

## SECTION 3-F CARTER 4-BARREL CARBURETOR

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### 3-20 DESCRIPTION AND OPERATION OF CARTER 4-BARREL CARBURETOR

#### a. General Description

The Carter Model AFB carburetor used on the *Series 50-60-70-700 engine* is a 4-barrel downdraft type which provides the advantages of a compound installation of two 2-barrel carburetors in one compact unit. See figure 3-40. To aid description and the proper identification of parts the carburetor is considered to be divided into a *primary section* and a *secondary section*.

The *primary section* covers the 2-barrelled forward half of the carburetor assembly. This section is essentially a complete 2-barrel carburetor containing a low speed system, high speed system, power system, and accelerating system. This section also includes a carburetor starter switch for starting the engine, and the climatic control (automatic choke) mechanism.

The *secondary section* covers the 2-barrelled rearward half of the carburetor assembly. This section is essentially a supplementary 2-barrel carburetor which cuts in to assist the primary section when a pre-determined car speed or en-

gine load is reached. This section contains its own high speed system. It has a separate set of throttle valves and a set of auxiliary valves which are located in the barrels above the throttle valves.

The *primary* throttle valves are operated by the accelerator pedal and the connecting throttle linkage. The *secondary* throttle valves are operated by the primary throttle valve shaft through delayed action linkage which permits a pre-determined opening of the primary valves before the secondary valves start to open. Action of the linkage then causes both sets of throttle valves to reach the wide open position at the same time.

The starter switch, which is operated by the *primary* throttle valve shaft, is fully described in paragraph 10-30. The other systems of the carburetor are described in the following subparagraphs.

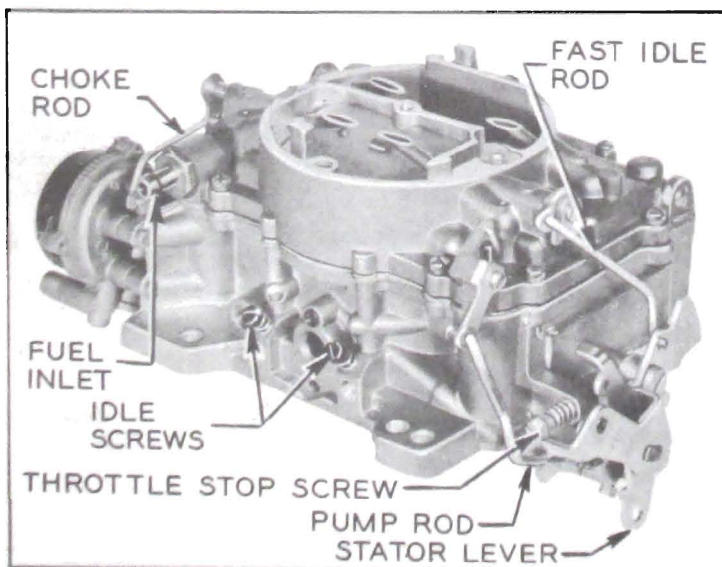


Figure 3-40—Carter AFB Carburetor Assembly

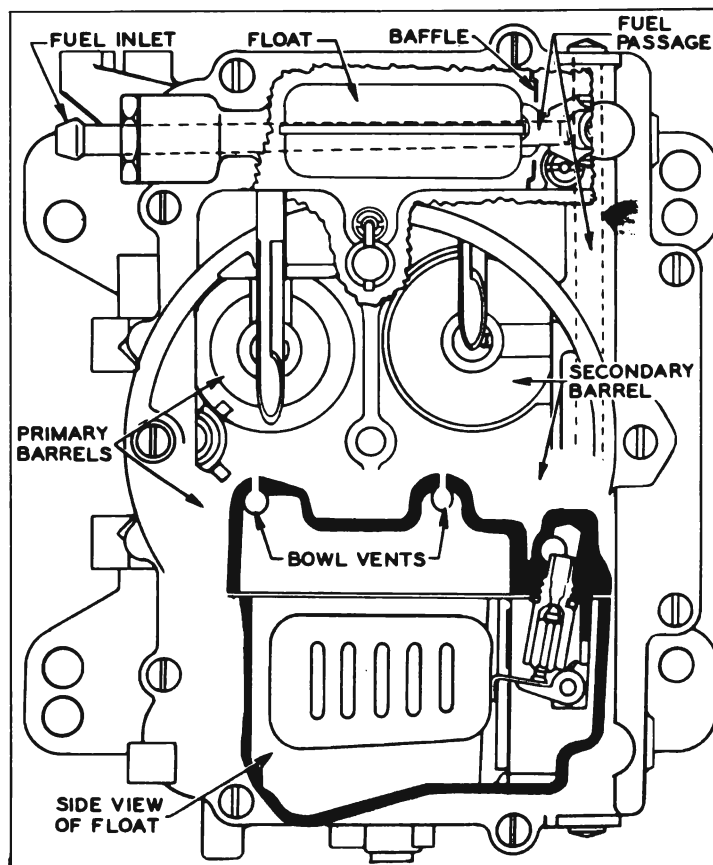


Figure 3-41—Float Circuits

### b. Operation of Float Systems

The purpose of the float system is to maintain an adequate supply of fuel at the proper level in the bowl for use by the low-speed, high-speed, pump and choke circuits.

There are two separate float circuits. Each float circuit supplies fuel to a primary low-speed circuit and a primary and secondary high-speed circuit. See figure 3-41.

Setting the floats to specifications assures an adequate supply of fuel in the bowls for all operating conditions. Special consideration should be given to be sure the floats do not bind in their hinge pin brackets or drag against inner walls of bowl.

The intake needle seats are installed at an angle to provide the best possible seating action of the intake needles.

Intake needles and seats are carefully matched during manufacture. Do not use the left needle in the right seat or vice versa. To avoid unnecessary bending, both floats should be reinstalled in their original positions and then adjusted.

The bowls are vented to the inside of the air horn and also to atmosphere. A connecting vent passage in the air horn effects a balance of the air pressure between the two bowls. Bowl vents are calibrated to provide proper air pressure above the fuel at all times.

### c. Operation of Low Speed Systems

Fuel for idle and early part throttle operation is metered through the low speed system. The low speed system is located on the primary side only. See figure 3-42.

Gasoline enters the idle wells through the main metering jets. The low speed jets measure the amount of fuel for idle and early part throttle operation. The air by-pass passages, economizers and idle air bleeds are carefully calibrated and serve to break up the liquid fuel and mix it with air as it moves through the passages to the idle ports and idle adjustment screw ports. Turning the idle adjustment screws *toward* their seats reduces the quantity of fuel mixture supplied by the idle circuit.

