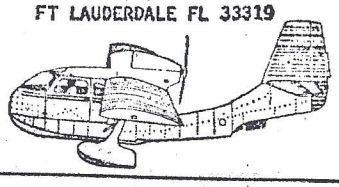
N-7

MAINTENANCE



How to Service and Maintain The Marvel-Schebler Carburetor

RC-3 has MA4-5 model (see ENGINE manual p45)

Lucidly detailed here are the company-approved methods for operating and adjusting the MA-3SPA model—now newly offered in the civilian market. And included is a handy "shooting" guide to service troubles, their probable causes, and the remedies.

OF THE UPDRAFT plain-tube fixed-jet type, this carburetor was designed by the manufacturer—Marvel-Schebler Div. of Borg-Warner Corp., Flint, Mich.—for use with the popular 6-cylinder Franklin, Lycoming and Continental aircraft engines. Two views of the units are afforded in our Figs. 1 and 2.

The design incorporates use of an accelerating pump, double float, manual mixture control, double venturi, idle fuel cut-off, back suction economizer, and safety throttle lever spring which keeps throttle open in the event of control linkage failure.

Accelerating pump insures smooth acceleration under all conditions by injecting fuel into the mixing chamber.

Manual mixture control and idle cut-off provide means of adjusting for all loads and altitudes and for stopping engine by shutting off fuel before switching off ignition. Details of working parts of this carburetor are shown in Fig. 3.

Principles of Operation

Idle system: When throttle (see Fig. 3) is slightly open, very little air passes through the venturi, and so the main nozzle does not discharge fuel. At the same time, however, the high vacuum above the throttle causes the primary idle nozzle to deliver air-fuel emulsion into that zone. Fuel from the fuel bowl passes through the mixture metering sleeve, fuel channel, power jet, and main nozzle. Thence it travels through idle supply holes of main nozzle into idle fuel restriction tube, where it is mixed with air from primary air vent.

Afterwards, all fuel and air continue upward through drilled passage having idle fuel delivery holes leading into throttle bore near throttle fly. At slow idle, only the uppermost hole is delivering to the engine. The hole below throttle will bleed air into the emulsion which eventually emerges into throttle barrel and combines with air passing throttle fly. Depending upon throttle position, small holes below throttle fly will either admit air into emulsion or deliver mixture from drilled passage.

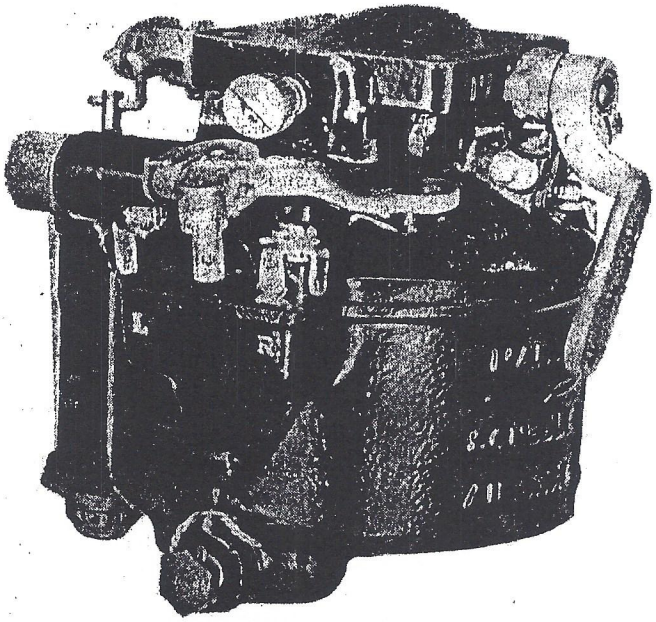


Fig. 1. Marvel-Schebler Model MA-3SPA carburetor, showing throttle and mixture control levers.

