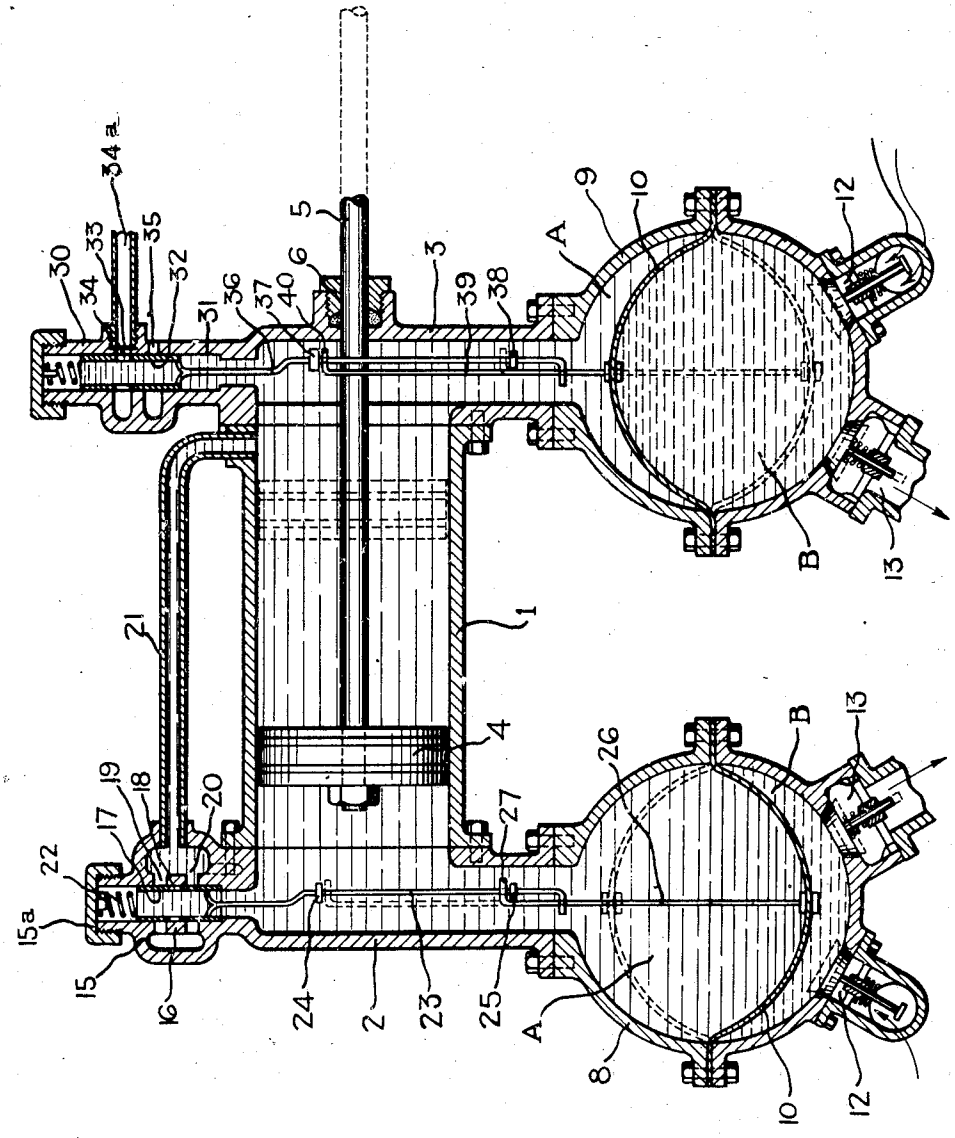
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PUMP

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PUMP

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This invention relates to improvements in pumps, and particularly to pumps wherein the pumping action is resultant to reciprocal movement of a piston within a cylinder; it being the principal object of this invention to provide a pump which retains all of the desirable features of the ordinary types of reciprocating pumps but avoids the most serious disadvantages.

