Touch up scratches in seconds with new MoPar paint applicator—only $1.00*

STOP RUST BEFORE IT STARTS
You can cover up unsightly scratches in your car’s finish in a hurry. It’s easy with this handy, new MoPar fountain-brush touch-up applicator. Each applicator comes complete with a self-storing brush and a generous supply of X-Act Match paint... factory checked to match the color of your Plymouth, Dodge, De Soto, or Chrysler car.

AS EASY TO USE AS A FOUNTAIN PEN
Just shake, and a built-in metal agitator mixes the paint thoroughly. Remove cap, and brush springs out, pre-dipped and ready to go. No mess or fuss. A few quick strokes and the job’s done. Paint dries evenly and quickly.

ASK FOR THE NEW TOUCH-UP APPLICATOR
at your Plymouth, Dodge, De Soto, or Chrysler dealer’s, and keep it in your glove compartment. And look for the MoPar label whenever you want official Chrysler Corporation parts and accessories, made to fit right, work right, last longer.

MoPar is more than just the name for a paint applicator.
It is the identifying name of thousands of parts and accessories designed and built especially for your Plymouth, Dodge, De Soto, or Chrysler car or Dodge “Job-Rated” truck.

*Manufacturer’s suggested retail price.
"I WENT OVER TO BORROW A CUP OF SUGAR
—and came away with a great idea!"

It was Saturday morning, and I wanted to surprise Joe with a fresh apple pie—but discovered I was short on sugar. So I ran across to the Jones’ to borrow some.

But I came away with more than the sugar!

Bill Jones was busy at work—installing a beautiful new floor. And he told me it would never need waxing because it’s factory pre-polished!

I got so intrigued, it was almost lunchtime when I got home. My poor Joe never got his pie that day. Instead, he had to listen to me tell him all about the stunning Goodyear All-Vinyl Flooring that smart Bill Jones was installing himself!

That afternoon, Joe went across to the Jones’—then he was gone for a while down to the shopping center.

Next thing I knew he was home—ready to do battle with our old kitchen floor! He went to work like a professional—armed with beautiful Goodyear All-Vinyl Tiles, and the handy self-installation kit which provides all the necessary tools.

Our new Goodyear All-Vinyl Floor was in before the weekend was over—and Monday night my Joe not only got the finest apple pie a proud wife could bake, but roast beef with all the trimmings!

SEND FOR FREE GOODYEAR “Self-Installation” BOOKLET—address post card to: Goodyear, Flooring Dept. T-8318, Akron 16, Ohio.

GOODYEAR All-Vinyl Flooring

FOR FLOORS • WALLS • COUNTER TOPS—BY THE TILE OR YARD

AUGUST 1954
YOU CAN'T BEAT CHAMPIONS...

FOR ECONOMY!

CHAMPION SPARK PLUG COMPANY
TOLEDO, OHIO

APRIL 20, 1954

SPLENDID PERFORMANCE OF REGULAR STOCK CHAMPION SPARK PLUGS HELPED STUDEBAKER CARS SWEEP TOP HONORS IN MOBILGAS ECONOMY RUN. SCORING HIGHEST ACTUAL MILES PER GALLON AND TON MPG IN EVERY CLASS ENTERED PLUS THE GRAND SWEEPSTAKES WIN CONFIRMS OUR LONG TIME JUDGMENT IN FACTORY-EQUIPPING ALL STUDEBAKERS WITH DEPENDABLE CHAMPIONS.

C.K. WHITTAKER,
EXECUTIVE VICE PRESIDENT
THE STUDEBAKER CORPORATION OF AMERICA

FOR PERFORMANCE!

CHAMPION SPARK PLUG COMPANY
TOLEDO, OHIO

MAY 31, 1954

FOR THE SECOND STRAIGHT YEAR I HAVE DRIVEN CHAMPION SPARK PLUGS TO VICTORY IN THE INDIANAPOLIS 500 MILE RACE. AVERAGE SPEED OF 130.840 MILES PER HOUR SETS NEW RACE RECORD. THANKS FOR A GREAT PRODUCT.

BILL VUKOVICH

Here's a real performance record! In their 24th Indianapolis victory Champions were the choice for every one of the 33 starting cars. And here's how they came through—NOT ONE CHAMPION SPARK PLUG WAS REPLACED DURING THE ENTIRE RACE!

Whatever the year or model of your car, better install Champions for better performance and longer engine life.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

ASK FOR CHAMPION SPARK PLUGS WITH THE EXCLUSIVE 5-RIB INSULATOR

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Other items, and manufacturers of available products described, are listed on pages 12, 14 and 16.
Advanced Chevrolet Engineering brings

BALANCED CAR SUSPENSION
for greater riding comfort

Behind Chevrolet's big-car riding ability is a lot more than just a suspension system. Actually it's a balanced combination of size, weight, weight distribution, tires and suspension system design that gives you that smooth ride you expect of a Chevrolet.

First of all, Chevrolet offers plenty of room in its wide, comfortable seats, cradled between front and rear wheels where they're least affected by road bumps. Chevrolet is a heavy-weight in its field, and the pounds are nearly equally distributed on all four wheels for greater stability.

Then in the suspension system itself: Famous Unitized Knee-Action, exclusive with Chevrolet in its field. A front ride stabilizer that reacts against any body roll tendency. Long, resilient rear springs that, leaf by leaf, diminish road vibrations. Tension type shackle hangers that regulate rear spring deflection rate and provide for a uniform ride regardless of the number of passengers. And, double-acting airplane type shock absorbers that not only cushion spring action but stabilize roll and body sway as well.

See your Chevrolet dealer and try out a new Chevrolet. See if Balanced Suspension doesn't give you a much smoother ride. . .

Chevrolet Division of General Motors, Detroit 2, Michigan.
Dejected is Dunkle –
  it is his dreadful loss
That he gets nothing more
  from car polish – but gloss.
So when it starts blowing,
  he puts on a duster
And reclines on the hood
  to keep dust off the lustre.

How different, Stan Stauncher!
  His enlightened selection
Is an easy-on wax that
  gives rock-hard protection!
For Bodygard forms
  such a shield against scratches
That his car is as safe
  as if stowed under hatches!
(He feels extra breezy, 'cause the job is so easy)

MORAL: Use New Liquid Bodygard –
  the first, easy wipe-on wax that
protects your car with this
  rock-hard finish. Protects 9 times
longer than skimpy-shine polishes.

YOU CAN'T SHINE DIRT,
  SO CLEAN YOUR CAR FIRST.

Every car must be cleaned before it's waxed.
Simoniz Liquid Kleener cleans better, faster.

True Simoniz Quality in
  a Liquid Car Wax. Only 98¢
in this corner

THE EDITORS

In the vivid story beginning on page 116, Roy F. Hall, former Army captain and now a Weather Bureau observer in Texas, tells of his tornado studies after surviving a twister that wrecked his home. In a subsequent letter Captain Hall describes his home experiments in reproducing tornado phenomena in a glass jar:

The trouble with tornado research has been that those pursuing it have dwelt too much on theory, while the means of simple experiments were right at hand. Wish you could have witnessed my glass-jug experiment, wherein I determined the rotational velocity necessary to force air out into a vacuum. I used up three glass gallon jugs in doing this before I eventually found that the jug had to be reinforced with several wrappings of heavy copper wire to prevent it flying to pieces. Balancing them true to the nth degree on the axle was something to bring on nightmares.

I used reducing pulleys in order to have the jug rotate at about 800 feet per second. With the motor turning at 1725 r.p.m., the jug flew to pieces and small particles of glass buried themselves in my barn 75 feet away. I wrapped the next with several turns of copper wire, but it was slightly out of plumb and blew up like a shotgun blast. The third did the business. It was wrapped from top to bottom with the wire and, being perfectly balanced, lasted throughout my tests, even up to a rotational velocity of 1000 m.p.h.

(Continued on page 8)

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

**FREE SAMPLE LESSON**

We offer you this free sample lesson so that you can prove to yourself that you CAN master Accountancy—quickly, thoroughly—in spare time at home.

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Get the latest information by sending for our 48-page book, "Accountancy, the Profession That Pays"...plus free sample lesson. The coupon at right will bring both to you without cost or obligation. LaSalle Extension, 417 S. Dearborn St., Chicago 5, Ill.

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So right now, today...if you are an adult, employed, and earnestly ambitious for rapid advancement in this highest-paying of all professions...send your name and address on the coupon below. We'll send the free sample lesson—plus our 48-page book outlining today's career opportunities and how you can qualify for them. A coupon like this has started many thousands toward greater success. It can do the same for you. Mail it today!
The experiment had to be conducted after dark, as nothing could be seen inside the jug at high-rotational velocity in daytime. At night, by directing a flashlight beam upward, the hollow vacuum in the center looked like a rigid, hollow glass tube, at speeds of 1400 f.p.s. and above. The higher the velocity, the larger the vacuum.

The jug merely proved my figures on 1400 f.p.s. as the velocity required to form a tornado vacuum, or funnel. The walls of the jug, of course, would not expand as would air at sea-level pressure, but this was compensated for by the cooling of the air within the jug by the carbon-dioxide fumes.

Roy F. Hall

To the Editor:
I have been able to build a working model of a 4-6-0-type locomotive with tender and a coach from memory, without consulting any blueprint. The model was made out of cigarette packets, odd bits of cardboard, bamboo, wire and springs. Motion pins, crank pins and axles are made of bamboo. Rubber bands supply the power.

S. N. Guha, Calcutta, India

To the Editor:
Thought you might be interested in hearing from one of your subscribers who, without previous experience, undertook building the intercom in your March issue.

Using only the schematic diagram plus the photos and text, a bill of materials was drawn, parts ordered and, in less than a week after receiving the parts, the work had progressed to the point where the system could be tested.

Much to my amazement, it worked and, having a well-equipped woodworking shop, I made my own cabinets for the master and two substations. As permanently installed,
The pressure is mounting. Competition for jobs is growing fast. Business and industry are tightening up. Every man or woman holding a good job is now, in effect, "on probation."

Are there "weak spots" in your training? Now's the time to get after them! Six months from now may be too late.

How can you fill the gaps—quickly? International Correspondence Schools can help you! There's no faster, surer way to get exactly the training you need!

You have 277 famous, spare-time I.C.S. Courses to choose from: trade, industrial engineering, office, executive, high school. Or you can arrange for "refresher" courses, advanced training or special instruction combining two or more specific business or technical subjects.

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2 FREE BOOKS
32-page, pocket-size gold mine of facts, "How to Succeed," plus catalog outlining opportunities in field that interests you!

For Real Job Security—Get an I.C.S. Diploma!

I.C.S., Scranton 9, Penna.

For August 1954
the system works fine and it is to your credit that your article was so clearly presented that such an inexperienced person as I could successfully build one.

Walter W. Weil,
Hammond, Ind.

Wooden Road

Ending service of 34 years is a 14-mile road built entirely of planks and logs on Graham Island off British Columbia. The road was built in 1920 to connect two frontier villages separated by treacherous muskeg. Whole logs were cut about three times the length of railroad ties and used to support the two-inch-thick planks which formed the roadway. As a result, the wooden road actually floated on top of the bog.

To the Editor:

This is a picture of my car which my dad and I built from an old lawn mower and transmission. It will go 25 miles per hour. It has three speeds forward and a reverse. It cost about $90 to make. The car is 6 feet long, 2 feet high and 3 feet wide. There is enough room for my two brothers, age 7 and 5, and myself, age 11, to ride.

Robert Scott Mefford,
Virginia, Ill.
I Will Send You BOTH FREE

Actual Lesson
The ABC's of SERVICING
64 PAGE BOOK
See How I Train You at Home in Spare Time
for Good Pay Jobs in RADIO-TELEVISION

You Practice Broadcasting with Equipment I Send

As part of my Communications Course I send you kits of parts to build the low-power Broadcasting Transmitter shown at left. You use it to get practical experience putting this station "on the air," to perform procedures required of broadcasting station operators. An FCC Commercial Operator's license can be your ticket to a better job and a bright future. My course gives you the training you need to get your license and coupon below. See in my book other valuable lessons that you build and keep.

You Practice Servicing with Equipment I Send

Nothing takes the place of PRACTICAL EXPERIENCE. That's why NRI training is based on LEARNING BY DOING. You use kits of parts I furnish to build many circuits common to both Radios and Televisions. With my Servicing Course you build the modern receiver shown at right. You also build an Electronic Multimeter which you can use to help fix sets while training at home. Many students make $10, $15 a week. Extra fees required to fix sets is a spare time, starting soon after enrolling. I send you special booklets that show you how to fix sets. Mail coupon for 64-page book and actual Servicing Lesson, both FREE.

I Trained These Men At Home

"Started repairing Radios six months after enrolling. Earned $12 to $15 a week so far." - DAVID KRAMLIR, Jr., Sunnystown, Pennsylvania.
"You come a long way in Radio and Television since graduating. Have my own business on Main Street." - JOE TRAVERS, Asbury Park, New Jersey.
"Answered ad for Radio and Television Serviceman. Got the job. Within a year my pay increased $50." - CHUCK WILLIAMS, Loma Linda, California.
"Am with WVOC, NRI course can't be beat. Passed exam for first-class Radio-telephone license with no trouble at all." - JESSE W. PARKER, Meridian, Miss.
"Am with W9BSF, as video control engineer on RCA color project. Own a lot of my success to your textbook." - WARREN DEEM, Malverne, N. Y.

Training plus OPPORTUNITY is the PERFECT combination. The sample lesson I send will prove to you that it is practical to keep your job while TRAINING right in your own home for better pay and a brighter future. My 64-page book should convince you that Radio-Television is truly today's field of OPPORTUNITY.

TELEVISION MAKING JOBS, PROSPERITY

Radio, even without Television, is bigger than ever. 115 million home and auto radios create steady demand for service. 3000 Radio stations give interesting, good pay jobs to operators, technicians. NOW ADD TELEVISION. 25 million Television homes and the total growing rapidly. 200 Television stations on the air and hundreds more under construction. Color Television soon to be a reality. Government, Aviation, Police, Ship, Micro-wave Relay, Two-way Communications for buses, taxis, trucks, railroads are growing fields providing good jobs for men who know Radio-Television. All this adds up to good pay now, a bright future later for men who qualify.

START SOON TO MAKE $10, $15 A WEEK EXTRA

An important benefit of Radio-Television training is that you can start to cash in fast. Many men I train fix neighbors' sets, make extra money, starting soon after they enroll. Multimeter built with parts I send helps locate and correct set troubles. Read at least how you build actual equipment that gives you practical experience, brings to life what you learn from my lessons.

MEN OF ACTION NEEDED MAIL COUPON TODAY

Act now to enjoy more good things of life. Get the benefit of my 40 years' experience training men at home. Take NRI training for as little as $5 a month. Many NRI graduates (some with only a grammar school education) make more in two weeks than the total cost of training. Find out about this tested way to better pay. Mail coupon below today for Actual Lesson and 64-page Book — BOTH FREE.

Mr. J. E. SMITH, President, Dept. 4HA
National Radio Institute, Washington 9, D. C.

Mail me Sample Lesson and 64-page Book, FREE. (No salesman will call. Please write plainly.)
Name
Age
Address
City
Zone
State

Available to VETERANS UNDER GI BILLS

Good for Both - FREE

AUGUST 1954
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POPULAR MECHANICS
INVENTORS

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

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

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

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

CLARENCE A. O'BRIEN & HARVEY JACOBSON
Registered Patent Attorneys
41-H DISTRICT NATIONAL BUILDING
WASHINGTON 5, D. C.

AUGUST 1954
ALSO GET READY for a Big Pay Job or a Business of YOUR OWN

in TELEVISION

Get the Best in TV Training

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City ______ State ______
County ____________________________

(Continued from page 12)

Alarm sounds if child or pet falls into unguarded swimming pools (Modern Design Engineers, 365 S. Avalon, Los Angeles)

Invisible sentinel timers operates in automatic door closers (Westinghouse Electric Corp., Merchandise Mart, Chicago 34)

Wonder oil ignores cold

Plastic beads popped like corn permit molding of foam plastic (Knippers Inc., Pittsburgh 19, Pa.)

Unsafe water purified (A. P. Schneier Co., Atalanta, Calif.)

Nestle's pack already in 4000 B. 33rd St, Milw., Wis.

Unfolded golf-cart handle becomes comfortable seat (Cart Co., 3333 North 17th Ave, Fort Worth, Tex.)

Presurized gasoline can mounts vanishing hose (Alva T. Smith Co., Madison 13, Wis.)

Tent made of tiberboard may shelter troops in Arctic (Gaylord Textile Corp., 11 N. 4th St, Lewistown, Mont.)

Recorded bird shrieks free towns of starlings

Today's known oil reserve greater than year ago

Dustpan 20 inches wide available in solid colors

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Air-filied hoses are ribs of roomy German sleeping tent

Leakproof battery stops flash-light corrosion

National Car Co., 30 East St., New York 16, N. Y.

Spider folding "fireplace" easy to carry and store (Seward Mfg. Co., 1513 E. Blaine St., Springfield, Mo.)

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Scientist takes pulse of earth daily

Ultraviolet picture tube for radar may be used in television sets

Radio Corporation of America, 30 Rockefeller Plaza, New York City 20

Discover oldest plant

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Experimental phone booth leaves both hands free

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Lathe roller forces metal into ornamental shapes

Grubbing tongues attached to tractor chain 

brush (Re-Bo Mfg. Co., 331 Madison Ave., New York City 14)

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How to build a low-cost Conrad alarm monitor

Radio Electronic Today (A) Purdue University, Lafayette, Indiana

(B) General Electric Co., Syracuse, N. Y. (C) Continental Electronics & Sound Co. 731 Lincoln Dr., Dayton 1, Ohio

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Horse-drawn plow converted for use with tractor

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FISHING

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Burlap sack laced to wheel rims keeps newly caught fish alive

Bent fishhooks taped to pole make efficient line guides

Sand spike made of steel rod acts as equipment rack

HOUSE AND HOME

Dustpan fitted with handle provides child's shovel

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Rubber hose makes shelf guards

(Continued to page 16)

14

POPULAR MECHANICS
Only men with training

Are you looking for a better job . . . where you work or elsewhere? . . . discouraged because you don't seem to "fit" the better jobs your company offers or in help wanted ads?

Do you realize that there are many jobs—good jobs—open right now? At this very minute industry is looking for trained men. Men with specific skills and knowledge get the best jobs, hold them through good times and bad.

Experience isn't enough. There are two types of experience. One comes from adding up the years. The other comes from adding years plus knowledge.

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State __________________________________________

Zone __________________________________________

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(Continued from page 14)

Rubber shield for broom handle

Shaving finishing clothes

Spring-type clothespin holds curtain rod

Chair-back pocket for home hair dressing

Breakfast table tops can be repaired with melted wax

Rug nap raised by steam iron

Hair curling adds rigidity to young hair

Kettle lid on fishbowl

Don't be startled to sheet plastic provide attractive

Putty knife protects woodwork when pulling nails

Refrigerator frozen-food space increased by insulated box

Cotton-on-the-cob holders turned from hardwood

Stop stripe on bookcase shelf keeps volumes aligned

Flooring door saves needed floor space in small room

Salt removes soap from carpet without smearing

Rubber cot protects finger when filling plaster casts

Flush-tank handle kept tight with copper-wire shim

Guide rollers at corners of house reduce garden-hose wear

Laundry plants on movable platforms for easy cleaning

Put holes used as "cushion" for baby's safety pins

Strawberry runners placed in cans to aid transplanting

Compact writing desk built in unused corner

MISCELLANEOUS

Self-propelled toy "tank" made of empty spoons

Bobby-pin "clamps" suspend brushes at desired depth in sink

Freezing pipe in emergency shuts off water

Rasor blade used as stencil

Lighter fluid added to polish improves shoe shine

Breaking in new pennant

Typewriter noise reduced with acoustical tile

Paper matchbook cover doubles as emergency shaving

Space-saving portable picnic table is easily disassembled

Marx mounted in wood jig reverses artist's copy

Hand truck capacity increased by removable extensions

Water content of gasoline barrels easily checked

PHOTOGRAPHY

Rubber-cup camera "tripod" attaches to car body

Masking arms of photo easel squared on ruled card

Syringe keeps lenses mildew-free

TOOLS

Drill bit used as center punch aligns hinge screw holes

Hole in old photo corner when slitting new glass

Holes in top tread of ladder prevent dropping tools

Tea spoon used to hold screwdriver for insertion

Emergency coil sprung wound in vise-heild jig

Tape provides correct angle when grinding small drills

Chalk covered with painter's putty on tool handle

Shopping for Tools-

Bolt-and-cut gauge (Quality Products, P. O. Box 1186, Gering, Neb.)

Tap wrench (Gilbert Mfg. Co., 139 Riverview Ave., Elk hart, Ind.)

Wire splicer (Aircraft-Marine Prod., Inc., Harrisburg, Pa.)

Deadlift saw (X-acto, Inc., 4841 Van Dam St., Long Island City, N. Y.)

Plastic screwdriver handle (Upson Bros., Inc., Rochester 14, N. Y.)

Sheet metal brake fits ordinary vise (Lund Mfg. Co., Biddeford, Me.)

Frame holder (Anco, Inc., 7014 W. 63rd St., Chicago 32)

Special clips hold cans for small parts (Hearings, 614 N.E. 3d, Madison, S. D.)

Tooling clamp (Holdwell Tool Co., 666 B. Hill St., Los Angeles 14)

Magnetic parts retriever (General Scientific Equip. Co., 2700 W. Huntington Blvd., Philadelphia 32)

Rotary plane (Henney & Mfg. Co., Inc., 2715 Oak St., Kansas City 8, Mo.)

Nickel-.monotrol (J. D. Wallace & Co., 134 California Ave., Chicago 12)

Saber saw accessory (American Machine & Foundry Co., 511 Fifth Ave., New York 17)

WORKSHOP HINTS

Use center punch to lock nut

Small parts sorted quickly on shower-curtain rings

Steel angles on mixer box allow saving heavy stock

Propriety called core links are easily lightened

Stack of cans for use on uneven floor built with three legs

Screen wire cleans files

Hinge or opening of door with side handle

Elastic tape sewed to pocket prevents loss of rules

Fast method of striking ellipse on layout of doorway arch

Wood shims on concrete still without using screw anchors

Shelves and partitions supported by basement-column brackets

Small-parts cabinet for shop assembled from precut pieces

Small screwdriver "sweat" screws

Screen molding mitered easily while tacked in place

Broken stud quickly removed with discarded tap

Dowel and tape life prolonging device

Raw potato provides "heat dam" when annealing metal strip

Wooden plugs in masonry walls held tightly with wedges

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Friction, as every schoolboy knows, is what makes engines wear out. In early steam engines, this was such a minor problem that talc was good enough for lubrication. Even in the first gasoline engines, almost any kind of oil could do the job.

But as engine heat increased and piston speeds approached 3000 feet per minute, lubrication engineers had to develop new oils containing "additives" you hear so much about.

Oil companies claim these additives are worth the extra 15c to 25c a quart you're paying for oil—and they're right. Purpose of these additives is to keep carbon and gum in harmless suspension in your oil—prevent deposits from forming in your engine. That's why your oil should look dark after a few miles of driving.

But here's the catch: the ordinary absorbent-type filter soaks up these valuable additives like a blotter. The more additives your oil filter soaks up, the "cleaner" your oil looks—and the more carbon, gum and varnish you may have forming in your engine.

Shocking? Yes, but that's only part of the story. Oil companies have developed still other additives—such as barium and molybdenum—which may make an engine overhaul something you don't even start thinking about.

A four page report on the most important lubrication discovery in a lifetime!

Advertised
until 250,000 miles or so. But there was no point in putting these oils on the market until an oil filter could be developed that would not remove additives. True, a few of these additives are already on the market in limited quantities—but, again, they are ineffective as long as they are being soaked up in absorbent filters.

The problem: find a filter that wouldn't soak up valuable additives, but would remove the microscopic abrasives that do the real damage to precision engine parts. These "danger zone" particles range from 10 to 30 microns in size (a micron is 39 millionths of an inch)—so small that several hundred of them would simply rattle around inside the period at the end of this sentence.

Since conventional absorbent filter material couldn't be packed tight enough to stop these tiny particles without reducing oil flow, engineers decided an entirely new kind of filter material had to be developed. Obviously, it had to be metal—but there was no way of making a metal screen fine enough.

Finally, metallurgists found the answer by fusing together millions of tiny bronze balls into a porous filter. Being non-absorbent, it wouldn't remove additives, yet abrasives simply couldn't get through the spaces between the tiny bronze balls. And, since bronze just doesn't wear out, it would never have to be replaced!

Tests Prove Life-time Filter Adds Years to Engine Life

Samples were rushed to government proving centers for testing. Results: the Life-time bronze filter not only solved the critical problem of filtering liquid oxygen, nitrogen, etc., for guided missiles, but could save the government millions of dollars now spent on filter replacement packs for trucks, jeeps, tanks and other vehicles.

Besides government tests, millions of miles of road tests in truck, taxi and car rental fleets reveal amazing results. Cars equipped with the Life-time filter have already passed the 300,000-mile mark without ever changing oil filters!

1. After 200 miles, unfiltered oil looks like this. Dark color is normal; it means detergent additives are keeping your engine clean. But abrasive particles are dangerous, should be filtered out.

2. Ordinary cloth or paper filters soak up additives, but let some abrasive particles get through when pressure forces "channels" in pack.

3. Because additives are removed, oil may look "clean" because carbon and gum are deposited in engine. Dangerous abrasives are still in oil.

250,000 MILES before a major overhaul should be normal with today's engines and oils. The Life-time bronze filter meets modern requirements.

By removing water from the oil, the Life-time filter prevents formation of sulfuric acid, deadly enemy of bearings, other precision engine parts.

DIESEL AND GASOLINE truck fleets have proved value of Life-time bronze oil filter in hundreds of thousands of miles of road tests.
Life-time Oil Filter Never Wears Out—eliminates filter pack replacement forever!

You never change the Life-time filter—just rinse it occasionally in gasoline and it’s good as new. In addition, you save the quart of oil soaked up and thrown away regularly with ordinary replacement filter packs, which can add up to a lot of oil during the life of this filter. How long is that? Well, the Life-time filter is guaranteed for 10 years.

But since bronze simply never wears out, the amount of money you save on the filter packs you don’t have to buy, plus what you save in engine overhauls, is something for your life insurance man to figure out for you.

To find out how you can have a permanent bronze Life-time filter on your car, see next page.

1. Since porous bronze can’t “channel,” abrasives can’t get through—but valuable additives can, because Life-time filter is non-absorbent.

2. After 2,000 miles—or 10,000—oil is free of abrasives, but dark, proving engine is clean. Dark oil means a clean engine, just as dirty water means clean hands.

How The **LIFE-TIME** Filter Works

As dirty oil is forced through element, all harmful particles drop to bottom of filter case. Only pure, filtered oil can get back into circulation.

"SMOKE TEST" proves superiority of Life-time porous bronze filter. Ordinary filters cause oil pressure to drop when fibers soak up oil, expand and prevent free circulation.

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1. If your car already has an oil filter, you can convert it to a Life-time filter with a kit which replaces your throwaway pack with permanent bronze. Just send us the make and number of your present filter pack (if you know it); otherwise, send us the make, model and year of your car or truck. Enclose $6.95 (we pay shipping) or send $2.00 deposit (you pay balance and C.O.D. charges on arrival).

2. If your car has no filter now, or you want to replace the one you have, send us the make and model of your car and $12.95 (we pay shipping) or $5 deposit, balance C.O.D.

3. A few cars have full-flow filter systems; Life-time filter conversion kits for these are $13.95.

EASY TO INSTALL

If your car already has an oil filter, you can install a Life-time permanent bronze element as easily as changing throwaway filter packs. You can put a complete Life-time filter unit on any car or truck in less time than it takes to change a tire; no special tools are needed.

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Wherever you go for service insist on Genuine Ford Parts
What's on the mind of the driver pushing his racing car toward the four-mile-a-minute mark on the Bonneville Salt Flats?

"One Out of Three Smashes Up"

Writes Mal Hooper

AS I HEADED for the starting line on the Salt Flats of Utah, I remembered two cars that had gone there earlier and how they had ended up—smashed to bits on the smooth, hard salt.

I remembered the judges in the timing stand and the spectators lining the course, tense as an oncoming streamliner began to fishtail. The car rolled over and flipped end for end, hammering itself into a mass of junk. It crashed on its back and slid past the last beam of the timing apparatus, automatically clocking its speed at more than 225 miles per hour. The car was completely ruined. Yet driver Sonny Rogers crawled out unhurt, his life saved by the roll bar and helmet.

My second memory was of Fred Carrillo. He wasn't quite so lucky when his 1300-pound streamliner began to drift away...
Tube extending from nose of the belly-tank lakester sucks air into its thirsty carburetor. This car covered the Bonneville course at an average 150 miles per hour.

Fred Carrillo's Class B streamliner, right, flipped over at more than 200 m.p.h. He got out with only a broken left leg and injured thumb. Car was total loss.

Right, LeBlanc streamliner with two V8 engines failed to get out on the salt last year. This year LeBlanc is hoping to compete with four V8s installed in the racer.

Modified roadster has novel streamlined nose. It placed seventh in its class, going over the Bonneville course at an average of 141.95 m.p.h.

Official starter gives the flag to a Class B modified roadster that placed third in its class with an average of 150.25 m.p.h. Car at rear pushes roadster to get engine going.
from the black line at top speed. Carrillo corrected with his wheel and the car bounced and jumped across the salt for 2000 feet, scattering parts and pieces in all directions. It seemed impossible that Carrillo was still alive yet he emerged with no greater injury than a broken leg.

One out of every three of the high-speed streamliners that have raced against the clock at Bonneville in recent years has beaten itself to pieces on the salt.

All this was in the back of my mind as our own new streamliner approached the line to make its run for the record. Tune-up trials were over and the car had seemed perfect on its last run.

But the trials had been over a three-mile distance and now we would use the full 14-mile straightaway. Would the engine hang together for that distance and for the return run? Ray Brown had spent weeks reworking the Chrysler V8 power plant. It now produced 325 horsepower, almost twice its original power, though it had been sleeved and stroked to reduce its displacement to less than 305 cubic inches.

The whole team had confidence in Ray's work and so my only real worry was whether I could hold the car straight while traveling well above the take-off speed for jet aircraft. But that, too, was pretty much out of my hands. The car had been designed to be as stable as possible. It should be easy to control and there was little the driver could do if he lost control.

Dean Batchelor and John Morris of Velocity Engineering had provided about two degrees of negative angle of attack for the body. The nose tilted down just a bit. This was to prevent my becoming airborne at high speed. It would have been ideal to have designed the streamlined shape for neutral buoyancy at 250 miles per hour, obtaining enough lift from the body at that speed to almost equal the car's weight. But then a strong gust of wind could add

Outstanding for its stability, this record-breaking car made more runs than all other streamliners combined

Hot Rod Magazine photo
In the unlimited class, Willie Young (hatless, center) drove the Kenz twin-engine streamliner 255.41 m.p.h. 

Placing canopy over driver before a run. Guide line is 14 miles long. You can't see the end from here.

enough lift to raise the nose and I'd be off the ground. The negative angle of attack was a safety factor and insured stability and traction.

Another way the designers sought stability was to bring quite a bit of the car's weight to rest on the front wheels. The ideal is to place slightly more than 50 percent of the weight in front. When you throw a hammer, its heavy head tries to stay in front and the same principle can be applied to high-speed straightaway cars.

Still another way in which stability was sought was to give the car a high polar moment: that is, to arrange its weight as much as practical like a dumbbell, out at the ends. The idea is that it takes little effort to rotate a heavy ball, much more effort to rotate a dumbbell of the same weight. A car that has its heavy components placed at its ends tends to travel in a straight line. You want just the opposite effect when designing for maneuverability and cornering.

I wouldn't need to worry about losing traction. The rear end of the car was independently sprung and Carl Fleischmann had adjusted the rear torsion bars to give no more than an estimated one percent wheel slippage on the salt. The rear tires wouldn't bounce in the air and then leave long stripes of black rubber every time they came down.
The car was as safe as the engineers could make it, now we would find out if I could drive. I'd been at Bonneville before and I'd had my share of high-speed thrills. I've thrown the treads off both front tires at close to 200 miles per hour in a belly-tank speedster. I saw the rubber fly past my head and I knew I'd lost the treads and yet nothing happened to the car. There wasn't even any vibration; that didn't begin until the speed dropped under 100 miles per hour.

I settled down in the cockpit, strapped on the shoulder harness, and pulled on the helmet and goggles that would protect my eyes if the transparent canopy happened to fly off. The push car started to shove me ahead. At 50 miles per hour the engine began firing and I put my foot down on the accelerator. The car jumped ahead so fast it was doing better than 90 miles per hour within a quarter of a mile. At 5000 revolutions per minute on the tachometer I backed off the throttle, eased the two-speed transmission into high and put my foot on the floor again. The tach crept up to 6200 and we were really going.

There's no special sensation of speed once you get above 100 miles per hour. The white surface close to the car is just a blur and you don't look at it anyway. Your eyes are aimed along the black marker stripe that stretches all the way to the horizon.

But two things tell me I'm going fast. One is the sound of the front wheels and tires. They whine like a jet airplane going into a dive. There's no noise from the engine behind me, only the scream of the tires.

The other indication of speed is the "snowstorm" that starts in the cockpit at about 225 miles per hour. That's what it seems like. Actually, the particles are salt crystals whipped up from the surface and drawn in through the few openings in the body. They drift in and settle on my arms and legs.

What we were seeking were new national and international records for Class C automobiles, the class of cars powered by engines ranging from 183 to 305-cubic-inch capacity. The old international records (229.77 miles per hour for the flying mile, 211.8 miles per hour for 10 miles) had been made in Germany in 1937.

I was to make one run in each direction so the speeds of the two trips could be averaged. My rate of travel would be clocked automatically in miles per hour and kilometers per hour. We knew our car could break the record, the real trick was to get it up to top speed quickly, then decelerate as fast as possible at the end of the run.

The reason for this is that there isn't any extra room at Bonneville. The AAA laid out a 10-mile straightaway course with

Sketch of what is under the skin of the car the author drove as he set six national, six international marks

Copyright Hot Rod Magazine

AUGUST 1954
BONNEVILLE SALT FLATS
(HARD LEVEL SURFACE OF WHITE SALT CRYSTALS)

Map of the Bonneville layout. Less than half of it is shown here. It is a 14-mile straightaway altogether.

Here is the author at the wheel with plastic canopy off. The instruments show water temperature, oil and fuel pressures, engine speed. Small rubber hose above the second dial carries fresh air into driver's compartment when top is sealed down two miles of overrun at each end and that's all the room there is. A raised highway crosses one end and there's soft, wet salt at the other. Nevertheless, Bonneville is the best straightaway speed course that has been found in the world. Cobb set his 403-miles-per-hour one-way record there.

A big valley cuts through the mountains that face the course and sometimes a breeze sweeps out of the valley. Gentle as it is, this crosswind could turn you around or flip the car at high speed, so you run for records right after dawn before there's much chance of a wind.

By now I was going so fast that the mile markers were sweeping by about 15 seconds apart. But it still seemed like an eternity before I reached the eight-mile post. Running wide open for a long distance is a real strain.

At the eight-mile post I got busy and began stopping the car as fast as I could. I had two more miles to go, to be sure, and there were two additional miles of overrun.

(Continued to page 240)
Easy-to-Use Resuscitator Operates Aloft or on Ground

Developed for the Air Force, a new resuscitator can be used at high altitude or on the ground. Many resuscitators now in use will not operate at high altitude. The new instrument is simple to operate and can be used to administer oxygen, air or any mixture of gas. Because very little gas pressure is required, the resuscitator can use either a compressed gas cylinder or a blower which is operated by electricity from a wall outlet or an automobile cigarette lighter. The breathing cycle can be adjusted to the requirements of adults or infants.

Aluminum Tube Holds Fish

Anglers can carry their catch easily and display the fish attractively for photographs with a new rigid fish stringer. The stringer is an aluminum tube 13 3/4 inches long fitted with 16 safety-pin-type hooks mounted on swivels. Because the stringer is short it is not likely to be fouled on rocks or to interfere with the operation of a motor. Ashore, the tube becomes a convenient handle for carrying the fish.

Flashlight Changes Color

You can switch a new flashlight from white to red to green light at the flick of a finger. Motorists can use it to warn oncoming drivers when roadside repairs are being made. Boating enthusiasts, campers and hikers find it useful. Containing two standard batteries, it is 7 1/2 inches long and throws a 500-foot beam.
Tampa Bay Crossing Spans 14 Miles Of Tidewater

Scheduled to open to traffic this month, a new bridge across Tampa Bay on Florida's west coast will be the longest open-water bridge crossing in America. A combination of filled-in causeways and steel-and-concrete bridges will stretch 14 miles from shore to shore, over water open to strong tides sweeping from the Gulf of Mexico into the large bay area. Total cost of the project is $22,250,000.

Motorists crossing the bay will make a net saving of 40 miles each way between points on the Gulf Coast Highway and the Tamiami Trail. Now they must detour through the congested Tampa area and around the bay. During the first year an estimated 660,000 motor vehicles will use the new bridges and causeways, paying a toll that is equivalent to the fee of the pres-

Biggest task was building the 4.2-mile central bridge. Center span, which crosses a main ship channel, is 864 feet long and 155 feet above water. Route across bay mouth joins St. Petersburg with coastal cities.
ent inadequate ferry service. Part of a system to speed traffic from the north, the project will relieve congestion and open up a large area to increased trade.

One of the objections to building the bridge was the claim that it would block the tides and cause shoaling of the ship channels which carry a large volume of foreign and domestic trade to several ports on the bay. However, because of the 135-foot distances between the concrete piers and an 864-foot opening at the ship channel, there will be 4.2 miles of virtually open water to keep the tides from miring through any narrow openings.

Six bridges are included in the system. The longest of these is the 22,373-foot central bridge which crosses the main ship channel between St. Petersburg and Tampa. The trestle-type bridge on either side of the center span rests on hundreds of reinforced-concrete pilings. The roadway then rises on a five-percent grade over 32 huge concrete piers resting on bedrock to the ship channel which it crosses on a fixed cantilever span 155 feet above the surface of the water. Each of the two largest piers supporting this span contains 8,900 cubic yards of concrete and is set on 360 steel piles sunk 100 feet below the bay bottom.

Much of the steel work was prefabricated and floated into position. All of the concrete used was of the prestressed variety and a complete floating concrete plant was constructed for the project. Dredges pumped over 4,000,000 cubic yards of sand for the causeways.

