Chapter 2

COMBINED HIGH PRESSURE SHUT-OFF COCK, BURNER PRESSURE VALVE AND FUEL DISTRIBUTOR UNIT

(Python Mk. 2 & 3 aero-engines)

LIST OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

1. The combined high-pressure shut-off cock, burner pressure valve and fuel distributor unit described in this chapter, is fitted to the Python Mk. 2 & 3 aero-engines. The unit controls the distribution of fuel to the burners, and during the starting cycle provides fuel at a pressure sufficient to ensure correct functioning of the torch igniters and starting atomizers, thus obtaining a satisfactorily atomized fuel for starting the engine. The high-pressure shut-off cock incorporated in the unit and controlled from the pilot's control lever provides the sole means of stopping the engine and when in the OFF position shuts off all fuel supply to the burners and starting manifold. Under engine starting and all running conditions the high-pressure shut-off cock is in the open position.

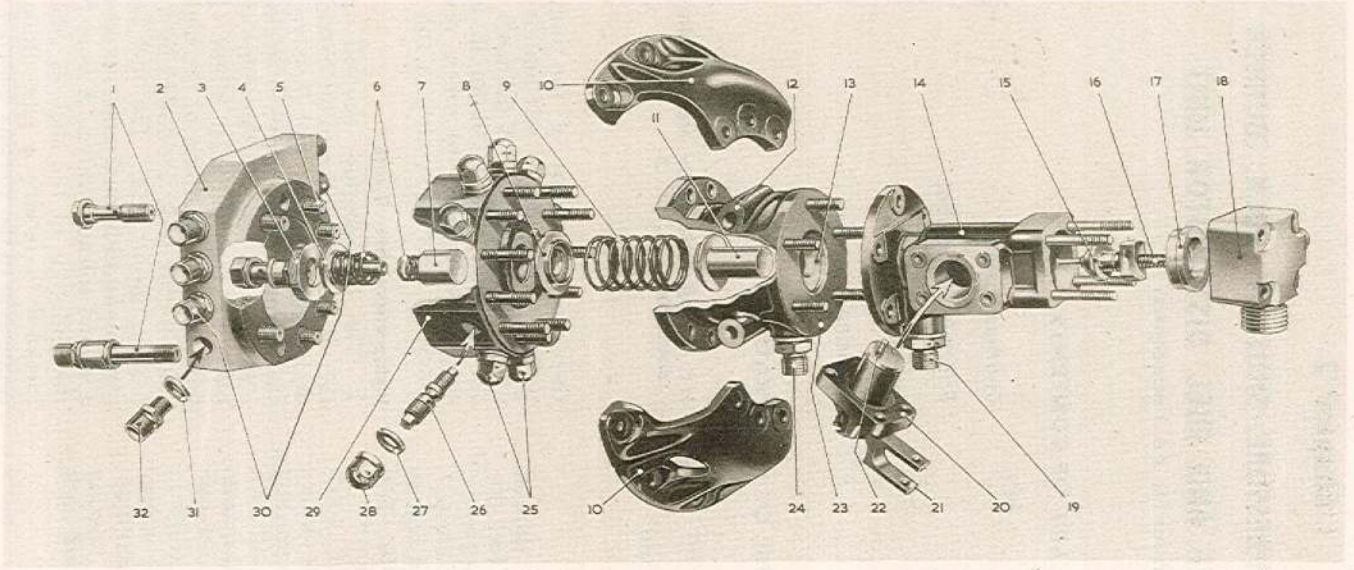
DESCRIPTION

2. The high-pressure shut-off cock, burner pressure valve and distributor comprise the three main sections of the unit. Each section of the unit is self-contained and is described separately. A dismantled view of the complete unit is shown in fig. 1 and should be referred to when reading the following description of each sub-assembly.

High-pressure shut-off cock

3. The high-pressure shut-off cock body (14) is an aluminium-alloy casting formed with a flange at one end for attachment to the burner valve body; a facing at the opposite end carries the four attachment studs for the fuel inlet elbow (18). The joint faces at each end of the high-pressure shut-off cock body are sealed by a Klingerit jointing gasket (23). The fuel inlet elbow contains an additional union for connection to a second solenoid valve. A boss formed on the underside of the shut-off cock body is threaded to receive a pipe union (19) for connection to the starting solenoid valve and starting manifold.

