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(54) Pressure powered liquid pumps

(57) A pressure powered pump has a chamber alternately connected to a supply of gaseous actuating fluid and to exhaust by valve members 18, 20. The valve members are operated by a float acting through an overcentre mechanism 24. The overcentre mechanism has a valve actuating lever 36 pivotal about an axis 32 by action of the float. Pins 46, 48 are provided on the lever 36 for displacement of the respective valve members 18, 20. When the valves are closed, there is a substantial clearance a between the actuating pins 46 48 and the respective valve member or its stem 50. This causes the actuating pin 46, 48 to strike the valve member 18, 20, so assisting its opening movement. Stops 58, 60 are provided to arrest the actuating lever 36 at its stable end positions. This avoids high impact forces being applied to the valve seats 62, 64 by the members 18, 20 when they close.

Figure 2

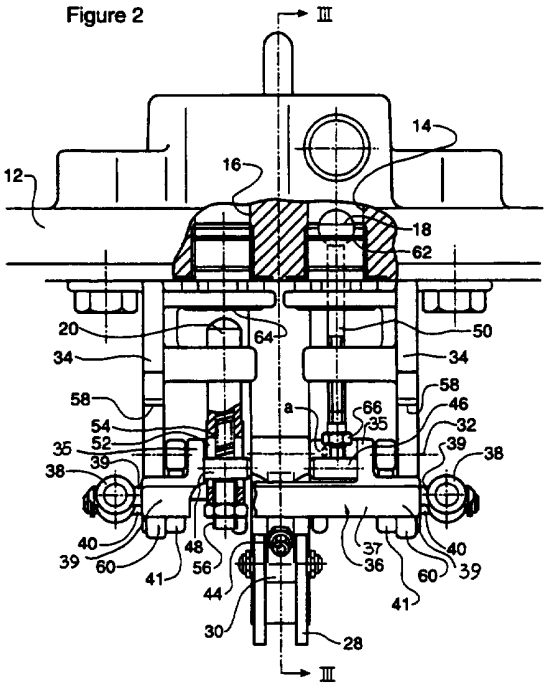

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Figure 1B

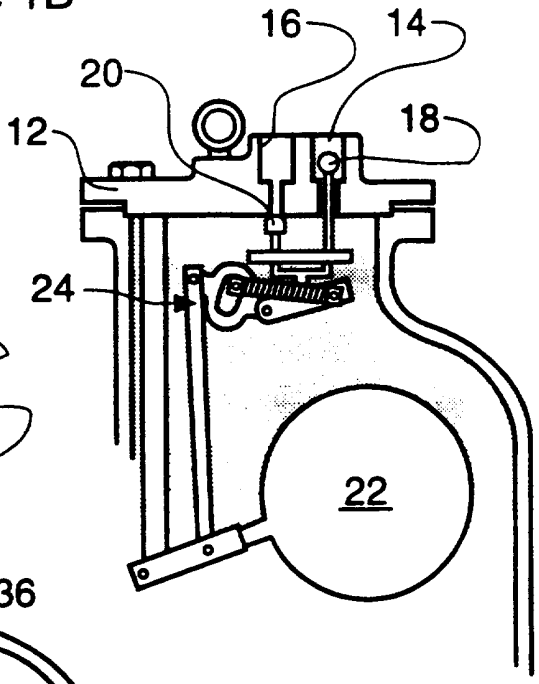


Figure 1A

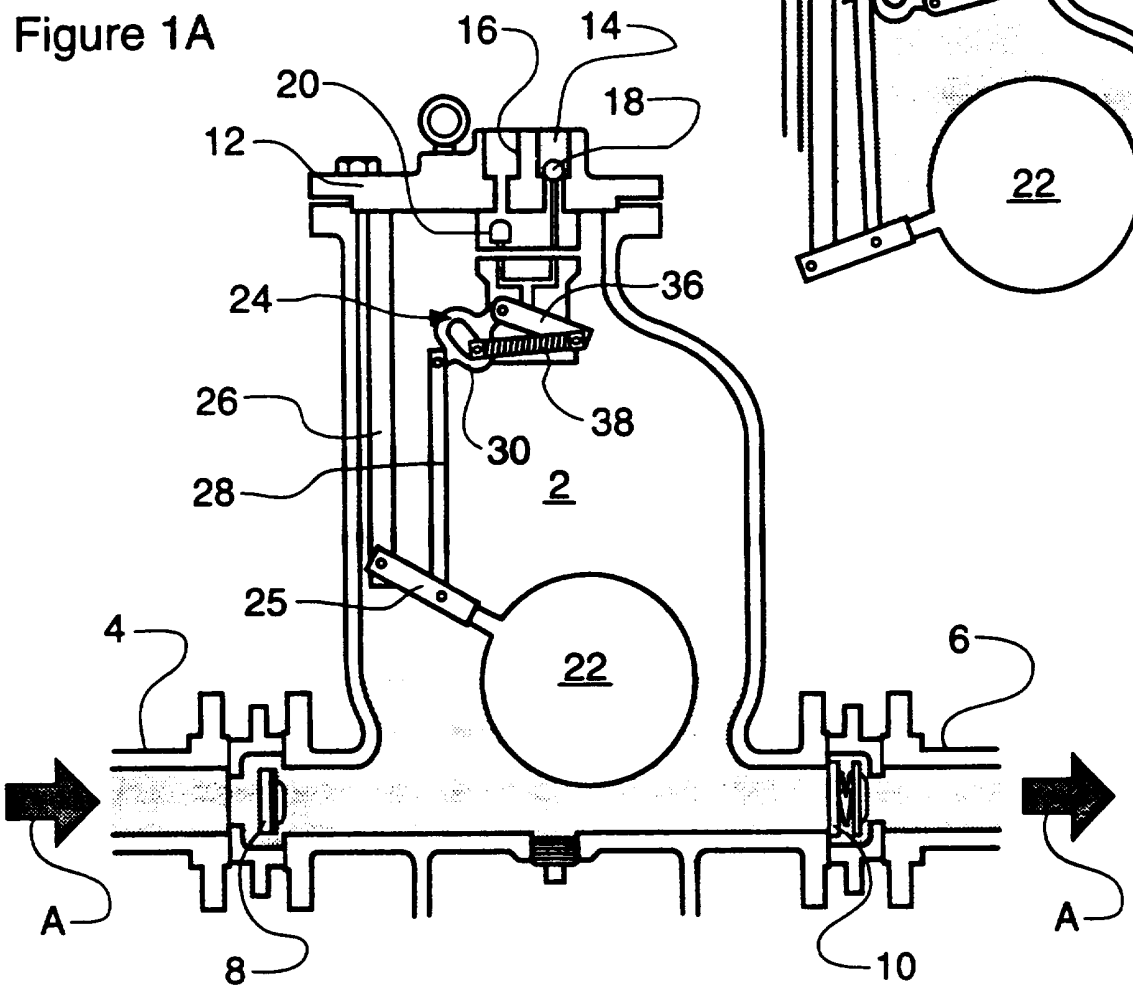
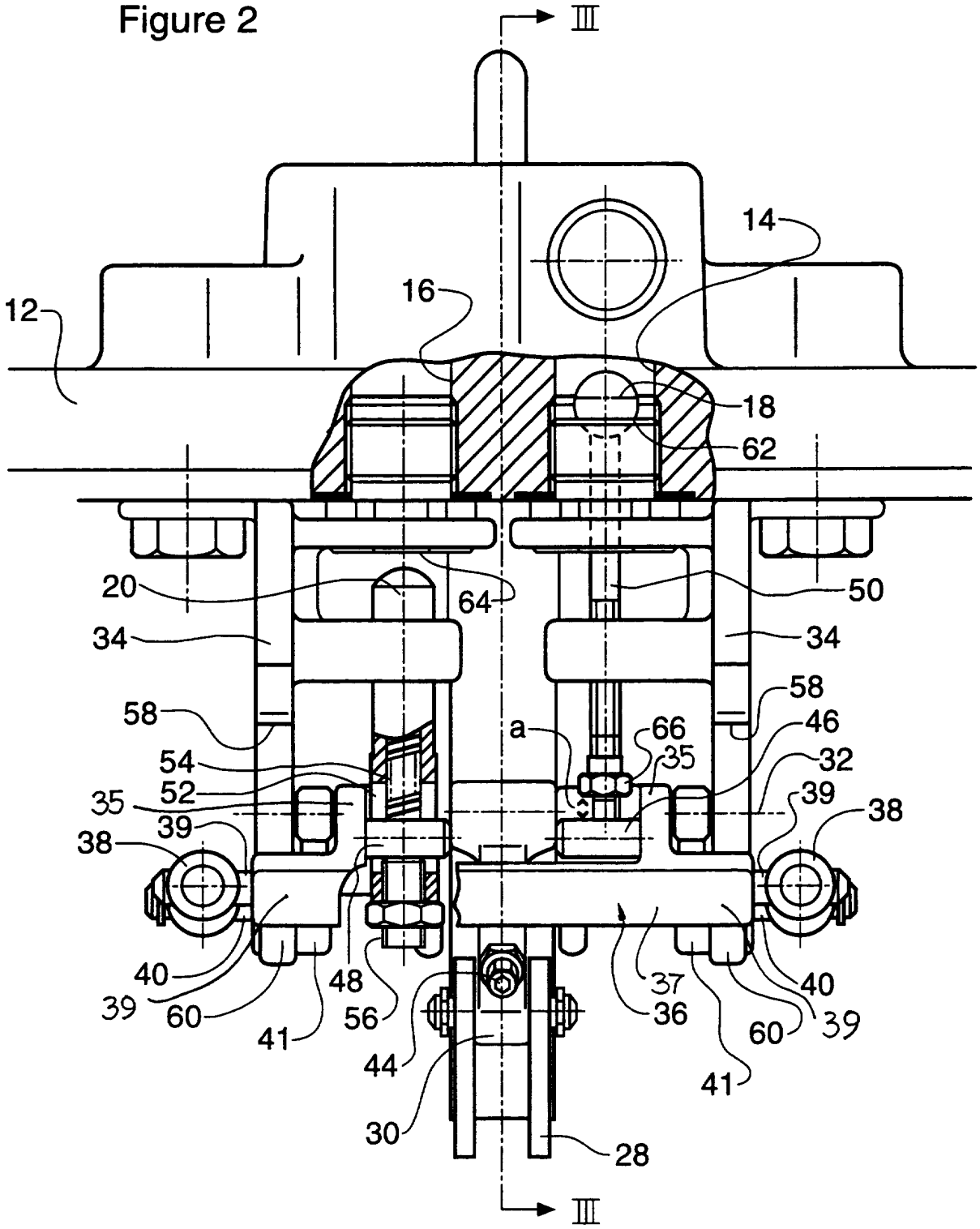


