

## Chapter I

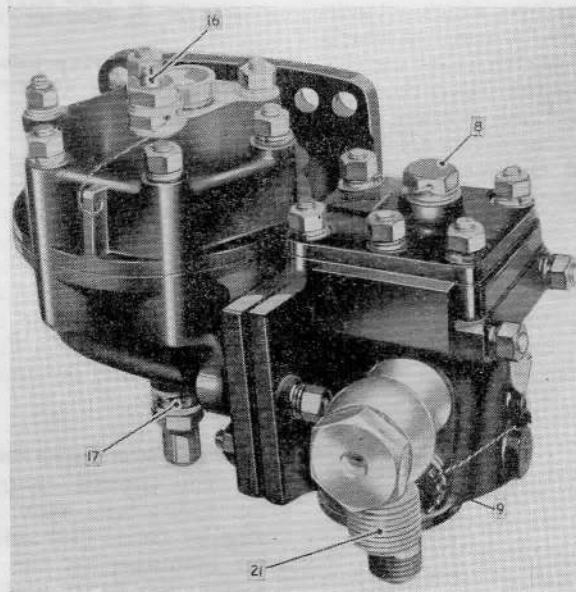
# BAROMETRIC PRESSURE CONTROL, TYPES B.P.C.3, B.P.C.7 and B.P.C. 18

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- 8 SPRING ADJUSTING SCREW
- 9 FILTER
- 16 PIVOT SCREW
- 17 STOP SCREW
- 21 PUMP INLET CONNECTION

Fig. 1. Barometric pressure control, type B.P.C.3 (front view)

#### INTRODUCTION

1. The barometric pressure control units described in this chapter control the high-pressure pump delivery to the engine, under varying conditions of speed, altitude, and

atmospheric conditions represented by nacelle pressure. The B.P.C.3, B.P.C.7 and B.P.C.18 units are basically similar but the B.P.C.18 is fitted with a rocker lever and bush assembly which replaces the rocker lever and

(A.L.40, Aug. 56)

pivot plate assembly on the earlier units and it also has a modified piston and stop-plate in the valve chamber. The B.P.C.7 is fitted with an adapter which has an elbow type connection to pump delivery instead of the normal straight union. Installation fittings and calibration settings are different to suit engine requirements.

#### DESCRIPTION

##### General

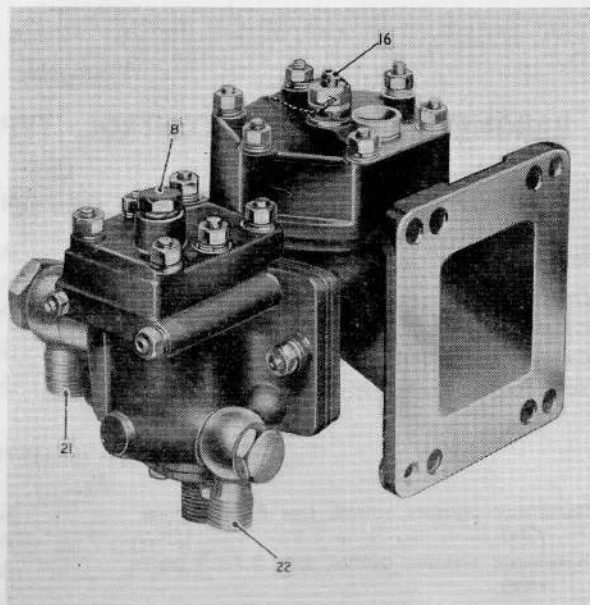
2. The main casting of the barometric pressure control unit (*fig. 3*), is subdivided into two chambers, a capsule chamber (1) and a valve chamber (2) by a pivot plate assembly (3) which carries a rocker lever (4) extending into both chambers. The pivot plate assembly provides a fluid-tight seal to isolate the two chambers. In the B.P.C.18 unit the two chambers are separated by a rocker lever plate and gasket and the lever pivots in a bush which is fitted with rubber sealing rings.

