No. 5—76 to 82 megacycles), and sends them out over another channel (No. 2—54 to 60 megacycles). The change is made so the outgoing signal will not interfere with the incoming.

Parsons figures his receiving-sending unit with coaxial-cable system to service 10 television sets could be manufactured to sell for about \$1000. That means if 10 neighbors got together they could have television from a distant city at a cost of \$100 each.

The system, too, looms as an answer for city apartment dwellers who draw frowns from landlords for cluttering up roof tops with aerials. One aerial could suffice for a whole apartment house, with telecasts piped to apartments via coaxial cable.

Although one of Parsons' receiving-sending units with coaxial cable is designed to take care of only 10 sets located within a radius of 2000 feet, additional units could be utilized to extend coverage in multiples of 2000 feet. The system will make pickups from satellite rebroadcasting stations as well as from parent stations.

That's Parsons' next move—erection in Astoria of a satellite station for receiving and sending telecasts over the air without use of cable. The proposed noncommercial, experimental satellite station in Astoria, for which FCC approval is required, would cover a radius of 20 miles. Ordinary television sets could not get reception from this station, says Parsons, but he has worked out a device to attach to sets so that they will.

He is putting in three receiving units so that he can switch from one to another if there is interference in any one area. It is technically feasible, adds Parsons, for as many as four satellites to pick up from one another.

A satellite station costs little in comparison with even the down payment on a full-fledged station. The "coax" system costs still less. With a network including all three, Parsons envisages in the not-too-far-distant future television for everybody.

## Radio Waves Speed Germination

By subjecting seeds to a brief dose of high-frequency radio waves, scientists at the University of California have speeded germination by nearly 100 percent. The technique promises increased farm crops in regions of short growing seasons. This radiation affects the internal chemistry of the seed. Because only short exposures are necessary, the treatment is especially suitable for large-scale operators.



In a tight spot?

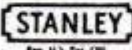
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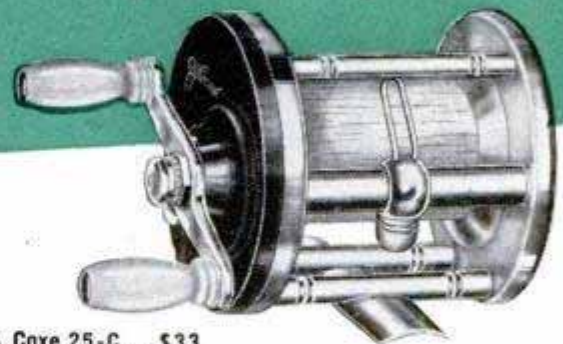
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J. A. Coxe 25-C . . . \$33

● Here's the world's only automatic free spool casting reel—the J. A. Coxe 25-C. This is the professional reel, the reel we designed not for a price but for quality that's unmatched anywhere! Exclusive Coxe cross-bolt construction gives you perfect spool alignment—10-second take-down—adds extra years of wear. If you're ready for the finest reel money can buy—ask your dealer for the J. A. Coxe 25-C.



**...your finest reel for the money**



Bronson "Green Hornet" . . . \$4.95

● It's the Bronson Green Hornet—the popular-priced reel with premium features. Beautifully designed with green anodized head and tail plate, and new lightweight snap-on plastic arbor. Bronson's easy-to-reach dial drag lets you pinpoint the correct tension with one simple turn. Just set the dial before you cast—the reel does the rest!

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Precision 4 in 1 Timepiece. Incabloc shock resistant feature. Sweep Second hand. Anti-magnetic. Radium Dial. Stainless steel back. Perfect for physicians, scientists, technicians, engineers, aviators, photographers, broadcasters, navigators, sportsmen, servicemen, etc. Thousands sold at \$71.50. Order now while they last at this record breaking low price.

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Now Only

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Plus  
**\$2.20**  
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**17-JEWEL WRIST WATCH** **\$16.95** PLUS \$1.70 TAX

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Sacrificed Because

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**TRIAL OFFER!** Wear at our risk! Money back in 5 days if not delighted. Send only \$1 down payment with order. Pay balance to postman on arrival plus postage. Or we pay postage if you include full payment plus tax with your order.

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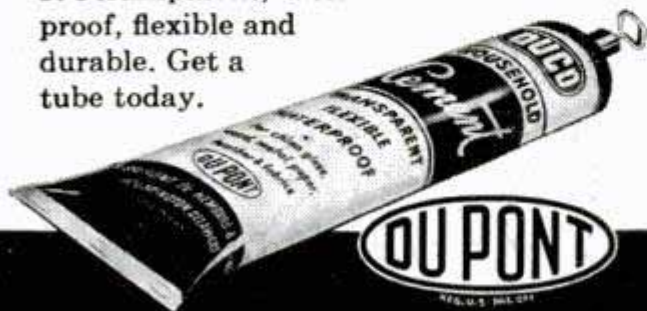


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It's transparent, water-proof, flexible and durable. Get a tube today.



**DUCO CEMENT**

REG. U. S. PAT. OFF.

**Are We Running Dry?**

(Continued from page 125)

manufacturing, paper manufacturing, metalworking, air conditioning, distilling, ice making and cold storage, food processing, rubber manufacturing, meat packing, brewing, railroads, gas and electricity.

Here are some facts that help explain the doubling of our consumption of ground water during the last 15 years: a single large paper mill can consume 50 million gallons a day—more than enough for a city of 500,000.

Electric-power generation by steam requires 600 to 1000 tons of water for every ton of coal—or 80 gallons per kilowatt-hour. To produce the annual total of about 182 billion kilowatt-hours of steam-generated current requires the handling of some 15,000 billion gallons of water.

One rubber plant uses 120,000 gallons of water a minute.

About 65,000 gallons of cooling are needed to produce one ton of steel.

Despite the fact that water is cheaper than dirt (purified water is delivered retail to most customers at five cents a ton or less), on weight and volume handled, water is the biggest business in the world.

Many of the larger cities in the U. S. luckily do not depend on ground water for municipal purposes. New York City, which consumes a billion gallons a day, gets its supply from a system of huge storage reservoirs containing surface water. When these reservoirs dropped to 40 percent of capacity last winter, the New York "water famine" was on. Chicago takes its water from Lake Michigan and purifies it. Philadelphia depends on the Delaware and Schuylkill Rivers for its "chlorine cocktail." The crystal-pure water in St. Louis and New Orleans actually comes from the muddy Mississippi River. Los Angeles and other leading cities in southern California get surface water from the 238-mile Owens River aqueduct (the water is from the Sierra Nevada Mountain watershed) and an aqueduct from the Colorado River.

Let's take a swing around the U. S. with Carl G. Paulsen, chief hydraulic engineer of the Geological Survey, who is probably the country's foremost water expert. First of all Mr. Paulsen likes to make clear that there is no serious over-all shortage of ground water in the United States. In fact, he is more than a little annoyed with scare stories to this effect. However, there are danger areas in the country that may have serious trouble if present conditions are allowed to continue.

The danger areas are found in California,

(Continued to page 274)

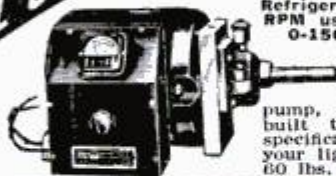
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## GENERATOR

IDEAL FOR: Home Lighting, Hunting Lodges, Stand-By Electricity, Running All AC Electrical Appliances including: Fans, Motors, Electric Razors, Refrigerators, Incubators, etc. 750 Watts at 1800 RPM using 1 1/2 HP gasoline engine.  
0-150 Voltmeter with Regulator; 1" diameter shaft with keyway for direct or belt drive, carried in two bearings, one bronze and one ball-thrust bearing. Protection for emergencies to operate oil burner, stoker, freezer, water pump, and lights. These units, built to exacting Signal Corps specifications, are the answer to your lighting needs. Shipping wt. 60 lbs. AN OUTSTANDING VALUE



(ITEM #67)

**59.50**  
F.O.B. Chicago

## GEAR TYPE-ALL MANGANESE BRONZE INSECTICIDE PUMP

FOR SPRAYING D.D.T., 2,4-D, SULPHUR COMPOUNDS, ETC.

