June 26, 1962 B. W. WHITEHURST 3,040,671

GRAVITY ACTUATED PUMP

Filed Jan. 11, 1960 3 Sheets-Sheet 1

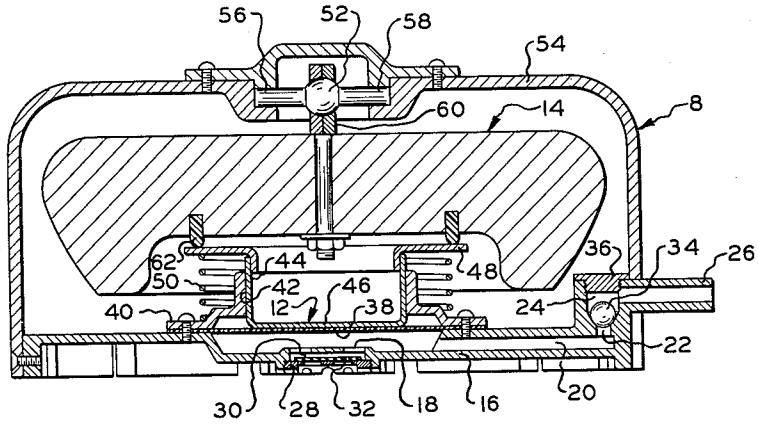

FIG. 1

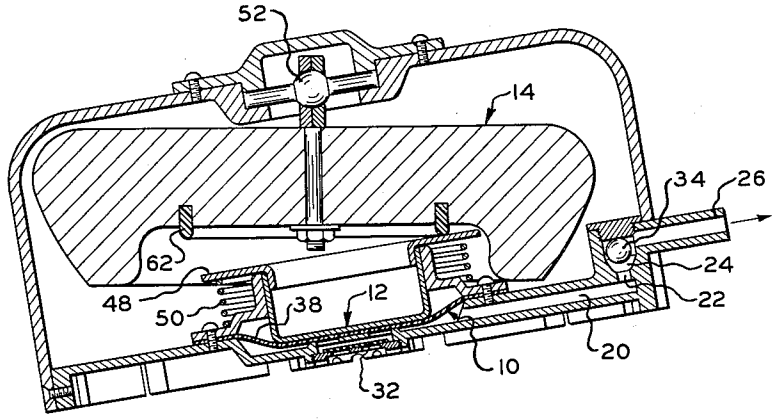

FIG. 2

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June 26, 1962 B. W. WHITEHURST 3,040,671

