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(54) FLUID CONTROL VALVES

(71) We, B.V.M.I. LIMITED, a British Company of Shaw Road, Bushbury, Wolverhampton, do hereby declare this invention to be described in the following statement.

This invention relates to fluid flow control valves and in particular to valves of the kind, hereinafter referred to as being of the kind specified, comprising a housing having a fluid inlet and outlet, an annular valve seat detachably mounted within the housing between the inlet and outlet, an aperture in the housing opposite the valve seat, when so mounted a bonnet or cover detachably mounted in sealing engagement with the housing to close the aperture, and a valve member extending through the bonnet being slidably mounted in sealing engagement therewith for movement towards and away from the valve seat to control the flow of fluid therethrough.

In a valve of the kind specified it may be necessary periodically to remove the valve seat from the housing e.g. to replace the valve seat with a seat having a different sized flow passage, in order to alter the flow characteristics of the valve, or simply to clean or replace the valve seat due to wear.

Since the valve seat is mounted inside the housing its removal is difficult and conventionally requires firstly the bonnet to be removed and then an operative to either insert his hand or a tool into the housing in order to grip and remove the valve seat.

Circumstances have arisen which make it desirable to be able to adjust or remove the valve seat without the need to insert a hand or a tool into the housing. For example, in the control of flow of radio active fluids, such a procedure can increase the risk of radio active contamination.

It is an object of the present invention to provide a valve of the kind specified in which the removal of the valve seat is simplified.

In accordance with this object we provide a valve of the kind specified in which the valve seat is detachably connected to the bonnet so that the valve seat can be positioned in and removed from its operational position in the housing by appropriate movement of the bonnet.

Thus if, for example, it is desired to remove the valve seat of a valve in accordance with the present invention the bonnet may be removed from the housing to open the aperture, and, by virtue of its detachable connection with the bonnet, the valve seat will also be removed. The valve seat may then be detached from the bonnet, to be cleaned, or replaced. Conversely, if it is desired to mount a particular valve seat in the housing, the valve seat is first attached to the bonnet and then the valve seat is moved to its operational position by movement of the bonnet.

It will be appreciated that the present invention thus provides a valve of the kind specified in which the valve seat may be positioned in and removed from the housing without the need for an operator's hand or tool to enter the housing. This makes the valve of the present invention particularly suitable for maintenance by remotely controlled devices.

Preferably the valve seat forms part of or is carried by a sleeve-like cage which in use extends around the valve member, one end of the cage being detachably secured to the bonnet and the other end either supporting or providing the valve seat.

For example, the valve seat may be an integral part of the cage being afforded by an inner surface thereof adjacent said one end, the walls of the cage being apertured to allow fluid to flow inside the cage and hence through the valve seat from the inlet to the outlet.

The valve seat may be adapted to be screwed into an inner part of the housing. In

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such an arrangement the bonnet will require to be rotated in the aperture in order to install and remove the valve seat.

5 The manner in which the cage is detachably secured to the bonnet will depend on how the bonnet is mounted on the housing.

For example, the bonnet may be secured to the housing by a ring which clamps a flange on the bonnet into sealing engagement with the housing, to close the aperture. In such an arrangement the ring may be secured to the housing by bolts which do not extend through the bonnet so that the bonnet is not required to take up a particular rotational position in the aperture in order for the ring to be bolted in position.

15 With a valve as described in the preceding paragraph the cage may be secured to the bonnet by a screw threaded member having a head which projects from the bonnet into a hole in a surrounding portion of the cage whereby upon rotation of the bonnet in the aperture the cage rotates relative to the housing.

25 In an alternative form of valve in accordance with the invention the bonnet is provided with a flange through which bolts extend to secure the flange in sealing engagement with the housing. With such an arrangement desirably the detachable connection between the bonnet and the cage will be such as to allow limited relative rotation therebetween so that after the valve seat has been screwed tightly into the housing the bonnet can be rotated backwards, if necessary, through a sufficient distance to enable the bolt holes to be aligned.

