

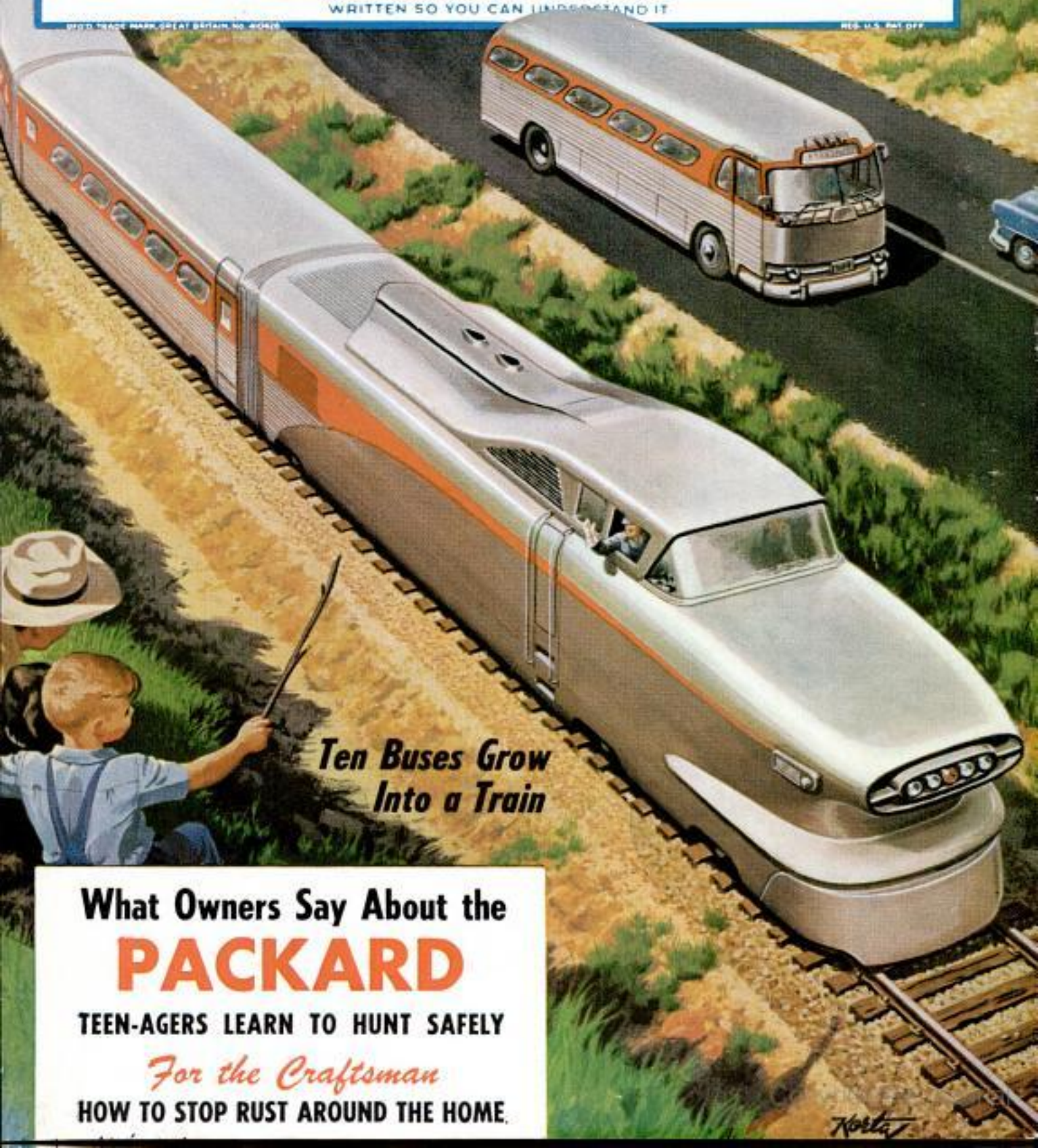
SEPTEMBER 1955

35 CENTS

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT



*Ten Buses Grow
Into a Train*

What Owners Say About the

PACKARD

TEEN-AGERS LEARN TO HUNT SAFELY

For the Craftsman

HOW TO STOP RUST AROUND THE HOME.

Kortz

Learn how homeowners everywhere save money by installing their own

MATICO TILE FLOORING



*MATICO's New Improved
Install-It-Yourself System
Makes It Easy!*

Yes, you can enjoy colorful, durable MATICO Asphalt Tile Flooring in your home at amazing low cost by installing MATICO yourself. You can't buy a more economical type of luxury flooring than MATICO. It lasts for years... is easy to keep sparkling clean and comes in 28 striking decorator colors that can't wear off because colors and marbleization go clear through the tile.

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tool kit. Why, you can finish a room in just a few hours.

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1—Mark straight lines through the center of the room in both directions, using a chalk and line.

2—With a notched trowel, spread adhesive evenly over floor and allow to "set."



3—Press tiles into position. You can walk on MATICO as soon as floor is in place.



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Please send me MATICO's money-saving install-it-yourself instruction kit and complete color chart.

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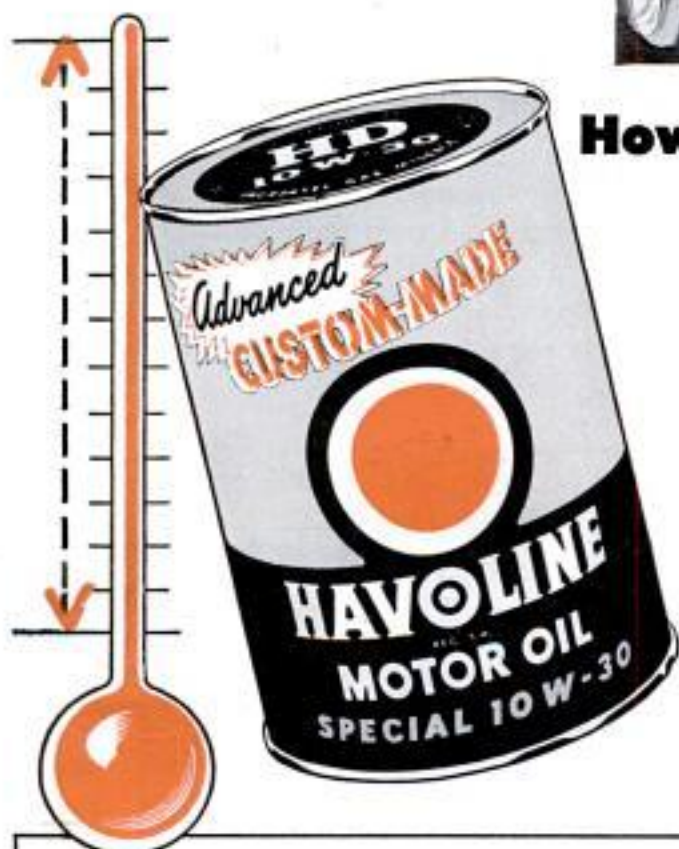
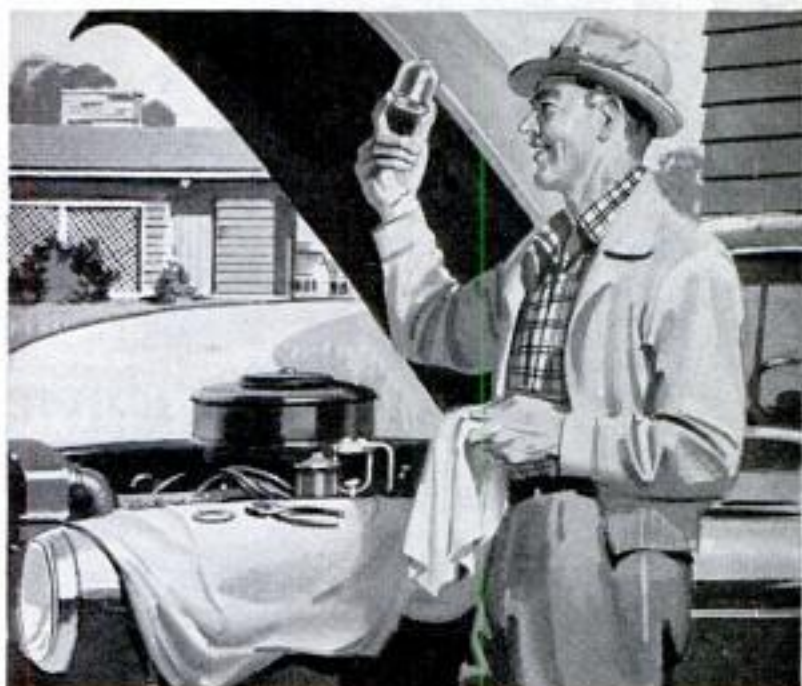
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4C-172

Texaco Tips On Car Care

How to enjoy → smoother starts

Often times, a partially clogged carburetor is the cause of stalling and difficult starting. To prevent the impurities which jam up your carburetor, drain and clean the fuel pump sediment bowl. Doing this at regularly scheduled intervals will help you get smoother starts and freedom from stalling.



How to assure faster pickup, better gasoline mileage

Use the newest member of the Havoline Motor Oil family — Havoline Special 10W-30. Independent road tests proved this all-temperature motor oil best for your car. It's "light" for cold starts, has "body" to withstand heat. Test cars using Havoline Special 10W-30 accelerated faster, using less gasoline—and engines stayed clean. For more engine "zip," and longer engine life, change to Havoline Special 10W-30. See your Texaco Dealer, the best friend your car has ever had.



TEXACO DEALERS IN ALL 48 STATES

Texaco Products are also distributed in Canada and in Latin America

TUNE IN: TEXACO STAR THEATER starring JIMMY DURANTE, on TV Saturday nights, NBC.



After initial adjustments are made, as in photograph, "Mr. Meticulous" automatically performs critical operations in making junction tetrode transistors—tiny experimental devices which may find important uses in the telephone system.

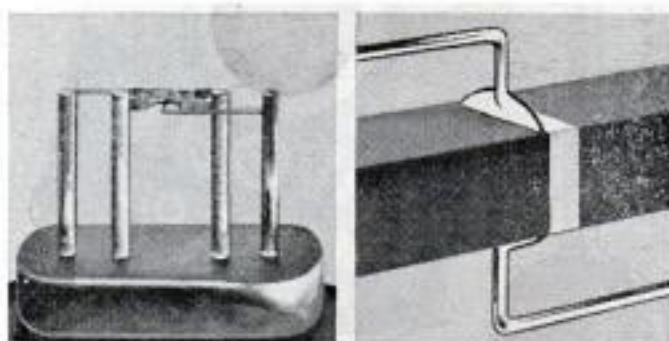
The machine we call "Mr. Meticulous"

Bell Laboratories scientists, who invented the junction transistor, have now created an automatic device which performs the intricate operations required for the laboratory production of experimental model transistors.

It takes a bar of germanium little thicker than a hair and tests its electrical characteristics. Then, in steps of $1/20,000$ of an inch, it automatically moves a fine wire along the bar in search of an invisible layer of positive germanium to which the wire must be connected. This layer may be as thin as $1/10,000$ of an inch!

When the machine finds the layer, it orders a surge of current which bonds the wire to the bar. Then it welds the wire's other end to a binding post. Afterward, it flips the bar over and does the same job with another wire on the opposite side!

Once only the most skilled technicians could do this work, and even their practiced hands became fatigued. This development demonstrates again how Bell Telephone Laboratories scientists work in every area of telephony to make service better.



Transistor made by new machine is shown in sketch at left, magnified 6 times. At right is sketch of area where wires are bonded. The wires are $2/1000$ inch in diameter, with ends crimped to reduce thickness.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in mechanical engineering.



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

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



Next Month

EVER SEE a vehicle that you drive from a walking position? This flat-bed Jeep has a folding steering post that permits the driver to control it while he walks or crawls behind, dodging bullets. Right now, the little Jeep is undergoing a series of ruinous tests on the Army's "torture rack"—Aberdeen Proving Grounds. There, new tanks and other war machines of our ground forces roar through mud, dust and swamp, up frightening grades, and spin along on highways of undulating concrete and roads consisting of loose, jagged granite rocks. Next month, in an exciting feature, the men who deliberately drive our war weapons to destruction give surprising answers to "Can Our Tanks Take It?"

Information not listed on articles in the index, starting on page 74, frequently is listed in the WHERE-TO-FIND-IT LIST, which is available to readers without charge. A copy may be obtained by writing to the Bureau of Information, Popular Mechanics, 200 E. Ontario, Chicago 11, Ill.

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**Now see
the most amazing NEW power tool
in years . . .**

Porter-Cable's revolutionary

ROUTO-JIG!

**Portable jig saw! High speed router! Precision shaper!
You get all 3 in this low-priced quality tool!**

Just convince yourself—see *and try* the sensational tool that puts dozens of new skills at your fingertips! Use the versatile new Routo-Jig as a portable jig saw, for cutting intricate contours and freehand shapes, for fast, accurate plunge cutting. Use Routo-Jig as a portable router, for mortising, grooving, dadoing, rabbetting. Use Routo-Jig as a shaper, with its own precision table—for moulding, beading, joining.

You'll find hundreds of money-saving uses for the Routo-Jig in your workshop and around your home—in cabinet work, furniture and toy making, home improvements of every kind. You'll do work of truly professional quality, faster and easier than ever before!

Like every Porter-Cable tool, the Routo-Jig is *quality-built* for years of dependable service. Right now, your dealer makes you the special introductory offer described on the opposite page—*saves you a cool \$7.00*. Read about it—see him today!



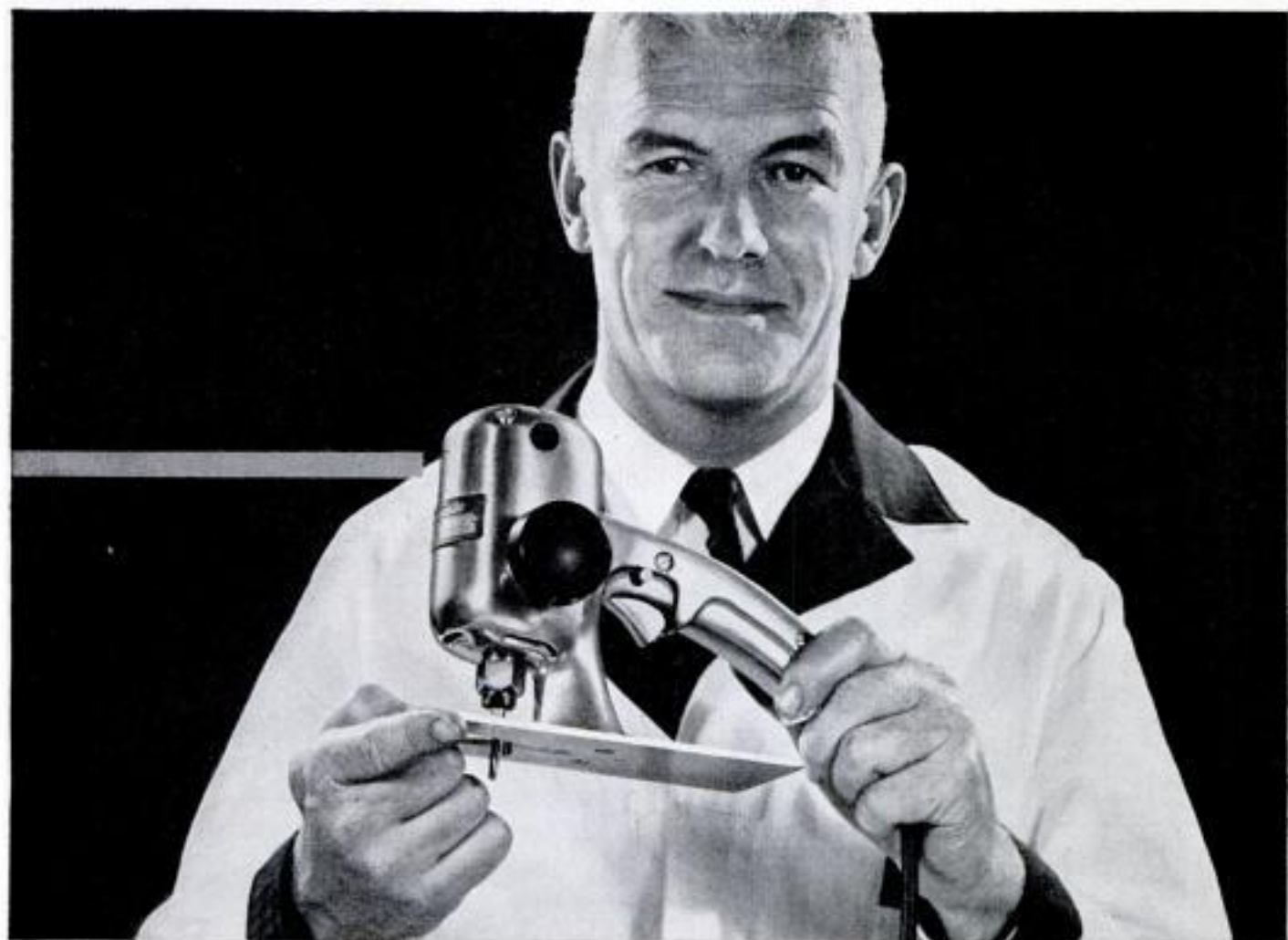
IT'S A JIG SAW!

Routo-Jig is a new kind of portable jig saw with *rotary* action—for intricate contours or straight cut-off work in wood up to 1" thick. No starting hole required. Sturdy cutting bit reduces blade breakage to a minimum.



IT'S A ROUTER!

Routo-Jig converts to a high-speed, efficient portable router in *seconds!* Special bits available for fast, easy work in wood, plastics, compositions. 24,000 R.P.M. speed for clean, smooth, *finished* cuts in every application.



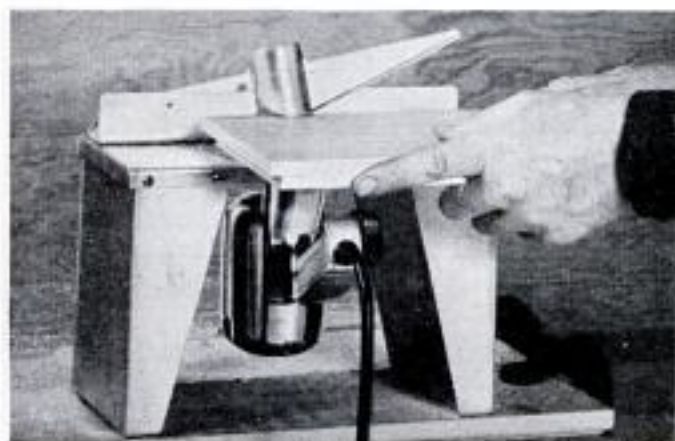
Limited time only — Special introductory offer saves you **\$7⁰⁰**

List price of the Model 140 Routo-Jig with jig saw and router bases is \$49.95. Model 5020 Shaper Table, regularly priced at \$12.00, is yours for *just \$5.00 additional* during the introductory period!

a \$61.95 value for only

\$54⁹⁵

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IT'S A SHAPER!

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Yes, send me a complete catalog sheet on the Model 140 Routo-Jig, and the name of my nearest dealer.

Name _____

Address _____

City _____ Zone _____ State _____

This one



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SEPTEMBER 1955

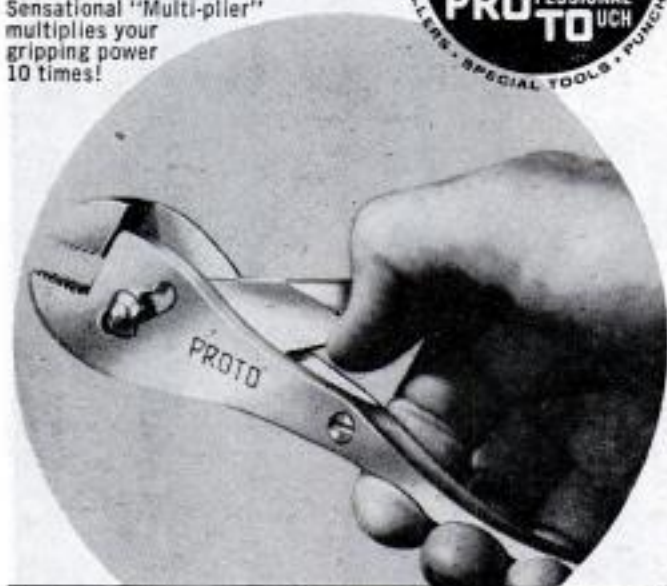
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ACROSS THE DESK



To the Editor:

In view of your recent article on "They Build Their Own Planes" (PM, June 1955) I thought perhaps you could use the enclosed photo of the "Doodle Bug," a sport plane that I designed and built myself. I finished the plane in December 1954 and have a total of 80 hours on it now. It is a very stable ship, has no bad characteristics and performs very well. It has tip tanks and wheel pants of glass fiber; the wings are aluminum, flush riveted back 40 percent of



the chord. The fuselage is tubular construction covered with fabric, the tail group is of the same construction. The gear is one-piece spring steel. The fuel capacity is 25 gallons. I have made several cross-country flights, one of 700 miles nonstop. The "Bug" was built in our one-stall garage and then the wings fitted to the ship at the International Airport. The ship was built in my spare time which covered a period of about 14 months. I am flight engineer for Continental Air Lines on the DC-6 run from El Paso, San Antonio and Houston. I am a member of the Experimental Aircraft Association.

L. K. Heuberger,
El Paso, Tex.

To the Editor:

I read with great interest an article in your *Popular Mechanics Magazine*, June 1955 issue, entitled "TV Crosses the Horizon" by Richard F. Dempewolff.

I have just imported a German "Telefunken" 17-inch television set, and am experimenting with trying to pick up a television station from Santiago, Cuba, on channel 2. This station actually originates

(Continued to page 8)

This **FREE SAMPLE LESSON** will prove you can become an expert **BOOKKEEPER... ACCOUNTANT** OR **C.P.A.**

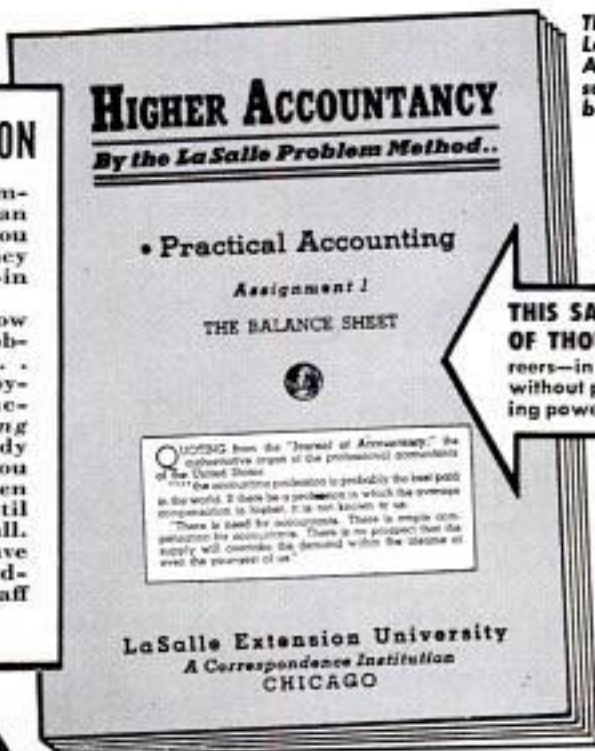
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If you were an expert accountant right now, chances are you would find yourself among the highest-paid of all professional men and women. Surveys show that accountants earn more than those in other major professions.

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(Continued from page 6)

from Havana but is relayed down by co-axial cable. Ever since installing the set I have picked up American stations on channels 2, 3, 4, 5, and 6.

Whether this reception is a freak or not I do not know, but the signals come in every day and the quality of pictures as reported by my friends who have seen American TV in New York is on a par and sometimes clearer than in the U.S.A.

The signals will be very strong from about 9:30 a.m. to 11:30 a.m., then come in again at 2:00 p.m. to 4:00 p.m., again at 7:00 p.m. and generally fade out by 9:30 p.m. I pick up North Carolina, South Carolina, Tennessee and Atlanta, Ga., but the most powerful is WUSN-TV, on channel 2, Charleston.

As you can readily observe I am picking up signals in a range of 1200-1500 miles and where I live the signal would have to "jump" our highest mountain which is to my north, an elevation of 7000 feet.

My antenna is about 48 feet high and I do not use a booster, but the set is a custom-built fringe-area circuit. The Cuban signal from Santiago comes in without any difficulty, but the American signal is subject to fade-outs as mentioned in your article.

Trevor A. Bitter,
United Estates, Ltd.,
Kingston, Jamaica, B.W.I.

To the Editor:

Enclosed is a picture of my portable shingle machine, which I designed and built. I had it on show at the Northeastern Steam Engine Rodeo on the Kewaunee Country fair grounds at Luxemburg, Wis. This machine can be operated by two or three men and is adapted to sawing small tracts of cedar or other soft timber into shingles.

Martin Hessel,
Green Bay, Wis.



(Continued to page 10)

PICK YOUR OWN SUCCESS STORY FROM THIS PAGE

These are the true stories of people who seemed trapped in routine, low-pay shaky jobs. Handicapped by lack of proper training, they couldn't get the things they wanted out of life—more money, a job they liked, security and happiness.

They are a small sample of the thousands of men and women—young and old—who turn to I. C. S. for help. Their will-to-learn plus I. C. S. training have changed the course of their lives.

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I. C. S. is the oldest and largest correspondence school. 277 courses. Business, industrial, engineering, academic, high school. One for you. Direct, job-related. Bedrock facts and theory plus practical application. Complete lesson and answer service. No skimping. Diploma to graduates.



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"As a college graduate, I found I.C.S. very valuable." Robert Lee took the I. C. S. Course in Advertising, is now Promotion Manager for a large corporation. "I. C. S. got me started on the way up," he says.



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Without cost or obligation, send me "HOW TO SUCCEED" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

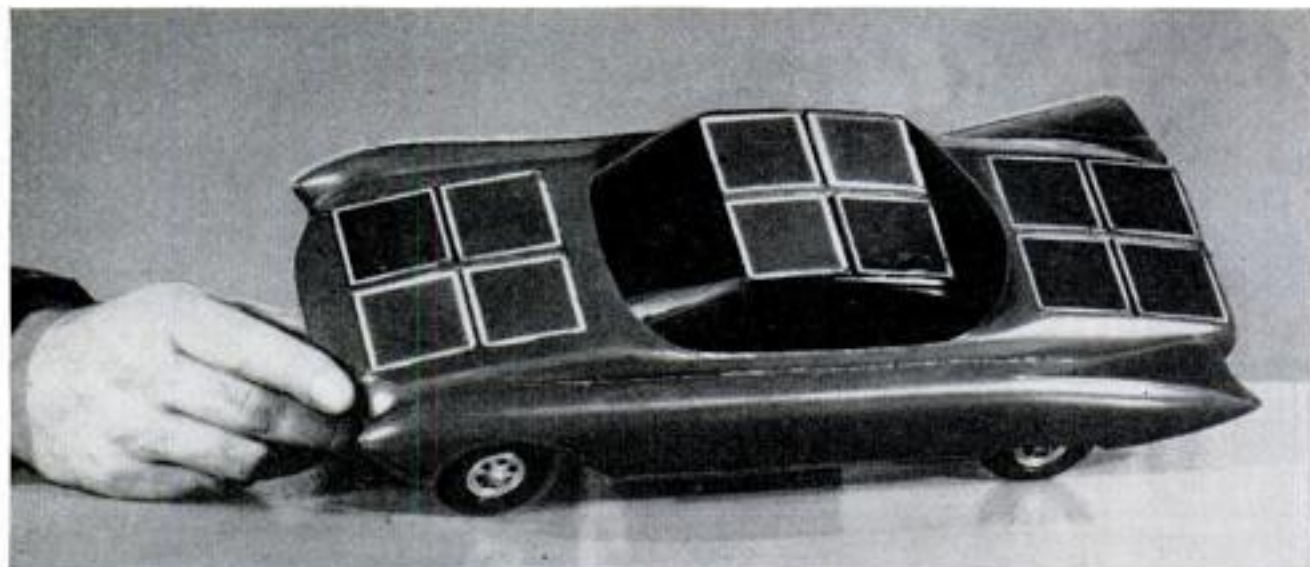
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Tax <input type="checkbox"/> Letter-writing Improvement <input type="checkbox"/> Office Management <input type="checkbox"/> Professional Secretary <input type="checkbox"/> Retail Business Management <input type="checkbox"/> Sales Management <input type="checkbox"/> Stenographic-Secretarial <input type="checkbox"/> Traffic Management <p>CHEMISTRY</p> <ul style="list-style-type: none"> <input type="checkbox"/> Analytical Chemistry <input type="checkbox"/> Chemical Engineering <input type="checkbox"/> Chem. Lab. Technician <input type="checkbox"/> General Chemistry <input type="checkbox"/> Natural Gas Prod. & Trans. <input type="checkbox"/> Petroleum Engineering <input type="checkbox"/> Plastics <input type="checkbox"/> Pulp and Paper Making | <p>CIVIL, STRUCTURAL ENGINEERING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Civil Engineering <input type="checkbox"/> Construction Engineering <input type="checkbox"/> Highway Engineering <input type="checkbox"/> Reading Struct. Blueprints <input type="checkbox"/> Sanitary Engineering <input type="checkbox"/> Structural Engineering <input type="checkbox"/> Surveying and Mapping <p>DRAFTING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aircraft Drafting <input type="checkbox"/> Architectural Drafting <input type="checkbox"/> Electrical Drafting <input type="checkbox"/> Mechanical Drafting <input type="checkbox"/> Mine Surveying and Mapping <input type="checkbox"/> Plumbing Drawing and Estimating <input type="checkbox"/> Structural Drafting <p>ELECTRICAL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Electrical Engineering <input type="checkbox"/> Electrical Maintenance <input type="checkbox"/> Electrician <input type="checkbox"/> Contracting <input type="checkbox"/> Lineman <p>HIGH SCHOOL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Commercial <input type="checkbox"/> Good English <input type="checkbox"/> High School Subjects <input type="checkbox"/> Mathematics | <p>LEADERSHIP</p> <ul style="list-style-type: none"> <input type="checkbox"/> Foremanship <input type="checkbox"/> Industrial Supervision <input type="checkbox"/> Leadership and Organization <input type="checkbox"/> Personnel-Labor Relations <p>MECHANICAL AND SHOP</p> <ul style="list-style-type: none"> <input type="checkbox"/> Gas—Electric Welding <input type="checkbox"/> Heat Treatment <input type="checkbox"/> Metallurgy <input type="checkbox"/> Industrial Engineering <input type="checkbox"/> Industrial Instrumentation <input type="checkbox"/> Industrial Supervision <input type="checkbox"/> Internal Combustion Engines <input type="checkbox"/> Machine Design-Drafting <input type="checkbox"/> Machine Shop Inspection <input type="checkbox"/> Machine Shop Practice <input type="checkbox"/> Mechanical Engineering <input type="checkbox"/> Quality Control <input type="checkbox"/> Reading Shop Blueprints <input type="checkbox"/> Refrigeration <input type="checkbox"/> Sheet Metal Worker <input type="checkbox"/> Tool Design <input type="checkbox"/> Toolmaking <p>RADIO, TELEVISION</p> <ul style="list-style-type: none"> <input type="checkbox"/> Industrial Electronics <input type="checkbox"/> Practical Radio TV Eng'ng <input type="checkbox"/> Radio and TV Servicing <input type="checkbox"/> Radio Operating | <ul style="list-style-type: none"> <input type="checkbox"/> Television Technician <p>RAILROAD</p> <ul style="list-style-type: none"> <input type="checkbox"/> Air Brakes <input type="checkbox"/> Car Inspector <input type="checkbox"/> Diesel Locomotive <input type="checkbox"/> Locomotive Engineer <input type="checkbox"/> Section Foreman <p>STEAM AND DIESEL POWER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Combustion Engineering <input type="checkbox"/> Diesel—Elec. <input type="checkbox"/> Diesel Eng's <input type="checkbox"/> Electric Light and Power <input type="checkbox"/> Stationary Fireman <input type="checkbox"/> Stationary Steam Engineering <p>TEXTILE</p> <ul style="list-style-type: none"> <input type="checkbox"/> Carding and Spinning <input type="checkbox"/> Cotton, Rayon, Woolen Mfg. <input type="checkbox"/> Finishing and Dyeing <input type="checkbox"/> Loom Fix'g <input type="checkbox"/> Textile Des'ing <input type="checkbox"/> Textile Eng'g <input type="checkbox"/> Throwing <input type="checkbox"/> Warping and Weaving <p>MISCELLANEOUS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Domestic Refrigeration <input type="checkbox"/> Marine Engineering <input type="checkbox"/> Ocean Navigation <input type="checkbox"/> Professional Engineering <input type="checkbox"/> Short Story Writing <input type="checkbox"/> Telephony |
|--|---|--|---|--|

Name _____ Age _____ Home Address _____

City _____ Zone _____ State _____ Working Hours _____ A.M. to P.M. _____

Occupation _____

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(Continued from page 8)

"Sunmobile"

Rays of light from Old Sol power a new car. Of course, the car is only 15 inches long but it demonstrates a possible power source of the future. Atop the "sunmobile" are 12 squares, each a photoelectric cell which converts light into electric current. The current then is used to power the model car. The cells are made of selenium, an element that has the property of turning light into electric power.

The "sunmobile" is being shown this

month at the General Motors' Powerama in Chicago. GM officials emphasize that solar power has no practical application to the automotive industry at present.

The little 15-inch car is one of the smallest exhibits at the Powerama. One of the largest is the new lightweight, high-speed train shown on our cover and described in a feature starting on page 81.

Occupying a 1,000,000-square-foot area on Chicago's lakefront, the Powerama dramatizes the importance of diesel and aircraft power in our modern economy.

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As part of my **Communications Course** I send you parts to build low-power **Broadcasting Transmitter** at left. Use it to get practical experience. You put this station "on the air" . . . perform procedures demanded of broadcasting station operators. An **FCC Commercial Operator's License** can be your ticket to a bright future. My **Communications Course** trains you to get your license. Mail coupon. Book shows other equipment you build for practical experience.

I Will Train You at Home in Spare Time to be a **RADIO-TELEVISION Technician**



TELEVISION Making Jobs, Prosperity

25 million homes have Television sets now. Thousands more sold every week. Trained men needed to make, install, service TV sets. About 200 television stations on the air. Hundreds more being built. Good job opportunities here for qualified technicians, operators, etc.

N.R.I. Training Leads to Good Jobs Like These

I TRAINED THESE MEN

"I have progressed very rapidly. My present position is Studio Supervisor with KEDD Television, Wichita."—Elmer Frewaldt, 2026 Stadium, Wichita, Kans.

"Fix sets part time in my shop. Made about \$500 first three months of the year. Could have more but this is about all I can handle."—Frank Borer, Lorain, Ohio.

"I've come a long way in Radio and Television since graduating. Have my own business on Main Street."—Joe Travers, Asbury Park, New Jersey.

"I didn't know a thing about Radio. Now have a good job as Studio Engineer at KMMJ."—Bill Deltzell, Central City, Nebraska.

BROADCASTING: Chief Technician, Chief Operator, Power Monitor, Recording Operator, Remote Control Operator. **SERVICING:** Home and Auto Radios, Television Receivers, FM Radios, P.A. Systems. **IN RADIO PLANTS:** Design Assistant, Technician, Tester, Serviceman, Service Manager. **SHIP AND HARBOR RADIO:** Chief Operator, Radio-Telephone Operator. **GOVERNMENT RADIO:** Operator in Army, Navy, Marine Corps, Forestry Service Dispatcher, Airways Radio Operator. **AVIATION RADIO:** Transmitter Technician, Receiver Technician, Airport Transmitter Operator. **TELEVISION:** Pick-up Operator, Television Technician, Remote Control Operator.



J. E. SMITH, President National Radio Institute Washington, D. C. Our 40th Year

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

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

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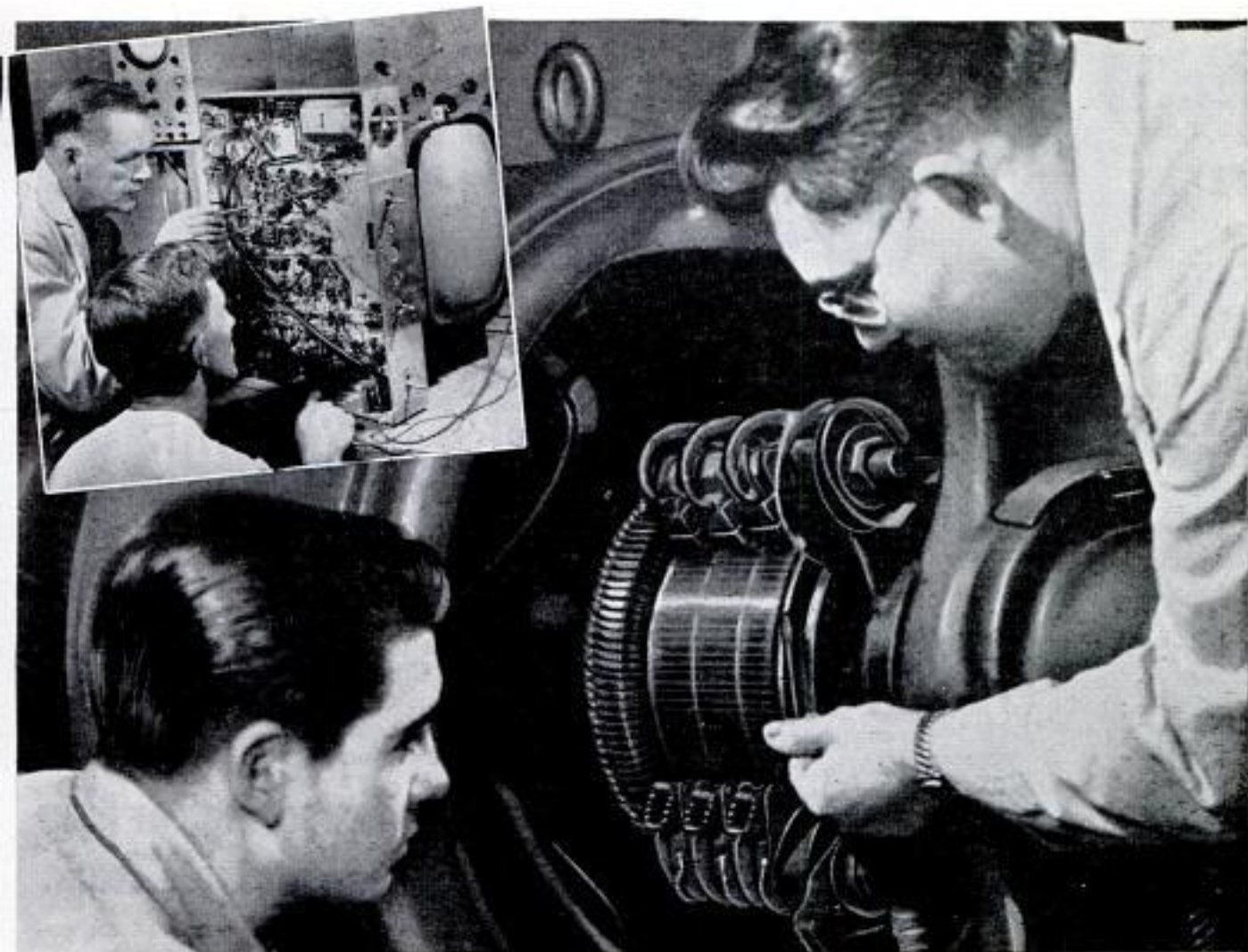
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700x15	4.85	700x16	5.05
700x16	5.45	700x17	5.85
700x17	6.45	700x18	6.85
700x18	7.45	700x19	7.85
700x19	8.45	700x20	8.85
700x20	9.45	700x21	9.85
700x21	10.45	700x22	10.85
700x22	11.45	700x23	11.85
700x23	12.45	700x24	12.85
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700x27	16.45	700x28	16.85
700x28	17.45	700x29	17.85
700x29	18.45	700x30	18.85
700x30	19.45	700x31	19.85
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700x32	21.45	700x33	21.85
700x33	22.45	700x34	22.85
700x34	23.45	700x35	23.85
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700x39	28.45	700x40	28.85
700x40	29.45	700x41	29.85
700x41	30.45	700x42	30.85
700x42	31.45	700x43	31.85
700x43	32.45	700x44	32.85
700x44	33.45	700x45	33.85
700x45	34.45	700x46	34.85
700x46	35.45	700x47	35.85
700x47	36.45	700x48	36.85
700x48	37.45	700x49	37.85
700x49	38.45	700x50	38.85
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700x52	41.45	700x53	41.85
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700x55	44.45	700x56	44.85
700x56	45.45	700x57	45.85
700x57	46.45	700x58	46.85
700x58	47.45	700x59	47.85
700x59	48.45	700x60	48.85
700x60	49.45	700x61	49.85
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700x63	52.45	700x64	52.85
700x64	53.45	700x65	53.85
700x65	54.45	700x66	54.85
700x66	55.45	700x67	55.85
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700x69	58.45	700x70	58.85
700x70	59.45	700x71	59.85
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700x85	74.45	700x86	74.85
700x86	75.45	700x87	75.85
700x87	76.45	700x88	76.85
700x88	77.45	700x89	77.85
700x89	78.45	700x90	78.85
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700x91	80.45	700x92	80.85
700x92	81.45	700x93	81.85
700x93	82.45	700x94	82.85
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700x99	88.45	700x100	88.85
700x100	89.45	700x101	89.85
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700x105	94.45	700x106	94.85
700x106	95.45	700x107	95.85
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700x108	97.45	700x109	97.85
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700x111	100.45	700x112	100.85
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700x113	102.45	700x114	102.85
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700x171	160.45	700x172	160.85
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700x195	184.45	700x196	184.85
700x196	185.45	700x197	185.85
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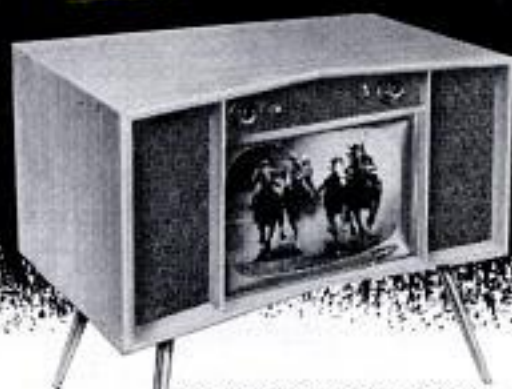
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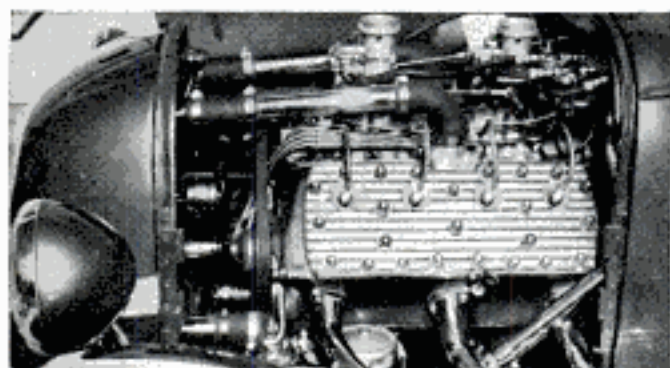
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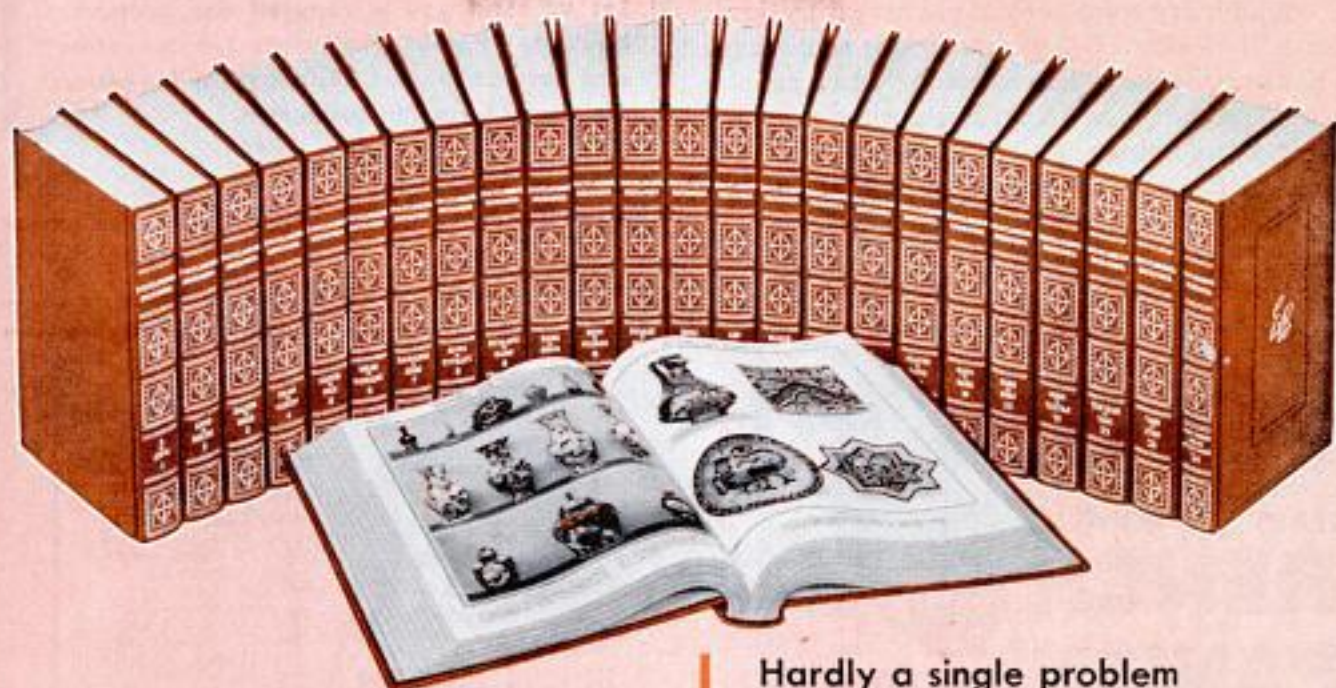
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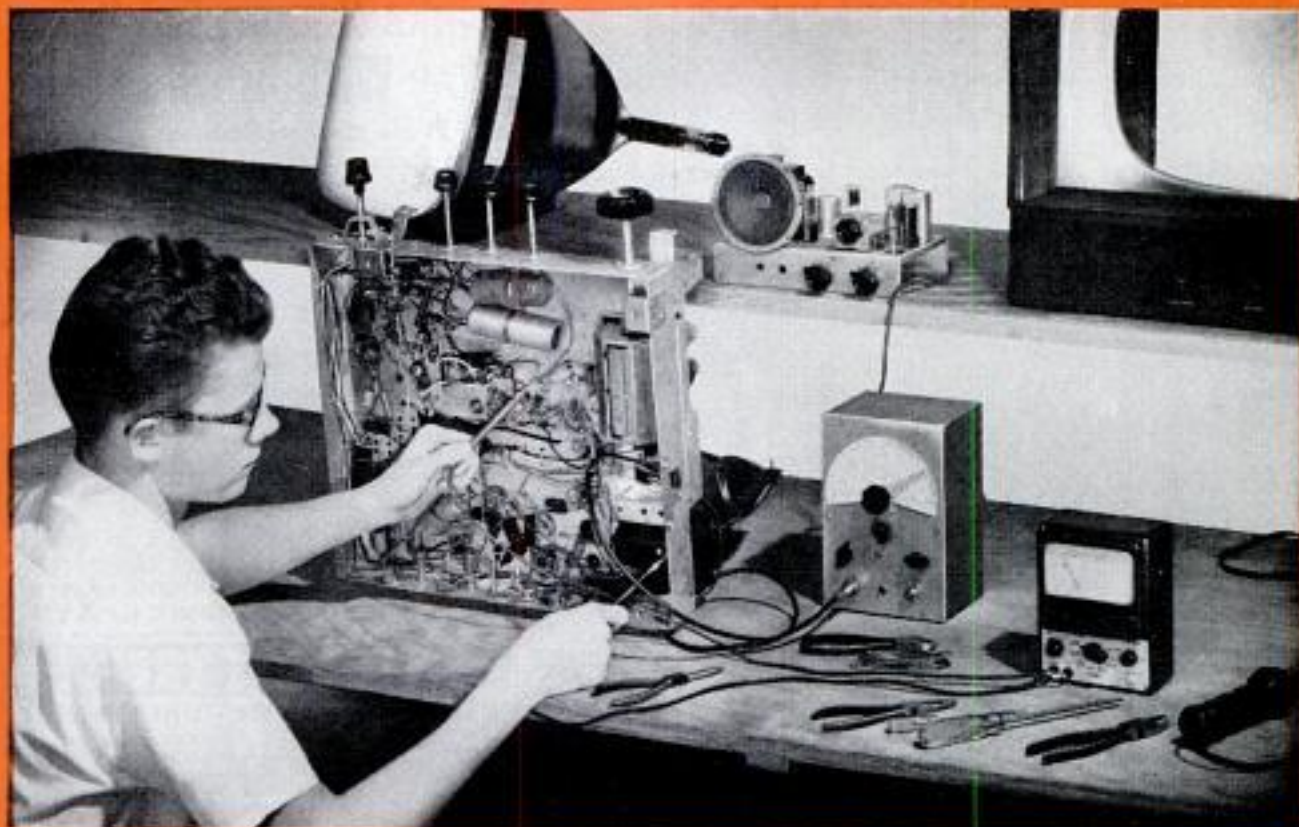
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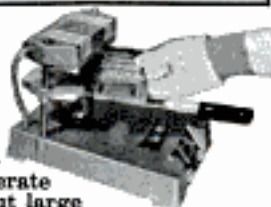
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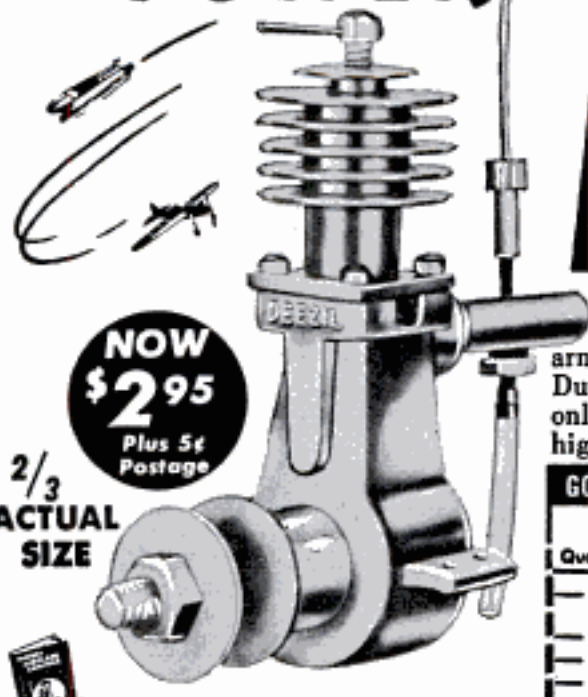
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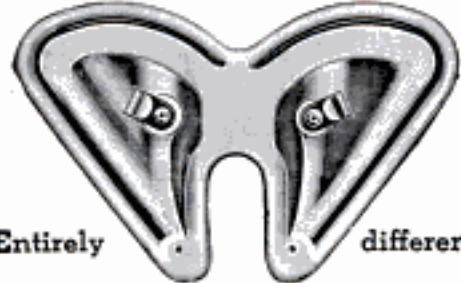
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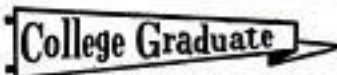


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Blueprints <input type="checkbox"/> Sanitary Engineering <input type="checkbox"/> Structural Engineering <input type="checkbox"/> Surveying and Mapping <p>DRAFTING</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aircraft Drafting <input type="checkbox"/> Architectural Drafting <input type="checkbox"/> Electrical Drafting <input type="checkbox"/> Mechanical Drafting <input type="checkbox"/> Mine Surveying and Mapping <input type="checkbox"/> Plumbing Drawing and Estimating <input type="checkbox"/> Structural Drafting <p>ELECTRICAL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Electrical Engineering <input type="checkbox"/> Electrical Maintenance <input type="checkbox"/> Electrician <input type="checkbox"/> Contracting <input type="checkbox"/> Lineman <p>HIGH SCHOOL</p> <ul style="list-style-type: none"> <input type="checkbox"/> Commercial <input type="checkbox"/> Good English <input type="checkbox"/> High School Subjects <input type="checkbox"/> Mathematics | <p>LEADERSHIP</p> <ul style="list-style-type: none"> <input type="checkbox"/> Foremanship <input type="checkbox"/> Industrial Supervision <input type="checkbox"/> Leadership and Organization <input type="checkbox"/> Personnel-Labor Relations <p>MECHANICAL AND SHOP</p> <ul style="list-style-type: none"> <input type="checkbox"/> Gas—Electric Welding <input type="checkbox"/> Heat Treatment <input type="checkbox"/> Metallurgy <input type="checkbox"/> Industrial Engineering <input type="checkbox"/> Industrial Instrumentation <input type="checkbox"/> Industrial Supervision <input type="checkbox"/> Internal Combustion Engines <input type="checkbox"/> Machine Design-Drafting <input type="checkbox"/> Machine Shop Inspection <input type="checkbox"/> Machine Shop Practice <input type="checkbox"/> Mechanical Engineering <input type="checkbox"/> Quality Control <input type="checkbox"/> Reading Shop Blueprints <input type="checkbox"/> Refrigeration <input type="checkbox"/> Sheet Metal Worker <input type="checkbox"/> Tool Design <input type="checkbox"/> Toolmaking <p>RADIO, TELEVISION</p> <ul style="list-style-type: none"> <input type="checkbox"/> Industrial Electronics <input type="checkbox"/> Practical Radio TV Eng'ing <input type="checkbox"/> Radio and TV Servicing <input type="checkbox"/> Radio Operating | <p><input type="checkbox"/> Television Technician</p> <p>RAILROAD</p> <ul style="list-style-type: none"> <input type="checkbox"/> Air Brakes <input type="checkbox"/> Car Inspector <input type="checkbox"/> Diesel Locomotive <input type="checkbox"/> Locomotive Engineer <input type="checkbox"/> Section Foreman <p>STEAM AND DIESEL POWER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Combustion Engineering <input type="checkbox"/> Diesel—Elec. <input type="checkbox"/> Diesel Eng's <input type="checkbox"/> Electric Light and Power <input type="checkbox"/> Stationary Fireman <input type="checkbox"/> Stationary Steam Engineering <p>TEXTILE</p> <ul style="list-style-type: none"> <input type="checkbox"/> Carding and Spinning <input type="checkbox"/> Cotton, Rayon, Woolen Mfg. <input type="checkbox"/> Finishing and Dyeing <input type="checkbox"/> Loom Fix'g <input type="checkbox"/> Textile Des'ing <input type="checkbox"/> Textile Eng'g <input type="checkbox"/> Throwing <input type="checkbox"/> Warping and Weaving <p>MISCELLANEOUS</p> <ul style="list-style-type: none"> <input type="checkbox"/> Domestic Refrigeration <input type="checkbox"/> Marine Engineering <input type="checkbox"/> Ocean Navigation <input type="checkbox"/> Professional Engineering <input type="checkbox"/> Short Story Writing <input type="checkbox"/> Telephony |
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So you see, it is even possible to conduct a business of this kind without investing in merchandise.



Mrs. McGinn, one of my students in Illinois, operates a gift shop and sells Arabian perfume by mail order. F. Basler, N.J., sells Aztec bird feather pictures from Mexico to stores and by mail order.

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Mr. G. W. Edgecumbe of California wrote me in part as follows: "Using the plan of buying foreign imports to sell mail order... offering beautiful and unusual foreign dolls... ready market... profitable field..."

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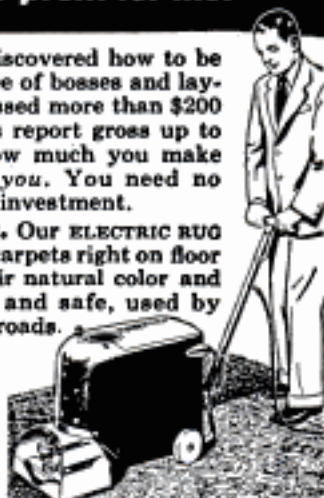
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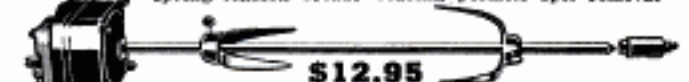
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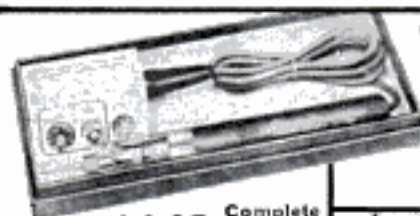
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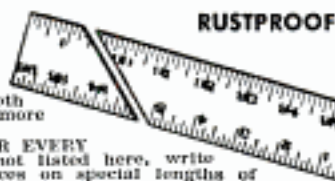
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TV Trade-in sets. Philco, Emerson, G.E., Admiral, Motorola, Tele-King, others. List available. 10"—\$17, 12"—\$20 up. Washtek Service Co., 1501 Boston Rd., Bronx, N. Y. DA 3-9281.

RADIO-TV service course. New method. No theory. Learn by experience. Guaranteed results. Complete course \$7.50. Radio Service School, 3502 Mills Avenue, Austin, Texas.

ELECTRIC Brain plays game! Build it! Challenge your friends to beat it! Easy, cheap to make. Rush postcard for full details. Jay Acey, Dept. P-3, Box 132, Greenwich, Conn.

BECOME A radio amateur. Free information on how to pass code and theory FCC examinations. American Electronics, 1205½ Bryant Ave., New York 59, N. Y.

FREE 324 Page 1956 Television, Radio, Hi-Fi, Electronics catalog! World's largest stocks, lowest prices. Everything for experimenters, builders, amateurs, servicemen. Latest build-your-own kits, Hi-Fi, phonos, recorders, P. A., TV accessories. Thousands of parts, tubes, test instruments, tools and books. Write for free copy! Allied Radio Corp., 100 N. Western Ave., Dept. 34-J-5, Chicago 80, Ill.

CRYSTAL Radio experimenters. Write Leslie Hulet, 305 Hope, Lakewood, N. J.

REPAIR Your own TV. Instructions compiled exclusively for your set. Simple as replacing light bulb. Send set name, chassis, model number, \$2.00. LS Engineering Company, Box 4113-PM-9, North Hollywood, Calif.

BUILD 15 Radio circuits at home—Progressive Radio "Edu-Kit" only \$19.95 complete. Free electric soldering iron and radio tester with "Edu-Kit." No radio background required. 30-day unconditional money back guarantee. Order direct or send for free descriptive literature, no obligation. Valuable radio and TV repair guide sent on request, no charge, no obligation. Progressive "Edu-Kits" Inc., Room 33-B, Progressive Building, 497 Union Avenue, Brooklyn 11, N. Y.

ENJOY Color television now! Multicolored screens for any b/w set. Easily attached. Complete details free. Zingo Electronics, Johnstown 76, New York.

TELEVISION Can sell your product faster for less money. Free information. Tele-sales, Box 24A, New York City 19.

FUSED AC line plug protects TV and home. Easily installed. With extra fuses, \$1.00. Plaza Television, 1408 Huntoon, Topeka, Kansas.

ALL Channel figure 8 serials. Light weight. Attic installation. Install yourself. Manufactured by Fred E. Smith, 119 N. Leroy, Fenton, Michigan, Telephone 9-6542.

WALKIE-Talkie. Build wireless two-way portable radiophone for less than \$10.00. Plans 50c. Springfield Enterprises, Box 54-B9, Springfield Gardens 13, New York.

AMAZING Tube tester. Tests all radio and television tubes including main picture tube. Satisfaction guaranteed. \$4.95 postpaid. Fryrick, 225 W. 34th Street, New York 1, N. Y.

62 PAGE. Illustrated, radio beginners booklet 25c. Franks Book Service, 3121 Racine, Chicago 8.

PROTECT Your home and television from costly damage. T.V.-lightning arrester for all sets, easily installed in 5 minutes by anyone, U/L approved. \$3.95 postpaid. Lawrence Sales, Box 131, Ridge-wood, N. J.

TAPE Recorders wholesale. Free catalog. Towers, 935 North 40th, Philadelphia 4.

SAVE Dollars! Repair your own T.V. Complete individual guide. Send make, model and \$2.00. TV Lab, Box 185, Yuba City, California.

BUSINESS OPPORTUNITIES

BECOME Tax consultant. Our students earn to \$3,000 in 3-month season, part-time. We train you—help you start. State approved. Union Institute, 68 Hudson, Hoboken 2B, New Jersey.

\$1,000 MONTHLY Possible in collection agency business. Free details. Write Cole Associates, Syracuse 2, N. Y.

WHOLESALE Catalog! 30-80% discounts! Typewriters, appliances, housewares, watches, jewelry, etc. Consolidated Distributors, 21-11 Lafayette, Paterson 15, New Jersey.

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LEARN Sewing machine servicing differently. Original trade secrets. Surprisingly odd! Booming! This vocation! \$1.00 lesson, plus details, free. Purdy's, Box 297-M, Weatherford, Texas.

SELL By mail. Modern 20-lesson course by specialist John Moran shows how to start on low capital. Hundreds ideas, sample ads and short cuts. Write Roy R. Poole Co., Sleepy Hollow Road, Rome, New York.

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. MX-955, 7530 Greenwood, Chicago.

RUN Cafe, diner. How to get started, menus, foods, revealed in home training. Write for free book "Cafe, Diner Business." School of Restaurant Arts, BU19, Fremont, Ohio.

START Your own business on credit. Your own boss. 1135 of our dealers sold \$5000 to \$30,000 in 1954. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant profitable business backed by worldwide industry. Write Rawleigh's, Dept. I-U-PPM, Freeport, Ill.

OPERATE Profitable magazine subscription service. Earn big Christmas profits. New telephone plan. Handle renewals for all magazines. No experience or investment. Rush name. McGregor Agency, Dept. 500-B, Mt. Morris, Illinois.

START A buying service, buy wholesale thousands nationally advertised products. Make big profits selling at sizable discounts. Postcard brings details. American Buyers, Hertel Station, Buffalo 16-C, N. Y.

FREE Booklet concerning hundreds profitable businesses started sparetime at home. Richard Company, Box 366-P, Hayward, Calif.

FREE "301 Profitable Small Businesses!" Amazing shoestring plans! Work home! Start sparetime! Deumant Surveys, Kenmore 23-PM, N. Y.

TO \$50.00 Weekly. Sparetime, home operated mailorder business. Successful beginner's plan. Everything supplied. Lynn, 10420-M National, Los Angeles 34.

MONEYMAKING Mailorder business plan, free! Write, George Lenhoff, Lincoln 8, Nebraska.

NEW Orleans help wanted columns airmailed \$1.00. Peterson, 1346 Prentiss Ave., New Orleans 22, La.

MAKE Perfumes, other products. Sell mailorder. Catalog free. International, 6347 Parnell PM-9, Chicago 21, Illinois.

MEN Wanted—Build luggage and cases at home. We sell your products, supply complete instructions, materials, everything. No special equipment needed. Free details. Cascraft, 805-G21 Sunset, Los Angeles 12, Calif.

"MAILORDER Laws and Regulations." Discusses federal, state, local licenses, taxes, legal requirements governing mail-order businesses. Play safe. Order today. Only \$1.00. Tasker, 105 East Custis Avenue, Alexandria, Virginia.

DOLLARS Daily! No canvassing! Free proof! Mailmarts, Cincinnati 36-F, Ohio.

TELEVISION Repair business. \$39.50 total cost. Amazing 1 day training. No studying. New proven technique. Make \$15 to \$20 day immediately! No experience needed. Investigate! Free home-business plan. Write Electronic Engineering, 1036-PS So. LaBrea, Los Angeles 19, Calif.

CONCRETE Manufacturing business. Molds for blocks, benches, tables, splash blocks, flower boxes. Circular free. Vyke Co., 2435—15th St., Denver 2, Colo.

SHINE Shoes without polish. New invention. Lightning seller. Shoes gleam like mirror. Samples sent on trial. Kristee 112, Akron, Ohio.

"HOT Dog on a stick." Something new. Dixie Hot Dog Mix. Scientifically blended with spices. Just add water. Sticks, bags all accessories, advertising material furnished. Steady supply and exclusive territories. Also Snow Ball, cotton candy machines, etc. For free information write National Industries, Inc., Wallace, N. C.

SELL Direct and through dealers best concrete sealer and decorator. Extra profit on contract jobs. Aquadry, 5511 W. North Ave., Chicago, Ill.

\$2000.00 OR More possible each month. New revolutionary service. Unlimited earnings. No merchandise. Keep present job. Can operate confidentially. Men or women. Send self-addressed stamped envelope. Checkers Service, P.O. Box 45, Winter Park, Florida.

"MAKING Money With Mushrooms." Simplified book. \$1.00 cash. Money-back guarantee. Mushroom Lab, 32 Kendrick, St. Lawrence, Mass.

WANTED! Home producers, by manufacturers in our clearing house service. Become subcontractor, casting plastic products for these companies. Thousands of easy-to-make items required for consumer-industrial use. Cash in at home, without previous experience. Plastic Service Associates, Dept. 9-PM, East Boston 28, Mass.

VITAMINS! Terrific profits! Direct and mailorder sales to homes, offices, stores and get your own needs wholesale. Details free. VimVite, 2908PM Beverly, Los Angeles 57.

SELL Merchandise by mail from your home. Everything supplied. Big profits. Stephenson's, Rattlesnake Drive, Missoula, Montana.

SELL Folios by mail. Free list gives low cost source. Ballard's, 425 East Catherine, Louisville 3, Ky.

EARN \$2.00 Hourly, making and selling sandals! Youngs, 1308-PM, South First, Arcadia, California.

\$40.00 PROFIT Daily making concrete drain tile in backyard with \$87.50 machine. Circular free. Coeten Products, Cornelia, Georgia.

PLASTERCRAFT Molds, liquid rubber, plasters, flocks, candle supplies. Catalog and manual free. Blue Rapids Supply, Blue Rapids, Kansas.

FREE "At Home Money-Making Plan." Increase your income. Start your own discount business with giant 100 page catalog. Send for free plan today. BTS Products, Oakland 10, New Jersey.

SELL Scotchlite reflective signs and letters by mail for good profit with no investment. Prestoflex Corporation, Mason City, Iowa.

EXCLUSIVE Distributorships available. Exceptionally good auto polish, local advertising assures big sales, investment insured. Details, sample \$2.00 refundable. K-K Products, Route 1, Box 76, San Bernardino, Calif.

NEW Wonder Dow Corning car polish. Cleans, glazes, weatherproofs year 'round. Really works! Send \$1 (refundable) for pint sample and selling plan. United Co., 1035 East 10th Street, Brooklyn 30, N.Y.

HANDY Men in small towns! Assemble and sell the finest three channel aluminum combination storm window. Work full or part time. Your cost— $\frac{1}{2}$ of retail price. \$100 starts you in business. Write for details! All-Time Mfg. Co., Dept. M3, New Britain, Conn.

WHOLESALE! 10,000 Name brand products. 30-80% discounts! New illustrated catalog. Terrific business plans included free! National Distributors, Paramus 7, New Jersey.

FREE Pamphlet, hundreds new small business opportunities. New System, 320 Melrose Building, Houston 2, Texas.

MAKE Money in landscaping—Start your own business, part or full time. Many good paying positions open. Earn while learning. Send for free book. National Landscape Institute, Dept. M-93-C, 310 S. Robertson Blvd., Los Angeles 48.

"100 CASE Histories of Successful Small Businesses." By editors of "Fortune" Magazine. \$4.50 postpaid. Details, Fabian Co., 5160 St. Urbain, Montreal 14, Canada.

MAKE \$5,000 Yearly with a lettership. Start small. Employ others. Publisher, 1018 S. Central, Burlington, Iowa.

OPERATE Profitable mail order business. Splendid opportunity. Write Blair Co., Perkinston, Miss.

TIN-Cans. Turn them into cash. Thirty methods. Instructions 50c. Charles Company, 12-DXB, Norwood, Ohio.

BUY Wholesale. Thousands name brand products. Free literature. Triple J Industries, 132 Berkshire, Bridgeport 8, Conn.

UNCLAIMED Watches pay big profits. All brands. \$4.95 up. Illustrated folder free. Cosmos Sales, 81 East 125 St., New York City 35.

LEARN Sharpen scissors. Profitable, easy instructions, \$1.00. Milton Leiser, Box 85, New York 51, N. Y.

FRANCHISES Make profits! Become exclusive franchised distributor, agency operator. Nationwide opportunities. Information rushed. National Franchise Reports, 333 North Michigan, Chicago 1.

MAKE Tough, attractive building plastic, easily, 88 $\frac{1}{2}$ % waste. 101 uses. 800% profit. Exclusive district. Grab it. Bays Laboratory, Oklahoma City 9.

\$5.00 HOURLY Bronzing baby shoes sparetime! Foster, 1520 Ardmore, Chicago 26.

BUY Wholesale, 800,000 items. Write Info-Center, 216 West Jackson Blvd., Chicago, Ill.

\$26,500 SALES in two weeks! Amazing radio-mail order method. Free details. Broadcast Service, 1413-A Great Northern Building, Chicago 4, Illinois.

BUY Wholesale, resell wholesale or retail. Lowest prices, biggest profits! Complete plan free, catalogue 50c. Thunderbird, Box 871-E, Killeen, Texas.

\$80.00 WEEKLY. Operate our selective mail-order business in your area, sparetime. Write House of Plastics, Paramus 25, New Jersey.

BARGAIN. 20 Ways each to make money from sawdust and tin-cans. Nine ways for glass-bottles. 50c each. 3 for \$1.00. Fender, Box 448-ACP, Kalamazoo, Mich.

OPERATE "Escalator" mailorder system, selling our products or any products. Most revolutionary mailorder system known. Postcard. Selbyco, Decatur 260, Illinois.

MEN-Women wanting \$10,000.00 yearly and better. Just ask tired people to use amazing new product without putting up money. Tested and approved Crosby Research Institute. Hire your own agents. Don't bother us unless you are go-getter. Normal-aids, 657 North Arden, Los Angeles 4, California.

UNUSUAL Opportunity, handspinning Angora wool. Fascinating, profitable. Angora House, PM, Springfield, Illinois.

EXPORT Business made easy! Expect something different. Complete setup, everything furnished. Hermes, 152 West 42, New York City 36.

SAWDUST. Turn it into cash. Forty methods. Instructions 50c. Charles Company, 12-DXA, Norwood, Ohio.

LEARN New product promotion. Start national business from home promoting your own new product ideas. Sell through retailers, wholesalers, chains, agents or by mail. Expert instruction. Details free. Banning AS, 40 South Los Robles Avenue, Pasadena 1, California.

FINEST Formulas for making world's fastest sellers. Literature free! Miller, Chemist, 1517-R, Tampa, Florida.

ADVERTISING Business—City, country. Low overhead, substantial income. Experienced advertising company offers complete setup. Harold, 69-S Bennett, New York City 33.

\$100.00 WEEKLY. Mail-order distributors wanted. Work at home sparetime. Experience unnecessary. Write: National Distributors, 340 Rt. 17, Paramus 1, N. J.

START Electrically operated parking lot. No experience. Amazing profits. Works while you sleep. Read ad on page 257.

YOU'LL Be amazed at the tremendous profit possibilities in the finest quality Bibles available anywhere! Many men make \$30,000 yearly and more! Get my free proven Bible sales course plus catalog of highest quality Bibles and related items. Joseph W. Cain, Wholesaler, Box 5063P, San Antonio 1, Texas.

MAKE Money helping others out of debt. Stop garnishments, save jobs, re-establish credit. Details free. Borum 87, 411 West Walnut, Kalamazoo 42, Michigan.

25 DIFFERENT Products mailed direct to your customers. Big mail order business without investment or inventory. Terrific sellers. Turner Company, 1170 Broadway, New York 1, N. Y.

\$70 WEEKLY—Home, spare time. Simplified mail bookkeeping. Immediate income, easy! Auditax, 34757AR, Los Angeles 34.

SELL Pen and pencil sets—Jeweled pens. Write for catalogue. Supercraft Mfg. Co., Dept. M, 445 Broome St., New York 13, N. Y.

MAKE Extra money between now and Christmas. Sell subscriptions to all popular magazines. Liberal commissions. For supplies write DeSales Magazine Service, 60 East 42nd St., New York 17, N. Y.

MINIATURE Trees. Why pay \$2.00-\$10.00 for growing secrets? Free details. Tiny Trees, Box 3084-P, Chicago 54.

AMBITIOUS? We establish you in your own business, supply catalogues, circulars etc., ship orders under your name, paid or c.o.d., show you exactly what to do. Household items needed in every home. Sell direct, by mail or through agents. Complete details absolutely free. Write Topval Corp., Lindenhurst 618, New York.

\$1,000 MONTHLY. Home, mailorder, free advertising method. Revealing information. Seidel, 6000-AI Sunset, Los Angeles 28.

BUY Wholesale! 100,000 name brand products! Save 66 $\frac{2}{3}$ %! Big profits selling others spare time! Free catalogs! National Buyers Service, Box 426EE, Oakland, Calif.

PRINT Without a printing press! Amazing new method! Print colorful signs, banners, cards, posters, glassware; anything at home. Big profits. Moneymaking opportunity! We supply everything. Beautiful sample, home-business plan free! Write Screen-Print Company, PM-9, Los Angeles 61, California.

FREE. Money making ideas, tips. Crystal, 38 Myles, Levittown, New York.

GET Merchandise orders by mail! Everything furnished—Orders filled. Big profits. Long, McKays Beach, Leonardtown 3, Md.

PROFITABLE Home collection office. Experience unnecessary. Details free. Hyatt, 411 West Walnut, Kalamazoo, Mich.

LIVE As we do. \$15,000 to \$40,000 annually. We vacation 365 days a year in this scenic sportsman's paradise. You can do the same. Experience unnecessary. Our 4,000 word prospectus shows you step by step how to organize and conduct this exceptional and lucrative business. No selling. Involves a public service which is being overwhelmingly accepted. Largely conducted through mail channels. Minimum capital required; start small, expand rapidly. Within a few months you should be paying yourself \$1,000 monthly, inserting the balance into the business. Our money-back guarantee assures your success. The magnitude of this offer makes its value unlimited. Our fee is \$3.00. Air mail your check or money order today. Terry O'Donnell, Farewell, Alaska.

\$25,000.00 BONUS Offered by U. S. government—Fortunes being made in uranium! Free booklet shows "How To Make Money Prospecting for Uranium." Please enclose 20c for handling, postage. Geiger Co., 195-PM5b Sackett Street, Brooklyn 31, N. Y.

\$3.75 HOURLY Minimum, evenings. Preparing tax returns—Simplified! Auditax, 34757AT, Los Angeles 34.

NEED Cash? For "know-how and where," write Business Service, 201 Bank Bldg., Cole Camp, Mo.

MAKE Big money in your spare time! Sell nationally advertised brand name merchandise. Appliances, cookware, housewares, watches, jewelry, dry goods, clothing, sporting goods, toys, gifts, etc. Build a profitable repeat business. Send for free 110 page illustrated color catalog with separate confidential cost sheet. Merit Home Products, Dept. PM9, 107 Manhattan Ave., Brooklyn 6, N. Y.

WHOLESALE! 16-80% Discounts! Appliances, tools, etc. Catalog 25c. Levesque Supply, Atlanta, New York.

NAMES Of ambitious men seeking own business. Recent, 1000, \$6.50. MacLaughlan, 378 Baldwin, Jersey City 6, N. J.

WHAT'S New in mailorder? Let "Mail-order World," published monthly, keep you informed. Sample, 25c. Wayne, 1233 Elden, Los Angeles 6, Calif.

NEW. Unique plan can earn hundreds of dollars for you. Free details. No obligation. Write: Best Distributors, 200 West 34th St., New York City 1, Suite 1003.

EXTRA Money sparetime sharpening farm discs. \$20 to \$25 daily profits. No dismantling—No moving. Simple portable machine sharpens whole disc right on farm. Free plan explains. B. L. Foley Company, Columbia Heights, Minnesota.

"FROG Raising!" Season just starting. Get this year's eggs. New book tells how. Folder 10c. Brool-A, Box 506, New Orleans 1, Louisiana.

DOLLARS: Baby record books, Kitty Kat shoes, My Baby albums, eleven thousand new prospects daily. Sold by mail, use our literature. No-Co-Ro, Oakland 6, Calif.

EARN \$35.00 Daily! Sell Liqui-Moly, new wonder lubricant for cars, trucks, buses, tractors. Used in jet engine, atomic energy plants. Nationally advertised magazines, newspapers, radio, television. Over 3,000,000 cans sold. Territories available. Write Moly Products, 314 Scholes Street, Brooklyn 6, N. Y.

WANT UP to \$100.00 weekly deposited in your mail box? Details free! Smith, 2708-P Ladera, San Bernardino, Calif.

SELL Printed stationery, business cards, by mail! Free catalog, samples. Sutton Printing, Box 853-M, Waycross, Georgia.

BUY It wholesale! Manufacturers, distributors offer 850,000 items. Literature free. Olsen, 1231-A East Third, Duluth 5, Minnesota.

START Home business, sparetime, opportunities unlimited. Write, Heam, Box 8892, Richmond 25, Va.

WHOLESALE Catalog of tools, sporting goods, jewelry, toys, etc. available free. Open your own business. No investment. J. M. Arnoff Company, Dept. X, 24470 Lakeland Blvd., Cleveland 23, Ohio.

ELECTROPLATE Auto parts, novelties, mirrors, baby shoes. Easy, inexpensive home processes. Free booklet. Tyco Metals, Box 13231-MM, Houston 19, Texas.

WHOLESALE. Thousands items. Supply source list. 10c. Idealer, Park Ridge, Ill.

LEARN Sewing machine repair. How to make big money at home sparetime. New machines. Everything supplied. Write Taylor Service, Box 2128, San Bernardino, California.

\$5 TO \$10 An hour. I've did it. I'm disabled now. Real genuine offer. Complete information only \$1. Lucas, 2200 Carson St., Pittsburgh 3, Penna.

IMPORT-Export opportunity, profitable, world-wide, mail-order business from home, without capital; or travel abroad. Established world trader ships instructions for no-risk examination. Experience unnecessary. Free details. Mellinger E701, Los Angeles 24.

REBUILD Batteries; repair dolls; make rubber stamps; silk screen printing. Catalogue "50 Ideas" free. Universal, Box 1076-A, Peoria, Ill.

BREED Rare tropical fish at home. Earn big money! Learn secrets! Help fill huge demand. Amazing opportunity! Free plan. Tropical Fish Breeders, Los Angeles 61, Calif.

HOW And where to obtain capital. Particulars free. Star Service, Wapakoneta, Ohio.

BE Appointed state notary public now. Write, Stationers, Helotes, Texas.

I want to send you proof of the wonderful pulling power of Popular Mechanics classified pages. What's your proposition? Write me today. Include literature if possible. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

FORTUNES Made raising crickets and fishworms. Write for free information. Carter Farms, Plains, Ga.

MAKE Money growing miniature trees on your window sill. Free seed and plan. National Nursery, Dept. FC, Inglewood 4, Calif.

FREE Folio "Up to \$45,000; Unlimited Vacations." No merchandise, equipment. Unknown! Work home, sparetime! Haylings, Carlsbad, Calif.

MONEY In sparetime fixit shop at home. Repeat cash business. Experience unnecessary. No selling. Free booklet explains. Victor Foley Company, Columbia Heights, Minnesota.

WE Love our mailman—He leaves over \$1000.00 monthly in our rural mailbox. My college professor husband drafted a scientific home mailorder method. We bought a Texas ranch, live as we always wanted. Now we sell the Ranch Mailorder Method. Operates anywhere. Inquire: Eveningshade Ranch, Helotes, Texas.

RESILVERING Mirrors, formula 50c; two-way lockout mirrors, (No one sees you), 50c; coppered mirrors, 50c. All \$1.00. Nelko-Mir, Box 3462-J, Chicago 54.

POPCORN And potato chip equipment. Eakins, Box 933-A5, Springfield, Ohio.

MEN—Income from local information. No selling. Neherco, LaVerne, California.

RUBBER Molds for casting plaques, figurines, novelties. Catalog illustrating over 100 fast sellers, 10c. Castcraft Studios, 508-PM Marion Street, Brooklyn 33, N. Y.

NEWEST Spare, full-time home business. \$5 to \$10 hour possible. Paint with suede. The finish with touch and eye-appeal. Beautiful auto dashboards, signs, radios, toys, figurines, lamps—1001 others. Complete, step-by-step instructions sent for no-risk examination. Free details. Coast, Los Angeles 61.

START Home manufacturing business. Make cleaners, soaps, polishes, cosmetics. Free literature. Kemix, Park Ridge, Ill.

IMPORT-Export mailorder opportunities! Details. Warner, Box 6, Fort Scott, Kansas.

NATURAL Molding rubber, extra thick. Free sample. Flock, W. Wooley, 115-A Donald, Peoria, Ill.

BOOKKEEPERS, Keep books, small firms spare time. Manual latest technique by C.P.A., \$3.00. Modern Business, Box 406, Youngstown 1, Ohio.

COPUBLISH Mail Sale Advertiser, leading mail order paper. Details, latest copy, dime. Vanroy Shirk, Lebanon, Penna.

GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay \$3.50 lb. We paid Babbitt \$4,165.00 in few weeks. Free book. Washington Mushroom Ind., Dept. 172, 2954 Admiral Way, Seattle, Washington.

\$25 WEEKLY Working two hours daily at home. Lycke, Box 2471-A, Cleveland 12, Ohio.

OPERATE Profitable mail order business. Write Walter Service, 4159-A East 112th, Cleveland 5, Ohio.

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries Company, Grand Rapids, Minnesota.

MINK Raising information free. Complete. Lake Superior Mink Farm, Superior, E.E.I. Wisconsin.

FREE Book "505 Odd, Successful Businesses." Work home. Expect something odd! Pacific, Oceanside, Calif.

MONEY In new greaseless doughnuts. Start in kitchen. No smoke. Sell stores. Free recipes. M. Ray Company, 3605 South 15th Ave., Minneapolis 7, Minn.

VENDING Machines—No selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, Dept. 73, 715 Ensor St., Baltimore 2, Md.

BRONZE Baby shoes. Instructions, equipment and mountings for genuine electroplated process. Free catalog. Hollywood Bronze Supply, Dept. B-3, 1624 East First Street, Los Angeles 33, Calif.

YOUR Own name brand business. No investment; no inventory. Part time or full time. Sell famous brands of appliances, housewares, silverware, radios, vacuum cleaners, lamps, tools, clocks, watches, jewelry, etc., over 1000 items. Join thousands of successful independent dealers. Send for free catalog and dealer price list. H. B. Davis Corp., Dept. W, 145 W. 15 St., New York City.

LIQUID Rubber. Make flexible molds. Free sample. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

STEADY Profits, home-operated business. Simply add water to concentrates. Make waterless hand cleaner, chrome renewer, etc. Free samples. Western B Aircraft, Los Angeles 19.

GOOD Paying business silvering mirrors, plating articles in the shop and home by late method. No tanks or shop required. Free booklet. Gunmetal Co., Ave. H, Decatur, Illinois.

GROW Orchids at home—Profitable, fascinating. Year 'round, Maine to California. No greenhouse. Gorgeous cattleyas, cymbidiums, etc. Successful home grower shows you how. Full details free. Flowerland, 4623 Wilshire, Los Angeles 5.

FIX Typewriters. Inexpensive home course teaches factory secrets. Free booklet. Write, Typewriter, Tarentum 1, Penna.

\$200 WEEKLY Cleaning Venetian blinds. Free book. Burt, 2434A, Wichita 13, Kansas.

WANT To make big money at home? \$5 profit in an hour possible with invisible re-weaving. Make tears, holes disappear from clothing, fabrics. Steady year-round demand from cleaners, laundries, homes. Details free. Fabricon, 8334-S Prairie, Chicago 19, Ill.

MONEYMAKING OPPORTUNITIES

MAKE Money at home as renewal headquarters for all magazines. Big Christmas sales profits now. Liberal commissions. Supplies furnished. Experience unnecessary. Write for free catalog. McGregor Magazine Agency, Dept. 500-C, Mount Morris, Illinois.

NEWLY Found money in Whitehall's fascinating photo line of Christmas and everyday cards, jewelry, gift items. Personalized stationery, napkins. Send for free samples. You, too, can make big money with Whitehall's photo line. Whitehall Studios, 25 Main Street, Elmira, New York.

START A buying service, buy wholesale thousands nationally advertised products. Make big profits selling at sizable discounts. Postcard brings details. American Buyers, Hertel Station, Buffalo 16-D, N. Y.

FOR Moneymaking mailorder plans write Central Sales Outlet, Robbins, N. C.

BRAND New opportunity. Free details. Reliant Sales Company, Box 55, Bangor, Penna.

LEARN Technical metaphysics and insure your future. Easy, inexpensive correspondence course. Simplest method known. Diploma. Write: Premier College of Technical Metaphysics, 2532 McKenzie St., Vancouver 8, B. C., Canada.

SELL Helbros watches-jewelry. 70% discount. Wholesale catalog 25c. Dorinda, Box 77, Huntington Station, New York City.

MAKE Spare time money preparing and mailing sales literature. Adams Surveys, 3513-AT Sunset Blvd., Los Angeles 26, Calif.

FREE! "301 Profitable Small Businesses!" Amazing shoestring plans! Work home! Start sparetime. Deumant Surveys, Kenmore 23-PM, N. Y.

SCHEMER Magazine. Canfield 1, Ohio. Mailorder and business plans. Year \$2.00, sample 25c.

OPPORTUNITY Mails three months 25c. Donovan, 791 Greenbelt, Levittown, N. Y.

\$1,000 MONTHLY Possible raising earthworms! Backyard, garage, basement. Complete illustrated booklet explains raising, feeding, packing, marketing. 25c postpaid! Ozark Worm Farm-J, Willow Springs, Mo.

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

BOOKS! Novelties! Moneymaking opportunities! Free circulars! Edward Koliba, 1310 Ewen Avenue, New Westminster, B.C., Canada.

PRIZE Contests provide fabulous and confidential home income opportunities! Here's how and where to win your share! Send stamp! National Contest Bulletin, Box 2685, Miami 16, Florida.

\$5—\$10 AN Hour teaching driver training in your own car. Complete detailed information \$1.00. Driving School Services, Box 428P, Goleta, Calif.

MAKE Money with camera. Professional secrets \$1.00. Brewer—Photographer, 5880 Hollywood, Hollywood 28, Calif.

RETIRED? Over 60? Want to earn money full-part time? No selling! Get free information! Burns, 1967-P, Gerritsen, Brooklyn 29, N. Y.

BIG Interesting mail. Business opportunities. Magazines, samples, etc. 25c. Oryder, Box 187, Barberton, Ohio.

RAISE Earthworms—Illustrated instructions 25c. Birchall, Box 8065-L, Orlando, Florida.

"MONEY Getter's Bulletin." Prints helpful money-making ideas, plans, tips. Sample 25c; details free. Distributors, Box 831-D, Monessen, Penna.

SELL Titania gems; far more brilliant than diamonds. Catalog free. Diamonite, 1404-M Mitchell, Oakland 1, California.

YOU Cast metal products. Free literature. Box 124, Lynwood, California.

START Your own toy business. Assemble, finish and sell wooden toys. Milled parts and kits available. Write Fulton Mfg. Co., Box 707, Blowing Rock, North Carolina.

EARN \$50.00 Daily making mats, shoes and mud guards from old tires. S and S Patents Inc., 1307 North Clark St., Chicago 10, Ill.

\$5 TO \$10 An hour. I've did it. I'm disabled now. Real genuine offer. Complete information only \$1. Lucas, 2200 Carson St., Pittsburgh 3, Penna.

MAKE To \$300 extra. New! Different! No selling! No mailorder! Details free. J-M Enterprises, 801½-A North Marsalis, Dallas 3, Texas.

DOLLARS In baby record books, baby shoe kits. Liebig Industries, Beaver Dam 2, Wisconsin.

FREE Literature describing moneymaking mailorder plans. Lewis Barlett, Richland, Georgia.

BUILD Sales by recruiting productive distributors selling direct or to retail outlets. Secure most concentrated circulation through classified columns of Salesman's Opportunity. Write for facts. Gilbert, Salesman's Opportunity, Room 1700, 850 N. Dearborn, Chicago 40.

FREE Folio "Up to \$45,000; Unlimited Vacations." No merchandise, equipment. Unknown! Work home, sparetime! Haylings, Carlsbad, Calif.

SPARETIME Profits taking subscriptions all magazines. Wholesale catalog free. Cassell Publishers, Westfield, New Jersey.

GENERAL Contest Bulletin. Issued monthly. Sample, 25c. 1609½ East 5th, Duluth, Minn.

GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay \$3.50 lb. We paid Babbitt \$4,165.00 in few weeks. Free book. Washington Mushroom Ind., Dept. 173, 2954 Admiral Way, Seattle, Washington.

50,000 ARTICLES Wholesale. Source directory, dime. Nelko, Box 3462-DR, Chicago 54.

FREE Book "505 Odd, Successful Businesses." Work home. Expect something odd! Pacific, Oceanside, Calif.

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

ATTENTION: Typewriter owners. Make handsome profits. Write today. Groves Company, 682, Hastings 8, Nebraska.

START A profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions paid for new and renewal subscriptions. Start earning money in this pleasant work at once! Clip this ad and send with your name and address to: Agency Bureau, Dept. PM, Hearst Magazines, 230 West 55th St., New York 19, N. Y.

LEARN Directing money-raising campaigns for churches, hospitals, institutions. Earned \$3065 in six weeks on my first campaign on \$50 investment. Unlimited field. Course backed by 35 years experience. William Arbogast, 229 East Mason Avenue, Alexandria, Virginia.

400% PROFIT. Seal in plastic the machineless way. Material and instructions \$1.00. Thompson's, Box 482, Mt. Ephraim, New Jersey.

WHOLESALE Watches, jewelry, folders free. Write Updegraff's, 459 North Schenley, Youngstown 9, Ohio.

DENVER Opportunities listings \$1.00. Airmailed. Rivers, 3055 Jackson, Denver, Colorado.

FREE. Home business plan. Samples, details. Fender, Box 448-ACQ, Kalamazoo, Mich.

\$100 OR More month spare time at home. Free information. World Sales Co., Box 179 PM, Ripley, Mississippi.

START A mail order business. Mail your own 8 page catalogue. 35 attractive items. No stock to carry, we ship your orders, 40% profit. Send \$2.00 for sample test 30 catalogues and information. Tepper Co., 111 Fifth Ave., New York 3, N. Y.

SELLING Is easy the copyrighted Elmer Wheeler way! Learn at home from America's super salesman. Earn big money full, spare time. Sure-fire method insures success. Details free. Wheeler, Dept. E-9, 684 N. Michigan, Chicago 11, Ill.

SCHOOL Seniors—Sell classmates America's most beautiful graduation name cards. Largest selection. Highest commission. Outsell all others. Free sample kit. Printcraft, Dept. M, 1509 Maple Street, Scranton 5, Penna.

MAKE Money with your typewriter! Details 25c. Barnett, 4033-89 Verona, Cleveland 21, Ohio.

WANT To go in business for yourself without capital? We show you how. Start part time your own home. Postcard brings details absolutely free. Topval Corp., Lindenhurst 620, New York.

BUY Wholesale! Save 66%!! Appliances, furniture, jewelry, toys, sporting goods, tools. Free catalogs. National Buyers Service, Box 426EB, Oakland, California.

HAVE Home business—Get \$10 orders in every mail. Keep \$8.00. Everything supplied. National, Box 88-W, Dorchester 22, Massachusetts.

HUGE Profits! Jigsaw necessary: 10c brings valuable patterns, illustrated information. Woodart, Bridgewater, Mass.

DO Home mailing. Simple, no selling, good income. Free details. National Industries, 33 Hyde Park Ave., Jamaica Plain 30, Mass.

DON'T Throw away those box tops, wrappers, labels. They are worth money. 25c brings information. Eschem, Box 4227, San Francisco, Calif.

EXCEPTIONALLY Profitable homework for adults. Free information. Baron's Recording, Lynden, Washington.

DO-It-Yourself! Money-making! Savings! Make perfumes, shampoo, remedies. Many useful products. Money-making ideas! 2 formulas and lists free. Tzane, 806AZ Lyon St., San Francisco 15, Calif.

FORMULAS, PLANS, ETC.

MODERN Formulas for today's fastest selling big-profit products. Literature free! Miller, Chemist, 1517-N, Tampa, Florida.

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

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse 4, N. Y.

PRODUCT Analysis, manufacturing formulas, processes developed. Moderate fees. Plastics, Box 1574, Boston 4, Mass.

ONE Commercial formula and catalog \$2.00. Milici-PM-Chemist, 1709 W. 7th St., Los Angeles 17, Calif.

PLASTICS

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

PLEXIGLAS. Cut to size. Clear. Any thickness. Colors. Rods. Tubing. McClarin Plastics, P.O. Box 168H, Hanover, Penna.

PLEXIGLAS, Fiberglass, polyester, acetate, vinylite. Fast service. Wholesale-retail. Catalog 15c. Gem-O-Lite, Box 6861P, North Hollywood, California.

MAKE Money laminating. Complete kit \$2.00. Klein, 1804 Harrison, New York City 53.

PLASTIC Glass. Any size transparent sheets $\frac{1}{8}$ ". \$1.10 square foot. Ultra Plastics Mfg., Pitman 23, N. J.

ACRYLIC Plastic, water clear solution for coating brass lamps, silverware, chrome, fishing rods, tools, lampshades. 8 ounces \$2.00. A. B. Dunn, Department A, Box 5537, Chicago 80, Illinois.

PLASTICS Home-craft course for men and women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for free booklet. Interstate Training Service, Dept. D-3-J, Portland 13, Oregon.

PLEXIGLAS, Lucite. Square foot cost $\frac{1}{16}$ ", \$1.15; $\frac{1}{8}$ ", \$1.52; $\frac{3}{16}$ ", \$1.86; $\frac{1}{4}$ ", \$2.21; $\frac{3}{8}$ ", \$3.25; $\frac{1}{2}$ ", \$4.38. Colors add 10%. Send 15% for postage. Aristocrat Plastics, 55 Clarkson St., New York City.

CHEMISTRY

NEW Idea chemical and apparatus outfits for home experimenting, photo-scales, microscopes, chemicals, biologicals and laboratory supplies in small quantities. Catalog 25c. Established 1931. John H. Winn, 124A West 23rd St., New York, N. Y.

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

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

CHEMICALS, Supplies, microscopes. Catalog 25c. Laboratory Sales, Box 161-A, Brighton, Mass.

AMAZING New Book of Science. Experiments, formulas and catalogue of laboratory supplies. Only 25c. National Scientific Co., Dept. PM-9, 2204 W. North Ave., Chicago 47, Illinois.

AGENTS WANTED

WOMEN, Men, make money spare time plus new car as bonus for encouragement. Amazing hosiery guaranteed to wear without holes, snags, and runs, or replaced free. For example, lovely 60 gauge nylons guaranteed for as long as 1 1/4 years, or replaced free. Write Wilknit, 1759 Wash., Greenfield, Ohio.

\$204 WEEKLY Selling miracle double-gloss, car wax, paste, glaze and wax, cleans and polishes in one easy operation, outshine them all, wipe on, let dry, wipe off, sells on demonstrations. Details free. 1/2 lb. can \$2. Norman Wiggs & Company, 1406 E. 52nd St., Los Angeles 11, Calif.

MAKE Money introducing world's cutest children's dresses. Big selection, adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. P-4341, Cincinnati 25, Ohio.

IMPORTING Without capital. Become successful U.S.A. resident agent for leading overseas manufacturers. High income, home operated, no risk. Complete arrangements furnished including U.S.A. distribution assistance. Impex, 1974-A Comstock, Los Angeles 25.

SELL Newest rage tall style Christmas, all occasion greeting card assortments in spare time. Unusual wrappings, novelties. Make up to \$1.00 per box plus bonus. Write for feature boxes on approval. 77 free samples personal Christmas cards, stationery, free catalog. New England Art Publishers, North Abington 933-K, Mass.

MAKE More money showing Elmira greeting cards this Christmas! Why more? Because Elmira offers more variety; beautiful cards for every taste, every purse. You get heart-warming, old-fashioned favorites and smartly simple ones for today's tastes. No matter who you sell, Elmira has a style to please everybody from grandmother to young Mrs. Executive. Send today for free personalized samples, catalog and sparkling assortments on approval with personalized stationery, imprinted napkins and lovely gift wrappings! Elmira Greeting Card Co., Elmira 200, N. Y.

\$119.02 IN One day! That's what Mrs. Orr of Minn. made, selling our new, unusual gifts, gadgets, greeting cards, imprinted stationery, toys and jewelry to friends and neighbors. Sell spare time or full time—Up to 100% profit. Write today for big free catalog and complete details. Hurry—Cash in on sensational Christmas profits! Greetings Unlimited, 3605 Park Square, St. Paul, Minn.

PROFIT With your own wholesale, name brand catalog. Appliances, watches, jewelry, gifts, tools. Imprint your name on cover. Full or part-time sales. Details free. Robel Sales, Dept. P.M., 487 Broadway, New York 13, N. Y.

BEAUTIFUL Feather pictures. 200% profit! Free sample. Apartado 9036, Mexico 1, D. F.

MAKE Money at home as headquarters for all magazines. Earn big Christmas profits. Liberal commissions. No experience, capital needed. Supplies furnished. Write McGregor Magazine Agency, Dept. 500-A, Mount Morris, Illinois.

BUY Wholesale thousands nationally advertised products at big discount. Free "Wholesale Plan." American Buyers, Herchel Station, Buffalo 16-A, N. Y.

150% PROFIT Selling 500 name and address labels. Retail \$1.00. You keep 60c profit. Free selling kit. Bruce, Box 71-Y, Boston 1, Mass.

"FUN And Profit in Selling." Beginner's booklet by retired sales manager. Inspires confidence. Helps remove mystery from selling, only \$1.00. Hylsand, P.O. Box 2216, Cleveland 9, Ohio.