4. A web cast integral with the body forms the inner support for the axially mounted



1 FUEL TRANSFER BOLTS (removed)
2 DISTRIBUTOR BLOCK
3 DRAIN PIPE ADAPTER
4 SPRING ADAPTER
5 FUEL TRANSFER BOLTS (in position)
6 DISTRIBUTOR VALVE SPRINGS
7 DISTRIBUTOR VALVE
8 DISTRIBUTOR VALVE RETAINER
9 BURNER VALVE SPRING
10 MOUNTING BRACKET
11 BURNER PRESSURE VALVE
12 BURNER PRESSURE VALVE BODY
13 BURNER PRESSURE VALVE HOUSING
14 HIGH-PRESSURE SHUT-OFF COCK BODY
15 HIGH-PRESSURE SHUT-OFF COCK COMBINED MAIN AND PILOT VALVE
16 SPRING FOR SHUT-OFF COCK VALVE
17 VALVE SPINDLE BEARING INSERT
18 FUEL INLET ELBOW
19 UNION FOR FUEL SUPPLY TO STARTING SYSTEM
20 OPERATING SHAFT HOUSING
21 OPERATING LEVER FOR SHUT-OFF COCK
22 ECCENTRIC OPERATING SHAFT
23 SEALING GASKET
24 UNION FOR PRESSURE GAUGE CONNECTION
25 SLOW-RUNNING JETS, SEALING WASHERS AND CAP-NUTS
26 SLOW-RUNNING JET (removed)
27 SEALING WASHER FOR SLOW-RUNNING JET
28 CAP-NUT FOR SLOW-RUNNING JET
29 DISTRIBUTOR BODY
30 MAIN JETS (in position)
31 SEALING WASHER FOR MAIN JET
32 MAIN JET (removed)