As a matter of explanation, it will be here stated that in most types of reciprocating pumps in which pistons operate to effect the pumping action, the liquid being pumped comes directly into contact with the piston and surfaces along or within which the piston operates, and in the event that the pumped liquid contains gritty or dirty substances, these operate to wear or cut the piston and cylinder surfaces so that leakage or other damage results. Also, should the liquid being pumped contain chemicals, these are apt to damage the packing or walls of the pumping elements so that repair would be required. It is practically impossible to provide a long wearing pump for liquids of a sandy or gritty character when the pumped liquid is permitted to come in contact with the pumping pistons.

In view of the above, it has been the object of this invention to provide a pump in which the principal pumping elements themselves do not at any time come into contact with the liquid being pumped but operate on a suitable, permanently retained liquid, which, in turn, operates through the medium of impermeable, flexible diaphragms to bring about a pumping action by displacement through the flexure of the diaphragms.

Another object of the invention is to provide a compound pump of the above character and to provide means which operates automatically to maintain a certain desired quantity of the liquid in the pump cylinder and heads, and to provide other means which operates automatically to balance the amounts at opposite sides of the pump piston so as to avoid distortion of the diaphragms, that might result from too much or not enough, or what may be termed unbalanced amounts, of liquid at opposite sides of the pump piston.

Other objects of the invention reside in the various details of construction and in the combination of parts, as will hereinafter be described.

In accomplishing these and other objects, I have provided the improved details of construction, the preferred form of which is illustrated in the accompanying drawing, which shows a longitudinal, sectional view of a pump embodied by the present invention.

Referring more in detail to the drawings—

1 designates a pump cylinder that is closed at its opposite ends by the cylinder heads 2 and 3 and within which a pump piston 4 is adapted to be reciprocally actuated by means of a piston rod 5 that operates through a suitably packed opening 6 in the cylinder head plate 3. Connected with opposite ends of the cylinder, through the heads 2 and 3 respectively, are spherically formed chambers 8 and 9, each of which is centrally divided by an impermeable, flexible diaphragm 10 providing in each chamber an upper compartment A and a lower compartment B; the upper compartments communicating with the cylinder at opposite sides of the piston and the lower compartments being completely separated therefrom by the flexible diaphragms.

The lower compartments B of the chambers 8 and 9 are each provided with a valved inlet 12 which, during a pumping operation, would be connected through suitable pipes or tubes, with the liquid to be pumped. They are also provided with valved outlets 13 for connection with a delivery pipe through which the pumped liquid is exhausted. The valves 12 may be of any suitable type and are arranged to open under suction within the chamber B and to close under compression, while the valves 13 are arranged to operate in an opposite direction thereto; that is, they are to close under suction within the chamber B and to open under compression.

In assembling the pump, it is arranged with the piston 4 centrally between the limits of travel and with the diaphragms 10 cen-

trally dividing their chambers. Then, the cylinder and the cylinder heads and all that volume of the chambers above the diaphragms is filled with a suitable liquid, which may be oil or any other substance which will have no damaging effect on the surfaces within which it is confined or which contains no foreign matter which might have a damaging effect on these surfaces.

It is apparent then that reciprocal action of the piston in one direction will, by the force of the liquid from the cylinder end into one of the chambers A and the withdrawal of liquid from the other chamber connected with the opposite end of the cylinder, effect flexure of the two diaphragms in opposite directions, and that reverse movement of the piston accordingly flexes the diaphragms in the opposite direction and this back and fourth movement of the diaphragms will continue in accordance with the back and forth movement of the piston to thereby effect a pumping action for the intaking and exhausting of the liquid being pumped through the lower compartments B of the chambers 8 and 9. The pumped liquid at no time comes in contact with the piston or cylinder walls, but is retained below the flexible diaphragms 10, which may be of rubber, leather, or any other suitable material which may be treated or prepared in a manner to make it suitable for this purpose. It is apparent, also, that during the pumping operation, no strain is placed on the diaphragms themselves regardless of the pressures produced in the pump, since the pressures at opposite sides of the diaphragms are at all times equalized. It is also apparent that the volume of liquid pumped by each reciprocal movement of the piston will be in accordance with the length of travel of the piston and the volume displaced thereby and this may be varied as desired up to a certain length of travel.

