HIGH PERFORMANCE TUNING INSTRUCTIONS

FOR MODEL 2300, 3160, 4150, 4160, 4165 & 4500 CARBURETORS

Read instructions thoroughly before attempting any performance modifications.

The High Performance Tuning Instructions are intended to supplement the rebuilding instructions provided in the Carburetor Service Procedure form supplied with this kit. It is important that the carburetor be rebuilt and adjusted to proper specifications before any performance tuning is attempted on the engine.

In order to help the beginner, the High Performance Tuning Instructions contain some basic procedure tips which will provide additional clarification on some often overlooked points.

This instruction sheet has been written by Holley Engineering. Magazine articles and other "high-performance" rebuilding kits have often described various "performance tips" which may not be contained in this instruction sheet. Rest assured that these "tricks" have been tested and we have eliminated those which do not provide any performance increases. Holley Performance carburetors are developed at great expense by dedicated enthusiasts. In general, we try to release calibrations which provide the utmost in total performance, however, some specific performance increases can be realized if you exercise patience and carefully tune your carburetor to your particular vehicle.

NOTE: Some performance modifications (particularly those which affect primary throttle calibration may alter the exhaust emissions performance of the vehicle and should be considered for off road use only.

Two barrel carburetors should be "tuned" in the same manner as the primary side of a four barrel carburetor.

CARBURETOR REMOVAL:

1. Tag and mark all vacuum lines with pieces of masking tape before removal.
2. Tag and mark fuel line and fuel bowl vapor vent line (Chrysler products only). Fig. 1

   CAUTION: Do not confuse these lines as fuel flooding could result.
3. Remove throttle linkage, transmission kickdown linkage and throttle return spring.

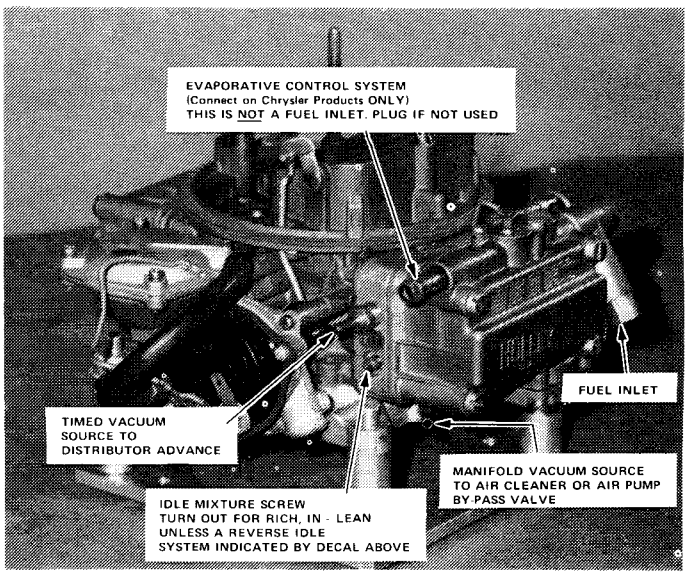

Fig. 1

4. Unbolt carburetor and lift carburetor from intake manifold.
5. Remove original carburetor flange gasket and scrape carburetor flange of intake manifold clean exercising care not to drop pieces of gasket into the manifold. It is best to cover the manifold bores when the carburetor is removed.

DISASSEMBLY:

1. Disassemble carburetor according to steps provided in accompanying rebuilding sheet.
2. **CAUTION:** In some cases small steel balls or steel needle weights are used as "check" valve devices in carburetor sub-assemblies. Care should be exercised so that these pieces are not accidentally lost.
3. If possible, disassemble carburetor on a large, clean, flat surface so that any dropped parts may be easily found.
4. Place disassembled parts in order of disassembly.

CLEANING:

1. Use a reputable carburetor cleaner. Soak main body, throttle body and metering bodies long enough to remove all gum and varnish deposits. A parts brush or a toothbrush can be used to help remove heavy accumulations. Fuel bowls, which do not have intricate passages should only be exposed to carburetor cleaner long

enough to permit removal of gum and varnish deposits with a brush. (**NOTE:** Some fuel bowls have internal "O" ring seals which are not removable, but can be damaged by prolonged exposure to some carburetor cleaning solvents.)

