

June 8, 1937.

H. M. LOEBER

2,083,073

DIAPHRAGM PUMP FOR AUTOMATIC WATER SYSTEMS

Filed Nov. 3, 1933

3 Sheets-Sheet 1

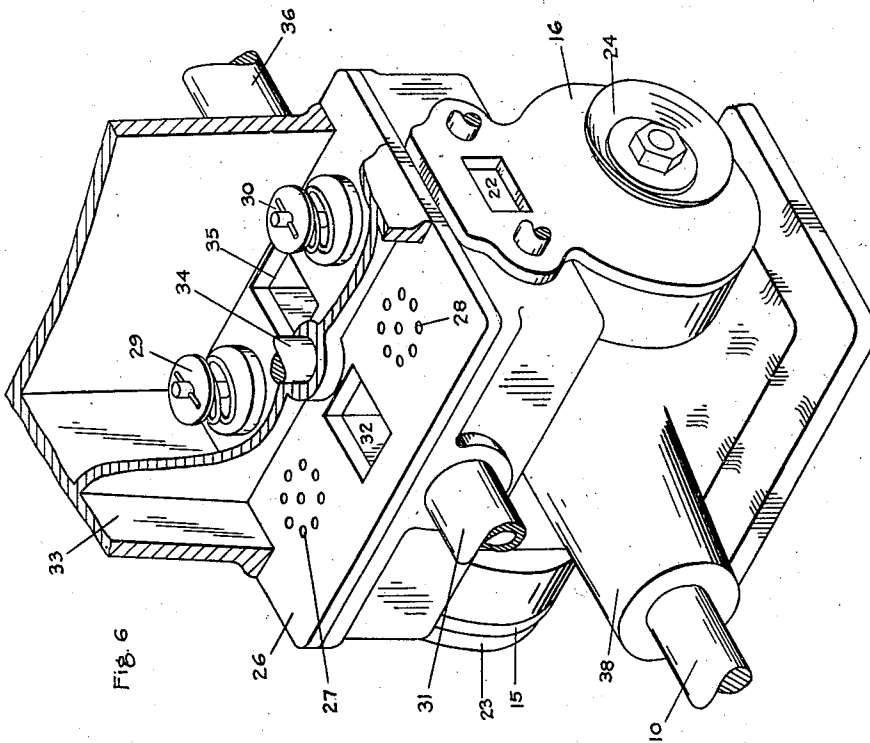


Fig. 6

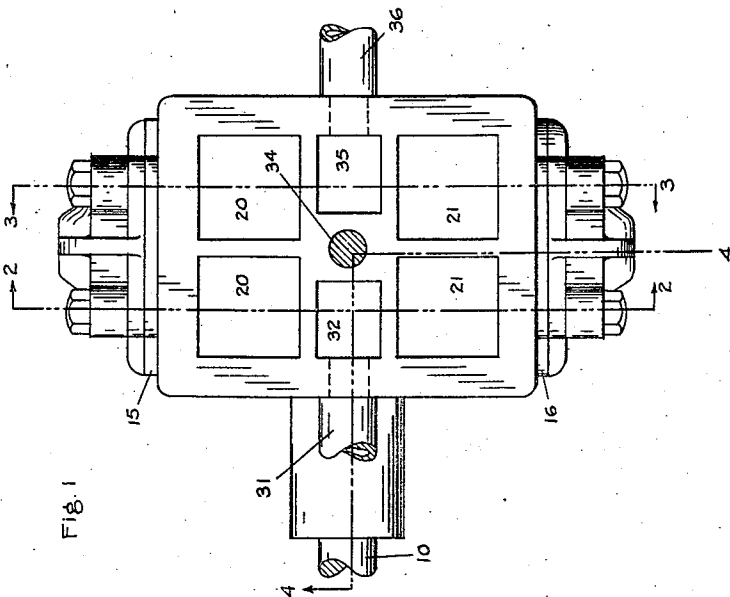


Fig. 1

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3 Sheets-Sheet 2

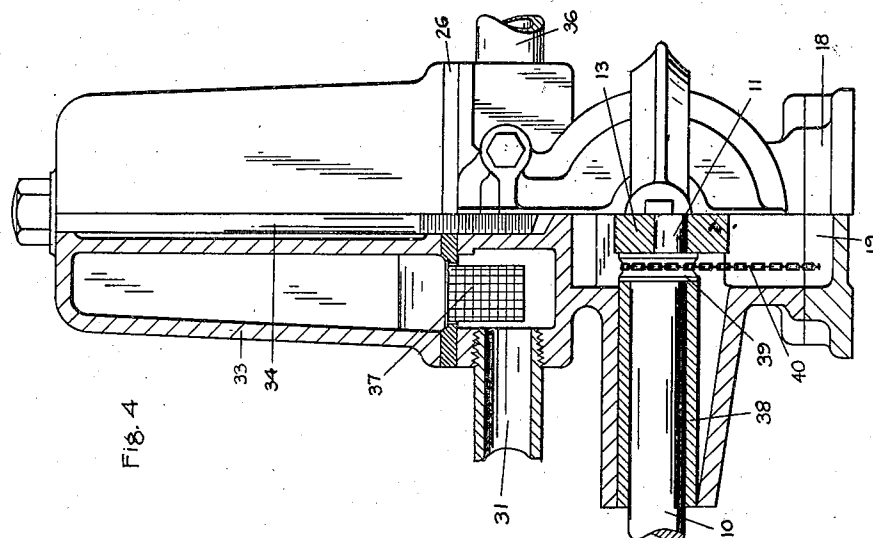


Fig. 4

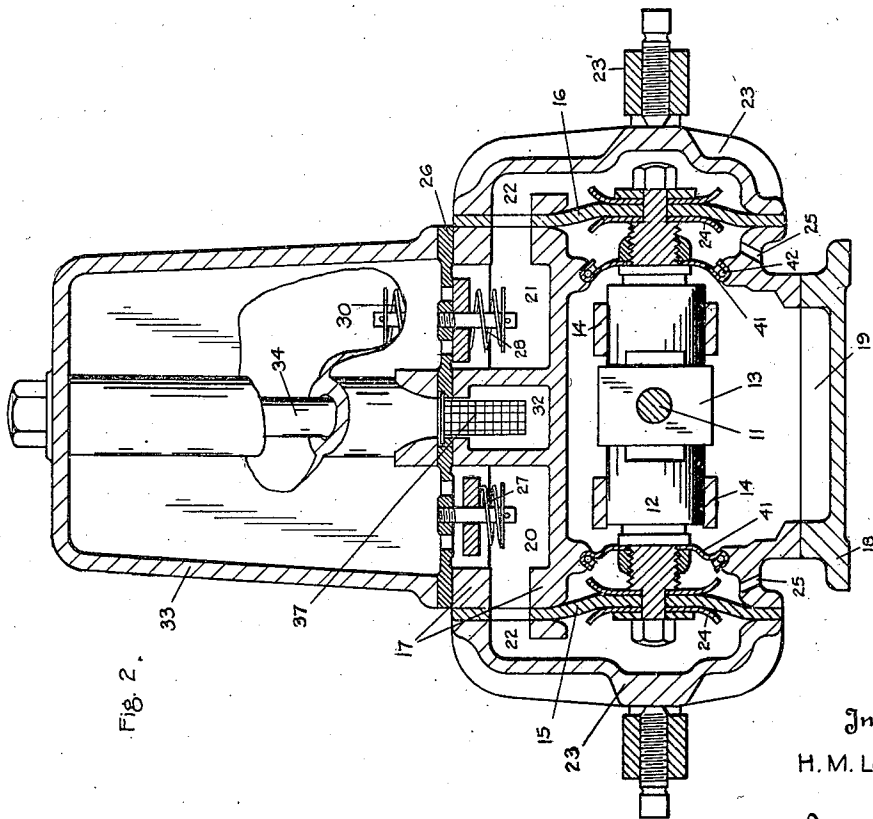


Fig. 2

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3 Sheets-Sheet 3

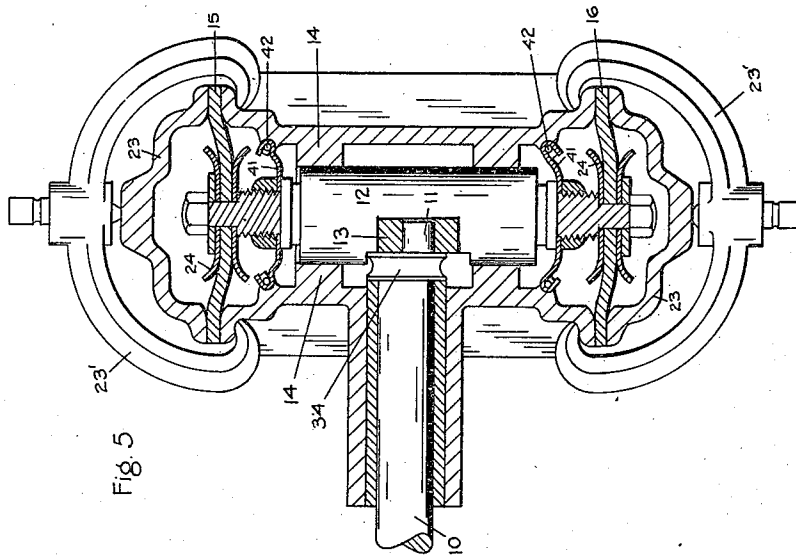