GRAVITY ACTUATED PUMP

Filed Jan. 11, 1960 3 Sheets-Sheet 2

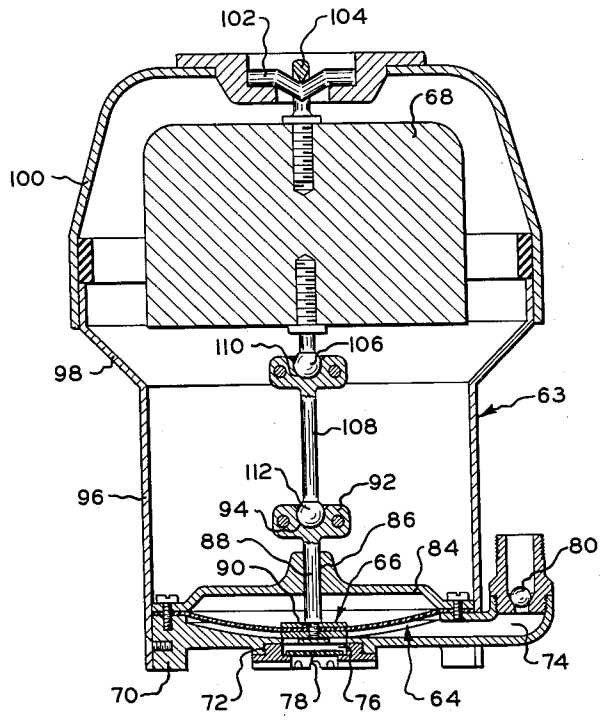

FIG. 3

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GRAVITY ACTUATED PUMP

Filed Jan. 11, 1960 3 Sheets-Sheet 3

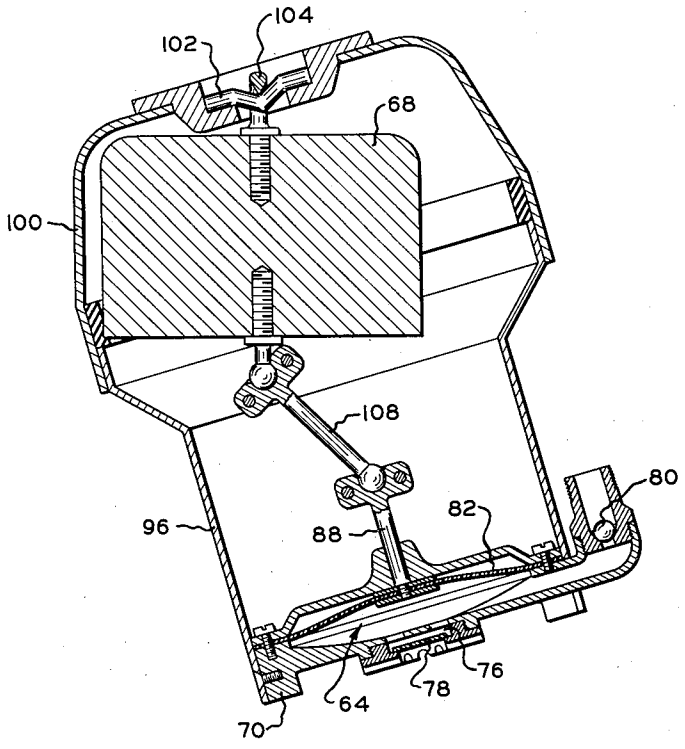

FIG. 4

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GRAVITY ACTUATED PUMP

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9 Claims. (Cl. 103—150)

The present invention relates to the pumping of fluids and, more particularly, to a versatile gravity actuated pump of a type capable of taking advantage of the rocking motion of a boat or the like in order to eject therefrom any water which has seeped or flowed thereinto.

The primary object of the present invention is to provide, in such a pump, a novel assembly of components including a pressure chamber having an input check valve and an output check valve that operate mutually exclusively, a pressure member defining the pressure chamber in part and a weight universally connected to the housing and universally connected to the pressure member. The construction is such that any motion of the weight whatsoever causes at least part of a stroke of the pressure member. For simplicity and compactness: the input check valve and the pressure chamber are disposed at the lowest possible location to permit any water whatsoever that may be present to enter the pressure chamber as easily as possible; the pressure member operates through a flexible diaphragm which effectively seals the pressure chamber from the remaining operating components of the pump but which transmits force from the pressure member into the pressure chamber; and the pressure member is constrained for reciprocal motion in the housing in response to pivotal motion of the weight. The construction permits water to enter the pressure chamber whenever the housing and the weight are at rest irrespective of their relative positions and permits the slightest motion of the weight away from its vertical position with respect to the housing to impart motion to the pressure member for the transmission to the pressure chamber.

Other objects of the present invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed disclosure, and the scope of which will be indicated in the appended claims.

For a fuller understanding of the nature and objects of the present invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a cross-sectional view of one embodiment of the present invention, in operative condition for the reception of water by its pressure chamber;

FIG. 2 is a cross-sectional view of the embodiment of FIG. 1, in operative condition for the ejection of water from its pressure chamber;

FIG. 3 is a cross-sectional view of another embodiment of the present invention, in operative condition for the reception of water by its pressure chamber; and

FIG. 4 is a cross-sectional view of the embodiment of FIG. 3, in operative condition for the ejection of water from its pressure chamber.

