Jan. 8, 1952 R. M. WITT 2,582,091

FLUID CONTROL APPARATUS

Filed Jan. 31, 1945

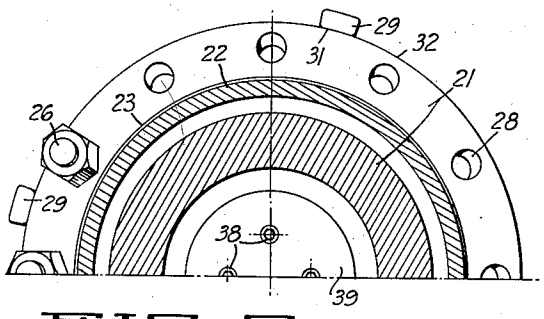


FIG_2_

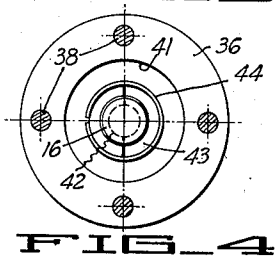


FIG_4_

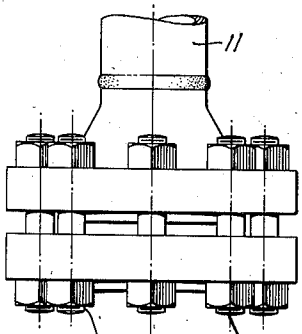


FIG_1_

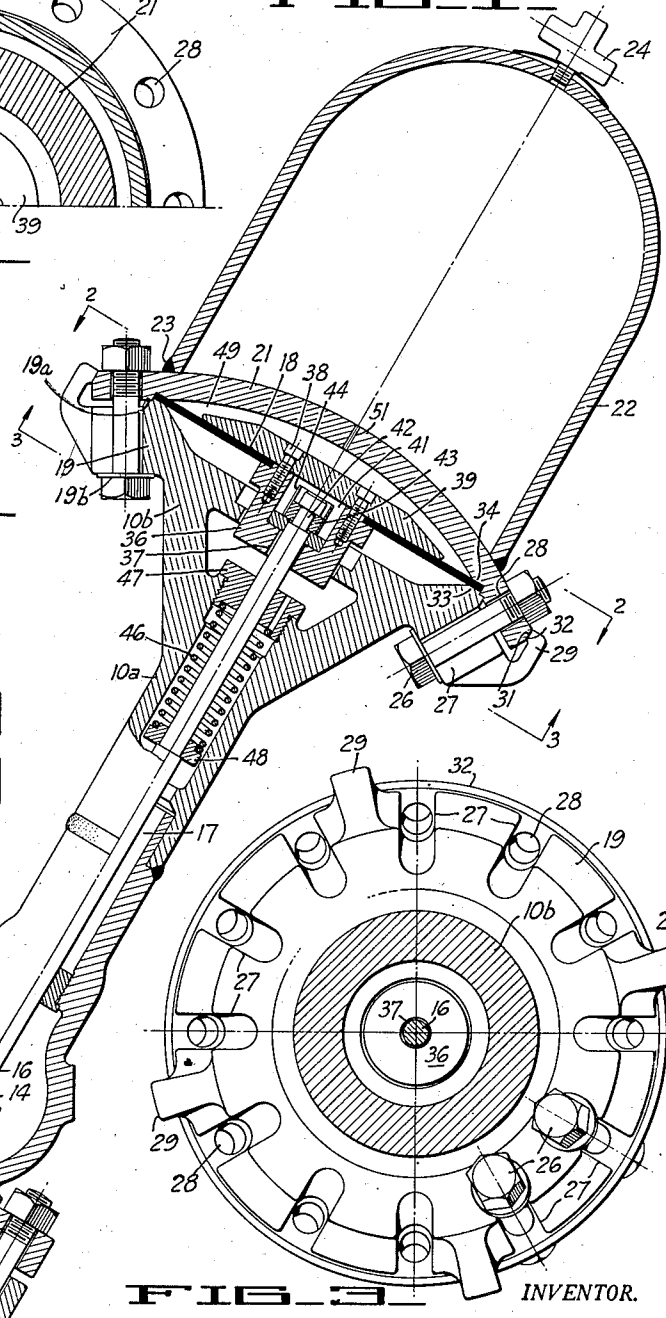


FIG_3_

INVENTOR.

BY R. M. Witt.

Paul D. Fleck.

ATTORNEY

Patented Jan. 8, 1952

2,582,091

UNITED STATES PATENT OFFICE

2,582,091

FLUID CONTROL APPARATUS

Richard M. Witt, San Francisco, Calif., assignor, by mesne assignments, to Grove Regulator Company, a corporation of California

Application January 31, 1945, Serial No. 575,433

4 Claims. (Cl. 137—157)

1

This invention relates generally to fluid control devices of the type utilizing a diaphragm adapted to be flexed by fluid pressures for operating certain parts, such as a valve member or the like.