Fig. 5

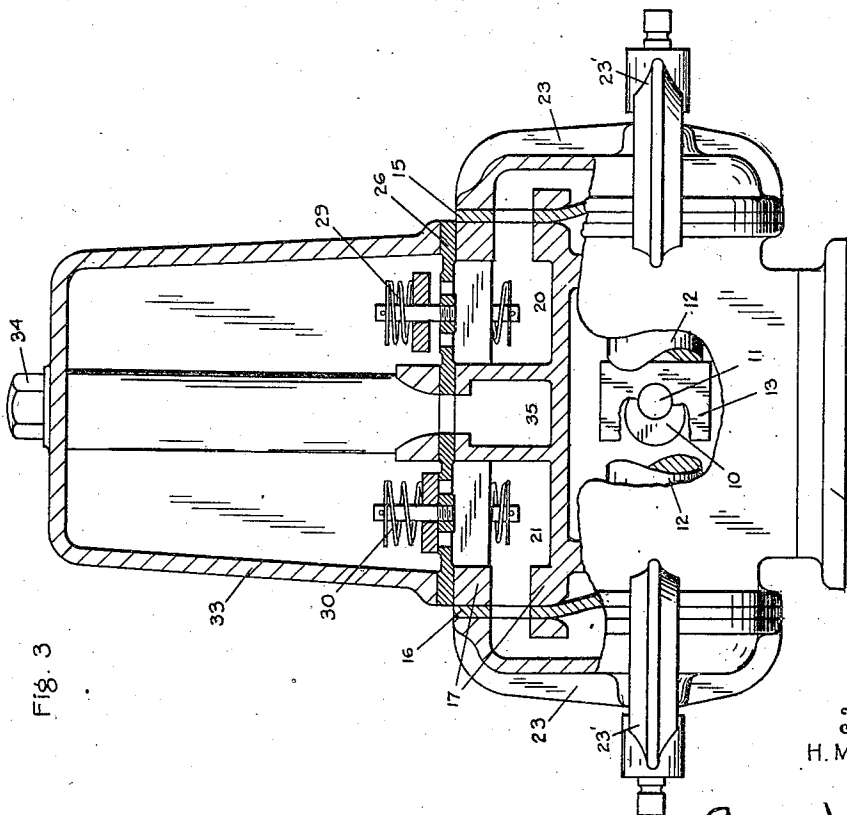


Fig. 3

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UNITED STATES PATENT OFFICE

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DIAPHRAGM PUMP FOR AUTOMATIC
WATER SYSTEMSHerman M. Loeber, Beatrice, Nebr., assignor to
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Application November 3, 1933, Serial No. 696,527

7 Claims. (Cl. 103—150)

My invention relates to diaphragm pumps, its primary object being the provision of a pump which is especially adapted for use in automatic water systems.

5 Another object of the invention is the provision of a double acting diaphragm pump so designed that each stroke of the plunger is both a suction stroke and a discharge stroke.

10 One of the important objects of the invention is the provision of easily accessible securing means for the diaphragms of a diaphragm pump for the easy removal and replacement of the diaphragm without disassembling the pump.