2. If recommended by the carburetor cleaner manufacturer, rinse parts in a suitable solvent (or hot water).

3. If possible, blow parts dry with compressed air; wipe dry with a clean lint-free cloth, and allow to dry, thoroughly.

REASSEMBLY:

1. Reassemble carburetor in reverse order of disassembly, using new gaskets, power valves, inlet needle and seats, and diaphragms; but retain original pump discharge nozzle(s) accelerator pump cam(s), and secondary throttle diaphragm spring.

2. **NOTE:** Reassemble carburetor in rebuilt, stock form without adjustments, so that fine tuning efforts can be analyzed with respect to the original calibration.

INSTALLATION:

1. Install carburetor on vehicle using new carburetor flange gasket.

2. *Attach all vacuum lines* to original fittings (check all rubber lines and hoses for cracks or leaks – replace as necessary).

3. Connect fuel lines, vent hoses, and throttle linkage making sure that full throttle opening and closing is attained without any binding or interference when accelerator (floor) pedal is fully depressed. (This sounds trivial and obvious, but many races have been lost because this point has been overlooked).

4. Insure that throttle return spring is in good condition and properly installed. A deficient throttle return spring could result in a sticking throttle and a runaway engine.

5. Start engine and check for leaks. Correct if found.

6. If carburetor is equipped with sight plugs, recheck fuel level with engine idle.

7. The accelerator pump should be adjusted so that the slightest movement of the throttle lever results in actuation of the accelerator pump. The pump override spring adjustment is checked while holding the throttle in the open position and the pump operating lever held in a fully compressed position. The clearance between the adjusting nut and the arm of the pump lever should be .015. See Fig. 2

8. After making this adjustment, move the throttle lever from a closed position toward open. Any movement at the throttle lever should be noticed at the pump operating lever. This indicates correct tip-in. This is adjusted as illustrated in Fig. 3.

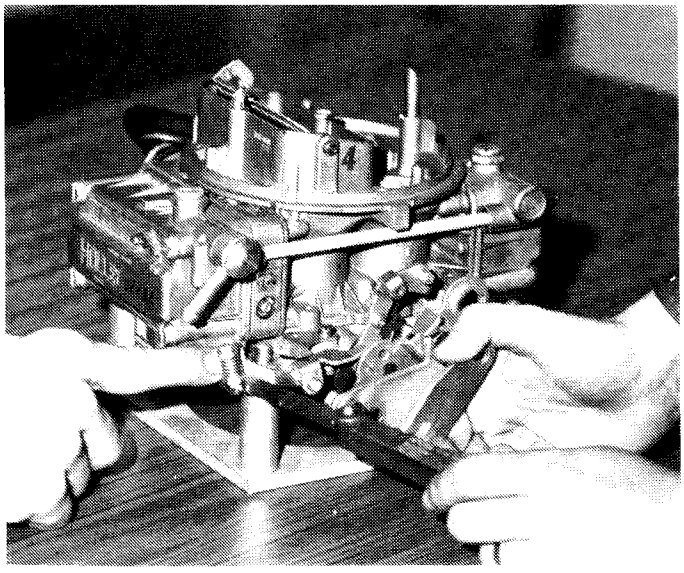

Fig. 2: Hold throttle lever at wide open throttle and check with .015" feeler gauge between the pump operating lever override screw and the diaphragm operating lever.

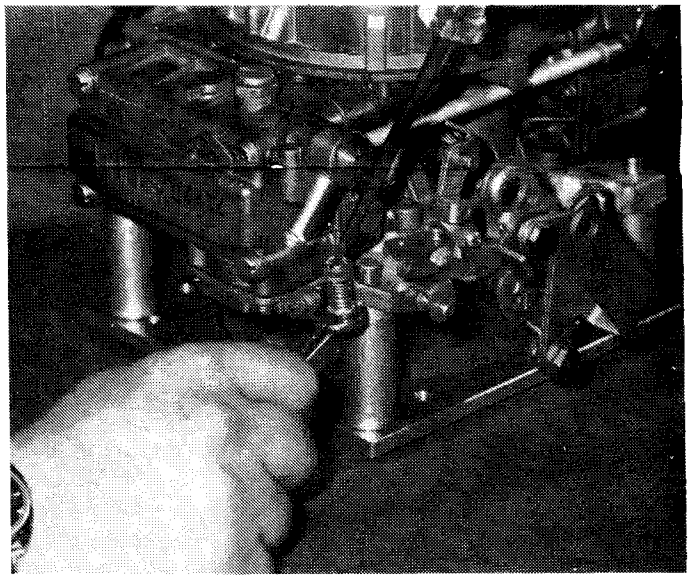

Fig. 3: .015 clearance is obtained by adjusting override spring screw as shown.

