Oct. 30, 1951 R. H. WUNN 2,573,238

BALANCED PLUG VALVE

Filed March 19, 1946

Fig. 1.

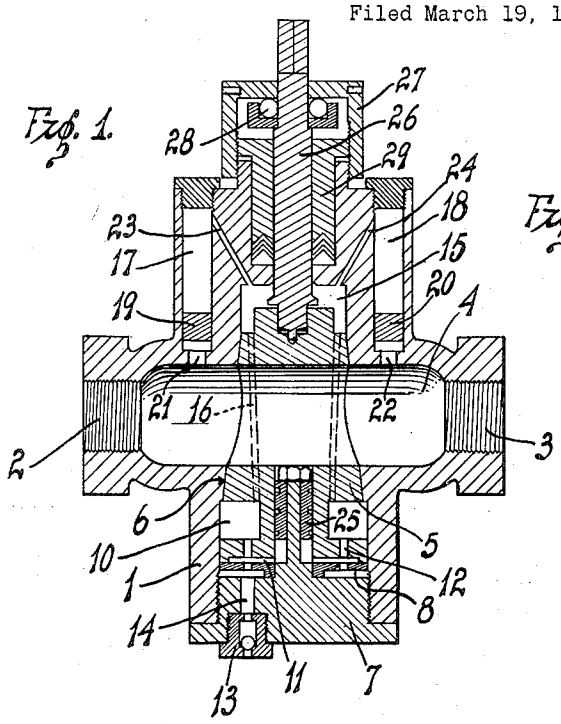


Fig. 2.

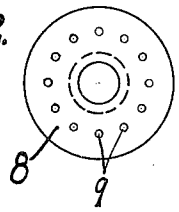


Fig. 3.

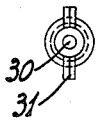


Fig. 4.

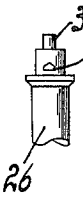


Fig. 5.

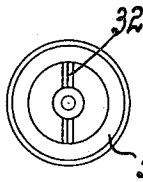


Fig. 6.

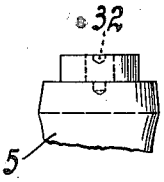
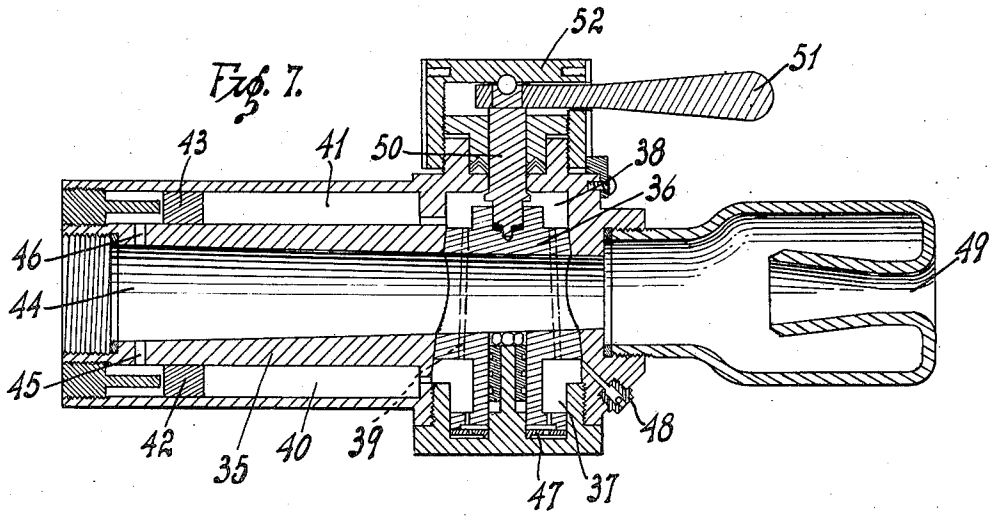


Fig. 7.



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BALANCED PLUG VALVE

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3 Claims. (Cl. 251—98)

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This invention relates to a novel balanced valve and particularly a means of balancing a plug valve.

An object of my invention is to provide a novel balanced plug valve in which the plug is balanced by means of chambers provided both above and below the plug of the valve, these chambers being interconnected, and also connected to pressure cylinders, these cylinders being open to the pressure in the line, and the area on the top and bottom of the plug being equalized by a piston area in the bottom of the plug.