It is an object of the present invention to provide an improved type of diaphragm mounting for fluid flow control devices, characterized in particular by its ability to withstand relatively high pressures without utilizing conventional clamping flanges of undue diameter.

A further object of the invention is to provide a novel assembly which will facilitate removal of the diaphragm for repair or replacement.

More specifically it is an object of the invention to provide a diaphragm mounting of the bolted flange type which will facilitate application or removal of the clamping bolts.

Additional objects of the invention will appear from the following description in which the preferred embodiment has been set forth in detail in conjunction with the accompanying drawing.

Referring to the drawing:

Figure 1 is a side elevational view partly in cross section showing equipment incorporating the present invention.

Figure 2 is a cross sectional detail taken along the line 2—2 of Figure 1.

Figure 3 is a cross-sectional detail taken along the line 3—3 of Figure 1.

Figure 4 is a cross sectional detail illustrating the parts serving to connect the operating rod with the diaphragm.

The particular flow control device illustrated in the drawings is intended for back pressure regulation, although as will appear after a detail description, features of the invention can be incorporated in other types of flow control equipment. The device as illustrated consists of a valve body 10 provided with inflow and outflow passages 11 and 12 and a stationary valve seat 13. A valve member 14 cooperates with the seat and is carried by one end of the valve operating rod 16. This rod is accommodated within a longitudinal passage 17 formed in the body part 10*a*. The outer end of the rod 16 has a special connection to the flexible fluid diaphragm 18, as will be presently explained.

The novel mounting which I utilize for the diaphragm 18 consists of an enlarged body portion 10*b* which is formed to provide the annularly contoured clamping flange 19. Instead of having this clamping flange flat or disposed in a plane, as has been common in the past, it is dished as illustrated, whereby its faces 19*a* and 19*b* are shaped to conform generally to the surfaces of two spaced and concentric truncated cones. Thus upper face 19*a* is convex while lower face 19*b* is concave. Cooperating with the outer convex face 19*b* of flange 19 there is a rigid metal plate 21 which is crowned or dished so that its

2

peripheral edge portion has a shaping conforming generally to that of the flange 19. In order to form a gas chamber upon one side of the diaphragm a dome 22 is provided, with the open end of the same having a weld connection 23 to the plate 21. Communication may be had with the interior of dome 22 through the fitting 24.

The flange 19 and the flange formed by the outer periphery of plate 21, are clamped together by means of the circumferentially spaced clamping bolts 26. These bolts are accommodated within slots 27 formed in flange 19, and the openings 28 formed in plate 21. The bolts are positioned whereby their axes are coincident with the surface of a cone, with the axis of the cone concentric with the axis of the flange.

In order to aid in centering the plate 21 with respect to the flange 19, during assembly, it is desirable to provide three or more centering ears 29 on the flange 19. The inner surfaces 31 of these ears are machined to fit snugly about the machined edge 32, formed on the periphery of plate 21. It will be noted that this machining conforms to the surface of a cylinder, having its axis concentric with the remainder of the assembly.

In order to form a sealing engagement with the peripheral edge portion of the diaphragm 18 and the body, the body and the plate 21 are provided with machined annular shoulders 33 and 34 which engage and grip the outer peripheral edge portion of the diaphragm 18, thus forming a tight seal.

The preferred assembly for connecting the operating rod 16 with the diaphragm is constructed as follows: On the under side of the diaphragm 18 (the side faced toward the rod 16) there is a cup-like member 36, having an opening 37 into which the rod loosely extends. Secured to the member 36, as by means of bolts 38, there is an upper diaphragm plate 39. The flexible diaphragm 18 has a central opening whereby the interior 41 of the cup 36 is accessible from the upper side of the diaphragm, upon removal of plate 39. When clamped upon member 36, the plate together with member 36 forms a tight seal with respect to the diaphragm.

That end of the operating rod 16 within the cup chamber 41 is provided with a portion 42 of reduced diameter, which is engaged by the split ring 43. The parts of this ring are retained in place by the retaining ring 44. Split ring 43 in effect forms a shoulder whereby cup 36 is locked to the operating rod, with only limited lost motion being permitted. However upon removing plate 39, ring 44 and then split ring 43 can be removed, to permit removal of diaphragm 18 together with the cup 36. Thus with an assembly of this character it is a simple matter to renew the diaphragm without disturbing the connec-

tions between pipe lines and the main valve body 10.

In the particular construction illustrated spring means is utilized for normally urging rod 16 toward closed position. Thus a coiled compression spring 46 is disposed about the rod, and one end of this spring abuts the guide bushing 47, while the other end abuts a ring 48 which is attached to the rod 16.