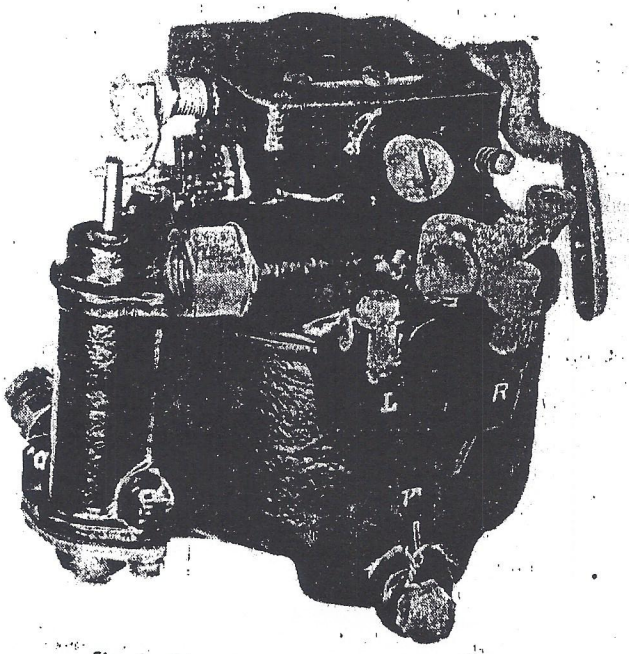


Fig. 2. Marvel-Schebler MA-3SPA carburetor viewed from accelerator pump side.