Generally, each of the illustrated embodiments of the present invention comprises a housing, at the base of which is a substantialy flat pressure chamber that is extensive in the horizontal direction and narrow in the vertical direction. This pressure chamber has an entrance flutter valve at its lower face and a water impermeable flexible diaphragm at its upper face and an output ball and seat valve. Operatively connected to the flexible diaphragm is a pressure head that is constrained for reciprocal motion by a suitable vertically oriented guide within the housing. The pressure head is universally pivotally connected to a weight composed of lead or other heavy metal. This weight, in turn, is universally pivotally connected to the housing. (The term pivotal is intended to include slidable and pivotal.) The arrangement is such that any rocking motion of the housing is transmitted, by virtue of the inertial and gravitational tendency of the weight to remain stationary, through the pressure member into the pressure chamber.

FIGS. 1 and 2 disclose a pump of the foregoing type having a housing 8, a pressure chamber 10, a pressure member 12 communicating with the pressure chamber and a weight 14 that is connected for universal pivotal movement with the housing and with the pressure member.

As shown, housing 8 includes a base casting 16 that is provided with a central internally threaded reentrant portion 18 and a port that is formed from the sequence of bores 20, 22, 24 and 26. Turned into internally threaded reentrant portion 18 is an internally threaded cap 28. Both reentrant portion 18 and cap 28 are provided with openings therethrough and define therebetween a disk shaped compartment 30, within which a solid washer 32 is free to move. Seated in port 24 at the entrance to port 22 is a ball 34, which is retained by a cap 36.

A flexible membrane 38, composed for example of rubber, is clamped between base casting 16 and an auxiliary casting 40. Casting 40 provides a flat lower face which cooperates with a corresponding face of base casting 16 to securely clamp the edges of diaphragm 38 therebetween. Casting 40 provides a vertical bore 42. Vertically reciprocable in bore 42 is the tubular stem 44 of pressure member 12, the closed end face 46 of which abuts against diaphragm 38 and the upper end of which is provided with an outwardly turned circular flange 48. Face 46 normally is urged into its most upward position by a helical spring 50, the opposite ends of which extend between flange 48 and casting 40.

Weight 14 is universally pivoted at its center by a ball joint 52, the spherical bearing of which is mounted on the cover 54 of housing 8 by opposite extending rods 56 and 58 and the face of which is connected to weight 14 as at 60.

It is apparent that pressure and chamber components may be assembled separately and that the weight and bearing components may be assembled separately in such a way that when the two sub-assemblies are integrated, weight 14 and flange 48 are operatively connected by an annulus 62. In operation, normally weight 14 is at rest with respect to the remainder of the housing so that water may enter through the apertures in cap 28, compartment 30 and the apertures in reentrant portion 18 into pressure chamber 10. The slightest rocking motion of the housing permits weight 14 to maintain its gravitational and inertial position but imparts a downward motion as shown in FIG. 2 to pressure member 12. In consequence, the pressure within chamber 10 is increased so that washer 32 checks the apertures in cap 28 and ball 34 rises slightly to permit water to be ejected through ports 16, 20 and 22.

FIGS. 3 and 4 disclose a pump of the foregoing type having, within a housing 63, a pressure chamber 64, a pressure member 66 communicating with the pressure chamber and a weight 68 that is connected for universal pivotal movement with the housing and for universal pivotal movement with the pressure member.

As shown, housing 63 includes a base casting 70 that is provided with a central internally threaded reentrant portion 72 and a port 74 that communicates therewith. Turned into internally threaded reentrant portion 72 is a cap 74 that provides a compartment 76. Compartment 76 contains a solid washer 78 that is capable of closing

the lower entrance or the upper entrance of compartment **76** depending on the differential pressure on its faces. Threaded into the outer extremity of port **74** is a ball and seat output check valve **80**.