Figure 2


III
14
12
16
18
62
20
64
50
34
34
58
58
a
66
46
54
35
32
52
35
39
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III

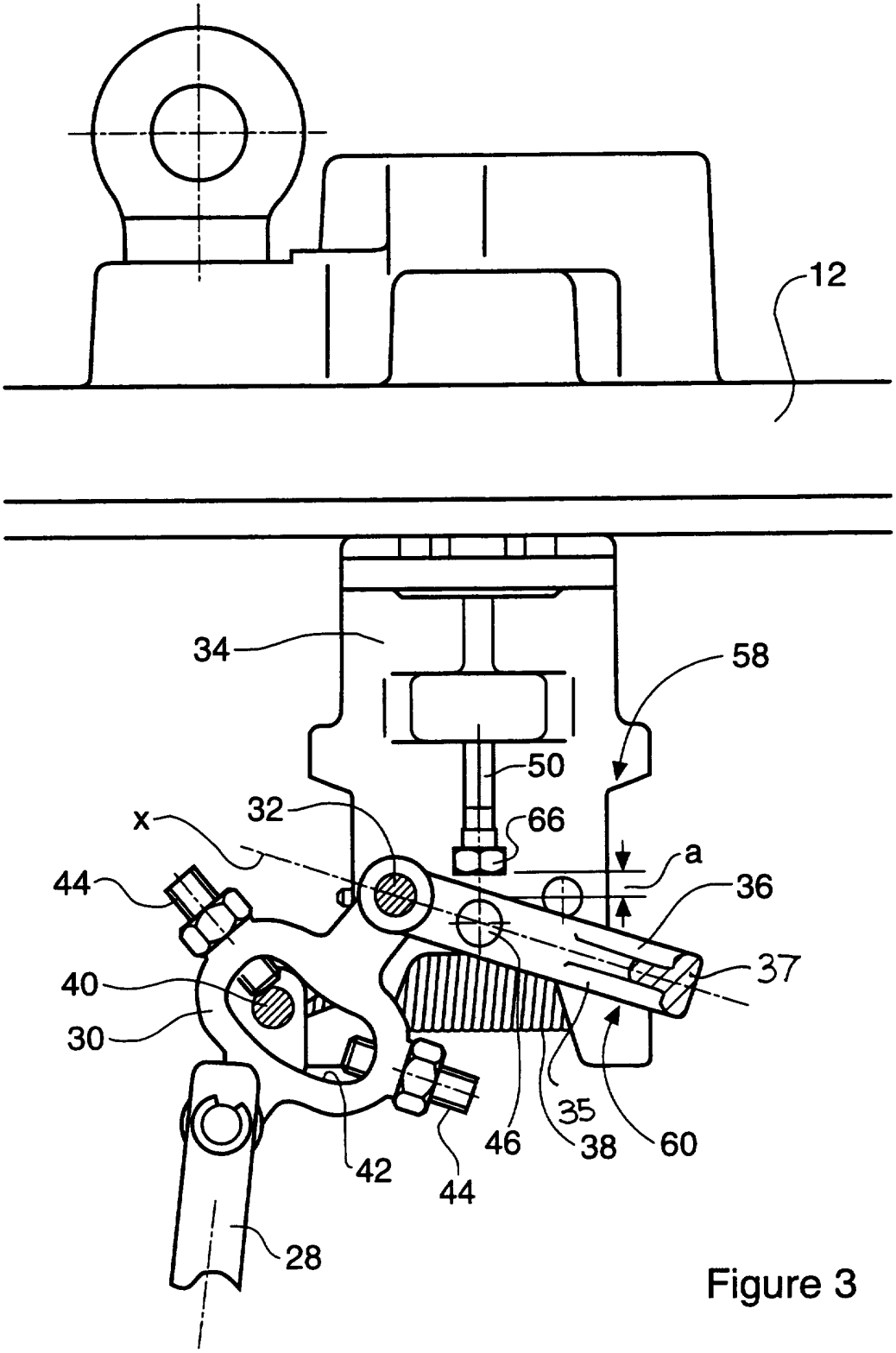

Figure 3

PRESSURE POWERED PUMPS

This invention relates to pressure powered pumps.

Pressure powered pumps are known in which the flow of a liquid into and out of a pumping chamber is controlled by check valves, and in which the pumping action is achieved by the controlled admission of a gas under pressure, such as steam or compressed air, into the pumping chamber. The admission of the compressed gas, and its subsequent venting, is controlled by a float within the pumping chamber which acts on inlet and exhaust valves through a spring-loaded overcentre mechanism. The overcentre mechanism includes valve actuating means which operates the valves. The overcentre mechanism is arrested at its end positions by contact between the valves and their valve seats. This has the disadvantage that the valves and the valve seats are subjected to the force applied by the spring of the overcentre mechanism.

According to the present invention, there is provided a pressure powered pump comprising a pressure chamber having an inlet and an outlet for liquid to be pumped and having an inlet valve and an exhaust valve for a fluid under pressure, the inlet valve and the exhaust valve each comprising a valve seat and a valve member which is displaceable into and out of sealing contact with the valve seat, the valve members being controlled by a float disposed within the pressure chamber, the float being operatively connected to a spring-loaded overcentre mechanism including valve actuating means which acts on the valve members and which is movable between a first stable position, in which the inlet valve is open and the exhaust valve is closed, and a second stable position, in which the inlet valve is closed and the exhaust valve is open, the valve actuating means being mounted for displacement between the first and second stable

positions on a support which is provided with stops for arresting movement of the valve actuating means at the first and second stable positions.

In a preferred embodiment, the valve actuating means is mounted for movement on a support, the stops being provided on the support. The valve actuating means may comprise a lever, the stops being positioned for engagement with the lever to arrest its movement.

For a better understanding of the present invention, and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1A and 1B show a pressure powered pump in two different operative conditions;

Figure 2 is a view, on an enlarged scale, of part of a valve operating linkage of the pump of Figures 1A and 1B; and

Figure 3 is a sectional view taken along the line III-III in Figure 2.

