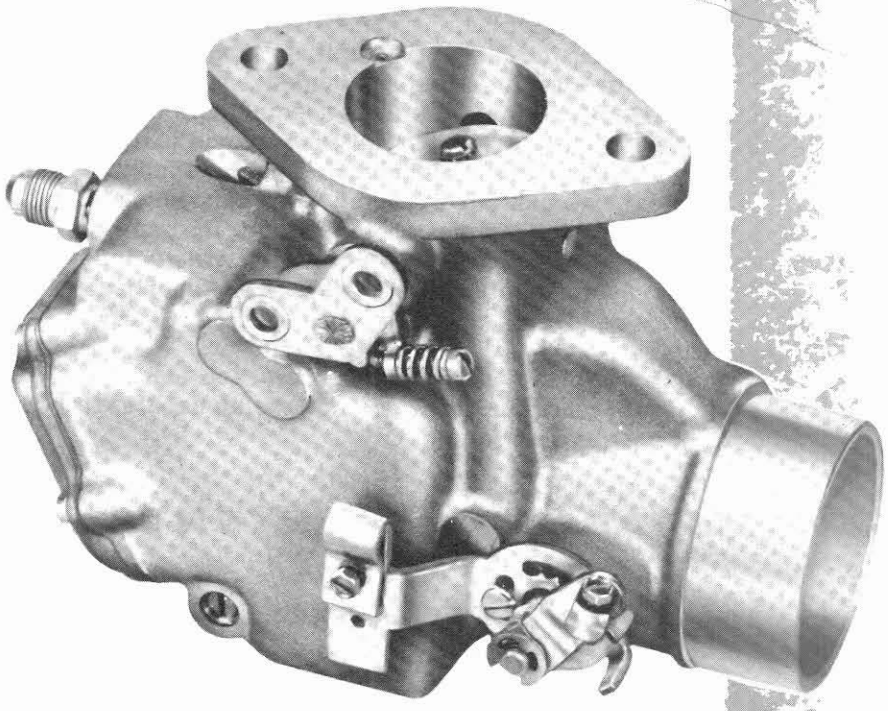
OVERHAUL MANUAL

MODEL USX CARBURETER



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DECATUR • ILLINOIS

INTRODUCTION

This Instruction Manual provides descriptive and overhaul data for the Marvel-Schebler Model USX Tractor and Industrial Carbureter.

Section I illustrates and describes operating principles of each of the six basic functions performed by the Model USX: float system, idle system, power system, accelerator pump system, choke system and economizer and venting system. It is recommended that a thorough knowledge of the functioning of these various systems be acquired before performing any of the overhaul operations listed.

Section II illustrates and describes procedures for disassembling, cleaning, inspecting parts and reassembling the Model USX unit. It should be remembered that overhaul is simple provided these instructions are carefully followed, and the special tools used properly. These tools are essential for removal and installation of throttle-shaft bearings and pump discharge nozzle. Bearings can be damaged by improper handling and the only method of properly locating the pump discharge nozzle is through correct use of these tools as described at applicable locations in the overhaul instructions.

> NOTE: Some variations of the Model USX carbureter do not have an accelerator pump system.

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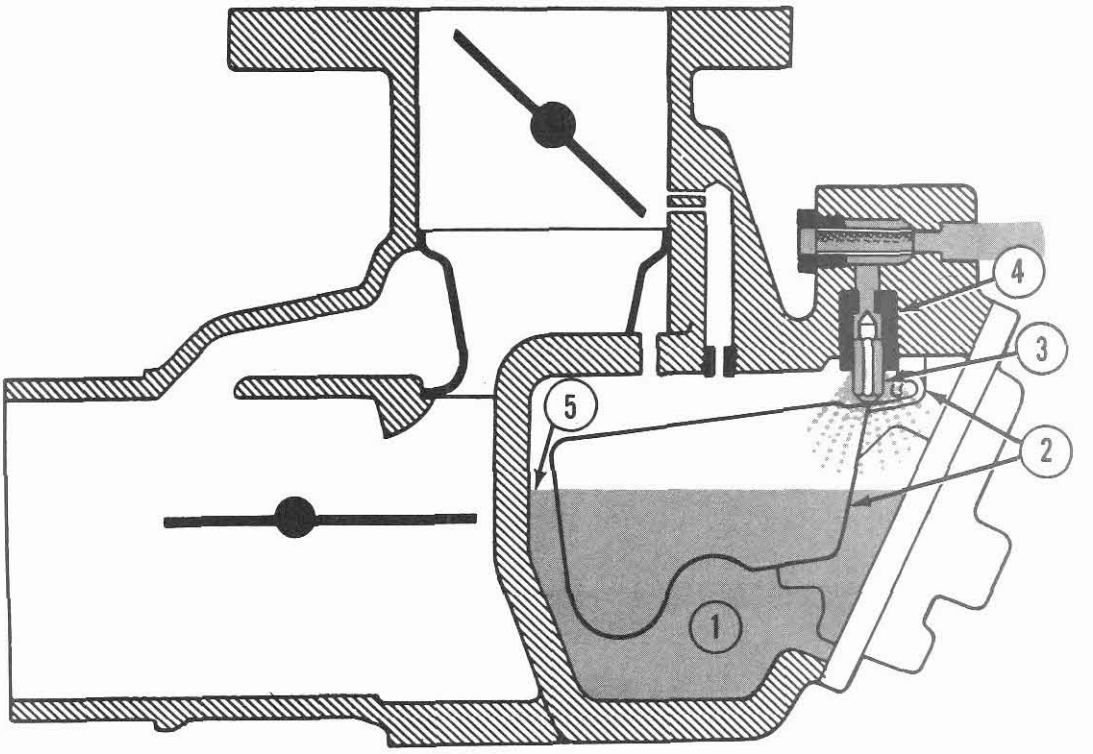
* Some models are not equipped with pump

