# THE MECHANICAL FUEL PUMP

## Repair or Replace? You Can Do Either

by SK Staff

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In April 2014, we published an article on the AC Fuel pump. We reprinted their instructions to the mechanics' trade on how to properly service and rebuild the fuel pump. Not to dispute their knowledge and abilities, today, fifty or sixty years later, a number of things have changed. These changes have to be recognized and have to be figured into the mix when rebuilding a fuel pump. The first and most obvious change is the quality of the gasoline. In 1959 (when the AC article was first published) gasoline did not contain ethanol. Next, in 1959 the metal used in the fuel pumps was much newer and hadn't suffered many of the problems that they have today. Finally, in 1959, when virtually all fuel pumps were mechanical, parts were readily available.

First, let's revisit an AC Shop Manual on the diagnosis of fuel pump problems.

### HOW TO DIAGNOSE FUEL PUMP TROUBLE

Fuel pump trouble is of only two kinds. Either the pump is supplying too little gas-or, in rare cases, too much.

If the pump is supplying too little gas, the engine either will not run at all, or it will cough and falter.

If the pump is supplying too much gas, you will be able to see gasoline dripping from the carburetor, or the engine will not run smoothly when idling.

Engines are usually hard to start when getting too much gas.

### LOCATING THE TROUBLE

ALWAYS CHECK WHILE THE PUMP IS INSTALLED ON THE ENGINE. Don't take it off to check it.

NOTE: A more accurate check of fuel pump condition may be obtained with an analyzer which consists of a fuel pump pressure gauge, fittings, rubber hose and a one pint container.

*The upper half of the gauge reads fuel pressure from the pump. The lower half reads vacuum when connected to a vacuum source.*

### Not Getting Enough Gas

If the engine is getting too little gas, the trouble may be in the pump, the fuel line, or the gas tank. First, be sure that there is adequate gas in the tank.

Disconnect the pump to carburetor line at the pump (or at the carburetor), whichever is easier to reach. Attach a hose to the outlet fitting of the fuel pump. Then, turn the engine over a few times, using the starting motor. It is best to turn off the ignition switch.

If gas spurts from the pump (or the open end of the line), the pump, gas line, and tank are OK.

If no gas flows at all, or if only a little gas* flows, follow the instructions on the following page:

### Getting Too Much Gas

More often than not, an oversupply of gasoline is caused by trouble somewhere else – not in the pump. So first check the following:

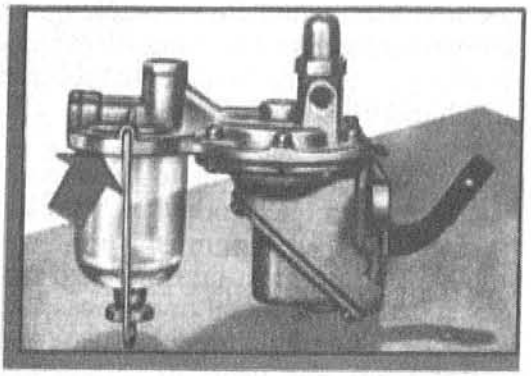
1. Defective automatic choke
2. Excessive use of hand choke
3. Punctured carburetor float
4. Defective carburetor needle valve
5. Loosely connected fuel line or loose carburetor assembly screws
6. Improper carburetor adjustment

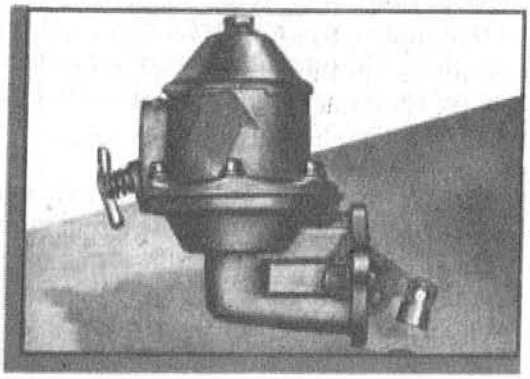
If none of these is the cause of the flooding or poor gasoline mileage, then the pump needs overhauling.

