

Chapter 43

INVERTED FLIGHT VALVES B.P. SERIES

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Introduction

1. The inverted flight valve is a self contained unit and is designed for use with fuel booster pumps. The combined unit ensures an uninterrupted supply of fuel to the engine under inverted flight conditions, and during negative G manoeuvres.

2. On aircraft in which the fuel booster pump is fitted with these valves the relevant fuel tanks are specially constructed to ensure that the open end of the valve casing remains immersed in fuel during periods of inverted

flight. Details of the fuel tank construction will be found in the relevant Aircraft Handbook.

3. In this chapter a typical flight valve is described and illustrated, with appendices at the end of the chapter detailing the differences between the various types.

DESCRIPTION**General**

4. Inverted flight valves consist principally of a number of valves mounted around the

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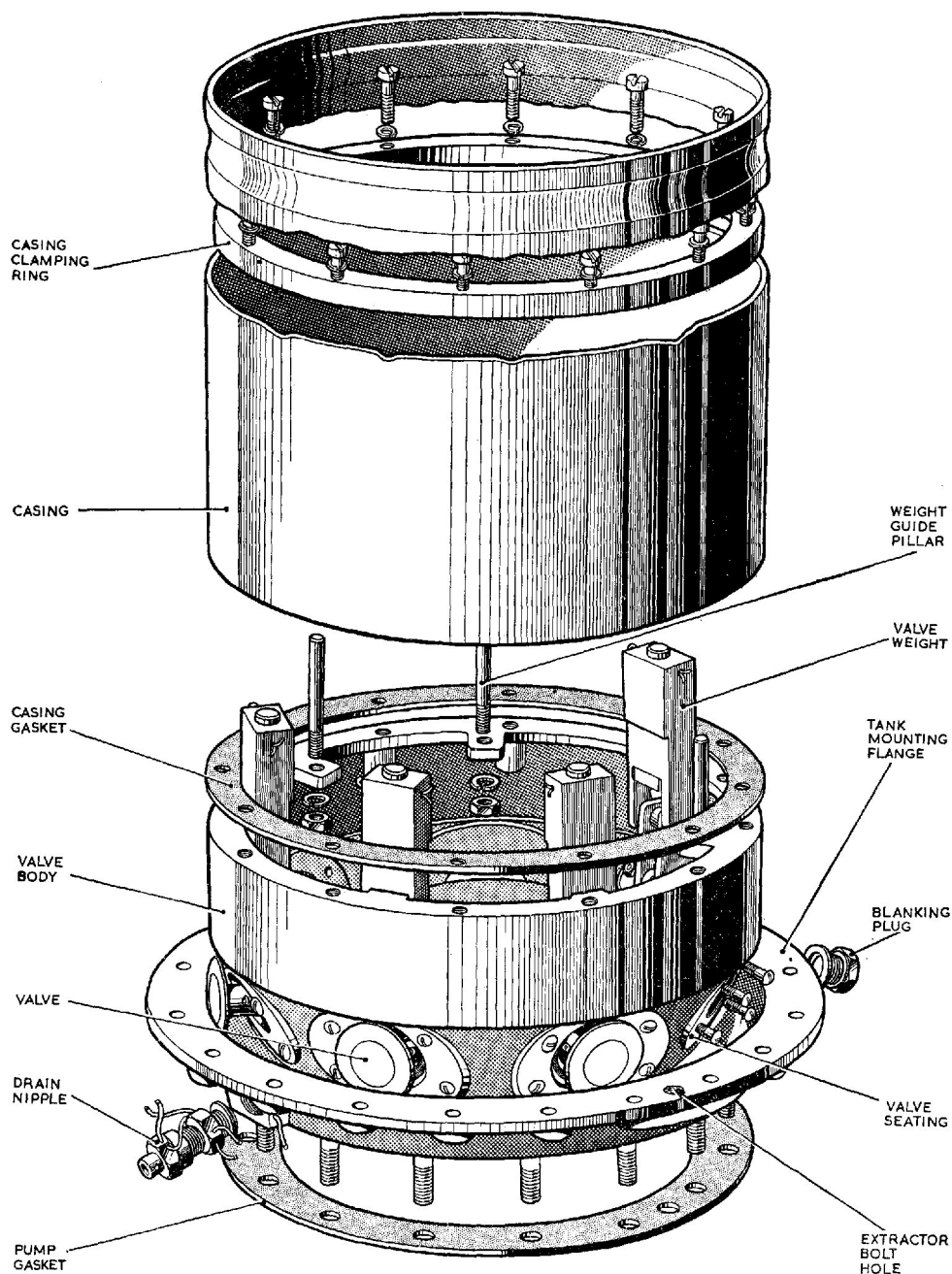


