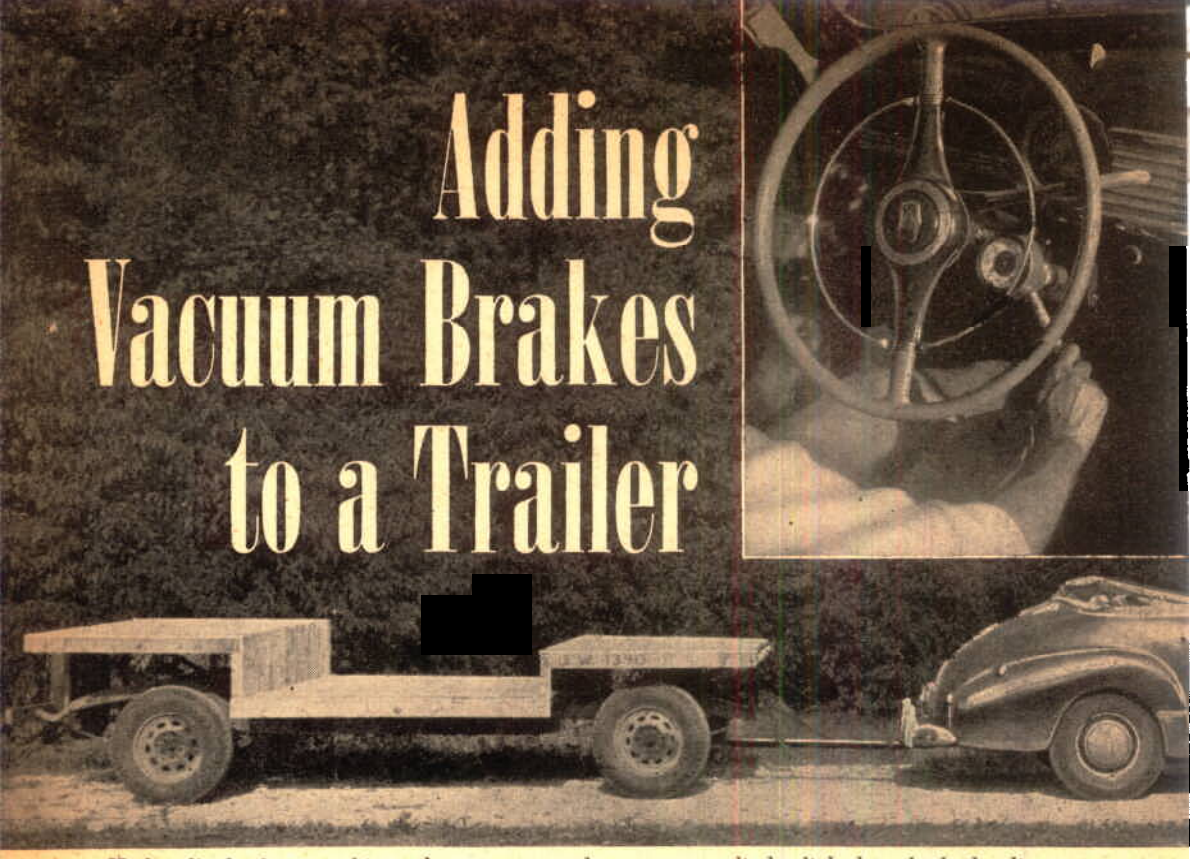
Adding Vacuum Brakes to a Trailer

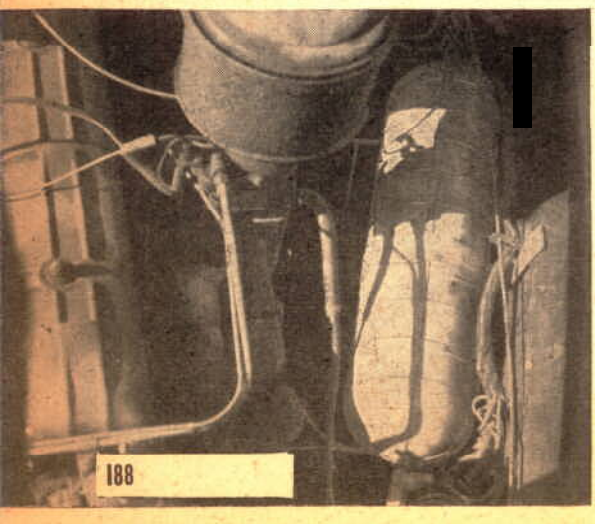


Hydraulic brakes on this trailer are operated from the car. A hand valve (inset) actuates a vacuum cylinder linked to the hydraulic master cylinder. A gauge shows the vacuum being used.