The idle ports are slot shaped. As the throttle valves are opened, more of the idle ports are uncovered allowing a greater quantity of the gasoline and air mixture to enter the carburetor bores. The secondary throttle valves remain seated at idle.

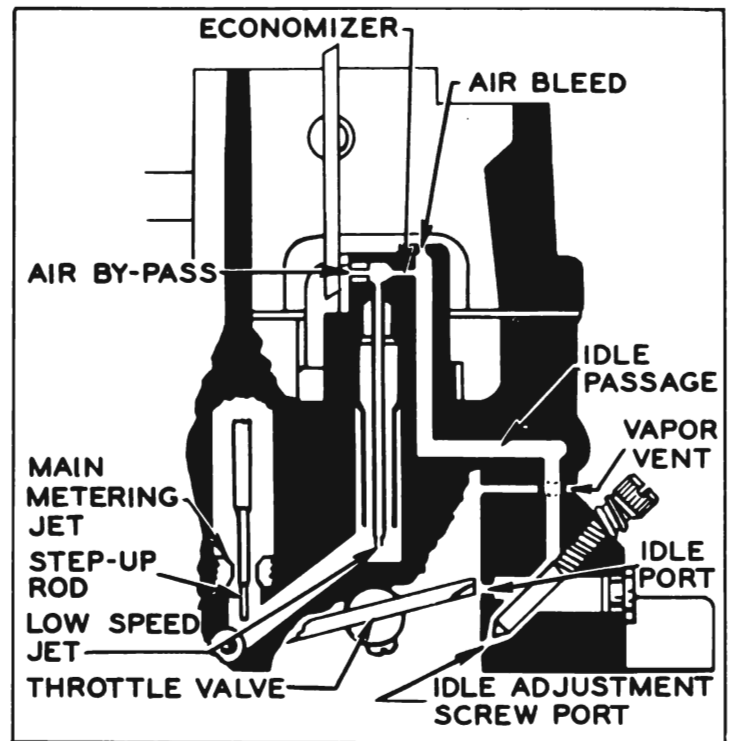


Figure 3-42—Low Speed Circuit

The low speed jets, air bleed, economizer and by-pass bushings are pressed in place in the venturi assemblies. Do not remove in servicing. If replacement is necessary, use a new venturi assembly. To insure proper alignment of the low speed mixture passage, each primary venturi assembly is designed so it can be installed on one side only.

To assist in quick hot engine starting, fuel vapor accumulated in the primary and secondary bores is vented to atmosphere through vent passages above throttle valves.

To combat engine stalling during warm-up on cool humid days, caused by "carburetor icing", exhaust gases are directed against a steel baffle plate that contacts the carburetor mounting flange. The heat transferred helps eliminate ice formation at the throttle valve edges and idle ports.

To compensate for loss of engine RPM while idling under very hot operating conditions, a thermostatic valve assembly is installed in the web between the right and left secondary venturi. When the temperature rises beyond a certain point, the calibrated thermostatic spring opens the valve. This allows additional air to flow through a special passage to an outlet below the secondary throttle valves. The thermostatic valve cannot be adjusted or repaired; therefore, a faulty valve must be replaced. See figure 3-43.

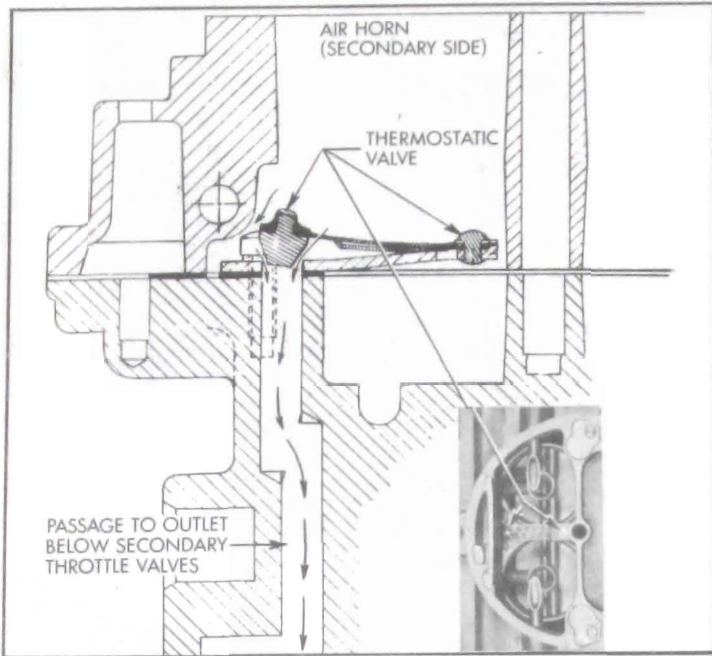


Figure 3-43—Thermostatic Valve Assembly

#### d. Operation of High Speed Systems

Fuel for all except early part throttle and for all full throttle operation is supplied through the high speed system. See figure 3-44.

The position of the step-up rod in the primary main metering jet controls the amount of fuel admitted to the nozzles. The position of the step-up rod is controlled by manifold vacuum applied to the vacuum piston.

During normal part throttle operation, manifold vacuum pulls the step-up piston and rod assembly down, holding the larger diameter of the step-up rod in the primary main metering jet. This is true when the vacuum under

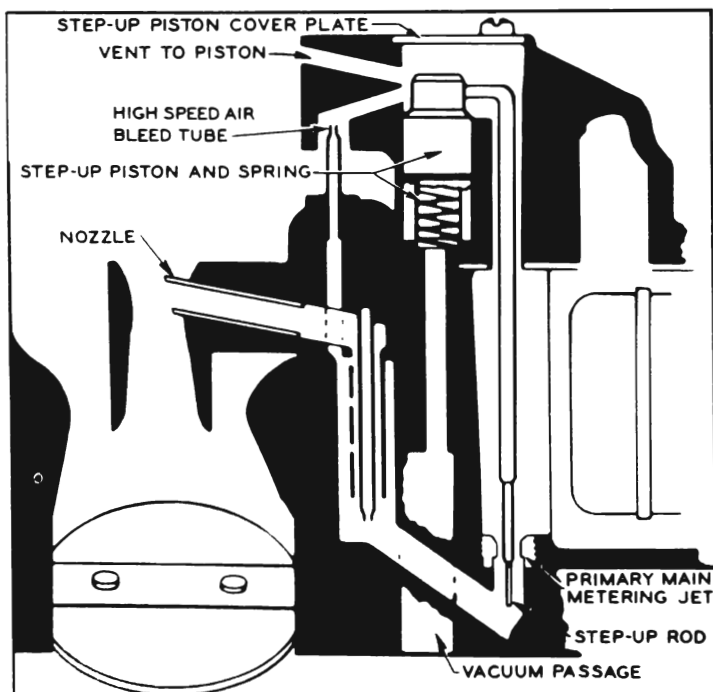


Figure 3-44—Primary High Speed Circuit

the piston is strong enough to overcome the tension of the step-up piston spring. Fuel is then metered around the larger diameter of the step-up rod in the jet.