Let's look at each of these problems and discuss the best way to solve them.

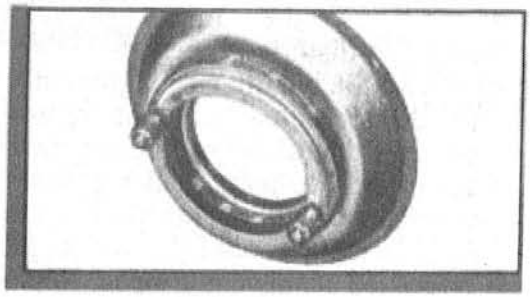
It's no secret that ethanol can play havoc with the rubber components in the fuel system – connector hoses, fuel pump diaphragms, seals and gaskets and carburetor parts. Interestingly, The Airtex Corporation, manufacturers of re-

## LOCATING THE TROUBLE (Con't.)



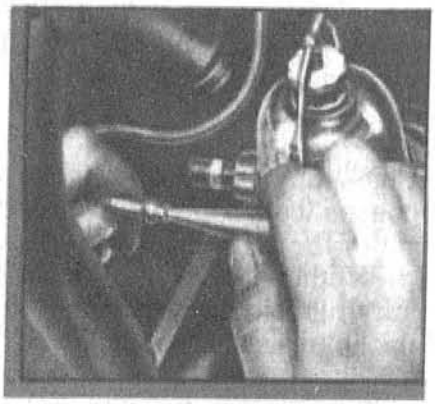


**1** Look for a leaky bowl gasket seat. Replace bowl gasket if you are not sure.

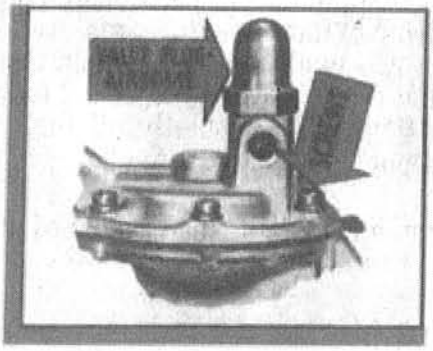


**2** Remove and clean with solvent the gas strainer or screen which is inside the pump bowl.

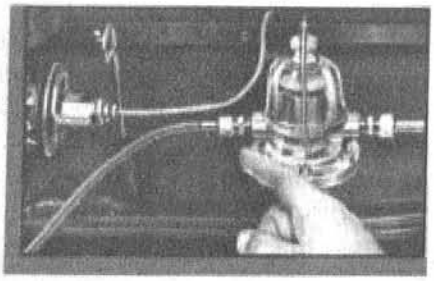
**3** Look for loose line connections. Check all the way back to the gas tank. Tighten all connections.



**4** Look for a clogged fuel line. Blow out with compressed air.



**5** Make sure that all cover screws on the pump are tight. Make sure that the external plugs over pump valves are tight.



