A robot doorman you can build without vacuum tubes or a radio technician's diploma.

This Button on the Dash Opens Garage Doors

Service at your finger tips. Push this button in the car either to open or close the garage . . .

By J. Raymond Schneider

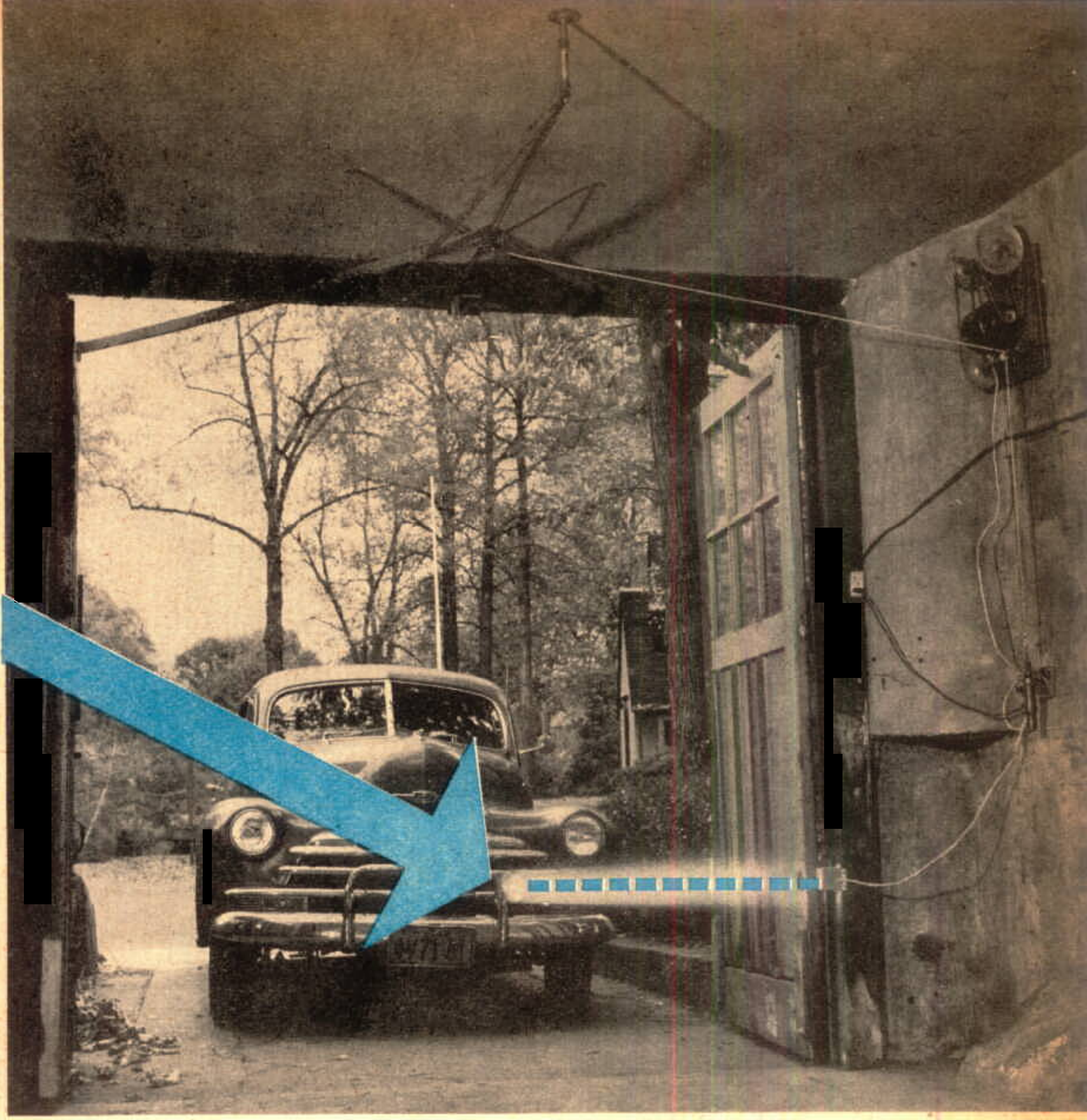
DOES your motoring day start like this? Open the garage doors. Get in the car and back it out. Climb out, make a detour around the front fender, and close and latch the doors. Dodge the fender again and get in. On returning, reverse the whole routine.

That's how I used to do it.

Today I walk into my attached garage from the house and touch a button. While the doors open, I get in the car. After backing it out, I pause long enough to touch a second button, under the dash. A spotlight on the car winks—and the doors close.

They lock, too. You can't get in from outside unless you have a key or drive up in my car. Headlights or an ordinary spotlight won't work. The rig takes no juice when it's standing by, because there are no vacuum tubes to be kept hot. But when I get back from a trip, whether in minutes or a month, it opens the doors at a touch of the button.

The dash button sends juice to the light and to a magnet that pulls a thin spring or reed on which a contact is mounted. This



. . . And a spotlight winks rapidly, exciting a photo cell that starts an automatic operating cycle.

breaks the circuit until the reed, released, closes it again, just as in a doorbell. Thus the light blinks at the reed's frequency.

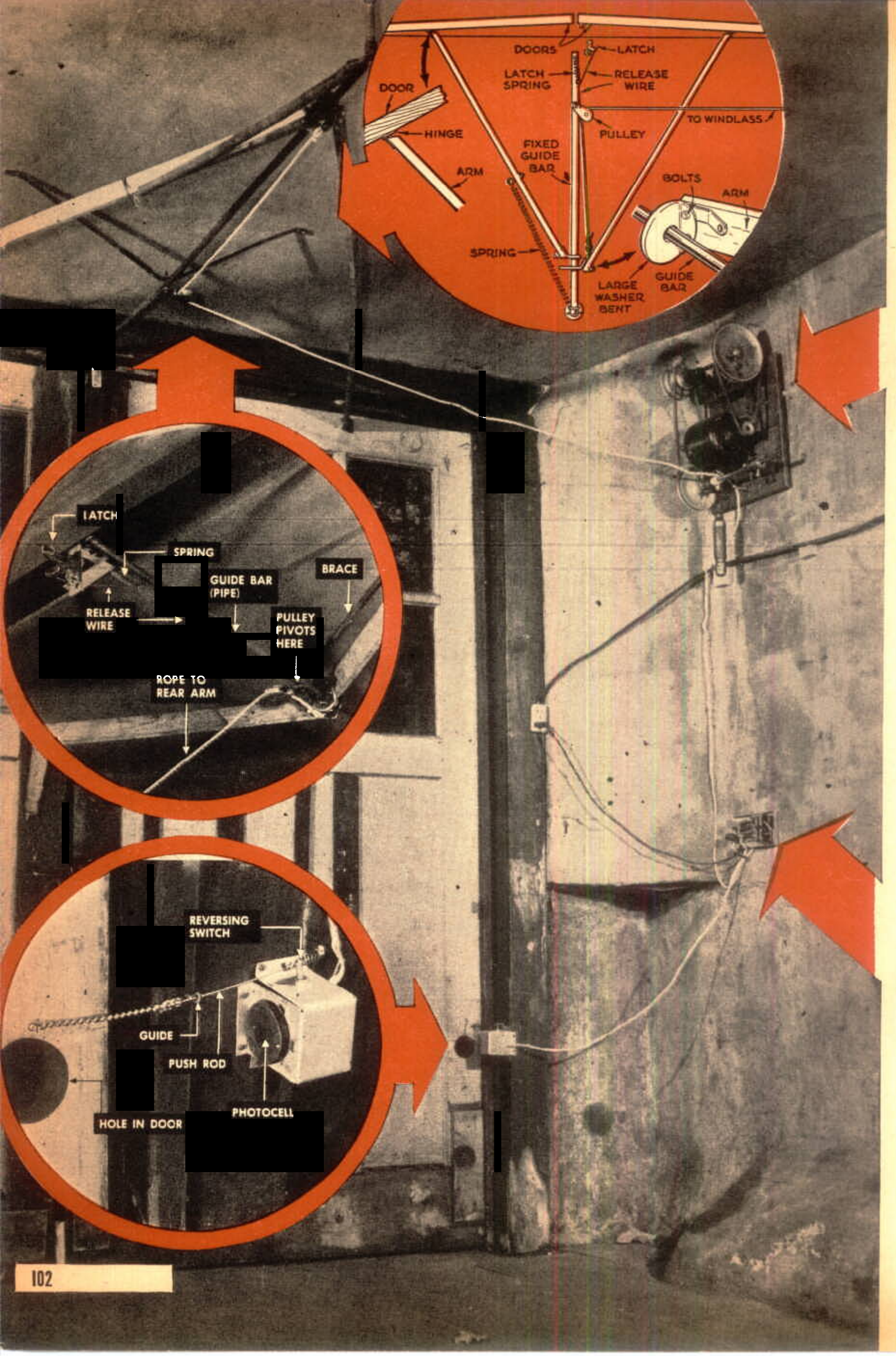
As the beam hits a photo cell on the garage, this generates a pulsating current that is fed into a coil of fine wire fixed on another, similarly tuned reed and poised over a permanent magnet. The current vibrates the reed at the same frequency, until it swings far enough to touch a contact that closes a 115-volt relay and starts the door mechanism.