30 Such an arrangement can be provided by arranging the cage to be secured to the bonnet by a screw-threaded member which extends from the bonnet into a circumferentially extending slot in the surrounding portion of the cage. With this arrangement the cage can be rotated by the bonnet through the engagement of the screw threaded member with one end of the slot and the necessary relative rotation between the bonnet and cage can be obtained before the screw threaded member contacts the other end of the slot.

35 If desired, the valve seat may be a press or push fit into a mounting in the housing. In such an arrangement the valve seat may be carried on the inside of one end of a cage as described above and the outside of said one end of the cage may be provided with a sealing member which seals said one end of the cage in the mounting in the housing.

40 Since in such an arrangement there is no need for relative rotation between the cage and the bonnet the cage may be simply bolted to the body member at the other end.

45 Three embodiments of the present invention will now be described, by way of

example only, with reference to the accompanying drawings in which:

Figure 1 is a section through one form of valve of the kind specified which is a first embodiment of the present invention; 70

Figure 2 is a part section on the line A-A of Figure 1;

Figure 3 is a part section on the line B-B of Figure 1;

75 Figures 4 to 6 are views corresponding to Figures 1 to 3 of a second form of valve of the kind specified which is a second embodiment of the present invention, and

80 Figures 7 to 9 are views corresponding to Figures 1 to 3 of a third form of valve of the kind specified which is a third embodiment of the present invention.

Referring to Figures 1 to 3, these show a valve having a housing 10 with end flanges 11 by which the valve can be bolted into a fluid flow pipe. The housing has an inlet 12 and an outlet 13 between which a valve seat 32 is disposed. Opposite the valve seat 32 the housing is provided with an aperture 15 over which a bonnet or cover member 16 is secured by a ring 17 which clamps a flange 18 on the bonnet into sealing engagement with the housing 10. A seal 19 is provided between the flange 18 and the housing 10 and the ring 17 is clamped to the housing by a bolt 20 which extends through holes 21 in the flange 17 into screw-threaded bores 22 in the housing 10. Extending through the bonnet is a valve member 23, which is sealed to the bonnet 16 by a bellows sealing member 24, one end of which is secured to the valve member 23 and the other end of which is secured to the bonnet 16.

85 A cage 25 surrounds a reduced diameter portion 26 of the bonnet 16 and is secured thereto by a screw 27 the head 28 of which projects from the bonnet into an aperture 29 in the cage 25. The lowermost end 30 of the cage 25 as shown in Figure 1 is arranged to be screwed into a threaded portion 31 of the housing 10 with a suitable sealing member 32a trapped therebetween. The inside of the cage 25 provides a valve seat 32 with which a head portion 33 of the valve member 23 may co-operate in order to restrict or cut-off the flow of fluid through the valve. Apertures 34 in the cage 25 allow fluid entering the inlet 12 to pass inside the cage 25 and hence through the valve seat 32 when the valve head 33 is disengaged therefrom. 120

90 Axial movement of the valve member 23 relative to the bonnet 16 towards and away from the valve seat 32 is controlled in a conventional manner by, for example, a handwheel (not shown) mounted on the bonnet 16. 125

The valve shown in Figures 1 to 3 is assembled as follows. The cage 25 is secured to the bonnet 16 by the screw 27 and the bonnet carrying the cage 25 and the valve 130

member 23 is then introduced into the housing via the aperture 15. The bonnet 16 is then rotated to screw the end portion 30 of the cage 25 into the threaded part 31 of the housing so that the sealing member 32a carried by the cage 25 is compressed against the housing. The ring 17 is then secured in position using the bolts 20 to secure the bonnet on the housing and compress the seal 19.

The cage 25 and thus the valve seat 32 can be removed from the housing by reversing the process described above.

Figures 4 to 6 show a valve whose construction is generally similar to that previously described with reference Figures 1 to 3. The description of Figures 4 to 6 will therefore be confined to the differences from the construction shown in Figures 1 to 3 and components similar to those shown in Figures 1 to 3 are numbered with the previously used reference numerals.

