S. C. LAIDLEY.

FLUID ACTUATED AIR PUMP.

APPLICATION FILED APR. 18, 1910.

983,729.

Patented Feb. 7, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

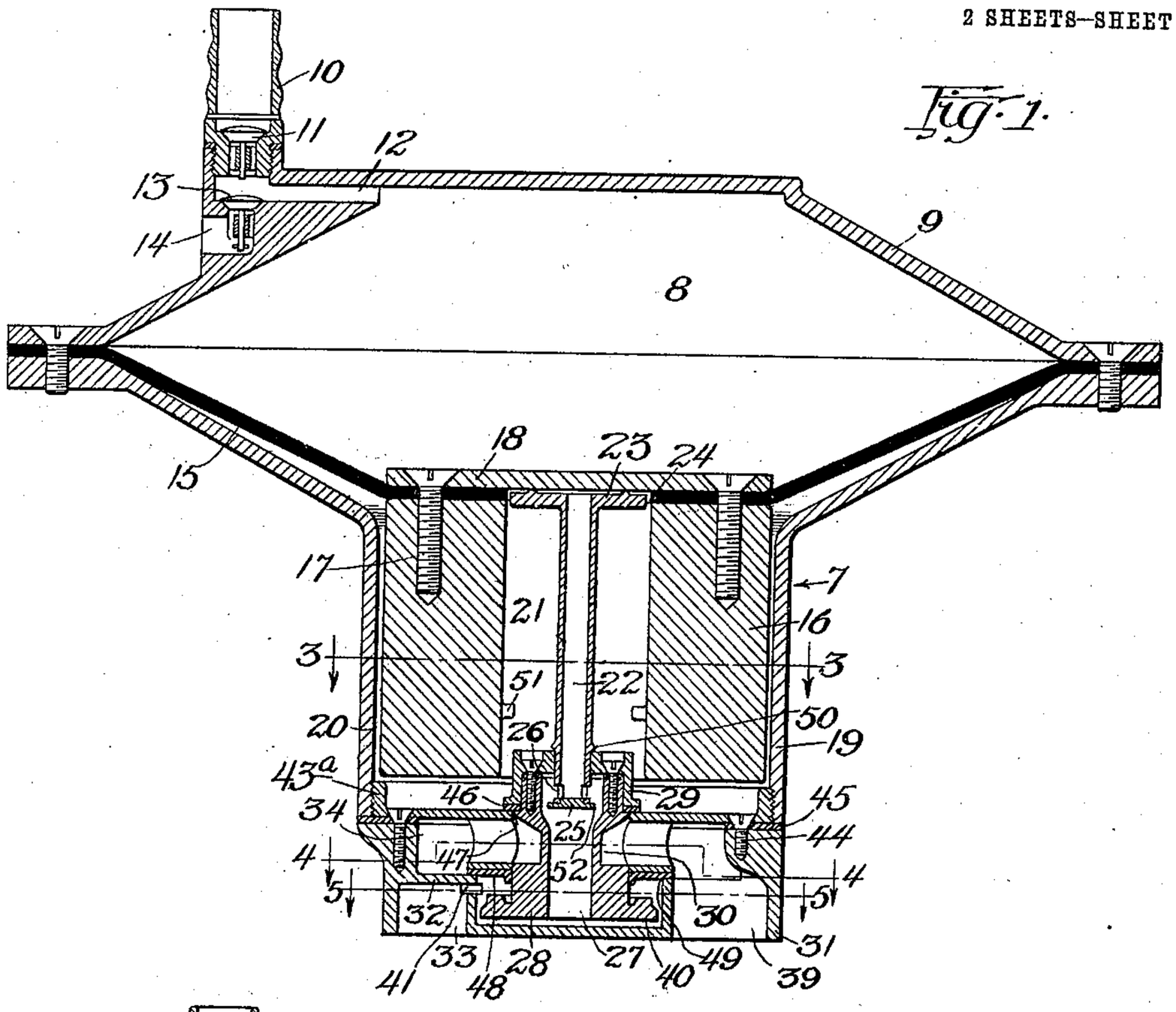
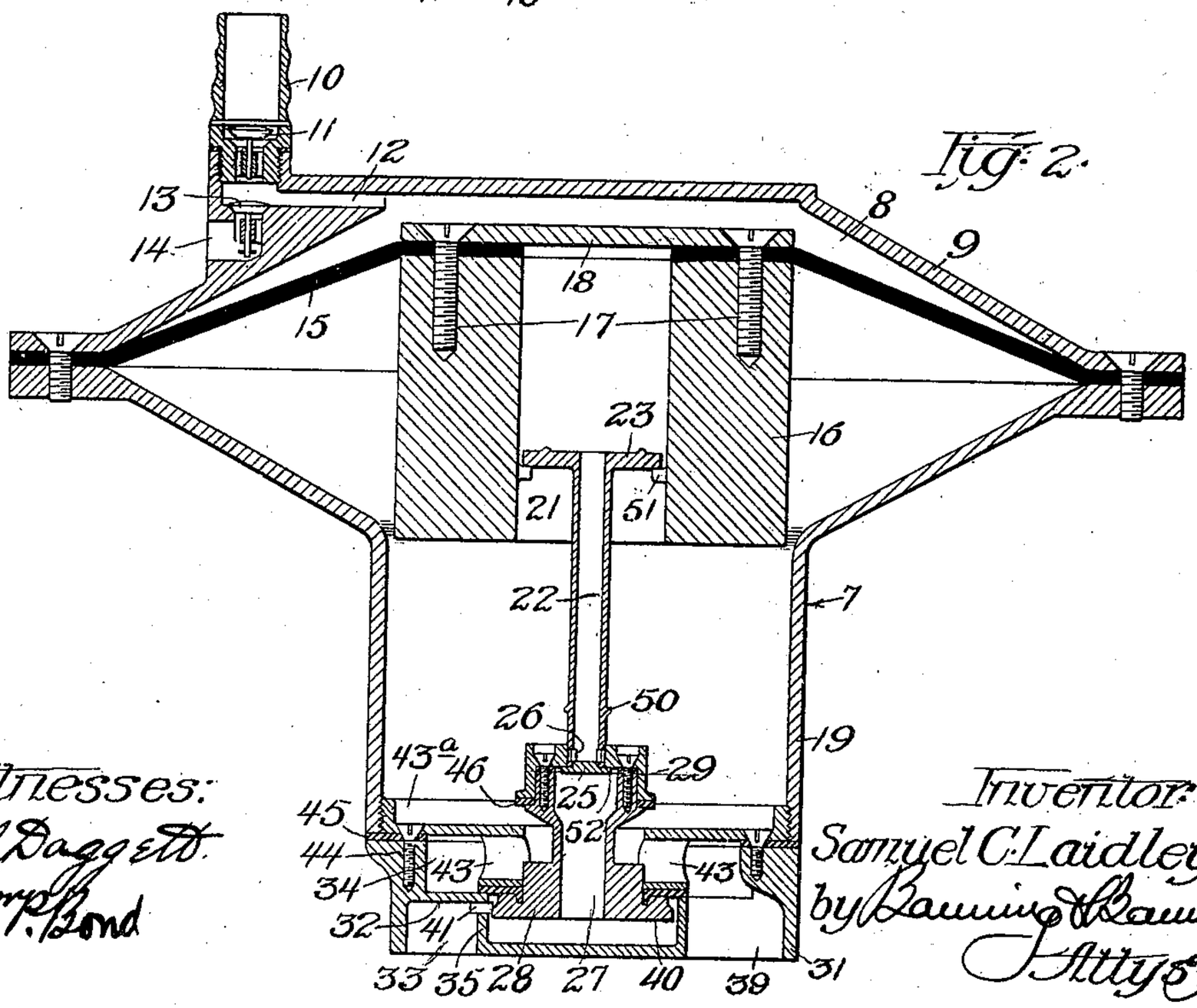