Gales of up to 50 miles per hour hampered the building of the bridge. In one heavy wind, 17 big barges sank or drifted away. Four rigs sank and two were salvaged; one was recovered 200 miles out in the Gulf of Mexico.
Lightweight "Stretcher" Straightens Body Wrinkles

Automobile-body repair work is done quickly with a lightweight jack that mounts in an endless variety of positions and applies pressure to straighten sheet-metal kinks. The jack adapts for either pushing or pulling and is versatile enough to work around obstructions. It is especially valuable for straightening crushed headlight openings in front fenders. The pulling is done in a forward and downward direction. Other jobs for the device include straightening hoods, grilles, bumpers, body panels and door panels, as well as tie rods, sway bars and stabilizers.

Quick-Change Spinning Reel Switches Spools in a Matter of Seconds

Spools on a new lightweight spinning reel can be changed within a few seconds. Two spools are provided with the reel, one for light line and the other for heavy line. They can be switched by removing one tension nut. The reel has a swivel base. In the casting position the reel faces the target, but for reeling in it swivels back parallel to the rod so it is operated much like a bait-casting reel. The clutch on the reel is adjustable. Line twist can be eliminated in one cast by pulling the spool off its shaft, reversing its position and casting. The spool then is returned to its normal position for retrieving. The spools are larger in diameter than most spinning-reel spools.

Steel Cellar Door Swings Open Like Hood of Automobile

Just a slight upward push swings open the sloping door of an exterior cellar-entrance unit. A coil-spring suspension counterbalances the weight of the door for easy lifting and lowering. The sturdy, reinforced door is strong enough to walk upon, overlaps its frame to keep out wind, snow and rain, automatically locks in the full-open position and is firmly secured by slide bolts when closed. Ordinary tools are sufficient to install the preassembled all-steel unit quickly.

Information not listed on articles in the index frequently is listed in the WHERE-TO-FIND-IT LIST, which is available to readers without charge from Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Illinois
Lathe Roller Flows Metal Into Conical Shapes

IN THE FIELD of metalworking, a new and basically different process has been developed. At first glance the technique appears similar to the old process of metal spinning, in which a metal blank is formed in a circular manner around a mold. In the new process, called Floturning, great pressure is applied scientifically to cause the metal to flow in a cold state. The process starts with a simple flat blank of exactly the same diameter as the finished part but somewhat thicker than the finished wall. The blank is mounted in a lathe against a mandrel. A roller wheel then applies great pressure to the blank, actually forcing the metal to flow in a cold state up the mandrel. The machine controls the operations and in many cases the part can be produced in a single pass to finish dimensions. Conical and cylindrical shapes, or any combination of these two, are possible with the new process, which was developed by The Lodge and Shipley Company of Cincinnati, Ohio. Many hard-to-work alloys can be used.

AUGUST 1954
CLIMB IN BESIDE A TEST DRIVER
FOR THE THRILL OF YOUR LIFE---

TWELVE HOURS ON THE TEST TRACK

Around and around goes the test car in dizzy circles as the driver tries to break the right front wheel

By Arthur R. Railton

IT'S MIDNIGHT. The Michigan countryside is dark except for a long, glass-walled building as brightly lighted as Times Square.

You enter the building with a test driver. Shift Three is going to work at Chrysler's new proving ground near Chelsea, Mich. Drivers from Shift Two swing dusty cars into line at gas pumps. They fill tanks, clean windshields, check oil and water, then walk into the Ready Room to make their reports.

Drivers in Shift Three take over. You open the door of a 1954 Plymouth.

You ask: Mind if I come along?

Driver: Not at all. I'll dump some sand. He drives to the Supply Room and unloads two bags from the front seat. You both get in. He drives toward the gate.

Driver: I drew a highway run tonight. Glad to get out of the snake pit. It's bad enough in daylight. At night, it's a killer! You: What's the snake pit?

Driver: That's what we call the test track. It drives you nuts sometimes.

You: What test are you on tonight?

Driver: Transmission cycle. We've got 30 miles to go before the next cycle. Look in the book and you'll see what I mean.

You open the notebook the driver gets

Here is the wheel-break test in daylight (see above). Front hubcap fell off just as the photograph was taken
with his assignment. It's the test car's life story—mile by mile. You look up the test description. It goes like this:

"40 to 75 WOT upshift, 10 times.
"0 to 30 WOT, stop and reverse.
"Repeat 10 times.
"50 miles at 60 plus."

You: What is WOT?
Driver: Wide-open throttle.
That's the toughest thing to do to

Tires fail in about 150 laps of wheel test; wheels may last as many as 1000
Chrysler's new proving ground covers 4000 acres. Shaded portion in upper right of map is not finished yet.

Driver can't "cheat" on his test runs because tell-tale clock records what car is doing every minute a transmission—wide-open upshift. There's a lot of torque there when the bands clamp down. This has a test transmission. Look on the back of the sun visor and see what it says.

You pull down the sun visor. On the back is a long list of parts with code numbers. Obviously there is more experimental about this Plymouth than transmission parts. One item listed is the engine.

You: What's this engine listed here?

Driver: Don't ask me. All I do is drive. And write what happens. When we work in the garage we know what's inside these cars, but when we're driving, we don't know a thing.

You sense that he's just being discreet—that he knows more than he's going to talk about. Meanwhile the Plymouth has been cruising easily at over 65.

You: How far do you go in a night?

Driver: Oh, 300 miles or so. There's too much starting and stopping in this cycle to go far. Then there's lunch and a few coffee stops. I'd say between 300 and 350 miles.

You: Can you stop when you want?

Driver: Yeah, but there's a telltale clock in back that records when you're going and when you're stopped. It shows the speed, too. We turn in the graph every morning and it doesn't look good to be stopping too often.

He swings the Plymouth onto a black-top road.
After each shift, test drivers make out their reports in the Ready Room. Chart on wall lists assignments.

Driver: I always run my transmission cycles on side roads. No traffic to worry about.

He tramps on the throttle, opening it wide. The Plymouth rams ahead to about 70 before it upshifts. He lets off the throttle and the car coasts swiftly and quietly in the dark. When it's back down to 40, he steps on it again. He does this 10 times.

Driver: This engine sure wants to go! I'd like to have it on the oval for a while. Next we do 0 to 30 at wide-open throttle.

He stops the car and again floors the accelerator. In seconds, the speedometer hits 30. He lets up and coasts down to a stop. This time, he backs up fast for about 100 feet. He does the same thing 10 times.

Driver: Funny thing, one night a driver backed into a tree doing this. The road curved and he forgot to turn. Rammed a

In the sand pit, a DeSoto does a series of figure eights to test traction, running gear and body tightness.
Cresting a steep grade on the 8.4-mile endurance track, a Plymouth with an experimental engine gets airborne.

tree alongside the road. Sure looked funny to see a car smashed into a tree backwards!

After the 0-to-30 cycle, the driver heads back to the highway for 50 miles at above 60.

You: What are you going to write up on this car? It seems perfect to me.

Driver: There's not much to write about, but our big job isn't finding fault. We're trying to wear these cars out. I'll mention that spark knock you heard. And there's a little front-tire vibration at high speed.

He returns to the big garage to let you out. It is still dark and you want to get on the snake pit before daybreak. You head down to the endurance track where a DeSoto is going to pick you up. A pair of headlights comes out of the night.

Driver: Come on in. Wally said you'd be down. Welcome to the snake pit. Unload a couple of sandbags, will you?

You do. The endurance track is an eight-mile route up and down hills with plenty of curves. There is no pavement—just various gravel surfaces, from hard and smooth to soft and rough.

You: What test are you on?

Driver: An endurance run. I just barrel this car around here all night and somebody else barrels it all day. I put on about 250 miles a night. Can't average more than 45 on this road. It's too rough.

You: I just came in off the highway. Everyone thinks being inside the proving grounds is a fate worse than death. Is it?

Driver (laughing): We all gripe about it and, I guess, it's better outside on the midnight shift especially. But for high speed we all like to be inside away from the maniacs on the highway.

You: Tell me about this course.

Driver: Well, you can see it's rough. It is curving and hilly with plenty of dust in dry weather. It's not so bad right now. At times we have to wear masks, the dust is so

Driver's view of the endurance road. Test cars go around the rugged gravel circuit for thousands of miles.
thick. Going around here at about 40 takes more out of a car in a day than in a month on the highway. The tires take a terrific beating. Gas economy is poor because of the poor traction on this loose gravel.

You: Ever get into a tight spot?
Driver: Not very tight. I had a blowout at 85 the other day on one of the banked curves of the oval and the car didn't even wiggle. It was a front tire and the car had power steering. Then one day I had a hood fly open at 85 miles per hour. That was a thrill. The safety catch jammed. The hood bent back over the windshield like paper. Lucky I was on the track and had room to wander. It was like driving with your eyes closed at 85 miles per hour.

You: Then you don't get bored out here?
Driver: Not on this run because you have to be driving all the time. The road winds and climbs and there's no chance to get bored.

The eastern sky is beginning to brighten as you get out of the DeSoto. You want to check the oval before breakfast. You hail down a big Chrysler. It has a sign on the back that reads: Stop & Go Driving.

Driver: You won't get any thrills here. This is tame. We're doing city-traffic cycle. It's the dullest of all, a simulated traffic condition—never over 40. I go a quarter mile at 20 miles per hour, stop, idle for 20 seconds. Then repeat it. It's just a long day's work and at the end of the day you're ready to go home.

You ask: What's the chain on the brake?
Driver: It operates a counter. It records every time I step on the brake. That's so Engineering can check up on us. There's a telltale in back, too, so you can't do a thing they don't find out about.

You: What's wrong with this car?
Driver: Not much ever shows up on this cycle—not to the driver, at least. You're not pushing it here. It's only when they tear down the transmission or brakes that they find out what's wrong. This car has an experimental set of brakes. Hear that strange noise when I put them on? That's new to me. It has high-compression heads, too. The book says to use high-octane gas only.

You: How are the new heads?
Driver: Can't tell. It's frustrating to be in a car that wants to fly and have to hold it down to 40.

You: What's the worst part of this run?
Driver: The monotony, I think.

Especially at this time of morning. Occasionally we used to see a deer. We had to stop high-speed night driving on the track because they hit a few deer out here.

You: Let me out next time around, I want to eat before the wheel-break test.
Driver: You'd better not. I'd take it on an empty stomach, if I were you.

You ignore his advice. After breakfast you go over to the "skid pad" where a Plymouth station wagon with its right front fender off goes round and round in a tight circle. Two drivers alternate on this run—it's too much for one driver.

Driver: You'd better get in back. I take up the whole front seat myself.

You see what he means. He sits with his back against the left door, his right leg straight across the seat and his foot pressed against the right door. His left foot operates the accelerator. You take a similar position on the back seat. The relief driver waits outside for his turn.

(Continued to page 238)
NOW THAT Studebaker and Packard are "wed," the industry awaits what may be the next step in the move toward a Big Four: The merger of Studebaker-Packard with American Motors (Hudson-Nash).

There seems little question but that within a year Packard, Studebaker, Hudson and Nash will all be one big family. This would give the new group a complete line-up of cars from the small Rambler and even smaller Metropolitan to the big, luxurious Packard. The Studebaker truck line would fill out the enterprise.

Such a possibility permits some interesting speculation. For example, Studebaker now has an excellent, small and economical V8 engine, smaller than the Ford V8, for instance. Packard will have for 1955 a large V8 engine and, with Packard's reputation for engineering, it should be an excellent design. This would give the Big Fourth a pair of V8 engines which could power the whole line, with the possible exception of the Rambler and Champion. These two might stick with their L-head sixes for lightness and economy, although the flat head does seem to be on the way out (see page 122). Various heads, manifolds and displacements would provide ample variety of power from the same two basic engines. Both could be made in the new Packard engine plant.

And in transmissions the same story holds. Packard's Ultramatic is expected to be replaced by a new design for 1955. Studebaker already has an excellent Borg-Warner automatic transmission. These two could make the family completely independent of General Motors' Hydra-Matic (now used by Hudson and Nash).

Unitized Bodies

Hudson and Nash both use a unitized-body design. By combining talents perhaps the new group could convert Packard and Studebaker to this stronger system of construction for 1956 and subsequent models.

Where Kaiser-Willys would fit in any future merger is a question mark. The Willys Jeep is a money-maker with good consumer acceptance and military usage. It already has a substantial export trade and, if foreign markets open up, it will increase this business. But the Kaiser-Willys passenger cars apparently can't compete in costs with the Big Three or, for that matter, with the other independents.

The cold, hard facts are that no independent can compete alone. It costs many millions to retool for a new engine and about $18,000,000 to retool for a new body shell. No single company that sells only one or two percent of the nation's cars can afford such an expense. That economic fact is resulting in the mergers of independents (currently scrambling for a total of about four percent of the market) as a way to share tooling costs.

What will happen to the Hudson Jet now that it has a more popular rival inside the family, the Nash Rambler? Hudson spent a reported $10,000,000 on the Jet, but it didn't sell as hoped. Mechanically it is fine, all seem to agree, but it is outsold by the Farina-styled Rambler.

Don't lose sight of Chrysler's situation during all this talk about independents. The current year has not been a good one for Chrysler. General Motors and Ford have dominated production and sales.

Latest figures available at this writing show that three Ford products (Ford, Mercury and Lincoln) increased sales over 1953 although total industry sales are down. Chevrolet, Buick and Oldsmobile are also up over 1953 while Pontiac and Cadillac are down slightly. But the big drops are in Chrysler cars (especially Dodge which is down about 50 percent) and among the independents.

1955 Announcement Dates

It looks now as though the General Motors line will come out during the period from October to November with Pontiac and Chevrolet leading the pack.

Ford cars and trucks may come out in November with Mercury and Lincoln to follow later in December.

It looks like a year-end debut for the entire Chrysler family. Apparently the last-minute styling changes have been okayed.

Studebaker is expected to announce in October or November; Packard, with new styling, engine, transmission, in January.

Hudson and Nash will show in January also. Now that Hudson is made in the Nash plant at Kenosha, Wis., it is likely that it will have the basic Nash construction. This could mean no more step-down design. The 1955 Hudson will get a new roof line, doors and grille. Nash is also expected to have sharp appearance changes this year.

POPULAR MECHANICS
Former Antiaircraft Gun Serves as Mount for Long-Range Camera

Technicians at the Atomic Energy Commission's Sandia Laboratory in New Mexico used a former antiaircraft gun as a camera mount in taking a picture 12 miles away. The photograph was of the Albuquerque television transmitter, located at an altitude of 10,678 feet. The center of the former gun now has a fused-quartz mirror 12 inches in diameter with a 60-inch focal length, amplified to 360 inches by a series of lenses. A 35-mm. camera is mounted at one end of the 360-power telescope.

Infrared Lamps Heat Patrons of Sidewalk Cafe in Brussels

Infrared lamps postpone winter at a popular sidewalk cafe in Brussels. Boxlike heating units mounted on 10-foot poles on the terrace of the Hotel Metropole "toast" cafe patrons with radiant heat. The open-air terrace fronts on the Boulevard Adolph Max, offering an unobstructed view of automobiles and pedestrians.

Meter Tests Hardness By Touching Metal

Metal parts are sorted according to their hardness by an instrument that detects hardness differences instantly and at a touch. It also measures paint and metallic-plating thicknesses. The metal is not scratched or damaged in any way, the probe simply touching it. The device uses a principle similar to that of the thermocouple which measures temperature differences by voltage changes. Hardness differences cause voltage changes on a meter after amplification. The instrument was developed in General Motors Laboratories.
CRASH BOATS are standing by off Mercer Island! "All airports in vicinity of Seattle are closed to normal traffic!" "Rescue helicopter now on patrol off Seward Park!" "Fire fighters standing by!"

"Your chase plane is airborne!"

Reports like these were part of the pre-flight preparations in July when copilot "Dix" Loesch and I prepared to streak down the concrete runway at Renton Airport and lift the prototype of America's first jetliner into the air on its initial test flight.

Boeing's 707 "Jet Stratotanker-Stratoliner" is considered the safest passenger transport ever built, yet Dix and I were happy about the elaborate precautions to rescue us if anything went wrong. All our recent preflight and ground tests had been perfect. We were expecting a normal routine ride on the first flight, but there's always a chance that the unexpected can happen.

And the unexpected did happen during an early taxi test. A landing gear strut unexpectedly folded up. The plane skidded along the runway on one wing for a few feet and the whole test program was delayed during repairs.

For the first flight test, it was comforting to know that the crash boats carried diagrams of the fuselage with "Chop Here" information, and that fire fighters were standing by even though we wouldn't need their help. We had landing priority at any airport within 50 miles and, as a final precaution, we were wearing parachutes.

All of this is routine procedure at Boeing when a new design is being flown for the first time. In this case the precautions were
more complete than usual, if possible, for our new plane is the pioneer American aircraft in the jet-powered passenger-transport field. Including engineering and research man-hours, this prototype was built at a cost of $15,000,000.

The 707 has a wingspan of 130 feet and is 128 feet long. It is smaller than a B-52 bomber and is larger, heavier and faster than the British Comet. It is a brand-new design with a striking sweptback wing. We are offering it to two different markets—to the Air Force as a jet-refueling tanker or for transport, and to the airlines as America’s first and the world’s best jet passenger transport.

As an airliner it will cruise at 40,000 feet at about 550 miles per hour, carrying you across the United States in about five hours. Westbound you’ll almost keep pace with the sun. Eastbound you’ll go from ocean to ocean in three hours if the pilot catches a lift on the high-speed jet stream high in the air.

The galley can be smaller than usual since there won’t be time to serve more than one meal per flight. Depending on seating arrangements, it will carry from 80 to 130 passengers.

The Jet Stratoliner is designed to combine the best features of both jet and piston-engine aircraft, something that seemed impossible in the past. It has the high speed and altitude capabilities of a jet plane and
Cockpit appears to be jammed with controls, but actually has fewer instruments than a big piston-engine plane

still has the good low-speed performance of piston-engine aircraft. It can climb out of a field as fast as most transports can cruise. It can make a steep, slow approach for a landing, then brake to a minimum stop.

During the rest of this summer Dix Loescher and I will complete its Phase I testing. Among other things, this involves proving its performance, stability and altitude capabilities. We will find out how closely it meets the specifications to which it was designed. Take-off and landing distances will be measured, as will its Mach number and indicated air-speed limitations. We'll check flutter characteristics, if any, in all speed ranges and under all conditions.
Jetliner has two main landing gears with four huge tires on each, giving pilot plenty of braking area of loading and centers of gravity. Fuel consumption under all conditions will be measured.

Probably we'll find a few minor faults that are expected with any new design. We don't anticipate any major troubles. In fact, part of our job is to prevent any major trouble from developing. An emergency in the air usually has a small beginning that multiplies itself. Finally the plane is in real trouble. It's up to us to prevent any minor malfunction from building up into an emergency. We've worked up cockpit procedures for stopping or eliminating any adverse condition almost as soon as it starts.

Loesch and I spent more than 10 hours in the cockpit before the plane was first taxied. Part of the time we rehearsed the ordinary handling of the aircraft and the rest of the time was devoted to practicing emergency procedures. Normally, an engineer sits behind us at his panel. He's part of the flight crew, but on the first flight we left him on the ground and swung his hinged panel around so we could read its dials simply by turning our heads.

During Phase I the aircraft carries a lot of instruments that automatically measure pressures, temperatures and other conditions at numerous locations. This information is transmitted to automatic recorders and cameras mounted in the fuselage. Phase II of the test program, which we'll enter during the fall, is a development phase in which any changes that seem indicated are made and tested. We may find, for instance, that the rudder is larger than necessary. That would mean we are carrying weight that we don't need so, during Phase II, a small rudder would be tested.

One of the reasons why the 707 is regarded as the safest transport ever built is its extreme simplicity. For one thing, much of the heavy, complicated and potentially dangerous apparatus that must be lugged around with piston engines is unnecessary with jets. We don't have propellers and their complicated controls, we don't need superchargers. All in all, our cockpit has about half as many controls and indicators as has a current piston-engine passenger liner.

Nor does the 707 require an independent pressurizing apparatus or a heating plant for cabin warmth and anti-icing. The needed hot air is bled directly from the compressors of a couple of the engines. It comes off at 700 degrees, in fact, and has to be cooled by a reduction turbine before it can be used.

Another thing we don't need (and this may surprise you) is any fire-extinguishing apparatus for the engines. Each engine is carried in its own pod away from the wing. If an engine fire occurs, it takes less than a second to shut off the fuel, oil, hydraulic fluid and electricity. Then the fire blows itself out. It can't keep on burning for there's nothing left to support combustion. And the fire can't get up into the wing. This plane, incidentally, can maintain altitude, loaded, on only two of its four power plants.

Here's another thing that will surprise you. Big transports use power-boosted controls because no pilot is strong enough to manipulate the big control surfaces all by himself. But not on the 707. The plane is designed to handle with the same ease that you fly a three-place job manually. The secret is that the ailerons, rudder and elevators are equipped with small control tabs, similar to trim tabs, built into the trailing edges. The cockpit controls operate the tabs and the tabs in turn force the control surfaces in the desired direction. It's an old principle that hadn't been refined until recently, when the engineers learned how to balance the tabs and eliminate the flutter that characterized earlier designs.

If you look at the 707 wing you'll see
that the trailing edge has various control surfaces instead of simple ailerons and landing flaps. How these surfaces are used is still a company secret. They are part of the reason why we have take-off and approach performance that compares with piston-engine aircraft.

The 707 won’t need a drag chute to serve as a brake when landing, partly because its tricycle landing gear permits normal wheel braking as compared to the bicycle landing gear on our jet bombers. Each main gear has four rubber tires and the nose gear has two, giving a lot of “footprint” area that makes for good braking and distributes our heavy load so well that we can use existing airports.

Some air disasters have occurred in the past because of improper fuel-tank venting. Explosive fumes collected inside a wing structure and then were ignited when an adjacent electric switch produced an arc. A fire or explosion was bound to happen. Authorities suspect that this has caused a number of unexplained crashes. This hazard is completely eliminated in the 707. You might say that the whole plane was built around its fuel tanks and their venting systems. Complete safety was the first

(Continued to page 248)
Standardized sections of the bomber are shipped in seven crates and assembled in field prior to launching. Matador roars away from its launcher with the aid of a rocket booster.

**Pilotless Bomber Packed in Crates**

UNDER DUTY in Germany are the first pilotless bombers to be sent overseas. The robot planes, United States Air Force B-61 Martin Matadors, are built in sections which are assembled in the field just before launching. Seven wooden crates contain the nose, wing, center section, aft tail, fin and bullet-fairing stabilizer sections and the instrumentation. No longer is it necessary for a complete unit to be assembled in a plant and shipped to its destination in a bulky package. The easily transported crates can be stacked and stored for long periods of time. All sections are interchangeable, fulfilling a long-time dream of the aircraft industry. The high-speed planes are launched from a small mobile platform. A rocket booster assists the turbojet engine at take-off.
Dome-Shaped Aluminum Auditorium Needs No Interior Supports

Twelve thousand persons can be seated in a dome-shaped metal auditorium erected at Longview, Tex., that requires no interior supports. The tentlike building, which is 85 feet high and 300 feet in diameter, was constructed at ground level by semiskilled workmen. A steel center pole was first erected, and a sliding steel collar raised gradually up the center pole until 15 successive rings of aluminum sheets had been bolted on. When the last ring was installed, the dome was lowered and firmly secured to a foundation ring of concrete. If desired, the center pole may be taken down after construction is completed. Concentric rings of acoustical material were suspended from the ceiling for sound control. Ventilation of the auditorium is through a 255-square-foot opening at the peak around the center pole. The prefabricated building could also be used as a warehouse, aircraft hangar or athletic field house.

Grubbing Tongs Attached to Tractor Chain Uproot Stubborn Brush

Brush and saplings up to five inches in diameter are uprooted with a slipproof pair of grubbing tongs. Attached to a chain drawn by a team of horses or a tractor, they tighten their hold as the pull increases. After the growth is uprooted, they are easily disengaged.

Japanese fishermen recently caught the first tagged albacore fish known to have crossed the Pacific Ocean; covering 4900 miles in 324 days, the fish averaged better than 15 miles a day.

AUGUST 1954
Arched Troughs Form Roof and Sides of Simple Steel Building

Arched steel troughs fastened together make up a new type of building without trusses or other supports. The building is erected on concrete slabs, and does not require heavy footings for a foundation. The length of the building is expanded simply by adding arches. It can be used as a warehouse, workshop, dwelling unit or office.

Running Model of St. Lawrence River Helps Engineers Plan Seaway

Every swirl and eddy of a 35½-mile stretch of the St. Lawrence river is duplicated in a running model built by Canadian engineers. Survey parties on the river and depth-sounding crews working in helicopters sent daily reports to Toronto during the 22 months it took to build the model. Twenty thousand metal strips embedded in the model river bed are placed to reproduce the unevenness of the actual river bed. Vertical scale is 1 to 100 while horizontal scale is 1 to 500. Six hundred tons of compacted sand was used to fill the base of the model, which consists of two-foot squares of plywood cells. Covering the cells and sand is a two-inch skin of concrete. Built by the Ontario Hydro-Electric Power Commission at Toronto, the model is expected to save money on an American-Canadian project near Ogdensburg, N. Y. The model will help to indicate the best design for powerhouse and control dam.
FLORIDA'S Blow-Boat Derby

By Max Hunn

BLOW BOATS—the work horses of the Everglades swamps—turn to sport one day of the year at a unique race in south Florida. It's a new venture for the queer craft which are blown over the soggy grasslands by airplane engines and propellers.

Blow-boat racing reached the big time in 1954 when the first state-wide air-boat derby was staged. Three elimination contests—at St. Petersburg, Miami and West Palm Beach—helped select drivers for the final race program on Biscayne Bay near Miami, Fla. An estimated 20,000 people viewed the finals from scattered points along the Rickenbacker Causeway. Prizes in the final races were $500, $200, $150, $100 and $75—welcome bits of change for the winning drivers.

Organized air-boat racing is a very young sport, but every sign points to its rapid development in the future. Air-boat racing of a sort dates back to 1950, the year the Air Boat Association of Florida, composed partly of sportsmen and partly of froggers, was founded. All organized racing is conducted under the sponsorship of the association.

Today's sleek aluminum racers are far different from the “meat and grocery” boats that were their ancestors. Developed in Florida about 1929, the first blow boats were used to speed in supplies and haul out the catches of professional froggers operating deep in the Everglades west of Miami. In those days the hunters speared the frogs from dugout canoes similar to those the Seminole Indians had poled through the 'Glades country for generations.

The “chow” boats plied regularly between the new Tamiami Trail (an east-west, cross-state highway) and the camps of the froggers, utilizing a newly opened canal and the natural waterways of the 'Glades.

Rescue boat retrieves a pilot who tried to take a turn too fast. Spills are frequent in blow-boat racing.
Operators of an air boat make last-minute adjustments in final test run before the big competition begins.

Essentially, the air boat is a 4-by-12-foot, flat-bottom, lightweight, shallow-draft, scow-type boat with an engine and propeller mounted aft. The first boats were powered by Ford engines—Model A and then V8. A few still mount auto engines, but most boats today use discarded airplane engines. Horsepower ratings vary from 40 to 265. The majority of the engines come from Cub or Lycoming planes and cost anywhere from $75 to $350. A few individuals have paid as much as $750 for their motors.

Because they’re airplane engines, the power plants require aviation fuel. The usual fuel is 80 octane “avgas” and regulations of the recent air-boat derby specified this octane rating. Some blow-boat operators use regular auto gasoline, but according to most experts, it doesn’t work well.

Marine plywood was used in the hulls of many early boats. It was gradually displaced by aluminum, which is tough enough to stand all but the hardest knocks. The air-boat enthusiasts found that the plywood tended to become waterlogged, thus slowing the boat, and also was more susceptible to damage.

No one in Florida is making air boats commercially. They can be purchased from some of the men who build them, but there is no manufacturing concern specializing in them. To all intents, they are homemade and strictly individual in design.

But homemade or not, they are not necessarily cheap. Depending upon the materials and the engine, the average homemade boat will cost $1000. It can be built in two or three weeks of spare time by a person with experience, the mechanical skill and the tools. Without these, construction takes much longer.

About 1930, froggers found the air boats could be used in place of the slow-moving, hand-poled dugouts, and the boats became popular for this type of work. Today, the work-horse air boats are used for transportation in the soggy portion of the ‘Glades that can be traversed by no other means. They are used for hunting, exploration, frogging or just plain adventuring. Skimming over the shallow, saw-grass-cluttered water can be thrilling and even risky, for the blow boats are as skittish as Kentucky colts.

More than one fatal accident has occurred when some driver got tangled up with a high-speed propeller. The early boats offered little or no protection from the whirring blades, but almost all of today’s craft mount a protective screen and frame to pre-
Blow boats, which can scoot along in only a few inches of water, are made to order for the marshy Everglades.

prevent an accidental encounter with the prop. Nevertheless, it's good advice to look before backing.

But the propeller is not the only element of risk in air boating. The hull of an air boat is thin, and if the pilot overlooks some husky log lying submerged in the grass or plows into some other obstruction, trouble can be plentiful. The boats will bounce over many objects and, in fact, will travel over saw grass on dry land if sufficient run to gather momentum is possible. But there's always the time when it doesn't bounce.

Too, there's only one engine, and if it conks out when you're back in the 'Glades, it's a long walk back to civilization. Rescue parties are organized to retrieve some expedition which has had engine trouble deep in the endless "sea" of grass. Normal safety procedure is for air boats to travel in pairs, but frequently some venturesome individual will fail to heed the advice of the 'Glades experts, and trouble follows. Usually it means two or

(Continued to page 244)

Air boats go as fast as 65 miles per hour, are steered with an aerial rudder that deflects propeller blast.
Assault Transport Plane Lands Troops on Enemy Beach

Guns, trucks, supplies or an assault company of Marines can be landed on an enemy beach by a "flying LST" that taxis up to the water's edge. The R3Y-2, a four-engine transport built by Convair, is scheduled for service with the Navy late this year. The 80-ton plane, which has a range of more than 2000 miles, lands in offshore waters and taxis to the beach. When the hull touches sand, the bow swings upward, a ramp is dropped, and vehicles or troops debark. The R3Y-2 can carry four 155-millimeter howitzers, three 2½-ton trucks, six Jeeps, two half-tracks or several other types of military equipment. It can carry 92 litters and 12 attendants in hospital-evacuation use or can be fitted with 103 demountable seats for transporting troops.

Smallest Jet Fighter Carries Atom Bomb

Only 25 feet from wing tip to wing tip is the Navy's new Douglas Skyhawk, the smallest and lightest U.S. jet combat plane ever built. Less than half the conventional size, it is superior in performance to many current operational jet fighters. Its combat radius is greater than present propeller-driven attack craft. It can carry atom bombs or rockets, machine guns, missiles and other weapons of combat airplanes. The plane is so small that it has been designed without the folding wings that are standard on carrier-based planes.

British Braking Parachute for Airplanes Folds Itself After Use

British experts have developed a parachute that folds itself. The chute, which is being tested with a racing car, would be used to slow landing airplanes. Upon landing, the pilot of a plane presses a button to release the chute. When the airplane slows to a given speed, he presses another button and the parachute is pulled in with a winch. A telescopic cylinder extends automatically, shrouding and stowing the parachute canopy. Normally, braking parachutes are left on the runway to be picked up later.
This is Monticello. Jefferson spent a lifetime building and rebuilding his home. The work of an architectural genius, it's one of the most fascinating homes ever built in America. In the end it drained away his fortune.

Thomas Jefferson Lives Here

By Clifford B. Hicks

To start unraveling a fascinating story, take a look at any nickel dated after 1938. On one side you'll find a man's profile. The other side shows the outline of a building, and beneath the building appears the name Monticello.

The man and his home (for the building is one of the most fascinating homes ever built) are fittingly joined in death as in life. Thomas Jefferson must have loved Monticello with an intensity few men can experience.

The building still stands, almost 200 years after it was started, as a monument to the architectural genius of our third president. Though the story of the home is deeply rooted in the past, it doesn't end there. Each year hundreds of thousands of visitors wander through the building and across its hilltop site—more visitors than Jefferson ever saw, even in his later years when people were so curious to see him that “one woman punched her parasol through a window pane to get a better view of him,” according to his great granddaughter.

The visitors see everything exactly as Jefferson saw it, from the wallpaper in

Milton L. Grigg, the Foundation architect, compares recast plaster frieze with a section of Jefferson’s original frieze.

AUGUST 1954 97
Inside the dining-room fireplace are two dumb-waiters. One delivered wine bottles, the other took away empties

Detective work that trailed back through history uncovered and duplicated original wallpaper pattern

Hostess at Monticello demonstrates revolving door, which was turned to deliver food to the dining room
the unique octagonal bedroom to the exact type of flower he had in each flower bed. But what they can’t see is equally important—the 80 steel beams carefully installed to hold up the floors, the air-conditioning ducts which Jefferson scarcely could have imagined. In fact, they can see little of the work that has gone into restoring the most unique home in American history.

Not since the early days of the Republic has there been so much activity on Monticello’s little mountaintop overlooking the 192-year-old city of Charlottesville, Va. Last winter, workmen from Charlottesville who had grown up under the spell of “Mr. Jefferson’s house” drove up the winding mountain road each day. Their greatest pride is the fact that you can’t see what they did.

To start unraveling the story on your nickel you must go back to pre-Revolutionary days. Of all the foothills of the Blue Ridge, this was the one young Tom liked best. As a schoolboy he spent day after day clambering over the 580-foot hill (the Italian name Monticello means “little mountain”) until he knew every fold of the ground, every tree on it. In 1763 he inherited the mountain from his father.

When he went away to college the mountain still called to him, and he returned at every opportunity. Some day, he vowed, he’d build a magnificent home on the very crest, where he could see the blue of the mountains to the west and the rolling green of the Piedmont to the east. To design the home, he began studying classical architecture. He taught himself well, so well that most historians agree America lost a magnificent architect when it gained one of its finest statesmen.

In 1768, eight years before the Revolution, he supervised the leveling of the mountaintop. A small brick cottage had already been built there. In 1772, when the winds of politics first started swirling about his tall figure, he married a young widow. Through a snowstorm he brought his bride to the little brick cottage, which ever since has been known as Honey-moon Cottage.

Then began a curious blend of statesmanship and architecture.
Jefferson became a member of the Continental Congress, wrote the Declaration of Independence and was elected Governor of Virginia. But always, whenever he could spare a few days, he returned to Monticello. Gradually the home took shape under his hands. No nails were available so he established a nailery on the mountain. In his own kiln he fired the bricks of red Virginia clay and waterproofed them himself with a coating of pine oil.

Only two of his six children survived infancy, and in 1782 his young wife died. Thereafter Monticello took an even larger place in his life. In 1784 he was sent to France, where he represented this country for four long years. But an invisible string tied him to the little Virginia mountain, and he spent much of his leisure time studying architecture and buying furnishings for his home. In all he sent 85 packing crates of furnishings back from Europe.

When he returned to America he wanted to retire to Monticello, but George Washington appointed him Secretary of State. In 1800 he was elected president and served two terms. But his home still called. Historians have calculated that he spent a solid year of his life just traveling to and from Monticello.

At last, in 1809 he was able to return. The home, in Jefferson’s mind, was never finished. He was always in the process of adding to it, tearing it down, renovating or redesigning it. During his last years he became “father” of the University of Virginia and designed all of the original buildings which are still in daily use. But the cost of Monticello and his hospitality had put him deep in debt. He was a happy captive of his own home.

Jefferson once wrote in a letter to a friend “All my wishes end where I hope my days will end, at Monticello.” On July 4, 1826, his days ended at Monticello, exactly 50 years after the signing of his Declaration of Independence.

In the settlement of his tangled estate, magnificent Monticello had to be sold, and thereafter the home entered dark days. A succession of owners neglected it. Rooms which had accommodated presidents and

Jefferson used this polygraph to make copies of all his work. Copies have been invaluable to historians.
ministers were used as dumps. One lonely caretaker lived in one room after another, closing the doors behind as each room became littered with filth. Old-timers around Charlottesville even now can recall seeing cows wander in and out of the entry hall. The steps leading up to the home were so covered with refuse that a wagon could be driven right up onto the portico. Monticello was a dump, a graveyard of the past. But beneath the refuse, thanks to Jefferson's genius, Monticello lived on.

In 1923 the Thomas Jefferson Foundation was organized. School children all over the country gave their nickels (remember the nickel in your pocket?) and thousands of Americans contributed funds to buy the home. Monticello was bought for $500,000, though Jefferson's daughter had trouble selling it for $7000 in all its glory, and soon Monticello was opened to the public.

In the ensuing years some 2,750,000 Americans have visited Jefferson's beloved home. The Foundation, a nonprofit organization, charges a nominal admission fee which pays for the upkeep of the building itself, its restoration, and the recovery of the original furniture whenever a piece can be found.
Servants' quarters and kitchen are hidden from view at Monticello, yet have their own ground-level entrances.

A few years ago signs of serious deterioration appeared. Floors sagged, ancient mortar crumbled away from the brickwork, the original oyster-shell plaster started to fall. The Foundation architect, Milton L. Grigg, one of America's leading authorities on colonial architecture, urged that the building be renovated. At the very moment he was meeting with the board of directors in New York a section of one of Monticello's bedroom floors collapsed into the basement in a cloud of dust and rubble.

Grigg was commissioned to go ahead with the work on the specific understanding that he would "preserve rather than restore, and restore rather than reconstruct." To Grigg, every handmade nail in Monticello is sacred. He and the contractor, R. E. Lee, Jr., of Charlottesville, were determined to hide all their work.

First step in the restoration was tuckpointing the brickwork to repair damage that had overtaken it through 180 years.

"The bricks themselves were in wonderful condition, thanks to Jefferson's 'pine oil,'" says Grigg. "In fact the bricks are superior to anything we can obtain today."

Grigg and his men chipped away some of the mortar and had it analyzed both physically and chemically. They then matched it precisely in color and texture.
After repairing the home they could proudly defy a stranger to show them where they had so much as touched the exterior. All the masonry then was given a coat of a silicone compound which forms an invisible seal, preventing water from penetrating the brick and mortar.

Actually, Jefferson's foresight as an architect was the root of the basic trouble inside Monticello. To fireproof and insulate the building Jefferson packed the area between all the floor joists with two layers of brick laid in a bed of clay. Structurally the building was strong enough to support these tons of dead weight for almost two centuries. However, later owners had permitted vines to climb in profusion over the exterior walls. The vines penetrated the mortar joints and brought moisture into this clay-and-brick nogging. Gradually the moisture built up within the floors, straining the timbers and threatening to burst the building apart.

In all, the contractor removed more than 100 tons of rubble from the floors. To prevent damage to the beautiful flooring, the work was done from below. The plaster on the basement ceiling was chipped away, the batten boards that held the nogging in place were knocked loose and the nogging itself removed. This exposed the 3½ by 10-inch yellow-pine joists. Steel beams were notched into these joists and the basement ceilings then were covered with metal lath and plastered with a fireproof volcanic-ash plaster. Not a floorboard on the first floor was touched and today the floors look exactly as they did in Jefferson's day, yet the building is considerably lighter and stronger.