In the valve shown in Figures 4 to 6 the bonnet 16 is provided with a thick flange 40 through which bolts 20 extend to secure the bonnet to the housing 10 and compress the seal 19. The cage 25 is mounted on the bonnet 16 by the screw 27 whose head 29 extends into a circumferentially extending slot 41. This allows the bonnet 16 to be rotated relative to the cage 25 through a distance equal to the circumferential length of the slot 41.

With the sleeve 25 mounted on the bonnet 16 using the screw 27 the bonnet is inserted into the housing 10 and the cage 25 screwed into the threaded portion of the housing 31 as previously described. During the screwing of the cage 25 to the housing the head 29 of the screw bears against the end 42 of the slot 41. When the cage 25 is screwed fully home to compress the seal 32a the bonnet 16 may then be screwed in the reverse direction in order to align the bolt holes in the flange 14 with the holes 22 in the housing 10. This reverse rotation of the bonnet 16 is accommodated by movement of the head 29 of the screw 27 along the slot 41.

Figures 7 to 9 show a further form of valve which is again generally similar to that shown in Figures 1 to 3 and in which similar components have therefore again been indicated by the same reference numerals. Again only the differences from the construction shown in Figures 1 to 3 will be described. The bonnet 16 is provided with a thick flange 50 by which the bonnet may be secured by bolts 20 to the housing 10. A pressurised metal O-ring 51 and packing piece 52 are provided to seal the bonnet 16 to the housing 10.

Alternatively the bonnet 16 may be secured to the housing 10 by a ring secured by bolts as described in figures 1 to 3.

The cage 25 is secured to the bonnet 16 by a bolt 53. The other end of the seal 25 is provided with a metal O-ring 54 which is held captive against a shoulder 55 on the cage by a ring 56 which is screwed onto the end of the cage.

The O-ring 54 is arranged to be a push or press fit onto a tapered surface 57 provided in the housing so that the cage 25 is mounted in the housing by passing the bonnet 16 and the cage 25 through the aperture 15 and pressing the lower end 30 of the cage onto the tapered surface 57 until the bonnet contacts the metal O-ring 51. When in this position the O-ring 54 is arranged to seal the joint between the cage 25 and the housing 10. The cage 25 is then retained in position by clamping the bonnet 16 to the housing 10 using bolts 20.

The present invention thus provides an improved form of valve of the kind specified in which the removal of the valve seat is greatly simplified and can be carried out without the need for the operator's hand or any tool to be inserted inside the valve housing. In particular, the valve seat of a valve in accordance with the present invention can be easily removed by a remotely controlled device thus making the valve of the present invention particularly suitable for controlling the flow of potentially radioactive fluids as previously described.

WHAT WE CLAIM IS:-

1. A valve of the kind specified in which the valve seat is detachably connected to the bonnet so that the valve seat can be positioned in and removed from its operational position in the housing by appropriate movement of the bonnet.

2. A valve according to Claim 1 wherein the valve seat forms part of or is carried by a sleeve-like cage which in use extends around the valve member, one end of the cage being detachably secured to the bonnet and the other end supporting or providing the valve seat.

3. A valve according to claim 2 when the valve seat is an integral part of the cage, being afforded by an inner surface thereof adjacent said one end, the walls of the cage being apertured to allow flow of fluid inside the cage and hence through the valve seat.

4. A valve according to any one of the preceding claims wherein the valve seat is adapted to be screwed into an inner part of the housing.

5. A valve according to claim 4 wherein the bonnet is secured to the housing by a ring which clamps a flange on the bonnet into sealing engagement with the housing.

6. A valve according to claim 5 wherein the cage is secured to the bonnet by a screw-threaded member which projects from the body member into a hole in a surrounding portion of the cage whereby

upon rotation of the bonnet in the aperture the cage rotates relative to the housing.

5 7. A valve according to claim 4 wherein the bonnet is provided with a flange through which bolts extend to secure the flange in sealing engagement with the housing, the connection between the bonnet and the cage being such as will allow limited relative rotation there between.