**6** Inspect the flexible fuel line for breaks or porous condition.

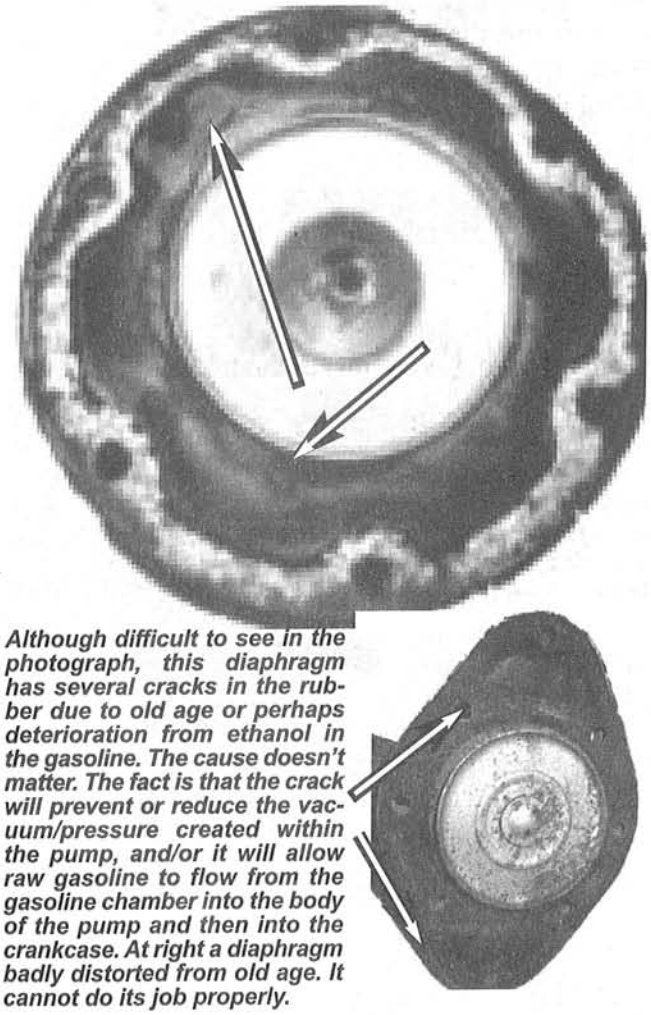
If correction of the above six items does not place the pump in operating condition, it should be removed for replacement or overhaul.

### * TESTING THE PUMP'S CAPACITY

1. Insert a 'T' fitting connecting the fuel pump, carburetor and rubber hose 2. With the engine at its lowest idle, note the time to fill a pint container (never use a glass container) 3. Adequate fuel delivery is available when a pint of gasoline flows in A: one minute for small engines under 225 cu. in., B: forty-five seconds for medium engines of 225 to 400 cu. in., C: thirty seconds for larger engines over 400 cu. in.

placement fuel pumps (both mechanical and electric) have done extensive testing with ethanol. They have determined that the most harmful gasoline/ethanol mix is the E10 – 10% ethanol and 90% gasoline and other additives. The E10, they advised me, is more harmful than even E85 – 85% ethanol.

Most fuel pumps contain only one major rubber component: the diaphragm. Plain, straight rubber or one of the rubber derivatives should not be used with ethanol-laced gasoline. A number of specialty rubbers are specifically formulated to be alcohol resistant (notice I didn't write 'alcohol proof'). See 'From My Perspective' in this issue regarding gasoline/ethanol resistant diaphragms. It does not provide a definitive answer, but it might help in choosing the correct material. Some pumps will have other rubber components; those parts, too, must be replaced with alcohol-compatible rubber parts.

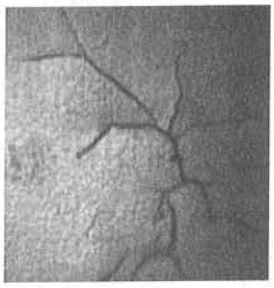


***Although difficult to see in the photograph, this diaphragm has several cracks in the rubber due to old age or perhaps deterioration from ethanol in the gasoline. The cause doesn't matter. The fact is that the crack will prevent or reduce the vacuum/pressure created within the pump, and/or it will allow raw gasoline to flow from the gasoline chamber into the body of the pump and then into the crankcase. At right a diaphragm badly distorted from old age. It cannot do its job properly.***

The fuel pump diaphragm works very hard. It flexes up and down once with each revolution of the camshaft. Plain rubber will not withstand that torture for very long. So the diaphragm rubber material must have a reinforcing scrim embedded into it. Finding a suitable diaphragm rubber has become much more difficult over the years.