NOTE: Under no circumstances should the pump override spring be adjusted to permit coil binding (or bottoming). This is sometimes recommended by some "experts" as a means to quicker delivery rate and increased fuel flow. All that such "adjustments" accomplish is to provide bent accelerator pump actuating levers and ruptured accelerator pump diaphragms. Liquids cannot be compressed, and therefore, "somethings gotta give" when such "tricks" are implemented. Override springs are carefully de-

signed to provide proper delivery pressure without damaging vital carburetor parts by momentarily absorbing pump force and regulating the pressure peaks within the system.

TUNING:

1. Before you begin to tune your carburetor for your particular vehicle, you must get a *"feel"* for your vehicles performance so that any changes you make (good or bad) will be readily apparent. Be patient and make only one change at a time so that only that change can be fully analyzed. This cannot be overemphasized as there are no "short-cuts" to peak performance. Recording each change and the resulting performance increase or decrease will provide you with a "handbook" of how vehicle performance is affected by individual carburetor adjustments. This may be helpful in the future or on other applications.

2. **THE ACCELERATOR PUMP**

The accelerator pump's purpose is to provide the proper momentary air-fuel mixture to enable the engine speed to increase in response to throttle opening. Differences in vehicle weight, transmissions, and rear axle ratios affect the amount of fuel and the delivery rate that should be provided by the accelerator pump. This may necessitate the "tailoring" of your accelerator pump to your vehicle and its use.

NOTE: The old saying "if a little is good, a lot is better" does not apply to the proper tuning of the accelerator pump. Your car's performance can be just as bad if it receives "too much fuel too soon" as if it receives "too little fuel too late."

Two factors affect the accelerator pump's delivery: the pump cam and the pump "shooter" (or discharge nozzle). The pump cam determines the total volume and affects delivery rate; the pump "shooter" affects delivery rate and helps determine the duration of the shot.

This kit contains three (3) accelerator pump cams and three (3) pump "shooters" (for each pump). The pump cams have two operating locations each. This provides six (6) distinct delivery rates. In general, #1 locations provide moderate initial delivery with greater final delivered volume; #2 locations provide greater initial delivery with a lesser total delivered volume. Fig. 4. The pump shooters (Fig. 5) have a number stamped on their casting which designates the shooter size in thousandths of an inch; i.e., a #25 shooter has .025" discharge orifices. Generally speaking, smaller diameter nozzles lengthen pump shot duration and are used with heavier vehicles or with vehicles equipped with lower numerical rear-axle ratio. Larger diameter nozzles (.035 – .037) shorten pump shot duration, but deliver a greater initial volume of fuel. These sizes should be used on applications where engine speed will increase rapidly (vehicles with good power-to-weight ratios).

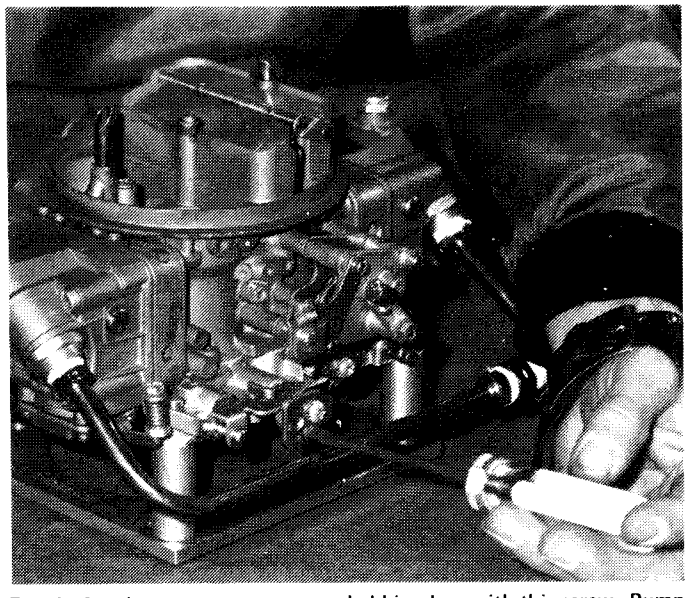

Fig. 4: Accelerator pump cams are held in place with this screw. Pump lever should operate instantly with the slightest throttle rotation when cam is properly installed.