Under any operating condition, when the tension of the spring overcomes the pull of vacuum under the piston, the step-up rod will move up so its smaller diameter or power step is in the jet. This allows additional fuel to be metered through the jet. The step-up rod does not require adjustment.

Fuel for the high-speed circuit of the *secondary* is metered at the main metering jets (no step-up rods used). See figure 3-45.

Initial discharge ports are incorporated to supplement starting of the fuel flow in the secondary high-speed circuit. These ports are located next to the venturi struts. When the auxiliary valves start to open, the vacuum on the initial discharge ports pulls fuel into pick-up tubes below the fuel level. Air bleeds serve to break-up the liquid fuel and mix it with air as it moves through the passages to the initial discharge ports where it is discharged into the air stream. As the auxiliary valves continue to open, and the secondary nozzles start delivering fuel, less fuel flows from the initial discharge ports.

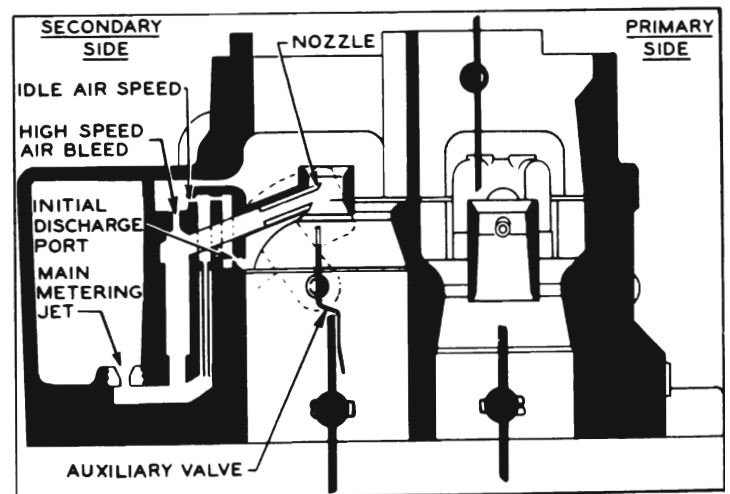


Figure 3-45—Secondary High Speed Circuit

The main vent tubes on primary and secondary sides mix air drawn through the high speed air bleed with the fuel before it passes out of the nozzles.

A clogged air bleed or main vent tube may cause excessively rich mixtures. The high speed bleed and main vent tubes are permanently in-

stalled. If replacement is necessary, use a new venturi assembly.

The high speed bleeds also act as anti-percolator vents when a hot engine is stopped or at idling speed. This will help vent fuel vapor pressure in the high speed and idle well before it is sufficient to push fuel out of the nozzles and into the intake manifold.

Engines operated at part throttle on level road use a mixture of maximum leanness. The mixture for greatest power and acceleration is somewhat richer, and is furnished by the power and accelerating systems described later.

The high speed systems in the *primary* section control the flow of fuel during the intermediate or part throttle range of operation and up to approximately 85 MPH. The *secondary* throttle valves remain closed until the primary valves have opened approximately 40-45 degrees, after which they are opened proportionately so that all valves reach the wide open position at the same time. While the secondary valves are closed, the auxiliary valves located above them are held closed by the weights on the auxiliary valve shaft lever (fig. 3-45); therefore there is not sufficient air flow through the barrels to operate the high speed systems in the *secondary* section.

When the *secondary* throttle valves are open and the engine speed is at least 1400-1600 RPM, the resulting air flow through the secondary barrels starts to open the auxiliary valves because their supporting shaft is located off-center in the barrels. When the auxiliary valves are open the high speed systems in the *secondary* section also supply fuel to the engine.

#### e. Operation of the Power System

For maximum power or high speed operation above approximately 85 MPH, a richer mixture is required than that necessary for normal throttle opening. The richer mixture is supplied through the high speed systems in the *primary* section through vacuum control of the step-up rods.

Each power circuit consists of a vacuum piston located in a cylinder connected to manifold vacuum and a spring which tends to push the piston upward against manifold vacuum. See figure 3-46.

Under part throttle operation, manifold vacuum is sufficient to hold the piston and rod down against the tension of the spring, so that the large diameter of the rod is in the metering

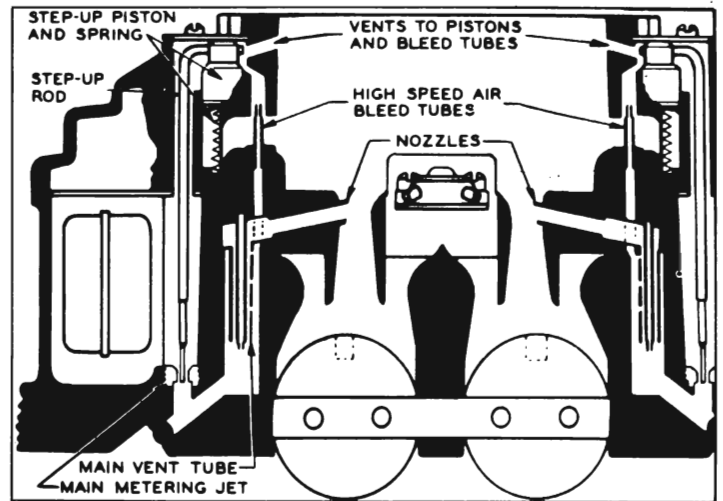


Figure 3-46—Power Circuit

jet for economy. When the throttle valve is opened to a point where additional fuel is required for satisfactory operation, manifold vacuum decreases sufficiently so that the piston spring moves the piston and rod upward to the small rod diameter to give the required richer mixture for power. As soon as the demand is passed, manifold vacuum again moves the piston and rod down.