Fig. 1. H.P. shut-off cock, burner pressure valve and distributor dismantled

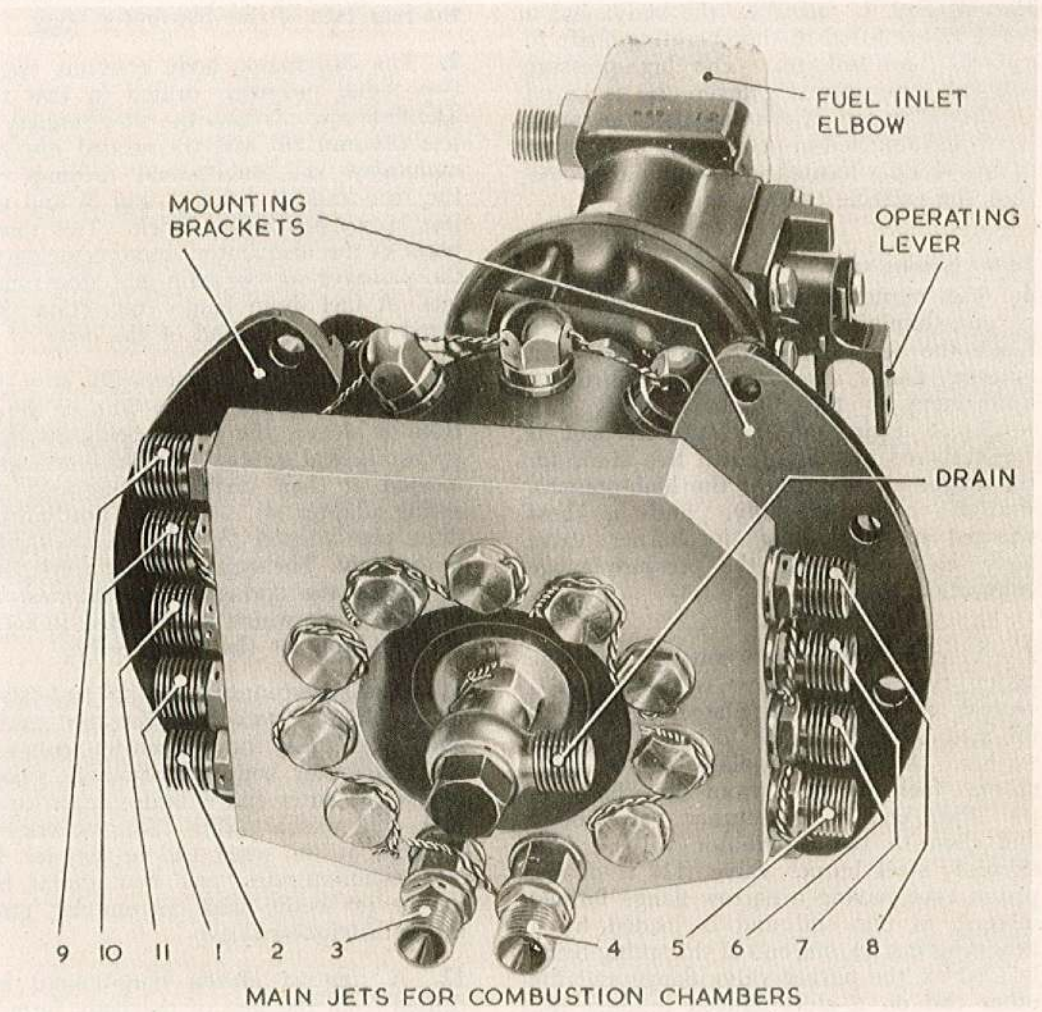


Fig. 2. H.P. shut-off cock, burner pressure valve and distributor, rear view
(*Note.—The numbers indicate combustion chamber connections*)

valve spindle, the outer end of the spindle being supported in a phosphor-bronze insert (17). The combined main and pilot valve (15) is a sliding fit on the valve spindle, its travel being determined in one direction by a tapered seating on the spindle and in the other direction by a steel spring ring located in a groove in the spindle. When in the closed position, the main valve seating is in contact with a seating in the body casting, this constituting the main shut-off cock. Passages drilled through the valve connect with the pilot valve, the seating of which is formed on the shoulder of the spindle. These passages and the seating constitute the pilot valve. A crosshead formed approximately midway along the spindle is slotted to receive the operating pin of the eccentric operating shaft (22). A coil spring (16) fitted over the valve spindle between the crosshead and the outer phosphor-bronze support bearing, retains the valves in the closed position against their respective seatings.

5. The eccentric operating shaft (22) is mounted in a separate housing (20), spigoted and bolted to the shut-off cock body (14).

A rubber seal is provided between the housing and its facing on the body. and a Gaco seal is fitted to the operating shaft to prevent fuel leakage. The high-pressure shut-off cock operating lever (21) is keyed to the outer end of the eccentric operating shaft and retained in position by a Twicklip spring retainer located in an annular groove near the extreme end of the shaft.

Burner pressure valve

6. The burner pressure valve body (12) is an aluminium-alloy casting bored to house the burner pressure valve (11). An external flange at one end is drilled for attachment to the distributor body. A reinforced facing at the opposite end is counterbored and fitted with five studs for the spigot attachment of the high-pressure shut-off cock assembly, and a boss situated midway along the burner valve body is provided for the pressure gauge connection (24).

7. A phosphor-bronze housing for the piston type burner valve is located in a central counterbore in the body and is retained by a set-screw locked by a tab-washer. A series of radially drilled ports allows fuel to pass from the bore to the inner end of the burner valve body and then to the distributor valve. The stainless steel burner valve (11) is of the piston type having a narrow flange formed integral at one end and is loaded by a helical spring (9), one end of the spring being located on the burner valve flange and the other end on a steel flanged retainer (8), which is spigoted into the bore of the distributor valve sleeve. The outward travel of the burner valve is limited by a retaining plate spigoted into the inner end face of the shut-off cock body casting. The spring loading on the burner valve is adjustable by the inclusion of shims between the inner end of the spring and the distributor valve retainer.

Distributor assembly

8. The distributor assembly consists of two parts, the cast aluminium-alloy distributor body (29) and the distributor block (2). The distributor body houses the valve assembly and the slow-running jets. The distributor sleeve is pressed into the central bore of the body and located by two flats on its flange which register with facings on the distributor body. The main jets are housed in a rectangular distributor block attached to the rear face of the distributor body.