Still another object is to provide a novel balanced plug valve in which the valve is slightly cammed off of its seat on rotation of the control handle.

A feature of my invention resides in the spring disk which bears against the plug, and yieldably presses the plug onto its seat.

Still another feature is to provide a novel balanced plug valve with means of introducing a fluid to the various balancing chambers in the valve, the chambers being all interconnected so that all of these chambers and connecting ducts can be filled with a suitable fluid from one source.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

In the drawing:

Figure 1 is a longitudinal sectional view of one type of valve embodying my novel construction.

Figure 2 is a plan view of the spring disk.

Figure 3 is a bottom plan view of the control shaft.

Figure 4 is a fragmentary side elevation of the control shaft.

Figure 5 is a top plan view of the plug.

Figure 6 is a fragmentary side elevation of the plug.

Figure 7 is a longitudinal sectional view of another type of valve embodying my novel construction.

Referring more particularly to the drawing, the numeral 1 indicates a valve body which includes ports 2 and 3, one of which is the intake and the other the outlet. For purposes of this description, it is assumed that the port 2 is the inlet, and the port 3 is the outlet. A transverse port 4 extends through the body of the valve, and this port is controlled by the tapered plug 5. The plug 5 is mounted in the longitudinal bore 6 in the valve body. A cap 7 closes the lower end of the bore 6, and this cap may be threaded into the body of the valve. A spring disk 8 rests on

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the cap 7 and bears against the bottom of the plug 5 to urge this plug upwardly into its seat. The disk 8 is provided with a number of ports or perforations 9 extending therethrough, the purpose of these perforations being to permit the free passage of fluid, which will be further described.

An annular fluid chamber 10 is formed in the plug 5 adjacent the lower end thereof, and this chamber is connected with a chamber 11 below the plug by means of the ducts 12. The oil intake fitting 13 is connected to the chamber 11 through a port 14, which opens below the spring disk 8 and thence to the chamber 11 through the perforations 9. An annular pressure chamber 15 is provided in the body of the valve at the upper end of the plug 5. The chambers 10 and 15 are connected by ducts 16, and these ducts may be in the plug 5 or in the body of the valve 1, as desired. A pair of cylinders 17, 18 are formed in the body of the valve, the cylinder 17 being adjacent the port 2, and the cylinder 18 being adjacent the port 3. Each of the pressure cylinders 17, 18 are provided with a piston 19, 20 respectively. A duct 21 extends from the bore 4 into the bottom of the cylinder 17, and a similar duct 22 extends into the cylinder 18. The cylinders 17, 18 are each connected to the chamber 15 by a duct 23, 24 respectively, so that pressure exerted in either or both of these cylinders will be transmitted to the chamber 15.

It will be evident from the foregoing description that the chambers 10, 11 and 15, as well as the cylinders 17 and 18, can all be filled with an oil, grease or the like from the fitting 13. When all of these chambers and cylinders are filled with oil or grease, any pressure exerted on the pistons 19 and 20 will be transmitted to the chambers 10, 11 and 15 to balance the pressure on the plug 5. When the plug is in closed position, if there is back pressure in the line, the piston 20 will transmit this back pressure to the cylinder 18, and this pressure is then transmitted to the chambers 10, 11 and 15 to again balance the pressure on the plug 5. When such back pressure occurs, it is desirable to exert pressure within the horizontal bore of the plug 5, and for this purpose I provide a piston 25, the cylinder bore of which is open at the top to the interior of the plug 5 and the bottom of the bore of this piston is open to the chamber 11, substantially as shown in Figure 1. Back pressure at the port 3 will thus be exerted on the bottom of the piston 25, forcing this piston upwardly to the position shown in Fig. 1, and thus exerting the pressure within the plug 5. When back pres-