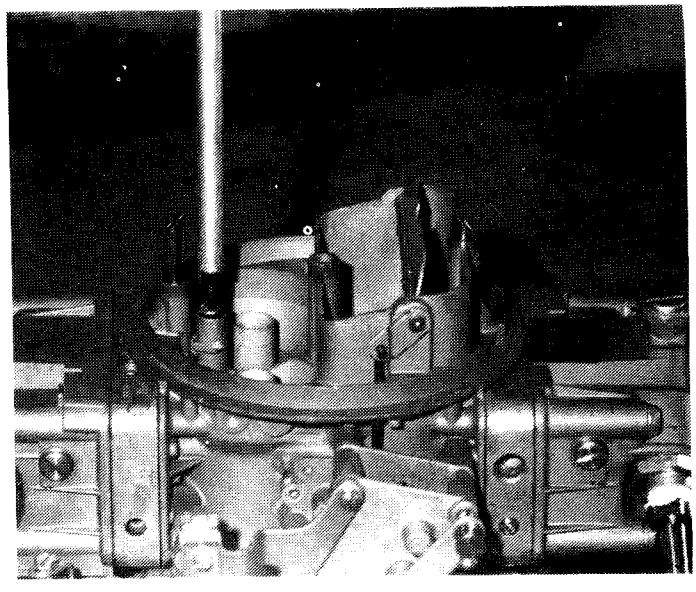

Fig. 5: Accelerator pump discharge nozzles are changed by removing large phillips' hold down screw. NOTE: there is a small gasket under the screw head and one between the nozzle casting and the main body.

When tuning your accelerator pump, change pump nozzles until the smallest diameter nozzle which provides the crispest response is found. Then change accelerator pump cams and locations until response is further improved. Finally, change the nozzles once again until crisp response is maximized.

If a nozzle size is desired that seems "in between" the nozzle sizes provided, the nozzles can be drilled to the desired size by using a wire drill held in a pin vise.

At this point, there should be no bogs, flat spots or black smoke (indicating excessive richness) when accelerating at wide open throttle from a standing start.

Best acceleration is achieved when the accelerator pump delivers the lean best power air-fuel ratio to the engine; not when the maximum volume of fuel is supplied.

An important point should be kept in mind when tuning double pumpers. The secondary accelerator pump must supply fuel for a sufficient time so that the secondary main nozzles can "start-up" and deliver fuel to the engine after the secondary throttles are opened. If the nozzles do not start by the time the pump shot expires, bogging will result.

Best starts (racing starts) usually result when the rear tires break loose for the first 10 to 25 feet. This allows engine speed to increase rapidly and get the secondary main nozzles started. If wide tires, which provide extremely good traction, do not permit the rear tires to break loose, bogging can result and best times may be recorded with narrower tires. This attention to tire size is not so important on vacuum operated secondary carburetors since the secondary throttles should not open until the secondary nozzles will be exposed to enough vacuum to get them started.

VACUUM OPERATED SECONDARY THROTTLES

Many people have the misconception that opening the secondary throttles sooner will provide increased performance and quicker drag strip times. Others think they must "feel" a kick in the pants when the secondaries "kick-in". Still others believe that they should disconnect the vacuum diaphragm and make the secondaries open mechanically.

Before going further, let us discuss these points in reverse order. First, if we could make our vacuum operated secondary carburetors perform better by opening the secondaries mechanically, it would be to our advantage to do so since all that vacuum actuating hardware is expensive and requires much time and money to calibrate. Our mechanical secondary carburetors all utilize a pump shot to prevent bogging when the secondaries are opened. Secondly, those who feel a kick-in the pants when the secondaries "kick-in" are actually feeling a flat spot during initial acceleration because the secondaries have already begun to open and have weakened the fuel delivery signal to the primary boosters. The engine struggles to increase speed and what they actually feel are the secondary nozzles "crashing in" as the engine finally reaches the speed where it provides the proper fuel delivery signal to primary and secondary venturii.

Third, opening the secondaries early causes the situation described above. The secondaries must not open until the engine requires the additional air. This allows torque to increase along the peak torque curve. Performance is compromised less by holding the secondaries closed a little too long than by opening them a little too soon. If the opening rate of the vacuum operated secondaries is properly calibrated there should not be a "kick-in the pants", only a smooth increase in power should be felt.