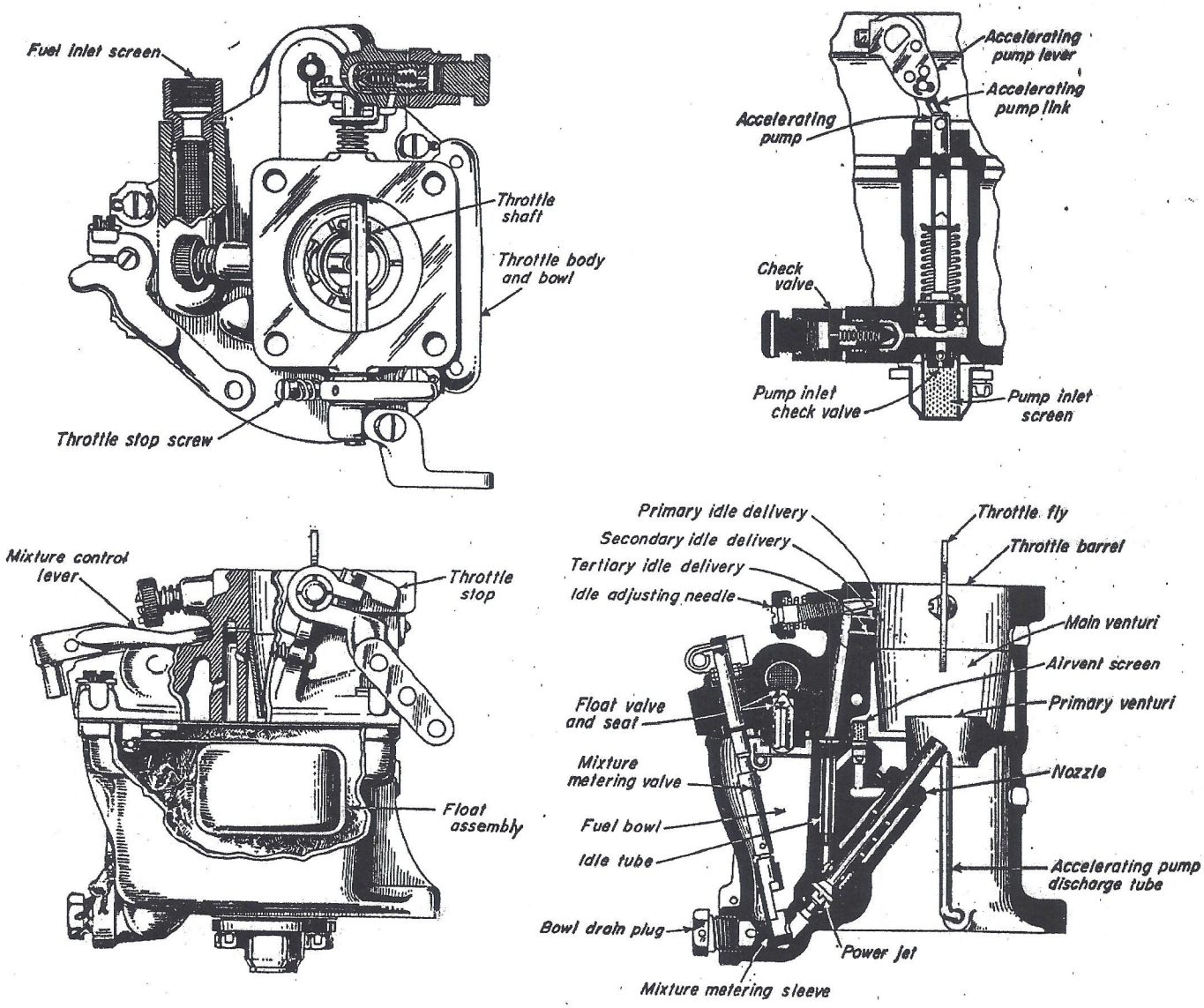


Fig. 3. Cutaway illustrations of carburetor with relative positions of the components depicted.

Idle adjusting needle controls the quantity of this rich emulsion and thus the quality of the idle mixture. Turning needle outward gives richer mixture, while turning inward makes mixture leaner. On idle, some air is drawn from below the throttle through the secondary idle delivery opening. This air blends with the idling mixture. Secondary idle mixture delivery begins as throttle is opened farther, blending with the primary mixture to prevent it from becoming too lean before main nozzle starts to feed. A tertiary idle delivery covers the broader idle range.

Up to about 1,000 rpm. all fuel delivery is from idle system. At higher rpm. increasing airflow causes main nozzle to start delivering fuel, while idle system fuel flow diminishes with decreasing suction as throttle is opened, until at 1,400 rpm. idle delivery is practically eliminated. At full throttle, all fuel flows through main nozzle.

Fuel Distribution

Because idle and main nozzle systems are connected by idle supply holes in the main nozzle, fuel delivered by either system depends upon the relative suction on both these nozzles, this suction being determined by engine load and throttle position. Main nozzle comes into action at any time when throttle is opened sufficiently to place engine under load, which causes a drop in manifold pressure.

Fuel to main nozzle passes through metering sleeve and fuel channel, then upward through power jet and nozzle bore, where it is mixed with air drawn through air vent and bleed holes. It is then discharged through nozzle outlet as an air-fuel emulsion. Air passing through nozzle air vent sweeps fuel from nozzle well and bore under very low suction, satisfying any sudden demand for fuel delivery. Air vent screen keeps out bugs and foreign matter.

Accelerating pump discharges only when throttle is opened. It provides additional fuel to equalize the sudden inrush of air caused by opening the throttle.

The pump plunger is moved downward by a lever connected to throttle shaft, thus forcing fuel through discharge tube into carburetor mixing chamber.

When throttle is closed, plunger moves upward, refilling pump chamber. If throttle is opened quickly, pump follow-up spring yields and thus prolongs pump discharge sufficiently to prevent overloading of the engine with fuel.