Pressures up to 200 lbs. and 14 gallons per minute - at 1200 R.P.M. Will not rust, pit, foul or freeze up. Use rubber hose inlet, 3/4" pipe outlet. Equipped with double mounting bracket. Weight 24 lbs. Dimen. 8"x7"x10". Standard 1" manganese bronze shaft with keyway. U. S. Govt. Acquisition Cost \$62.00. NOW... FREE - complete instructions and performance data with each pump.



(ITEM #50)

**15.00**  
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## PNEUMATIC AIR DRILLS

USED-LIKE NEW

Light, powerful, compact, pistol grip, trigger control. Ideal for shop use where air pressure is available.

ITEM #80 - Ingersoll-Rand, equipped with 1/4" Jacobs key chuck. Overall dimen. 6 1/2" long, 5" high, 1 1/2" thick. Wt. 3 lbs. F.O.B. Chicago..... **14.95**



ITEM #81 - Chicago Pneumatic, larger size Model "A", equipped with 1/4" Jacobs key chuck. Overall dimen. 7 1/2" long, 5" high, 2" thick. Wt. 4 lbs. F.O.B. Chicago..... **19.95**

## WATEROUS PUMP

Rated 500 gallons per minute at 120 P. S. I. This high efficiency pump is designed for front end mounting on General Motors, Dodge, Studebaker and Ford trucks and comes complete with rear box and power take-off for easy mounting and attachment to crank shaft. Net weight of pump 500 lbs. Shipping weight 1200 lbs. F.O.B. Chicago..... **149.50**



(ITEM #71)

## NEW AIRCRAFT QUALITY

# HYDRAULIC EQUIPMENT

## UNCONDITIONALLY GUARANTEED

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes... including actuating cylinders, control valves, tanks, pumps, fittings, hose, and data on hydraulic applications.

Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, brakes, plastic dies, auto frame alignment, etc., etc.

- ITEM #70 - Purolator hydraulic oil filter postpaid..... **4.95**
- ITEM #33C - Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings. postpaid..... **8.95**
- ITEM #16 - Double acting cylinder, 1 1/2" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 8 lbs. A \$55.00 hydraulic cylinder value for only **12.95** postpaid.....
- ITEM #17 - Double acting cylinder, 2 3/8" bore, 8" stroke. (Will lift 4500 lbs. in one second with Logan Pump.) Will withstand 1300 P.S.I. against wall. Wt. 7 lbs. A \$65.00 value..... postpaid **14.50**
- ITEM #15 - Double acting cylinder, 3" bore, 8 1/2" stroke. All steel hydraulic cylinder, (will lift up to 7000 lbs. in 3 seconds with Logan Pump). Wt. 12 lbs. A \$78.00 value..... postpaid **19.50**

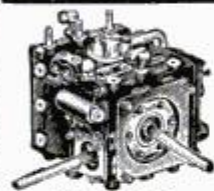


(ITEM #42)

- ITEM #31 - Double acting cylinder, 3 1/2" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Wt. 15 lbs. A \$92.00 value... postpaid **22.50**
  - ITEM #42 - Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 lbs. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for..... F.O.B. Chicago **32.50**
  - ITEM #61 - Double acting Hanna air cylinder, 5" bore, 26 1/2" stroke, 40 1/2" overall length closed. With 100 lbs. input will lift 1900 lbs. Net wt. 89 1/2 lbs. Gov't. acq. cost \$101.85..... F.O.B. Chicago **39.50**
- HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for 3/4" pipe and 50c ea. for 1/2" pipe.

## VICKERS MODEL AA16801A HYDRAULIC TRANSMISSION

Ideal for lathe drive, miniature cars, power machinery, gearing, etc. Rated 2 hp. maximum input at 3750 RPM. Output speed continuously variable from 0 to 1/4 of input speed in either direction. Self contained reservoir. All controls external. Even power at all speeds. Complete with two 1/2" shafts with flat for pulley attachment.



(ITEM #85)

Shipping weight 20 lbs. Gov't. acquisition cost \$325.00. A TREMENDOUS VALUE AT..... **25.00**

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## Hydraulic Control Valves

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A \$38.00 value..... **7.95** postpaid

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A \$60 value postpaid..... **10.95**

ITEM #28. A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Ship. wt. 8 lbs. A \$75.00 value, postpaid..... **14.95**



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For operating hydraulic cylinders and hydraulic motors on tractors, bulldozers, construction machinery, lift trucks, industrial applications, etc. Delivers 8 GPM at 1200 RPM at 1000 P.S.I. using 5 HP. Has 1/2" pipe thread inlet, 3/8" pipe thread outlet, 3/4" shaft with flat drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimensions: 7" L x 5 1/2" H x 5 1/2" W. A \$105.00 value. FOR ONLY..... **22.50**



(ITEM #29)

F.O.B. Chicago

## HAND HYDRAULIC PUMP

ITEM #11 Postpaid..... **8.95**  
ITEM #83 - Hand hydraulic pump with built-in transfer valve. Postpaid **12.95**



## LOGAN HEAVY DUTY HYDRAULIC CONTROL VALVE

Has built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removable mounting brackets with 4 bolt holes, 3/8" pipe thread connections. Overall dimen.: 12 1/2" H x 8 1/2" D x 8" W. Ship. wt. 17 lbs. Gov't. Acquisition Cost over \$100.00. An Excellent Buy. **21.95** (ITEM #37)



(ITEM #37)

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## ARC WELDER

250 AMP. MODEL 252

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ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. (ITEM #66) F.O.B. Chicago **10.50**  
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north central Oregon, south central Washington, Arizona, the Texas Panhandle, parts of Illinois, southwestern Louisiana, parts of Kentucky, Florida and — until recently — the west end of Long Island. There are many other isolated spots where ground-water supply is a problem, but these places are too widely scattered to group under one heading.

Paulsen points out that first of all in the West the ground-water problem is aggravated by the fact that all available surface water has been appropriated. If industries are to expand or irrigated acreage to grow the only remaining source of water lies beneath the ground. This has led to abuses that threaten entire rich areas.

Take California. There are approximately 1,550,000 acres under irrigation in the upper San Joaquin Valley. Tests conducted by the Geological Survey show that the water supply is sufficient for irrigating only 1,170,000 acres. Unless some way is found to recharge the ground reservoirs, thousands of acres may have to be abandoned. Along the Coastal Plain in Los Angeles and Orange Counties water is pumped from alluvial sand and gravel. This is one of the most heavily developed ground-water areas in the country. In the West Basin southwest of Los Angeles the current withdrawal is about twice the fresh-water recharge. The result is that salt water from the ocean is seeping into the depleted underground reservoirs. Already some wells two miles inland have been contaminated with salt. When this happens to a rancher's wells, there is nothing he can do except move on.

This district is looking hopefully across the nation to western Long Island, mainly Brooklyn, which was seriously hit with a similar encroachment of salt water a few years ago. For some years the pumpage had been as high as 300 million gallons a day for the entire island. The result was that the water table fell below sea level in an area of more than 80 square miles. Many wells were salted and others threatened. The Geological Survey was called in and a successful program of pumpage reduction and artificial recharge was introduced. Today more than 60 million gallons of water a day (used for cooling) are returned to the ground through a closed recharge system. The California situation is much more serious, but engineers are seeking ways to solve the problem.