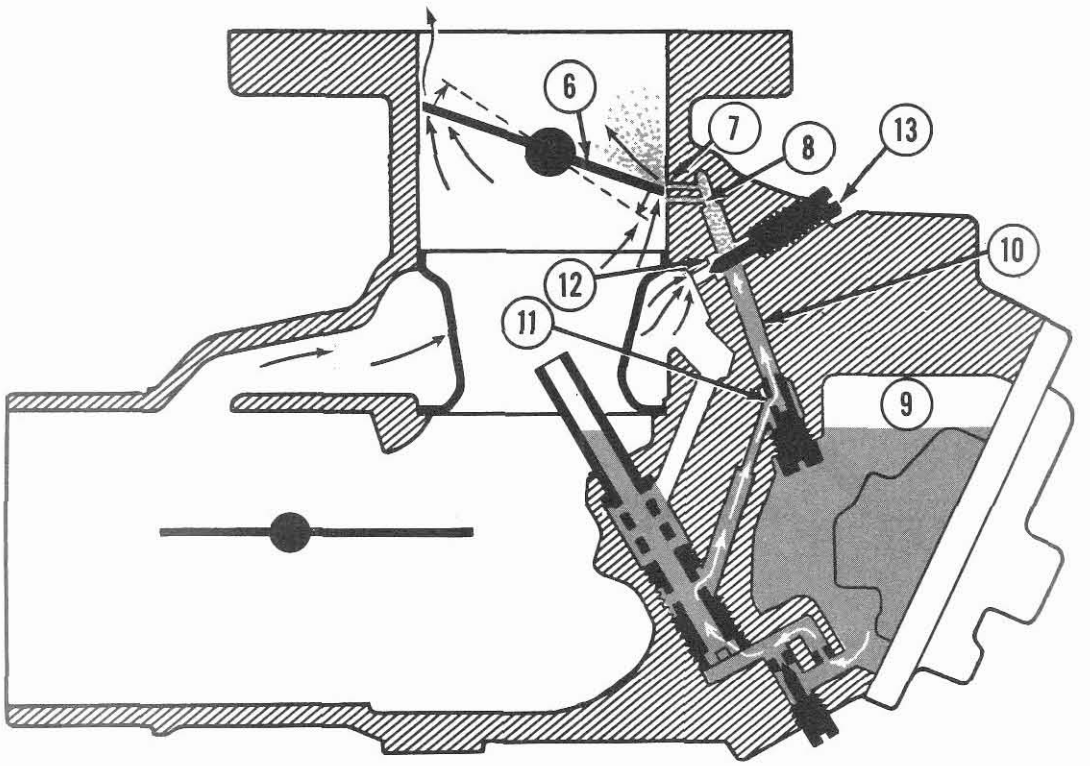


FLOAT SYSTEM

The float system controls the level and supply of gasoline in the fuel bowl throughout the operating range of the engine.

When the fuel bowl (1) is empty the float and lever (2) and float valve (3) drop and fuel under pressure from the fuel pump (or gravity feed) is forced through the float valve seat (4) around the float valve (3) and into the fuel bowl (1). As the fuel in the bowl approaches the correct operating level it raises the float and lever (2) with enough force to raise the float valve (3) and cut off the flow of fuel into the bowl. As fuel feeds through the carbureter jets into the engine the fuel level (5) drops, allowing additional fuel to enter the fuel bowl.

Under actual operating conditions the fuel level (5) and float and lever (2) automatically position themselves so that the inward flow of gasoline to the carbureter is equal to the outward flow of gasoline to the engine.



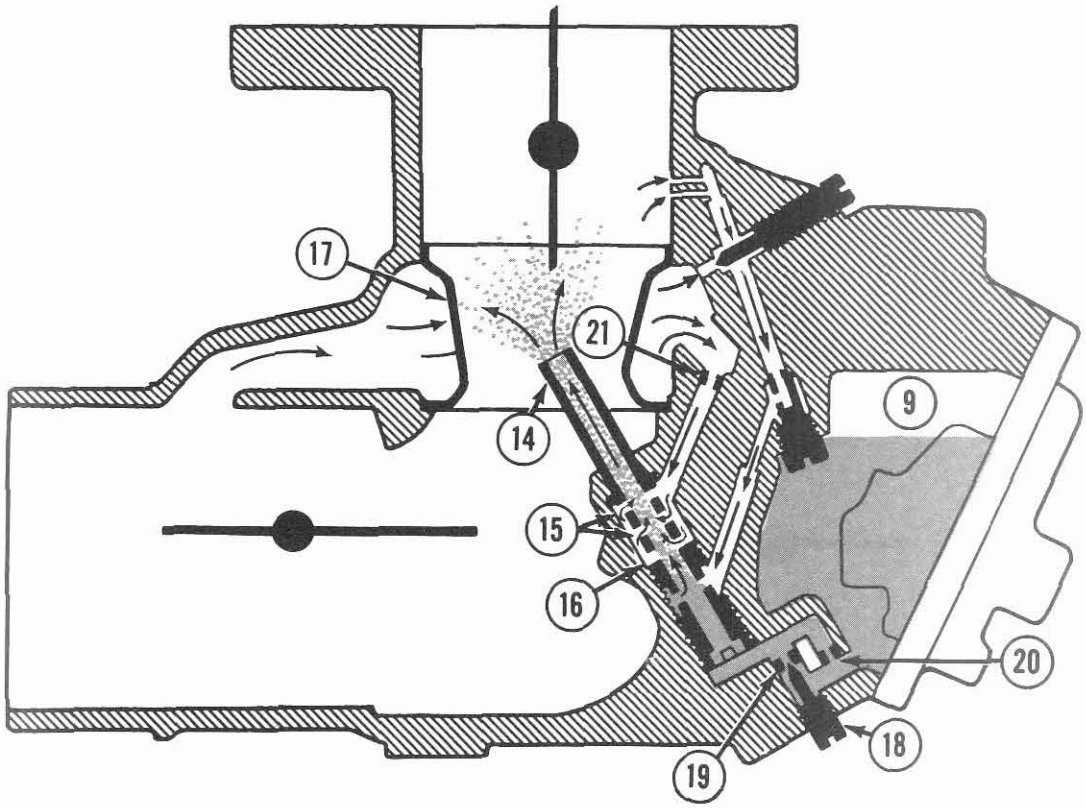
IDLE SYSTEM

The idle system controls the flow of fuel at idle speed and at slow speeds until the throttle is opened wide enough to allow the power fuel feed system to function.

When the throttle valve (6) is in the idle position, the edge of the valve is between the primary idle orifice (7) and the secondary idle orifice (8). With the valve in this position the air pressure (manifold vacuum) at the primary idle orifice (7) is lower than the air pressure in the fuel bowl chamber (9) and fuel is forced from the fuel bowl into the idle fuel passage (10). As the fuel travels through the idle fuel passage (10) it passes through the metering orifice of the idle jet (11) to the point where it is combined with air entering through the idle adjusting needle seat (12). The mixing of air with gasoline helps to atomize the fuel and this process is repeated at the secondary idle orifice (8) as the fuel travels through the idle fuel passage (10). As this rich mixture of fuel and air emerges from the primary idle orifice (7) it is reduced to correct proportions by the air which passes around the throttle valve (6) since this valve must be slightly open to permit the engine to idle. The resultant mixture is correct for operating engine at idle speed, provided the idle adjusting needle (13) is properly adjusted.

As the throttle valve (6) is slowly opened from the slow idle position it gradually subjects the secondary idle orifice (8) to intake manifold vacuum, and the secondary idle orifice (8) no longer bleeds air to the idle fuel passage (10) but feeds an additional quantity of fuel into the engine. This is proper since the throttle valve is now open wider and will admit a greater amount of air to blend with this additional fuel to maintain the correct proportions of fuel and air for the engine.

As the throttle valve (6) is opened still wider, the idle fuel delivery begins to fade out, however, the throttle valve at this point is far enough open for the power fuel feed system to begin functioning.