Fig. 1. Exploded view of typical inverted flight valve

lower end of a cylindrical casing. The unit shown in Fig 1. has seven valves. These valves are identical and each is actuated by freely moving weights, and maintained in the open position during normal flight. During periods of inverted flight the valves are closed by the action of the weights.

Casing

5. The casing of the inverted flight valve is a thin trunk or cylinder with a flange at its base, for attachment to the valve body. A gasket is interposed between the flange and the valve body and a securing ring is seated on the flange of the casing. Screws

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passing through the ring, casing flange and gasket, secure the casing to the valve body.

6. The casing is open at its upper end, but a wire mesh filter may be fitted over this opening to prevent ingress of foreign matter.

Valve body assembly

7. The valve assembly incorporates the weight operated valves, which are equally disposed around the valve body. The number of valves vary with the size of the unit.

8. A mounting flange near the lower end of the valve body, is provided with holes by which the complete unit is secured to its special mounting ring on the aircraft fuel tank. Two additional holes in the flange are tapped to receive extractor bolts, for use when it is necessary to remove the flight valve (together with the pump) from its seating on the fuel tank.

Weight operated valves

9. Each valve (*fig 2*), is actuated through a linkage mechanism by a weight. This weight which is forked at its lower end to carry the valve link, has a central hole through its length. This hole accommodates a ball bearing sleeve, which rides on a guide pillar screwed vertically into the body of the valve assembly. This construction ensures that the weight readily slides along its guide pillar when the inverted flight valve as a whole, is carried beyond the horizontal, towards an inverted position.

10. The valve link is connected to a pivoted crank lever, which in turn is connected to the spigot end of the valve. The surface of the valve and its seating are lapped to provide a fuel tight seal when the valve is in the closed position.

Water drain

11. Four identical tapped holes which communicate with the interior of the valve base, are provided around the circumference of the valve body at its lower end. Three of these holes are blanked off by screwed plugs

and the fourth is fitted with a drain nipple. The plugs and nipple are interchangeable, thereby enabling the drain nipple to be fitted in any one of the four positions to meet the requirements of particular installations.