3. The end of the rocker lever which extends into the valve chamber has a socket in which is fitted a half-ball (5) which seats on the orifice (6) in the base of the valve chamber and forms a valve. This valve is maintained in the seated position by the spring (7) which is suitably compressed by means of the adjustment screw (8) in the valve chamber cover.

4. Fuel at servo pressure from the pump is supplied to the underside of this orifice, the entry of any foreign matter into the valve being prevented by the filter (9) inserted in the servo fuel supply line.

5. The movement of the rocker lever is controlled by fuel at delivery pressure from the pump and by the capsule stack which is actuated by nacelle pressure. The pump pressure operates the lever through an operating disc (10), piston (11) and operating needle (12), housed in the adjusting sleeve (13) located in the base of the valve chamber.

6. The upper end of the operating needle operates against the adjustment screw (14) in the rocker lever. For adjustment purposes the bore of the adjusting sleeve is machined off-centre thus allowing the centre line of the operating needle to be moved in relation to the rocker lever fulcrum, consequently the operating needle can be moved across the face of the adjustment screw to increase or decrease the distance from the fulcrum point of the lever as desired.



- 8 SPRING ADJUSTING SCREW
- 16 PIVOT SCREW
- 21 PUMP INLET CONNECTION
- 22 PUMP SERVO CONNECTION

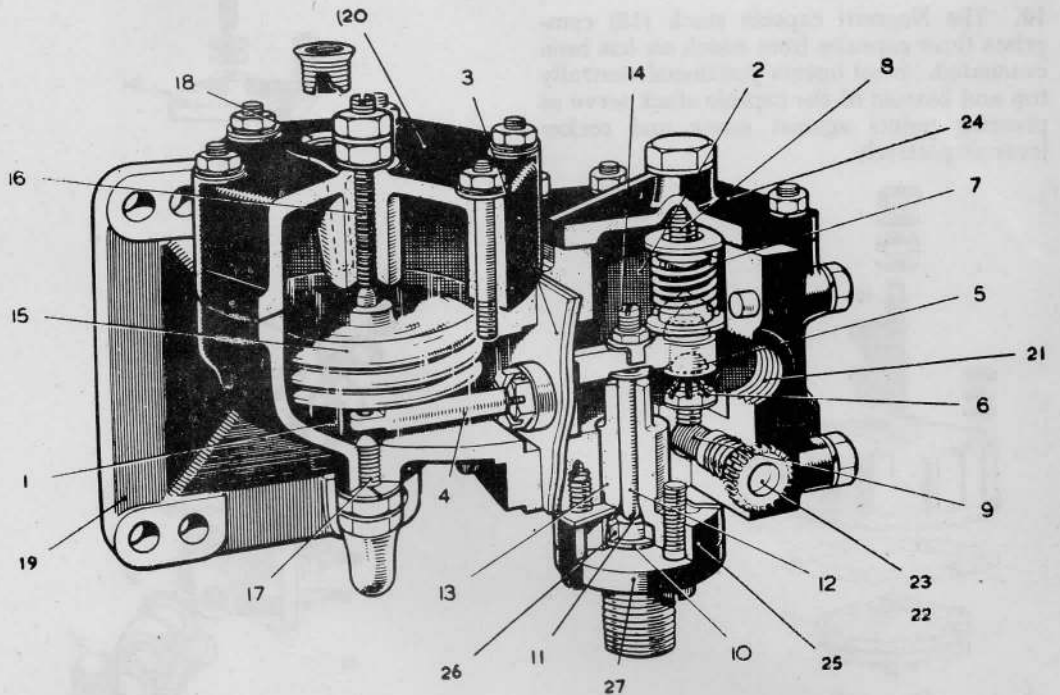
**Fig. 2. Barometric pressure control, type B.P.C.3 (rear view)**

7. The other end of the rocker lever which extends into the capsule chamber, is provided with a socket which locates with the lower pivot point of the barometric capsule stack. The upper pivot point of the capsule is located by an adjustable pivot screw (16) fitted to the capsule chamber cover, while a stop screw (17) in the base of the capsule chamber limits downward movement of the rocker lever.

