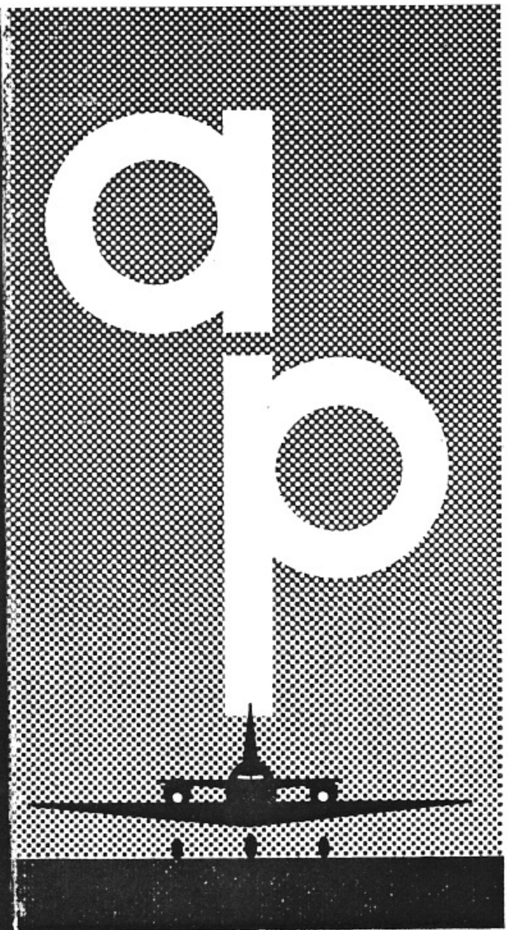
AC65-12A



Airframe & Powerplant MECHANICS

POWERPLANT HANDBOOK

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL AVIATION ADMINISTRATION

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low pressure at the tip of the nozzle not only draws fuel from the float chamber but also draws air from behind the venturi. Air bled into the main metering fuel system decreases the fuel density and destroys surface tension. This results in better vaporization and control of fuel discharge, especially at lower engine speeds.

The throttle, or butterfly valve, is located in the carburetor barrel near one end of the venturi. It provides a means of controlling engine speed or power output by regulating the airflow to the engine. This valve is a disk which can rotate on an axis, so that it can be turned to open or close the carburetor air passage. Where more than one throttle valve is necessary, they may be attached to the same throttle shaft or to separate shafts. In the latter case, it is necessary to check the uniformity of opening or synchronization.

Idling System

With the throttle valve closed at idling speeds, air velocity through the venturi is so low that it cannot draw enough fuel from the main discharge nozzle; in fact, the spray of fuel may stop altogether. However, low pressure (piston suction) exists on the engine side of the throttle valve. In order to allow the engine to idle, a fuel passageway is incorporated to discharge fuel from an opening in the low pressure area near the edge of the throttle valve. This opening is called the idling jet. With the throttle open enough so that the main discharge nozzle is operating, fuel does not flow out of the idling jet. As soon as the throttle is closed far enough to stop the spray from the main discharge nozzle, fuel flows out the idling jet. A separate air bleed, known as the idle air bleed, is included as part of the idling system. It functions the same as the main air bleed. An idle mixture adjusting device is also incorporated. A typical idling system is illustrated in figure 3–10.

Mixture Control System

As altitude increases, the air becomes less dense. At an altitude of 18,000 ft. the air is only half as dense as it is at sea level. This means that a cubic foot of space contains only half as much air at 18,000 ft. as at sea level. An engine cylinder full of air at 18,000 ft. contains only half as much oxygen compared to a cylinder full of air at sea level.

The low pressure area created by the venturi is dependent upon air velocity rather than air density. The action of the venturi draws the same volume of fuel through the discharge nozzle at a high altitude as it does at a low altitude. Therefore, the fuel mixture becomes richer as altitude increases. This can be overcome either by a manual or an automatic mixture control.

On float-type carburetors two types of purely manual or cockpit controllable devices are in general use for controlling fuel/air mixtures, the needle type and the back-suction type. The two types are illustrated in figures 3–11 and 3–12.

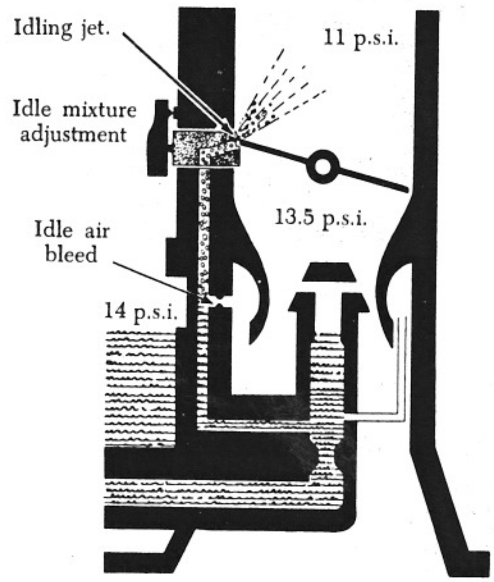

FIGURE 3–10. Idling system.