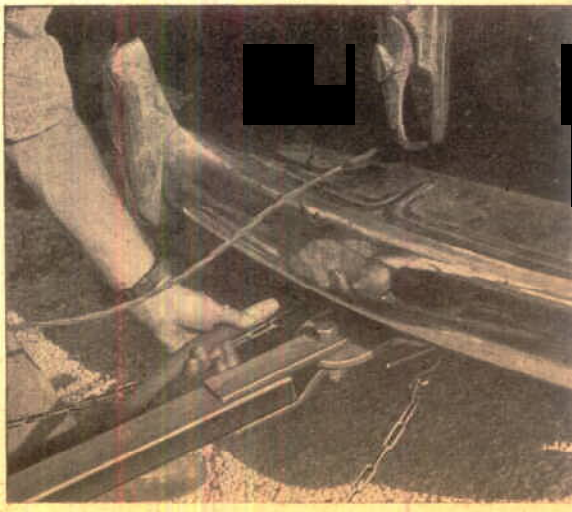
STRIPPED down to serve as a trailer, the old auto chassis above still has its hydraulic brakes but they're now applied by vacuum instead of by foot pressure. The intake manifold of the towing car provides the vacuum. A vacuum-line connector designed for trailer trucks allows quick coupling or uncoupling of the trailer.

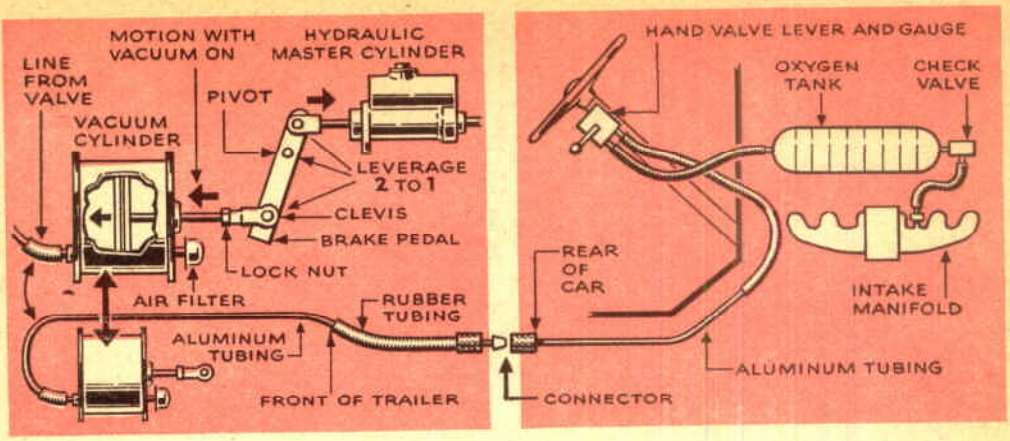
Nearly all the parts required were obtained from a truck-supply company. No

Reserve vacuum for faster brake action comes from this booster tank. There's a check valve in the vacuum line from the intake manifold.



A connector designed for trucks couples the vacuum lines, and a plug makes the electrical connection. Most states require safety chains.





changes were made in the chassis aside from installation of a towing and steering mechanism and addition of two extra leaves to each spring. A drop center in the trailer floor lowers the center of gravity. If desired, a house trailer could be placed on this chassis, or the brake system adapted to a two-wheel house trailer.

The trailer brakes are operated with a hand valve clamped to the steering column of the car. This valve includes a gauge to indicate the vacuum being applied. A booster tank with a check valve provides reserve vacuum. This was originally an oxygen tank, obtained from a war-surplus outlet. A T-fitting, substituted for the wiper fitting on the manifold, permits attachment of both the wiper and brake lines.

Two ¾" holes were drilled in the instrument panel, one for the line from the manifold to the hand valve and another for the line to the trailer. Most of the line is ½" aluminum tubing, but thick-walled rubber tubing was used at some points for flexibility.

The vacuum cylinder used in this installation has identical outlets at each end to give either a pulling or pushing action. About 8" in diameter, the cylinder has a 5½" stroke. Only a small part of the stroke is employed, however, when the brakes are properly adjusted.

In this case, it was found possible to retain the brake pedal as the linkage between the hydraulic and vacuum cylinders. Swung downward to provide clearance for the trailer floor, the pedal was pivoted for a two-to-one leverage. Its lower end was drilled for connection to the vacuum-cylinder piston. With the position of the pedal reversed, the cylinder pulls to apply the brakes.

Except on trailers of welded construction, a two-wire electrical circuit to the tail, clearance, and stop lights probably will do the best job. The hot side can be taken off the car taillight and the other side grounded. On the trailer, hook up the stop light through the master-cylinder switch so it will operate when the brakes are applied.

A little practice will show how much vacuum is needed to apply the brakes evenly. Smoothest action is obtained by pulling the hand valve a short distance, releasing it, and then pulling again. Full vacuum will usually slide the wheels. When parking with the engine shut off, it's probably wise not to count on the trailer brakes, though this one has held full vacuum for as long as 45 min.—*Charles T. Pearson, Chicago.*

Simple Light Checks Timing

HERE'S a simple timing light that will help you check and adjust the setting of distributor points. It also serves as a handy trouble light.