The pump shown in the Figures is a condensate pump for returning condensate in a steam system to the boiler.

The pump comprises a pumping chamber 2 having a condensate inlet 4 and a condensate outlet 6. Check valves 8 and 10 ensure one-way flow through the pumping chamber 2 in the direction of the arrows A.

The chamber 2 has a cap 12 which has a steam inlet passage 14 and an exhaust passage 16 which can be closed by an inlet valve member 18 and an exhaust valve member 20 respectively. The valve members 18 and 20 are operated by a float 22, acting through an overcentre mechanism 24. In operation, starting from the position shown in Figure 1A, the steam inlet passage 14 is closed and the exhaust passage 16 is open. Condensate, under a relatively low pressure, can enter the pumping chamber 2 through the inlet 4 past

the check valve 8. This causes the float 22 to rise and, when it reaches a high level, the overcentre mechanism 24 will snap over from the stable position shown in Figure 1A to the opposite position shown in Figure 1B. This will cause the valve members 18 and 20, which are operated in unison, to move upwards, so that the steam inlet passage 14 is opened and the exhaust passage 16 is closed. Steam under pressure can then enter the pumping chamber 2 to discharge the accumulated condensate past the check valve 10 and through the outlet 6. The float 22 accordingly falls, the overcentre mechanism 24 snaps back to the position shown in Figure 1A, and the sequence begins again.

The float 22 has a float arm 25 by which the float is pivotably supported on a support bracket 26 projecting downwardly from the cap 12. The float arm 25 is pivotably connected by a link 28 to a slotted link 30 of the overcentre mechanism 24. The slotted link 30 is pivotably mounted on a rocker shaft 32 carried by brackets 34 which are secured to the cap 12. Valve actuating means in the form of a lever 36 is also pivotable about the rocker shaft 32, independently of the slotted lever 30. As shown more clearly in Figures 2 and 3. The lever 36 comprises two arms 35 and a cross-piece 37 which extends between them. The cross-piece has projections 39 which extend beyond the arms 35. A pair of tension springs 38 extend between a pair of spigots 39 on the arms 35 and a spindle 40 which is movable within the slot 42 of the link 30. The spindle 40 is carried by a pair of levers 41 which are pivotable about the rocker shaft 32. Adjustment screws 44 are provided at each end of the slot 42.

The valve actuating lever 36 carries two actuating pins 46 and 48. The actuating pin 46 is positioned for engagement with a valve stem 50 of the valve element 18, and the actuating pin 48 is received in a slot 52

of the valve member 20. A spring 54 received in a bore formed in the valve member 20 biases the valve member 20 relatively to the actuating pin 48 so as to maintain engagement between the lower face of the actuating pin 48, constituting a contact face, and an adjustment screw 56.

As shown in Figures 2 and 3, there is a clearance a between the actuating pin 46 and the end of a valve stem 50 of the valve member 18. A similar clearance (not shown) exists between the actuating pin 48 and the adjustment screw 56 when the valve member 20 is closed.

Upper stops 58 and lower stops 60 are provided on the brackets 34, positioned for engagement by the cross-piece projections 39 of the valve actuating lever 36.

Valve seats 62 and 64 are provided for engagement by the valve members 18 and 20 respectively.

In the position shown in Figures 2 and 3, the valve member 18 is in sealing contact with its seat 62, while the valve member 20 is lowered by the actuating pin 48 from its seat 64. Consequently, the condensate pump is in the condition shown in Figure 1A and the pumping chamber 2 can fill with condensate. Air or steam within the pumping chamber 2 is vented through the exhaust passage 16.

As the level of condensate in the pumping chamber 2 rises, the slotted link 30 will turn about the rocker shaft 32 in a clockwise direction as seen in Figure 3. Eventually, this will cause the right-hand adjustment screw 44 (as seen in Figure 3) to engage the spindle 40, following which further turning of the slotted link 30 will carry with it the spindle 40, so extending the springs 38. The tension applied by the springs 38 to the valve actuating lever 36 will be resisted by the stops 60.