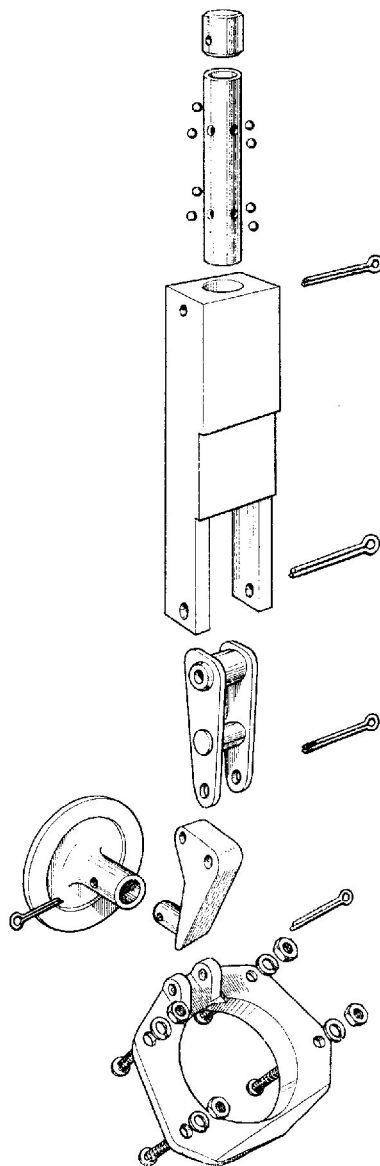


Fig. 2. Exploded view of typical valve linkage mechanism

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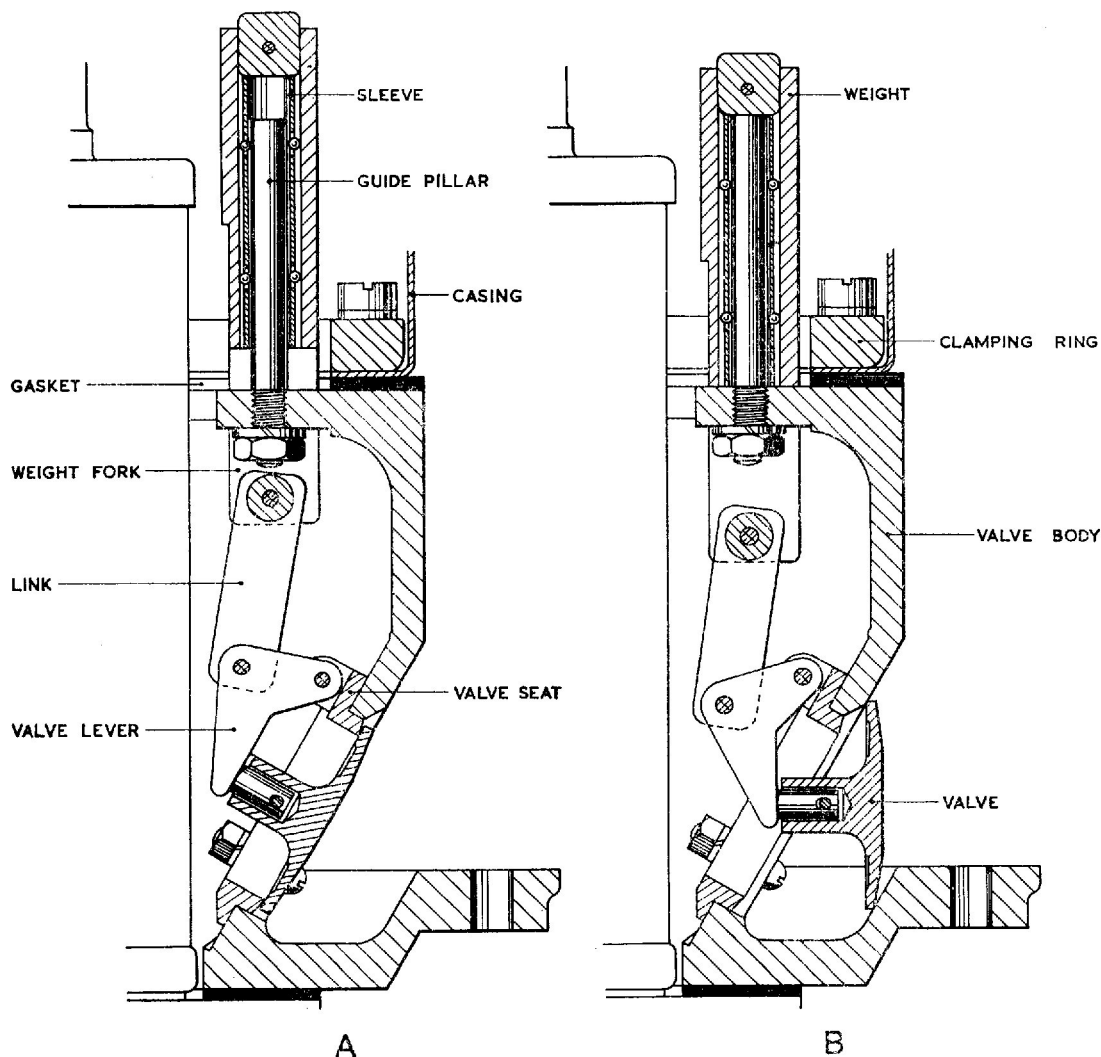


Fig. 3. Sectional view of typical valve in closed and open position

OPERATION

Normal flight

12. During normal flight the inlet valves are kept open by the action of the weights operating through the linkage mechanism. This allows free access of the fuel in the tank to the pump inlet, and the pump functions in the normal manner.