NEWLY Found money in Whitehall's fascinating photo line of Christmas and everyday cards, jewelry, gift items—Personalized stationery and napkins. Send for free samples. You, too, can make big money with Whitehall's line. Whitehall Studios, 25 Main Street, Elmira, N. Y.

SELL Sunshine cards, the name quality has made famous. No investment or experience necessary. 21 card deluxe tall slim assortment sells on sight! Imprints, Currier-Ives, religious, gift wraps, many others. Samples on approval, write: Sunshine Art Studios, Inc., Dept. PM-9, Springfield 1, Mass., Pasadena 1, Calif. (Note: East of Rockies address Springfield office.)

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

NEW Plastic mending tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 72, Akron, Ohio.

BIGGER Profits selling greeting cards. Get list of sensational factory surplus bargains. \$1.25 boxes for 50c. \$1 boxes for 35c—while they last! Big line new 1955 Christmas cards, stationery, gifts. Assortments on approval. Personalized samples free! Midwest Cards, 1113 Washington, Dept. 557-D, St. Louis 1, Mo.

AGENTS-Salesmen: Sell beautiful hand-colored plastic enlargements and sensational new personalized photo compacts, rings, bracelets, lockets, etc. Experience unnecessary. 40% advance commissions. We deliver, collect. Wonderful sideline. Better full time. Free sample outfit. Novel Portrait Co., 3343 North Ave., Chicago, Ill.

AT Last! Something new and sensational in latest tall Christmas cards. Make extra money fast! Show satins, velours, metallics. Gets easy orders. Pays up to 100% profit. 30 free samples. With name 50 for \$1.50. Big line. Amazing convertible pen-pencil, napkins, gifts, stationery. Several \$1.00 boxes on approval. Puro Greetings, 2801 Locust, Dept. 540-L, St. Louis, Mo.

STARTLING Discovery. Cleans white-wall tires like magic. Spray on. Sponge off. Whirlwind seller. Profits galore. Write for free sample offer. **Chemade Products Company, 777 Bayside, Detroit 17, Mich.**

SELL Miracle crosses Lord's Prayer easily read size of pin head in center. Rhodium finish cross has 10 large rhinestones and neck chain gift boxed. Send \$1.00 for sample, \$9.00 dozen. **Herman's, 2 Beaver St., Newark 2, N. J.**

AMAZING Unbreakable plastic housewares for bigger profits. Also tablecloths, drapes, utility covers. Free catalog PM59. **Acclaim, Box 4, New York 40, New York.**

SHINE Cars without polish. New invention. Lightning seller. Cars gleam like mirror. Samples sent on trial. **Kristee 75, Akron, Ohio.**

AGENTS: Sell Mexican feather cards. Good profit. Free sample. **Apartado 7118, Mexico City.**

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

COMBINATION Hand cleaner and spot remover. Millions sold. Sample, quarter. **Murphy Yale, Meriden, Conn.**

AMAZING Tall-Glow, Kodachrome Christmas cards sell swiftly. Free samples. \$52.50 profit on 50 boxes easy! Many cards, stationery, novelties. Profits to 100%. Gift bonuses. Samples on approval. **Hurry—Get sensational mail minder free. Creative, 4401 Cermak, Dept. 518-B, Chicago 23.**

WANTED: Men interested in making up to \$15,000 a year. Exclusive line of personalized articles. No investment. Free information and sales kit. Write **Hook-Past, Box 480 (PM), Rosnoke, Virginia.**

TREMENDOUS Profits! Every man, woman and child a customer. Suits \$1.50, pants 35c, dresses 20c, shoes 20c. Operate from store home, car. Free catalog. **Superior, 1250-A Jefferson, Chicago 7.**

LOWEST Wholesale prices. Thousands of name brand items. Free literature. **Parker Distributors, Box 55 (Dept. C) Williamsbridge Sta., New York City 67.**

FREE Color catalog of religious jewelry. 100% profit. Virgin Mary heart necklace, sample \$1.00 (value \$2.50). Money back guarantee. **Stephen-New York Inc., 1947 Broadway, New York 23.**

CHRISTMAS—All occasion cards, novelties and gift items. Largest selection. Highest profits. Satisfaction guaranteed. Send for sample offer coupon now! **Klots Distributing Co., Dept. 89A, 1012 Western Ave., Toledo, Ohio.**

EARN \$35.00 Daily! Sell Liqui-Moly, new wonder lubricant for cars, trucks, buses, tractors. Used in jet engine, atomic energy plants. Nationally advertised magazines, newspapers, radio, television. Over 3,000,000 cans sold. Territories available. Write **Moly, 314 Scholes Street, Brooklyn 6, N. Y.**

EARN Extra dollars selling cameras, film, projectors, recorders, typewriters, etc. Write: **Gladrose Gift Co., 150-M Broadway, New York 38, N. Y.**

EARN \$200 A week and up! Amazing profits are yours selling Seal-Tite, miracle puncture-proofing discovery! \$1.98 tube stops flats forever. Sure-fire appeal to America's \$6,000,000 motorists! Complete sales kit free on request. **M & M, Dept. M-2, 842 Third Ave., New York City 23.**

WHOLESALE Catalogue! Appliances, cameras, watches! **Anelag Industries, Rochester 1, Wisconsin.**

EARN \$150.00 Per week, giving away stainless steel tableware. **Nueblings-M, Sicklerville, N. J.**

\$5 TO \$10 An hour. I've did it. I'm disabled now. Real genuine offer. Complete information only \$1. **Lucas, 2200 Carson St., Pittsburgh 3, Penna.**

YOUR Own business—Used suits \$1.50, overcoats 65c, mackinaws 35c, shoes 12½c, ladies coats 30c, dresses 15c. Enormous profits. Catalog free. **Moro, 1218AA South Jefferson, Chicago 7.**

HAVE Your own business, buy wholesale, make big profits. Free general mdse. catalog. **Jay Norris, Dept. P, 445 Broome St., New York.**

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

GOLD Or silver letters, numbers. Windows, doors, trucks. 1" to 6". 500% profits. Free samples. **Atlas-T, 344 West 79th, Chicago 20.**

MAKE Extra money. Sell front door name plates to friends, neighbors. Retail \$1.98; you make \$1.00! Free selling kit. **Modern Engraving Co., P.O. Box 194, Boston 14, Mass.**

\$1.00 PROFIT Selling \$2.95 photo enlargement deal. **Allen Studio, Riegler Bldg., Little Rock, Ark.**

AGENTS—300% Profit selling genuine gold window letters; stores and offices. Free samples. **Metallic Sign Letter Co., 431-D North Clark, Chicago.**

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

CALIFORNIA Sweet smelling beads. Sensational sellers. Particulars free. **Mission, 2328 FR, W. Pico, Los Angeles 6, Calif.**

RUN Spare-time greeting card and gift shop at home. Show friends samples of our new 1955 Christmas and all-occasion greeting cards and gifts. Take their orders and earn to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. **Regal Greetings, Dept. 78, Ferndale, Mich.**

WHOLESALE Catalogue! Appliances, cameras, watches! **Cam Company, 6806PM 20th Ave., Brooklyn 4, N. Y.**

EARN \$30 A day! Sell Dab-It, amazing pocket-size, stick-form, "no ring" spot remover. Works like magic! Guaranteed! **M & M, Dept. M-1, 842 Third Ave., New York City 22.**

EASY Money selling the new Pro Candid 35 mm. camaras. Your area is open for anyone to cash in on these fast-selling cameras. Selling kits furnished, cash commissions guaranteed. For complete information write **Beaurine Industries Inc., 500 N. Robert Street, St. Paul 1, Minn.**

REAL Diamond rings. Sell direct. Make big middleman's profit. No investment. Experience unnecessary. Free catalog, details. **Gleamlight, 111-R N. Columbus, Mount Vernon, N. Y.**

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing light-weight Presto fire extinguisher. New chemical used by Airforce snuffs out fires instantly. Only \$3.98. Terrific commissions. Millions want it. Free kit. **Merlite, 114 E. 32nd, Dept. 59B, New York City 16.**

AUTOMOBILE Burglar alarms. Free sample offer. **Novak, 3131-W13, Gary 19, Indiana.**

WHOLESALE! Nationally advertised products. **Davis, 759-K Tilden, Flint 5, Mich.**

CAN You sell a popular product; part or full time? Write **Abundavita, 3422 W. 79th St., Ingewood, Calif.**

WHOLESALE Catalog! Appliances, cameras, watches. Postcard. **Selbyco, Decatur 160, Illinois.**

AMAZING Profits selling Kenya gems. Sparkles more brilliant than diamonds. Customers buy on sight. Fastest seller in years. Free literature. **Kenya Shop, Box 5165-P, Pittsburgh 6, Penna.**

WANTED! Salesmen not satisfied with \$10,000 a year. Old established firm has developed amazing new chemical for use in their famous safety equipment. Prospects including industrial users everywhere. **Jesse Lebow, Texas** has already made over \$6,000 this year. No investment. Earnings advanced. Free use of samples. Write **Dept. 364-Q, Box 272, Littleton, Colorado.**

NEW Wonder Dow Corning car polish. Cleans, glazes, weatherproofs year 'round. Really works! Send \$1 (refundable) for pint sample and selling plan. **United, 1035 East 10th Street, Brooklyn 30, N. Y.**

EXCITING Razor blade deal. Free sample, details. **Nucleus Trading, 2440 Amsterdam Ave., New York City 33.**

60% PROFIT On cosmetics—Famous nationally advertised Hollywood Cosmetics pay 60%! Makes \$25 day up! Hire others. For free samples, details, write **Studio Girl, Glendale, Calif., Dept. PM-95.**

SCHOOL Seniors—Be popular with classmates. Have spending money galore. Details free. **Craftcards, Box 235-L, Pittsburgh 19, Pennsylvania.**

RECEIVE Monthly red hot sales item brochure. \$1.00 registration. \$3.00 gorgeous August item free. **Sales Incentives, P.O. Box 923, San Jose, California.**

NEW 29c Kitchen gadget. 300% profit. Sensational seller—housewife, stores, mail. Two samples 25c. Catalog free. **Dohn-Marks, 2308-Z South 8th Ave., Maywood, Ill.**

YOU Can make a fortune with miracle discovery liquid cloth. Mends everything from boats to finest hosiery. Dries soft, durable elastic texture. Sells so fast production increased 34 times already. It's sensational! **Federal Products, Evanston 5, Ill.**

BUY Wholesale 450,000 products. Literature free. **Carter, Box 6011-B, Chicago 80.**

SCHOOL Seniors—Earn sensational profits selling classmates America's most beautiful graduation name cards. Largest selection. Outsell all others. Free sample kit. **Printcraft, Dept. M, 1509 Maple Street, Scranton 5, Penna.**

NEW Way to make money! Sell nothing yourself. Just offer free item to women for every two they sell for you. Household wares needed in every home. Postcard brings catalogue and details of amazing new kind of money-making plan. Absolutely no obligation. **Topval Corp., Lindenhurst 21, New York.**

BUY IT WHOLESALE

WHOLESALE! Musical instruments, phonographs, recorders, watches, appliances, etc. Discounts to 75%! Large catalogue 50c (refundable). **Strauss Music Company, 25-33 Lafayette, Paterson 23, N. J.**

BARGAINS, Joblots, close-outs. 2000 items. Save to 50%. Clothing, hosiery, toys, toiletries, gifts, jewelry, television, etc. Get acquainted. 25c brings wholesale catalog plus free \$1.00 merchandise certificate. **Reliable Jobbing, 311-B North Desplains, Chicago.**

WHOLESALE Catalog! 30-80% discounts! Typewriters, appliances, housewares, watches, jewelry, etc. **Consolidated Distributors, 21-20 Lafayette, Paterson 15, New Jersey.**

INDIVIDUALS. Nationally advertised merchandise. Wholesale. Tremendous discounts. **Kingsley, Chepachet, Rhode Island.**

BUY Surplus wholesale. Catalogue 25c (refundable). **Thomasville, Box 22A1, Penna.**

YOUR Cost as little as 25c on dollar! Household items needed in every home. Sell direct, by mail or to agents. Catalogue, confidential distributors' wholesale prices and money-making plans absolutely free. Rush postcard to **Topval Corp., Lindenhurst 224, New York.**

BUY Wholesale! Save 66%! Appliances, furniture, jewelry, toys, sporting goods, tools. Free catalogs. **National Buyers Service, Box 426EB, Oakland, California.**

SALESMEN—DISTRIBUTORS

CHAMONIS. Retail \$5.00 to \$6.50, whole skin's, wholesale \$2.50. **Kennedy Importers, Box 644, Solana Beach, Calif.**

GOLDMINE Of 600 money-makers. Copy free. **Specialty Salesman Magazine, Desk 5, 307 N. Michigan, Chicago 1.**

DISTRIBUTORS—Large profits. Terrific repeat orders. **Unique Italian brooms, details free. Write P.M. Peacock, 915 Bryant, San Francisco, California.**

NEW Jobs open in selling! Send name, address for five free issues of **Opportunity Magazine's money-making guide**, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. **Opportunity, 850 N. Dearborn, Dept. 17, Chicago 40, Ill.**

\$5 TO \$10 An hour. I've did it. I'm disabled now. Real genuine offer. Complete information only \$1. **Lucas, 2200 Carson St., Pittsburgh 3, Penna.**

BUSINESS Kit free! Postcard puts you in business! Complete line. **Leather jackets, 100 shoe styles.** New discoveries pay big commissions. No investment. Send for free kit. **Mason Shoe, MC37, Chippewa Falls, Wis.**

SELL Calendars. You make big money daily. **Giant line.** Every business buys. Also business printing, book matches, advertising specialties. **Big sales outfit free.** Write, **Arrow Press, 515-R Fourth Ave. So., Minneapolis, Minn.**

WILL You wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to \$30.00 a day even in spare time, without canvassing. W. Z. Gibson, 500 South Throop St., Dept. H-826, Chicago 7, Illinois.

EARN \$30 A day showing our famous boots. Part or full time. No experience necessary. Write for free sales outfit. No obligation. Jim Richards Shoe Co., Dept. M-9, Wellesley Hills, Mass.

WHY Work for peanuts? \$16.95 profit per unit possible with amazing new Alarm-O-Safe. Sells itself. No experience needed. Free sales kit. Merlite-Alarm, Dept. A-509, 114 East 32nd St., New York City 16.

AD Matches! Sell amazing designs—10, 20, 30, 40 and 240-light book matches. Bigger spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy nothing! Sales kit furnished. Match Corp., Dept. PM-69, Chicago 32, Illinois.

BIG Money-making opportunity. Exclusive line work uniforms. Jackets, pants, shirts, coveralls. Advertising embroidered. Every business prospect. Outfit free. Master Div., 570 Water, Ligonier, 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-955, 7530 Greenwood, Chicago.

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

BUY Wholesale thousands nationally advertised products at big discount. Free "Wholesale Plan." American Buyers, Hertel Station, Buffalo 16-J, N. Y.

GET New shirt outfit free: Make \$90.00 weekly on 3 average orders a day. Famous quality made-to-measure dress and sport shirts at \$3.95 up sell fast to all men. No experience needed. Full or part time. Write: Packard Shirt Co., Dept. 133, Terre Haute, Ind.

GOOD Man can make \$3,000.00 next 90 days. Every house in town wants amazing Nilite glowing curbside house numbers. Automatic selling plan pays profits everyday. Write today for details free. Nilite, 173 W. Madison, Dept. M-80, Chicago.

MONEY-Making opportunity! Take big profit orders for world famous patented varieties fruit trees. Also flowering shrubs, roses, vines. Big sales outfit free. Stark Bro's, Desk 30196, Louisiana, Missouri.

SPRAY—Can fire extinguisher. Sell \$2.00, you make \$1.50. Eleven other profitable pressurized spray can products. Amazing sellers, repeaters. Free literature. Strobel Aerosol Co., 2412XX Market, Louisville, Ky.

MAKE Up to 75c profit on each dollar! Household items needed in every home. Have others sell for you on commission. Sell wholesale to agents. Postcard brings details absolutely free. Topval Corp., Lindenhurst 225, New York.

MAKE \$10,000 Yearly selling old line industrial products. We finance, no investment required. Prospects everywhere. Mail \$1.00 for complete booklet, refunded first sale. Bell Laboratory, Inc., 2421 Kilgore, Orlando, Florida.

AGENTS Salesmen. Sell Futurline auto safety belts. 40% commission. Free details. Home Supply Service, Kiel, Wisconsin.

\$15.20 AN Hour is what W. F. Wydallis reports he earns with amazing Presto fire extinguisher. Sells itself. No experience needed. Free sales kit. Merlite, 114 E. 32nd St., Dept. 59A, New York City 16.

EDUCATIONAL AND INSTRUCTION

A Pleasing dynamic singing and speaking voice can be yours! Use self-training Canfield Voco-Records. Thrilling details! 2018-A—5th Avenue South, Minneapolis 4, Minnesota.

ORTHODOX Bible courses. Earn degree. Free bulletin! Bible School, 517 Merchants Bank Bldg., Indianapolis.

BE A real estate broker. Study at home. Write for free book today. GI approved. Weaver School of Real Estate, 2018P Grand, Kansas City, Missouri.

UNIVERSITY Degrees by residence, correspondence. Golden State University, Box 2883, Hollywood, Calif.

PIANO Tuning pays. Big money in spare time. Learn at home in 30 days. No musical knowledge necessary. Phonograph, records, tools and instructions furnished. Information free. Capitol City Tuning School, 16 Southwest 2nd, Dept. 102, Fort Lauderdale, Florida.

BECOME A doctor of psychology or metaphysics. Learn secret of contentment, happiness. Win degree of Ph.D. or M.S.D. Correspondence only. Free book. College of Universal Truth, 5038-C Broadway, Chicago.

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

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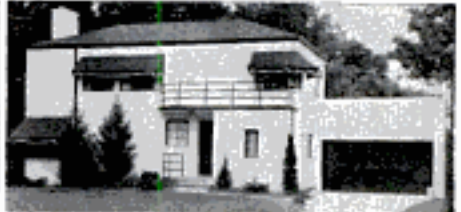
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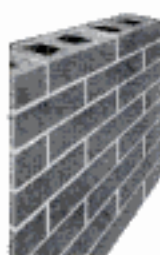
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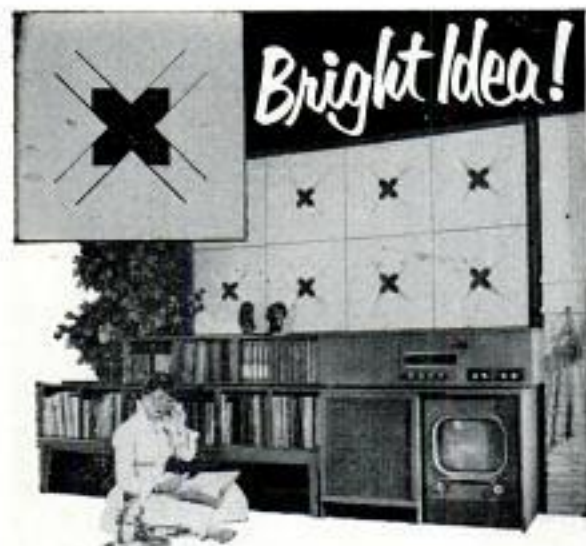
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**Planes Land Automatically
 On Carrier**

Navy planes can be landed safely aboard carriers despite adverse weather conditions through a new combination of radar and radio. The landing system, developed by Bell Aircraft Corp., has been tested ashore where hundreds of "hands off" landings were made. Further tests will be made aboard a carrier. Radar locates the aircraft to be landed and calculates its altitude, speed and direction. These figures are fed into a computer which determines the necessary course corrections. Radio signals then direct the airplane. The computer takes into consideration the speed of the carrier, its pitch and roll at the instant the plane is to touch the deck. The system also can be used to land aircraft with wounded or fatigued pilots.

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2. If your car has no oil filter, send \$12.95 for complete unit, including case and element. We pay postage.

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Present filter make (if known) _____

Address _____

City _____ Zone _____ State _____

Please ship

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Complete Life-Time filter, with element & housing for \$12.95.

I enclose full price; you pay shipping
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California residents add 3% tax.



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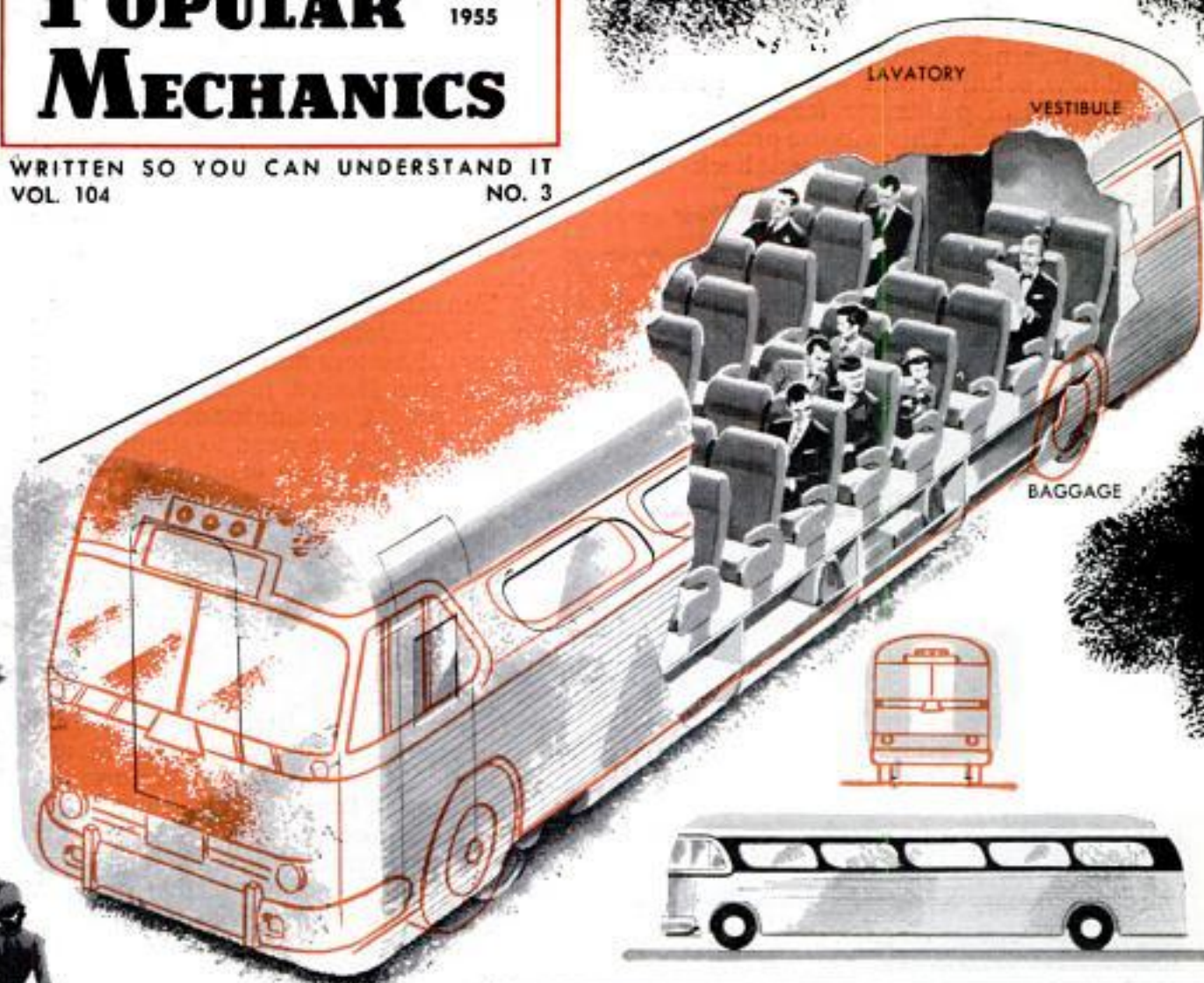


Dick Pope, Jr. makes a sensational jump with his Champion-equipped Mercury outboard hydro.



POPULAR SEPTEMBER 1955 MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 104 NO. 3



Bus body, indicated in red, is widened and mounted on rail wheels to make the coach. Right, note resemblance of coach to bus

TEN BUSES GROW INTO A TRAIN

By Clifford B. Hicks

BACK IN JUNE 1954, a half-dozen puzzled executives met to solve a problem that has been plaguing the railroads for decades. Out of that meeting rolled a passenger train so unique in concept that it may signal the biggest change in railroading since the diesel-electric locomotive snarled into existence.

Here was the problem pitched to executives of the Electro-Motive Division of General Motors:

For years, planes have been pilfering pas-

sengers from the railroads by offering high-speed travel. Buses have stolen countless others with low fares. Railroads, squeezed from above and below, are currently losing about \$700,000,000 a year on passenger service. Last year a committee of railroad officials asked rail-equipment manufacturers for new ideas that would: Reduce the investment in equipment; reduce operating and maintenance costs, lower the center of gravity, increase average speed, improve riding comfort and reduce the railroads'

passenger deficit. To this, GM executives added one more requirement: That existing parts be used wherever possible.

What was needed, obviously, was some brand-new solution that would punch the stuffing out of passenger fares and offer high-speed travel. This was the problem the Electro-Motive officials batted back and

forth at their conference in La Grange, Ill.

"What we need, say, is something completely new in a passenger train. . . . But it'll have to be a train so inexpensive to build and operate that railroads can't afford not to buy it . . . by the hundreds. . . . Can we chop fares down to a point where the railroads can compete with buses? . . .

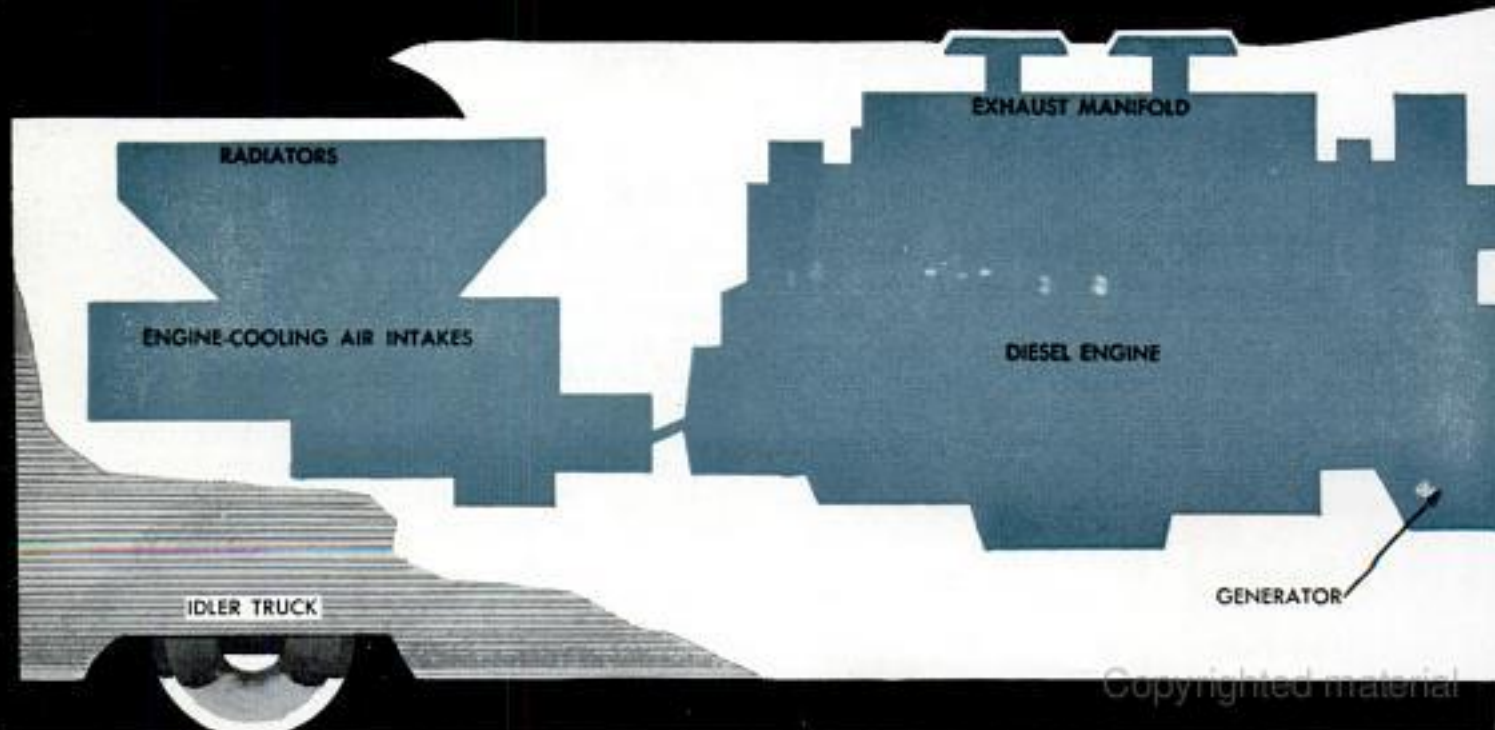
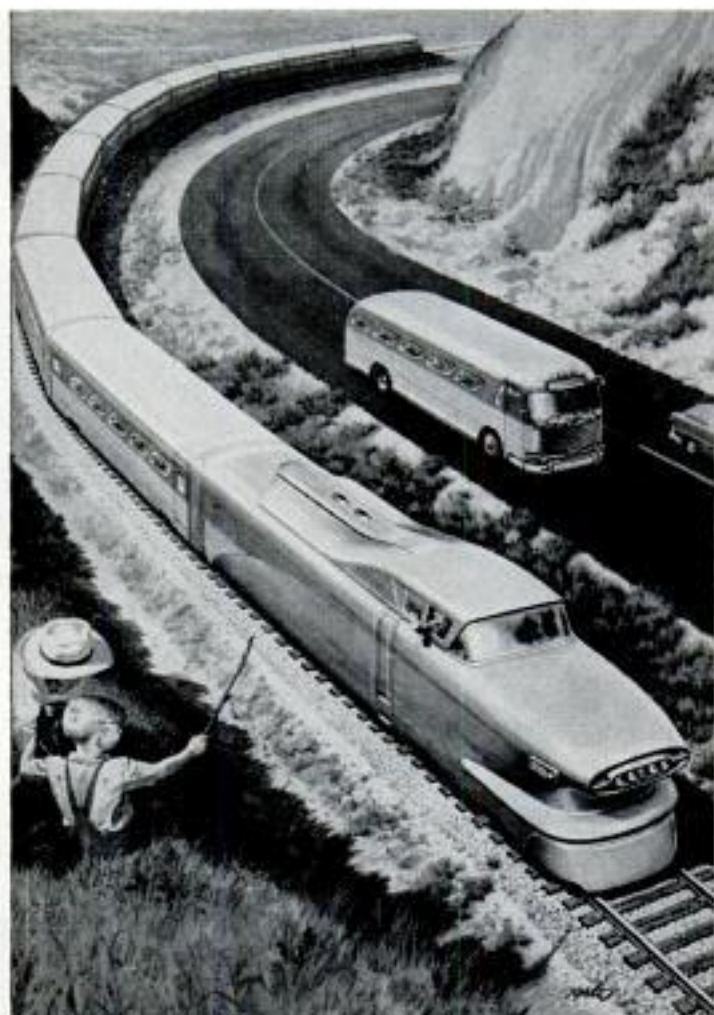
Let's think in terms of a train as cheap on a per-seat basis, say, as a bus—or even the family car. . . . Think about it. . . ."

Ten minutes after the meeting broke up, N. C. Dezendorf, vice-president of General Motors and general manager of Electro Motive, made a call to W. H. Harvey, Coordinator of New Products. "Maybe we need to simplify our thinking. What we want, basically, is a new concept of a bus on rails. That's been tried before, I know, and without much success. But no one has ever tried a train of buses on rails. Why don't we try mounting bus bodies on rail trucks, and pull the whole thing with a lightweight locomotive designed specifically for this train?"

Where could Electro-Motive find such bus bodies? Where but in another division of General Motors, the GMC Truck Division at Pontiac, Mich.

Within a couple of days Dezendorf and Harvey were in Pontiac inspecting bus bodies. They came back convinced that a bus body could be mounted on a strong framework that rolled on rail wheels.

That is the simple, basic design of the new train, which is being shown to the public for the first time at the GM Powerama in Chicago this month.



Actually, Electro-Motive has built two of the trains for cross-country display on the major rail lines. When one of them comes your way, take a long look at it, for you may soon be riding such a train whether you're a cross-country businessman or a suburbanite who curses commuter travel. This is one of the few trains that has ever been designed as a complete unit including the locomotive.

Actually, according to Harlow H. Curtice, president of General Motors, the company "has no intention of going into the railroad passenger-car-building business. It is primarily interested in the promotion of the use of its diesel motive power and presents the new cars as a service to its customers."

But the bus-body idea is so novel and so inexpensive you can bet a cross-country fare that it won't die out. The bus body, when it comes off the fabrication line, measures 40 feet long. It is made in two longitudinal sections, so the bus actually is split down the middle. By law, buses are limited to a total width of eight feet. Rail coaches can be built up to 10 feet wide, so to increase the feeling of spaciousness a strip 18 inches wide has been added down the length of the bus between the two sections. This makes it possible to use wide, comfortable seats and still have room for a broad aisle down the middle of the coach.

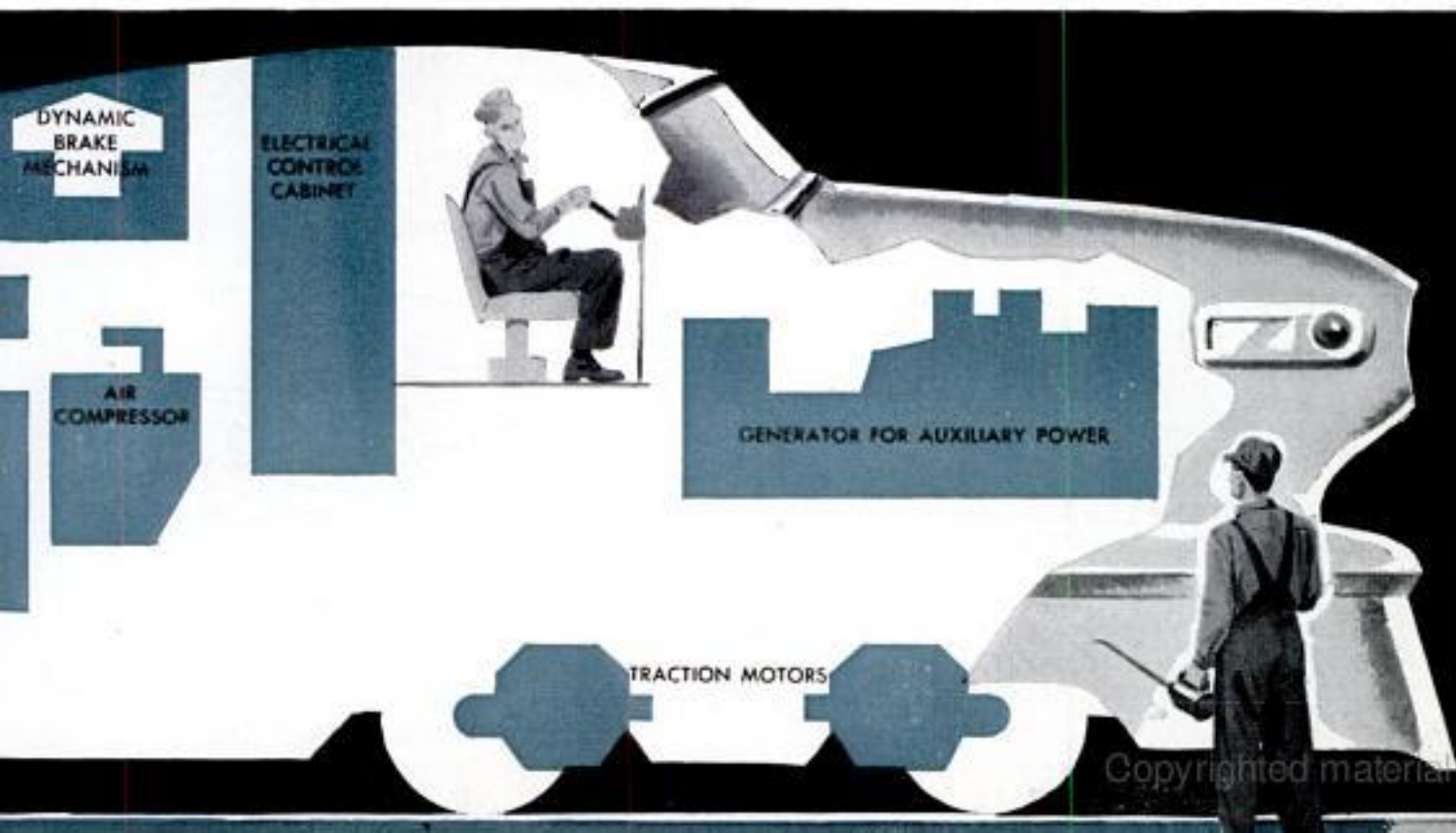
The undercarriage is simply a strong, steel framework mounted on four wheels. At this point, Doubting Thomas pops up with his question: "Doesn't the thing ride like a boxcar?" It doesn't because you're literally riding on air. Eight synthetic-rubber bellows—two at each corner of the car

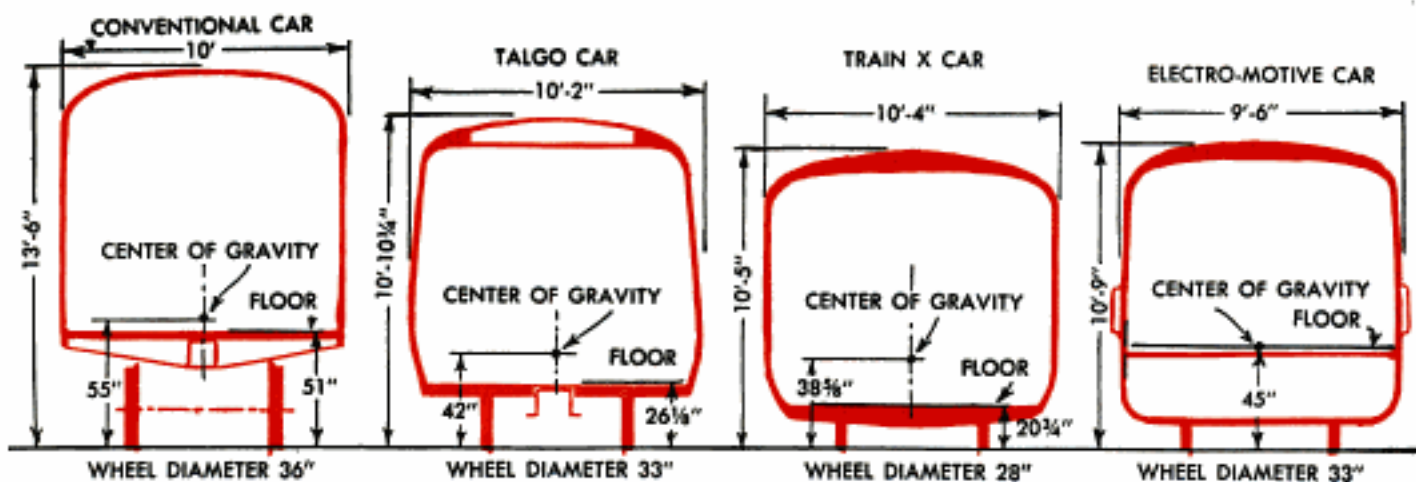
—are filled with compressed air from a reservoir inside the coach. When the finished coach is ready to roll, the air pressure is adjusted until the floor of the car is precisely 43 inches above the rails. As you climb on or off the coach, your weight triggers air valves which automatically pump or bleed off compressed air, keeping the car at the same level. An ingenious linkage holds the body on top of this air cushion.

Sections added at each end of the car (replacing the driver and engine compartments of the bus) contain lavatories, entry vestibules and small compartments that may be used for the preparation or serving of food. The two prototype trains have no specific provision for food en route because individual railroads have expressed interest in everything from coin-operated sandwich dispensers to full-scale diners. In these end sections are entry doors. The design permits a small section of the curved roof to be swung up out of the way when the coach is standing at a high platform. Hidden steps swing down into position to serve lower platforms.

Inside the car are 20 double reclining seats. Though this is a train designed to cut fares, passengers still have a genuine feeling of luxury. The coach is beautifully lighted and decorated, with an overhead "package rack" so large it can accommodate a great deal of luggage. Larger suitcases, though, are carried in compartments beneath the coach floor, reached through exterior doors, just as luggage is carried on buses. Below the floor, too, are the air-conditioning unit and the supplementary heating equipment.

Small, sleek locomotive has four traction wheels in front, with two idler wheels for support in rear





Trend in lightweight trains is toward lower coaches with lower center of gravity, permitting higher speeds

Why build a train out of buses? What's the matter with building trains from scratch? Well, scratch just won't build trains that can lower fares. Streamlined coach trains are built to a specific plan, much like the plan for a big building, and call for all kinds of heavy equipment and specially made parts. In the new train, every piece of equipment from air conditioners (GM's Frigidaire Division) to auxiliary generators (GM's Delco Products Division) are standard parts already in existence. No special dies were required to start turning out the coaches.

Where a conventional luxury streamliner costs around \$2200 per seat, the bus-train, now that design costs are back down the rails a piece, will cost something under \$1000 a seat. This makes it almost as inexpensive as a bus seat, and not far above the cost of a seat in your family car.

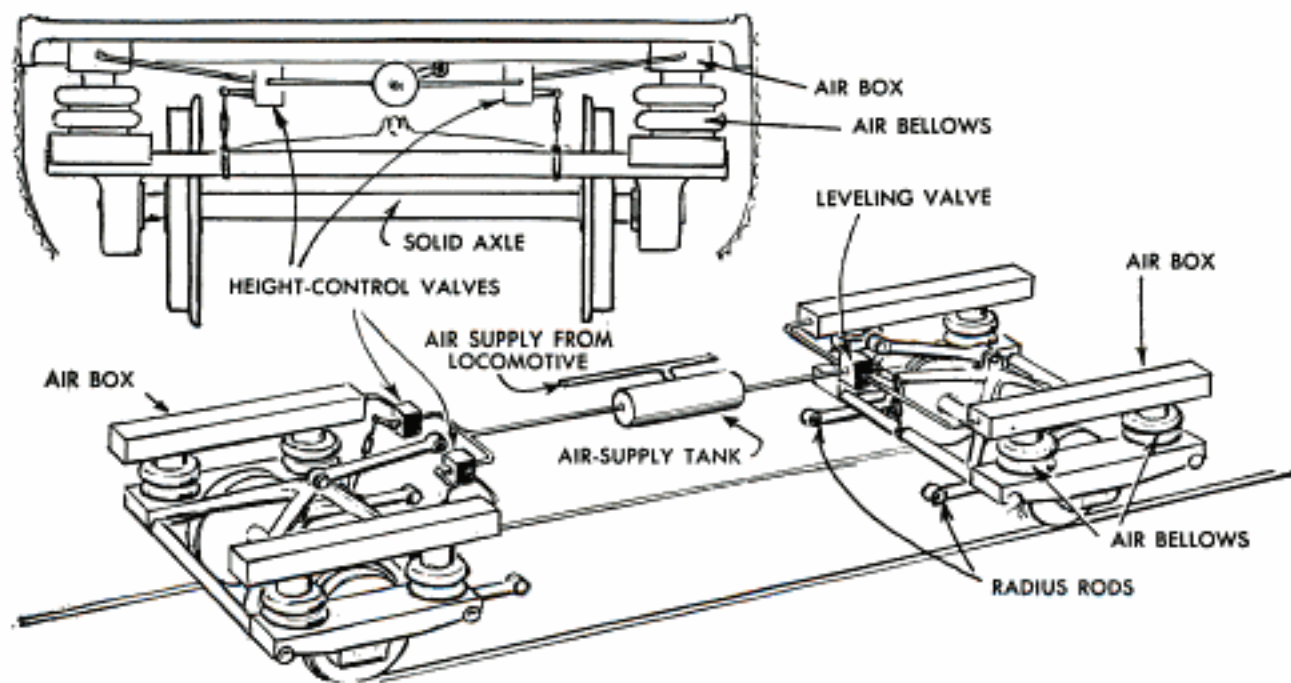
Then there's a tremendous advantage in the low maintenance cost. Experience has shown that the average rail coach must be completely overhauled after five to seven

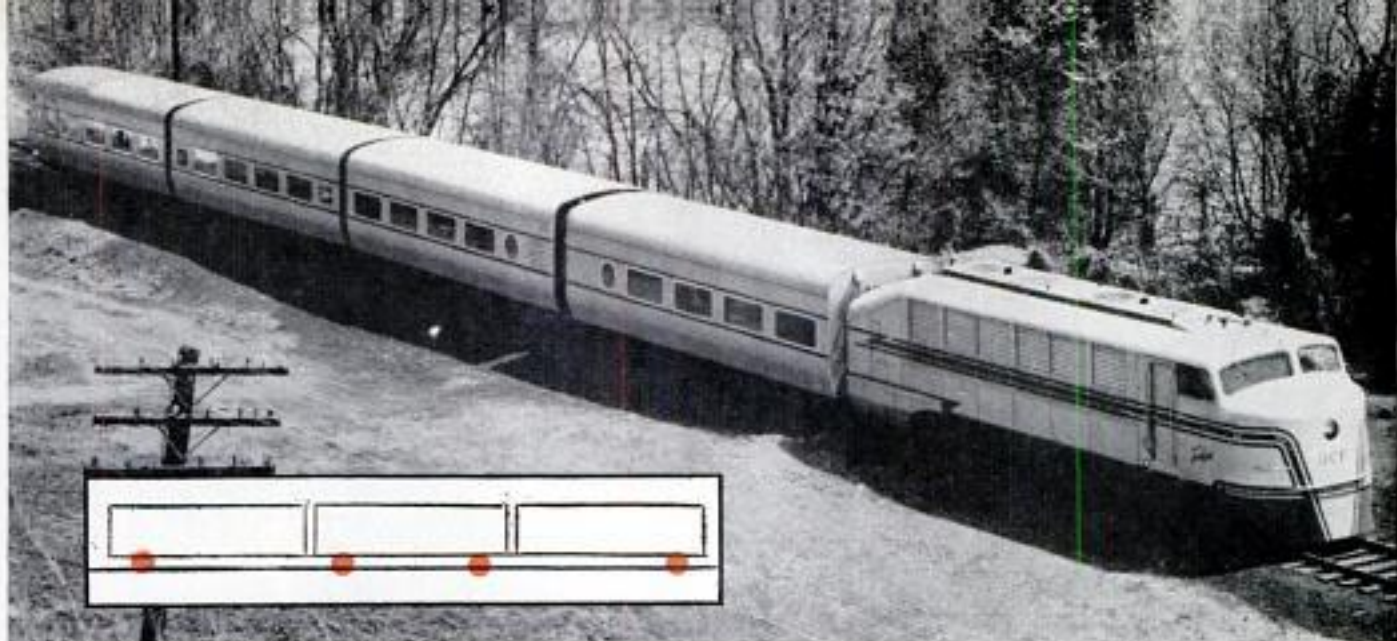
years in service. Seats are torn out and replaced, the car is redecorated, the floor and ceiling are rebuilt, and much of the paneling is reconstructed because it has developed annoying rattles and squeaks over a period of time. All this work costs the railroad from \$35,000 to \$50,000 per coach.

The new coach permits something far different in the way of rebuilding. After five to seven years of service, the car will be run into the shops and the coach, in effect, will be lifted off its underframe, seats and all, and scrapped. A brand new body then will be fastened to the underframe and the coach will be ready for passengers again. Expensive? Actually the cost is only a fraction of the cost of rebuilding a standard coach. And the resulting car really is a new one, for the new body contains all the improvements that have been engineered during the past five to seven years.

The new coaches are just as safe as standard coaches. An ordinary bus body is built to withstand great impact. Actually, the way the car is constructed, the undercar-

Coach literally floats on air in bellows. Valves automatically pump or bleed off air to keep the car level





Talgo-type train has three-car unit, plus end car. Outer cars of unit ride piggyback on center car's wheels

riage will absorb virtually all of the shock. Safety specifications of the Association of American Railroads call for a buff resistance in a light train (such as this) of 50,000 pounds. The coach is built to withstand a buff well above this figure.

Each of the two prototype trains has 10 cars, with seats for 400 passengers. As soon as Electro-Motive engineers plunged deep into the rail-bus concept, they were faced with another question: What kind of motive power would do justice to this new train? This, of course, is what GM is most interested in selling.

The locomotive that emerged from the planning sessions is a short, low, sleek job with an aluminum skin. It looks like a cross between an airplane fuselage and a racy sports car, and it performs to match its appearance. A conventional diesel-electric which pulls a 400-passenger train weighs around 320,000 pounds; the new locomotive weighs only 175,000 pounds. The conventional locomotive in comparable passenger

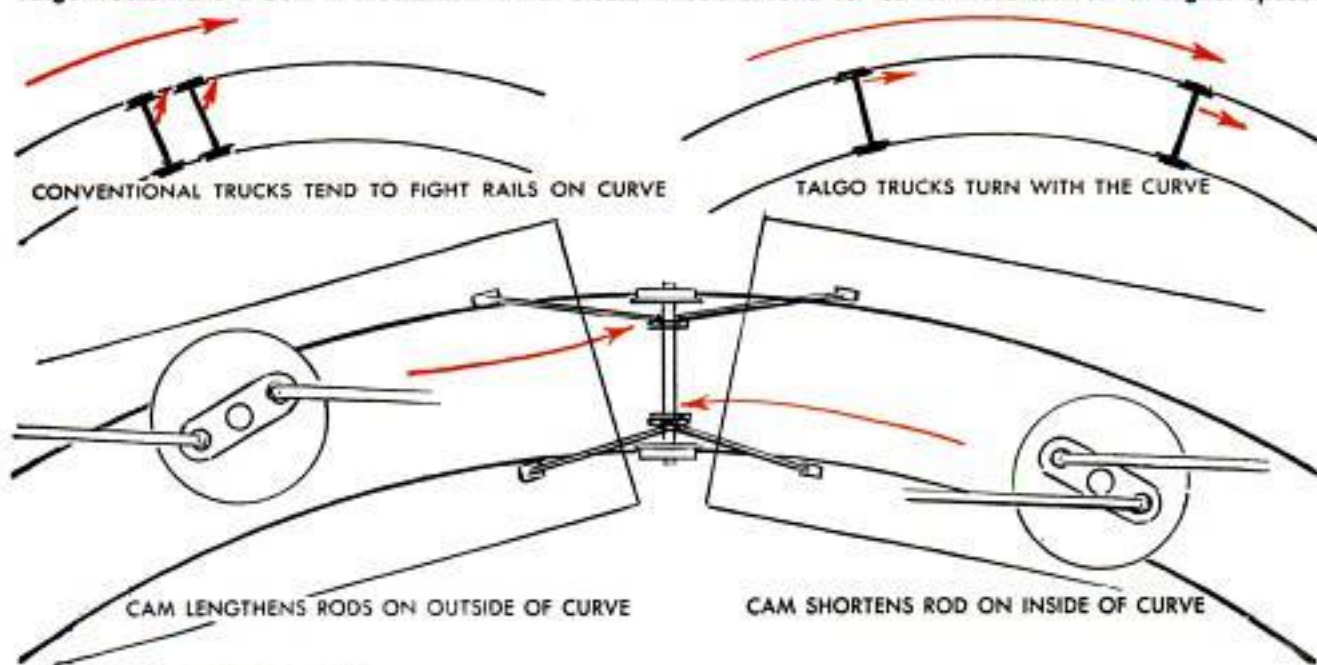
service packs about 2400 horsepower to pull its heavy load; the new locomotive will pull 10 fully loaded cars anywhere in the country with 1200 horses.

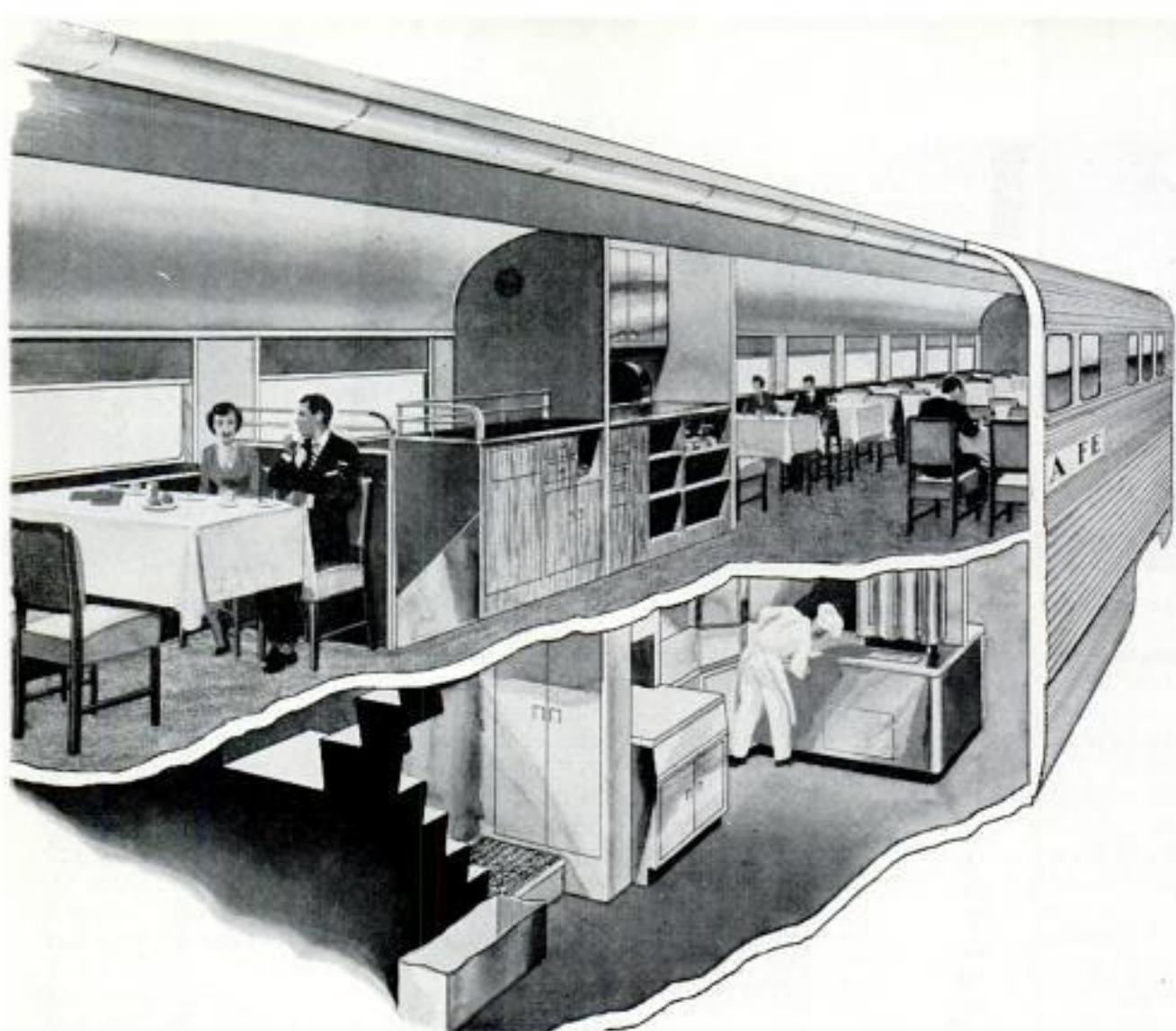
The low horsepower means you can go a mighty long way on mighty little fuel. The locomotive, pulling the loaded train at a top speed of 102 miles per hour, consumes only 1.3 gallons of fuel per mile. Ask any railroader whether that is cheap transportation and he'll call it phenomenal. Furthermore, the conventional train requires two, three or even four diesel units because of its weight, but the new train has only one unit to maintain and only one to rebuild when it finally starts losing its horses.

The diesel unit roars away in its cage just behind and below the cab of the locomotive. In the nose of the engine is the supplementary power plant for the train, which provides heat and electricity. Under normal conditions its fuel consumption is only one gallon per hour per coach.

Old-time steam-engine fans will think

Talgo trucks have a built-in mechanism which steers wheels around curves for more comfort at higher speeds





Scenic roads are bucking the trend toward lower cars. Double-deck Santa Fe diner will have a kitchen on the lower level, with dining tables above. Food will move from kitchen to upper level on elevators

the designers have gone loco when they see the wheel arrangement of the new job. Steam engines are classified according to their numerous wheels; some have had 20 or more wheels. The new locomotive has only six wheels. The four at the front end are powered by electric motors, and the two at the rear are simply idler or trailing wheels which support the locomotive.

The light weight of the locomotive and cars is one of the secrets of the low-cost operation of the train, which has a weight

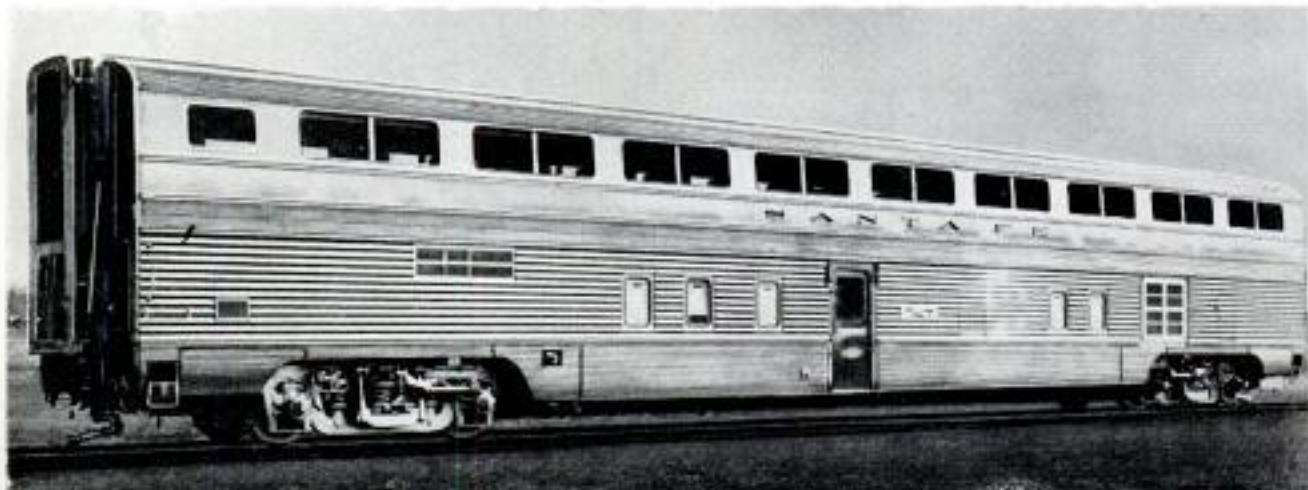
of only 750 pounds per seat. This compares, roughly with about 2000 pounds per seat in a conventional coach.

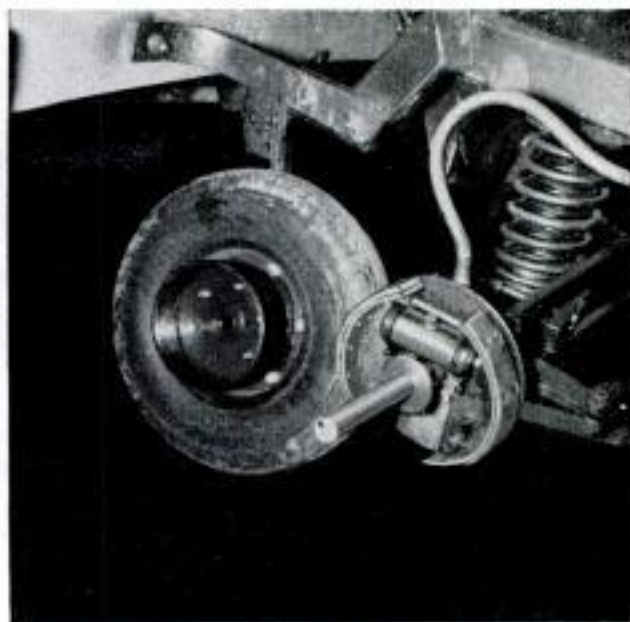
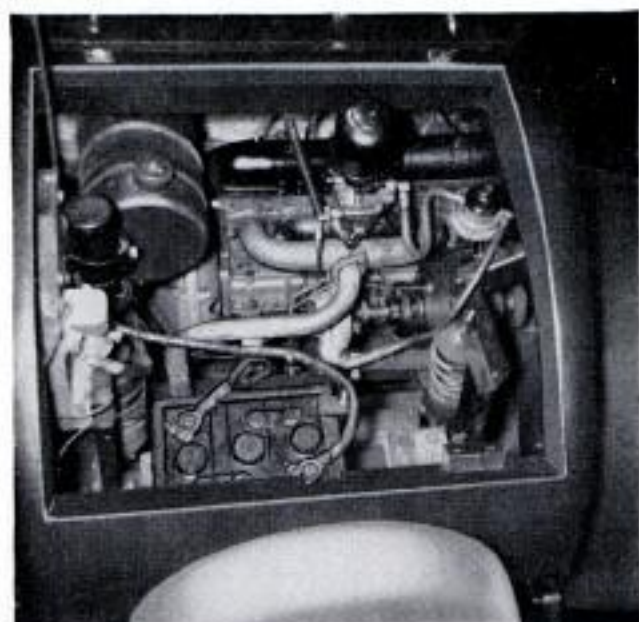
Bus fares now average about two cents per mile, with rail fares hitting up to 3½ cents. Electro-Motive officials feel that the bus-train can lop fares down to direct competition with bus fares.

The two demonstration trains cost Electro-Motive about \$1,000,000 apiece. Now that the design work is done, officials feel

(Continued to page 256)

"Hi-Level" coach is two feet higher than conventional coach, gives passengers top-story view of scenery





Pint-Size 1932 "Ford" Has Engine in Rear

Starting with four wheelbarrow wheels and an idea, David B. Wood, Jr., designed and built a $\frac{1}{8}$ -model of a 1932 Ford roadster that looks and drives like the real car. Just about everything except the Crosley engine and transmission is handmade. The engine is in the rear, mounted crossways, parallel with the axle. The car has a 66-inch wheelbase. Frame and suspension parts were designed and fabricated by Wood. He even built the brakes, welding and turning the drums from two pieces of flat stock. Handmade brake shoes are expanded by wheel cylinders from a Willys Jeep and a master cylinder from a 1951 Plymouth. A chain drive connects the transmission to

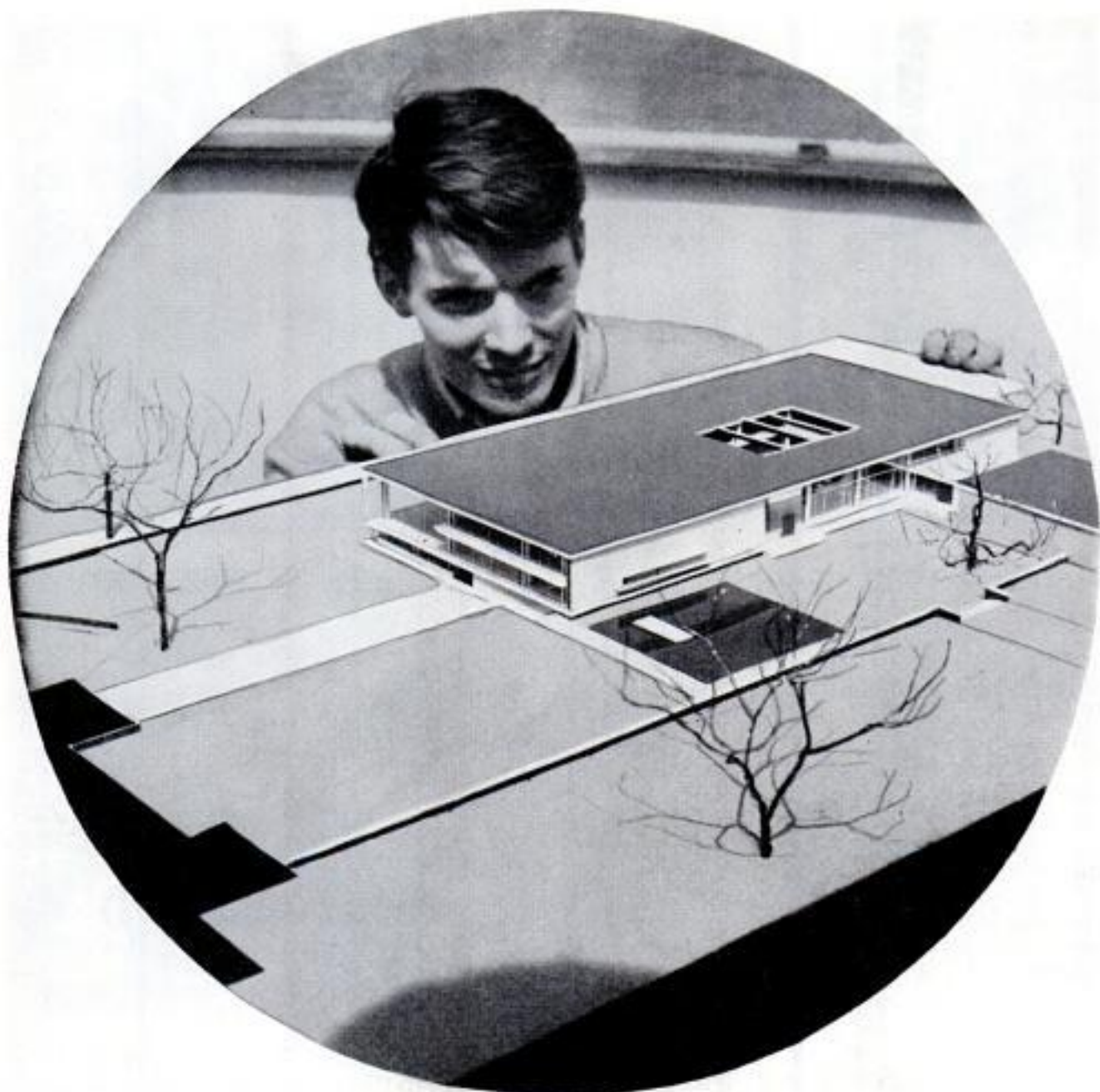


the left rear wheel. The gearshift lever is mounted in the floor. Wood doesn't say what he will do when he has a flat. The spare tire is Ponderosa pine painted white!



Corrugated Roof Unrolls on Job

Roll roofing made of corrugated aluminum can be laid as easily as composition roofing. The material is unrolled across the roof and nailed into place. It also can be applied as siding. No decking or sheathing is required, though it can be used if desired. The aluminum cuts easily and the corrugations, running in the same direction as the rafters, provide fast, unobstructed drainage. The material is rustproof, rat-proof and fireproof.



Student inside the laboratory's plastic dome uses sunlight to check the shading problems of house model

THEY'RE PLANNING

Your Home in the Sun

ARCHITECTS at Princeton University have come up with a three-step system for designing your home of the future. They see such a house properly oriented to the sun, and plan it with the sun constantly in mind.

- The first step is to position the house on the site. In the architectural lab, a basic model of the home is placed on a movable board. A powerful light bathes the board in "sunlight." The model then is moved to positions corresponding to the angles of the sun at the house site. Through such experiments the architects determine the best position of the house on the lot.

- In the second step they decide what type of shading blinds to use and build models of them. These miniature blinds are attached to the house model, which is placed beneath the light again. In some cases the architects build larger models of rooms and place them inside a "sun dome" in the building's roof.

- The last step is to decide whether to use opaque, semitransparent or transparent materials for the shading devices.

The result is a house oriented to the sun, taking advantage of Old Sol's heat in the winter but keeping it out of the home during the summer. ★★★



Powerful spotlight simulates the sun. Architects move board to determine sunlight, winter and summer



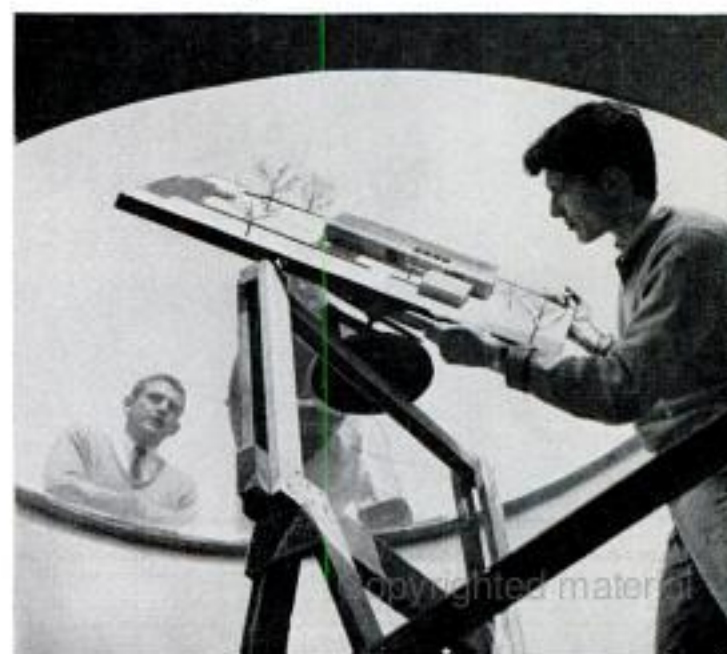
Twin brothers Victor and Aladar Olgay place model under plastic globe. Lines show path of the sun



Panels of shading material close off a model room. Cardboard man shows how sun would strike human in the full-size room. Below, plastic bubble in roof offers plenty of sunlight for checking a house model



Students at the laboratory test various types of shades. The kind of shade chosen for a particular house depends upon style of house and amount of shade needed. Below, model is maneuvered on board





180 M.P.G. Motor Bicycle Can Also Be Pedaled

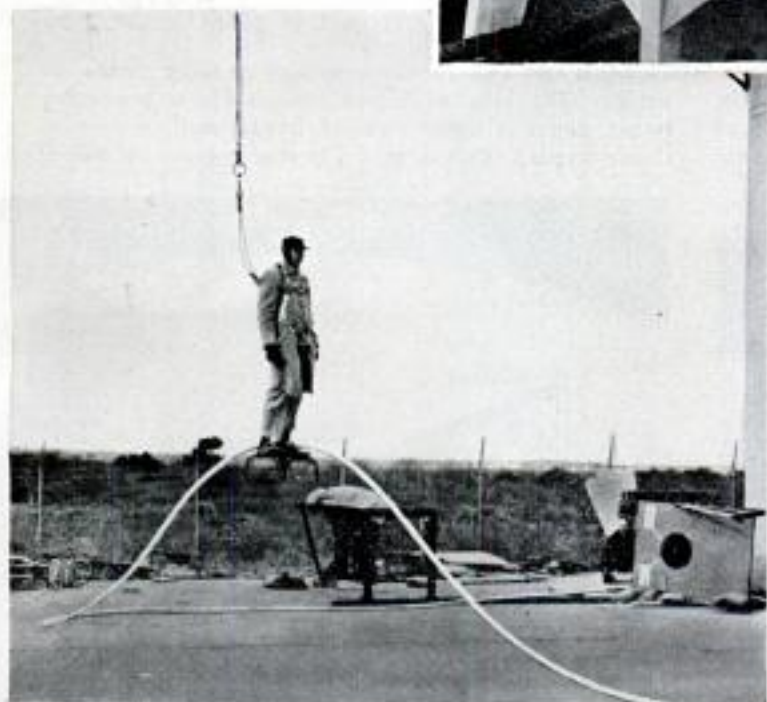
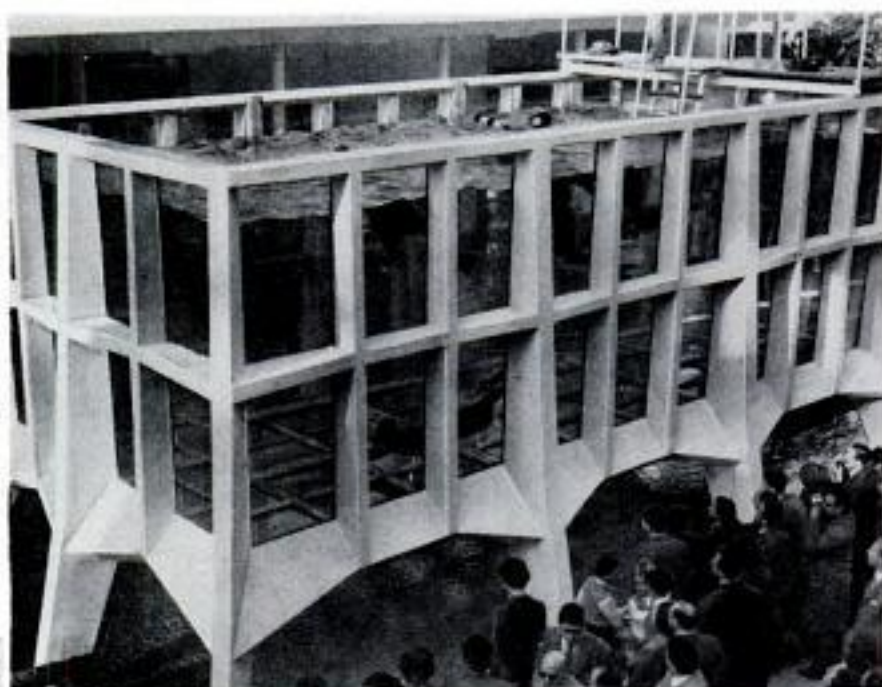
Light weight and high speed are features of a West German motor bicycle distributed in America. The 72-pound "Mopedo" is propelled by a 1½-horsepower motor to a top speed of 40 miles per hour. It is said to travel as far as 180 miles on a gallon of gasoline and to climb a 10-degree grade in high gear or a 23-degree grade in low gear.

Motor bike is ideal for scooting along the beach or climbing hills. Top road speed is 40 miles per hour

Glass-Walled Pool Shows Off Swimmers

Skin divers at the Milan Industrial Fair accomplished the unique trick of being above-ground and underwater at the same time. The divers performed in a glass-enclosed pool elevated on stilts. Interested onlookers gained new information on the techniques of underwater fishing.

Glass-enclosed swimming pool on stilts draws a large crowd at Milan Fair

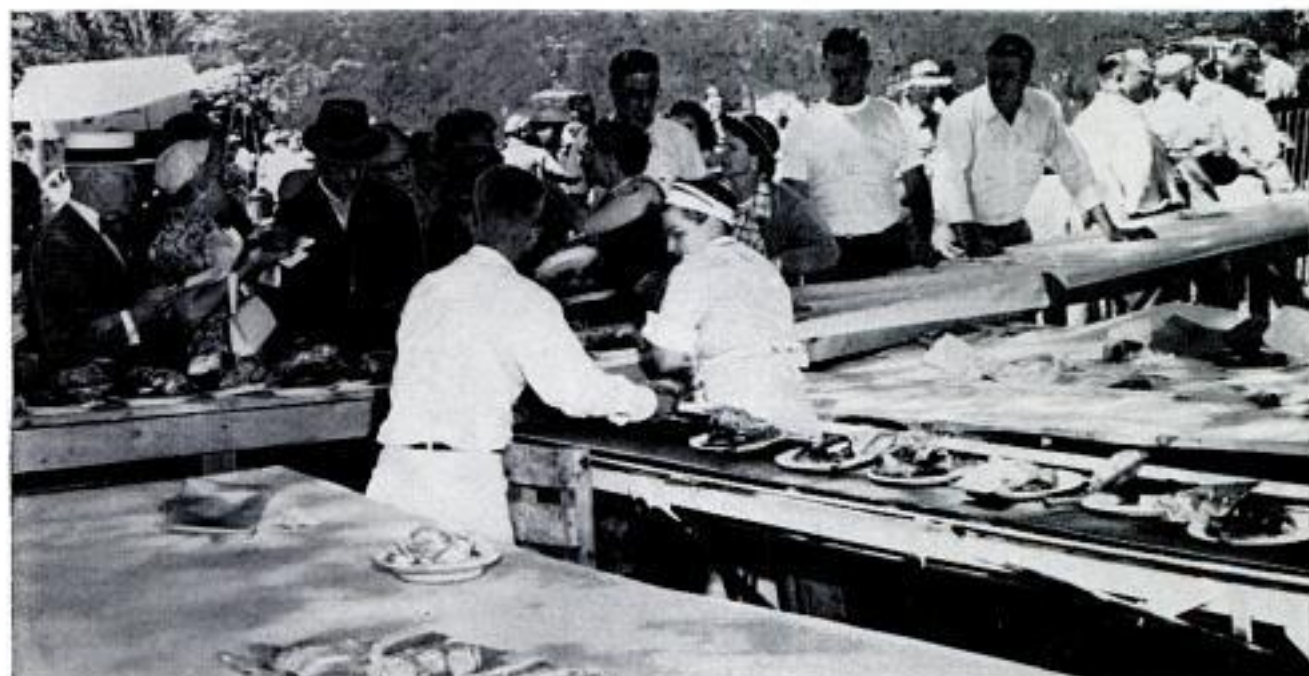


Pilot "Treads" Air On Jet Board

Intensified study of vertical take-off principles has brought forth some brand-new ideas in aviation, the latest of which is a jet board. It is buckled to the pilot's feet and supports him in flight by means of air jets from an attached hose. To hover, the pilot stands still, and to move, he merely leans in the direction in which he wants to travel. Tests of a simplified research model by the National Advisory Committee for Aeronautics show that the pilot has full control over the board, even in gusty winds up to 16 knots.

2500 Dinners Per Hour At Broiler Festival

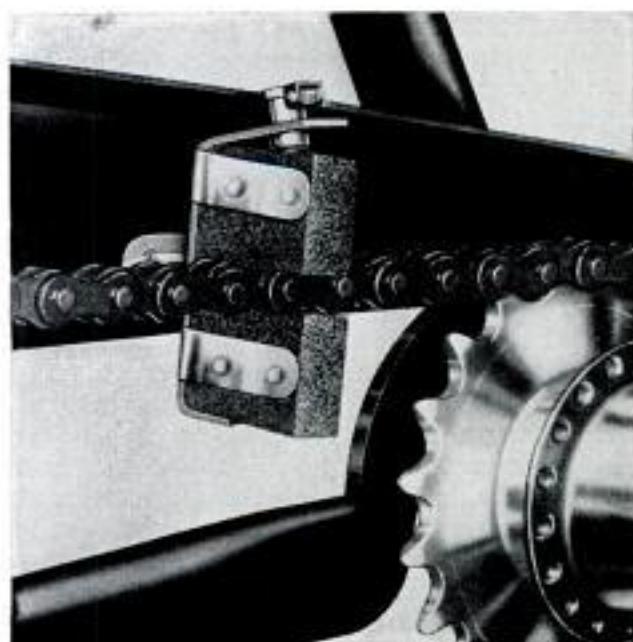
What is believed to be the world's largest outdoor chicken dinner is served at the annual Maine Broiler Festival, held in the town of Belfast, Me. During the two days of the festival, a 130-man crew works in three shifts to prepare 13 tons of Maine broilers over charcoal-fed barbecue pits totaling 300 feet in length. The birds, brown and hot, are then put on a 100-foot conveyor belt and carried directly from the pits to the serving tables. At the height of the festival, the conveyor brings 2500 dinners per hour to the hungry customers.

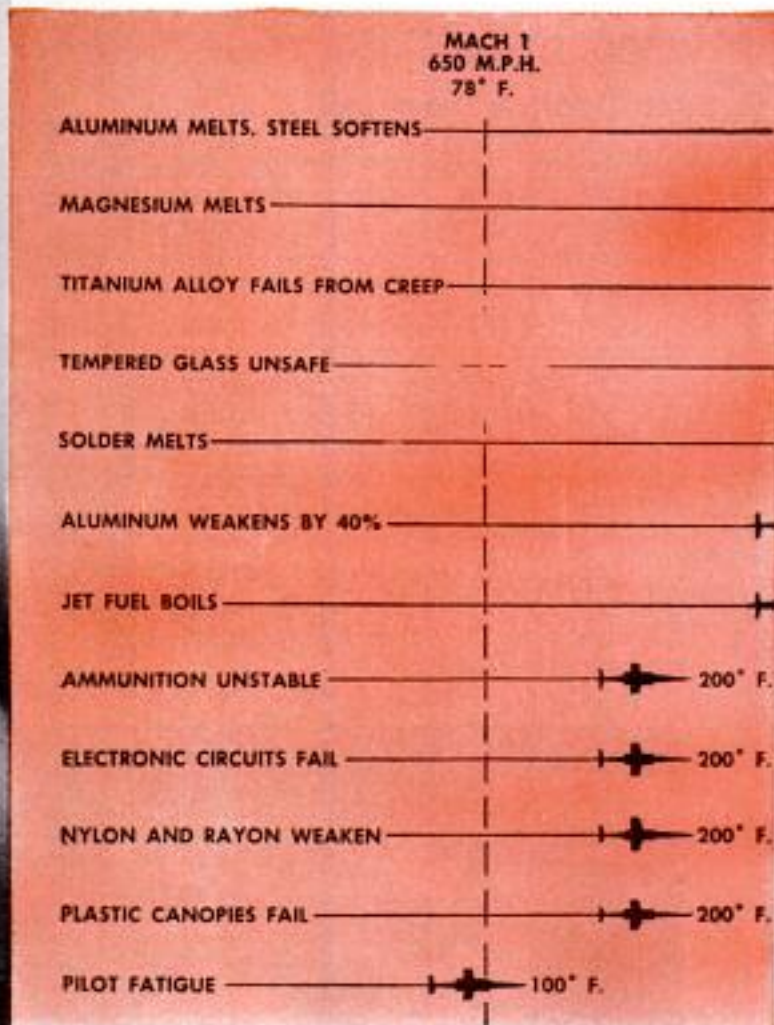


Felt Blocks of Bike Bracket Clean and Oil Passing Chain

Felt blocks, clamped on the chain guard of a bicycle, oil and clean the chain as it passes. The blocks are said to eliminate most of the abrasive wear on both chain and sprocket. A snap-top oil cup is mounted on the top block, which acts as a reservoir for the lubricant. The two oil-impregnated felts wipe dirt and grit from the chain and supply a thin coating of oil to the chain roller pins. Easier pedaling as well as less wear results. The unit lasts at least a year and is easily replaced.

George Westinghouse patented a new invention on an average of every six weeks for 48 years and established 60 manufacturing companies during his lifetime.





Heat is the biggest problem facing jet and rocket engineers today. Scope of problem is indicated on graph

JET PLANES HEAD FOR

By Thomas E. Stimson, Jr.

REMEMBER, TONY, this is a hot airplane! Don't burn it up!"

Test Pilot Tony LeVier was climbing into the cockpit of the brand new F-104 when Lockheed's Kelly Johnson gave him those final instructions, and Johnson wasn't joking. Aerodynamic heating is a real problem at the speeds at which the new fighter, still on the secret list, is designed to fly.

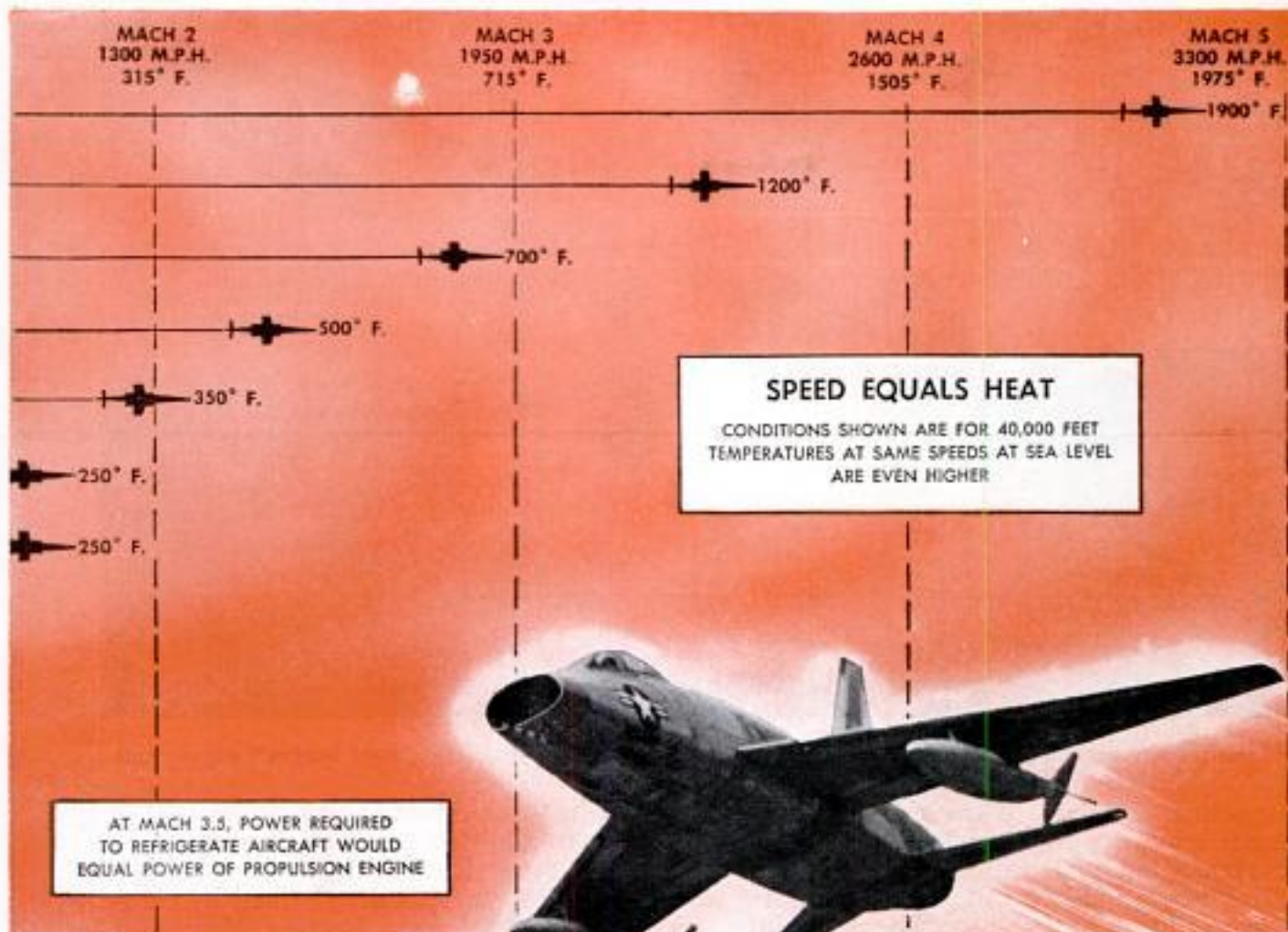
One pilot had to eject from an F-104 over the Mojave Desert during subsequent testing because of an ordnance failure. Some experts think that the ammunition got so hot from aerodynamic heat that it exploded.

You don't notice this heat in an airliner. At 300 miles per hour the temperature rise is only 16 degrees and the cabin air conditioner takes care of that. But if the airliner could cruise at 1000 miles per hour it would take on 180 degrees of heat simply from friction with the air. At 1500 miles per hour the heat rise would amount to 400 degrees. These temperatures are for flight in the dense air near sea level; at

high altitude they are somewhat less.

What raises the temperature even more is the heat that seeps into a fast plane through the insulation that surrounds the hot jet engine, and heat from the electronic circuits. Even today's military aircraft, not capable of sustained supersonic cruising, must refrigerate the pilot and the electrical gear. Some fighter and bomber planes are equipped with tiny AiResearch cooling units that weigh only 5½ pounds yet have the cooling capacity of 11 household refrigerators. Every bit of this cooling capacity is needed.

Some aluminum alloys lose 40 percent of their strength at 250 degrees, equal at low altitude to a speed of less than 1200 miles per hour. Plastic bubble canopies would soften and collapse at a sustained speed of more than 1000 miles per hour, which creates a heat of 200 degrees. Most radar and radio equipment, designed to operate at a maximum of 160 degrees, gives false signals or fails completely at 200 degrees.



THE MELTING POINT

These and other difficulties have created the so-called heat barrier, now one of the most pressing problems in aviation. To help whip it, aircraft manufacturers have added a new member to their design teams, the thermodynamicist. His job is to find ways of flying at supersonic speeds without actually cooking the pilot and plane.

The campaign to learn how to fly fast in spite of the heat is being conducted on various fronts.

A "hot" wind tunnel that is almost comparable to a blast furnace has been built by the National Advisory Committee for Aeronautics at its Ames Laboratory at Moffett Field, Calif. Temperatures as high as 1200 degrees can be created in the test section of the tunnel at the same time that air speeds of Mach 5 or 6 are obtained. Nearly all common structural aircraft materials would fail under these conditions. Even glass softens at such a high temperature.



Two views of North American F-100, Super Sabre, one of latest and fastest jets in military service. A supersonic fighter, it is made of heat-resistant metals and equipped with automatic cockpit air conditioning



Test instruments are carried in the needlelike nose of the X-3, jet designed for "heat barrier" experiments

Inspection windows in the side of the hot tunnel, consequently, are double, and fused quartz is used for the inner window.

The new tunnel permits studies of many aspects of the heat problem. The possibility of insulating a whole airframe will be investigated. The value of evaporation devices to keep an aircraft cool, and the possible use of "heat sinks" to drain off high temperatures from critical areas, will be studied.

The leading edges of a plane heat up first at high speed, next the trailing edges become hot, finally the rest of the structure warms up. This uneven heating tends to buckle the skin. Structural distortions occur, changing the aerodynamic shape. This problem of transient heating, as well as the stagnation effects that result when the entire structure reaches the same temperature, can be studied with the new tunnel.

Right, tiny air conditioner for Douglas A4D equals 11 refrigerators. Larger unit for Douglas C-133, turboprop transport, could cool three homes. Below, chart shows surface heat rise due to skin friction



An odd thing about the tunnel is that it would actually destroy itself if allowed to operate at the high temperatures that it creates. After the hot air (heated by compression plus electric heating elements) slams through the test section at supersonic speed, it passes through an aftercooler that brings down its temperature to 100 degrees or less. Unless this was done the hot air would burn up the bearings of the compressors that recirculate the air past the heating elements and through the tunnel again.

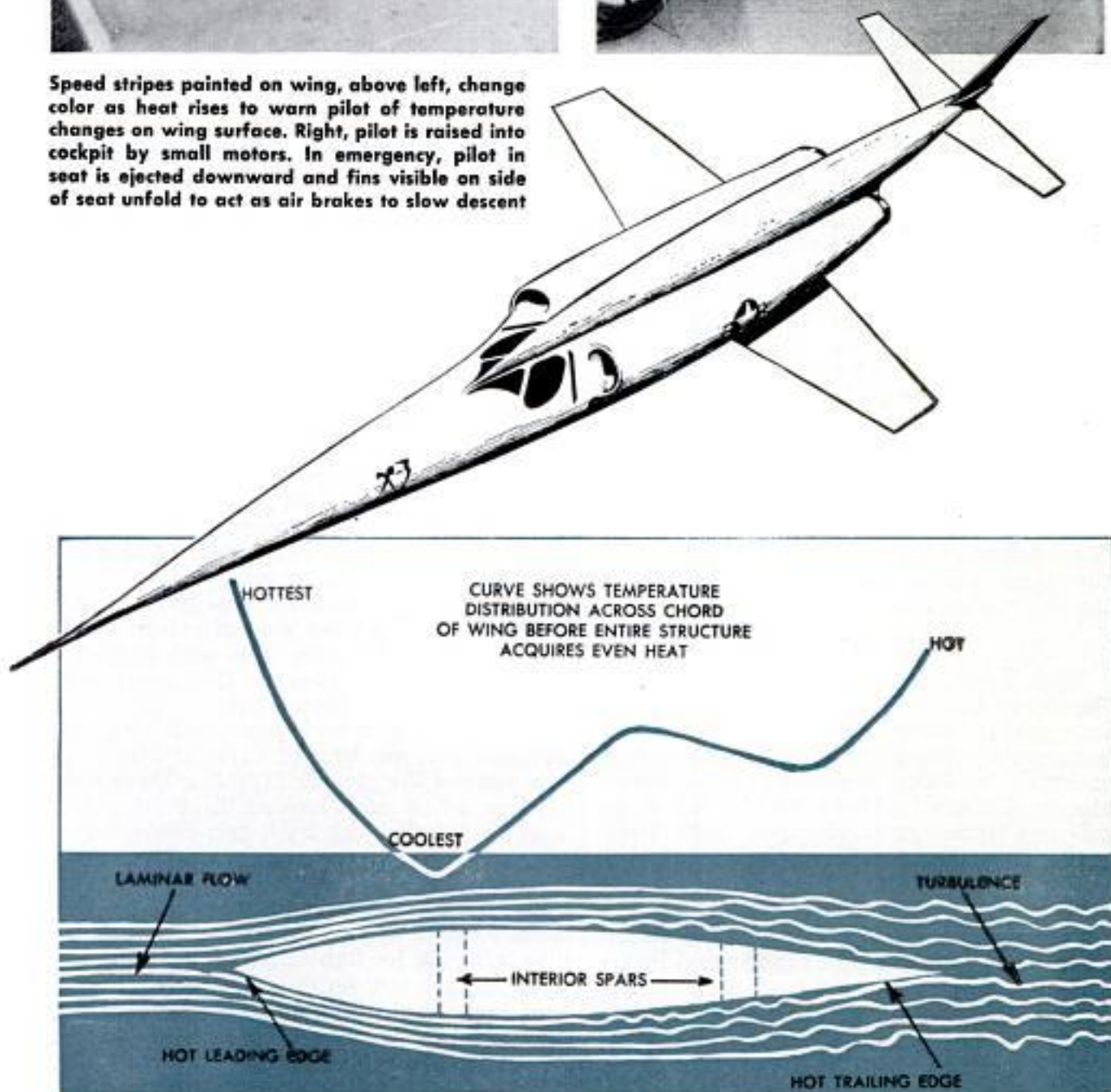
Other aspects of aerodynamic heating are being studied at Edwards Air Force

(Text continued to page 252)





Speed stripes painted on wing, above left, change color as heat rises to warn pilot of temperature changes on wing surface. Right, pilot is raised into cockpit by small motors. In emergency, pilot in seat is ejected downward and fins visible on side of seat unfold to act as air brakes to slow descent



Detroit Listening Post



By Leo Donovan

SANTA CLAUS' sleigh will be filled with new cars this year—at least so the industry hopes. All the 1956 models will be on the streets well before Christmas, in plenty of time for gift shoppers. All but one (the Rambler) will be out before Thanksgiving Day.

The 1956 parade starts with the Lincoln and ends with the Rambler. Both of these extremes will be wearing all-new bodies. But between the Lincoln and the Rambler will come a succession of familiar bodies sporting a variety of face lifts.

By the time you read this, the 1956 Lincoln will probably be in the showrooms. It is set to debut around September 1. It will be followed by the rest of the Ford divisions, including the Continental which is due out early in October. The new, so-called Edsel car is still more talk than reality. This car is supposed to fill the price gap between Mercury and Lincoln.

The Chrysler lines will hit the street during October with Dodge probably first. General Motors' divisions will make their debuts during the period from late October to early November. The Nash-Hudson and Studebaker-Packard lines will appear in the same period except for the all-new Rambler which is set for December.

What to Expect

With a few exceptions (such as Lincoln, Rambler, Continental and the Eldorado brougham), there will be few styling or engineering changes that can be called sensational in 1956, according to advance stories. Generally, there will be the usual off-year appearance changes, both front and rear, with more emphasis on engineering refinements involving added horsepower, improved transmissions.

Push-button control of automatic transmissions is expected on Chrysler and Packard automobiles. Now that muscle is not needed for shifting gears, there is no need to retain the shift lever—hence push buttons. The buttons look and operate just like the push buttons on your radio.

Packard, after discovering a real interest in torsion-bar suspension, will extend the system through its entire line for 1956. It will introduce another exciting mechanical innovation—this one in the rear end.

Somebody in sales has discovered safety. Two of the big producers are going to go all out to sell safety features for 1956. This has been a sensitive area for discussion in recent years, but the attitude is changing.

Some of these safety features have been around for a long time, such as seat belts, padded dashboards, recessed knobs. But with the sales and advertising departments going to work on them perhaps they will be important factors in 1956. In any case, the companies are playing it safe by offering most of the safety features as extra-cost options—you pay your money and take your choice!

At least one, and possibly two, of the 1956 cars will have compression ratios of 10:1, requiring the higher-octane fuels that the petroleum industry will have in the pumps by the end of the year. Engineers predict the increased fuel economy will be noticeable. At an eventual 12:1 ratio, cars should get 30 percent more miles per gallon, engineers say (if the cars are not 30 percent heavier by then).

Smaller Wheels Coming Later

Smaller-diameter wheels (as small as 13 inches eventually, but more likely 14 inches at first) won't be available for the 1956 models because of the production changes involved. But they are on the way.

The 14-inch wheels have been tried on some 1955 cars and they look and handle beautifully even with no chassis changes, according to one proving-ground source. Being smaller they will get more wear per mile, but the rubber companies are planning to build longer life into tires to compensate for the smaller size.

If you are among those who have been a little annoyed by the violent colors available on the 1955 cars, you will probably welcome the news that the 1956 paints will be grayed down somewhat.

The coming model year could be described (in one line of cars, at least) as the year of the glorified tail fin. There was a time when cars looked alike from the rear, but today the back-end character is even more emphatic than that in front. And the trend is expected to continue as the 1957 cars invade the area of jet-plane design. Rear fenders will be longer and higher, like the tail of a jet fighter plane.

If you are still on the fence about a new car, you should be able to do well during the next few weeks. Dealer inventories are about 50 percent above last year and the 1956 cars are on the way!



Ersatz Bird Wakes Sluggabeds

Gentle souls who resent the clanging fury of an alarm clock can now be twittered awake by a "bird alarm." A synthetic canary in a gilded cage starts to chirp when it's time to arise. Its voice is a small music box linked to a clock in the bird's cage. The unit, made in Villingen, Germany, was recently on exhibit at the industrial fair in Hanover, Germany.

Radio Waves Cook Turkey

High-frequency radio waves in a new electronic oven cook a 15-pound turkey in 45 minutes instead of the usual six hours. Developed by GE, the oven may be available in 1957. Unlike previous ovens, the new unit imparts an appetizing browned surface to the meat it cooks. Heart of the unit is a magnetron tube which converts ordinary house current into high-frequency current needed for electronic cooking.