##### Capsule chamber casting and capsule stack

8. The capsule chamber bowl, shown in *fig. 4*, is a light-alloy casting having a rectangular flange (19) with eight locating holes for mounting on the engine, and another rectangular flange with four studs, two long and two short, and two holes for locating the valve chamber casting. A boss in the centre of the base of the bowl houses the adjustable stop screw (17) for the rocker lever which is fitted with both a lock-nut and a cap-nut.

9. Six studs positioned round the top of the bowl locate the light-alloy capsule cover (20) in which is cast a central boss extending into the capsule bowl to house an adjustable screw (16) with lock-nut and nut. This screw forms the upper pivoting point of the capsule stack.

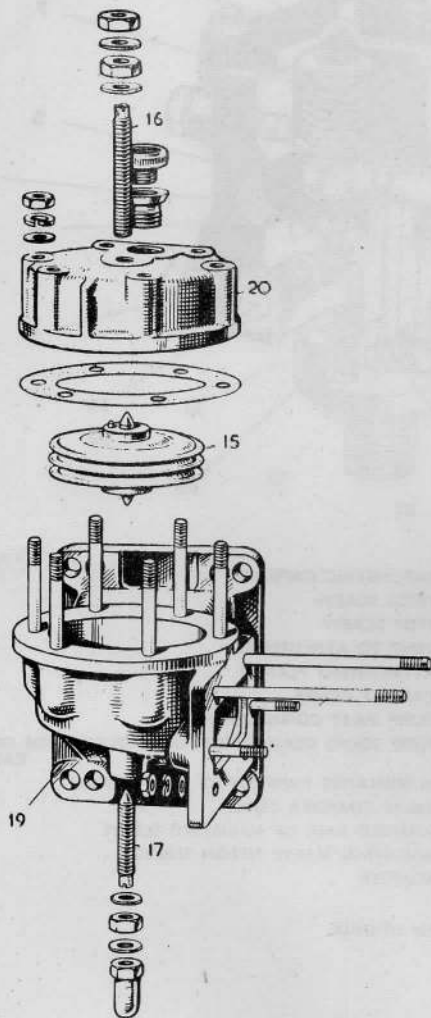


- |    |                              |    |  |
|----|------------------------------|----|--|
| 1  | CAPSULE CHAMBER              | 15 | BAROMETRIC CAPSULE                               |
| 2  | VALVE CHAMBER                | 16 | PIVOT SCREW                                      |
| 3  | PIVOT PLATE ASSEMBLY         | 17 | STOP SCREW                                       |
| 4  | ROCKER LEVER                 | 18 | VENT TO ATMOSPHERE                               |
| 5  | HALF-BALL                    | 19 | ATTACHMENT FLANGE                                |
| 6  | ORIFICE                      | 20 | CAPSULE COVER                                    |
| 7  | SPRING                       | 21 | PUMP INLET CONNECTION                            |
| 8  | SPRING ADJUSTING SCREW       | 22 | PUMP SERVO CONNECTION ON OPPOSITE SIDE OF CASING |
| 9  | FILTER                       | 23 | ALTERNATIVE PUMP SERVO CONNECTION                |
| 10 | OPERATING DISC               | 24 | VALVE CHAMBER COVER                              |
| 11 | PISTON                       | 25 | FLANGED BASE OF ADJUSTING SLEEVE                 |
| 12 | OPERATING NEEDLE             | 26 | ADJUSTING SLEEVE PISTON SLEEVE                   |
| 13 | ADJUSTING SLEEVE             | 27 | ADAPTER  |
| 14 | ROCKER LEVER ADJUSTING SCREW |    |  |

Fig. 3. Sectioned view of unit

A vent is provided in the top of the cover to enable the capsule stack to respond to nacelle pressure.

10. The Negretti capsule stack (15) comprises three capsules from which air has been evacuated. Steel inserts positioned centrally top and bottom of the capsule stack serve as pivoting points against screw and rocker lever respectively.

