THE 06DS ZENITH CARBURETOR AND HOW IT WORKS (AS USED ON THE OX5 AND OXX6 ENGINES)

Carburetor Used on the OX5 (Also OXX6[1]) Curtiss Engine

The model O6DS Zenith duplex or double carburetor is used on this engine. The carburetor has two carbureting chambers, or barrels, placed side by side. Each chamber is provided with a throttle T, Fig. 2, and both are permanently fastened by taper pins on a throttle shaft so that they work in unison through the single operating lever T1. Each chamber feeds four of the eight cylinders. Each chamber is provided with the standard compound nozzle. A single float chamber, or bowl is used to feed both compound nozzles. The air intake is fitted with a strangler or choke to facilitate starting and to insure "picking-up."

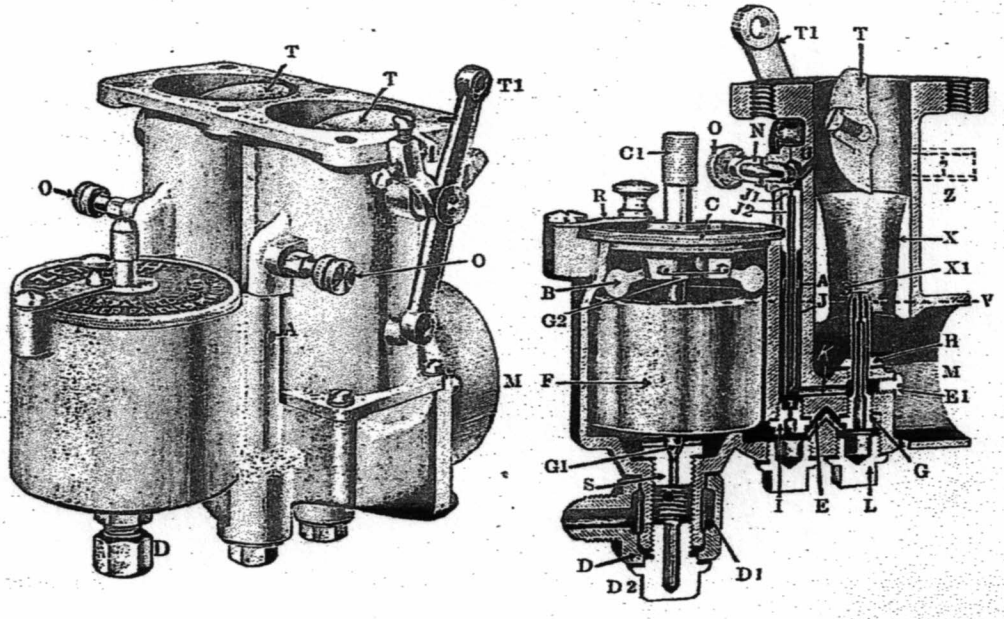


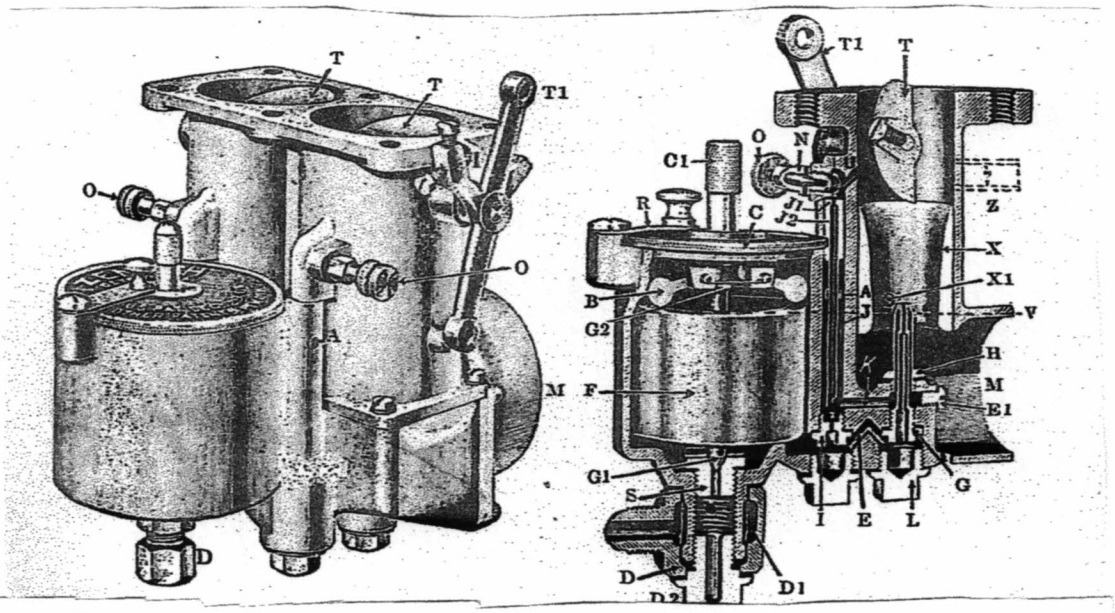
Fig. 2 (left). The Zenith (Model O6DS) duplex carburetor. This carburetor is 1½" size. Fig. 3 (right). Showing starting and idling device and points of adjustment. Names of the parts are: A, atmosphere inlet holes opening into well over compensator I; C, float cover; C1, needle valve cap, by unscrewing this the float can be operated for priming if necessary; D, connects to gasoline supply; D1, filter screen; D2, to drain; E, channel passage to main-jet; E1, main-jet set screw; F, float (metal); G, main-jet; G1, needle-valve seat; G2, needle-valve collar; H, cap-jet; I, compensator; J, idling well; J1, idling-jet; J2, idling or primer tube; K, channel passage to cap-jet; L, plug; M, main air intake; N, seat of idling or slow-speed adjustment screws; O, idling or low-speed adjustment screws; R, spring to hold float cover; S, part in which needle-valve seats; T, butterfly throttle valve which is operated by T1. The opening of T, when closed for idling, is regulated by the stop and two set screws shown to the side of T1; T1, lever operating throttle butterfly valve; U, priming hole; V, gasoline level when engine is not running; X, choke or venturi tube; X1, screw holding choke tube in place; Z, altitude, or mixture control valve located here.