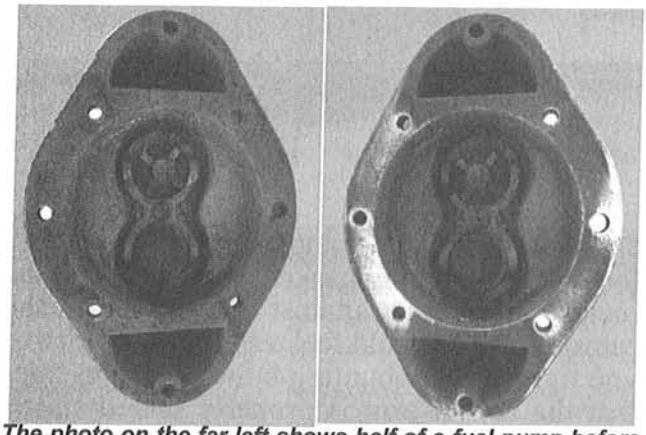
Which brings us to the second problem that we encounter today in rebuilding a fuel pump. Most fuel pumps were made of cast metal. You are most familiar with cast metal as pot metal, white metal or zinc cast. All kinds of parts were manufactured that way, and they provided years and years of satisfactory service. Then many began to crumble. Fuel pumps, fortunately, although cast, were manufactured with better metal and more care. But fuel pumps, too, suffered over the years.

The first problem you will encounter is when you clean and examine a fuel pump. Cracks, 'spider-webs' or other faults in the metal's surface can render the pump useless. If the cracks split, raw gasoline can spill and splash over the engine, the hot exhaust manifold or live wiring. As the metal cracked, it distorted – perhaps not a lot, but often enough so that the pieces, once disassembled, will not fit back together properly. I'd be afraid of patching the metal. Even some of the two-part epoxies which claim gasoline resistance will not always bond to the metal, and, if the metal continues, even slightly, to crack, the epoxied seams could open. Replace the fuel pump. More on that in a moment.



The second problem is less evident; you cannot see it, but the metal has warped. The screws have held everything in place, but when that pressure is relieved, the warp becomes evident. Eliminating that warp is paramount in getting a good seal between the top and bottom portions of the pump. Tape a piece of abrasive paper, between 300-500 grit, to a piece of glass. (Glass is amazingly flat and provides a reliable, hard, flat surface.) Lightly rub one section of the fuel pump on the abrasive paper and then examine the metal surface. You will see small areas

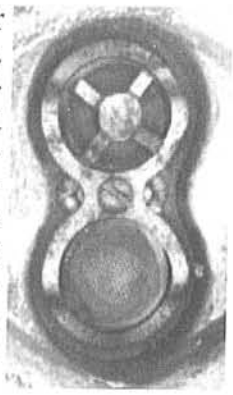
which are bright and shiny; the rest of the surface will be a dull grey. You have sanded off a couple of the high spots. To get a perfectly flat mating surface you will have to continue to sand until no dark, dull spots remain. DO NOT use a power sander – vibrating, belt or disc. The power sander will remove too much metal too quickly, and there is a definite chance of sanding at a slight angle which will ruin any future chance of the top and bottom sections forming an airtight seal. Do the same to the other half. When no high or low spots remain, the surface will be uniformly bright. It's hard work, but it's the only way you can get the necessary air tight seal.



***The photo on the far left shows half of a fuel pump before resurfacing to eliminate high and low spots which will cause a loss of vacuum. (Right) After taping a piece of abrasive paper to a sheet of glass, and rubbing the same half on the sandpaper, a few of the high spots begin to disappear as shown by the bright metal. The procedure has to continue until no dark grey areas remain. Do the same to the other half, and you will have flat mating surfaces.***

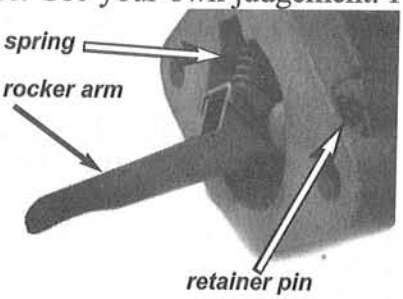
Most fuel pumps have two valves: one inlet, one outlet. Often they are octagonal mica or bakelite discs held in place by a very light spring, or they may be a mechanical-type valve. Most often a large hex-nut provides access to the mica valves. Be very careful when disassembling the valves. If those springs are lost, they are almost impossible to replace. Immediately put one mica disc, the gasket and its spring in a small zip-top plastic bag and mark it as 'Inlet' or 'Outlet'. The other disc and springs go into a separate plastic bag. Sometimes the valve components are the same as each other, sometimes not. Occasionally the valves are 'stuck' with gum from the gasoline. Hopefully a solvent will free them up.