#### f. Operation of Accelerating System

The accelerating pump circuit, located in the primary side, provides a measured amount of fuel necessary to insure smooth engine operation on acceleration at lower car speeds.

When the throttle is closed, the pump plunger moves upward in its cylinder and fuel is drawn

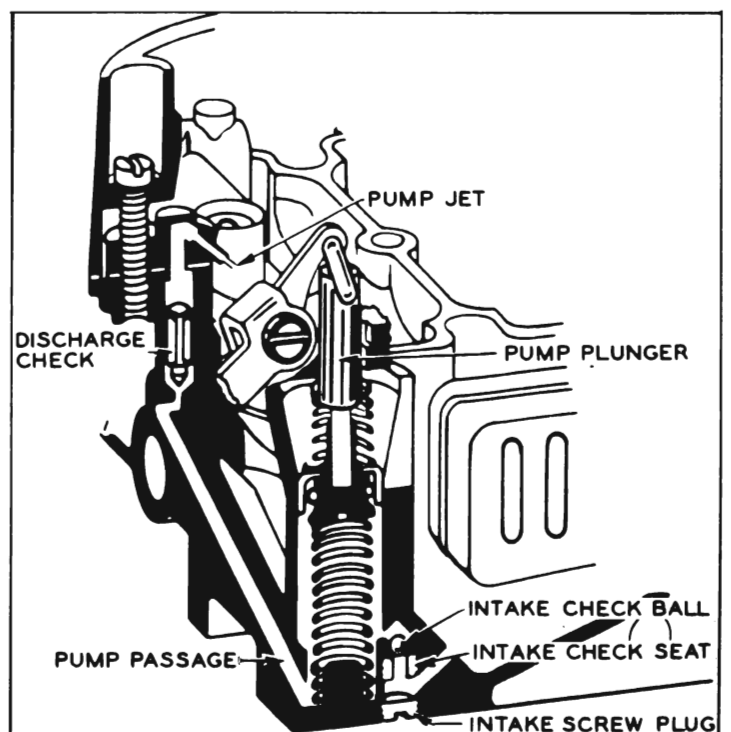


Figure 3-47—Pump Circuit

into the pump cylinder through the intake check. The discharge check is seated at this time to prevent air being drawn into the cylinder. When the throttle is opened, the pump plunger moves downward forcing fuel out through the discharge passage, past the discharge check, and out of the pump jets. When the plunger moves downward, the intake check is closed, preventing fuel from being forced back into the bowl. See figure 3-47.

At higher car speeds, pump discharge is no longer necessary to insure smooth acceleration. When the throttle valves are opened a predetermined amount, the pump plunger bottoms in the cylinder eliminating further pump discharge.

Be sure the pump plunger leather is in good condition and the intake and discharge checks and pump jet are free of lint, gum or other foreign matter. To facilitate service, the intake check ball and seat may be inspected and replaced by removing the screw-in plug in the face of the flange without complete disassembly of the carbureter.

#### g. Operation of Climatic Control

The choke circuit, located in the *primary* side, provides the correct mixture necessary for quick cold engine starting and during engine warm-up.

When the engine is cold, tension of the thermostatic coil holds the choke valve closed. When the engine is started, air velocity against the offset choke valve causes the valve to open slightly against the thermostatic coil tension. Intake manifold vacuum applied to the choke piston also tends to pull the choke valve open. The choke valve assumes a position, where tension of the thermostatic coil is balanced, by the pull of vacuum on the piston, and force of air velocity on the offset valve.

When the engine starts, slots located in the sides of the choke piston cylinder are uncovered, allowing intake manifold vacuum to draw warm air through the climatic control housing. This air is heated in a tube running through the exhaust manifold stove. The flow of warm air heats the thermostatic coil and causes it to lose some of its tension. The thermostatic coil loses its tension gradually, until the choke valve reaches full-open position.

If the engine is accelerated during the warm-up period, the corresponding drop in manifold vacuum allows the thermostatic coil to momen-

tarily partially close the choke, providing a richer mixture.

During the warm-up period, it is necessary to provide a fast idle speed to prevent engine stalling. This is accomplished by a fast idle cam connected to the choke linkage. The fast idle adjusting screw on the throttle lever contacts the fast idle cam and prevents the throttle valves from returning to a normal warm engine idle position, while the choke is in operation. See figure 3-48.

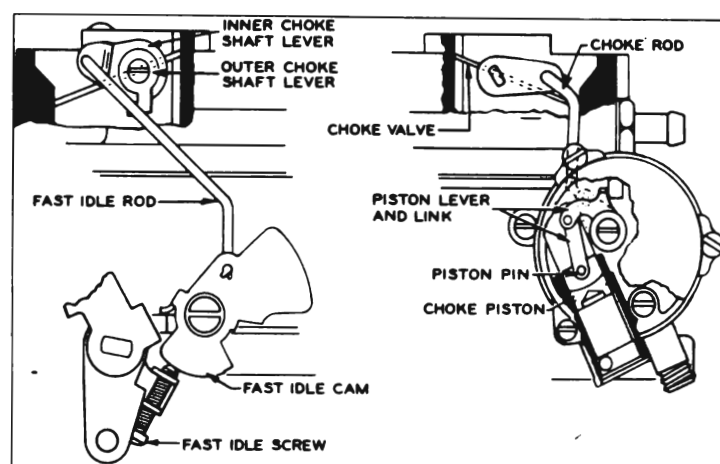


Figure 3-48—Choke Linkage

If during the starting period the engine becomes flooded, the choke valve may be opened manually to clean out excessive fuel in the intake manifold. This is accomplished by depressing the accelerator pedal to the floor mat. The unloader projection on the throttle lever contacts the fast idle cam which rotates and partially opens the choke valve.

The *secondary* section does not have a choke valve. In order to prevent air entering the carburetor through the secondary side during the engine warm-up period, it is necessary to lock the secondary throttle valves in the closed position. This is accomplished by engagement of a lock-out arm with a locking tang on the valve shaft lever. See figure 3-40.

With the choke valve in wide open position the lock-out arm rests in a lowered position, clear of the secondary valve shaft lever. As the choke valve closes it rotates the fast idle cam trip lever, allowing the lock-out arm to raise. As soon as the choke valve is closed a few degrees from wide open position, the notch in the lock-out arm lies in the line of travel of the locking tang on the valve shaft lever, thereby preventing the shaft and valves from turning.

