May 17, 1938. J. O. McMILLAN 2,117,563

AUTOMATIC PUMPING MECHANISM

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Fig. 1.

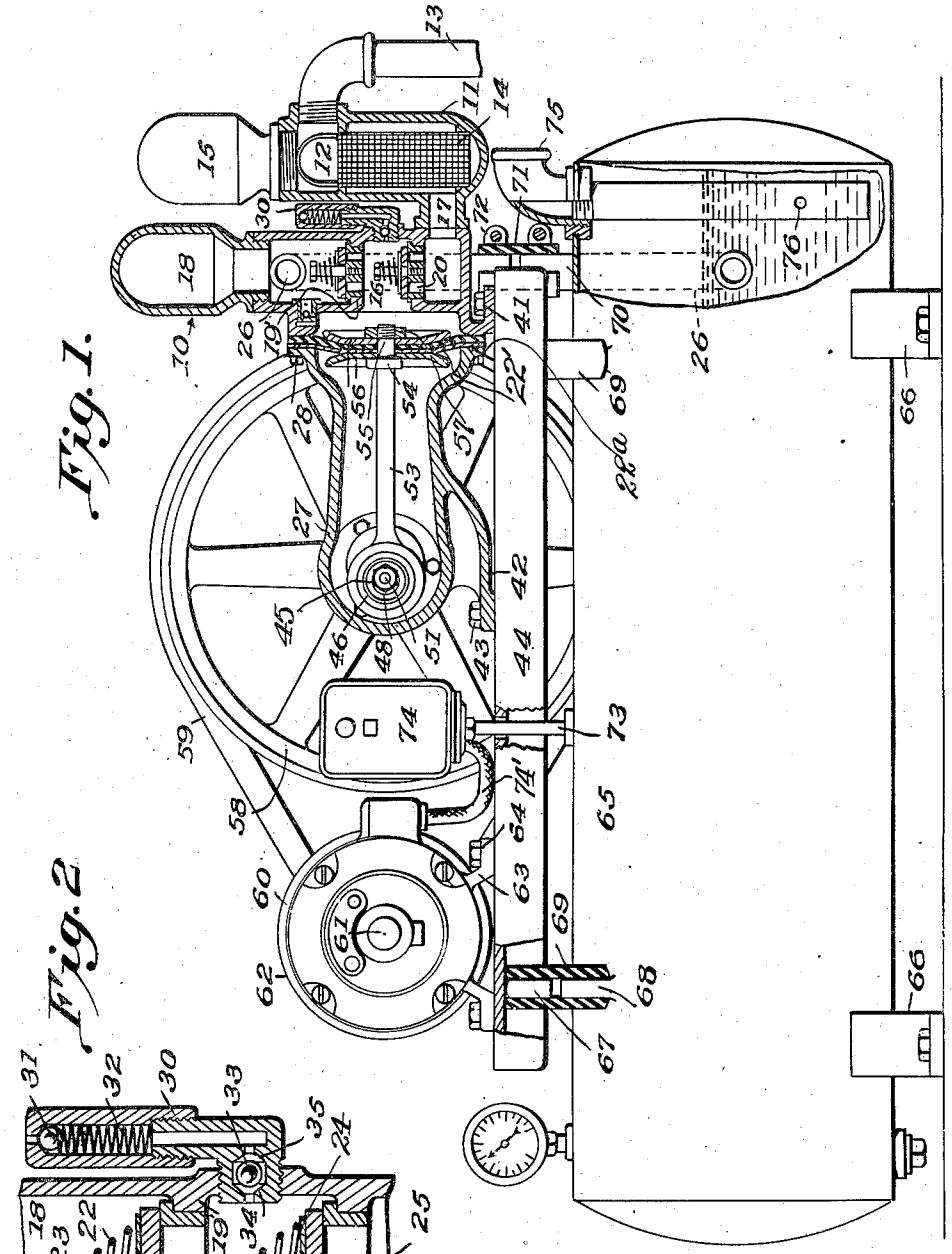
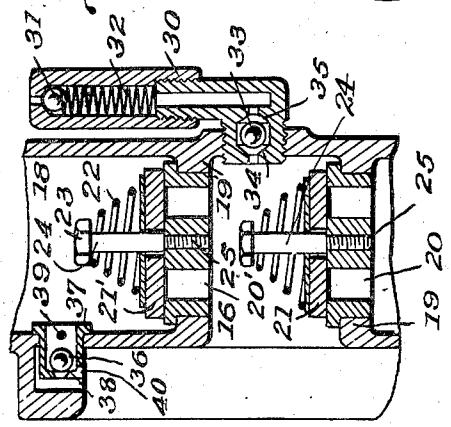