Eventually, the spindle 40 will cross the notional

plane X which contains the axis of the rocker shaft 32 and the axes of the spigots 39 which connect the springs 38 to the valve actuating lever 36. When this happens, the springs 38, instead of biasing the valve actuating lever 36 in a clockwise direction, as seen in Figure 3, will cause the valve actuating lever 36 to turn rapidly in the counter-clockwise direction. As the clearance *a* is taken up, the valve actuating lever 36 will gain kinetic energy which will result in the valve stem 50 being struck by the actuating pin 46 with a significant force, so assisting the remaining potential energy in the springs 38 in lifting the valve member 18 off the seat 62 against the pressure of the steam in the upper part of the passage 14.

The same movement of the valve actuating lever 36 will cause the actuating pin 48 to rise, so lifting the valve member 20, through the spring 54, into sealing contact with the seat 64 to close the exhaust passage 16. At the end of its stroke, the cross-piece projections 39 of the valve actuating lever 36 engage the stops 58, and the valve member 20 will be retained against the seat 64 by the force of the spring 54. In this condition, the lower face of the pin 48 will be lifted above the end of the adjustment screw 56, so leaving a clearance corresponding to the clearance *a* shown between the upper face of the pin 46 and the lower end of the stem 50.

As the float falls, it will eventually cause the slotted link 30 to turn the spindle 40 in the opposite direction, eventually causing the valve actuating lever 36 to return to the position shown in Figure 3. This will cause the actuating pin 48 to strike the adjusting pin 56 to move the valve member 20 away from the seat 64. Also, the corresponding downwards movement of the actuating pin 46 will allow the valve member 18 to return into sealing contact with the valve seat 62.

The adjusting screw 56 and a corresponding adjusting screw 66 on the lower end of the valve stem 50 enable the clearance between the valve members 18 and 20 and the actuating pins 46 and 48 to be adjusted to provide the optimum opening force on the valve members 18 and 20 as the valve actuating lever 36 moves between its two stable end positions defined by the stops 58 and 60. By arresting the valve actuating lever 36 against the stops 58 and 60, the valve members 18 and 20, when closed against their respective valve seats 62 and 64 are not subjected to the force applied by the springs 38. As a result, the valve members 18 and 20 and the valve seats 62 and 64 do not suffer high impact forces when closing, and consequently wear in the seating surfaces can be reduced.

CLAIMS

1. A pressure powered pump comprising a pressure chamber having an inlet and an outlet for liquid to be pumped and having an inlet valve and an exhaust valve for a fluid under pressure, the inlet valve and the exhaust valve each comprising a valve seat and a valve member which is displaceable into and out of sealing contact with the valve seat, the valve members being controlled by a float disposed within the pressure chamber, the float being operatively connected to a spring-loaded overcentre mechanism including valve actuating means which acts on the valve members and which is movable between a first stable position, in which the inlet valve is open and the exhaust valve is closed, and a second stable position, in which the inlet valve is closed and the exhaust valve is open, the valve actuating means being mounted for displacement between the first and second stable positions, stops being provided for arresting movement of the valve actuating means at the first and second stable positions, independently of the valve members.

2. A pressure powered pump as claimed in claim 5, in which the valve actuating means is mounted for movement on a support, the stops being provided on the support.

3. A pressure powered pump as claimed in claim 2, in which the valve actuating means comprises a lever which is pivotably mounted on the support, the stops being positioned for engagement by the lever.

4. A pressure powered pump as claimed in claim 3, in which the lever comprises two arms, which are pivotably mounted on the support, and a cross-piece which extends between the arms and which, in operation, engages the stops.

5. A pressure powered pump as claimed in claim 4, in which the support comprises a pair of brackets,

the arms of the lever being disposed between the brackets and the cross-piece having projections extending beyond the arms for engagement with the stops.

6. A pressure powered pump substantially as described herein with reference to, and as shown in, the accompanying drawings.

Patents Act 1977 9 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9526146.7
Relevant Technical Fields (i) UK Cl (Ed.O) F1R (ii) Int Cl (Ed.6) F04F 1/06; F16K	Search Examiner MR B DENTON Date of completion of Search 21 FEBRUARY 1996
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1-6

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A:	Document indicating technological background and/or state of the art.	**&:**	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	US 5141405 (FRANCART) whole document	1

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