Some of Monticello's secrets were uncovered during the restoration. One mystery was the action of the automatic double doors between the entry hall and the drawing room. When Jefferson opened either of the twin doors, the other door automatically opened at the same time. When either door was closed, the other swung with it. Yet no mechanism could be seen. Expert architects who inspected the home — including Grigg himself — were convinced that Jefferson hid his secret in the ceiling above the doors. However, when workmen removed the nogging from the floors beneath the doors they stumbled onto a mechanism so simple and foolproof that it works perfectly to this day. Jefferson simply made two sprockets, similar to bicycle sprockets, and connected one to the pivot point of each door. Chains, crossed in the center, are fastened to the two sprockets. When one of the doors swings open, the chains move, turning the other sprocket in the opposite direction.

(Continued to page 212)
Turbojet Engine Produces More Than 25,000 Horsepower

Producing the equivalent of over 25,000 horsepower at supersonic speeds, Pratt & Whitney’s new J-57 turbojet engine with an afterburner is being put in the fastest U.S. fighters. Already installed in the F-100 Super Sabre, holder of the world speed record of 755 miles per hour, it will also power the F-101, F-102, F4D and the B-52 bomber. The afterburner is a tube-like extension of the engine’s exhaust tailpipe. When a pilot needs a large boost of power for his aircraft, he sends additional fuel in a spray into the hot exhaust gases. This increases the thrust about 50 percent.

Invisible Sentinel Times Operation of Automatic Elevator Doors

Operatorless elevator systems now are controlled by an invisible beam of light that tells the doors when to open or close. The “traffic sentinel” projects an infrared ray across the entrance of an elevator car a foot above the floor. Whenever a person moves into the car, the invisible beam closes the door two seconds later unless it is again interrupted. As a rider exits the interval is cut to a half second. The instrument, developed by Westinghouse, may make it possible for automatic elevator systems to surpass attendant-driven systems in efficiency.

Alarm Sounds If Child or Pet Falls in Unguarded Swimming Pool

Unguarded swimming pools are automatically tended by an alarm box that signals when a child or a pet has fallen into the water. The battery-operated box is placed on the apron of the pool. Leading from the box is a metal arm that is connected to a float in the water. If a pet or youngster should fall into the untended pool, the ripple of water vibrates the sensitive float, tripping a switch to set off a loud bell. The alarm is turned off when the pool is in use.

(The buffalo-hide winter coats worn for many years by the Royal Canadian Mounted Police are being supplanted by nylon parkas.)
Undamaged, a jet drone lies on the desert floor after a parachute drop. A trailer and crane will retrieve it.

**Brightly Colored “Fish” Fly High Over New Mexico’s Sand Dunes**

Held by a special rack, one drone is carried beneath each wing. Tiger-toothed, fire-engine-red “fish” soaring over New Mexico’s sand dunes rarely get a second glance now. They are Firebee pilotless-jet target drones being flight tested by the Air Force. Imaginative paintbrushes add tiger teeth and fisheyes. The drones are launched singly from special racks mounted beneath the wings of a B-26. After an electric bomb-salvo switch starts them on their way, they are maneuvered by signals from a control box operated by an officer on the ground. The drones are parachuted to earth undamaged after each test.

**Lavatory Complete With Running Water Attaches to Side of Car**

One of the comforts of home—a clean face—is possible on the road when you mount a portable plumbing system on the side of your car. It’s a rubber bag equipped with a faucet which attaches to the car with hooks and suction cups. Below the faucet is a small wash basin. Made in Germany, it is designed for campers and for tourists who like to “freshen up” along the way.

**Wonder Oil Ignores Cold**

Temperatures far lower than 100 degrees below zero fail to bother a new wonder oil developed by the Elgin National Watch Company as a watch lubricant. It should have wide usage for other precision equipment subjected to extreme cold such as gun sights, fuses, meteorological and navigational instruments, the company said.

AUGUST 1954
What do the owners think of the Oldsmobile? To find out, Popular Mechanics surveyed 1000 owners of the 1954 Olds.

Here's What They Say About Oldsmobile:

**Performance**

"Has a higher top speed and better acceleration than some cars with a higher advertised horsepower."

*Detroit, Mich., supervisor*

"In Drive range, pickup is slow at low speeds especially when making sharp turns and climbing a slight grade."

*Manchester, Conn., engineer*

**New Body Styling**

"I like the body lines and minimum external chrome. Also wide seats and broad angle of visibility."

*Mercer Island, Wash., salesman*

"Old conventional style gave body a more balanced look. Extra view of new windshield is of minor importance."

*Kew Garden Hills, N. Y., retailer*

**Wrap-Around Windshield**

"Visibility in cutting city corners is much better."

*Detroit, Mich., structural engineer*

"Visibility very poor in driving rain. Water runs down slanted windshield. Wipers are too slow to keep it clear. Sun glare very strong."

*Boston, Mass., fire tender*
OLD S' OWNERS LIKE PERFORMANCE AS WELL AS LOWER, WIDER BODIES

Written by Oldsmobile Owners

WHAT DO OWNERS of the 1954 Olds-mobile like best about their cars? As you may have guessed, in view of the car's reputation, the most-popular feature is performance. More owners list performance as the best-liked feature than anything else.

"I like the surging power at the slightest touch of the gas pedal."—Arlington, Mass., manager.

"Has higher top speed than cars with a higher advertised horsepower. Also better acceleration. Sensitive to gasoline though, must use highest octane for good results."—Detroit, Mich., supervisor.

"Like its ability to get out and go when necessary."—Minneapolis, Minn., lawyer.

The new body styling—the lower and wider look—was next in popularity.

"Plain, beautiful lines. Not too much chrome."—Rehoboth Beach, Del., retired professor.

"I like the over-all styling. It has a 'rich' appearance. My wife informs me that when she drives the car it gives her 'prestige.'"—Indianapolis, Ind., salesman.

"Pleasing to the eye. I like the knowledge that I am driving one of the 'better' cars."—Detroit, Mich., advertising man.

"Appears to be a much larger car than it is. I am sold on the wrap-around windshield, but should make rear window higher so I could see more in the mirror."—Covington, Ga., National Guardsman.

There are some dissenters, of course.

"I think the old conventional style gives the body a more balanced look. The extra view that the new windshield gives is of minor importance. Conventional windshield gives sufficient visibility to either side."—Kew Garden Hills, N. Y., retailer.

"I like the rise in fender line at rear door. Rear end should be lower. Unless the trunk is loaded, the rear end appears too high."—New Rochelle, N. Y., student.

Rattles Bother Owners

More owners complained of poor assembly work and resultant rattles and squeaks than of any other thing.

"Mine has squeaks and rattles that the dealer has not been able to find. Very annoying. Glass rattles in the doors. Trunk rumbles."—Russiaville, Ind., farmer.

"Body seems very solid on rough roads although they are coming out of factory loose as to doors, dash and hood. All need tightening. Gas mileage not as good as

Clymer Road Tests the 1954 Olds

By Floyd Clymer

I DROVE a Super 88 four-door sedan 961 miles from Denver, Colo., to Dodge City, Kans., and return plus a circle trip through the Rockies out of Denver.

The Super 88, with the 185-horsepower Rocket engine of 324-cubic-inch displacement, is an excellent performer, with extremely high top speed (speedometer hit 115 miles per hour on open stretches). The (Continued to page 220)
Some owners complain that vision through rear-view mirror is too narrow. The men mark the limits of driver's vision. Below, there can be no complaints about the room in the trunk of the 98! It will carry all the luggage anybody would need.

Some owners complain that vision through rear-view mirror is too narrow. The men mark the limits of driver's vision. Below, there can be no complaints about the room in the trunk of the 98! It will carry all the luggage anybody would need.

could be.”—Dupuyer, Mont., store owner.

"Rattles under dash."—Minneapolis, Minn., municipal worker.

Also frequently mentioned by owners is poor gasoline mileage. See Percentage Table on page 109 for average miles per gallon as reported by the owners.

"Gasoline mileage is poor in city traffic. Rattle from right front seat is very disturbing when there is no one sitting there. Back of seat shakes on every bump."—Boston, Mass., bartender.

"I would like them to install a higher rear-axle ratio to increase gas mileage."—Phoenix, Ariz., real-estate salesman.

The lower body also improves roadability, say many owners.

"The low-slung body contributes a great deal toward easy handling, takes curves with no sway whatsoever."—Detroit, Mich., transportation driver.

"Has 100 percent improved roadability and handling over 1953 Olds, which was nose-heavy and had excessive roll."—Denver, Colo., wholesaler.

"Believe that the soft suspension could be stiffened a bit for better cornering. Dislike having to back off and apply brakes for a curve."—Emmetsburg, Iowa, produce dealer.

Cracked-Windshield Rumor

As with Buick owners, the owners of the 1954 Olds seem to be afraid of cracking or popping out their wrap-around windshields when the car is jacked up. There were only three owners who reported windshields cracking, but not one of them said it occurred while the car was being jacked up. There is no evidence to support the rumor, yet it seems to persist.

Generally, the owners like the new style of windshield.

"Visibility in cutting city corners is much better."—Detroit, Mich., engineer.

"I like being able to see in any direction. Also being able to see all four fenders. Windshield should
Owners from almost every state in the nation (shown in black) took part in the PM survey

Percentages from PM Poll
of Oldsmobile Owners

OVER-ALL RATING OF THE OLDs
BY THE OWNERS

<table>
<thead>
<tr>
<th>Rating</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>74%</td>
</tr>
<tr>
<td>Good</td>
<td>23%</td>
</tr>
<tr>
<td>Fair</td>
<td>2%</td>
</tr>
<tr>
<td>Poor</td>
<td>1%</td>
</tr>
</tbody>
</table>

Have owned an Olds before?  
Yes .................................................................................. 67%  
At least 5 Olds before ................................................................ 11%

Would buy another Olds?  
Yes .................................................................................. 83%  
No ..................................................................................... 17%

Owners' rating of dealer service  
Excellent ........................................................................... 46%  
Good .................................................................................. 32%  
Fair .................................................................................... 14%  
Poor .................................................................................... 8%

Owners' rating of engine  
Excellent ........................................................................... 90%  
Good .................................................................................. 9%  
Fair .................................................................................... 9%

Owners' opinion of new body  
Like ................................................................................... 92%  
Dislike .............................................................................. 4%

Owners' opinion of wrap-around windshield  
Like ................................................................................... 95%  
Dislike .............................................................................. 4%

GAS AND OIL ECONOMY

Average miles per gallon  
City: 14.2  
Country: 17.0

Super 88 owners: 14.2  
98 owners: 14.2

Oil consumption per 1000 miles  
88 and Super 88: 98%  
98 owners: 99%

88 and Super 88 owners: 97%  
98 owners: 98%

More than 1 quart: 0%  
98 owners: 0%

OPINIONS ABOUT POWER ACCESSORIES

(Percentage of owners who now have these accessories who would buy them again)

Power steering: 95%  
Air conditioning: 86%  
Power window lifts: 72%  
Power front seat: 71%  
Automatic headlight dimmer: 62%

PERFORMANCE RATINGS

Acceleration from zero  
88: 67%  
Super 88: 72%  
98: 79%

Excellent: 29%  
Good: 12%  
Poor: 1%

Acceleration from 50 m.p.h.  
Excellent: 70%  
Good: 26%  
Poor: 4%

Readability 88 and Super 88: 98%

Handling  
Excellent: 81%  
Good: 19%  
Poor: 4%

Structural rigidity  
Excellent: 54%  
Good: 37%  
Poor: 9%

BEST-LIKED FEATURES

(In order of popularity)

Engine performance  
Style and appearance  
Handling and maneuverability  
Visibility and wrap-around windshield  
Riding comfort  
Power accessories

MOST-FREQUENT COMPLAINTS

Careless body work  
Poor gasoline economy  
Poor paint job  
Wind noise at high speed  
Rear-seat headroom

Owners with no complaints at all  
88 and Super 88: 18%  
Classic 98: 33%

CHANGES OWNERS WOULD LIKE

(In order of frequency of mention)

Rear-view mirror position changed  
Better body workmanship  
Improved gasoline economy  
Dual-exhaust system  
More front-seat legroom  
Underseat heater  
More accessible oil filter

have electric wipers, though. There is really more horsepower in engine than needed."—Cheyenne, Wyo., salesman.

But while visibility may improve there apparently are some drawbacks to the windshield, according to the owners.

"New windshield comes back too far, making it hard for large persons to get into the car."—Dayton, Ohio, salesman.

"More wiper area needed to eliminate blind spots in bad weather."—Detroit, Mich., clerk.

There were many owners who listed riding comfort as a best-liked feature, but Oldsmobile offers the most novel two-tone combinations on the road today as these three sketches indicate

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Some owners do not like the heater location on the firewall, saying heat doesn't get to rear-seat riders as usual there were a few others who disagreed with this opinion.

"I like comfort on long trips."—Elkin, N. C., textile worker.

"Rides nice. Is easy to drive and quite economical."—Salt Lake City, Utah, traveling salesman.

"Rough riding. Also jerks every time it changes gears."—San Antonio, Tex., store owner.

By a wide margin, Oldsmobile owners say their car is wonderful. Of those reporting, 74 percent say the Olds is excellent, 23 percent say it is good, only 2 percent describe it as fair and 1 percent as poor.

Only 1 percent said they would not buy another Oldsmobile, while 83 percent said they definitely would. The other 16 percent are still uncertain.

**Miscellaneous Complaints**

Although most owners are enthusiastic about their Oldsmobiles, they still have complaints. And, as usual, the complaints are varied and interesting.

"Paint job is foggy in spots and in other places not much paint on it. Could stand a new paint job."—Henderson, Nev., painter (who ought to know).

There were a number of complaints about the wind noise at high speeds, due in part to the wrap-around windshield and to the cowl-level air intake.

"New windshield seems to have a lot of wind noise."—Newcastle, Wyo., foreman.

"Biggest complaint is wind noise. It would drive a sane man out of his mind in short order. When I first got the car it was so bad it was impossible to hear the radio."—Newark, N. Y., state trooper.

"Too much wind noise in air intake."—Centralia, Ill., contractor.

The following is a selection of interesting complaints mentioned by 1954 Olds owners. Most of these were mentioned by more

(Continued to page 226)
Plastic Beads Popped Like Corn

Tiny plastic beads which burst and expand like popcorn when heated permit the molding of foam plastic. Formerly foam plastic could be processed only in sheets and blocks. The new material is poly-

Unsafe Water Purified

Unsafe water is purified quickly with a plastic device that fits into a shirt pocket when not in use. Water poured into the top portion of the double bag flows through a purifying substance contained in the pinched-in waist. Bad tastes, odors and bacteria are destroyed. The 1 1/2-quart bag can be used 100 times without reducing its effectiveness.

Permit Molding of Foam Plastic

Styrene impregnated with a special foaming agent that reacts under heat. Light, buoyant and strong, the "popped plastic" can be used in life rafts, novelties and for insulation. Various densities are possible.

Weed Topper on Power Mower

On a new power mower a sickle bar moves back and forth to cut off the tops of weeds while the reel cuts the grass. The bar is in front of the reel and is low enough to cut weed tops before they go to seed, preventing the weeds from multiplying. The bar has the oscillating action of a farm mower.
Full-Length Sleeping Cot Rests on Top of Automobile Seats

Now the traveler can install a relief bunk in his car — an aluminum cot that extends above the seats from front to rear. While one person drives the other can sleep in full-length comfort. Made of lightweight tubing, the cot is supported by legs resting above the instrument panel, on top of the two seats, and on the rear-window ledge. It is quickly removed or installed and can be folded for storage. When folded, it is easily packed into place along with any reasonable amount of luggage. The bed can be adjusted for use as a regular cot.

Single Turboprop Can Power Bomber

Test pilots flying a B-17 experimentally equipped with four piston engine-propeller combinations and a single gas-turbine-driven propeller report the bomber "picks up speed" when only the turboprop is working. It produces 5700 horsepower, about 20 percent more than the other four power plants combined.

Irrigation Dam Made From Vinyl

Vinyl plastic has found another use — in lightweight irrigation dams. The plastic sheeting is laid in the ditch and over its banks for four or more feet. A pole running through a fold in the top holds up the end across the ditch. When the ditch is flooded, the weight of water on the apron holds the dam in place. The durable sheeting is easy to fold and carry. The dams are colored so they will be easy to locate in the field.
Underwater Motion-Picture Camera Takes Movies at 100 Feet

Automatically adjusting for changing light conditions, an underwater camera built by two California skin divers takes natural-light movies at depths of 100 feet and more. Basis of the unit is a war-surplus 16-millimeter wing camera. The men, Don Dotson and Bob Kimes of Culver City, Calif., installed a wide-angle lens and altered the operating speeds to those normally used in professional movie work. The waterproof case was designed and built by them so that all operational controls are available at the diver's finger tips. Power is supplied by batteries. An electric eye measures the natural light and sets in motion a servo mechanism that changes the diaphragm opening. A shutoff stops the camera when the film magazine is exhausted, and a buzzer warns when existing light is too dim for adequate exposure at the widest aperture. Released underwater, the camera will bob to the surface.

Garden-Hose Attachment Anchored in Turf Forms Portable Shower

Outdoor showers are provided by a device that can be quickly set up on any lawn. A metal pipe with a spray head at its curved end, it has a sharp point at the other end that can be pushed into the ground to hold the assembly upright. There is a connection in the pipe at ground level for the hose.

Hypodermic Gun “Fires” Liquid Injection

Scientists have developed a hypodermic instrument which hurls a tiny liquid column that can penetrate nearly four inches of tissue. The new device may be used for direct injection into internal organs and tumors. The liquid is put in a steel chamber and propelled through a .005-inch nozzle by the explosive action of a small wafer. The wafer is made from nitrosoguanidine, a heat-sensitive chemical, and is detonated by a small “soldering iron” in the device.
1. **CONTOUR-BED MECHANISM** is available in sizes to fit all standard beds. Two 1/4-horsepower motors raise or lower the head or foot to the desired position. Toggle switches within reach of a bedfast person operate the mechanism. Special mattresses, either foam rubber or innerspring, are available for the bed.

2. **WEATHER STRIPPING** for casement windows is a metal strip that just slips into place over the frame of the window without screws or nails. One form of the stripping is applied to the head and lock side, another to the hinge side and sill. There’s a packaged set for standard windows or you can buy any length.

3. **“SNOW-ICE”** sealed inside a plastic bag is frozen in your refrigerator or home freezer, then used to keep perishables fresh and cold during picnics and other outings. The material can be refrozen as many times as desired. You also can use it to keep foods cold while defrosting a refrigerator or home freezer.
4. CRUSHED ICE slips out of a new ice-cube tray at the twist of your wrist. The flexible plastic tray is divided into slim compartments to freeze 60 ice wafers. When you twist the tray they pop out to give you crushed ice without any chopping.

5. SQUEEZE CLEANER for mirrors and windows is a unit that combines a liquid cleaner, a sprayer and a squeegee. You squeeze the flexible container to spray the glass, then wipe it down with the squeegee.

6. CLOTHES DRIER attaches to the door of an automatic washer. The heater-blower has a timer which is mounted on top of the machine. When the clothes have been washed and rinsed you remove a cover plate from the blower and set the timer. The clothes are tumbled while the door-mounted unit dries them.

7. PORTABLE ELECTRIC OUTLET has a built-in fuse to minimize the possibility of blowing main fuses. There are four receptacles for plugs. The unit is built to withstand an electrical load up to 1000 watts without blowing fuses. In the event of an overload, the 15-amp. fuse in the unit blows first.

8. SPRINKLER SYSTEM contains enough plastic pipe, fittings and sprinkler heads to cover an area of 1200 square feet. You assemble the system, join the parts with a special adhesive, then bury the pipe beneath the surface by opening the sod with a spade. Sprinkler heads screw on the vertical risers by hand.
I'VE LOOKED INSIDE

A TORNADO

By Capt. Roy F. Hall

A MONSTER is devastating our land. It has left 4000 trails of disaster across the nation during the last 20 years. If these paths could be reduced to a single swath, it would be 500 miles wide and 10,000 miles long. In this great aisle would lie 10,000 dead, more than 100,000 injured and a billion dollars in property damage. This fiend—nature's most violent release of energy—is the roaring tornado.

In 1948 I sat on the floor of my home and looked up into the hollow, brightly illuminated interior of one of these swirling cores. Moments before, the tornado had blown off the roof of my house, so my view was unobstructed. The core had a diameter of possibly 125 yards. I could plainly see the lower end of the core cloud several hundred feet above my head.

A moment before the tornado struck, the roaring and screeching stopped. The effect was as though plugs had
suddenly been placed in my ears. Seconds later I was knocked down by the west wall of the house but heard no noise. I crawled into the next room and sat on the floor sheltering my baby. Here I saw the south wall of the house go down, leaving us on a bare floor with nothing overhead. There was no sound. I watched my neighbor's house, 50 feet away, suddenly dissolve. There was not the faintest tinkle of sound until the tornado had passed on, when the noise came back as suddenly as it had blanked out.

For the past 20 years I have studied tornadoes. With my own eyes I have seen several of these monsters walk with devastating steps across the land—and sea.

Almost 500 persons died in the big winds during 1953, the year of the highest tornado activity on record. More than 360 tornadoes were reported. In Waco, Tex., a tornado lanced into the business district and cut a channel for 20 blocks, killing 114 people and destroying an estimated $50,000,000 worth of property.

Something should be done to minimize the loss of life and property, and something is being done. The U.S. Weather Bureau, in 1952, established a Radar Tornado and Storm Warning Service. This year the radar net has spread over most of the tornado-affected area of the Southwest and Middle West.

What were the meteorological conditions that gave rise to so many severe tornadoes in 1953? There is no widely accepted

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About the Author...

Capt. Roy F. Hall retired from the Army in 1929 and immediately plunged into his hobby, the study of tornadoes. He has watched the formation of waterspouts, whirlwinds and tornadoes around the world, from Corregidor to his home in the tornado belt at McKinney, Tex. For four years he has served as an observer for the Weather Bureau.
Cold front creeps forward preceded by a finger of cold air, top, trapping the warm, moist air in a pocket

answer, as the real mechanism of the great funnel itself is shrouded in mystery. In many years of studying, analyzing and observing tornadic funnels I have arrived at some definite conclusions regarding the mechanism of the tornado.

One discovery stands out as significant: we have held firmly to the belief that a tornado is caused by warm air surging aloft, like the lowly whirlwind. We now know that the only characteristic the two have in common is that they rotate counterclockwise. A whirlwind is created when hot air rises from a heated surface. A tornado comes from above. It is formed in the clouds and spirals down to the earth.

A tornado is created when an overlying mass of cold, heavy air breaks through a lower layer of light, moist air. This cold, upper air, the advance guard of a ground-running cold front, seldom if ever breaks through the lighter air beneath unless it is triggered, and this triggering is the complicated part of the formation of a tornado.

If there are no prongs or tongues projecting out from the smooth elongation of the surface-running cold front, the warm ground air is shoved along at an angle ahead of it, and is gradually lifted aloft to form the familiar squall line preceding a cold front. These are the cumulus and cumulo-nimbus rain clouds. But occasionally a finger of heavy, cold air points ahead of the main cold front. Then the warm air moving along the face of the front is caught in the bay formed by the cold-front pro-

Turbulence at freezing line produces heavy hail which drills hole to the ground. Cold air pours down hole

jection. It is pushed aloft by pressure from the rear and the scooping action of the cold-air mass.

Funneling upward, this warm, moisture-laden air breaks through into the overrunning dry, cold air and condenses, forming the black towering clouds immediately ahead of the cold front. The light, moist air climbs rapidly to the ice crystal, or freezing line, 15,000 to 20,000 feet, and spreads to form the anvil top of the cloud below. This anvil top, pushed by swift currents in the higher air, is shoved ahead and precedes the rain clouds. This is the high cloud that blankets the sun first on the approach of a cold front.

The moist air, rising into the dry, cold air, saturates it and is instantly condensed, forming the clouds. Some of this falls as rain and some, carried to the ice-crystal line, as sleet. If the upsurge of warm air is of high velocity, this sleet is carried back to the freezing line where it is further enlarged by having another coating of moisture frozen around it. This may occur any number of times until the sleet pellets—now hail—reach the size of baseballs.

The hail, carried farther and farther to the forefront of the anvil cloud with each ascension, finally reaches a region where it drops free of the updraft all the way to the cloud base, further cooling the already cold air above the warm-air layer. Great instability is produced in the cold upper air and in the warm air below the base of the cloud as the hail falls to the earth. From
the anvil cloud to the ground a perpendicular tube now exists, cooler and heavier than the surrounding air. Top to bottom, this weighty column starts downward throughout its length, rotating in accord with natural laws, and a tornado is born.

At this stage the tornado is invisible. The whole column whirls faster as the cold, heavy air pours down the tube to the base of the cloud. The air, gaining momentum through the break-through hole, whirls so fast that the column begins to expand from centrifugal force into a hollow tube. Clouds sucked down from above are drawn into the vacuum and the tornado funnel takes on its first visible shape.

The lower end of the column may do minor damage to the ground, but its rotational speed is not nearly as great as the cloud-filled, inverted cone just below the cloud base. Occasionally at this stage the bottom end of the clear column spins fast enough to create a minor vacuum, though this is rare. When this occurs on land a visible shaft of dust and light debris is raised upward within the column to the lower end of the cloud funnel. Normally the expansion into a partial vacuum starts above the base of the cloud and continues downward to the earth’s surface.

The pressure within the funnel may reach as high as 50 percent of normal air pressure, but usually is much less. If there were no vacuum there could be no visible tornado funnel, for before the cyclone is fully developed the core of clouds from above composes the only portion of the column that can be seen.

The clear wind of the true tornado, however, extends much farther outward. A tornado with a base diameter of 500 yards may have a visible core diameter of only 50 feet. This core is whirling with the outer rotating winds of the tornado, but with slightly less velocity. Occasionally, the core itself rotates at around 1400 feet per second and becomes a hollow funnel within the whole tornado.

Prolonged study of tornadoes shows that the funnel is made up of three distinct parts: The interior core of clouds sucked down from above, the outer or true tornado which has a rotation speed of about 1400 feet per second and a downward spiral of 200 feet per second and the outside sheath of upward-moving wind, traveling at 200 feet per second.

The downward spiral of cold, heavy air in the tornado pushes hard on the surface of the earth and is forced outward by the terrific force of its spin away from the core. Normal air pressure then holds it against the true tornado and it climbs aloft in loose contact with the downward-moving wall of the main funnel. This is the part of the tornado that does the greatest amount of damage, and a tornado is not fully developed until this outside sheath reaches the base of the tornado cloud, usually within five minutes after the funnel core reaches the ground.

(Continued on page 218)
Two Cameras in Sealed Case Take Underwater Photographs

Two cameras—one conventional and one stereo—are contained in a transparent, waterproof Plexiglas case that makes underwater photography possible. The undersea explorer lines up the subject with a black sighting piece and aluminum bracket on top of the case. All settings are made with plastic knobs which project from the case. A rubber gasket on the base piece seals the case when wing nuts on the base are tightened, and air pressure inside is increased to six pounds or more with a tire pump that fastens to a valve embedded in the case. The outfit was designed and built by Frank Min of Honolulu for Dr. George W. Cottrell of Portland, Ore. It is ideally suited to the needs of a skin-diving photographer who can snap pictures of varicolored fish and lacy coral.

Salmon-Egg Dispenser Fits on Fishing Rod

Trout fishermen can keep salmon eggs in a container that clips right to the fishing rod. The container weighs only ½ ounce so it does not materially affect the balance of the rod. An adjustable steel clip permits it to be installed on rods of any size. When an angler desires a salmon egg he pushes the dispenser toward the handle and tips the rod. This causes one salmon egg to fall into his fingers. He closes the dispenser by shoving it upward so the hole is covered by the clamp.

Unfolded Golf-Cart Handle Becomes Comfortable Seat

Golfers can rest between shots on a seat that unfolds from a caddy-cart handle. A stainless-steel and aluminum-alloy rod folds down to support the weight of the golfer; another connects to the caddy cart. The seat can also be detached and used as an easily portable chair when watching a tournament, a horse race or when hunting or fishing.

Noisy Padlock

Criminals can't pick the combination of a new stainless-steel padlock by hearing or feeling tumblers clicks. Instead of clicks, a deceptive sound issues from the lock when the combination dial is turned, frustrating the "feeler" system of lock picking.
Pressurized Gasoline Can Mounts Vanishing Hose

No funnel is needed with a five-gallon, plastic-lined gasoline can that pours through a retractable six-foot length of hose. A built-in aluminum air pump provides one or two pounds of air pressure to force out gasoline—the can does not need to be tilted. The hose, fed through a squeegee gasket, cleans and dries itself as it is pulled out or pushed back. The gasket also releases air if there is too much pressure inside. A push-button vent makes it easy to release overpressure and control the flow of gasoline by regulating the air pressure inside the can. Owners of outboard motors find the can fills their needs.

Tent Made of Fiberboard May Shelter Troops in Arctic

Army troops in the arctic may soon be sheltered in tents made of fiberboard—the same material from which corrugated boxes are made. The tent, 12 feet in diameter, is stapled together in sections and requires no ropes or pegs. The fiberboard is water resistant and the tent is designed as an expendable item. Accommodating 10 men, the tent is said to cost about half as much as a canvas tent and is warmer. A special "igloo" door, so small that a person must enter it on his hands and knees, is cut into one section of the tent. The fiberboard shelter is now undergoing extensive field trials.

Portable Earth Borer Works by Vibration

No soil is removed by a portable earth borer that pressures a hole into the ground with a vibrating head. A five-horsepower gasoline engine mounted on wheels connects to a flexible shaft that drives the tapered vibrator head. The powerful throbbing motion produced sinks the head into the earth. A hole two inches in diameter and two to three feet deep is bored in less than a minute. A series of holes drilled around a tree or shrub permits the feeding of fertilizer directly to the roots, without waste or delay.

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GOOD-BY TO THE IN-LINE FLAT HEAD

By Roger Huntington
Member, Society of Automotive Engineers

Remember the old days—only 10 or 15 years ago—when a long straight-8 engine was the last word in road power? The longer the block and the longer the stroke, the better we liked it. That was the day of long-hooded Buicks, Packards, Studebakers, Chryslers and Hudsons. There were V-engines then, but only a dreamer would have predicted that the V would displace the in-line layout.

So what happened? Today the straight-8 is as dead as the rumble seat. The compact V8 layout has taken over. Only Packard and Pontiac are holding out in 1954 and both would have V8s today if tooling programs hadn’t fouled up unexpectedly. Even the in-line 6 is losing favor: Chevrolet and Plymouth both have V8s coming up in 1955.

The same switch occurred in valve placement. Ten years ago the side-valve or flat-head arrangement was the standard. Today everybody is going to overhead valves. What caused this revolution in engines?

Block Layout

In the first place, the V8 has several important advantages over the in-line with either 6 or 8 cylinders, regardless of valve system used. It’s a temptation in a story of this kind to throw the book at you at once and imply that all factors are of equal importance. But this is an engineering matter and we won’t do it that way.

There is really only one basic—and not very glamorous—reason why you probably have a V8 engine under the hood of your 1954 car. (By the way, in 1953 for the first time in history eights outsold sixes.)

Here is the reason: When a manufacturer plans a new engine he has to figure on the design being adequate for about 10 years with no major changes. Only in this way can he absorb his tooling costs without cutting into profits or raising the price of the car. (Tooling costs for a new engine these days are about $60,000,000!) Any new design must allow for anticipated conditions in 1960 and after. The trends are so clear today that we know just about what we’ll need a decade from now. Within less than 10 years we should see 100-octane pump gasoline, 12:1 compression ratios and engine speeds well over 5000 revolutions per minute. Let’s see what there is about
the V8 that makes it inevitable under these conditions.

Whip and vibration in the crankshaft are the real problem. Under the pounding of very high cylinder pressure (such as you get with a 10 or 12:1 compression ratio) and especially when operating over a wide speed range, a crankshaft will act almost like taffy. Each time a cylinder fires, the crankshaft bends a little downward and each torque impulse twists it. When it springs back after each deflection, it has in it the makings of a nasty case of synchronous vibration. The results: An annoying pounding in the car, fast bearing wear and maybe a broken crank.

The only way this vibration can be prevented is with a short, stiff crankshaft and a main bearing between each throw. And that's why we have the V8. The short crank is the key.

The short stroke is a big help, too. It permits the crank journals to overlap and that means a very stiff shaft. The V8 layout just overflows with rigidity. (Ford has even come up with a new twist by extending the crankcase down below the crank center line and getting 240 degrees of web support around the main bearings.) The short stroke also permits short, stiff connecting rods. Short rods, overlapping journals on a crankshaft only about 25 inches long, and five main bearings—all add up to the answer to the problem of crankshaft whip.

And there are other advantages. The short over-all length of the engine fits in well with current styling trends toward short hoods and more seating room inside the wheelbase. The new V8 engines weigh much less per cubic inch than old in-line types, so the car weight balance can be controlled. The

Overhead valves, right, permit unrestricted passage of fuel-air mixture into the cylinders. Flat-head design, left, has sharply restricted point where arrow narrows as mixture goes up through valves and into cylinders.

CRANKSHAFT LENGTH

STRAIGHT 8

As the crankshaft gets shorter, it gets stiffer and that means better performance under high compression. The advantages of the V8 crankshaft become apparent in this comparison with a crankshaft from a straight-8 engine.

Among V8 designs differences in crankshaft throw affect stiffness. Bottom crankshaft is from the long-stroke 1953 Ford V8. It has less overlap, thus less stiffness, than the crankshaft from the 1954 Ford V8 with shorter stroke.

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Valve diameters

Compact, square intake-manifold layout is very important: Short tubes of almost equal length distribute the fuel-air mixture more evenly to all cylinders, resulting in better performance and gas mileage. Contrast this with the long, narrow manifold on a straight 8!

But reduced friction is probably the most valuable bonus of our new V8s. At any given speed the friction loss in an engine is about proportional to piston speed. At a steady 60 miles per hour in the average car you could save up to 10 cents per hour on gasoline merely by increasing the bore and shortening the stroke an inch or so. All our new V8s feature an "oversquare" stroke-to-bore ratio—that is, the bore is larger than the stroke length. The shorter the stroke, the slower the piston speed for a given number of impulses.

Valve Layout

How about valves? How come flat heads yesterday and suddenly overheads today?

Again the answer is tied up with tomorrow's requirements. High-compression, high-output engines demand overhead valves. If you've ever tried to soup up a flat or L-head engine, you've hit this wall head-on: When you raise compression on a side-valve engine above about 8.5:1, the volume of the combustion space gets so small that there is a severe air-flow restriction across the block between the valves and cylinder. The engine can no longer breathe properly and power falls off despite the higher compression. Careful design can help—such as Hudson's relieving of the block face in 1954 models—but you could never use 12:1 compression with normal side valves and get any performance worth talking about.

Overhead valves have no such limitation. They've been used at 20:1 compressions with good results. And they breathe a lot better anyway. The straight path from the valve port down into the cylinder cavity offers little resistance to the flow of fuel, and the breathing, both intake and exhaust, is deep and full.

A secondary consideration here is combustion control. Overhead valves allow closer control of combustion-chamber shapes. By scientifically designing this shape and by placing the spark plug in precisely the right position, engineers can often use higher compression ratios on a given fuel octane without knock.

(Continued to page 224)
Precut Packaged Fence Allows You to Build Variety of Patterns

Busy homeowners can assemble a precut packaged fence quickly and in a variety of designs. The new fencing material is of cedar cut to a triangular shape. Each package contains all parts needed for an eight-foot length of fence four feet high. Two basic fencing designs are available, a Chippendale and a picket. By simply rearranging the parts or just eliminating the small crosspieces of the Chippendale, rail and grid fences of various designs are obtained. Extra pickets and rails are available for fencing six or eight feet high. A solid panel is obtained by using reverse rails and pickets.

Scientist Takes Pulse Of Earth Daily

Every day geophysicist John Pettit measures the rise and fall of the earth, which "pulsates like a living heart," according to the U.C.L.A. scientist. The pulsations are caused by the gravitational pull of the sun and moon upon the elastic earth. A steady rise and fall of the earth—measuring up to two feet—follows the line of attraction of the sun and moon as the earth rotates. Pettit keeps tab by measuring changes in the force of gravity.

Portable Barbecue Oven With Heat Controls Holds 15 Steaks

You can barbecue a whole pig, six chickens or 15 steaks in a portable oven said to be similar in principle to the barbecue ovens of the South Seas. Insulated construction prevents heat dissipation and permits use on lawns. A 150 to 600-degree cooking thermometer is included, together with a guide dial which tells the proper cooking temperatures of different kinds of meat. A sliding stove-section door controls intensity of the fire, while a shuttered damper at the oven chimney peak provides accurate draft control. Hardwood, charcoal or briquettes serve as fuel. Ashes are easily removed from a sliding firebox and fat drips into a removable trap. Barbecue hooks and a meat retriever are standard equipment.

High-quality fertilizers are made from phosphate rock and waste carbon dioxide through a recent economical process developed by four chemical engineers of the Tennessee Valley Authority.
Road-Patching Outfit Heats Mix and Dries Hole at Same Time

Small holes in oil pavement can be repaired during wet or snowy weather with a two-wheeled patching outfit that heats the mix and dries out the hole simultaneously. The boxlike machine has a gas burner on its underside and its flame is deflected into the hole, burning it completely dry. The heat from the flame also softens the patch mix, which is stirred on a metal shelf above the burner. The gas for the burner is provided by a pressure tank.

Ultrabright Picture Tube for Radar May Be Used in Television Sets

Halftone pictures bright enough to be viewed in brilliant daylight can be retained for several minutes on a new RCA electron tube. It was designed for direct daylight viewing of radar displays in an airplane cockpit or on the bridge of a ship. Now the relatively dim images on radar screens must be hooded to be observed and even then the viewer may have to wait several minutes before his eyes adjust to the dim light. Other uses for the tubes would be in airborne facsimile systems, oscilloscopes and telemetry. RCA believes similar tubes might be of value in television.

Floral Ferris Wheel Made From Pipe Puts Petunias on Display

Petunias ride a Ferris wheel at the T. A. Sears home near North Little Rock, Ark. Eight cradles of blazing flowers are suspended from a frame of one-inch piping that actually rotates. The stand, which is 20 feet high, was made of old pipe that was welded together and then painted white.