15 Another object is the provision of means for preventing contact between the lubricant and the water.

Another object is the provision of a novel diaphragm having long life and not readily subject to scuffing, abrasion or puncturing effects.

20 Having in view these objects and others which will be pointed out in the following description, I will now refer to the drawings, in which

Figure 1 is a plan view of the pump block after the valve cover or bonnet has been removed therefrom.

30 Figure 2 is a vertical sectional view of the entire pump, the section being taken on the line 2—2 of Figure 1 and looking in the direction of the arrows and being slightly offset in its lower portion, the partition in the valve cover being partly torn away to disclose a portion of the rear chamber.

Figure 3 is a sectional view on the line 3—3 of Figure 1 with a slight offset in its lower portion.

35 Figure 4 is a view in half elevation and half vertical section on the line 4—4 of Figure 1 looking in the direction of the arrow.

40 Figure 5 is a view in horizontal section showing particularly the actuating mechanism of the pump in its relation to the diaphragm arrangement.

Figure 6 is a perspective view partly in section as seen when looking down upon the valve plate.

45 The pump is driven through a drive shaft 10 having an eccentric pin 11 at its extremity for driving a plunger 12. As best shown in Figures 2 and 5, a sliding block 13 is secured to the eccentric pin 11, the up and down movements of the block 13 being guided through its connections with the plunger 12. The lateral movements of the plunger 12 are guided by bridges or connecting bars 14 which confine those movements to a horizontal line. The plunger 12 is 50 connected at its opposite ends to the diaphragms

15 and 16. Reciprocating movement of the plunger 12 will thus cause the movement back and forth of the two diaphragms.

The pump block 17 is mounted on a base 18 having a lubricant receptacle 19 in its bottom portion. The pump block is provided with a more or less cylindrical chamber whose axis is substantially that of the plunger 12. As subsequently to be described this cylindrical chamber is blocked off at both of its ends to provide two water chambers which communicate directly 10 with two chambers 20 and 21 through passageways 22. As shown in Figure 1, the chambers 20 and 21 do not communicate directly with each other. In explanation of Figure 1, a web is provided in the exposed face of the pump block 15 merely for the purpose of additionally supporting the valve plate. The web is of shallow depth and it does not divide either the chamber 20 or the chamber 21 nor does it interfere in any way 20 with the functioning of those chambers. The cylindrical chamber is closed at both of its ends by means of heads 23 which are secured by any suitable clamping device such as the crabs 23' as best shown in Figure 5. The heads 23 are 25 tightly clamped against the end walls of the pump block with the diaphragms 15 and 16 clamped between the heads and the end surfaces of the pump block. Projecting from opposite ends of the plunger 12 are screw-threaded spindles passing through the diaphragms each with a pair of oppositely dished discs 24 for the purpose of minimizing abrasive friction on the diaphragms. The pump block is also provided with telltale holes 25 for indicating leakage through 35 the respective diaphragms.

The valve plate 26 is best shown in Figure 6. This plate supports two intake valves 27 and 28 and two discharge valves 29 and 30. Thus the chamber 20 communicates with the intake valve 40 27 and the discharge valve 29 while the chamber 21 communicates with the intake valve 28 and the discharge valve 30. The intake for the pump is shown at 31, the water flowing through the passageway 32 to the upper surface of the valve 45 plate 26 from whence it may flow down through the intake valve 27 or the intake valve 28 depending upon the positions of the diaphragms. In other words, the water will flow into either 50 the chamber 20 or the chamber 21.

The valve cover or bonnet 33 rests on the valve plate 26 to which it is secured by means of a bolt 34 or other suitable fastening device 55 passing through the valve cover 33 and the valve

plate 26 and into the pump block 17. The valve cover is divided into two chambers which are transverse to the chambers 20 and 21. One of these chambers encloses the intake valves 27 and 28 while the other chamber encloses the discharge valves 29 and 30. The flow through the intake valve 27 into the chamber 20 may continue only through the discharge valve 29 while the flow through the intake valve 28 will continue through the chamber 21 and through the discharge valve 30. In either case the flow will continue through the discharge port 35 and thence through the discharge pipe 36.