### 3-21 DISASSEMBLY, CLEANING, INSPECTION OF CARTER 4-BARREL CARBURETOR

#### a. Disassembly of Carburetor

1. Remove pin spring from upper end of choke rod and disconnect rod from choke shaft lever. Reinstall pin spring on choke rod for safe keeping.

2. Remove retainer and spring from upper end of pump rod and disconnect rod from pump arm. Reinstall spring and retainer on pump rod.

3. Remove screws holding two step-up piston cover plates to air horn. Remove cover plates and remove each step-up piston, rod, and rod retainer spring as an assembly. Then remove two step-up piston springs. See figure 3-49.

4. Remove screw from end of choke shaft and remove outer lever and washer. Then re-

move inner lever and fast idle rod from carburetor as an assembly. Remove choke valve attaching screws. Remove choke valve and shaft.

5. Remove fuel inlet fitting, gasket, and strainer. Remove all air horn screws and lock washers, noting location of attached cable clip. Remove air horn and gasket from main body, lifting straight up to avoid damaging floats or pump plunger.

6. Remove float lever pins and floats. Remove float needles, needle seats, and gaskets. *Keep float system parts separated so that they may be reinstalled in original location with a minimum amount of adjusting.*

7. Remove pin spring from pump link. Remove link and reinstall pin spring. Remove pump plunger assembly from air horn. Remove air horn gasket.

8. Remove lower pump spring from main body. Remove thermostatic coil and housing assembly, gasket, and baffle plate from choke piston housing. Remove screw from end of choke piston housing shaft and remove washer. Then remove choke piston, lever, link and pin assembly.

9. Remove piston housing from main body. Remove small round gasket from piston housing. Remove choke shaft, lever, and rod assembly from piston housing.

10. Remove starter switch terminal cap, return spring, guide block assembly, plunger and ball from main body. Remove idle mixture adjustment screws and springs. *NOTE: If starter switch strainer is not visibly damaged or clogged, it need not be removed.*

11. Remove both secondary venturi assemblies and gaskets. Remove auxiliary valve assembly. Remove both primary venturi assemblies and gaskets. Notice that each venturi assembly is different and can be assembled in only one location. Notice also that primary venturi assembly gaskets are different from secondary gaskets.

12. Remove pump jet housing and gasket. Remove pump discharge check needle.

13. Remove all four metering jets. Notice that the primary jets have larger orifices than the secondary jets. This is because step-up rods are used only in the primary jets.

14. Invert main body and remove pump intake screw plug, check ball seat, and check ball. Unless passages in main body appear to be

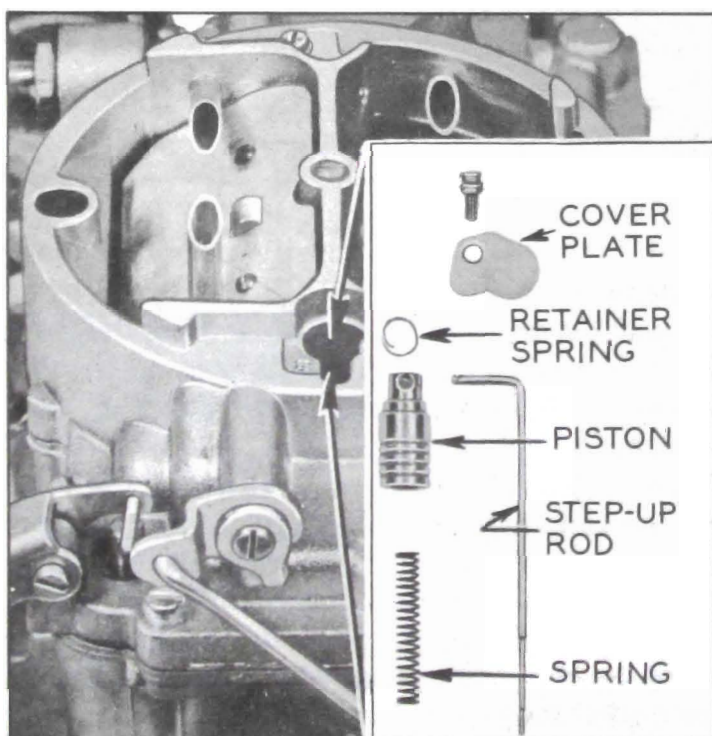


Figure 3-49—Step-Up Rod and Related Parts

clogged with carbon or gum to such an extent that penetration of cleaning solution is doubtful, it is seldom necessary to remove passage plugs.

For normal cleaning and inspection, it is not necessary to remove primary or secondary throttle valves and their connecting linkage. However, if throttle linkage is worn or damaged, service replacement parts are available.

### 3-22 ASSEMBLY AND ADJUSTMENT OF CARTER 4-BARREL CARBURETOR

During assembly of carburetor, use all new gaskets and any additional new parts found to be necessary during inspection. *Calibrated parts must be as specified for carburetor CODE number which is stamped in edge of mounting flange at rear center.*

1. With carburetor main body inverted, install pump intake check ball, ball seat, and screw plug with a new gasket.

2. Place main body in upright position on bench or mounting fixture. Install primary and secondary metering jets and tighten securely. NOTE: The *primary* jets are the two having the *larger* orifices and are installed in the holes nearest the center of the main body below step-up rod holes in air horn.

3. Install pump discharge check needle point down. Install pump jet housing and gasket.

4. Install auxiliary valve assembly with screw heads down. Then install secondary and primary venturi assemblies, using new gaskets. NOTE: If a primary venturi assembly does not fit in place flush with top of main body, it belongs on other side.

5. Install idle mixture adjustment screws. Seat lightly and back out  $1\frac{1}{2}$  turn, which will provide an average initial adjustment. Install starter switch ball, plunger (with groove up), guide block assembly, return spring, terminal cap and screws in main body. See figure 10-26. Lubricate terminal cap as described in paragraph 10-30 and check switch timing if there is any indication that switch is not functioning properly. Install new starter switch strainer if old strainer was removed.

6. Install choke piston housing shaft, lever and rod assembly in piston housing with lever and rod pointing away from heat pipe connector. Install small round rubber gasket in

housing recess, then install piston housing on main body using three black screws. Install choke piston, pin link, and lever assembly in piston housing. Install piston lever on flats of shaft in such a way that inner and outer levers are pointing in same general direction. Then install special washer and screw.

7. Place pump plunger assembly in position in air horn and install pump link. Install pin spring in upper end of link. Invert air horn and install new air horn gasket.

8. Install float needle seats and gaskets. Install float needles, floats, and lever pins, making sure they are installed in original locations.