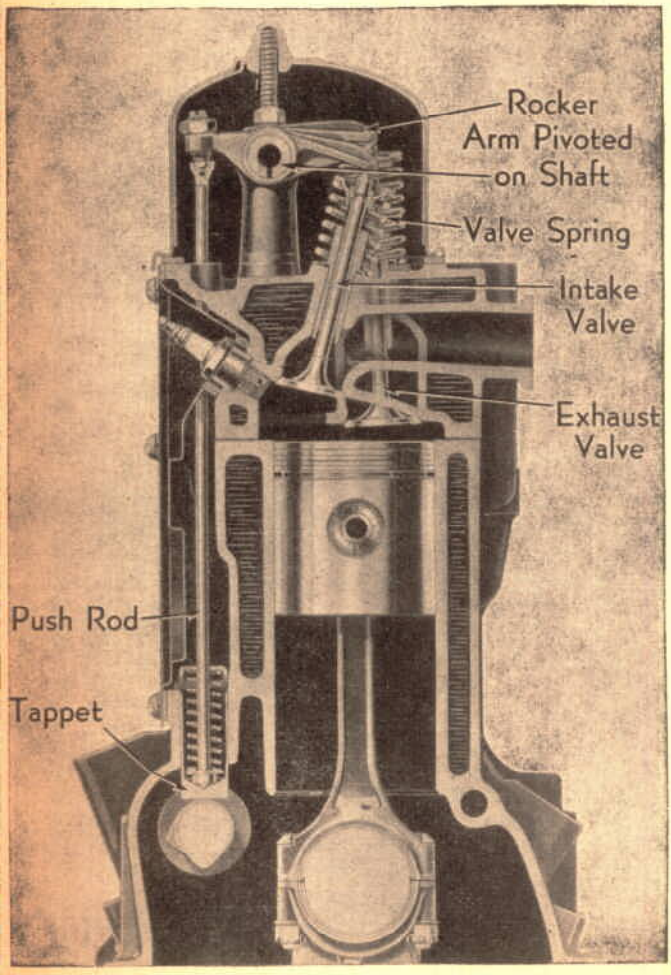
It was made by soldering the socket of a single-contact parking-light bulb to the pivoting end of a storage battery clip. One end of a 6' length of insulated wire was then attached to the socket and the other to a small battery clip. It may be used for timing by attaching the small clip to the low-voltage distributor terminal and clipping the bulb in a place where it will illuminate the flywheel timing mark as it flashes on. This will enable you to rotate the distributor body as required.—*John M. Avery, Delhi, N. Y.*

Good Valves Give Engines

THESE HARD-WORKING PARTS TAKE A BEATING EVERY TIME YOU

EVERY time you drive for one hour at 40 m.p.h. in an eight-cylinder car the 16 valves open and close 840,000 times. Your exhaust valves are exposed momentarily to temperatures as high as 3,800 deg. F. and operate normally at cherry-red heat.

And yet, a dripping faucet, which is also a valve, is apt to get attention more quickly —for you can *see* the faucet dripping. Waste because of pitted valve faces or faulty operation is just as pernicious, but frequently it is not apparent to the automobile owner until his motor begins to run erratically. Serious trouble can often be nipped in the bud, and fuel can be saved, by having your engine "stethoscoped" twice a year by a competent repairman whose shop is equipped with a motor analyzer. If attention should be required then, fewer replacement parts will be necessary if you are warned in time.



Both valves are over the cylinder in an overhead-valve engine, as shown here. On the facing page is an L-head engine valve assembly

You can make a quick check yourself by hand-cranking your engine. Valves that seat fully will hold the fuel charge and cause the crank to bounce back or rock as the engine is turned over. If resistance is lacking on the compression stroke, there is a leak—it can be heard usually as a hiss, and unless this hiss is in the breather, which indicates a leak past the piston and rings, it will mean a faulty valve.

Test with the hand crank on the compression stroke of every cylinder, and if any valves leak, they should be inspected. Punch holes in a piece of cardboard to accommodate the valves as they are removed, numbering the holes so the valves can all be returned to their original openings.

Clean off all carbon and burned oil and examine each valve carefully. Look for pitting and uneven wear on the valve faces, check the stems and their fit in the valve guides, and test the valve springs.