A steady light, or one of the wrong frequency, will agitate the resonant reed but won't swing it far enough to make contact.

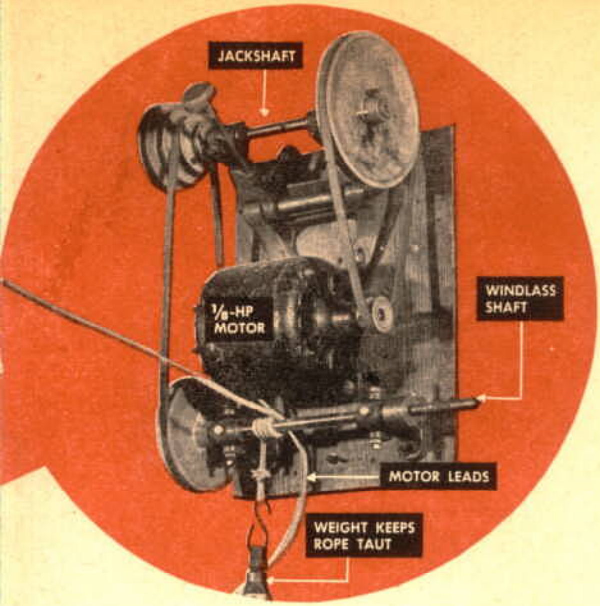
Power unit. A ⅛-hp. motor is the muscle that moves the doors. It's belted through a jackshaft to run an output shaft at about 175 r.p.m. Plain pillow blocks will serve instead of the adjustable jackshaft and self-aligning bearings shown.

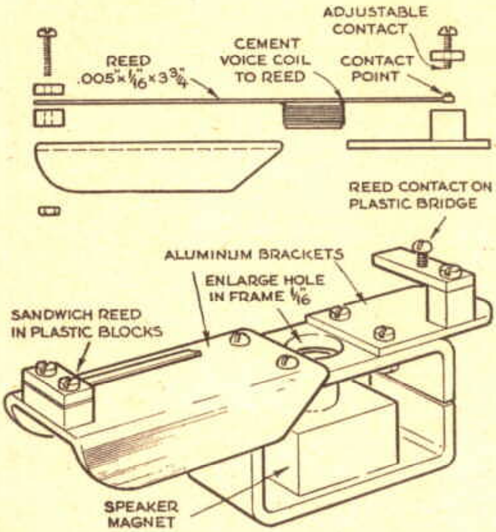
The rope that pulls the doors is simply looped four times around the windlass shaft and tied to a weight that hangs close to the wall. This gives plenty of traction but will slip if something jams.

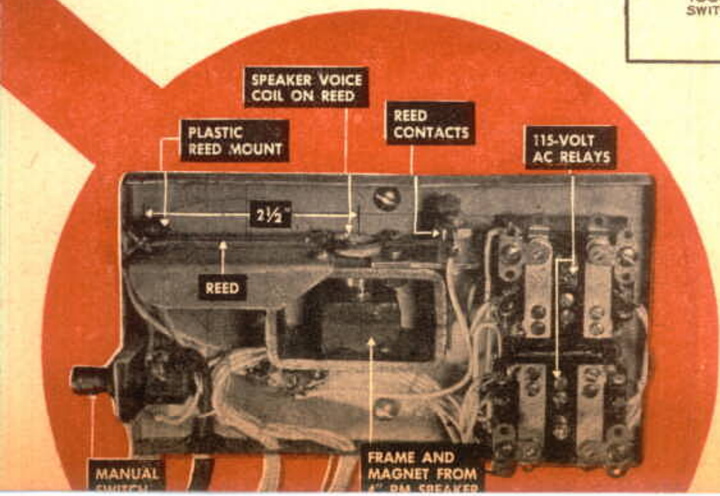
Door linkage. A piece of pipe set in ➡



DOORS
LATCH
LATCH SPRING
RELEASE WIRE
DOOR
HINGE
PULLEY
TO WINDLASS
FIXED GUIDE BAR
ARM
BOLTS
ARM
SPRING
LARGE WASHER BENT
GUIDE BAR
LATCH
SPRING
GUIDE BAR (PIPE)
BRACE
RELEASE WIRE
PULLEY PIVOTS HERE
ROPE TO REAR ARM
REVERSING SWITCH
GUIDE
PUSH ROD
HOLE IN DOOR
PHOTOCELL







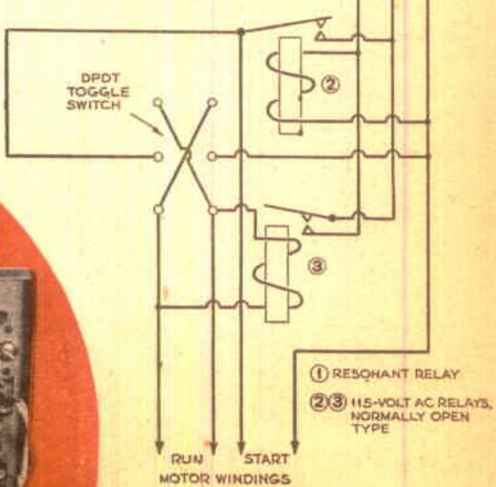
the center of the door lintel is fastened by an elbow and a short length of pipe to the garage ceiling. On this slide two large, loosely fitting washers bent to an angle along one side and bolted to wooden thrust arms.

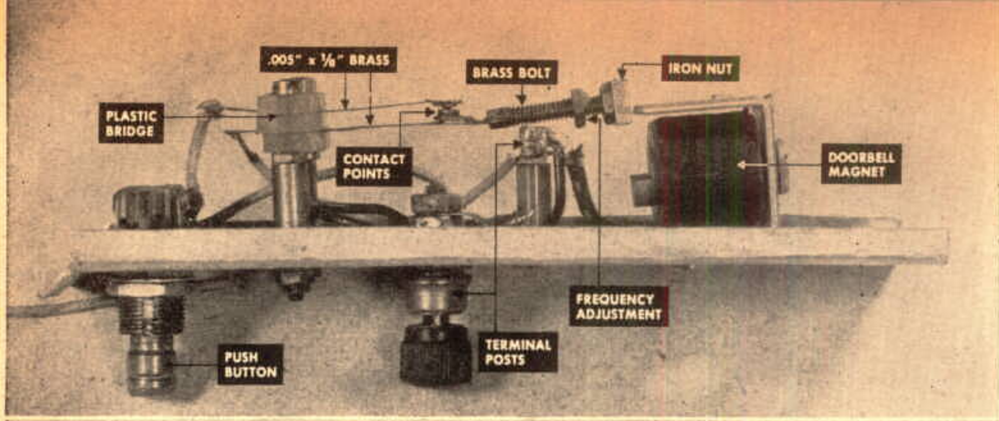
One washer necessarily slides behind the other. The rope from the power unit is fastened to the rear washer. As this is pulled forward, it pushes the other before it.