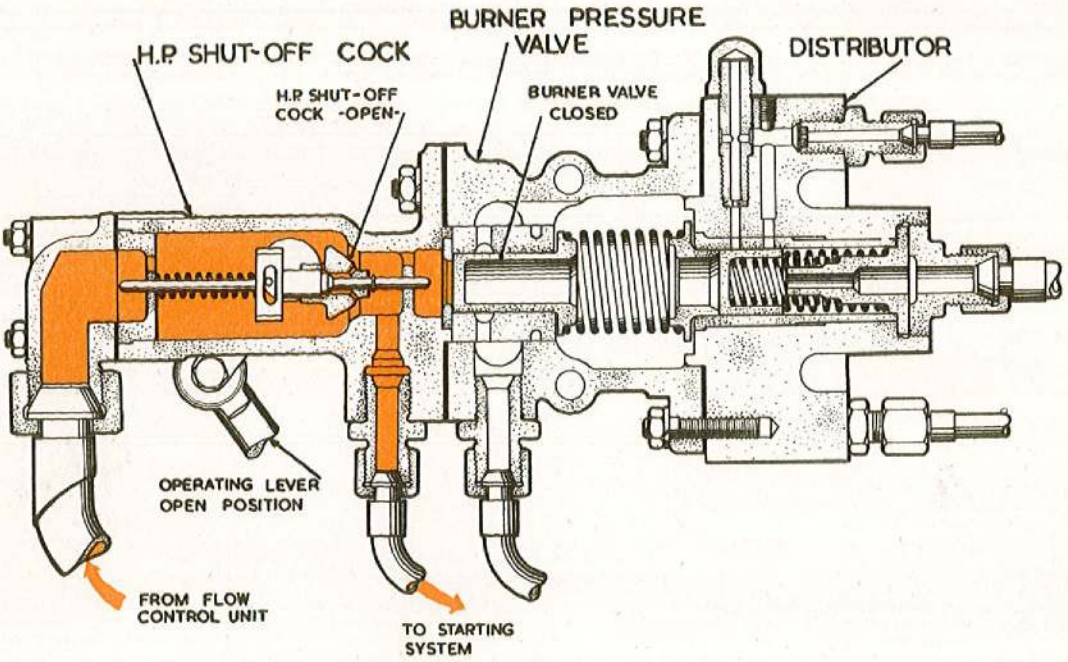
9. The distributor body contains twenty-two radial passages, drilled in two rows. The first row contains the slow-running fuel jets (25 and 26) and the second row communicates via longitudinal drillings with the fuel transfer bolts (1 and 5) and main jets in the distributor block. Two rows of ports in the distributor sleeve coincide with the passages to the main and slow-running jets. A fuel drain banjo connection (3) is fitted to the outer end of the body.

10. The distributor valve (7) is a steel piston which slides in the bore of the distributor sleeve, the piston being controlled by two helical springs (6). These springs are located at their static or inner end on a spring adapter (4), secured in position by a drain pipe adapter (3) screwed into the bore of the body. The spring adapter is cylindrical in shape, the spring being mounted in a central shank which is extended to form a limiting stop for the piston valve.

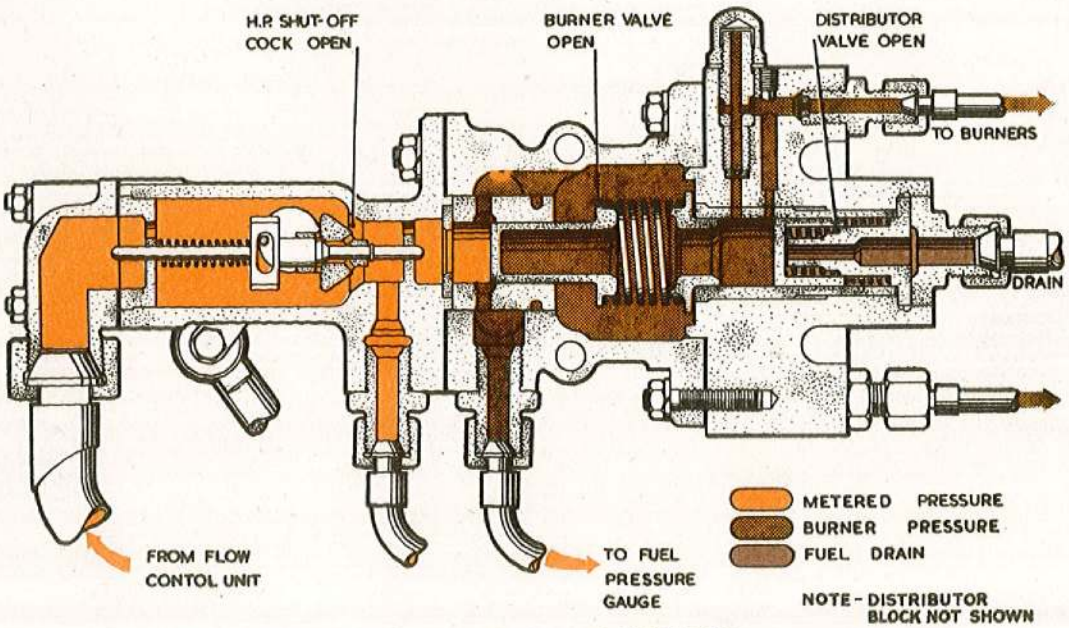
11. The slow-running jets (25 and 26) are of aluminium-bronze and threaded at both ends. The inner end of each jet screws into the distributor body slow-running passage, whilst the outer end is sealed by a cap-nut (28) and washer (27). The jet orifice is situated at the inner end of the jet bore and communicates, via four radial holes in the jet body, with an annular groove in the distributor sleeve.