Recorded Bird Shrieks Free Towns of Starlings

Sound trucks broadcasting starling "distress calls" have cleared two Pennsylvania towns of bothersome birds. Pennsylvania State University scientists Hubert Frings and Joseph Jumber tape-recorded the shrieks of captured birds when they were held and shaken. Sound trucks broadcast the recorded calls under individual trees for about 30 minutes before and after sunset. After several nights of shrieking, the trees were free of starlings. Fewer than 100 birds remained in the small town of Millheim, Pa., after only three nights of treatment.
Sheer hose and plastic bearings are both nylon. Single mold, before it is broken apart, includes 312 bearings

Remember when nylon meant wartime queues lined up for scarce hosiery? Nylon means many things today—brushes and gears and egg beaters. Let's look at this amazing plastic once more as

NYLON REACHES SWEET SIXTEEN

By Robert E. Paquin

NYLON, A COMMONPLACE WORD today, is just 16 years old, yet to many it seems as if it has always been here. For only 14 years it has adorned feminine legs, but today this tough, durable chemical has invaded a variety of industries. Molded-nylon components now go into everything from egg beaters to motorcars. Nylon's amazing toughness and resistance to wear, even when lubrication is nonexistent, have made it a first-class engineering material. New uses for the versatile plastic are being found daily.

In the automotive industry nylon is used in distributor, speedometer and windshield-wiper gears, small bearings, cams and clutch and brake-pedal bushings.

The interior lamps of many cars have lenses molded of .025-inch-thick nylon. The inherent toughness of nylon enables the thin lenses to withstand rough treatment both in assembly and service. Nylon resists the heat of the lamp and will not turn yellow with age.

One manufacturer adopted nylon for the speedometer take-off gear. The material is molded directly on the gear shaft in one operation, as compared to five separate production operations formerly required. This resulted in a 50-percent reduction in cost and improved performance.

Nylon has entered the home in the form of tough, easily sterilized combs, brush backs, tumblers, nursing-bottle funnels and kitchen utensils. Nylon rollers and slides for kitchen cabinets and stove drawers will operate for the life of the equipment with no lubrication. An added advantage is their smooth, silent operation. Nylon buttons and zippers won't break, are colorful

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Counting dials of calculating machine, above, left, are molded of nylon. Cost of manufacture is reduced and quieter, smoother operation of dials results.

All-nylon connecting rod is a key part of the high-speed electric shaver, above. It absorbs vibration, needs little lubrication and gives long service.

Battery case and other parts of miner's lamp at left are molded of nylon for light weight, toughness and insulation. New uses are constantly being found.

Speedometer take-off gear, lower left, made of tough nylon, is molded directly to the shaft. Four steps of production are eliminated, performance is improved.

Blood-donor and receiver needles have nylon shanks molded around them. Sixteen needles are encased in one operation. Medical uses of nylon are increasing.
Heat and pressure in torpedo chamber of injection-molding machine cause nylon to flow into the mold cavity and resist dry-cleaning solvents and ironing temperatures. Mixing-machine gears, washing-machine and fan parts, refrigerator-door rollers, cutlery handles, rollers and slides for windows and draperies—all these now contain nylon.

In an electric shaver, a durable nylon connecting rod transmits power from the motor shaft to the cutter blade. The connecting rod reciprocates at speeds of 15,000 to 17,000 half-cycles per minute with almost no lubrication. Nylon's ability to absorb vibration makes it ideal for many such high-speed applications.

High-quality egg beaters are provided with nylon gears which last 20 times longer than the metal gears previously used. The nylon gears operate more silently and efficiently and are not affected by salad oils and food acids. No lubrication is used.

Designed for both industrial applications and in the home workshop, a metalworker's hammer with resilient nylon faces will not mar the softest metal. In actual tests, made by pounding the nylon faces with sharp objects, it lasted 24 times longer than the next-best material tested.

Designers of business machines have turned to tough but attractive nylon for their difficult parts. One calculating machine features nylon dials, ratchets andcams. An intricate cam, now molded in a single operation, formerly required 20 production steps for its manufacture. Smoother operation and elimination of the need for lubrication point to more and more business-equipment parts made of nylon. For example, a manufacturer of filing cabinets now equips them with noise-reducing nylon rollers.

Medical uses include hypodermic-needle parts, surgeon's scrub brushes, inspiratory valves and components for blood-transfusion apparatus. Nylon's physiological inertness and its ability to undergo repeated sterilization in a steam autoclave make it an ideal material for these and numerous other surgical and medicinal uses.

One class of aircraft uses 16 miles of nylon-covered cables and wires in each plane. The nylon covering protects the wires from gasoline and oil and resists abrasion. It also affords protection against fungi and heat. Because of nylon's toughness and wear resistance, thinner, lightweight coatings can be used.

Other aircraft uses for nylon include grommets, wire connectors, switch components, self-locking nuts, insulated tools and mechanical parts.

In hydraulic equipment, the plastic has been found to be perfect for valve seats, as its resiliency allows it to form a tight seal even where slight irregularities in the mating surfaces exist. Look for it in the form of faucet washers in the near future.

Invading the photography field, nylon is now used for gears, cams and bearings for

In wire-coating mill, nylon is extruded around a wire to form a tough, flexible, lightweight coating
In extruding, nylon powder is plasticized by heat and pressure, squeezed through die like toothpaste. Nylon faces on metalworking hammer have impact resistance, won't chip, mushroom or harm soft metals.

cameras and projectors, where its cushioning action and freedom from lubrication problems make it a welcome new material. Nylon is not a trademark. It is the generic name for a group of compounds of polyamide resins which are related, but not identical, in chemical composition. Since it is a thermoplastic, articles molded from it can be reheated and reshaped numerous times without injury to the plastic. Thermostetting plastics, the other major type, cannot be resoftened. Nylon was first synthesized by Du Pont chemists in the early 1930s, and research continued until its first introduction to the general public in 1938 in the form of toothbrush bristles. Its nationwide debut in women's hosiery came in 1940 and met with prompt and overwhelming success.

Nylon molding powders were introduced to the plastics industry in 1941. Constant research and development since that time has brought forth the host of present-day applications. FM-10001 nylon is the most widely used type for injection molding. The most heat-resistant member of the nylon family, it is particularly suited for gears, cams and bearings.

The most flexible nylon material is the FM-8001, which until recently could not be molded or extruded by conventional processes. These limitations have now been eliminated with the development of an improved molding powder which can be processed by any of the common techniques.

When used indoors under normal conditions, nylon undergoes no appreciable change in long service. It does not deteriorate, nor is it subject to attack by fungi, rodents or insects. Exposed to direct flame, nylon will burn slowly, but it is self-extinguishing upon removal of the flame.

The color of articles molded from the various grades of nylon ranges from cream to light amber. Some types are translucent in thin sections. FM-6301 nylon can be made transparent by extruding the plastic directly into cold water.

A wide range of colors can be molded into some types of nylon. Solid parts can also be dyed by immersing the article in a boiling-water solution of the same dyes used for coloring nylon fabrics. Colors obtained by this method are resistant to boiling water and hot, soapy water.

Combining as it does a host of valuable properties, the future of nylon as an engineering material seems assured. There is little reason to doubt that hundreds of new uses will be discovered for this amazing plastic.

Today's Known Oil Reserves Greater Than Year Ago

Known reserves of gas and oil in the ground are greater now than a year ago, according to the American Petroleum Institute and the American Gas Association. At the end of 1953 the proved reserves of liquid hydrocarbons were 34,382,750,000 barrels compared with 32,957,205,000 barrels in 1952. A barrel is equal to 42 gallons. Reserves of natural gas were 211,447 billion of cubic feet at the end of 1953 compared with 199,716 billions of cubic feet a year earlier. Production is also up. Last year 2,614,554,000 barrels of liquid hydrocarbons and 9328 billions of cubic feet of natural gas were produced.

POPULAR MECHANICS
Sports Clothes Made of Treated Cloth Serve as Life Preservers

Wading boots and fishing vests made of a treated cloth not only are waterproof but serve as life preservers to support the wearer in the water. The cloth, imported from England, permits the passage of air but keeps out water. All the fibers running in one direction are waterproofed but those at right angles are left untreated. When the cloth gets wet the untreated fibers swell to close the holes around them. In the boots and fishing vests, pads of Dacron covered with the waterproof cloth are sewn at various spots. The pads are buoyant enough to support the wearer.

Dispatcher 200 Miles Away Lights Burners Under Railroad Tracks

Gas burners under railroad tracks in the snowy Cascade Mountains of southern Oregon can now be ignited by flipping a switch in an office more than 200 miles away. The burners, supplied with propane gas, are used to thaw track switches along the Southern Pacific line. Newly installed equipment enables the train dispatcher at Dunsmuir, Calif., to keep switches free of ice along the distant 62-mile stretch.

Attachments Convert Lawn Mower Into Mobile Home Workshop

With a new lawn mower and its attachments you can cut grass, trim hedges, edge sidewalks and polish your car as well as sand, grind, drill and buff in your home workshop. The owner installs his own electric motor or gasoline engine on the rotary mower, which has an 18-inch blade. The key attachment is a 50-inch flexible shaft which fastens to the top of the mower's cutter-blade shaft. The hedge clipper and other accessories are clamped in a chuck on the flexible shaft. The sidewalk edger is a whirling disk which trims grass neatly away from the edge of the walk. To use the mower as a portable workshop, the operator clamps the head of the flexible shaft in a workbench vise and installs the sanding drum, twist drills, grinding wheel or polishing pad. The mower moves around while the pad is used to polish the car.
Discover Oldest Plants

Primitive plant fossils more than two billion years old, believed to be the oldest organisms ever found, have been uncovered on the northern shore of Lake Superior. The plants were blue-green algae and simple forms of fungi, and were taken from flint-rock deposits near Schreiber, Ont., by Prof. Elso Barghoorn of Harvard and Dr. Stanley Tyler of the University of Wisconsin. The age of the earth’s crust is estimated at 3,500,000 years.

Surplus Life Raft Doubles as Crib

After they’ve provided sport in the surf, war-surplus one-man life rafts can be turned upside down to make a satisfactory beach bed for babies. The raft’s underside is soft and has a slight slope to the center that prevents the baby from rolling off into the sand. Because of the slight elevation, sand blown by surface winds doesn’t get into the baby’s eyes. The temporary crib allows parents to swim while the baby sleeps.

Multipurpose Plastic

Plastic with the toughness of rubber and the surface hardness of most metals promises to find wide industrial uses. The material, a styrene-type resin, is so shatterproof it can be molded into golf-club heads, so heat-resistant that it can hold boiling water, and so soluble that it can be sprayed in colors on elastic rubber surfaces but won’t chip off. It was developed recently by Marbon Corporation, a subsidiary of Borg-Warner.

“Packaged Radioactivity” Treats Tissue and Makes X-Ray Photos

“Pocket size” sources of X rays for use in industry and medicine now are possible. The new method of producing X rays is the result of work at Armour Research Foundation of Illinois Institute of Technology. No bulky electronic equipment is required. The system uses a small quantity of radioactive material surrounded by a layer of heavy metal. Beta rays, which consist of high-energy electrons from the radioactive core, drive out through the atoms of the metal. Deflection of the electrons produces the form of energy known as X rays. The X-ray source can be made in almost any size from a tiny pellet to a large block or sheet. Thus it can be built into a needle for tissue irradiation, a capsule for general use or a flat sheet for taking X-ray photographs. Industry can use the new system for examination of vital parts. For example, the radiation source could be placed inside an airplane wing and X-ray film wrapped around the outside, and produce better pictures than obtained by present methods.
Screen Frame Fits Garden Cart to Break up Lumps in Topsoil

Lumps and clods in topsoil, peat moss and compost are broken up by a new soil sifter that fits a garden cart or wheelbarrow. The sifter is a steel screen mounted in a steel frame. Hooks at one end of the frame anchor it to the cart or wheelbarrow. The gardener tosses topsoil into the frame, then shakes it with a handle. The handle also can be pivoted down and used as an easel for screening directly onto the ground.

Line Clip Aids Bricklayer

It’s easier to lay a perfect brick wall with a metal clip that holds the line true. The clip is fastened to the line, placed atop the wall and weighted with a brickbat. The projecting slot that holds the line borders the top brick edge, maintaining absolute alignment. When supported by clips, the line won’t sag or whip in the wind.

Swinging Door for Pets

Mounted in a wall or door, a swinging panel permits cats or dogs to enter or leave the house without any help. A four-way lock can be set to permit entrance only, exit only, entrance and exit, or neither entrance nor exit. The door fits openings 10 by 14 inches and will accommodate dogs up to about 24 inches high at the shoulder.
WILD DUCKS that should know better are trapped like flies in a unique installation on a midwestern Canadian lake. The huge trap is operated by the Delta Waterfowl Research Station, located on Lake Manitoba, fifty miles northwest of Winnipeg.

Delta Station technician Nan Mulder calls it a decoy pipe. It's a permanent semicircular funnel of netting and reeds opening into a large pond and extending back over a shallow, waterfilled trench for 50 yards to a holding pen where the birds are trapped and banded.

The station, which is operated by the Wildlife Management Institute and is dedicated to extensive scientific study of waterfowl and wildlife management, traps wild ducks, affixes small Federal-numbered aluminum bands to their legs and then releases them. Hunters who kill these banded birds return the tags to the United States...
Fish and Wildlife Service in Washington, D. C., where they are carefully tabulated and the flight pattern of migratory waterfowl is determined.

Decoy pens like the one at Delta are common in Holland where ducks are trapped for market. Nan Mulder and his brother operated the 104-year-old decoy pen on their small Dutch farm until Mulder emigrated to Canada and the one spot on the continent where his specialized skills could be used.

The station already had a decoy trap of an English type, but it didn’t work well. Mulder rebuilt it to the point where it now traps up to 200 birds a day. Eventually there will be four decoy pipes in pairs facing each other, to take advantage of all winds. Last year, Ducks Unlimited, an international nonprofit organization composed of sportsmen-conservationists, supplied earth-moving equipment to excavate or dike another mile of the marsh and to dig trenches for two more decoy pipes.

The marsh must be excavated to depths of one to three feet, to accommodate both diving and wading ducks. The decoy is located so that the prevailing winds blow down its...
Mulder scatters feed on water to entice more birds into tunnel. They are then chased into crate at far end length from the narrow end, since ducks prefer to feed into the wind.

The curving decoy pipe tapers from an entrance 18 feet wide and 15 feet high to about a yard square at the trap. Bows of aluminum pipe, graduated in size, support the fishnet which encloses the tunnel. At the end of the tunnel is an eight-foot slatted crate with a drop door at one end and wire screening at the other.

Grain or bran scattered on the water lures the birds into the decoy, curiosity takes them deeper and alarm drives them into the crate.

A little golden spaniel has been trained to run around a series of slanted screens at a pace which parallels the ducks' interest. He pays no attention to the birds. But at the first appearance of Mulder, they take flight toward the end of the tunnel. Mulder pulls a wire which drops the door shut behind them. It is then a simple matter to reach into the trap, pick out a bird and fasten a numbered band about its leg.

Dutch ingenuity shows itself in many details of the station. The tall dried reeds of the marsh, for example, have been woven into screens, into fencing for the station pond, into duckblinds in the marsh and into a "gazebo," an observation post overlooking the pond.

Mulder brought with him the technique of building "Gazebo" overlooking pond and marsh is an observation post covered with reed siding.
mallard nests, jug-shaped creations of dried marsh grass and galvanized stovepipe wire. In Holland, these are made of straw or willow withes and last four to seven years. Mulder keeps track of his nests and stores them during the winter. It takes Mulder 1½ to 2 hours to complete each nest. Sometimes he makes extra ones and sells them to private-estate owners.

Another way to increase the duck population is to provide more edging. Shoreline, rather than large expanses of water, is the essential ingredient in nesting success. At Delta, a long trench and more ponds were dug to create more shoreline. The ducks pre-empted the new dikes while the dragline was still at work.

The staff is now studying the effects of controlled water levels. The cheapest and simplest way of moving water is by “vyzel,” a Dutch spiral pump. The pump, powered by a two-horsepower gasoline engine, has an eight-foot shaft with twin spirals 20 inches in diameter. It moves 40,000 gallons of water per hour, lifting it four feet, and it can’t be clogged by duckweed or algae. The vyzel maintains the water level in several goose ponds, in the long trench and in the decoy ponds. Control gates fix the different water levels.
Floating Automobile Trailer Cruises Lake Under Own Power

When it's not rolling down the highway, a trailer owned by a West Berlin woman is likely to be found cruising around a lake. A pontoon raft turns the amphibious trailer into a houseboat. A small gasoline engine propels it when it's in the water.

Tweezers With Battery and Bulb in Handle Furnishes Own Light

Illumination right where it's needed is provided by a tweezers that has a small flashlight in its handle. The bulb is contained in the base of the blades. The instrument is designed for use on industrial assembly lines, in first-aid work and hospitals and in removing unwanted body hair. Made of surgical steel, the tweezers are precision ground after assembly to insure perfect matching. Battery and bulb are easily replaceable. The handle unscrews from the head for such changes.

Experimental Phone Booth Leaves Both Hands Free

There's no receiver to hold and no dial to turn in an experimental telephone booth that leaves both hands free. Installed at Boston's South Station, the soundproof booth has a recessed speaker, a wall-mounted microphone and a volume control that is regulated by the user. The installation can be made only where an attendant is on duty, since there is no coin box or dial in the booth.

Production of gasoline and oil directly from coal begins this summer on a commercial scale in a plant on top of a vast coal field in the Union of South Africa.
Twin-Turborotor Helicopter

Two gas turbines power the twin rotors of a helicopter modified by Kaman Aircraft in an Army-Navy project. The Boeing 502-2 turbines, which together produce 380 horsepower, are mounted side by side in the same location as was the single 240-horsepower piston engine they replaced. Their combined weight is less than that of the single engine that originally powered the HTK-1 Kaman copter. Both turbines are used for vertical take-offs.

Air-Filled Hoses Are Ribs of Roomy German Sleeping Tent

Compressed air upholds a wide, low sleeping tent made in Germany. The tent is raised by pumping air into built-in hoses placed at intervals in the canvas. This eliminates the use of metal or wooden struts. When morning comes, the user can quickly deflate the tent and fold it into a 16-by-20-inch bundle.

Synthetic detergents topped soap sales in 1953 with 53 percent of the total volume.

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ON THE OUTSKIRTS of Wilmington, Ohio, Dr. Frank Hazard makes a good part of his living by carefully raising some 17 species of insects—any one of which would send another person looking for the bug bomb. For the past decade Dr. Hazard has followed his unusual business, one which plays a vital role in the booming chemical-insecticide industry.

This industry, dedicated to the belief that a dead bug is a good one, is constantly coming up with new chemical concoctions for the never-ending war on insects. Then too, they have to run periodic tests to make sure their established insecticides maintain their insect killing powers. It's in testing these products that Dr. Hazard and his bug farm come into the picture. No one has found a better way to test insecticides than to see how many insects they'll kill in carefully controlled tests.

Dr. Hazard, who is also head of the Biology Department at Wilmington College, started raising insects for profit when he tested phosphorus pastes against roaches for a Midwestern company in 1942. It wasn't long until other organizations were asking him to conduct impartial tests with insecticides. Since then his business has grown steadily without benefit of advertising. Today he is kept on a monthly retainer by several large manufacturers of aerosol bombs for insects. In addition to these regular checks on established products he tests new insecticides and even develops new laboratory testing techniques for uncovering the killing power of various insecticides.

A few years ago his growing business forced him to build a new testing laboratory. This house of bugs is a small, one-story white structure on his farm at the edge of town. When he designed the building Dr. Hazard faced a peculiar problem: he had to test insect-killing chemicals in the same building where he was carefully raising valuable colonies of stock for future tests. He did this by erecting an eight-inch concrete-block wall across the middle of the building. There are no windows and no doors in the wall, and each room is entered through an outside door. This protects the growing insects from the death-dealing chemicals in the next room.

The rearing room measures 25 feet square. Adjoining it is a small greenhouse of 225 square feet where Dr. Hazard can rear colonies of agricultural insects on their food plants. The testing room, slightly larger than the rearing room, is equipped with its own heating and ventilating system, another protection for the growing insects.

The rearing room is populated largely by flies, roaches, and clothes moths, kept carefully isolated in jars and cages. There are also such insect pests as carpet beetles, granary weevils and the flour beetle.
Laboratory assistant sprays a measured amount of insecticide into "death chamber" containing insects

The homeowner and the farmer who fight such pests likely consider it an easy task for Dr. Hazard to keep his insects healthy. But, like all livestock enterprises, raising insects presents its peculiar problems. For instance, Dr. Hazard had trouble in raising clothes moths. He tried putting them in pint jars and feeding them plain cloth but they didn't prosper. He thought about the eating habits of wild clothes moths.

Then he put loose rolls of 100 percent pure-wool cloth into the jars. And he recalled that clothes moths always eat around the soiled spots on clothing first. So he put some dried brewer's yeast on the wool, and his moths were happy from that day on.

Last summer, working with the southern army worm, the same species that was making inroads on the farmers' forage crops in the area, he hit another snag. He couldn't get the insects to lay eggs. He decided they needed higher humidity. His answer was to wrap their cage in the greenhouse with a cloth which he kept moist. The army worms lost no time in filling out the ranks.

Most of Dr. Hazard's work, however, is with the common housefly. Throughout the year he conducts tests to see how well his clients' insecticides will kill flies. But flies in the wild vary considerably in their resistance to chemicals. To get an accurate idea of a chemical's fly-killing ability Dr. Hazard had to breed a "standard fly." He collected strains of insects from several laboratories with aerosol bombs arrayed on his desk, Dr. Hazard records results of tests made on them for an insecticide manufacturer.
in various parts of the country and mixed them up through seven generations. The result of this breeding is a family of flies now widely known in the insecticide world as the Chemical Specialties Manufacturers Association's "standard 1951 fly."

The Wilmington House of Bugs now supplies these standard houseflies to other laboratories throughout the eastern part of the country. They are sent air mail, special delivery, in their inactive pupae stage. The usual order is for 500 to 1000 flies. They're measured out in a small vial which holds 200 pupae, packed loosely between layers of soft paper in a small box and put into the mail without delay.

The reason for the haste in shipping is due to a factor beyond any entomologist's control. Flies stay in the pupae stage only three days. If the package is delayed, the adults hatch out and die en route.

In his rearing room Dr. Hazard keeps adult flies in foot-square cages of wood and fly screen. They're fed a mixture of milk and water on cotton. They also lay their eggs on the cotton. Later the eggs are collected and used to seed mixtures of moistened alfalfa meal and bran at the rate of 2000 eggs for each one gallon jar. It's from these jars that pupae are collected for shipping to other laboratories.

But most of the flies raised here are used for tests right in the laboratory building. The most common of these tests are conducted in a pair of white gas chambers that are six-foot cubes. A small wire cage holding 100 standard flies is placed on a revolving table in the middle of one of the gas chambers. The insecticide under test is released in measured quantities into the chamber. The cage of flies is kept for 24 hours in a separate recovery room to see how many survive. From this the percentage of kill is easily computed and noted on the records.

In recent years the multimillion-dollar chemical-insecticide industry has made big strides in insect control. But for every problem solved, a new one seems to come along. "We'll always have insects," says Dr. Hazard. That's why he sees a good future for his insect farm.  

POPULAR MECHANICS
Sponge Evaporator Cools Fan's Breezes

Clipped onto an electric fan, a diamond-shaped evaporator cools the air as it comes off the blades. The evaporator consists of a plastic water tank made in the shape of a half-diamond. In this tank a diamond-shaped cellulose sponge stands upright. The sponge draws the water upward into the path of the breeze where it evaporates, cooling the air.

Spider Folding "Fireplace" Easy to Carry and Store

Outdoor cooking is easy with a spiderlike device that holds food above the fire. The eight metal legs of the rack fold into each other for carrying and storing. The rack is two feet wide and adjusts to fit any size pan.

Leakproof Battery Stops Flashlight Corrosion

Flashlight batteries that can't corrode result from a construction that reverses the usual position of the carbon and zinc. The new battery has four zinc vanes on the inside and a carbon-lined casing, which can't corrode, on the outside. The leakproof cell will not swell, stick or jam in the flashlight. Because the zinc "fuel" is consumed more efficiently, the battery lasts longer and produces a brighter light.

Roof-Sprinkling Hose

You can cool a one-story building or the top floor of a two-story building with a perforated sprinkler hose that lies on the roof. The hose is laid along the ridge of a sloped roof or in a zigzag pattern on a flat roof. A gentle spray or a slow trickle is all that is required; the system uses a minimum of water.

Nitrogen, vital to the fertility of the soil, comes sifting down from the atmosphere onto the ground at the rate of 5.8 pounds per acre per year.
Screened Observation Platform of Trailer Folds for Transit

People who live in mobile homes (the new and approved name for trailers) can now sit on their front porches and watch the rest of the world go by. Prairie Schooner, the first company to introduce a front-door model, has brought out a front-porch design. Screened in, the porch provides a comfortable place to relax during summer. In winter, a set of plastic storm windows converts it into a weatherproof storage room. It also makes an ideal out-of-the-house play area for children. Naturally, it folds up when the mobile home is ready to become mobile.

Flat-Bed Truck Tilts Like a Dump Truck for Loading or Unloading

With the help of a flat-bed truck that has a built-in loading winch, one man can load and unload his truck effortlessly. The machine, which is built in Germany, uses a winch to pull the load either horizontally from a railroad flatcar or up a sloping ramp from ground level. In the latter case, the truck bed tilts and a pull-out ramp extends from the back of the truck to meet the ground. A folding prop supports the rear of the truck bed. A power take-off connected to the truck engine powers the winch. Wheels or rollers under the load enable it to roll more easily.

There's Everything in This Car—Even the Kitchen Sink

Everything is built into a car designed by a Swedish engineer—everything including the kitchen sink! The car is equipped with two beds and a kitchen. With the beds folded out of the way, it will seat seven passengers without crowding. Wheelbase is 240 inches, about six feet longer than the longest American car. Top speed is 125 miles per hour.
SIGHT-AND-SOUND NEWS

THREE OF THE FIRST commercial color-television receivers to come off the production line at the plant of the RCA Victor Home Instrument Division are shown in photo A. These 15-in. standard models are receiving their final test. On the screen of the receiver in the foreground is a color slide, while the other two receivers show color test patterns.

High-fidelity enthusiasts can now assemble their own preamplifier from a kit which provides complete facilities for phonograph-record equalization, including the recently adopted RIAA recording characteristic now being used by Columbia, RCA Victor, Decca, Capitol and Mercury on current releases. This Heathkit unit, illustrated in photo B, includes five input channels, each with its own "level" control, and it is claimed to have sufficient gain for the finest low-output magnetic cartridges.

Lovely Hollis Burke, television starlet, demonstrates the recently introduced Hallicrafters PT-17 ultracompact 17-in. screen TV receiver in photo C. The screen occupies practically the entire front of the set, the controls being mounted on the side. Because of the compact design, the set can easily be moved from room to room.

That magnetic tape is no longer fragile, is demonstrated in photo D. Even children can play with this Lifetime magnetic tape, which is claimed to have a breaking strength of six to eight pounds.

AUGUST 1954
HOW TO BUILD A LOW-COST

By Athan Cosmas W2PKD

AIRCRAFT flying at high altitudes depend almost solely upon some means of radio navigation. While certain specific frequencies and bands of frequencies are normally used for this purpose, direction-finding equipment is available for use anywhere in the range from 100 kilocycles to 200 kilocycles. This range of frequencies includes practically all services: Standard broadcast, television (TV), frequency modulation (FM), amateur and many others.

Obviously, the most effective way to remove this form of navigational aid to an attacking force would be to shut down all services. This, however, would leave Civil Defense authorities without a means of instantaneous mass communication for the broadcast of essential information and instruction to the general public.

To solve this definitely vital problem, Project Conelrad was established by Presidential executive order late in December 1951. Conelrad is a contraction of "Control of Electromagnetic Radiation." The FCC and the Air Defense Command of the U.S. Air Force, worked out a system of opera-

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**Fig. 1A**

CONTROL SECTION
OF KL14A
3-P.D.T. RELAY

TRANSMITTER
SWITCH

NOTE—WHEN RELAY KL14A OPERATES FOLLOWING CARRIER BREAK OF THE MONITORED STATION, THE BELL WILL RING.

**Fig. 1B**

1

2

3

115-V., A.C.

SW.

BELL TRANS.

ALARM BELL

CONTACTS 2 AND 3 CAN BE USED TO COMPLETE ANY DESIRED COMBINATION OF ALARM AND ALERTING CIRCUITS.

**Fig. 2**

OUTPUT TRANSFORMER
B+
4-OHM CIRCUIT

SPEAKER

**Fig. 3**

OUTPUT-TO-
LINE TRANS.

B+

600-OHM CIRCUIT

LINE-TO-
VOICE-COIL
TRANS.

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tion for standard broadcasting which minimizes
the effectiveness of broadcasting signals acting as
guiding beams for direction finders, but still per-
mits broadcast of essential defense information.

At the first sign of "probable" air attack the
United States may be placed under a Warning
Yellow. When the attack seems imminent, the situ-
ation will be changed to Warning Red. At some
time between these two warnings all radio stations
will be notified of a "radio alert." Usual broadcast-
station procedure will be to interrupt their car-
rier for five seconds, return to the air for five sec-
onds and again interrupt for another five-second
period. After the second interruption, the carrier
will come on again and the stations will announce
that they are leaving the air; that all listeners
should immediately tune their standard-broadcast-
band receivers either to 640 or 1240 kilocycles to
receive broadcasts of essential information. At
this point all normal serv-
ces (including amateur)
will cease operation. Cer-
tain broadcasting stations
will shift their frequency
to either 640 or 1240 kilo-
cycles, and commence oper-
cation in controlled clusters. Since the location of the
signal source is constantly changing at fre-
quent intervals, the radiated carrier is of little,
or no use for direction-
finding purposes. So far as
the listener is concerned,
he will receive a continu-
ous signal although its source is constantly
changing.

As all transmitters ex-
cept those authorized to
(Continued to page 234)

AUGUST 1954
RADIO AND ELECTRONICS TODAY

MANY OWNERS of small table-model broadcast receivers of the type that employ built-in loop antennas do not realize that they can tune in more stations and get greater clarity of signals by rotating the set. With your set mounted on the Rote-A-Tune device illustrated in photo A, you can turn it in any direction without risk of scratching the table. Thus the loop antenna will be omnidirectional in the same manner as a TV antenna becomes multidirectional when rotated.

The tiny radio receiver in photo B can be worn like a hearing aid. It has been developed experimentally by two General Electric engineers, in the company's Electronics Laboratory, primarily for use in civil defense. It is tuned to the single broadcast frequency of 1240 kilocycles, which is one of the Conelrad emergency-information frequencies. The set employs two penlight batteries, and the germanium transistor and double-based diode indicated.

Amateur radio operators will be interested in the compact "phone patching" device, illustrated in photo C, for feeding telephone conversations into amateur phone transmitters. This Cesco unit is claimed to provide clear undistorted speech at 100 percent modulation and to eliminate hum.

The model-train system, illustrated in photo D, was displayed at the last Institute of Radio Engineers convention in New York City to demonstrate how germanium products can be used in power and switching circuits. Ninety-six relays and about 200 germanium diodes and power rectifiers were used. The young lady in photo E is holding a short length of special wire described by General Electric engineers as an "electrical brake" for delay lines used in color-TV sets. The electrical current takes just as long to pass through the short wire as it would through the large coil at her feet.
ONE OF THE MOST interesting ways to get started in the hobby of metalworking is by fluting and etching a disk of polished metal to form an attractive ash tray, candy dish, serving tray or wall plaque. Mirror-finished aluminum is the ideal metal for this type of work, although satisfactory results also may be had with copper, brass or pewter. Polished-metal disks are available from most handicraft dealers in various thicknesses and in a range of sizes from 4 to 22 in. in diameter. A wide variety of full-size design patterns also may be purchased.

The first step in the etching process is to clean the disk thoroughly to remove any trace of oil or dirt from the surface. This can be done by washing with soap and water and rinsing thoroughly or by wiping the surface with alcohol. After cleaning the disk, locate a design sheet in position and fasten it to the disk with masking tape. Then slip a sheet of carbon paper under the design sheet. Use pencil-type carbon paper, as typewriter carbon paper will not transfer to the polished metal. Trace the design onto the disk as pictured in Fig. 2, using a stylus or hard pencil.

The next step, that of blocking out the design with black asphaltum varnish takes some patience but is not difficult. Although the varnish does not have to be applied smoothly, the design outline must be followed carefully and all the areas to be
Fluting tool detailed at the right is shown in use in photos above and below. Note how sheet-metal disk is held flat with wooden block while flute is bent blocked-out must be covered completely. While applying the varnish, be sure to keep your hands away from the metal in order to avoid fingerprint smudges on the surface.

After the varnish has dried hard (from 4 to 6 hours), the disk can be fluted, Fig. 4. The fluting is done at this time so the fluted disk will form a self-contained tray for the etching solution.

An etching solution for copper or brass can be made by adding nitric acid, 1 part, to water, 3 parts, using a glass container; for aluminum, add muriatic acid, 1 part, to water, 2 parts, also mixing this solution in a glass container. If you prefer, nonacid chemicals which are mixed with hot water, are available for etching aluminum. Caution: As the acids used are extremely corrosive, handle them with care. Always add the acid to the water to prevent excessive chemical reaction as the two fluids combine, and avoid inhaling the chemical fumes.

The etching solution is poured into the fluted disk to a depth of about ⅛ in. and allowed to remain on the metal for 30 to 40 min. Dispose of the acid by flushing it down the basement drain with generous quantities of water. After rinsing the etched metal thoroughly, use turpentine to wash off the black asphaltum varnish and reveal the finished design.

Fluting can be done with nothing more
Flutes are spaced equally by laying out paper pattern, above, and transferring to disk. Bend as below

After disk is blocked out with varnish and fluted, etching acid is poured over design to 1/8-in. depth

than a pair of pliers, the jaws of which have been wrapped heavily with friction tape. However, uniform results can be obtained more easily by using a simple fluting tool, Fig. 1, or the adjustable fluting tool detailed in Fig. 6. The advantage in the adjustable tool is that the spacing between the dowels can be varied to suit different thicknesses of stock. However, the tool shown in Fig. 1 can be used only on sheet metal having the same thickness as the distance between the dowels. The height of the dowels controls the depth of the flute. A flute depth of 3/8 in. usually is sufficient for 4-in. trays or coasters; 1/2 or 3/8 in. for 6 to 9-in. disks. Flutes on large trays or wall plaques 18 to 22 in. in diameter can be made as deep as 1/8 in.

The flutes are spaced and the fluting tool is used as in Fig. 5, exact spacing of the flutes being important in order to obtain uniform edges. The chart in Fig. 5 suggests flute depths in proportion to various spacings. There is no set rule insofar as flute spacing and depth is concerned. A good rule of thumb, however, is to use approximately as many flutes as the diameter of the work in inches. This spaces the flutes about 3 in. apart. To evenly distribute strain on the metal disk, first bend one flute and then the flute on the opposite side of the disk.

AUGUST 1954
Self-Propelled Toy “Tank”
Made of Empty Spool

Try this toy “tank” as a rainy-day entertainment for the little tots. It can be assembled quickly from items at hand. The flanges of an empty spool are notched to provide traction, then the spool is fitted with a rubber band. One end of the band is held with a short matchstick, which is bradded to one end of the spool. A disk cut from a candle, and another matchstick completes the construction.

B. Jackson, Toronto, Ontario, Canada.

Dustpan Fitted With Handle Provides Child’s Shovel

In winter when the small fry want to help with a snow-removal job, take advantage of their energy by furnishing them with a child-size shovel made by fitting an old dustpan with a wooden handle of the proper length. Taper the end of a broomstick or dowel to fit inside the handle of the dustpan and secure it with a wood screw. It also may be necessary to attach light flat steel brackets from the handle to the dustpan.

Small Parts Sorted Quickly On Shower-Curtain Rings

Shower-curtain rings provide a means of keeping small parts, such as screw eyes and washers, sorted for size and kind. The rings can be hung on nails over the workbench, permitting a quick check on quantity, or they can be dropped into the toolbox where they will not be misplaced among the tools. When the job is finished, it is easy to tell which kind and size of parts need replacement.

Use Center Punch to Lock Nut

When putting on a nut that eventually may become loosened, and no lock-washer is at hand, use a center punch to lock the nut in position. First tighten the nut with a wrench, then put a center punch in the middle of the bolt end and give it a sharp rap with a hammer. This will cause the bolt to spread slightly, so that the nut cannot come off without being forced.

Walter Shutok, Uniontown, Pa.
A Nibble Is a Catch With Tandem Fishhooks

To provide a tandem-hook arrangement, where permitted, two hooks may be coupled by passing the eye of one hook over hook of the other. When angling for small fish with worms used as bait, slip two or three worms onto hooks and leave ends loose to trail in water as attention getter.

If using minnows as a lure, fit both hooks inside. The short strikers, hitting at just the tail of the minnow will catch the trailing hook, while the side strikers are caught on front hook.

Slip a cricket on the leading hook and a small minnow on the trailing hook. When pulled along underwater this arrangement will make minnow appear to be chasing rapidly moving insect.

When frogs are used for bait, force the first hook up through the belly so it protrudes above back and let second hook trail between legs.

Another attractive lure is to fit a crawfish on the leading hook with minnow "chasing" it on the trailing hook. Variations on this particular idea are limited only by the angler's imagination.

Bobby-Pin "Clamps" Suspend Brushes at Desired Depth in Solvent

The problem of keeping artists' brushes suspended in a solvent without misshaping the tips is solved by suspending them with bobby pins. A wooden strip is screwed to the edge of a shallow metal container in which the solvent is kept, and the pins are screwed to the strip by passing small wood screws through the eyes and driving them into the strip. Small wire brads on each side of the pins keep them from pivoting. The brushes can now be slipped into the bobby-pin clamps and held at any depth in the cleaning solvent. A larger version of this tray could be made for use with regular paintbrushes, using a tray of sufficient size and spring clips of the type usually employed as broom holders.

Norm Jacky, Fond du Lac, Wis.

Steel Angles on Miter Box Allow Sawing Heavy Stock

If you have ever needed a miter cut on stock that was too thick to permit the saw enough guidance in a wooden miter box, you will appreciate this idea. Screw two lengths of angle steel to the top of the box at the angle you wish to cut and the saw will have the required extra guidance.

Solving Home Problems

SOAKING WALLPAPER before removing it can be done quickly and easily by applying water to the surface with an ordinary paint roller. Merely dip the roller in warm water and apply water to the wall in the same way as you would roll paint. Allow water to soak for a few minutes, then scrape off paper.

WOODEN DRAWER KNOBS that have a tendency to work loose will stay tight if the back edge of the knob is sanded to a slight bevel. In this way, the knob twists slightly on the threaded bolt when it is tightened, gripping the drawer front securely.

TODDLERS CAN'T OPEN the drawers of a sewing-machine cabinet if the drawers are held closed by means of a heavy rubber band. Just drive a screw eye into the rail between the drawers, pass the rubber band through screw eye and draw ends of band over the drawer pulls. The rubber band is removed quickly.

LENGTHS OF RUBBER HOSE of the type used for bath-tub sprays make excellent guards for the edges of glass medicine-cabinet shelves. The hose is slit lengthwise along one side and pressed over edge of shelf. This not only keeps objects from sliding off shelves but prevents breakage against shelf edges.