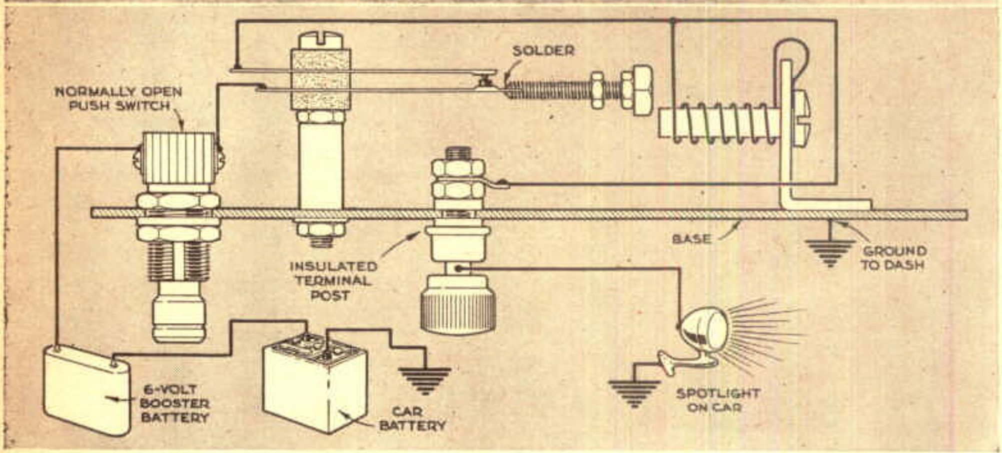
The wooden arms are pivoted on the doors by small hinges. A long spring holds the forward thrust arm back against the other thrust arm, so that the two move back together as the doors close. This spring is not powerful enough to drag the rope around the windlass and lift the weight. Thus the doors stay open until the motor reverses.

Any devices for holding the doors open must be removed. The center latch that secures one door shut is wired to a pivoted pulley over which the windlass rope runs. Being attached forward of the pivot point, the latch wire is tripped as soon as the rope pulls. A lock on the latched door enters a strike on the other, locking both.

Reversing switch. This is a double-pole, double-throw toggle switch of a rating high enough to handle the motor current. It's mounted on the door jamb atop a box that also houses the photo cell. ➧







A hole is drilled through the toggle arm parallel to its throw. A stiff wire through this is fitted with two stop collars and a spring, goes through a guide eye in the jamb, and is fastened to a small chain attached to the door. Proportion the wire and chain so that they snap the switch forward just before the door is wide open. This will stop the motor by opening the circuit for an instant, thus opening the power relay, and at the same time reverse it for the next half of the cycle. Set it so the door hits the end of the wire and flips the switch back just before it's fully closed.

Photo cell. This is an inexpensive selenium barrier-layer type, which generates a minute current when light strikes it. Bore a hole in the door for the light beam.

Spotlight blinker. This unit, which goes in the car, has a reed—a thin metal strip—that is vibrated by an electromagnet. Contacts on the reed open and close both spotlight and magnet circuits. The reed and its upper contact strip are sandwiched between plastic or fiber strips bridging two bolts. Contact points from an old relay or vibrator are soldered on. Adjust the reed, by turning the nut at its outer end, to vibrate six to eight times per second.

Since the spotlight current is intermittent, around 12 volts must be supplied to the 6-volt bulb to bring it up to full brilliance for exciting the photo cell. The easiest way to do this is to hook a 6-volt dry battery or four large dry cells in series with the car battery. The light is on only a second or two at a time, so they should have long life.

Resonant Relay. Triggered by photocell current, this is the control center in the garage. The permanent magnet of a junked 4" radio speaker was pried out of its bracket so that the bracket hole could be filed to a free fit for the voice coil. Then the magnet was cemented in place again. The reed itself forms one voice-coil connection; use fine wire for the other.

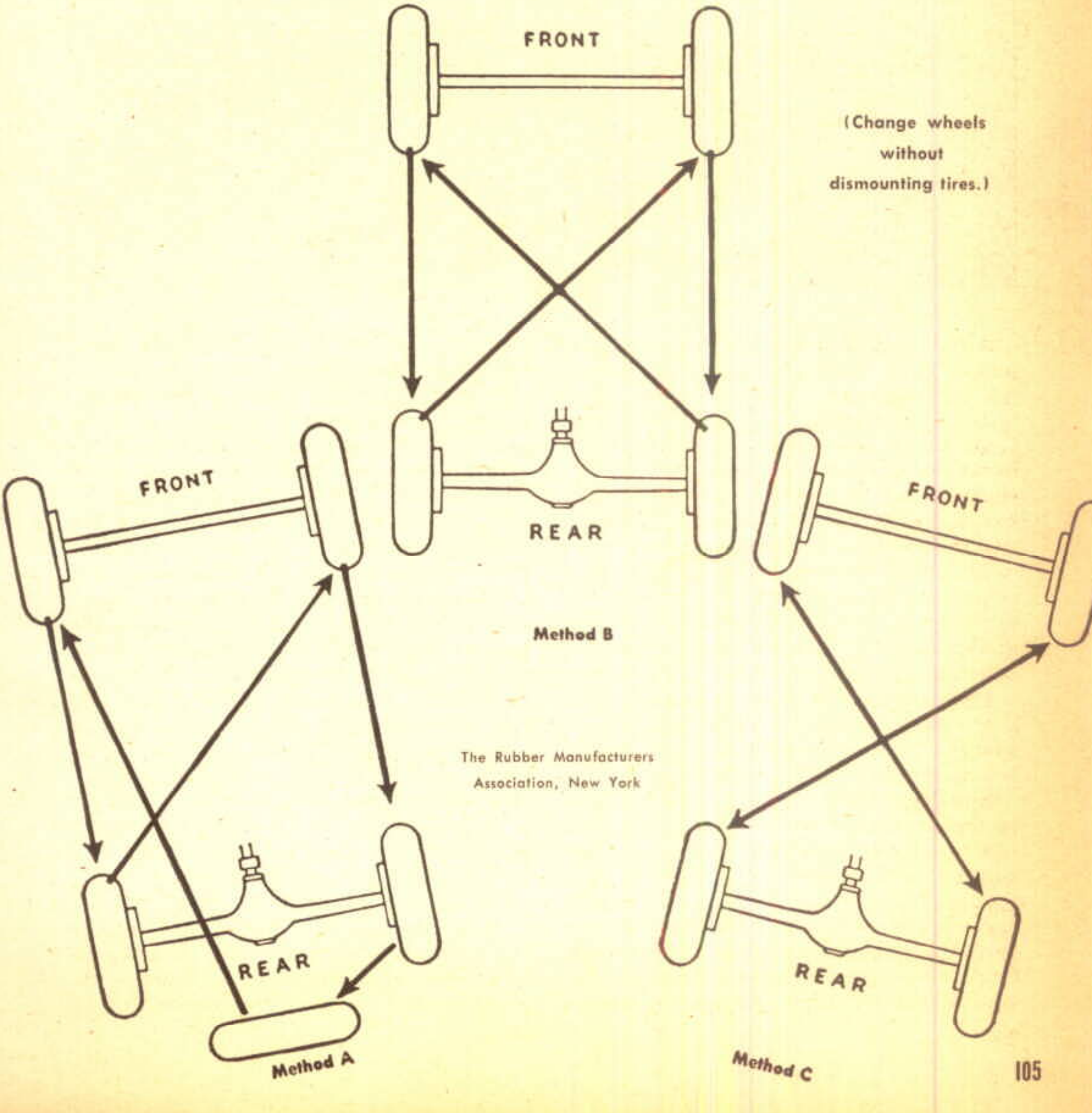
Adjust the reed to the same frequency as the blinker on the car by observing the reed in the spotlight beam, preferably at night, while tapping the reed with a finger. When in tune, the vibrating reed should appear still or nearly so because of the stroboscopic effect of the blinking light. Tune it by adding solder, or adjust the blinker reed.

Wiring. Remember the motor must turn to close the doors with the reversing switch flipped toward the door. Should you wire it backward, just loop the rope the other way on the windlass shaft.

You can adjust the resonant-relay contact so that the photo-cell current closes it in from a tenth to a full second. Half a second is about right. Closer adjustment may make the relay too sensitive to shock and vibration.