Fig. 2



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Fig. 5.

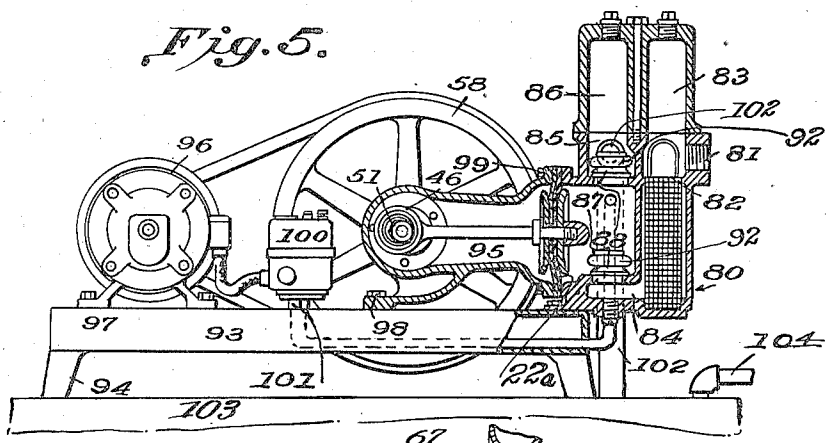


Fig. 3.

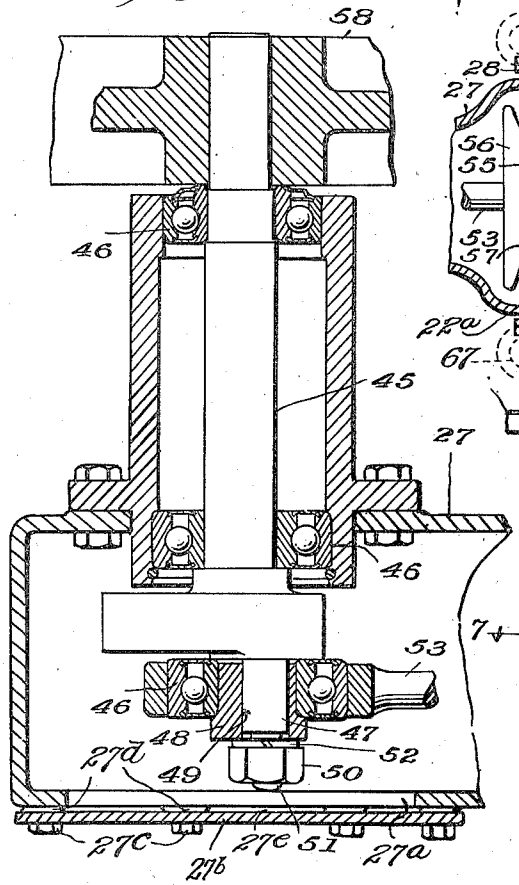


Fig. 4.