Altitude or mixture control valve: Cast on the side of each carburetor chamber of the model O6DS is a projecting air inlet terminating just above the choke (indicated by lines at Z). In these air inlets are located the altitude valves, peculiar to this model. They are similar in shape as the throttle valve T. The two valves are mounted on the same shaft and are operated by a single control. The adjustment operates like a valve and admits air above the choke (venturi) tube X, which lessens the suction in the high speed or main-jet G, therefore using less gas.

The function of the altitude or mixture control valve is to conserve fuel at high altitudes. The size of the choke tube, which regulates the ordinary supply of air, is determined at sea level. In passing into higher altitudes, the density of the air diminishes and the mixture would become somewhat richer, although still well within the range of usable composition. By opening the altitude valve gradually as high altitudes are reached, the air passage is increased; the mixture toned down, and maintained at the most economical composition.

Starting and idling: When engine is not running the compensator I feeds gasoline into well J to a level as shown by the fuel level line V. Idling or primer tube J2 projects downward to the bottom of the well J. The well over compensator I is open to the atmosphere through holes A. These air openings are important. Above the idling tube J2, is a small chamber which is adjustably open to the atmosphere through idling screw O and idling seat N.

[1]The Curtiss OXX6 aircraft engine uses the same carburetor, valve timing and firing order, in fact the installation dimensions and specifications are practically the same as those of the OX5—with the exception that the OXX6 has a ¼" larger bore, and instead of a single magneto it has two Dixie magnetos—a model 83 clockwise on the pump end and a model 85 anti-clockwise on the propeller end and two spark plugs per cylinder. The oil pressure relief location may also be different. It may be found in two different locations on different engines; in front near gear cover, or on the gear pump itself.



The compensator I also feeds gasoline to the cap-jet H through channel passage K. The gasoline level in cap-jet will also be as shown by the line V. Likewise, the fuel feeds from float chamber through channel passage E to the main-jet G, and its level will be as shown by line V.

