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2,950,684

FLUID PUMP

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FIG. 1

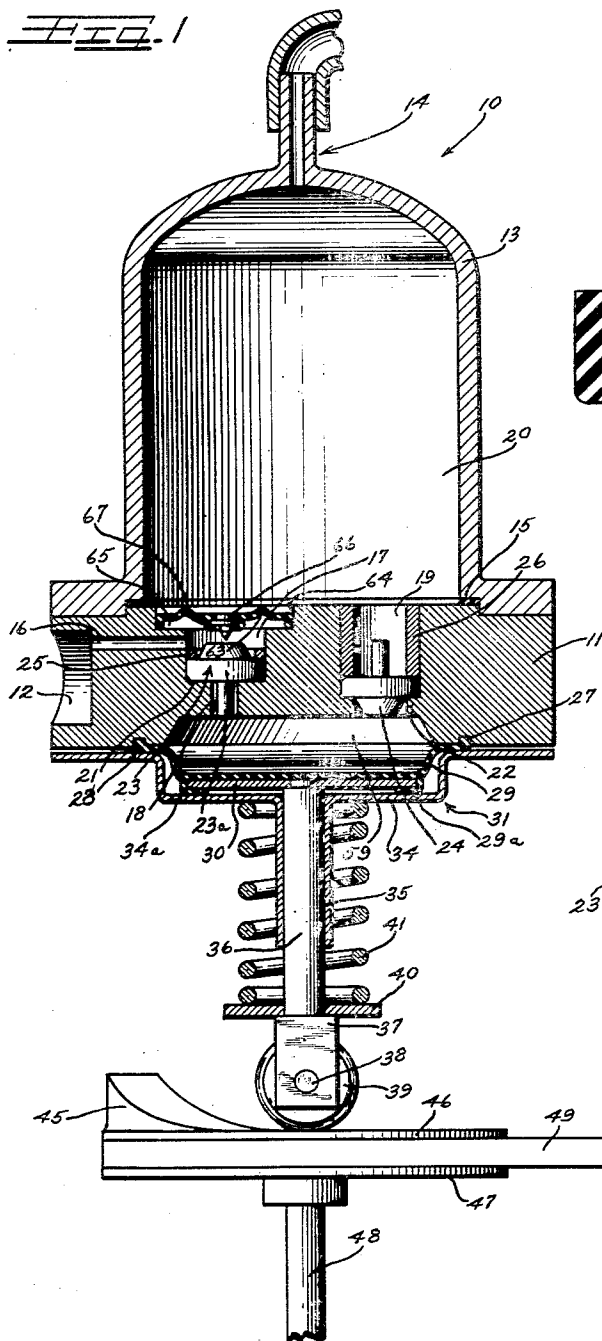


FIG. 2

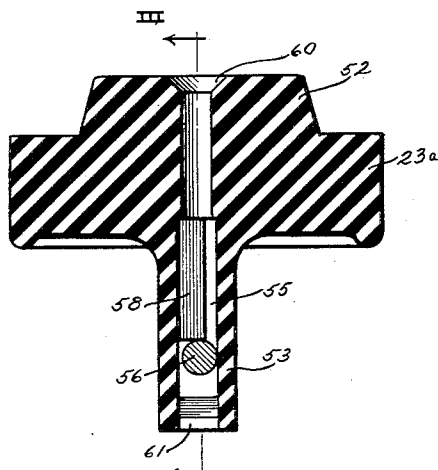
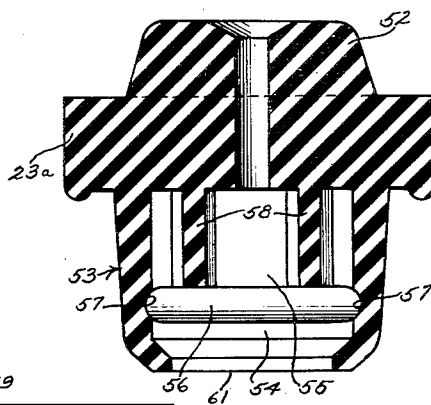


FIG. 3



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FLUID PUMP

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1 Claim. (Cl. 103—40)

This invention relates to fluid pumps and more particularly to diaphragm operated fluid pumps.

It has been found that fluid pumps utilizing diaphragm means for sucking fluid to the pump and diaphragm means for forcing fluid to a collection chamber have, in the past, been unsatisfactory due to the relatively short life of the diaphragm brought about by its continuous reciprocating movement during normal operation.