Excessive wear in either the valve stem or guide will make it impossible to obtain a tight seat by grinding unless a new guide is provided. In a very bad case, both the valve and guide may have to be replaced. Too much clearance in an intake guide admits air and oil into the combustion chamber and results in upset carburetion, increased oil consumption, and heavy carbon deposits. Sloppy exhaust-guide clearance causes misalignment and bad valve seating with rapid wear on both the valve and seat. In the absence of the manufacturer's specifications,

Extra Punch

STEP ON THE GAS

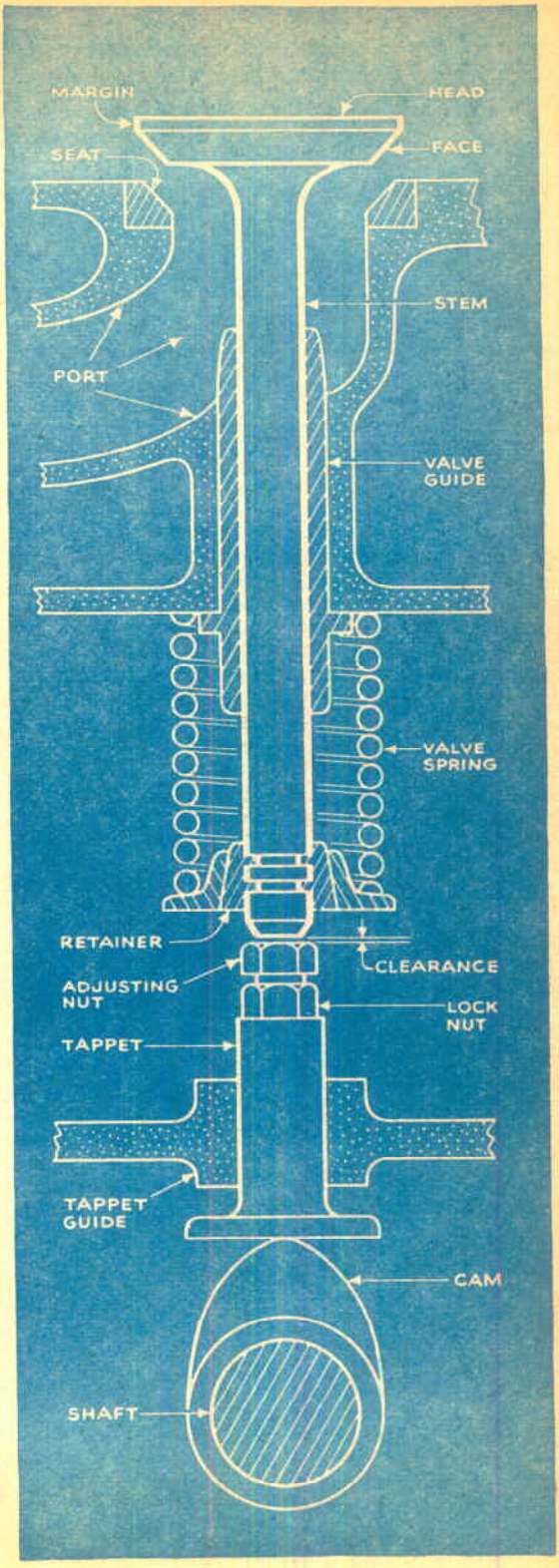
which should be followed exactly if available, replace any guide or valve that produces sidewise movement beyond that which is barely perceptible.

Valve springs should be tested for uniform length and correct tension. If available, a regular valve-spring tester should be used, but fairly accurate results can be had by standing the springs on a level surface and holding a straightedge across the tops to determine irregularity in height. Unequal or cocked valve springs will undo in the assembled job all the good work that has been put into it. Valve-spring tension that is too weak allows a valve to flutter, while tension that is too strong causes what is known as "stretched" valves.

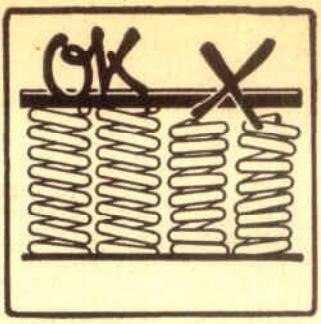
Inlet valves, admitting gas instead of providing an exit for hot flame, do not pit as badly as exhaust valves and rarely need grinding. A valve that leaks compression can usually be ground successfully if it is not burned or warped and if there are no ridges or shoulders on its seat. Burned or warped valves should be refaced with a refacing machine, and ridged seats require reseating with a reseating reamer.

Grinding is done by smearing the face of the valve with a grinding paste or compound and turning the valve back and forth in its seat until the roughness is worn down. This can be accomplished with the aid of a valve grinder—a tool similar to a hand drill, but provided with prongs that fit into the slotted top of a valve or with a suction cup that grips a valve with a smooth top surface. Grinding may also be done by hand, that is, by turning the valve stem.