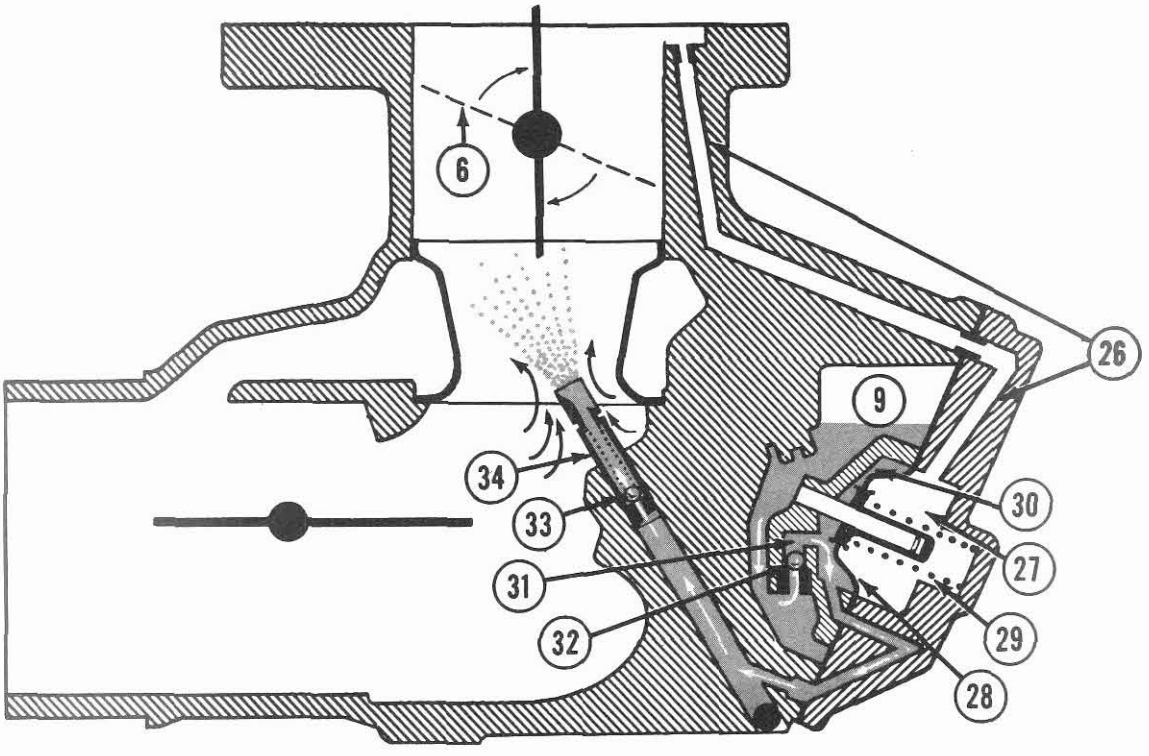


POWER SYSTEM

As the engine speed is increased from the slow idle position the air flow through the venturi (17) is gradually increased, and, as the idle system begins to diminish, the velocity through the venturi (17) is high enough to create a pressure at the tip of the nozzle (14) slightly less than the pressure in the fuel bowl chamber (9). Fuel, therefore, feeds from the fuel bowl through the opening between the power (load) adjusting needle (18) and the power adjusting needle seat (19) and also through the power jet (20) to the nozzle (14) to be discharged into the air stream at the venturi (17). Because the size of the power jet (20) and the position of the power adjusting needle (18) restrict the amount of fuel which can enter the nozzle (14), the fuel in the accelerating well (16) will soon be exhausted and air will then enter through the nozzle air bleeds (15) to mix with the fuel passing through the nozzle (14). The amount of air that can enter the nozzle (14) is limited by the size of the nozzle air vent (21).

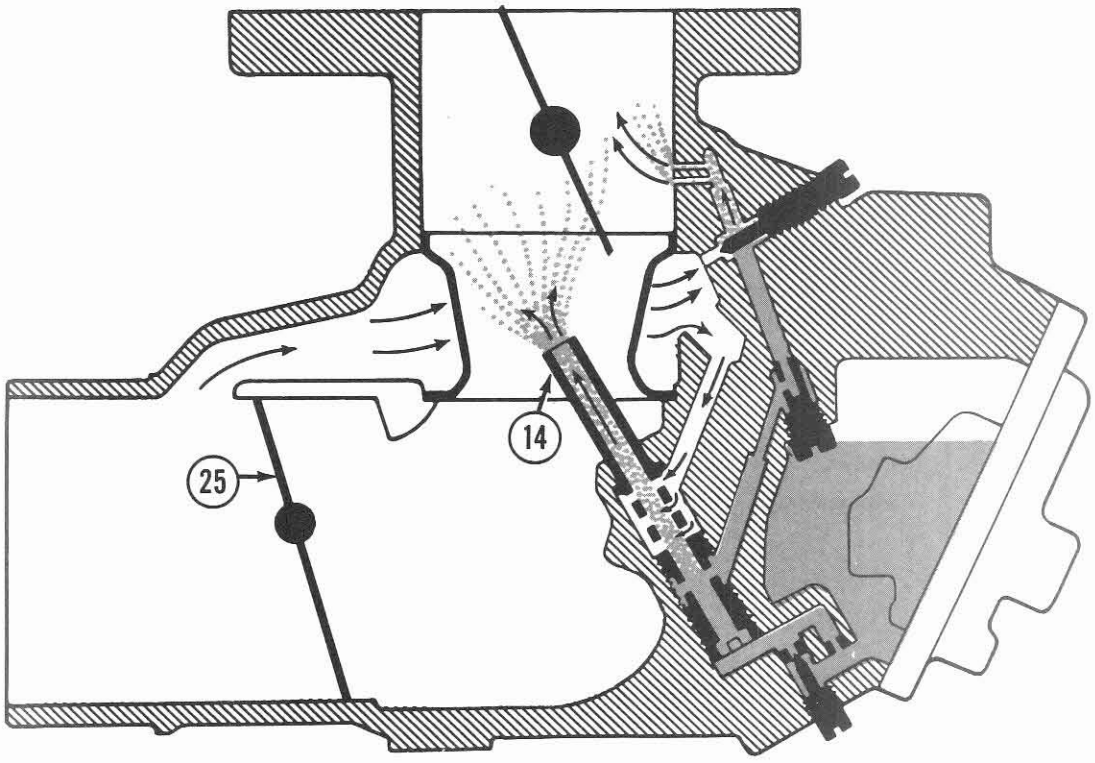
The result of air bleeding into the nozzle (14) is, to help atomize or break up the fuel into finer particles, to regulate the quantity and the rate of discharge of the fuel fed from the accelerating well (16) during acceleration, and to provide the correct mixture proportions for full throttle operation.

As the throttle valve is opened toward the wide open position, the velocity through the venturi (17) continues to increase, lowering the air pressure at the nozzle (14) and resulting in additional fuel being supplied to the engine as the speed is increased.



ACCELERATOR PUMP

When the throttle valve (6) is closed, the high vacuum existing above the valve is transferred through connecting channels (26) between the manifold flange and the accelerating pump diaphragm spring cavity (27). The diaphragm (28) is retracted and the spring (29) compressed. As the diaphragm is retracted a pressure drop is created in the opposite cavity (30) causing fuel to flow from the bowl through the indicated channels (31). When the throttle is opened, the vacuum drops and the spring (29) forces the diaphragm (28) forward. A pressure is built up in the fuel cavity (30) which seats the inlet ball check (32), opens the *discharge check* (33) and discharges fuel into the air stream through the discharge jet (34).