Cranking the engine causes a strong suction over the throttle T through the opening U, that is, when the throttle is cracked open. Fuel is drawn up idling tube J2, through the calibrated idling-jet J1, where it is mixed with air at N, and then drawn into the opening U, forming the proper mixture for starting and idling. A slight amount of air enters the main air opening M, but not enough to cause but little or no flow from cap-jet H or main-jet G.

The idling-jet operates only when the butterfly throttle valve T is barely cracked open. Further opening of the throttle automatically puts the idling device out of operation, because the increased flow of air picks up the gasoline from the main-jet G and cap-jet H, thus cutting off the supply to the priming hole U.

Acceleration: When the engine is idling, the well J is about half full of fuel. This provides a reserve for acceleration, as when the throttle is opened. Opening of the throttle draws surplus gas in well J through cap-jet H, which supplies a rich mixture for acceleration. Fuel is also drawn from main-jet G, and a greater air flow enters at M.

Full throttle opening: At this position there is a steady flow of fuel through main-jet G with tendency to get richer as suction increases. Flow through cap-jet H gets leaner as suction increases, due to the fact that compensator I only allows measured gravity flow to enter well J and air enters through air holes A in this well causing a balancing action of cap-jet and main-jet. This holds mixture at the same proportion at all speeds and overcomes tendency to become too rich at high speeds. By selecting the proper sizes of main and compensating jets for any given installation, the relation of total gasoline to air drawn through the carburetor can be kept constant at all engine speeds. See Addenda for an explanation of the principle of the Zenith "compound nozzle."

Adjustments: The choke X, main jet G, compensator I and idling tube J need not, as a rule, be disturbed. Their adjustment consists in finding, once for all, the different sizes or "setting" of air and gasoline passages suitable for the engine. These passages never vary and, once right, stay right.

The only adjustment that may be useful is the slow-speed adjustment. The strength of the suction in the idling tube can be diminished by "turning out" screw O, thus admitting more air. "Turning in" the screw O increases the effect of the suction and causes the jet to flow more gasoline, making the mixture richer. It should be remembered that this adjustment varies the idling mixture only, and has no effect upon the high-speed action.

Settings: With carburetors on the OX5 8-cylinder engine, 4" bore by 5" stroke, the setting used was 22 venturi, 120 main jet, 100 compensator, and 70 idling well for the Army; and the Navy setting, on the OXX 8-cylinder engine (4¼" bore by 5" stroke) was 23 venturi, 120 main jet, 115 compensator, and 70 idling well.

The float level for the models O6D and O6DS is 1$\frac{9}{64}$" below the top of the bowl casting. The fuel in the cap jet would be around $\frac{5}{64}$" below the top. Moving the collar on the needle valve away from the pointed end lowers the level and moving it towards the pointed end raises it.

Care: The plugs on the bottom of the carburetor should be removed and the carburetor flushed out, and the float mechanism examined occasionally. It is highly important to have good tight-fitting fiber gaskets under the jets. Lock and flat washers may be used for "safetying" the nuts. In putting on new inlet pipes use new gaskets.

Principle of the Zenith "Compound Nozzle"

The single jet carburetor, Fig. 1: It is a natural inference to suppose that as the speed of the engine increases, both the flow of air and gasoline will increase in the same proportion, but such is not the case. Under increasing suction the flow of fuel increases faster than the flow of air, therefore **the mixture becomes richer as the suction increases.** More speed should be a matter of a **larger ration, not a richer mixture.** Compare the fuel in float chamber F to a glass, and the main jet G, to a straw, as in Fig. 1A. The harder you suck on the straw the more liquid you will get. The suction created by the pistons will act on the fuel in the float chamber F, through the main jet G in the same manner.