When grinding, turn the valve back and forth until both valve and seat show a bright ring about 1/32" wide all the way around. Clean the valve and seat occasionally when using the hand method to see how the grinding is progressing. It is generally helpful as a guide after the pits have disappeared to clean the valve and seat and to place about eight equally spaced marks with a soft-lead pencil on the valve seat. A quarter turn of the valve



To be ground successfully, valves need a definite margin. A knife edge causes breakage and burning



Use one new spring, if possible, when checking length and tension with the aid of a straightedge

A valve seat should be narrower than the face, for if it is too wide it tends to collect carbon

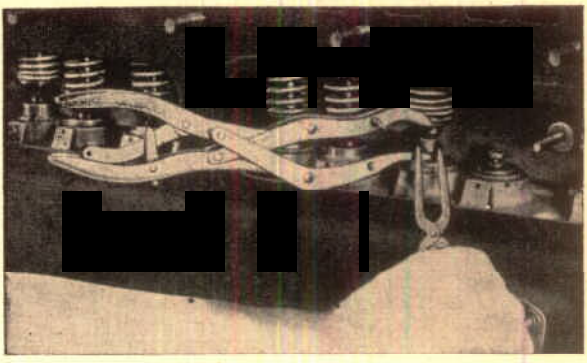
should then rub each pencil mark. If any marks are untouched, continue grinding.

Be sure to remove all traces of abrasive matter from the valve chamber and ports when the grinding has been completed. Then oil the valve stems and *reassemble each valve in its own opening.*

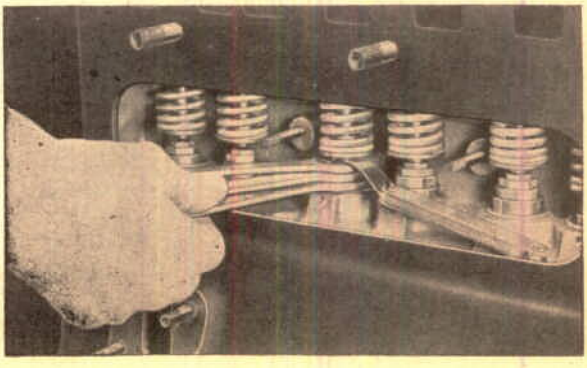
Some cars have insert rings as seats for exhaust valves. They seldom have to be replaced unless they become loose or are rendered useless by some abnormal engine operation. Loose rings are easy to remove, and others may be cut away with a drill and chisel. Use a bit with a diameter smaller than the width of the insert ring and drill a hole at two opposite sides, being sure not to drill all the way through as this may damage the recess. The undrilled portion can be cut with a chisel so that the ring can be removed in two pieces. A new insert ring should be packed in dry ice for at least 15 minutes before installation so that it will contract enough to be pressed into the recess. If a recess has been worn, an oversize insert can be obtained.

After reassembly, adjust the tappet clearances according to the manufacturer's specifications, which may be stamped on the valve cover plates. Unless directed otherwise by these instructions, warm the engine for about 20 minutes to attain normal operating temperature. Since exhaust-valve clearance is usually greater than intake, you can avoid confusion by adjusting all of one kind first and then the other.

For certain cars adjustments can be made only by grinding the valve stem. To do this, drop each valve into its opening before assembling the guides and springs, and rest the tappets on the heels of the cams on the camshaft. Slip a feeler gauge between a stem and tappet and, if there is insufficient clearance, remove the valve and grind the end of the stem carefully until the desired clearance is obtained.

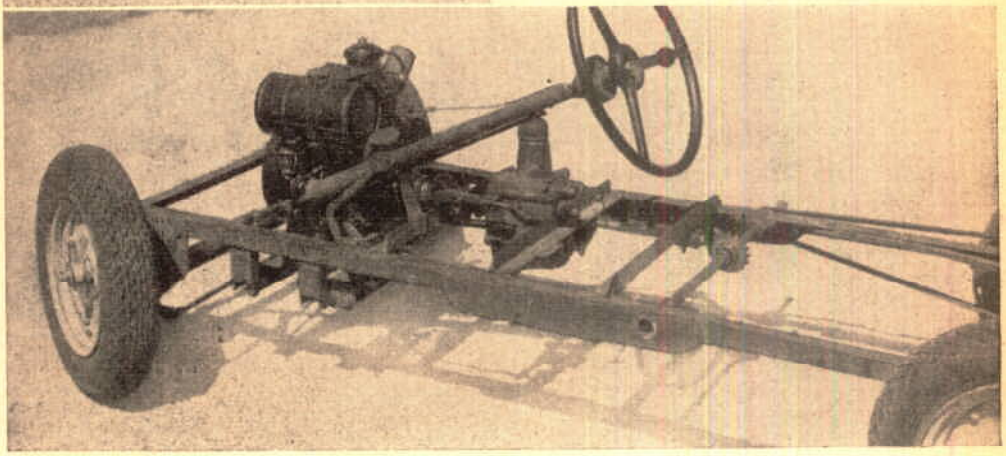


Use a valve-spring lifter to compress the spring when removing a spring retainer in an L-head engine. Pincers are needed to grip the retainer to avoid endangering the fingers. Below, a feeler gauge measures the clearance between the tappet and valve stem. The wrenches fit the lock nut and adjustment nuts