10 8. A valve according to claim 7 wherein the cage is secured to the bonnet by a screw-threaded member which extends from the bonnet into a circumferentially extending slot in the surrounding portion of the cage.

15 9. A valve according to any one of claims 1,2 and 3 wherein the valve seat is a press or push fit into a mounting in the housing.

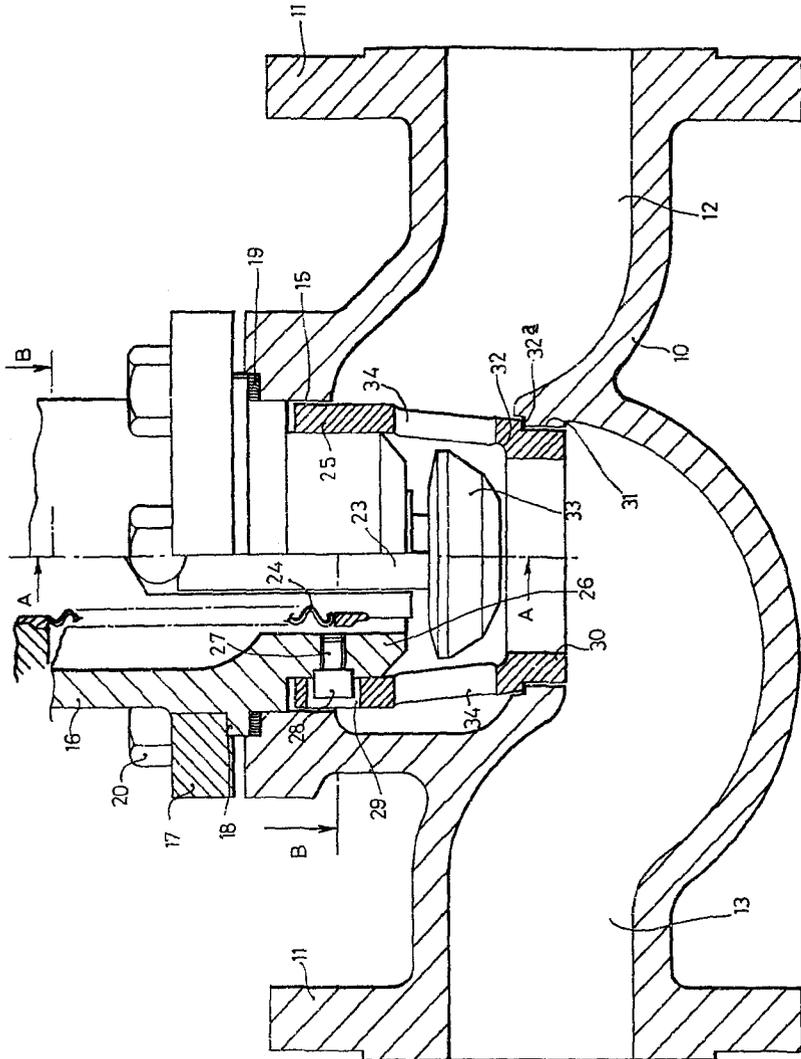
20 10. A valve according to claim 9 wherein the valve seat is carried on the inside of one end of the cage and a sealing member is provided which seals the said one end of the cage in the mounting in the housing.

25 11. A valve of the kind specified, constructed and arranged substantially as hereinbefore described, (a) with reference to figures 1,2 and 3; (b) with reference to figures 4, 5 and 6; or (c) with reference to figures 7, 8 and 9 of the accompanying drawings.