Inverted flight

13. When the aircraft is manoeuvred beyond the vertical bank condition towards full inversion the valve weights will slide freely along their guide pillars to close the inlet valves. Due to the construction of the tank in which the valve is fitted, the open

mouth of the valve casing will be immersed in fuel and there will therefore be sufficient fuel surrounding the pump inlet for a pre-determined period of inverted flight.

INSTALLATION

Fitting the inverted flight valve to the pump

14. Fit a new joint washer that has been smeared with Wellseal jointing compound over the securing studs at the base of the valve, and insert the studs in the holes of the normal mounting flange of the pump. Tighten the securing nuts evenly to ensure a fuel tight joint.

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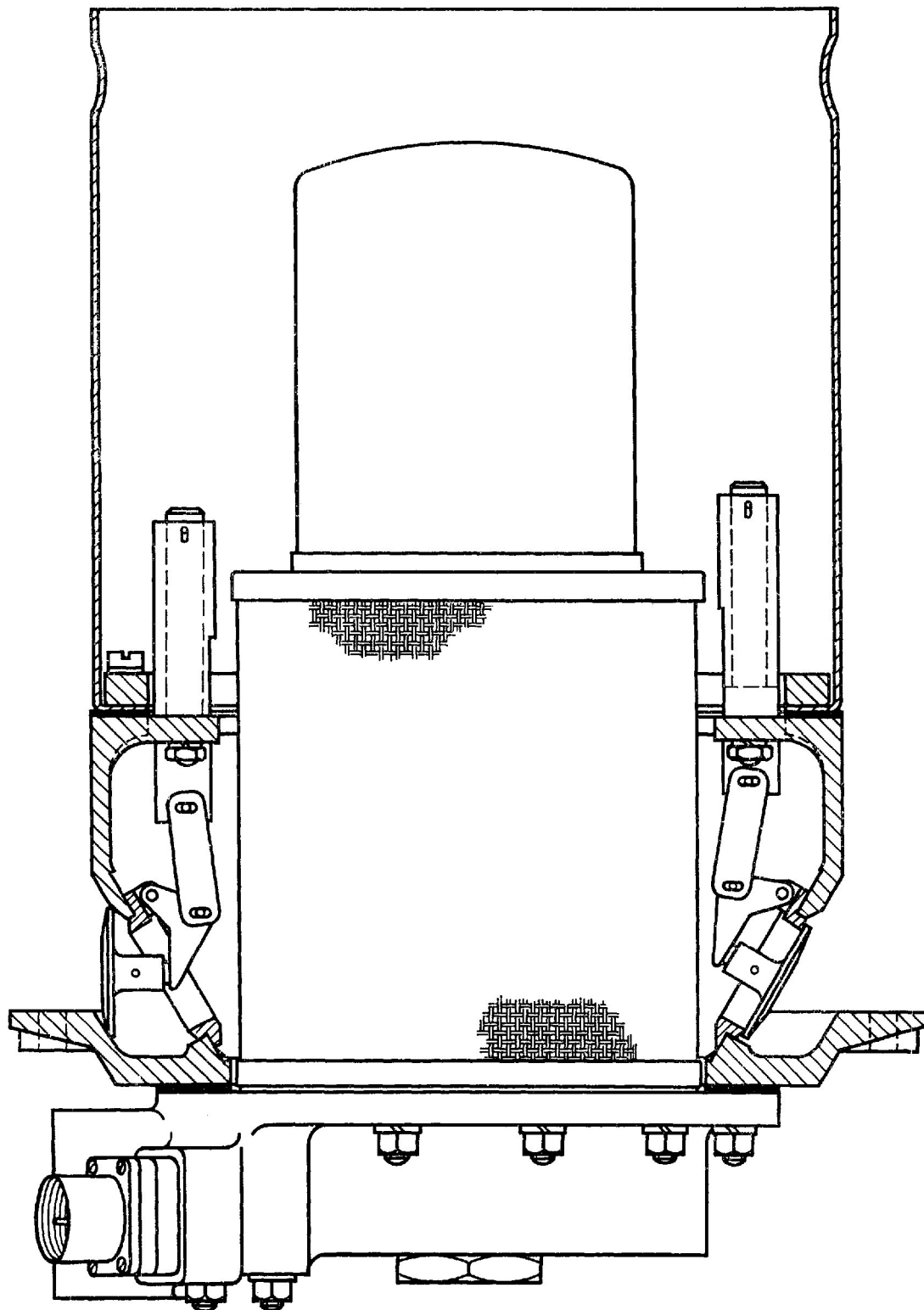