Examine the mica disc for cracks or excessive scratching. Often just turning the disc upside down will provide a fresh sealing surface. Use a new gasket under the hex nut. The unitized valves are often held in place by a clamp or strongback and use a very thin gasket. Replacing the gasket is sometimes all that is needed for a pump to begin to work properly again.



The diaphragm is held on the stem by a variety of methods. Sometimes it is riveted, a permanent installation, while at other times a nut holds the diaphragm to its linkage. Examine the pump once the two halves are separated to determine what method was used. If the diaphragm is riveted into place, it is not readily removable. If you have access to a machine shop, they can generally grind off the rivet, drill and tap the shaft, and replace the rivet with a screw.

The rocker arm and springs are held in place by a pin. Locate that pin in the pump housing and use a drift of the correct size to drive it out. This is a risky procedure. Use your own judgement. I suggest that you lay the pump over the jaws of a vise, with the two jaws separated just enough to allow the pin to pass through when you drive it out. By placing the pump housing on the vise, you are supporting it and minimizing the chances of destroying the metal housing. If that is broken, the pump is scrap! That's another problem with old cast metal: it gets brittle and breaks easily.




Before removing parts, photograph or at least sketch how the linkage is aligned. It must be reassembled exactly the same way or the pump will not operate. Make notes as you remove parts. There are several washers and retainers holding the diaphragm alone. Do not lose them or get them mixed up.

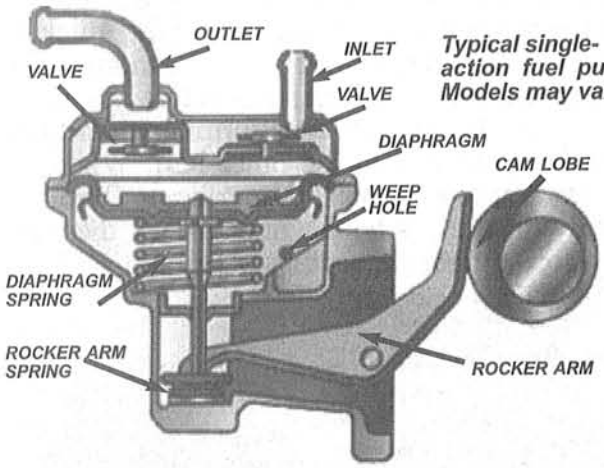
Clean all of the metal parts. Use a small brush to get into all of the crevices. Make sure that the weep hole is open. Check that the valve seats are not scored or damaged. Contact Olson's Gaskets for a filter bowl gasket and a mounting gasket, as well as the diaphragm material.

Use the old diaphragm as a template for making a replacement. Before punching any holes, double check the new diaphragm against the fuel pump. Use a set of hole punches to get a clean hole – for the body screws and for the diaphragm. Again, make sure that the screw holes all align with the holes in the body. Reassemble the rocker arm linkage, the valves and springs and the diaphragm.

A Double-action fuel pump provides vacuum, not only to pull fuel into the pump, but also to operate the vacuum windshield wipers as well. A separate vacuum connection is provided to accommodate the wiper motor.

Frequently the tapped holes in the bottom of the fuel pump have become stripped and the threads will not tighten adequately. Use a slightly longer screw and a lock washer and nut to tighten the top to the bottom. Use a drop of thread-locker to prevent the nuts from vibrating loose. Do not use any gasket cement or sealer between the top half and the bottom half. The diaphragm will be an adequate gasket. Depress the rocker arm (and hold it in that position) to put tension on the diaphragm, and then tighten the body screws in a criss-cross fashion so that even tension is applied across the body surface and so that there isn't any distortion. Install the filter bowl and gasket and snug it up. A very light coating of grease on the fuel bowl gasket will help it seal.