Fig. 1

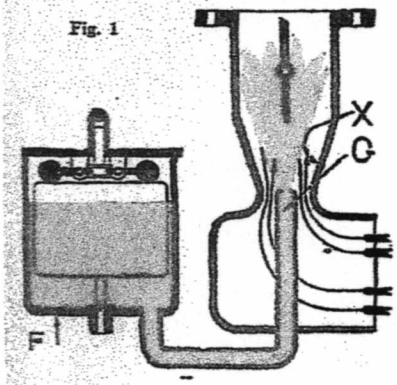
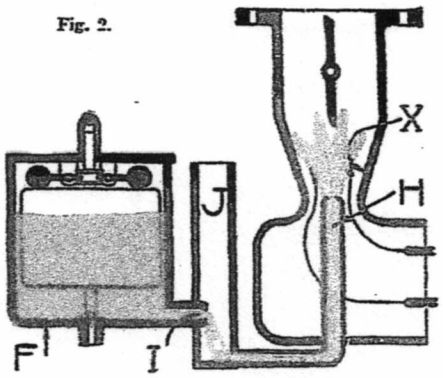


Fig. 1A.

Fig. 2A.

Fig. 2.



The Zenith "constant flow" device, Fig. 2: If we can combine with this jet G, which gives a flow increasing faster than suction, a jet having a flow which does not increase, they would act to balance each other, and both together could be made to give a mixture of constant proportion. Here the flow of fuel is limited to the gravity fall through the calibrated hole I into the well J which is open to the air. **The mixture grows poorer as the suction increases.** As the engine suction increases more air is drawn up through the carburetor, while the amount of gasoline remains the same and, therefore, the mixture grows poorer and poorer. Compare well J to a glass, compensating jet I to a bottle, and cap jet H to a straw,

Fig. 3.

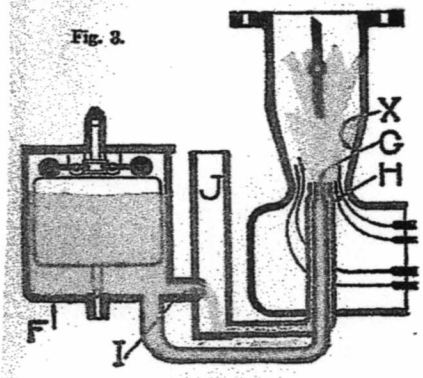


Fig. 4.

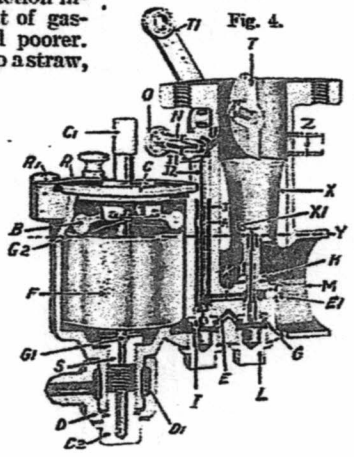


Fig. 2A. If you pour a tiny stream of liquid into a glass from bottle, you can only suck out from the glass as much liquid as the tiny stream allows you, no matter how hard you suck on the straw.

The Zenith compound nozzle, Fig. 3: Here the single jet, suction controlled, and "constant flow" device ignoring suction, are combined, that is, we have combined these two types of rich and poor mixture carburetors. Their opposite qualities match to give **under all suctions a mixture of constant proportions,** so that from cranking the engine to its highest speed there is a constant ratio of air and gasoline to supply efficient combustion.

Zenith carburetor in section, Fig. 4: In the Zenith carburetor there are **four measuring parts,** the sizes of which are determined by the manufacturer according to the type of engine. They are as follows: The **choke tube X,** which measures the amount of air taken into the engine. The flow of air increases as the engine speed increases; **main jet G,** which acts exactly like the jet in the simple carburetor in Fig. 1. It varies in flow with the suction; **compensating jet I** from which the flow is constant regardless of the amount of suction, or the speed of the engine; **idling jet J1** which operates only when the throttle is barely cracked open. Further opening of the throttle T automatically puts the idling device out of operating because the fuel in the well J is then all drawn through the cap jet H through passage K, and the increased flow of air picks up the gasoline from the cap jet H and main jet G, thus cutting off the supply to the priming hole U.

See elsewhere in this book for the **name of parts** and explanation of the action of **starting** and **idling.**