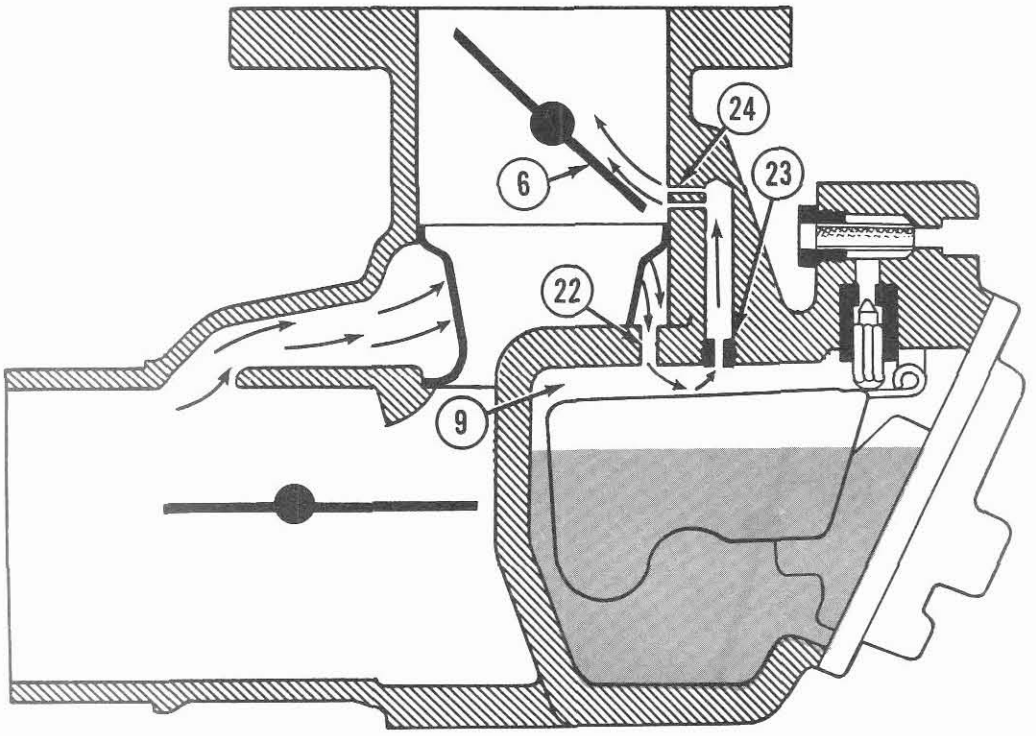


CHOKE SYSTEM

The function of the choke valve (25) is to restrict the amount of air that can enter the carbureter and to increase the suction on the nozzle (14) so that additional fuel will be drawn into the manifold. As soon as the engine fires and runs the rich mixture must be rapidly reduced to prevent stalling. This change in mixture is accomplished by the operator positioning the choke valve to provide the proper mixture. However, a few degrees movement of the choke valve (25) will make a big change in the mixture strength, and to help reduce the sensitivity of the choke valve (25) position, use is made of a spring loaded floating choke valve. This valve opens automatically with engine speed and load and eliminates a great deal of choke manipulation on the part of the operator.

When the engine has reached normal operating temperature, the choke valve (25) must be fully opened to assure maximum power and economy. In addition, extended use of the choke results in more gasoline being supplied to the engine than can be burned. A large percentage of the unburned gasoline is lost through the exhaust system. The remainder of the raw gasoline is forced between the pistons and cylinder walls, washing away the protective oil film and increasing engine wear; and enters the crankcase where it dilutes the engine oil.

Any adjustments that are necessary on the carbureter should never be attempted until the engine has obtained its normal operating temperature and the choke valve (25) has been placed in the wide open position.



ECONOMIZER AND VENTING

All the air that enters the fuel bowl chamber (9) must first pass through the air cleaner and the bowl vent (22). The size of the bowl vent (22) controls or limits the amount of air that can enter the fuel bowl chamber (9). The amount of air that is drawn out of the fuel bowl chamber (9) is controlled by the size of the economizer jet (23), the economizer orifice (24) and the position of the throttle valve (6), as its position determines the manifold vacuum or suction on the economizer orifice (24). As the throttle valve (6) is opened from the fast idle position, the economizer orifice (24) is gradually exposed to manifold suction, and air flows from the fuel bowl chamber (9), through the economizer jet (23) and out the economizer orifice (24). This air must be replaced by air entering through the bowl vent (22) but as the size of the bowl vent (22) restricts the amount of air that can enter, the resultant pressure in the fuel bowl chamber (9) will be lowered, reducing the difference in air pressure between the nozzle (14) and the fuel bowl chamber (9). The flow of fuel will therefore be retarded so that the exact economy mixture ratio will be delivered to the engine at this particular throttle opening. Opening the throttle valve (6) further exposes both economizer orifices (24) to manifold suction, resulting in additional air being removed from the fuel bowl chamber (9), again leaning out the mixture ratio to the correct proportions for this new throttle position. After the economizer orifices (24) are fully exposed to manifold suction, the amount of air that is drawn out of the fuel bowl chamber (9) is controlled by the manifold vacuum or suction at any given throttle valve (6) position. This suction decreases as the throttle approaches wide open position and less air is drawn out of the fuel bowl chamber. This causes additional fuel flow to the engine to provide the extra richness required for operation at heavy loads where maximum horsepower is necessary.

SECTION II – OVERHAUL

1. SPECIAL SERVICE TOOLS.

The table below lists the special tools required to insure complete and proper overhaul of the Marvel-Schebler, Model USX Carbureter (see figure 2-1).

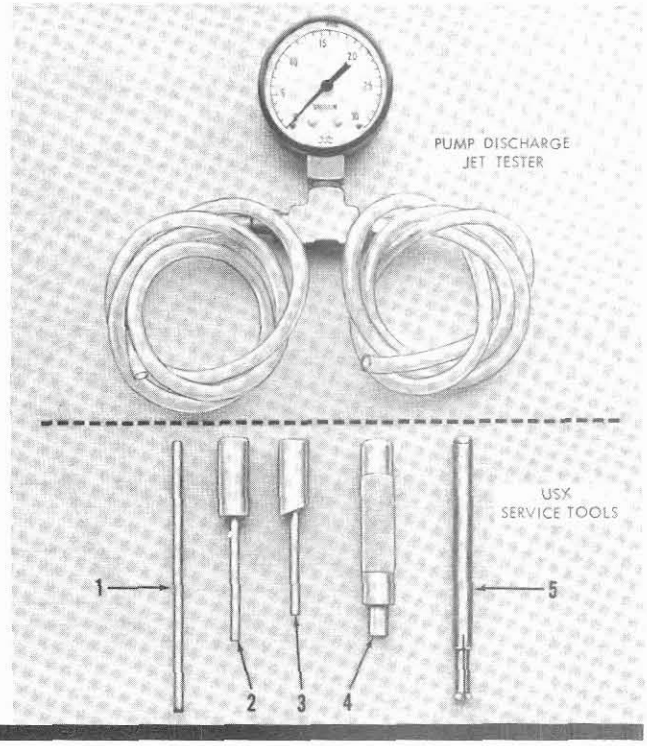


Figure 2-1. Special Tools

Index No.	Part No.	Name	Use
1		5/32" Diameter Rod, 4" Long.	For driving out the pump discharge jet.
2	M-502	Pump Discharge Jet Locating Tool.	For locating the pump discharge jet so that the slot will be in proper position after installation.
3	M-505	Pump Discharge Jet Installation Tool.	For pressing the pump discharge jet into final position.
4	M-503	Needle Bearing Installation Tool.	For pressing new throttle-shaft needle bearings into carbureter housing.
5	M-504	Needle Bearing Removing Tool.	For pressing out throttle-shaft needle bearings.
6		Pump Discharge Jet Tester (can be made with vacuum gage and tubing – see figure 2-1.)	For checking release pressure (or vacuum) of pump discharge check valve.