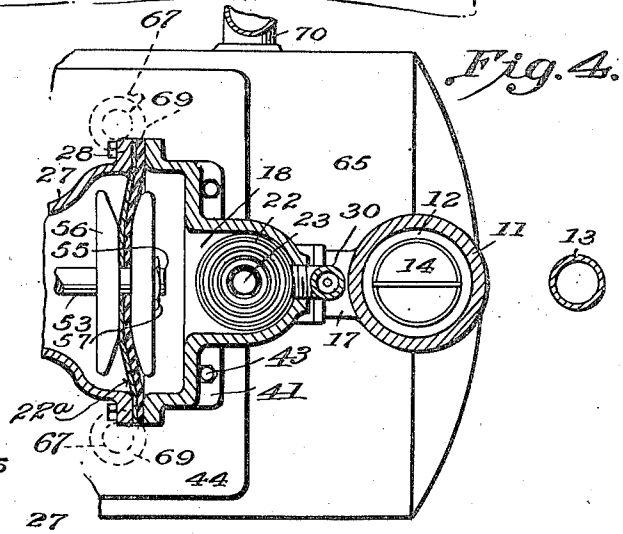


Fig. 6.

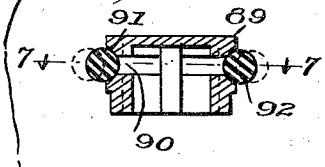
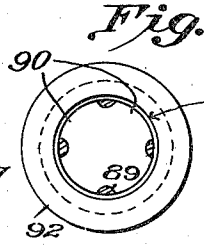


Fig. 7.



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Patented May 17, 1938 2,117,563

UNITED STATES PATENT OFFICE

2,117,563

AUTOMATIC PUMPING MECHANISM

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Application December 17, 1934, Serial No. 757,946

6 Claims. (Cl. 103—150)

This invention relates to a pumping mechanism and aims generally to provide a construction especially, but not necessarily, adapted for embodiment in an automatic domestic or household type, and a pump construction of a novel pulsating, positive displacement type, operating with minimum friction, having its moving parts isolated from contact with the material being pumped and so assembled as not to require additional lubrication after leaving the factory.

The invention enables me to dispense with the use of leather cups and associated parts, cylinders, cross-heads, wrist pins, packing glands, springs if desired, and the replenishing of lubricant in the crank case, by employing a crankshaft and a connecting rod and suitable bearings as the sole moving parts for the diaphragm employed; the connecting rod preferably being relatively long to eliminate strain and undue wear on the diaphragm.

A prime object is to provide a construction of pump of the class referred to having the diaphragm upright and the connecting rod substantially horizontal, with all parts readily accessible for inspection and repair, as well as simple, durable and efficient in operation.

Another important object is to provide means for automatically permitting escape of excess air and for maintaining a predetermined amount of cushioning air in the storage tank.

A further object is to provide means in such a system whereby the motor may store up excess energy during that cycle of operation which requires very little power and apply such stored up energy during the period required most, aiding in smoother and quieter operation.

Additionally I aim to provide such a pumping system as has the operating parts resiliently or equivalently mounted and wherein the pump is embodied in an automatic apparatus as shown in accompanying drawings and hereinafter more fully described.

Various additional objects and advantages will hereinafter be pointed out and others will become apparent from a consideration of said drawings taken in connection with the accompanying description.

In said drawings:

Fig. 1 is a view of one form of the improved apparatus, partly in elevation and partly in section;

Fig. 2 is an enlarged detail section particularly illustrating the valves of said apparatus;

Fig. 3 is a horizontal sectional view taken adjacent the crank shaft of said apparatus;

Fig. 4 is a horizontal sectional view taken across the diaphragm, pumping chamber and priming chamber;

Fig. 5 is a view of a modified form, partly in side elevation and partly in section;

Fig. 6 is a central vertical section through one of the valve devices used in said modified form, and

Fig. 7 is a detail section taken on the line 7—7 of Fig. 6.

Referring specifically to the drawings wherein like reference characters designate like or corresponding parts, 10 designates a pumping unit having a casing 11, preferably of suitable sectional construction, having a priming chamber 12 with which a suction inlet pipe 13 is connected and which pipe communicates with a well or other source of water or fluid supply. In priming chamber 12, a removable bucket strainer 14 is preferably disposed, while a vacuum chamber 15 caps the priming chamber.