Arizona's ground-water problem is second to none. In several areas the water level has dropped 50 feet in five years. Over most of the state water is being pumped from the ground twice as fast as

(Continued to page 276)

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HOME ASSEMBLED AUTO



## WORLD'S LOWEST PRICED AUTOMOBILE!

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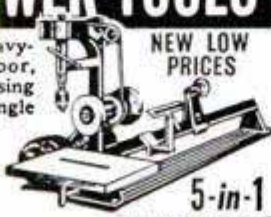
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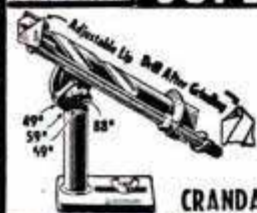
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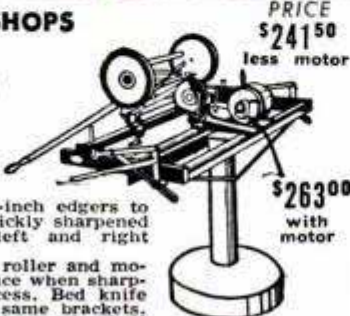
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it is replenished and in some places 18 times as fast. Arizona's big farming district is concentrated in 1200 square miles around Phoenix where more than half of the water to irrigate the desert comes from the ground. The reservoirs of the Santa Cruz and Salt River Valleys are seriously depleted. Paulsen estimates the current annual withdrawal at 2½ million acre-feet (an acre foot is one acre covered with one foot of water). The condition here is so serious that the permanence of irrigation farming is threatened. The state legislature recently passed a law to control drilling and use of new irrigation wells. The Geological Survey considers this just the first step toward solving the problem.

Arizona does not have to look far to find a successful example of controlling ground-water supplies in desert country. Over in the Roswell artesian basin of New Mexico the ranchers know exactly how much water can be safely removed from the ground each year. The state legislature has passed stringent controls based on figures supplied by the Geological Survey. Before the Survey was called in, wells and farms valued at \$5,000,000 had to be abandoned. Today, an area once threatened with economic disaster has an assured future.

In the High Plains of Texas south of Amarillo, irrigation farming has been expanding at a faster rate than any other area in the U. S. In 1943 there were 300 wells in this area irrigating 16,000 acres. Last year there were about 10,000 wells irrigating more than a million acres. In this region the underground reservoirs are replenished at a very low annual rate. A lot of people are getting rich but the water level is dropping at an alarming rate. Paulsen says that eventually a decision will have to be reached as to how long the stored water should be made to last.

Down in Louisiana in the land of torrential near-tropical rains one would not expect a water problem. However, a serious ground-water shortage exists in the southwestern part of the state. Years ago the rice growers irrigated with surface water, but now half the area is irrigated by pumpage. The result has been a gradually receding water level and the intrusion of salt water from the Gulf of Mexico. There are other scattered spots along the Gulf Coast in Georgia and Florida also troubled with the salt-water problem.

Over on the east coast of Florida, at Miami, an underground battle is being won over the salt intruder. Ten years ago hundreds of private wells and two municipal wells had been lost to salt-water encroachment. One ruined well was eight miles

(Continued to page 278)

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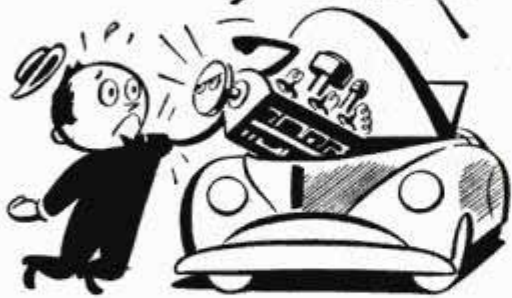
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from the seashore. The Geological Survey was called in and found that water-bearing formations below 300 feet contain only saline artesian water. The Survey also found that the canals draining the Everglades had lowered the fresh-water level which must be kept to a height of three feet above sea level. Engineers of Miami and Dade County designed adjustable and removable dams to be placed in the seaward ends of the tidal canals. These raised the water table and closed the canals to sea water.

New England's ground-water situation is generally good. In the Middle West there are "critical areas" and although water levels have been dropping, new techniques in pumping and drilling provide a better water supply than at any time in the past. Industrial areas give rise to most water problems. In the Chicago area the ground-water table is receding at the rate of seven feet a year, according to the Illinois State Water Survey Division. However, Lake Michigan water is always available in tremendous quantities and some communities inland are now depending on it. The most critical area in Illinois is at Peoria where the Illinois Survey is now conducting tests pertaining to artificial recharge.

Hydraulic engineers point out that our sudden awakening to ground-water shortages is one of America's growing pains. We are becoming a more densely populated nation and natural resources can no longer be lavishly used without a thought for the future. There are two simple answers to our ground-water problems: knowledge of what lies in the subterranean storehouses and wise controls over its usage.

## Maze Packaging Stops Insects

British scientists have discovered that one way to protect food from insects is to wrap it in a cellulose material folded many times to form a maze of tunnels. The cellulose is coated with DDT and, as the insect wanders through the tunnels, it picks up a fatal dose of the insecticide. Even insects that can bore their way through ordinary wrapping were stopped by the maze wrapping because of the natural tendency of insects to wander through tunnels and constricted openings. Instead of boring straight through the wrapping to the food, the insects would start roaming around in the material and soon die.

Scientists in Australia, by a study of solar radiation over a wide range of wavelengths, have confirmed that the sun's temperature is about 1,000,000 degrees Fahrenheit.



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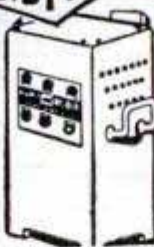
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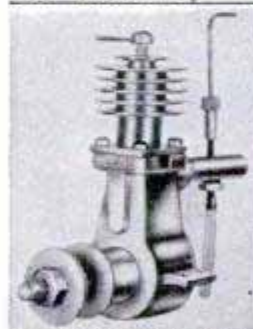
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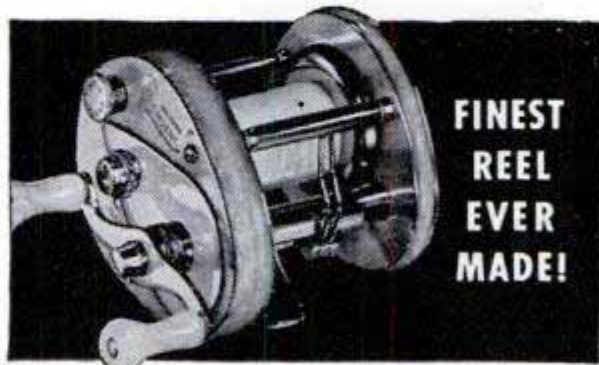
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## Thunder in a New Package

(Continued from page 113)

efficient on the first run that all the air was sucked from the laboratory. "Air," recalls one of the researchers, "was hissing through every crack, and the roof was creaking. We had to knock holes in the back wall, finally."

As with all jets and rockets, the men have trouble with the high heats generated by their new baby. Pyrometers, hooked up to thermocouples in the firing chamber, registered beautifully for the first few runs, except that the tiny pen ran off the paper at 2500 degrees. Then, adding insult to injury, the thermocouples melted and blew out the tail along with the exhaust.

An incredible cooling system, with copper tubing encircling the pipe like the arms of an octopus, squirts a dozen sprays of water over the 1/4-inch steel exhaust stack, through garden spray nozzles from the 5 and 10-cent store. A virtual waterfall cascades over the hot pipe. Even so, it's beginning to warp.

One of the most persnickety gadgets is the gas rocket—used exclusively for the study of scale effects. It is really a super blowtorch. When its high-powered fuel spray doesn't mix the liquid oxygen properly with the fuel, tiny globules of jelly—with a potential of nitroglycerine—form inside the rocket chamber. In a split second you'll have a burn-out.

Popular Mechanics' photographer set up his camera near the door, to get a picture of the standing shock waves visible in the rocket's supersonic exhaust. Just as the thing was about to be fired, Poole tapped him on the shoulder. "Better move over until she's going," he said. "These things have been known to blow up." The man stepped aside just as the switch was thrown. There was an ear-splitting crack, and a spray of hot shrapnel zinged through the doorway. There's no picture of standing waves to go with this article, but Popular Mechanics still has all its staff members.

Though there are tunnels and tunnels, Princeton's new wind tunnel is unique. The compressors and the 47 laminated-steel air-storage tanks came from Navy torpedo plants. The settling chamber once was the breech cylinder of a 16-inch gun.