Screw Eye
Rubber Band

Rubber Hose

RUBBER SHIELD for broom handle is provided by pressing a rubber crutch tip over end of handle. The tip will prevent the handle from marring the wall when the broom is set against it and also will keep the broom from sliding to one side.

SHOE-POLISHING CLOTHS made from the tops of discarded knee-length stockings are easier to use if fitted with clothespin handles. Hem both ends of the cloth and slip a clothespin inside each hem. If you prefer, place the clothespin crosswise inside the ends of the stockings and stitch on both sides of it.

SPRING-TYPE CLOTHESPIN holds telescoping curtain rod at desired length when it is removed from hooks. Before lifting rod from hooks, clamp clothespin over larger section of rod so inside jaw of clothespin also will grip the small rod section. Remove clothespin after replacing rod on window.

CHAIR-BACK POCKET for home hair-dressing keeps comb, shears and bobby pins within easy reach. The pocket is sewed from heavy cloth or plastic fabric and hung from chair back with loops of cord or cloth.

LEATHER TABLE TOPS marred by deep cigarette burns can be repaired with melted wax. Use wax of a color that matches the leather as closely as possible and drop the melted wax into the burn hole. Then smooth wax flush with the leather surface, using warm knife blade. Although repair is not perfect, it will be almost unnoticeable if colors are matched carefully.
Rubber-Cup Camera "Tripod" Attaches to Car Body

For quick "tripod" shots while on an auto trip try a large suction cup of the type used on automobile-top luggage carriers. The screw in the cup will fit the camera-pan head, thus enabling you to use any smooth surface on the car as a support. If the cup does not stay in place, wet the edge with a moistened finger.

Bruce C. Vaughan, Jr., Springdale, Ark.

Sawhorse for Use on Uneven Floor Built With Just Three Legs

The tendency of a sawhorse to wobble on an uneven floor can be prevented by building the horse with three legs instead of the usual four. The single leg is half lapped and bolted to the cross-rail, and should be spaced no farther from the pair of legs than a distance one third more than the over-all height of the horse. The spacing of the pair of legs should be equal to, or greater than the height of the horse, to assure that it will not tip sideways.

Freezing Pipe in Emergency Shuts Off Water

One maintenance crew on a night emergency call to repair a leaking water pipe, found that there was no street shutoff valve. The problem of turning off the water was solved by breaking up a 10-lb. block of Dry Ice and packing it around the defective pipe between the break and the street main. After an hour, the pipe was frozen solid and repairs were made, after which the pipe was allowed to thaw.

Irving H. Fox, New York City.

Properly Opened Chain Links Are Easily Retightened

When a chain is to be shortened, open one of the links by bending severed ends outward in opposite directions instead of spreading them to clear the adjoining link. This will assure that the link can be closed tightly. Use two pair of pliers with the jaws taped to prevent marring the chain.

Screen Wire Cleans Files

Unable to locate my file brush, I rolled up a piece of screen wire and rubbered one end back and forth along each file to clean it. I wrapped a piece of waste around the roll to protect my hands.

Howard E. Moody, Upper Jay, N. Y.

Razor Blade Used as Stencil

One way of adding an unusual decorative touch to a small box or other item is to use a double-edge safety-razor blade as a stencil. The shape of the opening varies with each manufacturer, allowing for a choice of designs, and the blade makes a flexible, easily cleaned stencil that will last indefinitely. Attach a strip of tape to one edge of the blade to protect your fingers, and use a stiff-bristled stencil brush with a minimum of ink or paint.
Half-Lapping Adds Rigidity to Latticework Gate

Although light and graceful in appearance, the latticework gate in the illustration is extremely rigid because of the many diagonal cross braces which are part of the design. Further strength is provided by edge-lapping the latticework at 10-in. intervals, the latticework being made from lengths of 1¾-in. lattice stock. The arch of the gate consists of two pieces jigsawed from 2 x 8-in. stock, and joined at the center by a half-lap joint that is glued and fastened with wood screws. The pattern for the arch is laid out on 2-in. squares, as shown in the detail. The “pineapple” knobs on the gateposts are separate lathe turnings.

Lighter Fluid Added to Polish Improves Shoe Shine

By adding a few squirts of lighter fluid to a tin of shoe polish every time some of the polish is taken up by the brush, you can improve the shine on your shoes. The fluid causes the polish to spread more evenly and penetrate the leather. Only a light buffing is necessary for a good shine. After several such treatments, the shoes become waterproof and dirt resistant.

Rug Nap Raised by Steam Iron

A steam iron held over spots in your rugs and carpeting where heavy furniture has flattened the nap will restore the carpeting to its normal condition. Pass the iron back and forth over the area an inch or two from the surface.

Ted Otsu, Vancouver, B.C., Can.
Kettle Lid on Fishbowl Foils Family Cat

To keep the water free of lint and dust, as well as to discourage the fishing habits of the family cat, one housewife covers the fishbowl with an ordinary kettle lid. A lid of the proper size has air holes punched or drilled in it and is then fitted over the bowl. The lid has advantages over using a piece of screen, in that it cannot be pushed in by the cat's weight, and is easily handled by the knob at feeding or cleaning time.

Prevent Opening of Door With Outside Hinges

To prevent a locked door from being opened when the hinge pins are on the outside, lock the pins in place so that they cannot be removed. This is done by drilling a small hole in the pin and one leaf of each hinge and then driving a wire pin or a broken drill bit into the hole. Since this will prevent the hinge pins from being removed, the door cannot be taken off from the outside.

Holder for Ferrotype Plates

A simple holder for ferrotype plates may be made from a strip of hardwood, which is slightly less than the width of the plates. Slots 5/8 in. wide and about 3/8 in. deep are cut crossways in the strip about 1 in. apart. In use, the plates are set on edge in the slots and when the prints dry, they drop down and are held between the plates.

Putty Knife Protects Woodwork When Pulling Nails

To avoid marring the surface of painted woodwork when it is necessary to pull a nail from it, use a putty knife as a shield. Insert the blade of the knife under the hammer claw, as shown in the illustration, and roll the hammer back on it as the nail comes out. Thus protected, the surface of the paint will not be marred when the job is finished.

Decals Applied to Sheet Plastic Provide Attractive Plaques

Attractive wall plaques for any room in the house can be made easily by applying decals to small rectangles of colored plastic. The 4 x 6-in. plaques are cut from sheet plastic, 1/8 in. thick, which is obtainable at most hobby stores. The edges of the two holes, which are drilled to receive a length of embroidery silk for hanging the plaques, are filed smooth to protect the silk. Thicker plastic can be used, but is more expensive and harder to work. The heavier plastic should have cut edges beveled, filed smooth, then polished.

Harry X. Lawson, Pulga, Calif.

To renew the appearance of an old screen-door spring, stretch it slightly between two nails driven into a board, and then paint it with a thin enamel of the type used for window screens. Let paint dry before removing spring from nails.
New do-it-yourself kits permit homeowner to assemble his own

ATTIC FAN

By Wayne C. Leckey

Among the many do-it-yourself products recently offered the homeowner are attic-fan kits which the buyer assembles himself and installs in a simple wooden box at a considerable saving. The kits provide all the necessary parts, namely: Fan blade, pillow-block bearings, shaft, pulleys, collars and belt, and are offered with or without a 1/4-hp. motor. The box in which the fan is mounted is assembled of 1 x 12 lumber and 1/4-in. plywood and is covered on one side with wire mesh. Some makers offer a fan that does not require a box for certain installations.

The size of your house determines the size of the fan. The fan you select should have a c.f.m. (cubic feet per minute) rating equal to or slightly greater than the gross cubic content of the house. A 36-in. fan will cool the average six-room house 15 to 25 deg. Where it is desired to cool the sleeping rooms only and not the entire house, the fan should have a capacity of 1.2 times the cubic content of the rooms to be cooled. Gross cubic content of your house is found by multiplying its width by its length by the ceiling height.
Suction box partially dismantled shows typical vertical installation of fan over ceiling grille. Pillow-block bearings do not permit horizontal mounting.

Suction box of plywood and wallboard provides duct between fan and grille. See drawing below. Fan exhausts air out attic window or louver in gable.

Of the two most common installations, a suction box over a ceiling grille is considered the most efficient as it allows a more even air flow throughout the house, especially when it is possible to place the grille in a hall that is fairly centrally located in the house. The suction box consists of an airtight duct or hood that connects the fan to the ceiling grille. Where the attic is practically airtight, the fan can be set in front of a gable or dormer window fitted with a louver, or shutter. Here, the entire attic acts as a suction chamber to pull the hot air up out of the house through a stairway or ceiling grille. As the stored-up heat in the attic and living quarters is discharged out through the attic louver, cool night air is drawn into the house through open windows. In this installation, a shelf or other means is used to support the fan vertically, and a canvas duct, or sleeve, is used to connect the fan box to the outer wall. It is recommended that the distance between the fan blade and the window louver should not be less than 6 in. Such an installation, being semipermanent, allows the fan to be used elsewhere in the house as a window fan or circulating room fan. Fitted with a handle, the fan becomes a portable unit.

Fan kits are available in 20, 24, 30 and 36-in. sizes. In installing one of these fans in my home, I selected a 30-in. Dayton fan.

Standard ceiling louver, or shutter, in hallway opens quietly when fan starts, closes automatically when fan stops. Louvers are available in various sizes.
kit and installed it in a suction box over a ceiling grille which I placed in a hall between the bedrooms. My first job was to cut the opening for the grille. Here again, the size of the grille is determined by the size of the fan. Generally speaking, the grille area should be 25 percent greater than the fan area. I used a commercial shutter-type metal grille, but a wooden "egg crate"-type grille, made of half-lapped slats, will do. During winter, a piece of blanket insulation can be placed over it. In cutting the opening for the grille, I had to cut out a section of only one ceiling joist as shown in the detail on the opposite page. You may find it necessary to cut through a second joist, depending on the size of the grille. In either case, the severed joists are bridged across with headers to box-in the opening. The drawing shows how I made the suction box of plywood and wallboard. Rigid insulation board is good, too. You’ll notice that I mounted the fan at the edge of the opening. Some recommend placing the fan one fan diameter from the edge of the opening. The suction box should be made as airtight as possible. I nailed cleats to the top edges of the headers and screwed the plywood sides to the cleats and to the fan box. Sheet wallboard conformed nicely to the curved sides by first slipping it under a rabbeted cleat across the top of the fan box. If the attic is insulated with loose fill, the joists should be floored in front of the fan. The drawing and chart at the top of the page give box dimensions for three different-size Dayton fans. The exhaust side of the box is faced with 1/4-in. plywood, cut out to suit the blade diameter. ** **

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<td>A 34 B 32 1/2 C 17 D 16 1/2 E 31 F 14 1/2</td>
</tr>
</tbody>
</table>

Below, where there are stairs to the attic, fan can be mounted directly in attic window and stair door left open. Such installation allows fan to be removed and used elsewhere in house as circulating fan.

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Cut each corner of the front so that it will form a pull-down "door" for the temporary unit. Line the inside of the box, including the door, with three thicknesses of corrugated cardboard for insulation.—J. F. Victor Vaughan, Montebello, Calif.

Elastic Tape Sewed to Pocket Prevents Loss of Rule

One carpenter eliminated the nuisance of having his folding rule constantly dropping from his overall pocket by having a loop of elastic tape stitched to the front of the pocket. When putting the rule in his pocket, he slips the loop over the projecting end, as shown, which holds the rule securely, yet makes it easy to remove.

Breaking in New Penpoint

To break in a new penpoint touch it to a match or other small flame for just a moment. The flame will burn the lacquer or varnish from it, allowing the point to hold ink better and write smoothly.

A. E. Fenn, Chicago.

Drill Bit Used As Center Punch Aligns Hinge Screw Holes

If a drill bit is used as a center punch to mark the holes to be drilled for mounting a hinge, accurate alignment of the holes will be assured. Use a drill of the same diameter as the holes in the hinge, hold it upside down and tap the cutting end with a plastic or wooden mallet. The conical point at the end of the drill shank will make a mark at the true center of the hole.

Ken Murray, Colon, Mich.
Clear-Plastic Cartridge Box

Both safe and practical, this cartridge box holds fifty .22-cal. cartridges in a sliding tray drilled to hold each cartridge separately, and the clear plastic from which it is made permits a check of the contents without sliding open the cover.

The tray is an 11/2 x 13/4 x 51/8-in. block of plastic, but if plastic this thick is not available, several thinner strips can be cemented together to build up an approximate thickness. Special plastic cement is best for assembling the box, although some model-airplane and household cements can be used.

When building up the block from plastic strips, clamp them together and make sure no air bubbles are left between layers. Use a No. 1 twist drill to make holes of the proper size to receive the cartridges. Locations for the holes should be marked on the adhesive-paper backing which is generally used to protect the plastic finish. In case there is no paper, temporarily apply a paper backing with rubber cement. It is best to use a drill press to bore the holes, but a hand drill can be used if care is taken to keep the holes straight. In either case, use a stop to assure that all holes are equal in depth and that the drill does not penetrate the block completely. Next, cement a piece of 1/4-in. plastic to each end of the block, allowing the edges to project about 3/16 in. above the top.

The sliding cover is constructed from four pieces of 1/4-in. plastic, the two side pieces measuring 13/16 x 57/8 in. The top and bottom pieces are 2 x 57/8 in. and overlap the sides. To be sure of sliding clearance,

End pieces of 1/4-in. sheet plastic are cemented to drilled block. Each piece projects 3/32 in. above top.
wrap a single sheet of cellulose paper around the tray assembly and fit the cover over it. Plastic and cement will not stick to cellulose paper, and removing the paper after the box is assembled will leave ample clearance all around.

A latch, made from spring brass or other suitable metal, $\frac{3}{8} \times 1\frac{1}{2}$ in., is used to hold the cover in place. One end of the strip is drilled to receive two small machine or self-tapping screws and the opposite end is bent at right angles $\frac{3}{8}$ in. from the end to provide a stop and finger grip. If machine screws are used, the plastic can be drilled and tapped to receive them; the self-tapping screws are driven into holes slightly smaller than their own diameter. The latch is located by centering it at one end of the lid. Next, a hole is marked on the latch so it is centered on the endpiece of the tray and a hole is drilled through latch, the lid and into the endpiece to a depth of $\frac{3}{8}$ in. A brass escutcheon pin is soldered in the hole in the latch, and cut off to just touch the bottom of the hole in the endpiece of the tray. In this way the latch pin engages the hole in the tray endpiece until released by lifting up on the latch.

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**Fast Method of Striking Ellipse on Layout of Doorway Arch**

Masons, carpenters, plasterers and others who often find it necessary to strike an elliptical arc can make use of this simple method. A good example is the layout for a doorway arch. Determine the height of the arch at the center and also half the required width. Then tack a straightedge to the bench, the straightedge being placed exactly at right angles to the edge of the bench with the end projecting beyond the edge a distance slightly greater than the height of the arch. Now round one end of a strip of wood and drill a small hole near the opposite end so that you can insert the point of a pencil. Measure from the hole along the length of the strip a distance equal to the height of the arch. Drive a nail through the strip at this point. Then place this improvised scriber against the straightedge. Insert a pencil point through the hole in the scriber and hold the rounded end of the scriber against the straightedge with the nail contacting the edge of the bench. Move the scriber to the left, keeping the pencil point, the rounded end and the nail in contact until the scriber has reached a point parallel with the edge of the bench. This will scribe a true elliptical arc.

L. L. Glover, La Plata, Md.

*POPULAR MECHANICS*
Tissue Box Taped to Sun Visor Aids Cleaning Windshield

Taped to the sun visor, a pocket-size package of cleansing tissues will come in handy for cleaning a misty windshield or wiping a child’s sticky hands. Two strips of adhesive or cellulose tape are fastened to the back of the package and allowed to extend a couple of inches beyond the ends. Two more strips are used to tape the latter strips to the visor, thus holding the package neatly in place.


Paper Matchbook Cover Doubles As Emergency Shoehorn

When a shoehorn is not at hand, you will find that a matchbook cover may be used instead. The outside surface of such covers usually are smooth enough to overcome friction, and the cover itself is flexible enough to conform to the shape of the heel. When inserted in a shoe as shown, the cover will allow the foot to be slipped into the shoe easily.

Wood Installed on Concrete Sill Without Using Screw Anchors

Mastic can be used to permit installing a wooden sill and trim on a concrete window sill without the use of screw anchors. The wooden sill is cut to a snug fit in the window frame, then removed and an even coat of mastic is spread on the concrete sill. The inside trim should be nailed to the sill piece, then the L-shape section is tapped firmly into place on the mastic on the sill to form a weathertight fit. The sill can be painted or varnished before it is installed.

Hi Sibley, Nuevo, Calif.

Space-Saving Portable Picnic Table Is Easily Disassembled

For locations where space is restricted, such as the cockpit of a small cabin cruiser, this 24 x 18-in. portable table is ideal. Because it is easily disassembled, it also can be carried in the trunk of an automobile for use on picnics or at the beach. The top is a piece of \( \frac{3}{4} \)-in. outdoor plywood, sanded smooth and varnished or painted. Wedge-shaped wooden pads at each corner of the top splay the legs to give the table stability. The legs are \( \frac{3}{8} \)-in. wooden dowels 24 in. long, one end of each being fitted with a ferrule made by cutting a \( \frac{3}{8} \)-in. brass-pipe nipple 4 in. long in two. The threaded ends of the fer-
SAFE SEWAGE

How to install and maintain a septic-tank disposal system for rural and suburban homes

IN RURAL AND SUBURBAN AREAS where there are no sewage facilities, a septic-tank system is the most practical means of sewage disposal. Any home that has running water can have such a system, and once you know how the system operates and what it requires, planning it presents few problems. Plenty of digging is required to install the system, but it is possible to rent motorized equipment to reduce the labor to a minimum.

A typical septic-tank layout is shown in Fig. 1. Ready-made steel tanks, Fig. 2, or precast concrete, Fig. 3, or tanks of vitrified-clay pipe are available. Also, you can pour concrete tanks on the site. Before planning a septic-tank installation, get a copy of your state's code on individual disposal systems and follow its provisions explicitly.

How a septic-tank system works: Solids entering the tank settle and form a sludge at the bottom. Grease and lighter particles rise to the top and form scum, as in Fig. 4. Organic matter in the sludge and scum is decomposed by types of anaerobic bacteria that thrive in the absence of light and air. Gases caused by the bacterial action escape through the house sewer and vent stack. The remaining liquid, called "effluent," collects between the sludge and scum. When it reaches the level of the tank outlet it flows out in amounts equal to the raw incoming sewage. Sewage should be fermented in a septic tank from 24 to 72 hrs. and longer in a two-chamber tank.

The effluent runs to a disposal field, where it seeps into the soil and is made harmless by aerobic bacteria. These, unlike anaerobic bacteria, require air for life and thrive near the surface of the soil, mostly within the first 36 in. Therefore, disposal lines must not be too deep.

Selecting the site: When planning a septic-tank system, first select the site for the disposal field. Its size depends on the sewage load and the absorptive quality of the soil. After determining the size, select the site in consideration of these qualities:

1. Distance from water sources. To avoid pollution, this should be 100 ft. or more.
2. The disposal line should be 25 ft. from any

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stream and 10 ft. from a house or lot line. A distance of 50 ft. from a drilled well is safe if the well casing is watertight to a depth of 50 ft.

2. If possible, the field should be exposed to wind and sunlight.

3. The ground should be well drained, sloping away from the house and water supply.

**Septic tanks**: Size of the tank depends on the sewage load. Table A gives the measurements of concrete tanks of various sizes. Consult the manufacturer's data sheets for the capacity of prefabricated tanks. It is better to have a tank too large than one that just meets minimum requirements. When determining the size, consider future additions to the plumbing system. The actual working capacity of a tank is the space below the outlet. The minimum size of a one-chamber tank is 500-gal. working capacity. A two-chamber tank, Fig. 4, is more efficient and requires cleaning less often; the minimum size is 750 gal. The tank outlet usually is about 3 in. lower than the inlet. Sufficient air space should be provided above the working capacity. Any of the inlet and outlet arrangements shown in Fig. 4 will prevent turbulence in the tank when sewage flows in, and also keep the scum from flowing out. The covers should fit tightly and may be sealed with a plastic compound to keep out ground water. Large tanks should have manholes, one near each outlet. Usually a septic tank is set so that it can be covered.
with 12 to 18 in. of earth, at which depth the inlet will be about 30 in. deep. The tank can be located any reasonable distance up to within 10 ft. of the house.

**Building concrete tanks:** Where the earth is firm, no outside forms are needed. Inside forms are “hung” in place as in Figs. 5 and 6. Use a 1:2½:2 mix of portland cement, sand and gravel respectively, by volume, with just enough water added to produce a workable consistency. The tank lids are cast in a mold on a level surface. They are reinforced and provided with handles.

**House drain and sewer:** The house drain should extend at least 5 ft. outside the foundation wall and, as a rule, cannot be installed under a basement floor. Basement waste must be raised to the house-drain level with a sump pump. The house sewer runs from the house to the septic tank. It can be any type of good sewer pipe. The joints should be permanently tight to prevent leakage or the entrance of tree roots. If vitrified-clay pipe is used, pour the joints with special elastic joint compound. Usually, a 6-in. house drain is preferred; 4 in. is the minimum size. Cast-iron pipe is most resistant to crushing and should be used if the lines run under a driveway at a depth of less than 3 ft. The line should be straight as possible, with a slope of 1/4 in. per ft. for 5 or 6-in. pipe, and 1/4 in. per ft. for 4-in. pipe. The line from the septic tank to the disposal field should have the same slope. If the tank is over 20 ft. from the house it is advisable to have a cleanout within 5 ft. of the tank.

**Size of disposal field:** The area required for the field is determined by percolation tests, Fig. 7. Do not make the tests in filled or frosty ground, and if rock formations are encountered, obtain the advice of the State Board of Health. To make percolation tests, dig a number of holes with a posthole auger about 18 to 24 in. deep. Fill them with water until it seeps away at a uniform rate. Then check the time for a known depth of water to seep away and divide this by the depth in inches to get the average seepage time per inch. Refer to Table B, which gives the absorption area (area of the trench bottom) needed for the number of persons to be served by the system. Next, refer to Table C to obtain the length and width of disposal trenches and to figure the length of pipe required. For example, if the seepage is 10 min. per in., a family

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Table A
SIZES FOR SINGLE-CHAMBER CONCRETE SEPTIC TANKS

<table>
<thead>
<tr>
<th>Persons served</th>
<th>Inside dimensions in feet</th>
<th>Working capacity (gals.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length</td>
<td>Width</td>
</tr>
<tr>
<td>4 or less</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>7 ½</td>
<td>3 ½</td>
</tr>
<tr>
<td>10</td>
<td>8 ½</td>
<td>3 ½</td>
</tr>
<tr>
<td>12</td>
<td>8 ¾</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>10</td>
<td>4 ½</td>
</tr>
</tbody>
</table>

Recommended thickness of walls, 6 in.

Table B
ABSORPTION AREA AT BOTTOM OF DISPOSAL TRENCHES REQUIRED PER PERSON SERVED AS BASED ON PERCOLATION TESTS

<table>
<thead>
<tr>
<th>Time of 1-in. seepage from test holes (minutes)</th>
<th>Absorption area per person (sq. ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 or less</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>52</td>
</tr>
<tr>
<td>15</td>
<td>63</td>
</tr>
<tr>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>60</td>
<td>120</td>
</tr>
</tbody>
</table>

Table C
CONVERSION OF ABSORPTION AREA TO LINEAL FEET LENGTH OF TRENCHES OF VARYING WIDTHS AND DEPTHS

<table>
<thead>
<tr>
<th>Width W in Fig. 8</th>
<th>Depth D in Fig. 8</th>
<th>Absorption area per lineal ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>18 to 30</td>
<td>1.5</td>
</tr>
<tr>
<td>24</td>
<td>18 to 30</td>
<td>2.0</td>
</tr>
<tr>
<td>30</td>
<td>18 to 36</td>
<td>2.5</td>
</tr>
<tr>
<td>36</td>
<td>24 to 36</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Spacing between trenches should be three times their width and not less than 6 ft.

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of five will require 250 sq. ft. of absorption area. Divide this by 1.5 (Table C) which gives a trench length of 173 ft. for the 18-in. width.

The disposal field should not be less than 150 sq. ft. of absorption and the lines should not be longer than 100 ft. Spacing between parallel lines should be 3 times their trench width, but not less than 6 ft. Tightly jointed pipe is used from the septic tank to the distribution box, and from the latter to the inlet end of the line.

Disposal-field design: A single line for a small system can be S-shaped as in Fig. 9. Where the ground slopes, the laterals are placed at progressively lower levels. If a line must be longer than 100 ft., use several short ones equaling the total length requirement. Two multiple-line arrangements for level ground are shown in Figs. 10 and 11. Other arrangements for sloping ground, where the laterals follow ground contour, are shown in Figs. 12 and 13. Any multiple-line system requires a distribution box. Sometimes each pair of lines is fed from a separate distribution box, as in Figs. 13 and 14.

The best depth for disposal lines is 12 to 18 in. below the ground surface, but no more than 36 in. Drainage slope of the lines should be from 2 to 4 in. per 100 ft., but not over 6 in. per 100 ft. Trenches should not be less than 18 in. wide at the bottom. A 6-in. layer of coarse, washed gravel (1/2 to 2 1/2-in. dia.) is required under the pipe, and a 2-in. layer over it.

Laying disposal lines: Pipe is laid to grade with a level and straightedge on guide boards, Figs. 16 and 17. The guide boards have pointed stakes nailed to them and are left permanently in place. The nail projecting from the straightedge assures getting the required slope. Drain tile is spaced from 1/4 to 1/2 in. at the joints, which are covered with tar paper, as in Fig. 18. Before filling the trench, the gravel layer is covered with untreated building paper, several layers of newspapers or 2 in. of straw. Where frost penetrates 5 or 6 ft., trenches are dug deeper than this, Fig. 22, and are filled with coarse gravel so that the pipe can be laid to a depth of 36 in.

Distribution boxes: Distribution boxes, Figs. 20 and 21, assure an equal distribution of the effluent to the disposal lines. A baffle is used to stop sudden surges of incoming effluent. Where a duplicate disposal field is used, Fig. 20, a stop board in the distribution box permits shutting off either field for rest or repair.

Disposal lines in tight soils: Where soils are too tight for rapid absorption (as indicated when 1-in. seepage requires 60 min. or more by percolation test) you can substitute sand-filter trenches, seepage pits or other approved means of disposal. Filter-trench construction is shown in Fig. 23. Where the surface soil is tight but is underlain with porous soil, one or more seepage pits, Fig. 24, may be used instead of disposal lines. The distance between pits should not be less than 3 times their diameter and the capacity of the pit should be no less than that of a septic tank.

Grease traps and garbage grinders: A grease trap, Fig. 19, is only needed when there is an abnormal amount of grease and
fat present in the sewage, as on a farm where considerable processing of meat and dairy products is done. However, some states require the installation of grease traps in individual disposal systems. Where one is used, an electric garbage grinder should not be installed in the kitchen waste line. Where a grease trap is not used and a garbage grinder is installed, the septic tank should be enlarged 50 percent.

**Storm water and chemicals:** Rainwater from roofs should not be led to a septic tank. Only normal quantities of laundry wastes should be admitted. Soap, drain solvents and other mild cleaning and disinfecting solutions will not cause trouble. However, constant disinfected wastes from sickrooms, milk rooms, strong chemicals for sterilizing equipment, pickle brine, photographic chemicals and waste from filters or water softeners should not be admitted to a septic tank.

**Care and maintenance:** Inspect the tank every 12 to 18 months. Cleaning is necessary when the space for liquids between the sludge and scum is reduced to one half of the total tank depth. In small tanks, this usually takes 2 to 3 years. Larger tanks and two-chambered tanks may go 10 or 12 years before cleaning. The removed sewage has disease-producing germs and should not be used as fertilizer. It should be buried in pits and covered with an 18 to 24-in. layer of earth, at points remote from water sources. Never use any kind of open flame in a septic tank, as the gases in it often are explosive. They also may be poisonous and asphyxiating, so the tank should be ventilated thoroughly before you enter it. When it is necessary to enlarge a system, a second tank can be connected to the original one, Fig. 25, and the length of the disposal lines increased proportionately.
Corn-on-the-Cob Holders Turned from Hardwood

The pleasure of eating piping-hot corn on the cob is multiplied by these wooden holders that keep the fingers cool. Because of their small size they can be turned individually from hardwood scraps or in multiples from one piece. The points are made from 1/8 x 1/4-in. stainless steel or aluminum stock, filed to a square point. The matching salt and pepper shakers are turned in the same way. Turn enough pairs of each to equip your family and any expected guests, and make a box just large enough to hold them. The bottom of the box acts as a tray for the holders.—Harrison Neustadt, New York City.

Shelves and Partitions Supported by Basement-Column Brackets

One home craftsman utilized normally wasted space by hanging shelves on the supporting columns in his basement workshop. Brackets to fit around the columns were made by bending 1/8 x 1-in. flat steel to a U-shape. The heads were cut off 3/10-in. bolts and welded to the ends of each piece. A hardwood spacer, used with the brackets, allows vertical mounting of wood strips or panels, while a length of angle steel, drilled to receive the welded bolts, will support a horizontal shelf. The brackets also can be used to install partitions such as when dividing the basement into rumpus rooms and laundry areas. The hardboard, plywood or plasterboard is nailed directly to horizontal wooden strips which are bolted to the posts by means of the brackets.

Arthur R. Tanner, Cold Springs, N. Y.

Stop Strip on Bookcase Shelf Keeps Volumes Aligned

A stop strip placed on the shelf behind books that are in constant use, will provide a means of keeping them neatly aligned with the front edge of the shelf. The strip is cut as wide as the space between the books and the back of the shelf, and just long enough to accept a set of books which are all of one size. If the bookcase has no back, it is necessary to nail or screw the stop strip to the shelf.
Folding Door Saves Needed Floor Space in Small Room

This four-panel folding door allows use of floor space ordinarily taken up by the swing of a conventional door. This feature is especially desirable in small bedrooms, both for closet as well as entrance doors to the room. The panels are \( \frac{\pi}{4} \) in. plywood, which can be of a wood to match the woodwork in the room. Width of the door frame divided by four determines the width of each panel. Deduct \( \frac{1}{16} \) in. from the width of each panel for hinge clearance and allow \( \frac{\pi}{4} \) in. clearance at top and bottom. When the panels are cut, allowance must be made for the width of the saw cut. Each panel is then mortised for three \( \frac{1}{12} \) in. butt hinges. The panel next to the frame is mortised on two sides, the inner panel on only one. A ring-type door pull is recessed near the inner edge of each inside panel. In the original installation, the old stop-strips were removed and a \( \frac{\pi}{4} \) in.-sq. piece of stock was fastened across the top of the doorframe.

Thomas I. Lucci, Avon Lake, Ohio.

Small-Parts Cabinet for Shop Assembled From Precut Pieces

A space-saving cabinet for small parts, using \( \frac{1}{4} \) in. stock for the sides and backs of the drawers and \( \frac{\pi}{8} \) in. hardboard for the bottoms, provides a maximum of storage for any given space. All parts of the cabinet can be precut on a circular saw and there are no horizontal partitions. The vertical \( \frac{3}{4} \) in. partitions are dadoed to provide drawer slides, and the projecting bottoms of the drawers then slide into the cuts. The cabinet assembly thus requires a minimum of fitting. The finger grips on the drawers of the cabinet in the photo were made by drilling two holes \( \frac{\pi}{8} \) in. deep with a \( \frac{1}{4} \) in. Forstner bit, then nailing a strip of hardboard across the top edge of the holes. Any suitable finger grip may be used. The dimensions of the cabinet given in the detail can be changed easily, to permit it to fit any available space on the shop wall. The drawers in the lower two or three rows can be made deeper to allow storage of larger items, and those in which nails, screws and other small parts are to be kept can be partitioned. — Will Thomas, Buffalo, N. Y.
PLAN of the MONTH...

FISHING-TACKLE BOX

Use mahogany, redwood or white-pine lumber

- 2 pcs. 3/4 x 8 x 3-1/16 — Box ends
- 2 pcs. 1/2 x 8 x 3-1/8 x 11 1/2 — Box sides
- 1 pc. 3/4 x 3/4 x 11 1/2 — Box top, bottom
- 1 pc. 3/4 x 3/4 x 11 1/2 — Bottom divider
- 1 pc. 3/4 x 3/4 x 11 1/2 — Bottom tray sides
- 4 pcs. 1/2 x 1 1/2 x 11 — Top dividers
- 2 pcs. 1/2 x 1 1/2 x 1 1/4 — Top dividers

LOWER TRAY

- 1 pc. 1/2 x 3/4 x 8 1/2 — Bottom
- 2 pcs. 3/4 x 1 1/4 x 8 1/2 — Sides
- 2 pcs. 1/2 x 1 1/4 x 8 1/2 — Bottom divider
- 1 pc. 3/4 x 1 1/4 x 3-1/16 — Divider

UPPER TRAY

- 1 pc. 3/4 x 3/4 x 20 1/8 — Bottom
- 2 pcs. 3/4 x 1 1/4 x 20 1/8 — Sides
- 1 pc. 1/2 x 1 1/4 x 20 1/8 — Divider
- 8 pcs. 1/2 x 1 1/4 x 24 1/8 — Dividers

Sheet Plastic or Hardboard

- 1 pc. 1/4 x 5 1/4 x 20 1/8 — Inside lid

EACH COMPARTMENT 2 1/4" WIDE

REMovable TRAYS

SPRING CATCH

1 1/8" HINGE

CORNER DETAILS

1/16" X 1/16" TENON

1/4" X 1/4" TENON

3/4" R.

3/4" X 1/16" SPLINE

22" FRONT SECTION

8 1/4" END SECTION

POPULAR MECHANICS
Tackle Box and Rod Cabinet

This month we feature two projects for the fisherman. On the opposite page are plans for a tackle box large enough to hold all the necessary small equipment. Note that two methods of joining the corners of the box are shown, either one of which may be used. On this page we feature plans for a wall cabinet to hold rods and reels. This makes a decorative and practical piece of furniture for the den, especially when a good hardwood is used for exposed surfaces.

**MATERIAL LIST**

Lumber
- 2 pcs.—3/4" x 7½" x 36"—Ends
- 2 pcs.—3/4" x 7½" x 20½"—Shelf and bottom
- 1 pc.—3/4" x 4" x 20½"—Rod holder, bottom
- 1 pc.—3/4" x 13¼" x 20½"—Rod holder, top
- 2 pcs.—3/4" x 4½" x 9½"—Drawer fronts
- 4 pcs.—3/8" x 4½" x 7½"—Drawer sides
- 2 pcs.—3/8" x 3½" x 9½"—Drawer backs

Plywood
- 2 pcs.—1/4" x 7" x 9½"—Drawer bottoms
- 1 pc.—1/4" x 20½" x 34"—Back

![Diagram of the Tackle Box and Rod Cabinet]

1/8" FIR-PLYWOOD BACK PANEL 21½" X 34". COVER WITH BURLAP AND TACK TO BACK OR FACE WITH 1/8" CORK AND CEMENT TO PLYWOOD

THUMB TACKS FOR DRAWER GLIDES

5/8" DOWELS

1" DIA. HOLE LINED WITH FELT OR RUBBER

1/4" CORK CEMENTED TO FACE

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Rubber Cot Protects Finger When Filling Plaster Cracks

Although your index finger provides a handy and flexible tool for wiping patching plaster into cracks in a wall, extensive use will result in a painful abrasion. However, by wearing a rubber finger cot of the type used for handling paper, a skinned finger can be avoided. This is also handy for applying joint compound to pipe.

Screen Molding Mitered Easily While Tacked in Place

Perfect-fitting miters can be cut at the corners of window-screen molding without using a miter box. Tack the molding in place on the screen, but do not fasten the last 6 or 8 in. at each end. Slip a piece of hardboard or thin plywood under the molding where it crosses at each corner. Cut through both pieces with a hacksaw or coping saw, keeping the angle about 45 deg. The cut ends will match exactly and can be pressed tightly together and tacked into place.

“Locking” Small Screws

Small screws that have a tendency to work loose in a model engine or locomotive can be secured permanently by coating the threads with fingernail polish before tightening the screws in place. A light application will do the job, yet permit their removal with a screwdriver if necessary.

Ed Packer, Chicago.

Burlap Sack Laced to Wheel Rim Keeps Newly Caught Fish Alive

One fisherman made a holder to keep his newly caught fish fresh and alive by lacing a burlap sack to the rim of an auto-steering wheel. The wheel rim fits under a steel-angle bracket screwed to the boat transom and is removed easily to permit carrying the holder ashore.

Bob Poulson, Los Angeles, Calif.

Salt Removes Soot From Carpet Without Smearing

Removing soot from a rug or carpeting with a vacuum cleaner alone will almost always result in an unsightly spot. However, if the soot spot is thickly covered with dry salt before the vacuum cleaner is used, there will be no stain or smear left.

Blanche Campbell, Las Vegas, Nev.

Tire Pressure Marked on Gauge

Rather than trying to remember the air pressure required by the tires of your car, mark them on a piece of adhesive tape and fasten it to your tire gauge. Make note of both hot and cold pressures for front and rear wheels. Maintaining the correct pressure at all times will add miles of wear to the tires and allow them to wear more evenly.—Richard Hanscom, Elmhurst, Ill.
WHEN WATER'S TOO SOFT

By William Gilman

WOULD YOU STEP on the accelerator when it's brakes you need? Yet, in a way, that's what many homeowners do about "hard water" problems. The hard water they try to soften isn't hard at all. It's exactly the opposite—too soft. This may sound surprising to the country dweller or villager with his private water supply, but it's a fact that sparkling cool water fresh out of the faithful old well or spring often can be too soft.

This water, known as corrosive water, contains too much carbon dioxide and the result is messy and costly. The water eats out your pipeline and the products of that corrosion result in a long list of complaints such as clogging the plumbing with rust, leaving brown stains on washcloths and porcelain and making the water look cloudy or taste "inky." Corrosive water is far more common than you might think and, although it does not occur as often as hard water, it causes considerably more trouble when it does occur.

Once corrosive soft water is recognized for what it is, the average homeowner's water supply can be cured with a filtering treatment based on only a few dollars' worth of crushed limestone. The method is as foolproof as it is simple. As the water percolates through the limestone, it loses carbon dioxide and gains minerals without getting too hard. As a bonus, the limestone acts like a gravel bed in filtering out any ordinary sediment that might be in the water. In addition, the treatment tank can be built in such a way that it will increase water storage for protection against the summer dry periods that affect many wells and springs.

Water that comes from drilled wells is more likely to be too hard than too soft.
Limestone is poured into two of the three filtering-tank compartments, in this case, forming a filtering bed 33 in. deep. Limestone compartments are 30 in. long and water-storage section is 27 in. long.