Mixture metering valve rotates in sta-

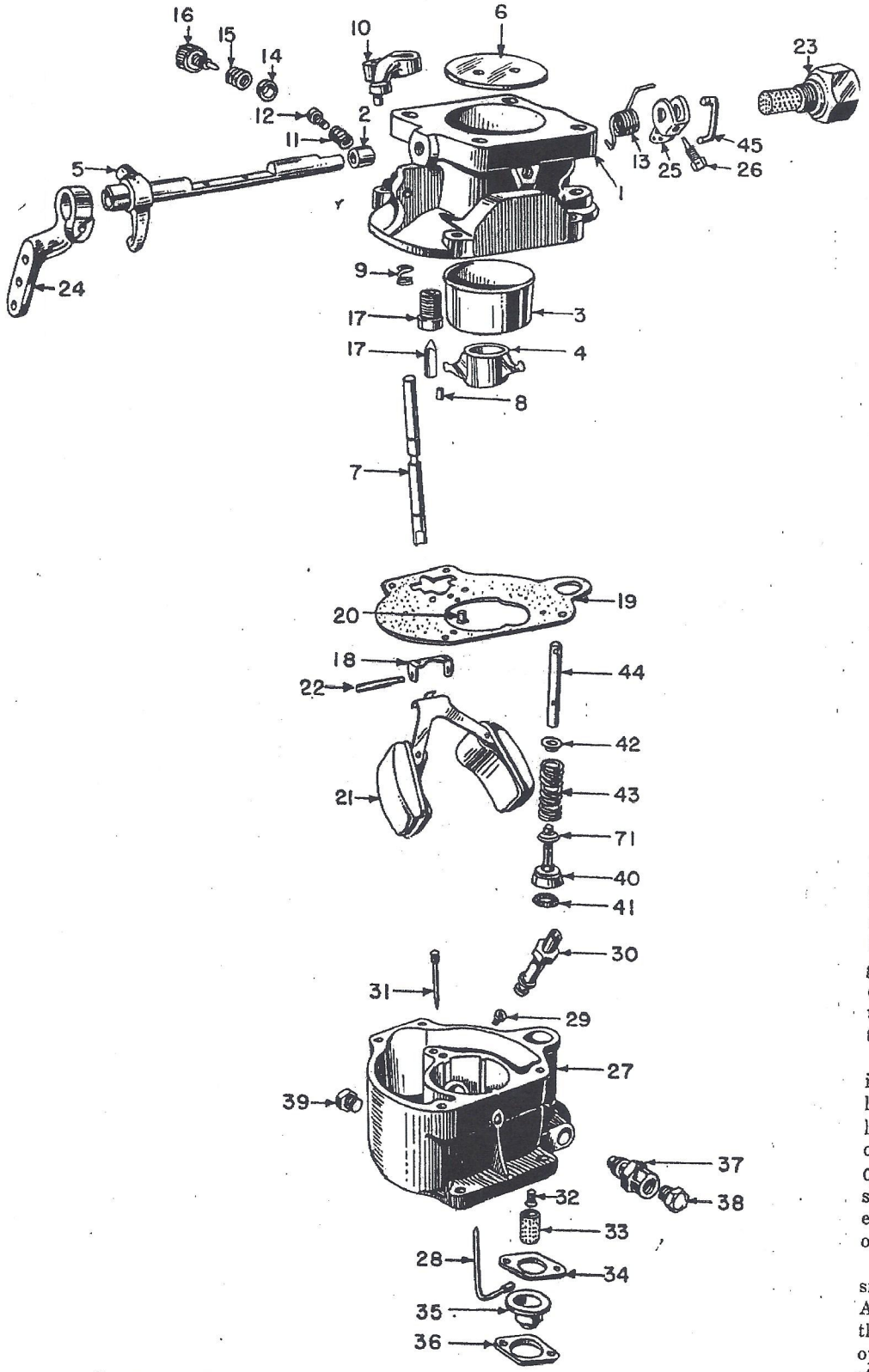


Fig. 4. Exploded view of carburetor. Key: (1) Is throttle body, (2) bushing, (3) main venturi, (4) primary venturi, (5) throttle shaft and stop assembly, (6) throttle fly, (7) mixture metering valve assembly, (8) economizer jet, (9) spring, (10) mixture control lever, (11) spring, (12) screw, (13) spring, (14) retainer, (15) spring, (16) idle needle assembly, (17) float valve and seat, (18) float bracket, (19) gasket, (20) screen, (21) float and lever assembly, (22) float lever shaft, (23) strainer assembly, (24) throttle lever, (25) pump lever, (26) screw, (27) body and bowl, (28) pump discharge tube, (29) power jet, (30) nozzle, (31) idle tube assembly, (32) check valve assembly, (33) screen, (34) gasket, (35) housing, (36) flange, (37) check valve, (38) plug, (39) plug, (40) pump plunger and stem assembly, (41) spring, (42) seat, (43) spring, (44) rod, and (45) connecting rod.