So, while the rocket men work on the problem of getting more oomph out of fuels and general design, the wind-tunnel men at Princeton work on the shapes that will make the most of that added efficiency in high-speed flight. Out of it all should come bigger and better supersonic engines, higher flights and, they hope, a little less thunder in the blue skies.

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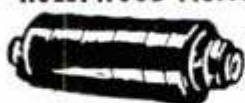
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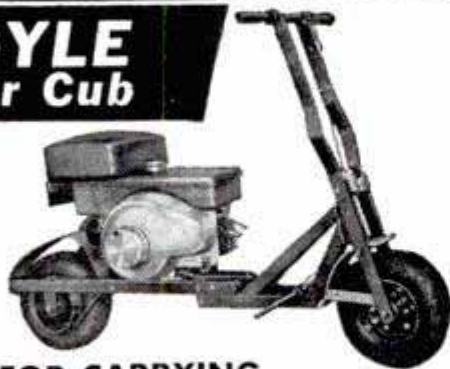
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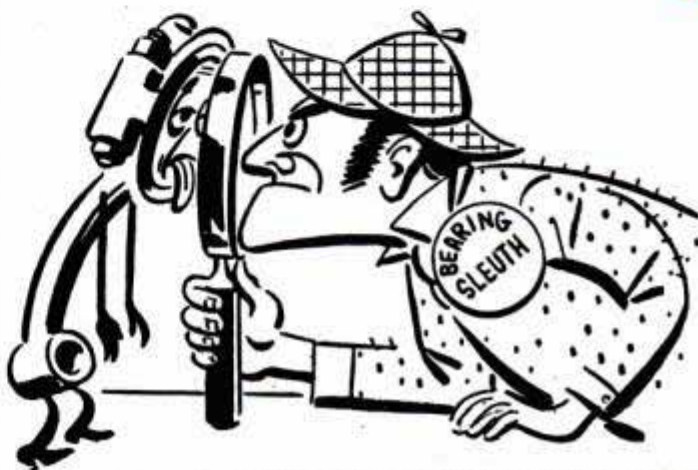
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where it starts...replace with  
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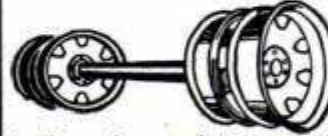
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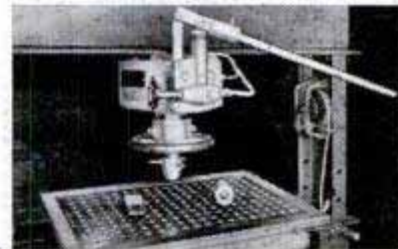
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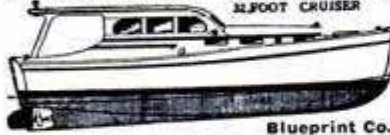
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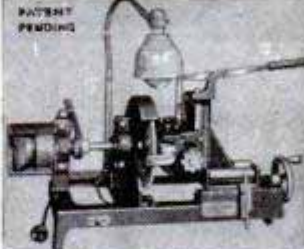
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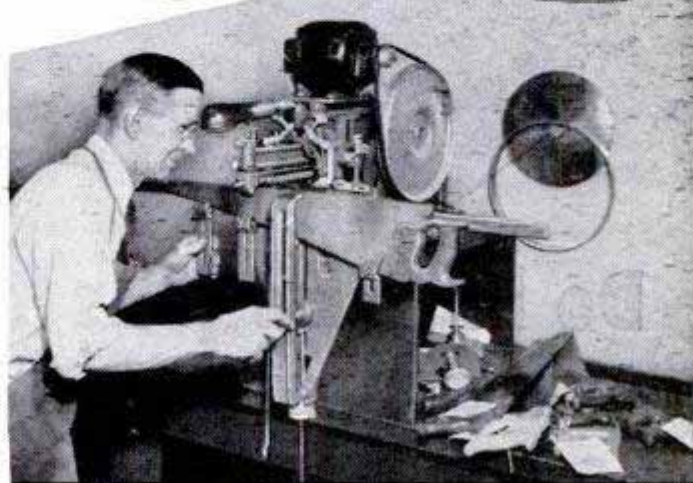
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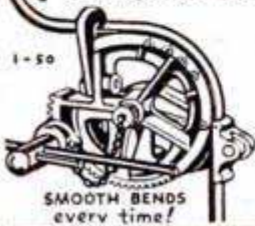
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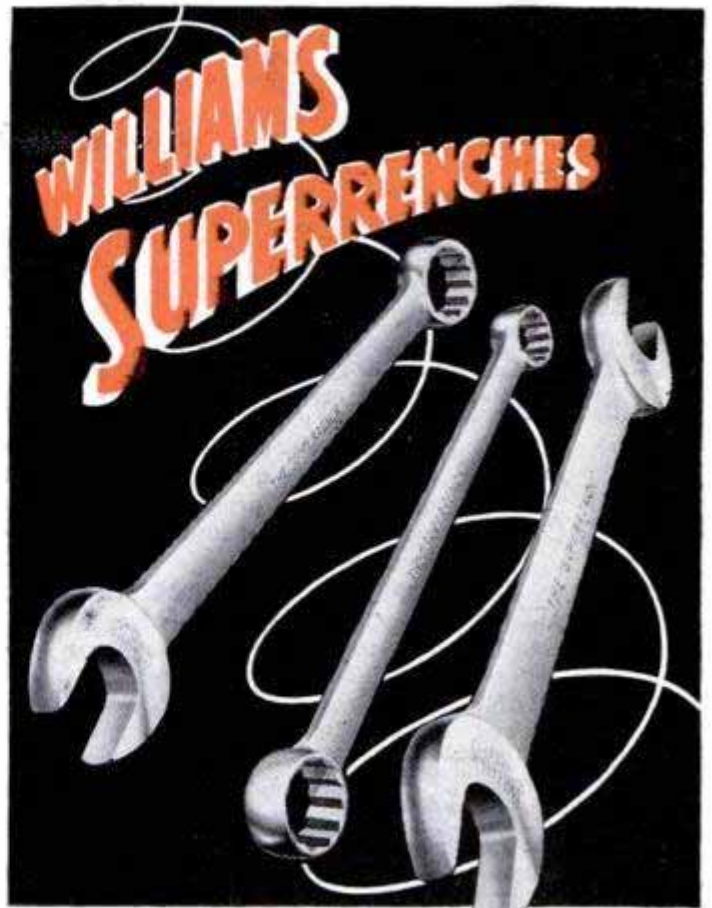
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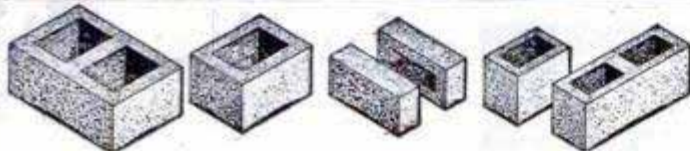


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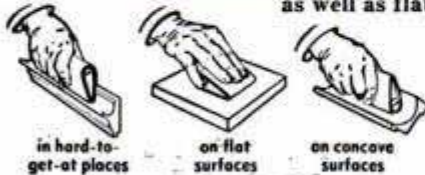
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No. 79