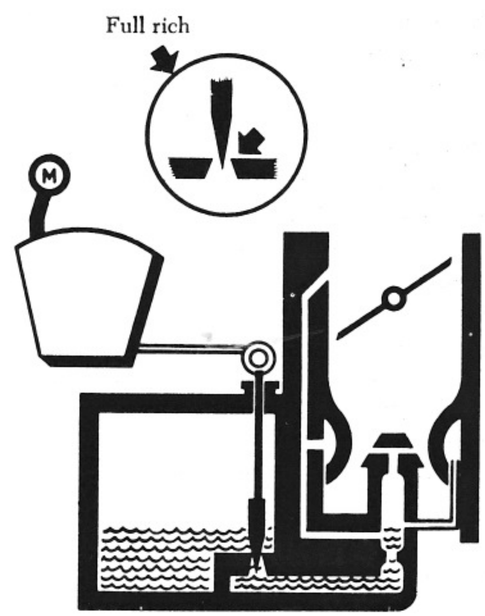

FIGURE 3–11. Needle-type mixture control system.

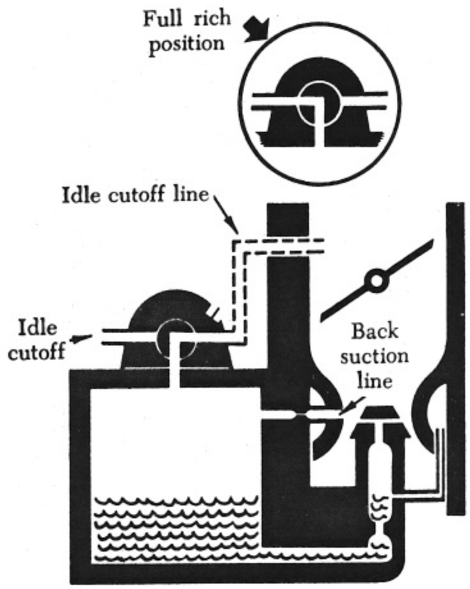

FIGURE 3–12. Back-suction type mixture control system.

With the needle-type system, manual control is provided by a needle valve in the base of the float chamber (figure 3–11). This can be raised or lowered by adjusting a control in the cockpit. Moving the control to "rich" opens the needle valve wide, which permits the fuel to flow unrestricted to the nozzle. Moving the control to "lean" closes the valve part way and restricts the flow of fuel to the nozzle.

The back-suction type mixture control system is the most widely used. In this system (figure 3–12) a certain amount of venturi low pressure acts upon the fuel in the float chamber so that it opposes the low pressure existing at the main discharge nozzle. An atmospheric line, incorporating an adjustable valve, opens into the float chamber. When the valve is completely closed, pressures on the fuel in the float chamber and at the discharge nozzle are almost equal and fuel flow is reduced to maximum lean. With the valve wide open, pressure on the fuel in the float chamber is greatest and fuel mixture is richest. Adjusting the valve to positions between these two extremes controls the mixture.

The quadrant in the cockpit is usually marked "lean" near the back end and "rich" at the forward end. The extreme back position is marked "idle cutoff" and is used when stopping the engine.

On float carburetors equipped with needle-type mixture control, placing the mixture control in idle cutoff seats the needle valve, thus shutting off fuel flow completely. On carburetors equipped with back-suction mixture controls, a separate idle cutoff line, leading to the extreme low pressure on the engine side of the throttle valve, is incorporated. (See the dotted line in figure 3–12.) The mixture control is so linked that when it is placed in the "idle cutoff" position, it opens another passage which leads to piston suction; when placed in other positions, the valve opens a passage leading to the atmosphere. To stop the engine with such a system, close the throttle and place the mixture in the "idle cutoff" position. Leave the throttle closed until the engine has stopped turning over and then open the throttle completely.

Accelerating System

When the throttle valve is opened quickly, a large volume of air rushes through the air passage of the carburetor. However, the amount of fuel that is mixed with the air is less than normal. This is because of the slow response rate of the main metering system. As a result, after a quick opening of the throttle, the fuel/air mixture leans out momentarily.

To overcome this tendency, the carburetor is equipped with a small fuel pump called an accelerating pump. A common type of accelerating system used in float carburetors is illustrated in figure 3–13. It consists of a simple piston pump operated through linkage, by the throttle control, and a line opening into the main metering system or the carburetor barrel near the venturi. When the throttle is closed, the piston moves back and fuel fills the cylinder. If the piston is pushed forward slowly, the fuel seeps past it back into the float chamber, but if pushed rapidly, it will emit a charge of fuel and enrich the mixture in the venturi.

Economizer System

For an engine to develop maximum power at full throttle, the fuel mixture must be richer than for cruise. The additional fuel is used for cooling the engine to prevent detonation. An economizer is essentially a valve which is closed at throttle settings below approximately 60 to 70% of rated power. This system, like the accelerating system, is operated by the throttle control.

A typical economizer system, as shown in figure 3–14, consists of a needle valve which begins to open when the throttle valve reaches a predetermined point near the wide-open position. As the throttle continues to open, the needle valve is opened further and additional fuel flows through it. This additional fuel supplements the flow from the main metering jet direct to the main discharge nozzle.