Several bricks are left out of one end of each baffle (on opposite sides of tank) so water can circulate through them. Opening to water storage compartment is covered with perforated sheet of copper.

Water supply must be kept clean and protected from contamination, so tank is covered with 2-piece lid of 2-in. planks. Ends and sides of planks are being faced with boards, above, which held lid in position.

Lid sections are covered with roll-type roofing to seal tank from surface drainage. A narrower strip of roofing is laid over seam formed by first two pieces. Standpipes in foreground lead to valves.

Photo below shows control rods for reaching valves used in this installation. End of lower rod engages standard handle on water-line gate valve. Upper rod is notched for wheel-type handle on bypass valve.

Either half of finished lid can be removed, as below, to permit access to filtering tank. Two standpipes in foreground should be covered to keep out debris, inverted coffee cans serving the purpose.
because it has passed through and dissolved such rock as limestone. Water that is obtained from shallow wells or springs, therefore, normally would tend to be soft—sometimes corrosively soft. As water is not always what it seems, it’s best to have an analysis made for bacteria and chemical content before attempting a cure. Most state health departments will perform this analysis free.

Before the chemical analysis, however, you’ll find plenty of clues which indicate that the water is corrosive. For example: The water may stain porcelain fixtures brown or red, or it might run “rusty” the first few moments after opening the tap. Then, too, it may turn cloudy after standing overnight. Even copper, brass and lead piping are not immune to this fast-rusting water.

Oddly enough, hard-water treatment can help the soft-water problem indirectly. But, at best, it only removes the products of corrosion. In severe cases, the softener itself may require protection in the form of a filtering or neutralizing tank.

The most effective solution to soft-water problems, then, is to build a filtering box, containing limestone, next to the well or spring. The box could be made of planks, but will be neater and more permanent if it is built in the form of a concrete storage tank. To keep the water in contact with the limestone as long as possible, the tank should be longer than it is wide or deep and contain a pair of baffles which divide it into three compartments. It should handle a cubic yard of crushed limestone or marble and, for the average family, have a water capacity of about 30 cu. ft. The stone particles shouldn’t be too large— screenings of 1/4 to 3/4-in. size are good. You also can use No. 1A road dist, the material which is applied as a top dressing on macadam pavement, or “chicken grit,” having particles which average about 1/8 in. in size.

A plank lid finishes the tank. In severe winter weather, the tank should be covered with boards or straw to prevent freezing. Unlike a water softener, the filter bed doesn’t need backwashing. After a couple of years you just dump in more limestone.

The photographs picture a tank 8 ft. long, 2 ft. wide and slightly over 5 ft. deep. It’s installed near a typical gravity spring and its water level rises and falls with the level in the spring basin. The limestone is in the first two compartments, the last compartment containing the neutralized, clear water. Actual dimensions and elevations of the tank will depend on your particular situation. Plan the tank size according to maximum water needs.

When building filtering tank, it’s sometimes well to rebuild spring, adding new concrete walls and tight cover
Faced with the problem of reversing the copy from which he was working, one artist developed this device to help him. It consists of a wooden base on which are mounted a mirror and a board for tacking up the copy to be reversed. The board and the mirror are mounted so that the angle between them measures 45 deg., as shown. By looking into the mirror, the artist sees a reversed reflection of the original copy on the mounting board.

Flush-Tank Handle Kept Tight With Copper-Wire Shim

To prevent the handle on a toilet flush tank from working loose when the opening in the tank was oversize, one homeowner used a wire shim on the fitting. The shim was formed by winding soft-brass or copper wire around the square shoulder of the fitting so that it is a snug fit in the open-

Bent Fishhooks Taped to Pole Make Efficient Line Guides

Fishermen who use a cane pole with a reel attached for still fishing can provide excellent guides for their line by bending fishhooks as shown in the illustration and taping them to the pole. The hook end is secured to the pole with several windings of either adhesive or friction tape and the eye of the hook, which then is in an upright position, serves as the line guide.

G. E. Hendrickson, Argyle, Wis.

Masking Arms of Photo Easel Squared on Ruled Card

To assure even borders on prints, the masking arms of a photographer's easel can be squared quickly by using a card ruled with crosslines at 1/4-in. intervals as shown. When the arms have been lined up with adjacent lines, masking or adhesive tape may be used to secure them in position. The back of an 11 x 14 piece of double-weight print paper is satisfactory for this purpose.

Clyde Allison, Cadillac, Mich.
MOTORIZED WHEELBARROW

By F. Lelan Elam

To eliminate some of the back-breaking labor of hauling heavy loads of droppings from his chicken houses, one poultry farmer built a motorized wheelbarrow with a dump-type hopper. A gasoline engine is pivoted inside the frame; the pivot is parallel to the axle of the wheel. When the handle of the wheelbarrow, which is hinged just behind the cross brace, is pulled inward, it causes a rod to tip the engine forward on the pivot. A roller, powered by the engine, contacts the tire and propels the wheelbarrow. A small lever near the end of the handle is the throttle. The front end of the hopper is pivoted on the axle of the wheelbarrow, and the back end is locked to the cross brace with a latch. Releasing the latch permits the hopper to tilt forward.

![Diagram of the motorized wheelbarrow]

Below are shown the details of the tipping mechanism for the hopper, control rod to tilt the engine and the position of the roller which propels the barrow.

Guide Rollers at Corners of House Reduce Garden-Hose Wear

Set at the corners of a house foundation, stone terrace or brick garden border, these spool-shaped rollers protect the garden hose from undue wear as it is pulled around the sharp masonry edges. They also keep the hose from jumping low garden borders and injuring the plants. The flanged rollers can be turned from 4 x 4-in. stock as in the detail, or made from large-sized spools of the type used for tailor's thread. To set up the rollers on a lawn, drive a ⅜ x 16-in. steel rod into the ground for each spool and hold the spools with cotter pins and washers. Where the rollers must be located on walks or driveways, use ¾ x 10-in. bolts, locked with mortar or lead in holes drilled in the concrete. Spikes may be used for shafts in asphalt.

Tom Riley, Portland, Ore.

Indelible-ink stains from a ball-point pen can be removed by sponging the spot with cotton soaked with rubbing alcohol.
IS THE OUTSIDE PAINT on your home cracked, blistering or flaking off? Unless you have put off a needed repaint job too long, such a paint failure may be due to premature old age. There are many causes for paint failure other than inferior paint and it will pay you to know about them in order to avoid such failures in the future. Then your next house-painting job can have a normal life cycle. Or perhaps you will find that immediate attention now will avoid a major job of removing all the old paint later.

Modern exterior paints. A good-quality paint made by a reputable manufacturer should last four or five years on the average home. This is twice the useful life of paints made 30 years ago. Modern paints are much more opaque and thus provide more covering ability than older-type
paints. White paints usually are self-cleaning, that is, the surface chalks off gradually in minute particles and washes away in the rain, carrying dust and dirt with it. Some white paints (titanium-zinc base) are fume resistant and are designed for industrial areas where fumes and gases cause early discoloration of ordinary paints.

Most white and tinted outside house paints contain quantities of white lead, zinc oxide and titanium pigments. Colored house paints have other pigments and generally outlast white and tinted types.

A good two-coat paint job of today—which is equal to three coats of the older type paints—should consist of a primer and a finish paint. It is best to use a primer and finish paint manufactured by the same company and recommended for use together. Paints and primers made by different companies may have a chemical reaction which will ruin the paint job. Also, unless it is recommended by the manufacturer, do not thin a finish paint with linseed oil to provide a primer.

**When repainting is necessary.** Repainting is necessary at the first sign of deterioration of the old coat. Cracks, blisters, peeling, thin spots in the paint or mildewed areas all indicate that the surface should be repainted. As soon as the paint film cracks, water can get under it and loosen paint adjacent to the cracks.

If a coat of paint was properly applied, you will notice the first signs of failure on the south side of the house because of its greater exposure to sunlight. Horizontal or sloping surfaces such as window sills, steps and porch floors will deteriorate more rapidly than on vertical surfaces such as walls. On the areas exposed to the south and those which are horizontal, apply an extra coat or two of paint. The added protection will aid in giving the over-all paint job a longer useful life.

Even the best paints are often blamed for failures which actually are caused by
excessive moisture in the material painted, by mechanical defects of construction, by improper preparation of the surface and incorrect application of the paint.

**Troubles from moisture.** The most common cause of paint blistering and flaking is the presence of excessive moisture under it. This condition often is found on wood, Fig. 1, on brickwork, Fig. 2, and on concrete and stucco. Therefore, it is important first to make sure that the surface to be painted is absolutely dry and, second, that moisture cannot get into the painted material.

Excessive moisture in the air inside the house, especially in winter, is the greatest source of moisture trouble in outside paint. Water vapor readily passes through plaster and insulation not provided with a vapor barrier. Older houses, which have blown-in insulation do not have a vapor barrier. The moisture from inside the house saturates the outside sheathing and siding, as indicated in Fig. 3, and the outside paint may loosen a few months after application.

The obvious cure for the problem is to reduce excessive humidity in the house. Exhaust fans in the kitchen and laundry will help. Moisture which rises from the earth in crawl spaces under the house can be controlled by covering the earth with a layer of coarse gravel over which is laid a blanket of 55-lb. asphalt-saturated felt, as in Fig. 4. Overlapping 4-in. joints are sealed with roofing cement. Openings in outside walls should also be sealed with felt. Dampness in basements and attics should be eliminated by suitable measures, such as ventilation or the installation of a dehumidifier.

The second step in controlling moisture in the house is to provide a vapor barrier on the walls themselves. This can be done by applying 2 or 3 coats of latex-base, or other moistureproof paints, on the walls and ceilings. Wallpaper can be applied over the paint, if you wish to use it in decorating. All cracks and openings at door and window frames, and even electrical outlets must be sealed to prevent the escape of moisture into the walls.

Outside the house, sources of excessive water are caused by leaking roofs, eaves troughs and downspouts. Also, wood that is in contact with the earth can draw moisture into the wall by capillary action. Any of these sources of water can be eliminated by proper maintenance and repair.

To dry wood siding that is to be painted, drive small wedges between the boards to temporarily permit air circulation. Dark mildew spots on paint indicate a high moisture content in the wood. A zinc-oxide base paint will retard mildew formation.

**Failures from poor workmanship.** Wrinkling of paint, especially on horizontal
Gutters and downspouts should be cleaned and repaired. Paint with roofing cement to preserve, patch surfaces, Fig. 5, often results from applying it too thickly and not brushing it out uniformly. Painting at a temperature of less than 50 deg. F., will cause this trouble because at this temperature the paint will not spread properly. Wrinkling also can result from painting just before a sudden drop in temperature. Consult a weather forecast before doing any extensive painting.

Thin spots in a paint job result from attempting to stretch the coverage by adding more linseed oil than necessary, or by brushing the paint out too thinly. To make thick paint flow more satisfactorily, add turpentine, not linseed oil.

Crawling and peeling of paint often shows if it is applied to a surface that is covered with a film of oil, grease or wax. This type surface should first be cleaned with benzine before it is painted. If a paint job has a soapy finish and seems to wash away readily in the rain, it may have been applied during cold, damp weather. Also, paint which contains a water-soluble pigment, or is made water soluble by a chemical action due to weathering, will wash off easily.

Blistering of paint may result from applying it on a surface exposed to the hot sun. The heat causes rapid evaporation of the vehicle or solvent, which bubbles up through the paint and prevents proper adhesion to the surface. Paint only in the shade on hot days. A further disadvantage of painting a hot surface is that the paint dries too rapidly to permit uniform spreading. Loose, blistering paint also may result from painting over loose spots of a previous job.

Yellowing of white paint, alligating and peeling in spots over knots and sappy wood, as shown in Fig. 6, may be caused by not sealing these spots with aluminum paint. Aluminum paint also prevents "bleeding" through the new paint by creosote or bituminous compounds in the old coat. Paint applied at intervals of less than three years—for the sake of appearance rather than protection—will produce a thick coat that may crack, as shown in Fig. 7. Checking of paint often is caused by allowing insufficient drying time between coats. At least two days should be allowed for a coat of outside paint to dry.

Paint failure caused by lack of uniform coverage frequently can be caused by incomplete mixing of the pigment in the vehicle. A good method of mixing paint is to pour off the surface oil into a clean, empty container and to stir the remaining paint until none of it sticks to the sides or bottom of the can. Gradually pour the oil back into the paint, stirring as it is done. When completely mixed, "box" the paint by pouring it from one container to another several times.

**Incompatibility of paints.** When repainting, use the same kind and brand of paint as the first coat, if it has given good service. Changing brands often results in paint failure, because the new paint is definitely affected by the old paint. In some cases, cracking and alligating, as shown in Fig. 8, may start within a few months, if the old and new paints are not compatible. Although this trouble is more frequently noticed when a white paint is applied over a dark color, it happens just as often when white is applied over an incompatible white paint. To make sure of avoiding trouble, use a primer and finish coat designed for use together.

**Preparation for repainting.** If a new coat of paint is applied to the outside of the
A regular calking gun makes the task of preparing the exterior for repainting easier and quicker.

Old, cracked putty should be removed from windows and new putty applied before the repainting begins.

house before the old coat has badly deteriorated, the job is fairly simple. Small areas of loosened paint should be scraped and wire-brushed and cracked boards and joints between boards should be calked with a suitable calking compound. Cement and brickwork also require calking at joints and seams. When the paint on the house is in an advanced state of decomposition, it is often necessary to remove all the old paint down to the bare finish. This can be done with chemical removers, by scraping and with a blowtorch. Electrically heated paint scrapers also are available. Mildewed areas and those streaked with dirt should be cleaned with a suitable paint-cleaning solution, rinsed with clear water, then allowed to dry completely before the new paint is applied. Areas of paint in good condition should be left, but slick or glossy spots should be rubbed with steel wool or sandpaper to provide a rough surface to which paint will firmly bond.

Nail down all loosened boards and drive in any projecting nails. Substitute slightly larger nails if the holes are enlarged. If rusty nails stain the siding, drive them below the surface with a nail set, and spot paint them. A day or so later when the paint has dried, fill in the holes with putty or calking compound.

Calking cracks. Calk all wood joints along door and window frames and wherever wood meets masonry. Be sure to get the calking compound deeply into the cracks instead of merely laying it on the surface. A regular calking gun does a quick, neat job and forces the compound into the cracks.

Where old calking compound has pulled away from the sides of a crack or joint, it may be necessary to break off and clean out the old calking. Cracks at mitered corners can be covered with siding corners. These are made of metal and can be painted to match the house. Fine splits and joints in a flat surface should be filled with putty applied with a putty knife; the calking gun would apply too much. Scrape off excess putty and allow it to dry a day or two before painting.

Clean all old cracked putty from window sash. Prime the bare wood and allow it to dry before applying new putty. The sash putty also should be allowed to dry a day or two before it is painted. The sash can be painted separately from the house wall, so the putty should not delay the job.

Painting time. The best time of year for painting is during the fall months when the temperature and weather are fairly constant. Begin painting at the highest point of the house and paint down in a 3-ft. band across one side of the house. Then, moving down for another 3 ft. strip, arrange your job so you stop at a window, doorframe or dormer, so that no definite vertical break will be noticeable. Paint the corners and trim boards first, if they are the same color as the house.

Summing up. Paint the house before the old paint has deteriorated badly. A good undercoat requires little or no primer, and one coat of good paint will cover and protect the surface. When the paint is allowed to become scabby, cracked or peeling, several days may be required to remove the old paint. Two or more coats of paint will be required to cover and protect the surface thoroughly, and all joints and cracks will need an excessive amount of calking.

Prepare the surface carefully, make sure it is perfectly dry and use only a good quality paint.
Raw Potato Provides "Heat Dam" When Annealing Metal Strip

When it is necessary to anneal only the end of a length of extremely hard metal, such as a clock spring or hacksaw blade, push the metal through a raw potato. Allow only the portion to be heated to extend. The potato will absorb most of the heat that travels beyond the heated area, thus preserving the temper in the metal that is not to be worked.

Broken Stud Quickly Removed With Discarded Tap

A discarded tap can be used to remove a stud or bolt that has broken off in a tapped hole. First, grind away most of the teeth on the tap. Next, drill a hole in the broken stud, of a diameter slightly smaller than the tap. Use light hammer blows to drive the tap into the hole, then apply a tap wrench to turn both tap and stud. Penetrating oil will aid in removing the stud, and if it is especially stubborn, sharp hammer blows around the area will help break it loose.

Friction-Tape Life Prolonged By Rubber-Cement Coating

When a roll of friction tape is allowed to lie around unused, the adhesive tends to dry out and lose its stickiness. One method of preserving the life of the tape is to coat both sides of the roll with rubber cement, which will seal the roll and keep it from drying out. A roll of tape may be kept indefinitely with such treatment because the seal remains when the tape is removed.

Sand Spike Made of Steel Rod Acts as Equipment Rack

Some bending and a little welding of \( \frac{3}{8} \) in. steel rod will provide the fisherman with a handy sand spike with which to keep his gear out of the mud and sand. The upright is a 4-ft. length of rod to which are welded cross bars, bent as shown, to act as hangers. An L-shaped footrest is welded to the upright near the bottom to facilitate driving the spike into the sand, and an eye is shaped in the top end to aid in removing it.—Ivan Grosvenor, Indian Rocks, Fla.

Syringe Keeps Lenses Mildew-Free

One cause of mildew between the elements of a camera lens is the habit of blowing across or into a lens when cleaning it. Moisture is thus carried into the lens and then sealed in when the units are reassembled. To avoid this, always clean lenses on clear, dry days, using a bulb-type syringe or other source of dry air for dusting.
A GOOD PART of the fun of editing color vacation movies is devising and filming novel, eye-catching titles. If there is a lot of film to edit, the job of titling the sequences can be simplified by obtaining colored souvenir decals at all the interesting places you visit on the trip. The decals provide titles, notes, lettering and color ready-made.

Filming colored decals as titles gives you a choice of procedures. Several steps to produce interesting and novel effects are pictured. Others are easily devised without the necessity of making elaborate sets for filming. Perhaps the simplest set is made by trimming the decal to the borders and

Decal is trimmed to border and placed over a suitable colored background. A color print serves well

Filmed in color the decal title with its sharp detail provides a novel introduction to the sequences

Superimposed decal and background print are placed between two pieces of clear glass before filming

A variation of backgrounds can be achieved by applying decal to a background of black masking paper
then superimposing it over a suitable color print as in the upper photos on the opposite page. The superimposed decal and print are placed between two pieces of clear glass for filming. The result is shown in the lower left-hand photo. Special care must be taken in the lighting to prevent sharp reflections from the glass. Another unusual effect is obtained by superimposing the decal on black paper and mounting between two pieces of glass for filming.

Backlighting selected decals also produces striking color effects. A typical set is shown in the upper left-hand photo below. The proper degree of backlighting must be determined by experiment. The size bulb to use and its distance from the decal depends on the detail and color in the decal itself. A light meter must be used to determine the correct exposure and, when lighted, the set should be carefully checked for light reflections before filming.

Another title-filming trick in which natural backlighting is utilized is pictured in the lower left-hand photo. A flat-sided glass fish bowl is placed before a window, preferably an upstairs window so that you can photograph against a field of blue sky. Direct sunlight should not strike the bowl. The appropriate decal is applied to the flat side of the bowl. Fill the bowl nearly full of clear water and check with a light meter for the correct exposure. Then, an instant before filming, drop two or three Seltzer tablets into the water and make the exposure at the moment of greatest effervescence. This is best done by fastening the tablets or wafers, side by side in a short piece of rubber tubing that has been split to form a holder, as in the photo. In this way the wafers are carried quickly to the bottom of the bowl. A variation of this method is to film a live fish, either goldfish or small gamefish, in a large bowl with an appropriate decal. By exercising a little patience in waiting for the fish to strike the proper pose, a most interesting title can be produced. Still another variation, which often serves to dramatize a situation, is to photograph a suitable decal against a windowpane background while raindrops are striking the outside surface of the glass. In
Decal often can be supplemented effectively with appropriate cutouts. After selection is made, both cutout and decal are mounted on hardboard or softwood and jigsawed to outline. Cut slowly to avoid tearing.

Props for the title cutout are a box filled with dry sand and a small piece of fir plywood for the background. These are set up as pictured with the cutout placed at the top of the sand which has been heaped.

Here's what you get as a result of filming the set pictured in the upper right-hand photo. Note especially how the lights were arranged to cast shadows on the background. Plywood grain gives feeling of clouds.

One way of introducing motion in the title itself is to suspend decal cutout lens field by means of two small chains. Blowing lightly on edge of cut-out causes it to swing slowly while being filmed.

Both the above variations special care must be taken in the details of the set and also in timing the exposure.

In many instances the decals can be supplemented very effectively with cutouts, comic cutouts being especially suited to this method of title making. The lower left-hand photo above shows a typical example and the two upper photos picture the method of making the set. First, a colored clipping and decal are selected and trimmed to outline. Then both are applied to 1/8-in. hardboard or softwood of equal thickness and the outline is sawed out on a jigsaw as in the upper left-hand photo. The set is built up for filming as in the right-hand photo by filling a shallow box with sand, heaping the sand as shown and placing the completed cutout at the center. Select any background that is in keeping with the color and nature of the cutout. In this case, a small piece of fir plywood served the purpose adequately as the bold graining and natural color of the wood contributed to the feeling of a desert scene at sunset.

A novel treatment which causes the title to come on the screen in motion is easily carried out. The lower right-hand photo shows one variation. The decal is applied to 1/8-in. hardboard and cut to outline. Then it is supported on chains, either in the viewing frame or by some other means, so that it will swing easily in a plane at right angles to the axis of the camera lens. Just before filming, the operator blows lightly against the edge of the cutout to start it swinging. Another variation of this is to suspend the cutout by a single thread. In this case, two identical decals are used, one being applied to each side of the hardboard. Just before filming, the thread is twisted slightly and released, imparting a slow, circular motion to the cutout and presenting both decals alternately to the camera.
Pot Holder Used as "Cushion" For Baby's Safety Pins

Hung on a cup hook screwed to the end of baby's crib, an ordinary pot holder will provide a handy "pincushion" for the safety pins necessary for his wardrobe. The holder has ample space for a number of pins, and can be dropped into the diaper bag when taking the baby out for a drive or visit with friends.

Victor H. Lamoy, Upper Jay, N. Y.

Jig Holds Mitered Corners When Gluing and Nailing

Nailing and gluing the mitered corners of picture molding to form a true right angle can be done with a homemade jig and a pair of C-clamps. The jig is two lengths of 2-in. stock which have been carefully mitered and screwed to a base plate to form a 90-deg. angle. In use, the mitered corner of the frame is glued, clamped on the jig, then nailed and left until the glue has set.

C. H. Drew, Sparta, N. Y.

Large Plants on Movable Platforms Shifted Easily During Cleaning

Large plants will be easy to move about when cleaning a room if kept on small platforms mounted on casters. Make the platform from thick plywood, cutting the pieces slightly larger in diameter than the base of the flowerpot. If you have only thin plywood on hand, several thicknesses may be glued together to make the platform sufficiently sturdy. Next, drill the underside of the circular-shaped platform to receive three casters. However, if square or rectangular platforms are desired, four casters will be required. Finish the platforms in a color that either matches or complements the surroundings.

R. F. Donavan, Guttenberg, N. J.

Strawberry Runners Placed in Cans to Aid Transplanting

Instead of starting strawberry plants in flowerpots where frequent watering is required, I sink tin cans from which the ends have been removed, into the ground and then let runners from mature plants develop new plants inside them. A rotary opener is used to remove the ends cleanly, after which cans may be either pushed into wet ground or driven into dry ground with a wooden or rubber mallet. If driving is necessary, it's a good idea to place a small piece of board over the top of a can to prevent crushing the rim. Large "staples" formed from paper clips are used to anchor the runners in the cans. When the new plants are well established, clip the runners, "dig" the cans and transplant the new growth. It may be necessary to wet the soil before removal.

J. Jerome Frisch, Cincinnati, Ohio.
the top tread is likely to be used, then the holes can be drilled through the extension tray. If the holes are sized carefully to take the tools snugly, the ladder can be tipped to a carrying angle without having them fall out. Twin-handled tools, such as pliers, will be less likely to fall out if two small holes are drilled for them.

**Tape Holds Screw on Driver In Restricted Location**

A strip of friction or adhesive tape will hold a screw on the driver blade when the screw cannot be started with the fingers because of an awkward location. Cut a slot in the tape and push the screw through from the adhesive side. Then place the screwhead against the driver and pass the tape up along each side of the blade as in the photograph. After the screw is driven, pull back on the screwdriver, which will tear the tape away from the screw.

**Holes in Top Tread of Ladder Prevent Dropping Tools**

You can easily prevent screwdrivers and other tools from rolling off the top tread of a stepladder, where they are momentarily placed while working, by boring holes large enough to receive the blades or handles of the tools. In addition to its convenience, this method of holding tools provides a safety precaution, especially where children are likely to be near the ladder. If
VERSATILE WELDING TABLE
By L. H. Houck

WELDING WITH MODERN equipment is fast, efficient and downright easy but the problem of holding parts of an assembly in place often makes welders wish for a "third hand." A sturdy all-metal table usually is the answer but its adaptability to the purpose depends largely on how it is designed and built. A suitable table must support the work firmly and the top should provide a means of attaching clamps and other holding fixtures. With these requirements in mind an experienced welder designed and built this special table for use in a job shop. As pictured in use in Fig. 1, the table is 24 in. square and 31 in. high, not including the leveling pads on the four legs, Fig. 7. It can be made any length, width or height to suit individual preferences or special requirements. Steel channels, 2 in. wide with 1/8 x 1-in. webs are uniformly spaced 3/8 in. apart to form the slotted top. The legs are 1/4 x 2 x 2-in. steel angles with the lower ends boxed by welding on a 12-in. length of the 2-in. angle to form a square section below the stretcher frame. The boxed sections of the legs are shown in Fig. 7.

To avoid distortion in the welded assembly, it perhaps is best to fabricate the legs and stretcher frame first. The latter is made from a single length of 2-in. steel angle by cutting 90-deg. notches in one web, the center-to-center distances between the notches equal to the length of the frame plus the thickness of the material. Bend the angle at the notches to form a four-sided frame. Miter the free ends and then weld all the meeting faces. Be sure that the frame is square and flat before welding. Now, duplicate this frame, using the same procedures. The second frame forms the base, or foundation, for the channels and is welded in at the top ends of the legs. Before welding in the frames, weld the 2-in. angles to the lower ends of the legs to form the boxed sections. Then place

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the center frame with its corners on the top ends of the boxed sections and weld in place, making sure that the assembly is square. When adequate clamping equipment is not at hand, it's a good idea to tack-weld the four legs to the center frame, then weld in the top frame and finish-weld the center frame to the legs. If the work is permitted to cool between operations there will be less chance of distortion developing as the welds are made. Note that the top frame must be welded into the assembly with the inside angle up.

The steel channels which form the slotted top are assembled in the top frame with the flat sides (webs) up and the ends flush with the top edges of the frame angles as in Fig. 10. In order to raise them uniformly to this height a 1 x 1-in. angle is tack-welded at each end of the top frame in the inverted position, so that it forms an inverted vee. The flanges of the channels rest on the vee to which they are welded after being spaced. As the final step in the top construction the ends of the channel webs are welded to the 2-in. steel angles that form the top frame. The welds are then filed or ground flush. This assembly forms the slotted all-metal top pictured in Figs. 1, 2, 7 and 10.

Adjustable leveling pads are attached to the four table legs. First, 2 x 2-in. squares are cut from 1/4-in. flat steel and center-drilled 1/2 in. Then assemble one of the four squares over one of the table slots and bolt them in place with 1/2-in. bolts as in Fig. 5. Weld the nuts to the squares and unscrew the bolts. This operation centers the nuts over the holes. Now weld the squares to the lower ends of the legs with the nuts inside the boxed sections. The pads are cut 2 1/4 in. square from 1/2 or 5/8-in. flat steel and center-drilled 1/2 in. Then cut the heads from 1/2-in. bolts and run the threads down to within about 1/2 in. of the ends. Insert the unthreaded ends of the bolts in
the holes in the pads and weld in place. If a lathe is at hand, chuck the pads individually and turn a recess in the bottom face of each 1½ in. in dia. and about ½ in. deep. Screw each pad to the legs by inserting the bolts in the holes in the squares which are already welded to the legs. Turn until the threads engage the nuts. Level the table on the floor by raising it slightly and turning the pads in or out as required. It should be remembered that the table also can be made adjustable up or down for a height variation of 6 in. or more by using longer ½-in. bolts threaded throughout the length and welded to the leveling pads in the manner described.

The slotted table top provides for attaching nearly all common types of clamps and also fixtures made for special work. You can make a straightedge by using a 24-in. length of 2-in. channel. Drill ½-in. holes near each end of the straightedge, aligning the holes with the outer table slots that the unit can be bolted in position either square or at an angle with the table top as in Fig. 1. Slotted clamps, Fig. 11, are probably the most useful of the simple clamps for holding work flat on the table in a squared position. In some cases, a machinist’s vise attached to the table top as in Fig. 10 comes in handy for holding small work or a part of some holding fixture.

One of the most useful of the straddle clamps is pictured in use in Fig. 6. It consists of two adjustable leveling fixtures made as in the left-hand detail in Fig. 9. The uprights are mounted on bases, each fitted with four leveling screws. The lower end of the upright is shouldered, threaded and provided with a nut and washer by means of which the unit can be attached to the welding-table top in any position. Full-threaded clamp screws with T-handles welded to the ends are turned through sliding sleeves which may be clamped at any point on the uprights. In addition the
Above, even a machinist's vise comes in handy for certain types of work. Below, close-up view of the ring clamp being used in welding a small T-handle.

Slotted clamps should be at hand in several sizes. They can be placed at any point on the slotted table. Note how rod is welded to nut to form handle.

The basic unit may be fitted with a single horizontal arm and a circle clamping fixture as in the center and right-hand details, Fig. 9. Figs. 2, 3, 4, 8 and 12 picture the varied uses of this auxiliary unit. The clamping fixture, Fig. 9, is made by welding two short pieces of 3/4-in. pipe at right angles and then welding on a small square of steel to form a boss which is drilled and tapped for the T-handled clamp screw. The latter is made as in Fig. 12 by welding a short length of 5/8-in. rod to the head of a bolt.

Figs. 3, 4 and 8 picture examples of the use of a single upright unit when combined with one or two horizontal arms to support the work in the desired position. The horizontal arms can be adjusted to support work at any angle, Fig. 2. Note in Fig. 9 that the inside diameter of the circle fixture, or ring clamp, is given as 2 in. This can be increased to 3 or 4 in. if desired. All clamping and holding units pictured and detailed can be made any reasonable size to suit the work to be done.

Hopper-Type Feeder for Hogs Made From Watering Tank

A stock-watering tank can easily be modified to provide a timesaving, hopper-type feeder for hogs. The straight sections of the sides, up to the curved ends, are cut away and bent inward toward the center to form the sloping sides of the hopper. The sides are supported at the ends by wooden brackets, cut to the desired angle, and nailed to the bottom and curved ends of the tank. Narrow feed-retaining strips are nailed to the bottom at each outer edge, and a V-shaped piece, the length of the tank, is placed in the bottom of the hopper to divert the feed to each side. If the feeder is placed in the open, it should be covered to protect the feed from rain.

Compact Writing Desk Built In Unused Corner

This attractive and compact little desk will dress up an unused corner in the home, and with its pigeonholes and shallow drawer for stationery and household ledger, serves as a convenient home office. The original desk was built-in and the existing walls paneled in plywood to form the back and sides of the kneehole. However the desk can be built as an individual unit which may be placed in the corner. The desk and paneling should be finished to match the decor of the room in which it is located. Dimensions given can be changed to fit any particular space.

Emergency Coil Spring Wound in Vise-Held Jig

When faced with the need of making a coil spring for an emergency stand-by, one mechanic wound it on a jig consisting of a steel rod, two wooden blocks and a metal disk. A flat was filed on one end of the steel rod to allow a setscrew in the disk to anchor the end of the spring wire. The disk is drilled off-center to permit a greater depth for the setscrew hole. To make the spring, the end of the spring wire is clamped to the flat with the setscrew, and enough turns of wire are made by hand to equal the width of the hardwood blocks. Then the rod is placed between the blocks and the assembly is clamped in a vise. The vise jaws are tightened until there is a definite impression in the faces of the wooden blocks which establishes the pitch of the spring. Thus, the spring wire feeds through the “threads” in the blocks when the rod is turned with a pipe wrench.

Method for Clearing Steamed Windows of Car While Driving

An efficient way to clear up steamed windows in a car in cool or cold weather is to close all the windows and ventilating panes and then open the cowl vent so that outside air can enter the body. It is the dryness of the outside air that does the trick. Actually, little more cold air can enter the car than that which replaces warm air that has escaped through the numerous small body leaks. As a result of the positive air pressure built up by the incoming air, the car is much quieter and drafts from around the doors are prevented. The radio, which usually is mounted beneath the vent, will help deflect the downdraft from the vent away from the feet, while turning the heater to a higher temperature will keep the inside of the car comfortable. It may be necessary at first, to use the defroster at full speed until the windows clear, after which it may be turned to low. However, best results with this arrangement can be obtained only on the open road.

Jack Probst, Royal Oak, Mich.

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Handy Wall Hangers in Garage Are Discarded Auto Valves

Discarded automobile-engine valves, because their heads are large in comparison with the stems, provide excellent wall hangers for miscellaneous gear stored in a garage. Holes slightly smaller than the valve stems are drilled at an angle in the wall studding, after which the valves are driven into them from 1/2 to 1/2 the length of the stem.

Poultry Fountains Kept Clean

Poultry watering fountains, which quickly become scratched full of dirt and litter when placed on the ground, can be kept clean by using a chicken-wire "antiscratch" ground covering. Chicken wire is nailed to a 6 x 6-ft. wooden frame, the assembly is laid on the ground and the watering fountain is located in the center.

Hot-Weather Driving Kink

To prevent my car motor from overheating dangerously when driving long distances during extremely hot weather, I turn on the car hot-water heater at full heat with the fan blowing. The additional cooling area usually will keep the water from boiling.—Lt. Richard S. Downie, USNR, San Francisco, Calif.

Tape Provides Correct Angle When Grinding Small Drills

In the absence of a drill-grinding fixture, a piece of masking tape can be used to control the angle of the cutting end of small drills. Glue a piece of masking tape on the wheel guide and hold a large-size drill with its cutting edge in contact with the wheel. Cut the tape along the edge of the drill and remove the unneeded tape. Small drills now can be sharpened to the correct angle by holding them parallel to the edge of the tape as shown in the illustration.

Horse-Drawn Plow Converted For Use With Tractor

In order to convert a horse-drawn gang plow to a tractor-mounted plow, one farmer cut off the beams with a cutting torch and then welded an A-shaped frame to the beams, making the unit suitable for use with a Ford tractor hydraulic system. Two 3/4-in. bolts are utilized to provide pivot pins to which the tractor drawbars are connected. The method of mounting the pins will depend on the type of plow used.—Edward Monroe, Schuyler Lake, N. Y.

Disk Taped to Bottom of Jug Acts as Shock Absorber

A glass jug of acid or other liquid used frequently around a shop is less likely to be broken if a disk cut from composition board is taped to the bottom. The disk will act as a shock absorber when setting the jug on a hard surface such as a concrete floor. Cut the disk the same diameter as the jug and attach with adhesive tape.
LATHE BENCH BUILT IN THREE STAGES

By Stanley L. Karal

It takes many hours to build a sturdy cabinet bench for a metal-working lathe, but the machine can be mounted ready for use in much less time if you build the bench in three stages as pictured at the right. After building the bench frame and mounting the lathe, the drawers and compartments can be built in whenever time permits.

A bench for a metal-working lathe must be rigid and the top must be level and sufficiently strong to support the motor drive and lathe without springing. Next in importance in the general design is the height of the bench itself, as this governs the height of the lathe spindle from the floor. Some operators of bench lathes prefer that the spindle be a little above waist height. Perhaps the best way to determine this to your own satisfaction is to place the lathe on a table and raise it, if necessary, by means of small blocks until you have the spindle at a convenient height. From this test you can decide what spindle height is most adaptable to your purpose. Note in the detail on the following page that the height of the bench is given as 31½-in. over-all. This height, plus that of the lathe itself, gave a working height from the floor that suited the owner of the lathe pictured. Check this construction detail carefully before you cut stock for the bench.

Stock 2 x 4s and 4 x 4s are used in framing the bench, the 4 x 4s being used for legs and the 2 x 4s for the top and bottom rails. The ends of the rails are mortised into the legs to their full thickness. Note that mortise dimensions are not given in the detail due to slight variations in the stock. Take measurements direct from stock at hand. Then you will be sure of a tight fit of the rails in each individual mortise. It should be noted also that other dimensions of the bench may have to be changed to accommodate the lathe at hand.

The top is made by joining two pieces of ¾-in. plywood with screws and glue. Note that the top piece is 1¾ in. wider. When joined, the offset at the back should be ¾ in. and at the front ¾ in. The offsets form rabbets into which the back panel and the front facing board fit when these parts are applied in finishing the cabinet. Perhaps the best way of making the mortises is to saw down to depth on the gauge lines, then make a series of adjacent saw cuts inside the gauge lines and remove the waste with a chisel. Then cut the long rails to length and join to the legs with glue and ½-in.
carrier bolts. Now just a reminder before joining the top rails: If you have a circular saw run ¾-in. grooves across the inside faces of the top rails to take the drawer slides. If this is done, the 1¾-in. notches in the drawer slides will have to be altered to fit. Cut the four short rails to length and join to the legs with glue and bolts. Before the glue sets, level the assembled frame and check for squareness at all four corners. After the glue is dry, install the center cross members between the top and bottom rails. Note that the bottom cross member is installed with the flat face up while the top member is installed edge up. The top can be attached to the frame by driving long screws down from the top face into the rails, or by means of metal angle brackets attached with screws from the underside. With the bench at this stage the lathe can be mounted. Although not essential, most operators prefer to bolt it to the top.

When building in the cabinet, first install the plywood back, bottom and end panels, fastening them in place with screws and glue. Next, install the strips at the ends of the frame to serve as drawer runners, nailing a wider piece to the back face of each strip to form a guide. Note that these strips are cut so that the long drawer rail can be nailed to the ends. Then install the center drawer slides and nail to each the strips that form the drawer runners. Make sure that all these parts are at exactly the same height in relation to the bench frame. Install ¾-in. facing boards on the three rails and the front faces of the legs. As detailed, the outer ends of the drawer sides, the back and the plywood bottom are housed in grooves.