SEPTEMBER 1955

Crystal-Ball Department: THE 1956 AUTOMOBILES

Here is a summary of rumor, speculation and hearsay (some true, some perhaps false) about the 1956 automobiles.

Buick: Major face lift. Unlikely rumor is that air suspension will be used.

Cadillac: Same as Buick. Will offer the Eldorado Brougham, a hardtop version of the luxurious convertible. All-new Hydra-Matic will not be a torque converter.

Chevrolet: Important grille changes. May offer four-door hardtop. Power up.

Chrysler: Rear fenders and front grille new. More power. Transmission is unchanged except for push-button shifting.

Continental: Return of a classic. You'll spot it as a modern descendant of the earlier model. Very lush, but in good taste.

De Soto: Unusual rear-end styling, all-new front grille (no teeth). Power is up.

Dodge: Surprising amount of sheet-metal changes for second-year body. Emphasis at Chrysler Corporation is on rear-end styling. Important engine change. Even more emphasis on the "flashy look" of the Lancer.

Ford: Emphasis on engines and safety features. Grille, chrome and taillights changed. More power. No four-door hardtop expected.

Hudson: Major face lift; identification changes to distinguish it from Nash. The front fenders and grille to be new.

Imperial: Rear-fender changes.

Lincoln: All-new body is long, low and uncluttered—strong bid for prestige market. More power. Current fine handling is retained; soft "boulevard" ride added.

Mercury: Same as Ford, plus addition of a new low-price model.

Nash: Same as Hudson.

Oldsmobile: Major face lift.

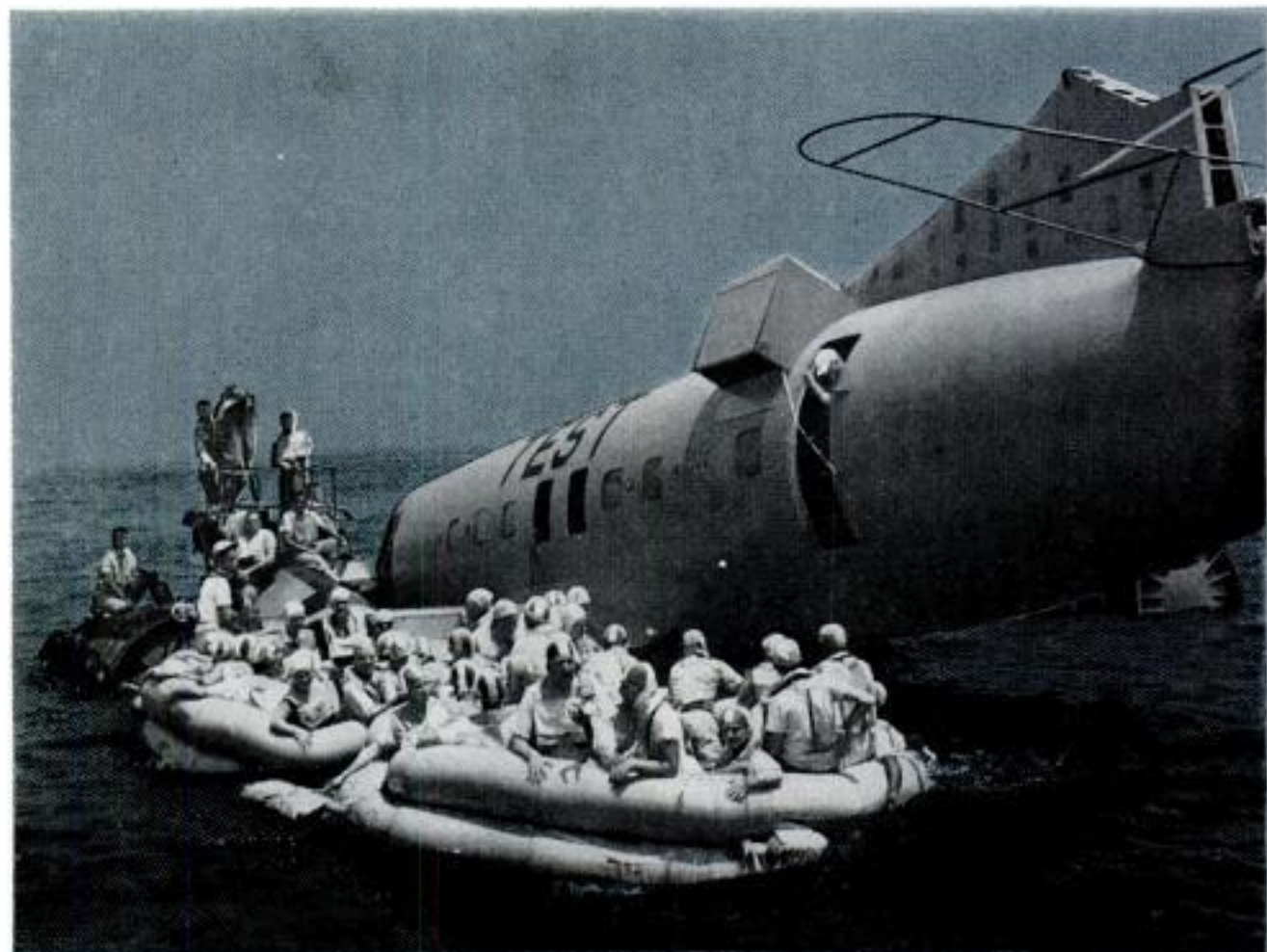
Packard: Torsion-bar suspension to be extended to all Clippers. Revolutionary rear end is the big mechanical story. Push-button transmission. Horsepower will be up as will displacement.

Plymouth: Same as Dodge. All Chrysler Corporation cars have push-button operation with Power Flite. Four-door hardtop.

Pontiac: Same as Chevrolet.

Rambler: An all-new body for 1956. Said to be as advanced in styling as tomorrow's dream cars. It will have wrap-around windshield, of course. May even offer a four-door hardtop. Still a six but power up.

Studebaker: Will build two different cars this year: One is the long, low sportster that has been the company's best seller since 1953; the other, an all-new-looking and more conventional family car. Both considered in low-price field.



In 4 minutes and 20 seconds, a safe margin, 40 passengers were evacuated from this downed airliner

Operation Ditch

FOR NEARLY A WEEK, early this summer, 40 volunteers, mostly government office workers, ranging from a 65-year-old white-haired grandmother to an 11-year-old boy, became a typical plane load of passengers for a series of survival tests known as "Operation Ditch." Sponsored by the Civil Aeronautics Administration, in conjunction with the airlines and other organizations in aircraft and allied industries, the trials were staged to observe the efficiency of present ditching systems, to try out new equipment and procedures, and to watch the reactions of a typical group of people who might make up a load of passengers on any commercial airliner.

The "ditched" plane was a production-line fuselage of a Martin 404 land-based, twin-engine airliner, with standard seating arrangements. Stripped of engines and wings, it floated on steel drums nose down in the water, just as it would do in a regular ditching. Tail surfaces were removed to indicate they'd been lost in landing, and also so the plane wouldn't nose into the wind. On calm days when the sea wasn't tough enough to suit observers, high-pow-

ered Navy crash boats tore back and forth beside the hulk to make big waves and rough things up for the stoic volunteer survivors, who dubbed themselves "drownies."

Actually, few airlines have ever had to ditch a plane, and most don't expect they'll ever be faced with such an emergency. But every overseas plane is equipped with life jackets for all passengers, enough rafts to accommodate everyone aboard and a set of procedures for the crew to follow.

For Operation Ditch, a United Airlines pilot, copilot and two hostesses played the part of crew on the damp research fuselage. "We followed the procedures taught us at school," explains hostess Roberta Randolph. "There's always time to prepare for a ditching, so these volunteer passengers always had seat belts fastened and life jackets on before the whistle blew. My post was at the forward hatch, over the wing. The other hostess was at the door. Passengers in the center of the cabin were evacuated first—through the door. Those up forward went out the hatch to the wing. Our job was to see that all were safely aboard rafts in record time. Then we

jumped in after them."

A ditched plane will float for about 15 minutes, which should be ample to get everyone safely in rafts and away. But casualties and "goofs" can often make a tight squeak of it. Operation Ditch was no different.

On one test run, minutes were lost when the white-haired grandmother, who couldn't swim, slipped on the wing, sat down and refused to jump across to the raft. Hostess Randolph finally had to roll her aboard. On another run, a raft failed to inflate, another was thrown in on top of it and, as "drownies" leaped into it, the dud underneath suddenly decided to fill up. As it inflated, it heaved people from the top raft into the sea in all directions. The resulting shambles cost about five precious minutes. So did the raft that triggered itself too soon and inflated inside the plane.

"Those misfires were just what we wanted to see," explained one observer. "The human element simulated here is identical to what you might find on any ditched plane. By observing such errors in a test like this, we can see how foolproof our equipment and procedures are."

According to Dr. Barry King of CAA, Operation Ditch was not to prove anything. "Purely experimental," he says, "to see what happens when a plane goes in the ocean. It is the first time this kind of ditching test has been accurately simulated with a land-type plane."

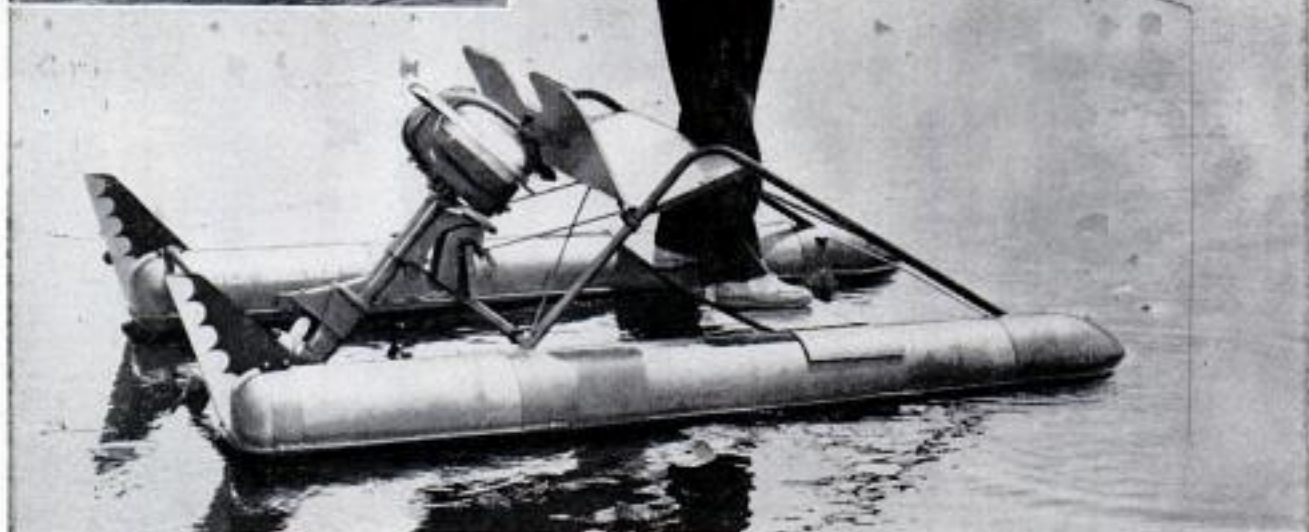
Whatever it proved or didn't, Operation Ditch's "drownies" had themselves a 10-day workout. During the long series of tests, they jumped from starboard exits, port exits and both sides together—into water, into rafts and both ways at once. They slid into rafts on a new pneumatic escape slide, which was originally designed for evacuating people from high doorways of planes on land, but showed itself equally



Garrett Corporation photo
Passengers demonstrate escape from plane via pneumatic slide, originally designed to evacuate people from high doorways of planes on land. After evacuation it can be detached from plane and used as a life raft.

capable of chuting chuters at sea. Attached to the doorsill of the plane, it inflates outward automatically. Trapped passengers can zoom down it like kids on a playground slide. When everyone's out, it can be detached and used as an additional piece of flotation gear.

Chances are millions to one that you will ever ride a plane that has to ditch in years to come. But if you do, everything should go like clockwork—and you can thank the Norfolk "drownies" who survived 10 days of ditching back in 1955. ★ ★ ★



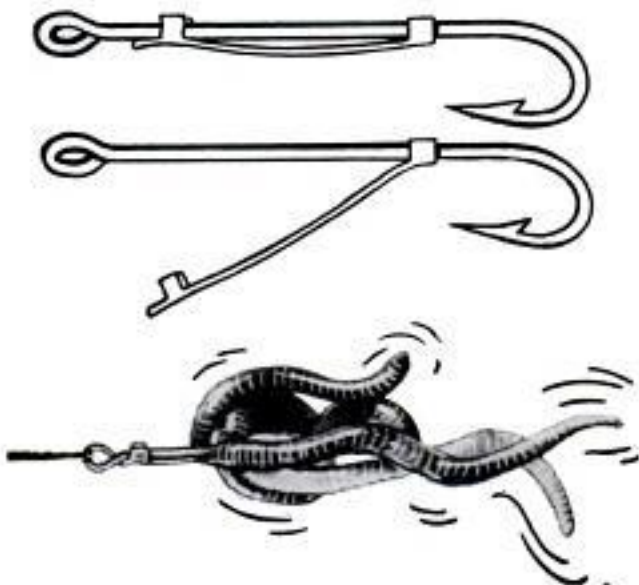
Sportsmen can cruise in marshes and shallow ponds with a pontoon boat that mounts an outboard motor. The 125-pound, 12-foot craft can also be equipped with foot pedals, an engine using an airplane-type propeller, or a sunshade canopy. A seat of marine ply-

Pontoon Boat

wood big enough for two is mounted on tubular-steel framework. The twin pontoons are each divided into four watertight compartments, and are made of molded glass fiber which requires no maintenance. The boat is quickly assembled from a kit.

Clip on Fishhook Holds Worms

There's no need to thread a worm on a new fishhook. On the shank of the hook is a small clip. The angler places two worms under the open clip and then closes it. The clip grips the worms securely, yet permits them to wiggle, giving the bait a live action.



Light on Fishing Rod Warns When Fish Bite

Those lights you see winking at night around the edge of a lake or along a riverbank may not be fireflies. Instead, they may be the sign that some lucky fisherman has a bite, and a small light clipped to his rod is warning him to wake up before the fish gets away. Battery operated, the little light clips to either a casting rod or a cane pole, and lights up at the slightest tug on the line, according to the manufacturer. It also can be used as a flashlight to help you see when baiting the hook.





Coming next month

OUR 1955

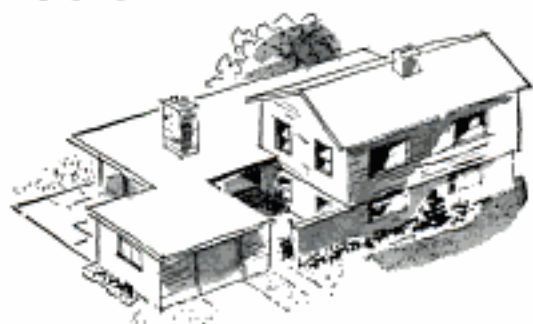
SPECIAL SECTION ON HOMES



50 PAGES—with an idea for your home on every page
INTRODUCING

the PM Young-Family House

A split level designed by a noted architect for our readers



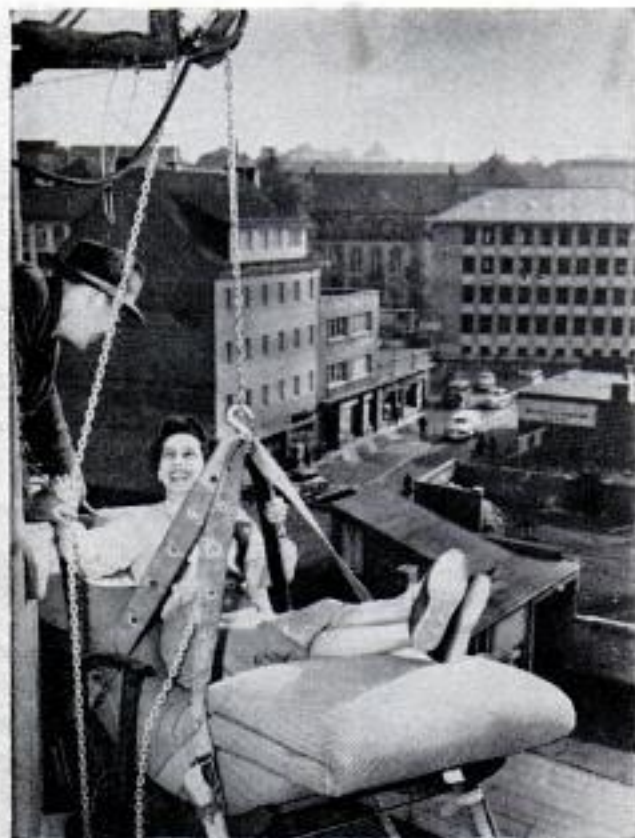
OTHER FEATURES:

- A thousand-dollar tip on the right colors for your home
- How to bring your kitchen up-to-date
- How to build your own carport
- All about electric heating
- Our annual album of prize homes
- One-man remodeling jobs
- A valuable check list for rating your home
- How to plan for future improvements before you build
- A small retirement house with elbowroom
- How to tile a ceiling
- How to make screens
- Many pages of full-color illustrations, photos, diagrams



Look for the 50-Page home section in October





Moving Get You Down? German Elevator Gives Needed Lift

Hoisted to her fourth-floor apartment while seated in a chaise longue, a young German woman recently demonstrated a

furniture lift that speeds moving. It can be mounted in any window and handles loads up to 300 pounds.

Movie-Film Rewinder

Movie film is rewound during projection by equipment designed to fit all 8-millimeter and 16-millimeter projectors. A system of rollers gently leads the film from the center of the upper reel. As the film comes from the projector, it is automatically rewound on a removable hub. A roller plate, hubs, reels and film containers comprise the system.

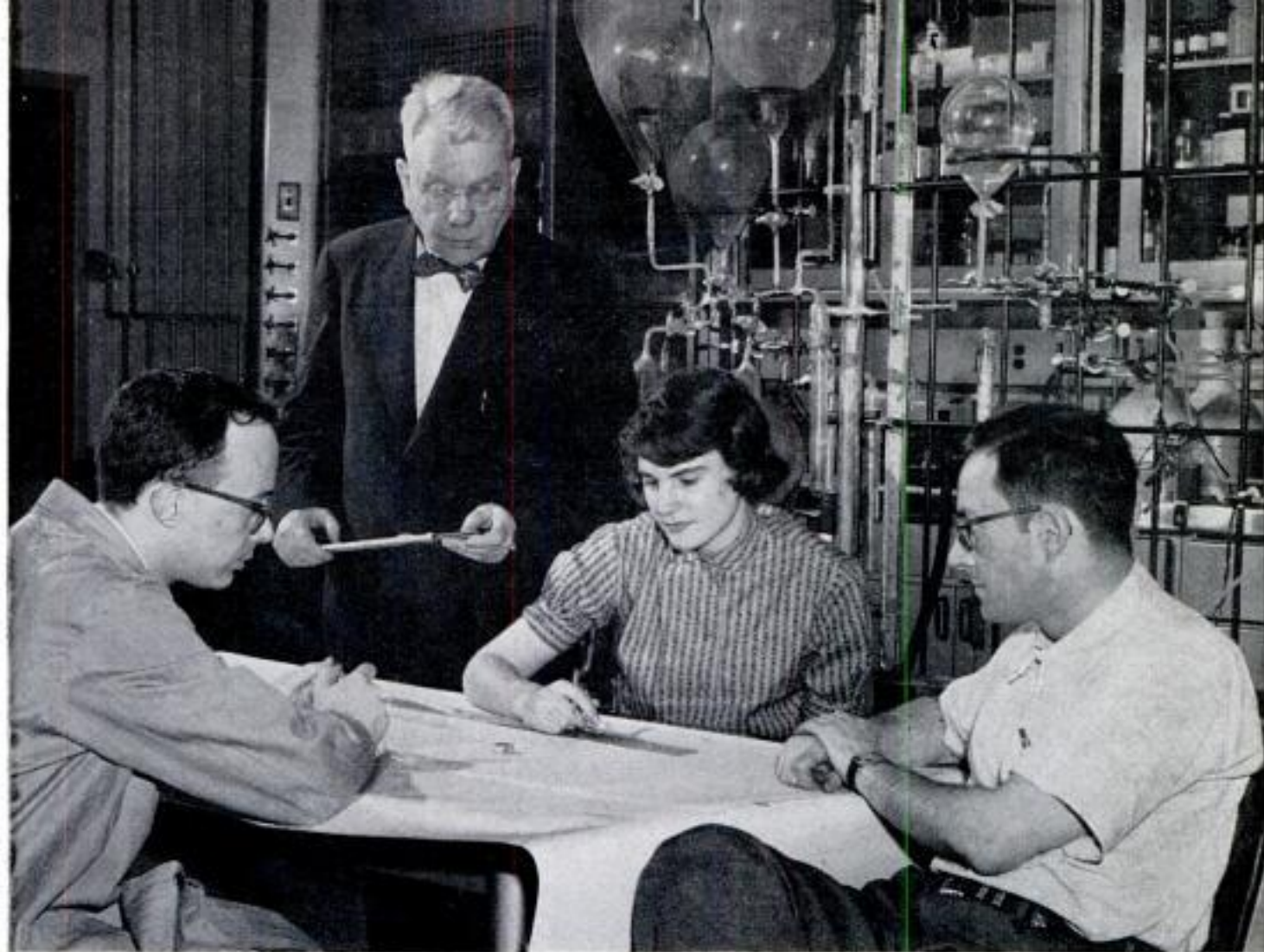
London Sees First Commercials

Britain's first commercial television station, built near London, is scheduled to begin transmission September 22. Two other commercial TV stations are slated to open in March. The three stations will be able to reach almost 60 percent of the total population of the United Kingdom. It is expected that eventually 40 to 50 commercial stations will serve the nation.



"Buckaroo" Trains Backs

When the chant of "Hit that line!" goes up in the University of Washington stadium this fall, coach Johnny Cherberg's running backs will be glad they have only human linemen to charge, instead of the monster known as "Buckaroo." Buckaroo is a contraption of webbing and springs invented by Cherberg to teach his backfield runners to drive into the line with power and determination. When lunging at the machine, if each player maintains balance and keeps his feet driving under him, everything is fine. But if he fails, the springs snap back, upending him suddenly and roughly.



Doctor Urey inspects chart drawn up by his assistants. Equipment behind them measures radioactive carbon

**A renowned professor of nuclear chemistry offers sage advice to youth:
Get into the field of atomic science!**

IF I WERE A STUDENT TODAY

By Dr. Harold C. Urey

MY HIGH-SCHOOL DAYS extended from the autumn of 1907 to the spring of 1911, and the location was Waterloo and Kendallville in northeastern Indiana. My home was in the country near these towns and my stepfather was a farmer, as were most of my relatives. No one was ever able to tell me anything of the world of magnificent wonder in which I have spent most of my life!

Of course, part of this wonder can never be told. I have been privileged to discover a few facts of nature and perhaps to understand some few things which no one ever knew or understood before. The magnificent thrill that comes to one on the occasion of even a small but original discovery must be experienced to be understood. But can you — and I hope you are a young student — hope to enter a field in which this can be done? Well, what

were the chances that a poor farm boy of northeastern Indiana, whose country grade school lasted only seven months a year, would become one of the moderately famous scientists of the 20th century? If it happened to me, it may happen to you. Why not try?

Since World War II nuclear science in its chemistry, physics and engineering phases has come to public notice through the daily press and magazines. Unfortunately, this publicity has concerned weapons of war to such a large extent that many people do not realize the immense interest of the subject for pure science and peacetime technical uses. We hear of the A-bomb, the H-bomb, or thermonuclear bomb, jet planes, rockets with atomic warheads that will carry these weapons thousands of miles, deadly radioactivity of the C-bomb, etc.; and we hear these

Nobel Prize winner and key figure in the development of atomic energy, Doctor Urey is Professor of Chemistry at the Institute for Nuclear Studies of the University of Chicago



Students in training at Argonne National Laboratory learn details of the operation of a research reactor

Urey reads results of test measuring oxygen isotopes. Discovery of hydrogen isotope won him Nobel Prize



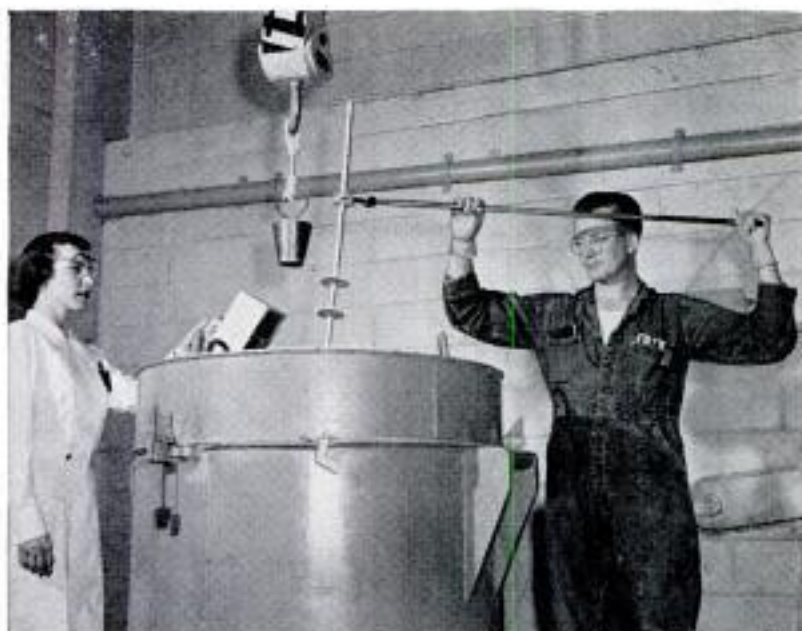
things repeated over and over, day after day, until we all, myself included, begin to believe that these destructive things make up all of the subject of nuclear science in its various phases. This is not true and it is the purpose of this article to tell some of the fascinating phases of this subject.

In addition, we all know that some information is classified, that is, kept secret from the public and from other scientists. The constant discussion of "atomic secrets" gives the public the idea that nearly all information is secret, whereas most of it is public and is published in our scientific journals as usual. The *Physical Review* published 6880 large pages during 1954, and a very large fraction of these deal with nuclear physics. What have been kept in the secret category have been weapons and data of direct importance to these, and information in regard to nuclear reactors of all kinds. Much information about nuclear reactors for power purposes is now being made public. During the coming years the scientific and engineering features of nuclear science will become as much a part of the public knowledge as any other part of scientific activity. This will come about as all of us realize that most of the scientific and engineering knowledge is possessed by people on both sides of the Iron Curtain and that there is little knowledge that we

have that others do not have. Moreover, nuclear science will grow beyond our government laboratories and establishments and will become partly privately owned and operated. Also, the military aspects of the subject will become less important in the whole picture than they are now. By the time high-school students of today acquire their doctor's degrees in various phases of this subject, the whole field will look more desirable than it does now.

Nuclear science deals with problems of enormous energies, the transmutation of the elements, the source of the energy of the sun and stars, temperatures of millions and billions of degrees, and the origin of the elements themselves. Particles of matter disappear in the energy of light or into other particles, or they are produced from light or even from nothing but the light energy in a vacuum at high temperature.

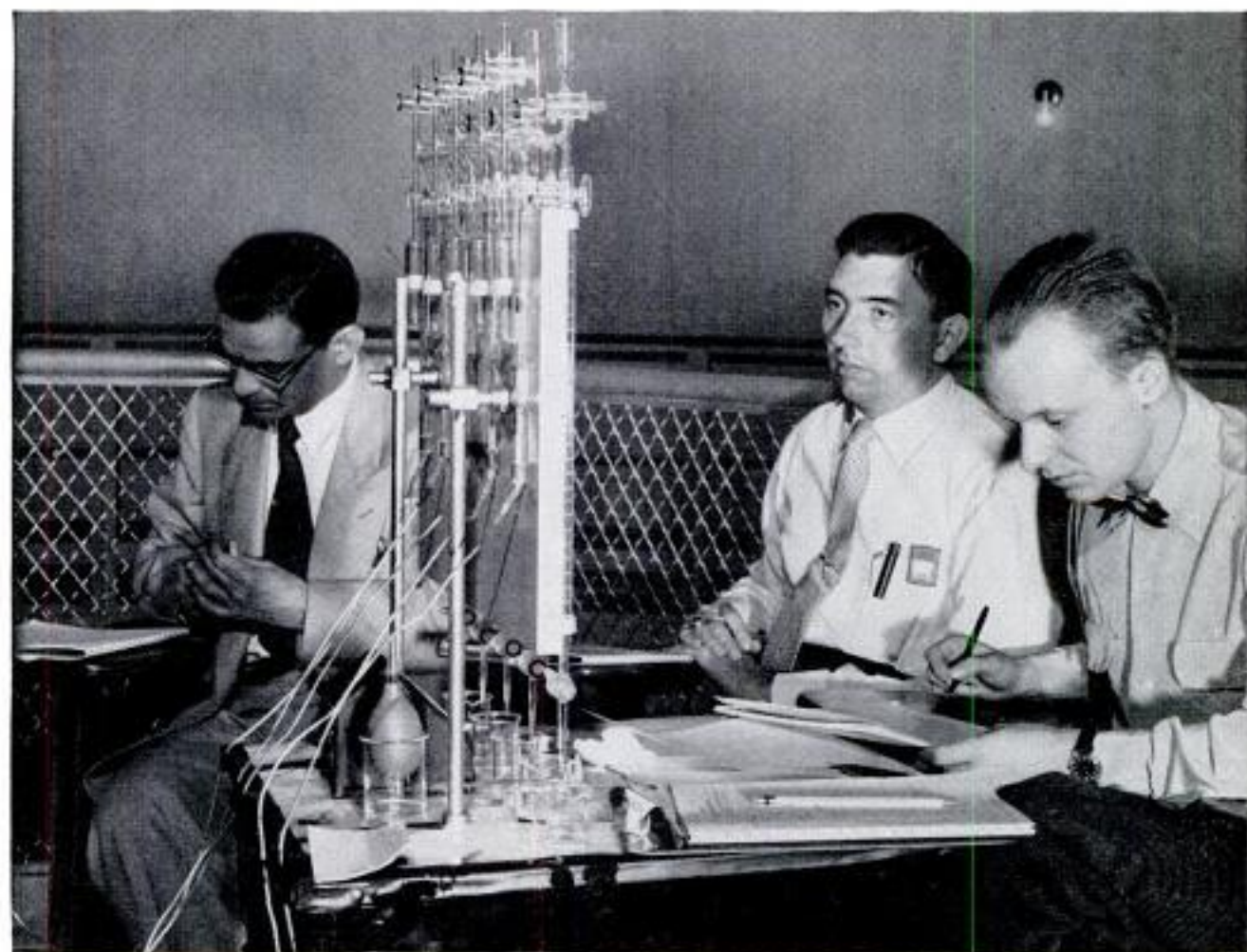
Let us look in on scientists at work. A group of scientists is moving about a concrete room. One is in a white jacket; an-

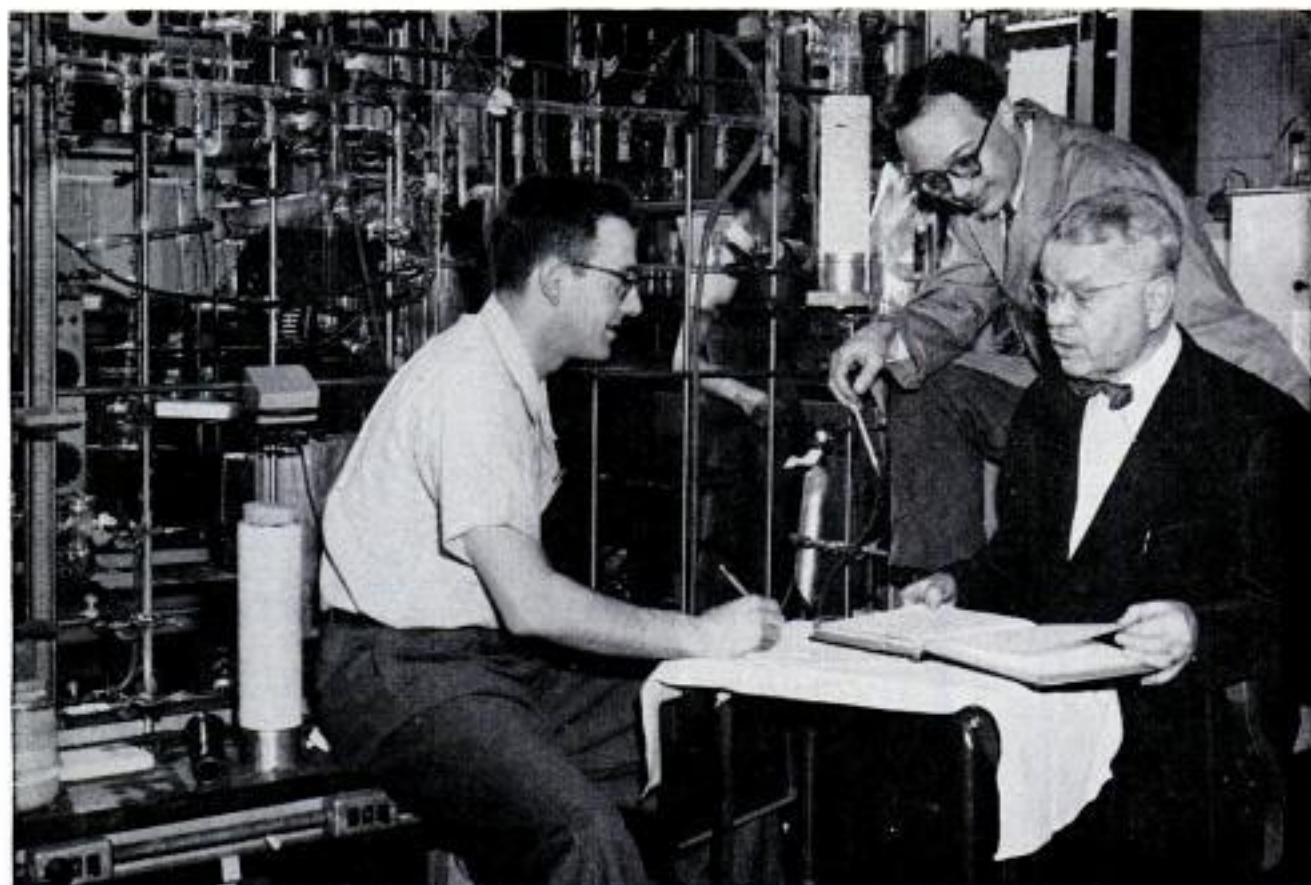


Argonne National Laboratory photo
Chemist calibrates a new radioactive-concrete source. The tube he is lifting with a handling tool contains a chemical solution that decomposes, at a known rate, in the presence of radiation

other in coveralls. There are a number of holes in one wall through which come invisible particles with velocities near the velocity of light. Behind this wall is a cyclotron, or a betatron, or a cosmotron—a complicated mass of metal weighing as much as a cruiser, which is producing these

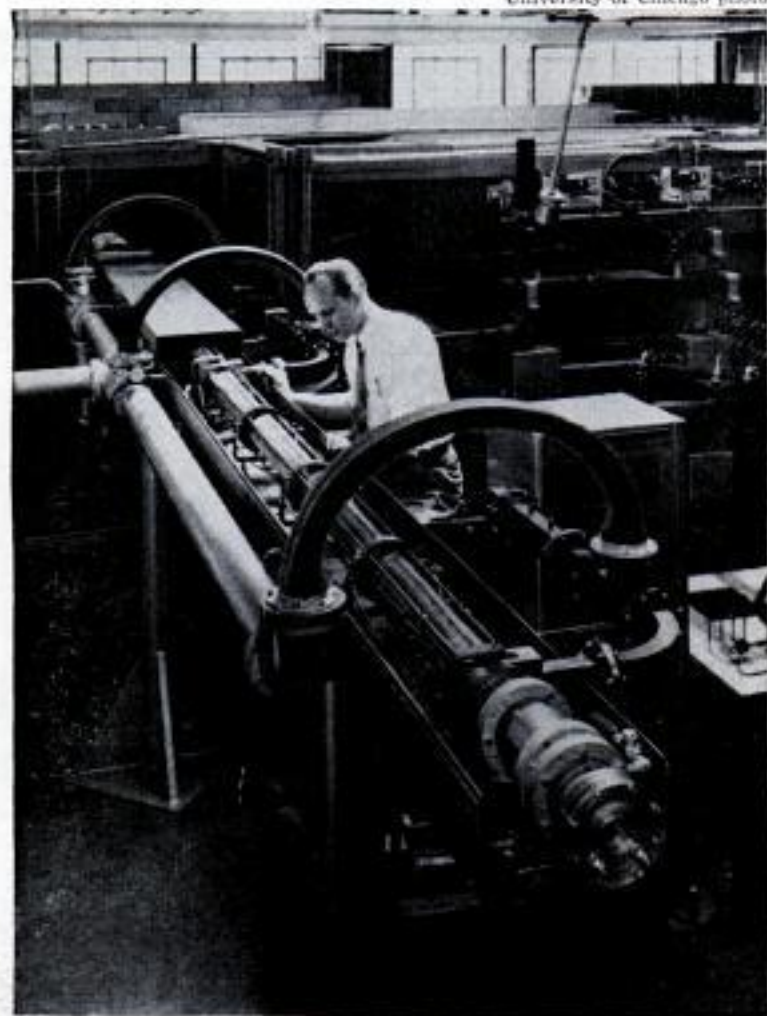
Students learning of effects of nuclear bombardment conduct experiment in the disassociation of liquids





Doctor Urey confers with assistants in laboratory. Vacuum equipment behind them reduces material for testing

Electrons ride radar waves down 16-foot wave guide of microwave linear accelerator. Instrument is useful in cancer research
University of Chicago photo



particles, beta rays, neutrons, protons, mesons, etc. The particles are deflected with magnetic fields or material substances, or they produce radioactive substances. The machine is valuable and expensive to operate, and it is scheduled for 24 hours a day and seven days a week.

Or a group of scientists is sending a balloon to 100,000 feet above the earth's surface. That balloon carries instruments to record its height and the intensity of cosmic rays, and a stack of photographic plates. These plates will be developed when they return to earth and they will be examined under a microscope. Here the tracks of nuclear particles of high energy will be found. They record processes of the highest energy we have ever observed.

Or scientists are putting materials into a large reactor. It is covered with a thick shield of concrete to stop the neutrons and gamma rays which would kill the operators if they were exposed to the full intensity for a second. The substances become radioactive and are transferred by mechanical means behind protective walls to

(Continued to page 246)



Boat for Resort Sight-Seers Made With Aluminum pontoons

Three adults ride comfortably in an all-metal paddle boat designed for rental use at lake resorts. Two aluminum pontoons provide buoyancy and make the boat virtually unsinkable. The deck between the pontoons is flat and slip-proof. There are only two controls—an engine control and rudder control. A small air-cooled gasoline engine operates about eight hours on a gallon of fuel. Speed is four miles per hour. Constructed to take the rough treatment rental boats normally get, the unit is said to be damageproof.

Cranes With Long Beams Erect 22-Story Buildings

Cranes are being used as skyhooks (right) to erect four 22-story apartment buildings in New York City. The cranes are equipped with 230-foot beams, said to be the world's longest. They are lifting 50,000 cubic yards of concrete and 6000 tons of reinforcing steel. The buildings are almost 200 feet tall. Two of the cranes working together cover an entire floor, the concrete and steel going from truck to bucket to the spot where they are needed. To do the same job using conventional techniques, eight elevators, eight towers and eight bucket hoists would be required.

Ship TV Links Key Points

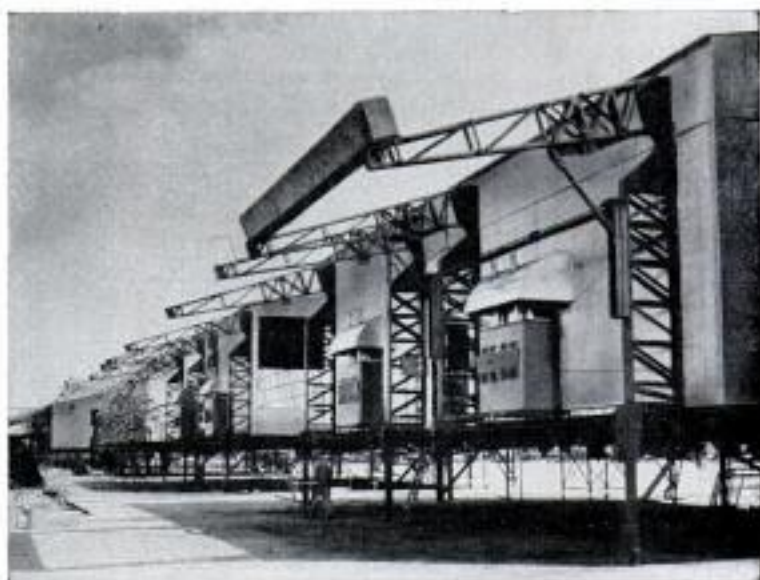
TV will soon be used aboard a Canadian navy ship to relay tactical information. A camera will be focused on the plotting chart or table, where the movements of enemy planes and ships are recorded. The bridge and four or five other key points in the ship will be equipped with receivers.





Swing-Up Shelters Shield Mechanics at Work on Giant Planes

Portable steel houses shelter Air Force mechanics working in the field on huge planes like the monster XC-99 cargo-troop transport. The maintenance docks—four units to a plane—roll under and fit over the wings. Cantilevers permit the roof and wall to be raised to a 45-degree angle to admit the wings and then lowered to provide sheltered working space for the mechanics. This electrically driven operation takes only 90 seconds. The floor of the shelter serves as a working platform and can bear the weight of plane engines. The insulated units have both heating and air-cooling equipment.



Process "Vitamin Cherry"

Juice from the acerola, Puerto Rican cherry, claimed to contain 80 times as much vitamin C as orange juice, is being processed at a pilot plant at Sabana Seca, Puerto Rico. Formerly, orange juice was commonly believed to be the best natural source of vitamin C. The tart, refreshing juice will be used in infant foods and may later be added to other foods and soft drinks. The tree grows semi-wild in the Caribbean islands and yields four crops a year. A commercial planting of 30,000 trees is expected to yield 900,000 pounds of fruit by the end of 1955.

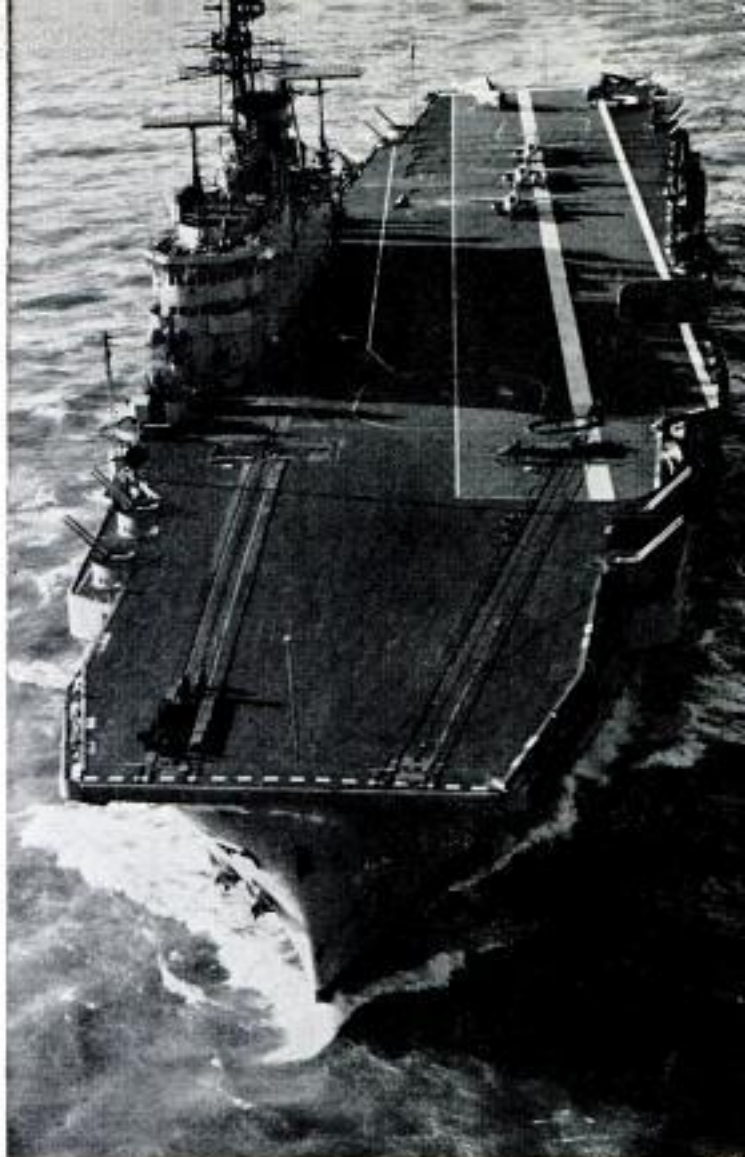
Britain's Atom-Age Carrier

BRITAIN'S latest aircraft carrier, the *Ark Royal*, will be able to launch an atomic attack or weather the effects of a nearby atomic explosion.

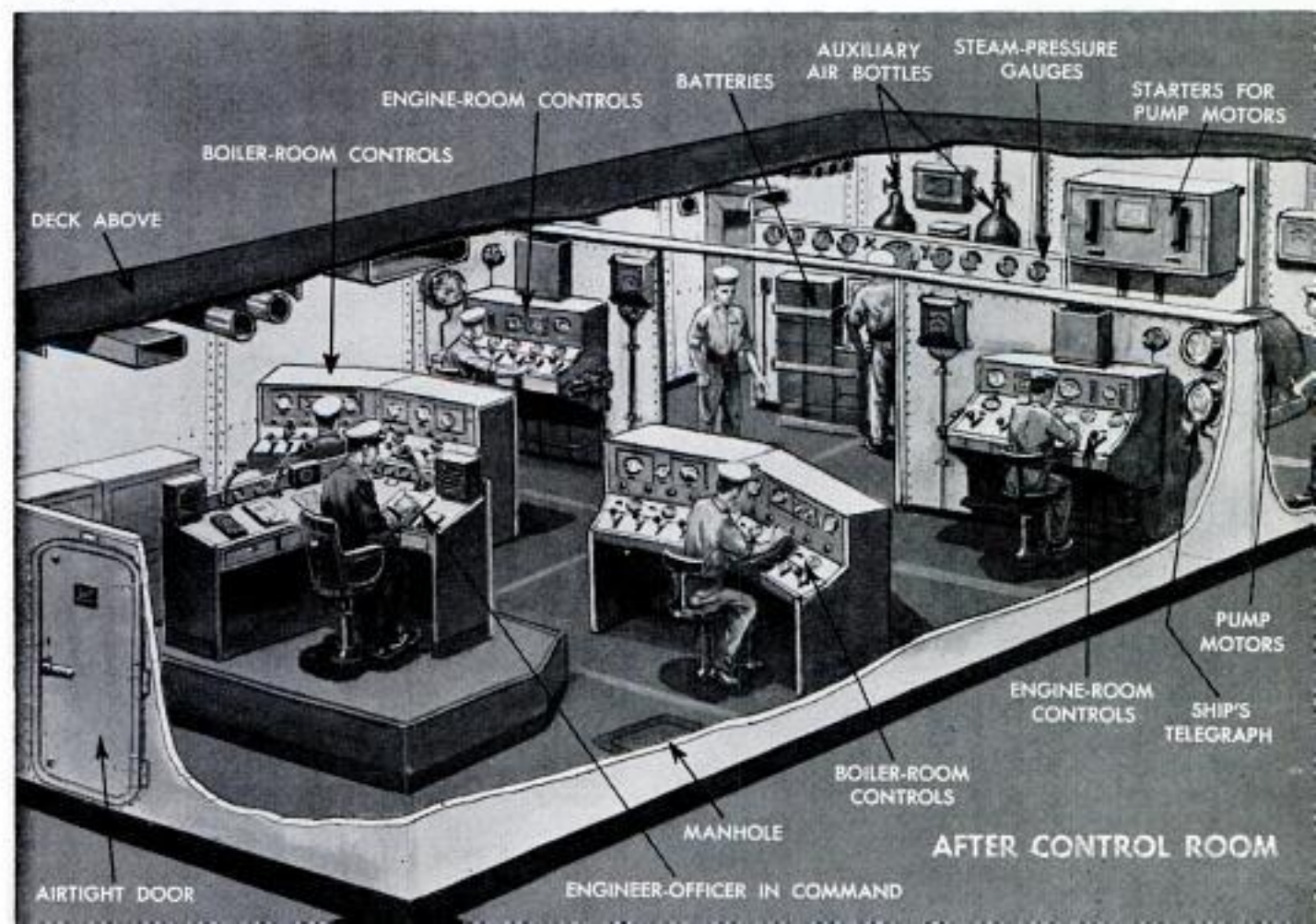
After an atomic attack, the *Ark Royal's* boilers and engines can be run by remote control from hermetically sealed and air-conditioned rooms. Provisions were made for clearing the engine rooms of personnel because the engines would suck in huge quantities of radioactive air. Two remote-control rooms, one forward and one aft, allow the crew to control engines and boilers while the ship speeds out of the contaminated area. Meanwhile, spray nozzles wash the exposed deck.

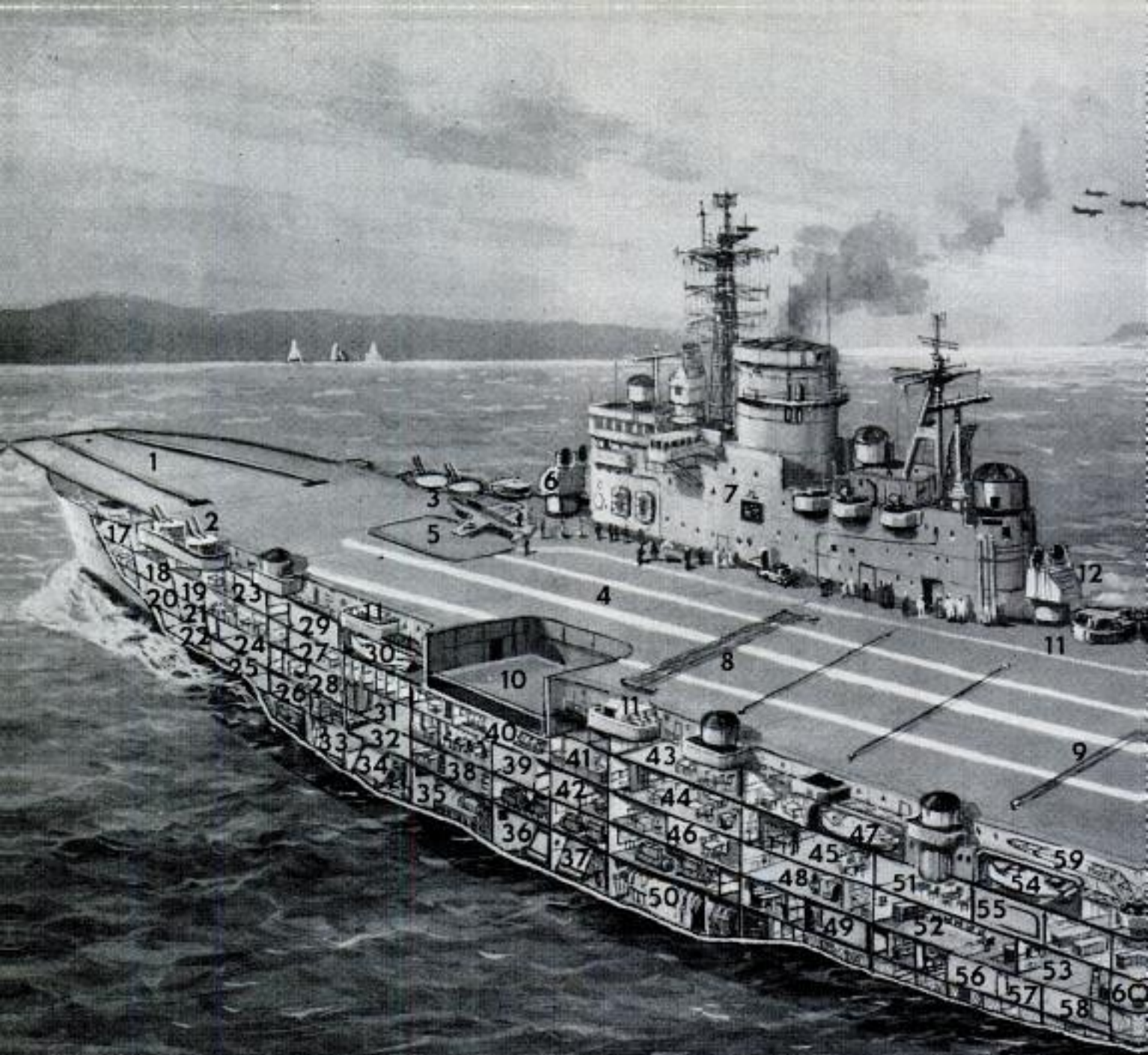
The vessel carries 100 aircraft and 2200 officers and men. The largest carrier in the British fleet, it has a standard displacement of 36,800 tons (half that of the *USS Forrestal*) and a length of 808 feet. It has two steam catapults, an angled deck and a mirror landing guide. A cutaway drawing of the aircraft carrier appears on the following pages.

★ ★ ★

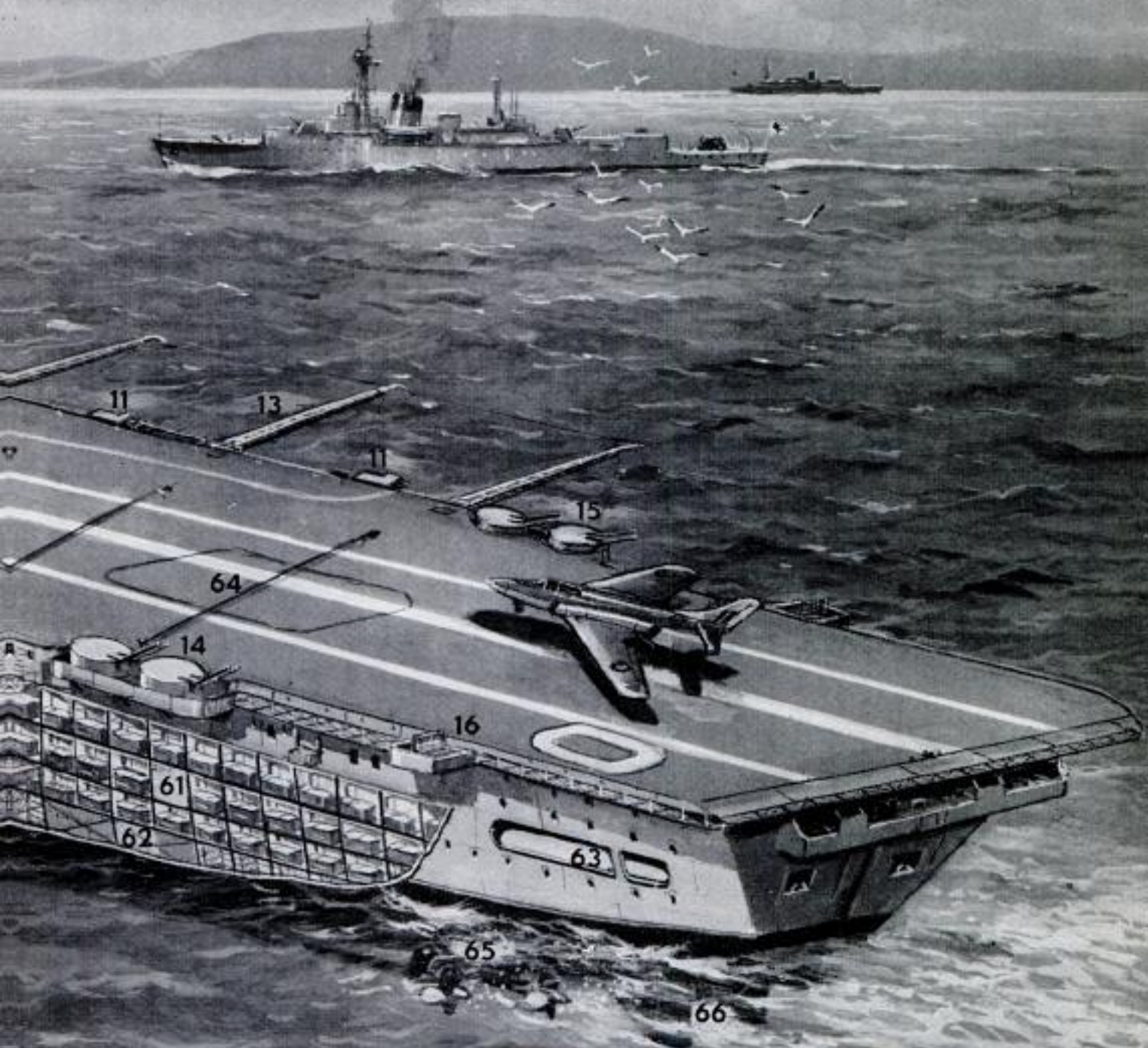


Ark Royal has top speed of over 30 knots. Keel of the recently completed ship was laid May 3, 1943. Modifications to make it most modern carrier afloat slowed delivery. Below, a remote-control center





G. HEAVIS
1955



BRITISH AIRCRAFT CARRIER ARK ROYAL

1. steam catapults; 2, 3. dual-purpose guns (4.5-inch); 4. angled flight deck; 5. aircraft lift; 6. director tower; 7. superstructure; 8. arrestor net (lowered); 9. arrestor wires; 10. deck-edge lift; 11. Bofors guns; 12. director tower; 13. radio masts lowered; 14, 15. dual-purpose guns (4.5-inch); 16. deck-landing controller; 17. mess; 18. mess; 19. dining hall; 20. mess; 21. pantry; 22. laundry; 23. air workshops; 24. hospital; 25. stores; 26. forward remote-control room; 27. mess; 28. offices; 29. showers; 30. 32-foot cutter; 31. stores; 32. mechanics' mess; 33, 34. forward boiler rooms; 35. forward port engine room; 36, 37. after port boiler rooms; 38. engineers' offices; 39. mechanics' mess; 40. lift machinery; 41. wash place; 42. lobby; 43. mess; 44. mess; 45. dining hall; 46. recreation rooms; 47.

36-foot speedboat; 48. mess; 49. after remote-control room; 50. after port engine room; 51. mess; 52. dining room; 53. ante-room; 54. 36-foot speedboat; 55. open space; 56. prison; 57. stores; 58. refrigerated stores; 59. crane; 60. captain's lower office; 61. officers' cabins; 62. fresh-water tanks; 63. quarter-deck; 64. after aircraft lift; 65. twin propellers; 66. twin rudders. SUPERSTRUCTURE CUTAWAY: 67. bridge; 68. flying commander's bridge; 69. admiral's office; 70. captain's sea cabin; 71. navigation officers' sea cabin; 72. control room; 73. admiral's sea cabins; 74. executive officers' sea cabins; 75. squadron officers' cabin; 76. planning rooms; 77. switch room; 78. boiler uptakes; 79. operations rooms; 80. fan machinery; 81. briefing room; 82. ready room; 83. fire-control tower



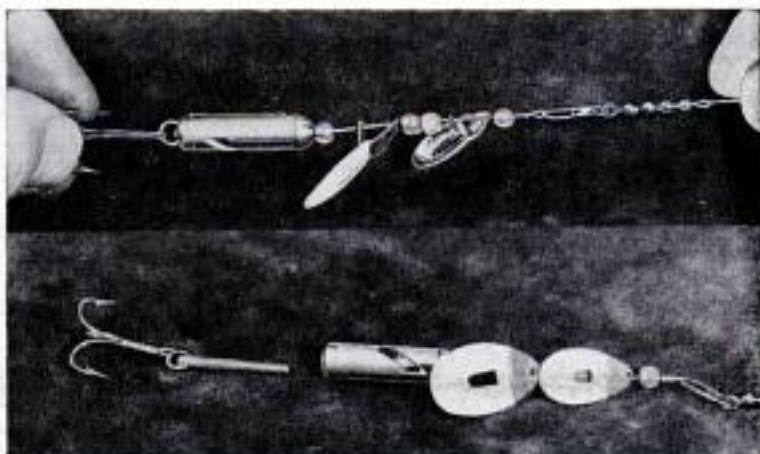
German Body Shop Turns Chevrolet Into "Le Sabre" Dream Car

You don't have to be president of a big automobile company to have a dream car, Maj. Ralph W. Angel, U. S. Air Force jet pilot, discovered. He simply bought a secondhand Chevrolet while stationed in Germany and drove it to the Spohn body works in Ravensburg. He sketched up his idea of a dream car (inspired considerably by General Motors' famed Le Sabre) and turned the Chevrolet over to the body men.

In six weeks, he had his dream car. It is completely custom built as far as sheet metal is concerned. The chassis and engine are stock Chevrolet except for a dual carburetor and a split exhaust manifold that leads to twin exhaust pipes. It cost the major \$4500. Since his return to this country, he has sold the car to a Phoenix, Ariz., used-car dealer. "It attracted too much attention," Angel said.

Self-Releasing Lure

If the angler snags a new lure he can release it by pumping on the line. Pulling the line taut and releasing it operates a small ratchet mechanism built into the lure. The ratchet unscrews the hook from the main part of the lure, which then is retrieved. Extra hooks are provided with the lure and the angler simply screws a new hook into place. The lure is made in six models for casting, spinning and trolling.



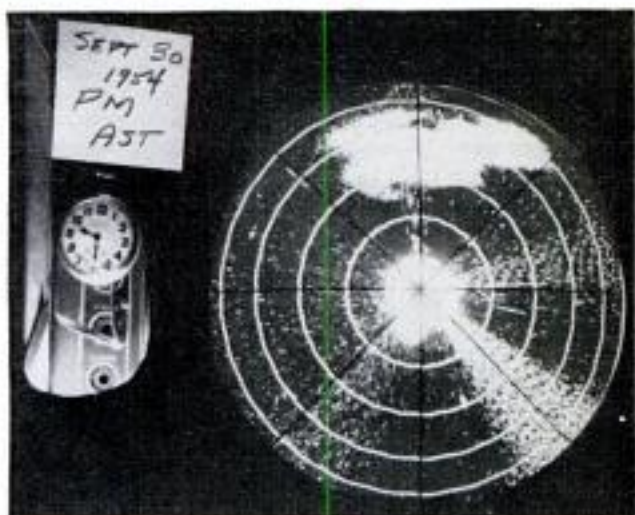
Raft Has Window For View of Fish

Swimmers can observe marine life through a window while relaxing on an air mattress manufactured in Germany. A high rubber rim prevents water from covering the top surface of the window. A hose permits the swimmer to draw off air bubbles which may form under the window to obscure the view. The swimmer can paddle the mattress around a lake or pond while he views the marine life.



Aurora "Curtain" of Tiny Rays Forms Along Magnetic Field

Through simultaneous photographs and radar observations, Cornell University scientists have found that the aurora borealis actually is composed of hundreds of thousands of relatively tiny rays. The auroral display looks like a curtain of shimmering light. The rays which produce this effect are continuously forming and fading along the lines of the earth's magnetic field. They are formed by protons thrown out by the sun, which smash into the earth's outer atmosphere to produce electric fields. The northern lights can shift about 300 to 3000 feet a second. They disturb long-distance shortwave broadcasts but improve television and other high-frequency waves. Cornell scientists analyzed simultaneous radar



images and photos of the aurora and detected the tiny rays. The scientists have been carrying on experiments with radio echoes from the northern lights since 1951.

Small Jets on Wing Tips Increase Safety During Take-Off

Single-engine take-off performance of the giant twin-engine C-123B transport plane is improved more than 300 percent by the thrust from two small jets, one mounted on either wing tip. The Fairchild J44 turbojet units, rated at 1000 pounds of

thrust each, increased take-off rate of climb with one main engine feathered from 150 to 500 feet per minute. Installation of auxiliary jet engines for emergency use was seen by Fairchild engineers as an important stride forward in twin-engine safety.



WHAT'S NEW FOR

1. DRY-CLEANING DEVICE for home use is an aluminum table-top unit which swishes clothing through dry-cleaning fluid to loosen dirt and then squeezes out the excess fluid. After cleaning, little or no pressing of garment is required. Paper filters furnished with unit permit fluid to be reused a number of times

Remuzit Home Products Co.,
1724 Chestnut St., Philadelphia, Pa.



2. WASHING MACHINE requiring no rinse tubs has a two-way hose that fills it directly from water faucet. Same hose also pumps dirty water into sink drain. Two-way hose saves about 15 minutes on each wash
Central Rubber and Steel Corporation, Findlay, Ohio

3. WATER-HEATER accessory automatically delivers hot water in two temperature ranges from a single heater. For appliances, water is 160-180 degrees; for normal home use, it is 100-140 degrees at faucets
Ithcum Manufacturing Company, 7600 S. Kedzie Ave., Chicago

4. SALT SHAKER dispenses salt no matter how damp the weather—and even under water—when bottom is turned. Operated through a series of gears, an agitator forces salt through holes in top of shaker
Dot-A-Mar, 25 Almerin Ave., Coral Gables, Fla.



5. PRESSURE PAN operates on 120-volt alternating current and, in addition to cooking under pressure, it also fries, steams, boils, braises and sterilizes. Once set, it automatically maintains pressure and temperature. Made of aluminum, the pan has a capacity of four quarts. Heatproof legs permit it to be used on any table top

Aluminum Goods Mfg. Co., Manitowoc, Wis.

6. WINDOW GUARDS that are easily installed by the homeowner in both steel casements and double-hung windows are designed to prevent small children from falling out and also to protect the home against intruders. Units are available to fit all standard windows. Made of cold-rolled steel, they are protected from rust by wax

Hudson Hardware and Oilburner Co.,
5035 Broadway, New York City 24

7. FIRE EXTINGUISHER uses compressed air from the air hose at the gas station in place of CO₂ and soda acid to build up operating pressure. The unit sends a steady stream of water 35 to 40 feet until its 2½-gallon supply is exhausted. A gauge on top tells when pressure is low. Smaller units are planned for later production

Elkhart Brass Mfg. Co.,
1302 W. Beardsley Ave., Elkhart, Ind.

8. EXACT TEMPERATURE for any kind of cooking can be dialed on a new built-in electric range. The dial eliminates the guesswork connected with using conventional controls marked only "low," "medium" and "high." The new-type unit not only heats to exact degree but maintains heat automatically at desired temperature

Admiral Corporation, 3800 Cortland St., Chicago 47



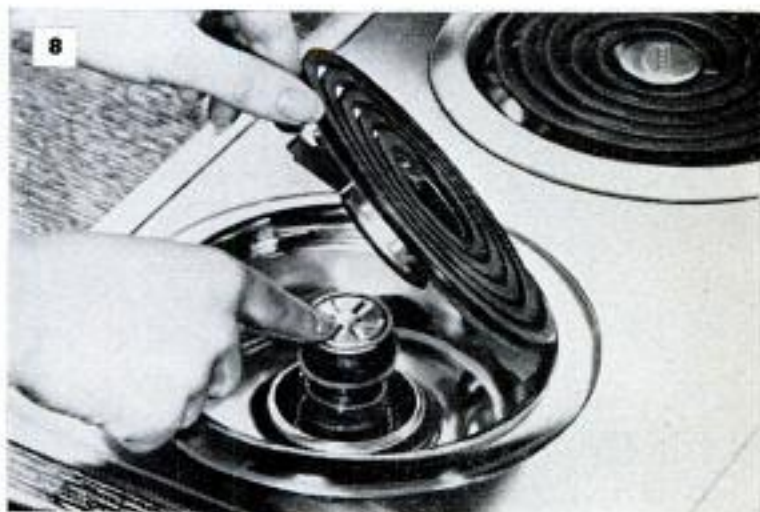
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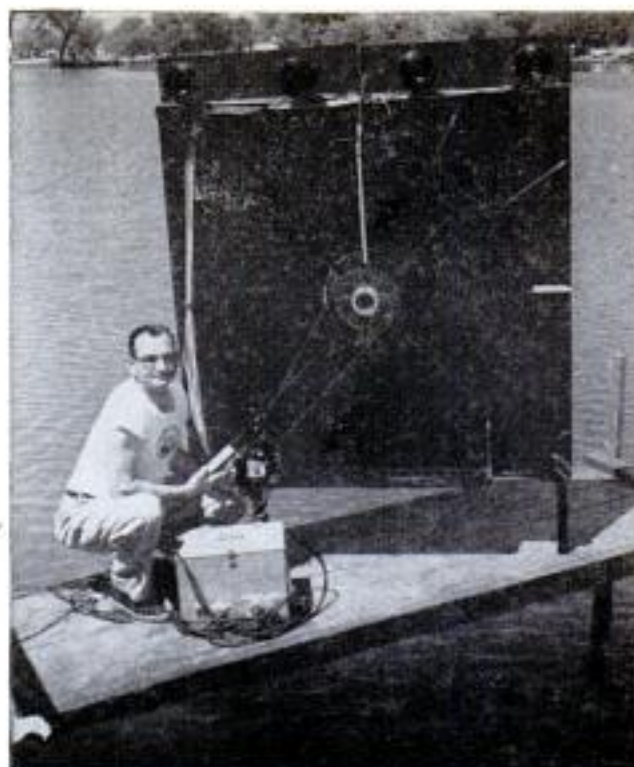
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8



Start of race is 35 seconds away. Fluorescent-yellow face of "blackout" clock is almost half eclipsed



Clock from reverse side, showing bicycle-chain rig that turns blackout mechanism of starting clock

"Blackout" Racing Clock Shows Time and Trips Starting Cannon

EVERYONE gets off to an even start when a new "blackout" racing clock is used. Used to tick off the seconds in the last minute before the race begins, it shows the time left for maneuvering.

The fluorescent-yellow face of the clock is four feet in diameter and can be seen for three miles. As the sweep second hand starts to revolve, the used portion of the minute shows in black on the clockface.

By the time the hand completes its one-minute revolution, the face is completely blacked out. At zero instant two finger springs flick a pair of toggle switches. One stops the electric motor which drives the clock and the other sets off the starting cannon.

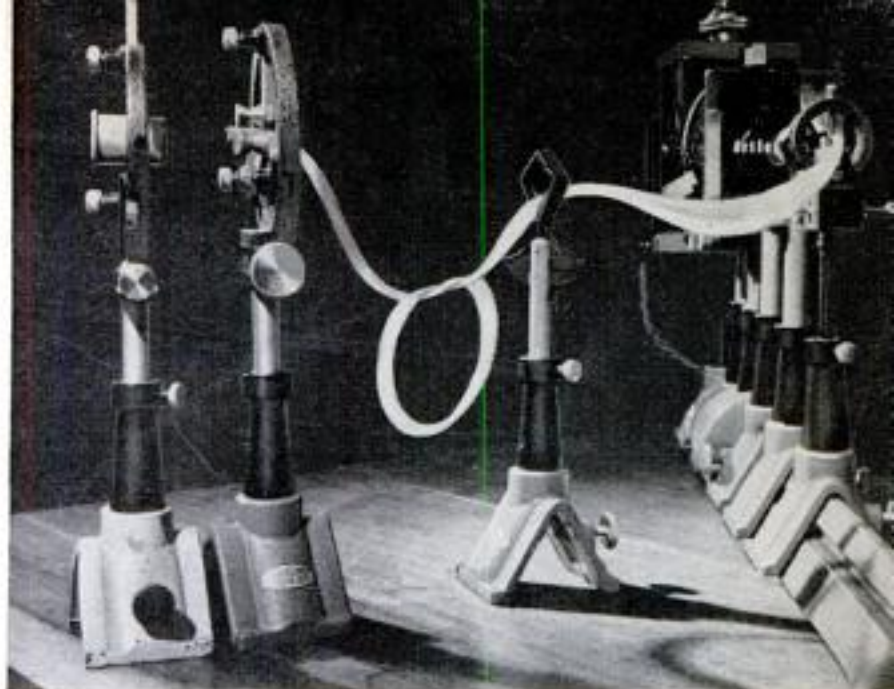
Four colored lights on top of the unit are used to give advance warning of starting time before the hand begins to turn.

Boats dart away from starting line. When clock hand makes a full circle, it trips trigger of starting cannon

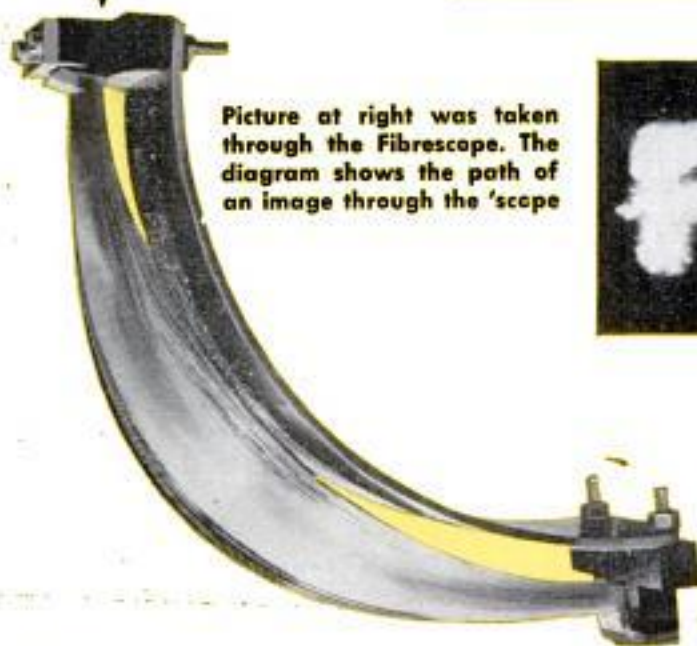
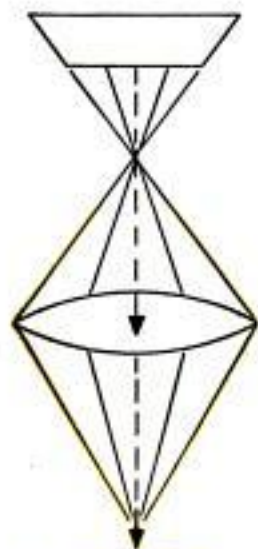
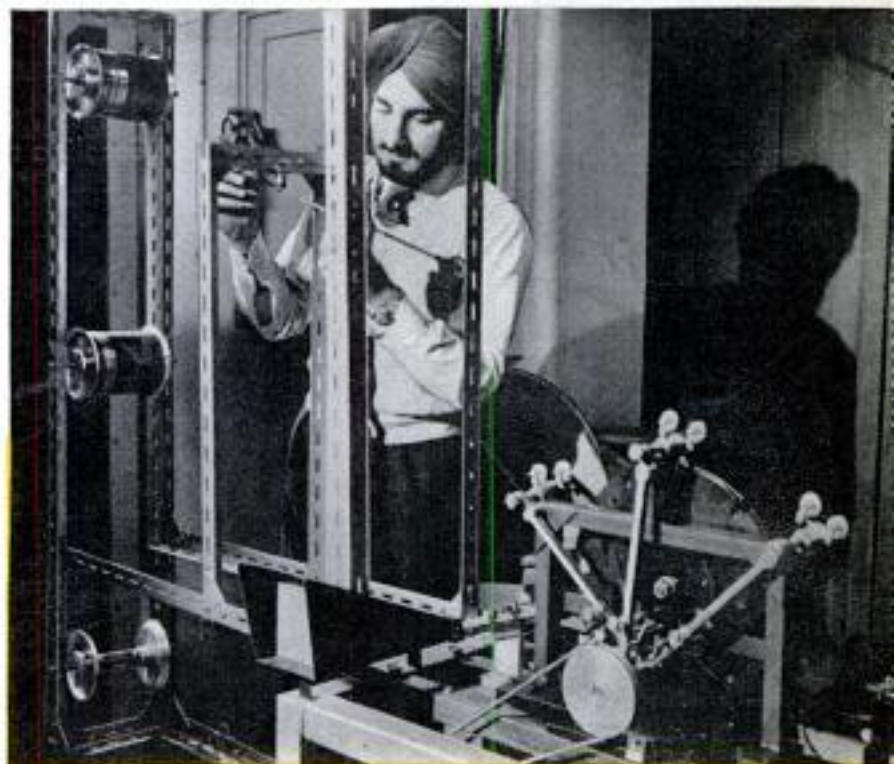


Rope 'Scope

GLASS FIBERS finer than human hair make up the chief part of an optical instrument that can see around corners. The fibers are aligned in a rope bundle. By looking along the axis of the fibers, you can see an image at the other end, no matter how the rope is looped or twisted. Doctors may use it in internal examinations of the human body. Scientists could observe radioactive materials shielded behind lead walls and engineers could use it to investigate concealed parts of complex machinery. Known as the Fibrescope, it was developed by Dr. H. H. Hopkins and a 27-year-old Punjabi, Dr. Narinder Singh Kapany, at the Imperial College of Science in London. The simple instrument may replace expensive optical systems which are bulky and inflexible.



Even when a loop has been tied in the fiber, image at one end can be seen through a lens placed at the other end. Below, Dr. Narinder Singh Kapany adjusts the machine which aligns the glass fibers. Kapany, a 27-year-old Punjabi, is co-developer of the Fibrescope



Picture at right was taken through the Fibrescope. The diagram shows the path of an image through the 'scope



OWNERS REPORT:

Torsion-bar suspension

"It rides like you're on a cloud! The levelizer is wonderful."

Minnesota doctor

Exterior styling

"Styling is modern without being overdone."

New York wholesale grocer

Some Complain About

Rattles

"Doors rattle."

Kansas real estate man

Reassembly

"Not enough attention to detail on assembly."

Ohio scientific equipment worker

Handling ease

"I like the ease of handling. Less tiring on long trips."

Iowa contractor

Performance

"Quick pickup. Fast, immediately responsive overtake."

California sailor

Some Complain About:

Rattles

"Rather noisy on rough roads."

Florida mine manager

Gasoline mileage

"Uses too much gas. Unable to get carburetor adjusted properly."

Texas owner



CLYMER TESTS THE CLIPPER CUSTOM

By Floyd Clymer

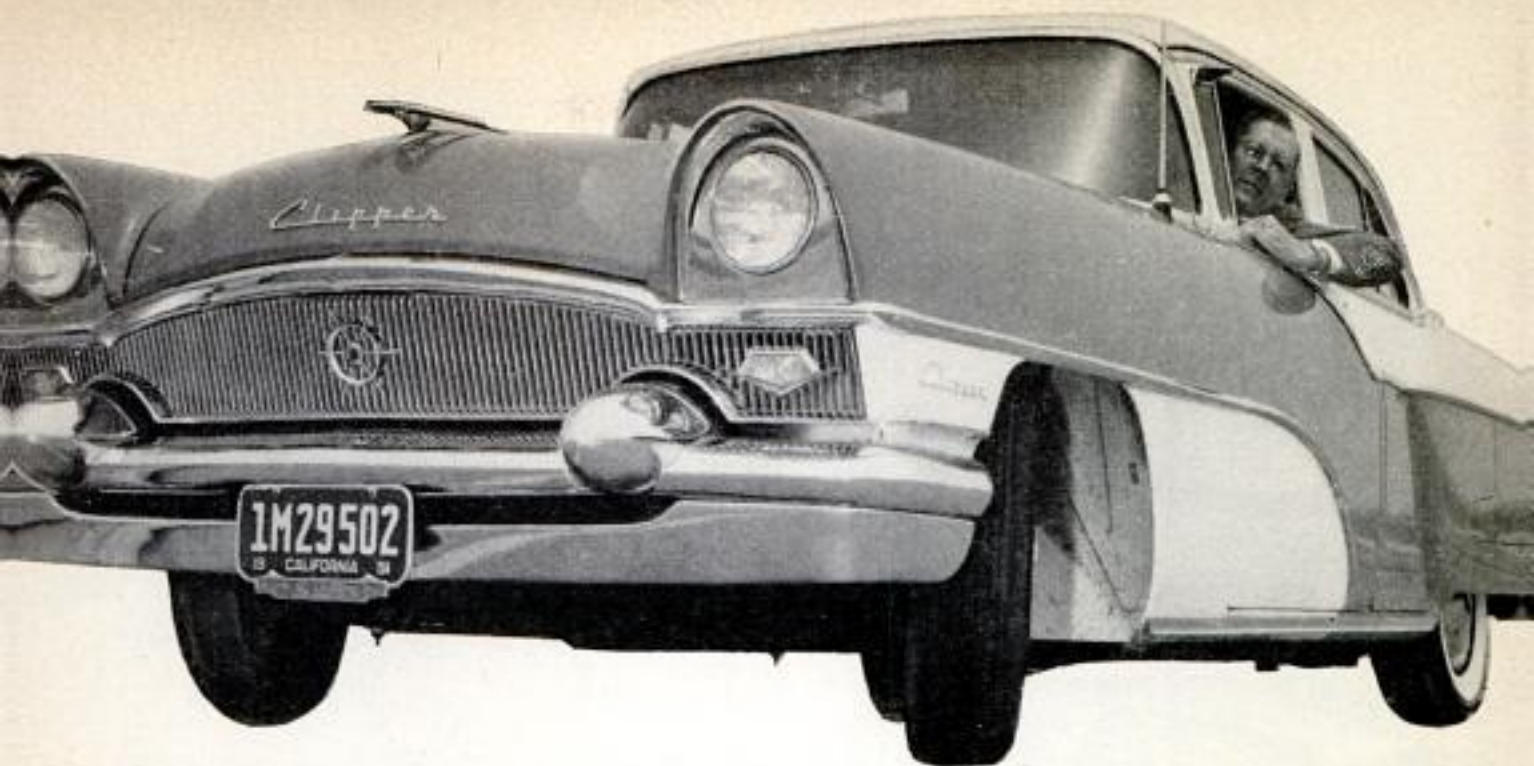
THE CAR TESTED was the 1955 Clipper Custom four-door sedan with torsion-bar suspension. The test was from Los Angeles to Las Vegas, Nev., then to Beatty, Nev., through Death Valley to Lone Pine, Calif., returning to Los Angeles via the Mojave Desert, a distance of 769 miles, which included some back-road testing.

The test Clipper had Packard's new 352-cubic-inch, 245-horsepower V8 engine with four-barrel carburetor. It is Packard's first V-type car engine since the Twin Six, although Packard has built thousands of V-type aircraft engines. This over-square engine (4-inch bore x 3.5-inch stroke) with 8.5 compression ratio is a lively job with the greatest torque I've ever tested.

Handling characteristics are different

from any other car, due to the torsion-bar system, which has eliminated coil and leaf springs. For stability, both front and rear ends have independent stabilizers to reduce roll and side sway. You can drive into a corner at high speed with this car and the body remains almost level. There is much less roll or sway than with any car using conventional springs. Due to an automatic levelizer, the body of the car remains level fore and aft, regardless of unequal loading. This is excellent for night driving as the headlight beam remains level. I drove at high speeds over extremely rough roads, with very little bounce. It was the most comfortable ride I've ever had with a feeling of security at all times.

(Continued to page 230)



Packard Owners Like Torsion-Bar Ride

By Packard and Clipper Owners

WHAT'S ALL THIS talk about torsion-bar suspension? If you can believe the owners who are riding on it, it's the greatest advance in riding since the primitives rounded off the corners of the square wheel.

The riding qualities of the torsion-bar suspension are far and away the best-liked feature of Packard and Clipper Custom owners in our monthly survey (only the Clipper Custom has torsion bars, the other Clippers have coil and leaf springing).

Here are some of the reasons why the owners think so highly of this new departure in suspension systems:

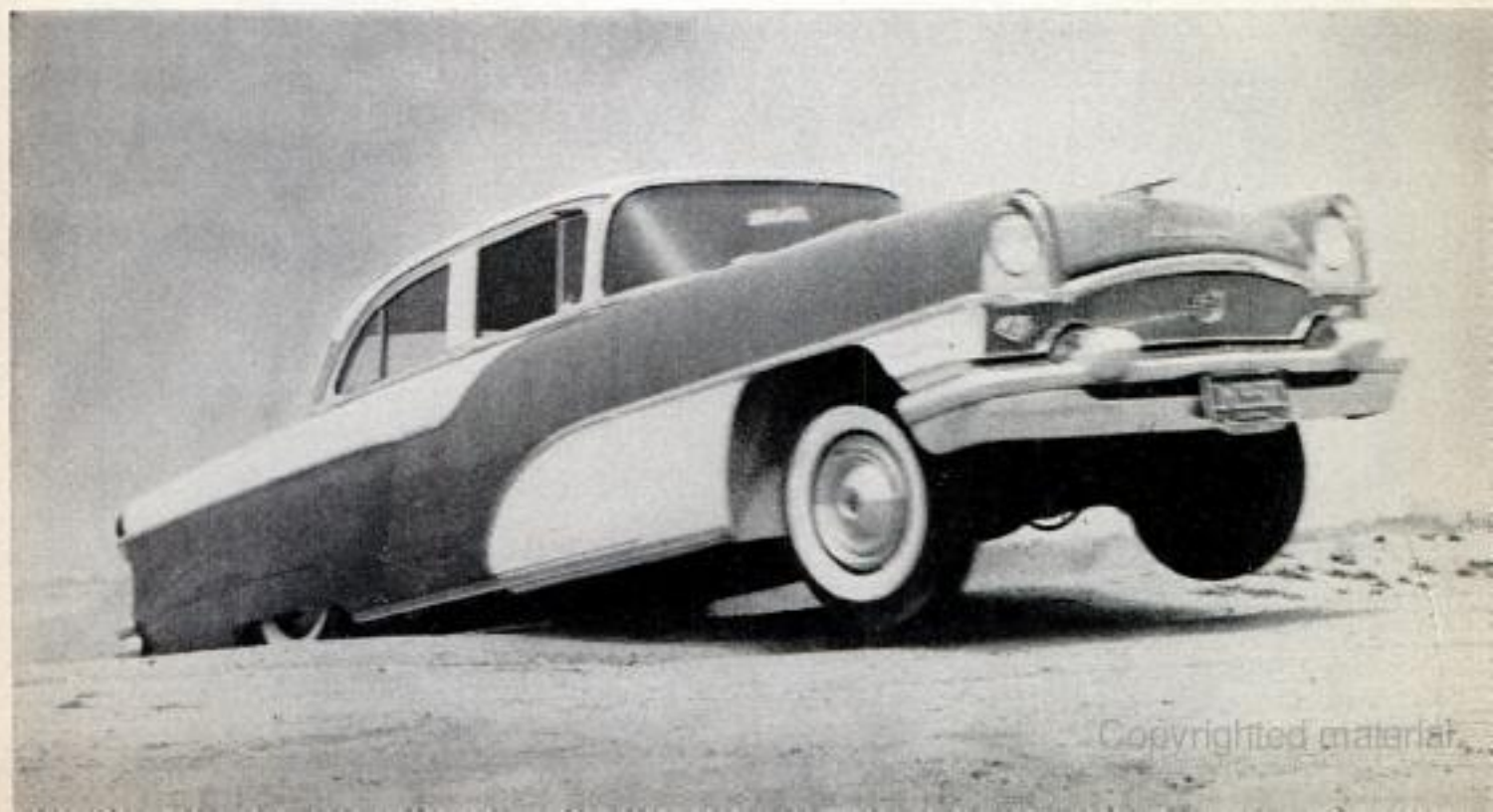
"It rides like on a cloud! The levelizer is great."—Minnesota doctor.

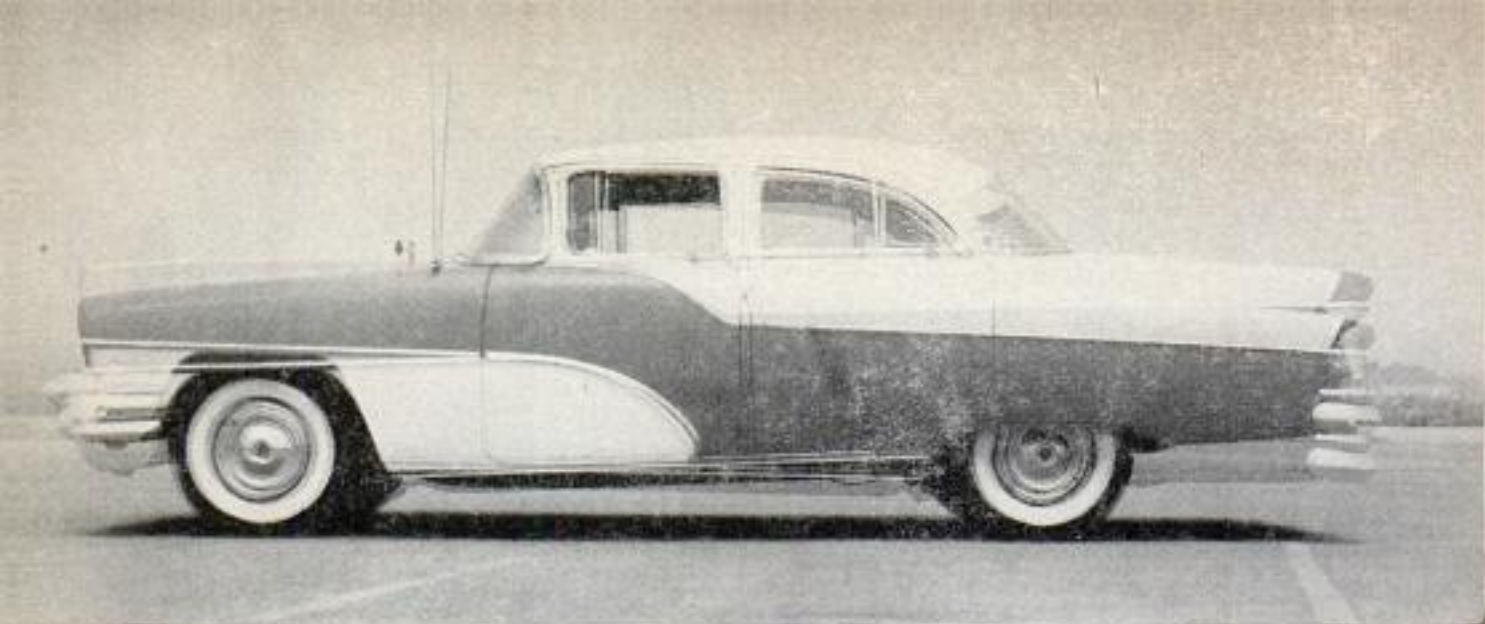
"Ride is very comfortable without being mushy. Self-leveling feature keeps loaded car from dragging on steep driveways."—New Jersey manufacturer.

"Drove from Cleveland to Huron two times at night and did not have one car signal me to dim my lights even though I had luggage in the trunk. That was due to torsion-bar suspension. It keeps headlights on the road at all times."—Ohio ship's officer.

"We have had as much as 500 pounds of seed corn in the trunk plus two riders in

Clymer "jumps" the Clipper over the crest of a hill. He says the car needs better front-end rebound control





When a load is added to trunk, rear end goes down. Automatically, levelizer goes into action, leveling body



Glove compartment is placed in center of dash, but some owners miss last year's drawer-type design

Two-tone paint styling of the 1955 Clipper Custom is simple and provides a flowing line from front to rear

the rear seat for a 250-mile drive on all kinds of roads and car was always level. However, in the first 800 miles I owned the car I blew three fuses on the levelizer circuit, but after changing to 30-ampere fuses have had no more trouble."—Minnesota real-estate broker.

"Exceptionally easy and smooth ride, but self-levelizer needs improvement. It's noisy and sometimes works too often. Fine for heavy loads though."—Ohio supervisor.

"Torsion bars pop when new, but soon wears off."—Washington, D. C., tailor.

"Very soft, yet on curves it's firm and handles well."—Ohio manufacturer.

Of course, there are some complaints about the new suspension system and some suggestions for improvements.

"Self-levelizer should be wired through the ignition switch."—Ohio housewife.

"Out of adjustment. Car is higher on one side than the other. Rear of car had to be lowered three times. Dealer has no tools to make correct adjustment."—Pennsylvania manufacturer.



Digitized material



PM asked owners in 41 states (in color) to tell you about their experiences with the 1955 Packard

Percentages from PM Poll of Packard and Clipper Owners

Packard Owners

Best-Liked Features

Torsion-bar ride.....	63%
Exterior styling.....	48%
V8 performance.....	43%
Handling ease.....	26%
Interior styling.....	14%

Most-Frequent Complaints

Rattles	14%
Poor assembly.....	11%
Leaks dust.....	6%
Poor gas economy.....	6%
Hood latch.....	6%

54% had no complaints at all

OVER-ALL RATING	
Excellent	97%
Average	3%
Poor	0%

What Should Be Changed?

Needs no changes.....	60%
Improve body work.....	6%
Brake-pedal position.....	6%
Ash-tray location.....	2%

Had trouble with engine?

None	94%
Some	6%
Considerable	0%

What was engine trouble?

Noisy valves.....	6%
-------------------	----

Torsion-bar suspension

Excellent	94%
Poor	6%
No difference.....	0%

Self-leveling feature

Excellent	100%
Poor	0%
No difference.....	0%

Would buy another?

Yes	94%
No	0%
Might	6%

Clipper Custom Owners

OVER-ALL RATING	
Excellent	72%
Average	21%
Poor	7%

Best-Liked Features

Torsion-bar ride.....	62%
V8 performance.....	45%
Handling ease.....	45%
Exterior styling.....	23%
Roominess	10%

Most-Frequent Complaints

Rattles	33%
Poor assembly.....	23%
Uses oil.....	15%
Poor gas economy.....	13%
Poor paint, chrome.....	12%

25% had no complaints at all

What Should Be Changed?

Needs no changes.....	45%
Improve body work.....	13%
More gas economy.....	6%
Change hood latch.....	3%

Had trouble with engine?

None	61%
Some	32%
Considerable	7%

What was engine trouble?

Uses oil.....	12%
Noisy valves.....	10%
Carburetor	7%
Water leaks.....	3%

Torsion-bar suspension

Excellent	89%
Poor	4%
No difference.....	7%

Self-leveling feature

Excellent	95%
Poor	3%
No difference.....	2%

Would buy another?

Yes	64%
No	11%
Might	25%

Clipper Owners

OVER-ALL RATING	
Excellent	73%
Average	22%
Poor	5%

Best-Liked Features

Handling ease	44%
V8 performance	42%
Riding comfort	41%
Exterior styling	23%
Roadability	12%

Most-Frequent Complaints

Rattles	24%
Poor gas economy.....	13%
Poor assembly	12%
Noisy engine	8%
Uses oil	8%

24% had no complaints at all

What Should Be Changed?

Needs no changes.....	52%
Improve body work.....	4%
Move hand-brake handle.....	4%
More gas economy.....	4%
Improve Ultramatic	4%

Had trouble with engine?

None	71%
Some	21%
Considerable	8%

What was engine trouble?

Uses oil.....	12%
Noisy valves.....	10%
Plugs fouling.....	4%
Carburetor	3%
Blown head gasket.....	2%

Does not have torsion-bar suspension system

Would buy another?

Yes	71%
No	5%
Might	24%

"Factory slow in sending adjusting wrenches to dealer. Present setting too low in rear with leveler turned on."—Illinois electrician.

"Noisy when it levels off."—New Jersey steam fitter.

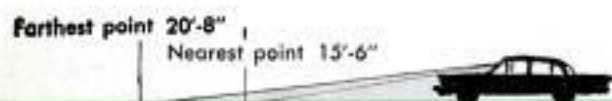
But the suspension is not all that Packard

has that is new this year. The big V8 engine (biggest in the industry) is all new and the owners rate its performance as the second best-liked feature.

"Engine always responds quickly. Power must be used cautiously to prevent spinning rear wheels."—Illinois engineer.

TEST DATA

1955 CLIPPER CUSTOM
Four-Door Sedan with Ultramatic



Acceleration Test

¼ mile from zero -	18.9 seconds
½ mile from zero -	29.9 seconds
0 to 30 miles per hour -	4.0 seconds
0 to 60 miles per hour -	12.1 seconds
All acceleration tests using "Dart" (lower driving range)	
Top speed by speedometer -	116 miles per hour
True top speed -	108 miles per hour

Economy Test

Constant-Speed Mileage

At constant 30 miles per hour -	19.2 miles per gallon
At constant 50 miles per hour -	17.2 miles per gallon
At constant 60 miles per hour -	15.7 miles per gallon
At constant 75 miles per hour -	13.0 miles per gallon

Cross-Country Mileage

Los Angeles to Las Vegas, Nev. -	15.3 miles per gallon
Las Vegas to Lone Pine, Calif. -	16.7 miles per gallon
Lone Pine to Los Angeles via Mojave Desert and Angeles Crest Highway -	14.7 miles per gallon

(Premium gasoline used for all testing)



Every month, *Popular Mechanics* brings its readers two reports on automobiles: 1. The test of day-by-day usage as given and told by the owners themselves; and 2. the Clymer road test. Together, these reports tell the complete story of a car

"Fast pickup when needed. Has a top speed of 119 miles per hour on the speedometer."—Michigan salesman.

"Has power to spare but is noisy at low speeds and the Ultramatic seems to grind at 5 to 20 miles per hour."—Kentucky electrical supplier.

Owners' Complaints

So much for the top-ranking good features of the 1955 Packard and Clipper. What are the complaints? The one most frequently mentioned trouble is rattles, followed by poor assembly and sloppy workmanship. A very high percentage (54 percent) of the Packard owners have no complaints at all. There are 25 percent of the Clipper owners and 24 percent of the Clipper owners with no complaints.

"An excellent automobile except the doors rattle."—North Dakota owner.

"Doors rattle. Trunk leaks dust."—Kansas real-estate man.

"Has minor body noise which is hard to locate. Body work rather poorly done for a high-price car."—Minnesota retired owner.

"Upholstery of the headlining was poorly put in."—Florida retired owner.

"Poor attention to detail in factory. Door handles and window cranks fall off."—Indiana insurance man.

Why They Buy Packard

We asked owners to name the one feature that most convinced them to buy Packard. First on the list is previous satisfactory experience with Packard. Second is the torsion-bar suspension, followed by the V8 engine, the exterior styling and the large trade-in allowance given by the Packard dealer.