2. DISASSEMBLY. (See figure 2-2.)

a. Remove throttle valve screws (1), throttle valve (2), throttle shaft (3), packing retainer (6), packing (7) and cup (8).

b. Remove choke valve screws (9), choke valve (10) and shaft assembly (11). Remove snap ring (14), lever (13), spring (12), cotter pin (15) and swivel (17). Remove washer packing retainer (18) and packing (23).

c. Remove choke bracket screws (19), bracket (20), choke packing (23) and choke shaft hole plug (24).

d. Remove strainer retainer (25), washer (26), strainer (27) and fuel-line connection (28).

e. Remove bowl cover screws (29), housing (30) and gasket (31).

f. Remove pump housing screws (32), housing (33), pump (34) and pump spring (35).

g. Remove float shaft (36) and float (37). Remove float valve (40), float valve seat (39) and gasket (38).

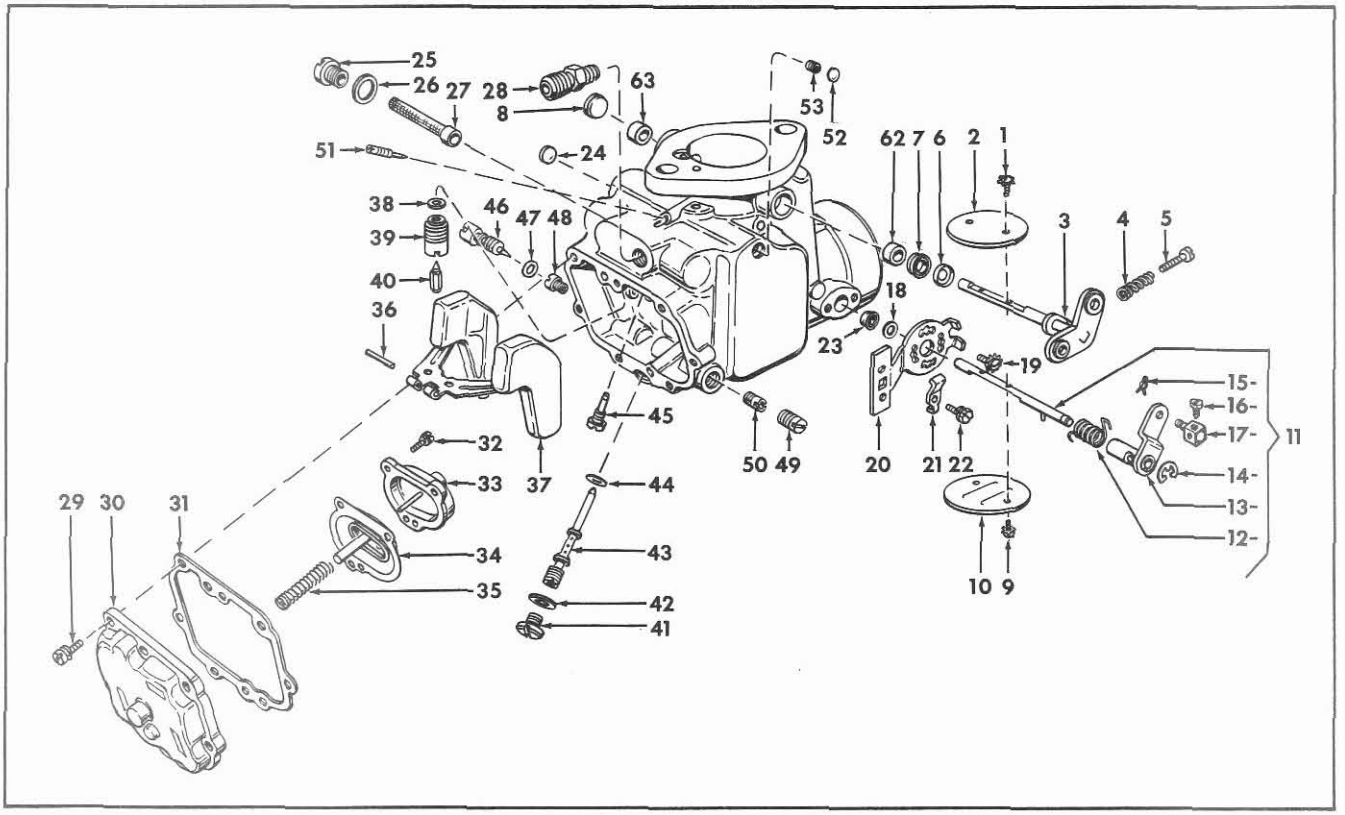


Figure 2-2. Exploded View of Typical USX Carbureter

h. Remove nozzle plug (41), gasket (42), nozzle (43) and gasket (44).

i. Remove idle tube (45).

j. Remove power needle (46), "O" Ring (47), power needle seat (48), minimum fuel jet plug (49) and minimum fuel jet (50).

k. Remove idle needle (51).

NOTE

Some models have an economizer jet (53). This is not subject to wear and should not require replacement. However, if prior tampering makes it necessary to replace it, remove the welch plug (52) by drilling a small hole in the center and prying it out. Remove the jet (53) with a screwdriver.

3. INSPECTION AND CLEANING.

a. Dispose of the following parts as they are contained in the repair kit: throttle shaft, gaskets, packing and retainers, springs, needle seat, power jet, idle needle, fuel strainer, float shaft, float valve assembly and pump.

b. The remainder of the parts and castings should be soaked in a reliable brand of carbureter cleaner until all foreign material has been removed. Follow the instructions for the type cleaner selected. Dry with compressed air after cleaning.

4. ASSEMBLY AFTER CLEANING.

a. Blow out all passages with compressed air.

NOTE

Do not direct compressed air into the pump channel, as this may affect the ball check valve assembly.

b. Install nozzle gasket (44), nozzle (43), gasket (42) and plug (41).

c. Install idle tube (45).

d. Assemble pump spring (35) on diaphragm assembly (34) and attach the pump housing (33) to bowl cover (30) with screws (32).

e. If removed, install minimum fuel jet (50) and plug (49), power needle seat (48), "O" Ring (47) and power needle (46).

f. Install float valve seat (39) with gasket (38) and valve (40).

g. With throttle flange down, insert float (37) and float shaft (36). Set float lever at this time. The float lever must be parallel with the flange, and must operate with proper clearance all

around. Bend with needle nose pliers if necessary. (See figure 2-3.)

h. Install bowl cover assembly (30) with gasket (31) and screws (29).

i. Install idle needle (51). Insert strainer (27) into plug (25) and install it with gasket (26) and fuel fitting (25).

j. Place two or three drops of light-machine oil on bearing (62) and (63). Insert "V" packing (7), retainer (6), plug (8), throttle shaft (3) with screw (5) and spring (4) in place into casting. Attach throttle valve (2) to shaft (3) with screws (1).

k. Install choke shaft plug (24) and choke packing (23). Install choke bracket (20) on casting with screws (19). Clip (21) and screw (22) should be in place.

l. Assemble the choke shaft (11) by attaching spring (12), lever (13), snap ring (14), swivel (17), cotter pin (15) and screw (16).

m. Slide washer (18) on shaft (11) and install it in casting. Install choke valve (10) with screws (9).