9. *Align Float.* Sight down side of float to determine if side is parallel with outer edge of air horn. If adjustment is necessary, bend float lever by applying pressure to end of float with fingers while supporting float lever with thumb. See figure 3-50.

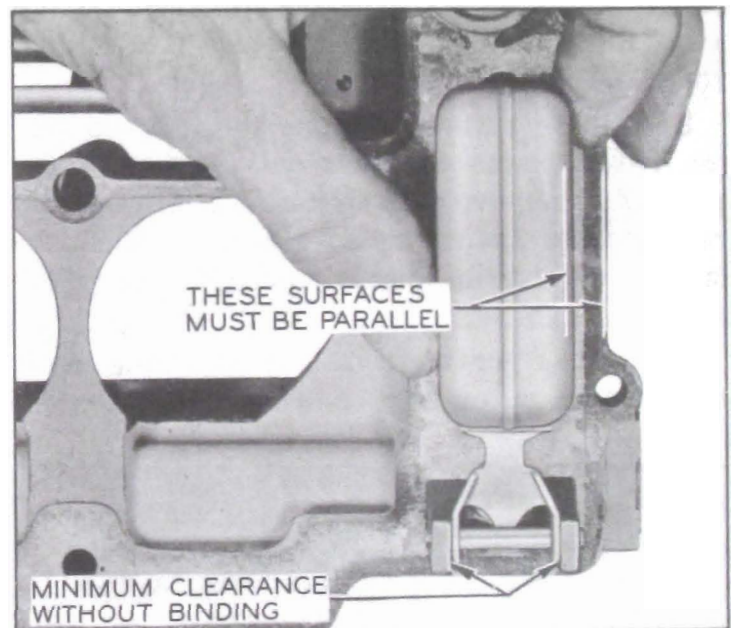


Figure 3-50—Float Alignment

Remove any excess clearance between arms of float lever and lugs on air horn by bending float lever arms. Arms should also be parallel to inner surfaces of lugs. After aligning, each float must operate freely.

10. *Adjust Float Level.* With air horn inverted and air horn gasket in place, check clearance between each float (at outer end) and air horn gasket using Float Gauge T109-106 ( $\frac{7}{32}$ " ) or a  $\frac{7}{32}$ " drill. See figure 3-51. To adjust, bend float lever. After any adjustment, recheck float alignment.

11. *Adjust Float Drop.* With air horn held in upright position, measure vertical distance

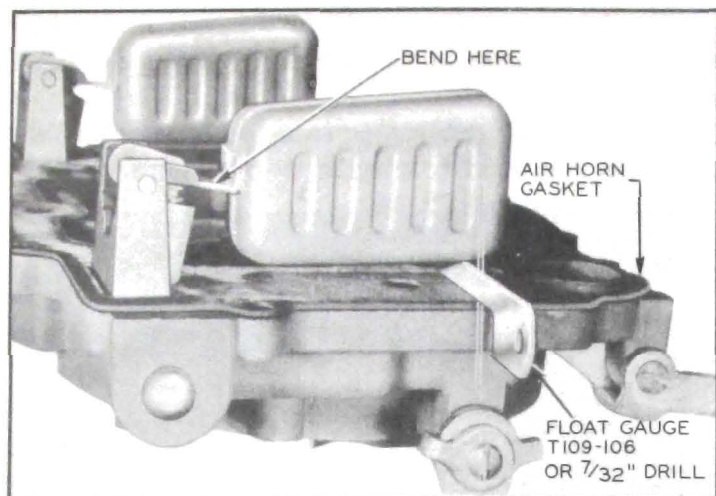


Figure 3-51—Checking Float Level

from air horn gasket to outer end of each float using a scale. Bend float arm tang as required to obtain  $\frac{3}{4}$ " measurement. See figure 3-52.

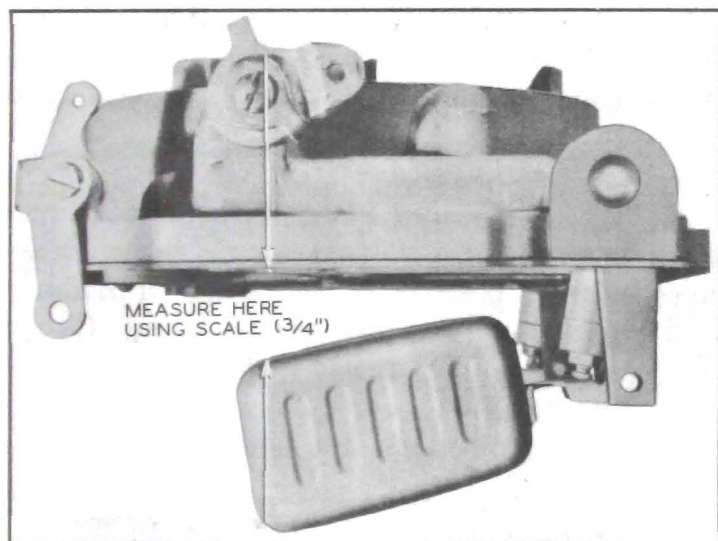


Figure 3-52—Checking Float Drop

12. Place lower pump spring in pump well (opposite choke piston housing). Install air horn assembly on main body, using care to avoid distortion of floats. Install air horn screws and tighten evenly. (Two longer screws go in middle holes.) Install fuel inlet strainer in fuel inlet and install inlet in air horn. Check auxiliary valve assembly by opening from above. Auxiliary valves must be perfectly free in any position.

13. Install choke shaft in air horn with attached lever toward choke piston housing. Install choke valve with markings up and install screws loosely. Align choke valve by working choke shaft endwise while maintaining an upward pressure on choke shaft lever. Tighten and stake choke valve screws. Check for uniform clearance and freedom from sticking,

as improper fit or binding may cause hard starting. Mechanism is free if choke valve will fall open from its own weight.

14. Install assembled fast idle rod and choke lever by first engaging fast idle rod in fast idle cam. Then place lever over end of choke shaft so that it points toward accelerator pump. Install special washer on shaft and then install choke shaft outer lever so that tang on outer lever is above tang on inner lever when choke valve is open.

15. Install two step-up piston springs. Install each assembled step-up piston, rod, and rod retainer spring. Carefully push down on each step-up piston and rod until rod enters metering jet. *Use care to avoid bending step-up rods.* Then install cover plates, holding plates down while tightening screws.

16. Install upper end of pump rod in pump arm. Use spring and retainer on rod, making sure that bronze washer is on opposite side of pump arm from spring.