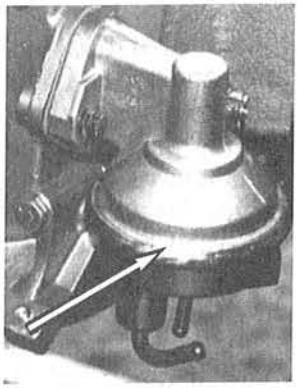
Double check everything and then bench test the pump before installing it on the car. Connect a length of hose to the inlet side of the pump. Put the other end of the hose in a small can of gasoline. Do this out of doors; you don't want gasoline squirting all over the garage or shop. Operate the rocker arm by hand. You should be able to create adequate vacuum to lift the gas out of the can, into the filter bowl and it should squirt out of the outlet hole of the pump. You could also connect a vacuum gauge to the inlet side. You may be able to pump it fast enough to get a reading of about 6 inches of vacuum. Then connect a pressure gauge to the outlet side of the pump. That reading should be between 2¼ and 5 pounds of pressure.



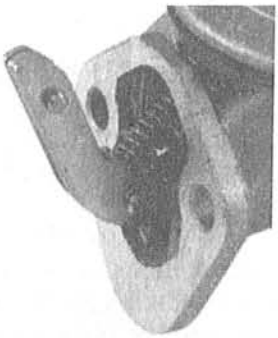
*Typical single-action fuel pump. Models may vary.*

Re-install the pump on the engine – don't forget that mounting gasket. Make sure that the rocker arm rests against the lobe on the camshaft. You should feel a spring resistance as you tighten the mounting bolts. That indicates that the rocker arm is properly seated and is pushing against the cam lobe.

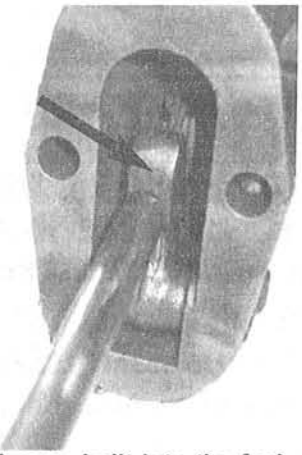
We have been discussing those mechanical fuel pumps which can be readily disassembled by releasing the screws holding the top and lower sections together. But there are newer fuel pumps which crimp the top section over the lower portion. These, unfortunately, are not designed to be rebuilt. Often they are new enough that replacements are available, or they can be ordered through an auto parts store or on-line (see Kanter's Auto Products listing on page 32). Your best bet is probably a smaller specialty auto-parts store rather than the national chains. Too often the kids working at those chain stores don't know a fuel pump from a tire pump. If you do order one from an auto parts store, be sure to bring your old pump with you when you pick up the replacement.


*The top of the fuel pump is crimped onto the lower section. It was not designed to be rebuilt.*

Check to be sure that it is, in fact, an exact replacement. 'Close' is generally not good enough. Make sure that the mounting bolt arrangement and layout are identical. The hole size, hole spacing and the hole alignment must be exact so that the rocker arm engages with the lobe on the cam shaft. Not all the holes are horizontally aligned, either. They are often offset. The rocker arm has to be the same, as well. Don't let them tell you that it will work just as well as the old one. Size, shape and angle are all important. Finally, the fitting locations. This, perhaps, is the least important. Often new lines from the gas tank (the inlet fitting) or to the carburetor (the outlet fitting) can be made to fit, but why bother. The correct replacement fuel pump should just be a bolt-on affair, with no modifications necessary.

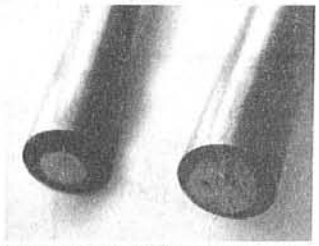


If something under the hood has been changed though - a replacement engine of a slightly different type, a different carburetor, etc., then the fuel pump listed in the parts book might not fit exactly. You will have to match the one on the vehicle.