5. PRELIMINARY NEEDLE SETTINGS: Power Needle — 3 turns open; Idle Needle — 1-1/2 turns open; Throttle stop screw — 1-1/2 turns open.

6. SERVICING THE MODEL USX NEEDLE BEARINGS.

a. With proper care, the hardened throttle shaft needle bearings should last for the life of the carbureter. Experience has proved, however, that the throttle shaft seals are almost always neglected until dirt causes enough wear to affect the idle.

b. Throttle shaft needle bearings may be removed and replaced in the shop in the following manner:

(1) Remove throttle shaft, packings and retainer; insert bearing removing tool, Part No. M-504 (see figures 2-4, 2-5 and 2-6.)

(2) Insert the tool through the throttle shaft bore (head first) so the split end will "snap" into the bearing shell as shown in figure 2-5.

CAUTION

Do not "drive" the bearings out as they are hardened and will break. Press them out in a large vise. (See figure 2-6.)

(3) The lips of the split tool (Part No. M-504) may be spread apart with a small screwdriver so the tool will seat firmly on the inner rolled edge of the needle bearing. (See figures 2-5 and 2-6.)

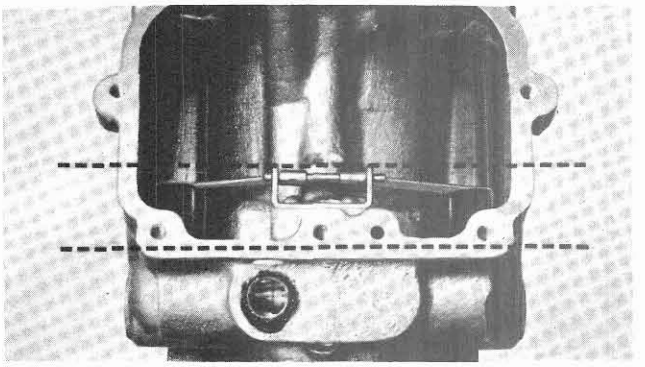


Figure 2-3. Checking Float Lever

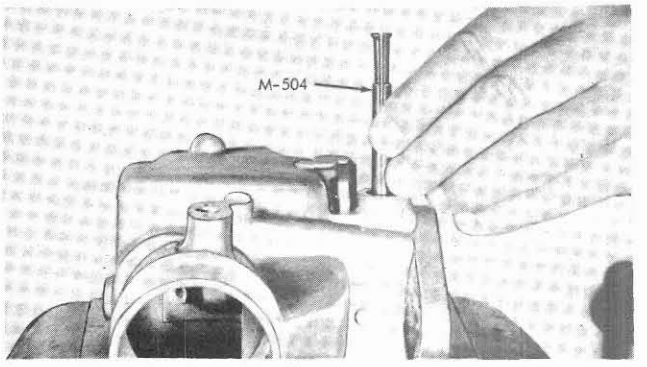


Figure 2-4. Inserting Needle-Bearing Removing Tool

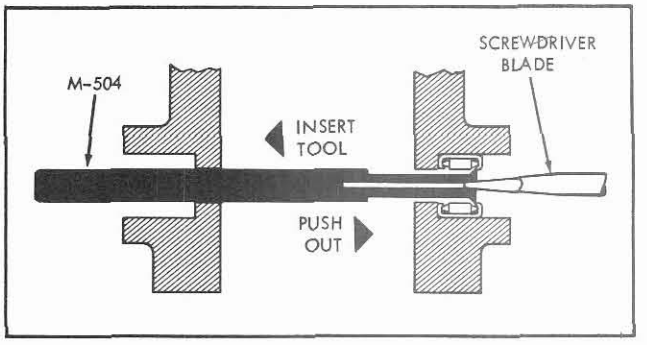


Figure 2-5. Needle-Bearing Removing Tool

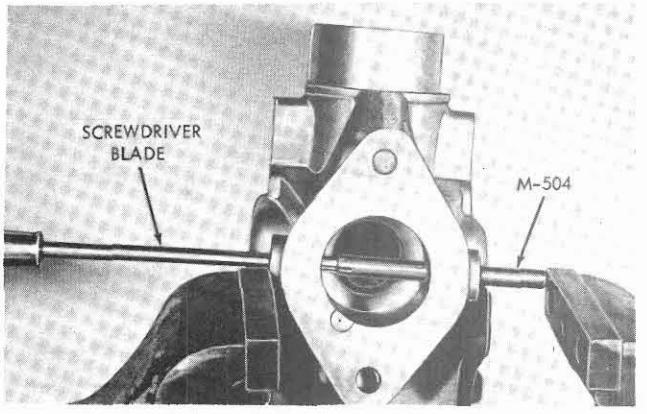


Figure 2-6. Pressing Out Needle-Bearing

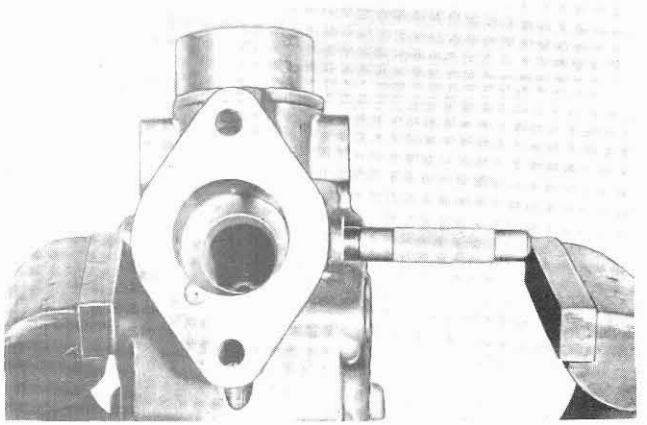


Figure 2-7. Pressing New Needle-Bearing Into Carbureter Body

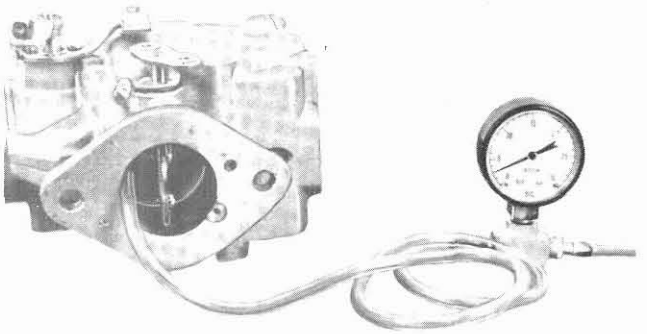


Figure 2-8. Vacuum Gage Connected to Pump-Discharge Nozzle

c. Press new throttle-shaft needle bearings into place with tool, Part No. M-503. (See figure 2-7.)