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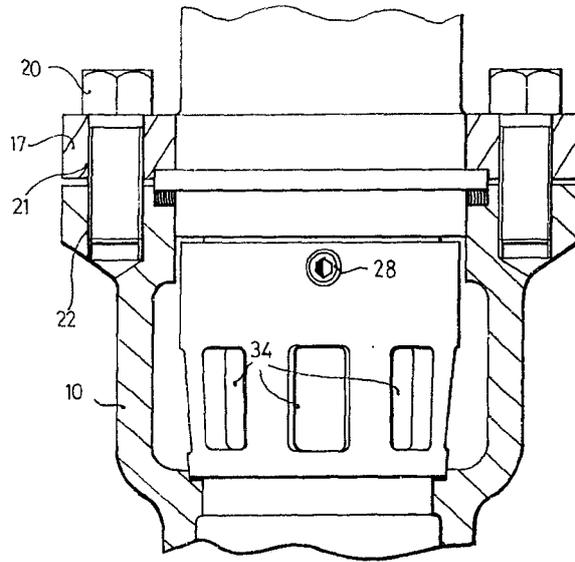


FIG. 2.

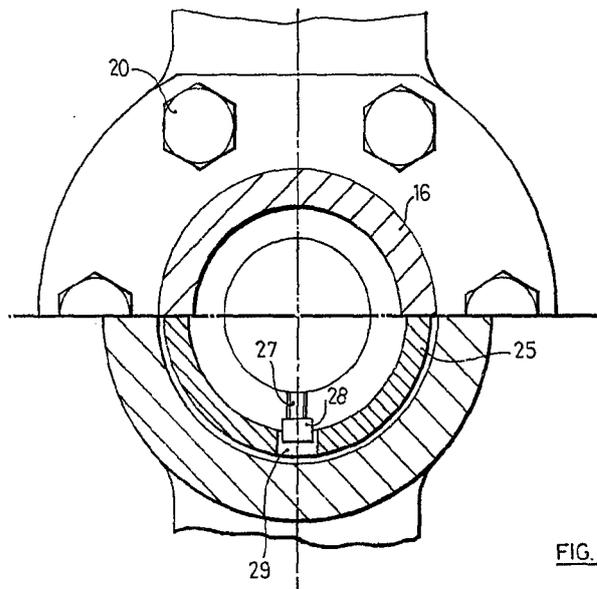


FIG. 3

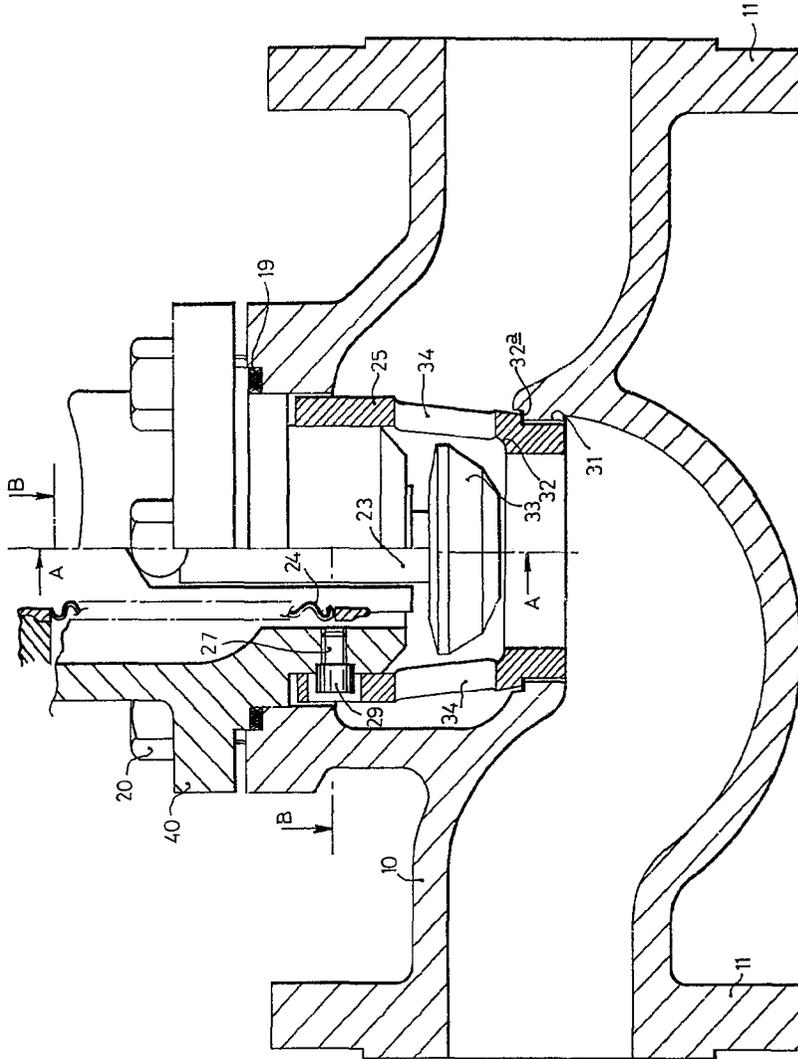


FIG. 4.