Said casing 11 has a diaphragm or suction chamber 16 communicating with the priming chamber by means of a conduit or passage 17 and an air and discharge chamber 18 surmounts and communicates with the suction chamber 16. Spaced apart, horizontal walls 19 and 19' are formed in the suction chamber 16, having one or more fluid-inlet ports 20 and 20' therethrough, over which disk valves 21 and 21' of metal, rubber or other suitable material are disposed, which are urged into contact with the said walls 19 and 19' by expansive springs 22 engaging the same and also engaging heads 23 on studs 24, which the springs surround, and on which said valves 21 and 21' are slidable. Studs 24 may be screwed to the walls 19 as shown at 25. The outlet or discharge pipe of the pump is shown at 26 leading from the chamber 18 close to the valve 21 therein.

Particular attention is directed to the fact that the casing 11 is formed with a vertical open side, being the left hand side in Figure 1 and this side or opening is closed water-tight by a diaphragm 22' of rubber or other suitable flexible material and which is operable to actuate the pump by providing the necessary pulsations. Said diaphragm preferably has a leather backing 22^a to increase its life by minimizing chafing and wear.

A horizontal crank case 27 is open at its right hand end in said Fig. 1 and said end is fastened against the diaphragm 22', bolts 28 preferably passing through said end, the diaphragm and portion of the open side of the casing; the diaphragm thus functioning as a closure for the

open side of the casing, and also as a gasket, as well as being readily accessible for inspection and replacement.

An L-shaped valve body or tube 30 is connected to and communicates with the casing 11 between the valves 21 and 21', with the suction chamber 16, having a ball check valve 31 therein urged to its seat to cut off the inlet of air by an expansive spring 32. Another ball check valve 33 is located in tube 30 and movable to and from seats 34 and 35. On the suction stroke of the pump, air is drawn into the suction chamber through tube 30, past valves 31 and 33, the latter valve being loose in the tube and moves from seat 34 to seat 35. When it engages the seat 34, the intake of air through the tube 30 is cut off. Thus the amount of air permitted to enter is limited. It is controlled by the extent of the movement of said valve 33 between its seats. On the opposite stroke of the pump, valve 33 is forced against its seat 35 to prevent the escape of water or other fluid to the atmosphere.

Attention is directed to another valve or ball 36 carried by a cage 37 disposed in an interior wall of chamber 18, the ball being loose in the cage and movable between a seat 38 and a pin 39, the seat being grooved or channeled at 40 whereby it is never fully closed by the ball so that water may leak from chamber 18 past the ball 36. This leakage occurs below the point where water enters discharge pipe 26 so as to keep the entrance to the pipe sealed with water to maintain a high suction efficiency.

Said casing 11 and crank case 27 have legs 41 and 42, respectively bolted or otherwise secured at 43 to a platform or base 44.

A transversely disposed crank shaft 45 is journalled in a plurality of lubricant-filled and sealed ball bearing devices or equivalent at 46 and the crank 47 of that shaft is disposed within the crank case 27. On said crank, a sleeve 48 is disposed by means of an eccentric bore 49 and which sleeve is fastened rigidly in place, in any adjusted position by a nut 50 threaded on a stud 51 on the crank, a lock washer 52 preferably being interposed. A horizontal connecting rod or pitman 53 is journalled on said sleeve 48 and is connected to the diaphragm. The adjustment of the sleeve 48 previously referred to, controls the throw of the connecting rod. Said parts are accessible for adjustment through an opening in the crank case at 27^a which is closed by a plate 27^b bolted to the crank case at 27^c. Said plate, about the bolt holes thereof, has bosses 27^d to space the plate between the bolts from the crank case at 27^e to enable breathing of the device to relieve any pressure or partial vacuum on the diaphragm.

Reverting to the connection of the connecting rod and diaphragm, an abutment 54 is formed on the connecting rod beyond which a stud 55 extends. On this stud 55, two reversely dished washers or plates 56 of bronze or other suitable metal, with the diaphragm 22' therebetween, are strung and then clamped tightly together and against the abutment 54 by a nut 57 screw threaded on the stud 55. This construction permits access to all of the parts for inspection and repair and as all of the various bearings, such as 46 are filled at the factory with suitable lubricant, the interior operating parts will seldom and perhaps never require replenishing of the lubricant throughout the life of the apparatus.