"This is my fifth Packard and they were all good."—New Jersey inspector.

"I took a ride on a rough road and the torsion-bar suspension sold me."—Wisconsin executive.

"The new V8 engine and the way it stood up under the 25,000-mile endurance test."—California machinist.

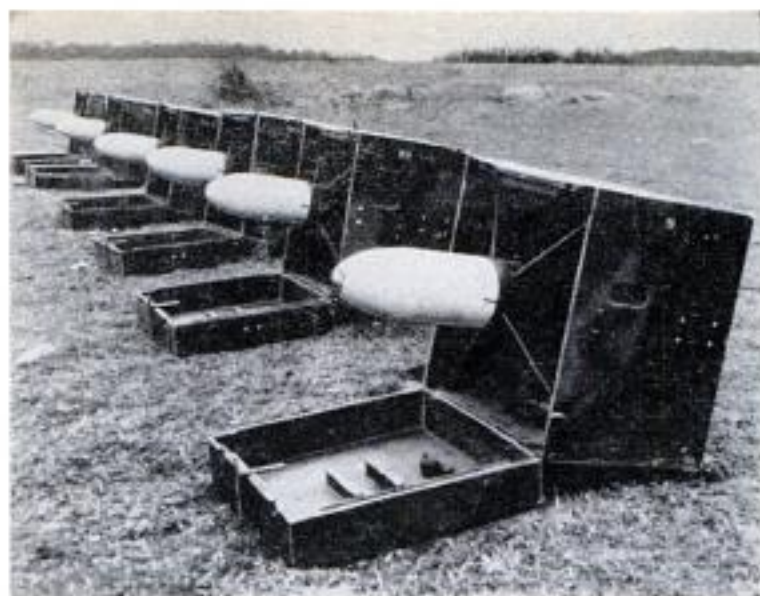
"Modernistic styling convinced me."—New York salesman.

"Packard gave me a better trade."—Maryland printer.

Have Engine Trouble?

When a new engine is brought out there is frequently considerable trouble with the early production run. To find out if Packard was plagued that way, we asked owners to describe any engine trouble they had. Of the Packard owners, 94 percent had no trouble at all, 6 percent had some and none had considerable trouble. Among the

(Continued to page 236)



With their warheads thrust forward, the rockets are ready for firing as the boxlike carrying cases become launching stands



The soldier-technician guides the rockets to their target with a tiny "joy stick"

"Suitcase" Rockets Guided to Target by Soldier-Technician

"Suitcase" rockets launched from their own carrying cases are being tested by the French army against tanks, half-tracks and other battlefield equipment. The electronically launched and guided missiles can pierce any known armor plating, according to the French. After a rocket is launched,

it is kept within the sights of a soldier-technician who guides it toward the target with a small stick and a control box. Its deadly accuracy, say French army officials, promises to make it the backbone of anti-tank warfare. The newly developed ground missile is labeled the SS-10.

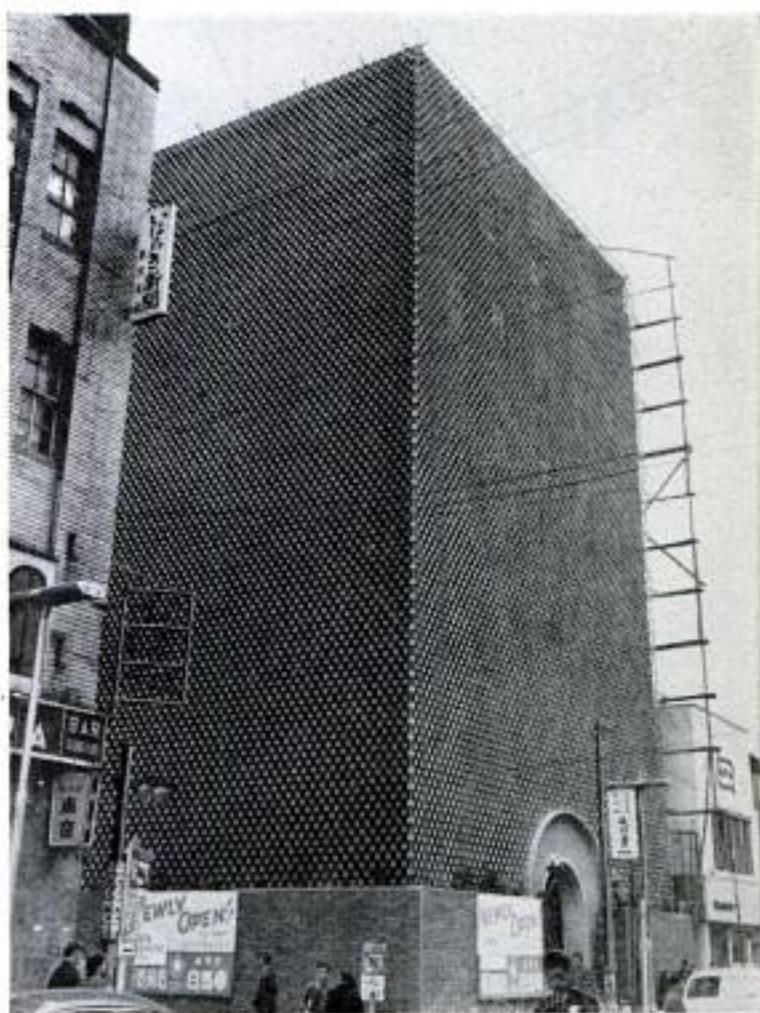
Grille of Metal Flowers Covers Tokyo Building

Grillwork containing 10,000 metal flowers covers the sides and all the windows of a six-story building in downtown Tokyo. The unusual front serves to attract customers to the teahouse and night club housed in the structure. It is located in the city's Ginza section.

Television Channels Cover 69,000 Miles

Coaxial cables get most of the credit for intercity television relays, but actually microwave radio relay does the bulk of the work, according to the Bell System. At the end of 1954, there were 49,000 miles of radio relay and only 20,000 miles of coaxial cables in the United States. This marks a tremendous expansion of facilities since 1948 when there were only 900 channel miles of relay in the country, all along the East Coast.

☐ In the last five years, Americans have bought more than 350,000,000 electrical appliances.





Transparent Mylar has one third the tensile strength of steel. Right, film can be metallized with aluminum

MYLAR

the New Synthetic Film

By O. A. Battista

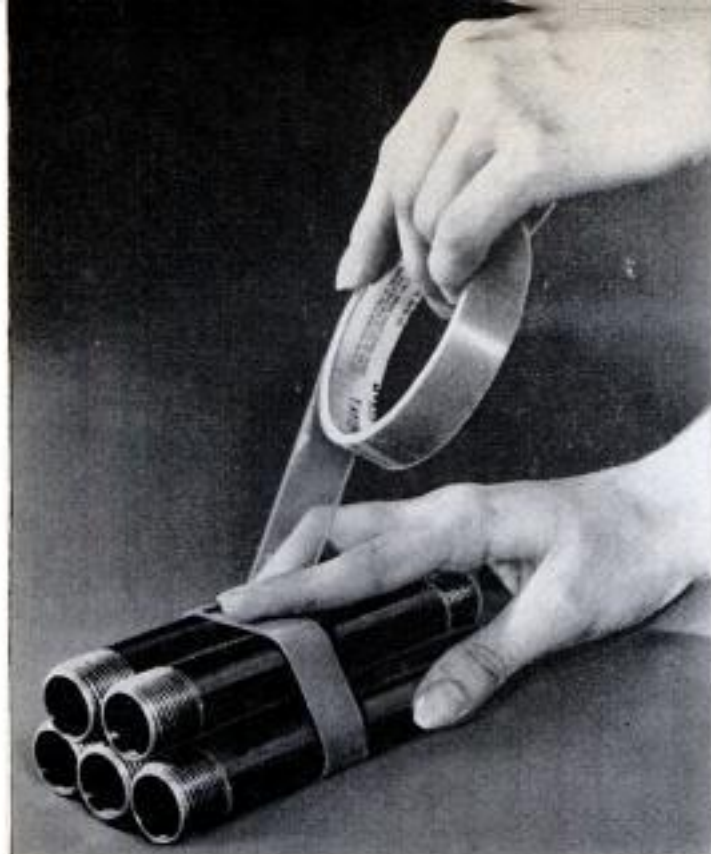
THAT WIZARD of chemistry, the late Dr. Wallace H. Carothers, started this story back in 1928. Carothers, called the "father of nylon," discovered a good many products in addition to those he sought out. First came nylon, then Orlon and Dacron. And now comes Mylar, a polyester film that looks like cellophane but behaves like nothing ever seen before. Mylar is made largely from chemicals derived from natural gas and petroleum.

At Circleville, Ohio, a big Du Pont plant is turning out Mylar by the mile and every bit of it is bought as soon as it is produced. There's a waiting list for the product because of its unusual properties: Mylar film retains its dimensions and flexibility over a temperature range from minus 75 to 300 degrees Fahrenheit; its tensile strength is a third that of machine steel; it can be mass-produced in sheets as thin as .0075 inch; it has unusual shock resistance and can be bent indefinitely without cracking. It is chemically inert, moisture-insensitive,

solvent-resistant and is unaffected by many acids and alkalis.

These aspects of Mylar's personality fit it for countless jobs. Take the capacitors that help prevent the pitting of dial-telephone relay contacts. Telephone engineers have discovered that Mylar is just what they've always hoped somebody would produce for this purpose. Today Mylar is taking the place of impregnated paper which is used to separate the metal-foil electrodes. It is tougher, cheaper, stands more voltage and needs no impregnation. The new capacitors require no protective housing and are much smaller.

Acoustical tiles are being covered with sheets of Mylar printed in attractive designs. Owens-Corning, the manufacturer, says the film actually improves the tile's soundproofing qualities. It is now possible to produce more attractive acoustical ceilings and walls. In the past, irregular surfaces have limited the decorative effects of acoustical tiles and have made them diffi-



Tapes made of Mylar are surprisingly strong, can be used for bundling, sealing, masking and splicing

cult to clean. Tile made with Mylar is easily washed with soap and water, and the colors remain brilliant for years.

In the field of tape recording, the most common material now in use is a tape of cellulose-acetate film. Mylar tape has greater tensile strength, resistance to wear and dimensional stability. Also Mylar needs no plasticizer, which prevents most films from drying out and becoming brittle. For these reasons Mylar has already made a big name in the sound-recording field. It can be used and stored under extreme conditions of temperature and humidity.

Tapes made from Mylar also are serving in some of the remarkable new electronic "brains," and are telemetering information at airports. Still another type of tape made of Mylar may be used as a substitute for the steel strapping used to hold large cartons together, and for palletizing shipments.

Mylar also is being laminated to metals, making it possible to draw the metals into desired shapes. In this process Mylar protects the sheet steel, eliminating the need for lacquering or tin plating.

When Mylar is laminated to aluminum foil, kraft or asbestos papers, the resulting materials are solvent-resistant and moisture-insensitive. Reverse-printed with wood designs, Mylar can be laminated to inexpensive grades of plywood. The surface of the film then acts as a protective finish for the beautiful wood-grain effects.

Unfortunately, Carothers did not live to see all his brain children reach commercial success. Mylar, the baby of the family, shows promise of overcoming the lead of its older brothers and sisters. ★ ★ ★



Moisture insulation, now under test, is made of a film of Mylar bonded to aluminum foil, then to paper



Sound-recording tape won't shrink, stretch or dry out and is stronger than types now in use. Below, material is ideal for industrial and electrical tapes





First step in any gun-safety course is bench work—learning every detail about the gun and its ammunition

Teen-Agers Learn to Hunt SAFELY

By George Laycock

IN AN EASTERN state last year a youthful hunter aimed carefully at what he thought was the head of a deer. He made his kill, but it was not a deer. It was another hunter.

Such hunting accidents break into the news every fall as legions of hunters take to the fields. In the more crowded sections of the country the danger has become so great that even seasoned hunters often stay home on opening day.

But now officials think they've found a way to cut down the number of hunting tragedies. Their answer lies in education. All across the country boys and girls are enrolling in hunter-safety courses. The training is producing results. Several states

have cut down hunting accidents among young hunters.

This nationwide plan to teach hunter safety to teen-agers had its birth in New York State in 1949. Officials there were distressed by the growing number of accidents, and started searching for a way to reverse the trend. Why, they wondered, couldn't gun safety be taught in much the same way that driving or swimming safety is taught?

This thinking led to a new state law requiring hunter-safety training of every hunter under 17 before he could get his first hunting license. Later the law was changed to include anyone under 21.

That first year it was the game protectors





Pop-up targets require split-second decisions. Boys fire only on game in their sector, and never at the dog

who taught hunter safety. They soon learned that this left little time for enforcing game laws. At this point the New York officials called in the National Rifle Association and asked its members to set up a hunter-safety program.

The NRA, working closely with the National Education Association, designed a four-hour course in gun safety for beginning hunters. By 1952 New York had 1162 instructors qualified to teach the course. There were 19,611 students in their classes that year and, almost immediately, hunting accidents in New York began to drop.

Meanwhile the idea was spreading to other states. By early 1955 five other states, New Jersey, New Hampshire, South Dakota, California and Massachusetts, had passed laws providing for hunter-safety instruction for beginning hunters. A dozen other states were studying similar laws. Across the country there were 8422 qualified instructors, with some in every state.

By the time other states started to take up this plan, Kentucky, where the tradition of the rifleman is strong, was already well along in its own program to teach gun safety to large groups of teen-agers. The program is taught through Kentucky's

system of Junior Conservation Clubs.

There are more than 30,000 young Kentuckians in nearly 700 of these clubs. Behind Kentucky's Junior Conservation Clubs is ex-schoolteacher Ed Adams who started the program in 1944. At their monthly club meetings and at summer camps these boys and girls study a wide range of outdoor activities. But gun-safety instruction ranks high in the program.

"Every one of our club members now gets some form of instruction in gun safety," says Adams. "So far, not one of our club members has been involved in a serious hunting accident."

Ed Adams and Kentuckians in general think they've hit pay dirt in their gun-safety program. They believe their Junior Conservation Club work is one of the best things to hit the state since Dan Boone

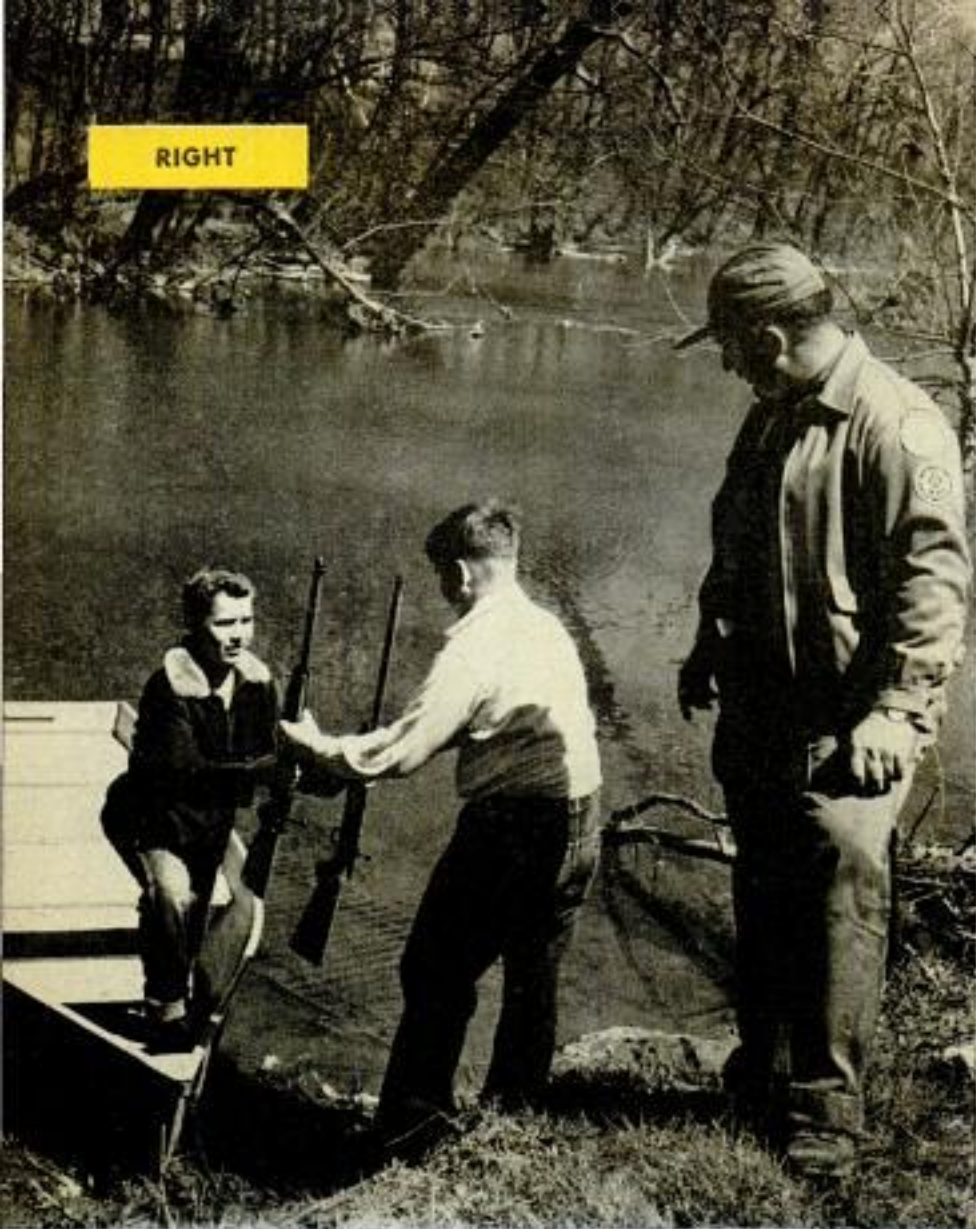


Don't Shoot!

Boys demonstrate a common but dangerous practice. Hunters in a party should split the area into zones and never fire into another hunter's zone



RIGHT



One boy holds both unloaded guns on the bank while the other lad climbs into the boat. Then firearms are handed over before second boy climbs in. Never lean a firearm against a tree. If the hunter in the foreground should bump gun with his elbow, it could fall and kill his companion

WRONG



came through the woods. "These lessons stick with them," Adams says. "In later years when they're hunting they will remember what they've learned in their clubs."

Adams has been told by more than one adult hunter that these trained boys make better hunting companions than most adults who have been hunting for years. One thing that distresses Adams is the fact that many parents aren't keeping up with their children in learning gun safety. "We are losing some of our kids," he says, "by accidents that happen in the home where the parent has left a shotgun, rifle or pistol loaded or where ammunition for these weapons is easily accessible."

Leaders in these gun-safety training programs have no doubt that education is the best attack on the loss of life and limb from hunting accidents. Says the National Rifle Association, "Virtually all hunting casualties are the result of carelessness bred of ignorance, and even one such accident would be entirely too many."

The real part played by carelessness and ignorance in hunting accidents shows up in the NRA's "Uniform Hunter Casualty Report." This report summarizes information on hunting accidents in 24 states and it brings to light some revealing pointers for those who want to go hunting and stay alive. In the states reporting last year, 71 percent of hunting casualties occurred on clear days and 26 percent in open country. In 57 percent of the accidents the gun was fired intentionally. Many victims were mistaken for game.

Among the deaths from guns fired accidentally, a large percentage of

hunter victims were shot when they stumbled and fell. Others were killed when the trigger caught on brush, when putting a gun into a car or taking it out, when crossing fences or when loading or unloading a gun. Still others died as a result of horseplay with a gun that was thought to be empty.

Who are the hunters that cause most of the tragedies? The Hunter Casualty Reports come up with some evidence on this, too. Of the cases reported through the NRA from 1950 to 1953, the offending guns in 38 percent of the accidents were carried by hunters 19 years old or younger.

The hunter-safety program has grown large but not unwieldy. There is still close personal work between instructor and student. "I don't want my classes to be larger than 12 students," says Alan Ward, a certified hunter-safety instructor in Madison County, Ohio. Ward, who is also the county conservation officer, teaches hunter safety in his free time. His classes are typical of the hundreds of hunter-safety classes conducted in all parts of the country.

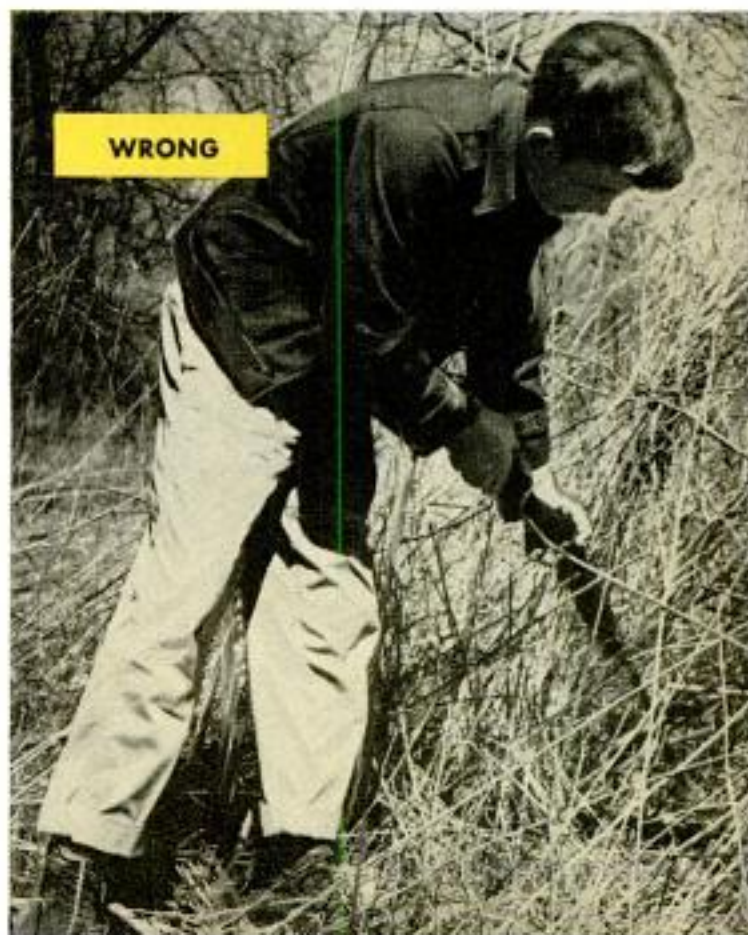
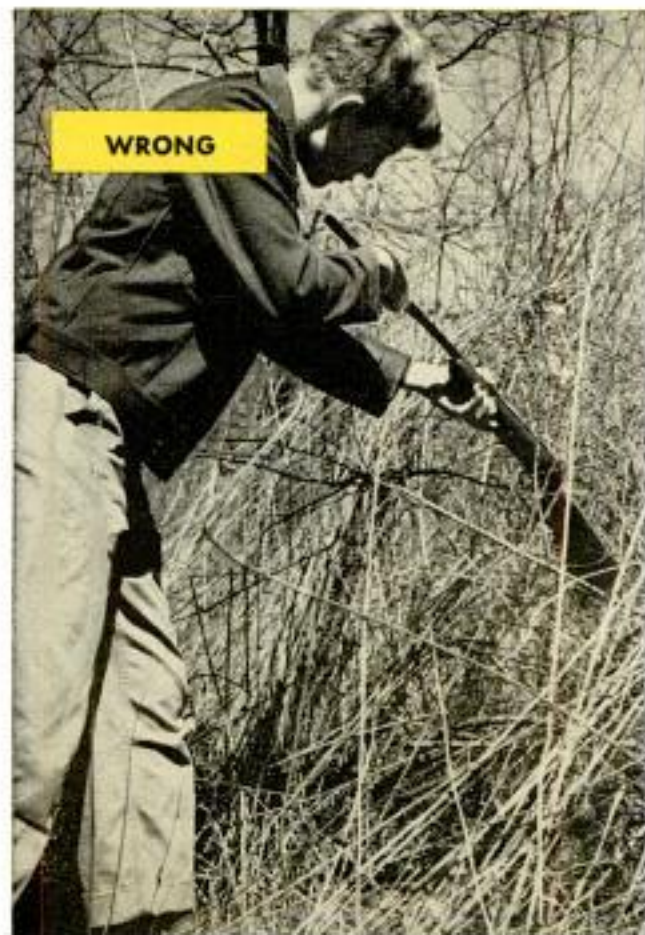
Each of his classes meets four times. They're supposed to get in an hour's training at each meeting. "But the fourth meeting," says Ward, "is usually on Saturday morning and it often lasts the full morning." During the first three meetings boys and girls learn the parts of a gun, how to take care of a gun and the different kinds of ammunition. They learn the rules for safe gun handling under a variety of field conditions. They learn that a gun improperly handled can be a lethal weapon and that a slip of the finger can kill a man.

Actual gun handling and range practice are an important part of the training and all students



Teen-agers learn that the safest way to climb a tree with a gun is not to climb it at all

Never use a gun to push aside the brush, muzzle or stock first. It may discharge or dirt may clog the muzzle





At mockup of fence, instructor teaches teen-agers that one hunter should cross first while other holds both guns. Below, in heavy brush, gun should be held high to minimize chance of catching the trigger



Lone hunter unloads gun, places it through the fence muzzle first, then crosses fence at the next post

are supposed to shoot with either shotgun or rifle before they have completed the course in gun safety.

This four hours of concentrated instruction is enough to give the youthful hunter the knowledge he needs to handle guns safely. It is also enough to give him confidence in his weapon and instill in him some pride in becoming known among his companions as a safe hunter, a hunter who would be a good field companion. Once the teen-agers have completed their course and successfully passed the written quiz, they are given an NRA Safe Hunter shoulder patch and a pocket card.

The gun-safety rules these young hunters learn in hundreds of classes across the country are rules all hunters should know and obey. Among the most important ones are these:

1. Treat every gun as a loaded gun.
2. Always control the direction of the muzzle. There is no excuse for pointing a gun at other people or allowing others in your party to do so.
3. Know what you're shooting. Always identify your game before you point your gun. Too many hunters are shot each year because other hunters mistook them for deer, bears or even rabbits or squirrels.

Other prime rules include: Be sure the barrel is free of obstructions, unload unattended guns, don't mix alcohol with shooting, always unload a gun before crossing obstacles in the field and keep the safety locked until you're ready to pull the trigger.

These safety precautions are becoming standard procedure for a growing number of beginning teen-age hunters. Your future hunting trips promise to be safer ones because we're giving our teen-agers basic training in hunter safety. ★ ★ ★



Technicians used the hearts of 265 pictures in making the mosaic. Photos were first enlarged, then pasted up on four-by-nine-foot panels of hardboard. The completed picture, right, is 60 feet long, 9 feet wide and shows a 26 by 4-mile area

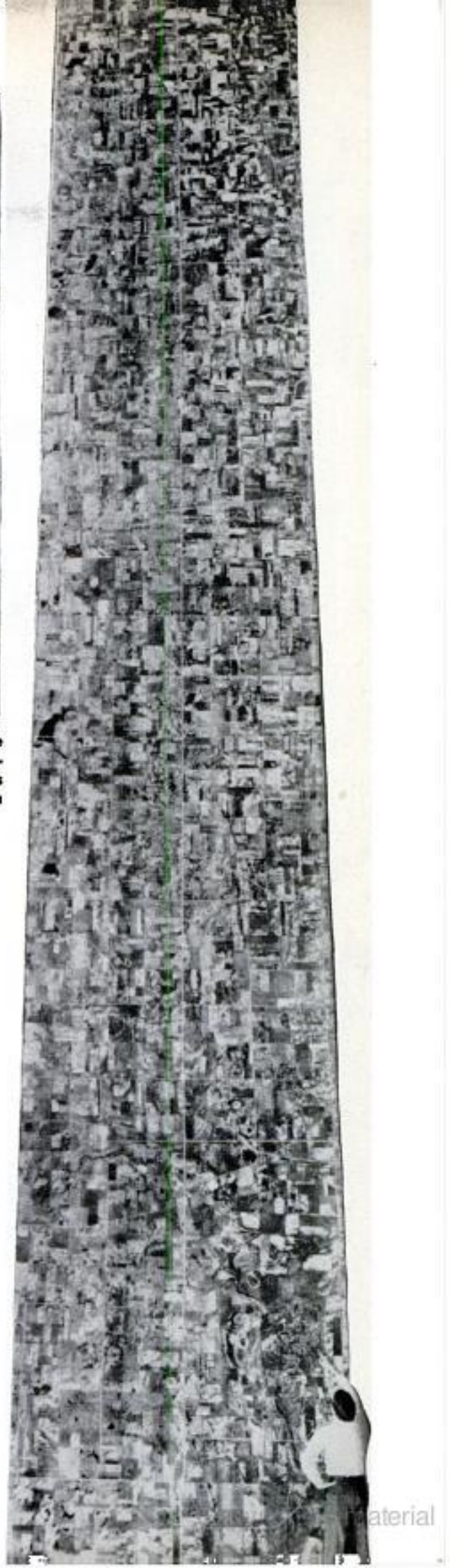
Portrait of a Highway

EVERY ROAD, building and tree along 26 miles of U. S. Highway 41 can be seen in a giant photo portrait made for the Wisconsin Highway Commission. The 9 by 60-foot map shows two miles of area on each side of the heavily traveled thoroughfare between Milwaukee and Chicago.

With such a picture, engineers can hold conferences in their offices and estimate the problems of widening the present highway, building grade separations or clover-leaf intersections, or building a whole new road through less-developed neighboring country.

The aerial pictures used in the mosaic were taken on nine-inch film, with a scale of 500 feet to the inch. Controlled enlargements brought the prints to a 200-feet-to-the-inch scale. Corrections were made to correct errors in scale on the film caused by change of altitude or pitch during photography.

As the pictures were taken with a 60-percent overlap in succeeding exposures and a 15-percent overlap in the flight strips, only the central, most-accurate part of each picture was used for the mosaic. To make the picture, the aerial-mapping technicians used the hearts of 265 pictures. The project was done by the Abrams Aerial Survey Corporation of Lansing, Mich.





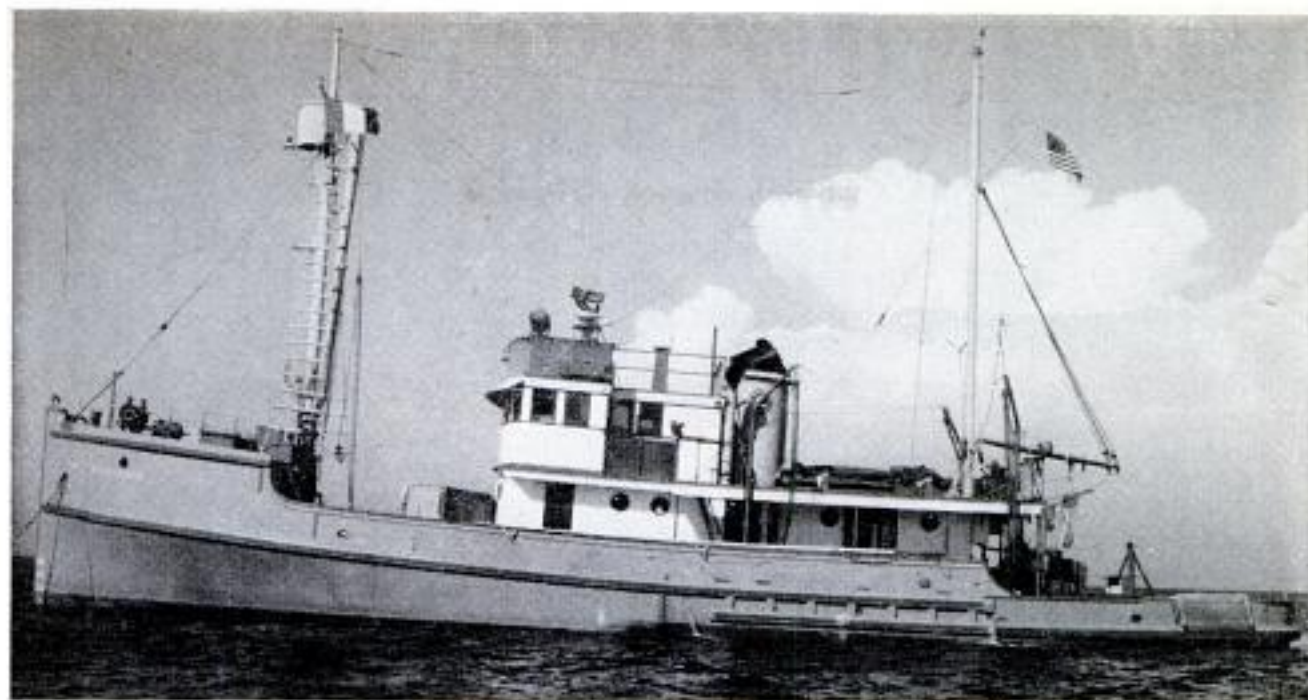
They Pray Into the Lives of Fish

To learn the habits of ocean fish and how long they'll survive as our food supply, California biologists go fishing with an eight-mile line

By Claude M. Kreider

Yellowtail fish (top of page) wears bridle and button tags. Man at left puts float on flag marker as others pay out eight-mile line





N. B. Scofield was especially built for deep-sea research. It has a 350-horsepower engine, cruises at 10 knots

PROBING THE LIVES of Pacific Ocean fish is a year-round job for marine biologists of California's Department of Fish and Game. They're keeping careful watch of a crop that yields a huge harvest each year.

Over 300,000,000 pounds of tuna were canned last year in southern California. During one month, 66,000 sport anglers in 276 party boats caught 418,000 ocean fish. Meanwhile, sportsmen along the shore fished the rolling breakers, clam hunters scoured the beaches and skin divers plunged for lobsters and abalones.

Can this keep up? The Fish and Game experts intend to find out. Their study of growth, migrations, habitat, food and spawning will form the basis of future regulations to make sure there are always plenty of fish in the sea.

At the Terminal Island Laboratory in Los Angeles Harbor, a crew of 24 trained biologists probes the mysteries of ocean life. The investigators are aided by scientific equipment and a record bureau containing 10,000,000 carefully classified cards. "Field" work is carried out with two specially equipped research vessels. One, the 100-foot, diesel-powered *N. B. Scofield*, cruises thousands of miles in the Pacific on laboratory projects. A team of biologists directs each expedition.

A recent cruise took the *Scofield* to equatorial waters off the western coast of Central America,

where commercial ships operating from California canneries take up to 400 tons of tuna each.

The tuna clippers throw live bait overboard to attract surfacing schools of fish, then "jack pole" them in with barbless hooks. The lower ocean strata had not been touched by the commercial fleets. Man's knowledge of the deep, teeming waters stopped just below the surface.

The *Scofield* fished deeper, with a "long line" eight or nine miles in length. The

Chart shows 26 long-line "sets" made on Jan. 23 to Mar. 18 *Scofield* cruise. Most large tuna were taken at points 5 and 9



Flag-marked floats at 1260-foot intervals upheld line. Dropper lines hung from main line held baited hooks

line, similar to that used by the commercial fishermen of Japan, also resembles a glorified fresh-water trotline. The main line, almost the size of sash cord, carries up to 300 drop lines spaced about 90 feet apart. The droppers, sometimes 90 feet long, end in very large hooks, like those used for swordfish. Sardines serve as bait.

Fast teamwork by the crew permits the vessel to proceed at seven knots while the main line is payed out and the droppers, coiled six to a basket, are attached to rings with a special snap. Stainless-steel oxygen tanks, 24 inches long, serve as floats. One is attached to the end of the line, the others spaced at 1260-foot intervals. On each float is fastened a bamboo pole, carrying a yellow flag, to indicate the "lay" of the completed set.

Setting takes about an hour. After six hours the line is pulled in by a high-speed retriever powered by an electric motor.

Diving biologist prepares to go below to shoot movies of underwater life. Crew member holds cased camera



134

Depending upon the extent of the catch and the size of the fish, recovery and coiling takes about three hours.

In the warm equatorial waters, sharks are a menace and a nuisance. During the Central American cruise, 236 sharks of varied kinds were caught in 26 long-line sets. Dangerous to bring aboard, the fish are cut loose as quickly as possible.

The expedition snagged 78 marlin and sailfish, a 700-pound broadbill swordfish and 16 specimens of rare big-eye tuna, each weighing over 300 pounds.

An important result of the cruise was the capture of 76 giant yellowfin tuna, many weighing over 200 pounds. Yellowfins this big are seldom caught by the commercial boats. It may be that the big ones live deep, that new methods of taking them can develop an entirely new fishery.

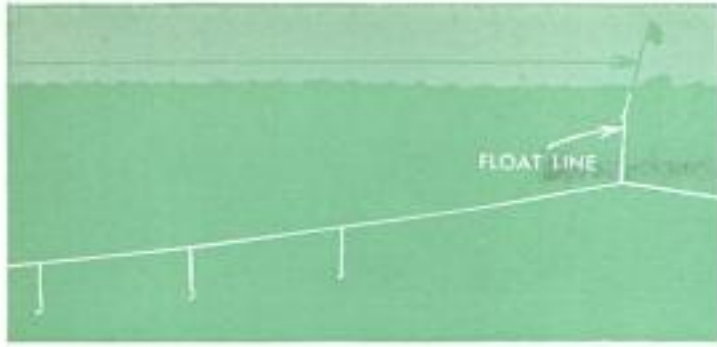
Other projects of the *Scofield* have included mile-deep trawling: Large nets are

Hooked shark bares a wicked set of teeth. Expedition caught 236 sharks, cut them loose as soon as possible



POPULAR MECHANICS

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dragged along the sea floor to gather marine life. Two huge, electrically driven drums carry 10,000 feet each of $\frac{5}{8}$ -inch steel cable for use with trawling nets. Recently this deep dredging disclosed an unguessed shrimp bed, and a new fishery and processing plant resulted.

Fish brought up from the deep are quickly tagged so that their later movements can be discovered, then released. The smaller surf and rock fish are marked with a small plastic button attached to heavy nylon thread that is sewn through the back under the dorsal fin. Larger fish carry a "bridle" tag of flexible Vinylite which is inserted through the fish under the backbone and knotted on top in a loose loop. A small core inside the Vinylite casing carries the necessary identification.

Nothing was known of the growth rate of the yellowfin tuna until a fish tagged off the Peruvian coast was caught by a commercial vessel a year later. Although

it was the only one of the 281 tagged fish ever heard of again, the fact that it had gained 25 pounds was duly recorded.

A later tagging project produced far better results. It called for the marking of 10,000 yellowtail, the premier game fish of the southern California coast. By the time 5000 fish were tagged, 300 tags had been returned to the Commission.

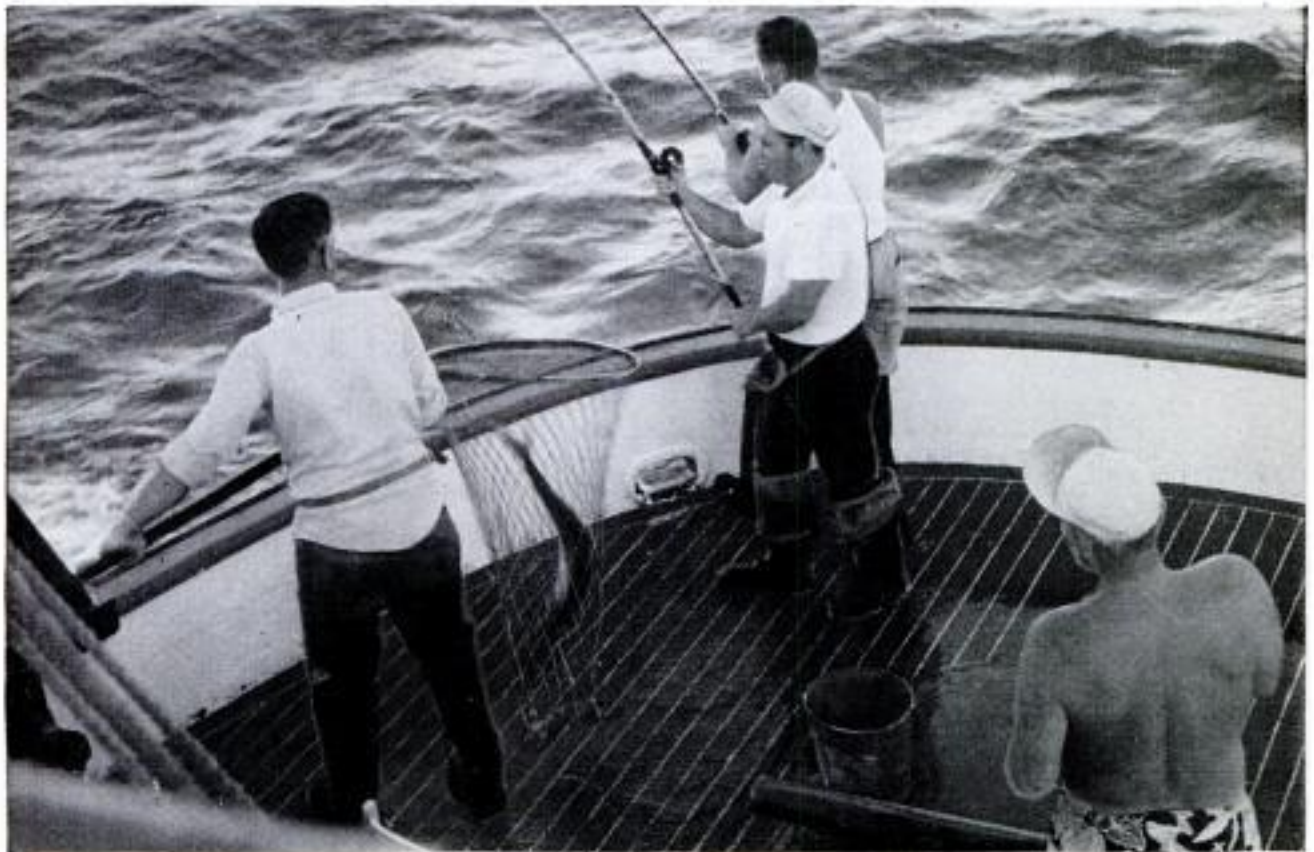
The movements of the albacore (longfin tuna), which appear each season along the south coast in tremendous schools, have long puzzled the scientists. The fish appear suddenly and leave as mysteriously, always traveling into the north and west. The species is known in Japanese waters, but it was hard to believe that the fish regularly crossed the Pacific Ocean.

After hundreds had been tagged, an albacore marked off Catalina Island was taken by a fishing boat out of Tokyo. The fish had traveled 4500 miles in 324 days, a straight-line average of 14 miles per day.

The patient biologists are learning much about the migration pattern, distribution and spawning habits of popular California fish. Each tagged fish has an individual record in the department files. When a marked fish is caught and examined, the numbered tag provides a clue to its history.

Even shellfish are under the constant scrutiny of the marine scientists. While some of the biologists dig clams on the beaches, other investigators turn skin diver to study the lobsters and abalones. ★ ★ ★

Sport fishing is combined with research in taking yellowtails for tagging. Caught fish are handled carefully





Binoculars can be used as telephoto lenses—one eyepiece for picture taking, the other for view-finding

Binoculars Used in Telephoto Photography

Photographers can take close-up shots of distant subjects by coupling newly designed binoculars to the camera lens to serve as telephoto lens. An adapter unit, available with the binoculars, permits the use of them with almost any type of camera, still or movie, including twin-lens reflex models. One eyepiece of the binoculars

is used for the picture taking, the other becomes a viewer. The 7x50 binoculars provide the equivalent of a 560-mm. telephoto lens. According to the manufacturer, D. P. Bushnell & Company of Pasadena, Calif., ordinary binoculars cannot be used successfully this way because of their low relative-light efficiency.

With standard lens, your photo of a camel behind the bars of the zoo comes out as unexciting as this one



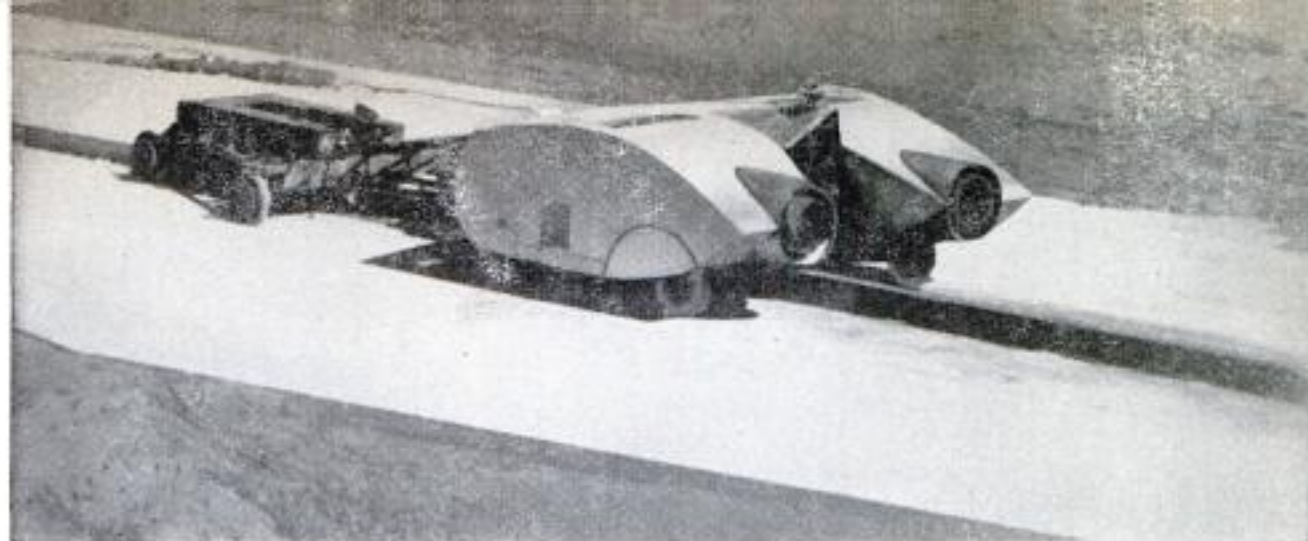
Using binoculars, here's what you shoot. Binoculars are quickly removed from the camera for normal use



Implanted Magnet Moves Artificial Eye

Magnets move a new artificial eye, duplicating the motions of the living eye. The eye was developed at the Veterans Administration hospital in Boston, Mass., and already has been implanted in more than 150 New England veterans who have lost one eye. A tiny magnet is molded into a clear, nonirritating plastic implant, which then is

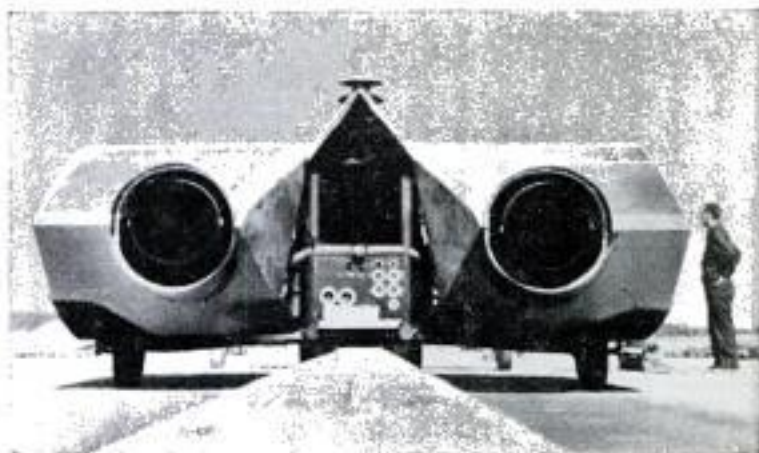
buried in the eye socket by surgery. The muscles of the removed eye are attached to the implant. An artificial eye then is made to match the patient's good eye, and another magnet is set into it. The eye muscles move the implant, causing the artificial eye to move in the same direction and at the same time as the living eye.



Twin-Engine Jet Car Tests Plane Equipment

Two Allison jet airplane engines power a strange-looking car that pushes a simulated airplane at speeds equal to those of a landing jet plane. The purpose of the device is the testing of aircraft arresting gear. The simulated airplane is a four-wheel, powerless "wagon" on which is loaded steel plates to approximate the weight of the airplane. The jet-powered pusher car drives the "wagon" along a 5000-foot rail until it reaches the desired speed. Then the pusher is braked to a stop and the "wagon" goes ahead on its own to be stopped by the airplane arresting gear undergoing test. The development of arresting gear has taken on new importance

Above, the jet engines push a small cart which is loaded with steel plates to approximate the weight of the aircraft. Below, jet car from the rear, showing how it straddles the guide rail



since the advent of high-speed jet planes. As longer runways become necessary, the need has become acute for adequate means of stopping the aircraft.

British Ejection Parachute Saves Pilot of Taxiing Plane

Pilots can bail out of a plane safely when it is only a few feet above the ground with a British-designed ejection parachute. It would prove effective even when the plane is on the ground and heading for a crash. The instant the pilot pulls a small protective blind over his face, the seat takes

charge. He is shot out of the plane by an ejector cartridge and a time-operated gun flicks open miniature parachutes to slow down and balance the seat. Another time switch unfastens the seat harness, enabling the main chute to open while the seat falls away.



Motorcycles Invade the Wilds



Nobody breaks the speed limit along trails like this one on the North Fork of Clearwater River in central Idaho. Below, occasionally, small creeks have to be crossed and the lightweight cycles take them in stride



By David Brazil

THE MOTORCYCLE is invading the wilderness! Back-country packers and their pack animals are astounded when they meet motorcyclists riding nonchalantly along trails high in the mountains far from any road. Lonely foresters stare at tire tracks etched into remote trails and scratch their heads in confusion.

All of this has come about because a few Lewiston, Idaho, cyclists decided to broaden the scope of their activities. Led by E. B. Stranahan, these enthusiasts head for central Idaho's vast primitive area on week ends. Mounting stripped-down American lightweights (Harley-Davidson 8s), they head for remote trout streams or distant peaks on Forest Service pack trails.

At speeds that vary according to conditions from a mile or two to 20 miles per hour, these men travel the wilderness trails at an average of 7 to 10 miles per hour. This is from two to four times as fast as a man or horse can walk over the same paths. Stranahan puts it this way:

"We can take off early in the morning, travel 15 miles beyond the end of the road to a trout stream that doesn't get fished very often.

"That same trip on foot or by pack train," he adds, "would take at least three days—and you'd have to eat all of your fish on the trip.

"Besides," he concludes, "the average workingman doesn't have the time or money it takes to make three-day trips by pack string."

With gripster tires on the rear wheels and their low-gear sprockets (60 teeth), the lightweights climb very steep trails. The boys have a system for getting around the sharp switchbacks on trails that zigzag up the mountains. They lift the front wheel and "float" it around, riding all the while. Gas consumption amounts to less than a gallon per trip.

The stripped-down motorcycles weigh about 150 pounds each.

No spot for jittery riders are trails cut into rock 50 feet above Clearwater River



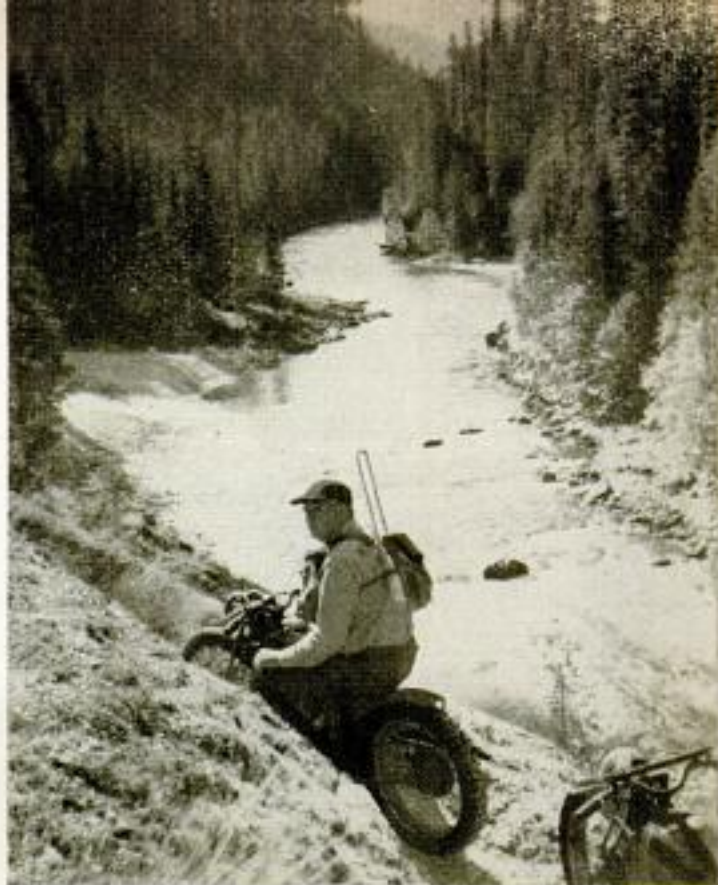


Each cyclist carries on his back a light packsack and fishing rod protected inside an aluminum tube

When pack horses are met, the boys stop, lift their lightweights off the trail and let the animals pass.

Two to four always travel together. All motors are fully muffled, excepting the last one in the group. As they string along the trail no one has to look back to see if the ones behind are all right as long as the unmuffled motor can be heard. Whenever the tail motor becomes silent the group stops to check. Mufflers must be

Riders travel in small groups, never alone. They can travel about four times as far as they could on foot



Pioneering the sport of motorcycling in the wilds was E. B. Stranahan, who poses here along Clearwater

mounted higher than usual so they won't be torn off by rocks along the trail.

Because the leader's motor is quiet, there is no danger of frightening pack animals on the trail. When animals are met, a signal is sent back down the line and the tail man turns off his noisy motor.

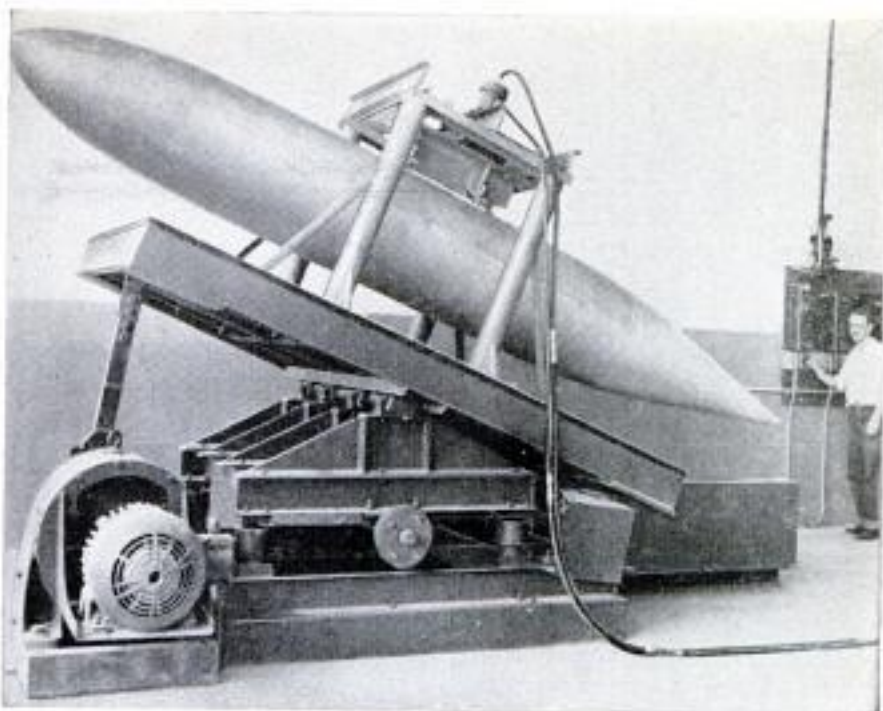
Spills and falls seldom occur. No one has ever been hurt even though the boys often follow narrow trails along cliffs with dropoffs of 25 to 200 feet. ★ ★ ★

It isn't apparent here, but there is a trail among this rocky confusion and the cycle is following it



Plastic Fuel Tank Undergoes Tests

Tests on a slosh and vibration table have shown that a disposable plastic fuel tank for aircraft is durable enough for military use. The plastic tank, reinforced with glass fiber, would replace the "droppable" aluminum tank which can be salvaged by the enemy and reused. The plastic tank is good only once. It is strong, lightweight and resists weathering, rot and corrosion. It was developed for use by the United States, British and Canadian Air Forces.



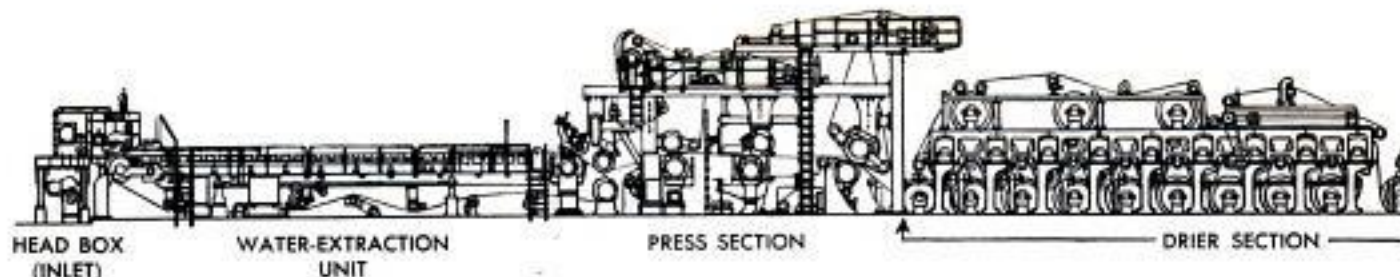
Easy on Battery

Drawing so little power it can be used continuously for 15 hours without depleting the battery, a 15-watt fluorescent light plugs into the car's cigarette-lighter socket. A 35-foot extension cord is provided with the light so it can be used inside the house, camp or tent, if desired. It gives as much light as a 60-watt incandescent bulb, says the manufacturer of the unit.

Brig Has Power

Built to precise scale, an operating model of the U.S. Brig Wasp can do one thing its square-rigged predecessor couldn't do—sail dead into the wind. The quarter-size version of the Navy ship of 150 years ago has an outboard motor tucked under a false quarterdeck. Measuring 27 feet, the brig is complete with 22 sails and rigging, even down to miniature cannon. The vessel was built under the direction of Comdr. C. J. von Zielinski, USNR, whose hobby is building and sailing these ships.





Mile of Paper in Two Minutes

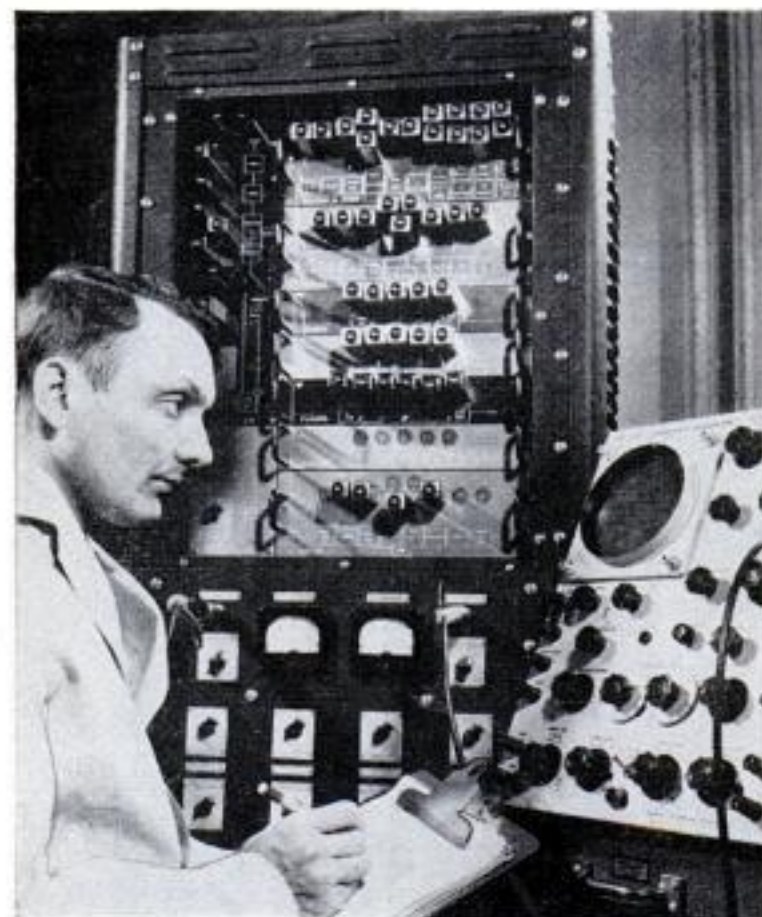
Every two minutes and seven seconds a mile of paper 21 feet wide will be produced by a new machine at East Millinocket, Me. When finally operated at this top speed, the huge papermaker will be the most productive and fastest in the world, according to its builder, the Beloit Iron Works. Over 400 tons of newsprint, enough for 1,500,000 copies of a 40-page newspaper, will be produced each day. Longer than a football field, the 375-foot machine has over 1000 feet of paper in process at any one time. In a half minute it converts a soupy mix-

ture of water and $\frac{1}{2}$ to 1 percent wood pulp into finished stock. The wet material is dropped onto a swiftly moving bronze screen that passes over oscillating vacuum boxes that shake and draw out the water. The sheet of compressed fibers passes through squeezing rollers and is dried further by 54 hollow drying rollers filled with live steam. Pressure rollers compress the paper to give it a good printing surface before it is finally wound onto a reel at the end of the machine. A fully wound reel weighs almost 10 tons.

Robot "Brain" for Houses Gives Life Span in Minutes

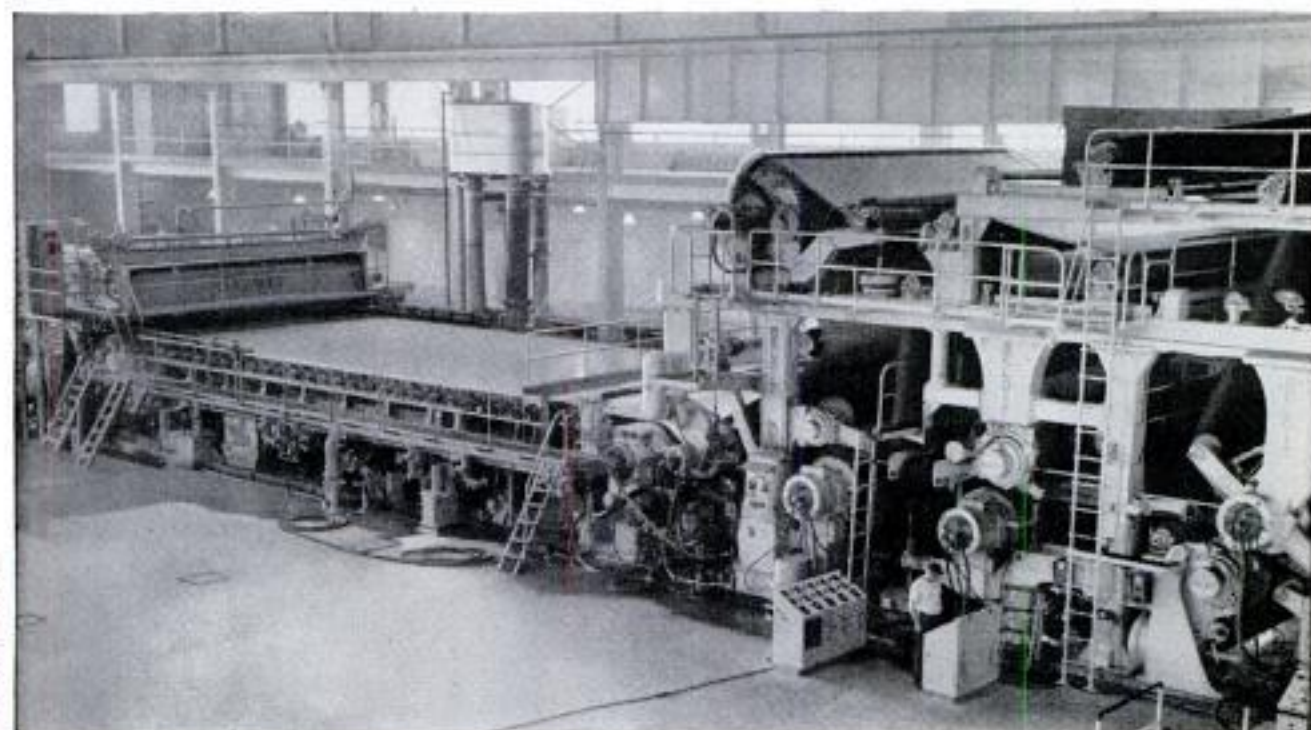
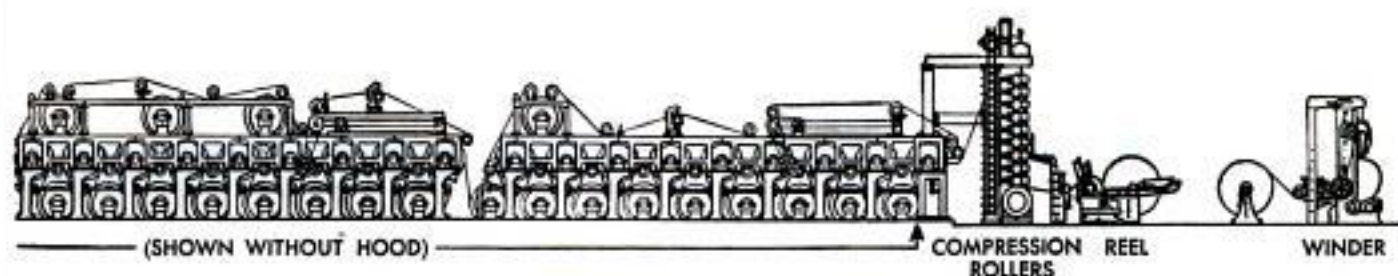
Designed for testing home heating, air conditioning and building materials, an electronic "brain" can simulate any kind of house in all sorts of weather. The

machine flashes answers on a radar-type screen and condenses 60 days' actual time to one second. Time required for testing equipment is expected to be shortened by as much as five years. The brain is fed such information as size of a house, size and type of doors and windows, exterior finish, sheathing, insulation and other factors along with the desired weather required for the test. Measuring heat losses and gains as they vary with time is the primary concern of the brain which was developed by the Minneapolis-Honeywell Regulator Company.



Fluid Dust Fighter Keeps Surfaces Clean

Dust slides right off wallpaper, upholstery and other materials treated with a preparation that fills up pits and crevices that catch dirt particles. The fluid, a colloidal silica, contains particles so small that 600,000,000 of them would be required to cover the head of a pin. Brushed or sprayed on, the silica imparts dust resistance to painted surfaces, wallpaper, window shades, Venetian blinds, lamp shades, upholstery, rugs and draperies.

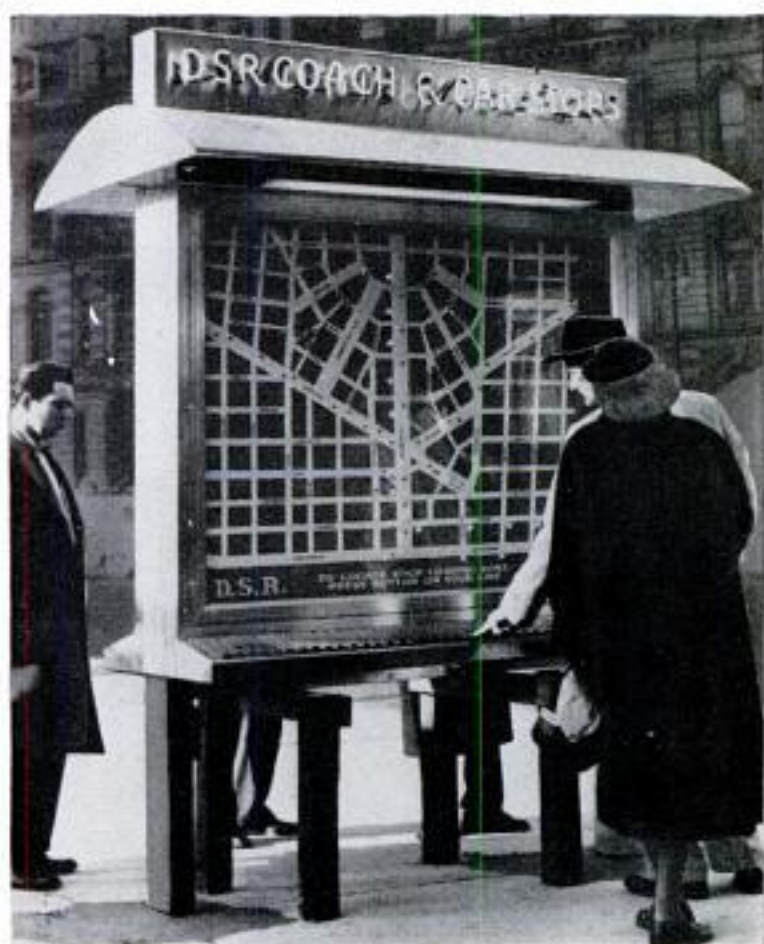


Bus Finder →

Across from Detroit's city hall is a robot answering machine that shows you where you can catch a bus or streetcar in the downtown area. You simply push the button of the transit line you want. A tiny bulb lights up on the map to show you where you can board the bus or trolley.

Car Warming Unnecessary

Warming up your automobile engine on cold winter mornings offers "no real advantage," states P. N. Ku of the National Bureau of Standards. Most people believe that oil will not flow right away if a load is put on the engine too soon, that some of the bearings will lack proper lubrication. Ku, acting chief of the engines and lubrication section of the bureau, believes that little if any damage is caused if the driver waits only until the car motor is turning over satisfactorily. When the motor is turning over, lubricating oil is flowing through the engine.





Craft Patterns Printed on Plywood

Patterns for home-workshop projects are printed on $\frac{1}{4}$ -inch plywood. The various parts are pre-painted in nine different colors. The craftsman simply cuts out the parts with a jigsaw or scrollsaw and assembles them with nails or screws. The panels measure 19 by 24 inches and each contains from 1 to 15 projects depending upon the size of the parts. The projects are designed for various age groups and range from wall plaques to bird houses.

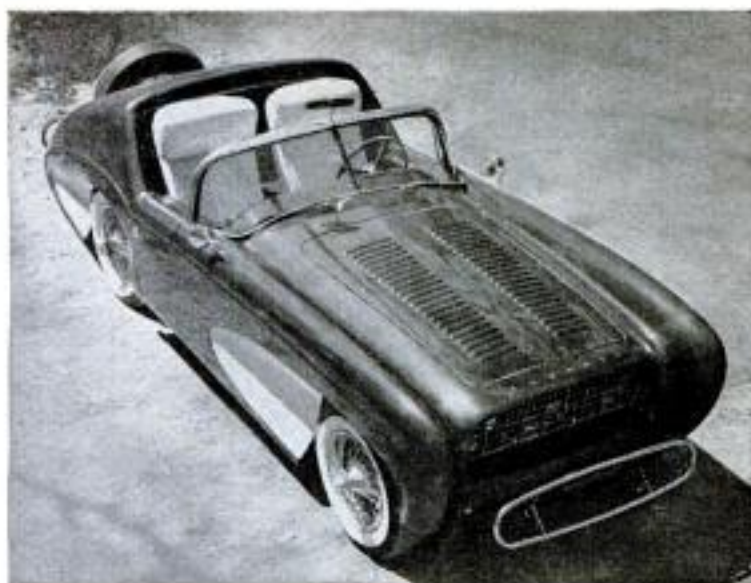
Pin-Wheel Plane

You don't have to have pilot training to fly the Helivector, a one-man Pogo stick that may make the ground soldier obsolete. Anybody can fly the aircraft, according to the United States Navy. A large horizontal propeller revolves under the standing driver who guides the aircraft by shifting his weight in the direction he wishes to go. It is said to be capable of speeds up to 90 miles per hour.

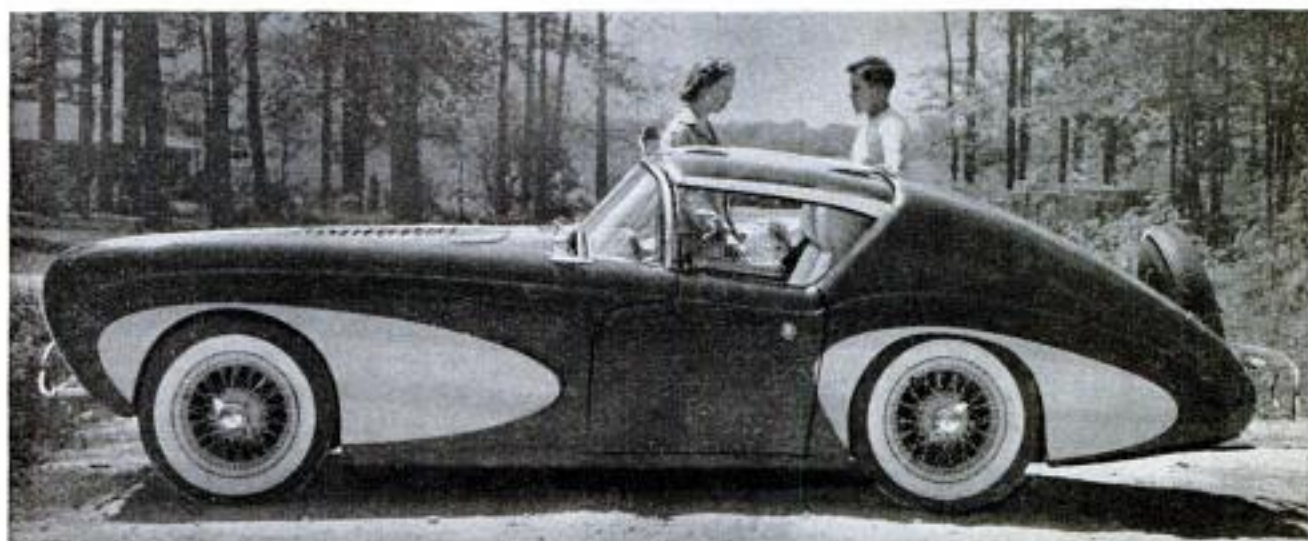


Car Exercises Dogs

With six racing dogs to keep in top shape, Dewey Blanton of Columbus, Ohio, has developed a "canine exerciser" that fastens to his station wagon. Blanton built a frame to support a long plank beside the vehicle. Springs fastened to the plank are attached to the dogs' collars, permitting the dogs to run wide. Longer chains keep the dogs in check. The broad plank bumper prevents injury to the dogs as they race along at 35 miles per hour. Best of all, the dogs seem to love the exerciser.



Stylist Flajole demonstrates the sliding roof. Right, with the roof retracted, the car is an open sportster



Despite its short wheelbase (100 inches), the Forerunner looks long. Body is all plastic. Chassis is Jaguar

Auto Stylist Styles His Own Car

HOW WOULD A professional stylist design his personal car? What would happen if he were freed of concern for production problems, cost limitations, public buying habits?

One stylist, at least, has answered that question. He is William Flajole of Detroit, Mich., consultant for American Motors and other manufacturers.

Flajole styled his own car and called it the Forerunner. The chassis is a modified Jaguar, but the body is completely Flajole.

Scooped fenders provide a fleet look and at the same time have the functional value of cooling brakes and tires.

Most unusual feature is the retractable Plexiglas roof. The car is a true hardtop convertible. With the top locked forward, the car is weathertight, suitable for any season. In hot weather, the top slides back

into the rear deck to make the car an open sportster.

Bumpers are deceptively delicate in appearance and light in weight. The whole bumper unit, including brackets, weighs only 10 pounds. Yet being an oval of one-inch alloy steel tubing, it is rugged.

The car is a two seater. Its seats are big and comfortable, patterned after those on airliners. They have backs that extend seven inches higher than standard, providing a comfortable headrest for long trips and at the same time hiding a substantial roll bar.

Headlights are recessed in the unobtrusive grille. They are located more than a foot behind the leading edge of the front fenders. There are no chrome gimmicks or decorations on the car which, although small, appears long and massive.



One hand on rope, Orlin Trego, owner of Razien mast, shows how easy it is to balance the 800-pound load

He Builds
**WINDPROOF
 TV MASTS**
*—but would
 rather not*

By Gilbert Hill

Drawing shows mast construction. Sand in bottom section of pipe acts as counterbalance. Trego's 60-foot mast at right survived 85-mile-per-hour winds





Antenna adjustments are easy when mast is tipped over. Motor on top of pole turns the antenna for tuning

BUILD A BETTER PRODUCT and you'll be in business whether you want to be or not, says John Razien of Woodward, Okla.

Razien deals in second-hand steel pipe. He buys it, cleans it and sells it, and is equipped to cut and weld it.

Woodward, up in the northwest corner of Oklahoma, is a long way from television broadcasting stations. Antenna masts are 50 to 100 feet high, heavy and complicated. Combine that top-heavy equipment with the kind of high winds that created the Dust Bowl and it is easy to understand the

maintenance and repair problems of TV-set owners.

Razien started out to help customers who wanted to buy pipe. He built a scale model of a TV mast that they could make themselves. But a lot of people didn't want to. So Tom Lukes, his engineer, built a few and Barney Laird, another employee, began setting them up in his spare time.

The first thing Razien knew, he was in the mast-building business. He had about 25 installed when an 85-mile-per-hour wind struck one night. Woodward is the town that had a tornado eight years ago that



Pin in base is removed so mast can be tipped over for repairs. High winds may necessitate adjustments

wiped out 110 city blocks and killed 90 persons. A lot of people thought another twister had arrived.

When the wind died most of the TV aerials in town were down, but all the Razien masts were standing.

That did it. Razien was in business despite his wishes. He hasn't patented a thing and would rather "just sell pipe—but I

find myself selling pipe for TV aerials at a faster and faster rate."

There are no guy wires on the masts, which "whip like a green limb on a tree, but never fall," says Laird.

The secret, the three men believe, is that the mast itself is set in sand, and has plenty of room to "give" with pressure or even spin if necessary.

Razien first sets a six-inch pipe four to six feet deep. This first pipe is set rigidly in concrete.

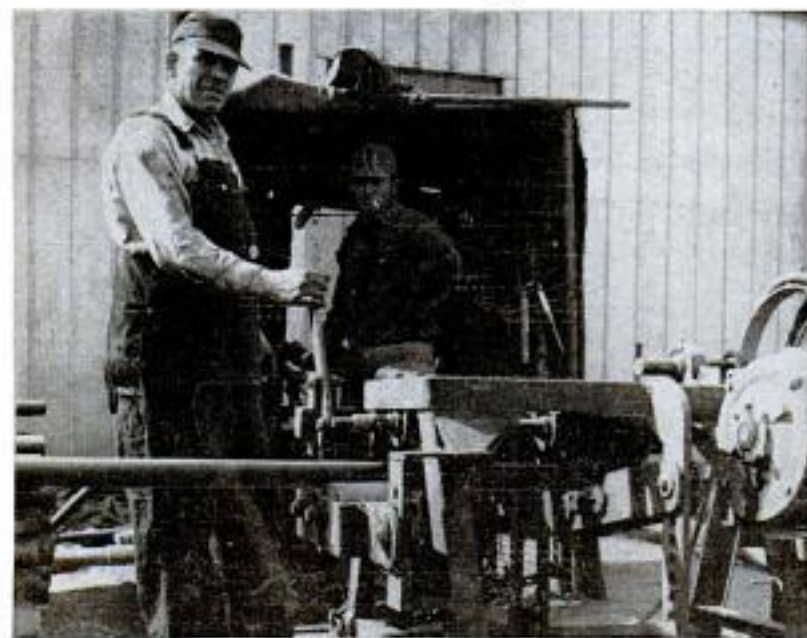
The mast itself is a piece of four-inch pipe about 20 feet long. It is set in the six-inch pipe and ordinary river sand poured around it. At the top of this post a bar-steel hinge is welded, and the mast is fastened with a single bolt to the sides of the hinge. The bottom section of the mast is filled with sand as a counterbalance to the top which may extend 40 to 60 feet above the hinge.

Each joint of pipe in the mast is one size smaller than the one below. It is held in place with four $\frac{3}{8}$ -in. steel stud bolts set in the outside post and through holes in the inside post. The fastening makes it possible to assemble the pole at the site.

The completed mast is simple to repair. A pin at the bottom of the mast is released, a rope attached to the base, and the mast is gently tipped to earth while the sand-filled base counterbalances the top section of the mast. After adjustments are made, you pull the rope to swing the bottom end back into place for locking.

Razien estimates that "eight or nine of us" have been busy making and installing masts. It's a good way to sell pipe. If someone would just push the thing and let him provide the pipe, he says, "We could have a real business. But remember—I'm not a manufacturer." ★ ★ ★

Machine cleans dirt and rust from old pipe before it is bolted together, telescope fashion, into TV masts



KEEPING UP WITH THE ATOM

WITH THE *Nautilus* already at sea and the second atomic-powered submarine *Sea Wolf* launched during the summer, the Navy has stepped up its plans for nuclear submarines. Four more are scheduled for construction in 1956 and a total of eight including the *Nautilus* are planned for the fleet.

☆☆☆

What happens to tobacco smoke when it is inhaled? This is another assignment given to the medical detectives working with radioactive isotopes. Researchers plan to introduce radioactive compounds into the tobacco plant. The radioactive smoke will then be introduced into experimental animals, and their bodies checked with geiger counters to trace the products of combustion through the organs to their final elimination. Harmless soft beta rays will be used so that it may be practicable to make the tests on human subjects.

☆☆☆

By 1962 it is estimated that nuclear power can be produced at a cost of five to seven mills per kilowatt hour.

☆☆☆

Atomic-powered railway locomotives may become practical in the future, but Forman H. Craton of the General Electric Company's locomotive works believes that for the next 25 years they will meet stiff competition from electric, diesel-electric and gas-turbine-electric types. Some engineers forecast a new era of railway electrification powered by nuclear electric generating plants spaced along the lines, rather than individual atomic plants built into the locomotives themselves.

☆☆☆

Four noted atomic scientists who had key parts in the prewar and wartime development of plutonium have been awarded a payment of \$400,000 for their patent rights by the Atomic Energy Commission. The scientists are Dr. Glenn T. Seaborg, Dr. Joseph W. Kennedy, Dr. Arthur C. Wahl and Dr.

Emilio G. Segre, who did their significant work on plutonium separative processes at the University of California in 1940 and 1941.

☆☆☆

"Gold guns" for treating cancer have been developed by the staff of the Royal Hospital at Chelsea, London, and are now being manufactured for export. Shaped like a heavy automatic pistol, the gun fires radioactive gold isotopes into cancerous areas of the body; it can be set to eject the bullets to the exact depth of the tumor. The gold isotopes lose their radioactivity after ten days or so, and thus can be left in the body without harm to the patient. The bullets, which are "cooked" in atomic piles, are $\frac{1}{10}$ inch long.

"Hot" Bath

Maintenance work at the Hanford atomic plant is done in a "hot" bath. Workmen wearing rubber gloves for protection from dangerous atomic radiation manipulate tools inside a plastic box filled with water (below), which absorbs the perilous rays.



Helicopter Tug Sweeps Up Mines

Helicopters now can sweep up enemy mine fields, cutting down the danger to mine-sweeping vessels. In tests, Piasecki H-21 helicopters were equipped with tow bars, cables and hooks. They towed conventional mine-sweeping gear and demonstrated that they could sweep an initial path through mined waters. Ordinary mine sweepers then can sweep the remainder of the field with greater safety. The tests also proved that a helicopter can tow the gear in sea conditions too rough for surface craft and is more maneuverable for sweeping restricted areas. The helicopter is capable of towing several times its load-lifting capacity. The pilot flies the craft in a nose-down position, which gives the rotors the maximum pull in the desired direction. The "aerial tug" has also passed

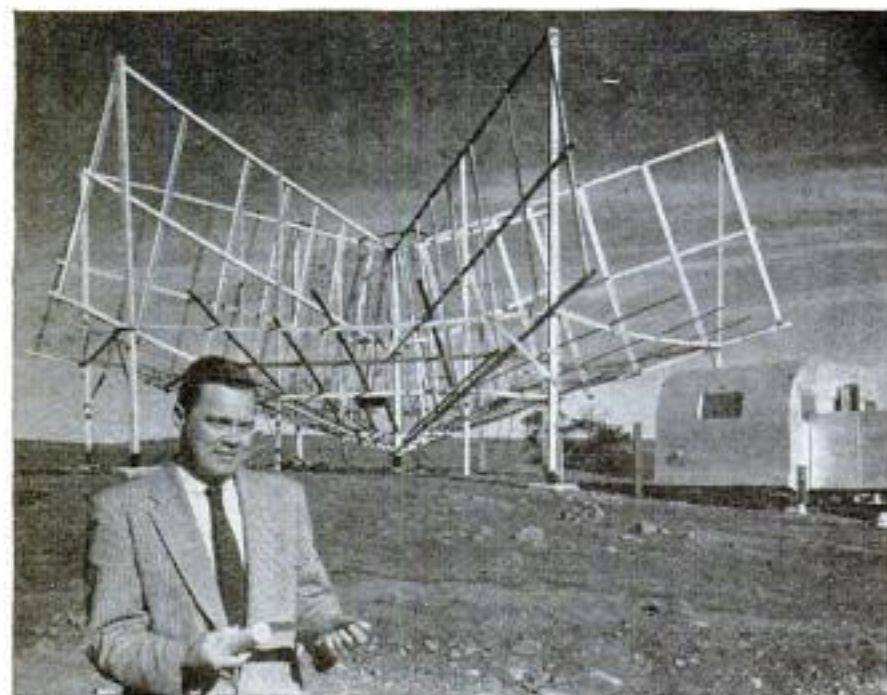


tests in which it pulled free heavy trucks that were mired in deep mud. Further tests have shown that vessels stranded on bars or rocks could be towed by helicopters.

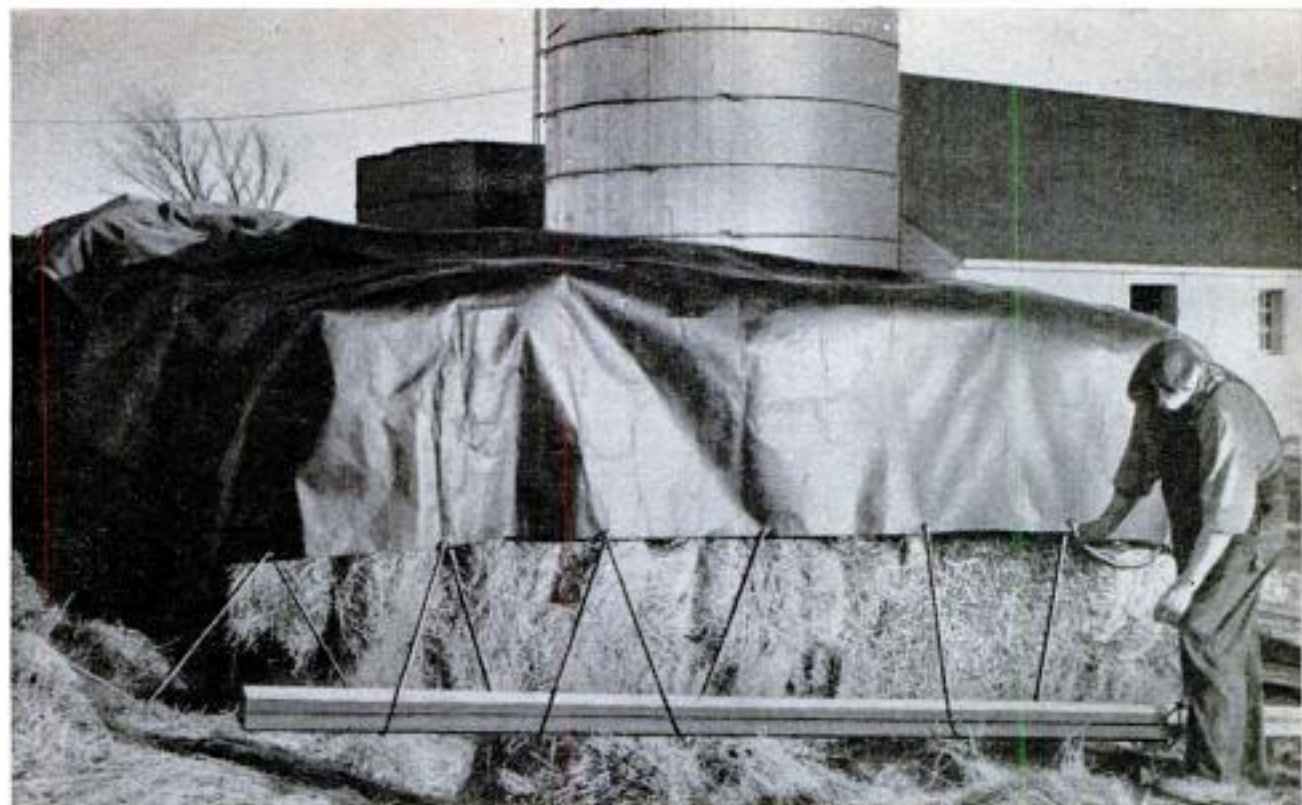
Stanford "Spider" Uses Radar to Chart Fall of "Stardust"

Information about radio communications, weather and the solar system is being gathered by a spiderlike radar installation on the Stanford University campus. The "Spider"—some 50 feet across and 20 feet high—charts the path of me-

teoritic particles no bigger than a grain of sand. Signals are beamed upward in six different directions from "corner reflector" antennas, and echoes recorded on film and sensitized paper. The meteoritic dust—10,000,000,000 particles of which hit the earth's atmosphere each day—leaves ionized air in its wake. Long-distance radio waves can be "bounced" off this ionized trail, the Stanford scientists discovered. Meteoritic dust particles are believed to serve as the nuclei for raindrops, and movements of their trails reveal ionospheric wind currents. Information about the "stardust" would help weather studies and knowledge of the meteoritic dust should aid solar-system study.



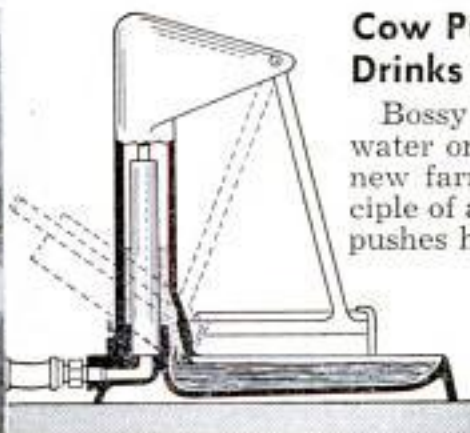
☐ Maine's extension of its turnpike from Portland to Augusta is 63 miles long, and has 90 bridges.



Paper Tarp Protects Hay and Equipment at Low Cost

Low-cost protection from the weather can be provided for haystacks, farm and industrial equipment with a new material called Brownskin Tarp, pressure-laminated asphalt-impregnated kraft paper reinforced

with glass-fiber yarns. Brownskin Tarps come in standard tarpaulin sizes and have grommets placed at 24-inch intervals for securing with rope. Light in weight, the paper tarp is easy to handle.



Cow Pumps Water as She Drinks From Pendulum Trough

Bossy pumps her own drink of water on some farms in Germany. A new farm pump works on the principle of a pendulum. Each time a cow pushes her muzzle into a trough, the trough swings to pump water. The pump works so easily that even a young animal soon learns to pump a drink. It can be operated by hand.

French Jet Training Plane Has Butterfly-Type Tail

Built with a butterfly, or V-shaped, tail a new French jet trainer has a top speed of about 500 miles per hour. The trainer, called the Magister, has been ordered in quantity by the French Air Force. It is powered by two jets of 880 pounds' thrust each, has a span of 37½ feet and a length of 32 feet 3½ inches.



"COWBOYS" LASSO a RHINO

By F. Wallace Taber

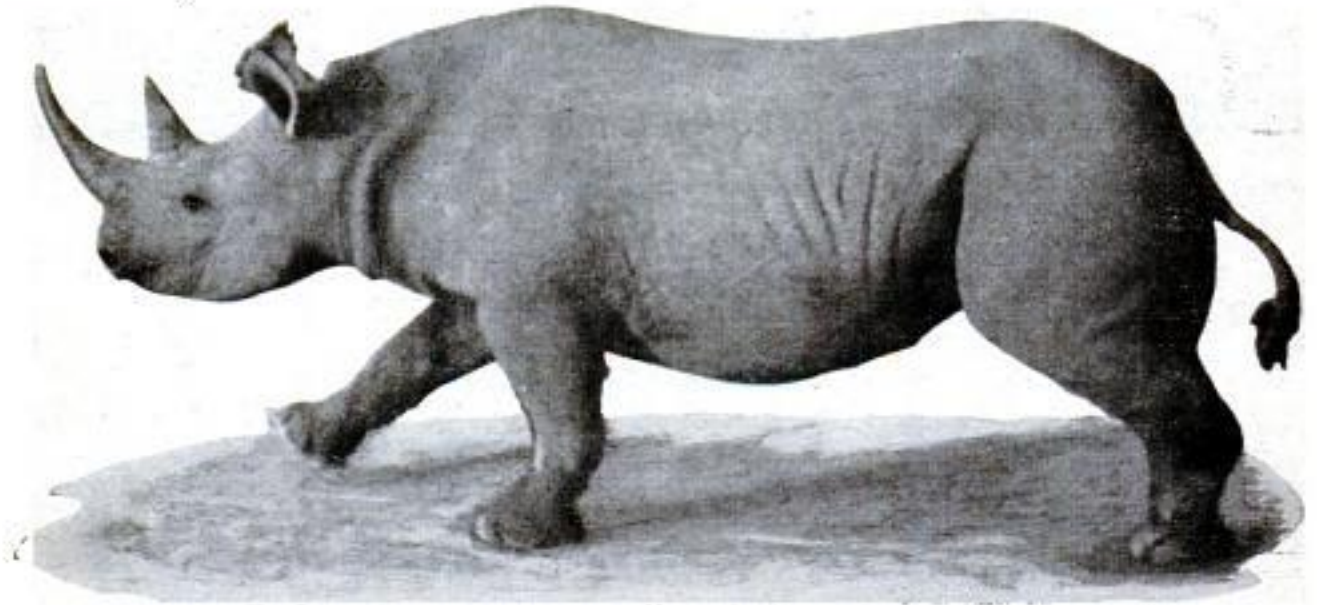
Photos by Charles Guggisberg



Maneuvered onto a dry-lake bed, mama rhinoceros may prefer tackling the truck to deserting her calf

JUST ABOUT the stubbornest, most cantankerous and downright meanest beast in the world is the rhinoceros. Small wonder that wild-animal collector Piet Jones is in for a rough day when he goes after such a critter.

Usually the order for a rhinoceros comes in the form of a cablegram from a zoo, a circus or even Hollywood. Addressed to Jones in Tanganyika, it says, in effect, "please ship one rhino calf soon as pos-

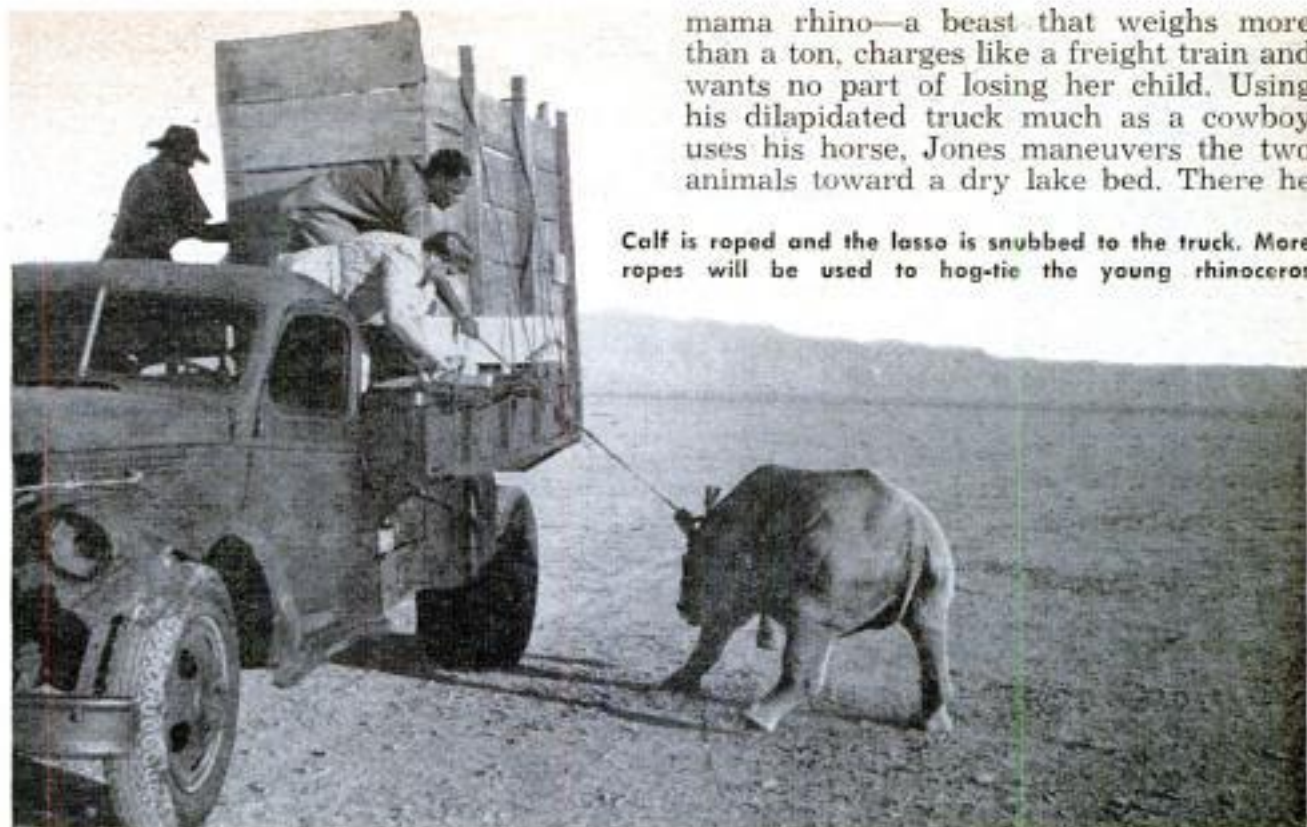


Here's more than a ton of meanness and temper, a rhino determined to protect her calf and escape to brush

Lasso is looped over a forked stick. The open noose soon will be dropped over the head of the weary calf

Tail between legs is a sign that the calf is tired. Truck is maneuvered alongside as animal slows to trot





mama rhino—a beast that weighs more than a ton, charges like a freight train and wants no part of losing her child. Using his dilapidated truck much as a cowboy uses his horse, Jones maneuvers the two animals toward a dry lake bed. There he

Calf is roped and the lasso is snubbed to the truck. More ropes will be used to hog-tie the young rhinoceros

sible.” That sends Jones off on a rhino hunt.