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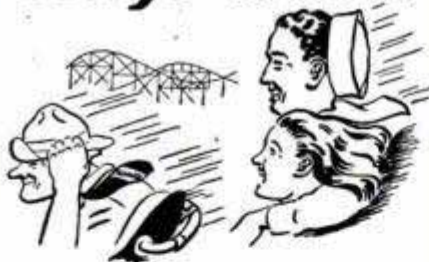
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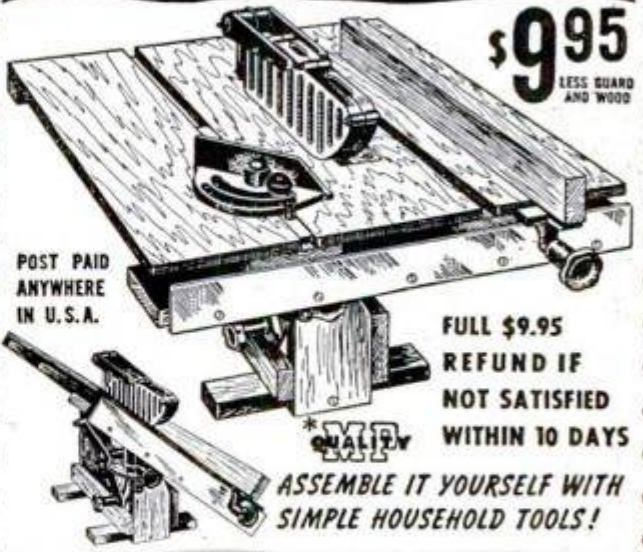
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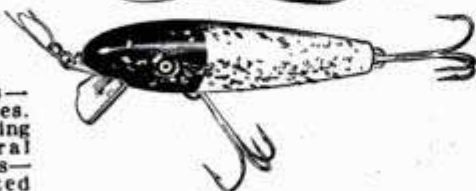
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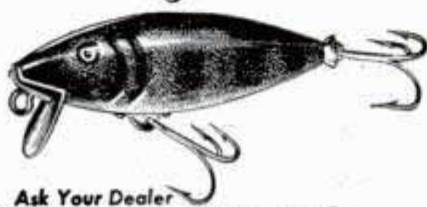
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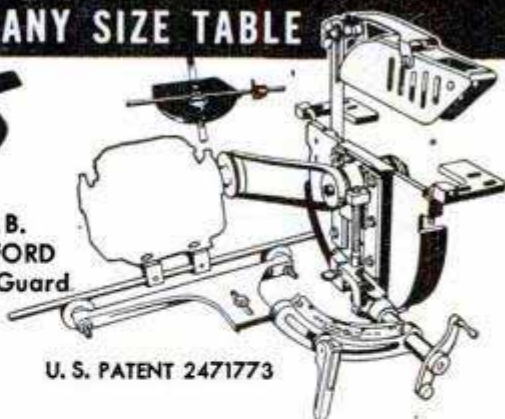
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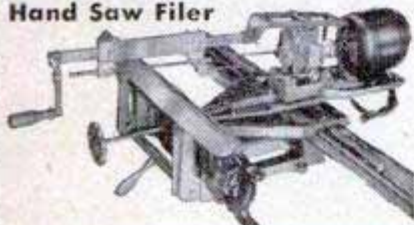
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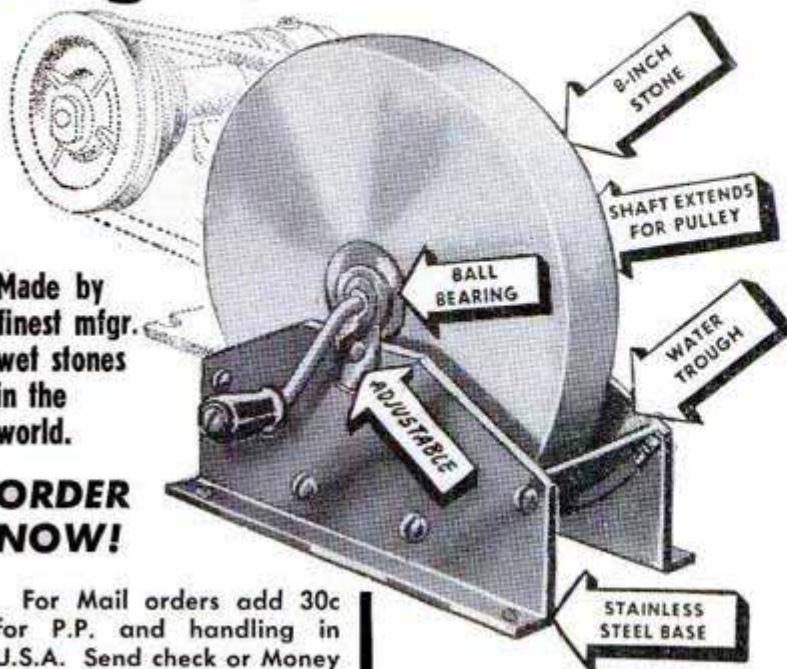
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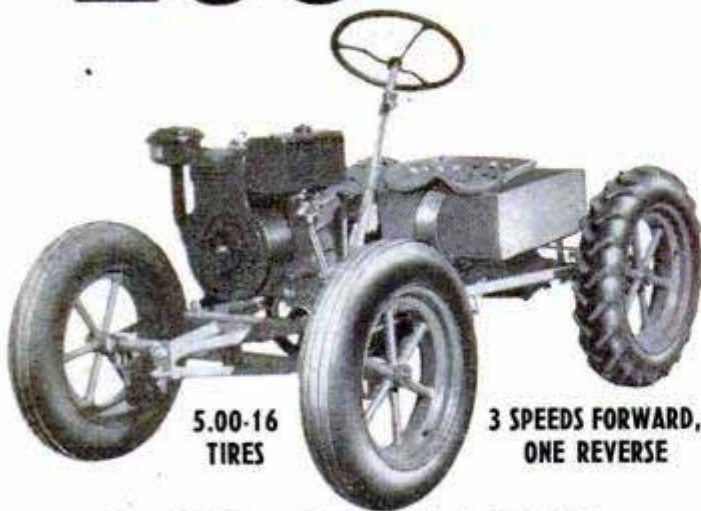
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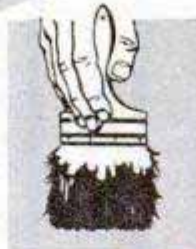
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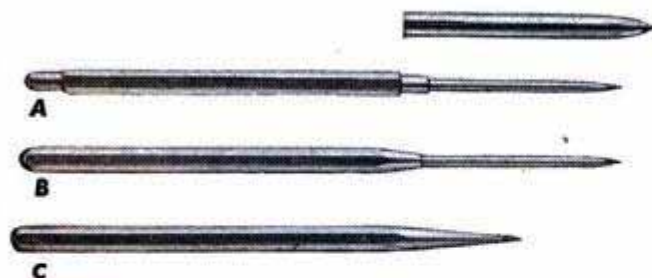
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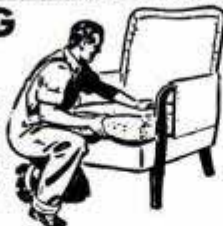
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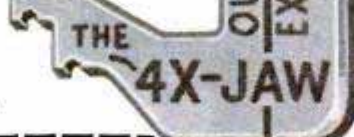
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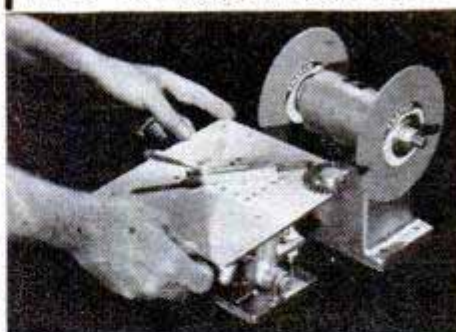


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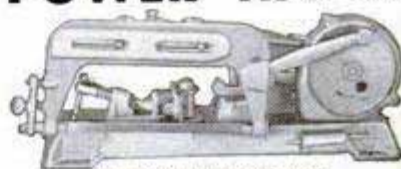