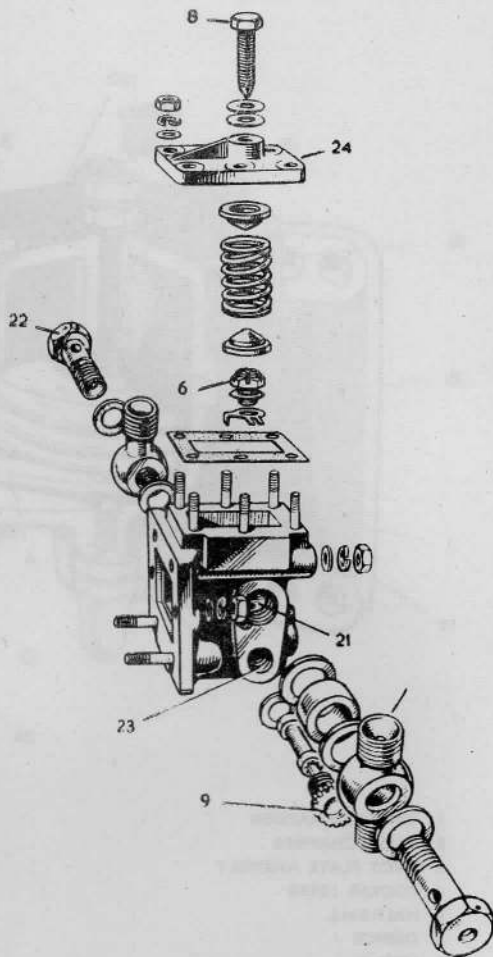


- 15 BAROMETRIC CAPSULE
- 16 PIVOT SCREW
- 17 STOP SCREW
- 19 ATTACHMENT FLANGE
- 20 CAPSULE COVER

Fig. 4. Exploded view of capsule chamber assembly

#### Valve chamber casting and cover

11. The square valve chamber (fig. 5), is a light-alloy casting having three tapped holes



- 6 ORIFICE
- 8 SPRING ADJUSTING SCREW
- 9 FILTER
- 21 PUMP INLET CONNECTION
- 22 PUMP SERVO CONNECTION
- 23 ALTERNATIVE PUMP SERVO CONNECTION
- 24 VALVE CHAMBER COVER

Fig. 5. Exploded view of valve chamber assembly

in its machined walls, one of which (21) connects with the pump suction and the other two (22) and (23) are alternative connections to the H.P. pump servo.

12. A cylindrical wire-wound filter (9) is included in the pump servo duct. This duct opens into a tapped boss inside the base of the valve chamber in which is fitted a landed orifice (6) of steel, having a tungsten carbide insert.

13. The machined face on the base of the valve chamber casting has three tapped holes to receive screws for securing the adjusting sleeve assembly.

14. Two rectangular flanges on the top and side of the valve chamber casting accommodate the cover and capsule chamber casting respectively. Six studs in the top flange secure the cover and the capsule chamber casting is secured to its mating flange by two studs, the remaining four holes accommodating the four studs fitted to the capsule chamber.

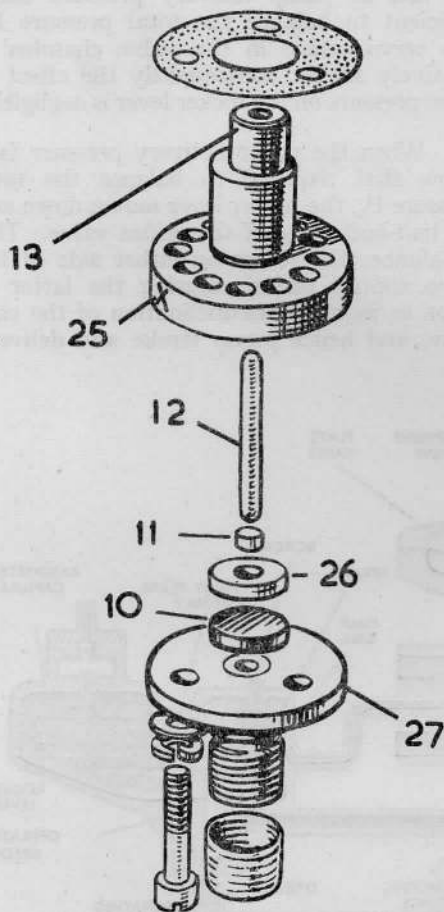


Fig. 6. Adjusting sleeve assembly

15. The rectangular cover (24) is a phosphor-bronze casting which has a raised centre boss with strengthening web. The cover is tapped to accommodate an adjustment screw (8), by means of which the spring-loading of the rocker lever may be varied.