17. Install upper end of choke rod in choke shaft lever, using pin spring on rod.

18. *Adjust Choke Rod.* With choke valve tightly closed, check clearance between choke piston lever and stop in housing using a No. 56 drill (.045"). To adjust, place Tool J-5197 on upper section of rod and bend as required. See figure 3-53.

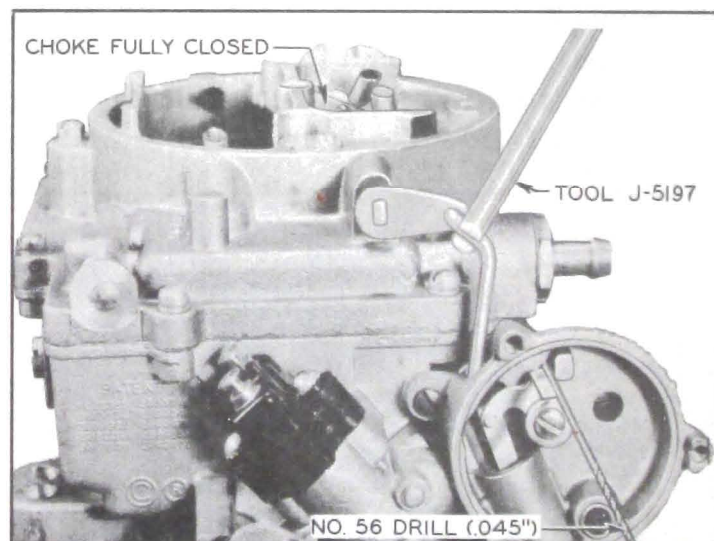


Figure 3-53—Choke Piston Adjustment

19. Install baffle plate in choke piston housing. Install thermostatic coil and housing assembly with gasket. Rotate clockwise until index marks align and choke valve is just closed. Turn cover one notch rich, then tighten screws and retainers.



20. *Adjust Pump.* Push fast idle cam aside and back out throttle stop screw until throttle valves seat in throttle bores. Measure from air horn to top of plunger shaft with scale. Bend pump rod at lower angle as required to obtain  $\frac{1}{2}$ " measurement using Tool J-4552. See figure 3-54. Turn throttle stop screw in (from fully closed throttle position)  $\frac{1}{2}$  turn which should provide an initial idle adjustment.

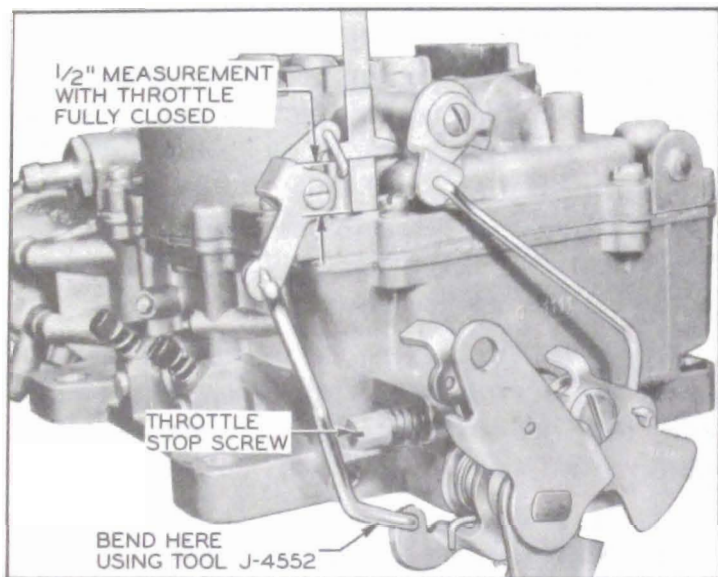


Figure 3-54—Pump Adjustment

21. *Adjust Fast Idle Rod.* Hold choke valve closed and hold fast idle cam against stop on casting by lifting on inner lever, then check clearance between lugs on inner and outer choke shaft levers using Gauge T 109-200 or .010" feeler gauge. Bend fast idle rod at lower angle as required to obtain this clearance using Tool J-5197. See figure 3-55.

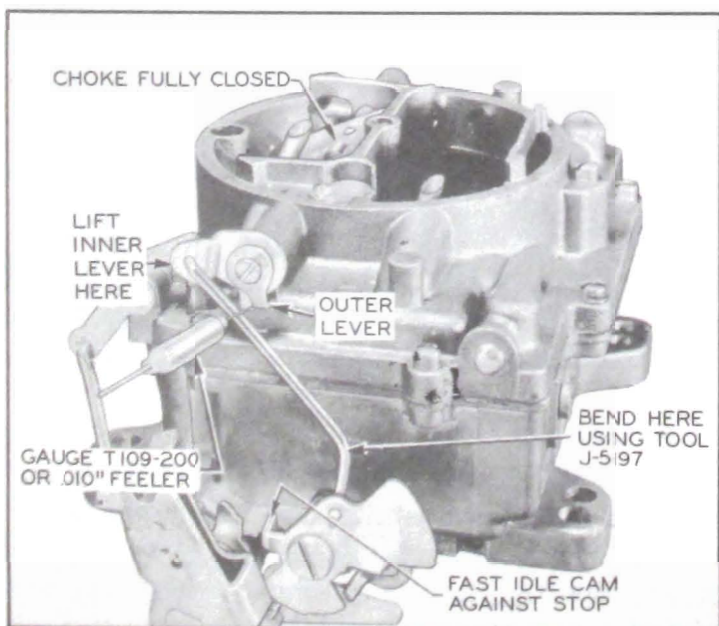


Figure 3-55—Fast Idle Rod Adjustment

22. *Adjust Unloader.* Hold throttle wide open and check clearance between upper edge of choke valve and inner wall of air horn using a  $\frac{3}{16}$ " drill. Bend unloader tang on throttle shaft lever as required to obtain this clearance using pliers. See figure 3-56.