In some instances the restricted space 49 between the diaphragm assembly and the plate 21, may be in free communication with the main space of the dome 22. Also in some instances the dome 22 may be omitted in entirety and a connection made directly through the plate 21. In the construction illustrated however the space 49 communicates with the main space of the dome 22 through the flow restricting orifice 51. Thus the arrangement utilizes the invention disclosed and claimed in Grove Letters Patent No. 2,047,101.

Operation of the device described above can be reviewed as follows: In assembling the various parts, after insertion of the diaphragm assembly, plate 21 is placed upon the flange 19 with the openings 28 in registry with the slots 27. The bolts 26 are then applied and tightened in the same manner as is customary with conventional flange couplings. After the bolts are applied a strong assembly is formed which is capable of withstanding relatively high pressures. In comparison with the conventional flange type couplings, the overall diameter of the flanges is considerably less than would otherwise be required, and at the same time a high degree of strength is afforded capable of withstanding the severe stresses to which the flanges are subjected. A further advantage is that the upper flange utilized in conjunction with the dome 22 is a part which can be inexpensively made from suitable materials such as pressed cold rolled steel. In structures requiring a diaphragm plate extending over the diaphragm, my assembly avoids the use of a flanged dome having a separate machined orifice plate such as shown in Patent No. 2,047,101. The attachment between the operating rod 16 and the diaphragm is likewise desirable in that it facilitates making replacements of the diaphragm without disturbing the pipe connections with the main valve body.

Assuming that the device is employed as a back pressure regulator, dome 22 is loaded with gas under pressure and inlet 11 is connected with the pressure system to be regulated. Outlet 12 can discharge to the atmosphere or can be connected to a low pressure system. When the pressure applied to the inlet 11 exceeds a certain value for which the dome is loaded, diaphragm 18 is flexed upwardly to open the valve member 14, thus permitting fluid to escape to relieve the pressure. When the pressure has been reduced below the pressure level for which the device is set, then the valve member again moves to closed position.

It will be evident from the foregoing that features of the present invention, such as the novel diaphragm mounting, can be utilized with a variey of flow control devices, including pressure reducing regulators, back pressure relief valves, so-called diaphragm motor operated valves, and the like.

I claim:

1. In fluid control apparatus, a body provided with an annularly contoured and dished flange, the faces of said flange conforming generally to the surfaces of two spaced and concentric truncated cones whereby one such face is convex and the other concave, an annularly contoured diaphragm extending across one side of the body and having its center aligned with the axis of the flange, said one side of the body corresponding to the convex side of the flange, and a dished plate positioned with its concave side faced toward the diaphragm and with its peripheral edge portion overlying the convex face of the flange, said flange and plate forming between them annular shoulders for gripping the peripheral edge portion of the diaphragm, said plate and diaphragm forming a fluid chamber between them and the plate having a passage therethrough for communicating with said chamber, and means for clamping the plate and flange together.

2. Apparatus as in claim 1 in which the flange is provided with circumferentially spaced slots and the margin of the plate provided with circumferentially spaced holes aligned with said slots, and in which said clamping means comprises bolts accommodated in said slots and holes.

3. In a fluid control apparatus, a body provided with an annularly contoured and dished flange, the faces of said flange conforming generally to the surfaces of two spaced and concentric truncated cones whereby one such face is convex and the other concave, an annularly contoured diaphragm extending across one side of the body and having its center aligned with the axis of the flange, said side of the body corresponding to the convex side of the flange, a rigid dished plate positioned with its concave side faced toward the diaphragm and with its concave peripheral edge portion overlying the convex face of the flange, said flange and plate forming between then annular shoulders for gripping the peripheral edge portion of the diaphragm, said plate and diaphragm forming a fluid chamber between them and the plate having a passage therethrough for communicating with said chamber, a dome mounted upon the convex side of the plate and forming a gas chamber, said last chamber communicating with said first named chamber through said passage, and means for clamping the plate and flange together.

4. Apparatus as in claim 3 in which the flange is provided with circumferentially spaced slots and the peripheral edge portion of the plate is provided wtih circumferentially spaced openings aligned with said slots, and in which said clamping means comprises clamping bolts accommodated in said slots and openings, the bolts positioned with their axes coincident with the surface of a cone, such cone having its axis aligned with the axis of the flange.

RICHARD M. WITT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
945,992	Stevens	Jan. 11, 1910
959,397	Simmons	May 24, 1910
983,101	Weber	Jan. 31, 1911
2,178,974	Smith	Nov. 7, 1939
2,202,313	Grove	May 28, 1940
2,227,668	Parker	Jan. 7, 1941