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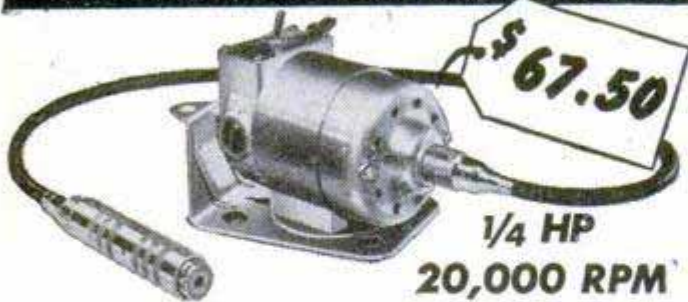
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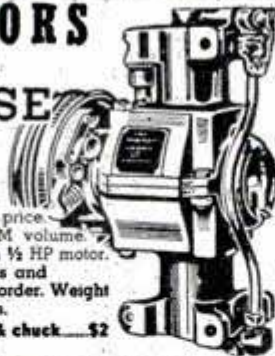
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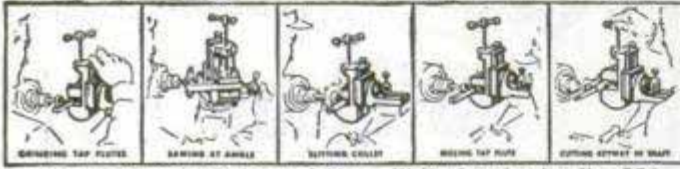
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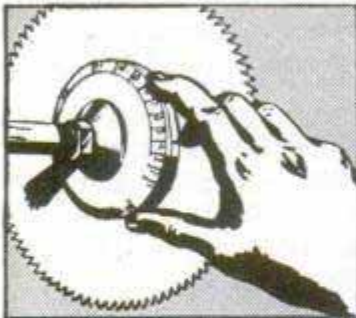
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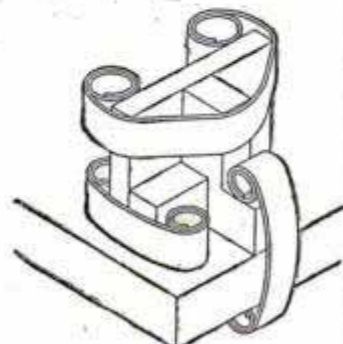
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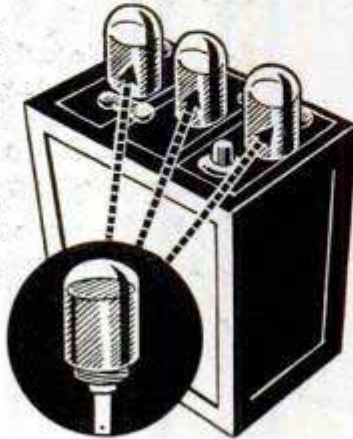
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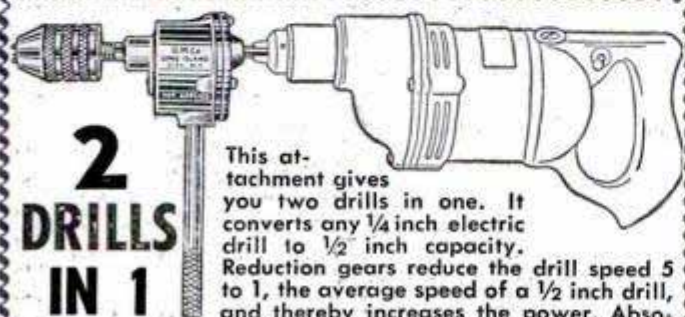
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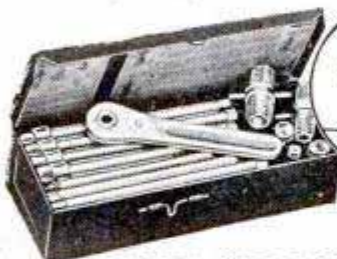
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3 tools in one—a Jig . . . a Jack, and a Vise. Ideal for handymen, model makers, home workshops. Use it for holding any piece for drilling, finishing, assembly. Assures accurate work as all surfaces are ground true. Write for complete information and illustrated circular.

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## 100s of "Impossible" Jobs are Quick and EASY with VISE-GRIP WRENCH

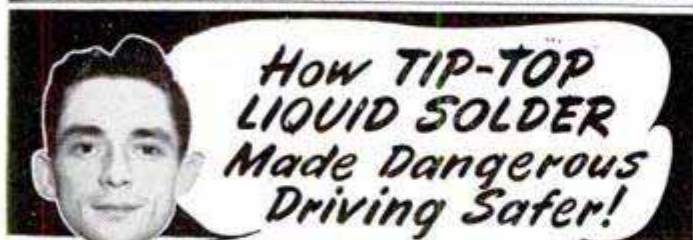
Turning Close-To-Wall Pipe



The most amazing hand tool ever built, gives your hand Terrific Power! LOCKS to work with more than Ton-Grip. Does "impossible" jobs QUICK and EASY! Does jobs no other tool can do! Insist on the genuine VISE-GRIP. Only the genuine has these features. Involute Jaw Curve holds all shapes with unbelievable ease. Knurled Jaw Tips hold work at the very tip. Thin Nose. Super Wire-Cutter. Fine alloy steels, specially hardened. Nickel plated finish. With cutter—No. 7W, 7-in., \$2.25; No. 10W, 10-in., \$2.50. Without cutter—No. 7C, 7-in., \$1.85; No. 10C, 10-in., \$2.25. If not at your dealer's order direct.

PETERSEN MFG. CO., Dept. P-4, DeWitt, Nebr.

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Convert your electric drill into a powerful, portable saw for only \$9.95

Your electric drill becomes a portable saw with power to spare when you attach the new Bull Saw! It's sturdy, rigid—yet light enough for one-hand operation. New visual guide lets you see where you're going; new extra wide shoe plate keeps saw blade on the straight-and-narrow. One-piece safety guard of polished aluminum . . . blade of high-carbon steel . . . double bearings for long life. Fits rigidly on any 1/4" electric drill. Depth of cut: 1 1/8". Complete, ready to use in drill.

**\$9.95**

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## IF YOU ALREADY OWN A BULL BUFFER

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13

## COMPLETE POLISH-SAND-'N-SAW KIT

Includes (photo 2) Bull Buffer\*, famous right-angle polisher-sander complete with rubber pad, sheepskin bonnet, 2 sanding discs and (photo 13) Saw Housing that fits on Bull Buffer angle head to give you a powerful Bull Saw. A \$19.90 value, yours for only . . .

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2

\*Bull Buffer only, with sheepskin bonnet and 2 sanding discs, \$9.95. At your dealer, or send cash, check or M.O. for prepaid shipment

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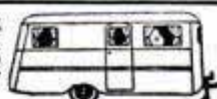
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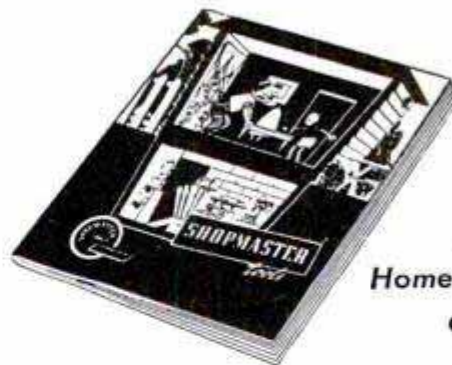
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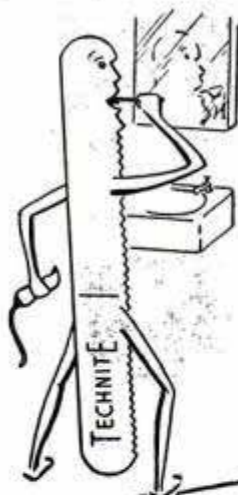
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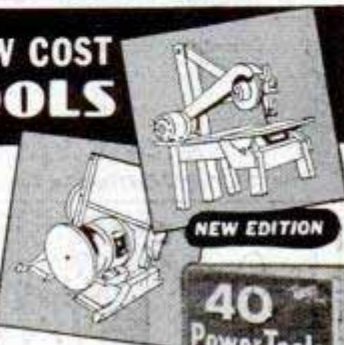
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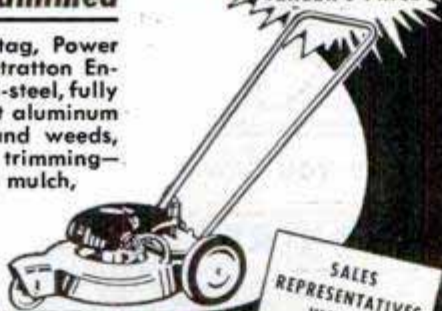
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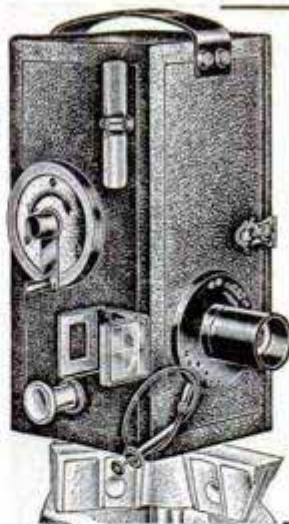
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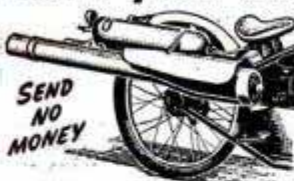
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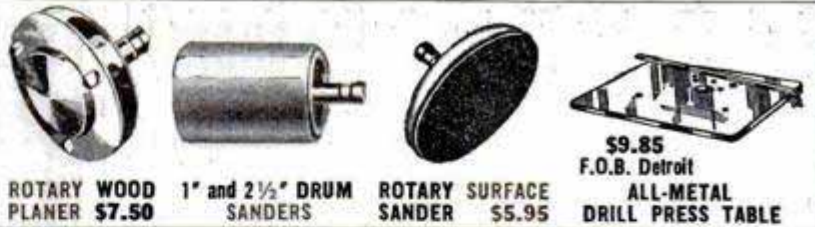
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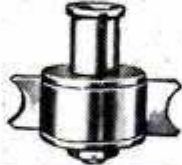
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ALL-METAL SHAPER FENCE \$8.25 F.O.B. Detroit