He’s armed with a rifle and has the help of his wife and a pair of Mbulu “boys”—actually grown men. There’s no single label for his form of transportation. It’s an ancient truck of mixed ancestry with fenders and doors battered by scores of encounters with rhinos.

Jones reconnoiters brushy retreats that he knows to be rhino haunts until he spots his victim. Usually it’s a half to three-quarter-grown calf accompanied by its mother.

The big trick is to separate the calf from

manages to get between the mother and the calf, and eventually to drive off the mother. At any moment, though, she may prefer to charge the battered truck rather than desert her calf.

After he drives the mother away, Jones pursues the calf in the truck until the animal tires. Carefully he maneuvers the truck alongside the weary behemoth until his wife is able to drop a noose over the calf’s head. Once roped, the animal does a lot of tugging until additional nooses are dropped into place. Then it is worked into a heavy crate, loaded onto the truck and hauled off for shipment. ★ ★ ★

Tired, roped but still undefeated rhino struggles against the ropes that pull it alongside the truck

Hog-tied rhino is virtually harmless. It will be loaded into the strong crate carried in the truck



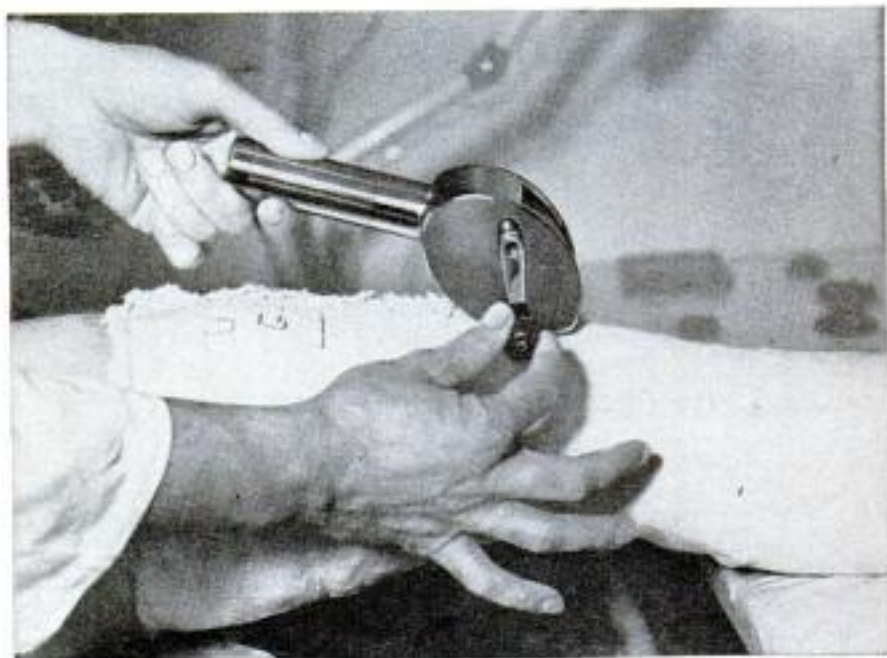


Midget Greenhouse

Cuttings from plants quickly take root when they are planted in a miniature, mist-filled greenhouse. A fogging nozzle attached to a garden hose sprays 1½ gallons of water per hour into the enclosure, a milk-white plastic dome. The cuttings are planted in concrete sand. A steel-rib framework resting on a circle of bricks supports the protective dome which holds 1000 cuttings at a time. After the cuttings take root they are transplanted.

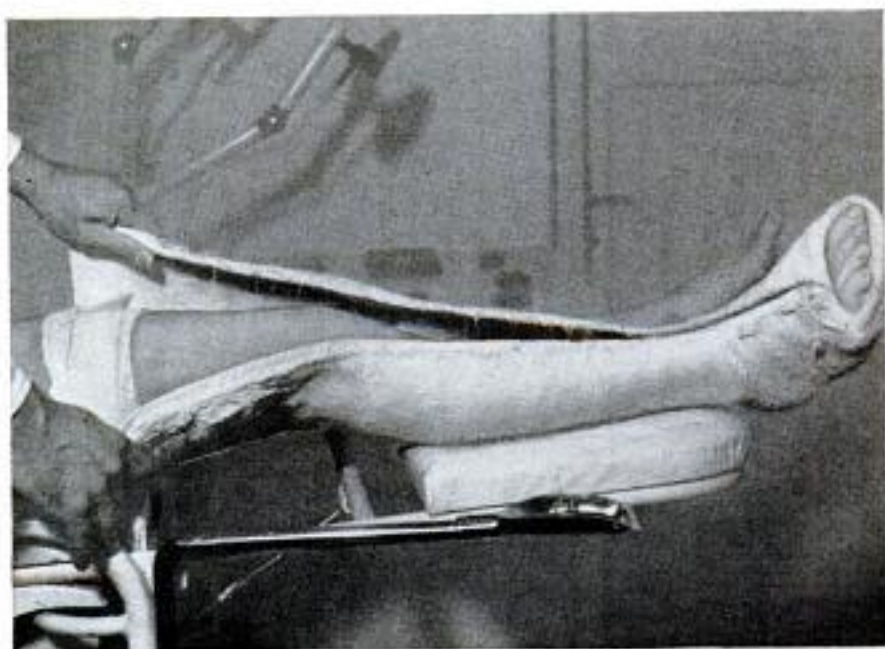
Embedded Wire Zips Open Cast

Plaster casts are opened like a pack of cigarettes through a system developed in Europe. A piece of strong, fine wire is embedded in the cast when it is made. A loop of the wire is left exposed at one end of the cast. When the cast is to be removed, the loop is hooked in a hand-held reel. Turning a crank winds up the wire (right), cutting open the cast (below) without pain to the patient.



Radar Pictures Travel by Phone

Robot radar antennas connected by ordinary telephone lines to a central monitoring station are possible with a new system. Radio engineers have found a way to "squash" the radar-screen signal so it can be transmitted on standard telephone lines. At present, coaxial cables or microwave relay systems are necessary to carry radarscope pictures. The new system scans the original radarscope picture at 1/100 the usual speed, producing no significant loss of information in the received image.



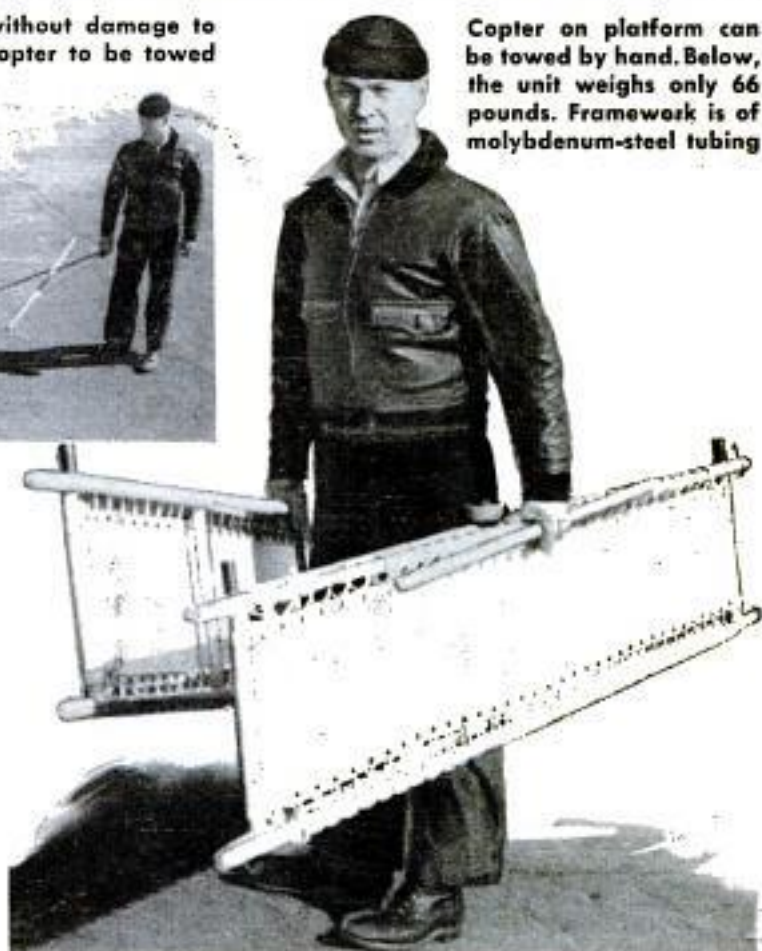


Helicopter settles to rest on canvas "bed" without damage to pontoons. Below, wheels permit landed helicopter to be towed



Portable Heliport Docks Pontoon Copters

Pontoon-equipped helicopters that can't find a wet place to land can now touch down on a canvas heliport. As the copter hovers four feet above the ground, crew members hop out, unlash the disassembled unit from the pontoons and put it together in a minute. A pair of small wheels under the platform permits the copter to be towed away to the hangar after landing.



Copter on platform can be towed by hand. Below, the unit weighs only 66 pounds. Framework is of molybdenum-steel tubing

Soviets Foster Redwood Tree

Russian scientists are busily adapting the giant American redwood tree to Soviet use. The first redwood trees were brought from America in the 1860s and used to decorate parks in the Caucasus and on the southern coast of the Crimea. Now, however, the tree is being introduced into the forests of the Crimea and other parts of the Soviet Union. By hybridization of the giant tree, crossing it with larch, cypress and others, the botanists hope to make it grow farther north.

Computer Translates Morse Code

Messages in Morse code are automatically translated and printed by a new electronic instrument. The code converter is a computer that accepts signals from a radio receiver, translates the message and instructs a typewriter which letters to print. Memory circuits permit it to "copy behind" the signal in the same way as a human operator. During this memory phase the instrument determines when a figure rather than a letter is being transmitted and shifts the carriage for numbers.

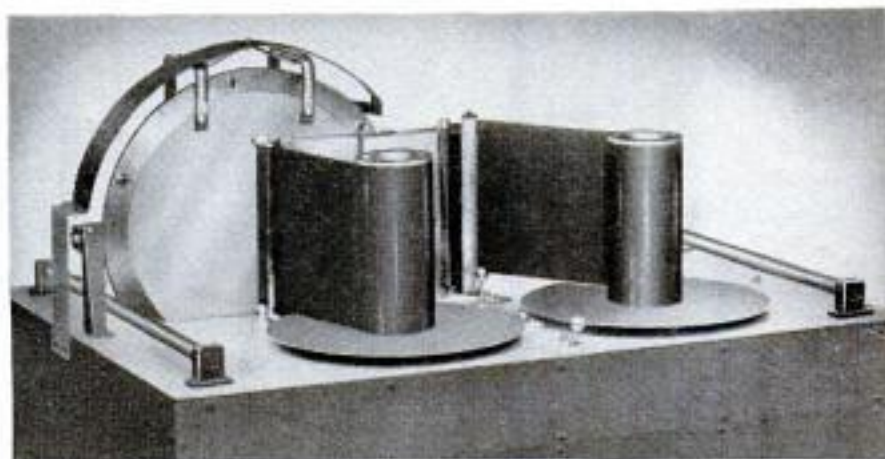
Babies' Showcase For Proud Dads

Showcase views of newborn infants can be obtained by proud fathers and other visitors in Community Hospital, Long Beach, Calif. Eight bassinets at a time can be arranged under slanting glass, so that babies can be viewed from above, as are goods under a glass counter. The arrangement pleases fathers and saves time for nurses, who are no longer called upon to hold infants up for display to relatives. A stainless-steel bar is provided for visitors to lean on.



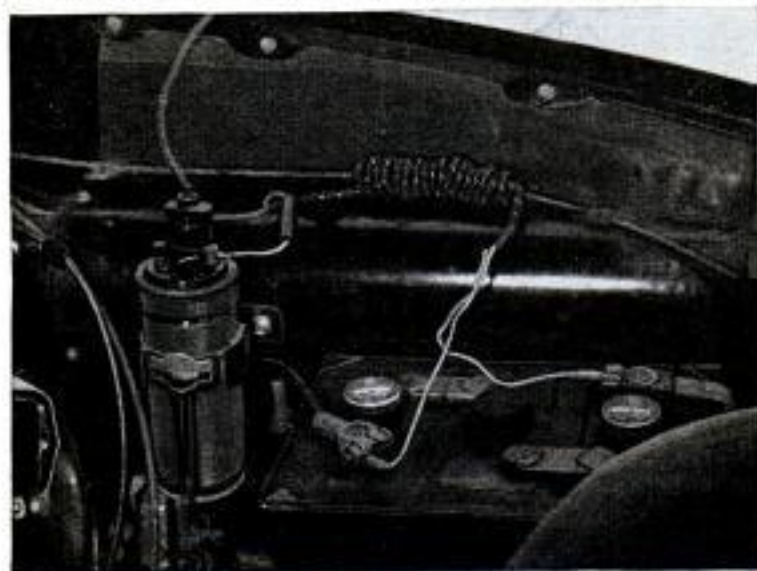
Ultrasonic Tape Recorder

Sounds 250 times higher than the average person can hear are recorded on a new magnetic-tape instrument designed for the Signal Corps. The human ear can hear sounds up to 20,000 cycles per second. The new tape mechanism records electronic signals up to five megacycles (5,000,000 cycles) per second. The tape, 10 inches wide, runs from one cylindrical reel to another at a speed of nearly 50 inches per second. A nine-inch disk with six recording heads contacts this tape. The instru-



ment was designed, not for sound recording, but to record data on radar, aircraft, computers and complex weapons which involve high-speed phenomena.

Under-Hood Charger for Automobile Batteries Handles 6 or 12 Volts



Small enough so it can be mounted on the car's fire wall, a portable battery charger can handle both six and twelve-volt batteries. Or, if desired, it can be hung on a wall of the garage and used to keep two batteries charged in a two-car family. To use it, you simply plug it into any 110-volt a.c. socket. Overcharging is impossible.

☐ Civil Aeronautics Administration figures show that U. S. businessmen, farmers, sports fliers and other nonairline users flew a total of 8,772,000 hours in 1954, compared to 3,200,000 hours for scheduled flights.

Color Converter for Black-and-White TV



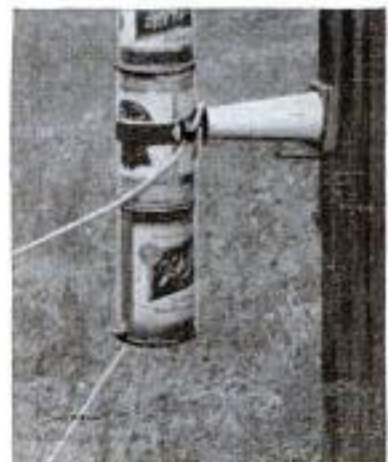
Black-and-white TV sets are converted to full color by an adapter that costs about \$150 plus installation. The adapter includes an electronic circuit to reduce the black-and-white picture to 12-inch size. A rotating filter, electronically synchronized, stands in front of the set to add full color to the picture.

Low-Cost Tape Recorder Sells for \$30



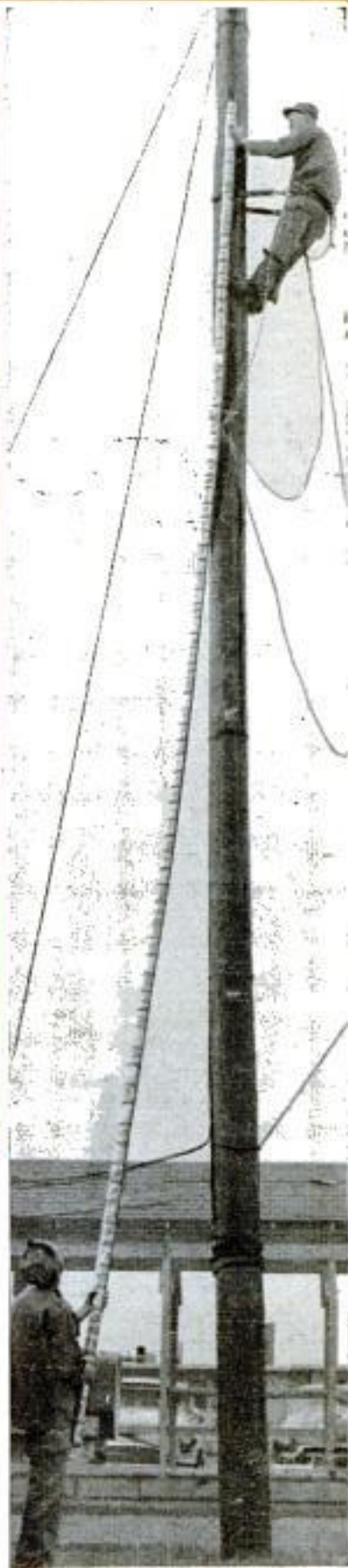
Handy to have around the house for leaving messages and instructions, a low-cost tape recorder is simple enough for a child to use. It makes no high-fidelity claims, but it records just like the more expensive models. No toy, it has a four-tube amplifier, a four-inch loudspeaker, crystal microphone and two 150-foot tape reels.

• A switch turns off all hi-fi components when the last record is played. With it, you can go to sleep to the music of favorite recordings. • An electronic robot "listens" to Morse code and types out the message on a teletypewriter at 600 words per minute.



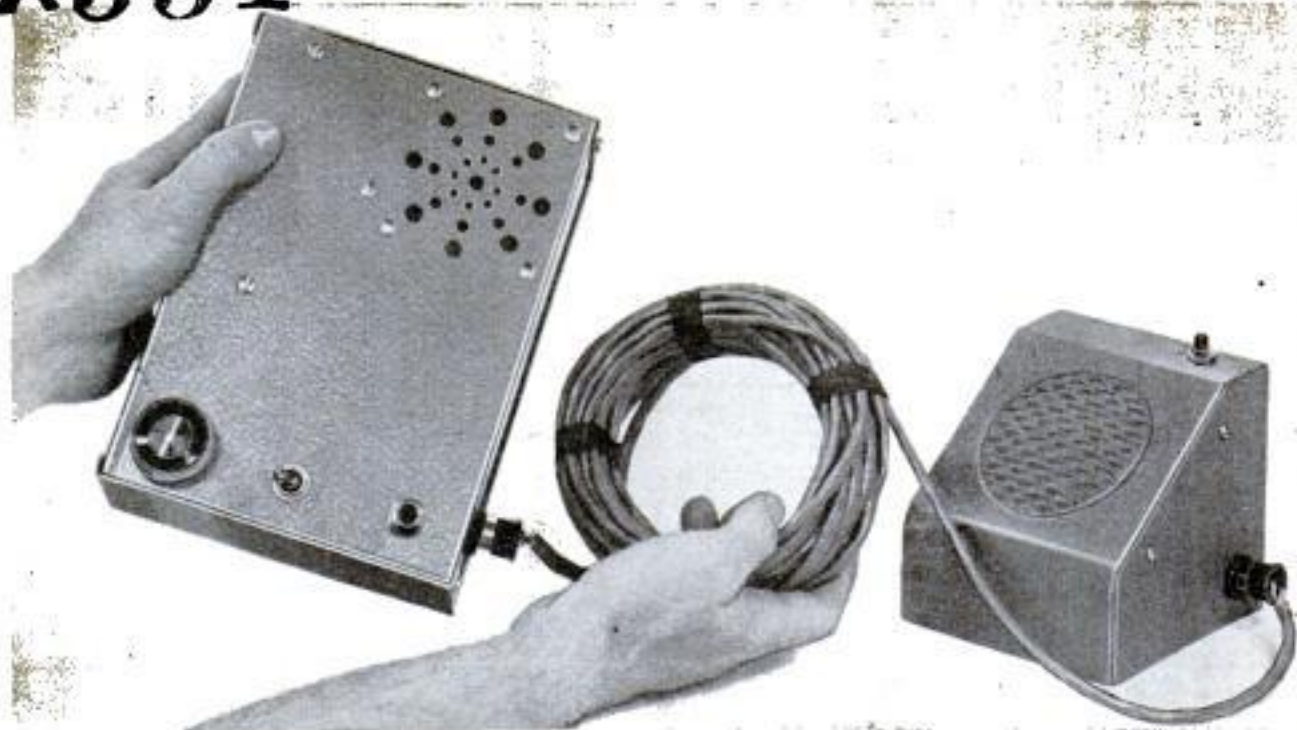
Airmen's "Can-Tenna"

At the Altus Air Force Base in Oklahoma there's a short-wave antenna that proves you should never throw away anything! It is the antenna for a Globe King transmitter and is made of 84 beverage cans that have been soldered together, end to end. Its height is 27 feet, 10 inches, about a quarter wave length of the 40-meter band.



X351

"Electronics Made Easy"



Suitable for use anywhere, this battery-operated intercommunication system is easy and inexpensive to build

BATTERY-OPERATED INTERCOM

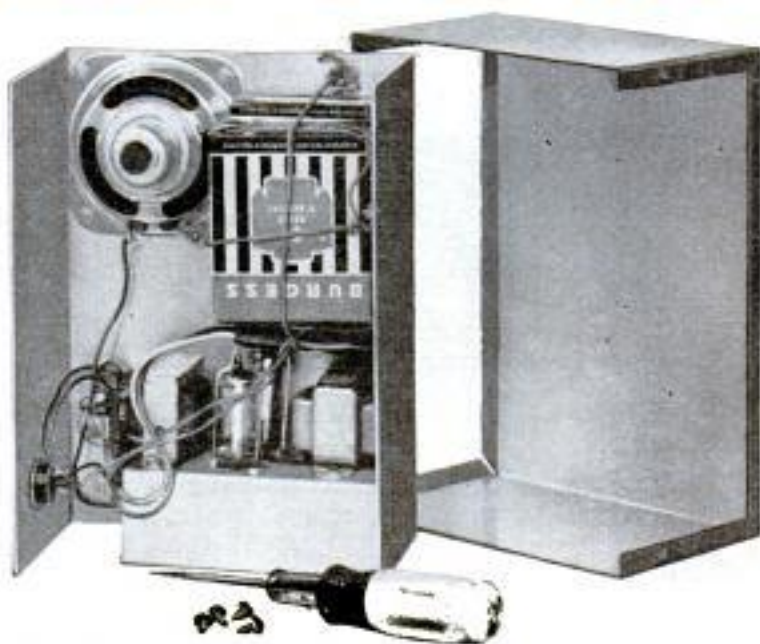
By Lothar Stern

INDEPENDENT of external power, a battery-operated intercom system has many uses around the home, farm or shop.

Inexpensive to build, this system has the advantage of low battery drain because power is used only during actual conversation periods. Of course, this requires the operators at both master and substations to depress the press-to-talk buttons when speaking into the set.

To increase the versatility of the system, a monitor switch (Sw 2) is added to the master station. With the switch on, power is applied to the amplifier and the person at the master station hears what is going on at the substation. This is useful for baby sitting or if the person at the substation cannot readily press his switch. Of course, battery power is being consumed while the switch is in the "on" position. Therefore, it should be turned off when monitoring is not required.

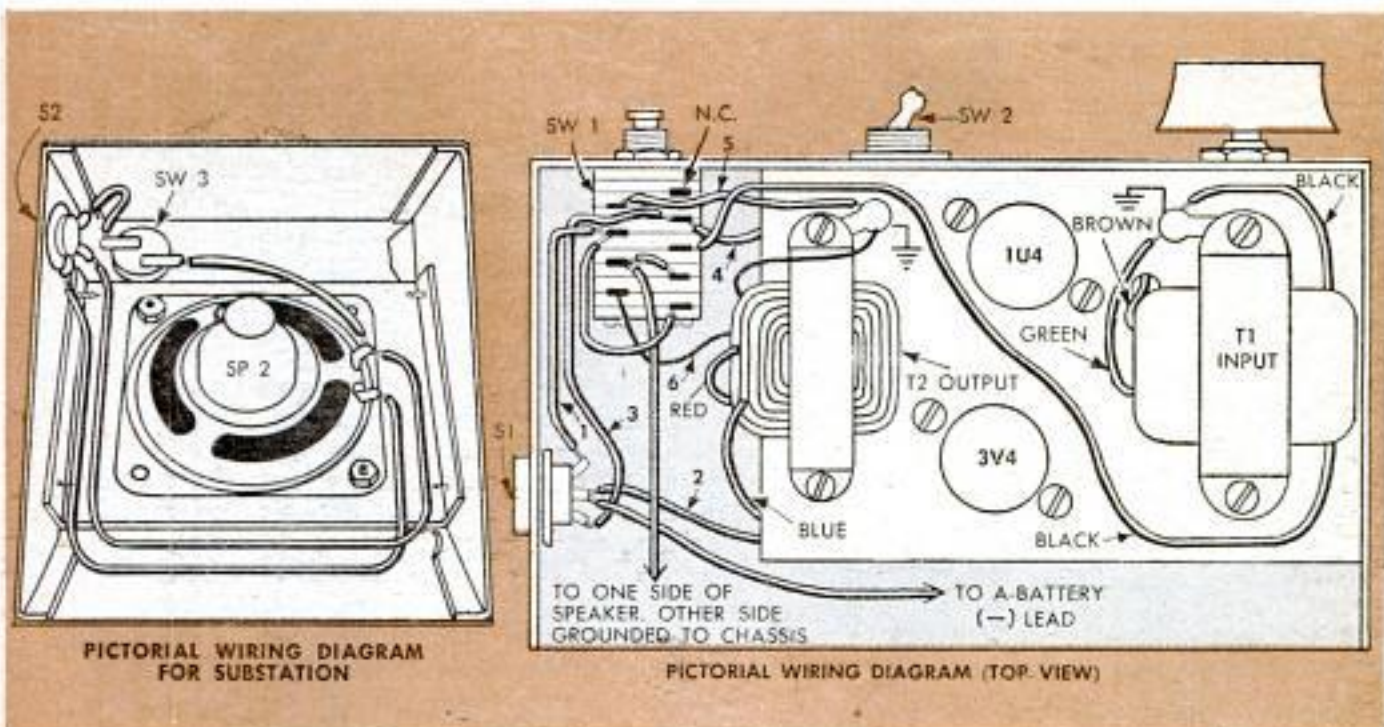
The system is sensitive enough to pick up normal conversation from across an average room and to reproduce it with enough power to be easily understood. A call can be heard distinctly even if the person being called is not near the speaker. If desired, the volume control may be



Batteries are held in place above the chassis by wires that are threaded through four ground lugs bolted to the aluminum case

turned down to a level for private listening.

The circuit consists of an amplifier, a switching system and two speakers. It is wired so that the substation speaker is used as a microphone unless the press-to-talk switch at the master station is depressed. Then the master-station speaker becomes the microphone and the other speaker gets the amplifier output. The substation switch merely completes the filament circuit of the amplifier so that power is applied and the substation may initiate calls.

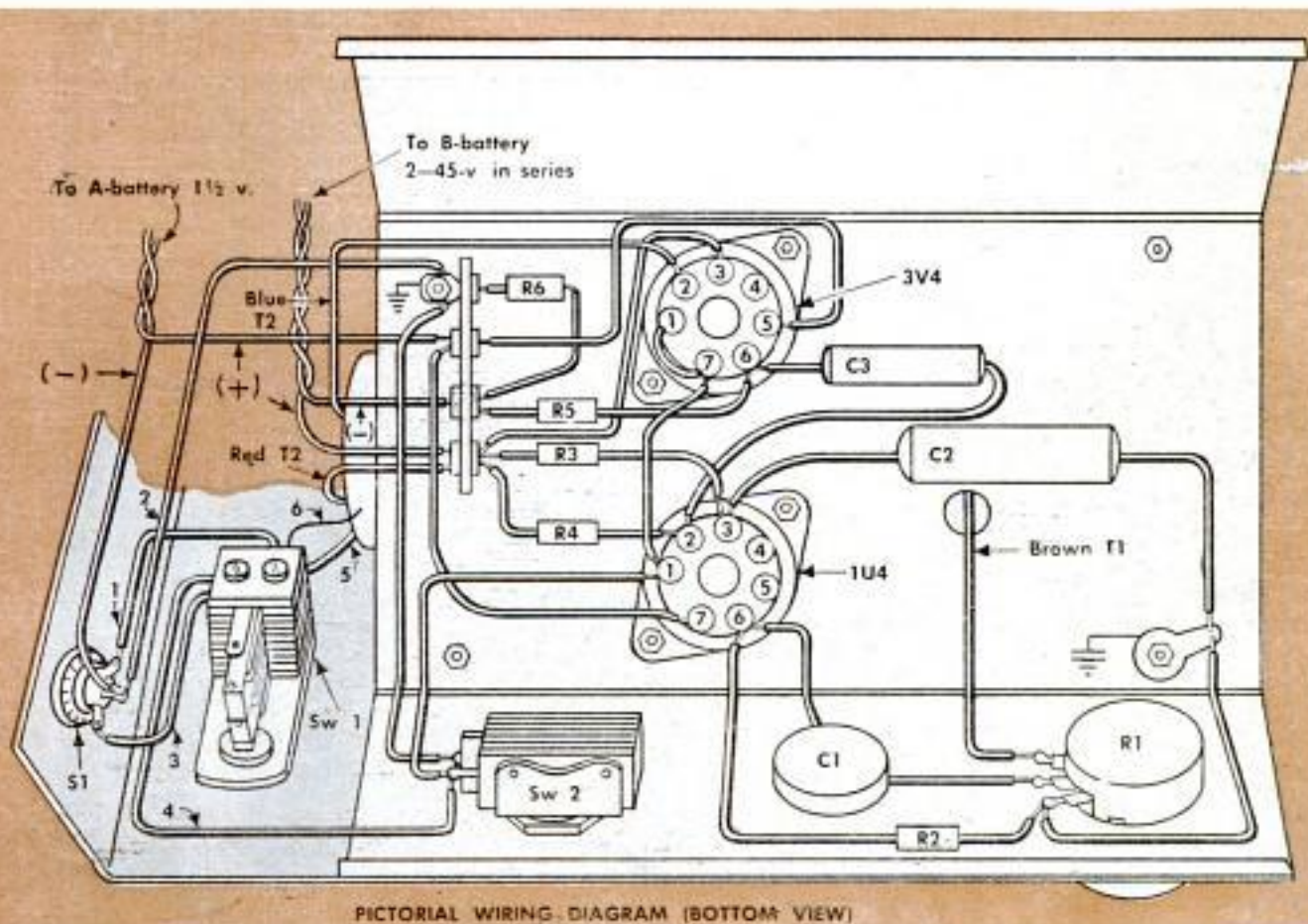


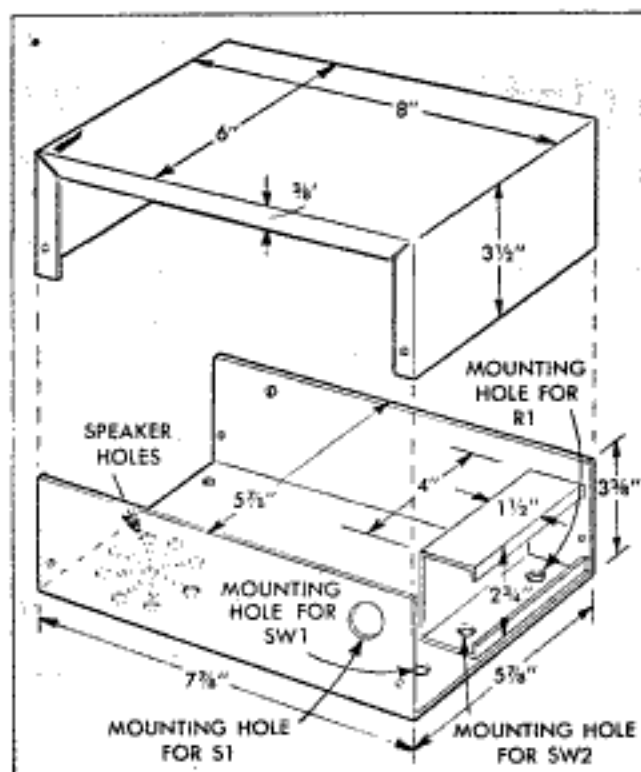
Circuit Details:

The amplifier is composed of a 1U4 voltage-amplifier stage and a 3V4 power amplifier. These tubes receive operating plate voltages from a 90-volt source (two 45-volt B-batteries in series). Filament voltage is obtained from a 1.5-volt A-battery. With all switches in the unactivated positions, the filament circuit is open so the tube fila-

ments are not energized. Although the B-battery is in the circuit at all times, no plate current flows unless the filament circuit is completed.

When the three-pole, two-position press-to-talk switch (Sw 1) at the master station is depressed, the filament circuit is closed so the amplifier is in operating condition. The master speaker becomes the micro-





phone so the operator may call the substation. The substation answers the call by pressing the press-to-talk switch (Sw 3) there. This completes the filament circuit, but leaves the substation speaker in the microphone position. The monitoring switch, when closed, completes the filament circuit so it is unnecessary for the substation switch to be depressed to answer calls.

Construction:

The master-station assembly is enclosed in a 3 1/2 x 6 x 8-in. aluminum case. A diagram of it is shown below. The case for the substation speaker and switch is available commercially.

The parts layout is designed not only for ease of assembly, but also for maximum versatility of operation. The master station can be placed on a bench or table, or hung against the wall.

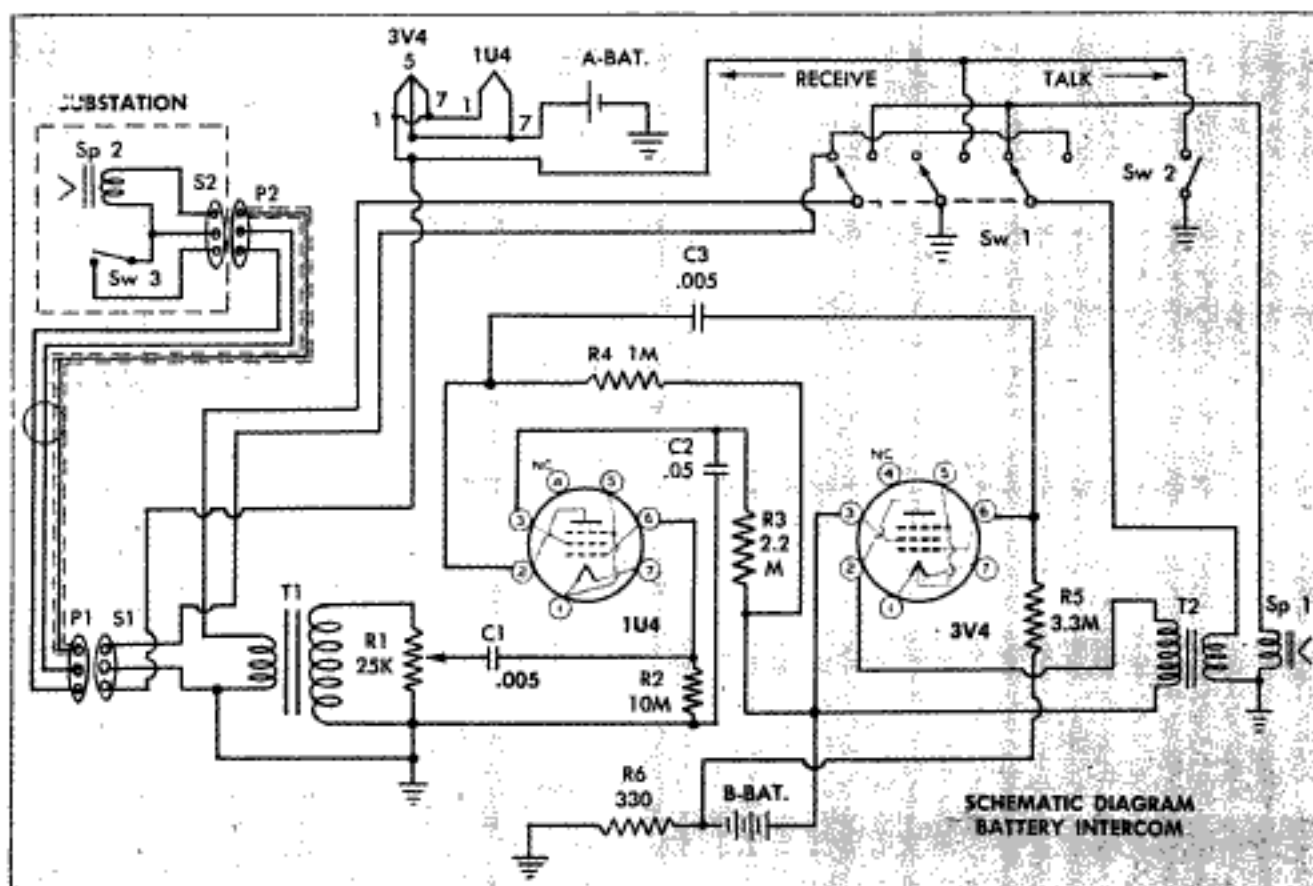
Tubes, transformers and small parts are mounted on a separate chassis. The switch and speaker of the master station are fastened directly to the aluminum case. This permits you to wire the chassis and switch separately and connect them during final assembly. The chassis is held to the case by the mounting nuts of the volume control and toggle switch.

The batteries are held in position above the chassis by two wires that serve as straps (see photo page 158). These wires are threaded through ground lugs bolted to the case itself.

The substation is connected to the master by a three-conductor cable or a two-conductor shielded cable. If the two-conductor cable is used, the shield braid serves as the third conductor or common ground. Any length of cable up to several miles may be used.

To simplify construction, the chassis and case should be made of aluminum for easy

(Continued to page 242)



the

POPULAR
MECHANICS

CRAFTSMAN



COLORING WITH STAIN

UNLESS HE simply painted it, the homeowner in the past had no other way of adding gay, exciting color to his woodwork, wall paneling or furniture, now so fashion-right with modern interior stylists.

But what a shame, thought many a do-it-yourselfer, to cover up beautiful wood grain merely to color it. If only there were some way of transforming it into bright colorful tones that would still let the grain show through in all its natural beauty and charm.

Now, thanks to paint manufacturers such as the Martin-Senour Paint Co., the homeowner is no longer limited to the opaqueness of paint. The Martin-Senour people alone have over 169 prescription-mixed custom stains, called Nu-Hue, that offer the week-end decorator a panorama of color containing all the hues of the rainbow.

While there are many bright colors from which to select, strong hues tend to detract from the basic appeal of most wood grains. Best bets are colors that are nature's own,

These three color samples show results when stain is applied to fir plywood. Note how hard and soft grain give driftwood effects to this common-type wood





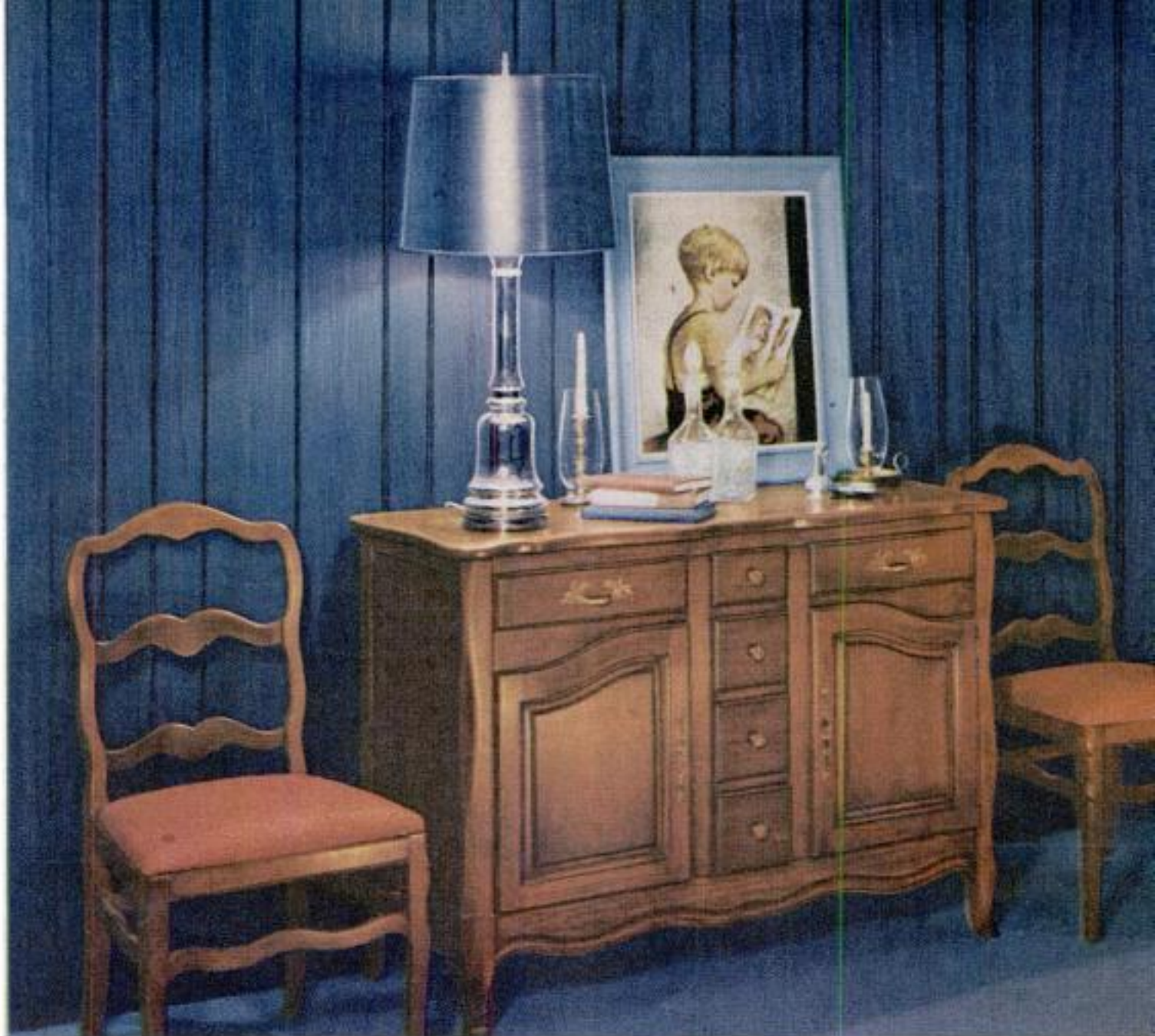
Yellow stain applied to this planked bedroom wall of knotty pine adds a feeling of glowing warmth to the room

such as muted greens, gray browns, grays and earth reds, like bisque and terra-cotta tints. It is advisable to select a hue that will match the color of existing walls, or use a contrasting color for maximum accent. If furniture, such as cabinets, bookshelves, tables, storage units and room dividers, is painted to match the wall, a built-in look is achieved and the room is given unity as well as the appearance of spaciousness. In selecting contrasting accent colors, choose a color from a fabric or wallpaper in the room. Accent colors go well on doors of cabinets as well as inside both bookshelves and cupboards.

Working with these new stains is com-

paratively simple. Naturally, it goes without saying that the old original finish must be completely removed down to the bare wood. And as color effects vary with the natural growths of wood, it is recommended that the stain be tried first on a scrap of the actual wood to be finished. It is quite possible that varying results will be obtained with the same color on different grades of the same type of wood. This can be controlled to a great extent by wiping. Lighter shades may be produced by wiping the stain with a soft cloth after it has partially penetrated the wood. Likewise, darker shades may be produced by allowing the stain to penetrate more fully





Mahogany furniture stands out in rich contrast against blue-stained background wall of vertical planking

before wiping off the excess with a cloth.

Close-grained woods, like birch, maple, gum, white pine, fir, poplar and cedar, should be sanded thoroughly and dusted well before staining. Brush on one coat of custom stain as it comes from the can and allow it to dry until three fourths of the surface has flattened out. This takes about 15 to 30 min. At this point, the stain is wiped with a soft cloth and then allowed to dry 12 to 15 hours. Finally, one or two coats of spar varnish are applied, sanding lightly between coats with 00 sandpaper. For a rubbed-effect finish, use a dull varnish for the final coat.

In the case of open-grained woods, such

as oak, korina, walnut, chestnut, ash and elm, the pores of the wood must be filled with a stained filler consisting of stain, 1 part and transparent paste wood filler, 1 part. This is packed into the grain by first applying it with a brush, letting it stand until it begins to flatten out and then rubbing it off across grain with a coarse cloth, such as burlap. After the filler has dried thoroughly, it is sanded lightly with 00 sandpaper. From this step on, the finishing procedure is the same as previously mentioned. Special effects may be produced on any type of wood. However, most striking results are obtained on open-grained woods such as those mentioned. ★ ★ ★

TYPE OF WOOD

Birch
Maple
Gum
White Pine
Fir
Poplar
Cedar



CLOSE-GRAINED WOODS

SAND THOROUGHLY with the grain and dust

1. Brush on one full coat of custom-finish stain. Allow to dry until three fourths of the surface has "flattened out" (usually 15 to 30 min.).
2. Remove excess stain by wiping with rag.
3. Allow ample time for drying (12 to 15 hr.).
4. Apply one or two coats of Martin-Senour spar varnish, floor and interior varnish or Lin-X clear glass. Sand lightly between coats with 00 sandpaper.

NOTE: If a dull or "rubbed effect" is desired, use a dull varnish for the final coat.

OPEN-GRAINED WOODS

SAND THOROUGHLY with the grain and dust

1. Apply one coat of stained filler made as follows:
Custom-finish stain, 1 part.
Martin-Senour transparent paste wood filler, 1 part.
2. Brush stained-filler mixture on surface. Allow to dry until three fourths of surface has flattened out.
3. Use coarse cloth, such as burlap; rub across the grain until pores are filled. Use same cloth to remove excess filler from wood. Allow to dry and sand lightly with 00 sandpaper.
4. Apply one or two coats of Martin-Senour spar varnish, floor and interior varnish or Lin-X clear glass. Sand lightly between coats with 00 sandpaper.

NOTE: If a dull or "rubbed effect" is desired, use a dull varnish as final coat.

Oak
Korina
Mahogany
Walnut
Chestnut
Ash
Elm



Whether it's wall paneling or furniture, first step is to sand surface well before applying stain as in step 2

When stain penetrates desired amount, excess is wiped off with soft cloth, step 3



3

2



Finally, protect stain with two coats of spar varnish, sand lightly and top with dull-type varnish

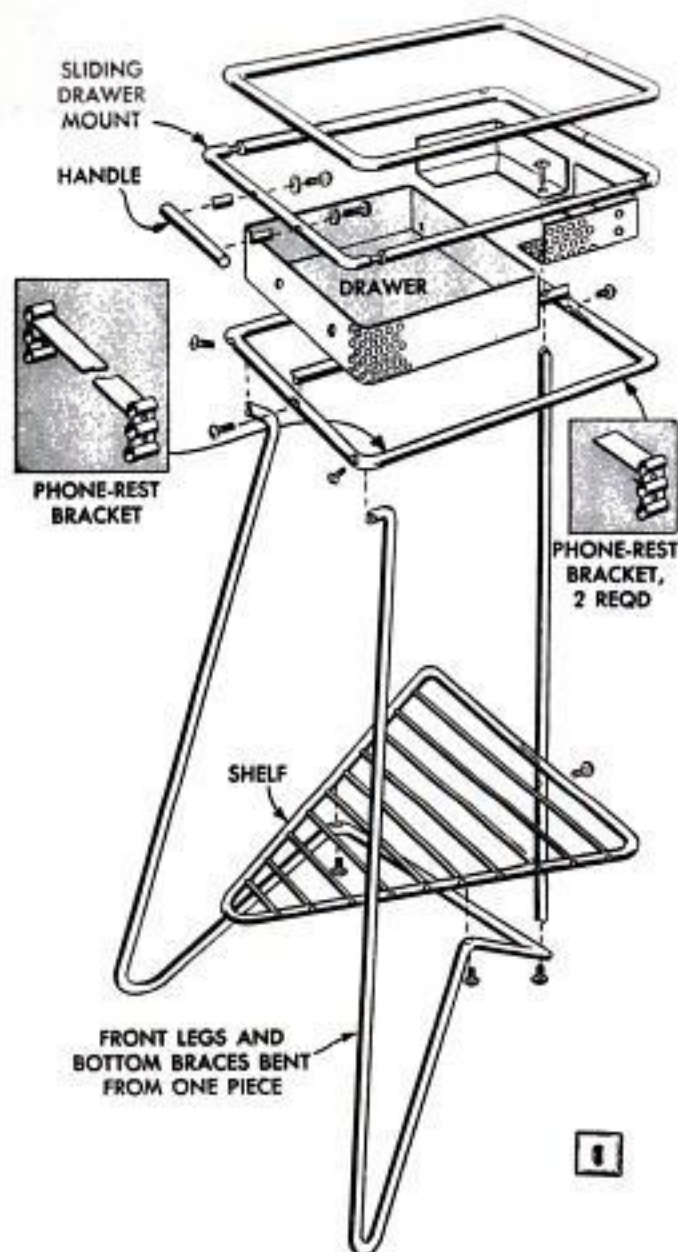


4

Wrought-Iron Telephone Table

By Kenneth Dale Collister

Lightweight and graceful, this wrought-iron telephone table includes a drawer for note pad and pencil plus a shelf for the telephone directory. Complete assembly may be accomplished without welding



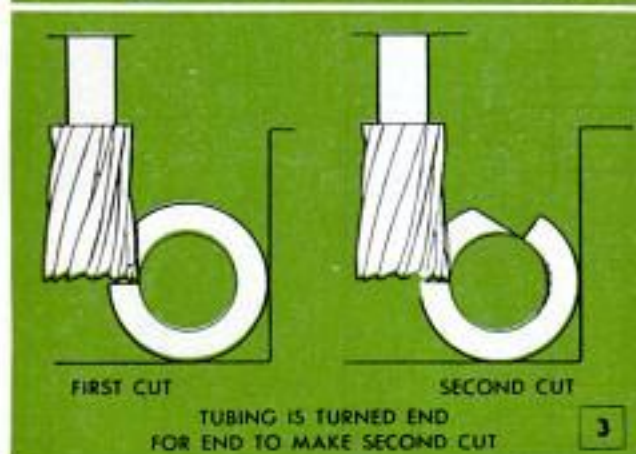
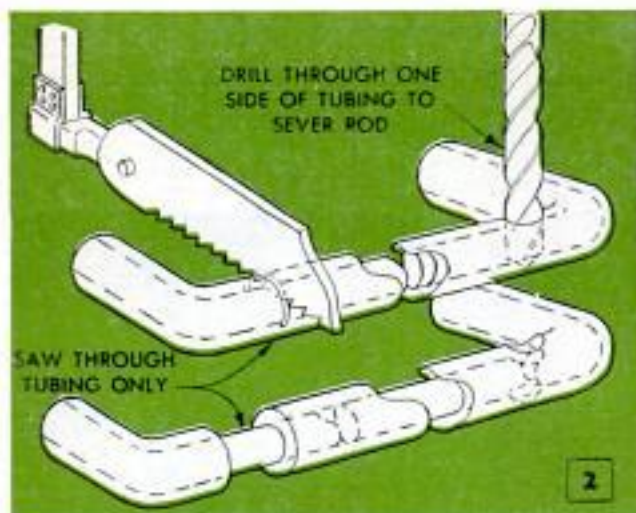
DESPITE ITS graceful appearance and seemingly intricate construction, this modern wrought-iron telephone table is assembled entirely without welding. Except for crossbars in the bookshelf, which are soldered in $\frac{1}{8}$ -in. holes, all components of the table are assembled with 6-32 screws. As indicated in the details in Fig. 4, all holes are either $\frac{3}{64}$ -in. clearance holes or $\frac{7}{64}$ -in. tap holes for 6-32 screws.

The table consists of four main parts, as shown in Fig. 1: The two front legs, the hollow rear leg which permits concealing the phone wire, the shelf for phone books and the phone-rest-and-drawer assembly.

The front legs and braces are bent from a single length of $\frac{3}{16}$ -in. round steel bar, 8 ft. 6 in. long. For accurate bending draw a full-sized pattern of the leg unit on the workshop floor or bench top using the dimensions in Fig. 4.

The rear leg of the table is a 24 $\frac{1}{2}$ -in. length of $\frac{3}{16}$ -in.-o.d. tubing. Both ends are plugged with 1-in. lengths of $\frac{3}{32}$ -in. steel rod. Drill and tap the end of each plug. Then file the ends of the plugged leg to fit against the front-leg assembly and table-top frame as indicated in details D and B in Fig. 4. To permit threading the phone wire through the leg, drill a hole just beyond each plug or cut away a section with a small milling cutter chucked in a hand grinder, as shown in Fig. 3.

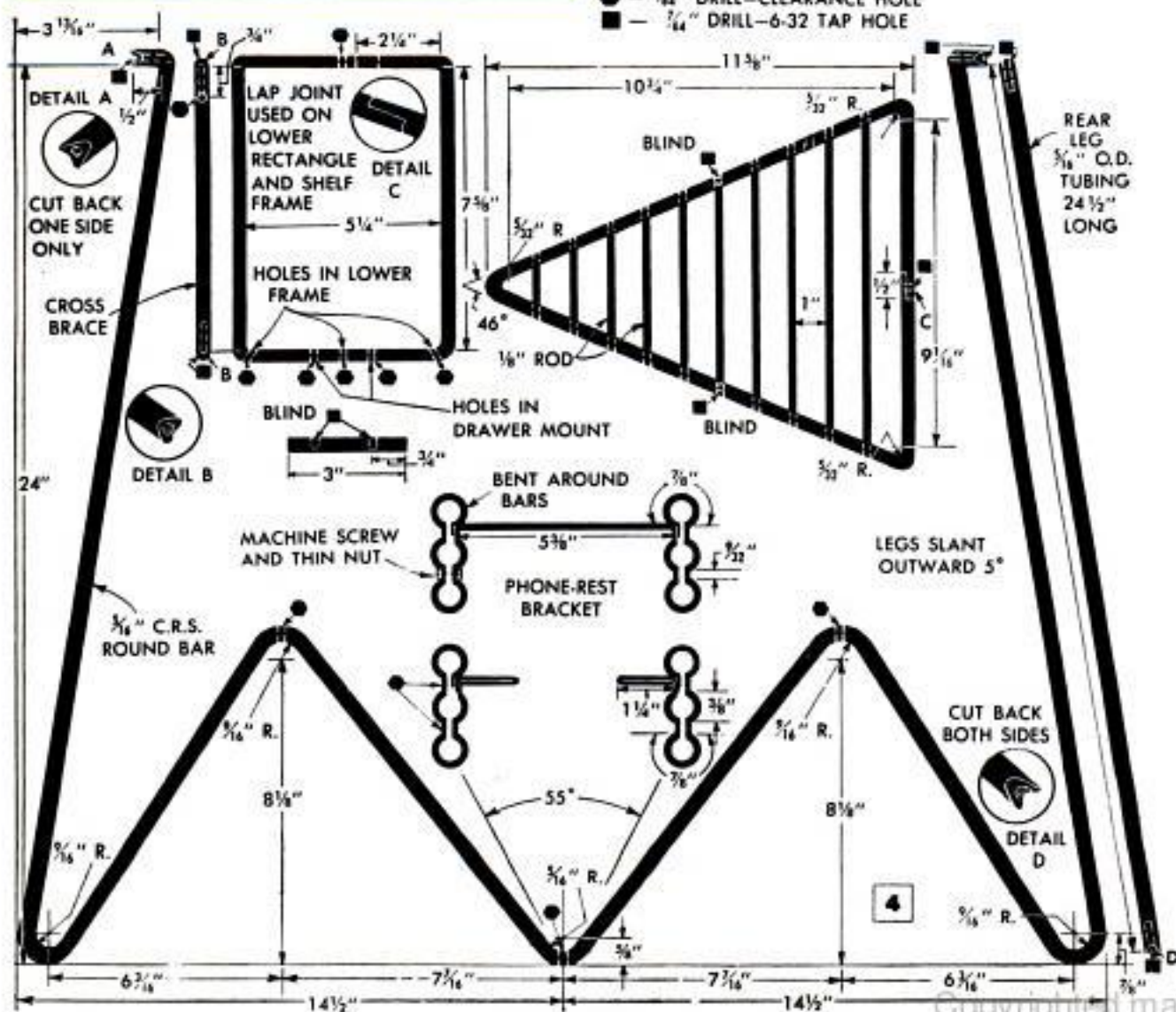
The triangular-shaped bookshelf is bent



from $\frac{3}{16}$ -in. round steel bar, the ends being half-lapped $\frac{1}{2}$ in., as shown in Fig. 4. The outside half of the lapped joint is drilled for clearance, the inside half is drilled and tapped. A screw passed through a hole in the rear leg is turned into the threaded hole, holding the leg and shelf together. An adjustable T-bevel is used to keep the drill aligned when holes are drilled in each leg of the triangle for the $\frac{1}{8}$ -in. crossbars. The holes then are countersunk to receive the solder with which the crossbars are held in place.

The frame of the phone rest and drawer slide consists of three rectangles. The top and bottom rectangles are bent from $\frac{3}{16}$ -in. round bar, the bottom one being half-lapped in the same way as the shelf. The middle rectangle is the drawer slide. To make them, a length of $\frac{5}{32}$ -in. steel rod is forced through a length of $\frac{3}{16}$ -in. tubing, then both are bent together. After this, the tubing is drilled carefully $\frac{1}{2}$ in. from the rear corners to sever the rod inside, Fig. 2. Next, the tubing only is cut through with a fine-toothed saw $\frac{1}{2}$ in. from the front corners and the slide is pulled apart. The ends of the rod are filed smooth and the rod is lightly lubricated. A drawer-support

- — $\frac{3}{32}$ " DRILL—CLEARANCE HOLE
- — $\frac{3}{32}$ " DRILL—6-32 TAP HOLE

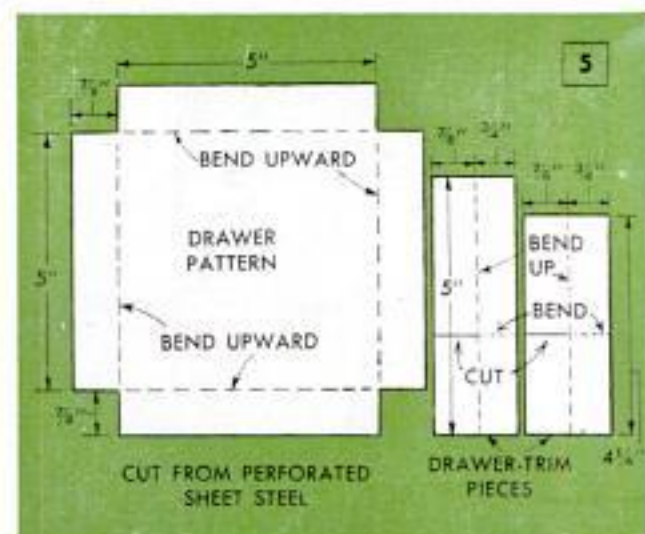


rod is fitted lengthwise in the middle of the lower rectangle, and the three frames are assembled with $\frac{1}{2}$ -in. sheet-metal brackets bent around the bars and tubing, as shown in Fig. 4. The drawer is cut and bent from a piece of perforated sheet metal, available at radio-supply houses. Drawer and drawer-trim dimensions and bends are shown in Fig. 5. A drawer handle is made from a 3-in. length of $\frac{3}{16}$ -in. steel bar and two scraps of tubing.

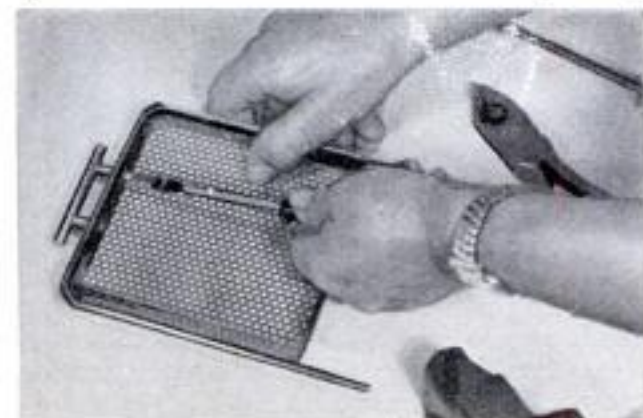
When assembling the table, the front-leg unit will have to be rebent at its center point to align it under the triangular shelf. Check the detail in Fig. 4 to determine which holes are to be tapped and which are for clearance. Details also show how the ends of various pieces must be filed to provide a good fit with the pieces to which they are joined.

Approximately 24 ft. of $\frac{3}{16}$ -in. round steel bar are required, about 5 ft. of $\frac{3}{16}$ -in. tubing and 32 in. of $\frac{3}{8}$ -in. steel rod.

Clean and smooth the assembled table with emery cloth, then paint it with a dull-black metal enamel or brushing lacquer. A paint sprayer, of course, will do an excellent job of applying either a lacquer or enamel finish. After the finish dries, apply a few drops of oil to the drawer rods. ★ ★ ★

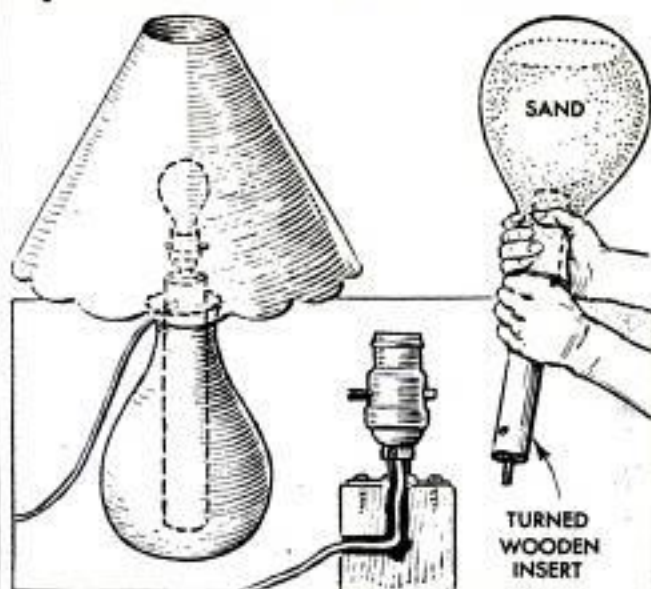


The drawer pull is drilled and tapped and fastened to the drawer from the inside, as below. Handle is spaced $\frac{5}{16}$ in. from drawer front with scrap tubing



SEPTEMBER 1955

Vase Converted to Lamp Base By Removable Wooden Insert



A narrow-necked vase used as a lamp base can be restored to its original form in a few moments if a removable wooden insert is used as the lamp standard. First, make the insert by turning a length of dowel to a diameter slightly smaller than the inside of the vase neck. Cross-drill it near the top for the lamp wire, as indicated in the detail. Next, fill the vase to within a few inches of the top with clean, dry sand. Place the end of the dowel in the neck of the vase and invert the vase. Hold a hand around the insert so the sand does not spill, and slip the insert up through the loose sand until it touches the vase bottom. The latter operation eliminates driving the insert into the sand, which might fracture the vase. Removing the insert and pouring out the sand restores the vase.—Norman C. Dickie, Johannesburg, South Africa.

Dust Plug for Rifle Barrel Made From Pipe Cleaner

To keep dust out of the barrel of a small-caliber target rifle and yet permit adequate ventilation to avoid dampness and rust, one sportsman uses a pipe cleaner as a barrel plug. The cleaner is twisted double so a finger loop is formed on the closed end. The loop permits easy removal of the plug and prevents the cleaner from being forced too far into the barrel.



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Rubbing Strips on Boat Hull Are Lengths of Garden Hose

One boat owner uses lengths of rubber garden hose as easily replaced rubbing strips on the hull of his boat. Galvanized pipe clamps are used to fasten the hose to the wood. The detail shows two methods of installing the hose, depending on the shape of the boat hull and gunwale. Brass screws are used in the clamps, and the installation should be thoroughly waterproofed to prevent rot occurring under the clamps.

Jack Brian, Jackson Heights, N. Y.

Convertible Trouble Lamp Used as Extension Cord



To increase the versatility of a trouble lamp, cut the cord about 1 ft. from the lamp and fit the short cord with a male plug. A female plug on the end of the long portion of the cord converts it to an extension cord for use with an electric drill or

other power tool. To reconvert the cord to a trouble lamp, simply plug the lamp into the extension-cord socket.

Hugh Lineback, Stillwater, Okla.

Hardboard Panels Covering Holes Keep Rats Outside Building

To prevent rats from entering buildings having breaks in the walls or floors, one exterminator covers the openings with 1/4-

in. hardboard. A piece of board measuring an inch or two larger than the opening on all sides is attached with screws inserted through drilled holes. The hardboard, which apparently is not palatable to rodents, has been used in this manner with complete success for several years.

—Courtesy Masonite Corp.

Lawn "Table" for One Glass Made From Dowel and Can

Assembly of a handy one-glass "table" for use on lawn or beach requires only a length of dowel and a shallow tin can. Point one end of the dowel for easy pushing into the ground. Punch a hole in the center of the can bottom and screw it to the opposite end of the dowel, using a washer under the screw-head. Push the dowel into the ground alongside a chair and the table is ready.



Vise Provides Extra "Hand" When Clamping Work

A vise sometimes can be used to provide an extra "hand" when several parts of a job are to be clamped together. The clamp is held in the vise as shown in the illustration. Both hands then can be used to hold the various pieces and to tighten the clamp.



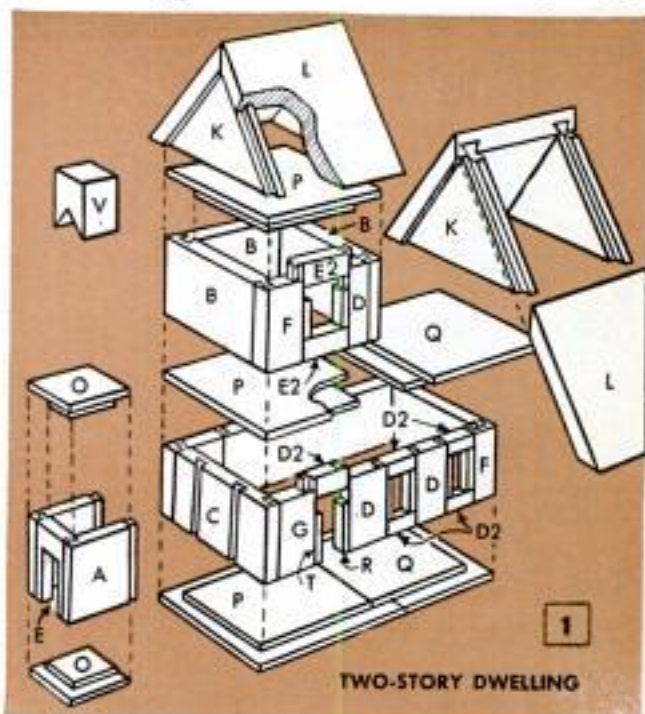
☐ To remove ink spots from varnished wood, rub well with a soft cloth that has been dipped in a mixture of equal parts of vinegar and linseed oil.

BUILDING BLOCK SET

By Hi Sibley

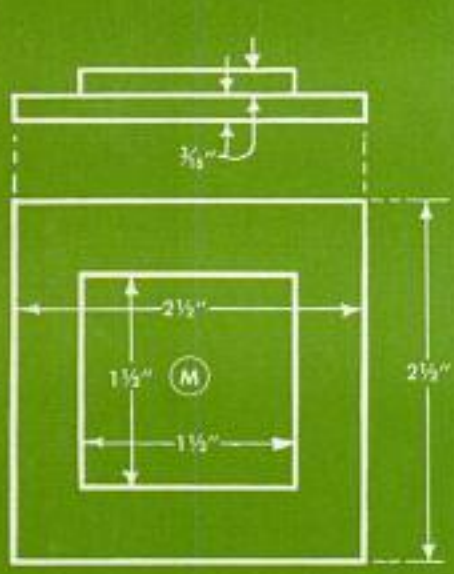
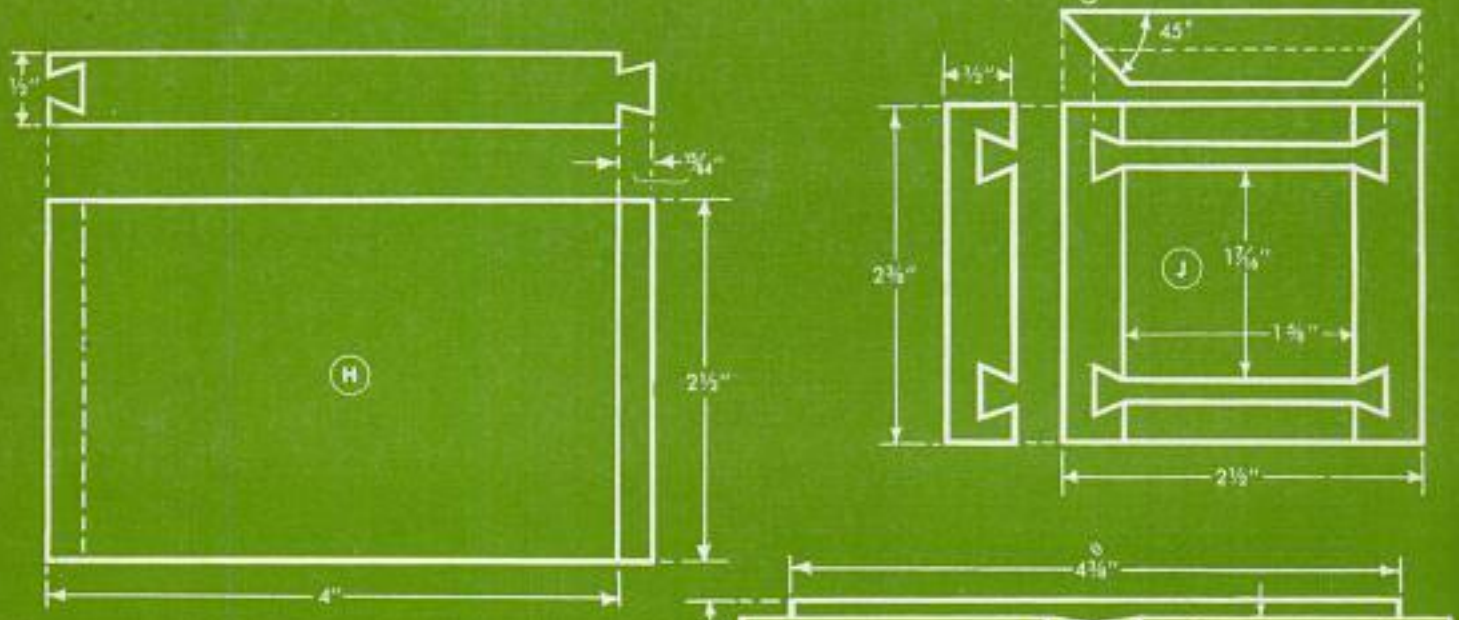
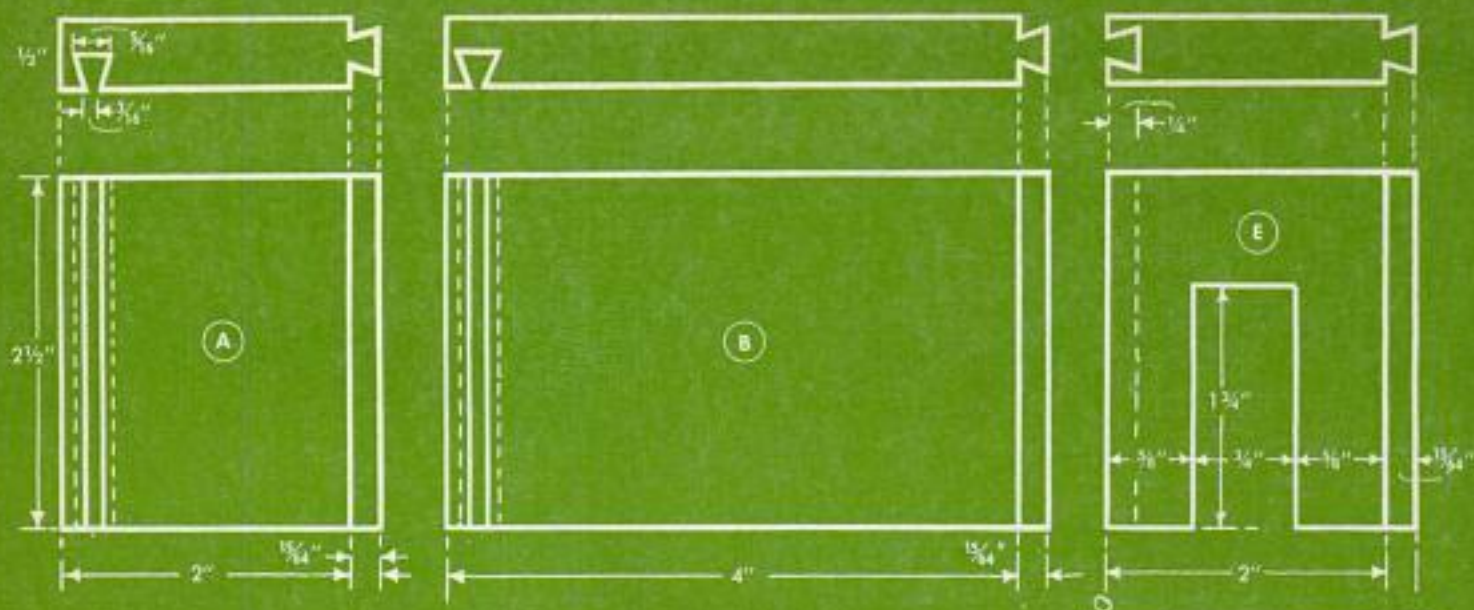
LOOKING FOR A spare-time money-maker to put your shop on a paying basis? This set of interlocking building blocks could very well do it. It's a natural sales product for a home workshop and one that requires a minimum of "tooling up." Made of redwood, for example, the product is already colored to save additional finishing time and expense. And by setting up simple fixtures on the saw and drill press, you can turn out the parts at a production-line rate. Building blocks such as these are always appealing to the small trade and command a nice profit.

While your packaged sets can contain as many as 48 separate pieces, which is the number required to build the two-story dwelling pictured in Fig. 1, you can limit the sets to fewer pieces. Although not keyed in the drawing, the rear wall consists of parts A, H and G. Small versions of the toy are pictured in Fig. 5, showing a blockhouse, garage, cottage and school. Many of the parts in each of these buildings are interchangeable which helps standardize the shapes and thus reduces the number of different blocks required.

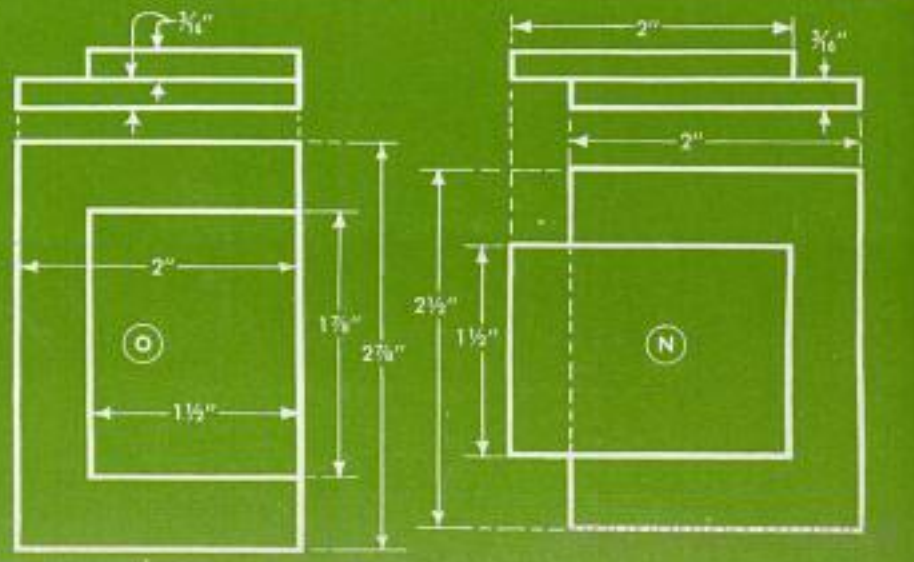
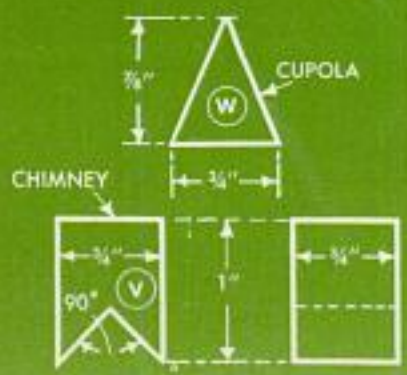
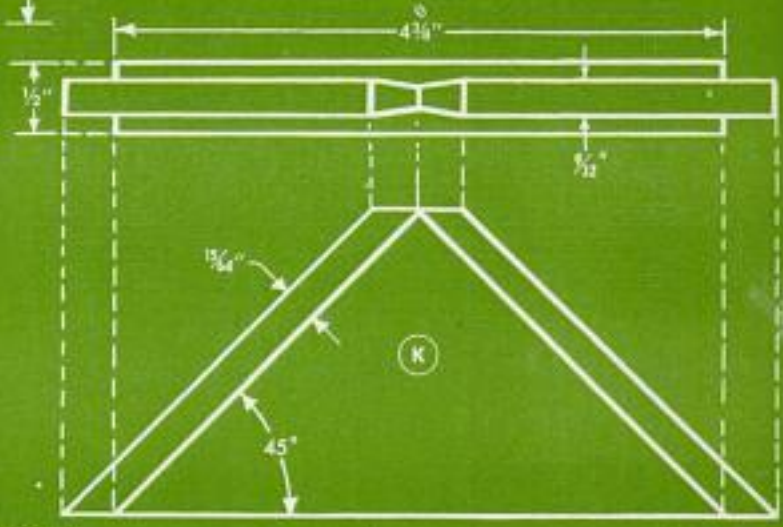


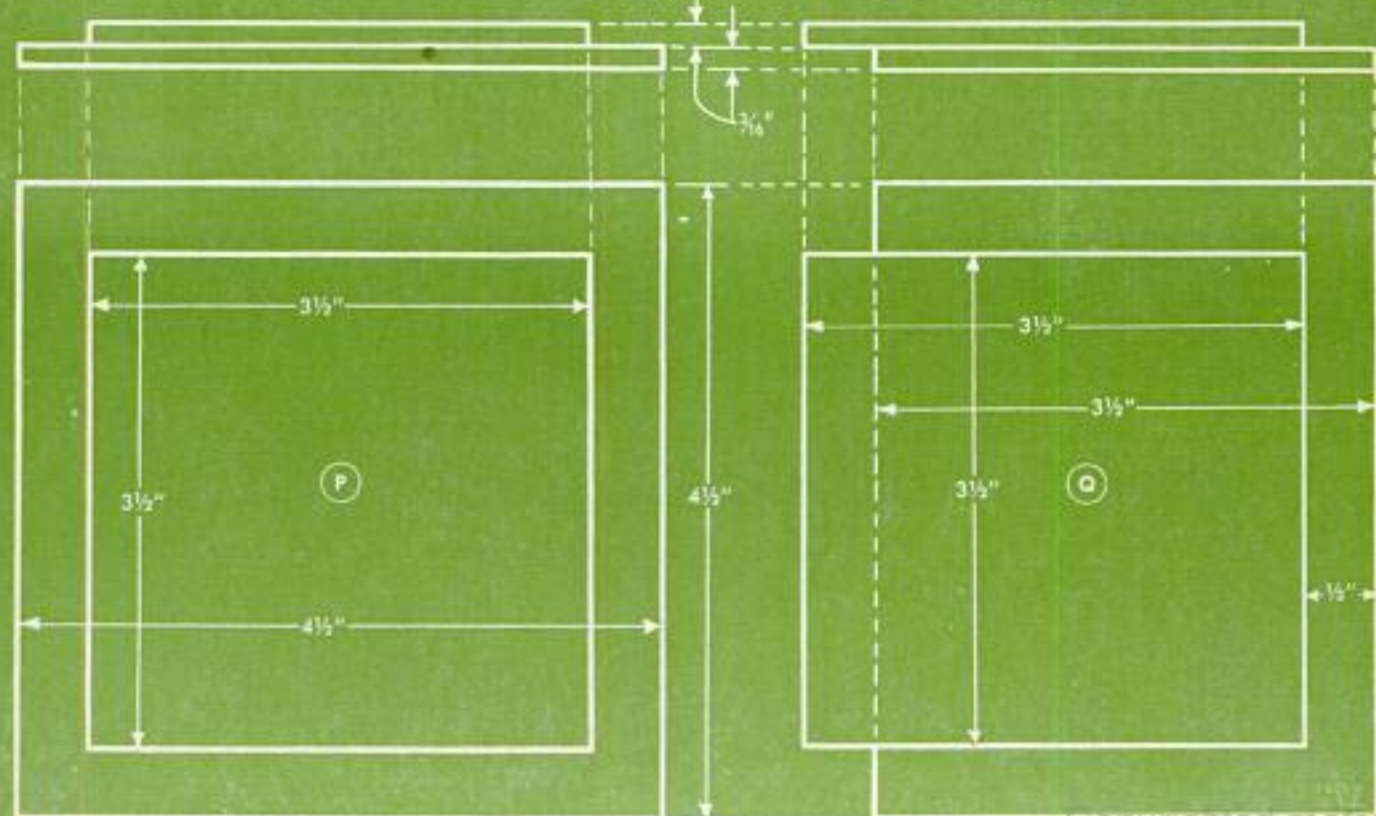
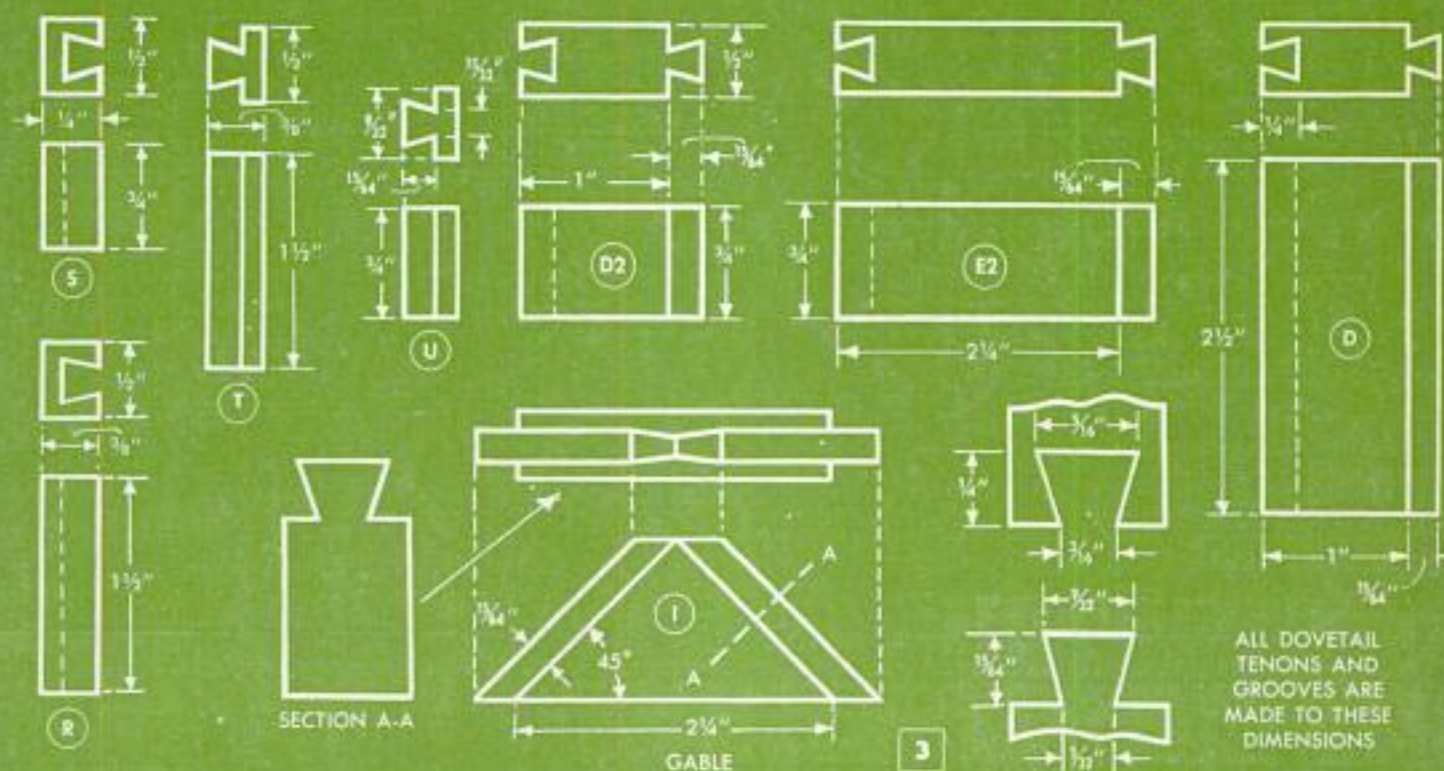
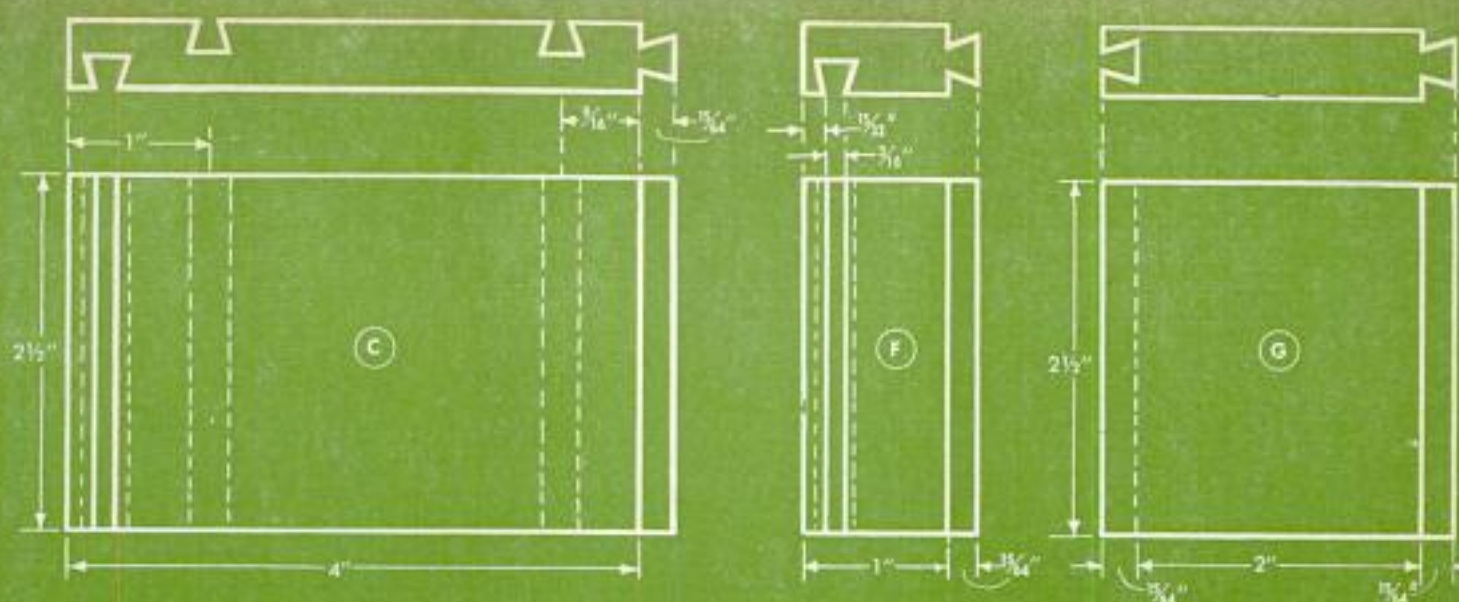
This drawing is keyed with plan drawings on following pages to show at a glance where various parts go

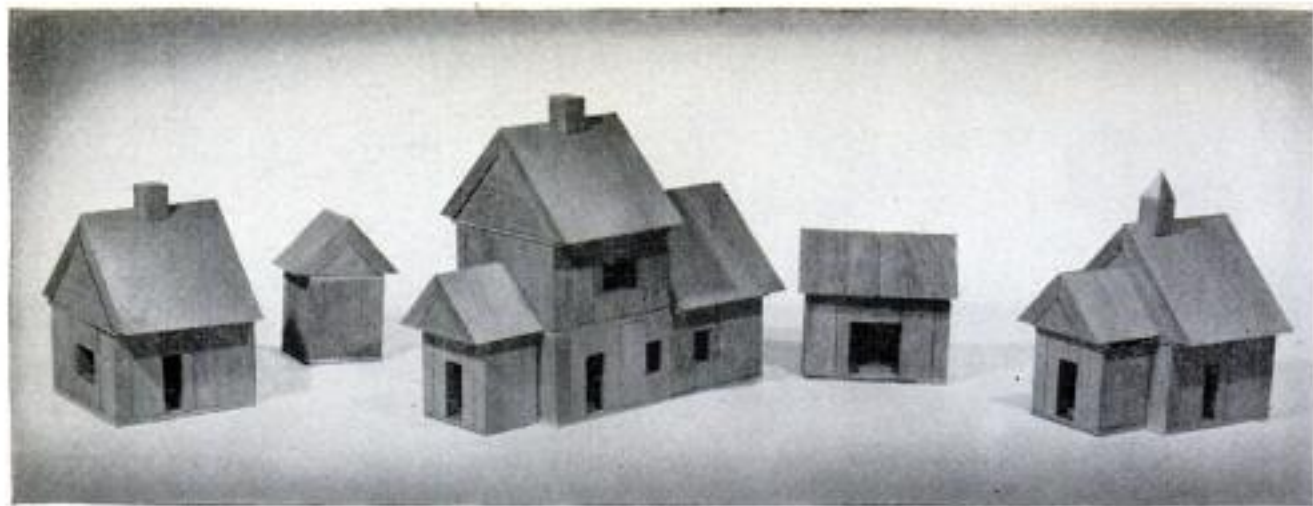




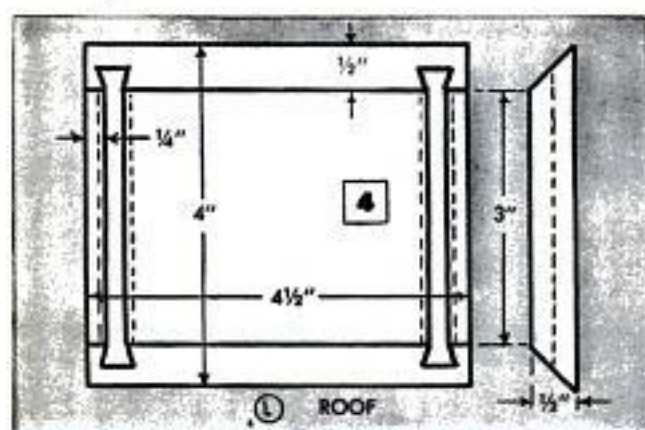
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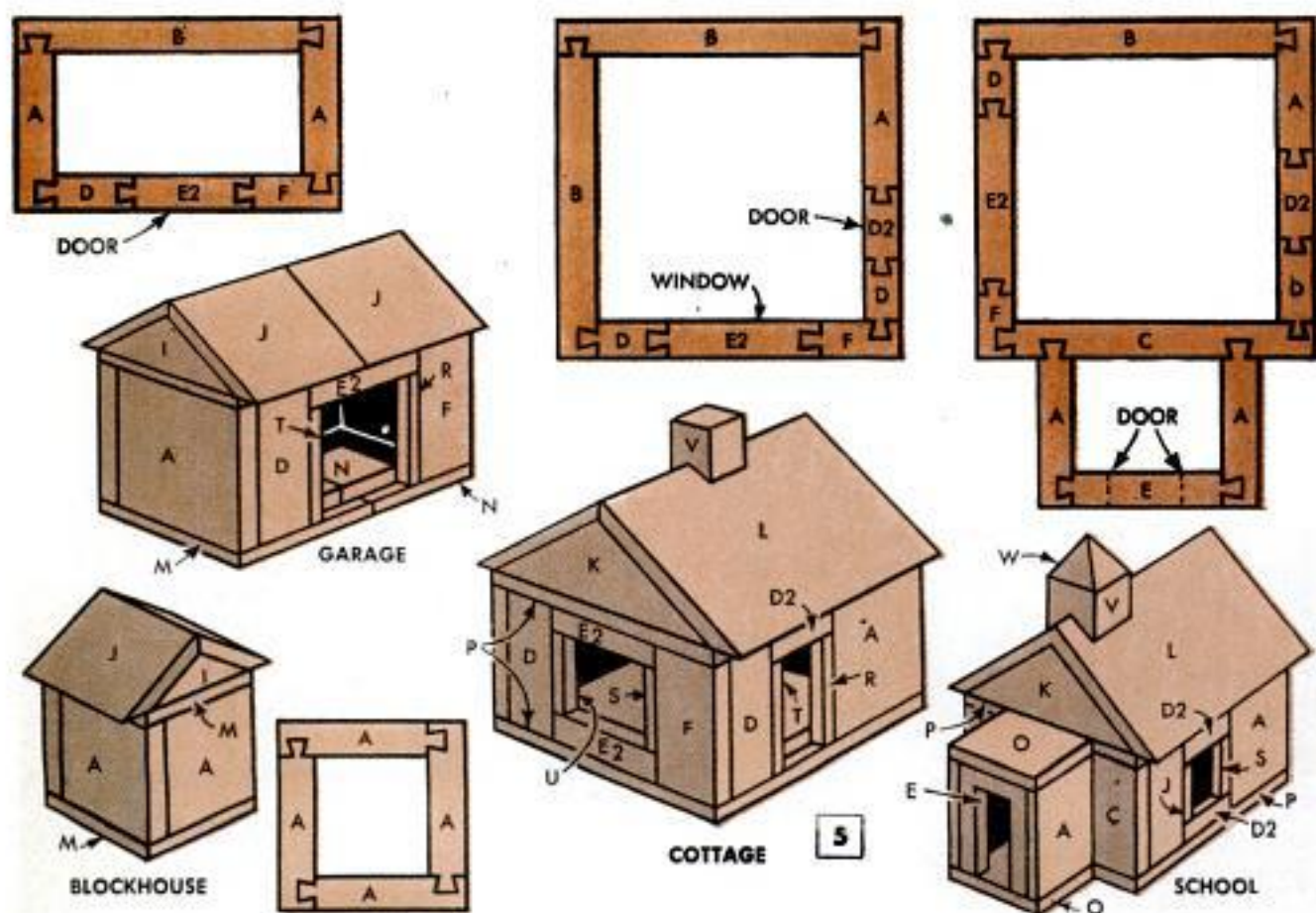




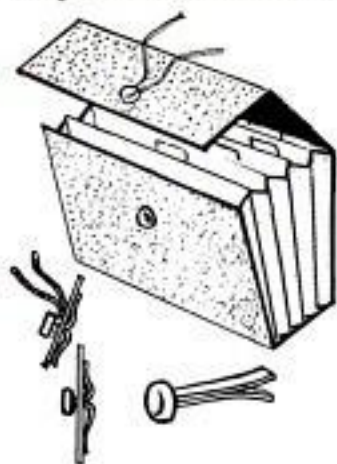
Many of the parts are interchangeable so they can be used with others in building several different units



Matching dovetail edges lock the blocks together and the best way to run these edges in a productionlike manner is with a small shaper, although they also may be cut with shaper cutters chucked in a drill press. In either case, the stock is first ripped to size in long strips, run through the shaper to cut the male joint, then again to cut the female joint and finally sliced off on the circular saw to the proper length. Figs. 2 and 3 give the sizes of the various parts required and are keyed with the assembly drawings for quick reference. Fig. 4 shows how the roof boards are grooved on the underside before beveling the two edges. Of course, your finished sets should be boxed complete with a keyed instruction sheet like the one below. ★ ★ ★



Paper Fasteners Used as Ties



Paper fasteners can be used to make tying devices for folders, envelopes and files. Insert one of the fasteners in the flap and another in the body of the folder, with the heads on the outside. Tie a light cord or strong thread around one head, leaving

loose ends long enough to reach the other fastener and wrap around it several times. These ties can be used on envelopes which have the standard prong fastener to replace the prongs after they have been bent too often and broken off.

Jack Tomlinson, Berkeley, Calif.

"Filling Station" for Pens

An eye dropper fitted into a bracket taped to an ink bottle will eliminate the need for removing the stopper each time a ruling pen or other drawing instrument is filled with ink. The bracket is shaped from light sheet metal to the dimensions given in the detail. A flat girder from a child's construction set might also be used. A particular eye dropper might require a hole of a different diameter from that shown. In use, the eye dropper is filled with the approximate amount of ink needed for a job, then slipped into the bracket and used as shown.

John J. Rea, Urbana, Ill.



SEPTEMBER 1955



Rustic Soft-Drink Cooler for Patio Made From Barrel Halves

This soft-drink cooler is wonderful for serving refreshments at a lawn or patio party, and it is attractive as well as practical. To make it, simply saw a wooden barrel in half, turn it end to end and fasten the halves together with hinges. The cooler in the picture holds 24 bottles with plenty of ice packed around them, but any size of barrel could be used, depending on your needs. As a preservative and finish, give the cooler a coat of dark-red creosote stain. Then bind the top edge with awning canvas tacked in place with upholstery nails, and add a bottle opener and handles for carrying. It is best to keep water in the cooler when it is not in use to prevent the staves from separating.

LeRoy Terrell, Atherton, Calif.

Taped Block Holds Small Parts

To prevent losing parts when disassembling small motors and machines, press the parts onto strips of tape fastened sticky side up on a block of wood. The parts can be placed on the tape in order of removal to simplify reassembly. Also, while the machine is being worked on, the block with its parts can be set aside so it is outside of working area.