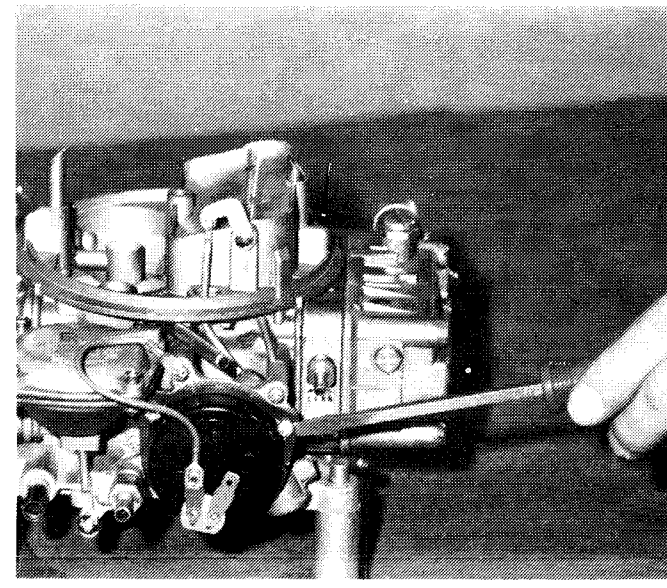

Fig. 6: Remove choke cap by removing 3 retaining screws.

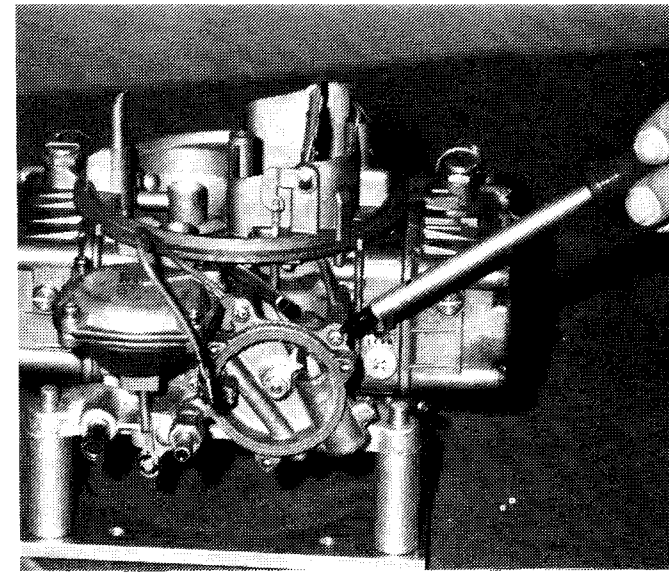

Fig. 7: Remove choke housing by removing three screws holding housing to main body.

This kit contains three secondary diaphragm springs. The larger diameter the wire, the stiffer the spring and the later the secondaries will open. Secondary diaphragm springs are replaced as follows:

1. Remove choke cap and choke housing (if carburetor is equipped with integral choke). Fig. 6 and 7.
2. Remove three screws attaching secondary vacuum diaphragm to main body. Fig. 8.
3. Remove four screws securing diaphragm cover. Fig. 9.
4. Gently remove cover and change spring.

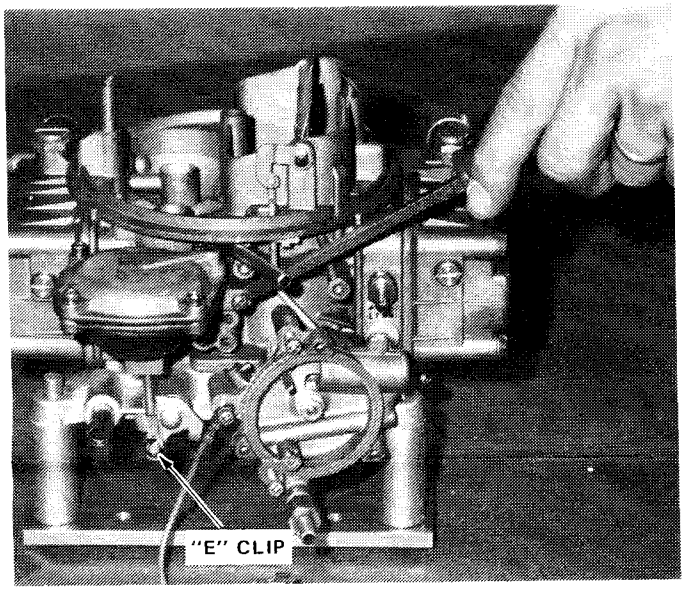

Fig. 8: With choke housing swung out of way, remove 3 screws holding secondary throttle diaphragm assembly. Remove "E" clip at throttle lever.