The reed contacts activate relay 2, which then sends current into the reversing switch. Besides starting the motor, this energizes relay 3, whose contacts shunt those of the reed and hold relay 2 shut after the reed stops. As the doors reach the end of their travel and flip the reversing switch over, the toggle throw cuts current to relay 3 momentarily, which opens relay 2, leaving all at a standstill until the resonant relay or garage button starts a new cycle. This button can be placed wherever convenient. END

Three methods for rotating tires . . .

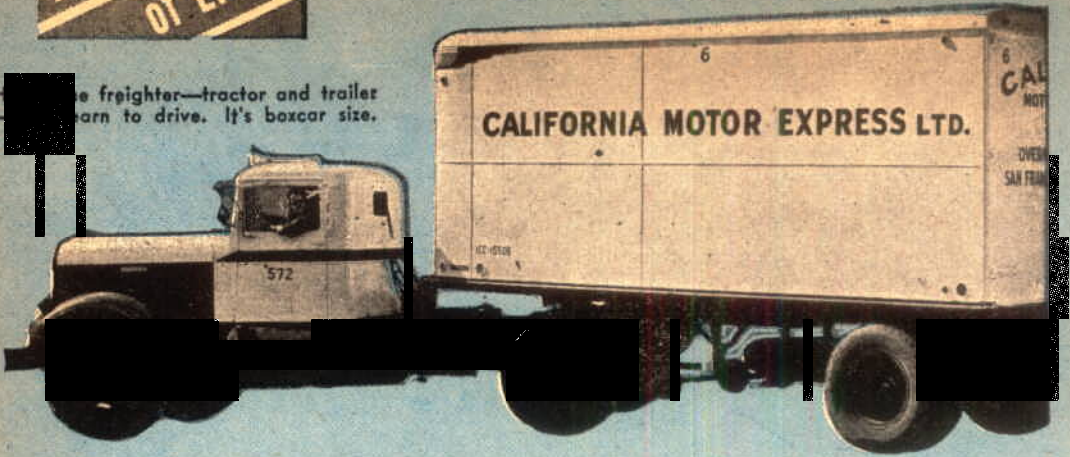


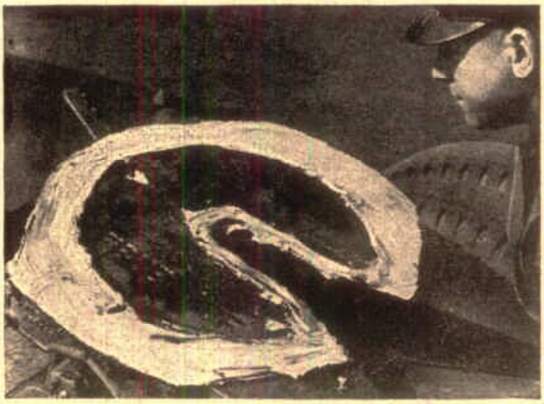
The Rubber Manufacturers Association, New York

Mechanics of LIVING

HOW TO DRIVE A

H[redacted]e freighter—tractor and trailer —[redacted]earn to drive. It's boxcar size.



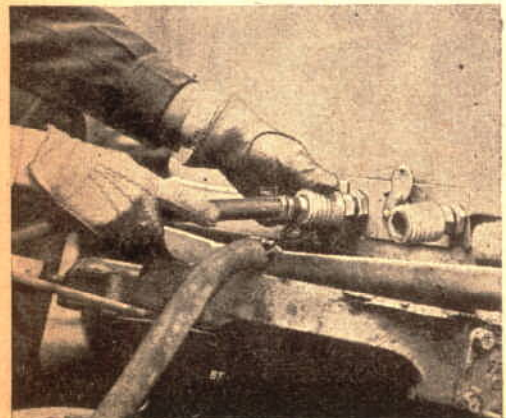


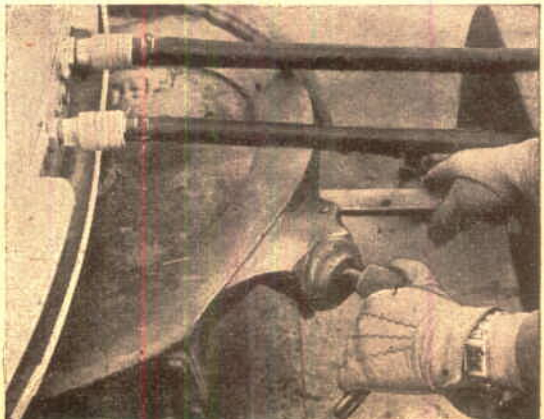
1. Our teacher is Edson Smith, twice world-driving champ. He checks warning flare to be sure it'll work. Rule No. 1: Inspect equipment,

2. Tractor's fifth wheel gets a good going over. It's the baby that carries the front end of the trailer. Tires, fuses, bulbs, brakes are also checked.

3. Next, hoses running from tractor to trailer's brakes are connected. This is a vital operation because load will run amuek unless all brakes hold.

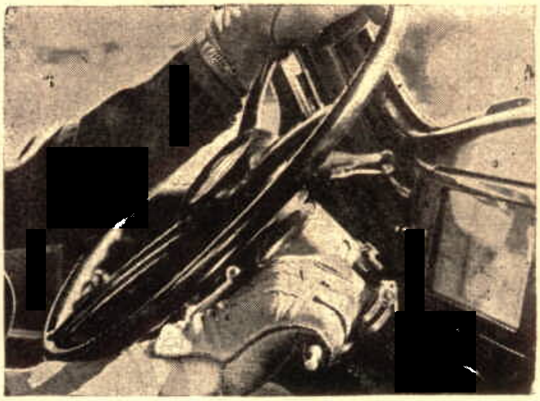
4. Smith pulls auxiliary lever with right hand as his left jerks hook that drops fifth wheel. Next step is to hook up tractor and trailer.



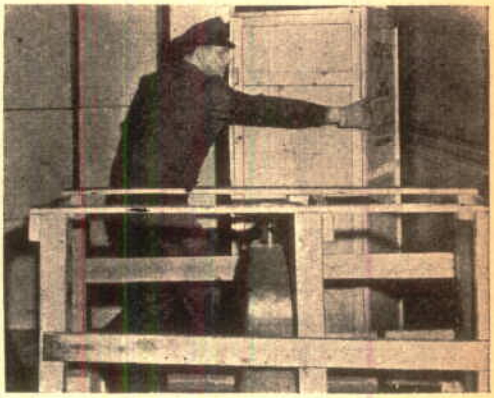


TEN-TON [redacted] TRAILER

5. On the road. Smith is about to "take" the truck ahead. He looks into rear-view mirror, gives arm signal, eases to left, passes fast. When it's slippery chains are used on trailer and tractor wheels.

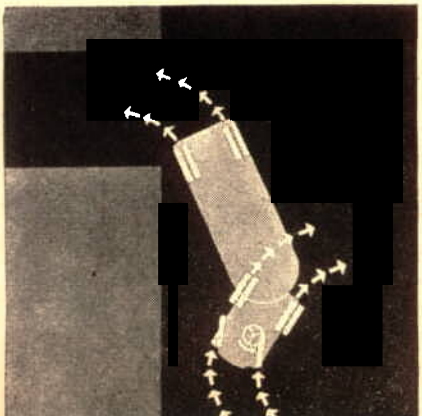


6. To stop, trailer brakes are hit first by pulling lever on steering wheel housing. If tractor brakes were applied first, trailer would fish-tail.

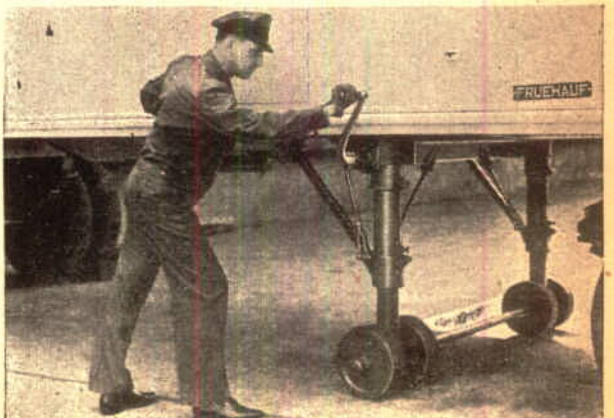


7. Now and then Smith stops and inspects his load. If it has shifted, he redistributes it. An unbalanced, shifting cargo could throw truck on curves.

