Chapter 11

COMBINED CONTROL UNIT, TYPE CCU.67

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LIST OF ILLUSTRATIONS

Description

1. Grouped together in the combined control unit is the throttle valve, shut-off cock, low pressure filter, and the flow control unit.

2. The flow control meters the fuel to match the requirements of the engine at any throttle opening up to an altitude of approximately 30 000 ft. It also allows a reduction in pump pressure at low engine speeds.

3. Control of the pump output is effected by a servo valve connected to the pump servo system. The valve is carried in a hinged lever, the position of which is governed by a piston that senses the pressure drop across the throttle valve and by a capsule that is responsive to changes in altitude, atmospheric conditions, and aircraft speed.

4. The throttle valve plunger is manually controlled to move in or out of an orifice in the fuel delivery line between the pump and burners. A hole is drilled axially through the plunger to ensure a balance of pressure at either end, and grooves are provided around the circumference which give radial pressure balance and promote ease of operation. Provision is made for some fuel to by-pass the throttle valve; this by-pass mechanism is set on the test rig during calibration.

5. A back pressure valve is fitted immediately downstream of the throttle valve to provide sufficient pump delivery pressure and servo pressure for controlling purposes at low fuel flows.

6. Movement of the throttle valve is effected by rack and pinion, the rack teeth being cut in the side of the plunger. The pinion is carried on a spindle which is rotated by a lever connected to a manual control. By moving the throttle valve plunger, the metering area is varied and, correspondingly, the pressure drop is also varied. This difference in pressure is made to act upon a control piston operating in a cylinder, into which fuel is supplied at pump delivery pressure to the control needle side of the piston and at burner pressure to the other side. Movement of the piston is transmitted through a control needle to a lever, which incorporates a half ball valve over an orifice communicating with the pump servo system. The lever is spring-mounted at one end and inserted freely at the other end into a stirrup, which is connected to a bellows and capsule. The bellows is open to intake air (barometric pressure) and the capsule is evacuated, thus rendering the system responsive to absolute atmospheric pressure.

7. The control piston is loaded by a spring, which has a screw adjustment to enable the desired loading to be achieved. The piston is thus arranged to move against its spring when a given pressure difference is exceeded. As a result, the control needle will also move and the lever will be permitted to lift and increase the spill from the servo valve orifice, thus reducing the pump servo pressure. This will cause the pump servo system to come into operation and reduce the delivery of fuel from the pump to compensate for the alteration in pressure drop.

8. Attenuators are positioned on either side of the control piston to damp out any pressure fluctuations.

Operation

9. When the engine is idling at ground level, the throttle valve metering orifice is very small. The fuel then being supplied to the engine is dependent upon the flow creating a pressure drop across the metering orifice that is just sufficient to balance the control piston against its spring loading and maintain the servo valve in a floating position. Any tendency for the pump to deliver more fuel will result in an increase in pressure drop and the pressure on the control-needle side of the control piston will then exceed the proportional pressure on the other side and cause the piston to move against its spring loading. This will permit the lever to lift, increase the spill from the servo valve and reduce the output of the pump until the exact quantity of fuel required by the engine is again being delivered.

10. When the throttle is opened, and the area of the metering orifice increased, the pressure drop across the control piston will be reduced, the pressure on the control needle side being only slightly less than that on the spring side. This will cause the piston to move under the pressure of its spring and the control needle will thus exert a greater pressure on the lever, reducing the servo