*A cam, built into the fuel pump, is 'pushed' by a rod engaging the cam lobe.*

A few cars, not many, didn't use a rocker arm to activate the fuel pump diaphragm. They used a push rod. Instead of the rocker arm which is directly connected to the diaphragm assembly, a cam was fitted into the fuel pump. A steel rod (generally hardened steel or at least with hardened ends) would fit through a hole in the block, behind the fuel pump. It engaged with the lobe on the camshaft, and 'pushed' the cam in the fuel pump to activate the diaphragm.



*Both ends of the push rod (shown in this composite photo) show wear. Even a slight reduction in length could prevent the diaphragm from doing an adequate job.*

Despite the hardened steel, those push rods did wear over thousands of miles of use and millions of revolutions of the cam. Even slight wear could be enough to prevent the diaphragm from moving up and down adequately to supply gasoline to the engine. It is often difficult to find the exact specifications for your push rod, but often the vehicle's parts manual or service manual will supply the specifications - length and diameter. Kanter Auto Products does carry a selection of push rods for select vehicles. Try them first. It might save you a lot of searching.

**Replacing a Broken or Damaged Fuel Pump**

As indicated above, the cast metal bodies of most mechanical fuel pumps are fragile, and have grown more fragile over the years as the metal has aged and become brittle.

If the body of the fuel pump is broken or cracked, do not chance using it. A raw gasoline leak could cause a serious fire. Generally, for a few dollars, you can purchase a rebuilt or sometimes even a new fuel pump. If the mounting 'ears' are broken and you have both parts, a good two-part epoxy might provide a repair. Glue the two parts together, and when the epoxy has cured cement a fender washer over the bolt hole so that both pieces are under the washer. That will provide some additional strength at the break. Remember though, there is a lot of vibration in the fuel pump. The rocker arm is constantly moving in and out operating the diaphragm. The vibration will probably cause the broken pieces to separate.

Although most fuel pumps do the same job, there are enough variations so that it is improbable that you can merely remove the original and bolt on one that you found at a local swap meet. The most critical part is the rocker arm. You would be absolutely amazed at how many different sizes and shapes there are, each designed to mate with a certain type engine and its camshaft. (A few pumps did not use rocker arms; they used push rods. Many GM products, some Lincolns, Franklins and AMC used push rods. These rods can become worn after years of use and do not completely activate the diaphragm pumping assembly. If you do not have the original specifications [length] of the old push rod, consider just replacing it with a new

one. Many are available from Kanter Auto Products. See their catalog.) Next is the mounting footprint. Although the mounting bolts may have the same center-to-center dimension, the fuel pump must mount in exactly the same orientation as the original so that the rocker arm interacts properly with the camshaft lobe. Finally are the inlet and outlet fittings. Often a copper line can be designed to overcome this problem.

We will not address the option of replacing a factory original mechanical fuel pump with an electric pump. Our objective remains keeping the car or truck as close to factory original as possible. The odds are against you, if you walk into a local parts store and ask to buy a replacement fuel pump for a 1937 Packard or a 1933 Graham. The kid behind the counter will be totally lost. Fortunately Kanter Auto Products (see their ad on page 42 of this issue) carries an extensive line of rebuilt fuel pumps. They carry both the single action and double action pumps as exact replacements for your car, or, if you prefer, you may send them your old pump and they will supply a rebuilt unit. That will save you the core charge. Kanter has also begun to manufacture new fuel pumps - exact replicas of the original, so that you can just bolt it into place, connect the fuel lines and be on the road.

Contact Kanter Auto Products and get their newest catalog. It has many replacement fuel pumps (as well as hundreds of other items listed). It's a great reference.

We strongly recommend that when you order a fuel pump you send photographs of the pump which you are replacing (unless of course, you send the old pump as a core). Photograph not only the body, but also the rocker arm and the fuel fittings. Send measurements as well. In that way, if there is more than one option, they can match up your new pump to the old one.

**KANTER AUTO PRODUCTS**
**76 Monroe Street,**
**Boonton, NJ 07005**
**800-526-1096**
**www.kanter.com**

S.K.

*We would like to thank the AC Spark Plug Division of General Motors for making this information available so that we, these many years later, can avail ourselves of their expertise in helping to keep our old cars and trucks on the road and running well.*