**Adjusting sleeve assembly**

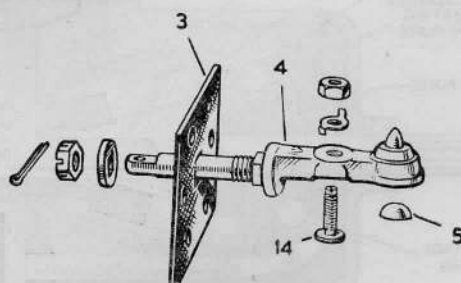
16. The steel adjusting sleeve (13) (fig. 6) has a flanged base (25) with a series of holes equally spaced round the flange. The centre boss of the sleeve is machined eccentric to the flange and is bored to receive an operating needle (12). This needle is maintained in contact with the base of the adjustment screw (14) in the rocker lever by a steel piston (11) and sleeve (26), and a rubber operating disc (10). These parts are retained in the recessed flange of the sleeve by a brass adapter (27), through which fuel at pump delivery pressure is supplied.

17. The adjusting sleeve assembly is secured to the base of the valve chamber casting by three screws which pass through locating holes in the flanges of both adjusting sleeve and end cap.

**Rocker lever and pivot plate assembly**

18. The rocker lever and pivot plate assembly (fig. 7) is interposed between capsule and valve chamber castings.

19. The pivot plate assembly consists of a rectangular brass base, with rubber bonded upon either side. This locates with the square



3 PIVOT PLATE ASSEMBLY  
4 ROCKER LEVER  
5 HALF-BALL  
14 ROCKER LEVER ADJUSTING SCREW

Fig 7. Rocker lever and pivot plate assembly

centre section of the rocker lever and is tightened against the lever flange by means of a castellated nut which is locked by a split pin; a light alloy reinforcing plate is interposed between the nut and the pivot plate

assembly. Holes in the pivot plate assembly locate with the studs in both valve chamber and capsule chamber castings.

20. The end of the rocker lever extending into the valve chamber is formed into a spigot upon which the lower spring plate seats. A helical spring locates with this spring plate and an upper spring plate engages with the adjustment screw (8) in the top cover.

21. The underside of this end of the rocker lever has a socket to accommodate the half-ball (5) of tungsten carbide. The flat face of the half-ball, which is ground to fine limits, seats on the landed orifice (6).

22. Situated midway between the half-ball location and the fulcrum point of the lever is a tapped boss which accommodates the adjusting screw (14). This screw has a flat circular base in contact with the operating needle and is locked by a lock-nut and tab-washer.

#### PRINCIPLE OF OPERATION

23. In fig. 8 the arrangement between the barometric pressure control and the main fuel pump servo system is shown diagrammatically. The forces applied by fuel at pump

delivery pressure on the operating disc and by total pressure ( $P_1$  or nacelle pressure) on the capsule stack exert moments of force in opposite directions about the pivot plate assembly.

24. As the screw in the valve chamber cover is adjusted to load the rocker lever spring sufficiently to maintain the pivot points of the capsule stack in compression, the system represents a pin-jointed capsule subject to total pressure  $P_1$  and opposing pump delivery pressure on the operating disc.

25. Under normal operating conditions the system is in equilibrium with the half-ball in the rocker lever slightly off its orifice seating, the fuel at pump delivery pressure being sufficient to balance the total pressure  $P_1$ . The servo orifice in the valve chamber is relatively small; consequently the effect of servo pressure on the rocker lever is negligible.