8. Trip is over and Smith backs into unloading platform off narrow alley. Diagram shows how he stops ahead of target, backs with wheels cramped.



9. Before uncoupling, trailer's supports are cranked down. Huge freighters are seldom in accidents because their drivers know the safety rules.



How Dual-Fuels Pep Up Cars

By R. P. Stevenson

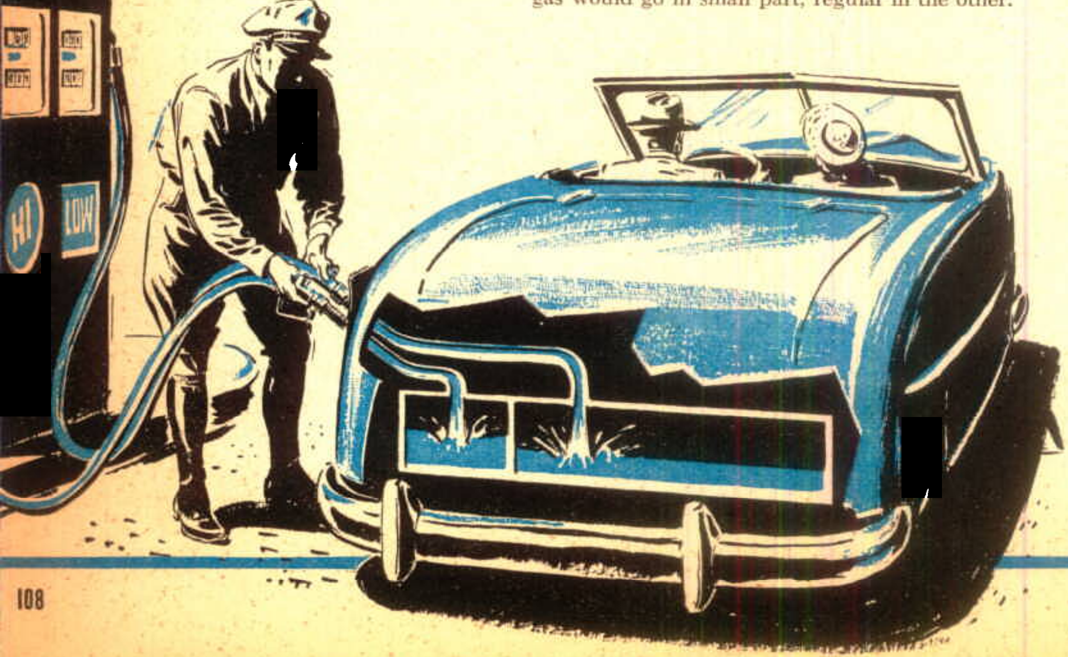
"Octane overdrives" save high-test gas by giving engines peak power only when needed.

YOU'VE been wasting gas. No matter how lean your mixture or how gently you tap the throttle, part of your gasoline dollar has been dribbling uselessly out of your exhaust pipe.

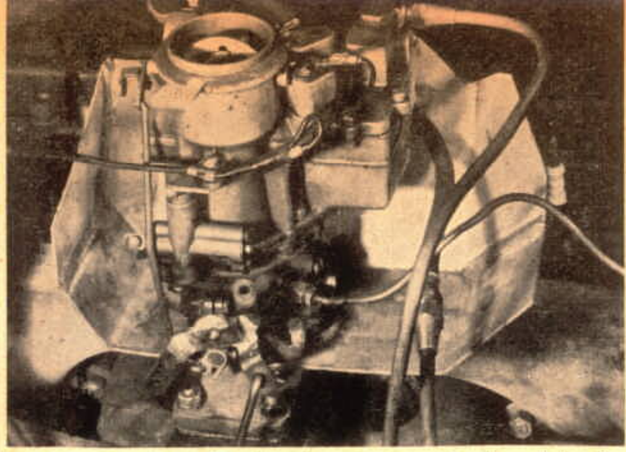
It's not your fault. It's simply that even the best auto engines now made don't take full advantage of the fuel you feed them. They need high-octane quality only a fraction of the time, yet they burn the extra quality all the time.

This wasted *quality* didn't matter when gas was cheap and quality was plentiful. But gas costs more and more. And increased demand—not only for gasoline, but for Diesel and fuel oils—has put a limit on the amount of high-test gas that can be made.

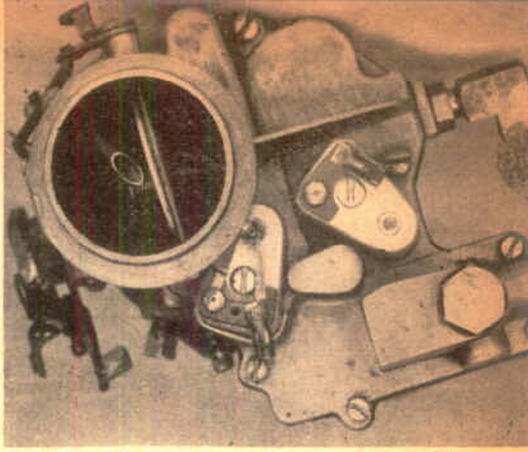
Auto engineers will tell you that engines with almost double present compression ratios are a very practical dream. They offer both efficiency and economy. But the trouble



Fill 'em both up! If dual-fuel systems become common, the tank would be divided. High-test gas would go in small part, regular in the other.



A two-bowl carburetor was developed for the dual-fuel experiments. Here it's installed on a Socony-Vacuum test car. A sheet-metal heat shield prevents vapor lock from exhaust heat.



Looking down on carburetor, you see low-octane inlet at right, the premium inlet above it at upper right. Below circular air horn is solenoid that helps change from one gas to other.

will be to get enough 100-octane to feed them. One such super-engine with a rumored ratio of 12 or 14 to 1 has already been cut to 9 to 1.

Any increase in compression above the present top ratio of 7 to 1 can't come too fast. In the past, it has cost the refining industry millions of dollars to add a single octane number to gasoline. Today costs are even higher. To boost production of premium gas above the present 85-octane also means more steel and crude production.

These are the conditions that have forced some brand-new thinking in automotive circles. Right now, refiners, carburetor and car makers, fleet operators, and others are testing developments ranging from dual-fuel systems to economy gadgets that can be hooked onto present cars.

Some of these developments will have to be engineered into cars not yet designed. Others are now in use in limited areas. All have one thing in common: a way of keeping an automobile on a low-calory diet by giving it a shot of pep only when pep is needed.

When you first start up, when you are going up hill, when you step out on the level —these are the only times your engine really needs the extra octane numbers it gulps all the time. Under average driving conditions, these peaks total only a fifth of the time the engine is running.

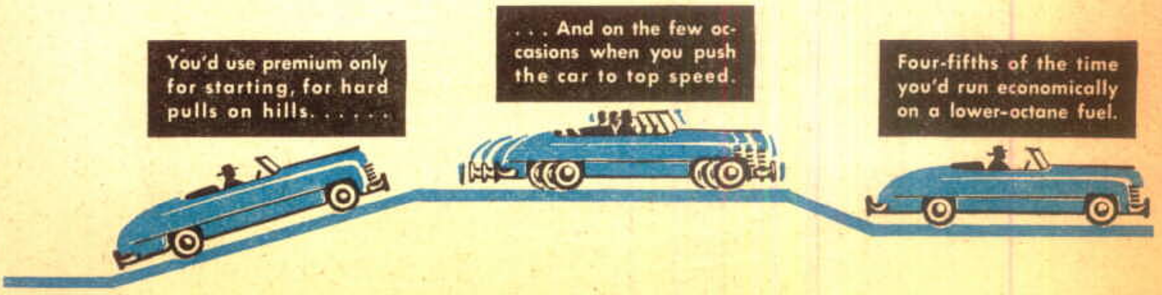
A dual-fuel system solves this problem automatically. You don't do anything but step on the gas. No push-pull, no switch-twist. The Socony-Vacuum experimental car I drove looked—and acted—like any other of the same make. But under the hood there were two complete gasoline systems, ending in a double-bowl carburetor that squirted high- or low-octane through a common jet.