On shaft 45, a pulley wheel 58 is fastened and trained thereover is a driving belt 59, preferably a V-belt which is driven in any suitable manner from an electric motor 60, whose shaft 61 carries a fly-wheel 62. Feet 63 on said motor 60 are bolted as at 64 to the base 44.

Said base 44 is mounted directly over a hydropneumatic tank 65 supported by feet 66 or otherwise on a suitable foundation. The base and tank have aligned studs 67 and 68, respectively over which are telescoped, removable rubber or other resilient tubes 69 longer than the two studs engaged thereby so that the studs of the tank and of the base cannot touch through vibration.

The discharge pipe 26 has a lower section 70 disposed out of metallic contact therewith, connected to the tank 65 so as to discharge into the latter. A rubber or other flexible hose 71 is removably telescoped over the free ends of discharge pipe sections 26 and 70, with the aid of conventional clamps 72.

A pipe 73 rises from and communicates with the interior of tank 65, being unconnected to platform 44 and carrying a switch 74 of conventional form to control the supply of electric current from a suitable source, operable by the pressure in tank 65 communicated through pipe 73. From the switch 74, a flexible conducting cable connection leads to the motor 60. As far as my invention is concerned, element 74 need be merely any conventional type of pressure-operated switch. However, in actual practice, it preferably has a thermal element to protect the motor from low voltage and overload, etc., an automatic start and stop switch, and a manual switch.

The water is permitted to flow from or drawn out of tank 65 through a discharge or outlet pipe 75, under conventional control, say of a spigot (not shown).

Should an excess of air be pumped into the tank 65, it will gradually escape from the tank through outlet pipe 75 in view of the provision of an aperture 76 therein. Use of a complicated and expensive air volume control is thus avoided.

Presuming operation, water is drawn into the pump on the suction stroke of diaphragm 22', through pipe 13, priming chamber passage 17, ports 20, (valve 21 being open and valve 21' being closed) into suction chamber 16, air to a limited extent also being drawn in through tube 30 under control of the valves therein, the vacuum chamber 15 insuring a steady suction and the pulsating shocks being cushioned by the air in chamber 18. Leakage occurs past valve 36 because of groove 40. On the discharge stroke of the diaphragm, valve 21 seats and valve 21' opens, the water passing through ports 20' into chamber 18 and thence through pipes 26—70 into tank 65 from which it is withdrawn through pipe 75. When valve 21' is open, valve 33 closes tube 30 against the escape of water. Because of the withdrawal of water through pipe 25, the pressure in the tank 65 fluctuates and as the operation of switch 74 is dependent upon that pressure, due to withdrawal within a limited range, it operates automatically to drive the motor 60, belt 59, pulley 58, crank shaft 45, connecting rod 53, diaphragm 22' and all other parts of the apparatus.

Various changes will be apparent and may be resorted to within the spirit and scope of my invention. For instance, I may use the modified form illustrated in the figures not heretofore specifically referred to. The pump casing 80 of this form has an inlet at 81, priming chamber 82, vacuum chamber 83, passage 84, suction chamber 85 and discharge and air chamber 86, corresponding to and operating like the parts,

13, 14, 15, 17, 16 and 18, respectively. In lieu of the valves 21 and 21', valve structures 87 and 88, respectively, are used, although it is to be understood that the said valves 21 and 21' may also be used in this form, if desired.

Said valve structures 87 and 88 consist of cages 89 fastened to the casing 80 and contain ports 90 therethrough. About said ports, the cages have annular concave seats 91 engaged by contractile rubber ring valves 92. A diaphragm 22a similar to the leather backed diaphragm 22' is mounted and driven by the same means as in the preceding form. On its suction stroke, the lower ring valve 92 is dilated to open the ports of its seat while on the other stroke the remaining ring valve 92 dilates to open its ports while the first mentioned ring valve contracts and closes its ports. In this form, the tube 30 and valves therein, and the valve 36 and cage 37 may be omitted. The casing 80, crank case 95 and motor 96 of this form, are bolted as at 97, 98 and 99 to a base 93 having supporting legs 94. The switch 100, functioning like that at 74, is supported on the base, having a pipe 101, communicating with the pumping chamber of the pump intermediate the valves 87 and 88 to function like that at 73. A discharge pipe 102 leads from chamber 85 to a tank 103, like that at 65, having a draw-off or outlet pipe 104.