1



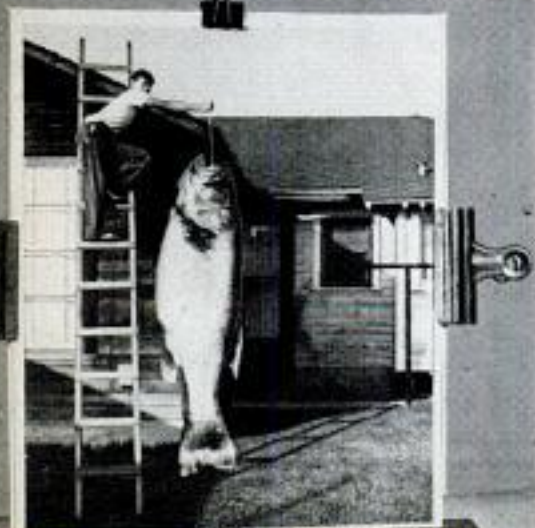
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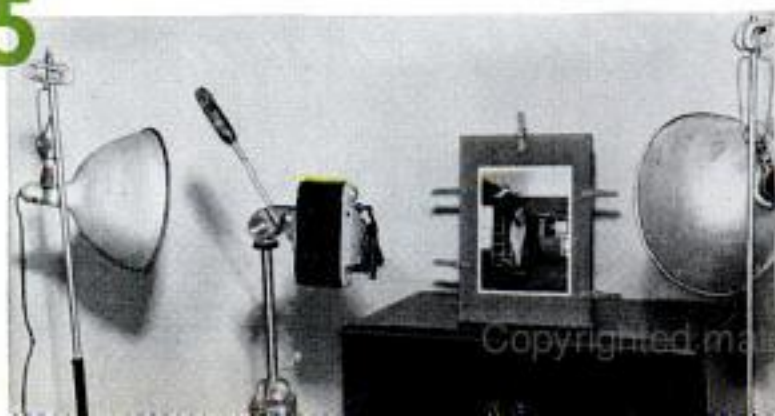
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4



5





HOW TO MAKE

PhotoKinks 58

INCREDIBLE PICTURES

LAUGH-PROVOKING trick pictures are fun to make and more fun to show. Contrary to popular belief, such pictures can be produced by the amateur photographer, even though he has only limited equipment. Trick shots involve two steps: cutouts and pasteups. The equipment required for them, in addition to a camera and enlarger, is a sharp knife, a sheet of clear glass large enough to hold an 8 x 10 glossy print, and a piece of heavy cardboard of the same size.

The basic print on which the cut is later pasted is made first. See step 1 on the opposite page, and photo B above. This should be a sharp print with good middle tones. Use a ruler on this print to determine the exact size of the cutout needed. Next place the cutout negative, step 2, and photo A, in the enlarger and adjust the size of the cutout image to suit. The print should be made on single-weight glossy paper. Using an old magazine as a cutting board, cut

carefully along the outline of the subject, step 3. Slant the knife away from the subject so that blade undercuts the edge.

The basic print is now placed on the cardboard, the cutout is arranged in place, and the sheet of glass is clamped over the combination, as in step 4. The last step, 5, is to photograph the composite picture. Two lights (house lamps of 150 watts will do) in reflectors are used, one on each side of the camera. The composite is propped up against a solid support, and a check should be made to see that the glass is not reflecting the light. The camera height is adjusted until the lens is 2 or 3 in. above the center of the picture, and then tilted slightly downward until the picture is centered on the ground glass. With a lens opening of f:8, use an exposure of $\frac{1}{25}$ sec. if the camera is 2 ft. from the subject; $\frac{1}{10}$ sec. at 3 ft.; or $\frac{1}{8}$ sec. at 4 ft. On cameras having no focus control, use an inexpensive portrait lens. ★ ★ ★



Waterwheel Drives Scraper In Water-Supply Ditch

The domestic water supply for one town is drawn from a mountain creek through an open ditch several miles long. To keep fish from swimming out of the creek and down the ditch, a screen was placed across the mouth of the ditch. It was found, however, that leaves and other debris often clogged the screen, choking off the flow of water. To eliminate the necessity of cleaning the screen too often, a water wheel was constructed to drive a scraper back and forth over the screen.

Harold L. Monroe, Lomita, Calif.

Book of Matches Kept Dry On Trouser Belt



To keep book matches from becoming wet with perspiration on a hot day, hook them over a belt as shown. With the matches on the belt, there is no need to reach into a pocket with dirty

or paint-smear hands. Also, it is possible to remove a single match and strike it with one hand when necessary.

Willis B. Kern, Arlington, Va.

Breaker-Point Spring Repaired By Using Small Rubber Band

If the breaker-point spring in the distributor of your car should break while driving on the open road, an emergency repair sufficient to enable you to reach the near-

est garage can be made easily by using a rubber band. Simply give the rubber band several turns around the points themselves so that proper contact is made.

Ralph I. Smith, Ossining, N. Y.

Variable-Toned "Water Flutes" Provide Party Stunt

A laugh-provoking stunt at your next party can be set up by providing your guests with variable-toned "water-flutes" and asking them to play tunes. The flutes are made by fitting balloons over the ends of short lengths of tubing and filling the balloons with water through the tubes.



Blowing across the open ends of the tubes produces notes, which are varied by squeezing the balloons. Water forced up into the tubes changes the length of the air column, thus changing the note.

Broken Key Section Removed With Cork and Needles

A tool made from two sewing needles forced through a large cork sometimes can be used to remove a broken key that cannot be gripped with pliers. As shown in the photograph, the needles are pushed through the cork at sharp angles so the points can be forced together against the key. The slender points of the needles can reach farther into the lock than can the jaws of even a pair of needle-nose pliers.

Ed Packer, Oak Park, Ill.



Blunting the point of a nail will permit it to be driven into wood with much less chance of splitting. To blunt the point, place the nail head down on a solid surface and tap the point with a hammer.

Speed of Cuckoo-Clock Call Slowed by Reducing Weight

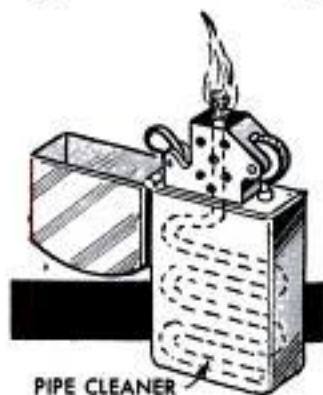


If the bird in a cuckoo clock gives his call in too fast and frenzied a manner, he can be calmed down by reducing the weight controlling the call. To do this, drill a $\frac{1}{4}$ or $\frac{5}{16}$ -in. hole in the bottom of the weight. Drill a shallow hole first, then check the call. Repeat drill-

ing and checking until the bird calls at the desired speed.

Clinton R. Hull, Santa Ana, Calif.

Pipe Cleaner Replaces Wick



Cigarette-lighter wicks sometimes break off flush with the top of the lighter, making it necessary to take the lighter apart to pull up the old wick. If a pipe cleaner, folded to fit into the case as shown, is used to

replace the old wick, a stub end of the wire will always stick up over the top of the lighter, making it possible to pull up another length easily without having to dismantle the lighter.

M. L. MacDonald, Campbell, Calif.

Candle-Powered Emergency Light Mounted on Broomstick Standard



Uses for this candle-powered lamp range from emergency lighting during a power failure to a decoration at a lawn party. The lamp assembly consists of a dental-floss can to hold a candle, a shallow tin can to take an oil-lamp chimney and a length of broom-

stick for a standard. The cans are screwed to the end of the stick, which is pointed for easy pushing into the ground.

SEPTEMBER 1955



Pockets Sewed to Tent Walls Hold Miscellaneous Items

Canvas pockets of any desirable size can be stitched to the walls of a tent to provide safe storage for glasses, flashlights, cigarettes, shoes and other items. For convenience, the pockets should be located within arm's reach of the camp cot. If a permanent pocket is not desired, a temporary one can be held in place with safety pins.

Borrowed-Tool Record Kept

The problem of remembering who has borrowed your tools and when they are to be returned can be lessened by using a large calendar as a reminder pad. Hang the calendar in a prominent place in your shop. When a friend borrows a tool, ask him when it will be returned. Write the man's name and the tool borrowed on the appropriate date square. It seldom will be necessary to ask a man to return a tool when he sees his name on the calendar every time he visits your shop.

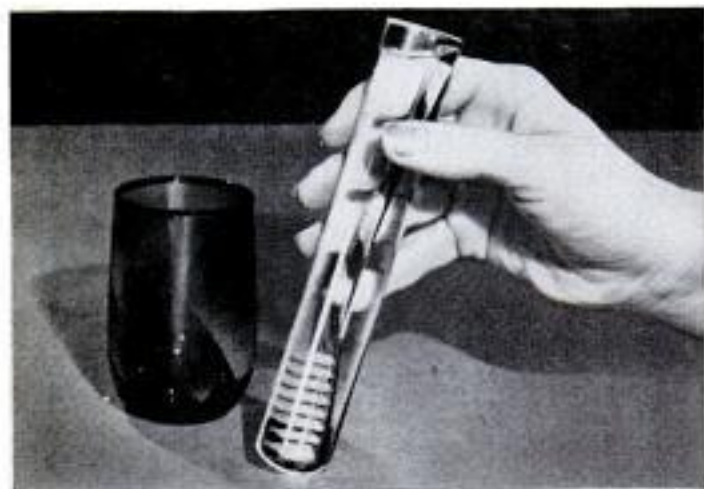




TROUSER HANGER that no longer clamps the cuffs securely still can be used if its ends are fitted with short pieces of rubber garden hose. Cut four rings from the hose, making the rings about $\frac{1}{2}$ in. wide, and then slip the rings over the ends of the hanger as shown above. A sharp knife or razor blade moistened with water will cut hose

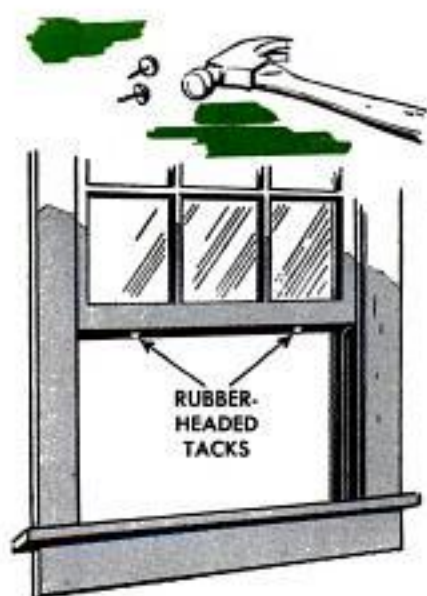
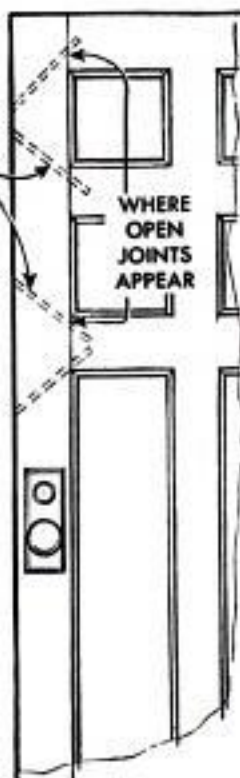
Solving HOME PROBLEMS

TO SOAK A TOOTHBRUSH in antiseptic solution, use a glass container of the type in which toothbrushes are packaged. The container permits soaking the brush thoroughly with a minimum of the antiseptic. Place brush in the tube bristle-end-down, as in photo at the left, and prop the tube in a water tumbler overnight



PANELED-DOOR JOINTS that have separated due to expansion and contraction of the wood can be repaired with $\frac{3}{4}$ -in. dowels. When door is thoroughly dry so the wood has shrunk a maximum amount, bring the joints together with bar clamps as in the lower left-hand drawing. Then bore holes at an angle through the stiles and into the rails. Finally, glue dowels in holes and sand ends of dowels flush with door edge

WINDOWS THAT RATTLE even when the sash is locked can be silenced by driving two rubber-headed tacks into the underside of the lower sash as shown below. Rubber heads of the tacks absorb vibration and help to prevent rattling

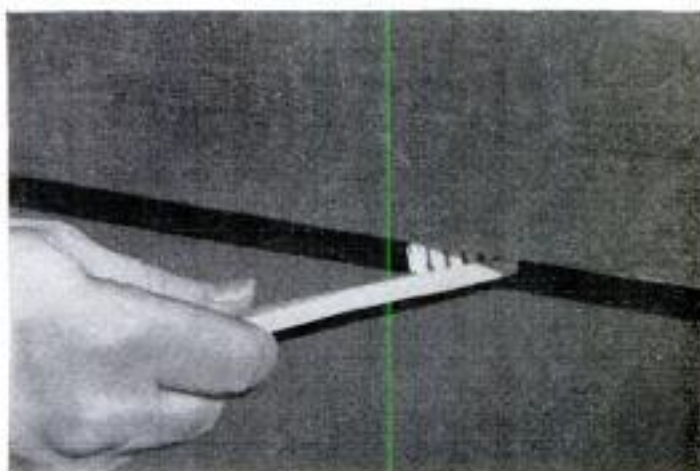




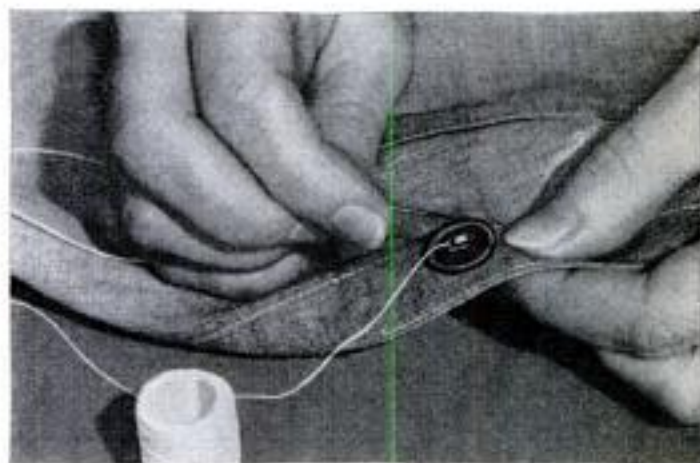
PENCIL ATTACHED TO YARDSTICK with rubber band is always at hand for marking measurements on work, above. Wrap rubber band around yardstick until it is fairly tight, and just replace pencil under the band after each use



PAINTING BOTTOM EDGE OF DOOR is a must if door is to be protected from moisture damage. Taking the door off its hinges is so much trouble that this important job usually is delayed or neglected entirely. However, to paint the bottom edge without difficulty, simply apply the paint with a toothbrush as in the right-hand photo

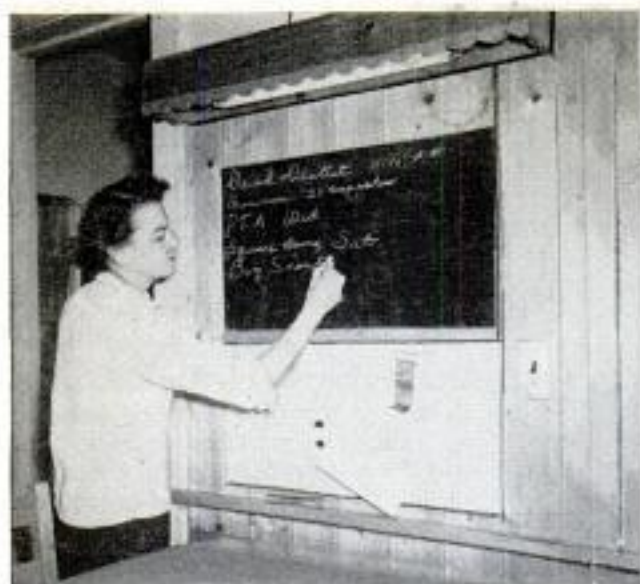


WHEN CLOTHING is given such hard usage that ordinary thread is not sufficiently strong to keep buttons from being pulled loose, use dental floss to sew the buttons in place. The strong dental floss will anchor buttons to clothing that gets the roughest treatment, such as mechanics' coveralls and children's play clothes



FURNITURE-POLISH DISPENSER improvised from a large oil can is convenient to handle and has two advantages. It prevents wasteful use of polish by dispensing it a drop or two at a time and practically eliminates spillage, as the can may be dropped to the floor or tipped over without losing more than a few drops of polish



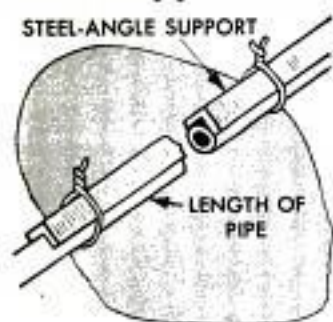


Handy Kitchen Bulletin Board

This combination blackboard and bulletin board in the kitchen has an endless number of uses for members of a busy family. Grocery lists, phone calls and personal memos are written on the blackboard. Letters, cards, cartoons and other items to be shared by all members of the family are thumbtacked to the bulletin board. The blackboard is a piece of painted hardboard and the bulletin board is a section of insulating wallboard. A fluorescent light above the boards is used as a night light for family members coming in late, and to assure that important messages on the boards are not overlooked.

Hal Reed, Hinsdale, Ill.

Angle "Splint" Reduces Sag In Unsupported Water Line



To reduce the sagging of a length of unsupported pipe, wire a steel angle to the upper side as shown, using wire at as many points as necessary to hold the pipe flush against the angle.

The sagging will not, of course, be completely eliminated, but will be considerably reduced. An overhead water line between farm buildings is one example where the angle could be used, since hangers or supports would be impractical.

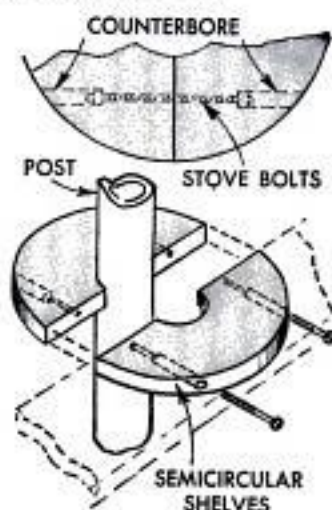
Cooled Glue Remains Liquid

When it is desirable to keep a water-mixed resin glue in a fluid condition for longer than normal, the "setup" time can be extended by keeping the mixture cool.

In the summer, work with the glue in a cool place. In very hot weather set the glue pot in a pan of ice. It is possible to keep the glue in a fluid state overnight by storing it in a refrigerator. When warmed to 70 deg., the glue will harden in the normal fashion.—D. T. Hurd, Burnt Hills, N. Y.

Attaching Circular Shelves To Round Basement Columns

Long stove bolts fitted in counterbored holes permit attaching circular shelves to round basement columns without the need for drilling and tapping the column. Each shelf consists of two pieces which are drilled edgewise for the bolts before being cut round. After cutting the shelf halves to fit



a column, the straight edges of the halves must be planed slightly to provide a tighter fit on the column. For a more finished appearance, plug the counterbored holes with short lengths of dowels.

Putty Provides Temporary Spout When Pouring From Jar

Pouring liquid or powdered material from a wide-mouthed container into a smaller one is no problem if a lump of putty is used. Press the putty to the edge of the larger container and shape it to form a suitably sized spout. A temporary funnel also can be formed from the putty and fitted in the smaller container to further assure pouring without spilling. Modeling clay also may be used for this purpose.

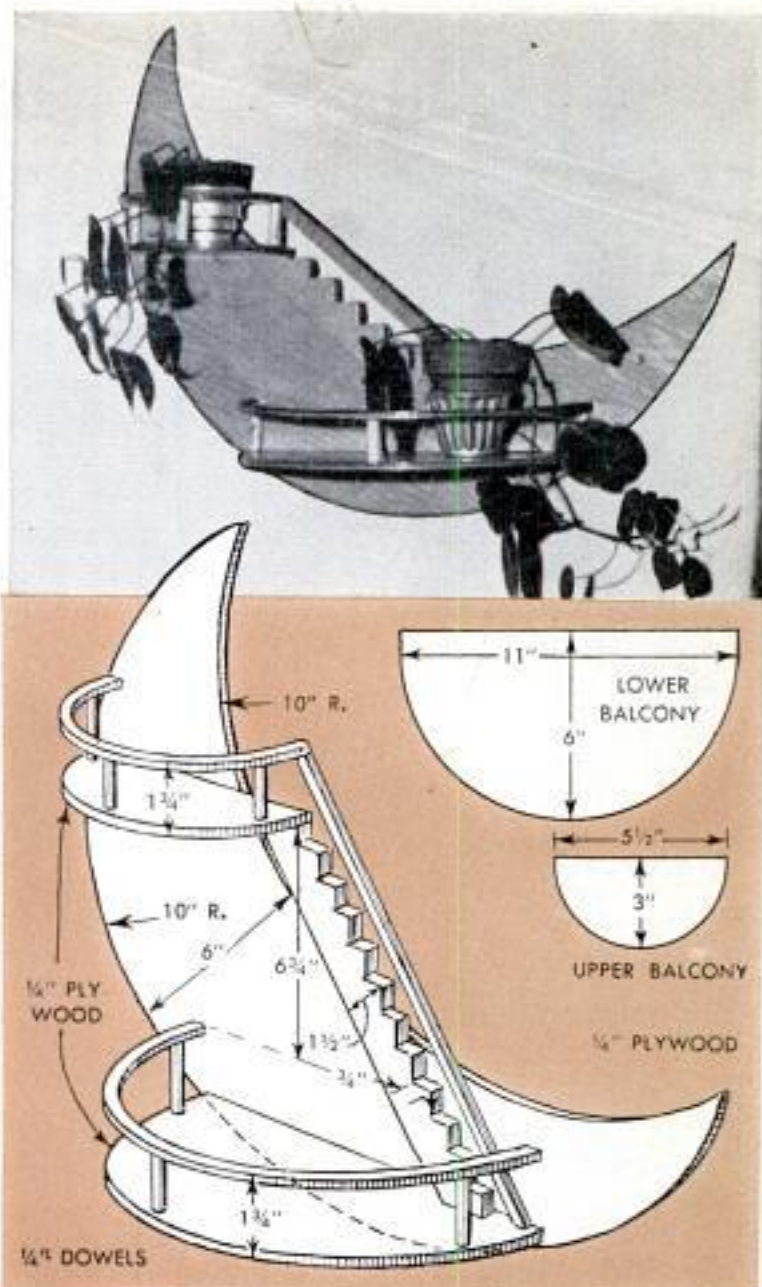


HALF-MOON WALL PLAQUE

By Eugene C. Moysen

If you're looking for something a bit different to set off a dead spot on a wall, or if you'd like to replace a run-of-the-mill wall plaque with an unusual one, this half-moon design will appeal to you. The two little balconies are fine for house plants or as places to display bric-a-brac. The average craftsman will find this an easy one-evening project, the most difficult part of the job being the circular cuts. These can be made with a coping saw, but of course would be easier on a jigsaw.

The pattern for the half-moon is made by scribing two 10-in. circles on $\frac{1}{4}$ -in. plywood. The center point of the second circle is located 6 in. from the center point of the first circle. The horns of the moon will then be located at the points where the two circles intersect. Patterns for the two balconies are shown. The assembly is done with glue and brads or small screws. The original model was given several coats of clear varnish as a finish, but the plaque could be painted or stained any color to suit. Aluminum gelatin molds may be used as flowerpot holders.

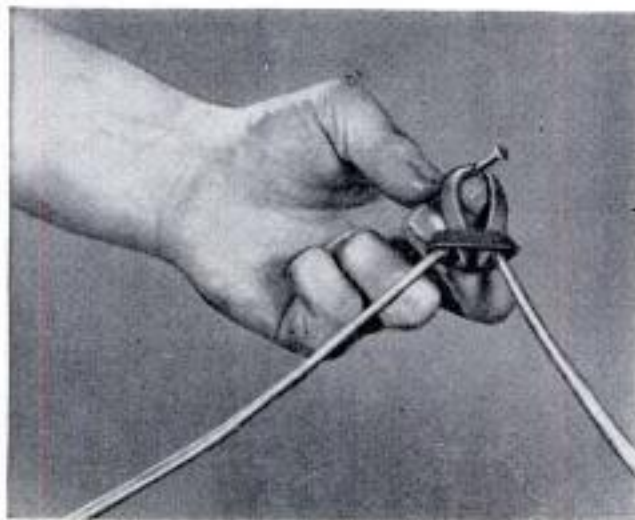


Cord Suspended on Rubber Bands Protected Against Kinking

Looped over an extension cord, as shown, fruit-jar rings or heavy rubber bands can be used to support the cord on nails or hooks when it must be held up out of the

way. The rubber bands do not kink the cord and are removed in an instant when it is taken down. Loops of heavy cord or light rope also can be used in the same manner as the rubber bands.

Enno Haan, Evanston, Ill.



Fruit for Table Centerpiece Polished With Salad Oil

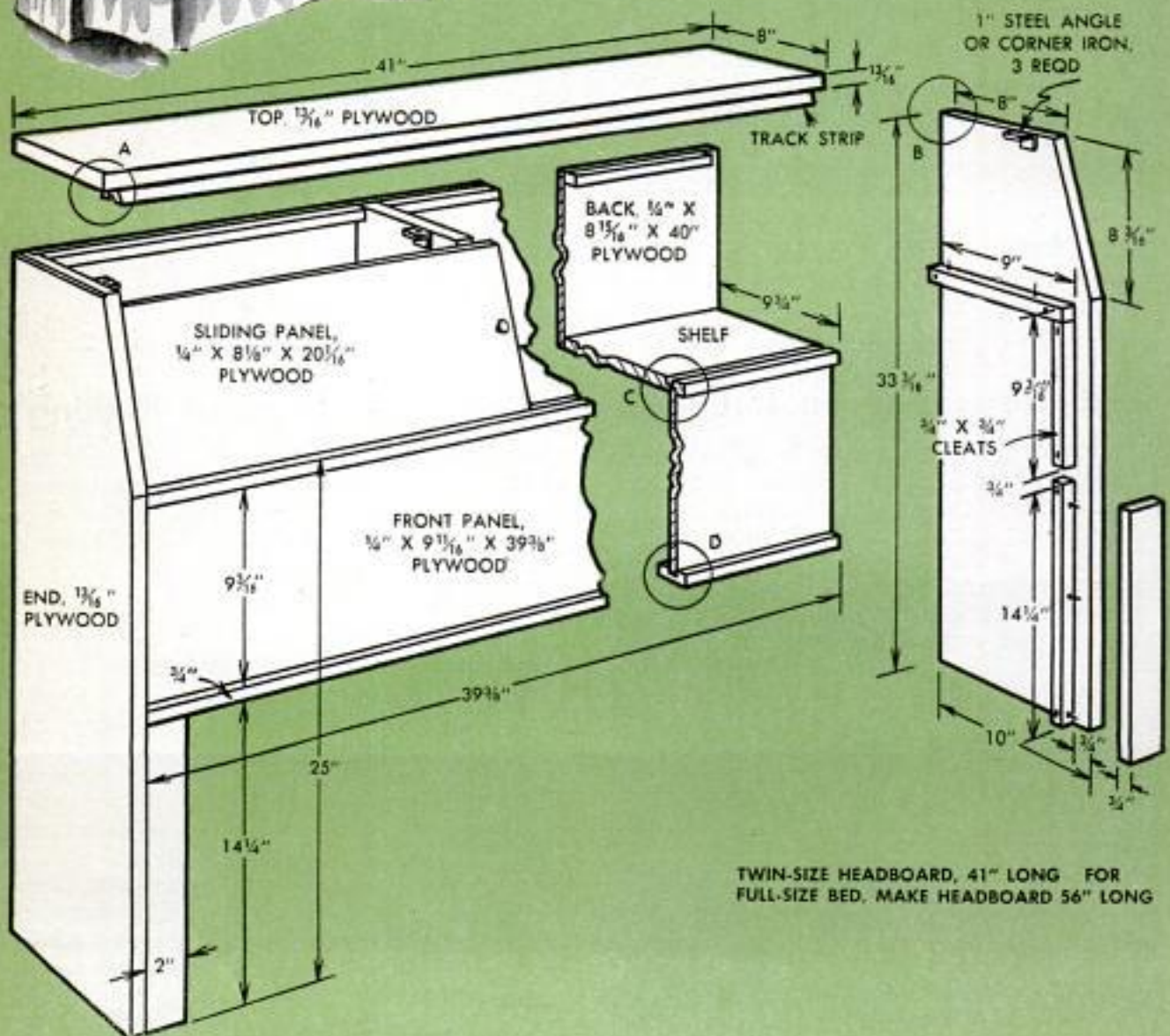
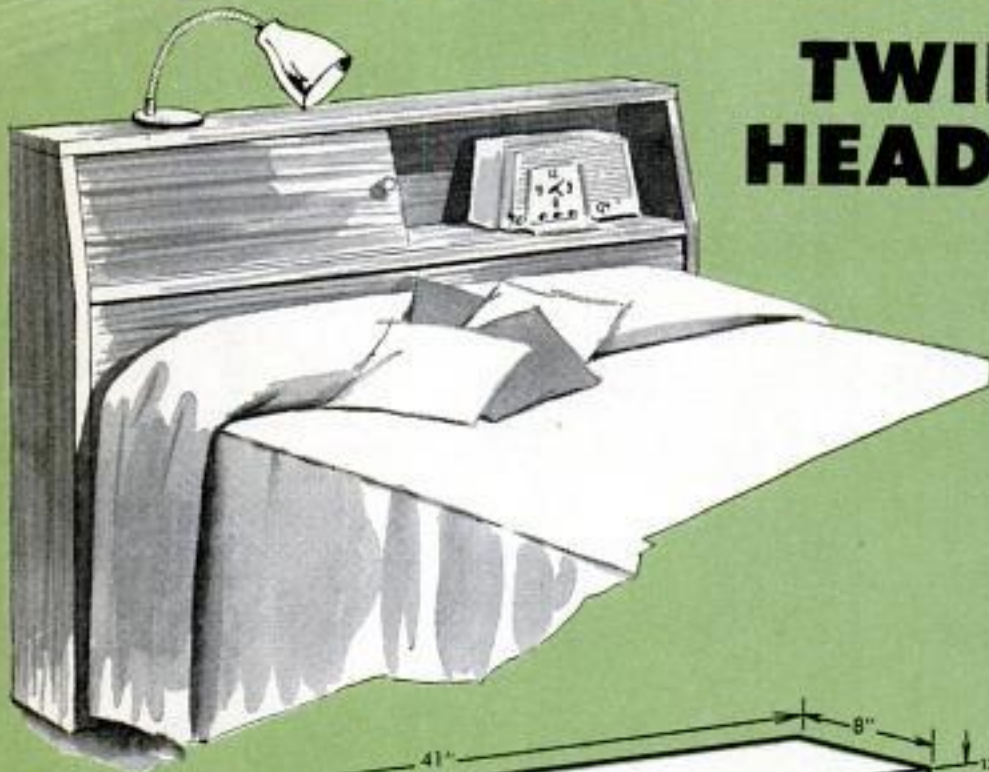
One man who operates a fruit stand advises that apples, oranges, pears and other fruits take on a lovely sheen if they are polished with a good grade of salad oil. Saturate a small cloth with oil and rub it over the surface of each piece and then buff with a dry cloth. Fruit used to decorate the centerpiece of a table will be much more attractive when so treated, and it will also last longer.

Blanche Campbell, Los Angeles, Calif.

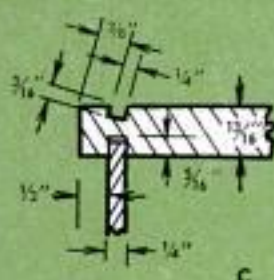
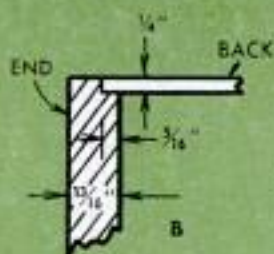
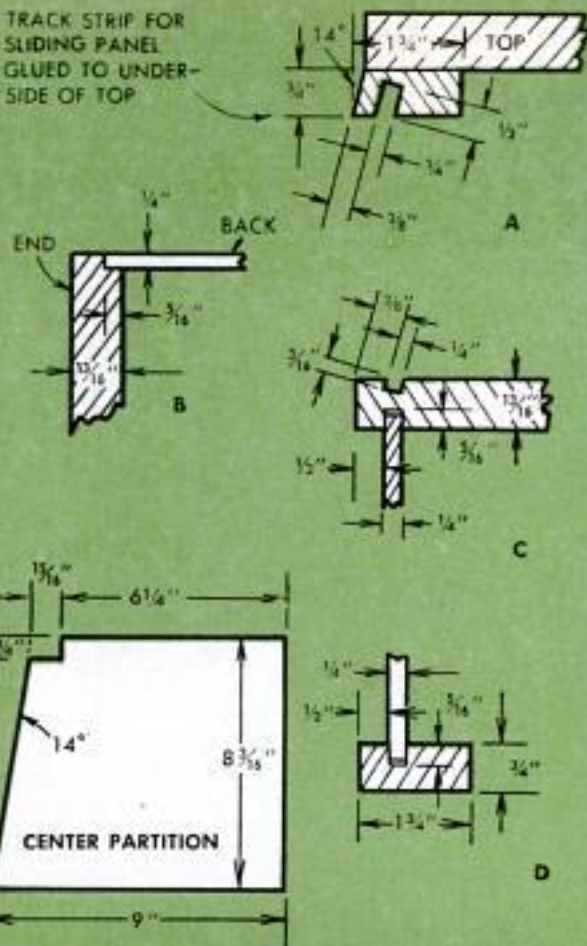
Modern Furniture

PATTERNCRAFT

TWIN-BED HEADBOARD



TRACK STRIP FOR SLIDING PANEL GLUED TO UNDER-SIDE OF TOP



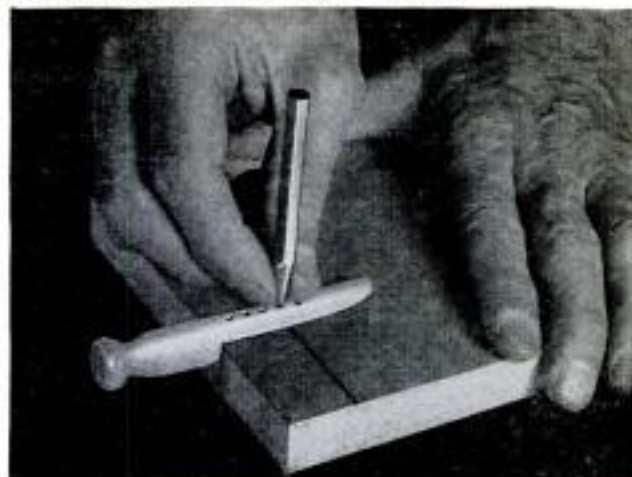
Built of beautifully grained hardwood plywood selected to suit your bedroom furnishings, this twin-bed headboard offers the extra convenience of a utility shelf and a top shelf for books or a reading light. The easy-to-reach utility shelf is divided at the center. One half of the shelf, which is intended for storage, is covered with a sliding panel while the other half remains open for your clock-radio. The top, sides, shelf and partition are of 13/16-in. lumber-core plywood. For the full-length front panel, sliding panel and back, 1/4-in. plywood is used. Grooves for the sliding panel are cut in the shelf, detail C, and in a track strip, detail A, which is fastened along the underside of the top. You will notice that both the track strip and the shelf are grooved at a 14-deg. angle. A headboard of the same design can be made for a full-size bed merely by increasing the over-all length to 56 in.

FULL-SIZE PATTERN

You can take all the guesswork out of making the headboard by using a full-size pattern—together with completely detailed directions. To obtain your pattern, send 50 cents to Patterncraft, Popular Mechanics Press, 200 E. Ontario St., Chicago 11. Ask for Plan No. 119 when ordering pattern

cut of print

Marking Gauge Improved From Wooden Clothespin



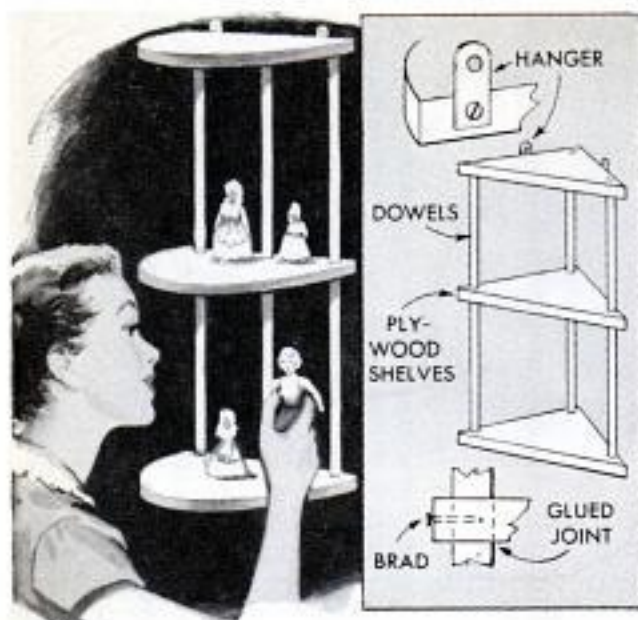
A modified wooden clothespin provides an acceptable marking gauge when standardized measurements are used for marking a number of pieces of lumber to be rough-sawed to width. One leg of the clothespin is cut off and holes are drilled in the remaining leg to receive a pencil.

Hinged Perches on Martin House Keep Out Unwanted Tenants



To keep martin houses free of sparrows until the rightful tenants arrive in the spring, install hinged perches that can be closed over the door holes. Strips are pivoted to the ends of the perches as shown, so all perches can be raised or lowered simultaneously. The perches are controlled from the ground by light cables or cords hooked to the lower ends of the pivoted strips and passed through a pulley or screw eye on the end of the house. A small boat cleat screwed to the martin-house support column is used to hold the lower end of the line after the perches are in position.

Whatnot Shelves Assembled From Plywood and Dowels



If your wife has asked for whatnot shelves to fit a particular space or corner, use this simple plywood-and-dowel assembly to make them. Two, three or more plywood shelves are cut at the same time to assure identical size and shape. Aligning holes for the dowels are drilled while the shelves are still clamped together. In assembly, glue and brad each shelf to the dowels as shown in the detail. If small bric-a-brac is to be stored on the shelves, $\frac{1}{4}$ -in. plywood and $\frac{1}{4}$ -in. dowels can be used. For larger objects, use correspondingly heavier wood and dowels.

Steel Wool Held in Clothespin "Sands" Inside Corners



loose strands of steel wool and "extending" the reach of your fingers.

When smoothing the inside corners of drawers, cabinets and other locations not easily reached with sandpaper, use a small pad of steel wool held in a spring-type clothespin. The clothespin makes an excellent holder, protecting the hands from

Applicator for Powdered Graphite Utilizes Medicine Dropper

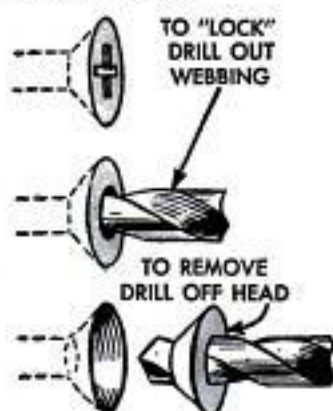
By keeping powdered graphite in a small medicine-dropper bottle and applying it with the glass dropper, you'll find it easy

to gauge the amount used inside locks and other hard-to-reach mechanisms. The long, slender dropper, which is fitted with a leak-proof, screw-on cap, is ideal for directing the powder into otherwise inaccessible places which require lubrication.

Andrew Brennan, Philadelphia, Pa.

Locking Socket-Head Screws

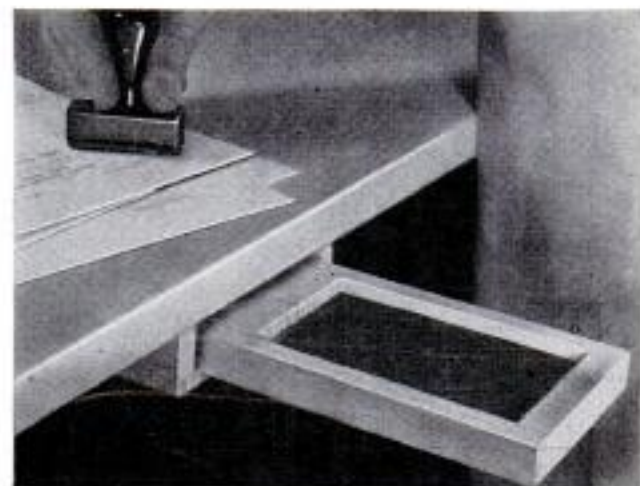
Spotlights, antennas and other parts held on the outside of a car by socket-head screws can be "locked" in place, making them difficult to steal, by drilling out the center of the head as shown. With the center removed, it is almost impos-



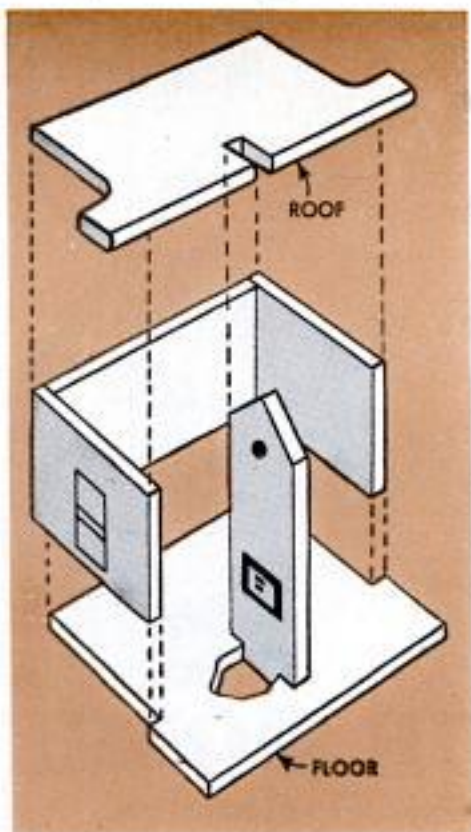
sible to turn the screw with a screwdriver. However, should it later become necessary to remove the screw, this can be done by drilling through the head as shown in the lower detail. The threaded portion of the screw which projects after the accessory is taken off can be removed with lever-jaw or other type pliers.

Ink Pad Stored Conveniently On Slide Under Table

Fitted in a recessed slide under a table top, an ink pad is kept handy for occasional use. The slide consists of two wooden cleats screwed to the underside of the table top. A piece of sheet metal or hardboard nailed across the bottom of the cleats provides a surface on which the ink pad slides. The pad, as shown in the photograph, can be fitted with a wooden frame. The frame permits handling the pad with less chance of getting ink-smudged fingers. If a number of rubber stamps are used, a second slide could be made to store them.



Toy Garage Puts Young Car Hikers in Business



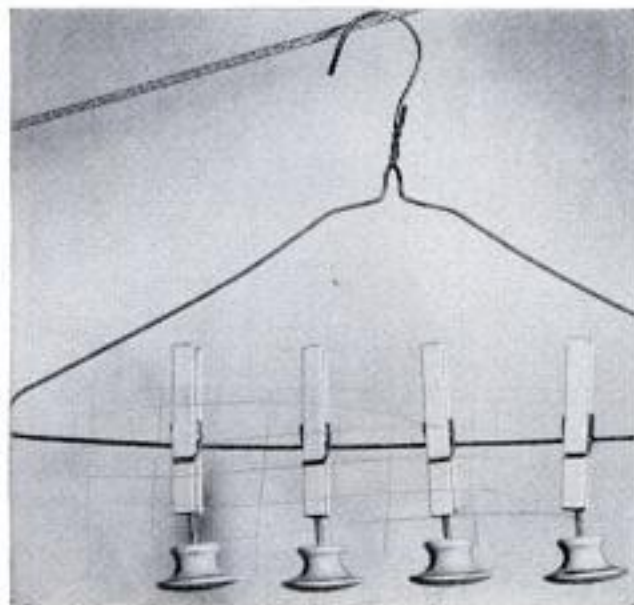
Parking cars just like downtown in this realistic toy garage will while away many an hour for young rainy-day shut-ins. And when the sun comes out, the building itself will double as a handy toy box to keep the cars from underfoot. It's a saw-and-hammer project that Dad can knock together easily in an evening. Wood from a couple of apple boxes will provide all the material that's needed. While

construction is simple, it can be further simplified by forgetting about mortising the pillar into the base and by simply resting the sides of the building on the top of the base and nailing up through the bottom. Simulated doors and windows can be ruled on gummed paper and applied after the building is painted. Size of cars will determine size of garage.—Walter Washington, Chicago

Freshly Painted Drawer Knobs Held by Clothespins on Hanger

The problem of holding freshly painted cabinet-drawer knobs while they dry can be solved neatly by using a wire coat hanger and several spring-type clothespins. Slip the clothespins over the crossbar of the

hanger, then clip the screws of the knobs in the pins. If the knob screws cannot be taken from the cabinet, temporarily turn a screw into the knob. The coat hanger can be hung in any convenient location.



Net Bags Prevent Loss of Parts Soaked in Degreasing Tank

Net bags are used by one mechanic to prevent loss or intermixing when parts from several jobs are soaked in a degreasing tank. The bags are the kind in which onions and other vegetables and fruits are sold. A wire hook is used to lift the bags from the tank so hands need not contact the degreasing solvent.



Frank A. Javor, North Bergen, N. J.



STOP RUST IN YOUR HOME

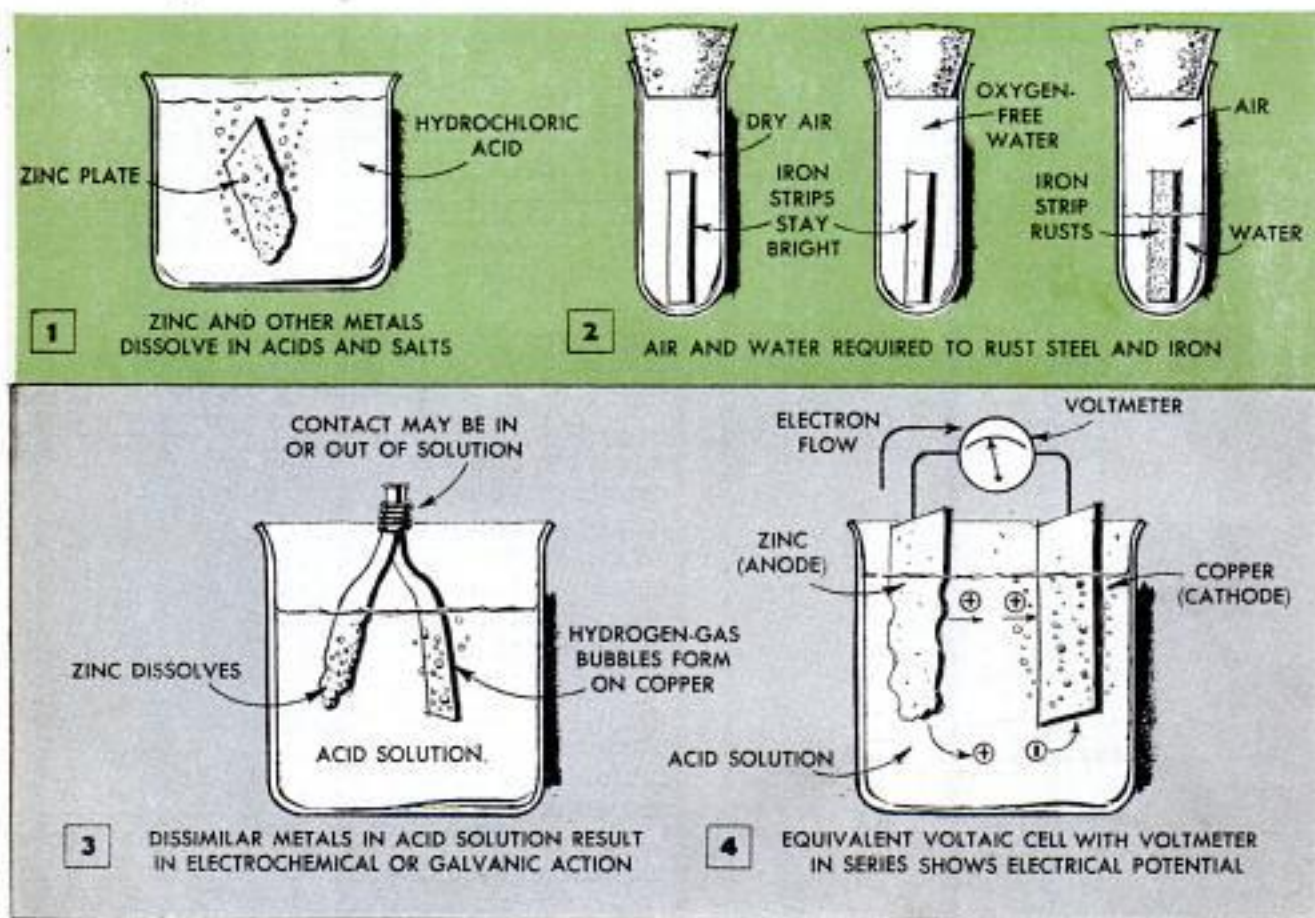
PART I

By John B. Mullen

RUST AND CORROSION of metals used in gutters, downspouts, flashing, fencing, your car and common household accessories cannot be entirely prevented. However, there are methods of inhibiting corrosion by a careful choice of materials,

correct installation and other practical measures which can do much to prolong the life of home equipment.

Types of corrosion: Corrosion is simply the destruction or dissolving of metal by chemical action. There are several differ-



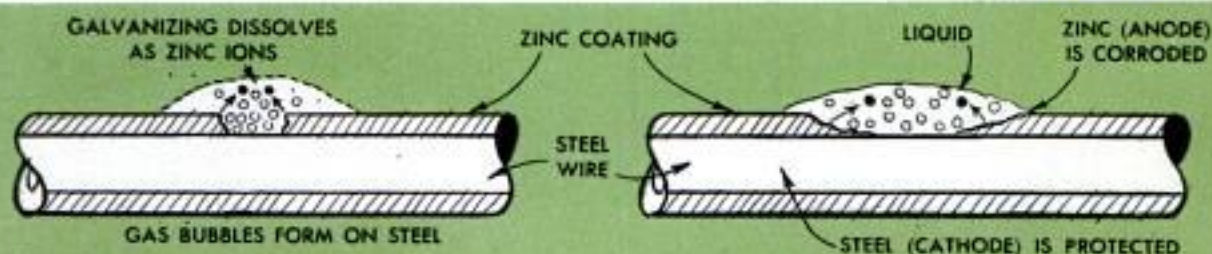
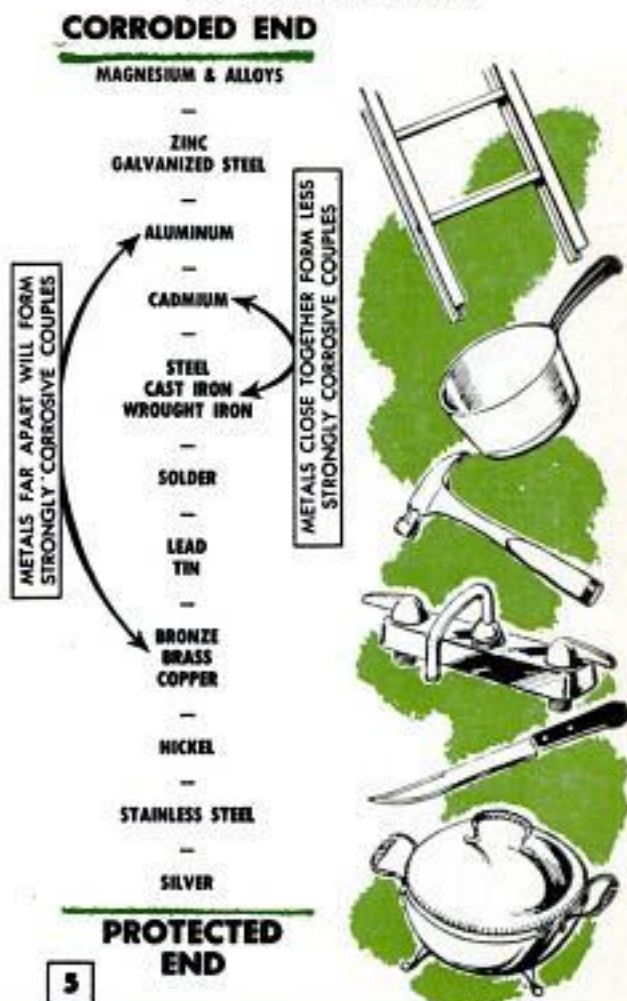
ent things that cause this trouble. What happens to a strip of zinc when it is placed in hydrochloric acid, Fig. 1, is a typical example. Ordinary rusting of iron proceeds in a similar manner, except that both water and oxygen must be present, Fig. 2. Galvanic or electrochemical corrosion is another form which takes place when two different metals are in contact with each other in the same body of water or chemical solution. This contact sets up an electric current (voltaic cell) which causes rapid corrosion of one of the metals. The more-active metal in such a couple is the anode and the electrochemical process which takes place causes the anode to be corroded much faster than it would be if it were not coupled to the other metal, which is the less-active cathode. Cathode action serves to protect this metal instead of corroding it. Often the action takes the form of a discharge of hydrogen ions from the water. The discharge is given off as bubbles of hydrogen gas, Fig. 3. Current flow between the anode and cathode can be measured with a voltmeter as in Fig. 4.

A third type is what is known as concentration-cell corrosion, also electrochemical in nature. This type has a cell made up of two liquids differing in composition which are in contact with the same metal. Such a "couple" produces corrosive results.

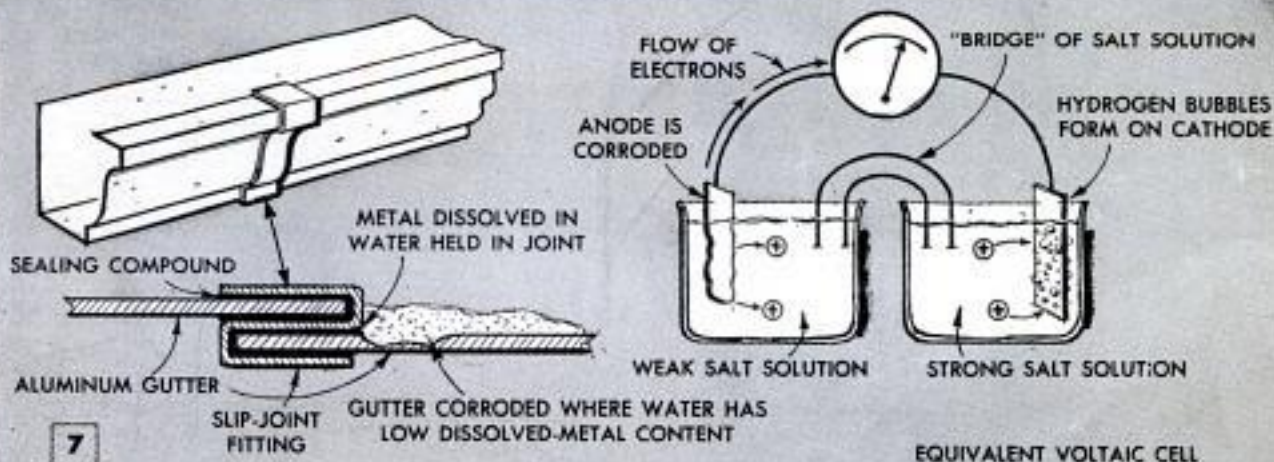
Fig. 5 gives the activity relationship of the common metals in the order of their chemical activity. From it one can determine what metal in a given couple will be

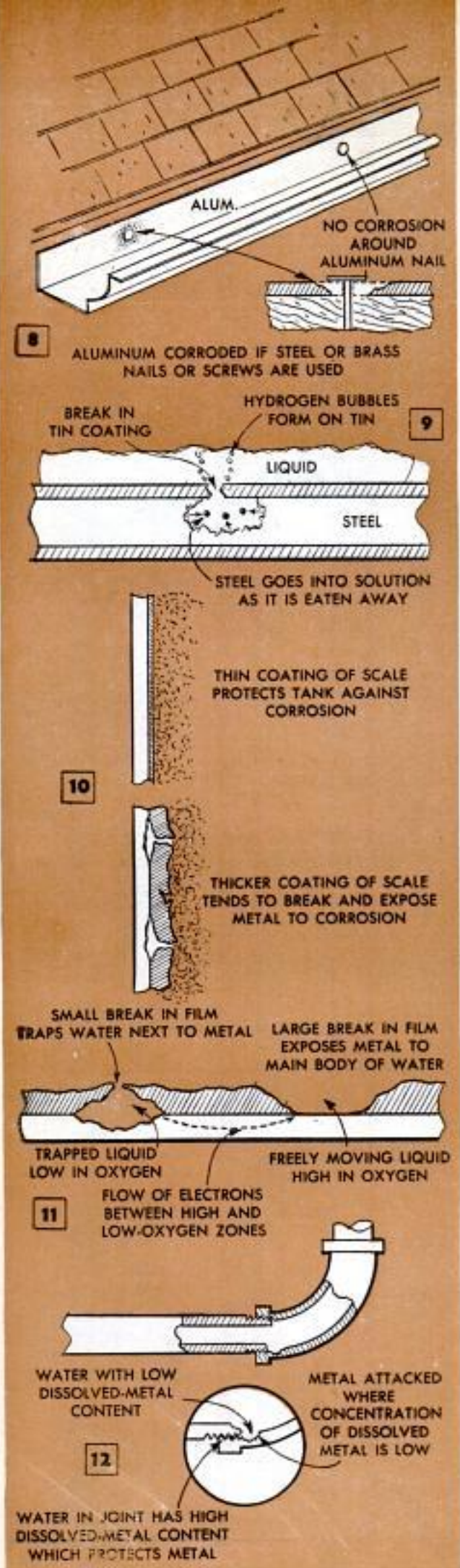
"ACTIVITY SERIES" OF METALS

Metals are arranged in order of decreasing chemical activity



6 STEEL (CATHODE) IS PROTECTED EVEN WHEN GALVANIZING IS BROKEN. ZINC IONS DISSOLVE IN GALVANIC CELL WHICH RESULTS FROM ACTION BETWEEN ZINC AND STEEL





the anode and will be corroded. A study of the table will give a clearer idea of how these corrosion processes work in and on various types of home equipment.

Fencing: A wire fence around the backyard represents a considerable investment. It pays to purchase first quality fencing as this will be heavily galvanized, the coating forming a protective oxide when exposed. Even if the zinc film is broken, as it eventually will be by exposure, it continues to act as a protective film as it is anodic to iron and is dissolved by galvanic action, protecting the wire. The process, shown in Fig. 6, continues until the zinc is dissolved and rust appears. Painting the fencing with a weather-resistant paint interposes a film which prevents the iron-oxygen "couple" when water is present. Because of this, rust will be inhibited as long as the paint film remains unbroken. As a further protective precaution, fencing should always be attached to posts with galvanized fasteners. At the time of installation, stretch the wire with the bottom strand above ground. It will help to keep grass and weeds trimmed short along the length of the fence.

Siding: Uncoated nails used to attach wooden siding to house framing can cause unsightly discoloration of the wood when they rust. The corrosion coating that forms also affects the holding power of the nail. Use heavily galvanized nails, or aluminum nails, to prevent this trouble. If uncoated nails have been used and rust stains already have appeared, the nailheads should be set below the surface and the holes filled with putty after the first coat of paint. Allow the putty to dry and then sand smooth before applying the final coat of paint.

Gutters and flashing: Gutters should have sufficient pitch throughout the length to drain completely. Corrosion usually starts at the joints where soldering flux may remove the protective galvanizing. Scrape or wire-brush the joints and apply red lead or zinc-chromate primer and follow with a finish coat of rust-inhibiting paint. Gutters installed with slip-joint connectors may be subjected to concentration-cell corrosion, Fig. 7. Here two areas of the same metal become anode and cathode in contact with a corrosive body of water consisting of pure water on the one side and a relatively strong solution of dissolved metal on the other. To prevent this, seal the joints with calking compound. Use coated nails or screws on galvanized gutters and downspouts, aluminum fasteners on gutters and downspouts of aluminum, Figs. 8 and 9. Always install flashings so that water cannot become entrapped and thus set up a corrosion cell. It's best to mop in flashings with hot asphalt. Copper

flashings, gutters and downspouts installed with copper fastenings will usually last the life of the building.

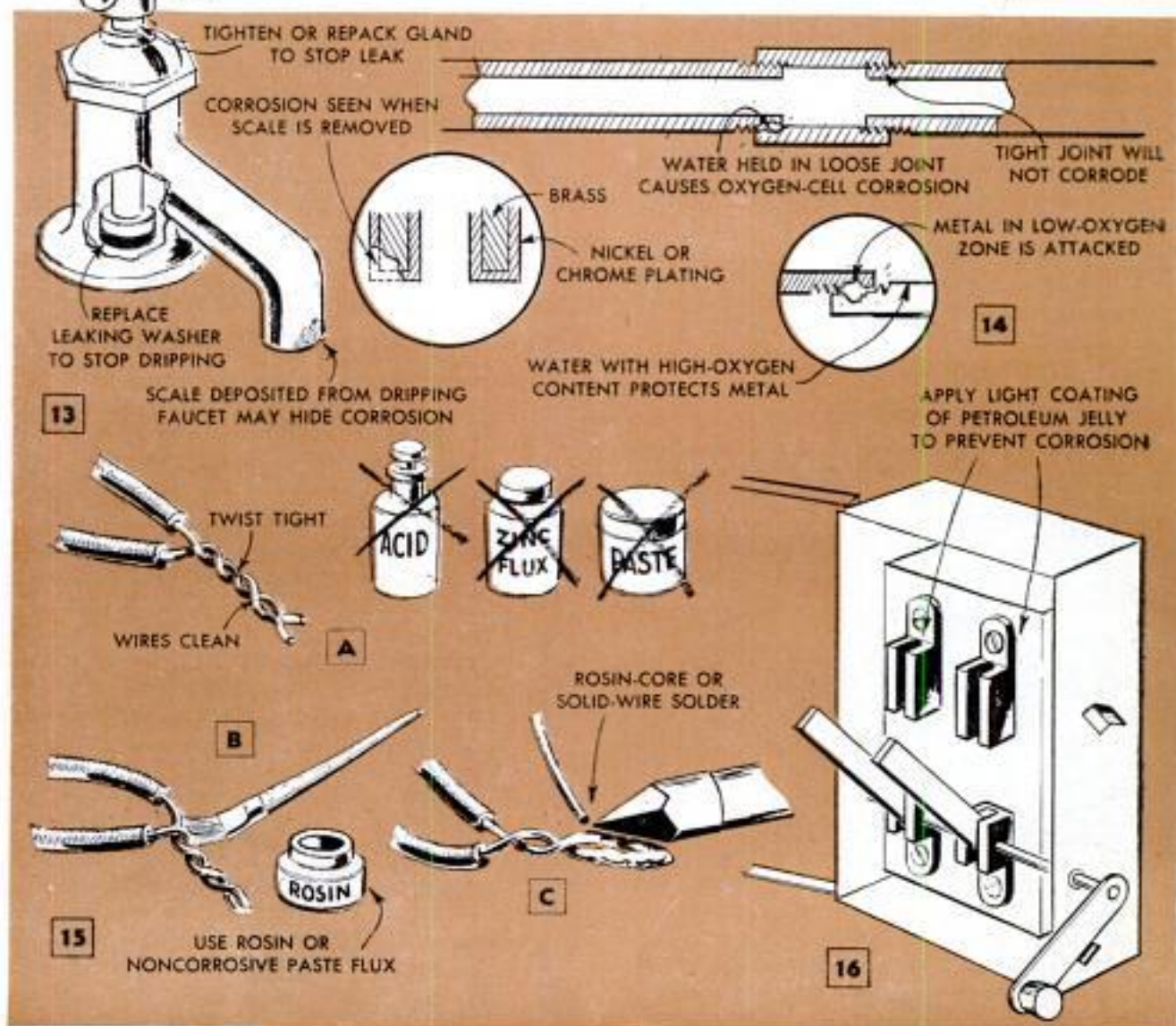
Pipes and fittings: The scale that forms in hot-water tanks and pipes in hard-water areas is a principal cause of frequent repairs. Heat speeds precipitation of the calcium salts in hard water, forming a scale which in time cracks and loosens, exposing bare metal. Water entrapped behind the breaks sets up what might be called oxygen-cell corrosion, Figs. 10 and 11. Where the scale breaks away, Fig. 11, water with the normal amount of oxygen in it is in contact with the fully exposed metal which becomes the cathode of a voltaic cell. Where the oxygen content is low under the "blister," the metal becomes the anode and is corroded rapidly. These processes result in deep pits which eventually cause leaks. The conditions are difficult to overcome but draining and flushing of the tank and hot-water lines periodically will help. Also, the use of artificially softened water in the system will help to hold in check corrosion of the metal parts due to the effects of

scale. However, do not drain a hot-water heating system at the end of the season and replace with fresh water. This practice fills the pipes and boiler with oxygen-saturated water and corrosion will follow until the oxygen is again used up. Much longer life will result if the system is never drained.

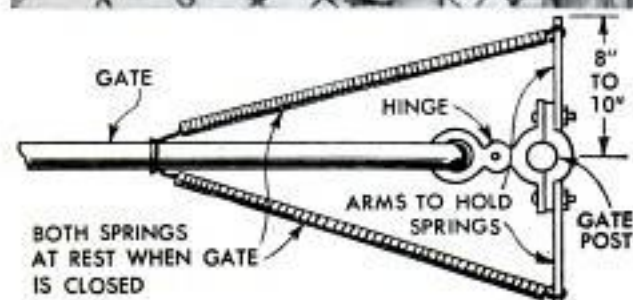
It's important to repair leaky valves and faucets in the plumbing system immediately as there is always the possibility of the formation of a corrosive concentration cell, Figs. 12 and 13. Fig. 14 shows how corrosion often develops in pipes.

Electrical equipment: Corrosion damage to electrical equipment usually occurs in switches, plugs and sockets in damp locations indoors and out. When electrical connections are made it is imperative to use a noncorrosive flux. Details A, B and C in Fig. 15 show how to make wire connections. It is essential that all connections be mechanically tight before soldering. Screws must be driven tightly on connectors. Corroded contacts on switches of the type shown in Fig. 16 can be cleaned with sandpaper or a wire brush (be sure the current is off) and coated with petroleum jelly.

(Continued next month)

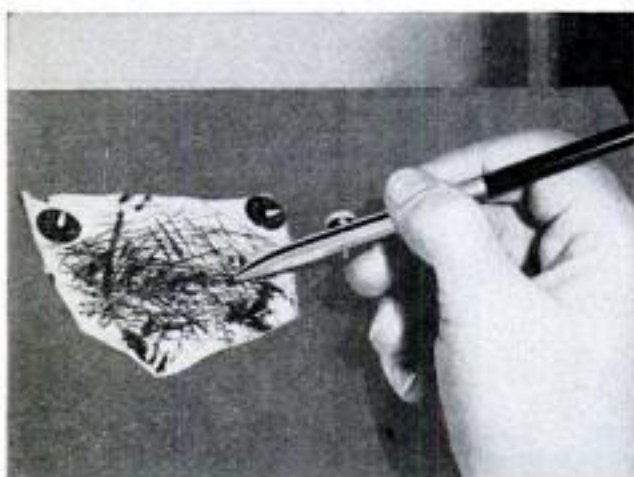


Two-Way Gate Kept Closed By Screen-Door Springs



A gate that opens toward either side can be kept closed automatically by means of two screen-door springs. Each spring is fastened to a $\frac{1}{4}$ x 1-in. piece of flat steel that extends from 8 to 10 in. from the gate posts as shown in the illustration. On steel gates these pieces are bolted to the upper hinge clamps. To operate properly, both steel arms should be of the same length and both springs should be of equal length and tension. No matter which way the gate is opened, one of the springs will return it to the closed position.

Flow of Ink in Ruling Pen Started on Chamois



It is customary for most artists and draftsmen to start the flow of ink in a ruling pen by drawing it lightly across the back of the thumb or hand. To avoid soiling the hands, a small piece of clean chamois

should be tacked to one corner of the drawing board. When the pen is drawn across it, the flow of ink is started just as well as when touched to the flesh of the hand.



Adding Paste Coloring to Paint

A quick method of adding paste color to paint is to first mix the paste with solvent in a screw-top glass jar. Squeeze the tube of paste into the jar, add solvent and shake vigorously. Waste is kept to a minimum and the liquefied color mixes readily with the paint. When several cans of paint are to be matched, carefully measure the amount of solvent used per tube of paste coloring, then add precisely the same amount of the paste-solvent solution to each can.

Stove Grates on Garden Wall Serve as Flowerpot Shelves

One homeowner, when making a wall of natural stone blocks in his garden, used the grates from an old-style kerosene stove as shelves to hold flowerpots. As the wall was put up, the edges of the grates were stuck into the cement between the blocks. When the cement had set, the grates provided strong yet ornamental shelves.

Grover Brinkman, Okawville, Ill.

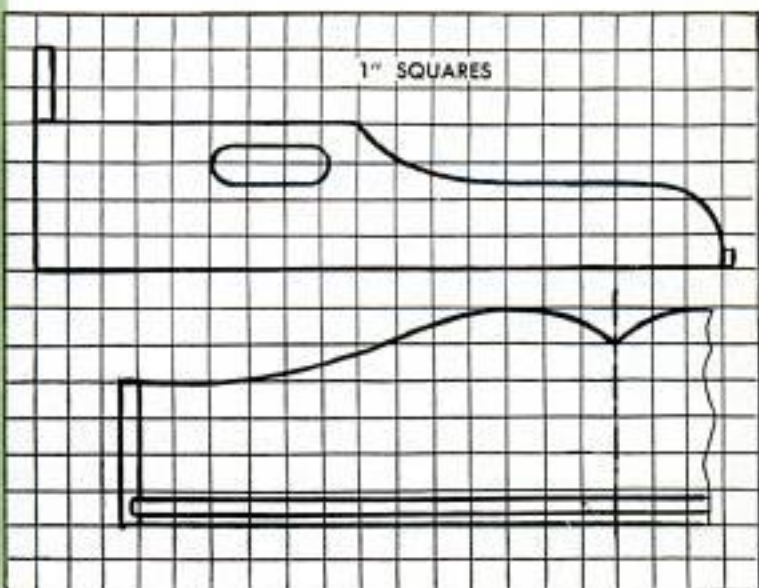
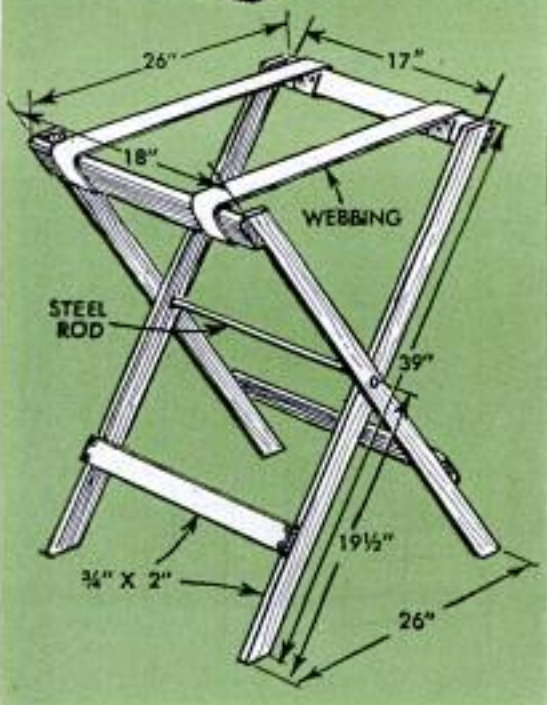
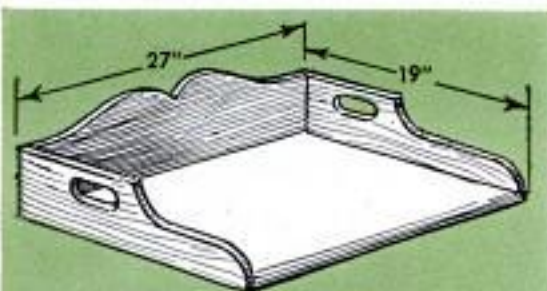
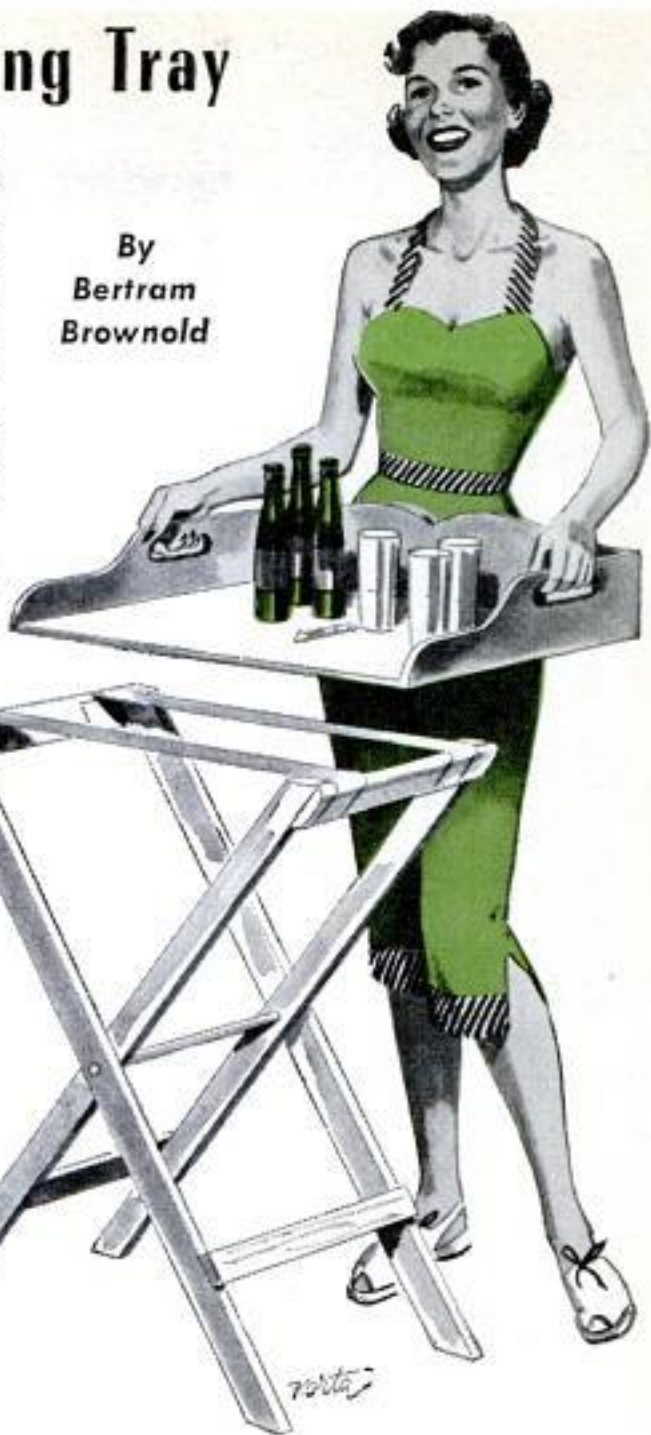


"Wagon Seat" Serving Tray

THE MULTIPLE USEFULNESS of the "wagon seat" type of tray, with one side open for convenient serving, was discovered long ago, and such trays have been popular ever since. One of these trays gives a real helping hand when serving guests in the living room or out on the lawn, and also serves as an extra sideboard in the dining room. Next to the bed in a sickroom, it provides ample space for medicines, drinking water, books and writing materials. Then, when not in use, it can be stored in a minimum of space.

A squared pattern for parts of the tray is shown below. After the parts are assembled with glue and screws, a good finish, consisting of several coats of varnish, should be applied. The folding stand for the tray is of simple construction and folds by pivoting on a steel rod. To keep the rod from slipping out of place,peen the ends over tight-fitting metal washers. A gay touch of color can be added if bright plastic webbing is used in place of the usual brown woven type. Wrap the webbing around the cross brace several times before tacking in place.

By
**Bertram
Brownold**





Good patching job depends on use of proper tools

HOW TO PATCH PLASTER

By V. Lee Oertle

EVERY HOME with plastered walls sooner or later needs minor plaster repairs to take care of cracks due to settling, dry-rot damage and accidental knock-outs. The average homeowner, by following the right methods and using the proper materials, can make them himself at very little cost. The right tools are important and should include a large, soft-bristled brush, a putty knife, a trowel, a chisel and a ham-

mer. If patches are to be made in a textured surface, a rubber float will be needed to give the finish a sandy appearance. For patching ordinary cracks and small holes, the best materials are Spackling compound and patching plaster. Spackling compound should not be used to patch large areas as it does not form a good bond to gypsum plaster and may peel away. If the repair is deep, extending all the way

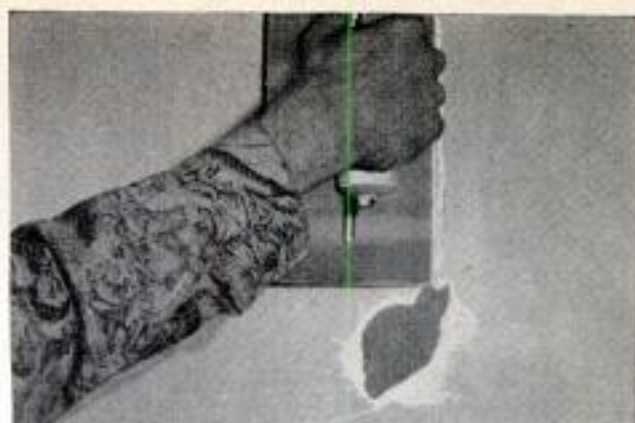
1. The first step in repairing a damaged wall is to remove all loose and crumbling plaster with a chisel

2. Large holes usually are deep. Best material to use for patch is either molding or wood-fiber plaster





1. Use a chisel to open crack slightly, insuring good bonding surface, before applying Spackling compound

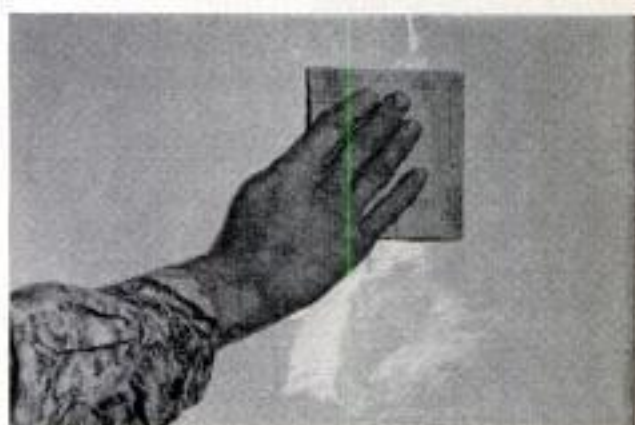


2. Dip edge of trowel into Spackling compound and fill crack in one motion, overlapping sides about 1 in.

3. Using the edge of the trowel, slice down across the crack to remove excess material. Allow 8 hr. to cure



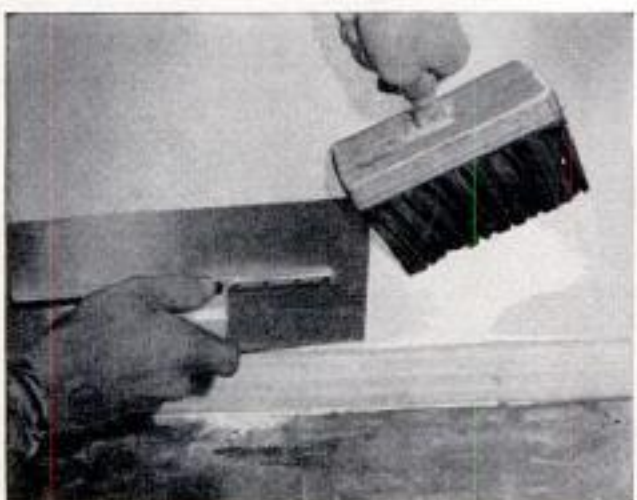
4. After curing, remove burrs and rough spots with fine sandpaper, using a circular motion over crack



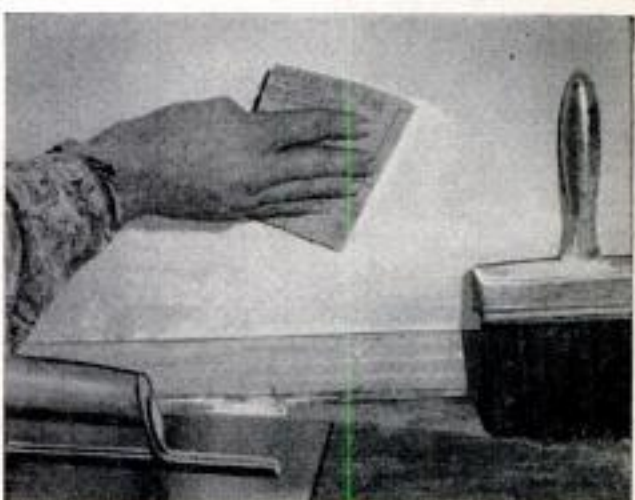
to the lath, it is best to use either wood-fiber plaster or molding plaster for the repair. The latter requires about 15 min. to set, but should be allowed to cure a day or so before sanding. To do a permanent repair job in areas where moisture has entered the wall and caused dry rot, as around sinks and bathtubs, portland cement plaster is recommended. Experts advise that the wood or gypsum lath in such areas be replaced with metal lath, as a help in preventing the dry rot from recurring.

For the final finish coat on large patches, the most commonly used materials are a lime and gauging-plaster mixture or a mill-mixed plaster (lightweight, premixed gypsum-and-aggregate mixture that produces an exceptionally hard surface). Molding plaster (plaster of paris) also can be used for this. The pictures on these pages show the proper methods to use in making plaster repairs around the home. Those above picture the four basic steps in patching a running crack. ★ ★ ★

3. To get smooth finish after patch has been made, wet spot with brush, followed closely by trowel



4. Make several passes with wet brush and trowel. Then sand smooth and feather edges after curing



Corkscrew "Pegs" for Tent Driven Without Hammer



Tent pegs that do not require hammering into the ground can be made by bending lengths of $\frac{1}{4}$ -in. iron rod into the shape shown in the illustration. First, one end of the rod is ground to a point, after which it is heated and bent into a spiral shape with the upper end bent at a right angle to provide a driving crank. The pegs are driven by inserting the point into the ground and turning the crank in a clockwise direction.

Clean Molten Metal Under Dross Poured Through Hole in Ladle



size of the hole and its distance below the rim of the ladle will depend on the type and amount of metal being used and the amount of dross expected.

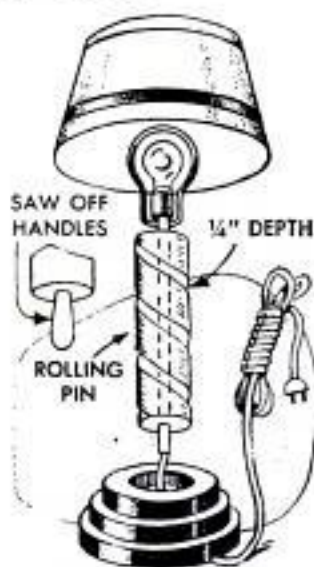
String Wound on Fishing Reel Prevents Usual Tangling

A discarded fishing reel can be used to store short lengths of string and twine without the usual problem of tangling. Fasten the reel in some convenient spot,

such as on the inside of a cupboard door or to a basement post. Additional lengths of string are simply tied to the end of the string already on the reel. If no discarded fishing reels are available, inexpensive ones can be purchased.

"Rolling Pin" Table Lamp

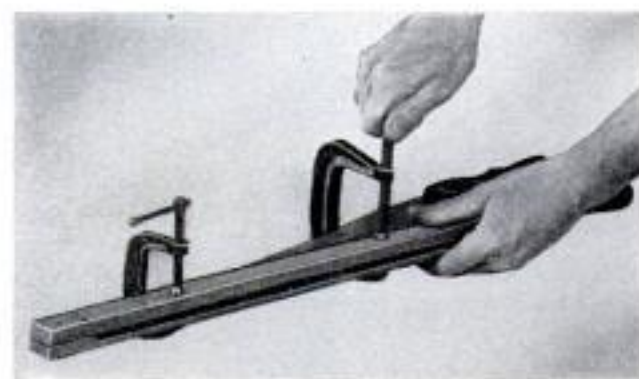
The column for this attractive table lamp requires no turning, being made from a wooden rolling pin. Both handles are cut off, then a spiral is marked around the pin by wrapping a strip of $\frac{1}{2}$ -in. tape around it. Use a fine-toothed saw and cut a groove along each edge of the tape $\frac{1}{4}$ in. deep. Remove the tape and cut out

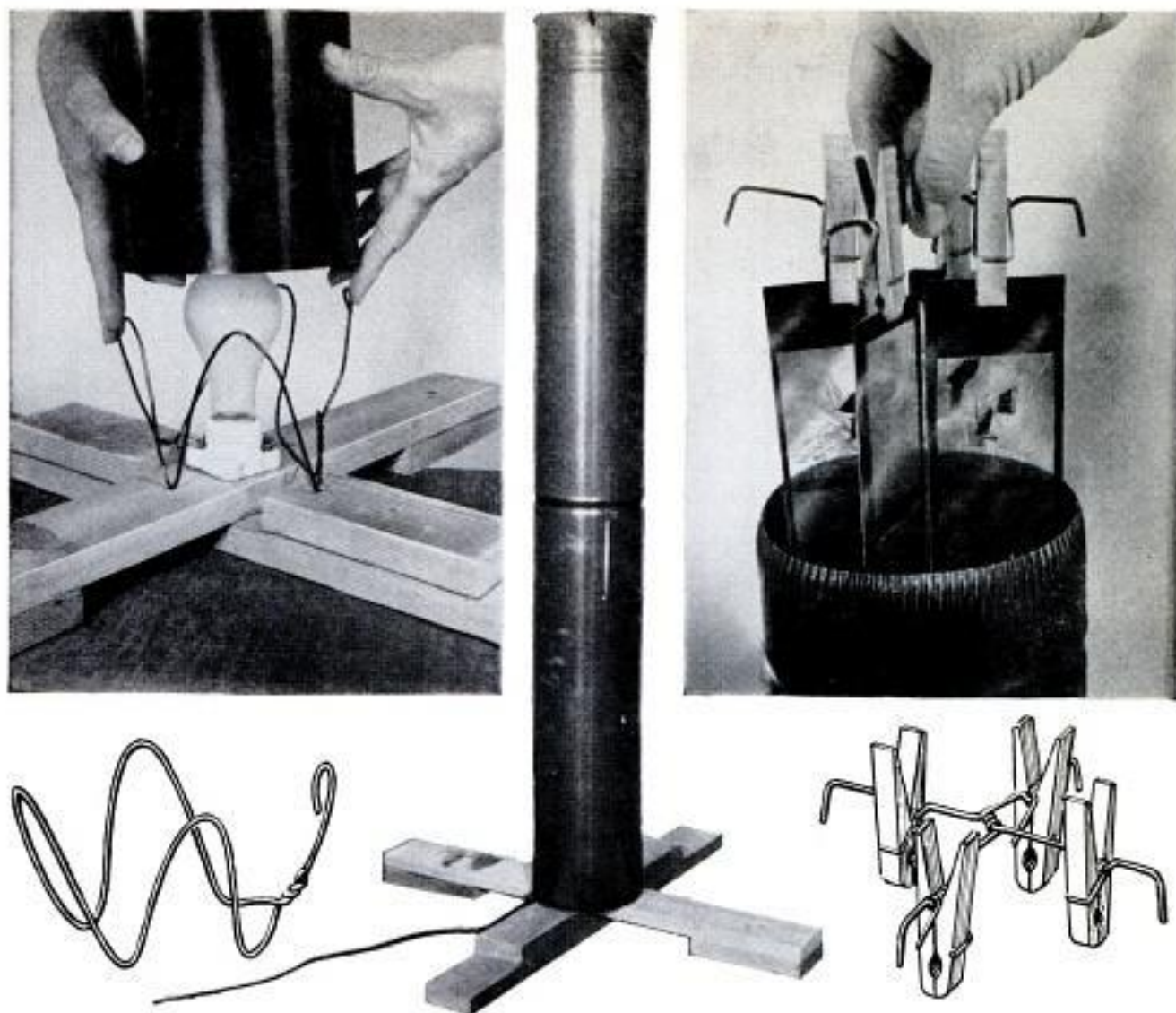


the wood between the saw cuts with a narrow wood chisel. Drill a hole through the center of the rolling pin with a sharp auger to accommodate a length of $\frac{1}{8}$ -in. electrical pipe. Three disks are used to make the lamp base, being $3\frac{1}{2}$, 4 and $4\frac{1}{2}$ in. in dia. respectively. The $3\frac{1}{2}$ -in. disk is bored out to receive the lower end of the rolling pin. Light sockets and lamp harps can be purchased at most appliance and hardware stores.—Joe Levigne, Chicago.

Gauge Clamped to Handsaw Assures Uniform Cut

A gauge consisting of two strips of wood clamped to the blade of a handsaw will assure uniform depth of cut when cutting grooves. The wood strips are screwed together at one end with a spacer between them the thickness of the saw blade. In use, the gauge is clamped on the blade, allowing the required depth of cut to project below it.





Bulb Provides Heat for Stovepipe Film Drier

An efficient convection-type drier for roll film is something any photographer can build for his darkroom at small cost. Made from 6-in. stovepipe, the drier protects film from dust and, because of the increased drying speed, results in negatives of a finer grain. Materials required include wood for the simple cross base, two or three lengths of stovepipe, an electric-

light socket and a 60-watt bulb. The rack from which the film is suspended and the spring clip which holds the pipe on the base are both bent from coat-hanger wire. To prevent curling, a clothespin is attached to the bottom of each film as a weight. Under ordinary conditions, four rolls of film will dry in less than an hour.

Eugene M. Hanson, Venice, Calif.

Set Plane Iron Quickly With Thickness Gauge

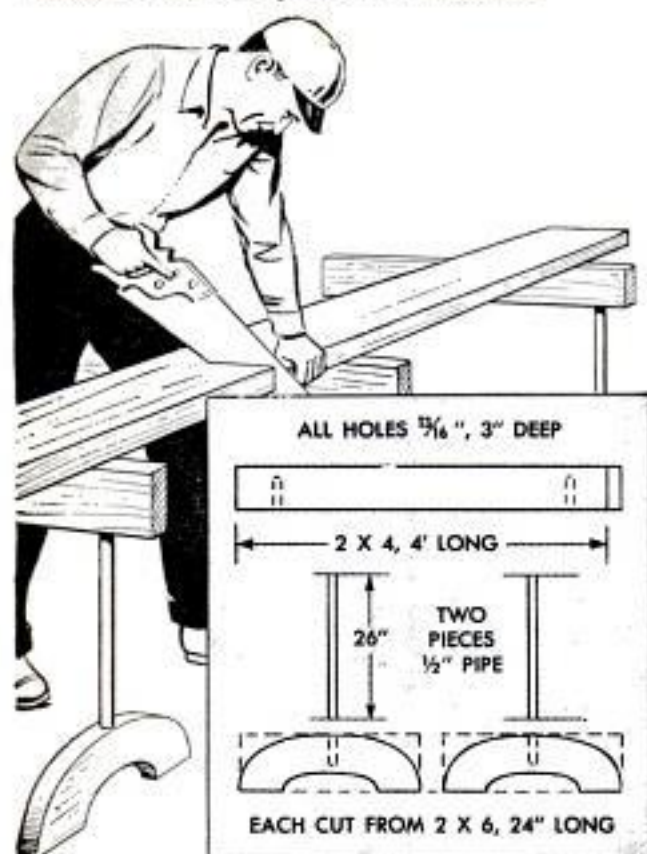


To set the iron of a hand plane uniformly and quickly, use a thickness gauge. First, lay a straightedge on the sole across the iron, slip the gauge under the raised end and adjust the iron to touch the gauge. If the setting is found right for soft wood, such as pine, it may be necessary to back off the plane iron a bit to take less "bite" when planing hardwood, such as maple.

Ken Murray, Colon, Mich.

☐ A little lipstick applied around the edges of a soldering job will act as a mask to keep the solder off adjacent areas.

Lightweight Utility Horses Made From Pipe and Lumber



These sawhorses can be knocked down for transporting, or simply folded flat against a wall where they will project only 2 in. As shown in the detail, the top piece of the sawhorse is a 48-in. length of 2 x 4. The uprights are lengths of 1/2-in. pipe and the feet are cut from 24-in. lengths of 2 x 6 lumber. A sheet of plywood and two or three of the horses can be used to make a quickly knocked-down table for a backyard or for setting up a model train.

J. W. Welker, San Bernardino, Calif.

Chemically Softened Water Will Poison House Plants

Many makes of home water softeners replace the curd-forming calcium in hard water with sodium. This softened water is desirable for most uses around the home, but it should not be used to water house plants, since the sodium in the water is a poison to many plants. Thus, if you have a water softener and find that your plants

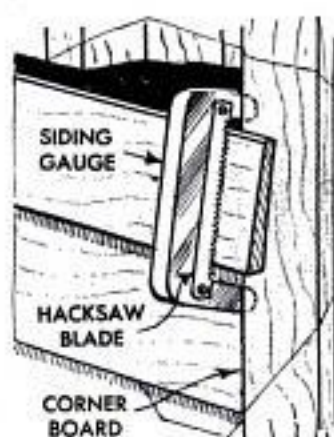
A Modern Kitchen . . .

decorated in cheerful colors and featuring well-lighted, step-saving work areas is the dream of every housewife. Old-fashioned kitchens can be made into dreams like this, as you will see in next month's story on modern kitchen design. It's packed with ideas and plans you'll want to copy

are droopy and sickly, stop watering them with the softened water. Instead, obtain water for them from the bypass valve, or use trapped rainwater.

Siding Gauge Uses Saw Blade For Quick Scoring

A siding gauge can be altered so that it will mark the cutoff point while held in one hand, leaving the other hand free to hold the siding in place. The alteration is made by screwing a hacksaw blade to the gauge. To permit proper operation, the opening between the legs of the gauge should be 1/2 to 1 in. greater than the width of the siding. In use, the gauge is set snugly against the corner boards, window or door frames and then moved up and down so that the teeth score the siding.



Telescope Support Improvised Utilizing Camera Tripod

A camera tripod can be used as a sturdy support for a telescope if a mounting block is made for attachment to the tripod. To do this, groove a wooden block, then drill and counterbore a hole at the bottom of the groove to accommodate the tripod screw and a nut. The telescope-retaining band is a strip of heavy sheet metal drilled and screwed to the sides of the block. A strip of felt inside the band will hold the telescope firmly without marring it.



SN 57



Winterize Your Car's ELECTRICAL SYSTEM

AS THE TEMPERATURE lowers with the approach of winter the efficiency of your car's electrical system lowers proportionally. This can be due to increased resistance within the various circuits and also in large part to the greater load imposed by cold-weather starting, prolonged use of accessories, moisture condensation and increased frictional drag in the engine and transmission during the longer warm-up period in cold weather.

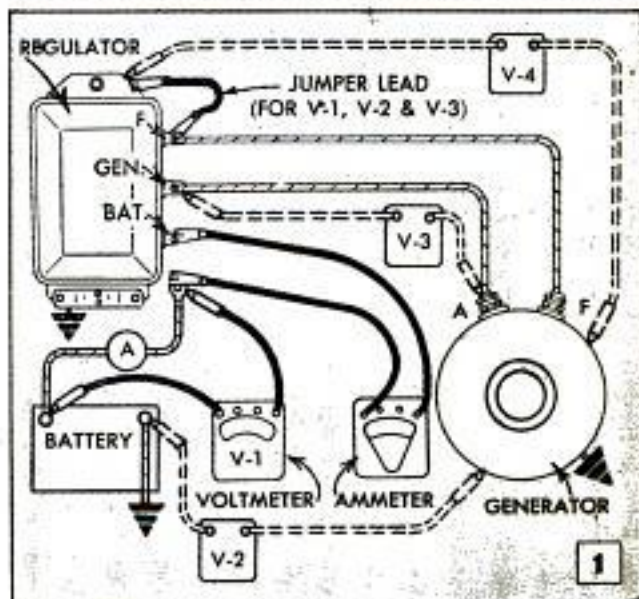
Car electrical systems are made up of four circuits, the charging circuit, starting circuit, ignition circuit and accessory circuit. The accessory circuit varies greatly on different makes of cars and frequently requires highly specialized tools for proper checking and adjusting for cold-weather operation. The charging circuit includes the battery, generator, regulator and ammeter. The starting circuit is made up of the battery, starting motor and solenoid switch. The ignition circuit includes battery, distributor, ignition coil, ignition resistor (on new 12-volt systems), ignition switch, spark plugs and the distributor-to-plug wiring harness, or loom.

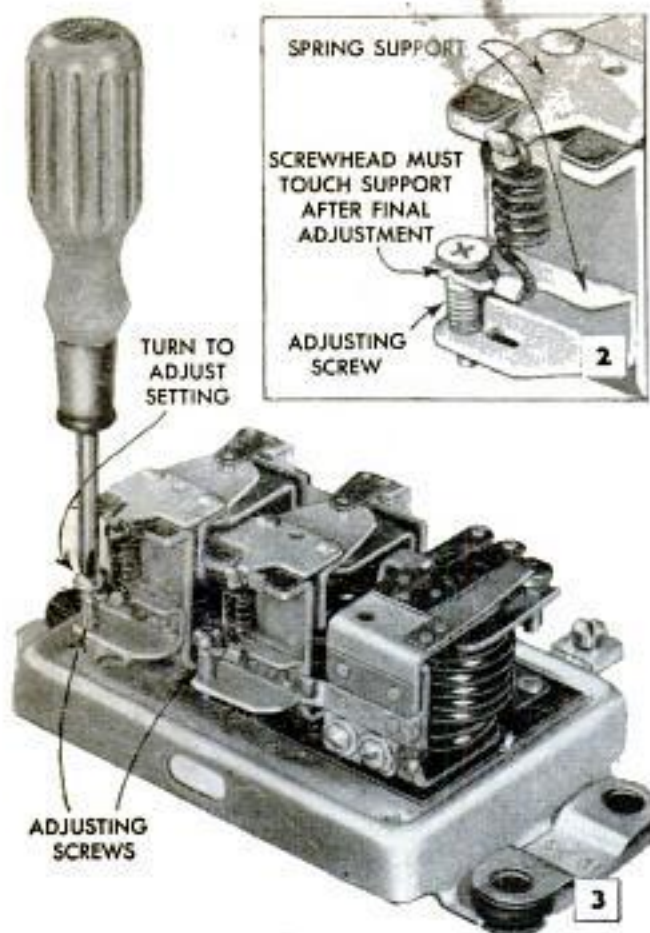
The battery, included in all the circuits, is the key unit of the system, and the one most likely to give trouble if the proper precautions are not taken. However, premature battery failure, or frequent dis-

charging of the battery, generally indicates a defect elsewhere. In a large percentage of such cases the cause may be traced to excessive resistance in the wiring due to defective leads and loose or corroded connections at terminals.