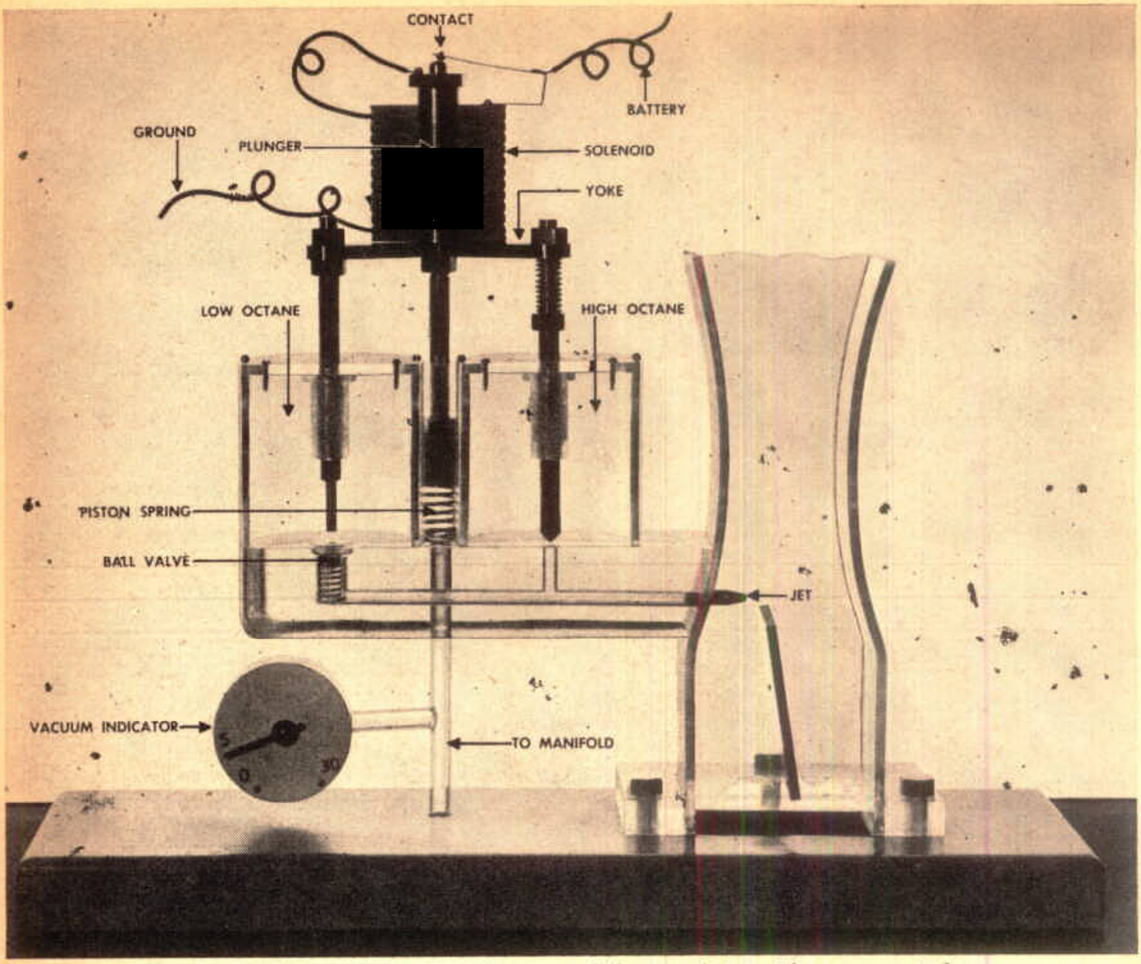
Lights Tell What's Happening

Mounted on a special panel on the dash were two small lights, one green and one red, with a vacuum gauge between. The lights were wired so the green would glow when the engine was using low-octane, red when it was getting premium.

When the motor was started, the red lamp came on briefly, but soon gave way to the green. The red took another turn as I accelerated for the getaway—but not for long.

Very soon we again had the green light, the low-octane indicator, and it remained





This schematic model indicates basic parts of the two-bowl carburetor. An accelerating pump that feeds fuel from the high-octane bowl was omitted for simplicity. The vacuum indicator is merely for illustrative purposes. For operation of the carburetor, see the facing page.

shining as we drove a mile or so at normal cruising speeds.

Then I began putting the system through its paces. After slowing almost to a crawl, I abruptly stepped on the accelerator. The vacuum-gauge needle swung toward zero and the red light came on.

Alternately slowing and hitting the accelerator, I soon had the vacuum needle in a crazy dance and the red and green lights winking.

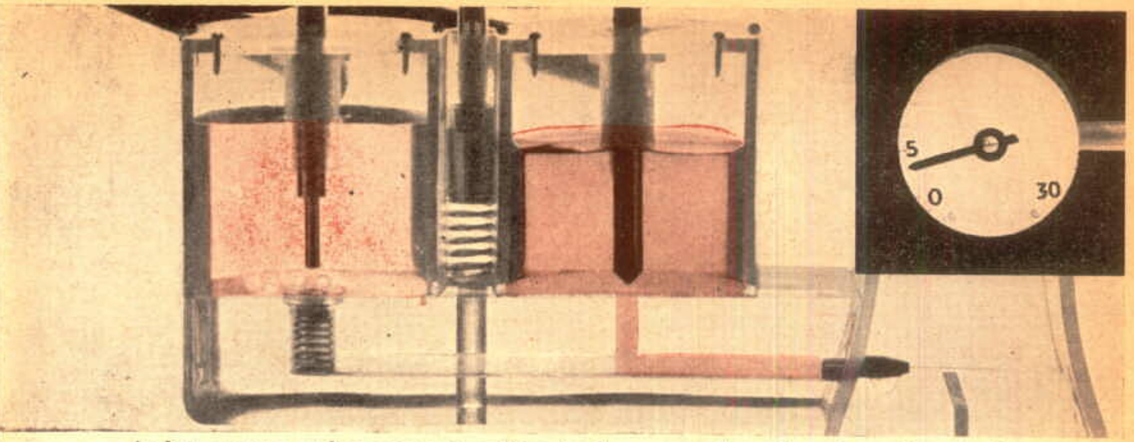
But the engine performed perfectly. When it demanded high-octane gas, it got it. When the lower grade was all it needed, the engine was satisfied. There was no confusing the system. It seemed almost human.

Both Socony-Vacuum and Ethyl Laboratories are experimenting with dual-fuel systems. Results will be turned over to the manufacturers for possible incorporation in the new models you'll be buying a few years from now.

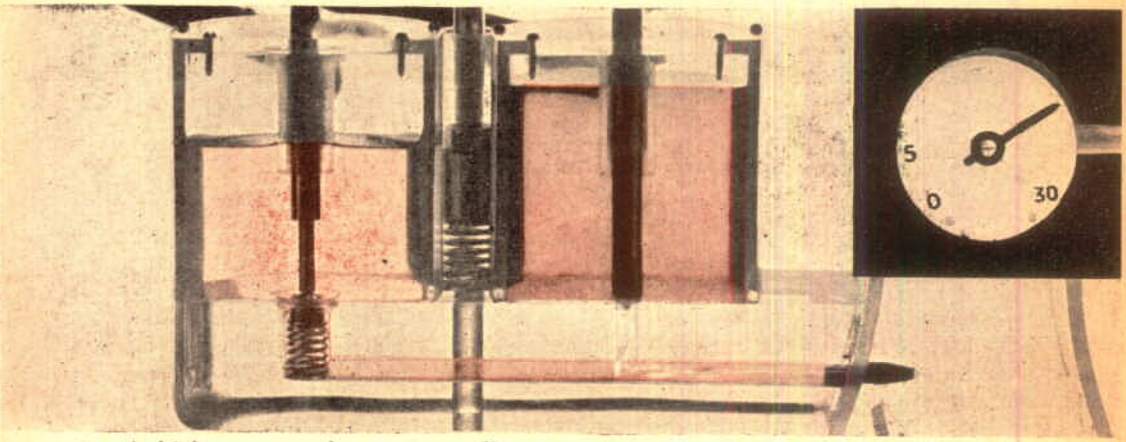
Eventually, if this program works out, you'll drive your new car up to a double pump. The attendant will stick two hoses into your double tank. And for every four gallons of ordinary gas a gallon of premium grade will be delivered.