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

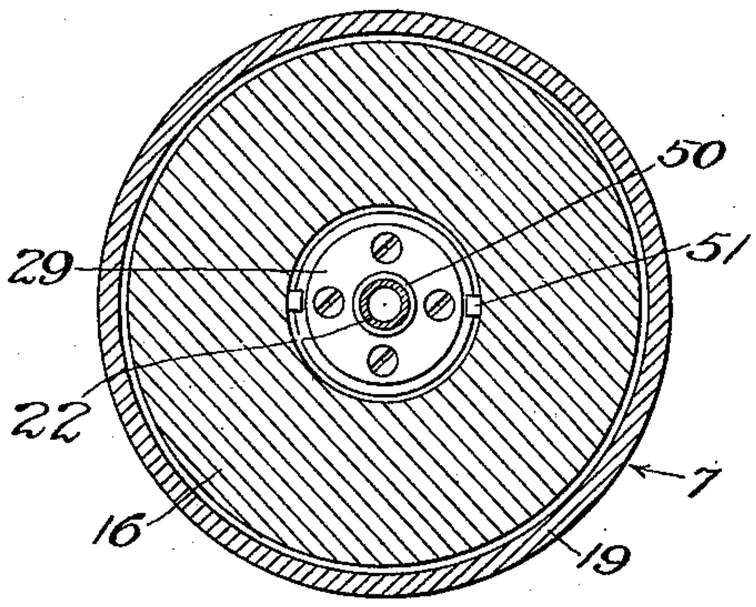


Fig. 6.

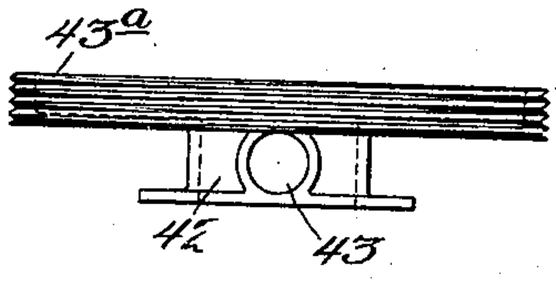


Fig. 4.

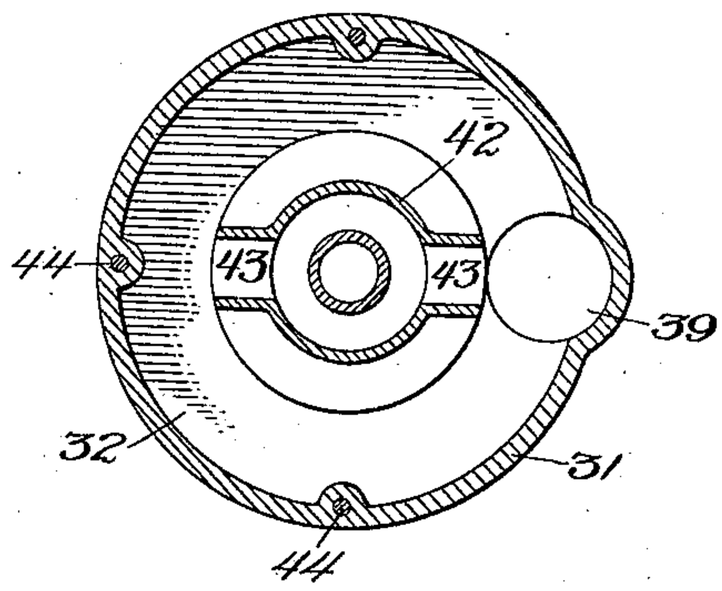
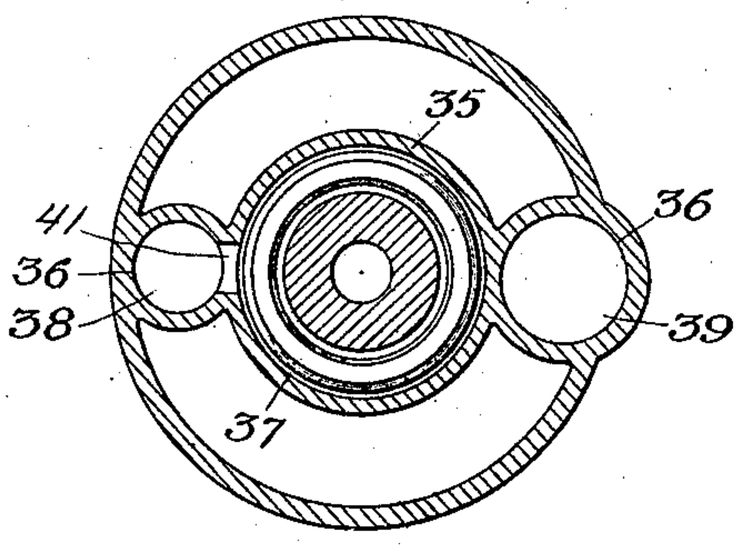


Fig. 5.



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FLUID-ACTUATED AIR-PUMP.

983,729. Specification of Letters Patent. Patented Feb. 7, 1911.