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You can convert any standard make drill press into your most versatile, useful, low cost workshop tool. Barron Precision Tools now enable you to perform 15 indispensable shop operations—surface—plane woods and plastics—rabbet—tenon—panel—bead—groove—bevel—mortise—route—cut dovetail—sand surfaces and contours—shape—cut moldings—grind and buff. Over 200,000 Barron Tool users. Every tool sold on full 10 day money back guarantee.

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### Close Trimming Easy

Move the "swing about" wheels forward. Then you can run the side of the mower along fences and foundations for close clipping. Hand trimming is greatly reduced.



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The steel guard and front section of the chassis fold back to make the cutting of tough, tall weeds easy. Sensation has ample power to cut small trees.



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## CUTS ANY KIND OF GRASS

Sensation has more useful mechanical features than any other mower. Adjusta-Hi-Cut enables operator to vary cutting height from 1/2" to 4" in two minutes. Lawns cut longer than normal grow thicker . . . healthier. Sensation's whirling blade chops clippings into lawn building mulch . . . no raking required.

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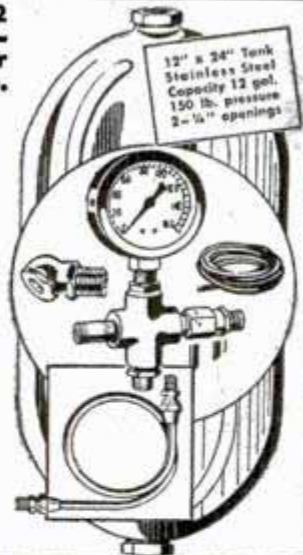
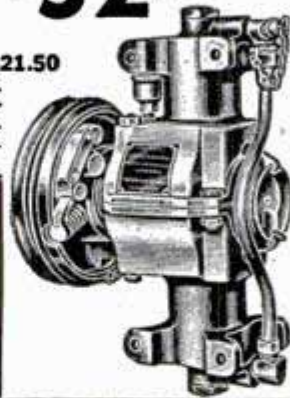
# "Wellworth" Sensational Offer! Reg. \$60.50 WESTINGHOUSE AIR COMPRESSOR

Model T-1 Brand New — 2  
CYLINDER PISTON TYPE. Operates with 1/2 H.P. Motor or equivalent gas engine.

Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. COMPLETE OUTFIT, wt. 52 lbs.

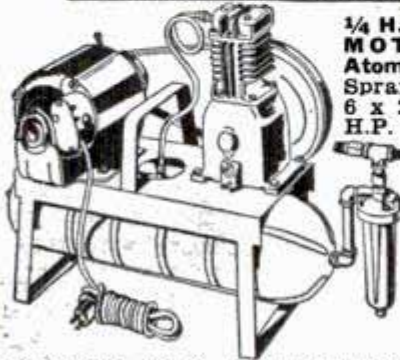
**\$32.50**

Equipment less Compressor, \$12.50. Compressor separately, \$21.50  
Compressor has 2" bore, 1 1/2" stroke, ball bearing, 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11 7/8"x6 3/4". Wt. 26 lbs. Ideal for spraying paints, insecticides, etc., inflating tires, operating air tools, and other uses. All new equipment. U.S. government surplus. Replacement parts available. Amazing buy. Don't miss it.



12" x 24" Tank  
Stainless Steel  
Capacity 12 gal.  
150 lb. pressure  
2-1/4" openings

## PORTABLE SPRAY OUTFIT



1/4 H.P. HEAVY DUTY MOTOR External Atomizing Gun Paint Sprayer mounted on 6 x 24 inch tank, 1/4 H.P. 110 V. 60 cy. Heavy duty motor with overload relay, 10 ft. cord and plug, V belt drive. Piston type Compressor with 2 Compression rings, 1 oil ring, 2 inch Bore, 1 3/4 inch stroke, displacement 2.86 C.F.M. at 60 lbs. pressure. Safety Valve. Gun external atomizing. Flat and round spray, quart cup; maintains 35 to 40 lbs. working pressure. Oil and water extractor, 1



air gauge, 20 ft. heavy duty 2-braid air hose with leak proof fittings, complete with carrying handle. Net weight 54 lbs., ship. wt. 60 lbs. Outfit less motor. Wt. 30 lbs.

**\$57.50** Complete Outfit

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Used—Like New!  
CHICAGO PNEUMATIC RIVETER & CHIPPING HAMMER

CP4X Pistol grip handle. Takes up to 3/16" rivet. Weight 6 lbs. List price \$73.00.

Ideal for work on fenders and auto bodies

SPECIAL PRICE **\$10.95**

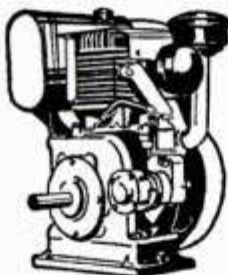
Same as above, brand new **\$22.50**



Ingersoll Rand AIR DRILL  
Lever or Pistol type

With 1/4" Jacob Chuck, Wt. 2 lbs. List price \$53.00. Only **\$14.95**

## SAVE 33 1/3% ON GAS ENGINES!



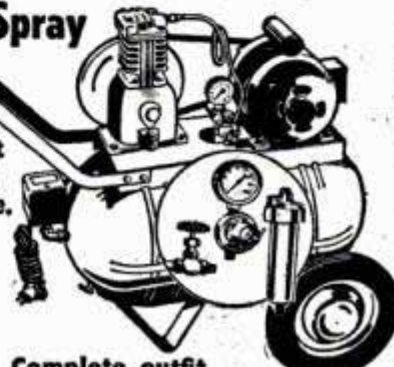
All Brand New Equipment  
Wisconsin Model VE4 with clutch, H.P. 13 to 20.5. List \$342.00. **\$228.00**  
Price.....  
Wisconsin Model AEH, H.P. 3.3 to 6.1. List \$130.95. **\$87.00**  
Price.....  
Wisconsin Model A.B. H.P. 1.7 to 3. List Price \$90.00. **\$60.00**  
Price.....

## GENERATOR and ENGINE FOR LIGHT PLANT

Brand new! Generator and gas engine bargain! Climax Generator. 2500 to 3000 Watts 110 Volt A.C. with 6.5 H.P. Wisconsin Gas Engine. **\$225.00**  
Price value. \$230 value.  
Price only.....