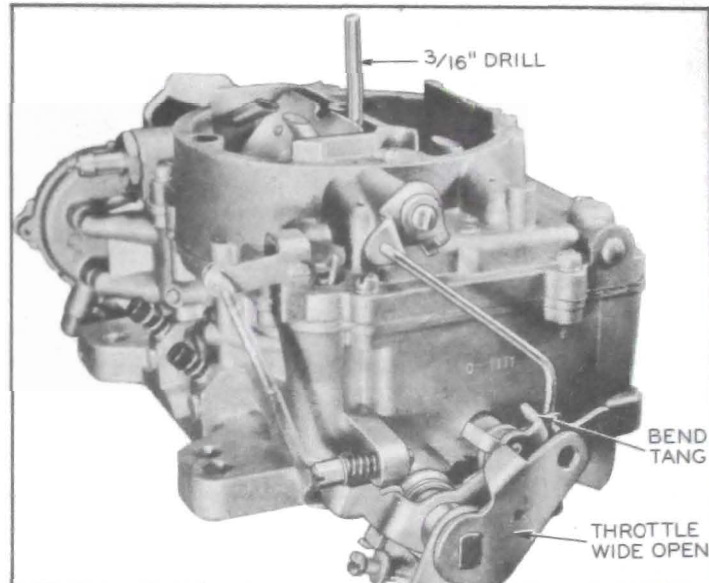


Figure 3-56—Unloader Adjustment

23. *Adjust Closing Shoe.* With primary and secondary throttle valves closed, check clearance between positive closing shoes on primary and secondary throttle levers using Gauge T 109-29 or a .020" feeler gauge. Bend secondary closing shoe as required to obtain this clearance using pliers. See figure 3-57.

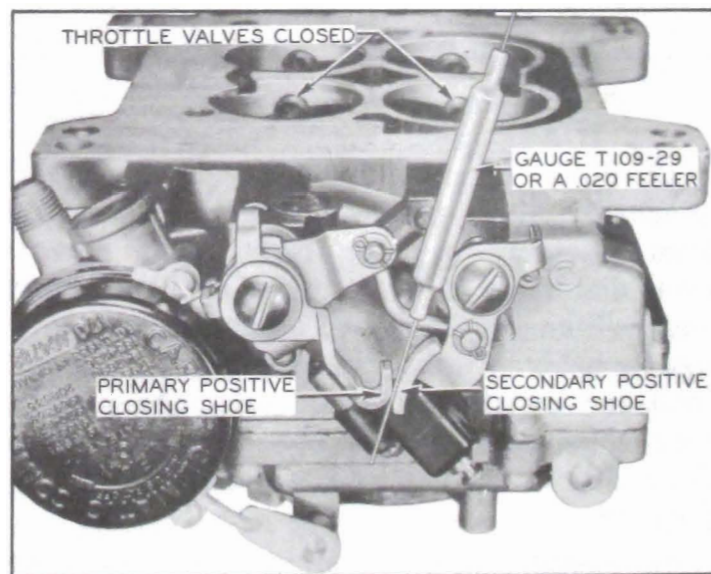


Figure 3-57—Closing Shoe Adjustment

24. *Adjust Secondary Throttle Opening.* The pick-up lever located on the primary throttle shaft has two points of contact with the loose lever on the primary shaft. Caution should be taken that the pick-up lever contacts the loose

lever at both points at the same time. See figure 3-58. If they do not make this contact, bend pick-up lever to obtain proper engagement.

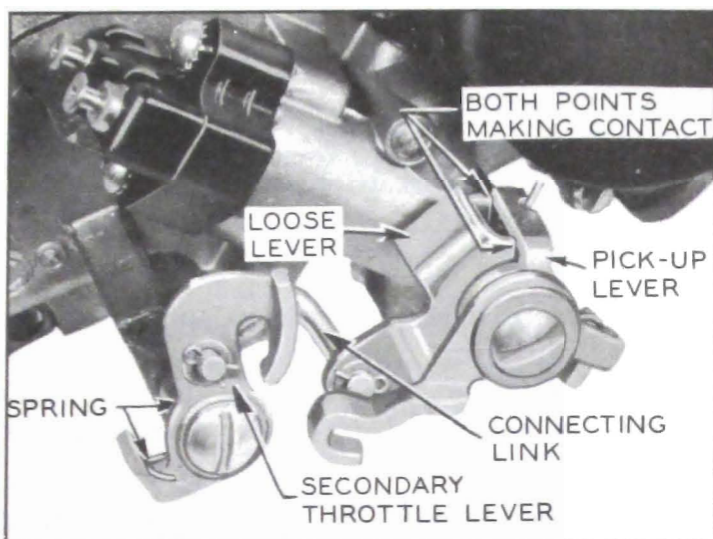


Figure 3-58—Secondary Throttle Opening Adjustment

The primary and secondary throttle valve must come to the wide open position simultaneously. If the secondary throttle valve opening is not synchronized with that of the primary, bend the connecting link. See figure 3-58.

25. *Adjust Secondary Throttle Lock-Out.* Open primary throttle valves slightly and manually open and close choke valve. Tang on secondary throttle lever should freely engage in notch of lock-out dog while barely missing

edge of notch. If necessary to adjust, bend tang on secondary throttle lever using Tool J-6058-A. See figure 3-59.

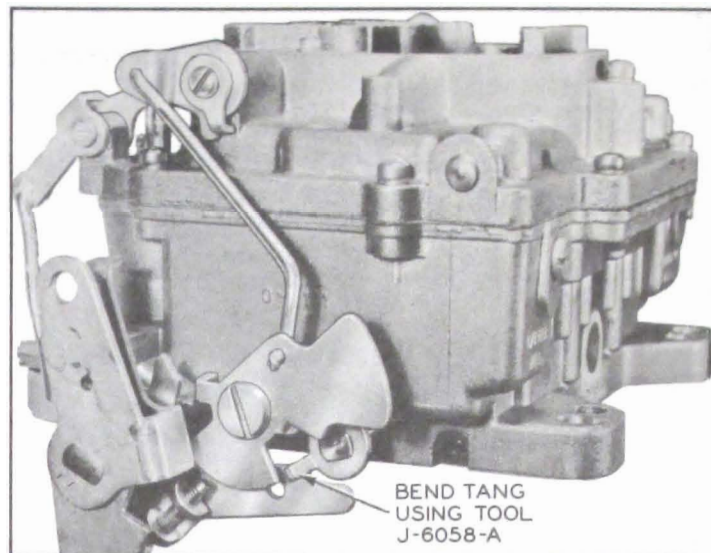


Figure 3-59—Secondary Throttle Lock-Out Adjustment

26. Install carburetor on car. Make final idle speed and mixture adjustments on car in normal manner. See paragraph 3-8.

27. *Adjust Fast Idle.* Make adjustment on car with engine at normal operating temperature as follows:

- (a) Push fast idle cam to position where fast idle screw contacts high step of cam.
- (b) Adjust fast idle screw until engine is running 1500 RPM.