Fig. 4. Sectional view of typical valve and pump unit
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Fitting the combined valve/pump assembly to the tank

15. On aircraft where these units are to be used, the base of the tank will be fitted with a similar mounting ring, but larger than that normally used for mounting the pump only.

16. The method of installing the combined unit is similar to that for the pump in that the combined unit must be offered to the tank aperture, and the valve casing inserted into the tank until the mounting flange on the body of the flight valve seats on the tank mounting ring.

17. Care must be taken to ensure that the gasket between the flange and the mounting ring is not damaged.

SERVICING

18. Very little servicing will be necessary to the inverted flight valve but in accordance with the appropriate Servicing Schedule an examination of the securing nuts and of the installation itself should be made to ensure that there is no leakage of fuel through the joint washers.

Note . . .

It will be necessary to remove the tank access panels to examine the unit.

19. The water drain plug should be eased periodically and any water which has collected drained off.

20. At the appropriate inspection periods care should be taken to ensure that the valves seat correctly and that the linkage mechanism operates freely.

Appendix 1

INVERTED FLIGHT VALVES TYPE B.P.—VARIANTS

Type	Ref. No.	Associated pump	Remarks
BP. 21 Mk. 1	5UE/4748	B.P. 1 series	Generally similar to the unit described and illustrated in the main chapter. Seven valve assemblies.
BP. 21/F Mk. 1	—	B.P. 1/F series	This unit has five valve assemblies and is illustrated in Fig. 1.
BP. 21/F Mk. 2	—	B.P. 1/F series	Generally similar to BP.21/F Mk. 1, but has a shorter inlet chimney.
BP. 21/F Mk. 3	—	B.P. 1/F series	Generally similar to BP.21/F Mk. 2, but to clear access to extraction holes, the I.F.V. is turned through 60 degrees in a clockwise direction and the pump outlet retained in its original position relative to the aircraft centre-line. To clear an obstruction in the aircraft, the drain adaptor is moved to an alternative boss 140 degrees in an anti-clockwise direction from its original position.
BP. 21/F Mk. 4	—	B.P. 1/F series	Generally similar to BP.21/F Mk.3, but a filter is fitted over the inlet chimney to prevent tank sediment and foreign matter from entering the valve.
BP. 23 Mk. 1	5UE/4922	B.P.3 series	Basically similar to the unit described and illustrated in the main chapter. Seven valve assemblies.
BP. 24 Mk. 1	5UE/5586	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle; margin-right: 5px;">}</div> <div style="display: inline-block; vertical-align: middle;"> B.P.3 B.P.8 B.P.1003 </div> </div>	Basically similar to the unit described and illustrated in the main chapter. Seven valve assemblies.
BP. 24 Mk. 2	5UE/6136		Generally similar to BP.24 Mk. 1 but has improved valve linkage system fitted.
BP.24J Mk. 1	5UE/5994		Basically similar to the unit described and illustrated in the main chapter.
BP. 26 Mk. 2	5UE/6168	SPE. 1007	Basically similar to the unit described and illustrated in the main chapter, but has a special mounting plate (<i>fig. 2</i>). Seven valve assemblies.