Accordingly, it is a principal object of this invention to provide a means for periodically deactivating the reciprocating diaphragm of a fluid pump.

It is a further object of this invention to provide a means for deactivating the diaphragm in a fluid pump upon predetermined minimum pressures being reached within a collection chamber associated with the pump.

A still further object of this invention is to provide a fluid pump of novel design having the advantages noted above and which is economical to manufacture.

Other features and objects of the present invention will become apparent from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

In the drawings:

Figure 1 is a vertical sectional view through a fluid pump constructed in accordance with the present invention;

Figure 2 is a vertical sectional view through a check valve for the pump described above; and

Figure 3 is a view taken along lines III—III of Figure 2.

In the preferred embodiment of the present invention illustrated in the drawings, an air pump 10 is provided for supplying compressed air to some desired service line. In particular, an air pump 10 is shown which includes a valve block 11 having an inlet 12, and an associated housing 13 having an outlet 14 to which a service line may be attached. The housing 13 is sealed to the valve block 11 by means of a gasket 15 and secured in any suitable manner (not shown). The inlet 12 communicates with an air passageway 16 which, in turn, terminates in an inlet port chamber 17.

The valve block 11 also includes a second air passageway 18 extending downwardly from the port chamber 17 into a diaphragm chamber 59. Block 11 includes an additional passageway 19 which extends up from the diaphragm chamber 59 into communication with an accumulator chamber 20 formed by the housing 13 in conjunction with the block 11.

A flange 21 and a flange 22 in the valve block 11 are arranged to support inlet and outlet check valves 23 and 24, respectively. The sealing ring 23a of the inlet check valve 23 is tightly seated on flange 29 of the valve block 11 by means of a retaining ring 25. Similarly, a clamping ring 26 serves to hold the outlet check valve 24 in tight sealing engagement with the valve block 11. The outlet valve 24 is like the inlet valve 23 but is positioned in the valve block in an inverted position.

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Chamber 59 is formed by a recessed portion in the bottom of the valve block 11 and a flexible diaphragm 29 secured thereto. Preferably the diaphragm 29 has an outer annular raised bead 28 which is seated in a mating groove 27 formed in the valve block 11.

The diaphragm 29 may be made out of rubber or any one of the known substitutes for rubber and is provided with a reinforced central portion which is formed with an annular disk 30 held on the underside thereof by means of a depending lip 29a.

A base plate or cap 31, extends over the diaphragm member 29 and retains the marginal edge thereof seated against the valve block 11. The base plate 31 includes a cup portion 34 and a hollow stem portion 35 which receives a reciprocating power shaft 36. An air vent 34a is provided in the base plate 31 to keep the underside of diaphragm 29 in communication with the atmosphere for reasons which will hereinafter become apparent.

The power shaft 36 is operatively connected at its upper end to the diaphragm 29 and at its lower end to a yoke 37 which is pivotally mounted, by means of a pin 38, to a cam follower wheel 39. An annular disk 40 carried in the yoke 37 at its lower end portion provides a reaction means for a compression spring 41 which extends between the cap member 31 and the annular disk 40.

The wheel or roller 39 rides on a cam flange 45 formed on the upper surface 46 of a cam wheel 47. The wheel 47 is rotatably supported on a shaft 48 and is driven by a belt 49 which is operatively connected by a power driving unit (not shown).

The check valves 23 and 24 are alike and each includes a valve body 52 formed of rubber or the like. The valve body 52 has a depending somewhat flattened hollow portion 53 which is generally of rectangular cross-section. Member 53 has an elongated passageway 54 therein in communication with a central passageway 55 and in direct alignment therewith. Disposed within the hollow portion 53 is a pin 56 which extends lengthwise thereof and which is snugly retained at opposite ends by the end walls of the portion 53. The sidewalls of the portion 53 in conjunction with pin 56 form a valve to restrict the passage of air through the unit. Pin 56 has its opposite ends rounded as at 57 where it engages the opposite ends of the passageway 54 and slightly stretches the member forming said passageway. Two depending tongues 58 extend downwardly toward pin 56 and serve to properly locate pin 56.

Whenever the pressure around the outside of the elongated passageway member 53 is less than the air pressure at the inlet 60 of the check valve, the walls of the passageway 54 yieldably expand and spread apart to permit the movement of air past the pin 56 to the outlet 61 of the check valve. When, however, the pressure surrounding the elongated passageway portion 53 is greater than the air pressure at the inlet 60 of the check valve, the greater air pressure on the exterior of the passageway member 53 will collapse the walls 53 and prevent the passage of air past the pin 56.