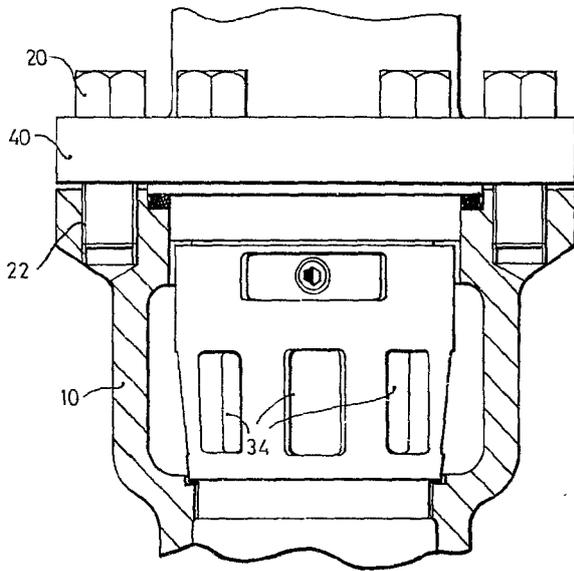


FIG. 5.

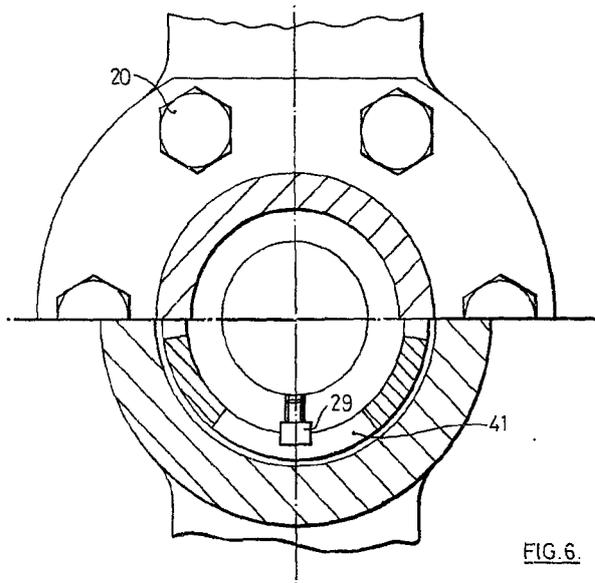
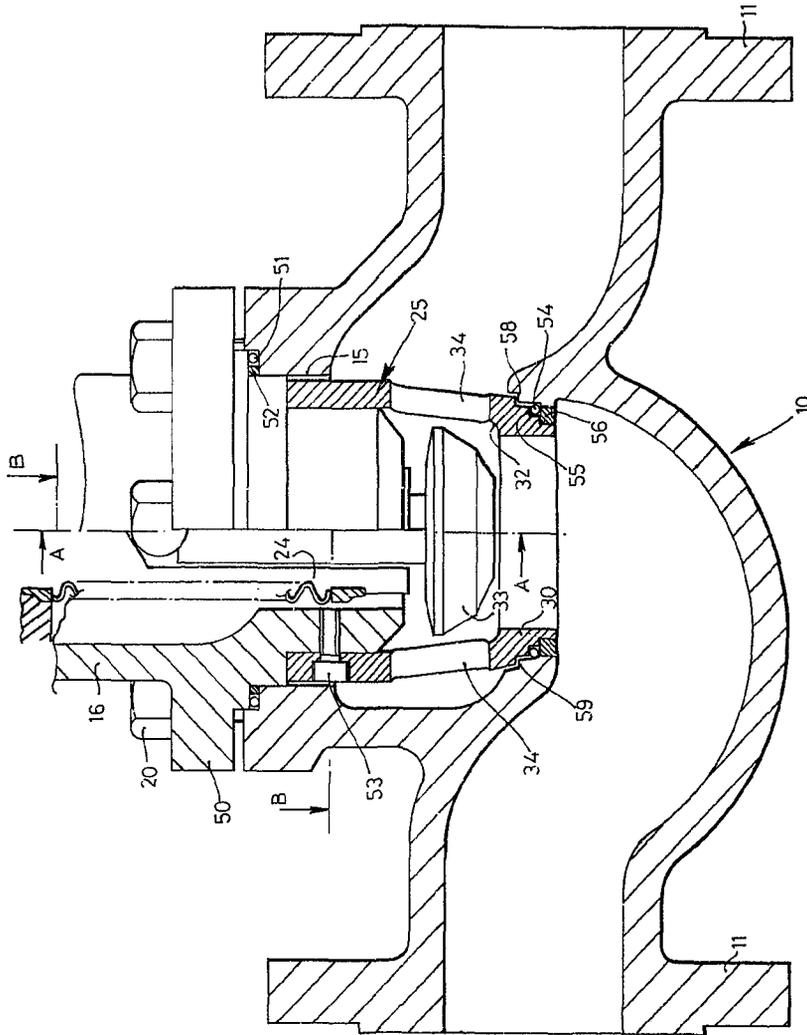