It is obvious that the principles of the apparatus may be used not only to pump water but may be adapted for any fluid, air or other gas or mixture of them.

I claim as my invention:—

1. An apparatus of the class described having a pump casing open at one side, a diaphragm closing said side, means to actuate said diaphragm, said casing having a priming chamber, a suction chamber and a discharge chamber, two valves, one to open as the other closes, controlling communication between the chambers and coacting with the diaphagm on the opposite strokes thereof to effect pumping, the casing having a passage for the intake of air into the suction chamber, said passage having two seats therein, a valve movable from one of the said seats to the other seat, said valve being movable through operation of the diaphragm and against one seat to limit the intake of air and against the other seat to prevent discharge through the passage.

2. An apparatus of the class described having a pump casing open at one side, a diaphragm closing said side, means to actuate said diaphragm, said casing having a priming chamber, a suction chamber and a discharge chamber, two valves, one to open as the other closes, controlling communication between the chambers and coacting with the diaphragm on the opposite strokes thereof to effect pumping, the casing having a passage for the intake of air into the suction chamber, said passage having two seats therein, a valve movable from one of the said seats to the other seat, said valve being movable through operation of the diaphragm and against one seat to limit the intake of air and against the other seat to prevent discharge through the passage, said discharge chamber having an outlet, a passage for leakage from said discharge chamber to the suction chamber adjacent said outlet having a seat therein provided with a groove, and a ball to engage the last mentioned seat on the suction stroke of the pump.

3. In combination with an upright flexible diaphragm and means to flex the same, a pumping unit comprising a casing, said casing having a suction chamber closed at one side by said diaphragm, a vertically disposed priming chamber forming part of said casing, a vacuum chamber capping said priming chamber, said casing having an air and discharge chamber substantially parallel to the priming chamber and disposed on a line passing between the priming chamber and diaphragm, said casing having an upper and a lower substantially horizontal wall in the suction chamber in relatively close relation to each other, said casing having a passage leading from adjacent the base of the priming chamber to a port in the said lower wall, the said upper wall having a port therein above the first mentioned port communicating with the lower portion of said air and discharge chamber, and valves for said ports coacting with the diaphragm one to open as the other closes.

4. In combination with an upright flexible diaphragm and means to flex the same, a pumping unit comprising a casing, said casing having a suction chamber at one side thereof, a vertically disposed priming chamber forming part of said casing, a vacuum chamber capping said priming chamber, said casing having an air and discharge chamber substantially parallel to the priming chamber and disposed on a line passing between the priming chamber and diaphragm, said casing having an upper and a lower substantially horizontal wall in the suction chamber in relatively close relation to each other, said casing having a passage leading from adjacent the base of the priming chamber to a port in the said lower wall, the said upper wall having a port therein above the first mentioned port communicating with the lower portion of said air and discharge chamber, the wall of said casing having a part projecting laterally beyond the air and discharge chamber and disposed about the suction chamber outwardly of said upper and lower walls and in direct engagement with the diaphragm.

5. The combination of claim 3 having a conduit forming part of the said passage, said conduit spacing the priming chamber from the suction chamber, and normally closed means connected to the suction chamber in the space between the latter and the priming chamber operable on the suction stroke of the apparatus to enable the diaphragm to draw air into the suction chamber.

6. The combination of claim 4 having a conduit forming part of the said passage, said conduit spacing the priming chamber from the suction chamber, and normally closed means connected to the suction chamber in the space between the latter and the priming chamber operable on the suction stroke of the apparatus to enable the diaphragm to draw air into the suction chamber.

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