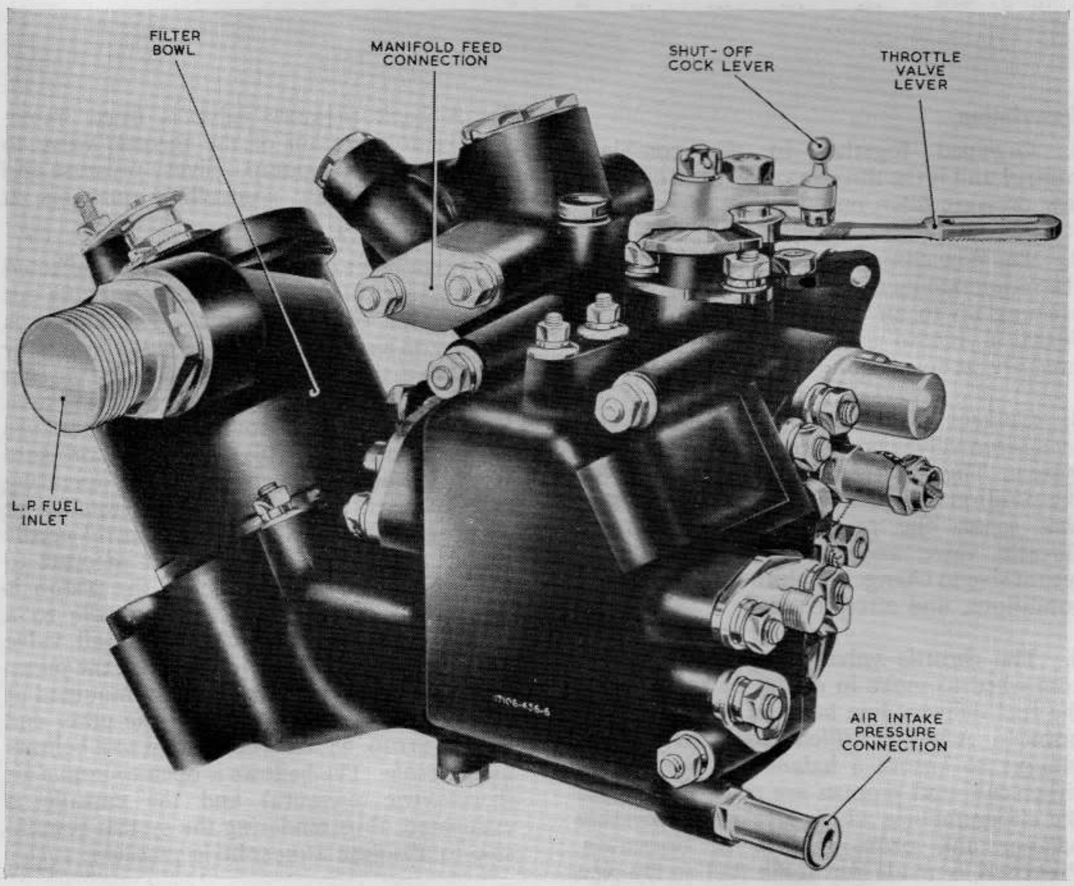

Fig. 1. Exterior view

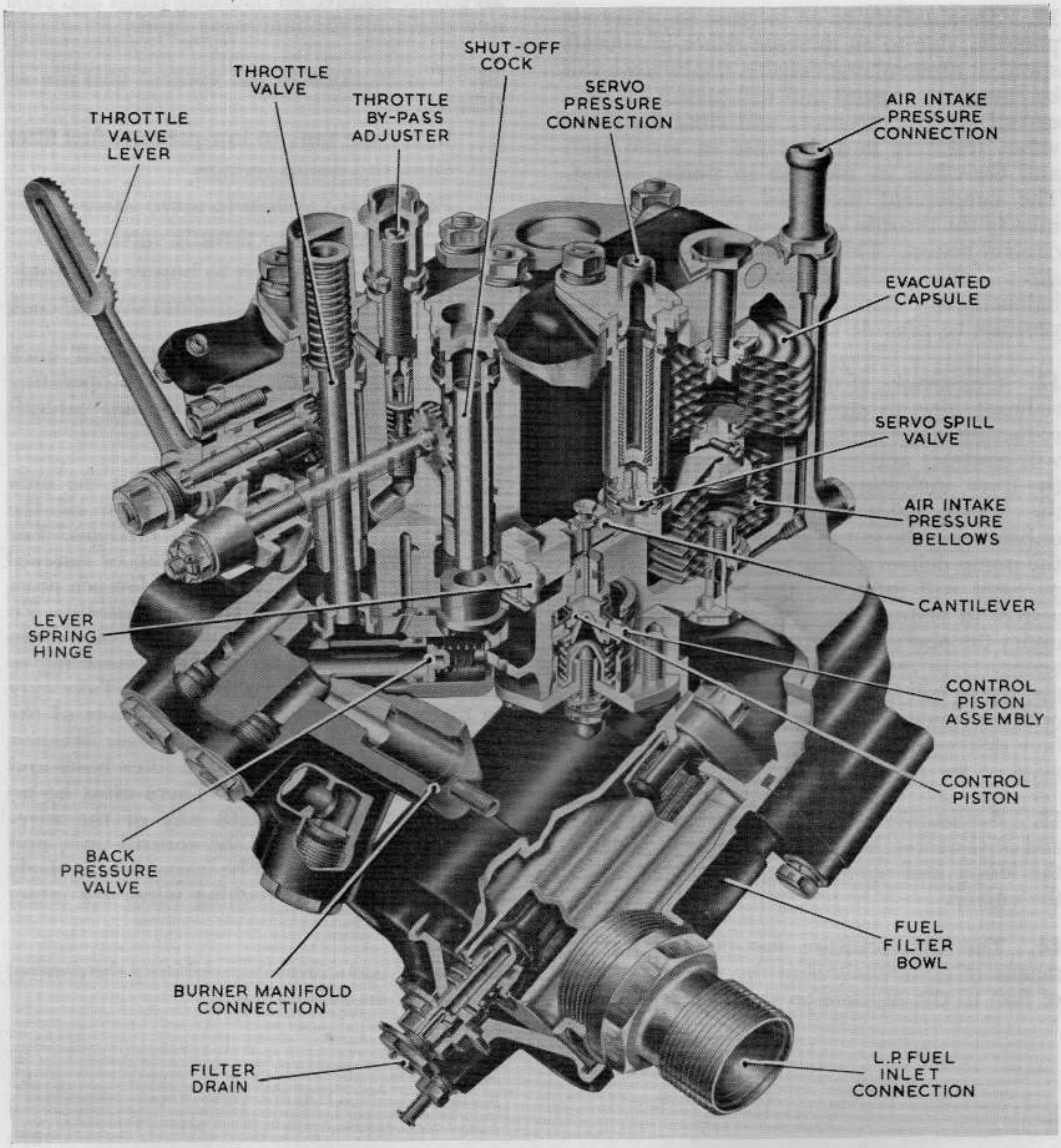

Fig. 2. Cutaway view

valve spill and thereby influencing the pump servo system to increase delivery from the pump. The pressure drop across the throttle valve again builds up sufficiently to cause the pressure control piston to move to its balanced position and restore the servo valve to its normal floating state.

11. Should there be an increase in intake air pressure, due to an increase either in aircraft speed or atmospheric density, the bellows will be caused to expand and will permit the free end of the lever to move and close the servo valve, resulting in a decrease in servo spill and therefore an increase in pump output. The consequent increased pressure at the inlet to the throttle valve will be sensed by the control piston. This will move to restore the servo valve to its floating position, thus balancing the pump servo piston in its new position to provide the desired air/fuel ratio.

12. Conversely, if the intake air pressure is reduced, due to slower aircraft speed or a reduction in atmospheric pressure, the bellows will contract and exert a pull on the end of the lever, deflecting it sufficiently to increase the servo valve spill and consequently unbalancing the pump servo system to reduce the pump delivery. The reduction in delivery pressure will influence the pressure control piston to restore the system to equilibrium under the new conditions. The pressure drop necessary to overcome the spring loading of the piston will be reduced and the servo valve orifice opened, resulting in a decrease in the fuel delivered by the pump to restore the state of the equilibrium.