In the Figure 2 position the diaphragm 15 is in its suction stroke while the diaphragm 16 is in its discharge stroke. Referring now more particularly to Figure 6, it will be seen that water entering through the pipe 31 and intake port 32 will pass through the intake valve 27 and into the chamber between the diaphragm 15 and head 23. The movement being a suction movement, the valve 27 will be open while the valve 28 is closed. The diaphragm 16, however, is in its discharge stroke and this forces the water through the passage 22 into the chamber 21. The water pressure will keep the valve 28 tightly closed and the water can therefore pass up only through the discharge valve 30 at the opposite end of the chamber 21 and from thence it passes downwardly through the discharge port 35 and outwardly through the discharge pipe 36. On the opposite stroke of the plunger 12 the water entering through the intake port 32 will pass downwardly through the intake valve 28 and into the chamber between the diaphragm 16 and the head 23. During this movement the discharge valve 30 is kept closed because of the suction created by the diaphragm 16. At the same time the diaphragm 15 is moving in its discharge stroke and it forces the water into the chamber 20 and out through the discharge valve 29 from whence it passes through the discharge port 35 and the discharge pipe 36. The steps are thus continuous due to the fact that the pump is double acting and that it has two diaphragms which are alternating in their suction and discharge strokes.

It is desirable that water entering through the intake port 32 be screened before it enters the pump. For this reason I provide a screen 37 for removing any solid matters which might interfere with the action of the various valves.

The drive shaft 10 has an elongated bearing 38 as shown in Figure 4. The shaft is provided with a grooved end portion 39 for carrying a chain 40. This chain dips into the lubricant of the lubricant container 19 and carries the lubricant to the bearing 38 and to the plunger 12 and its sliding block 13. Since a slight puncture in either diaphragm 15 or 16 may cause water to enter the lubricant chamber 19 or since the lubricant might enter the water chamber in a suction stroke, it is advisable to block off the water passages from the lubricant by means which will be effective in case of the puncturing of one of the diaphragms. For this purpose I provide a second pair of diaphragms 41 which are positioned inwardly from the diaphragms 15 and 16. The pump block is provided with a pair of circular grooves for receiving resilient wire rings 42. It is thus only necessary to place the diaphragms 41 in position and to snap the rings 42 into position to tightly hold these diaphragms. The puncturing of one or the other of the diaphragms is readily indicated by the

leakage through one or the other of the telltale holes 25 but the intermingling of the oil and water is prevented by the use of the supplemental diaphragm 41. It is to be understood, however, that other means may be employed for blocking off the water and oil, the supplemental diaphragm merely showing one of my preferred devices for accomplishing the result. In case of the puncturing of one or the other of the diaphragms it is only necessary to remove the crab and head at that end of the pump block and to replace the punctured diaphragm. The diaphragms must be waterproof and they must be resistant to the abrasion to which they are subjected from fine particles of sand passing through the pump and they must be resistant to the scuffing effects resulting from their movements. A material which I have found which meets the requirements is a fabric treated with a phenolic resinoid compound.

Attention is called particularly to the positions of the diaphragms and to the crabs 23' which hold the heads 23 tightly pressed against the ends of the pump block with the diaphragms clamped between the heads 23 and end surfaces of the pump block. The position is such that when a diaphragm must be replaced, the pump must be stopped for only a few minutes while the crab and the head are removed to afford easy access to the diaphragm which is first removed and then replaced by a new diaphragm. The trickling of the water from one of the two telltale holes 25 indicates the puncturing of one or the other of the diaphragms and it also indicates which of the two diaphragms must be replaced. The use of the supplemental diaphragm is also very important since the interior chamber of the pump block contains lubricant which must not be permitted to come into contact with the water which is being pumped. Nor must the water be permitted to come into contact with the lubricant as such contact would not only introduce water into the oil but it would taint the water which is being pumped. The supplemental diaphragms are also easily accessible by the simple removal of the heads 23. After access is obtained to the supplemental diaphragms they are very easily removed owing to the simplicity of the resilient rings 42 which readily snap into or out of position.