Application filed April 18, 1910. Serial No. 556,063.

To all whom it may concern:

Be it known that I, SAMUEL C. LAIDLEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Fluid-Actuated Air-Pumps, of which the following is a specification.

The pump of the present invention is intended more particularly for use in supplying air to beer kegs for the purpose of keeping the beer in a live and proper state; and has for its objects, to construct a pump which is simple and cheap of manufacture; which will occupy but a small space when placed in operative position; which will employ a diaphragm and a weight for returning the diaphragm to normal position; and to so position and construct the weight that the pressure of the fluid will act upon it to move it conjointly with the diaphragm, thus relieving the diaphragm of the strain of the weight during the upward movement of the diaphragm; and to furthermore employ the weight to form a restriction between the fluid chamber and the diaphragm, so that violent impact of the fluid against the diaphragm is prevented; to construct a valve for controlling the supply of fluid into and out of the fluid chamber, which valve will be maintained in open and closed position by the pressure of the fluid; and to construct and arrange the parts so that the mechanism may be easily separated for the purpose of cleaning.

The invention further consists in the features of construction and combination of parts hereinafter described and claimed.

In the drawings, Figure 1 is a sectional elevation showing the diaphragm in lowered position; Fig. 2, a similar view showing the diaphragm in raised position, and the valve mechanism in position for exhausting fluid from beneath the diaphragm; Fig. 3, a section on line 3—3 of Fig. 1, looking in the direction of the arrow; Fig. 4, a section on line 4—4 of Fig. 1, looking in the direction of the arrow; Fig. 5, a section on line 5—5 of Fig. 1, looking in the direction of the arrow; and Fig. 6, a detail of one of the castings employed in the base member.

The device consists of a casing 7 enlarged at its upper end to form a compression chamber 8; and has its upper end closed by means of a cap or cover 9, which, as shown, is concave and forms a portion of the compression chamber. The cap or cover is provided with an upwardly extending nipple 10, to which is connected a tube or other suitable member leading to a storage tank, provided with a check valve 11 for controlling the admission of air from the compression chamber into the nipple; and from the valve 11 a passage 12 leads into the compression chamber. The admission of air into the chamber is controlled by a check valve 13 leading from a passage 14, which communicates with the outside air. Positioned in the compression chamber and secured, as shown, between the cap or cover and the casing is a diaphragm member 15, which has secured thereto a downwardly depending member 16, which serves as a weight for returning the diaphragm to normal position when the valve mechanism acts to exhaust the fluid from the fluid chamber.

The depending member 16 is secured to the diaphragm, as shown, by means of screws or other fastening means 17 entered through a plate 18 resting upon the upper surface of the diaphragm. The member 16 is entered into the contracted portion 19 of the casing, which forms the fluid chamber. As shown, the member 16 is positioned so that a relatively small space 20 is left between its outer surface and the inner face of the walls of the fluid chamber. This small space serves as a restricted passageway, so that the fluid entering from the fluid chamber against the diaphragm is prevented from striking the diaphragm with a violent impact, which is an undesirable feature in devices of this class, because of the fact that unequal movement of the diaphragm tends to strain the parts and materially shorten the life of the diaphragm.

The member 16 is formed with a recess 21 in the central portion thereof, into which extends an elongated tube or hollow stem 22, provided, at its upper end, with a head 23. The head, as shown, fits relatively close within the recess 21 and provides a secondary restricted passageway 24, through which the fluid passes in entering the fluid chamber. The tube has a closed lower end 25, adjacent to which are formed a plurality of openings 26; and the tube extends into a passageway 27 formed in a valve member 28. The valve member 28 has secured to its upper end, as shown, a cap or cover forming a head 29,

through which the tube 22 passes; and the valve member is further provided with a circumferential groove 30, which is adapted to establish communication between the water chamber and the exhaust passage when the valve is in proper position, as will be more fully hereinafter set forth.

The valve member 28 is positioned within a base 31, which is divided by a horizontally extending partition wall 32, to form a lower chamber 33 and an upper chamber 34. The lower chamber is subdivided by a partition wall 35, to form outer chambers 36 and an inner intermediate chamber 37. One of the outer chambers 38 provides a water inlet chamber, and the opposite outer chamber 39 provides a water exhaust chamber communicating with the upper chamber 34; and the intermediate chamber 37 provides a recess in which a head 40 formed on the valve member 27 rests.