If no power tools are available for cutting grooves, the parts may be butt-joined. Before making the drawers be sure to check the size of the drawer openings and allow 1/8-in. clearance. Although not detailed, the drawers can be partitioned either the short or long way if desired. Doors to the lower compartment can be of the paneled type as shown in the photo on the preceding page or made from a single plywood panel, the latter door being the simplest to make. Allow sufficient clearance so that the doors do not bind on closing. Attach metal pulls to both drawers and doors. If the bench is to be painted, you will get a better finish if you first apply a coat of sealer to all exposed parts.
Wooden Plugs in Masonry Walls Held Tightly With Wedges

Wooden plugs used in masonry walls will not loosen readily if they are expanded with wedges driven into the inner end. Drill the holes in the masonry about 2 in. deep and just large enough to provide a snug fit for the plug. Saw a slot in one end of the plug, making it about twice as deep as the length of the wedge to prevent splitting the plug when the wedge is driven in. When installing the plugs, place the tip of the wedge in the slot and gently force in the plug. When the wedge strikes the bottom of the hole, drive the plug in with a hammer, which causes the wedge to spread the plug tightly in the hole.

Grip on Jointer Push Stick Is Electric-Iron Handle

For use when running material over a jointer, this push stick employs the plastic handle from a discarded electric iron as a grip. The stick is a 3/4-in. piece of hardwood 3 in. wide and 15 to 16 in. long. A 1/4-in. recess is cut into the bottom of the front portion. Depending on the shape of the iron handle, it may be necessary to use a beveled block on top of the push stick to mount the handle. Longer flat-headed screws of the same size as used to hold the handle on the iron are used to hold it to the stick. The screw heads are countersunk to prevent damaging the jointer blades during use.

Ralph S. Wilkes, Keuka Park, N. Y.

Water Content of Gasoline Barrel Easily Checked

To test gasoline stored in a barrel for the presence of water at the bottom, wrap a length of cotton string around a dowel or stick and insert in the barrel through the bung. Make sure the stick touches the bottom of the barrel at its lowest point. When the stick is withdrawn, the gasoline will evaporate quickly from it, but that portion of the stick wrapped in string, which has absorbed water, will remain wet.

Hand Truck Capacity Increased By Removable Extensions

The capacity of a hand truck, which is limited when the truck is used to carry light but bulky packages, can be greatly increased by attaching two lengths of pipe to the truck frame by means of floor flanges. The flanges are bolted to the frame as close to the lower end as possible. Lengths of pipe then can be screwed into the flanges to permit carrying large-size packages. The pipes are quickly unscrewed when the truck is to be used for other purposes.

(If) Fluorescent paper, glued to the tips of clock hands and the hour marks, will enable you to read the time in the dark.
SHOPPING FOR TOOLS

1. WIRE SPLICER automatically strips insulation and crimps wire ends in a specially designed cartridge connector which provides an insulated connection that is completely waterproof. Eliminates twisting the wire ends by hand and wrapping with insulating and friction tape. Does the complete job in seconds. Developed under the direction of the U.S. Signal Corps for maintaining communication lines near the battlefront.

2. BOLT-AND-NUT GAUGE provides a quick, accurate means of checking all common bolt types for length, diameter and thread size. Handy in hardware stores, factories, assembly rooms and even in the home shop. Scales are raised and are easily read against a black background. Can be carried conveniently in pocket where it is ready for quick reference.

3. TAP WRENCH is designed to fit a ½-in. capacity geared drill chuck and in this manner utilizing the accuracy of the drill press for hand tapping. Equal in accuracy to machine tapping. Reduces tap breakage to minimum. Can also be used for hand reaming with straight reamers up to ½ in. in dia. For best results, use a cutting oil on both soft and hard metals.
4. SPECIAL CLIPS are designed to hold cans of a uniform size, such as coffee and soup cans, on the four sides of a post or column to provide orderly, convenient storage for small items. Each can is easily removed from its individual clip without disturbing the others. Clip is held securely when replaced. Clips are of metal, cadmium-plated to prevent rust. Each clip attached with screw.

5. TOOLING CLAMP for use either with jigs and fixtures or as a holder on drill presses and milling machines is equipped with a fast-action screw that holds securely at any point along its entire length.

6. DOVETAIL SAW, or "razor" saw, comes in two blade widths of ⅝ and 1 in. and is adapted to extremely fine work on wood, soft metals and plastics. Blades are replaceable and set includes a detachable handle. Blade shank is offset, a feature which permits work in corners or close to vertical member of an assembly.

7. PLASTIC SCREWDRIVER HANDLE is made twist and impact-proof by press-fitting the driver shank into a hexagonal cavity by means of a plastic liner, or sleeve, which also is hex shaped.

8. SHEET-METAL BRAKE fits onto an ordinary machinist's vise having jaws 4½ in. or less in width. Bends 16-ga. steel up to 3 in. wide and 3/16-in. flat steel up to ½ in. wide. Material to be bent is clamped between frame of brake and movable jaw of vise as pictured. Makes radius bends over round piece of stock.
9. ROUTER-MORTISER for cabinet shops, pattern shops and door manufacturers handles boring and routing jobs with a high-speed efficiency equaling that of much heavier machines. Motor mounts are interchangeable for standard 1750 r.p.m. motor or high-speed router operating at 22,000 r.p.m. Maximum table travel is 12 in. Available in floor and bench types.

10. ROTARY PLANE is powered by a ½-in. portable electric drill. Cuts 2 in. wide and can be tilted for cutting bevels up to 45 deg. Makes a smooth cut on hard and soft woods, plastics and aluminum. Depth of cut can be adjusted to suit different materials. Drill drives through chuck to bevel gears operating in a grease-packed housing. Weight is about 3½ lb.

11. SABER-SAW ACCESSORY is now available for use on radial saw. Drive is direct from radial-saw motor. No belts or separate parts are required. Can be tilted left or right up to 45 deg. for sawing bevels on intricate scroll work. Makes inside and outside curved cuts on stock up to 2 in. thick with a maximum clearance between saber blade and radial-saw frame.

12. MAGNETIC PARTS RETRIEVER is fountain-pen size and comes with an extendible tip which can be flexed to reach otherwise inaccessible places. Two models are available, one with a tip ½ in. in dia., the other having a tip ⅛ in. in dia. and capable of lifting much heavier objects, as in photo. Handy for lifting chips from chucks, bed ways and machine-table slots.
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AUGUST 1954
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AUGUST 1954
DECEPTIVE GAS GAUGE

If you run out of fuel while the gas gauge says you have plenty left, there is probably electrical trouble, and here is the way to locate and correct it:

Remove the tank unit from the gasoline tank, under a plate in the luggage compartment, covering the hole while the unit is out. Connect a wire from a 6-volt battery to a Mazda "51" light bulb, then connect the ground side of the bulb to the terminal on the tank unit. Now run a wire from the other battery post to the case of the tank unit. With the float up (full position) the light will burn brightly; light will dim as float is lowered to empty position. This indicates the tank unit is operating.

Remove wires from test equipment and re-connect the tank unit to wire from panel gauge, grounding tank unit to the car. Watch panel unit as you work float up and down. If gauge does not follow movement of float, look for a break or a short in wire from tank unit to gauge. In most units, a short will cause the panel gauge to show "full." If all wires are O.K., replace panel gauge.

If tank unit has two wires, test system by using a new tank unit to test the panel gauge by connecting it to wires 1 and 2 on the tank unit. Then ground to the case and work float as before. If panel gauge does not operate, you need a new one.

Be careful not to bend float arm of the tank unit during testing.

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"MORE POWER, Less Gas, Less Oil" is an illustrated manual on car care which can prove helpful to you in many ways. It gives you the facts on Sealed Power KromeX Ring Sets, with solid chrome face on top compression ring and on side rails of MD-50 Steel Oil Ring, for more than double normal mileage. It also shows you how the MD-50 provides complete oil control, even in badly tapered and out-of-round bores. Read it, and learn why it pays to use Sealed Power KromeX Ring Sets when your car needs new rings. For your free copy, address a postal card to Sealed Power, Dept. G-8, Muskegon, Michigan.

Clinic for Homemakers

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.

Chimney Problem

Q—I have an old home in the country, recently purchased, which is constructed with solid brick walls having chimneys built into the walls. In one the flue comes down only to the second floor. The other comes down to the first floor. My contractor says that chimneys will have to be rebuilt to vent a fireplace and heating plant. Is he right?

S.R., Pa.

A—It may be possible to utilize the longer flue to vent the fireplace, provided the flue is large enough, which is rather doubtful. Usually in old homes of the type you describe, the chimney flues vented wood-burning stoves or heaters of various types and sizes. Rarely are they large enough for even a medium-sized fireplace. However, in your case it may be practical to consider utilizing the longer flue for a fireplace by building up from the basement on a suitable footing and opening the wall. Build the fireplace in a manner is necessary to use the existing flue. In some cases such a procedure has been carried out successfully. However, this suggestion should not be taken as superseding in any way the opinion of your contractor who is already on the ground and in a much better position to judge the possibilities than we are. The other chimney undoubtedly will have to be rebuilt if it is to be used to vent a heating plant located on a first floor or in a basement.

Cracked Plaster

Q—The plaster on two ceilings in my home is quite badly cracked, the problem of repair being further complicated by the fact that the edges of the cracks are often openings as much as 1 in. or more. My problem is should I level the plaster by sanding or some other means, then fill the cracks or should I cover the ceiling with plasterboard?

D.H., Mo.

A—We would be inclined to recommend that you cover the defective ceiling with plasterboard, although this will likely be more expensive. The (Continued on page 210)
HOW TO GIVE YOUR HOME PROJECTS THIS PROFESSIONAL LOOK!

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Concrete Shield

Q—I’ve always wondered how the concrete cornice or guards, at the top ends of drain tile leading from downspouts are installed. Mine are cracked and will require renewal within a short time. Is the concrete precast to fit the tile end or is it, after it is poured, put in with some material to form a seal?—G. R., Ark.

A—The simplest and perhaps the most common method is to lift out the lower section of downspout, then carefully remove the tile and concrete and whatever remains of the wire re- tainer. Great care must be taken that the pieces do not fall into the tile. While you have the tile open flush it out with the hose. Turn the water on full force, insert the hose in the tile and push it down as far as it will go. A hard stream of water will wash away sediment, particles of slate and leaf stems that may collect in one of the turns or elbows and cause eventual clogging. Next cut a disk of fine-mesh screen (hardware cloth), about ¾ in., to fit snugly inside the bell end of the tile. Cut a hole in the center of the disk. Place the disk in the bell end of the tile and force it down to the shoulder. Then reassemble the lower section of the downspout with the end projecting through the hole in the screen. Now mix cement and clean sand in equal proportions and use instead of a neat mixture. Work it into a heavy consistency and trowel it into the space around the downspout, pressing it down firmly and building it up slightly higher around the spout so that it forms a watershed. Trowel the surface smooth.

Soundproofing Ceiling

Q—I would like to soundproof the ceiling over my living room so that objectionable noise does not penetrate from above or below. However, I’m told that this will require removal of the plaster and lath and replacement of the joists so that there is no wood-to-wood bearing except at the ends. This is not expensive?

A—There are acoustical ceiling tiles available which are said to possess soundproofing qualities suitable for the purpose you have in mind. These tiles are quite inexpensive and simple to install. A common method of installation is attachment of the individual tiles to strips of wood fastened to the ceiling over the plaster. In nailing the strips use nails sufficiently long to pass through the plaster and lath and enter the joists a distance of an inch or more. Also, be sure that the strips are flush all the way across the ceiling. Shim up any low parts. Handle the tiles very carefully so that you do not break the edges or corners.
The "Pee Gee" Pocket Comparator is a precision optical instrument for determining extremely small dimensions. It has almost unbelievable accuracy through the use of a powerful magnifying lens (approximately 6 power) and tiny transparent patterns called "reticules" which are actually extreme reductions of large precise "Master" layouts. The "Scales" reticle, which comes in the instrument, is used to measure dimensions from .0025 to .5000 of an inch in steps of .0025, and 0 to 10 MM in steps of .2 MM.

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This instrument is extremely valuable to printers and artists...and to those whose hobby is building scale models, collecting stamps, making costume jewelry, engraving or etching. It can also be used for a wide variety of small-dimension measuring operations in the home workshop, and is widely used in industry for precise inspection operations.

Six extra reticles for measuring:

- **Radii**...from 1/8" to 1/4" in steps of 1/8" (Reticle #102).
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- **Diameters**...circle scales for .005, .010, .020, .030, .040, .050, .100, and 1/4" to 1/4" in steps of 1/4" (Reticle #109).
- **Dimensions**...linear measurements from 0 to 1/2" in steps of 1/4" (Reticle #116).

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AUGUST 1954

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ThomasteaftorlovesHere

(Continuedfrompage103)

The renovators also exploded the old story that Jefferson raised his bed to the ceiling on pulleys. The pulleys are there, it’s true, but prying workmen found that the bed itself has always been bolted to the walls. Jefferson used the pulleys to operate the overhead skylight.

After a good deal of debate, the Foundation decided to install a heating-and-air-conditioning system at Monticello. Members hastily explain that the idea is not to turn the building into a supermodern museum, but to preserve the building itself and the centuries-old furnishings. A dehumidifying system pulls moisture from the air and the relatively constant temperature prevents damage.

When Grigg and the air-conditioning engineers set to work planning the installation they checked Jefferson’s own drawings of Monticello.

“Mr. Jefferson’s drawings are so specific,” says Grigg, “that certain dimensions are figured down to 1⁄1000 inch! Mr. Jefferson, in fact, helped us air condition and heat the building, for he built ventilating flues into Monticello. These built-in flues now serve as ducts for the heating and air-conditioning system.”

Sensitive visitors might be appalled to see modern heat outlets in the old home, so Grigg has cleverly hidden them behind bed canopies, cornices, mirrors and pictures. You can’t see them unless you’re standing on a ladder or looking behind something you shouldn’t be looking behind.

Grigg spared neither himself nor others in restoring the home to the glories of its Jeffersonian days. A good example is the wallpaper in the octagonal bedroom. When Grigg became the Foundation architect there was no paper on any of the walls. However, he noticed a faint pattern in the plaster in this particular room. He became convinced that there had been wallpaper on these walls early in the life of the building, and a very slight chemical reaction had etched the pattern into the plaster.

Since little wallpaper was made in this country in Revolutionary days, Grigg deduced that Jefferson had picked up the paper during his long stay in France. Off went letters with sample tracing of the pattern to museums and old wallpaper manufacturers in France, asking if by chance any old plates of that pattern had been preserved. Each letter brought a negative reply.

Then one day Grigg received a call from

(Continued to page 214)
POWER

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NEW DU PONT CAR WASH cleans faster and easier than you ever thought possible. Just sponge it on . . . rinse it off . . . and your car dries itself. No wiping or chamois work! Du Pont Car Wash gets off all the grease and grime . . . leaves your car spotless.

One tablespoonful washes your car. Half-pound can gives 20 washes!

DU PONT NO. 7: PRODUCTS
From Chemical Research . . . For Easier Car Care

a friend in Williamsburg, Va. During the restoration of one of the homes there, a few strips of wallpaper had been found on the wall of a closet. Grigg drove over, held his traced pattern against the wallpaper and found that it matched perfectly. He's convinced that Jefferson bought the wallpaper in Europe, papered the octagonal room with it and gave the remnants of the rolls to his friends when he was next at court in Williamsburg.

Experts analyzed the paper in the closet, determined the type and the original colors. Then a well-known wallpaper manufacturer made special plates and ran off enough paper to cover the octagonal room. Today the walls look exactly as they did when Jefferson's daughter used the room.

Jefferson had embellished many of the rooms with a plaster frieze on a wide wood moulding. The figures depicted events that transpired during his eight years as President. The plaster had fallen away in some areas. Grigg carefully removed one good section of the frieze and sent it out to expert casters for duplication. Moulds were made from the Jefferson originals, and today Grigg can defy you to tell him which is the new plaster work.

During the restoration a few rotted timbers had to be replaced. Grigg figured that new beams cut on a circular saw would show curved marks that had never been seen in Jefferson's day. He insisted that the new timbers be whipsawed so the marks would be straight.

Some years ago the Garden Club of Virginia undertook to make the gardens exactly as they had been in Jefferson's day. They were aided in their work by voluminous sketches Jefferson had made of his garden plots. He brought many of the flowers and shrubs to this country from Europe. One of his pet projects was the introduction of the cork oak to this continent. He imported tiny oaks, one after another, but each died in the climate atop the mountain. Today there's a cork oak growing just a few feet from the home. Curtis Thacker, superintendent of Monticello and a real authority on its history, carefully covers the oak each winter with a burlap tent. The tree now is about 10 feet high, thanks to Thacker.

"I don't know what I'll do if the thing keeps growing until it's 40 feet tall," Thacker says. "I can’t keep it covered with a tent forever. But there's some slight satisfaction in knowing that we apparently are doing something Mr. Jefferson himself couldn't do."

A high-pressure water supply and a modern fire-fighting system have been in-

(Continued to page 216)
Now! Do Your Own CEMENT Jobs with Ready-to-Use SAKRETE

Do a professional Cement Job yourself with SAKRETE Products

SAKRETE Gravel Mix—for major jobs.
SAKRETE Sand Mix—for patching and pointing.
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70 MILES PER GAL. GAS
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7070 N. Wood Blvd., Los Angeles 28, California

FREE LITERATURE

“HANDY TIPS FOR HANDY MEN”
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NEW WAY TO CUT PERFECT GROOVES WITH CIRCLE SAW!

Just draw any of 40 cuts. Parallel, clean, no sanding! Only $4.95

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Sharpening Lawn Mowers...
SPARE OR FULL TIME

Mr. C. E. Hardy of Missouri says, “I am doing a fine business with the Universal Grinder. One Customer sends another. I spent 40c for a newspaper ad and have done nearly $500 worth of business,” G.E. of Ark. says, “I have had my Universal Grinder 2 months and made a net profit of $227.”

ONLY ON THE UNIVERSAL LAWN MOWER GRINDER

... can the inside face and edge of the stationary blade, as well as the reel blades, be ground to proper clearance ALL IN ONE SET-UP, without removing any blade from either hand or power mower. Send Today for Free Details.
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Speedway teaches BETTER SHOCKS give smoother, safer ride!

Here's what Bill Vukovich, winner of the Indianapolis “500” in both 1953 and 1954, says: “We give a great deal of credit to the Monroe-Matic Shock Absorbers used on our car... the added stability and control they contributed, especially through the curves, gave us complete confidence. These great shocks are standard equipment with us.”

SOFT, WHIPPY SPRINGS of modern cars must be controlled by shock absorbers to prevent dangerous bouncing and to keep wheels on the road for best traction and safety. Worn shocks should be replaced promptly for greater safety and comfort.

IMPROVED TRACTION is obtained through the action of the new Monroe-Matic Shock Absorbers, the only shock absorbers with automatic adjustment. Drivers report in qualifying tests at Indianapolis, “After installing Monroe-Matic Shocks, increased miles per hour 10%.”

MONROE AUTO EQUIPMENT COMPANY MONROE, MICHIGAN

AUGUST 1954
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New color setting! In handsome "Sportsman-Gray" with bright metal trim and smart black and red accents. A full size meter, weighs only 4 oz.

Complete with epochal in "fast-clear" Gift Box... Ever-ready Case...$1.95

New, full size photoelectric exposure meter eliminates tricky computations and guesswork. Has changeable ASA Index Slides that correspond to all popular films—black & white, color, indoor, outdoor. By merely inserting proper slide in meter you read correct camera settings in f-stops from 1/1 to 1/22 and speeds from 1/30 to 1/200. Covers entire color film range in 1/6 stops and has special marks for movie settings.

Complete computer dial on back—for special films and light conditions other than normal. Calculates speeds from 1/1000 to full 16 seconds; f-stops from 1/1 to 1/64; ASA Indexes from 3 to 800.

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THE SCRUG-ALL DRIVER GIVES YOU

TWO IMPORTANT TOOLS

IN ONE!

Save tools! Save money!
The SCRUG-ALL Driver converts your electric hand drill in seconds. Successfully used in our factory for nearly four years. Simply chuck into your hand drill as you do a bit. A simple slip clutch assembly lets you control the speed and torque. The SCRUG-ALL is a quality tool that will last for years. It adapts to hold any size bit.

"SCRUG-ALL" Driver with extra Phillips bit, $5.95 Ppd.
Please — No C.O.D.'s. MONEY BACK GUARANTEE

PENTAGON METAL PRODUCTS Corp.
BOX 225, SPRINGFIELD, NEW JERSEY

installed in the mansion. The hoses and extinguishers are the only innovation which visitors can see, but here a compromise was necessary so the equipment would be instantly available.

Today, as you stroll through the mansion, you'll see the famous "gadgets" of Monticello. Some are Jefferson's inventions, others adaptations.

His old swivel chair—believed to be the first in America stands in his study. He designed a long upholstered bench that fits the contours of the chair exactly, converting it into a chaise longue. Astride the chaise longue is his worktable with a revolving top. If a book or paper lay on the other side of the table, he simply pushed the table around to bring it within reach. He was probably the first man to use storm windows. He also developed large three-sash door-windows. You simply raise the two bottom sashes to the top one, and the floor-length window becomes a door. Awn-

In the entry hall stands the magnificent clock which Jefferson himself designed. He even imported a Swiss clockmaker to build it. The clock and its chimes are operated by 15-pound cannon-ball weights. Today, as in Jefferson's day, the weights are wound to the top of the wall each Sunday morning, and gradually descend during the week. Painted on the walls are the days of the week, and the position of the weights indicates the particular day. Here, though, Jefferson's own calculations went slightly awry, for the days from Sunday through Friday appear from the top to the bottom of the wall but there's no room for Saturday. Jefferson solved this miscalculation very simply by cutting a hole in the floor through which the weights could pass, and placing Saturday in the basement!

Hidden shutters unfold from Monticello's window casings. Outside each of the full-length windows is a wooden grille which Jefferson is said to have installed after President Madison laughed so hard he fell backward off his chair and out the window.

You'll find all these things and many more at Monticello. Thanks to the Foundation you'll see everything exactly as Jefferson saw it. And you'll feel something you can't see—the spirit of a man who worked desperately for his country while he dreamed impatiently of returning to the one spot on earth he called his own. There's some such spot that calls to each of us, and perhaps Thomas Jefferson is history's finest example of man's innate love for his home. Jefferson still lives at Monticello. **
For Tasty Home Cooked Meals

drive a REO

One reason Reo trucks are so popular mechanically is because they satisfy the "inner man". Reo drivers find that Reo dependability*, Reo power that takes steep grades in stride and Reo's easy handling in traffic get them there and back on time or ahead of schedule. Reo drivers' wives don't serve warmed up left-overs ... Pop eats with the family when he drives a Reo!

*Have you heard about Reo's Polar Plan of guaranteed maintenance?

REO MOTORS, INC.
LANSING 20, MICHIGAN

AUGUST 1954
I've Looked Inside a Tornado

(Continued from page 119)

In my trips over the country visiting areas devastated by tornadoes I have found many cases of farm wagons and even automobiles having been apparently carried up by the tornado and dropped in exactly the same spot they had been before. I knew this was impossible. With the help of other students of tornadoes and mathematicians, I have found that a tornado can exert pressure on the earth's surface of over 5000 pounds per square foot. Here we have the answer for the wagons and automobiles being pushed into the ground up to their axles, as most of them were. They had not been lifted and dropped back in the same spot; they had been shoved right down in the ground where they stood. All this was done by the wind flaring outward at the lower end of the tornado. It started back upward instantly to form the sheath, which I believe is the most destructive part of the tornado.

We're now ready to put the entire tornado into perspective. It is caused by warm, moist air rising swiftly into a cold-air medium. The tornado funnel is created when hail drills a great hole through both the upper and lower air layers. Cold, heavy air from aloft pours down this tube, rotating due to natural laws and expanding the upper column into a funnel. Clouds rush in from above to fill the vacuum thus created, which is mistakenly believed to be the tornado itself. The outer, true tornado is invisible until it folds back on itself like a glove peeled from a hand, to carry dust and debris aloft to form the fully developed, inky-black tornado funnel, the sight of which causes terror throughout the broad tornado belt.

After many years of observation and experiment, I believe this is the true explanation of the tornado. But left unexplained are these phenomena:

From what source came the bright, pale-blue light that illuminated everything as the tornado passed over my head? I saw nothing inside the funnel core emitting light. It appeared to come from everywhere, shimmering and glowing like fluorescent illumination.

And what law of air-impact pressure applies when this outer sheath of the tornado turns sharply back on itself and climbs with almost the same rotation speed as the inner-air column? I can find no acceptable law that proves two air columns can slide past each other with a closure speed of 400 miles per hour without affecting each other.

It is done within a tornado.
GET GOOD PERFORMANCE
THE WAY BIG FleETS DO...

Yellow Cab, Oakland, Cal., standardizes on Federal-Mogul oil-control engine bearings.

Yellow Cab Company rolls up more than half a million miles every month, delivering the good people of Oakland, California to their destinations.

Dependable performance is a Yellow Cab must. That's why they always replace with Federal-Mogul oil-control bearings on every engine overhaul.

Federal-Mogul oil-control bearings have led the replacement field for 30 years—because of quality. They will restore fine performance to your car, too. Ask your mechanic! FEDERAL-MOGUL SERVICE, Division Federal-Mogul Corporation, Detroit 13, Michigan.

for New Power . . .

FEDERAL-MOGUL
Oil-Control Bearings
Clymer Road Tests the 1954 Olds

(Continued from page 107)

four-barrel carburetor performed perfectly with no tendency to "load up" even at altitudes ranging from 4700 feet to over 10,000 feet in the Rockies.

I found it to have improved suspension and road-holding characteristics. Even on the sharpest turns there was little evidence of roll and the body remained about as level as any modern American car I have driven.

Riding qualities are well controlled by double-action shock absorbers in front and direct-action shocks in the rear. There was some tendency for the rear end to "bottom" when hard bumps were taken at high speed.

Oldsmobile's hydraulic brakes, with total lining area of 191.7 square inches, are effective with little or no brake fading. Location of the power-brake pedal in relation to the throttle is far better than in most other cars and I found braking action better than on most other power-brake-equipped cars I have tested.

The new body developed no squeaks or rattles during my test. Acceleration is terrific and even the steepest grades in the Rockies were climbed almost as though we were on level ground.

When the Hydra-Matic shift occurs in each range it is quite noticeable and certainly is not so smooth as a torque-converter unit. There are some things I do not like about the control system. When the ignition switch is off, the shift lever may be moved to any position, yet the indicator needle (inside the speedometer dial) does not function. I also don't approve of moving the indicator dial from its former position on the steering column, where it was close to the eyes, down to the bottom of the speedometer dial. But the worst feature of this new shifting-indicator dial is that, when the lever is quickly pulled from "D" to "S" (the two normal operating positions) there is no stop and, unless the driver is careful, he is very apt to pull the lever beyond the "S" position into "Lo." For normal gear selection in traffic, however, the unit operates very well.

An extremely high rear-axle ratio of 3.23:1 makes cruising on the highway unbelievably smooth with little engine strain or vibration.

The square overhead-valve engine, with 3½-inch bore and 3½-inch stroke, is of advanced design; Oldsmobile (along with Cadillac) was the first to introduce this modern trend in engine development. While the compression ratio of 8.25:1 is unusually high and premium gasoline is

(Continued to page 222)
Molly Screw Anchors hold any fixture securely in any hollow wall construction. Molly puts an end to loose fixtures and allows you to install new ones exactly where you want them—not where the studs are. Molly puts an end to broken wall surfaces and crumbled plaster!

Molly will not pull through. It forms its own backing and actually reinforces the area in which it is used. Once installed, anchorage is permanent. Fixtures can be removed for cleaning and be replaced in the same anchor! Mollies are inexpensive and easy to install!

ASK YOUR HARDWARE DEALER
Write For FREE Folder!

MAGNETS
 Genuine Alnico—Never Weakens
AMAZING, PERMANENT MAGNETS—WILL NOT WEAKEN! NON-ELECTRIC
Retrieve guns, tackle, tools and other steel items from lake, river, planting tacks, driving or other hard-to-reach spots. Recover drills, taps, etc. from sweeper. Clear alley of harmful tacks, nails. Many other uses. Prices for steel quickly. Guaranteed. Try any magnets one week. Money refunded if you are not well pleased.
No. M-725 (Weighs 54 oz.). Has pull of 235 lbs. on steel block. $1.50
No. M-65 (Weighs 12 oz.). Has pull of 175 lbs. on steel block. $1.00
No. M-509 (Weight 7 oz.). Has pull of 120 lbs. on steel block. $0.90
No. M-406 (Weight 5 oz.). Has pull of 80 lbs. on steel block. $0.60
No. M-36 (Weight 2 oz.). Has pull of 15 lbs. on steel block. $0.30
No. M-30 Handyman assortment of six small magnets. $0.95

MIAMI MAGNET COMPANY, 3240 N. W. 27th Ave., Miami 42, Fla.

Scrape paint quickly
ask your dealer for
Red Devil
Wood Scrapers

Red Devil Tools.

Get your FREE copy of "HOW TO MAINTAIN WOOD FLOORS."
MAIL COUPON TODAY
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130 Colt Street, Irvington, N. J.

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EASY TO INSTALL
NO SPECIAL TOOLS NEEDED
1. Drill hole same size as Molly...tie Molly
2. Use a screwdriver to turn screw
3. Molly is fully installe
4. Next remove the screw
5. Now place fixture in position, return screw and tighten

WHERE SCREWS WON'T HOLD!
USE
MOLLY SCREW ANCHORS
MOLLY CORPORATION • DEPT. H7 • READING, PA.

car stall?
get instant starts
with a
STEWART-WARNER
Electric
FUEL PUMP

Yes, quick, sure, instant starts—every time—in any weather. No more stalling! This Stewart-Warner Electric Fuel Pump delivers all the gas your engine can use the second you turn on the ignition. Operates independently of the engine. Saves your battery. Easy to install on any car or truck.

STEWART-WARNER
Instrument Division, Dept. N-84
1840 Diversey Parkway, Chicago 14, Ill.

AUGUST 1954
recommended, there was no undue pinging with regular gas. I used regular gas for about 200 miles in Colorado's high altitude, however, Oldsmobile owners will secure better results with premium gasoline.

The 12-volt electric system now used on all Oldsmobile models provides greater battery capacity, which is highly desirable with so many electrically operated units placing additional load on the battery. Power windows, power-controlled front seat, radio and heater all demand considerable voltage. Undoubtedly more cars in the future will turn to the 12-volt system.

I like the unit-type power steering used by Oldsmobile although 5¼ turns of the wheel, lock to lock, seem excessive, especially with power assistance. This unit provides a slight pressure on the wheel when driving in a straight line or in beginning a turn, so that the driver tends to have a better "feel" of the road than with some other types of power steering.

The combination of a comfortable driving position, the excellent seat cushions and rear suspension by long leaf springs makes the new Oldsmobile the most enjoyable car that I have driven over long distances.

Vision is excellent and adds greatly to driving safety. When one again drives a car with conventional-width windshield, there is a definite feeling of limited vision. I like the new wrap-around windshield. I also like the high rear-fender tips in which the taillights are housed. They serve as guides for parking or backing out of narrow driveways. Rear vision is also good.

The steering wheel is well positioned. The top of the wheel is low enough that it in no way hinders front vision. Its full-circle horn ring is smaller in diameter than most others and offers no obstruction to instrument visibility and the instrument dials, including speedometer, are very readable. The cool-air vents are direct-operating and very efficient. Heating, I think, could be improved. On a cold morning it was difficult to secure enough heat to be comfortable when driving at ordinary speeds.

One of the most appreciated features is the center-located glove compartment, which makes for quick accessibility by either driver or passenger. Directly below the glove compartment are switches to operate the courtesy light and front and rear radio speakers. The clock is on the extreme right side of the instrument panel, fine for the passenger, but a little too far away for the driver.

I am glad to see Oldsmobile continuing the needle gauges for amperes and oil (Continued to page 224)
It's easy to make these REPAIRS

You can make loose metal, wood, or plastic parts tight; anchor bolts in concrete to stay; seal cracks in metal; tighten loose screws and fixtures in wood, metal or tile—with Smooth-On No. 1, the iron cement of many uses. Just mix, and fix. Smooth-On No. 1 hardens quickly like iron, and expands as it sets. Forced into any opening, its unique expanding action makes the repair. Keep a can on hand, it will not deteriorate. Smooth-On No. 1 is at your hardware store.

FREE Repair Handbook
40 pages, many illustrations, easy directions for ingenious time and money saving repairs you can make yourself. Write for your free copy.

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570 Communipaw Ave., Jersey City 4, N. J., U.S.A.

SMOOTH-ON
THE IRON CEMENT OF MANY USES

NEW, IMPROVED CALCULATOR FOR WOODWORKERS only 25c
Instantly gives information on lumber, nails, concrete mixes, painting materials, etc. Convenient, simple to read. Just set dial for nail specifications, to convert linear to board feet, and bit sizes for screws, compare characteristics of woods. 6" diameter, heavily varnished cardboard. Send 25c, 20 stamps, please to Greenele Tool Co., 2108 Columbia Avenue, Rockford, Illinois.

POWER TOOLS, INC.

MODERN LAWN MOWER SHARPENER
Service departments of leading Lawn Mower manufacturers use the Modern Lawn Mower Sharpener. One lever moves lawn mower into grinding position. Gasoline and oil remain in engine while sharpening, no dismantling of blades, wheels or handle. The Modern is precision-ground knife grinder—no extra grinder to buy. Imitated but never equalled—Compare before you buy. If it isn't a Modern it can't be Modern.

Drive out Basement dampness
with the amazing FRIGIDAIRE electric DEHUMIDIFIER

18¾" high — 20½" long — 11¾" wide—
Positively controls moisture in linen closets, basements, playrooms, bank vaults, workshops— or any closed area up to 10,000 cu. ft. where moisture is a problem.
Fan draws air through refrigerated coil. Moisture is condensed and collected in container. May be connected to drain. Plug into any outlet.

See your Frigidaire Dealer for further details. Or write for free folder to Frigidaire, Dept. 2275, Dayton 1, Ohio. In Canada, Toronto 13, Ontario.

MODERN MFG. CO.
160 N. Fair Oaks - Pasadena 3, Calif.

AUGUST 1954
pressure. This is a far superior arrangement to the warning-light system which has recently become the designers' or engineers' dream of a quick solution to electrical and oil-pressure problems.

The massive, wrap-around bumpers are substantial and afford good protection, both front and rear. However, the two bumper guards extend too far ahead of the front bumper. I especially like the quick-acting cranks on the windows: 3/4 turns front and 3 1/2 turns rear are required to open and close the windows—a sensible ratio. The locations of both armrests and inside door handles are excellent and lever for front-seat adjustment is nicely located and does not require a contortionist to operate it, as is the case in some other makes.

Fuel economy of the Rocket engine is excellent for a car of its size and weight, especially when one considers that the Rocket is a powerful, high-performance engine that the average driver is more inclined to abuse.

Also offered by Olds is the Series 88, with the same wheelbase, chassis and displacement as the Super 88, but with less horsepower. The 98 Series has the same displacement and horsepower as the Super but is four inches longer (126-inch wheelbase) and shipping weight is 3865 pounds, or 112 pounds more than the Super 88. A complete line of body styles is offered, including the flashy Starfire 98 convertible.

Good-by to the In-line Flat Head
(Continued from page 124)

There's been a lot of this "mechanical octane" business in the last five years. Of course, there is hardly 100-percent agreement as to just how the chamber should be shaped. Chrysler Corporation uses an open spherical shape, while Oldsmobile, Cadillac, Studebaker and Ford products use a small wedge-shaped chamber.

However, nobody disputes the fact that overhead-valve placement is a must for tomorrow's passenger-car engine. It costs more to build and to maintain and it is a headache to design, but it does the job when you step on the accelerator.

These are the reasons why you probably bought an overhead-valve V8 this year.

It has the rigidity needed for tomorrow's outputs, the breathing and combustion control, the low friction for more miles per gallon, the compactness to hide in the confusion of today's crowded engine compartment, and it gives the smooth flow of power only a flock of cylinders can give. It had to be a V8. Too bad it couldn't have happened 20 years ago and saved us the bother of trying to build a better straight 8! ★ ★ ★
This storage wall serves two rooms!

get complete detail drawings and easy-to-follow directions in

FREE PATTERN KIT 322
—along with the picture-packed booklet, "Enchanting Homes of Western Pines." Write for it to Western Pine Association, Dept. 322-N, Yeon Bldg., Portland 4, Oregon

The clean-cutting woods of the Western Pines prove perfect for this well-organized storage wall. Built into an existing partition—or planned for a new home—it includes a wardrobe with shoe-rack, drop-leaf desk, shelves, cupboard and sports equipment cabinet.

The smooth surface and even grain of the Western Pines take all finishes well. You'll find these carefully selected, well-seasoned woods a joy to work—and economical, too. Your local lumber dealer will give you an estimate—see him soon!

the Western Pines

IDAHO WHITE PINE
PONDEROSA PINE
SUGAR PINE

"SNOOPER" GEIGER COUNTER

Supersensitive! Only 1 1/2 lbs.1 Fits pocket—uses flashlight battery. Find a fortune in uranium. Order now! Send $5.00, balance C.O.D. MoneY BACK GUARANTEE. FREE CATALOG—scintillator and larger uranium and metal detectors. DEALERS WANTED.

PRECISION RADIATION INSTRUMENTS
2235 PIM S. LA BREA, LOS ANGELES 16, CALIF.

Print Your Own


KELSEY PRESSES, N-37 MERIDEN, CONN.

Build this 14-foot FIBERGLAS PLASTIC BOAT

only $197.50

No experience needed; can be assembled in 12 hours with ordinary household tools. Simple 1-2-3 instructions make assembly a snap. 52" beam, 16" depth. Kit complete except paint. Cross members and seats of highest quality hardwood. Constructed of pressure-molded plastic sheets. DENTPROOF . . . ROTPROOF . . . NO MAINTENANCE. Write for illustrated folder. Available assembled only $295.00.

Plastic sheets for boat parts also available. Write . . .

UTILITY PLASTICS CO.
1544 E. 6th Dept. P.M. Tulsa, Okla.

AUGUST 1954

SPEED and ACCURACY

P&C

TORQUE WRENCH
makes no errors

No dial—no clicks. You furnish the pull...it does the job. Just set and lock. Automatically releases at desired torque and resets. 3/16" or 1/4" square drive, plain or ratchet. Every P&C Tool guaranteed—"the BEST tool money can buy". Ask your dealer for a P&C Torque Wrench today and be convinced.

P&C HAND FORGED TOOL COMPANY
Dept. H-854 Box 5926 Portland 22, Oregon

Get your P&C Tools from this convenient display.
Send 10c NOW for big P&C catalog. Complete info on over 500 tools.
The Owners Report on the 1954 Oldsmobile
(Continued from page 110)

than one owner but none by any important percentage of owners.
“Dislike the lower body as it is hard for extra large people and older people to get into the car.”—Idaho Falls, Idaho, farmer.
“Poor heating system and defroster. Heater should be under the seat.”—Detroit, Mich., retailer.
“Snow and ice can easily plug up the intake air vent and more than normal usage of fan is necessary.”—Beacon, N. Y., laboratory worker.