For the purpose of maintaining balanced amounts of liquid at opposite sides of the piston, regardless of any leakage that may pass the piston during the pumping action, I have provided an automatic, equalizing valve mechanism comprising the valve housing 15 formed with a cylindrical guide cylinder 16 within which a valve sleeve 17 is slidably contained. The lower end of the valve sleeve is open and communicates with that end of the cylinder, and it is provided centrally between its ends in its side wall with a laterally opening port 18. The valve housing 15 is provided in its side wall with vertically spaced ports 19 and 20, which communicate, through a pipe 21, with the opposite end of the cylinder 1. The valve sleeve 17 is normally held at its medial position of travel by a spring 22 that is connected therewith and with a cap 15ª that closes the top of the valve housing, and when this valve sleeve is at its medial position, the port 18 therein is disposed midway of the ports 19 and 20. A valve rod 23 is connected with the sleeve and depends into the cylinder head where it is provided with two spaced apart stops 24 and 25. A rod 26 is fixed to the diaphragm 10 within the chamber 8 and this extends upwardly and, at its upper end, has a loop 27 that is slidable on the rod 23 between the stops 24 and 25. The stops are so arranged on the rod 23 that they will not be engaged by the looped end of the rod 26 so long as the proper amount of liquid is contained in that end of the pump cylinder, but should there be too much liquid in this end, which will cause the diaphragm to be flexed downwardly, or distorted beyond a desired degree, the looped end 27 of the rod 26 will engage with the stop 25 to pull the rod 23 and valve sleeve 17 downwardly to thereby bring the port 18 of the sleeve into registration with the port 20 to permit liquid to flow back from that end of the cylinder through the pipe 21 and to the opposite end of the cylinder. Likewise, if the diaphragm moves upwardly too far because of there not being enough liquid in that end of the cylinder, the sleeve 17 will be actuated upwardly to admit liquid from the opposite end of the cylinder through the pipe 21 into the valve housing 15 and that end of the cylinder. With this mechanism, the desired amounts of liquid in opposite ends of the cylinder is automatically maintained.

I have also provided means for automatically replenishing the supply of liquid within the pump cylinder, and for this purpose, I have provided the cylinder head 3 with an upward extension 30 forming a cylinder 31 within which a valve sleeve 32 is slidably contained. The sleeve is open at its lower end to the cylinder and is provided in its side wall with a port 33 normally registering between a supply inlet 34 and an exhaust port 35. The supply port connects with a pipe 35ª leading from a supply of liquid. A rod 36 connects with the lower end of the valve sleeve and this depends downwardly within the cylinder and is provided at vertically spaced intervals with stops 37 and 38. A rod 39 is fixed to the diaphragm 10 in the chamber 9 and this extends upwardly therefrom and, at its upper end, is provided with a horizontal loop 40 that is slidably contained on the rod 36 between the stops 37 and 38. With this arrangement, should the diaphragm 10 of the chamber 9 move upwardly beyond a certain limit because of there not being enough liquid within that end of the cylinder, the loop 40 at the upper end of the rod 38 will engage with the stop 37 to shift the valve sleeve 32 upwardly to bring the port 33 in registration with the supply port 34 to thereby admit an additional amount of liquid to the cylinder. Likewise, should the diaphragm 10 be flexed downwardly too far

because of too much liquid in that end of the cylinder, the valve sleeve will be pulled downwardly to bring the port 33 in registration with the outlet port 35 to discharge some of the liquid. Thus, this mechanism operates automatically to maintain the proper amount of liquid within the cylinder.

The principal advantages gained by the construction of a pump of the above character resides in the fact that liquids which, on account of their chemical or physical properties, would be difficult or impossible to pump with the ordinary type of reciprocating pump, are handled without difficulty and without damage to the pump.

Pumps of this type may be made single or double acting and need not necessarily be provided with the automatic controlling features shown.