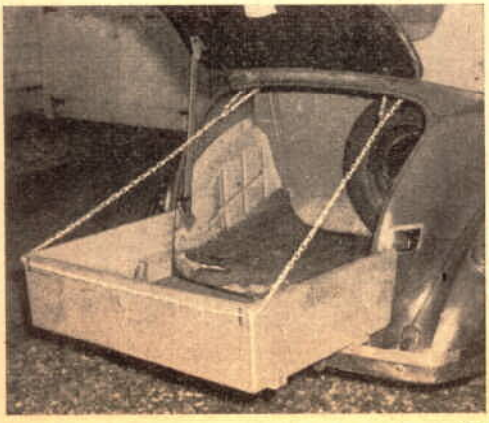
Play Car Teaches Young Driver

To TEACH his son to drive, L. S. Robbins of Chickasha, Okla., built a play car for him with a gearshift, clutch, brake, and foot throttle that work like those in a big car. Robbins used a 1½-hp. Cushman motor, a V-belt clutch, a Model-A transmission, and a drive shaft brake from a Plymouth. Tires are 4.00 x 16. The body is an aluminum airplane fuel tank. The car's top speed is 15 m.p.h.—plenty fast for a beginner. Rear wheels are belt-driven, and slight belt slippage eliminates need for a differential.



Extension Hauls Big Loads

WITH the trunk extension shown below, you can easily carry bulky loads. Made of 1″ by 12″ boards with a plywood bottom, the box rests on the bumper. The bumper guards stick up through holes in the bottom, keeping the box in place. Chains with snap fasteners support it as shown. Cleats on the side make it easy to lash a tarpaulin in place.—*Karl Greif, Binghamton, N. Y.*

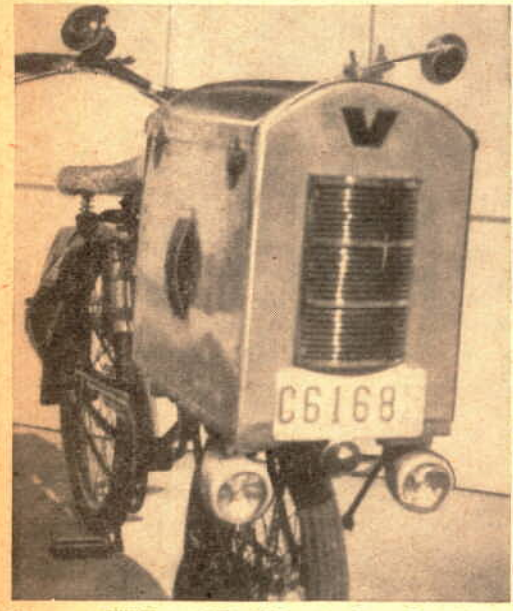


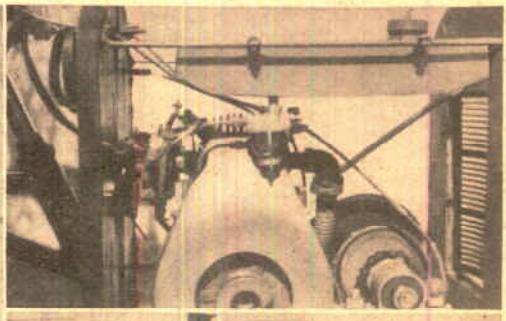
Car Carries Roof-Top Bed

ON TRIPS, Carl M. Miller, of Zion, Ill., never has to worry about hotel reservations. He carries his bed on top of his car. Made of ¾″ plywood, the platform is 4′ wide and 6′ long. The folding framework for the canvas tent and the ladder were formed from ½″ rigid conduit. The windows are plastic screening, and the window flaps are controlled from inside. The job cost $48.47.