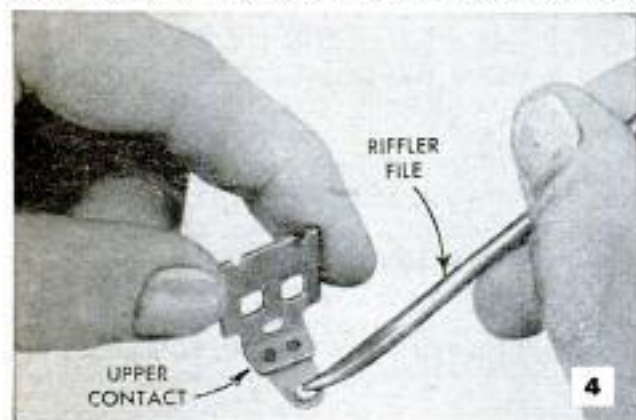
To locate such defects check the charging circuit, grounding the F-terminal of the regulator, Fig. 1, and operating the generator at a speed that will give approximately

To locate the causes of voltage drop in the charging circuit make the series of quick checks as indicated





Two views above show how to adjust voltage regulator to keep battery charged under special conditions



Above and below, always use a riffer file to clean the contact points of current and voltage-regulator units. Never use sandpaper or other type of abrasive



a 20-amp. charging rate. Then measure voltage drop at points V-1, V-2 and V-3. Reading at V-1, plus V-2, should not exceed 0.5 volt. The reading at V-3 should not exceed 0.3 volt. Readings above these figures indicate resistance in the circuit being checked. For the second check remove the ground lead at the F-terminal of the regulator. Stop the engine and switch on the full accessory load, including the lighting. This will approximate 20 amps. Now measure the voltage drop at V-4. If this is more than 0.1 volt, resistance is indicated in this portion of the charging circuit. Usually replacement of any defective wiring and cleaning and tightening connections will lower resistance to safe levels.

When checking the specific gravity of the battery electrolyte, always correct the reading for temperature. For example, if the electrolyte is above 80 deg. F. add 4 points (.004) for each 10 deg. above 80 deg. F. Subtract 4 points for each 10 deg. below 80 deg. F. When the specific gravity of each cell tests above the recommended minimum and the variation between cells is less than .025, check terminal voltage, using the starter as the load. The voltage drop should not exceed 9.0 volts (in a 12-volt battery). When using the starting motor for this purpose, be sure to ground the primary lead of the distributor to prevent the engine from firing. Also, don't operate the starter for more than 30 seconds continuously as otherwise it may be overheated and damaged. Keep the battery clean by coating it occasionally with a thick paste of baking soda and water. Leave the coating on for a minute or so, then wash off with clear water. Before flushing with water, cover the air vents in the caps with adhesive tape. Be sure the battery is anchored firmly in the carrier.

Figs. 2 to 5 inclusive show recommended methods of adjusting the voltage regulator and cleaning the contact points, should this be necessary. Voltage regulators usually are factory-set to limit current and voltage within a normal range. However, in extremely cold weather, or under special driving conditions, the normal range setting may not pass sufficient current to keep the battery fully charged. The correct setting of the regulator will keep the battery fully charged without excessive use of water. If the battery requires more than 1 oz. of water per cell per 1000 miles, the regulator setting may be too high. If you do the job of "tailoring" the regulator setting to suit your own driving requirements, two points of procedure are important. Before adjusting the regulator, bring it to operating temperature and after disconnecting and reconnecting regulator-generator leads for any purpose, be sure to polarize the

generator before starting the engine. This is done by momentarily connecting a jumper lead between the generator and battery terminals of the regulator.

Whenever the ignition system is serviced the distributor parts should have a quick check, especially the three pictured in Figs. 6, 7 and 8. There are various ways of checking the opening of the points, but the most accurate setting is obtained by using a dial indicator, Fig. 6. Be sure that the setting agrees with the manufacturer's instructions. It also is important that the tension of the breaker-arm spring be checked occasionally, using a spring scale like that pictured in Fig. 7. If the tension is over that specified for average operating conditions, rapid wear will result. If it is under the required amount, the arm may "bounce" at high speeds. Slight variations usually can be corrected with long-nose pliers, as in Fig. 8, without dismantling the unit. While you have the distributor cap off, examine it closely for any evidence of arcing. Clean the cap thoroughly and be sure the rotor is in proper operating condition. Then lubricate the unit in accordance with the manufacturer's instructions. It is necessary to make a careful check of the recommendations as these vary. Clean spark plugs and replace defective cables in the distributor-to-plug wiring harness.

In some cases, low generator output is caused by oxidized contact points in the voltage regulator. A quick check can be made as in Fig. 9 by turning on the headlights and operating the engine at a speed that will give a charging rate of about 5 amp. Then ground the F-terminal. If the generator output increases more than 2 amp. with the F-terminal grounded, oxidized points in the regulator are a possible cause. Another series of quick checks for resistance in the starting circuit is shown in Fig. 10, the three checks being made with the starting motor operating. If tests V-1, V-2 or V-3 exceed 0.2 volt, excessive resistance is indicated in that portion of the circuit being checked. ★ ★ ★



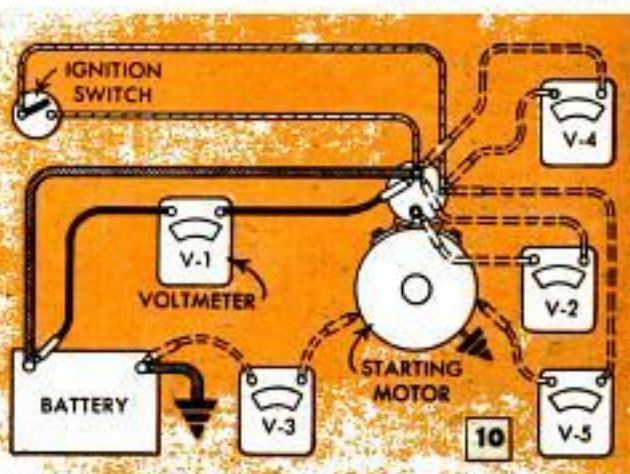
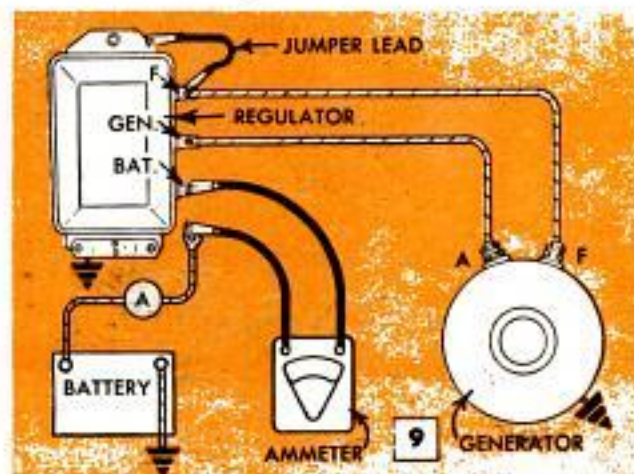
There are various methods of checking distributor-point opening, but a dial indicator is most accurate



Whenever a new breaker arm, or lever, is installed always check the spring tension with spring scale



Usually the spring tension can be altered slightly simply by bending the spring with long-nose pliers. Correct tension is important in high-speed operation





"Outrigger" Under Stepladder Prevents It From Tipping

An "outrigger" fitted across the lower ends of a stepladder will prevent it from tipping sideways. The outrigger is simply a length of 1-in. stock, long enough to project about 1 ft. or more on each side of the ladder. Two L-shaped brackets screwed to the outrigger provide grips for C-clamps which attach it to the ladder.

Postage-Stamp Holder



A convenient holder for rolled postage stamps is made easily from a can in which 27-ft. lengths of 35-mm. film are packed. Cut a slot $\frac{1}{16}$ in. wide from top to bottom in the side of the can

and feed the stamps through as shown. Replace the lid on the can and the holder is ready for use.

Small Magnet Holds Loose Papers Against Auto Instrument Panel

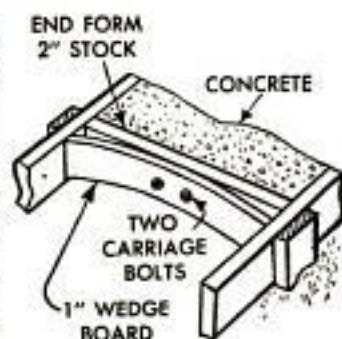
When you have several sheets of notes or other loose papers to carry with you in the car, you can hold them by placing them on the instrument panel and putting a small magnet over them. A number of

small sheets may be held in this manner. They are readily available and will not blow about in the wind.

Howard E. Moody, Upper Jay, N. Y.

Wedge Board in Sidewalk Form Eliminates Nails and Stakes

Instead of nailing or staking the movable endboard of a concrete-sidewalk form, use a wedge board that can be removed quickly when the concrete has set. A strip of 1 x 4, slightly longer than the 2 x 4 form



board is bolted to the center of the form board. The smooth heads of the bolts are located on the concrete side of the form board. Pressure of the wet concrete will force the form board back, tending to straighten the wedge board which is forced more tightly against the side forms. Stakes must be located on the outside of the side forms at the points where the wedge board is forced against them. The stakes prevent the side forms from bowing outward under the pressure of the wedge board.

Cut Lengths of Wire Duplicated By Stop Gauge on Pliers

Bent from a strip of sheet metal, a simple gauge speeds the job of cutting a number of identical lengths of wire with side-cutting pliers. One end of the metal strip is bent to a U-shape to fit snugly over one jaw of the pliers. The U-shape is offset so the extended portion of the strip aligns with the cutting edge of the jaw. The opposite end of the strip is bent up at right angles to provide a stop.



Musty odors in a basement or cellar can be eliminated by using chloride of lime on the floor. The powdered lime, which is obtainable at most drugstores, is sprinkled on the floor, allowed to remain until the odors are gone, swept up and discarded.

MAKE YOUR OWN ALUMINUM STORM SASH

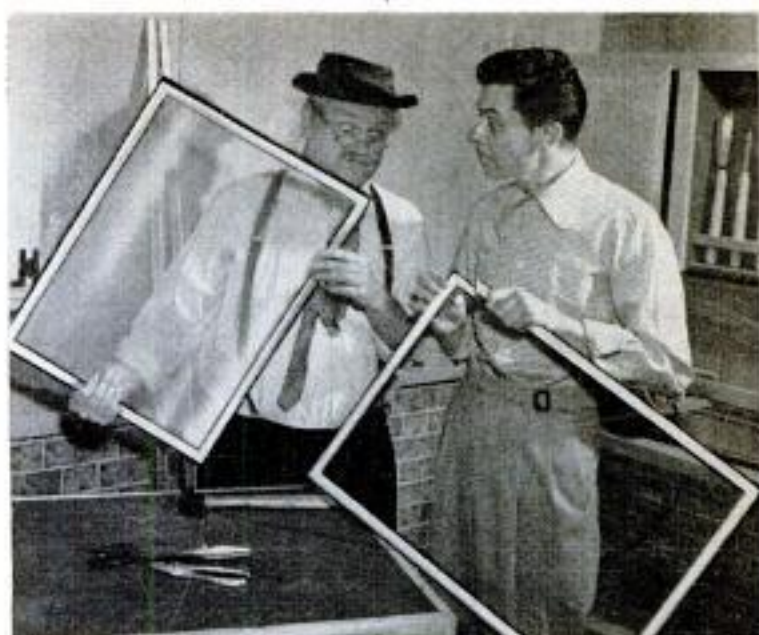
SEE THESE WINDOWS BUILT
ON THE NBC-TV SHOW
DO-IT-YOURSELF,
SEPT. 18 AT 5:30 p. m.
CENTRAL STANDARD TIME

By Edward Mickley

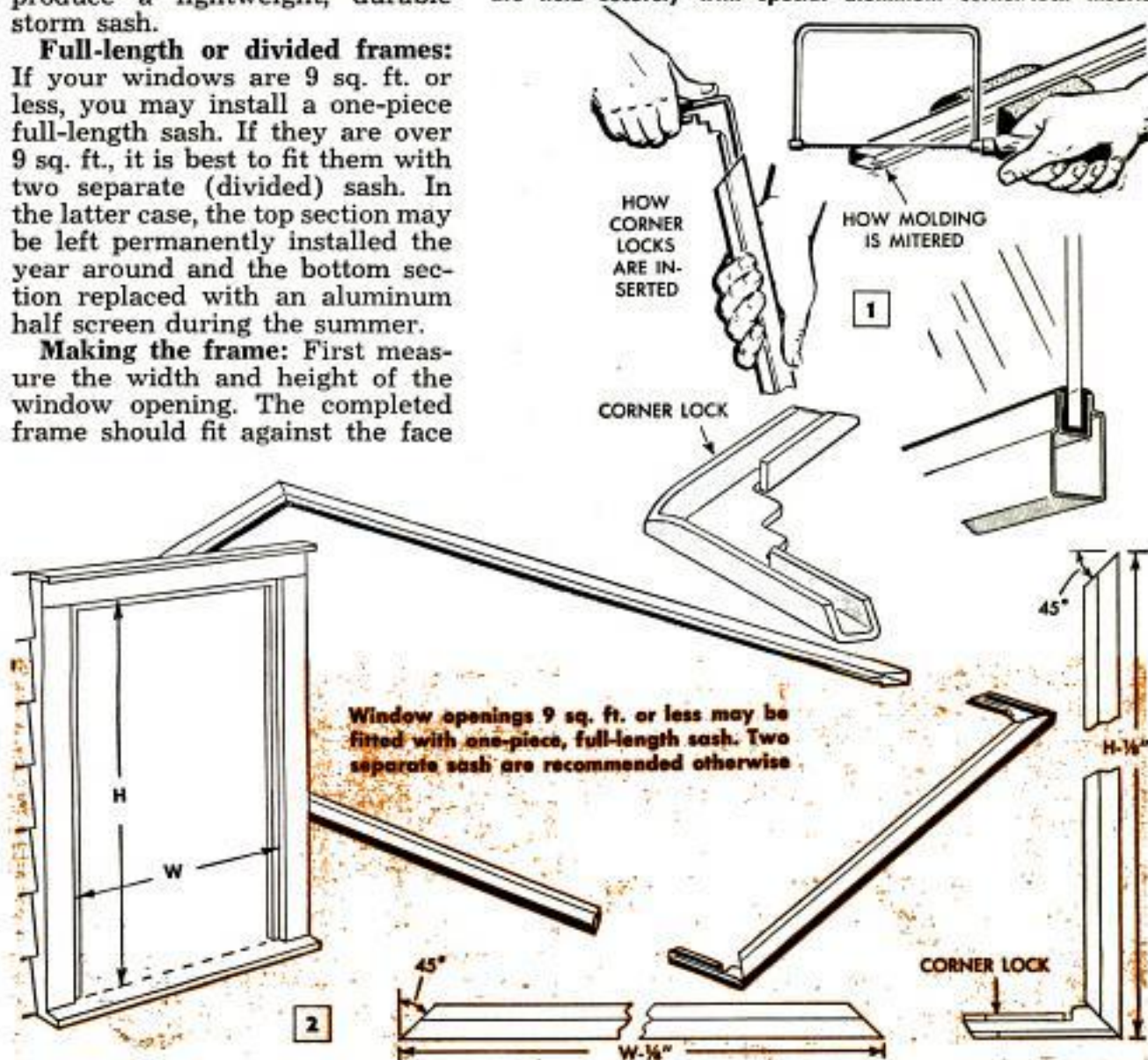
IMAGINE making storm sash for all the windows of your home in a week end. It's been made that easy with the introduction of a special aluminum molding that fits over the edges of the glass and locks securely at the corners to produce a lightweight, durable storm sash.

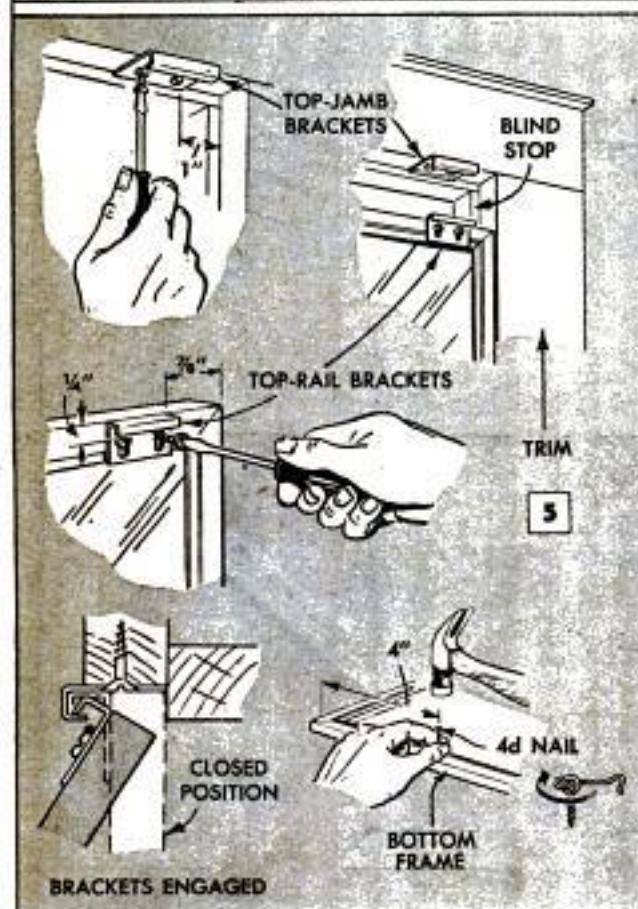
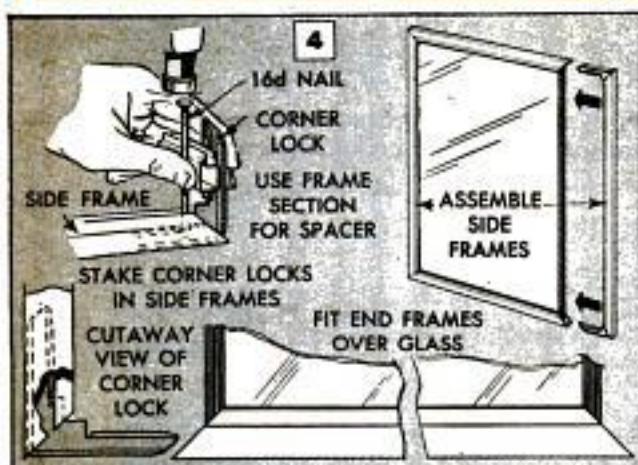
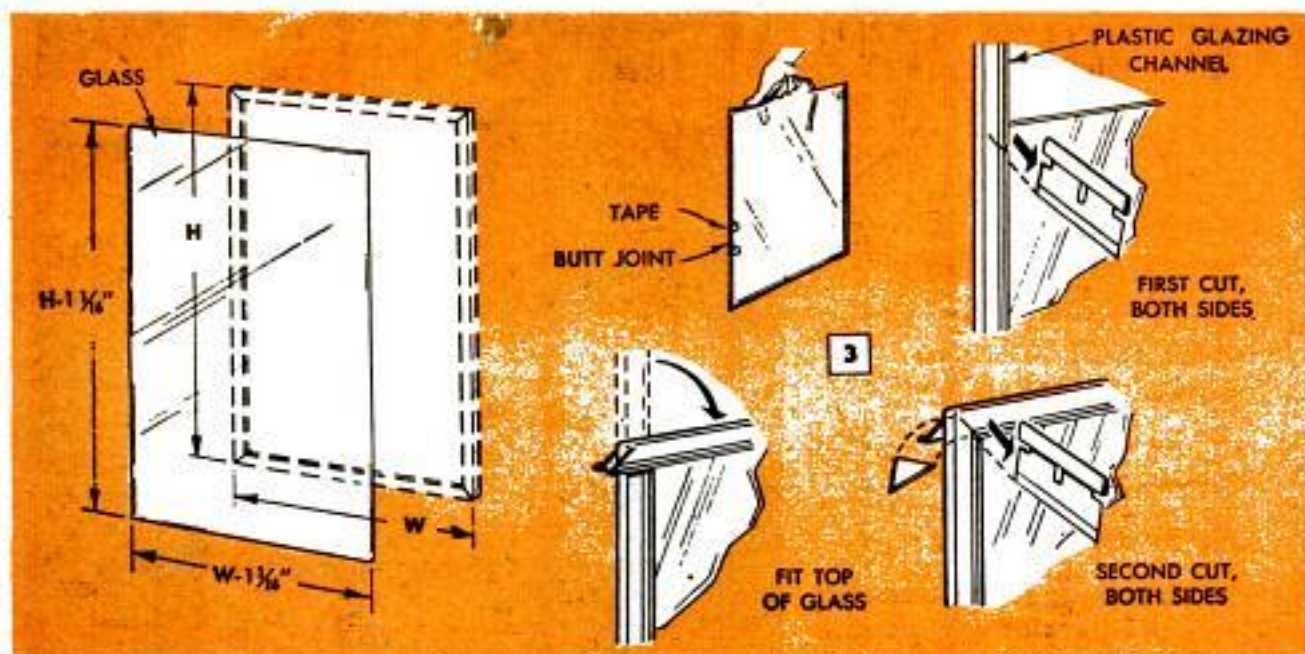
Full-length or divided frames: If your windows are 9 sq. ft. or less, you may install a one-piece full-length sash. If they are over 9 sq. ft., it is best to fit them with two separate (divided) sash. In the latter case, the top section may be left permanently installed the year around and the bottom section replaced with an aluminum half screen during the summer.

Making the frame: First measure the width and height of the window opening. The completed frame should fit against the face



Dave Willock, right, shows Cliff Arquette how corners of frame are held securely with special aluminum corner-lock inserts





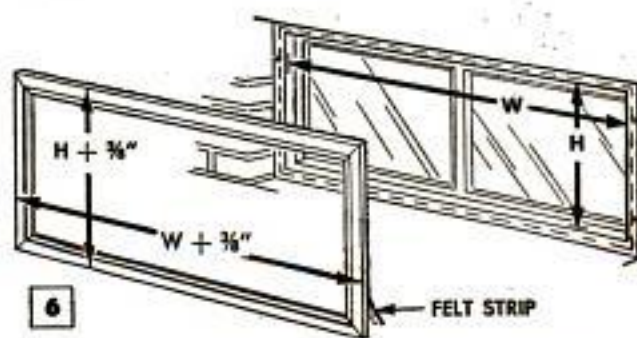
of the blind stop of the window casing, Fig. 2. When measuring for divided frames, you may divide the height equally or you may fit the sash so the dividing line comes even with the bottom edge of the upper sash.

Plastic glazing channels that seal the glass in the frame are furnished with the molding. These are pulled out of the molding and laid aside until later. After each piece of molding is marked for length, the ends are mitered. This is done with either a fine-tooth hacksaw or a coping saw as in Fig. 1. The ends are filed smooth.

Inserting the glass: Single-strength glass is okay for windows up to 6 sq. ft. but double-strength glass should be used for windows of greater area. The plastic glazing channel fits either glass thickness. In the case of a full-length frame, the glass should measure $1\frac{1}{16}$ in. less all around than the outside measurement of the frame.

In both full-length and divided sash, the frame should have a $\frac{1}{8}$ -in. clearance all around when installed. Basement sash screw directly to the edge of the window frame and, therefore, must be made to overlap the latter $\frac{3}{8}$ in. all around as in Fig. 6. Notice felt seal cemented to sash.

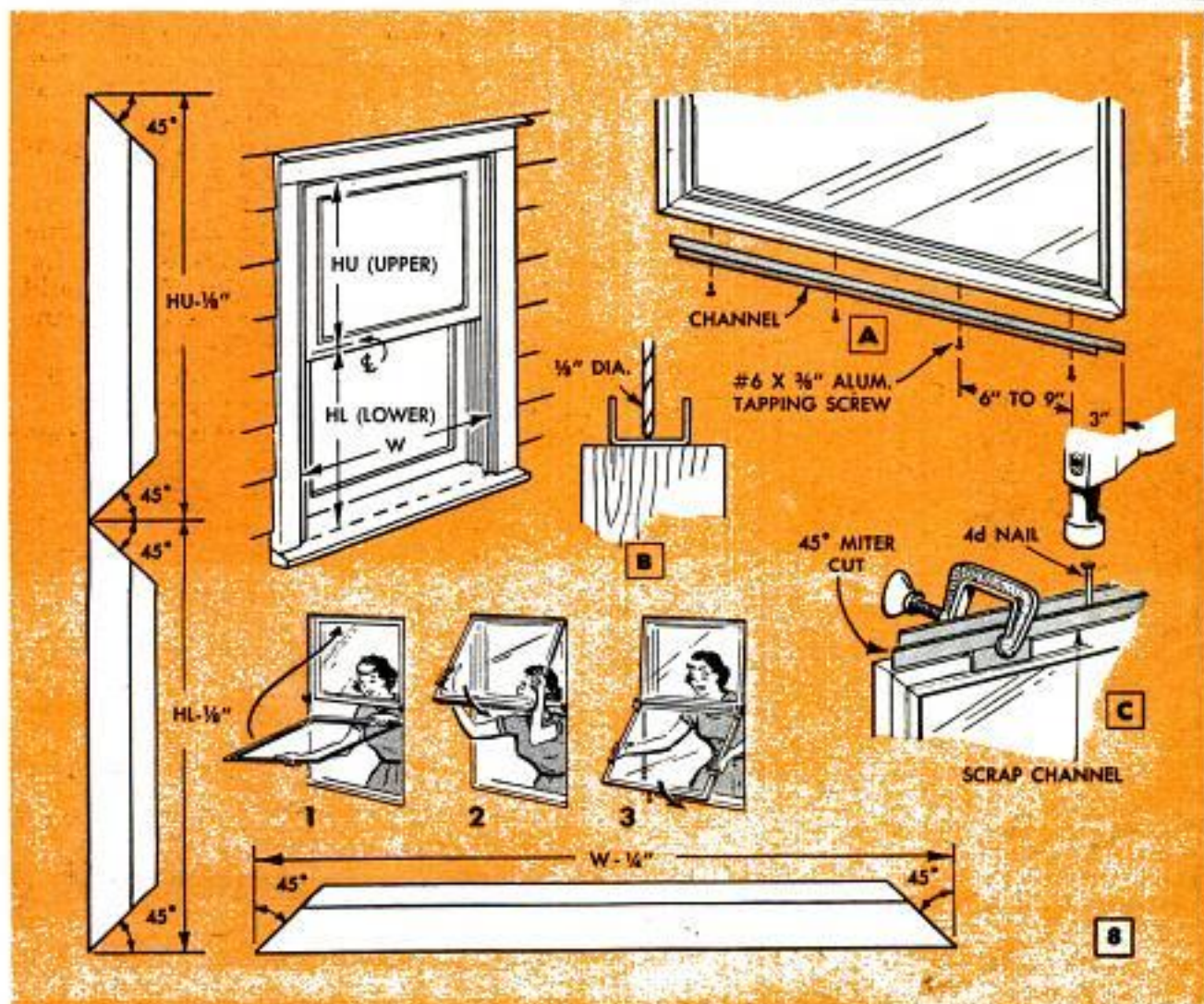
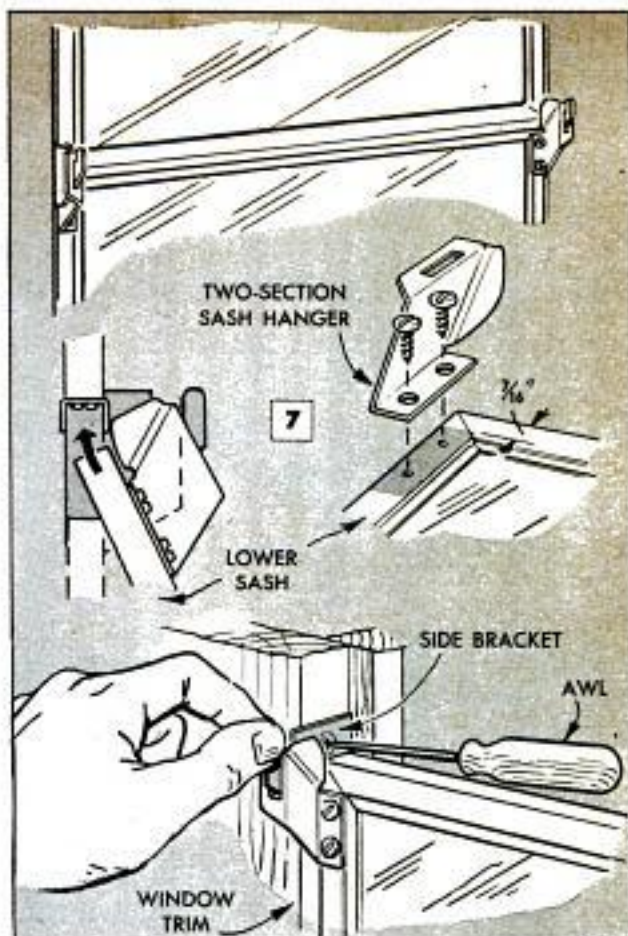
Assembling the frame: With the glass cut to size, start stretching the glazing channel over the edges, first mitering the end. Start at one corner and hold the chan-



nel in position with tabs of cellulose tape placed about 1 in. down from the corner. The glazing channel is mitered as it rounds each corner of the glass, as shown in Fig. 3.

Now place the top and bottom frame members over the glazing channel, centering them so they will match properly with the mitered ends of the side molding. Each end of the side members is fitted with a special aluminum corner lock which is inserted as in Fig. 1 and anchored in place by piercing the metal with a nail as in Fig. 4. A scrap piece of molding held as shown will spot the nail at the right place. Finally, the side members are placed over the glazing channel, pressing the corner locks in the ends of the other members at the same time.

Hanging storm sash: Special metal hangers are available for hanging aluminum sash and Figs. 5 and 7 show how they are attached to both storm sash and window frame. Fig. 7 pertains to divided sash. Steps A, B and C in Fig. 8 show the method of attaching an aluminum channel to the lower edge of the upper sash to receive the lower sash and produce an airtight joint. It is perhaps best to add this channel before the glass is in place. ★ ★ ★



Strap Hinge Bent to Form Flexible Ladder Hook for Paint Pail



A hinged S-hook for hanging paint pails on ladders with either round rungs or flat steps can be made from an ordinary 4½ or 5-in. strap hinge. For round rungs, hooks are bent on the ends of the leaves as shown in the detail. When used on flat-

step rungs, one leaf of the hinge is bent to fit the step, with the hinge pin projecting beyond the edge of the step so the hinge leaf can swing freely.

Simple Flashlight Improvised From Dry Cell and Bulb

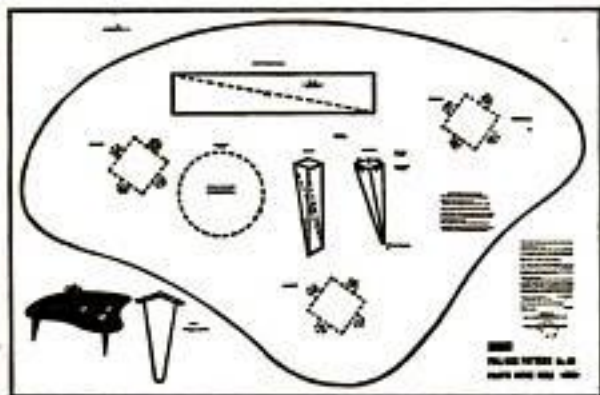
A quickly improvised flashlight can be made from a flashlight dry cell, a strip of tin and a one-cell flashlight bulb. Cut the tin strip to a point at one end and punch a hole near the opposite end into which the bulb can be



screwed. Bend the strip at right angles in the center and force the pointed end between the dry-cell case and the cardboard sleeve. Bending the tin strip so the bulb touches the dry-cell contact as shown, lights the bulb.

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No. 116. Palette Coffee Table

Above is an actual photograph of Pattern No. 116, a Palette Coffee Table, which is 31½ x 47½ inches at its widest points. It can be made in one evening, if you have a bandsaw for making the curved cuts. The pattern includes complete construction and finishing details and costs 50c.

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MAKE YOUR OWN ROUTER

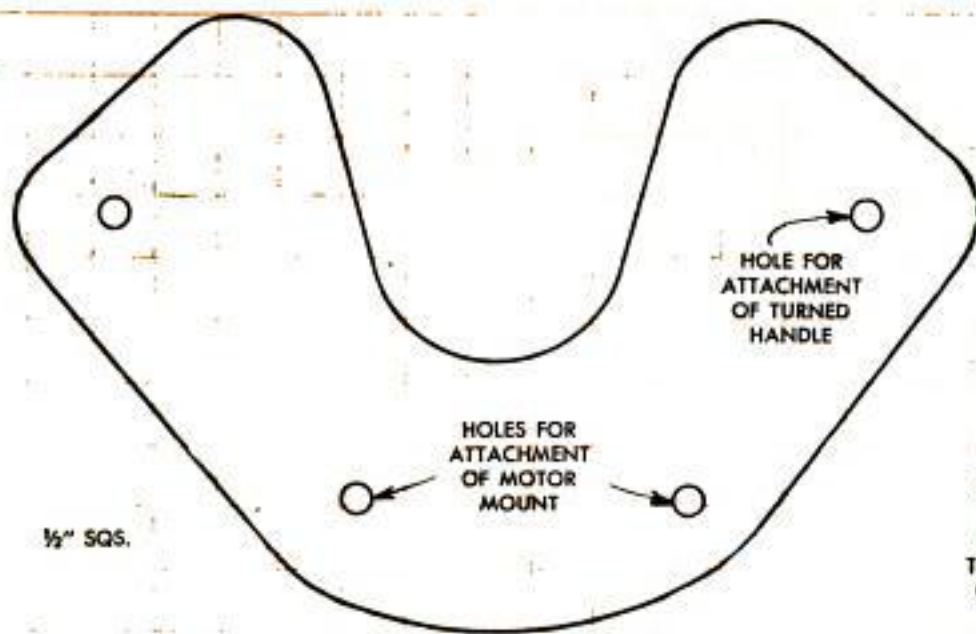
By M. C. Anderson and J. W. Wilson

A SMALL ROUTER will handle some woodworking jobs no other power tool will do. It's also one of the simplest power tools to build in the shop, as the router bit is the only driven part. The power unit of the shop-made router pictured above is a vacuum-cleaner motor of the flange-mounted type designed for operation in a vertical position. When selecting a used motor of this type be sure that the bearings are in good condition. The

shaft diameter should be $\frac{3}{16}$ in. to take a standard chuck. *Deep - Best number*

Remove the motor brushes, keeping them in order so that they can be replaced in the same position as they were originally. Remove the armature and field coils. Cut away the flange at one end of the motor frame, using a hacksaw to cut off the waste and finishing with a file. If a metal-turning lathe is available, then the flange is easily turned down flush in the lathe. Slot the

187-0029



NOTE—SIZE AND SHAPE OF BASE PLATE MAY HAVE TO BE ALTERED TO SUIT VARIOUS TYPES OF VACUUM-CLEANER MOTORS



Motor housing is slotted to take two $\frac{1}{4}$ -in. bolts which permit vertical adjustment on mounting block

motor frame as shown in the upper left-hand photo on this page. The slot takes two $\frac{1}{4}$ -in. bolts, as pictured, which hold the motor in a vertical position on the mounting block and permit a vertical adjustment for depth of cut, as shown in the right-hand photo above.

The mounting block is made from hardwood and is attached to the base plate with bolts as in the details below. The base plate is sufficient for free-hand routing of recesses and also for straight work where the plate can be worked against a guide strip. For more exacting jobs the base plate is replaced by the edge guide detailed below. This unit works against either straight or curved edges. All parts should be made

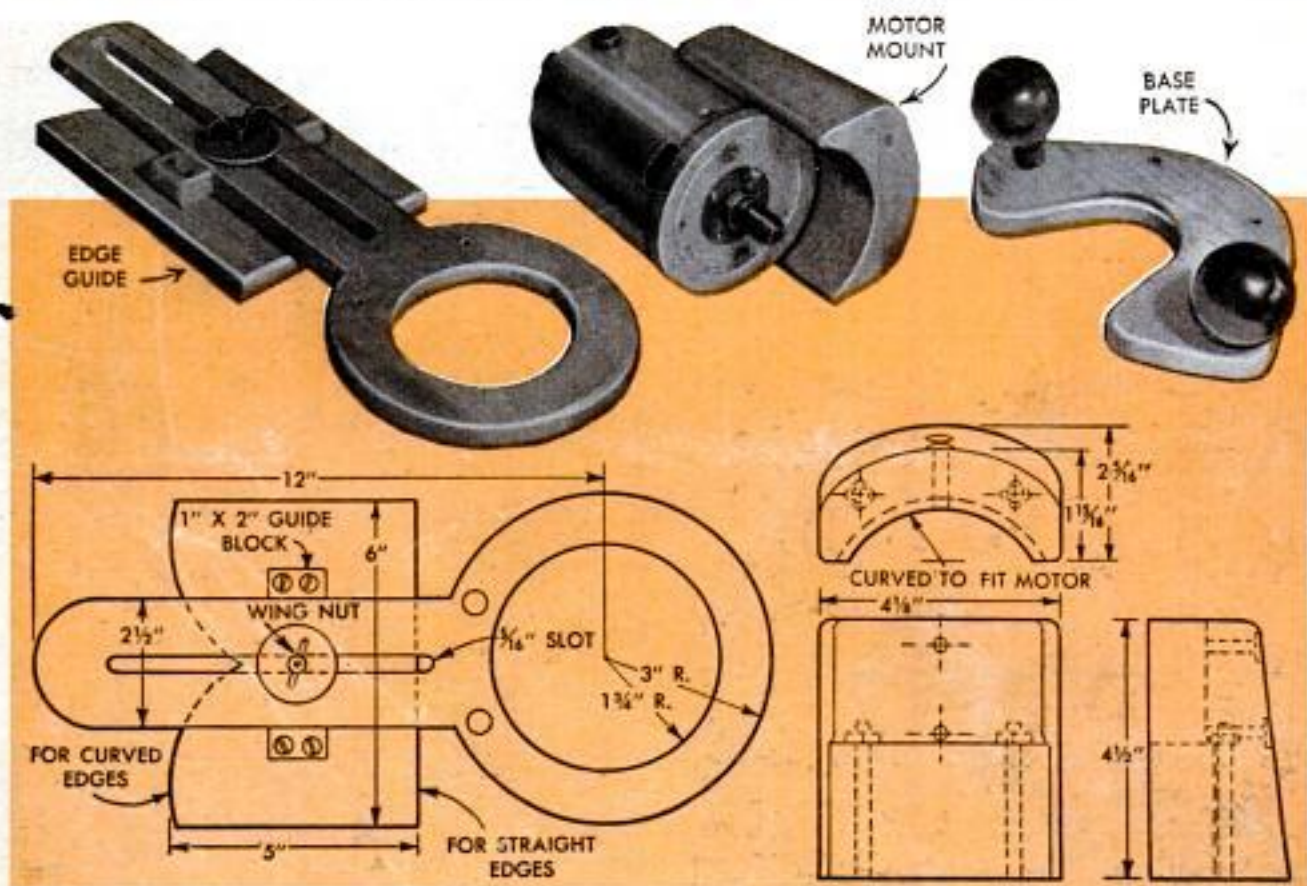


Mounting block is of hardwood shaped to fit curve of motor housing. Block is bolted to the base plate

accurately of hardwood, smoothly finished.

When reassembling the motor, place the bolts in the slot in the frame before replacing the field coils. On some motors the slot can be cut without removing the coils. Be sure that the motor end plate fits true in the housing before tightening the bolts.

The chuck sleeve should fit snugly on the motor shaft. Remove any rust from the shaft by holding a piece of fine abrasive cloth in contact with it while the motor is running. Cut off a portion of the shaft, if necessary, so that the chuck fits as closely to the bearing as possible to reduce overhang and prevent vibration in heavy cuts. Follow the motor manufacturer's instructions for oiling the motor. ★ ★ ★



Setting Carburetor Float Level With Cylindrical Gauge



Accurate setting of a carburetor float level is more certain with a cylindrical gauge than with the usual flat type. The cylindrical gauge gives a constant measurement on

any diameter, avoiding inaccuracies which may result when a flat gauge is tipped slightly. Cylindrical gauges are made by turning short lengths of steel round to accurate diameters.

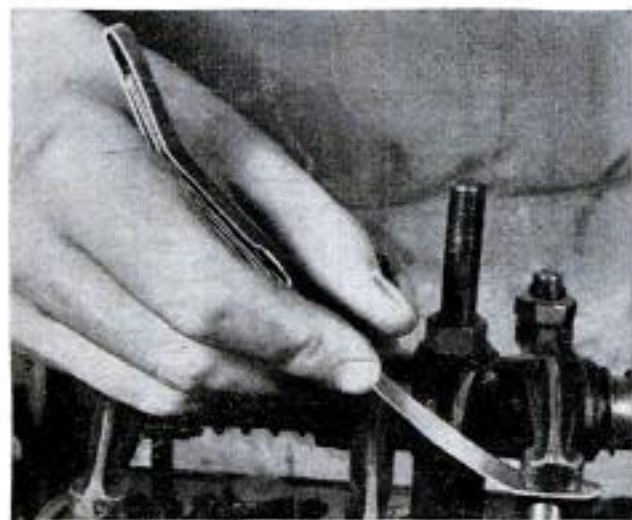
Charles Erwin Cohn, Chicago.

Remove All Wax and Polish Before Refinishing Floor

Unless all wax and oil polishes are removed from floors before they are revarnished, the new coat of varnish will not dry satisfactorily. The floor should be washed with turpentine and, while it is still wet, wiped dry with clean cloths. To make certain that all traces of polish are removed, the operation should be repeated.

Angled Feeler Gauges Speed Overhead-Valve Adjustment

Straight feeler gauges can be bent at an angle of about 30 deg. to permit more convenient use when setting tappets on an overhead-valve engine. Holder and blades are bent together. Fit a piece of sheet metal between the holder and blades on each side of the blades to protect them. Clamp the assembly in a vise with smooth or covered jaws and bend about $\frac{5}{8}$ in. from the end opposite the holder pin. Some of the blades may require a slight rebending to match the holder after removing from vise.



Drag Chain on Feed-Bunk Floor Aids Feeding Silage to Cattle

Feeding silage to 35 head of cattle, which once required 35 min., is now done in $2\frac{1}{2}$ min. by one farmer with the aid of a drag chain installed on the feed-bunk floor. Silage is forked from the silo, which is adjacent to the bunk, then rolled onto the drag as it runs by at 20 f.p.m. When the drag reaches the opposite end of the bunk it is shut off and the cows eat the feed in front of their stanchions. The drag chain is fitted with angle-steel flights 20 in. long, riveted to the chain at 20-in. intervals. The chain runs over sprockets at each end of the feed bunk and returns under the floor. A $\frac{3}{4}$ -hp. electric motor powers the unit.

George Laycock, Batavia, Ohio.

Removing Key Stuck in Keyway

A key that has become wedged in the keyway can be driven out by using a cape chisel and small steel blocks. The chisel is driven between the bearing housing and the key until the width of the chisel no longer is sufficient to bear against the key.

A steel block then is taped to the shaft as shown. Several blocks may be required, depending on the size of the chisel and the length of the keyway.

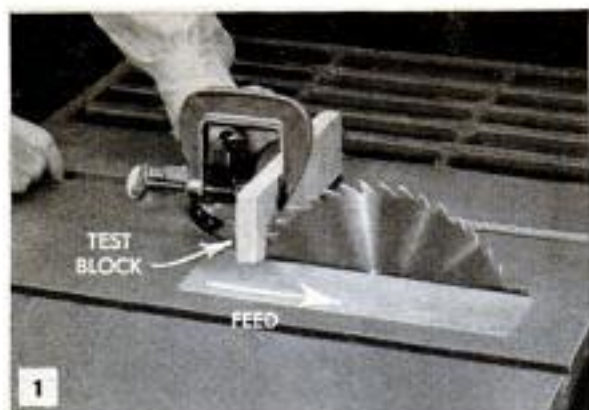


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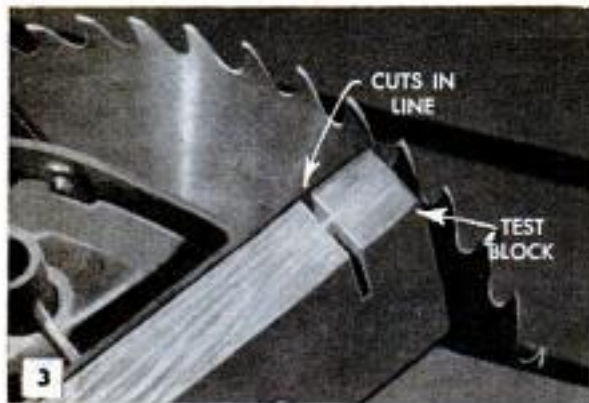
CHECK UP ON

Saw Alignment

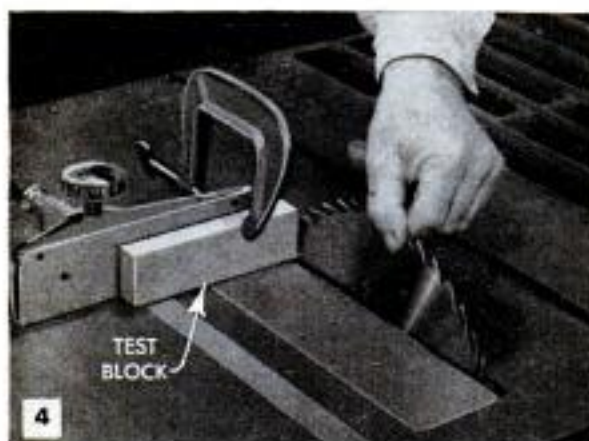
By
Sam Brown



That the saw blade be parallel with the table is the basic rule in saw alignment. This can be determined by the reverse-cut method pictured below. Saw cuts line up when adjustment is okay



Sawing a test block in two also will check blade-table alignment. With power off, blade is rotated by hand until "high" tooth rubs against block. Back of blade is checked to note variation



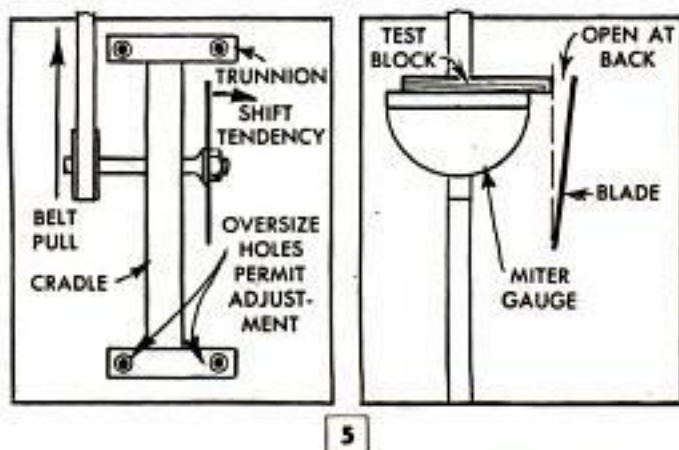
IF THE OLD faithful circular saw does not turn out the work the way it used to—if the work is out of square or tends to creep away or bind against the fence—it is time to check the alignment of the saw and make any necessary adjustments.

Table adjustment: The fact that the table must be parallel with the saw blade is the basic rule of saw alignment. With a tilt-table saw, a table error is likely to be in either direction. However, with a tilting-arbor saw, the shift of the blade usually is in a clockwise direction, due to motor drag, Fig. 5.

Table alignment may be tested by clamping a block of wood to the miter gauge, setting the blade at maximum height, and cutting halfway through the block with regular forward feed, Fig. 1. Then a similar cut is made with backward feed, Fig. 2. As this will tend to hog the work, hold the work firmly and feed slowly. When the block is turned over, Fig. 3, the saw cuts will line up if the table and blade are parallel.

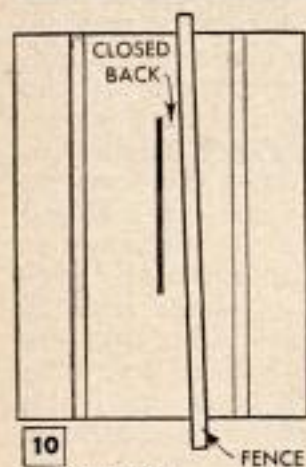
For an alternate test, saw the block in two. Then, with the block still clamped to the miter gauge, rotate the blade by hand until the "high" area, or tooth, rubs against the block as in Fig. 4. Next, move the block to the back of the blade, rotate the blade backward and check the distance between the block and the same "high" tooth.

If either test discloses an open-back error

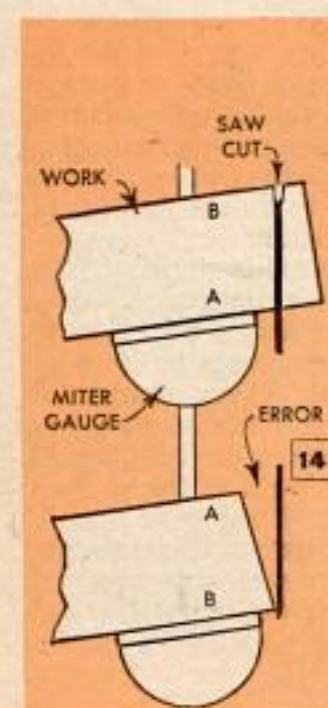
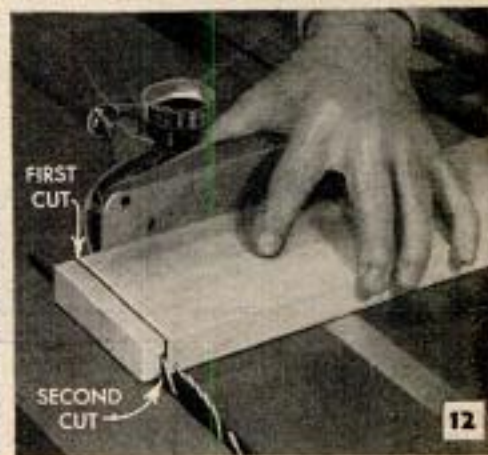




TEST CUTS SHOW FENCE OUT OF ADJUSTMENT

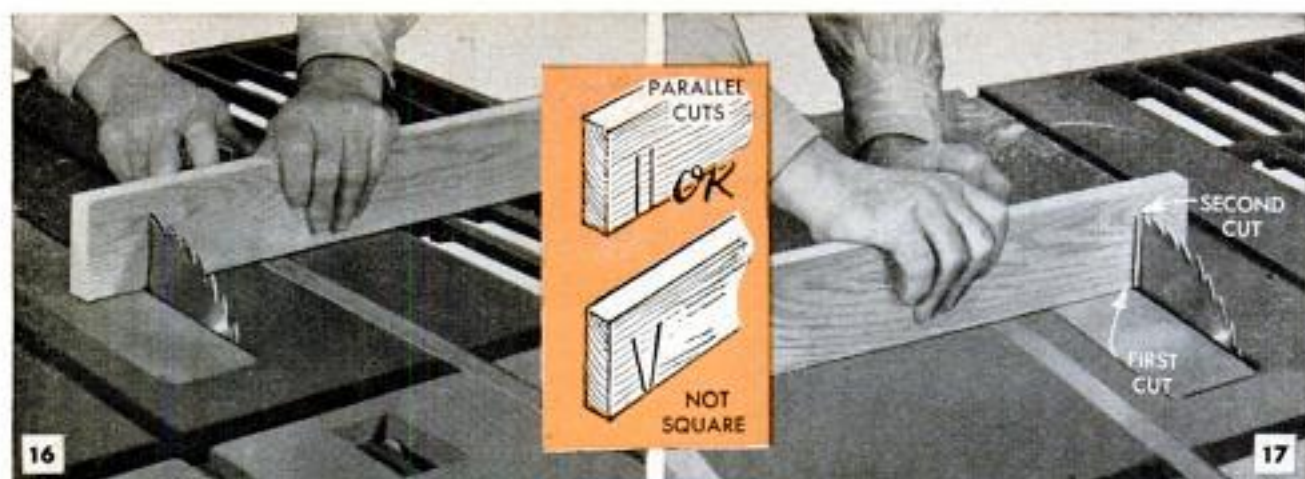


10 PREFERABLE ERROR IN FENCE POSITION

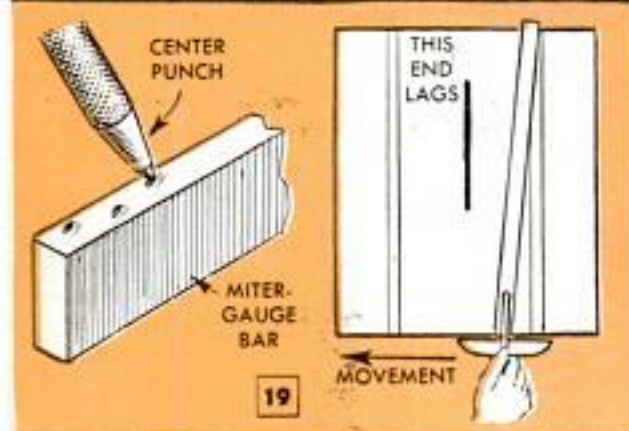
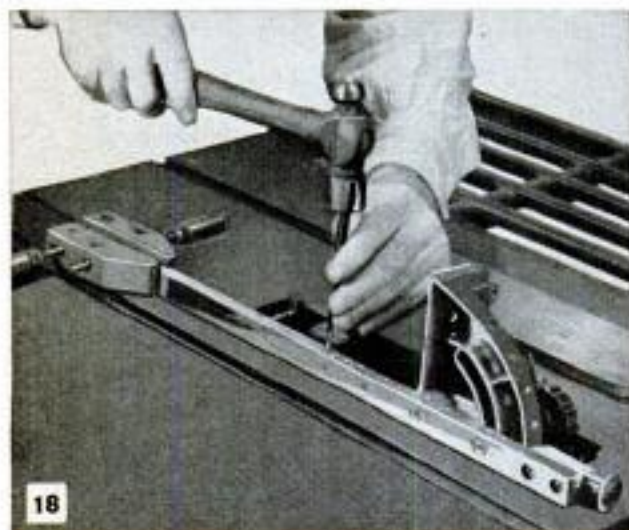


Miter gauge should permit an accurate 90-deg. cut. Cuts made halfway through test stock indicate error as above. Parallel cuts show that gauge is properly set. Miter gauge is reset by backing off screws holding index pin, right





Vertical squareness is checked by the reverse-cut method as shown in the photos and detail above. If blade is not vertical, back off stop screw which controls blade or table tilt, adjust and then reset



greater than $\frac{1}{64}$ in., or a closed-back error, adjustment is required. This is done by backing off the screws holding the trunnions, Fig. 5. Some saws have setover screws which then are turned as needed.

Fence alignment: After blade-table alignment is satisfactory, adjustment of the fence is simply a matter of setting it parallel with the table slot, Fig. 9. To do this, loosen the screws that hold the fence to the guide. The preferable error is a closed back, Fig. 10. Note that a slight amount of open back, as in Fig. 5, automatically provides the same amount of closed back in connection with the fence. Checking the fence setting can be done with reverse cuts, Figs. 6 and 7, which will be in line if the fence is parallel with the blade. Fig. 8 shows an obvious case of misalignment. If the fence is set parallel with a blade that is out of alignment, Fig. 23, the saw will rip satisfactorily but will not crosscut.

Adjusting miter gauge: The miter gauge is checked at the 90-deg. position with a test block having parallel edges. With the saw set at half work depth, cut one face of the block, Fig. 11. Then turn the work over and cut the other face, Fig. 12. As in Fig. 13, parallel cuts show a perfect setting, while a wedge shape indicates that the gauge is not set accurately. Another miter-gauge test made with a piece of stock having parallel edges is shown in Fig. 14. After crosscutting, turn the work over and note if the cut end remains parallel with the blade. To adjust the miter gauge, loosen the screws holding the index pin, Fig. 15, or back off whatever device is used to set the "square" position. Then, using the clamping screw only, adjust the gauge as needed. When a satisfactory cut is obtained, set the index pin and tighten the screws.

Vertical squareness: Whether or not the saw blade is perpendicular to the table can be checked by the reverse-cut method, Figs. 16 and 17. If the blade is not vertical, back off the stop screw which controls the table or blade tilt, adjust for a vertical cut and reset the screw. Repeat with the

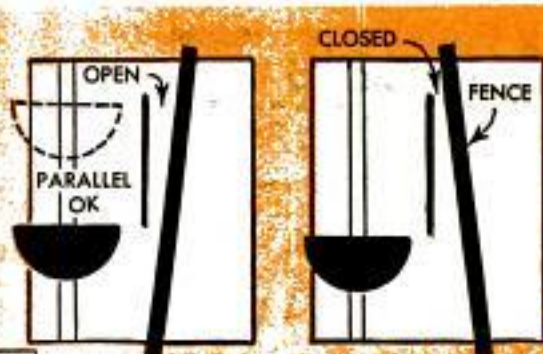
blade or table set in the 45-deg. position.

Mechanical faults: Slight errors sometimes are caused by a loose miter-gauge bar. This can be corrected, at least temporarily, by making a number of punch marks on the side of the bar, Figs. 18 and 19, to raise the metal slightly. A pronounced error often is caused by shifting the fence with pressure applied at the extreme end, Fig. 19. The right way to shift the fence is by grasping it as in Fig. 20.

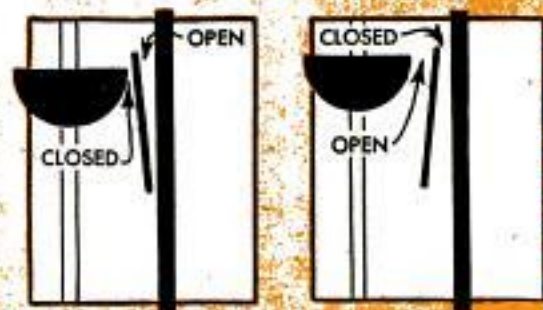
Six cases of misalignment: The six common cases of misalignment are shown in Figs. 21, 22 and 23. The identifying feature in all cases is whether the blade is "open" or "closed" in relation to the miter gauge and fence. If your saw has the usual error which is an open back when tested with the miter gauge, Fig. 22, right-hand detail, the resulting crosscut will be as shown in Fig. 24. If the fault is serious, making the cut will be impossible due to binding action. However, if the blade has a considerable amount of set or if the fault is slight, the cut may be satisfactory. Figs. 24 and 25 show what happens.

The open-back error has about the same effect on a ripping cut as on a crosscut. However, a slight error of this type is desirable in ripping, as it pushes the work against the fence. The opposite misalignment, left-hand detail of Fig. 22, leads the work away from the fence.

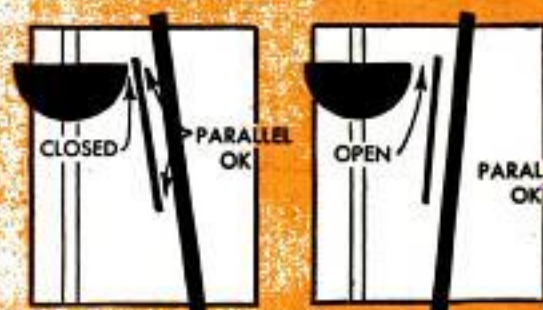
To summarize correct adjustment: The table and blade should be parallel, with a slight open back permissible. If the table and blade are parallel, the fence should be toed-in slightly to obtain good tracking. If the table-blade alignment is slightly off on the open-back side, the fence will have a corresponding closed back when adjusted parallel with the table slots. ★ ★ ★



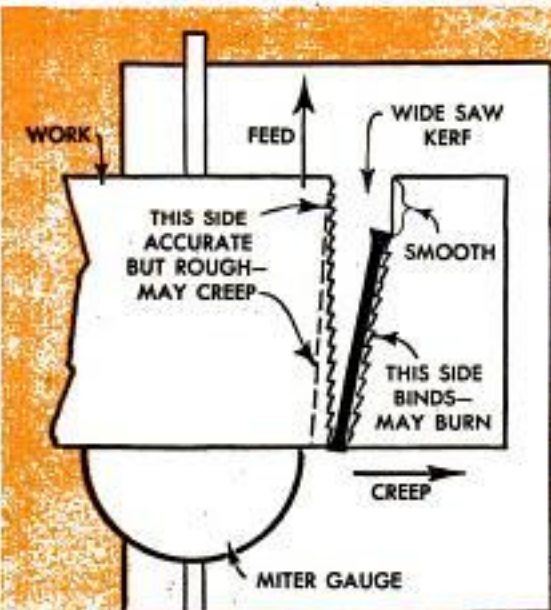
21 Fence not parallel with table is simple fault easily corrected. This error affects only ripping, not crosscutting



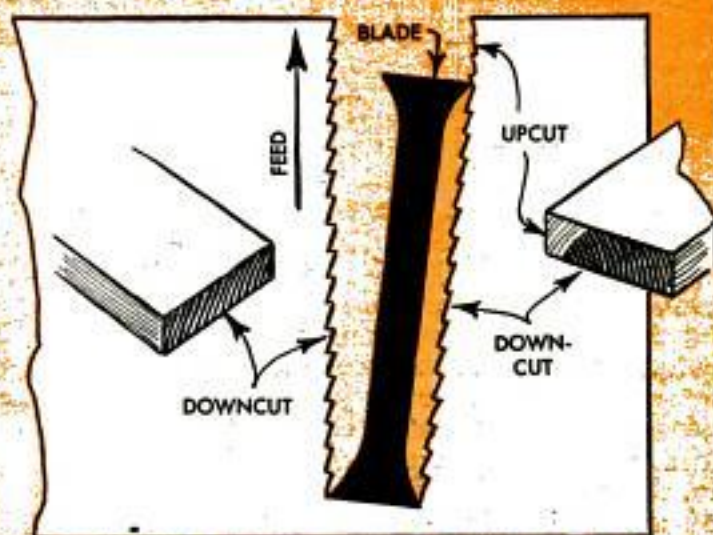
22 Blade not parallel with table is basic fault. If this error is excessive the saw neither rips nor crosscuts satisfactorily



23 With blade and fence out of alignment, saw can produce suitable ripping cut. However, a clean crosscut is impossible



24 CROSSCUT WITH OPEN BACK



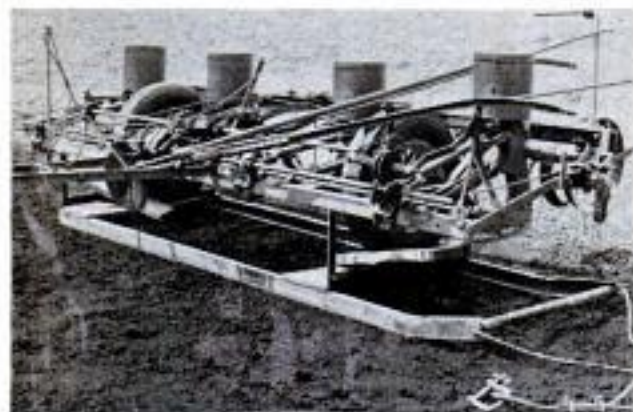
25 RIGHT SIDE WILL NOT BE SQUARE UNLESS WORK IS PUSHED ENTIRELY BEYOND BLADE

Swing Gate Keeps Hogs Clear Of Fence-Line Feed Trough



Cleaning and filling a hog trough is simplified on one farm by locating the trough on the center line of the hog-pen fence. A vertical-swinging wooden gate replaces a fence section above the trough. A slide, made as shown in the illustration, permits the gate to be locked on either side of the trough. When the trough is being cleaned or filled, the gate is swung inward and locked to keep the animals out of the way. To feed the animals, the slide is pulled up, then dropped inside the trough so the hogs cannot push it past the edge of the trough. Pipe stakes driven into the ground around the trough keep it from being pushed out of place.—Arthur A. Stevens, Canby, Ore.

Corn Planter Towed on Sled



One farmer solved the problem of towing a four-row corn planter through narrow gates by building a welded-steel sled to carry the planter lengthwise. The runners of the sled are steel channels, 1½ in. x 3 in. x 10 ft. The runners are bent up 18 in. from the front end and a 3-ft. length of steel pipe is welded between them. Spaced the width of the planter's wheel tread, two 3-in. steel angles are welded between the runners at the rear of the

sled. A length of 1 x 12 plank is bolted to each angle and a wheel chock is spiked to the lumber. Two notched steel flats support the frame of the planter and keep it upright. A hole drilled near the front of each runner permits a towing cable to be passed through the pipe.

Wax Prevents File Clogging When Working Soft Metals

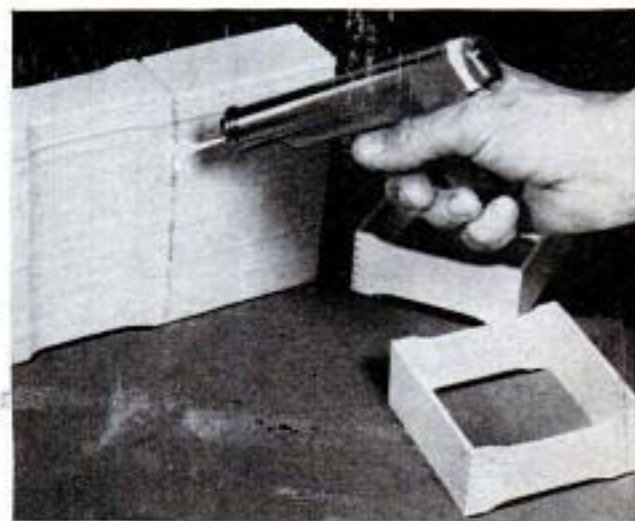


Candle wax will aid in preventing file teeth from clogging when working brass, aluminum or other soft metals. Clean the file thoroughly with a file card, then rub a candle stub over the full area of the teeth. After the job is done, the file can be warmed slightly to aid in brushing away the remaining wax. Use only enough heat to loosen the wax; excess heat will destroy the file temper.

Moistening Section-Box Blanks For Immediate Use in Beehive

Instead of dipping new section boxes in water before bending them to shape, one beekeeper uses a water pistol to moisten only the scored portions. The small amount of water used quickly dries out of the wood, permitting the boxes to be fitted with foundations and placed in the hive almost immediately.

Benjamin Nielsen, Aurora, Neb.

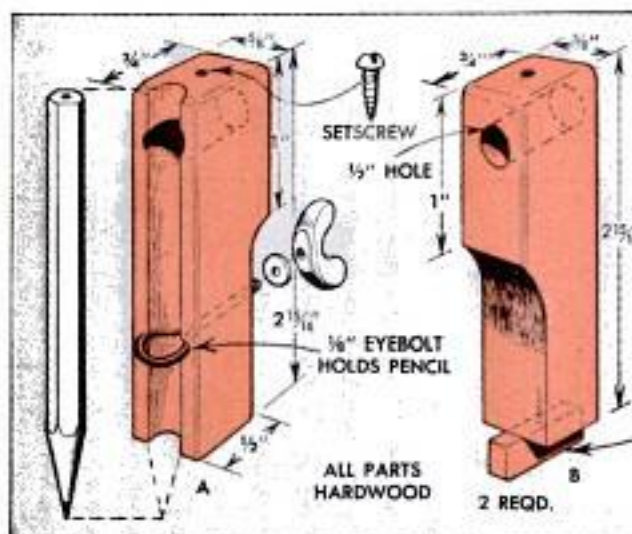
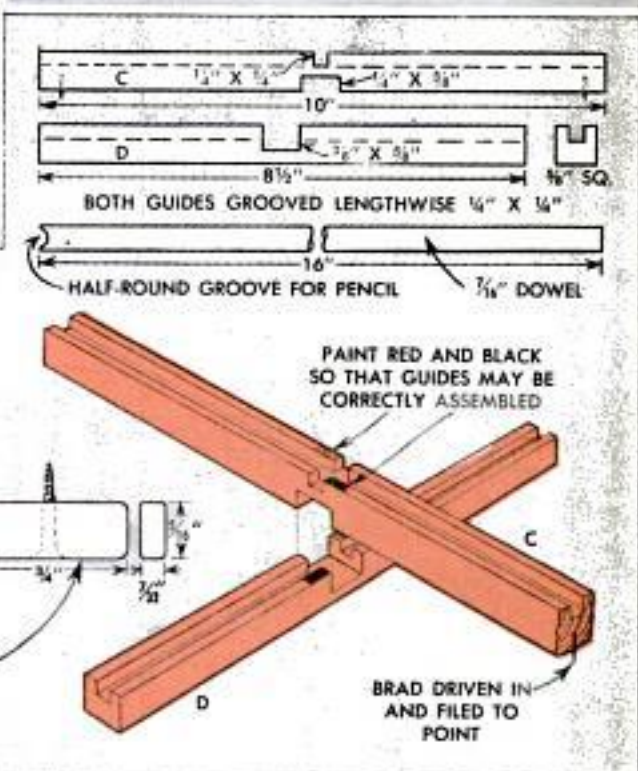
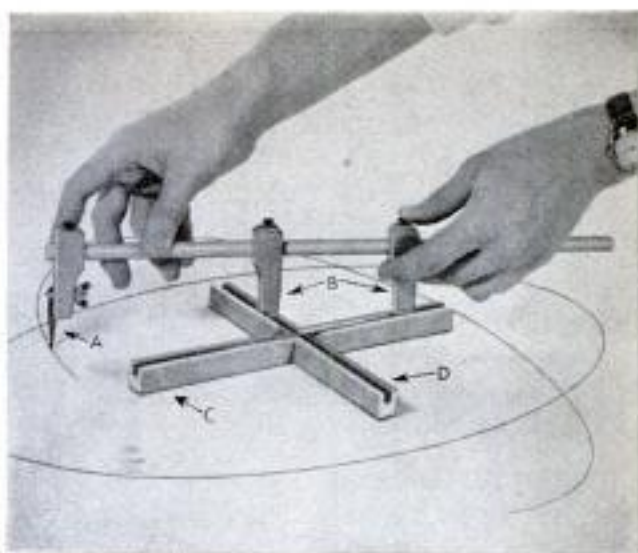


PERFECT OVALS

made with this scriber

This simple bench-made scriber was used by early woodworkers for scribing perfect ovals, or ellipses, when laying out exacting work. It consists of the parts A, B, C and D and a length of $\frac{7}{16}$ -in. dowel. All parts must be accurately made from hardwood. The parts A and B (part B is duplicated) are assembled on the dowel and adjusted to give the size ellipse desired. The swiveling guides on the parts B slide in the grooves cut in parts C and D. The setup is made as in the photo, pointed brads in part C being forced into the surface of the work. Adjust the scribing pencil. Then, with hands in position shown, swing arm right or left to scribe half the oval. Repeat the movement in the opposite direction.

Edw. Zitzman, Sr., Pacific, Mo.



Orders Written on Blackboard Speed Farm Deliveries

Located on the side of a building adjacent to the farm driveway, this blackboard is used to leave delivery orders so drivers



SEPTEMBER 1955

can read them without leaving their trucks. The board is a timesaver for giving special chores or directions to the farm hands, and also serves as a handy "scratch pad" for figuring anything from dimensions to prices.

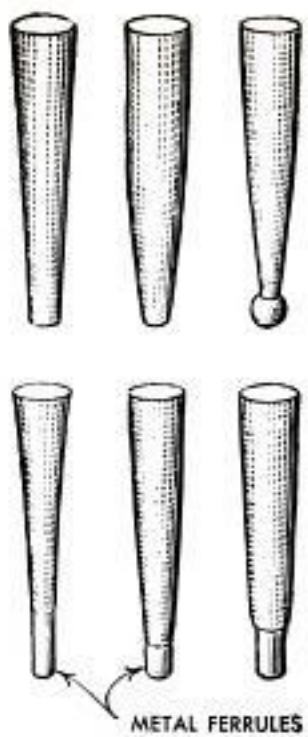
Garden-Hose Washers Improvised From Bottle-Cap Liners

In an emergency, when no regular washers are available, garden-hose connectors can be made watertight by using washers improvised from the cork liners of bottle caps. First, using a sharp knife, cut a disk from the center of the cork, leaving a ring about $\frac{1}{8}$ in. wide. Next, carefully pry out the ring. Because the cork is quite thin it usually will require two for each hose connection.—D. Gower, Guadalajara, Mex.

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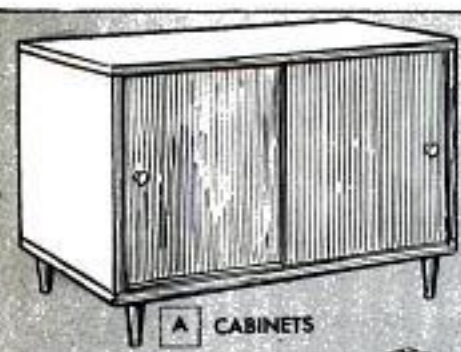


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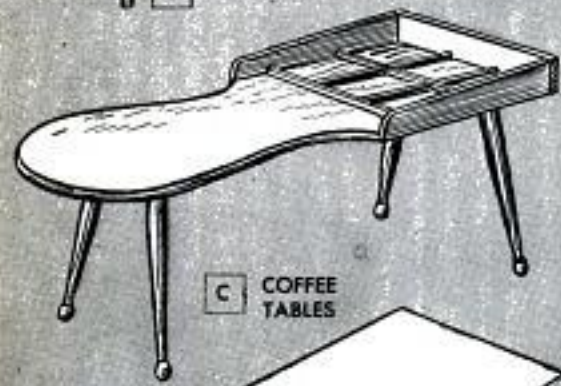


2 LEG STYLES

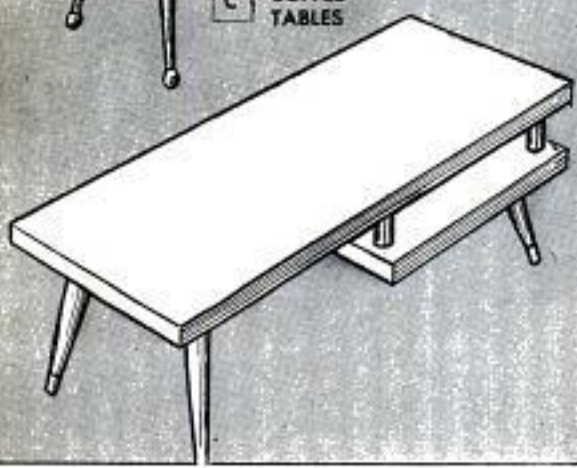
PLAIN TAPERED TURNINGS



A CABINETS

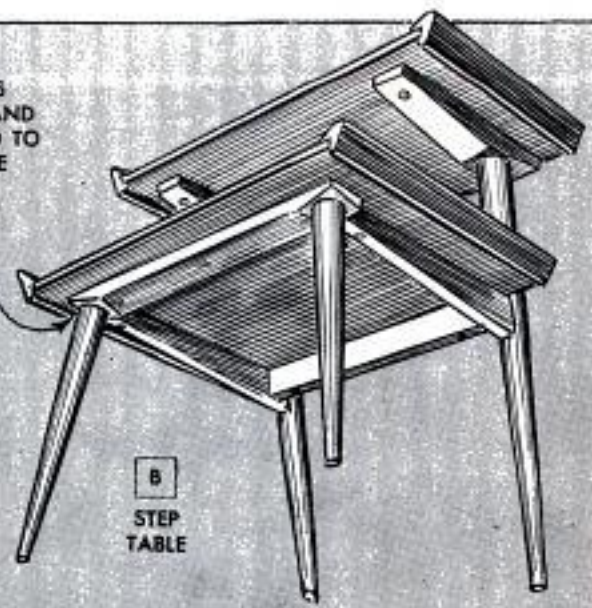


C COFFEE TABLES

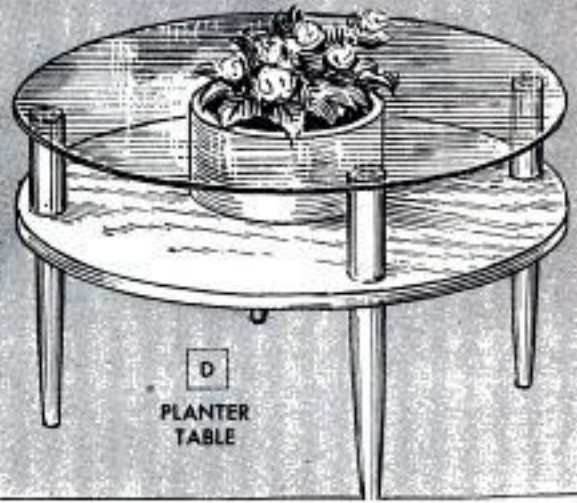


3

LEG IS
GLUED AND
SCREWED TO
FRAME



B
STEP
TABLE

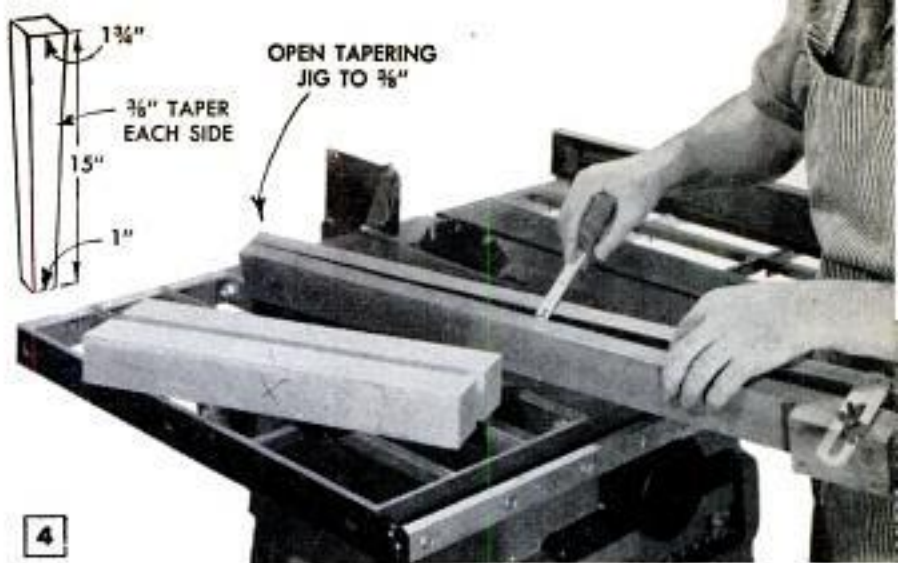


D
PLANTER
TABLE

MODERN DESIGN helps to reduce waste of material by the use of plain tapered turnings for cabinet, bench and table legs. Although there are allowable variations in styling, the plain turning has none of the intricate bead-and-cove combinations which are basic design features of earlier "spool" turnings.

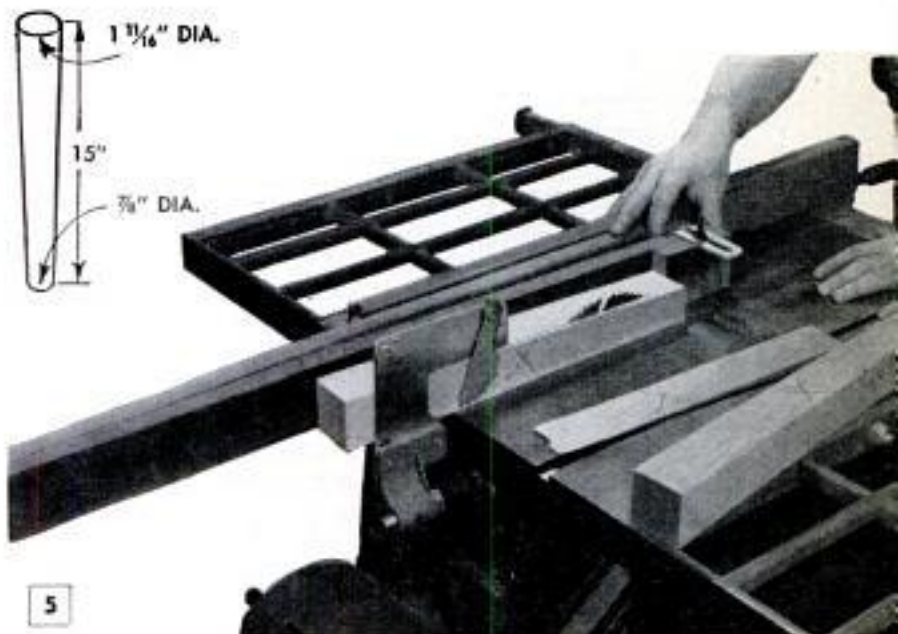
The six styles detailed in Fig. 2 are those in common usage in modern furniture construction. Several applications are shown in Fig. 3, details A to D inclusive. The step table, B in Fig. 3, is pictured in Fig. 1. In any case, the hand-turning job begins with the square and you can save a lot of time and shavings if the taper is first ripped on the four sides of the square with a tapering jig as in Fig. 4. Set to the dimension required for the first two cuts on opposite sides of the square, then rip as in Fig. 5. Reset the jig to twice the first dimension and make the two final cuts. When determining the taper to be used, be sure to provide sufficient stock to allow for turning into round so that you end up with the leg size required.

Where there are no offset tenons or shoulders to cut in, turning the plain taper is a simple between-centers job in the wood lathe. Make sizing cuts at both ends with a parting tool as in Fig. 6, then rough-turn into

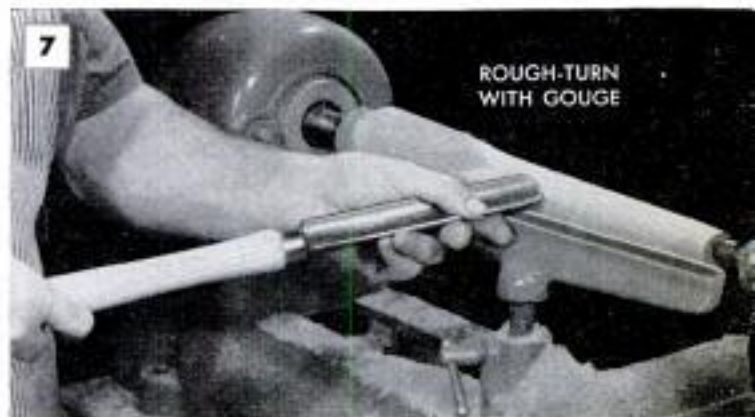
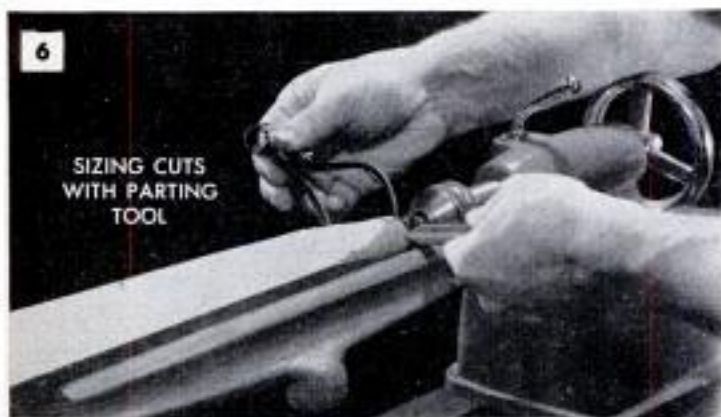


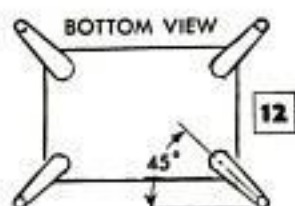
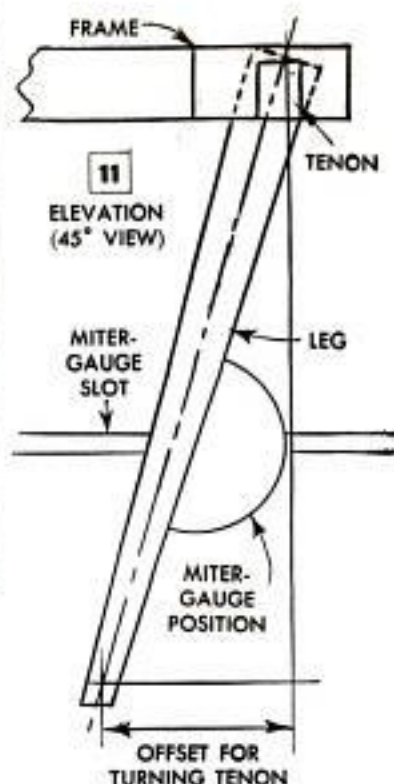
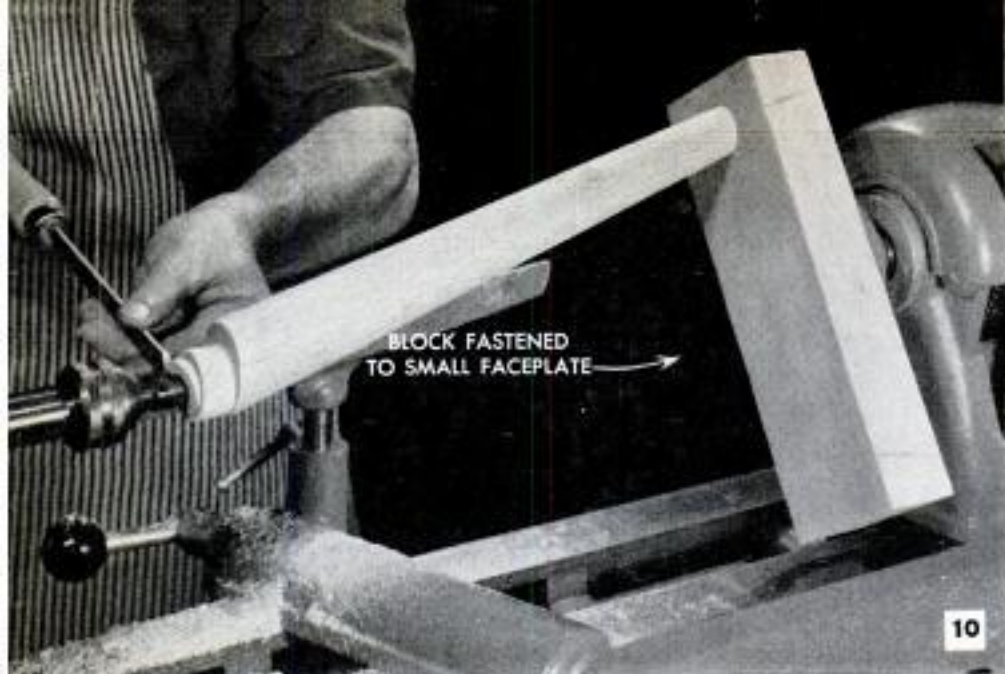
4

You can save a lot of lathe time by tapering the square from which turning is to be made. This is done as in photos above and below, using a tapering jig. When making taper cuts, be sure to allow sufficient stock for rough-turning into round. Plain, straight tapers are turned as in Figs. 6 to 9 inclusive



5





Turning a round tenon on a splayed leg is easy to work in lathe by offsetting as pictured above. By making a full-size drawing of that shown at right you can take off all measurements, also angle for trimming ends

round with the gouge as in Fig. 7. Finish with the skew chisel as in Fig. 8, and there you are. When finished work comes down to a small diameter in proportion to length, it may tend to vibrate under the turning tool when making cuts midway between the lathe centers. When this happens, some turners finish with a block plane as in Fig. 9. The plane must be razor-sharp and set to take a very light cut. In use the plane is held at an angle as pictured. This position gives a clean, shearing cut with the stroke of the plane made toward the tail center.

Where the frame, or base, of the project can be bevel-cut to take the upper end of the leg, the latter can be cut square across for fastening with a screw and glue. Or the leg can be turned with a concentric tenon. But in some cases the nature of the assembly will require the self-tenon to be turned by offsetting at an angle as in Figs. 10 and 11. To obtain accurate offset and angle it is helpful to draw a full-size elevation of the leg joint, Fig. 11. Then make the

Set miter gauge from a full-size detail made from Fig. 11. Then make first trimming cut as shown below

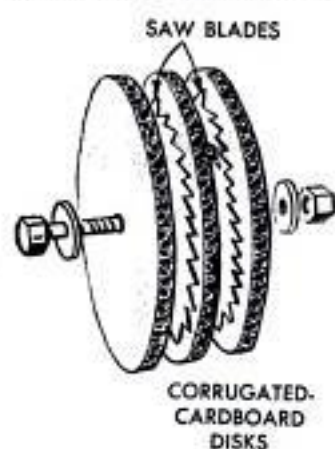
lathe setup in Fig. 10 and turn the self-tenon to the required size. Use calipers to assure a perfect fit as the degree of support afforded by the splayed leg is entirely dependent on an accurate fit of this joint, especially when no stretchers are used.

When metal ferrules are used, Fig. 2, care must be taken when turning the shoulder to obtain a precise fit, as otherwise a slight shrinkage of the wood will cause the ferrule to loosen. When locating splayed legs, with or without ferrules, be sure to place each one in the 45-deg. position in relation to the frame or base on which they are mounted, Fig. 12. If the upper ends of the legs are tenoned, either straight or offset, it is important to make sure that the tenon is cut to the right length, which is slightly less than the depth of the hole into which it is to be glued. When it is necessary to trim both ends of each leg, take the miter-gauge setting from the elevation drawing, then cut as in Figs. 13 and 14, shifting the miter gauge to the opposite groove in the saw table for the second cut. It is important to keep the same side of the turning up for both cuts. ★ ★ ★

Move the gauge to the opposite groove in the saw table and make second cut. Keep work same side up



Circular-Saw Blades Stored Between Cardboard Disks



Spare circular-saw blades can be protected against damage by storing them between disks cut from heavy corrugated cardboard. Cut the disks slightly larger in diameter than the saw blades, then assemble disks and blades on a 1/2-in. bolt. Washers on

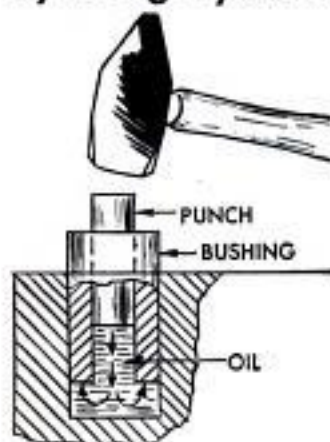
each side of the assembly help prevent bolt head and nut from crushing the cardboard. If the blades are stored in a box with other tools, hardboard disks offer greater protection.—George Kapitan, New York City.

Portable Stile Folds Flat For Easy Carrying



Instead of climbing over a woven-wire fence, which slackens the wire, one farmer uses a portable stile which is easily carried in a pickup truck. The stile folds flat and consists of two short ladders made of 2-in. stock hinged together at the top.

Bushing Removed From Blind Hole By Using Hydraulic Pressure



A "frozen" bushing that must be removed from a blind hole with minimum damage can be forced out by using hydraulic pressure. Fill the hole about half full of heavy oil and insert a close-fitting punch. Wrap a cloth around the punch and hold it down against the

bushing to shield against oil forced out past the punch. Strike the punch sharply with a hammer. The force of the hammer blow will be transmitted to the lower end of the bushing through the oil.



Cistern Cover Sealed to Rim With Auto-Tire "Gasket"

One Ohio farmer has made his cistern cover insect and dirt-tight by using an automobile tire as a gasket under the cover. A concrete rim around the cistern opening is shaped to hold the tire in place. The weight of the cover seals the cistern by forcing the tire tightly against the rim. Should the cover accidentally be dropped, the tire also provides protection against breakage.

Marks Painted on Monkey Wrench Permit Accurate Presetting

An adjustable wrench can be preset to the required-size opening if marks are painted on the shank, as shown in the photo. Use a rule to adjust the jaws and mark the 1/4, 1/2 and 1-in. measurements with a light-colored paint. Paint the 1-in. marks all the way across the shank, the 1/2-in. marks slightly shorter and the 1/4-in. marks shorter still.—R. Hanscom, Elmhurst, Ill.



SHOPPING FOR TOOLS



1

1. STRAPBREAKER provides a safe means of removing steel strapping used on shipping containers. Cuts steel straps to 2 in. wide. Has no moving parts. Head is heat-treated forging with two cutting edges. In use, cutting lip of slotted head is slipped under strap. A push or pull on handle severs strapping

Gustave Lidseen, Inc., 830 S. Central Ave., Chicago 44



2

2. COMBINATION DRILL countersinks and counterbores for common sizes of wood screws in one operation. Available in four screw sizes, Nos. 6, 8, 10 and 12, in lengths from 2 to 2 $\frac{7}{8}$ in. Can be adjusted to countersink screwhead flush or below surface. Adjustable to stop automatically at correct depth

Oswall Tool Co., Ltd., 928 Broadway, New York City

3. HIGH-SPEED CONVERTER multiplies drill-press spindle speeds through a 4-to-1 gear train. Fits any $\frac{1}{2}$ -in. drill-press chuck and high-speed converter chuck holds drill bits from 5/32 in. to No. 80, covering the range of small-hole drilling in cast-iron, brass, aluminum and plastics in the small job shop

Dinzus Machine Shop, 1423 S. 52nd Ave., Cicero 50, Ill.



3



4

4. HAND TAP cuts metric threads in standard sizes and pitches. Widely used in the repair and maintenance of foreign automobiles and machine tools. High-spiral flutes lower torque requirements and cut sharp, clean threads due to added chip clearance. Made from high-speed steel, specially hardened

Shearcut Tool Co., 7045 Durby Ave., Roseda, Calif.

5. SELF-POWERED JIGSAW has tilting frame that permits cutting at any angle up to 45 deg. in either direction, right or left. Built-in sawdust blower keeps working area clear. Has full 20-in. throat clearance. Blade turns 90 deg. right or left for ripping cuts. Machine is supplied complete with motor

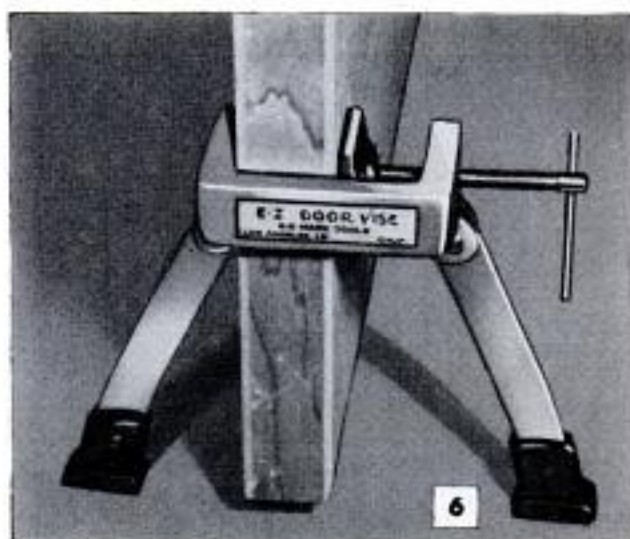
Synco Corp., Oxford, Mich.

6. NONMARRING DOOR VISE holds a door in an edge-up position for boring lock mortises, installing hinges and cutting and fitting panels. Also holds a door in vertical position for glazing or painting. Door cannot slide or tilt while boring and planing operations are being carried out. Vise adjusts to 2 in.

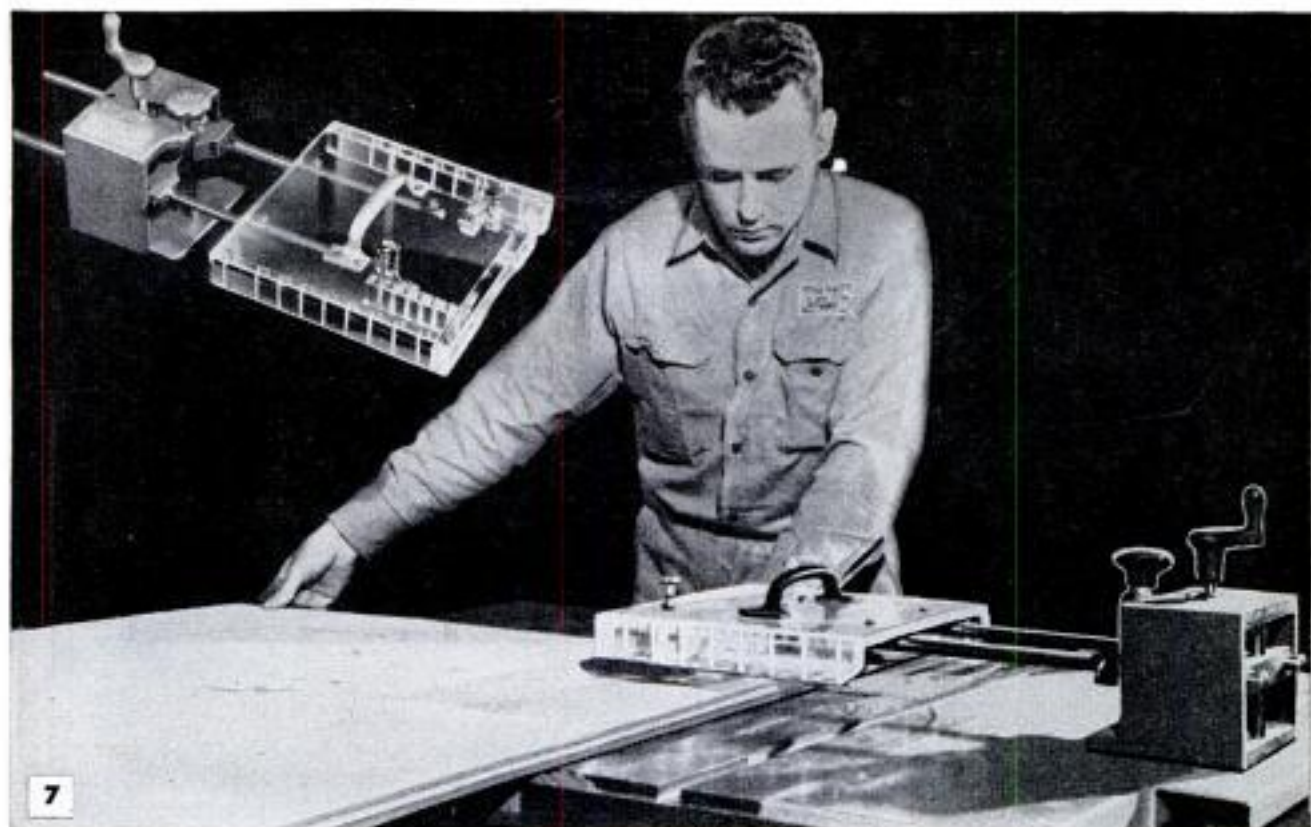
E-Z Mark Tools, Los Angeles 16, Calif.