The partition wall 35 has formed therein a passageway 41, which provides communication between the inlet chamber 38 and the intermediate chamber 37, and the head 40 forms a restricted passageway 41 in the intermediate chamber, through which the water must pass to enter the passageway 27 in the valve member 28. The upper chamber 34 has extending thereinto a circular neck 42 depending from a screw-threaded ring 43^a, which latter is screw-threaded into the wall of the fluid chamber 19; and the ring 43^a, as shown, is secured to the base by screws or other fastening means 44; and interposed between the ring and the base is a packing ring 45. The neck 42 is provided with openings 43 oppositely disposed from one another and serving to establish communication between the exhaust passage and the fluid chamber when the valve 28 is in proper position to have the circumferential groove 30 in the position shown in Fig. 2.

The cap 29 is provided along its lower face with a ring of packing material 46, which normally rests against the floor of the screw-threaded ring 43^a and serves to seal the opening 47 in the floor of the ring, through which the upper end of the valve member 28 passes; and the neck 42 has secured to its lower face a ring of packing material 48, which serves to seal the open upper end 49 of the intermediate chamber 37.

The tube 22 is provided with contacts 50, to limit the downward movement thereof, and which strike the cap 29 and force the valve 28 downward during the downward movement of the diaphragm; and the weight member 16 is provided with contacts 51, preferably two in number, and oppositely disposed from each other, which are adapted to contact the head 23 and move the tube 22 out of normal position during the upward movements of the diaphragm. The tube 22 is provided with a flange 52 at its lower end, which strikes the cap 29 and raises the valve 28 during the upward movement of the diaphragm.

The operation is as follows: Water is admitted into the inlet chamber 33, and passes through the opening 41 into the intermediate chamber 37, flowing through the restricted passageway 41 provided between the valve member 28 and the walls of the chamber 37. The fluid then passes up into the opening 27 and through the ports 26 into the hollow tube 22, and out from said tube into the restricted passageway 24, and then into the fluid chamber. It will rise in said chamber and pass through the restricted passageway 20 until it contacts the diaphragm 15 and carries the diaphragm upward to a predetermined point, thus compressing the air in the compression chamber and forcing it out past the check valve 11 into the nipple 10, from whence it is conducted to a suitable storage tank.

By referring to Figs. 1 and 2, it will be seen that the lower face of the weight member 16 offers a substantially broad surface against which the fluid in the fluid tank will exert pressure. Hence, there will be a constant pressure against the lower end of the weight member, so that when the water acts to raise the diaphragm, the pressure on the bottom of the weight member will act to raise it, so that the strain incident to the upward lifting of the weight member will not be imparted to the diaphragm. This also serves to prevent stretching of the diaphragm and prolongs its efficiency in use.

When the diaphragm has risen sufficient distance, the abutments 51 on the weight member 16 will contact the head 23 and move the tube 22 upward, bringing the ports 26 into the position shown in Fig. 2, thus cutting off communication between the passage 27 and the tube 22. Upon a slight movement of the diaphragm, the valve member 28 will be thrown upward into the position shown in Fig. 2, at which time the circumferential groove 30 will be in the position shown in which it serves to establish communication between the water chamber 19 and the interior of the neck 42, and from whence the fluid passes through the openings 43 into the upper chamber 34 of the base member, and thence into the exhaust passage 39, the upward movement of the valve being limited by contact of the head 40 against the floor of the neck 42, and the downward movement of the valve being limited by contact of the cap 29 with the floor of the ring 43.

As will be seen by a study of Fig. 2, when the parts are in raised position, there will be a constant upward pressure against the lower end of the head 40 of the valve member 28 and the closed lower end of the hollow tube 22. This pressure will be greater than

the pressure on the top of the valve member, because of the fact that the water is passing out from the fluid chamber through the exhaust passage. Hence, this upward pressure will serve to keep the valve mechanism in the position shown in Fig. 2 until the diaphragm has descended far enough for the plate 18 to contact the head 23 and push the stem downward, and moving the valve member 28 into the position shown in Fig. 1. And after it has assumed this position, there being a free passage for the fluid through the passage 27 and stem 22, upward pressure will be relieved from against the valve member 28 and tube 25, and the downward pressure of the water in the fluid chamber will bear against the cap 29 and serve to keep the valve seated.