CRAFTSMEN ON WHEELS

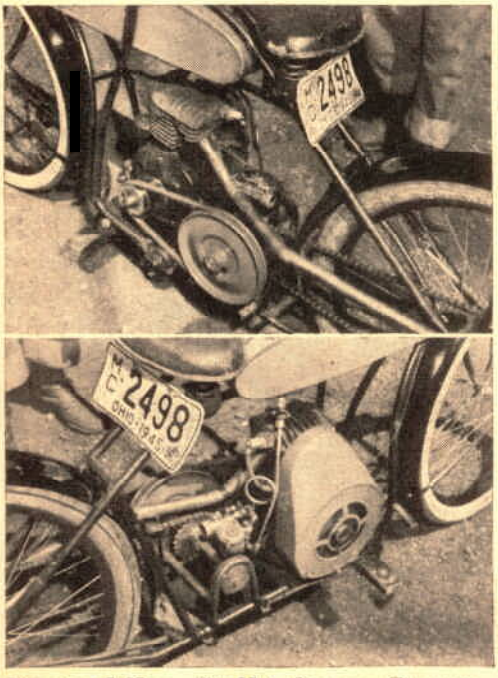
Scooter Has Three Speeds. Before becoming a cadet-midshipman at the US Merchant Marine Academy, William R. Kern welded some ¾" pipe, added a few gears, chains, and a 1½-hp. motor, and came up with the two wheeler shown above. It carries him 80 miles on a gallon of gas at an average speed of 30 m.p.h. A V-belt the tension of which may be varied by an idler pulley acts as a clutch to engage the three-speed transmission. The latter transmits power to the rear wheel through a chain. Gears were cut on a milling machine and hardened.



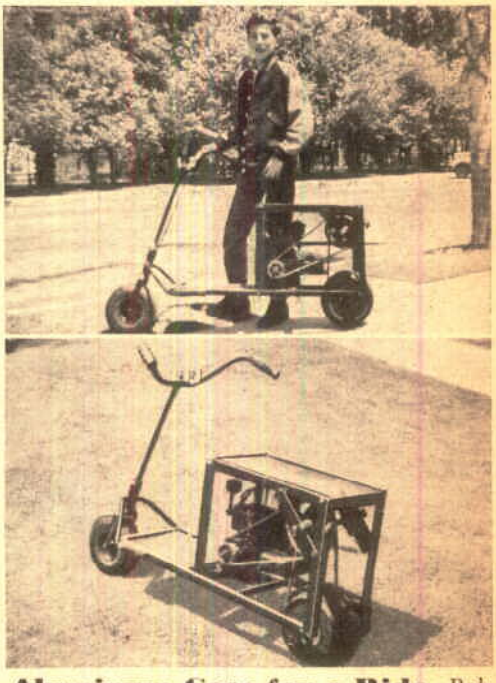


Front Wheel Is Motorized. Using a standard bicycle as a base, Dr. William S. Voorhees constructed this unique front-wheel driven motorbike. In addition to the 2-hp. engine, the front housing holds a 1-gal. gasoline tank—enough for 120 miles. The motor is connected through a belt and a ball-bearing idler pulley to a countershaft which is geared to a sprocket on the front wheel. A brake on the countershaft is actuated by a handlebar lever; with this and the coaster brake, both wheels have braking action. Speeds from 6 to 42 m.p.h. may be obtained, and the bike is said to be quite stable on turns as well as straight runs. The speedometer works off the rear wheel.

Scooter Takes Hills Easily. Employing a reduction of about four to one from motor to driven wheel makes this little scooter an excellent climber. Since it uses a 2.3-hp. engine, it still has enough power to cruise at 35 m.p.h. The Rev. J. Karlton Dewey, who built the machine, used ½" water pipe for the frame and welded all joints. Fittings are made from flat and angle iron. Clutch action is obtained through a jackshaft located just behind the motor. The shaft, which swivels in a horizontal plane, is moved by a pedal to slacken or tighten the drive belts in operation.

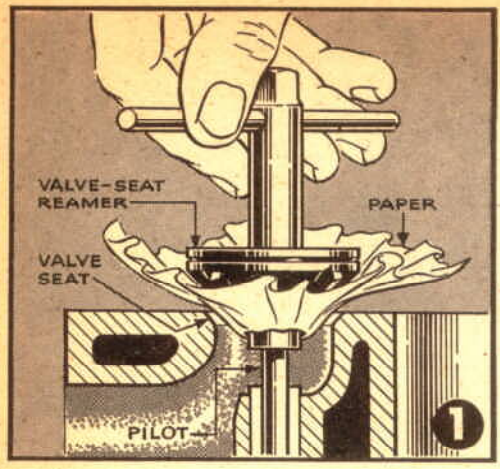


Motorbike Built from Scrap. Cast-off parts that he found lying around his father's machine shop became the raw materials for Robert Barr's lightweight motorcycle. A washing-machine motor, to which he added a carburetor for smoother performance, gives Barr a top speed of better than 40 m.p.h. Wheels, front assembly, and coaster brake were salvaged from old bicycles, and additions to the frame were made of ¾" gas pipe. Drive pulleys and chain sprockets give a ratio of 6 to 1.