## Portable Automatic Paint Spray Unit

Spray paint your home, car, garage, etc.



Complete outfit including Spray Gun. **\$89.50**  
\$150.00 Value.

Same unit, stationary, \$79.50  
Use also for spraying insecticides on plants and flowers. 1/2 H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle, 2 x 1 3/4 inch piston type compressor, splash feed lubrication, 12 1/2 x 24 inch tank, automatic pressure switch, CFM 2.8 at 100 lbs. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, spray gun with 20 ft. air hose and air chuck for inflating tires. V belt drive. Mounted on 2 wheels, ball bearing, with 2" x 10" pneumatic tires. Portable, with handle. Shipping wt. 90 lbs. Regular \$150.00 value. ONE YEAR GUARANTEE. Only \$89.50 complete.

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Compressor.....17.50 wt. 16 lbs.  
Automatic pressure switch.....7.50 wt. 3 lbs.  
Regulator, gauge and filter.....8.50 wt. 5 lbs.  
Spray gun.....9.95 wt. 4 lbs.  
Tank, wheels and base.....17.50 wt. 32 lbs.  
20 ft. hose.....2.95 wt. 6 lbs.  
1/2 H.P. Cap. motor.....22.50 wt. 28 lbs.  
Air gauge.....1.75 Adjustable pop valve.....1.50  
1/4" check valve.....2.75 wt. 2 lbs.



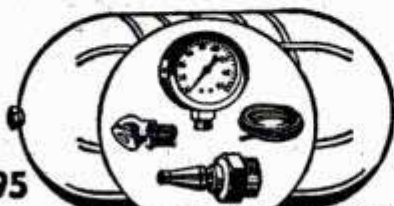
6 FT. STOW FLEXIBLE SHAFT  
Heavy Duty, 3/8" Core. Best piano wire. Ball bearing handle and arbor, rubber covered housing; for 1 1/2" motor shaft; for 1 1/2" bore wheels. Operates on 1/4 H.P. Motor at 1725 or 3450 R.P.M. \$29.00 Value, **\$14.50**. Wt. 8 lbs.

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Air receiver, stainless steel, 12 1/2"x24", 400 lb. test. Ideal for carrying on trucks, autos and wherever compressed air is needed. Equipped with 500 lb. air gauge, tire chuck, 3 ft. high-tens air hose, air inflation valve with core for retaining pressure in tank, and fittings. Complete outfit... Shipping wt. 20 lbs. Tank only.....**\$6.95**



Openings 2-1/4"

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Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13 1/8"x11 3/8"; inlet 8 3/4". Height 19". Width 18". Depth 16 1/2". C.F.M. 1/4" S.P. 1600; outlet vel. 1575; motor 1/4 H.P. with overload relay; cord & plug, 110 v. 60 cy. AC. Ship. Wt. 67 lbs. Special **\$39.50** price.....

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Here's your chance to "STEAL" Aircraft Quality STOP NUTS at less than the cost of common commercial hex nuts. They're ALL NEW Cad plated Steel and a large quantity are even pre-tapped for easier wrenching. ELASTIC or FIBER LOCK SEAL gives a Positive . . . Shock-proof . . . Vibration & Rust Resistant fastener. No lock washer necessary . . . One operation does the job. Just run on the nut. Ideal for use in all types of metal fabrication, assembly, construction etc. . . .

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836	.59	.31	.28	.25	.23	.21	.19
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1/4-28 FL	.63	.39	.36	.33	.30	.27	.25
1/4-28 PT	.63	.39	.36	.33	.30	.27	.25
5/16-24PT	.84	.64	.61	.58	.56	.54	.49
3/8-24PT	.94	.74	.71	.68	.66	.64	.59

Note: FL means Fiber Lock (not pre-tapped). PT means Pre-tapped, ESSNA Brand.

SAVE! SAVE! SAVE! - We have TREMENDOUS quantities of AIRCRAFT Quality BOLTS - SCREWS - RIVETS & BEARINGS. Our huge stocks include a great variety of sizes and lengths. PRICED LOWER THAN YOU PAY FOR ORDINARY COMMERCIAL QUALITY!

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Made by Parker Appliance Co. For bending thin wall seamless tubing of soft Copper, Brass, Aluminum Alloy or fully annealed steel. Ideal for Plumbers, Auto & Aircraft Mechanics, Steam Fitters, etc. Makes bend from 0 to 180 deg.

No. 5 - 5/16" Capacity . . . **5.45**

No. 6 - 3/8" Capacity . . . **7.65**

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Made for the U.S. NAVY. For turning an edge bead on all kinds of metal up to 18 gauge thickness. Has high grade steel faces, hardened & polished. Easily removable from shafts. Back gearing drive is enclosed in case. Top shaft adjustable for thickness & pressure. 5 faces furnished include Nos. 0 - 01, 1, 2 & 3. Has 1-1/4" hexagon shaft for bench mandrel.

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Cleco Pliers - For inserting and removing Cleco type skin fasteners. Heavy black enamel finish. NEW **69c**

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This engine is rated from 4.4 to 5 HP. Has optional power take-off of 1 to 1 from crankshaft or 2 to 1 reduction from camshaft. Makes an ideal auxiliary power plant or can be used to drive pumps, generators, compressors, small boats, etc. Lightweight rugged and contains such fine component parts as Bendix-Timken-Air Maze, etc. . . . . **ONLY \$52.95**

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Mildew & Flame Resistant, Cheap Outside Storage. They are Really Moving at These Prices

5' x 7'	<b>\$3.95</b>	16' x 32'	<b>\$39.95</b>
8 1/2' x 10'	<b>\$8.50</b>	16' x 22'	<b>\$29.95</b>

Rubberized Linen 7' x 11' NEW **\$5.95**

Only 3 lb. light weight yet waterproof Ideal for outside car storage.

### RUBBER Neoprene Sheet Stock

Thickness Approx. Width Price per run yd.

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#328 .032 1/32" 22"	1.38
#330 .064 1/16" 36"	2.39
#331 .093 3/32" 36"	3.39
#329 .125 1/8" 46"	4.75

Note: No. 329 is Laminated rubber sheet with cloth center. Flexible & very fine for heavy wear.  
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6 DIFFERENT TYPES 6  
Contains 1 each of the following items:  
Flight Check-off Position Indicator  
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These instruments contain sensitive meter movements, jewels, bearings, gears & valves.  
**COST THE GOV'T MORE THAN \$500.00**  
**SPECIAL!! ALL 6 FOR ONLY 5.95**

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**CONVERTED GUN CAMERA** - Fully reconditioned with start switch on front. Choice of finishes - Gray, Black, Blue. . . . . **33.95**

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With 57mm yellow amber, 6 base lenses. Optically Precision Ground and Polished! Your doctor will recommend these. Not a Cheap "Process" Lens. Reduces headlight glare & sharpens 'object focus' during night driving. In Men's size or Ladies Hatterquin style. ND-1 **\$16 VALUE \$4.59**

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Sturdy, Yet Light Wt. Satin Lined with Tie Straps, 14 Outside Pockets, Plus Knife, gun, or Tool, Leather Holder, 2 large 11" x 8" Pockets Inside, Wonderful Hunting, Fishing, or Mechanic. A Steel **\$2.49**

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6" chrome vanadium blade handle, leather grip. In leather sheath **\$5.98 Value For Only \$1.89**

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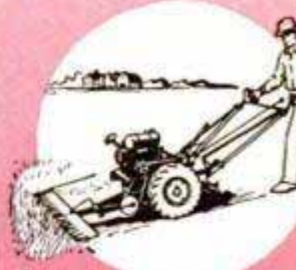
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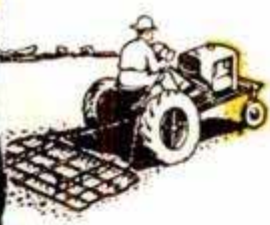


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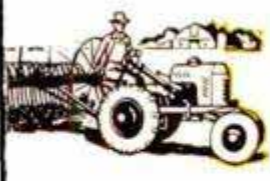


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