7. SERVICING THE MODEL USX PUMP DISCHARGE JET ASSEMBLY (when used).

a. Procedure for checking the pump discharge jet while it is installed in the carbureter. These operations must be performed while the bowl cover (30, figure 2-2) is removed from the carbureter body.

(1) Slip a tube down thru the throttle bore and over the pump discharge jet. Connect the tube thru a vacuum gage (see figure 2-8).

(2) Using the mouth, draw (suck) on free end of tube. (See figure 2-9). Draw very gently while listening at the fuel channel at the bottom of carbureter casting.

(3) The discharge jet will release air at 3-inches of mercury (Hg.) on the gage. This will be audible as the ball check leaves the seat. If the discharge jet releases below 3-inches Hg., it must be replaced.

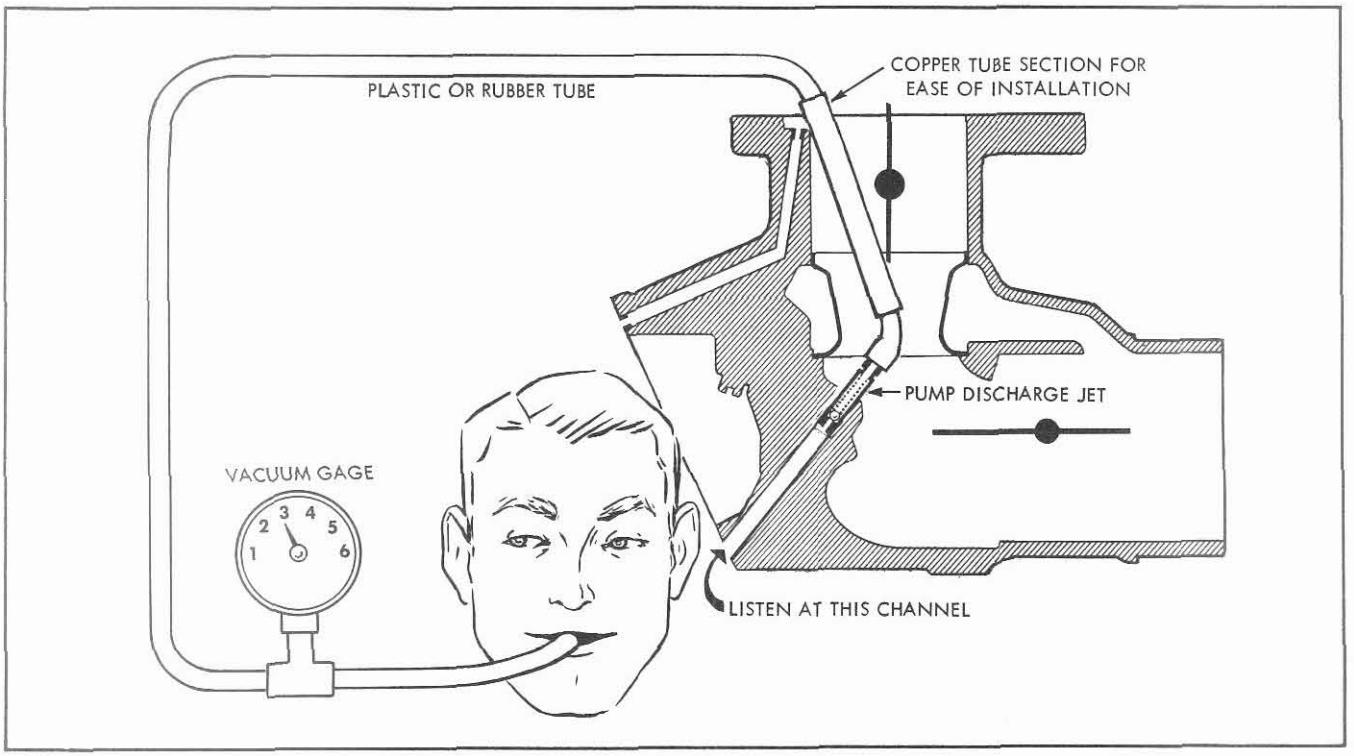


Figure 2-9. Checking Opening Pressure of Pump-Check Valve

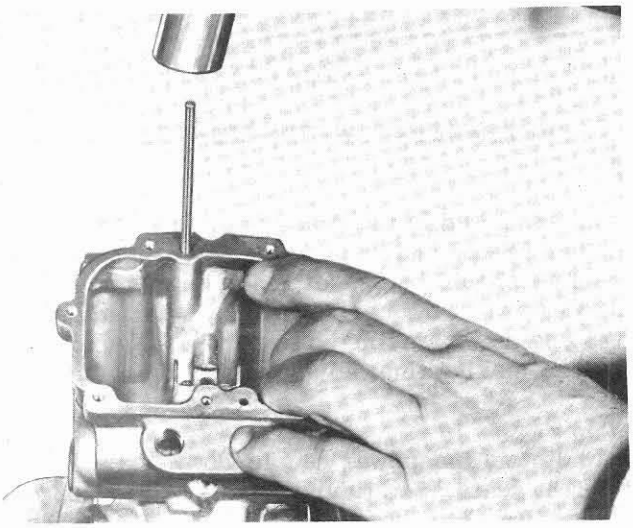


Figure 2-10. Driving Out Pump-Discharge Valve

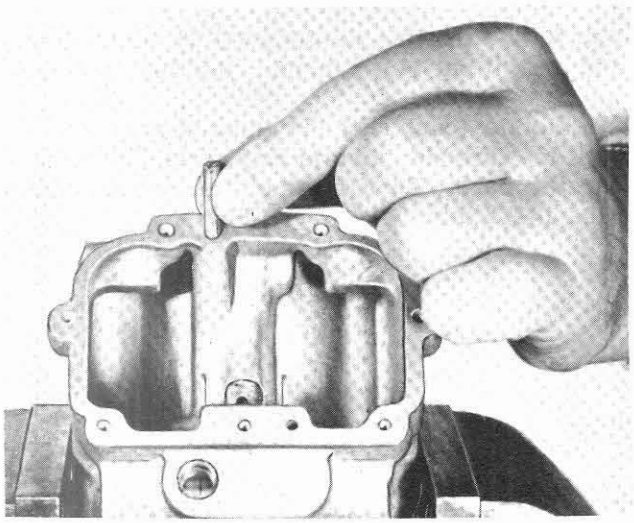


Figure 2-11. Placing Pump-Discharge Valve In Channel

b. To remove the pump discharge jet, drive thru from below with a 5/32-inch diameter rod approximately 4-inches long. (See figure 2-10.)

c. To replace the pump discharge jet, insert a new jet with the slot up into the casting. (See figure 2-11.)

(1) Using tool (Part No. M-502) which has a tang that fits into a slot in the base of the jet (figure 2-12), rotate the jet to position the discharge seat as shown in figure 2-14.

(2) After it has been pushed in and located firmly, press in with tool (Part No. M-505). (See figure 2-13.)

(3) The final location is as shown in figure 2-14, with the slot tolerance 0° to 5° true angle from parallel with centerline of carbureter.