sure occurs in the valve, the plug 5 tends to be forced downwardly and off of its seat. To balance this back pressure and to hold the plug onto its seat, the piston 25 is moved upwardly, as previously described, and pressure is thus exerted against the upper surface of the horizontal bore in the plug, and this pressure, together with the upward pressure in the chamber 10, will balance the downward pressure in the chamber 15. The area on the top of the plug 5 against which pressure is exerted to force the plug off of its seat is equalled by the area on the bottom of the plug 5 within the chamber 10, plus the area of the piston 25. The plug 5 is rotated by means of the handle shaft 26, which extends through a cap 27 threaded onto the top of the body 1. A thrust bearing 28 bears against the cap 27 and serves to properly position the plug 5 on its seat. A packing 29 surrounds the shaft 26; and may be of usual and well-known construction. The shaft 26 extends into the top of the plug 5, and is centered by the pin 30. A pair of wedge shaped wings 31 extend from the shaft 26, and loosely fit into wedge shaped grooves 32 in the top of the plug 5. Thus, when the shaft 26 is rotated, there is a small amount of lost motion between the shaft and the plug, and this lost motion causes the tapered wing 31 to press against the tapered wall of the groove 32, thus camming the plug 5 downwardly a very slight amount but enough to free the plug on its seat. If the plug 5 should become stuck due to standing in one position for a long period of time, it is possible to push this plug off of its seat by screwing the cap 27 downwardly. Since the shaft 26 bears against the cap 27, it will be evident that a slight amount of downward movement of this cap will free the plug 5 and permit it to rotate.

In Figure 7 I have shown a fire nozzle embodying the same features of construction as far as the balancing of the plug is concerned. The fire nozzle consists of a body 35 and a transversely mounted plug 36 in the body. Balancing chambers 37, 38 are provided on each end of the plug, and these chambers are connected by ducts 39. A pair of cylinders 40, 41 are provided in the body of the valve, and the inner end of these cylinders are connected to the chambers 37, 38 respectively. Each of the cylinders is provided with a piston 42, 43 respectively, and the outer end of the cylinders are open to the main fluid passage 44 of the valve through ducts 45, 46 respectively. A spring disk 47 bears against the bottom of the plug 36 and urges the same against its seat. An oil or grease fitting 48 permits all of the chambers and cylinders to be filled with oil or grease from this one source. The nozzle tip 49 is usual and well known for this type of valve, and the detailed construction thereof forms no part of this invention. The plug 36 is rotated by means of the shaft 50, which in turn is rotated by the handle 51. A cap 52 is threaded onto the body of the valve, and serves to hold the shaft 50 and handle 51 in assembled position. The coupling arrangement between the shaft 50 and the plug 36 is the same as that previously described as interconnecting the shaft 26 and the plug 5. When the chambers 10 and 15 are filled with oil or grease, this oil will be forced around the plug 5, that is onto the seat of the plug, thus lubricating the same and permitting the plug to move freely.

Having described my invention, I claim:

1. A balanced plug valve comprising a body, said body having a fluid passage extending therethrough, a plug mounted in said passage, said plug having a transverse port extending therethrough, said body having a balance chamber above and below said plug, said body having ducts therein interconnecting said chambers, said body having a cylinder therein, said body having still another duct extending from the cylinder to one of said chambers, a piston in said cylinder, said body having an opening extending from the fluid passage to said cylinder, a fitting in the body, said fitting being connected with one of said chambers, said plug having a cylinder bore therein, a balancing piston mounted in the cylinder bore, said cylinder bore being open at one end to the interior of the plug and at the other end to said chamber below the plug.

2. A balanced plug valve comprising a body, said body having a fluid passage extending therethrough, a tapered plug rotatably mounted in said passage, said body having a balance chamber above said plug and a second balance chamber below said plug, said body having ducts therein connecting both of said chambers, a shaft rising from said plug, a cap threaded onto the body, said shaft shouldering against the cap whereby downward movement of the cap will press against the plug and free said plug in its seat, said body having a cylinder therein, said body having another duct extending from said cylinder to one of said chambers, a piston in the cylinder, said body having an opening extending from the fluid passage to said cylinder, and a fitting in the body, said fitting being connected with one of said chambers, said plug having a cylinder bore therein, a balancing piston mounted in said cylinder bore, said cylinder bore being open at one end to the interior of the plug and at the other end to said chamber below the plug.

3. A balanced plug valve comprising a body, said body having a fluid passage extending therethrough, a tapered plug mounted in said passage and having a port therethrough alignable with said passage, said body having a chamber above and below said plug, said body having ducts therein interconnecting said chambers, said plug having a cylinder bore therein, a piston mounted in said cylinder bore, said cylinder bore being open at one end to the lower chamber, and at the other end to said port in the plug, the area of said piston exposed to the port equalizing the area of the bottom of the plug with that of the top of the plug, said body having a cylinder therein, said body having still another duct extending from said cylinder to said chamber above the plug, a piston in said cylinder, said body having an opening extending from the fluid passage to said cylinder.

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