13. Adjustable stops are provided at each end of the throttle valve lever travel to enable the idling and maximum flows to be set on the engine.

14. The high pressure shut-off cock is the means of completely shutting off the supply of fuel to the burners to stop the engine. It is of the by-pass type, and is so designed that when moved to the closed position, the fuel in the burners and pipes is allowed to escape to atmosphere.

Installing and servicing

15. Before installing a new control unit on an engine remove all blanking plugs and caps and drain off the inhibiting fluid.

16. Connections to the control unit are as follows:—

Inlet from tank to low-pressure fuel filter

Outlet to pump suction

Pump servo system to servo valve

Pump delivery to throttle valve

Shut-off cock outlet to burner manifold

Burner manifold drain from shut-off cock

17. The throttle valve and shut-off cock levers should be connected to the operating levers as described in the relevant aircraft Air Publication.

18. When installed on an engine the only adjustments permissible are those of the throttle and shut-off cock lever linkages. For the instructions on the inspection or renewal of the low-pressure fuel filter, reference must be made to the aero-engine publication. To drain the filter bowl, unscrew the drain nozzle two or three turns after connecting to the nozzle a suitable rubber pipe. Take care to unscrew the nozzle only by means of the outer, or smaller, hexagon; the larger hexagon retains the drain valve in the filter bowl and should not be disturbed. There must be no attempt to interfere with any of the wire-locked adjustments on the control unit, and these adjustments must be inspected regularly to ensure that their locking wires are intact and secure.