The heart of the dual-fuel system is a double-bowl carburetor designed by Carter. Up to now, carburetors have been beautiful little machines for precisely measuring out the *quantity* of gasoline demanded by conditions. The new carburetor adds the new dimension of *quality*.

To illustrate the ingenious mechanism by



At low vacuum, when engine is pulling hard, spring has shoved up piston, plunger has closed solenoid contact, and this magnetized coil has snapped up the valve yoke. As shown above, this lets ball valve (left) close and opens needle valve (right). High-octane fuel now feeds engine.



At high vacuum, when engine is idling or running at part throttle, downward pull on piston has overcome spring, opening solenoid contact. Drawn by a second spring, the valve yoke has now dropped down. As shown, this shuts off high-octane (right) and admits the low (left).

which the carburetor shifts from one grade of gas to the other, POPULAR SCIENCE made and photographed an animated model of plastic and brass. Keep your eye on the pictures while we see just how this two-fisted fuel system works.

The changeover from one fuel to the other is instantaneous. A solenoid and a vacuum-operated piston, acting against a spring, do this part of the job. The tension of the spring determines at what manifold vacuum the change will take place. The manifold vacuum is low when the engine is working hard, and high when it is under no strain.

While the engine is stopped, there's of course no vacuum at all. This allows the spring to shove up the piston, closing a contact that leads to the solenoid.

As soon as the ignition is turned on, this solenoid is energized. It immediately draws up a metal plate, opening the high-octane valve and closing off the low-octane.

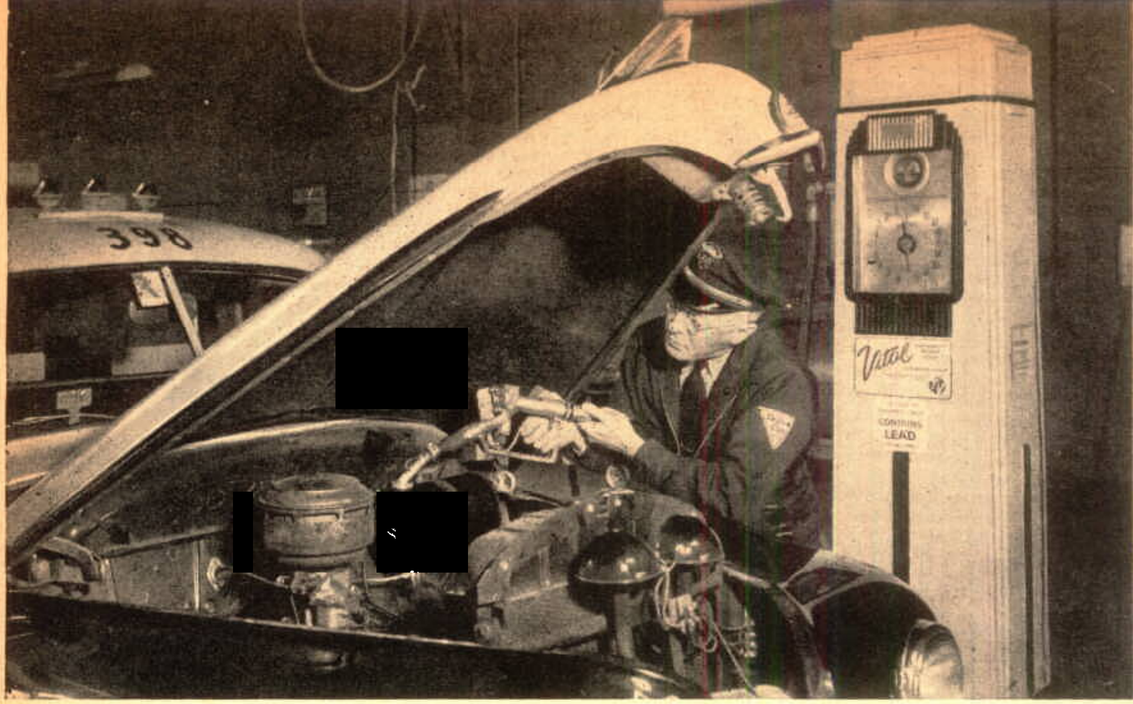
The engine starts and runs briefly on high-octane.

The predetermined changeover point is reached when the manifold vacuum pulls harder than the spring pushes. The piston is then drawn down, opening the low-octane valve and simultaneously closing the other.

During idle and part-throttle operation, the engine continues to use low-octane fuel.

Then perhaps you come to a steep hill—or step down hard on the accelerator for a quick pickup.

As the vacuum drops below the changeover point, the piston is pushed up by the



Water injection is another way of conserving gasoline quality. In Cleveland, Yellow Cabs are now making a wholesale test of the Vitameter Ⓣ, an injector developed by the Thompson Products Co. Above, the 5-qt. tank of a cab is being filled with Vitol Ⓣ, an alcohol-water solution that's used in the injector. You'll be able to buy antiknock Vitol soon at gasoline stations.

spring and closes the magnetic-coil contact. The low-octane valve closes and high-octane feeds to the engine.

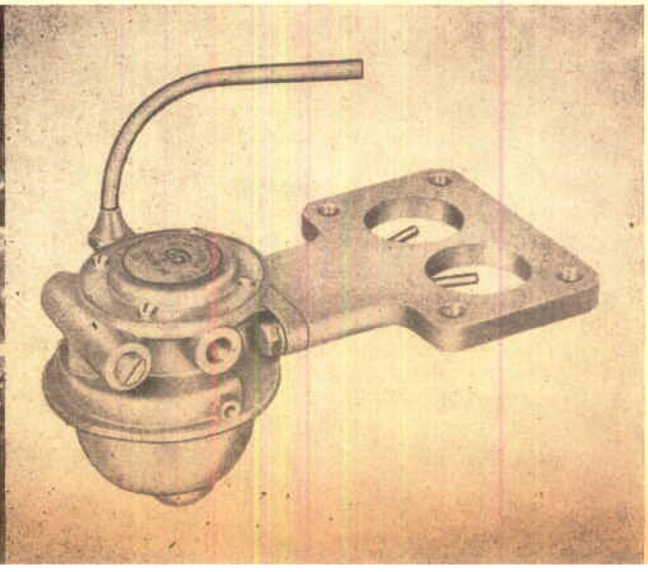
In Socony-Vacuum's test car, an electric pump delivers high-octane from a temporary tank, and the existing pump and tank are used for low-octane. In a production car, the dual-fuel system would have a double fuel pump.