Referring now again to Figure 1 of the drawings, a rubber or rubber-like annular diaphragm 63 is sealed to the side wall 64 of a second diaphragm chamber 65. A plunger 66 is centrally located in the diaphragm 63 and is held in place by a depending portion 67 which is formed integrally with the diaphragm 66. The plunger 66 acts as a valve and is arranged to open and close the inlet 60 of the inlet check valve 23.

The operation of the pump is as follows: Assume, for illustrative purposes, that the cam wheel 39 is resting on the cam wheel 47, at the beginning of the cycle of operation. As wheel 47 is rotated cam roller 39 will ride up

onto the high portion of the cam flange 45 which in turn will force shaft 36 upwardly against the action of spring 41 and the diaphragm 29 will be moved upwardly into juxtaposition with the uppermost portion of the diaphragm chamber 59. Further rotational movement of the cam wheel 47 will bring the roller 39 off of the cam 45 and back to the level illustrated in Figure 1, by the spring member 41. Since the outlet check valve 24 will not allow the passage of air from the air accumulator chamber 20 to the compression chamber 59, a partial vacuum will be formed within this chamber causing the air on the inlet side of check valve 23 to expand the side walls 53 of the check valve to open the air passageway into the compression chamber 59 and permit the flow of air thereto. When the power shaft 36 and the diaphragm 29 are again raised to their uppermost position by the cam flange 45, the increased pressure of air caused by the piston action of the upwardly moving diaphragm 29 on the outer walls of the inlet check valve 23 will be greater than the pressure on the inlet side of the valve 23, and the valve will close. However, on the up stroke of the diaphragm 29 the pressure at the inlet 60 of the outlet check valve 24 will be greater than the pressure surrounding the elongated passageway walls 53 and thus air will pass through the valve, the outlet passageway 19 and into the accumulator chamber 20.

The manner in which the compression diaphragm is rendered inoperative under certain conditions is one of the principal features of applicants' invention. The means for accomplishing this includes a diaphragm shut-off valve 63 which is arranged to be depressed and block the inlet opening 60 of check valve 23, whenever the pressure in the accumulator chamber 20 exceeds some predetermined amount, such for example as 6 p.s.i. Upon depression of the valve 63 the plunger 66 engages and completely closes off the inlet 60. With the port 60 closed off, a vacuum will be created above the main diaphragm 29 as the spring 41 tries to return the diaphragm 29 to its lower position. This vacuum is sufficiently great, however, so that the spring 41 is unable to overcome it. The diaphragm 29 will thus remain in its upper position, without flexing, so long as the accumulator chamber pressure remains above the predetermined minimum. Thus, even though the cam wheel 47 is rotating, the diaphragm 29 is not being moved and no additional air is being forced into the accumulator chamber 20. It may now clearly be seen that as long as the pressure within the air accumulator chamber 20 is of sufficient magnitude to keep the diaphragm check valve 63 in its depressed condition the cam roller 39 on the end of power shaft 36 will be held above the cam flange 45 except at its highest point.

When air is withdrawn from the accumulating chamber 20 through the outlet fitting 14, the decreased air pressure within chamber 20 will permit the diaphragm shut-off 63 to snap back to the position illustrated in Figure 1, thus allowing the cyclic pumping operation to be resumed. Due to the fact that the diaphragm is inactive whenever the pressure within the accumulator chamber 20 reaches a predetermined minimum, as for instance six pounds per square inch pressure, the life of the diaphragm is greatly extended over that of a constantly reciprocating diaphragm. Indeed, it has been found in practice, that its useful life will be increased some 40 or 50 times.

It will be understood, of course, that this embodiment of the invention has been used for illustrative purposes only and that various modifications and variations of the present invention may be effected without departing from the spirit and scope of the novel concepts thereof.

We claim as our invention:

20 A fluid pump comprising a valve body having an inlet and an outlet, a fluid reservoir communicable with said outlet, a volumetrically variable pressurizing chamber communicable with said inlet and outlet, a check valve seated within said inlet having a flow passage there-
25 through and operable to permit only unidirectional flow to said chamber, a movable wall forming a portion of the wall of said reservoir such that the central portion thereof will move outwardly of the interior of the reser-
30 voir upon predetermined pressure levels within said reservoir, and a valve member centrally mounted on said movable wall and disposed adjacent said check valve and movable into engagement with a portion of said check
35 valve defining said flow passage to shut off fluid flow therethrough upon outward movement of the central portion of said movable wall with respect to the interior of said reservoir.

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