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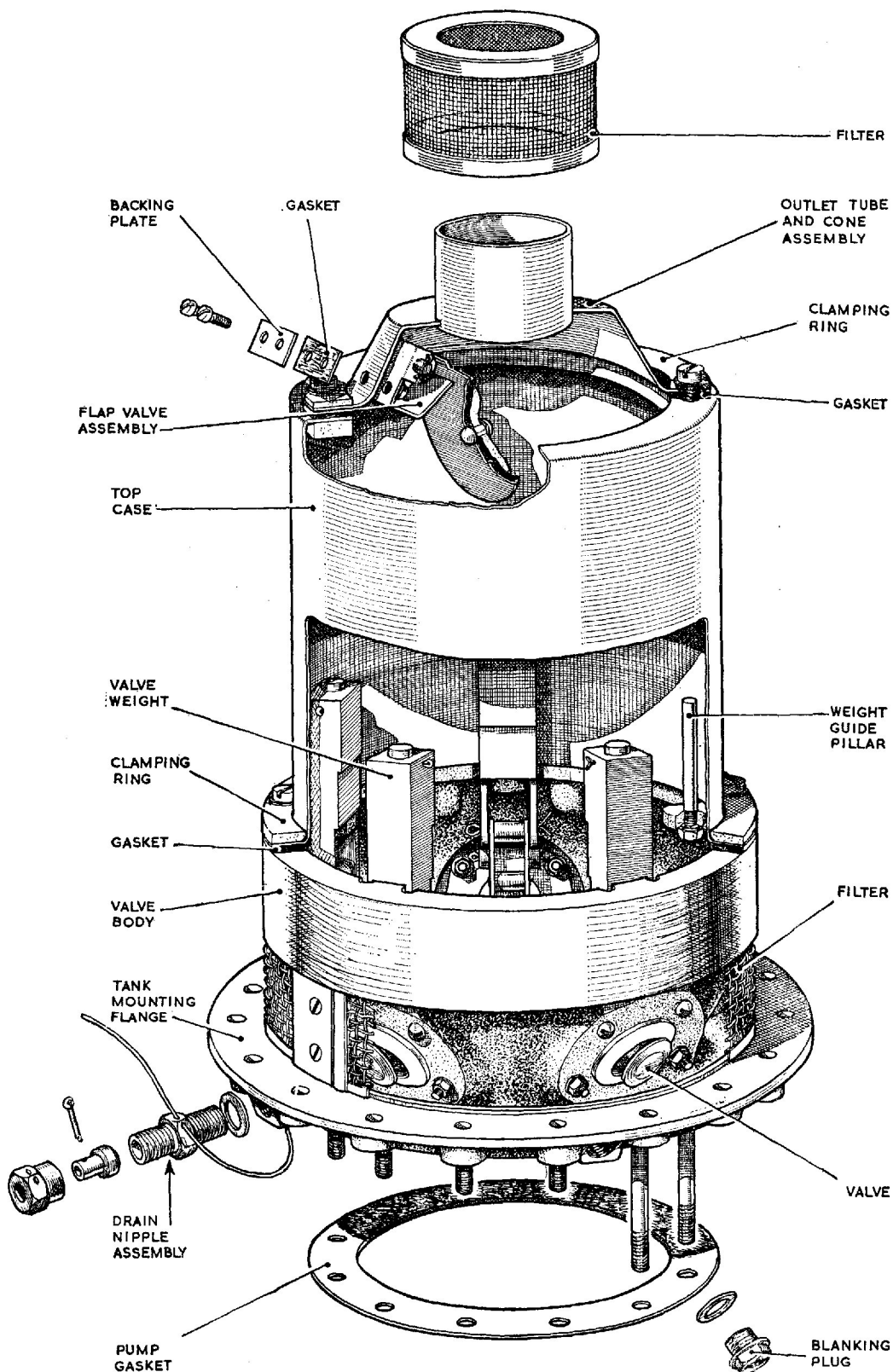


Fig. 1. Sectional view of inverted flight valve BP.21/F Mk.1
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