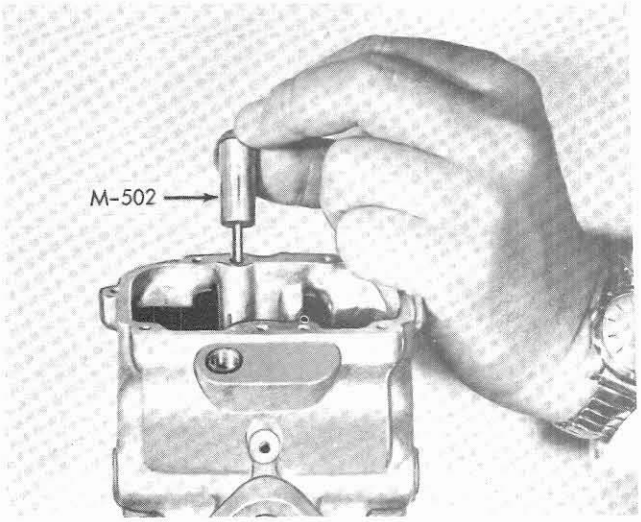


Figure 2-12. Locating Pump-Discharge Valve Prior to Driving It Into Final Position

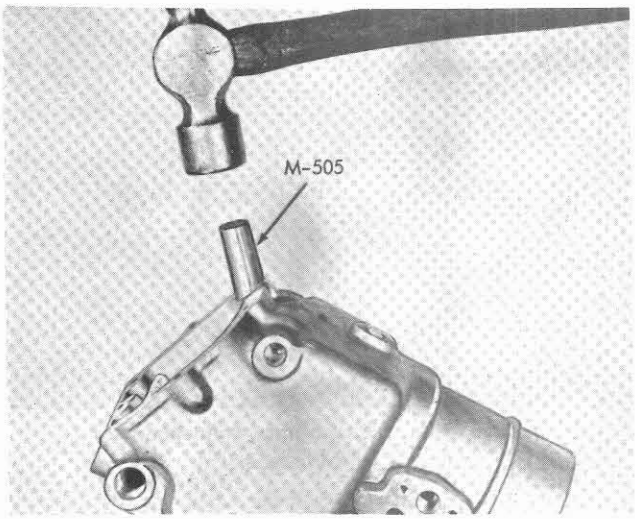


Figure 2-13. Driving Pump-Discharge Valve to Depth in Housing

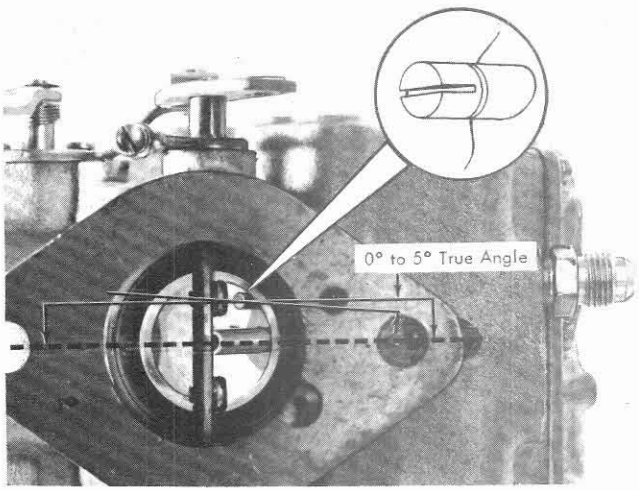


Figure 2-14. Pump-Discharge Valve Properly Located

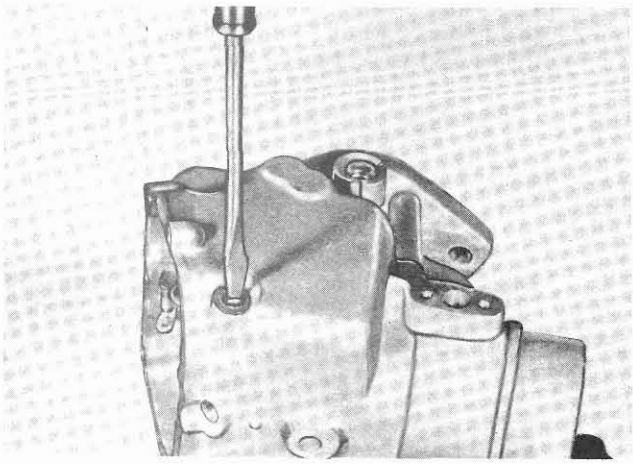


Figure 2-15. Preliminary Adjustment of Power Needle

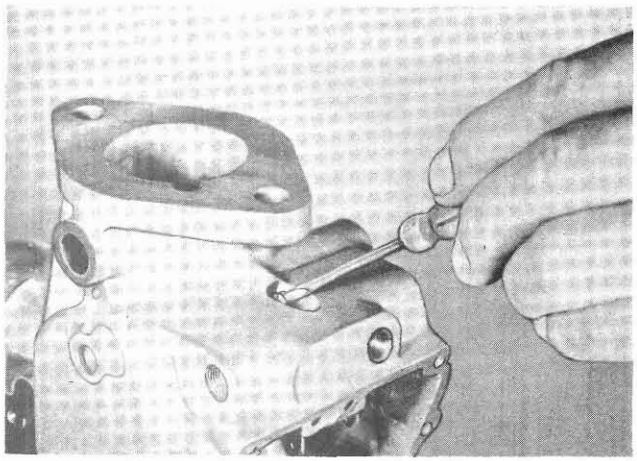


Figure 2-16. Preliminary Adjustment of Idle Needle

8. PRELIMINARY ADJUSTMENTS.

a. As stated in the reassembly procedure, the power needle, idle needle and throttle stop screws should be preset so the engine will start and run when the carbureter is installed. Allow the engine to warm up to normal temperature before making final adjustments.

b. Rotate the power needle down carefully until it seats. (See figure 2-15.) Avoid excessive tightening as this would damage the seat. Then back needle out three turns.

c. Rotate the idle needle until it seats lightly and back it out 1-1/2 turns. (See figure 2-16.)

d. Rotate (back out) the throttle stop screw until the throttle valve is just seated in the carbureter bore. Then rotate the screw clockwise 1-1/2 turns.

PROPER MAINTENANCE PAYS OFF

Off-the-road vehicles are subjected to the additional service hazard of operating in extreme dust. Dirt in any form in an engine is an abrasive and is the BIGGEST SINGLE FACTOR IN ENGINE WEAR.

A considerable amount of research proved that an air leak in the induction system can "wear out" an engine in an extremely short time. Where do these air leaks occur????

Around the air cleaner connectors, in the intake hose, etc. Most important are the leaks which occur in the "high-vacuum" area above the carbureter venturii. Throttle shaft seals must be in good condition at all times. An air leak where the throttle shaft seal contacts the shaft, caused by wear equivalent to a 1/8-inch diameter hole, can remove one thousandth of an inch from cylinder walls in 50 hours of operation. Compression can disappear at an alarming rate if this condition is permitted to continue.

PLUG THESE LEAKS and SAVE THE ENGINE

Before the Start of Each Season, clean the carbureter thoroughly and replace all throttle-shaft and choke-shaft seals. Reassemble the carbureter with new gaskets throughout.

At Each Engine Overhaul, rebuild the carbureter with a factory recommended repair kit.

FOR BEST SERVICE, ALWAYS USE ORIGINAL EQUIPMENT REPAIR PARTS