Having thus described my invention in such full, clear, and exact terms that its construction and operation will be readily understood by others skilled in the art to which it pertains, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a diaphragm pump for water systems, a hollow pump block having an opening, a diaphragm secured on the end of said pump block and closing the opening thereof, a reciprocating plunger within the hollow portion of said pump block, said plunger being secured at its outer extremity to said diaphragm for the actuation thereof, and a second diaphragm secured to and surrounding said plunger and secured at its edge to said pump block, said pump block being provided with a telltale hole between said two diaphragms for indicating leakage through said first named diaphragm.

2. In a diaphragm pump for water systems, a hollow pump block, a reciprocating plunger within the hollow portion of said pump block, a pumping diaphragm and a supplemental diaphragm secured in spaced apart relation to said plunger, said diaphragms being secured at their

edges to said pump block, said pump block being provided with a telltale hole between said two diaphragms to indicate leakage through said pumping diaphragm.

5 3. In a diaphragm pump, a pump block having a chamber with a mouth at the end of said pump block, a diaphragm seated at its edges against said pump block to close the mouth of the chamber thereof, a head having a concave surface, said head being seated at its edges against said diaphragm to define a pumping chamber therebetween, means for clamping said head to said pump block, reciprocating means for alternately expanding and contracting said pumping chamber, an inlet chamber having an inlet conduit, a discharge chamber having a discharge conduit, a one way conduit for conducting water from said inlet chamber to said pumping chamber, a one way conduit for conducting water from said pumping chamber to said discharge chamber, a valve plate located adjacent to said inlet and discharge chambers, intake and discharge valves in said plate and communicating with said pumping chamber, an intake conduit for conducting water through said valve plate and through said intake valve and into said pumping chamber while said pumping chamber is expanding, a hollow cover fitted against said valve plate and having a septum positioned between said intake valve and said discharge valve, and a discharge conduit associated with said discharge valve whereby the contraction stroke of said pumping chamber will force the water therefrom through said discharge valve and out through said discharge conduit.

4. In a diaphragm pump, a hollow pump block, a flexible diaphragm seated across the end of said pump block and closing the opening thereof, a head having an inner concave surface seated at its edges against said diaphragm to define a water chamber between said head and said diaphragm, clamping means for securing said head against said pump block with said diaphragm compressed therebetween, a second water chamber communicating with the first said water chamber through an aperture in said diaphragm, a third water chamber communicating with said second water chamber, a valve for admitting water from said third water chamber to said second water chamber, a fourth water chamber communicating with said second water chamber, a valve for admitting water from said second water chamber to said fourth water chamber, said two valves being automatically operable in alternation in response to the reciprocatory

movements of said diaphragm, an intake conduit for said third water chamber, a discharge conduit for said fourth water chamber, and reciprocating means within said pump block for actuating said diaphragm.

5. A pump comprising a casing, a pumping chamber in the casing, a lubricant chamber in the casing, a slide member in the lubricant chamber having an end projecting into the pumping chamber, a diaphragm in the pumping chamber secured to the projecting end of the slide member, means wholly within the lubricant chamber for slidably mounting the slide member therein, means disposed in spaced relation to the diaphragm and engaging the slide member for cutting off communication between the lubricant chamber and the pumping chamber, said casing having an opening to the atmosphere between said diaphragm and said means cutting off communication between said chambers, and operating means for the slide member.

6. A pump comprising a casing, a pumping chamber in the casing, a lubricant chamber in the casing, a slide member in the lubricant chamber having an end projecting into the pumping chamber, a diaphragm in the pumping chamber secured to the projecting end of the slide member, means wholly within the lubricant chamber for slidably mounting the slide member therein, means fixed to the slide member and to the casing for cutting off communication between the lubricant chamber and the pumping chamber while permitting movement of the slide member, said casing having an opening to the atmosphere between said diaphragm and said means cutting off communication between said chambers, and operating means for the slide member.

7. A pump comprising a casing, a pumping chamber in the casing, a lubricant chamber in the casing, a slide member in the lubricant chamber having an end projecting into the pumping chamber, a diaphragm in the pumping chamber secured to the projecting end of the slide member, means in the lubricant chamber for slidably mounting the slide member therein, a second diaphragm secured to the slide member in spaced relation to the first diaphragm and secured to the casing for cutting off communication between the lubricant chamber and the pumping chamber, said casing having an opening to the atmosphere between said diaphragm and said means cutting off communication between said chambers, and operating means for the slide member.

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