A flexible membrane **82** is clamped between base casting **70** and an auxiliary casting **84**. Casting **84** provides a flat lower face which cooperates with a corresponding flat face of base casting **70** to securely clamp the edges of diaphragm **82** therebetween. Auxiliary casting **84** provides a vertical bore **86**. Vertically reciprocable in bore **86** is a rod **88**, the lower end **90** of which is connected to diaphragm **82** and the upper end **92** of which is provided with a ball seat **94**.

Extending upwardly from base casting **70** is a housing body **96** that is flared outwardly at **98**. Extending upwardly from housing body **96** is a housing cover **100** that provides a housing bearing **102**. Weight **68** is universally pivoted at **102** by a hook member **104** to which it is connected. Extending downwardly from weight **68** is a ball **106**. A rod **108** is universally pivoted to both rod **88** and weight **68** by a seat **110** which receives ball **106** and a ball **112** which is received by seat **94**.

In operation, weight **68** when at the position shown in FIG. 4 with respect to the remainder of the housing positively releases diaphragm **82** so that water may enter through compartment **76** into pressure chamber **64**. Then the slightest rocking motion of the housing permits weight **68** to maintain its gravitational and inertial position in such a way that a downward reciprocal motion is imparted to pressure member **88**. In consequence, the pressure within chamber **64** is increased and washer **78** checks the entrance to compartment **76** in order to eject water from output check valve **80**. The universal pivots connecting rod **108** to universally swinging weight **68** and to reciprocating rod **88** exercizes a positive constraint on diaphragm **82**.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted in an illustrative and not a limiting sense.

What is claimed is:

1. A pump comprising a housing, means including a flexible diaphragm in said housing defining a pressure chamber, input check valve means and output check valve means communicating with said pressure chamber, said pressure chamber being defined in part by said diaphragm, a pressure member constrained for motion in said housing in contact with said diaphragm, and a weight for operating said pressure member during relative movement of said weight and said housing, said weight being constrained for motion in connection with said housing and for motion in connection with said pressure member, said housing having pivot means about which said motion occurs relative to said housing, said weight being disposed in said housing intermediate said pivot means and said diaphragm.

2. The pump of claim 1 wherein said connection with said pressure member is slidable and pivotal.

3. The pump of claim 1 wherein said connection with said pressure member includes two universal pivots.

4. A pump comprising a housing, means including a flexible diaphragm in said housing defining a pressure chamber, input check valve means and output check valve means communicating with said pressure chamber, said pressure chamber being defined in part by said flexible diaphragm, a pressure member constrained for motion in said housing in contact with said diaphragm, and a weight for operating said pressure member during relative movement of said weight and said housing, said weight being constrained for universal pivotal motion in connection with said housing and for universal pivotal motion in connection with said pressure member, said housing having pivot means about which said motion occurs relative to said housing, said weight being disposed in said housing intermediate said pivot means and said diaphragm.

5. The pump of claim 4 wherein said connection with said pressure member includes an annulus affixed to said weight and a flange affixed to said pressure member, said annulus and said flange being in slidable and pivotal contact, and a spring urging said flange against said annulus.

6. The pump of claim 4 wherein said connection with said pressure member includes two universal ball joints.

7. A pump comprising a housing, means including an input check valve at the bottom of said housing, means including a flexible diaphragm defining a pressure chamber communicating with said input valve, means including an output check valve communicating with said pressure chamber, a guide affixed to said housing adjacent said diaphragm, a pressure member constrained for reciprocable motio in said guide into abutment with said flexible diaphragm, resilient means urging said pressure member to normal position from said diaphragm, a weight constrained for motion in said housing about a pivot means, said weight being disposed between said pivot means and said pressure member, and means for interconnecting said weight and said pressure member in order that said pressure member is directed toward said diaphragm when said weight moves about said pivot means away from a normal position.

8. The pump of claim 7 wherein said guide has an internal periphery and said pressure member has an external periphery, said internal periphery and said external periphery being relatively movable.

9. The pump of claim 7 wherein said weight is in the shape of an inverted dish partially enveloping said pressure member.

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