tionary sleeve provided with a transverse slot through which the fuel enters between longitudinal flat on the valve and the edge of slot in the sleeve. When mixture control is in "R"—full rich—position, metering is controlled by the power jet, but in other positions metering is by the relative positions of the edges of the sleeve and valve. With the mixture control lever in "L"—full lean—position, no fuel is allowed to enter the nozzle. This provides what is called "idle cut-off" to prevent accidents when working around a hot engine.

Back suction economizer consists of passages connecting the throttle barrel with the sealed fuel bowl. The position of the openings into the throttle barrel are so placed that, in the cruising range, manifold suction is transferred through the passages to the fuel bowl. This suction is modified by the atmospheric bowl vent, with the result that a differential suction is created in the fuel bowl, varying both with engine suction and atmospheric pressure. This back suction diminishes fuel flow from fuel bowl to nozzle and idle system and provides an "economy" mixture at cruise.

Starting

If engine is cold, set mixture control "full rich", prime engine according to manufacturer's instructions, and set throttle so that throttle stop is 3/32 in. from stop screw. This will open throttle about 1/10. Turn engine over two or three times, *with switch off*, to draw combustible mixture into cylinders. Turn switch on and start engine. Because this throttle setting gives richest mixture, engine should idle satisfactorily under these conditions. Allow engine to warm up until it is firing evenly, before opening throttle farther.

If engine is warm, set mixture control in "full rich" position. Pull throttle lever back against stop screw. If engine has just been running, it should start on first turn after ignition is switched on, but if it has been standing for a short time, it may be necessary to turn engine a few times before switching on ignition.

Note that a warm engine should idle smoothly with throttle in idling position. A hot engine should not be primed, and throttle should never be "pumped"—opened and closed several times—when starting, since this causes raw fuel to be deposited in carburetor air box, resulting in a dangerous fire hazard in case of backfire.

Use of Manual Mixture Control

Below 5,000 ft. altitude, mixture control should not be used. Above this point, mixture control is adjusted by moving slowly in and out, with throttle at cruis-

ing or full open position, until highest rpm. are attained. Mixture will then be correct for all loads and throttle positions at that altitude. Mixture control should always be moved to full rich position when coming in for a landing, so that full power will be instantly available if required. If this setting is not used under these conditions, engine may overheat because of too lean a mixture, or it may actually stop by "starving".

In stopping, pull mixture control to "idle cut off" or "full lean." Open throttle slightly from idle, making engine speed about 1,000 rpm. Turn off ignition only after engine stops from lack of fuel. Manifold and cylinders will then be full of air, after which mixture control may be returned to "full rich" for starting.

Service Inspection

Gaskets and fuel line should be inspected daily for evidence of leakage. If any signs of leakage are seen, defect should be remedied immediately, because there is a dangerous fire hazard in this condition even when plane is standing in the hangar with the engine not running.

Idle adjustment: After checking all other points on engine, if it is found necessary to adjust carburetor, following method is used: Warm up engine and set throttle stop screw so that engine idles at about 550 rpm. Turn idle adjustment out until engine "rolls" from rich mixture, then turn needle in until engine misses from lean mixture. This will give the extreme range through which the engine will idle. Now turn needle out again until setting is richest on which engine will run smoothly. This adjustment will give a slightly slower idling speed than a leaner mixture with same throttle opening, but it will also give smoother idling.

Change in idle mixture will affect idle speed, and it may be necessary to readjust idle speed by resetting throttle stop screw. Idle adjusting needle is usually set open between ¾ and 1 full turn. Care should be taken not to damage the idle needle seat by turning in the needle too tightly, because adjustments are difficult to make satisfactorily unless this seat is in good condition.