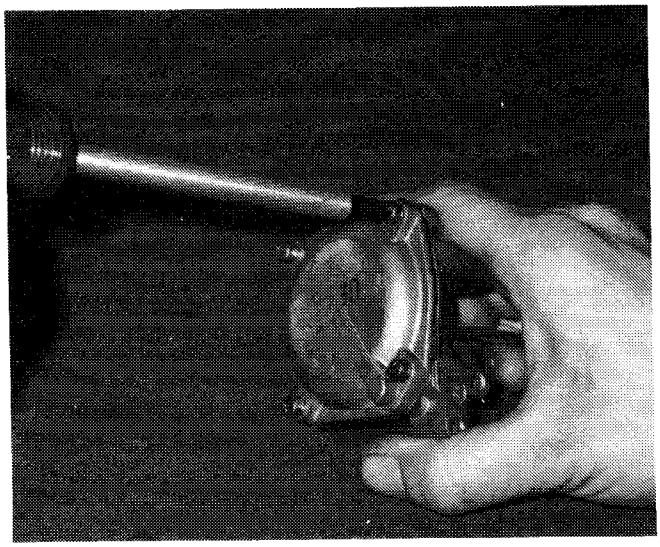

Fig. 9: Remove secondary diaphragm cover screws. Tap top of housing lightly with mallet to ease removal.

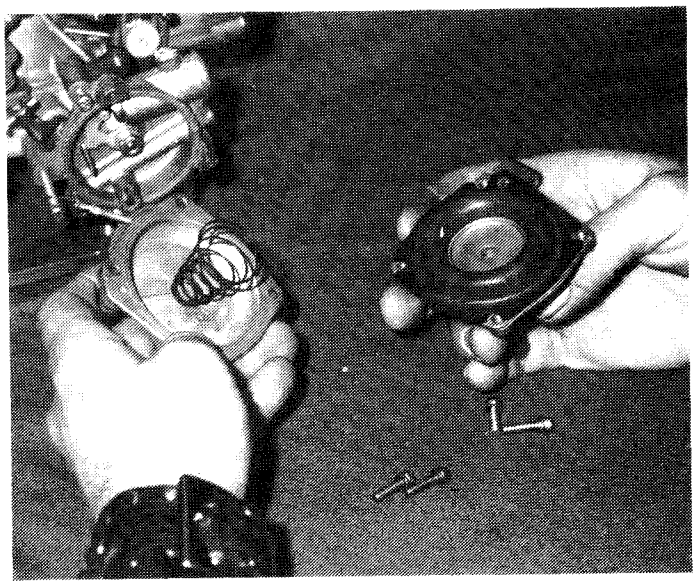

Fig. 10: Install alternate secondary diaphragm spring as shown.

5. When reassembling secondary diaphragm parts, exercise care to properly align vacuum passage in casting with "cut-out" in rubber diaphragm. Likewise do not pinch or tear rubber diaphragm. Fig. 10.
6. Make sure cork gasket in secondary diaphragm housing mates with main body casting and reassemble. Fig. 11.

In general, heavier cars require stiffer secondary diaphragm springs than light cars. Air cleaner configuration and restriction plays an important part in spring selection so be sure to use your air cleaner when evaluating your

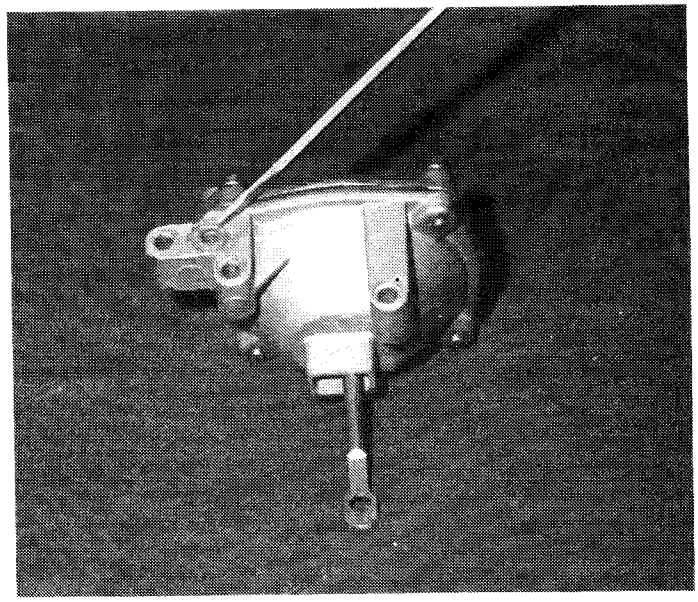

Fig. 11: Make sure cork gasket in secondary diaphragm housing seals properly with vacuum passage in main body.