5



6

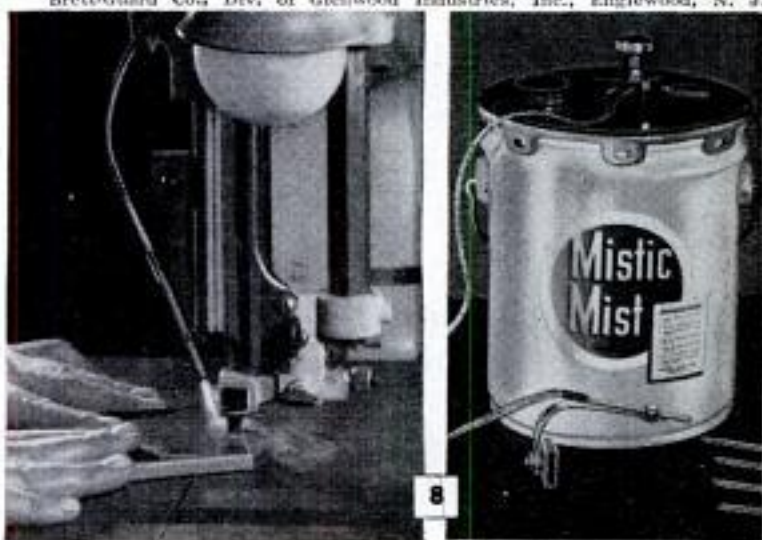


7. SAW GUARD gives full vision from any position for all cutting and grooving operations normally carried out on a circular saw. Unit has antikickback device which is spring-loaded to guard against binding of blade when ripping cross-grained wood. Guard is crystal-clear plastic, chip and break-resistant

Brett-Guard Co., Div. of Glenwood Industries, Inc., Englewood, N. J.

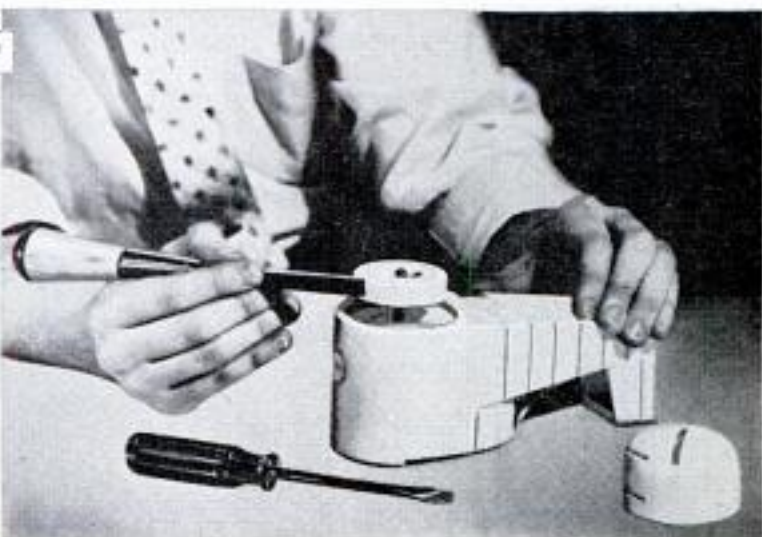
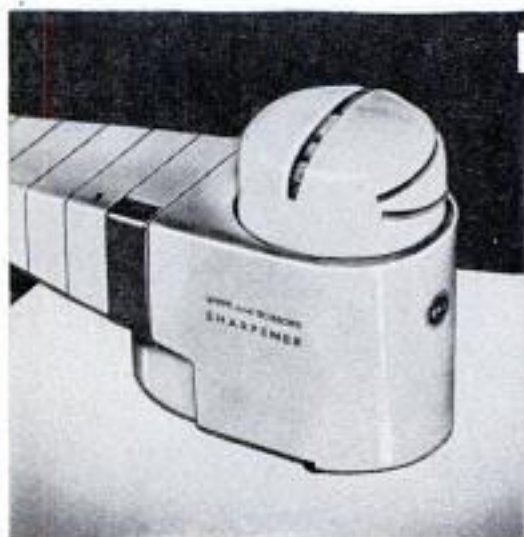
8. MIST COOLING SYSTEM applies coolant to cutting tools in the form of a fine mist that dissipates heat through evaporation of minute liquid particles. Nozzle holder is magnetic, can be attached to any metal part in most effective, convenient position. Eliminates coolant pumps, drip pans

Aetna Mfg. Co., Bensenville, Ill.



9. ELECTRIC KNIFE SHARPENER doubles as a light tool grinder for small chisels, carving tools and bladed instruments. When sharpening cutlery or instruments wheel guard serves as accurate guide for blade. Guard is removable for grinding small chisels and other edge tools on face of wheel

Burgess Vibrocrafters, Inc., Graylake, Ill.



Putty Dam Around Drilling Job Supplies Oil to Bit



You can avoid repeated applications of oil to the bit when drilling metal in a drill press by using a putty dam to confine the oil around the bit. After setting the work, form the dam around the area to be drilled and apply the oil. Be sure the dam is high enough to prevent the bit from throwing out the oil.

Dim Car Lights Brightened With Aluminum Foil



Aluminum foil can be used to brighten taillights, turn-indicator and parking lights that have become dim because of rusted or tarnished reflectors. Press a

sheet of the foil around the bulb inside the light as shown. The lens will hold it in place. Lights not originally equipped with reflectors can be improved in the same manner.

"Trays" for Giant Ice Cubes Are Empty Milk Cartons

Giant ice cubes for quick cooling of hot-weather drinks, or for use in a portable icebox, can be made by filling empty milk cartons with water and placing them in the home freezer. If the cubes are to be used in

a beverage, wash under running water after the carton is stripped off. Washing will remove the wax particles from the waxed carton which freeze into the cube.

Joe Frisch, Cincinnati, Ohio.

Notch Filed in Tailstock Quill Locates Tool Bits on Center

A V-shaped notch filed in the quill of a lathe tailstock will provide a quick means of adjusting tool bits to on-center height. The notch is filed so its upper surface is horizontal and on the exact center-line height. Placing the top edge of a tool bit against the top surface of the notch, then tightening the tool-post screw, locates the cutting edge of the tool bit exactly on the center line.—C. W. Woodson, Chicago.



Insulation Stripped From Wire By Electric Brush

Stripping insulation from the ends of a number of pieces of wire is done quickly with a wire brush. The wire to be stripped is passed through a hole drilled or punched in a sheet-metal shield and held against a rotating wire brush. The length of the portion to be stripped is determined by the length of wire allowed to project through the shield. Light, multistrand wire will require the use of a softer wire brush than will solid wire.





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How to choose the right film for the right job



To suit the wide variety of picture-taking situations you may encounter—and to give you more control over the results—Kodak makes a number of different films. Each has its own special merits and applications. Below, we describe the most widely used Kodak black-and-white and color roll films. It will help you to know what each is especially made for.

One suggestion: learn about one film at a time by *using* it. Learn the proper ex-

posures for various lighting conditions. In other words, find out what the film can actually do for you before you tackle others. That way you'll get the most out of the special qualities built into each Kodak film. And it will show up in the quality of your pictures.

You can process all Kodak black-and-white films at home and make prints and enlargements yourself. Kodak's new Ektachrome Film can also be home-processed.

BLACK-AND-WHITE FILMS



Taken on Verichrome Film, 1/50 at f/8

KODAK VERICHROME FILM is a fairly fast all-purpose orthochromatic film for everyday snap shooting—using either daylight or flash. It will give good tone gradation and moderate grain. It has a wide exposure latitude and thus permits reasonable exposure errors. This saves many a picture when there's neither the time nor inclination to be very precise about exposure. It is ideal, of course, for fixed-shutter, fixed-aperture cameras. It is available in popular roll-film sizes—116, 120, 127, 616, 620.



Taken on Plus-X Film, 1/200 at f/16

KODAK PLUS-X FILM is a fast, fine-grain panchromatic film capable of excellent tone rendition, reproducing colors with the same degree of brightness as your eye sees them. It's the film to use for all indoor and outdoor work when enlargements are to be made from small or moderate-size negatives. It is desirable, too, when brightly colored objects are pictured, or where accurate rendering of delicate flesh tones is sought. Plus-X is available in roll-film sizes, including Nos. 135 and 828, and in film packs.



Taken on Tri-X Film, 1/100 at $f/3.5$, no flash

KODAK TRI-X FILM is a new, extremely fast panchromatic film of moderately fine grain. It is so sensitive that pictures may now be taken in light so subdued that good shots would hitherto not have been possible. Tri-X Film, in effect, gives the man with an $f/3.5$ lens an $f/2$ lens, and enables the man with an $f/2$ lens to get pictures impossible to get before. Because of its speed, Tri-X alternatively permits faster shutter speeds for action pictures or reducing the aperture for great depth of field. Tri-X produces superb pictures indoors with only the daylight that comes through the windows—and because deli-

cate tones are well rendered, the pictorial quality is high. Tri-X Film comes in roll film Nos. 120, 127, 620, 828, and 135. It is not recommended for fixed-aperture, fixed-shutter cameras unless the light level is quite low.

KODAK INFRARED FILM—a special-purpose film—produces unusual dramatic effects. Skies come out almost black, clouds fleecy white, and foliage very light. With this film and special infrared flash bulbs you can also make pictures in complete darkness. Kodak Infrared Film is available in 35mm magazines and in several sheet film sizes.



Taken on Infrared Film, 1/25 at $f/8$

COLOR FILMS

KODACHROME FILM gives you 2 x 2 slide transparencies in full, brilliant color. You can enjoy them in a hand viewer, project them on a large screen, and have them made into prints and enlargements. Kodachrome is available in miniature camera sizes Nos. 135 (20 or 36 exposures) and 828 (8 exposures) in both Daylight Type for outdoor shots, and Type A for use with flood or flash lamps.

KODAK EKTACHROME FILM is a new, fast color film in both roll and miniature sizes which provides excellent color transparencies comparable in quality to the Kodachrome type of film. But Ektachrome is three times as fast outdoors as Kodachrome. This makes it particularly valuable in situations where subjects are poorly lighted, or when faster shutter speeds to stop action are necessary. Ektachrome comes in Nos. 135 and 828 sizes, which give you 2 x 2 color slides for viewing in a hand viewer, projecting on a screen, or from which color prints can be made. The 120 and 620 roll-film sizes are generally used for making prints only, although there are projectors large enough to accommodate them in the

form of slides. Both Daylight Type and Type F (balanced for clear flash lamps) are available. Processing is done by local laboratories through your dealer. Or you can develop Ektachrome Film at home, if you wish, with the Kodak Ektachrome Processing Kit, Process E-2, \$1.80. Kit capacity is six 20-exposure 135 magazines or ten 828 rolls; for 120 and 620 film, four to five rolls.

KODACOLOR FILM, when developed, results in a "color negative" from which sparkling color prints are made. Kodacolor snapshots can be made with most any roll-film camera. It is fast enough to be used even in a simple-lens camera.

Kodacolor is available in Daylight Type or Type A for artificial light. It comes in popular roll-film sizes—116, 120, 127, 616, 620, 828.

Your Kodak dealer will help you select any Kodak film you need. He also has the Kodak Films Data Book which gives detailed information of these and other Kodak films—each designed for a particular purpose.

Prices subject to change without notice

Eastman Kodak Company, Rochester 4, N. Y.

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SEATING NEW RINGS

Even the best re-ring job depends, for enduring satisfaction, on how the engine is driven during break-in. When the engine is started for the first time with new rings, it should be accelerated quickly to an engine speed equal to 25 to 30 mph. This insures getting plenty of oil up onto cylinder walls and rings. Keep engine at this fast idle until it reaches normal operating temperature. Do not allow engine to idle at low speed during the warm-up period, and never run cold water through the radiator while seating new rings.

After engine is warmed up, drive car in low or second gear, to insure good lubrication and reduce load on compression rings. Accelerate in second gear to 35 mph, then drop back to 25 mph. Continue for 10 minutes. High idle speed with a light load as in second gear prevents overloading pistons and rings. Drive at 50 mph for first 200 miles.



TIMING WITH HIGH OCTANE

If the timing of your engine hasn't been checked lately, this should be done to make sure it is within manufacturers' specifications. With high octane gas, timing may be advanced, but only as specified. If you use high octane continuously, advance timing until a slight detonation is heard when you accelerate in high gear from 19 to 30 mph. Now retard timing just enough to eliminate the detonation, then idle and check for smooth operation. For economy, engine should be timed for the type of gasoline you use.



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For professional suggestions on car care, send a postal card for your free copy of Sealed Power's new illustrated manual, "Care and Feeding of Engines." And when you re-ring, be sure to use Sealed Power KromeX Ring Sets—for fast break-in, for immediate oil economy, and for double ring life. They are the best ring sets built, proved in millions of road miles. Sealed Power, Dept. G-9, Muskegon, Mich.



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PISTON RINGS

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As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.

Cold-Air Returns

Q—I have a hand-fired gravity heating system. Two rooms, one upstairs, one down, have never been comfortably warm. There are three cold-air registers, one in the hall, one in the living room and one in the kitchen. Is there any way to alter the installation to obtain uniform heating?—E. D., Mich.



A—Without a plan of the installation, we'll have to guess the cause and probable remedy. In this we are assuming that the cold rooms are not shut off from the rest of the house, that is, by a closed door, screen or drape. Usually the trouble in such cases is a lack of sufficient cold-air returns to maintain a proper circulation of air in all the rooms. Another possible reason is restriction of existing cold-air openings by placement of furniture, built-ins or rugs. You do not say whether the cold-air return in the hall is upstairs or down, but it is probable that its location would make little difference if the fault is a lack of adequate cold-air intake. However, if a new cold-air duct is installed the register should be upstairs, in the cold room if possible, if the cold-air register in the hall is downstairs. Conversely, if the existing cold-air register is upstairs then the new one should be placed downstairs. This arrangement is more likely to effect an equalization of air circulation. If it is possible, the new duct should be brought directly into the furnace jacket. It is likely that the installation of a new duct, with a cold-air intake located as suggested, will help correct the trouble.

Mildew in Closet

Q—We are troubled with mildew in clothes closets. It has damaged clothing, luggage and leather footwear, some items so badly that they had to be discarded. The two closets giving the greatest trouble have no windows. Would installation of windows help? Is there any other practical solution?—R. N., Ala.



A—It is probable that installing a window in each of the two closets would help, provided the sashes were adjusted to give some ventilation. Also there is the possibility that installing of louver

(Continued to page 226)

ALL ABOUT TOBACCO... INCLUDING SEVERAL REASONS WHY

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Only Edgeworth gives you slow-burning "chunks" made for pipes and pipes alone.



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Tobacco experts know white burleys are the world's coolest smoking tobaccos. Edgeworth is a blend of aged burleys only. Other tobaccos use white burley too—but nobody yet has found how to process tobacco to give it the even-burning, cool-smoking character of Edgeworth "Ready-Rubbed".

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WOLF'S HEAD OIL REFINING CO., INC.
OIL CITY, PA.

(Continued from page 224)

doors in the closets would provide for sufficient air circulation. However, these alterations would be rather expensive to carry out. A cheaper way, and in most cases even more effective, is to install a receptacle near the baseboard for a 60-watt bulb. The receptacle should be of the flush type and wired into the lighting circuit so that it can be controlled by a wall switch. The bulb should be provided with a protective shield so that it cannot be broken by any object falling from above. The heat from a single 60-watt bulb will "dry" the air in the average-sized closet sufficiently to prevent the formation of mildew. Larger closets will require two bulbs, one at each end of the closet and located just above the baseboard. Also, there are special low-wattage electric heaters available which are designed to eliminate dampness and mildew in small enclosed areas such as clothes closets.



Curled Shingles

Q—The composition shingles on our new home seem to have curled so that the butts are raised noticeably. Near the ridge on one side the shingles appear to have buckled, resulting in a long, wavy ripple. What is causing this? Are there any preventive measures?—T. O., Neb.

A—Probably the most likely cause is shrinkage of the roof boards which, of course, is due to use of lumber not properly seasoned at the time of application. Insufficient nailing of the boards also can be a contributing factor. Adjacent boards, one or both of which shrink in varying degree, can set up a lateral pull on two or more courses of shingles and cause the buckling you describe. Boards insufficiently nailed may cup badly in drying. Shingle butts that come directly over cupped boards may be raised as much as 1/2 in. Adjacent rafters that bow upward in drying are also a contributing cause. Unfortunately, there isn't much you can do directly to remedy the defect. However, time is on your side as drying of the rafters and roof boards will cause them to stabilize at some point. As soon as stabilization occurs the shingle butts will gradually level sufficiently to correct the defect, or at least minimize it to such an extent that it is no longer objectionable. Buckling usually will correct itself in time, for the same reasons.

Wet Basement

Q—Water seeps into my basement every time there is a hard rainstorm. It seems to come in where the walls meet the floor and also around the footings of the center supports. There is never any great quantity of water, never more than an inch or so. It does not back through the drains. I'm told that the installation of vertical pipes, or stacks, in the drains will cure the trouble. The pipes are threaded to screw into special fittings installed in the drains. Will these help to cure my trouble?—R. O., N. J.

A—Ordinarily, we do not recommend the installation of the so-called "pressure" pipes to cure the trouble you describe as they do not relieve the pressure at the point of seepage in the average basement floor. There are several procedures, all of them comparatively expensive to carry out, but they do effect a permanent cure if the work is properly done. If the original floor is cracked or otherwise in bad condition, it's generally best to break it up and lay a new 4 to 6-in. reinforced floor over a tamped gravel fill. After the old floor has been removed and before the new floor is poured, it's a recommended procedure to cement-plaster the walls from the footings to the grade level, running in a well-rounded cove at the point where the wall meets the footing. When the new floor is poured, it is reinforced with 3/4-in. rods laid 8 in. on centers in two directions. Another method is pouring a new floor over the old where there is sufficient headroom. The surface of the old floor must be acid-etched, or scarified by chipping so that the new floor will bond to it.

- A. Ball-Race Steering gets a workout on the "skid pad" at General Motors Proving Grounds.
- B. The reduction in actual turning effort is measured by a recording wheel attached to the normal wheel.
- C. A Chevrolet's front wheels are turned—with velvety ease—by these 54 micro-polished steel balls.

"Here's why Chevrolet is easier to steer"

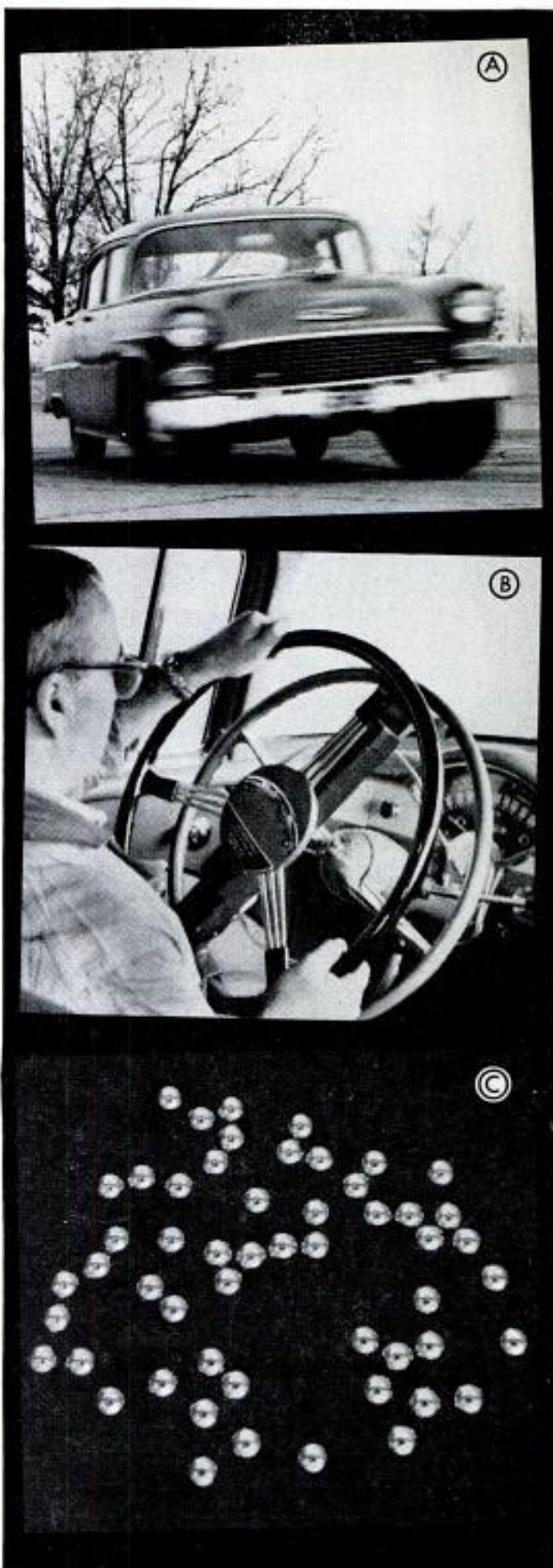
says Ed Cole, Chevrolet Chief Engineer

One thing that can rapidly turn driving fun into driving fatigue is heavy, stiff steering. This is a serious problem with modern cars, where so much of the weight is on the front wheels.

When we were designing the 1955 Chevrolet we attacked this problem in two ways: First, we moved the center of weight back to lighten the load on the front end. And then we incorporated Ball-Race steering, which substitutes the *rolling* friction of 54 micro-polished steel balls for the usual *sliding* friction.

If you imagine the steering column as a sort of giant bolt, the "threads" on this bolt are a closely packed spiral of those steel balls. When you spin the steering wheel the ball-bearing threads rotate inside a huge "nut" that is linked to the front wheels, pushing it down or up and thus turning the car.

That's how Ball-Race steering creates a manual system that comes awfully close to the ease of power steering—as you'll discover on your first demonstration drive. Why don't you sample it, soon, at your Chevrolet dealer's? . . . Chevrolet Division of General Motors, Detroit 2, Michigan.





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MARLIN .35 CAL.

**Now Only
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Carbines! \$10 Price Reduction Also
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HERE'S the only gun in this brush-blasting caliber that provides the split-second speed of lever action.

A terrific value . . . a tremendous favorite . . . at its original price of \$78.95! Practically a "steal" now—at only \$68.95*!

Available with regular pistol grip . . . or "Texan" style, with straight grip. All Marlin 336's are factory drilled and tapped for Weaver and other top mounts.

See your Marlin dealer now (name of one nearest you available on request). Many Marlin dealers have an installment finance plan for you.

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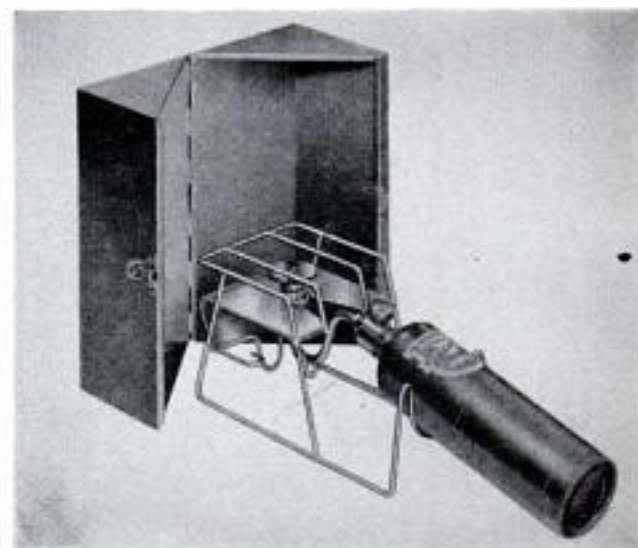


Toy Helicopter

Unlike most toy helicopters, which merely look like the real thing, a tiny craft driven by electricity actually flies. The helicopter, which is maneuvered from a remote-control box, was developed by Jack Bennett, an American airplane pilot living in Bad Homburg, Germany. A German firm is planning to manufacture the toy.

Portable Camp Stove

It takes only seconds to set up a portable gas camp stove fueled with a disposable tank. The unit fits into a metal carrying case 11 inches long, 5½ inches deep and 5½ inches wide which also serves as an adjustable wind shield. The entire package weighs only six pounds. The burner lights instantly and can be regulated for varying cooking requirements. The unit's light weight, compactness and economy of operation make it ideal for camping, picnics and summer-cottage use.



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Pennzoil with Z-7 keeps vital parts free from all harmful contaminants. Allows the *Tough-Film*® to lubricate completely, *unlocking* horsepower for instant response, for better gasoline economy.

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Clymer Tests the Clipper

(Continued from page 118)

The front end is designed for a soft ride. It is unusually soft for a torsion-bar system. In fact, I think it is too soft because at high speeds, while cresting the top of a sharp incline, I jumped the car at 60 miles per hour. The torsion system held the front end off the ground longer than it should and, in one instance at very high speed, the wheels actually left the ground. Heavier shocks to control the rebound would correct this situation.

There is a minimum of tire squeal on the corners. Due to the soft springing, there is considerable dip to the front end when the brakes are applied quickly. Packard engineers have tried to maintain the traditional American car soft front-end ride (desired by most buyers) and yet secure the advantages of the torsion-bar system with typical sports-car handling characteristics. It's a good trick if you can do it and Packard has succeeded to a certain extent. A switch under the dashboard disconnects the equalizer motor and this should be done when the car is left standing, as children and adults seem to find this device fascinating to watch in operation. An improvement over the manual switch control would be to have the switch turn off when the hand brake is applied with a flasher warning light attached, and to go on again when the brake is released, or, perhaps, to go off when the ignition is turned off.

The steering wheel, lock to lock, requires $3\frac{7}{8}$ turns, which is satisfactory (the $4\frac{3}{4}$ turns on cars without power steering seem excessive.) The turning diameter, curb to curb, is 41 feet with the power-steering car I drove—not bad for a 122-inch wheel-base automobile.

The Clipper brakes are better than on previous models, but I did find some fading while doing a lot of braking on descending hills and turning sharp corners. The pedal action requires a little more pressure than with other power brakes.

The Clipper Custom is one of the fastest stock cars in the United States today. The speedometer indicated over 116 miles per hour. The car operation is so smooth that it would creep up to 90 and 100 almost without effort on long, open stretches. It was so smooth and fast that I felt the speedometer must be much too fast, but, to my surprise, it was only about 7 percent fast at 100 miles per hour.

Economy was satisfactory, the consumption being perhaps a little on the high side, but I abused the car far more than the

(Continued to page 232)

"Pro" Glue Gives Hobbyists "Pro" Results!

For years Weldwood® Plastic Resin Glue has been the "Old Reliable" of professional cabinetmakers. Now, more and more hobbyists are using this "pro" glue. It's the best wood glue made! Makes glued joints stronger than the wood itself. The joints actually grow stronger with age. Weldwood Plastic Resin Glue is highly water-resistant too! Try it today.



YOU can machine Jobs 20 minutes after Gluing!

You save a lot of time when you can machine a job just 20 minutes after gluing! Hobbyists who use Weldwood Presto-Set® Glue often do just that! Presto-Set Glue is ready-to-use! Sets fast! Bonds like magic! It's the first white glue worthy of the Weldwood name. Bonds wood to wood, wood to cloth, cloth to paper, upholstery fabrics to wood, and many, many other combinations! Let this Wizard with Wood speed things up around your workshop!



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Weldwood Glues... Satinlac,® Firzite® are available at all hardware, lumber and paint dealers.

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Painters' Secret Revealed!

Many hobbyists have been wondering how professional painters get those beautiful natural wood finishes. The magic word is Satinlac! Satinlac gives a handsome, satiny effect which wears well and is easy to maintain. Dries so quickly it's ready for the next coat in just 3 or 4 hours. In a jiffy you have a "custom-finished" job!



Clear Firzite tames Wild Wood Grain!

Now it's easy to give fir plywood the appearance of costlier woods. When staining, start with a coat of Clear Firzite. It soaks into the wood pores and subdues the wild grain. Practically eliminates grain raise and face checking. For oak, walnut and mahogany stains, add colors-in-oil.



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For... The job saves there n... of the glue maker and remember specially tackle. choice of s... cause they're the choice men who know glues best...

New Way to Bond Micarta without Clamps or Presses!

Now, it's really easy... even for an amateur... to apply plastic surfacing materials like Micarta to table tops, kitchen counters, bathroom and powder room surfaces. Sensational new Weldwood Contact Cement bonds instantly and permanently on contact—without clamps or presses. Has a thousand and one other uses around home, shop or garage. Also... it enables you to put up plywood without nails. This Wizard with Wood bonds all combinations of wood, cloth, leather, paper, glass and metal (including do-it-yourself aluminum).



Blond Finish on Furniture? Use White Firzite!

Now you can give furniture a blond woodsy finish without a "painty" or artificial look! Finish it yourself with White Firzite. This Wizard with Wood is equally wonderful for getting an eye-catching pickled finish. For tinted effects add colors-in-oil. (On soft wood or fir plywood paint jobs, White Firzite as an undercoater helps prevent grain raise and checking.)



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Amazing new TWO BY FOUR Attachment makes all sawing easy! Cuts 1-11/16" at 90°, 1-3/8" at 45°. Professional power saw features, too; Telescope Guard, Rip Fence Guide, Bevel and Depth Adjustments. Easy-grip handle for one-hand perfectly balanced use. Any Cummins 1/4" pistol grip geared chuck drill runs it. At your Cummins Dealer—Now!

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New Saw Table has *Para-Lock* Rip Fence!

TWO BY FOUR Attachment hooks to new Saw Table in seconds. Table has exclusive *PARA-LOCK* Rip Fence Guide—automatically aligns guide with blade. Table top 14-3/4" x 15-1/2". Easy to add wood extension for 24" x 24" surface. Complete with 10" miter gauge \$12.95.



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Cummins Drills run quieter, smoother, longer. They're made better, with shock-proof gears, double-coil motors, dynamically balanced armatures—to give better job results. Cummins Model 304, shown, \$24.95 Others from \$19.95 to \$34.95



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average driver would. I added one quart of oil at about 500 miles.

Packard has improved their Ultramatic transmission which, as I have said before, was already the best automatic transmission offered in any car. The new Twin-Ultramatic combines all of the desirable features of the old Ultramatic and, in addition, offers dual speed ranges permitting the driver to select the range most desirable to satisfy driving tastes and conditions. One drive range is provided for normal forward driving. It reduces engine speed and provides smoother starting from the complete stop and is especially desirable when starting on snow, ice or wet pavement. A second range is provided for fast acceleration in traffic. This range is called "Dart." I found the normal driving range to be extremely smooth from a standstill to top speed. In the Dart range, the car has a terrific acceleration and very few production cars today can stay with the Clipper while accelerating from zero. With the throttle wide open, the upshifts are constant with no jerk. However, once in second gear, when the throttle is depressed at speeds below 25 miles per hour, the downshift is quite rough and acceleration is terrific. The car jumps away so fast it will spin the wheels on dry pavement. I don't like this leaping action below 25 or 30, but it smooths out above 35 miles per hour.

A two-stage torque converter with a direct-drive clutch is used, hence when the clutch is engaged by automatic action there is a positive drive with no possible slippage. It now also combines a two-speed automatic planetary train. Packard claims it gives the highest torque in the industry. It really gives the driver a choice of two automatic drives.

The best feature of the new Twin-Ultramatic is the fact that, in both of the driving positions, when the throttle is depressed about half way (instead of all the way down), the downshift takes place instantly and with excellent effect.

The shift-lever movement is smooth, but there is not enough space between the High and Low shift positions. The indicator selection is too precise and more movement of the lever should be required between these two positions. The indicator dial is mounted on the instrument panel. It should be closer to the steering wheel, as the steering hub partially obstructs the dial letters.

The driving position is comfortable and the seat is of chair height. This driving position, coupled with the torsion-bar suspension, gives the most relaxed ride that

(Continued to page 234)



All-chrome portable spotlight has powerful 4½" sealed beam unit. Perfect for night car repairs, spotting street signs, etc. Plugs into lighter socket. Pistol grip handle, with built-in on-off switch. 6 volts. 10-ft. cord included. (26414) **\$5.59**



It's easy to repair brakes with Wizard Master and Wheel Cylinder Kits. Includes live rubber cups, boots; precision made valves, springs. For most cars, trucks. Master Cylinder Kits, less piston (25820-48) from..... **69c**
Wheel Cyl. Kits (25905-28) from. **39c**



More pep and power! Marvel Mystery Oil lubricates top piston cylinder rings, hydraulic valve lifters of late model cars. Makes starting easier. For both crankcase, gasoline tank. Ideal year-around additive. 4 oz. (A1315) **30c**, Pt. (A1316) **85c**, Qt. (A1317) **\$1.35**

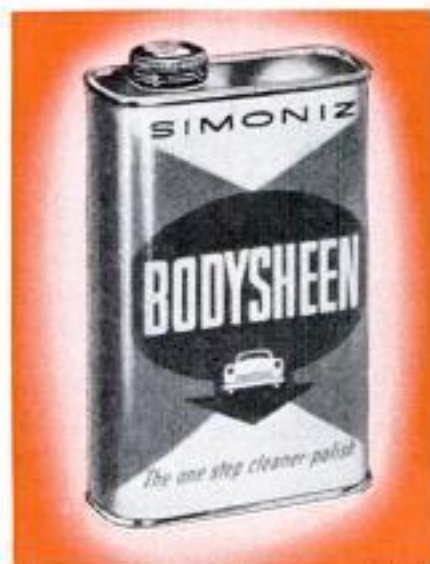
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The one-step cleaner-polish! New Simoniz Bodysheen cleans and polishes, in one easy step. Just wipe on, then wipe it off! Brings out natural brilliance, enriches colors. Gives your car a long-lasting, weather-resistant finish. (27112)..... **98c**



Add new beauty and style to your car's interior, and protect your floor mat from wear with these handy rubber Utility Mats. Also has many uses around the house. Your choice of 5 colors. 17" x 17" (26102-09) **Ea. 95c**
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NEW Coleman Portable COOLER - Newest "Pal" for more fun on picnics, camping, outings of all kinds. Low "K" factor holds cold longer...keeps food, drinks cold, fresh. All inside corners rounded—easy to keep clean and odor-free. Soldered leak-proof. Exclusive latch opens with finger-touch. 3 sizes. Top quality at low price. See them today!

side corners rounded—easy to keep clean and odor-free. Soldered leak-proof. Exclusive latch opens with finger-touch. 3 sizes. Top quality at low price. See them today!

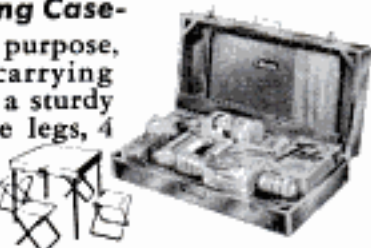
Coleman Floodlight Lantern means more hours of fun outdoors. Floodlights 100-ft. area. Lights instantly. Burns 8 to 10 hours on one filling. Safe; stormproof. Coleman Reflector makes it a powerful spotlight. Single, double mantle models.



Coleman Folding Camp Stove cooks like a gas range, any place, anytime. Lights instantly. Burns low cost fuel readily available. All the heat you want for any cooking—instantly regulated. Folds up and carries like a suitcase.* 2 and 3-burner models.

cost fuel readily available. All the heat you want for any cooking—instantly regulated. Folds up and carries like a suitcase.* 2 and 3-burner models.

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I have ever experienced. I was less tired driving this Clipper Custom 769 miles than I would have been in any other car.

I found the body to be tight and no leaks or rattles developed, although there is considerable hood flutter on rough roads. Very little vibration was noticed, with the exception of a slight steering-wheel vibration at about 40 miles per hour while accelerating. This vibration diminishes as speed increases.

The interior of the car is nicely furnished and the instruments well arranged. There is an excellent view of all instruments and no upper half of the horn ring to obstruct vision. Temperature and fuel gauges have needle indicators, but Packard is using warning lights for generator and oil signals. I prefer needles.

The glove compartment is large and well located directly in the center. The starter is key-operated.

The windshield wipers are positive and efficient because an engine-driven rotary-type vacuum pump provides vacuum at all engine speeds. Smokers are going to enjoy the Clipper because it has two large ash trays, one on each side of the dash.

The windows open or close easily with $3\frac{1}{2}$ turns of the crank. The doors open easily from the inside and have a solid feel when closing. Door opening from outside is by push button and they are the easiest-opening doors of any car I have ever driven.

The foot throttle and brake pedal are very close to each other. In fact, they are a little too close. A wider brake pedal extending farther to the left would be desirable in this instance.

The left-hand-operated parking brake operates satisfactorily but is a rigid shaft. A hinged pivoted bracket would permit smoother operation. The T-handle should be mounted nearer the door because, when the brake is on, the handle extends too far back and too close to the driver's left leg.

Packard engineers, like too many others, have forgotten the need for practical bumpers. Two bulletlike extensions project from the front bumper. These projections may have eye appeal, but they are impractical as, when they strike the bumper of another car, they have no flat surface to match up with the car in front. As a result, these sharp bulletlike projections either go above or below the rear bumper of the other car. I can't understand the use of impractical bumper projections on any car.

There is an amazing amount of trunk space.

Packard has taken a few bold steps in 1955 and when such radical changes take place there are bound to be some "bugs." Most seem to have been corrected. ★ ★ ★

Good News for
budget-minded
HANDYMEN...



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NOW BUY THIS BASIC POWER TOOL WORKSHOP

by **SHOPMASTER**

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- All steel stand is 26" deep, 34" long and 36" high
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- Both tools have sealed-for-life ball bearings
- Saw-jointer combination, stand and motor sell for only \$174.50

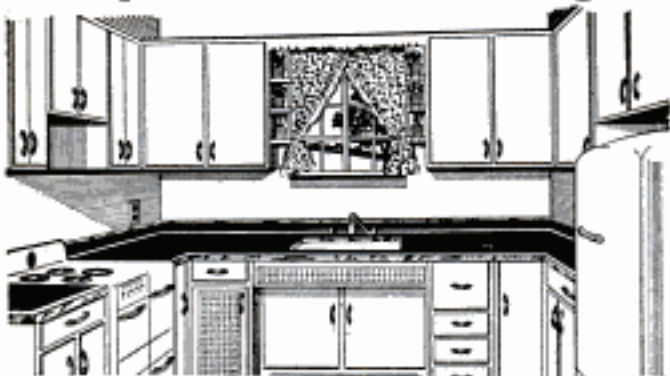
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Full-Size EASI-BILD Pattern #201, Kitchen Base and Wall Cabinets, only \$1.00. Just trace, saw, assemble. Send \$1.00 in cash or stamps to Elmer's Pattern Dept., PM-95, P. O. Box 215, Pleasantville, N. Y.

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Make your kitchen a joy to work in—a pleasure to live in—inexpensively! Do it yourself with these easy-to-follow patterns. Just be sure to glue cabinets and put on plastic laminate counter tops with materials the professionals use. ELMER'S® GLUE-ALL is the strong plastic glue that speeds assembly. It's quick-setting, won't stain. Comes in handy squeeze applicator. ELMER'S CONTACT CEMENT bonds plastic laminates to plywood. Never needs clamping... highly resistant to heat, water. Outperforms others in stress tests. The Borden Company, Chemical Division, Dept. PM-95, 350 Madison Ave., N. Y. 17, N. Y.



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The simple sensible Red-Kut way as thousands have—SAVE HALF. SHOP TESTED PLANS "SPIRIT OF THE CENTURY" Narrow waist 80" tall or stately straight side "SPIRIT OF AMERICA." EASY-TO-FOLLOW photopack plans tell all—plus BROCHURE of heavy brass weight Westminster, tube chime, movements, gorgeous dials, 3/4" solid mahogany case kits. Send \$1.00 today—Both plans \$1.50 NOW.
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Finest quality Boat Kits at the lowest prices in history! Mahogany decks. Easy to build.
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CHECK THESE FEATURES: size—4"x7"x5 1/2"; weight—4 1/2 lbs., including batteries; rugged aluminum case; long battery life; six sensitivity ranges; large 1"x1" NaI crystal

• **HIGH QUALITY** • **MODERATE PRICE**
Write for FREE details
GOLDAK COMPANY 1542PM W. GLENOAKS BLVD. GLENDALE, CALIF.

Packard Owners Like Torsion-Bar Suspension

(Continued from page 122)

Clipper owners engine trouble was more frequent as you will see by reading the percentage table on page 121.

The most-frequent engine troubles were oil consumption and noisy valves.

"Uses too much oil. Rings failing to seat. I am to get a new ring job."—Minnesota engineer and Clipper owner.

"Noisy. When cold, it sounds like a threshing machine at the start."—Florida sales manager and Clipper owner.

SPECIFICATIONS		
1955 PACKARD and CLIPPER		
ENGINE		
	Clipper Super Clipper Deluxe	Clipper Custom Packard
Type	OHV V8	OHV V8
Bore and stroke.....	3.8125 x 3.5 in.	4.0 x 3.5 in.
Piston displacement...	320 cu. in.	352 cu. in.
Brake horsepower.....	225 at 4600 r.p.m.	245 at 4600 r.p.m. (Custom) 260 at 4600 r.p.m. (Packard)
Compression ratio.....	8.0 to 1	8.5 to 1
Transmissions	3-speed conventional Ultramatic standard and Ultramatic	standard all Clippers; all Packards; Over- drive optional all Clippers
GENERAL		
Steering wheel turns, lock to lock.....	4 3/4	3 3/4 with power steering
Turn circle, curb to curb	43 ft.	45 ft.
with power steering..	41 ft.	43 ft.
Suspension	coil springs, front leaf springs, rear	torsion bars, front torsion bars, rear
BODY		
	All Clipper models	Packard models
Shipping weight.....	3700 lb. 3917 lb. (Custom)	4355 lb.
Wheelbase	122 in.	127 in.
Tread, front.....	59.8 in.	60.0 in.
Tread, rear.....	60.0 in.	60.9 in.
Height over-all.....	62.0 in.	62.3 in.
Width over-all.....	78.0 in.	78.0 in.
Length over-all.....	214.8 in.	218.5 in.
INTERIOR DIMENSIONS		
Front hiproom.....	62.8 in.	62.8 in.
Rear hiproom.....	62.0 in.	62.0 in.
Front headroom.....	36.2 in.	36.2 in.
Rear headroom.....	34.5 in.	34.9 in.
Front legroom.....	43.3 in.	43.0 in.
Rear legroom.....	43.8 in.	48.8 in.
CAPACITIES		
Oil	5 qt.	5 qt.
Water	26 qt.	26 qt.
Gasoline	20 gal.	20 gal.

Here are some more owner's quotations about engine troubles:

"Water leak in head."—Illinois township supervisor and Clipper owner.

"Tendency for oil to foul plugs. It is now remedied."—New York confidential investigator and Clipper owner.

"Had two head gaskets replaced."—Pennsylvania service-station operator and Clipper owner.

(Continued to page 238)

Special BLUEPRINT SALE 10 for \$1.00

A plan for every project—no matter what it is . . . modern home furniture, workshop bench, model ship, toy, ice yacht. We have a limited number of blueprints available at 10 for \$1.00, regularly 40c each! You can save dollars by buying now!



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Beginner or craftsman, you will know exactly how to give your project that professional touch if you follow our plans. There will be no waste of materials—no extra cost. You choose from more than 70 different designs, including:

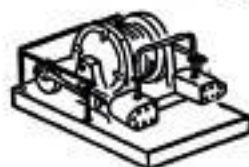
- 638 Flat Roof Arbor
- 764 12 Point Star Lamp
- 795 Two Cedar Chests
- 821 Entrance Unit
- 912 Folding Card Table and chairs
- 918 Martha Washington Sewing Cabinet
- 981 Colonial Coffee Table



- 985 Bent Metal Flower Stand
- 989 Speedy Motor Scooter
- 993 Twin Deck Beds
- 994 Console Table
- 996 Modern Table Lamps
- 997 Speedy Bobsled
- 1005 Six Towel Racks
- 1027 Hostess Tray



- 1030 Workshop Electromagnet
- 1043 Cricket Chair
- 1044 Chairside Magazine Case
- 1045 "Whizz" Fast Class E Ice Yacht
- 1049 Swedish Supper Cart



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of Building, Remodeling!



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NEED for
FLOOR
SURFACING
CONTRACTORS!**

Be Own Boss—BIG Earnings!

Look down any street at all the new homes going up, remodeling and construction of all kinds being done! All around you are new floors to be finished; old worn floors to be re-surfaced! Never before was the opportunity so great for you to quickly establish yourself in a fine business that pays you well . . . sanding floors with an easy-to-run American machine. Many earn \$50 a day and more. Age no barrier—men from 18 to 80, even with physical handicaps, enjoy this pleasant year 'round work. No schooling, no special talent or skills required. Only small investment in sander gets you started in a business that has brought financial security and happiness to thousands! Send today for "money-making booklet".

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FOR . . .



THE **AMERICAN**
FLOOR SURFACING MACHINE CO.
ESTABLISHED 1922

The American Floor Surfacing Machine Co.
535 So. St. Clair St., Toledo 3, Ohio

Here is 25c in stamps or coin for booklet "Opportunities in Floor Surfacing", telling me how I can start my own floor sanding business.

Name.....
Street.....
City..... State.....

More Best-Liked Features

The following quotations describe other best-liked features of Packard and Clipper owners. They are arranged in order of frequency of mention.

"The car is very easy to handle on the road and it does not sway. It's easy to drive in the city and you can park it or put it in the garage easily."—Illinois refrigeration serviceman.

"I like the ease with which it handles. When you make a long trip, you are rested when you arrive instead of being beat up."—Florida minister.

"Styling is modern and up-to-date without being overdone."—New York wholesale grocer.

"Interior in excellent taste yet it is striking."—Connecticut research worker.

"Easy to see the road because of the height of the front seat and the large windshield."—Kentucky housewife.

"Plenty of room inside. Rich styling gives appearance of bigness and wealth."—Texas soldier.

"I like best the way it holds the road."—Illinois carpenter.

"I have had every type of transmission and this Twin-Ultramatic is the best automatic."—Michigan dentist.

"Dependable. As a Packard buyer since 1949 I find that I have had very little me-

chanical work done on any of them."—New York salesman.

And Some More Complaints

The following complaints are typical of those made by the owners and are arranged in order of frequency of mention.

"Ultramatic doesn't shift into direct until between 30 and 35. Our speed limit is 30 and that accounts for the high gas consumption."—Colorado bank teller.

"My chief complaint is poor gas economy."—Rhode Island illustrator.

"During break-in period, oil consumption was exceptionally high. Seems to have cleared up around 2800 miles."—Michigan trucker.

"Windshield leaks. Have tried to get it fixed but had little success as yet."—Pennsylvania construction man.

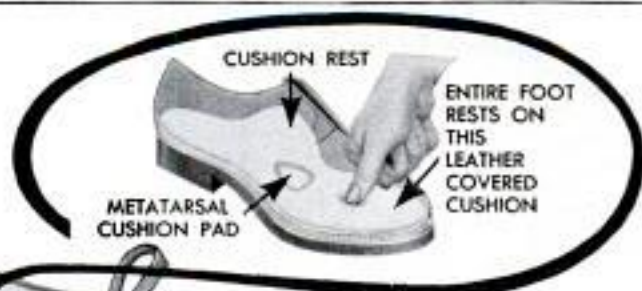
"Dust comes up into the trunk when driving on country roads. Company should take more pains in sealing body cracks."—Illinois merchant.

"Paint job was very poor. Had to have front fender repainted because spray gun missed it. Chrome is bad. Seams in back of rear fender rusted the first time it rained."—New Jersey salesman.

"Valves have a tendency to rattle when first started."—North Carolina supervisor.

(Continued to page 240)

NO. 286



**Non-marking
Oil Resistant
corded soles and heels**

Full Cushion Foot Comfort

Amazing, the comfort you get from these Star Brand Work Shoes! Full cushion insole is soft, resilient, gives snug support, floating comfort, even as you work! And they feature: soft, pliable Burgundy leather uppers—solid leather counters—built in steel shank—yet they look like dress shoes. Try a pair on—soon.



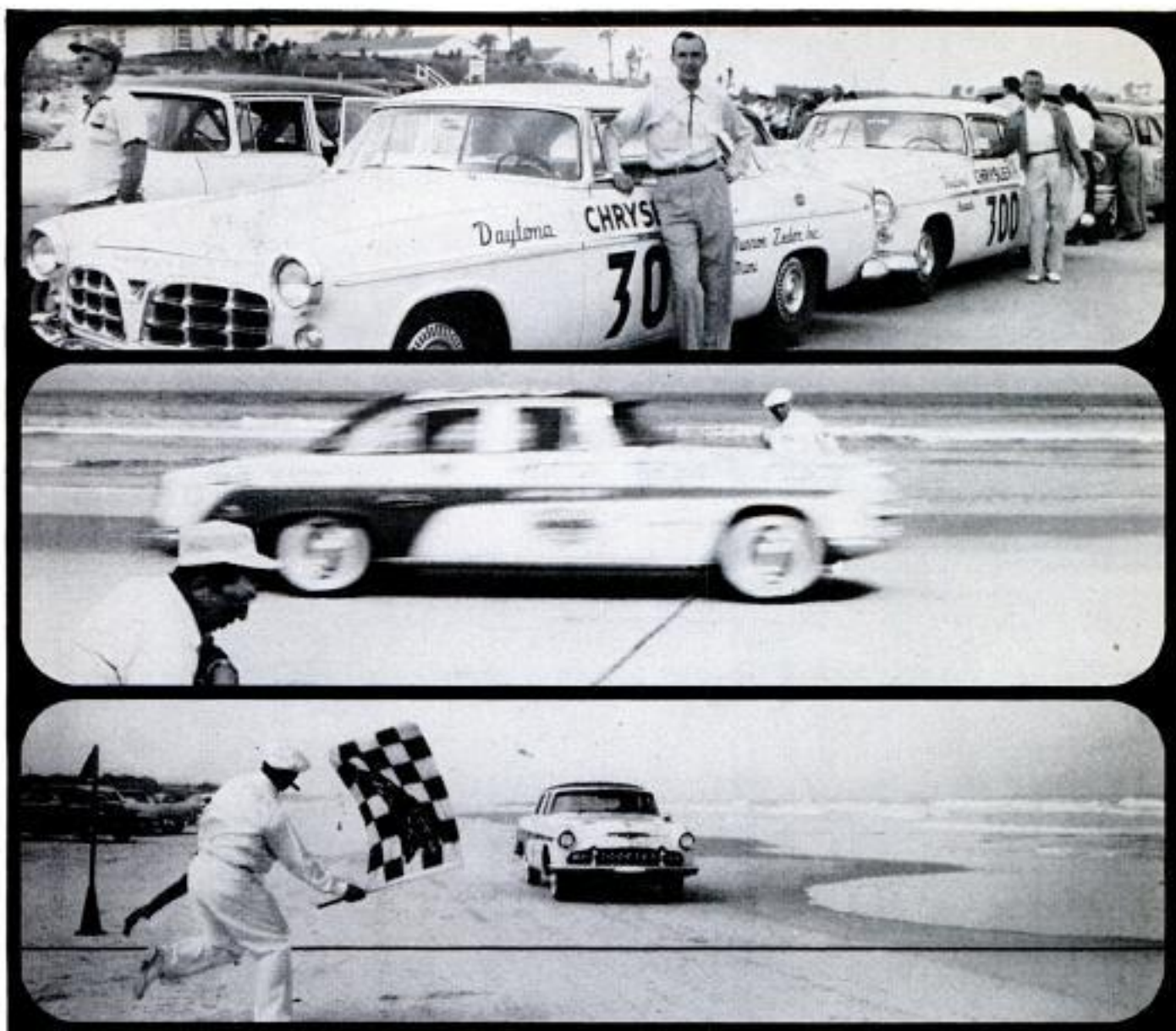
Ask for

STAR BRAND

Cush-N-Bilt work shoes

For nearest dealer write:

ROBERTS, JOHNSON & RAND, Div. of International Shoe Co., St. Louis 3, Mo.



DAYTONA BEACH. Chrysler Corporation cars sweep first and second places in National Stock car races. Chrysler "300" (top picture) breaks record in "Flying Mile" (127.58 mph) and 160-mile Grand National (92.05 mph). De Soto (below) speeds to first place over all cars in its displacement class (112.29 mph).

This, Too, Is **THE FORWARD LOOK**

Another part of THE FORWARD LOOK at Chrysler Corporation is the *finest engines* America has yet produced. Of America's passenger-car manufacturers, only Chrysler Corporation harnesses the extra power and efficiency of the hemispherical combustion chamber used in modern airliner engines. It is not surprising that these V-8 engines break speed and endurance records.

Since the marks shown above were set, 17 more first place wins have been chalked up, plus the dra-

matic victory at the gruelling Mexican Road Race in which Dodge swept the first *four* places over 37 other cars in its class! All told, Chrysler Corporation cars have rolled up enough firsts at tracks across the nation to completely dominate both NASCAR and AAA-sanctioned stock car racing events.

This exceptional performance is another reason for the public's great acceptance of the beautiful cars of THE FORWARD LOOK.



CHRYSLER CORPORATION

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Tops in TV drama—"CLIMAX"—CBS-TV, Thursdays.

SEPTEMBER 1955

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Get Good Performance the Way Big Fleets Do...

East Texas Motor Freight, Dallas, Uses Federal-Mogul Engine Bearings

Some 500 communities between the Gulf of Mexico and the Great Lakes know East Texas Motor Freight's direct daily service.

ETMF keeps its modern equipment in top shape by careful maintenance work. For many years, ETMF has been a good user of Federal-Mogul engine bearings.

Federal-Mogul oil-control bearings have led in the replacement field for 30 years—because of *quality!* Get this quality, next time your car engine is overhauled. It costs no more to get the best—ask your mechanic!

for New
FEDERAL-MOGUL
Oil-Control
Bearings



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PRECISION MANUFACTURING • SERVICE

"Power brakes not as good as previous models. Too much pressure required. I understand this is being corrected."—Michigan salesman.

"Ash trays on dash are inaccessible. Take them out of those corners."—Florida owner.

"Poor visibility of Ultramatic quadrant."—Mississippi minister.

"Needs a full horn ring. Can't find it when I am turning corner."—New Jersey machinist.

"Glove compartment too small."—Michigan service-station operator.

"Buttons on the deluxe-upholstery seat backs are very uncomfortable."—Maine traveling salesman.

"While riding yesterday at 60 miles per hour the hood flew open without slightest warning. Only good luck and skillful driving of those behind me avoided a chain-reaction smashup."—New Jersey architect.

"Hood latch too well hidden and hard to operate."—Connecticut sales manager.

"Surge shock on quick acceleration at 20 to 30 miles per hour. Body should have more sound deadening."—Ohio owner.

What Changes Would You Make?

Because no piece of machinery is perfect we always ask the owners taking part in our surveys to list the one single change they would like to have made in their automobiles. We think that from this survey the manufacturers might learn something that will help them improve their products.

A large number of Packard and Clipper owners do seem to feel their cars are perfect and they are anxious to have no changes made. But there were a few with suggestions for the Packard Company to take seriously.

"I would like better coach work."—New Jersey executive.

"Move the parking-brake handle. It protrudes so far I hit my knee on it getting into the car."—Nebraska salesman.

"Move the brake pedal away from the accelerator."—Illinois engineer.

"All I want is more gas mileage."—South Carolina real-estate man.

"Left-handed ash tray is inconvenient on driver's side."—New Jersey bookkeeper.

"Go back to the pull-out glove compartment they had in 1953 models."—California foreman.

And that is the story of the 1955 Packard and Clipper as told by the persons who own them. These quotations point out the good and the bad, giving you a summary of the car's characteristics from which you can make up your mind. ★ ★ ★

To begin Floyd Clymer's road test of the 1955 Clipper Custom turn back to page 118.

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Soldering's really a "cinch"... when you use time-tested, reliable KESTER... available everywhere.

FREE! "Soldering Simplified"... 16-page how-to-solder booklet. At your dealer or write direct.

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IN SPARE OR FULL TIME.

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Have a business of your own in your garage or basement, sharpening lawn mowers. Be your own boss. Small investment. We furnish everything you need to start. Write FREE Dept. M-95 today for complete details



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FREE BOAT KIT CATALOG Write: **LUGER INDUSTRIES** DEPT. B 4452 NICOLLET AVE. MINNEAPOLIS 9, MINN.

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- Assemble your own boat
- No experience necessary
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12 ft. Runabout Pictured.



KING MIDGET — WORLDS LOWEST PRICED CAR



Lower Priced, greater performance. Drive it for 75c per week. Also KING MIDGET JUNIOR, finely engineered, less than one-third cost of any comparable car, one twelfth cost of large cars. Agents wanted. **IT WILL PAY YOU TO GET THE FACTS.** Send 25c for literature and agents proposition on both cars, or \$1 (refunded first order) for this plus actual assembly book and service manual.

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Makes your job easier.
You'll do neater, more accurate woodworking with SHARK BRAND SWEDISH CHARCOAL STEEL paring chisels... holds its sharpness 3 times longer than ordinary chisels.

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Sandvik Saw & Tool
Division of Sandvik Steel, Inc.
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Here's the handiest paint a handy-man can use for re-finishing or re-touching... indoors or out! No fuss, no mess, no brush — just press a lever and spray. **SPRAY-O-NAMEL**, the proven brushless paint, is foolproof. Won't run, won't bubble. Dries to a smooth, durable finish in 5 minutes. "Not an ounce of work in a 12-oz can!"

LARGEST SELECTION OF COLORS
Including: Chrome Aluminum, Golden Lustre, Coppertone, Battleship Grey, Garden Green, Canary Yellow, Medium Blue, Ivory, Pink, Chartreuse, Orchid, Sky Blue, Orange, Chinese Red, Wrought Iron Black, Dove or Maytag Grey, Dearborn Blue, Hollywood Tan, Burgundy Maroon, Ridge Green, Gloss White, Gloss Black, Appliance White, Flat White, Clear Plastic Zinc Chromate — and matched farm implement colors.

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Send Check or M.O.

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NO BRUSH!
NO MESS!

ILLINOIS BRONZE POWDER CO., Inc.
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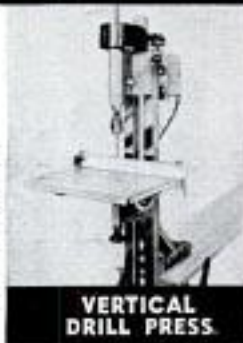
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 2635 N. Normandy • Chicago 35, Ill.

ONLY
\$36.50
 LESS
 MOTOR

Battery-Operated Intercom

(Continued from page 160)

drilling and reaming. If the unit is wired as shown in the diagrams no difficulty will be encountered in obtaining proper operation. It is suggested, however, that you recheck the wiring carefully before you connect the batteries to the chassis so as to avoid short-circuited batteries or burned-out tubes.

Testing:

When the wiring has been checked, the unit is tested by placing the substation next to the master station and turning on the monitor switch. This activates the amplifier

PARTS LIST

Battery-Operated Intercom System

- R1—25K ohm control #4 taper
- R2—10 meg. 1/2 watt
- R3—2.2 meg. 1/2 watt
- R4—1 meg. 1/2 watt
- R5—3.3 meg. 1/2 watt
- R6—330 ohm 1/2 watt
- C1—.005 mfd.
- C2—.05 mfd.
- C3—.005 mfd.
- T1—Stancor A4744 intercom transformer
- T2—Stancor A3879 output transformer
- S1—Amphenol 78-535 3-prong socket
- S2—Amphenol 78-535 3-prong socket
- P1—Amphenol 71-35 3-prong plug
- P2—Amphenol 71-35 3-prong plug
- Sw1—Switchcraft, type 1009, 3p.d.t. push-button switch
- Sw2—S.p.s.t. toggle switch
- Sw3—S.p.s.t. normally open push-button switch
- SP1, SP2—Jensen "Viking," type 3J6, 3" speakers
- A-Bat. Burgess 2D, 1 1/2 volts
- B-Bat. Burgess XX30, 45 volts (2 reqd.)
- Aluminum case, 3 1/2" x 6" x 8", ICA type 29444
- Speaker case for 3" speaker, ICA type 3987
- Cable, 3-conductor (as required)
- Chassis, 1 1/2" x 4 1/8" x 2 3/4", ICA type 29078
- 1U4 tube
- 3V4 tube
- Tube sockets, Amphenol 147-500 (2 reqd.)
- Knob Nuts
- Battery connectors Screws
- Terminal board Hookup wire
- Solder lugs Solder (rosin-core)

and should cause acoustical oscillations or howls through the speakers when the volume control is at maximum.

These oscillations will cease when the two units are separated by a reasonable distance.

Turn the monitor switch off and take the substation to another room. Have someone press the substation switch and talk into the speaker. The call should be heard clearly at the master station.

The final check involves pressing the press-to-talk switch of the master station to answer the call from the substation. If the operator at the substation can hear the reply, the system is performing properly and is ready for operation. ★ ★ ★



The Fremont
No. 521-S



Certainly
YOU CAN AFFORD TO OWN THIS HOME!

It's America's Most Complete House "Package" and LOOK...

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COMPLETE with Utility Room (Home can be built with full basement if desired.)

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If you've been putting it off because building costs are too high—PAGEMASTER has solved your problem! Never before have you been able to buy so much house at such low cost. What's more, you help plan it just the way you want it—you erect it the easy way and save even more dollars on construction costs.

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Garage-Door Sealer Strip

Overhead garage doors are sealed at the bottom by a flexible vinyl strip that is tacked on with a hammer and rustproof nails. The strip cushions the door when it closes and keeps out cold, dust, snow and driving rain. Molded on either side of the strip is a tube which acts as an air pocket. When the door is closed, this tubing presses down against the floor to form an effective seal. It not only keeps water from collecting under the door and freezing, but shatters any ice that has formed on it when the door is released and the vinyl springs back to its normal shape. The stripping, which is 1 $\frac{3}{8}$ inches wide, covers the entire edge of the door and protects it from damage.



Water-Repellent Shoes

Shoes that shed water and still "breathe" result when a silicone is tanned into the upper leather of the shoe. In a demonstration, a treated shoe and an untreated shoe were placed in a salt solution until one was shrunken and curled. The silicone-treated shoe remained straight, soft and flexible. The manufacturer says the treated leather permits the passage of air to maintain foot comfort, but stops water.



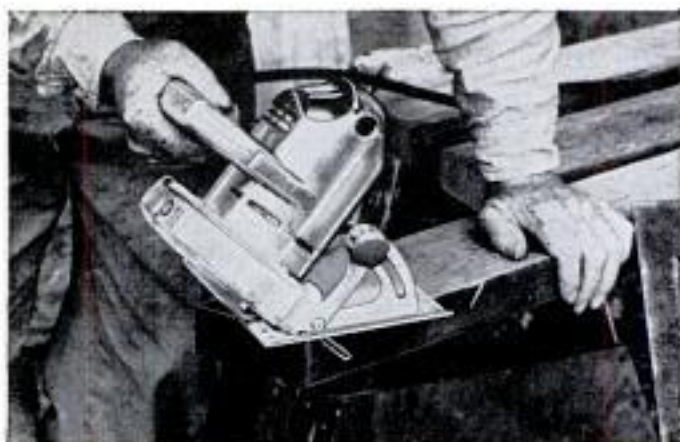
STANLEY PUTS SKILL IN YOUR HANDS



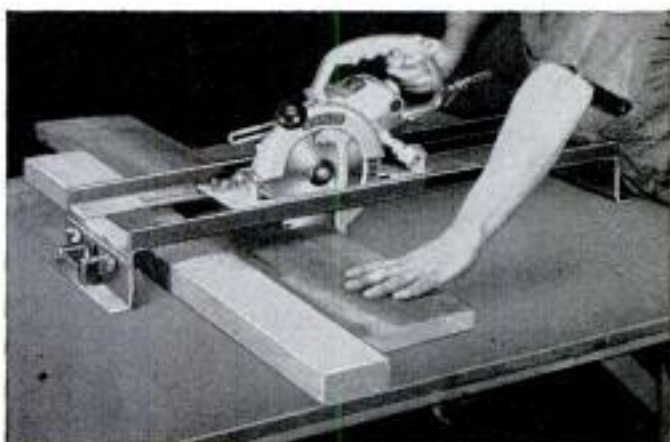
The "Yankee" Spiral Ratchet Screw Driver. This is a big, rugged, professional tool that takes the work out of screw driving. It drives and draws screws, and the spring-return handle is always ready *automatically* for the next stroke. Comes with three most wanted bits. No. 130A — \$7.70.



The "100 PLUS" Hammer. A 16 oz. beauty with a selected white hickory handle that *absorbs* impact shocks — doesn't carry it to your hand. All the hammer fine points carpenters look for — 2° toe-in, triple wedging, perfect balance, finely beveled claws. No. 11½ — \$3.75.



The 7" Builders Saw. This heavy duty, portable electric saw cuts 2 x 4's at 45°. It's a work-hungry tool, loaded with power and designed to make tough jobs easy. Exclusive Stanley "Motor Saver" protects motor from impact loads, as when striking a nail, etc. Multi-grip handle... convenient switch... automatic safety guard. No. H70 — \$77.50.



Saw Track for electric saw. This effective device is handy for many saw cuts where accuracy of angle is vital. It's virtually indispensable for production jobs like cutting rafters, fence pickets, etc. Recommended for cutting slate, marble, other stone with abrasive wheel on saw. No. H158 — \$25.75.

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 - free Electric Tool Catalog EH15
 - 25¢ Pocketbook — "How to Work With Tools and Wood" — I enclose 25¢.

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How to choose a paintbrush that does faster, streak-free work



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1. No break-in! You don't have to soak or flex a new brush . . . If it has "Tynex" nylon bristles.



2. Full paint pickup! Specially tipped and flagged "Tynex" bristles hold a full load of paint.



3. Smooth, even flow! Anyone can do streak-free work, because each tapered "Tynex" bristle provides better, more even flow.



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FREE! 8-page booklet full of helpful painting tips. Write Du Pont Company, Polychemicals Dept. PM-9 Wilmington 98, Del.



"Tynex" is the registered trade-mark for Du Pont nylon bristles.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

If I Were a Student Today

(Continued from page 106)

chemical laboratories for investigations of numerous kinds.

And away from the machines are the theoretical scientists, who are making calculations and theories about all the experimental results. They publish their ideas and experimental people are stimulated to try new experiments, and these in turn stimulate new theories.

These activities result in an understanding of the nucleus of the atom. This body occupies only about one millionth of a millionth of the volume of the atom itself. It consists of protons, the nuclei of hydrogen atoms, and neutrons, the neutral particles so important in the chain reaction of the atomic bomb, and they are held together in the nucleus by the most powerful forces that we know of. These studies enable us to know the processes that change elements into other elements and furnish the energy of the sun and stars, and they are leading us toward an understanding of possible processes that produced the atoms and perhaps the whole universe itself.

Our studies join with those of scientists working in other fields. We are learning the age of the earth and solar system; we are supplying materials for research in biochemistry and medicine and in industry.

On the purely human side there exists a fellowship among all true scientists that binds us together with an overwhelming devotion to learn the truth about these unknown things in nature. It is given to very few of us to make truly revolutionary discoveries, but it is given to many of us to contribute something and to be a part of the grand march of scientific knowledge.

All these things are mostly outside the classified activities of the Atomic Energy Commission. They are published in scientific journals and are freely discussed by scientists at their meetings. Most of the work is being done in our universities.

Of course these are not the things which young people who read this article will be doing. None of us knows what will be done some 10 years from now and this is the fascinating thing about science. The future always holds something new, something more fascinating, more unexpected, than the past or present. We are constantly opening new vistas and these you will explore. You will stand before the new machines, or write the new mathematical theories, or think of the new experiments, and ponder the behavior of the newly discovered radiations or particles or the great stellar explosions that originally produced

(Continued to page 248)

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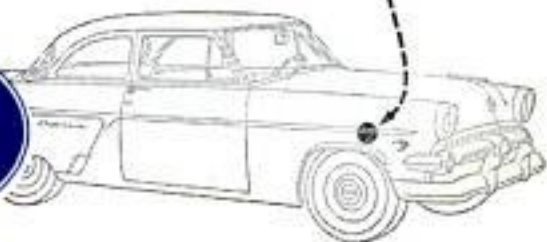
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the elements. All of this is a challenge.

On the engineering side the purpose of scientific work is different, though the methods and often the actual experiments are the same. Applied science has for its objective the application of science to useful ends, while pure science seeks to understand natural phenomena.

There are many useful things which can be done with nuclear science, but let us discuss the problem of first importance, namely, economical peacetime use of atomic power. Many predictions have been made in regard to this question, some hopeful and some pessimistic. Of course no one can tell whether atomic energy will ever be economical until many men have really tried to make it so. And this illustrates the fascinating thing about engineering. Is it possible to devise nuclear-power plants such that the cost can be kept lower, say, than efficient coal-fired power plants or water power? The engineer tries his ideas by calculations and model experiments. He is part of a team that is batting ideas back and forth, criticizing, suggesting small or large modifications, or chucking the whole thing for a quite new line of approach.

It is my expectation that the development of atomic energy for power purposes will go forward in this way. We have the *Nautilus*, which is now in the Atlantic

under atomic power. It uses very expensive power, but atomic power nevertheless. Other experimental power plants are being run in the National Laboratories of the Atomic Energy Commission, but these are not economical either, and have been built to learn something about the problem. But before long, power plants capable of competing with other sources of power in special places, where fuel is difficult to secure, will be devised. These will be used in the arctic regions or in the tropics where coal and oil are not available.

The engineer starts with the scientific literature or data collected in industrial laboratories. He has an idea for producing some new product or power plant. He estimates by calculations as to whether it might be possible and economical. He convinces others as to its possibilities. Together they organize a group of engineers and workmen. They hold conferences of the most serious kind, making decisions involving millions of dollars. The plant is decided upon. It grows under the guidance of the construction engineers. In a year or two it is finished and begins operation. The "bugs" are slowly worked out of it. There stands a towering mass of concrete and steel with humming motors and pumps and a glistening control room of dials. It is

(Continued to page 250)

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successful, its power flows over wires, it lights our homes, runs our motors or its chemical product is sold in our markets. The engineer turns his back for he is now on another idea; but don't forget that the thrill that comes from an idea that has grown to a large plant of steel and concrete and many intricate new devices devised by him and others is his even though he laughs it off. Of course, only a few have the great ideas, but many of us are privileged to contribute.

Scientists are broadly educated. We have our specialties in which we spend most of our time and energies. But an ability to use our native tongue skillfully and effectively is important. We are citizens and take an interest in politics. We read the current literature of magazines, novels, serious books and—yes, alas—detective stories. We speak correct English and often a foreign language as well. We dance the "light fantastic" and could tell Milton that it becomes somewhat heavier with time. We accumulate libraries of technical books at the office and of literature and music at home. We travel at home and abroad for pleasure or on business or to give lectures in other universities in our own country and abroad. We belong to the "intellectuals" and are proud of it. Join us, young people, and live in a land of superb wonder, also in a land of work, work, work and in a land of comradeship with interesting people from the entire world.

But can you do this? It is my belief that many people do not have the particular capacities required to make scientists and engineers. However, more people have this capacity than we are accustomed to believe. Moreover, women have become outstanding scientists and the idea that women are inferior to men in this connection is not true. Two women at the Institute for Nuclear Studies at the University of Chicago are accepted on the same basis as men.

It takes many years of study to become a scientist, but all success of a real kind requires much work, study and years of application. Take the long look! Try to think what you may be at 30, 40, 50, not what you will be next year. The solid substantial esteem of your fellows is acquired only through persistence and effort in all fields.

We need scientists and engineers. We need scientists to learn to understand the facts of this universe, both physical and biological and to give us this magnificent understanding of our universe and our place in it. We need engineers and doctors to bring the practical applications of science to our daily lives. We all of us look to the new generation of young people for those who will continue our work. ★ ★ ★

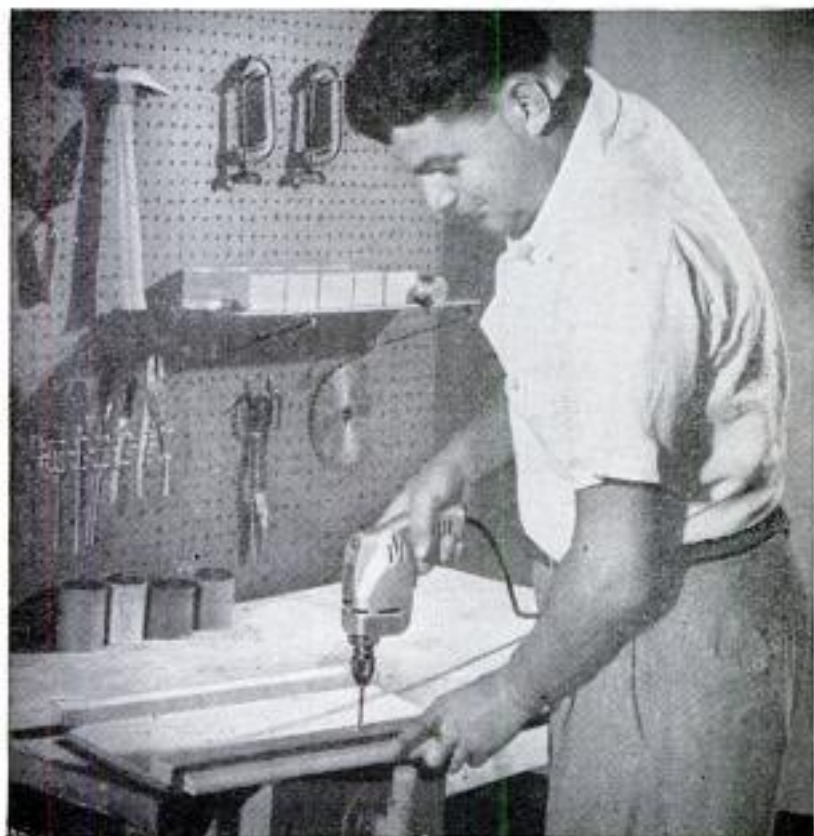
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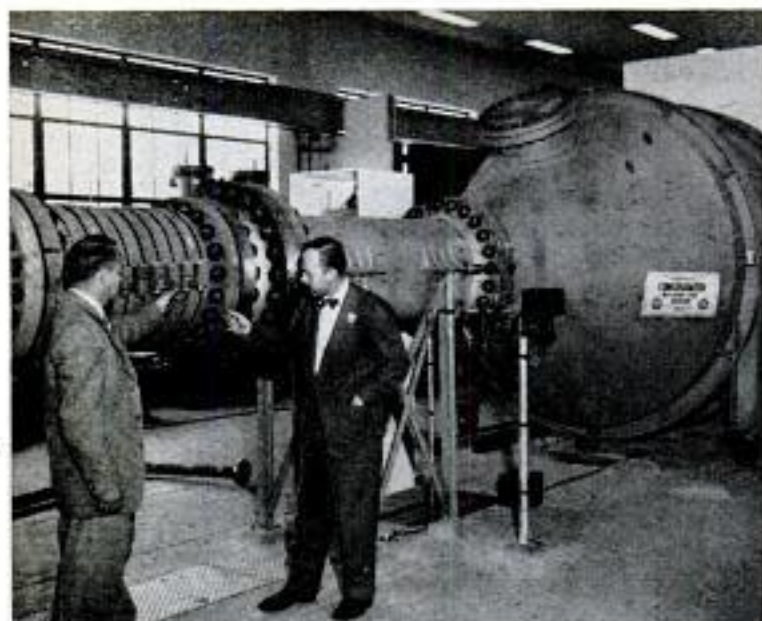
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Test section of NACA "hot" tunnel grows four inches longer when heated. Expansion joint being examined here takes up growth

Jet Planes Head for Melting Point

(Continued from page 94)

Base where the Air Research and Development Command has placed special instruments on the Bell X-1B, a rocket plane that can travel at the rate of 1500 miles per hour for short periods of time. At Edwards, too, the NACA is making heat studies with the Douglas X-3, a plane that was designed from the start to beat the problems of speed and heat. The X-3 has been called the "Flying Stiletto" because it is almost 67 feet long but has only a 22-foot wingspan.

The X-3 was built overly strong to make up for the loss of strength that its aluminum and titanium structure would experience at high temperature. Thus each wing core began as a 2000-pound billet of solid

Missilelike probe is visible through double windows of inspection port in test section of NACA experimental hot tunnel



aluminum that was milled down to a grid weighing only 160 pounds. This grid was covered with an aluminum skin $\frac{1}{2}$ inch thick at the wing root and $\frac{1}{4}$ inch thick at the tip.

Instead of insulation, the X-3 depends on a 2500-horsepower refrigeration plant to keep its pilot and instruments cool. The fuel tanks, however, are insulated against aerodynamic heating and, as a final precaution, the plane's fuel is pumped through a precooler on the ground just before a flight. Otherwise the fuel might boil away.

The air that cools the interior of the plane goes through a wide range of temperature changes before it can be used. Air at 40,000 feet has an ordinary temperature of 65 degrees below zero and the temperature of this frigid air is

raised to 300 degrees by ram action (aerodynamic heat) when it enters the refrigeration compressor. Compression further heats the air to 700 degrees. Next an air-heat exchanger pulls the temperature down to 300 degrees again, after which a water evaporator cools the air to 145 degrees. Then, by expansion, it is dropped to 32 degrees, the freezing level.

The final step is to mix this air with warm air from inside the plane, bringing it to a comfortable 65 degrees. This is the temperature of the air that circulates around the pilot in the cockpit. From there the air is blown across the 1200 pounds of instruments on board and finally across the tires and landing gear.

Keeping the tires cool is extremely important in a "steady state" aircraft that is designed to fly at high speed long enough to heat up completely. Without special cooling the tires could cook during a long flight and become so weak they would blow up when landing, wrecking the plane.

Designwise, the X-3 already is a number of years old and now engineers are hoping that they can defeat the heat barrier by new methods. If possible they want to avoid the over-strength construction and the enormous refrigeration plant that are features of the X-3.

It may be, for instance, that an inch of polished glass fiber over a metal framework can be used as a self-insulating airframe. An even newer idea is to coat an aircraft with $\frac{1}{4}$ inch of magnesium-oxide insulation. Figures prepared

(Continued to page 254)

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by H. W. Adams, chief design engineer of Douglas, show that the skin of an uninsulated airplane takes on the temperature of the boundary layer in about one minute but that when protected with magnesium oxide the time lag is nearly 10 minutes. When protected with glass fiber the skin never gets as hot as the boundary layer.

Film cooling has been proposed, in which water flowing out of many tiny orifices in the leading edge is converted into steam by the heat, carrying the heat away with it. One difficulty is that a great deal of water would be required.

An intriguing possibility advanced by M. A. Sulkin, North American thermodynamicist, is to manufacture cold air on board a supersonic plane instead of carrying heavy, bulky refrigeration equipment. Tanks of liquid oxygen and liquid nitrogen plus a mixing valve would be enough.

Sulkin points out that the whole problem would be simpler if the pilot could be left on the ground. Still, it's difficult to design untenanted aircraft "because the pilot is an extremely light piece of equipment for the things he can do."

But no one has a good answer for what happens to a pilot who must leave a plane while traveling at a high Mach number. He would be immediately subjected to a hot blast of aerodynamic heat. Even at 1000 miles per hour this would amount to more than 150 degrees the instant he is ejected, though the heat would diminish as he slows down.

Escape capsules seem to be the best answer for bailing out of supersonic aircraft; now it appears they will need to be refrigerated as well as pressurized.

Many of the problems that confront the designers of fast aircraft are even worse in the guided-missile field, for here the speeds are much higher. A nose cone may become incandescent from aerodynamic heat, turning the rocket into a manmade meteor. The rocket might blow up if the heat penetrated into the warhead. One promising suggestion is to use a very thick nose cone of a metal having a low melting point. Its surface would continually melt away and the sloughing metal would carry much of the heat away with it.

Ideas like that, and brand new "cermet" materials that are partly ceramic and partly metallic, are under study. Convair, with a contract to design a ballistic missile that would fly far out into space and then plunge back down through the atmosphere again, has converted war-surplus searchlights into solar furnaces that can produce heats as high as 7000 degrees. The newest materials are being tested at temperatures approaching this heat. ★ ★ ★

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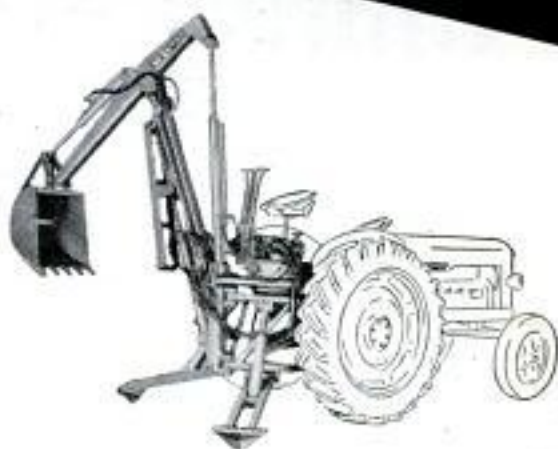
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Ten Buses Grow Into a Train

(Continued from page 86)

that 400-passenger trains can be turned out for something around \$400,000 to \$500,000 apiece, provided they are ordered in sufficient numbers. This actually is less than the cost of one of the more luxurious dome cars! It's a mighty cheap initial cost, and would put the train right down to where it could be purchased even for suburban service for which it is ideally suited.

If it penetrated the light-train field, Electro-Motive would be bucking some stiff competition. All the major manufacturers are making the rounds like old-time railroad butchers hawking their wares. In this case they're selling lightweight trains. This is the biggest trend in passenger service since the first streamliner appeared in 1934.

For years engineers have been working on the highly publicized Train X, and two of these trains are now under construction, one for the New York Central and the other for the New Haven. The Talgo-style train, originally built by American Car & Foundry for the Spanish National Railways, will appear in an Americanized version this fall. P. B. McGinnis, president of the New Haven Railroad, has stated that he is interested in buying from 20 to 30 of the Talgo-type trains if other railroads will join him with similar orders so the initial cost can be reduced. Actually the Rock Island will be the first road in this country to own a Talgo, which will be delivered this fall. The Rock Island train will consist of four cars, each of them about 109 feet long. Each car really is made up of three articulated subcars. The center section has wheels at each end, while the two outer sections have wheels at their outer ends only, and ride piggyback on the center section. The three-unit car is completely reversible, whereas the original Talgo cars could be operated only in one direction.

One of the big advantages claimed for the Talgo type is that each car actually is steered around a corner. Ordinary rail cars have trucks that are free to pivot on curves. This makes the wheels tend to fight the rails and accounts, in some cases, for the screech as a high-speed train rounds a bend. The Talgo has a linkage system that actually steers each car around curves so the wheels are always tangential to the rails.

Rail-equipment manufacturers aren't just blowing smoke when they point out certain advantages of the lightweight trains. The Talgo, Train X, Budd's new lightweight tubular train built for the Pennsylvania, and the new Electro-Motive bus-train all are built of lightweight materials, have a

(Continued to page 258)

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very low center of gravity and achieve high speeds at low cost.

But some experienced railroaders express precisely the opposite philosophy. They say that passengers who want to get there in a hurry will continue to hop on planes, and that passengers who want to get there at the lowest-possible cost will continue to ride buses. This leaves only one type of passenger for the railroad—the man who wants luxurious travel. These railroaders believe that only special, heavy equipment with all the built-in comforts of a deluxe hotel will attract the traveler. Only time will tell whether they are right.

There's another difference of opinion as to where you will sit when you ride. One idea, expressed in most of the lightweight trains, is to drop the center of gravity and put you as close to the rails as possible. This means, of course, low seats and low windows. Others, particularly those connected with scenic roads, are convinced you'll want to ride high where you can enjoy the view. They're carrying the dome-car trend even farther. Santa Fe, for example, has announced that by the middle of next year its crack chair-car train, the El Capitan, will be completely equipped with ultramodern "Hi-Level" cars. These cars, in effect, are all domes. They are 15½ feet high, about two feet higher than conventional cars. The seats are eight feet above the rails, or four feet higher than the floor of a regular coach. The double-level arrangement eliminates vestibules, thereby adding 28 revenue-producing seats to each car. Doors are located in the center of the car, and luggage is carried on shelves in the lower level. A double-level diner built along the same lines has tables throughout the top level, with the kitchen below. Two elevators carry up your food.

At no time in recent history has railroad travel been in such a state of flux. Most of the railroads are now committed to new equipment of one type or another, with at least half a dozen orders placed for new lightweight, low-slung trains. Actually these are test orders to see how you, the passengers, will like the new equipment. You are the big question mark. Does high-speed, low-cost transportation appeal to you, or do you prefer luxurious travel? Will you continue to desert trains for planes and buses?

Only time will tell, but meanwhile a good deal of radical new equipment will start rolling along the rails. It may set the pattern for rail travel in the future. The streamliner that was such a fascinating sight in the '30s may be destined to join the steam locomotive and old wooden trestle in the railroad's nostalgic past. ★ ★ ★

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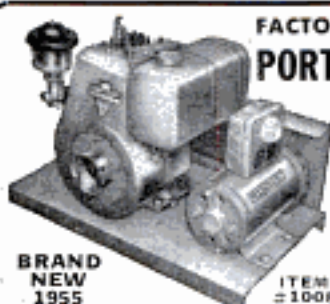
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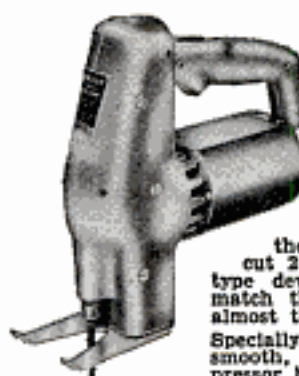


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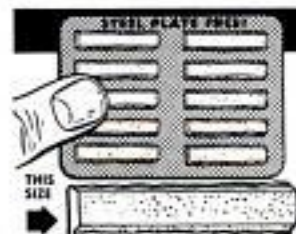
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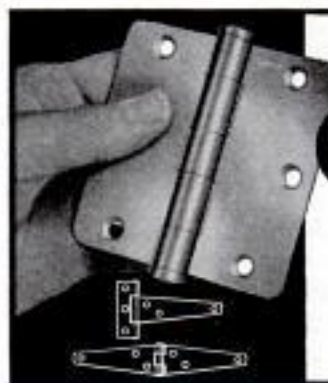
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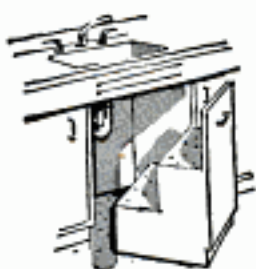
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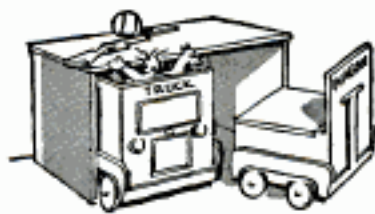
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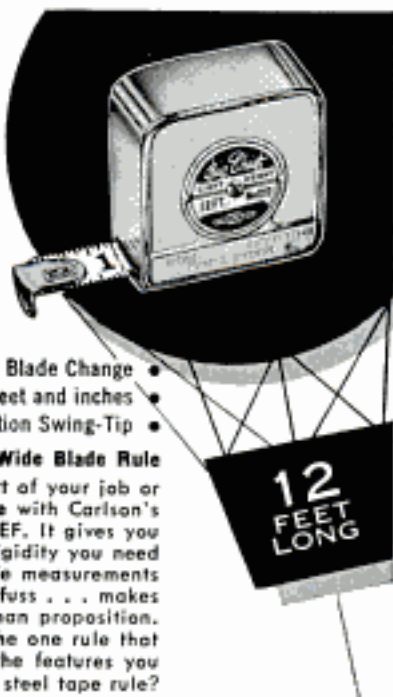
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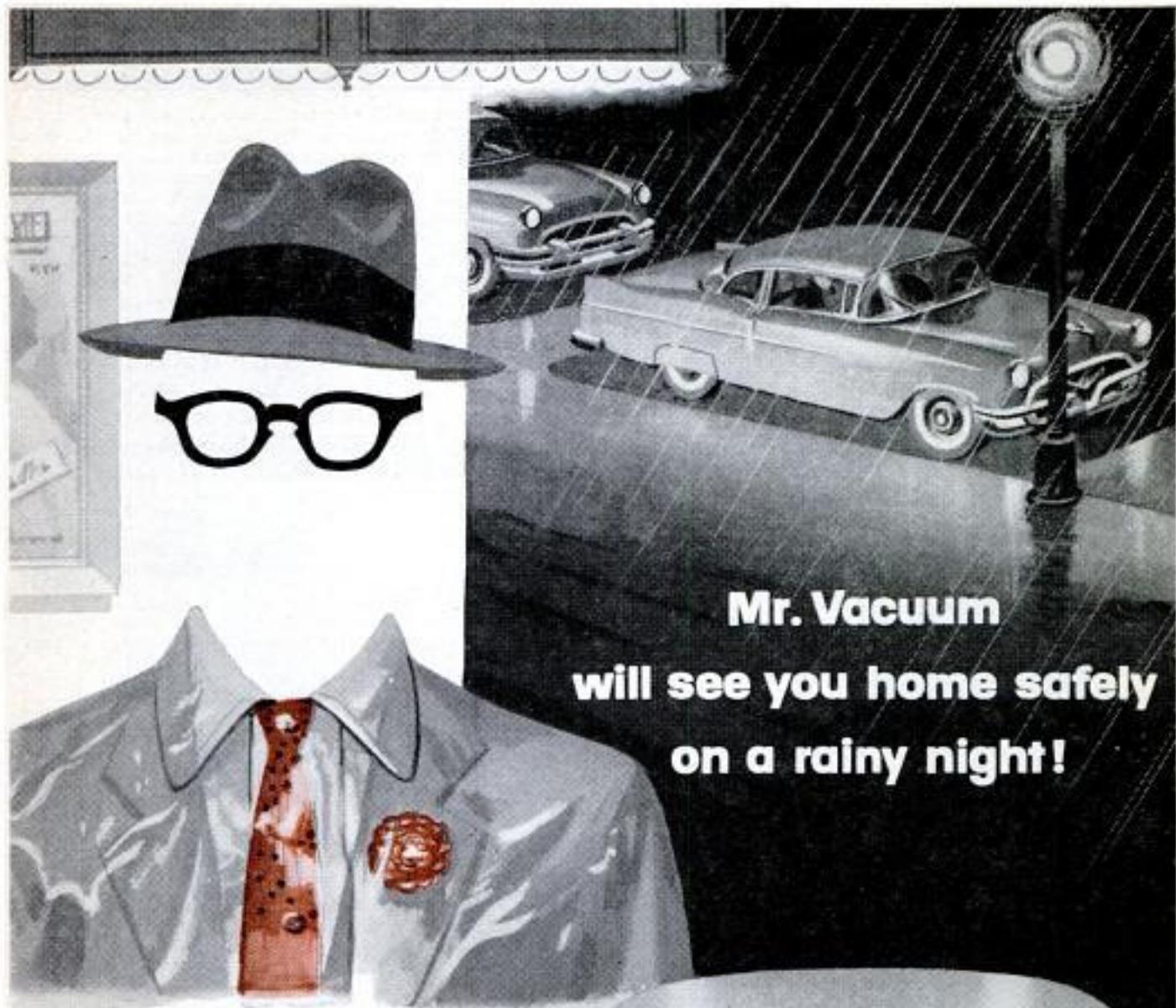
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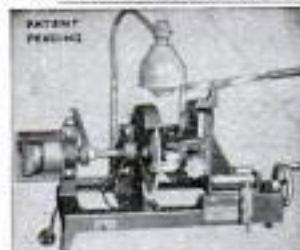
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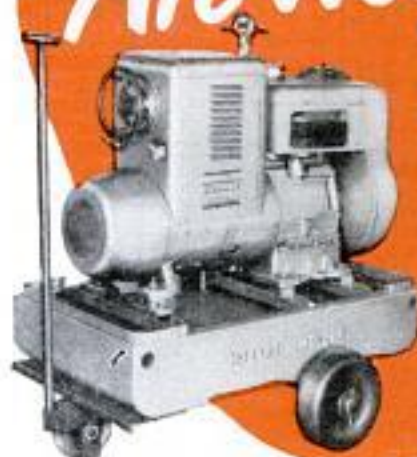
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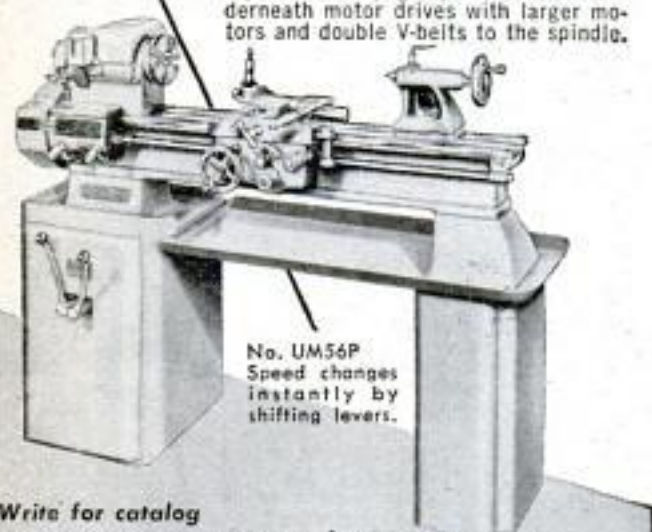
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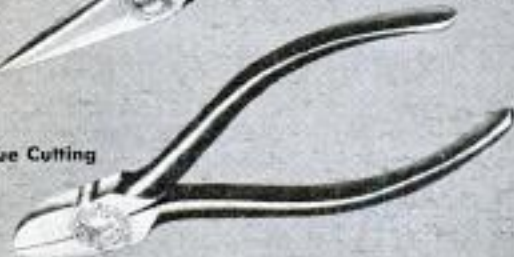
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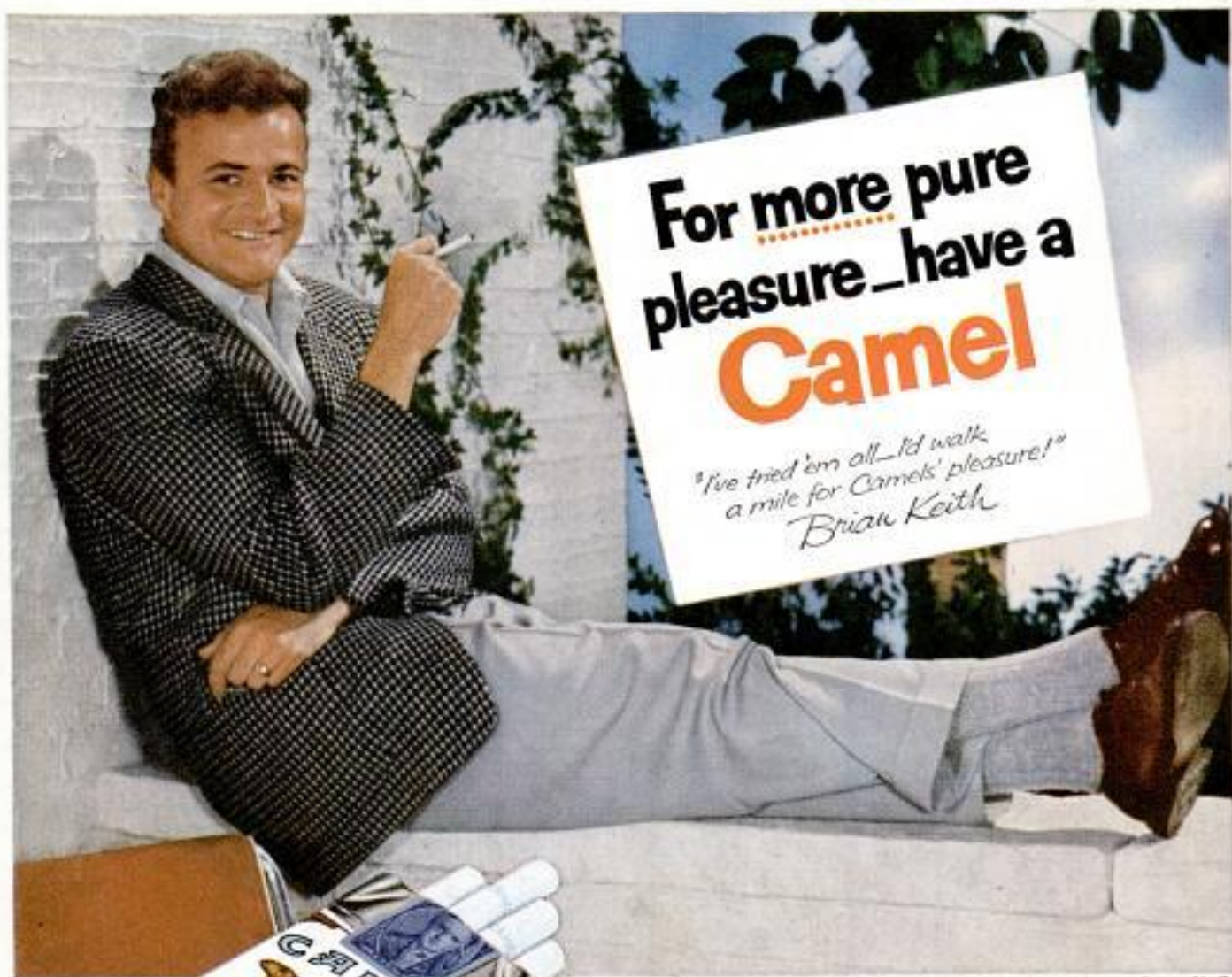
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