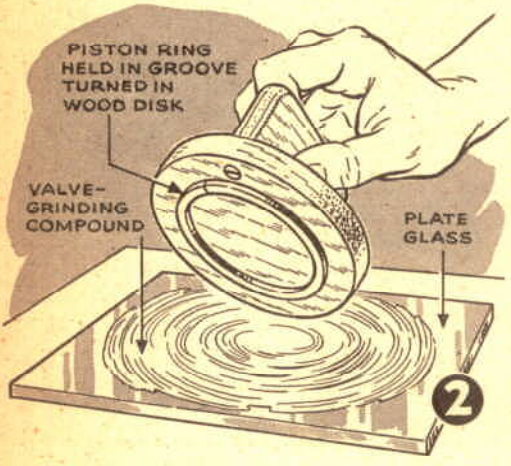


Aluminum Goes for a Ride. Bob Wurgaft gets a top speed of 25 m.p.h. from his aluminum-framed scooter. It uses a ¾-hp. washing-machine motor whose action simplifies the design. For one thing the machine needs no clutch because it starts readily with just a slight push; the brake was also omitted since it was found that motor compression stopped the wheels quickly after the motor was shut off. With two passengers a cruising speed of about 15 m.p.h. is obtained.

Hints From the



1. Stopping Chatter. If you have to ream a valve seat by hand, here's a trick that has been useful in the Model Garage. Slip a piece of thin paper over the pilot and ream right through it with short, quick turns. This will prevent the vertical ridges or chatter marks that sometimes ruin jobs of this kind.

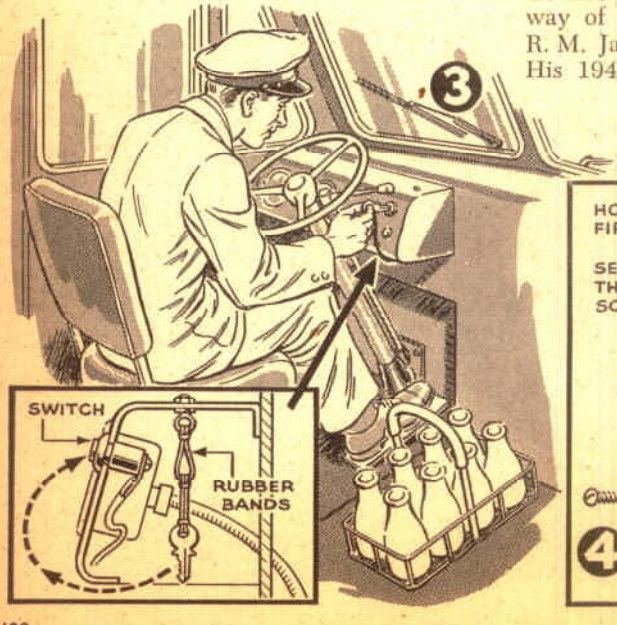


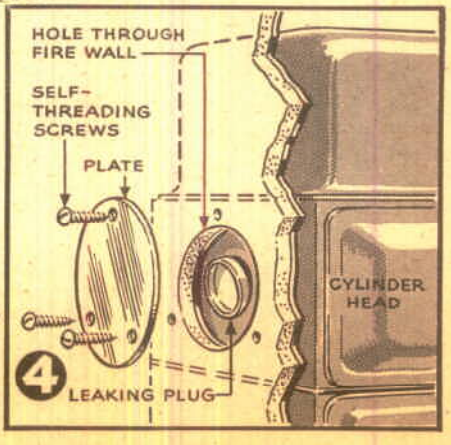
2. Ring Sized in Jig. Piston rings that are oversize in width can be ground with this jig. Saw out the disk and turn a groove in which the compressed ring will partially fit.

3. Ignition Key Hidden. A milkman must often go out of sight of his truck while making deliveries. Rather than invite theft, one driver pocketed his ignition key each time that he left. But it was always a nuisance to fish around for the key when he returned. He has now solved the problem by fastening the key behind the instrument panel with a rubber band. This keeps it hidden, but always at hand.

4. He Kept His Head On. An easy way of doing a tough job was found by R. M. Jackson, Jr., of Patuxent River, Md. His 1941 Buick developed a leak in the

Drawings by Stewart Rouse





Model Garage

freeze-out plug at the back of the head. The repair job threatened to be long and costly, because the closeness of the fire wall seemingly meant that the head had to be removed. Instead, he cut a hole in the fire wall and had the job done in minutes. A plate closed the hole.

5. Getting Back Lost Plates. Erich Dallmer, of Narrowsburg, N. Y., suggests painting your name and address on the back of each license plate. It's a fine idea, and costs less than a replacement.

6. Wrenches Kept Together. Tired of hunting through his tool case for a needed box wrench, Arthur E. Nordhoff, of Seattle, made a large "safety pin" from a clothes hanger. This keeps them all at hand.

7. Lock Protects Motorcyle. This rig, writes Ivan J. Stretten, of Detroit, will both lock a motorcycle and prevent it from rolling off the stand. The slot in the arm lets you stow the arm in the tool box when it's not in use.

8. Clamp Added to Light. A spring clamp of the kind used on photographic lights lets you clip a trouble-shooting lamp in practically any desired position. H. Zave, of Chicago, makes the suggestion.

Gus Wilson