12. A ring of eleven longitudinal holes drilled from the rear of the body form fuel passages connecting both the slow-running and the main jet passages to the distributor block. These passages are threaded for part of their length to receive the fuel transfer bolts (1 and 5).

13. The distributor block (2) is mounted on the rear face of the distributor body, and retained in position by the fuel transfer bolts (a sealing washer being interposed). The centre of the block is bored to provide access to the drain pipe adapter (3). Radial passages in the block are threaded at their outer ends to take nine of the eleven main jets. These nine jets are shown in fig. 2 together with the two remaining jets which are positioned in the outer ends of the two lowest transfer bolts. The main jets consist of drilled brass inserts calibrated on a fuel-flow test rig. These inserts are each housed in a steel union.



FUEL FLOW AT STARTING CONDITIONS



FUEL FLOW AT RUNNING CONDITIONS

FIG. 3 H.P. SHUT-OFF COCK, BURNER PRESSURE VALVE & DISTRIBUTOR

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PRINCIPLE OF OPERATION

14. The following description of the principle of operation of the combined high-pressure shut-off cock, burner valve, and distributor unit should be read in conjunction with the description of the complete fuel system given in Section 1, Chapter 1. The fuel flow through the unit is shown in fig. 3 of this chapter which should be read in conjunction with the fuel flow diagram given in Section 4, Chapter 1. It should be noted that for the purpose of clarification, the distributor block has been omitted from fig. 3, the main jets being shown in the distributor body and not in the distributor block.

15. When the high-pressure shut-off cock is opened, fuel for starting purposes is permitted to pass from the high-pressure pump and flow control unit to a priming chamber situated immediately downstream of the high-pressure shut-off cock. From this chamber the fuel passes through an outlet union and pipe to the solenoid valve, then to the starting manifold, torch igniters and starting atomizers. When the engine starts there is a rapid increase in the pressure of fuel from the high-pressure fuel pump and at approximately 50 lb. per sq. in. the burner valve opens. The opening of this burner valve is followed by the opening of the spring-loaded distributor valve which exposes the ports to the slow-running jets, fuel then flows via the burner and distributor valve to the slow-running jets and burners. This fuel supplements the supply from the priming chamber to the starting manifold.

16. When the engine r.p.m. has increased to ground idling speed, and the ignition switch governor has automatically closed the solenoid valve in the starting system, all subsequent fuel passes through the slow-running jets. When the throttle is opened to the FLIGHT IDLING position of 7,800 r.p.m., the increase in fuel pressure from the high-pressure pump will cause the distributor valve to open still further against the action of the second and stronger spring. This movement of the distributor valve opens a second set of ports leading to the eleven main jets, thus permitting an increased flow to the burners necessary for normal running conditions. From the eleven main jets the fuel passes through individual pipes to a burner in each of the eleven combustion chambers.

INSTALLATION

17. The unit is mounted on two aluminium-alloy brackets on the forward face of the accessory drive box and engine bulkhead. The brackets are secured by six of the studs and nuts which secure the burner valve body to the distributor body. Each bracket is drilled to take the four bolts which secure the unit in position.

SERVICING

18. The operation of the high-pressure shut-off cock control and the tightness of the pipe connections must be checked in accordance with the instructions given in the relevant Air Publication. Apart from these checks, no servicing of the unit is necessary. In the event of the unit becoming faulty, it must be removed and a serviceable replacement unit fitted as detailed in A.P.4293A, Vol. 6, Part 1, Section 2, Chapter 1.