### 1954 OLDSMOBILE SPECIFICATIONS

<table>
<thead>
<tr>
<th>ENGINE</th>
<th>B8</th>
<th>Super B8</th>
<th>98</th>
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<td>Type</td>
<td>8-cyl., V-type, OHV</td>
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<tr>
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<td>185 @ 4000 rpm</td>
<td>185 @ 4000 rpm</td>
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<td>Compression ratio</td>
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<tr>
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<td>3-speed conventional, Hydro-Matic automatic transmission optional.</td>
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<th>INTERIOR DIMENSIONS</th>
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<tbody>
<tr>
<td>Front-seat width</td>
</tr>
<tr>
<td>Rear-seat width</td>
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<tr>
<td>Headroom, front</td>
</tr>
<tr>
<td>Headroom, rear</td>
</tr>
<tr>
<td>Legroom, front</td>
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<tr>
<td>Legroom, rear</td>
</tr>
</tbody>
</table>

*Rear-view mirror blocks view of cars to the right at four-way stops.*—Centralia, Ill., distributor.

*Bulges on front bumper protrude too far. I damaged my grille due to the fact that it hit before bumper did.*—Billings, Mont., sheet-metal worker.

*Engine seems to be too sensitive. Has to be timed perfectly to get average performance. Doesn’t seem to go straight down the highway. You have to drive it very second (I have power steering).*—Rapid City, S. D., contractor.

*Every time it rains, water comes in on (Continued to page 228)*
EASIEST, FASTEST paint remover you've ever used!

New, Improved Heavy Bodied KLEAN-STRIP

New semi-paste won't drip off overhead or upright surfaces. Peels any finish from any surface. Non-inflammable, safe to use. Needs no after-wash.

Sold by all Klean-Strip Dealers

THE KLEAN-STRIP CO., Inc.
2340 South Lauderdale • Memphis 6, Tenn.

Electron Tube for Airplanes Functions Over 1000 Hours

First of its kind to be developed for mass production, a new heat-resistant electron tube will function at a bulb temperature of 572 degrees Fahrenheit for a minimum of 1000 hours. Up to now the problem of cooling or ventilating electronic equipment has been an increasingly difficult hurdle in over-all aircraft design. Developed by the Bendix Aviation Corp. primarily for military aircraft, where a single plane may have 14 electronic systems and 650 tubes, the new heat-resistant unit is also being made available for airline use. It will withstand a 200-G shock repeated 18 times per second for 200 hours.
Install this noise-muffling ceiling yourself

Why let noise take the fun out of your basement playroom? You can provide comfortable quiet—and have a handsome ceiling finish, too—simply by installing a noise-absorbing ceiling of either Armstrong's Cushiontone or Perforated Temlok Tile. It's easy, economical—do it yourself.

1. Both Cushiontone and Temlok Tile are perforated wood fiber materials. Cushiontone's noise-trapping holes are arranged in Armstrong's exclusive new "Full Random" pattern, while Temlok's perforations are in neat, straight rows. Both materials are factory finished, can be washed or repainted if desired.

2. Start by nailing up seasoned wood furring strips as a base for installation. 1" x 3" strips should be nailed at right angles to the joists on 12" centers. Shim the furring where needed to provide a smooth, level surface. Cushiontone can also be cemented direct to plaster or other smooth surfaces.

3. The special Lok-Bevel joint with its extra wide flange speeds nailing or stapling of Perforated Temlok Tile. The shallow-drilled nailholes in each corner of Cushiontone also help to make installation quick and easy. When nailing up Cushiontone, use nails with flatheads or collars 3/8" to 3/4" in diameter.

4. In a few hours, your noise-absorbing ceiling will be finished—a beautiful and practical ceiling for your playroom. Your whole family will be so pleased with the new-found quiet, you'll also want to sound condition your kitchen, workshop, or den with Cushiontone or Perforated Temlok Tile.

Your building materials dealer will be glad to give you full details on Full Random Cushiontone, Temlok Tile, and Armstrong's other building materials. For a free booklet on Cushiontone and Temlok acoustical ceilings, write Armstrong Cork Company, 4208 Watch Avenue, Lancaster, Pennsylvania.

ARMSTRONG'S CUSHIONTONE

Temlok® • M-67® Monowall® • Insulating Wool • Hardboards • Cushiontone®

AUGUST 1954
1. Guaranteed to fire in oil. Aldor spark plugs have bi-metallic thermostat control that keeps spark plug always at peak efficiency for smoother running, easier starting. Adjusts to any heat range requirement automatically. Special non-burning electrodes. In sets (812828-6) $0.90

2. Wizard fuel pumps, guaranteed for long, dependable service. Diecast body; precision machined surfaces and parts; fully tested for correct pressure. Diaphragm of extra high quality for longer life, top performance. For all popular cars (827201) $1.75

3. Wizard De-Sludge-Er oil filter cartridge has new filter agent of 100% cellulose. Out-filters either paper or cotton. Removes sludge-forming elements from oil. Won't clog, channel or by-pass. For all cars, trucks, tractors with full-flow or by-pass systems. Chev. 1937-53 (555111) $1.59

New Power... New Beauty...

Over 45 Years... Headquarters

7. Bright, new arm rest covers snap on quickly, without removing the arm rests. Made of beautiful quilted Vinyl plastic. Choice of five popular colors—yellow, gray, blue, green or red—to harmonize with any seat cover or interior trim. Attractive pin-point Vinyl trim. Pair (203899-2921) $1.59

8. Easy to change tires at night, spot street signs, house numbers with this all-purpose spotlight. Plugs into lighter socket, or dash socket which is included. Beautiful die-cast chrome-trimmed handle and rim with blue enamel back. On-off switch, GE bulb, 10' cord. (203814) $5.19

9. Here's the quick easy way to replace brakes—Stop-Rite lined brake shoes, ready to slip right into drum. Wire-backed lining permanently bonded to shoe for positive "non-grab" braking, long quiet service. Trade-in allowance. All popular cars. Front or rear. Set of 4 as low as (592744) $3.75 each.

FREE: Mail post card today for folder explaining how to get more horsepower
Add new beauty to your car with these top quality Wizard Country Club Plastic Seat Covers. Beautiful Saran plastic panels with harmonizing trim, top cap, sides and back. Stay lovelier longer. Wide choice of patterns and colors sure to please. All car sizes, from (N.C. 189) $26.95

Get better gas mileage, smoother idling, greater power with a fully guaranteed remanufactured carburetor. All parts brand new or fully remanufactured like new. Pressure and flow-meter tested, assuring correct gas and air ratio for top performance. For all popular cars. (Exc. 1952) $4.75

Gives your car showroom shine in minutes—without rubbing. Only liquid car wax with the “Simoniz Secret”! Easy to use: just spread it on, wipe it off—and a miracle takes place before your eyes! Protects better: tests prove Bodygard will outlast any other liquid wax or polish ($9.74)

New Safety For Your Car At Western Auto
STORES AND ASSOCIATE STORES

Why risk worn brakes? Reline with Stop-Rite Brake Linings. Designed for individual braking requirements of all cars. Pressure molded. Wire backed for extra strength. Will not absorb grease or moisture. With rivets and instructions. Easy to install. All popular cars from $1.98

Don’t be stranded by a worn-out fan belt. Replace now with a Western Auto extra-quality fan belt. Inner core of endless cable cords. Tough rubber cushion reduces heat, assures long life, cooler-running performance. Can’t warp, slip, or stretch. Guaranteed fit ($3.98)

DO-IT-YOURSELF and SAVE MONEY

Popular Mechanics New Series Tells You How
With Step-by-Step Directions . . . Shows You
How with Photographs, Drawings and Diagrams

1. How to Paint Inside and Out: Complete information on painting including how much paint to use, preparing the surface, etc. ................................................................. 25c

2. How to Lay Linoleum and Tile: Everything you want to know about the tools to use, methods of laying plastic, asphalt and metal tile. .................................................. 25c

3. How to Remodel Your Basement and Attic: Fully illustrated with instructions on insulation and heating included. ................................................................. 25c

4. How to Take Care of Your Lawn: Establish a new lawn this summer by learning how to prepare and properly condition the soil. .................................................. 25c

5. House Wiring and Electrical Repairs: Save many dollars rewiring your home for modern living with this book. Complete instructions. .................................................. 25c

6. Small Boats You Can Build: Build a dinghy, a sailing scow, a sailing knockabout and other boats with this easy to understand book. .................................................. 25c

7. Plumbing Repairs Made Simple: Get the facts now about your home water-system, its troubles and cures. Save labor costs. .................................................. 25c

8. Fences, Gates, Trellises and Walks: Beautify your yard and garden this summer with fences, gates and trellises you can build. .................................................. 25c

9. Built-In Furniture for Your Home: This book covers all the latest ideas in built-in furniture including how to mount photo murals. .................................................. 25c

10. Build Your Own Barbecue: Do-it-yourself with this step-by-step method and enjoy tasty tantalizing meals in your yard this summer. .................................................. 25c

11. Lawn and Garden Projects: Now you can build luxury garden equipment at little cost with this book. Only simple tools required. .................................................. 25c

12. Three Low-Cost Homes You Can Build Yourself: Save thousands of dollars on your future home. Three styles to choose from. .................................................. 25c

Only 25c Each!
How to Check the Shock Absorbers on Your Car

SHOCK ABSORBERS ARE IMPORTANT, they slow down and even out the spring action on your car—help keep the car from "hitting bottom." Shock absorbers also help keep the car in contact with the road at all times...this means better steering control, better tire life. Because your car's shock absorbers have a big job to do, they need careful attention for they do wear out. Shock absorbers should be checked frequently, replaced as needed.

THE BUMPER-JUMPER TEST is one way to find out if your shock absorbers are working. Stand on a corner of your bumper—rock the car up and down—then jump off. If your car moves up and down more than once, you need new Golden Glide Shock Absorbers on that corner—repeat test on each corner, near the wheel.

WATCH YOUR TIRE TREAD. If uneven tread wear is showing, it may mean that your shock absorbers are allowing too much wheel bounce, contributing to bald spots or scuffing. If this is the case, you need new Golden Glide Shock Absorbers.

LOOK FOR OIL LEAKS. If you see big blanches of oil on the lower part of your shock absorbers, you can be sure that the fluid has leaked out and they are in dangerous condition and need replacement.

BE SURE TO BUY GOLDEN GLIDE SHOCK ABSORBERS

These are a product of America's oldest hydraulic shock absorber manufacturer. They are stronger, better protected, longer lasting. There are Golden Glide Shock Absorbers custom-built to do the best possible job for every make and model car. Buy them from your auto parts jobber, service station or independent repair garage. If you have difficulty locating Golden Glide Shock Absorbers, write us for the name of your nearest dealer. Handafile-Hershey Corporation, Buffalo 11, New York.

Ride Better, Ride Safer with Golden Glide

CUSTOM-BUILT SHOCK ABSORBERS

AUGUST 1954
You'll get a lot more real satisfaction and pride of ownership out of a home that is clean and neat and trim in a fresh coat of paint! Pays its own way by improving your property, too!

Because Archer Pol-mer-ik contains polymerized oil, it gives you a tougher, more durable paint film than ordinary linseed oil. When you reduce your paints with Pol-mer-ik, they brush easier, level better, and give you a smoother, dirt-resistant finish. Wonderful brush conditioner, too!

Handiest single product in your house or shop. Does the job of a dozen specialized products. A few of

**POL-MER-IK'S 101 HANDY USES:**
- Refinishing Antiques
- Protecting Ladders
- Sealing Screws
- Protecting Gun Stocks

**ARCHER Pol-mer-ik LINSEED OIL**
Protects Most Everything

How to Build a Low-Cost Conelrad Alarm Monitor

(Continued from page 147)

continue, must leave the air as soon as the threat of air attack has been established, the burden is upon the operators to promptly receive a “radio alert” and take immediate action.

The Conelrad alarm monitor illustrated and detailed for construction, provides operators of all services with a reliable means for continuous silent or aural monitoring of a broadcast carrier and the actuating of an alarm circuit, or the immediate “cease operation” of the radio transmitter upon receipt of a “radio alert.” Several choices of monitoring operations are suggested in the application diagrams, Figs. 1, 2 and 3; the unit proper appears in the complete circuit diagram of the Conelrad monitor. Photo A shows the writer and his amateur radio station in which this alarm monitor was tested. Photo B is a top view of the completed chassis base and panel. Photos C and D show front and rear views of the unit installed in a metal cabinet. An underside view of the chassis base appears in photo E. The monitor can be used in conjunction with any simple superheterodyne receiver covering the standard-broadcast band. The station operator should study photos B, C, D and E carefully before starting construction. All component parts are standard and easily available from any good radio-parts house. These parts are few in number and all are specified in the monitor-circuit diagram. The fixed resistors are all 10% carbon types. The s.p.d.t. plate relay can be either 2500 ohms or an Advance type 850, 1600 ohms. The Potter and Brumfield KL14A multiple-contact relay is a 5-amp. type, 115-v. a.c. with a 50 to 60-cycle coil. The terminal strip on the rear of the chassis base is an ICA, 9-screw terminal type, with terminals marked

(Continued to page 236)
Which of these brake linings is safe?

YOU COULDN'T TELL TO SAVE YOUR LIFE UNLESS YOU KNEW THE NAME!

One of the brake linings pictured above may be a dangerous, inferior lining, which might suddenly fail—just at the moment when you need it most. The other is a safe lining.

Your life could depend on choosing the safe lining. But neither carries a name or trademark where you can see it. You couldn't tell which is which, could you? So you'd be just plain lucky if you made the right choice!

But here's something to be glad of—when you buy dependable GRIZZLY Brake Linings, you don't have to trust your luck. We at Grizzly want your safety to be as certain as possible. That means we make the safest, most dependable brake linings on the market, but it means something else, too.

when you buy

GRIZZLY

the famous name, Grizzly bear
and grade are stamped on
the outer side of the lining,
where you can see them

The Grizzly Authorized Brake Shoe Exchanges are provided with special branding stamps which not only show that you are getting famous, reliable GRIZZLY linings, but also show whether you are getting Grizzly Syncro, our excellent lining engineered for regular duty, or our special Silvertip lining for extra rugged high-mileage, multi-stop service.

When your brake serviceman gets his relined shoes from a GRIZZLY Authorized Brake Shoe Exchange, both you and he can take one look and know that you are getting the consistent performance and long, safe, service you need. The GRIZZLY reputation is known everywhere: more than forty years of making and selling the best brake service products available.

BUY GRIZZLY BRANDED BRAKE LINING—KNOW THE SAFETY YOU ARE GETTING

Grizzly Manufacturing Division, Paulding, Ohio

AUGUST 1954
Referring to the monitor-unit diagram, the operation is as follows: A small voltage taken from the AVC bus of the receiver places a bias on the grid of the 2D21 thyatron. A sudden loss of signal will remove this bias, allowing the 2D21 to conduct. The flow of current will cause the plate relay to function and its contacts will complete power to control the relay with the following results. (1) The green or "normal" pilot lamp will go out; the red of the "alarm" pilot lamp will come on. (2) The speaker will be connected for aural monitoring, regardless of the position of the speaker switch. (3) The contacts for the externally controlled circuit will function (see Figs. 1-A and 1-B). Contacts 2 and 3 energize the "make"; can be used to complete an alarm or alerting system. Contacts 1 and 2 can be used to instantly take a transmitter off the air, as they energize to "break." In case of an amateur station, they break the line to the antenna change-over relay, effectively putting the amateur station in the "receive" position. When the broadcasting station continues its regular programs the ham operator can quickly "reset" the push-to-break switch. The voltage applied to the grid of the 2D21 (AVC voltage) will depend upon the strength of the signal being monitored. The 2-megohm potentiometer should be set just past the cut-off point for the 2D21 thyatron. The device can be tested with a 3-volt battery, negative to terminal 9, positive to terminal 8. Suggested 4-ohm and 600-ohm speaker circuits are shown in Figs. 2 and 3.

The speaker switch permits silent or aural monitoring of the broadcast carrier. Terminals 4 and 5 allow selection of proper terminating resistor for substitute speaker load when the switch is in the "silent" position. Monitoring units of this type have been in use in broadcasting stations for over a year of 24-hour-daily operation.
Meet the one heating expert who can save you up to 25% on fuel oil

...AND GUARANTEE IT IN WRITING!

This man offers you money-saving magic! He is your Timken Silent Automatic Direct Factory Dealer. He can cut your fuel oil bills more than any other dealer in the heating business! He sells and installs the amazing Timken Silent Automatic Wall-Flame Oil Burner—which in test after test, home after home, has cut fuel oil bills up to 25% and more!

He offers you an exclusive written guarantee of fuel savings. As an authorized factory-trained heating expert, he will scientifically test your heating plant and tell you what you can expect to save on fuel oil by replacing your gun-type burner with a new Wall-Flame burner. If you buy, he'll guarantee these oil savings in writing!

If you heat with coal, this guarantee is important to you, too. For you are assured the same fuel economy, proved over other types of oil burners in home heating tests everywhere!

Let him show you this most advanced principle of oil heating. Completely quiet, clean, and with only one moving part, this amazing burner blankets your heating plant walls with a natural, unhurried, blue-hot flame. There is nothing to get out of order.

Phone your local dealer today for a free fuel-saving estimate! He is listed in the "yellow pages" of your phone book. Remember: your home is like no other. That is why it will pay you to get his expert advice. Hundreds of Timken Silent Automatic Wall-Flame Burners have already paid for themselves in fuel savings alone.

FREE! SEND COUPON FOR FACTS TODAY!

A complete line of oil and gas furnaces, boilers, conversion burners and water heaters for every home heating need. No down payment. 36 months to pay!

Timken Silent Automatic Oil Heat
TIMKEN SILENT AUTOMATIC DIVISION
Rochelle Springs and Aisle Company - Jackson, Michigan

The Timken-Detroit Axle Company of Canada, Ltd., Toronto, Ont.

FREE! SEND COUPON FOR FACTS TODAY!

Timken Silent Automatic Products
Timken Silent Automatic Division
Dept. PM-84, Jackson, Michigan

Show me how homeowners in my community have saved money with Timken Silent Automatic.

Name
Street
City ............................................ State ............................................

Also facts on (type of equipment) ............................................

(Students, check for special data) □

AUGUST 1954
Twelve Hours on the Test Track

(Continued from page 81)

Driver: When you want out, say so. He gives it the gas and around you go, hanging on tight. The speedometer stays at 15 miles per hour. You feel like you're flying. You count the laps: 5, 10, 11, 12, 13—you wish you had taken the driver's advice and not eaten—14, 15, 16. This is not exactly pleasant. In fact, it's nauseating! You wonder if it's supposed to test wheels or men. You tap the driver on the shoulder and motion for a stop. You clamber out and spiral over to where the relief driver is waiting.

You: Tell me what's going on here? It's too much for me. I'm dizzy.

Relief driver: We're trying to break the right-front wheel. He makes 50 circles as fast as he can and then I do the same thing. How's your stomach?

You: Terrible, thank you. How long does it take to break a wheel?

Relief driver: Don't know. Some go 10 laps, some 1000. Depends on the kind of wheel. Our big headache on this test is tires. We have to change them every 150 laps or so. That's about as long as they last.

You: Don't you get dizzy?

Relief driver: At first I did, but 50 laps don't bother me now. Well, it's my turn.

The first driver gets out, walks over and lights a cigarette. There's no noose in his walk.

You: What do you think of this run?

Driver: Not much. But then each driver gets it only once or twice a month. It sure makes a long day, spinning like a phonograph record. Oh, well (looking at his watch), six more hours!

You head for the high-speed oval again. Cars speed by like racers at Indianapolis. You pick up the radiotelephone at an emergency station beside the track and ask to ride a high-speed test car. You get an okay and stop the first car that comes along with headlights on (the mark of a high-speed test car). It's a Dodge.

Driver: Get in. We have 300 more miles to run at maximum speed.

You: How fast is that?

Driver: There's a speed limit of 85 actual on the oval—about 90 on the speedometer. This Dodge will do lot more than that.

You: How fast have you driven here?

Driver: I covered 623 miles in just a few minutes over 6 hours in a Chrysler, an average of 103 miles per hour. The wind was strong that day or I would have done better. You can hold a Chrysler at 115 on the oval with no strain. Of course, we're not out here to set speed records. We only

(Continued to page 246)
Makes a Table Saw or Drill Press Out of Famous-Name Electric Drills

NOW, convert your Black & Decker, Skil, Mall or Miller-Falls 1/4" drill into a complete home workshop . . . a table saw, drill press, grinder, buffer, router. All at this amazingly low introductory price that includes basic unit, 5" saw blade, arbor, rip fence, and miter gauge.

Large cast-aluminum table top, machine finished. Heavy gauge metal parts, all ruggedly simple and of the finest quality, plus precision workmanship throughout. Hailed at the Boston and New York "Do It Yourself" Shows as one of the most promising new tools to be shown and demonstrated . . . one that adds valuable new convenience and utility to famous-name drills.

Specifications

Table Top .......................... 9" x 12"
Depth of Cut ................................ 1 1/2"
At 45° Angle .................................. 8 1/4"
Drill Stroke .................................. 4 1/2"
Capacity in Wood ............................. 1 1/2"
Capacity in Steel .............................. 1/4"
Angle Drilling

Mail This Coupon Today!

McCONNELL MFG. CO., Inc.
Syracuse 6, N. Y.

Gentlemen: Please send me full information on the Drill-Shop.

( ) I Have a 1/4" Drill
( ) I Have No Drill

Name ..............................................
Address ...........................................
City ................................................
Zone ..............................................
State .............................................

It's easy to "weave" a carport

with MASONITE PRESWDWOOD

It's different! Attractive! And easy to make! Use tough, grainless Masonite Tempered Preswdwood®. Resists heat and cold, wind and water. Lasts indefinitely. Plan can also be used for a woven fence. See your building materials dealer. Send for "Idea Book" and carport plan No. AE-296.

LICK SUMMER DROUGHTS!

HAVE WATER WHEN YOU NEED IT.

Drill your own wells with a sturdy CON-SOL well driller, built for years of service. Deep wells, shallow wells ... outdoors or in cellars. Low cost makes CON-SOL easy to buy ... light weight makes it easy to erect, operate ... opportunities for rental, contracting, resale make it easy to get back investment. Guaranteed for 90 days against defective materials or workmanship. Drills through many feet of rock before hard insert needs renewing. Used by U.S. Dept. of Agriculture and Forestry, U.S. Navy. For 4" casings, $385 F.O.B. factory; includes drill, boiler and 100' cable. Additional casings, up to 300', 3/4 hp electric motor or 1 1/2 hp gasoline engine, available at extra cost. Heavy duty model, for 6" casings, available with gasoline engine, at $1295 F.O.B. factory. Prices and specifications subject to change without notice.

CONSOLIDATED INDUSTRIES, INC.
WEST CHESTER, CONNECTICUT, U.S.A.

AUGUST 1954
"One Out of Three Smashes Up"
(Continued from page 70)

In four miles I had to decelerate from some 240 miles per hour to dead still.

The compression of the engine began to bring the speed down nicely as soon as I backed off the throttle but you can't afford to use this kind of brake too long. The engine would be wrecked if left in gear. Pushed by the rear wheels, the rods would stretch and the pistons would start slamming the tops of the chambers.

When the tach dropped to 3500 revolutions per minute I disconnected the power plant with the hand clutch and then the car almost seemed to pick up speed, for a streamliner has virtually no wind resistance. Nothing seemed to happen when I began pushing down on the brake pedal. The end of the measured course went by, I kept hitting the brakes and finally got the car down to a crawl. Even so, I ran into the soft salt before I could stop and eight men were needed to push the car out of the marsh and get it turned around for the return run.

The average of the two runs gave us a speed of 236.36 miles per hour for the flying mile, 215.97 miles per hour for the 10-mile distance. In all, the car broke six national and six international records. Probably we'll have to go faster still to retain these honors this coming September.

August 30 to September 6 are the dates for this year's Bonneville National Speed Trials, to be attended by hot-rod owners and automobile enthusiasts. Streamliners seeking international records will make their runs during the week following and we expect there'll be real competition in our class. Because of this, Ray Brown is adding more horsepower to our engine. So far we've used alcohol for fuel, this year we may mix 10 to 50 percent nitromethane with it. The explosive mixture will give us more speed but the big question will be whether an engine running on nitro will stay together on the 10-mile runs.

One thing we'll be needing soon is a body brake comparable to the fuselage brakes of high-speed aircraft. Speeds can go way up when we can travel wide open all the way to the finish line, then pull a lever that extends the body brake, multiplying the wind resistance of the car.

The brake surfaces will need to be located pretty far aft to insure straight-ahead travel and they would be of the split type, opening vertically. It would be suicide to attach wind brakes to the sides of the car because the slightest difference in their size or rate of opening could bring the car around in a screaming turn. 

★★★
ADD A CLOSET IN A HURRY
with a NOVOPLY Sliding Door Unit

Family cramped for closet space? Make a closet and face it off with a Novoply Sliding Door Unit. It includes everything you'll need in one complete package—jambs, header with track, roller track hangers, doors with pulls and floor guides.

HERE'S ALL YOU DO:
1. Assemble header (1) and jambs (2) and place in rough opening. Shim jambs to make frame square.
2. Place adjustable overhead roller carriers (3) in grooves of overhead track in header (1).
3. Adjust doors with wedge (Fig. B) and secure with screw in carrier.
4. Install door guide clip (5) in floor (Fig. C).

You can have units ranging in height from 6' 9¼" to 8'; in width from 2' to 8'. Several together make a modern storage wall. Doors can be stained or left natural. Units available with or without upper storage area; in Novoply or genuine birch.

See your lumber dealer or send today for free folder.

FREE PLAN
tells how to start your own business
FILING SAWs

Here is a steady repeat CASH business you can start in your own basement or garage in your spare time. You can file hand, band and cross-cut circular saws on the Foley Saw Filer. No eye-strain—no experience needed. "The first saw I sharpened with my Foley Filer came out 100%"—writes Clarence E. Parsons.

Every saw you sharpen with the Foley Saw Filer brings you more customers. "I rented a two-car garage and have all the work I can do"—Charles H. Smith.

FREE BOOK
Shows How To Start Send coupon today.
No salesman will call.

SEND COUPON FOR FREE BOOK
FOLEY MFG. CO., 816-4 Foley Bldg.
Minneapolis 18, Minn.
Send me free book "Money Making Facts"

Name:
Address:

AUGUST 1954
Of all automatic drives in the low-price field:

Fordomatic is

**Gives you that extra “Go.”** Simply press down on the accelerator at any speed up to 58 mph and you get nearly 50% extra passing power with Fordomatic’s automatic intermediate gear. Only Ford in its field has it.

**Gives you smoother braking down hill.** When selector is moved to low at speeds above 25 mph, Fordomatic goes into intermediate gear until speed falls below 25, then goes into low... for smoother, extra-sure braking.

**Provides an extra measure of safety.** Fordomatic lets you go from neutral to reverse without having to pass through a forward drive position. Selector must always be in neutral (N) before starter will operate.

Worth more when you buy it...
Worth more when you sell it!

Fordomatic Drive is available on all Ford models at extra cost.
the most versatile

Fordomatic combines a simple 3-element torque converter with a 3-speed planetary gear system to provide the widest range of fully automatic operation!

Fluid torque converter smooths the way. With Fordomatic's torque converter, power is always transmitted to the rear wheels through a "cushion of oil." There is no direct mechanical connection between engine and rear wheels. So you get smooth operation with a minimum of wear.

Mechanical gears widen operating range. Starts in Dr range are through automatic intermediate gear which combines with converter to multiply torque as much as 3.11 times for fast, smooth starts. For unusual conditions, selector may be set at Lo to multiply torque up to 5.13 times!

Choose the only V-8 in the low-price field! Team Fordomatic with the industry's most modern engine—the new 130-h.p. Ford Y-block V-8—and you have the smoothest, most versatile automatic "power package" in the low-price field. Deep-block, low-friction design spells smoother going, more "Go" per gallon and longer life.

Your Ford Dealer cordially invites you to Test Drive the FORDOMATIC Ford

AUGUST 1954
Florida's Blow-Boat Derby

(Continued from page 95)

three days with mosquitoes and slender, if any, rations until he walks out or is rescued.

Often an air-and-ground search is organized, and when the air spotters locate the missing boat, they radio directions back to the ground party. The air boats, too, assist in the search for aircraft downed in the 'Glades. In the association is a Civil Air Patrol division of 30-odd members, who specialize in helping the rescue of airmen. Many of their boats are equipped with battery-operated headlights which permit the search to be carried on in daylight or dark.

During an extended search for Everglades victims, airplanes sighting the lost party after dark drop flares to mark the location, and the headlight-equipped air boats keep on traveling until they reach the stranded party. Without air boats there would be no efficient means of traversing the 'Glades to rescue fliers or for any other purpose.

Racing—the latest development in the use of air boats—is tricky with the shallow-draft craft. The bottom of the boat is perfectly smooth—no underwater rudder or keel to keep the boat on a straight course. Steering is accomplished by means of a stick—similar to the type used on aircraft—hitched to an aerial rudder or rudders. Some boats have only one rudder, some two—mounted directly aft of the propeller. By deflecting the propeller blast, the driver can steer his strange craft.

Coming to turns—and virtually all races are over a circular course—the air-boat driver literally skids his way around. If he hits the turn too fast, he'll slide off course and lose valuable time and distance before he gets straightened out. If he slows down too much he may be overtaken.

If he's trailing and hits the wake of the boat ahead, he's in for a rough ride and possibly a spill. Spills also can occur when the frail boats—which are actually top-heavy since the engine must be mounted high in order to provide propeller clearance, and also because the driver must ride in a high seat forward in order to see over the towering saw grass—hit a turn too fast and literally roll over. It takes a nice bit of rudder maneuvering to achieve the maximum speed on a turn and yet avoid trouble. Speeds as fast as 65 miles per hour have been achieved by air boats, and moving that fast in a craft with a high center of gravity and no keel is decidedly dangerous.

There are some 400 air boats—fresh-water craft—registered with the Air Boat Association, and experts estimate that there are 200 more salt-water craft which are unregistered.
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**AUGUST 1954**
drive as fast as Engineering tells us to.

You: What do you think about when
driving at high speed?

Driver: About driving. You can't day-
dream at 115 miles per hour because there
are other cars out here and you sneak up
on them fast. I worry some about tires al-
though we use specially broken-in tires.
We don't trust brand-new tires for that.

You: You mean it's better to use older
tires for high speeds?

Driver: Tires have to be broken in if you
want to be sure they'll stand up. Last night
a Chrysler on highway test had a whole
tread peel off a new tire at 70 miles per
hour. It just peeled off sideways like the
peel on a tangerine. The car held the road,
though.

By now you have made several fast laps
around the four-mile oval. The Dodge's
speedometer reads just under 100. There
is no slackening of speed on the curves. In
fact, there is little sensation of speed, the
steep banks offsetting the side thrust.

You: What speed will the track handle?

Driver: The top lane will take 140 with-
out side thrust. I've never had a car up
against the rail yet. It's a 35-degree slope
and you've got to be going to stay up there.
I think you could hit 275 here in a racer.
At 140 on the top lane you can take your
hands off the wheel and the car will follow
the curve perfectly. Want to see?

What can you say? You're sure he knows
what he's doing and you agree, weakly.

Driver: We won't be able to hold 140.
We'll try it lower down at about 110.

The Dodge picks up speed. You notice
that the other cars are all pulled off the
track and you suspect a plot! The Dodge
rams into the turn at just over 110. Half-
way around, the driver raises both hands
off the wheel. You hold your breath, afraid
you'll throw the car off balance if you
breathe! But like a train on a track, the
Dodge follows the curve perfectly. The
driver takes over again. On the next turn,
he repeats the stunt.

Driver: See, this thing will drive itself!

You: Well, twice is enough for that.
It doesn't look as though there's anything
wrong here. What will you report?

Driver: Not much. Yesterday there was
a high-speed miss at about 70 or so. I
changed plugs but that didn't stop it. Must
have been cam trouble. I notice they put
a different engine in it last night. It has
a converter whistle. Maybe you heard it?

You confess you hadn't, but after riding
around here for 12 hours perhaps it's not
strange that you didn't. On the next lap
you get out and head back to the hotel and
a long, deep sleep—your head still spin-
ning slightly. 

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(Continued from page 89)

stipulation. The main tanks are in the wings, integral with the structure. They are semipressurized with ram air to prevent the fuel from boiling during fast ascents to high altitudes. Vents are in the trailing edges, out near the wing tips. Wiring and all electrical apparatus are confined to a different zone in the wing, separated from the fuel-system areas.

Boeing has built more than 600 jet bombers, and all the experience gained in their construction is in the background of the new tanker-transport. But this is not a “warmed over” B-47 or B-52. Aside from its stock instruments and its crew seats and rudder pedals, every part of the 707 is new both in design and construction.

One trend evidenced by the 707 is its relatively stiff wing. Its tips come up only about a foot in flight, as compared to five or six times that deflection in our jet bombers. Perhaps you’ve noticed that the wings of a B-52 appear to droop while on the ground. They do, because of their flexibility. The wings become level when airborne. The stiffer 707 has a slight amount of positive dihedral, though this isn’t apparent on the ground.

Another trend found in the 707 is that its wing skin is quite highly stressed. The skin is thick and carries much of the load, while the spars inside are very light. We are approaching the time when internal spars will serve primarily as bracers to hold the upper and lower surfaces of the wing apart.

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CIVIL, STRUCTURAL & ELECTRICAL ENGINEERING
- Civil Engineering
- Construction Engineering
- Electrical Drafting
- Electrical Engineering
- Electrical Maintenance
- Electrical Instrumentation
- Electrical & Contracting
- Electronic Instrumentation
- Electronics & Communications
- Line Int. & High School Subjects

LEADERSHIP
- Leadership
- Personnel Administration
- Personnel-Labor Relations

MECHANICAL & SHOP
- Gas-Electric Welding
- Heating & Ventilating
- Industrial Engineering
- Industrial Instrumentation
- Industrial Supervision
- Machine Design-Drafting
- Machine Shop Practice
- Mechanical Engineering
- Quality Control
- Reading Shop Blueprints
- Refrigeration
- Sheet Metal Worker
- Tool Design
- Toolmaking
- Wire Drawing

RADIO, TELEVISION
- Electronics & Communications
- Practical Radio-TV Engineering
- Radio and TV Servicing
- Radio Operating
- Television-Technician

RAILROAD
- Air Brake Inspector
- Car Inspectors
- Diesel Locomotive
- Locomotive Engineer
- Section Foreman

STEAM AND DIESEL POWER
- Combustion Engineering
- Diesel-Elec.
- Diesel Eng's
- Electric Light and Power
- Stationary Foreman
- Stationary Steam Engineer

TEXTILE
- Carding and Spinning
- Cotton, Rayon, Woolen Mfrs.
- Finishing and Dyeing
- Loom Fixing
- Textile Designing

TEXTILE ENG'S
- Throwing
- Yarn Drawing

MISCELLANEOUS
- Domestic Refrigeration
- Marine Engineering
- Ocean Navigation
- Printing
- Short Story Writing
- Telephone

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3 Easy Ways to Ruin Your Battery This Summer

...and two ways to make it last longer

by Frank E. Williams, Inventor of the Life-Time Battery

You might as well be warned right now that I believe my company makes the best battery in the world—the Life-Time battery—that we guarantee it for six years, and that my purpose in writing this is to convince you that you ought to buy one.

Obviously, our chances of selling you a battery with a six-year guarantee are better if your present battery conks out for keeps after you’ve had it only a few months—which often happens.

I don’t mind telling you why ordinary batteries fail and how to make yours last longer, because this is the quickest way to explain how we solved some technical problems in developing the Life-Time battery.

Why Your Battery Fails

Although you often don’t realize your battery is done for until the first cold morning, what ruins ordinary batteries is actually not cold, but heat.

One way to overheat your battery is to take a long summer trip with your generator set a little too high. Another way: leave your car at home in the garage while you’re away on vacation. As the water evaporates, your battery plates dry out and harden permanently in summer heat. The same thing can happen if you go fishing for a couple of weeks and leave the car with your wife without telling her to have the water level checked regularly.

The cruel fact is that an ordinary battery is a fairly delicate thing.

Why Can’t Better Batteries Be Built?

Twelve years ago, I asked myself that question. First, I reviewed every plate material that had been tried since Volta’s original battery in 1801, including Ritter’s gold-ammonia battery and Gauthier’s platinum plate experiments over 150 years ago. Working with metallurgists, it was fairly easy to find an alloy—now called the “neutronic plate” — which we developed for higher power.

But the big problem—heat—still had to be solved. Ordinary material used for the insulators that keep battery plates apart breaks down under heat and acid—allowing the plates to buckle and short. We either had to find a new insulating material, or find a way to keep batteries cooler.

As it happened, we did both. We found a porous synthetic insulator that was completely unaffected by acid, yet let the acid circulate freely, acting as a built-in cooling system.

Torture-Testing the Life-Time Battery

Tested by one of the largest U. S. laboratories, the Life-Time battery cranked an engine for over 17 minutes and 57 seconds in 180-degree heat without damage! Later, in the cold test, it ran for 17 minutes and 54 seconds!

Other tests proved an amazing thing: the best time to get a Life-Time battery is in Summer. Much like breaking in a new car, the Life-Time battery will get better with use, gaining power for Winter.

How Long Will the Life-Time Battery Last?

We guarantee the Life-Time battery for six years—a figure called “conservative” by the multi-million-dollar company which backs our bonded guarantee. Actually, it may last considerably longer: recently, for example, we have had adding Tellurium (atomic number 52, with 16 neutrons) to our grid metal for still longer life.

How Much? And Where?

The Life-Time battery sells for one price for all cars: $29.95 for six-volt models, $34.95 for 12-volt; both guaranteed for six years (saving you about $100 over normal battery replacements and a lot of trouble during the next six years).

Ten thousand dealers have the Life-Time battery. If you don’t know the address of your nearest Life-Time dealer, you can order by mail from the coupon below and we’ll have your nearest dealer install a Life-Time battery for you.

[Diagram at right shows how thinner insulators (gray) allow use of thicker, more powerful plates (black) in Life-Time than in ordinary battery at left. © 1954]
WHERE IS PRESSURE GREATER...

100 fathoms under the sea
...or inside your car’s engine?

When combustion occurs, pressure within the cylinders of your car’s engine goes as high as 600 lbs. per square inch...actually twice as high as the pressure at 100 fathoms below the sea!

Old style top piston rings, operating where pressure is greatest, heat is highest, and lubrication is poorest, wear twice as fast as modern chrome rings. But in Perfect Circle’s 2-in-1 Chrome Piston Ring Set, BOTH the top ring AND the oil ring rails are chrome plated...assuring thousands of extra miles! Perfect Circle Corporation, Hagerstown, Ind.; The Perfect Circle Co., Ltd., Toronto, Ont.

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