FIG. 6.



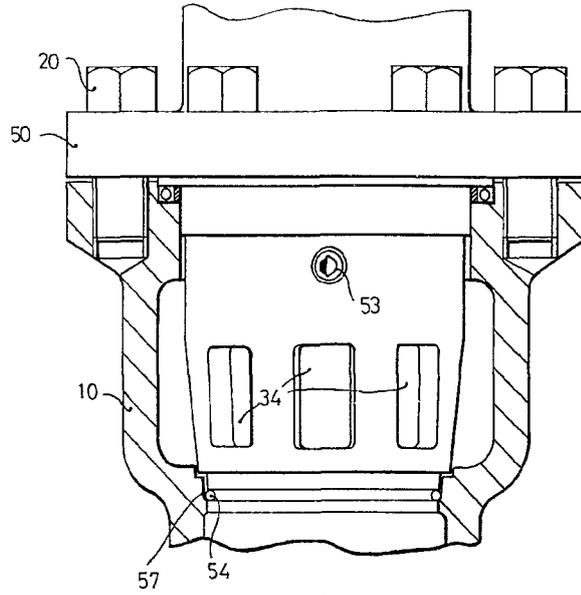


FIG. 8.

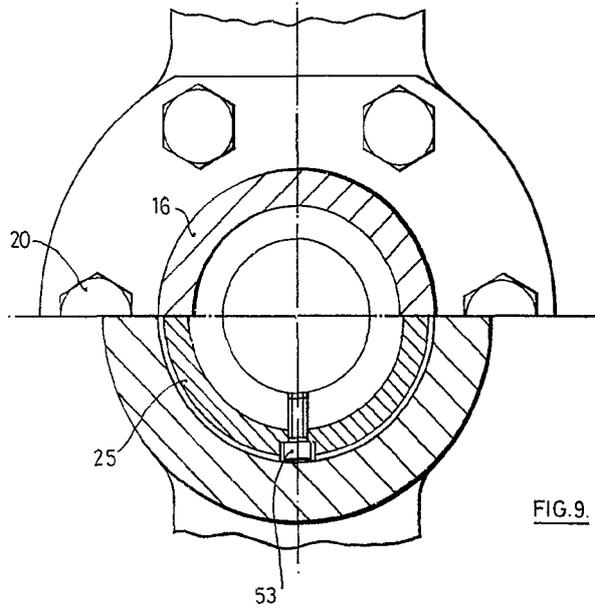


FIG. 9.