19. For instructions on inhibiting the control unit, refer to A.P.4471A.

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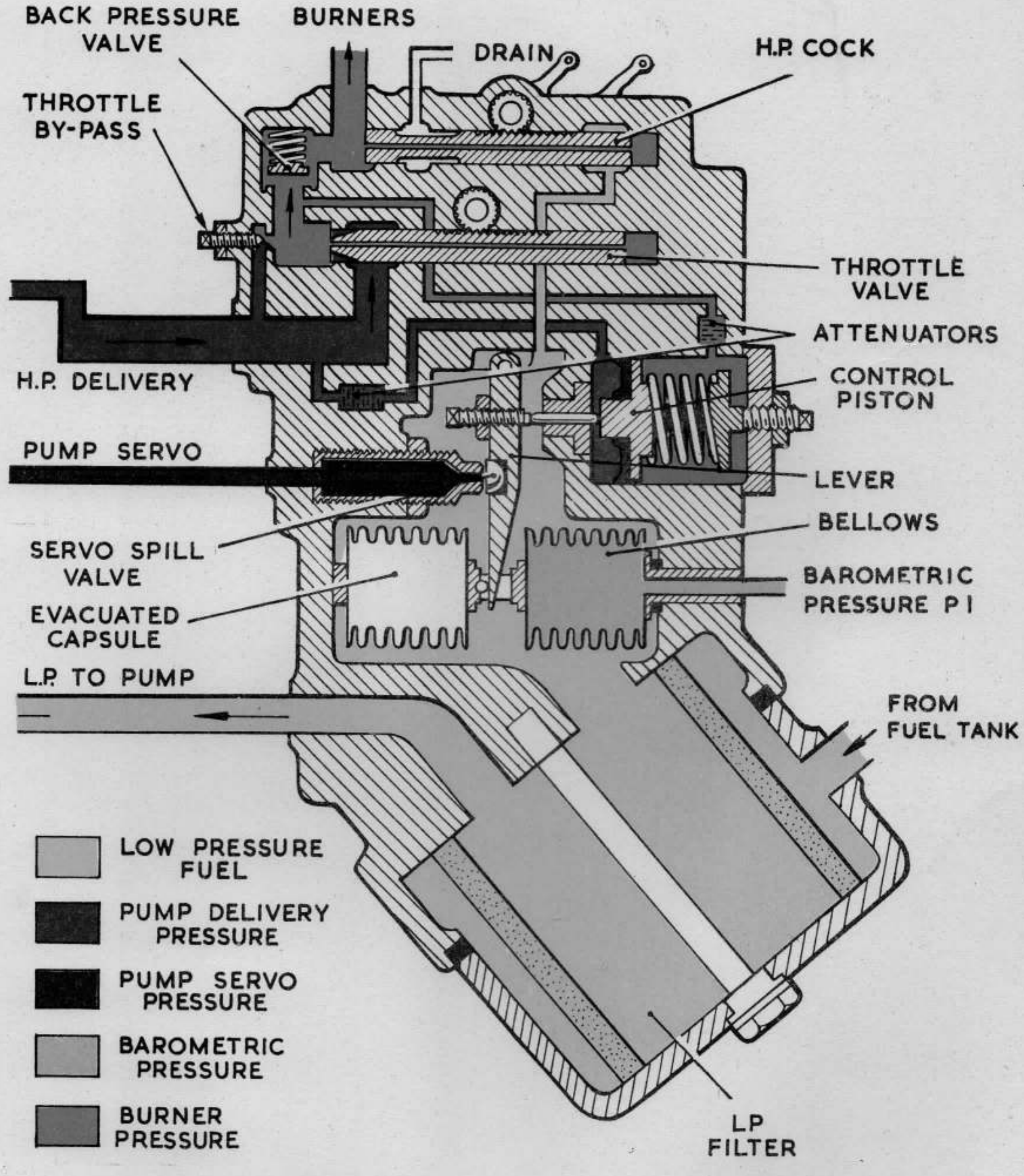

Fig. 3. Functional diagram

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