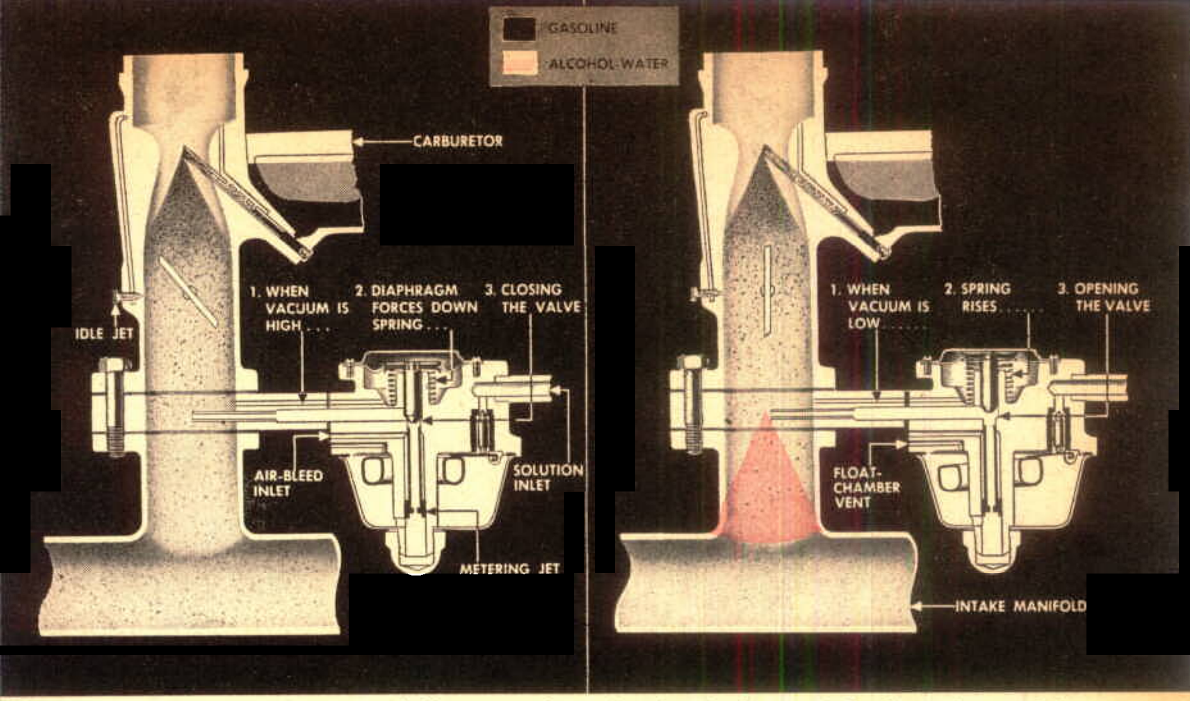
There's another way of shooting octane numbers into an engine for peak demands that is now being tried out. This method injects water or a water-alcohol solution into the fuel mixture.

Since last April, Yellow Cabs have been running around Cleveland on 58-octane gas. Under their hoods is an injector flamboyantly named the Vitameter Ⓣ but engineered and manufactured by Cleveland's conservative Thompson Products—makers of valves and donor of aviation's Thompson Trophy.

It has long been known that a water-

Vitameters, right below, are mounted, as shown at left, by means of a flange that fits between the carburetor and intake manifold. Notice the filter bowl in the line running from solution tank.





How Vitameter works. Manifold vacuum determines when injection will occur. You've often noticed that a windshield wiper slows down or stops when vacuum drops during times of full throttle. At these periods, the engine needs injection to prevent knocking. Because vacuum is low, the spring can open the valve. Spring tension is adjustable for different engines.

moistened fuel mixture gives an engine more pep. You've probably noticed this on rainy days, when the air that mixes with the fuel is moisture laden.

By keeping down the temperature of the explosive mixture, injected water promotes a more even explosion and prevents detonation—the annoying knocking or pinging that comes from your engine when it's pulling hard.

With injection, you can use lower-octane gas and still have no knocking. That's why the Cleveland cabs get by with a gas that stands at only 58 in the octane scale.

Gives Pep When Needed

The Thompson Vitameter is engineered to inject a water-alcohol solution only when your engine needs the pep this injection can give. In effect, it is another carburetor. Antiknock fluid, held in a float bowl, is metered into the air-fuel mixture as needed. Once again, it's the intake manifold vacuum that determines when injection will occur.

If the engine is idling or operating at low throttle, high manifold vacuum closes the main valve and no fluid flows. As the throttle is opened wider, a diaphragm spring overcomes the slight force then exerted by the low manifold vacuum. The valve opens, allowing fluid to be injected. The point at which this occurs can be varied by adjusting the spring tension. Interchangeable jets of different sizes regulate the amount injected.

Thompson engineers report that injection has the effect of adding 10 to 20 octane numbers to the fuel that's being used. This opens up three interesting possibilities.

How Injector Can Be Used

When the proposed new high-compression engines appear, you could install a Vitameter and still use the present premium gas. This was demonstrated at a recent meeting of the Society of Automotive Engineers. The engine of the demonstration car had been souped up to a 9-to-1 compression. Normally, it would have required 100-octane fuel for knock-free performance. Yet with the Vitameter it showed no detonation on premium gas of about 85-octane.

Or take the case of a current car that requires premium gas. By installing an injector, you could use the more economical regular grade and raise its 76-octane rating well above the premium level. Besides economizing on gas, you would get all the other advantages claimed for injection.

Again, if your car operates satisfactorily on regular gas, you could install an injector and use a fuel of still lower octane rating. This means little to the average motorist, since refiners agree that it would be economically unfeasible to make a third grade of gas available at all service stations. But commercial fleets could buy third-grade fuel in tank-truck lots.

In fact, the Thompson company proposes that the big refiners supply fleet operators a special low-octane, straight-run gasoline to be known as Vitane ⓣ. That's what the Cleveland cabs are using. Such gasoline can be produced at considerably less cost than cracked, blended, or reformed fuel—the type now available at gas stations.

Special Fluid Prevents Knocking

It's expected that gasoline stations will handle a special antiknock fluid to be used in the Vitameter. This will sell by the quart at about the price you pay for motor oil.

Called Vitol ⓣ, the fluid consists of about 85 percent alcohol, 15 percent water, with 3 cc. of tetraethyl lead per gallon. It also has an inhibitor to keep rust from forming in the carburetion system.

Vitameters and Vitol will be available for passenger cars this year in part of Ohio. The territory will expand from there as rapidly as a supply of Vitol and service instructions can be made available. For most of the United States, this may not be before late in 1949.

Road tests in recent years have revealed some surprising results concerning octane requirements at different speeds and throttle openings. Both the Vitameter and dual-fuel system are based on these results.

Here's an example:

With the spark set for maximum economy, the experimenters found that fuels of only 20 to 30 octane number gave knock-free operations at low speeds on level roads.

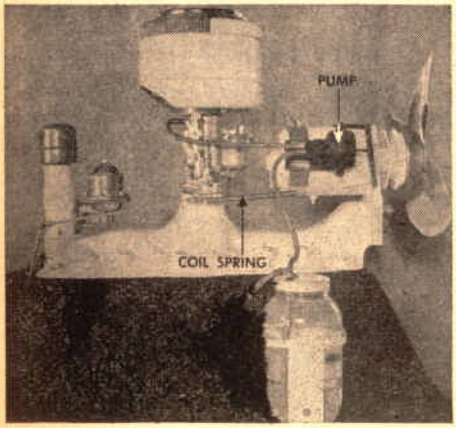
Even at 60 miles an hour at half-open throttles, a 45-octane gas was satisfactory. But for so-called "full-throttle" conditions —starting, hill climbing, and top speeds— the same car had to be given a 75- to 85-octane gas for satisfactory performance.

Dual-fuels are still in the experimental stage. Before they become a part of the package of transportation called "your car," they will have to meet the standards of volume production. The last hurdle will be, as always, testing in use by the public.

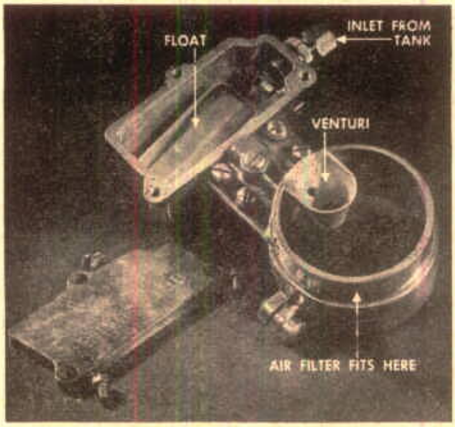
But as compression ratios creep upward, the need to conserve the limited octane numbers in every barrel of crude will push the development of dual-fuels.

You may be saying, "Fill them both up!" sooner than you think. END

Injectors on Market Give Power as Needed



Hydro-Jector ⓣ. Made by Associated Laboratories, Cleveland, it pumps a shot of water into carburetor each time you press gas pedal. If you then keep pedal steady, a coil spring, linked to throttle, relaxes in a few seconds and injection stops.



Octa-Gane ⓣ. A product of Continental Carburetion, Richmond, Calif., it works like a carburetor. A collar fits between the air filter and carburetor, bringing the Venturi within the air stream. Water feeds in proportion to air-stream speed.