It is apparent also that various details of construction other than those herein illustrated may be employed without departing from the spirit of the invention and, for this reason, it is not desired that the claims be limited only to the details shown.

Having thus described my invention, what I claim as new therein and desire to secure by Letters-Patent, is:

1. In a pump comprising a cylinder, a piston reciprocally operable in the cylinder, pumping chambers connected with opposite ends of the cylinder, flexible diaphragms dividing the pumping chambers, said chambers having valved inlets and valved outlets at one side of the diaphragm and a liquid pumping medium filling the cylinder and chambers between the piston and the other sides of the diaphragms, and means associated with the cylinder for automatically maintaining a predetermined amount of pumping medium in the cylinder, and means for automatically maintaining a predetermined amount of the medium at the opposite sides of the piston.

2. In a pump comprising a cylinder, a piston reciprocally operable in the cylinder, pumping chambers connected with opposite ends of the cylinder, flexible diaphragms dividing the pumping chambers, said chambers having valved inlets and valved outlets at one side of the diaphragm and a liquid pumping medium filling the cylinder and chambers between the piston and the other sides of the diaphragms, and means provided for automatically maintaining predetermined amounts of liquid in the cylinder at opposite sides of the piston and which is operated by abnormal flexure of the diaphragm of one of said chambers.

3. A pump as in claim 2, wherein means is provided for automatically maintaining a predetermined amount of pumping liquid in the cylinder and which is operated by the abnormal flexure in either direction of the diaphragm of one of said pump chambers.

4. A pump of the character described, comprising a cylinder, a piston reciprocally operable therein, pump chambers connected with opposite ends of the cylinder, flexible diaphragms dividing the pump chambers; said chambers having valved inlets and valved outlets at one side of the diaphragm, a liquid pumping medium filling the cylinder and chambers at the other side of the diaphragms through which reciprocal action of the piston in opposite directions effects flexure of the diaphragms in opposite directions for producing pumping action in the chambers for the intaking and discharge of liquid through said valved inlets and outlets, a valve housing connected with opposite ends of the cylinder and through which liquid may be transferred from one side of the piston to the other, a valve in said housing for controlling the flow of liquid and means operable by abnormal flexure of one of the diaphragms in either direction for moving the valve to open position.

5. A pump of the character described, comprising a cylinder, a piston reciprocally operable therein, pump chambers connected with opposite ends of the cylinder, flexible diaphragms dividing the pump chambers; said chambers having valved inlets and valved outlets at one side of the diaphragms, a liquid pumping medium filling the cylinder and chambers at the other side of the diaphragms through which reciprocal action of the piston in opposite directions effects flexure of the diaphragms in opposite directions for producing pumping action in the chambers for the intaking and discharge of liquid through said valved inlets and outlets, a valve housing connected with opposite ends of the cylinder and through which liquid may be transferred from one side of the piston to the other, a valve in the said housing for controlling the flow of liquid, a valve actuating rod, stops fixed in spaced relation on the rod, a rod fixed to one of said diaphragms and slidable on the valve rod between the stops and adapted to engage with said stops incident to abnormal flexure of the diaphragm for opening the valve.

6. A pump of the character described comprising a cylinder, a piston reciprocally operable therein, pump chambers connected with opposite ends of the cylinder, flexible diaphragms dividing the pump chambers; said chambers having valved inlets and valved outlets at opposite sides of the diaphragms, a liquid pumping medium filling the cylinder and chambers at the other side of the diaphragms through which reciprocal action of the piston in opposite directions effects flexure of the diaphragms in opposite directions to produce pumping action in the said chambers for the intaking and discharge of liquid through said valved inlets and outlets, a valve housing connected with the cylinder and having a port for connection with

a supply of liquid and having a discharge port therein, a valve normally closing said ports and means operable by abnormal flexure in one direction of one of said diaphragms for actuating the valve to open the supply port and operable by abnormal flexure of the diaphragms in the opposite direction for opening the discharge port.

Signed at Seattle, Washington this 24th day of October, 1928.

FREDERICK H. JENSEN.