26. When the pump delivery pressure falls below that required to balance the total pressure  $P_1$ , the rocker lever moves down and the half-ball seals off the orifice valve. This unbalances the forces on either side of the servo control piston, causing the latter to move to increase the inclination of the cam plate, and hence pump stroke and delivery

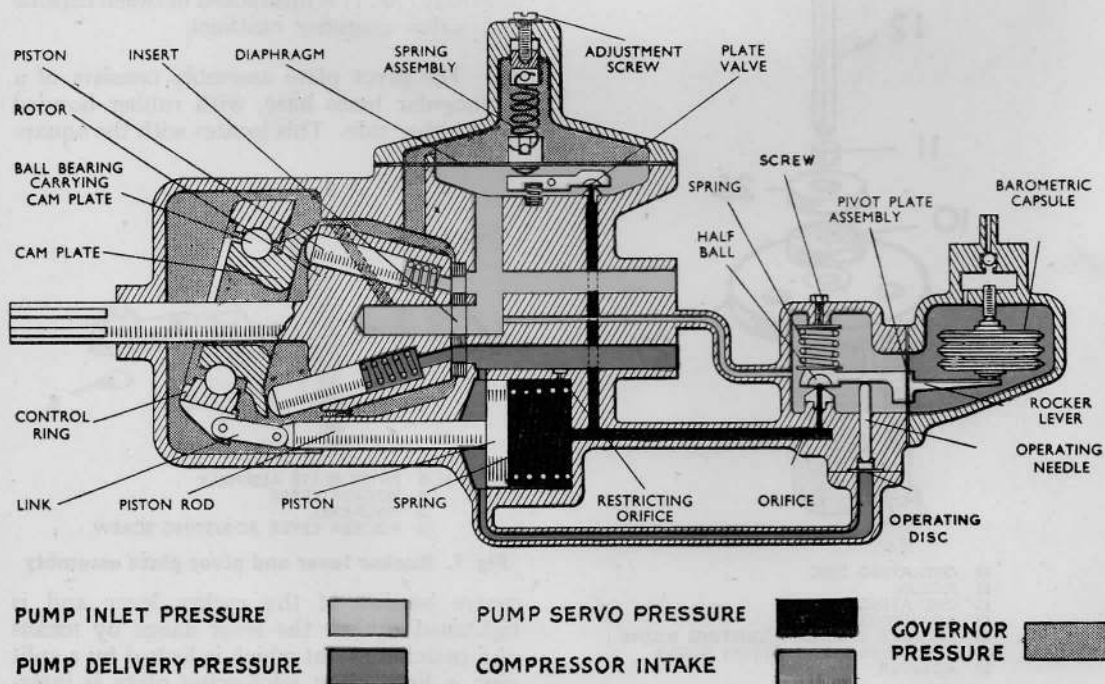


Fig. 8. Diagrammatic layout showing connection between the barometric pressure control unit and the H.P. pump servo system

pressure. Conversely a rise in pump delivery pressure above that required to balance the total pressure  $P_1$  will cause the rocker lever to be lifted by the operating needle and open the servo orifice still further. The pump control piston will thus be unbalanced in the reverse direction, causing both the cam plate angle and thus the stroke of the rotor pistons to be reduced with consequent reduction in pump delivery and pressure.

**27.** The pump delivery pressure  $P$  is thus related to the total pressure  $P_1$  by the equation

$$P = AP_1 + B$$

where  $A$  is a constant equal to the ratio of capsule to diaphragm areas and  $B$  the residual spring-loading of the system. The constants for the various types of units are given in their relative chapters in Vol. 2, Part 3, Section 3.

**28.** The correct functioning of the system is therefore dependent upon the relation of  $P$

and  $P_1$ , as defined by the engine and atomizer characteristics.

#### SERVICING

**29.** Normally no servicing is required apart from a periodic check of pipe joints and connections for leakage. In the event of leakage, examine joint washers and pipes for damage and replace if necessary. No leakage is permissible.

**30.** Whenever pipe joints are disturbed, or before running the engine after standing, the system must be bled as described in Section 2, Chapter 1, of this Volume.

#### INSTALLATION

**31.** For installation particulars, reference should be made to the relevant engine Air Publications, and to A.P.4471A for inhibiting and packing instructions.

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