Float height: By removing throttle body assembly and turning upside down, the float height can be checked. This causes floats to fall into position which closes fuel valve, enabling setting to be measured. Height from float top to top of cover gasket should be 7/32 in. Top surface of float should be parallel to surface of gasket. Both floats should be checked.

Accelerating pump: Pump link may be placed in any one of three holes in pump lever, in order to vary length of stroke. Normal position of link is in No. 3 hole (giving longest stroke), though No. 2 hole may be used in extremely hot climates or with high test fuels. No. 1 hole (giving shortest stroke) is rarely used.

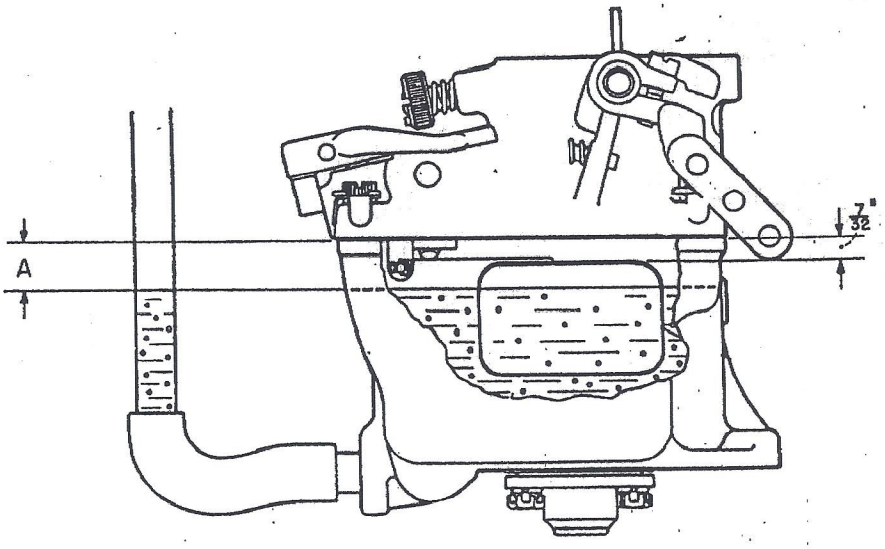


Fig. 5. Method of testing float valve and seat. Distance "A" should be exactly 11/16 in. for this model. Float height must be 7/32 in.

Testing

Connect carburetor to fuel supply under pressure specified for engine installation. Then attach rubber tube to carburetor drain and insert glass tube, as shown in Fig. 5. With 24 in. pressure head on fuel, distance "A" should be 11/16 in. and float height 7/32 in. If float level rises, this indicates leakage around seat. If leakage cannot be corrected by cleaning, float valve and seat should be replaced by a matched set obtained from Marvel service station or factory at Flint, Mich.

Accelerating pump is tested by operating throttle lever three or four times through its full stroke. This should expel a fine spray of fuel through discharge nozzle each time throttle is opened. Operator should, of course, stand in a position where fuel spray will not be directed at his eyes and face. If discharge is weak, pump plunger requires replacing or repacking; but if no fuel is discharged, inlet check valve must be renewed or serviced. Discharge tube will give either one of the above effects if it is clogged, so this part should be checked to make sure that it is clear.

Service Troubles and Their Remedies

Trouble	*Probable Cause*	*Remedy*
Engine sputters or dies	Water in Carburetor Defective fuel pump Dirt or ice in line Mixture too lean	Drain carburetor bowl Replace or repair Disconnect line and blow out Adjust idling needle
Engine races and will not idle properly	Throttle not working Mixture too rich Defective fuel pump Throttle stop screw improperly set	Free controls and linkage Adjust idling needle Replace or repair Adjust (see text)
Engine will not start	Defective fuel pump No fuel Ice or dirt in gas line	Replace or repair Refuel Disconnect and blow out fuel line. Drain carburetor
Loss of power	Dirty air cleaner Improper grade of fuel Accelerator pump jams Icing of carburetor and manifold	Service cleaner element Use right grade Replace plunger assembly Reset heat control