As will be seen from the drawings, the device is of a nature to be easily disassembled, the process of disassembling merely requiring the operation of unscrewing the base member from the casing, after which the base member and valve mechanism, together with the tube 22, can be withdrawn therefrom, the arrangement of the lugs 51 being such that the head 23 can be tilted or canted and withdrawn past the lugs.

I claim:

1. In a device of the class described, the combination of a casing, having a compression chamber and a fluid chamber therein, the compression chamber having an air inlet passage and an air discharge passage, a diaphragm within the compression chamber, a member carried by the diaphragm acting as a weight to return the diaphragm to normal position, said weight member having a chamber therein, an elongated tube extending into said chamber and having an enlarged head upon its upper end, the head forming a restriction to prevent a sudden rush of water into the fluid chamber, and having a valve member on its other end, and means whereby the tube is operated by the movements of the diaphragm to actuate the valve member and control the passage of fluid into and out of the water chamber, substantially as described.

2. In a device of the class described, the combination of a casing, having a compression chamber and a fluid chamber therein, the compression chamber having an air inlet passage and an air discharge passage, a diaphragm within the compression chamber, a member carried by the diaphragm acting as a weight to return the diaphragm to normal position, and extending into the fluid chamber and forming a restriction to prevent the sudden rush of fluid onto the diaphragm, said weight member having a chamber therein, an elongated tube extending into said chamber and having an enlarged head upon its upper end, the head forming a restriction to prevent a sudden rush of water into the fluid chamber, and having a valve member on its other end, means whereby the tube is operated by the movements of the diaphragm to actuate the valve member and control the passage of fluid into and out of the water chamber, and the fluid acting to lift the member carried by the diaphragm simultaneously with the diaphragm, whereby the diaphragm is relieved of the weight of the member carried thereby during the upward movement of the diaphragm, substantially as described.

3. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chambers, a valve member entered into the intermediate chamber and having a passage therein for the conduction of fluids, a tube entered into said passage and serving to conduct fluid from the passage in the valve into the water chamber, and means for raising said tube, whereby communication will be cut off between the passage in the valve and the interior of the tube, and communication established between the water chamber and exhaust chamber, substantially as described.

4. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a diaphragm between the chambers, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chambers, a valve member entered into the intermediate chamber and having a passage therein for the conduction of fluids, a tube entered into said passage and serving to conduct fluid from the passage in the valve into the water chamber, means for raising said tube, whereby communication will be cut off between the passage in the valve and the interior of the tube, and communication established between the water chamber and exhaust chamber, and a member carried by the diaphragm acting as a weight to return the diaphragm to normal position, said weight member extending into the fluid chamber and forming a restriction to prevent the sudden rush of fluid onto the diaphragm, the fluid acting to lift the member carried by the diaphragm simul-

taneously with the diaphragm, whereby the diaphragm is relieved of the weight of the member carried thereby during the upward movement of the diaphragm, substantially as described.

5. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chambers, a valve member entered into the intermediate chamber, and provided with an enlarged head on its lower end, said valve member having a passage therein for the conduction of fluid, and said head serving to restrict the passage of fluid between the inlet port and the passage in the valve, a tube entered into said passage and serving to conduct fluid from the passage in the valve into the water chamber, and means for raising said tube, whereby communication will be cut off between the passage in the valve and the interior of the tube, and communication established between the water chamber and exhaust chamber, substantially as described.

6. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a diaphragm between the chambers, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chambers, a valve member entered into the intermediate chamber, and provided with an enlarged head on its lower end, said valve member having a passage therein for the conduction of fluid, and said head serving to restrict the passage of fluid between the inlet port and the passage in the valve, a tube entered into said passage and serving to conduct fluid from the passage in the valve into the water chamber, and means for raising said tube, whereby communication will be cut off between the passage in the valve and the interior of the tube, and communication established between the water chamber and exhaust chamber, and a member carried by the diaphragm, acting as a weight to return the diaphragm to normal position, said weight member extending into the fluid chamber and forming a restriction to prevent the sudden rush of fluid onto the diaphragm, the fluid acting to lift the member carried by the diaphragm simultaneously with the diaphragm, whereby the diaphragm is relieved of the weight of the member carried thereby during the upward movement of the diaphragm, substantially as described.

7. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chamber, a valve member entered into the intermediate chamber and having a passage therein for the conduction of fluids, an elongated tube entering into and in communication with the passage in the valve member, and having communication with the water chamber, said valve member having a circumferential groove therein adapted to establish communication between the exhaust chamber and the water chamber, and a connection between the tube and the valve, whereby the movement of said tube out of normal position will cut off communication between the tube and the passage in the valve member and move the valve member to bring the circumferential grooves in position to establish communication between the water chamber and the exhaust passage, substantially as described.

8. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chamber, a valve member entered into the intermediate chamber and having a passage therein for the conduction of fluids, an elongated tube entering into and in communication with the water chamber, said valve member having a circumferential groove therein adapted to establish communication between the exhaust chamber and the water chamber, a connection between the tube and the valve, whereby the movement of said tube out of normal position will cut off communication between the tube and the passage in the valve member and move the valve member to bring the circumferential

grooves in position to establish communication between the water chamber and the exhaust passage, and a member carried by the diaphragm acting as a weight to return the diaphragm to normal position, said weight member extending into the fluid chamber and forming a restriction to prevent the sudden rush of fluid onto the diaphragm, the fluid acting to lift the member carried by the diaphragm simultaneously with the diaphragm, whereby the diaphragm is relieved of the weight of the member carried thereby during the upward movement of the diaphragm, substantially as described.

9. In a device of the class described, the combination of a casing, having a compression chamber and a water chamber, a diaphragm between the chambers, a base member entered into the casing and comprising upper and lower chambers, said lower chamber being subdivided by a partition wall into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said partition wall having a passage therein to establish communication between the inlet and the intermediate chamber, a valve member entered into the intermediate chamber and having a passage therein for the conduction of fluids, an elongated tube entering into and in communication with the passage in the valve member, and having communication with the water chamber, said tube having an enlarged head on its upper end, a recessed member carried by the diaphragm and serving as a weight to return the diaphragm to normal position, the head on the hollow tube lying within the recess in the weight member and providing a restriction for the fluid passing into the fluid chamber, and a projection carried by the weight member adapted to contact the head and raise the tube out of normal position, said valve member having a circumferential groove therein adapted to establish communication between the exhaust chamber and the water chamber, and a connection between the tube and the valve, whereby the movement of said tube out of normal position will cut off communication between the tube and the passage in the valve member and move the valve member to bring the circumferential grooves in position to establish communication between the water chamber and the exhaust passage, substantially as described.

10. In a device of the class described, the combination of a casing, having therein a compression chamber and a fluid chamber, a diaphragm between the compression and fluid chambers, a base member secured to the casing, said base member being divided into upper and lower chambers, said lower chamber being subdivided into outer and intermediate chambers, one of the outer chambers serving as a fluid inlet and the other serving as a fluid exhaust, said inlet chamber having communication with the intermediate chamber, a valve member depending into the intermediate chamber and having a passage therein for the conduction of fluid, an elongated hollow stem entered into said passage and extending into the water chamber, a hollow neck depending into the upper chamber of the base member, and surrounding the valve member and having openings in its walls, said valve member having a circumferential groove adapted to register with the openings in the walls of the neck, a head on the upper end of the valve member resting against the top wall of the upper chamber when the valve is in normal position and preventing the flow of fluid from the water chamber into the exhaust chamber, substantially as described.

11. In a device of the class described, the combination of a casing having therein a compression chamber and a fluid chamber, a compression member actuated within the compression chamber by the fluid, a main fluid inlet, a valve for controlling the passage of fluid from the fluid inlet to the fluid chamber, a head on said valve serving as a restriction between the main fluid inlet and fluid chamber, and serving to prevent the passage of sediment from the inlet into the chamber, means operatively connected to said valve to move it to open and closed positions, said movements occurring when the compression member has reached its limit of movement in either direction, substantially as described.

12. In a device of the class described, the combination of a casing having therein a compression chamber and a fluid chamber, a compression member actuated within the compression chamber by the fluid, a main fluid inlet, a valve for controlling the passage of fluid from the fluid inlet to the fluid chamber, a head on said valve serving as a restriction between the main fluid inlet and fluid chamber, and serving to prevent the passage of sediment from the inlet into the chamber, a stem forming a portion of the valve mechanism extending into the fluid chamber, and a head on the upper end of said stem forming a secondary restriction to prevent the passage of sediment into the fluid chamber, substantially as described.

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