vehicles performance after each change. Do not expect to "wing" the throttle and see the secondaries begin to open. If they do, they will probably open too soon. Secondaries should normally only open when the engine is under a load. Do not clip a spring in an effort to make a spring lighter so that the secondaries will open sooner. Strange as it seems, clipping springs actually increases spring rate and will delay opening. If additional springs are required, they may be purchased from your Holley distributor under part number 85BP-3185.

JETTING:

Due to the varied applications for which this kit is supplied, no jets have been included; however a few tips on jetting are applicable.

1. Out of the box jetting is extremely close for most applications.
2. Carburetors are calibrated at 70° at sea level. Decrease jet size one number (approx. .002) for approximately every 2000 ft. increase in altitude. Increase jet size one number for every 35°F drop in temperature.
3. Holley jets are broached, flowed, and stamped according to flow rate. Do not drill jets as this seriously alters flow characteristics. Stamped numbers are reference numbers and do not indicate any drill size.
4. In most cases it will be unnecessary to increase jet size more than four numbers greater than out of the box jetting. Exceptions could arise when the carburetor is mounted on a very large volume, plenum-ram manifold.
5. When used with high velocity emissions manifolds, some older calibrations actually show power increases when jet size is lowered a couple of number sizes below stock jetting.
6. Spark plugs provide best indication of proper jetting. Allow plugs to color before jumping to conclusions.

AIR BLEEDS:

Experimenting with air bleeds is not recommended. Countless hours of testing on expensive flow stands is required to obtain the proper bleed sizes for a given calibration. It is unlikely that a better bleed calibration can be obtained without extensive experience and facilities; and it is extremely likely that a useless piece of junk can result from what was previously a high-performance carburetor.

POWER VALVES:

The number stamped on a power valve, such as 65, indicates the manifold vacuum below which the power valve is operational. In this case, at all manifold vacuums below 6.5" Hg. the power valve is operating. Generally a 65 power valve is sufficient for most high performance applications; however, some problems can result with radically cammed, full-race machines equipped with automatic transmissions. These vehicles often "idle" at 2000 rpm and at 6.0" Hg. At this point the main nozzles are feeding an enriched mixture (supplied by the power valve) and the engine will probably "load up". To correct this problem, install a 45 or 35 power valve. This will provide clean idling and proper fuel flow under wide open throttle conditions when manifold vacuums seldom rise above 1" Hg.

SLOSH TUBES:

Slosh tubes can be used in the secondary jets to prevent the secondary main jets from being uncovered as fuel rushes to the back of the fuel bowl during extreme accelerations.

FUEL BOWL VENTS:

The white plastic "whistle" vent should be used in the primaries to prevent fuel from spilling out of the primary vent tube during hard acceleration. The vent extends into the fuel bowl from the top of the primary metering block. Drill an .063 starter hold in the drill point in the top center of the metering block. Drive the self tapping nail through the hole into the vent whistle. Make sure the vent does not bend under the drive nail.

The brass vent should be used on the secondary side and mounted on the two top center locating pins on the fuel bowl face of the metering block between the fuel bowl gasket and the metering block.

GENERAL:

For some strip use, it is advisable to discard the moraine fuel filters which are sometimes installed behind the fuel inlet. If this is done install an inline Holley fuel filter, Part No. 62R-123A, between the fuel pump and the carburetor.

Recommended Fuel Pressure;

7-1/2 psi maximum
5 psi minimum

NOTE: Fuel pressures above 7-1/2 psi can create severe fuel control problems and are not recommended.

Fuel lines should be a minimum of 3/8".

This instruction sheet cannot contain all of the information which may be desired by some individuals. Further clarification is available in *Holley Carburetors*, published by H.P. Books and available at your Holley Distributor (Part #36-49).