

March 20, 1956

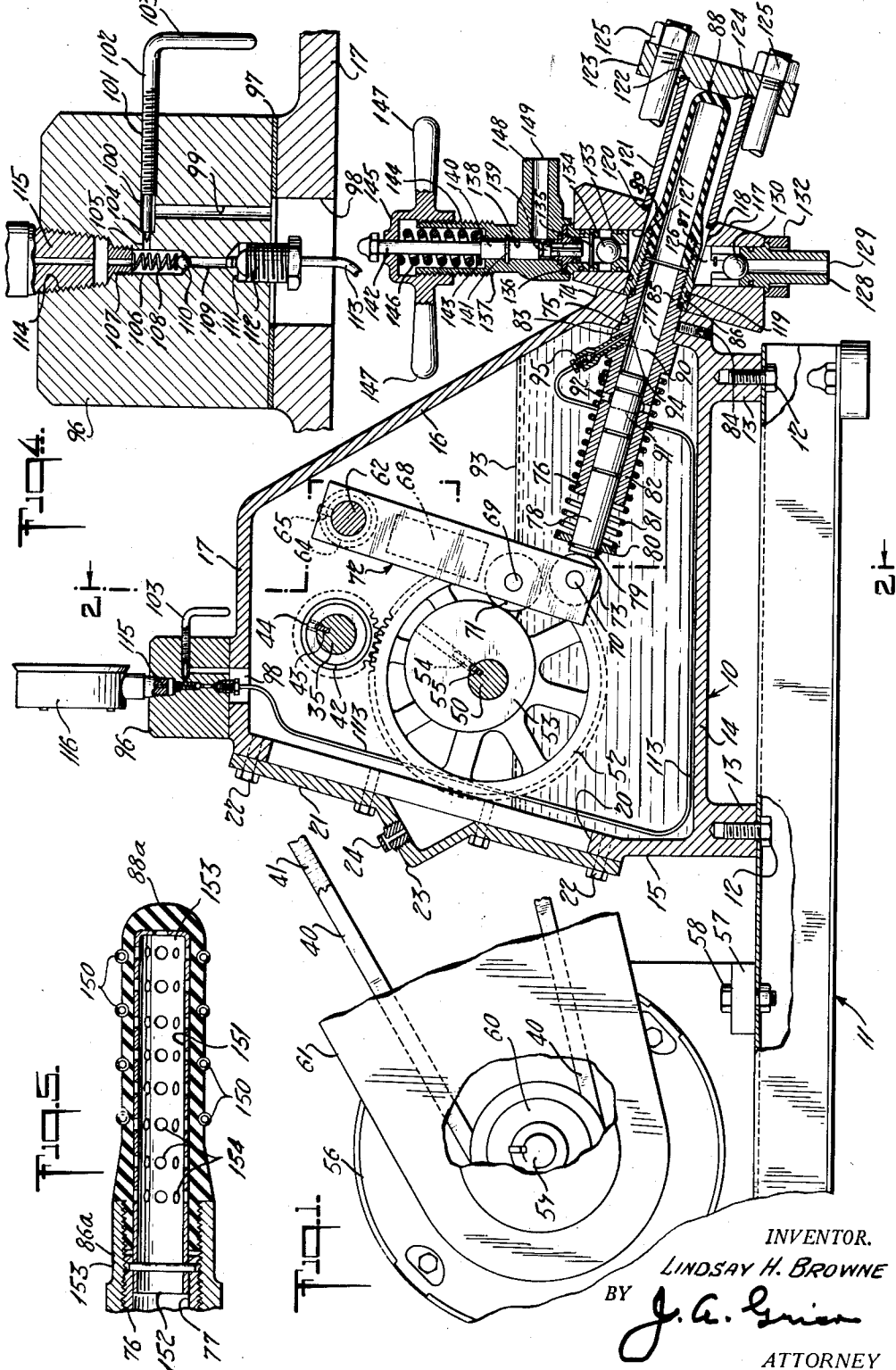
L. H. BROWNE

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PUMPS

Filed June 23, 1950

2 Sheets-Sheet 1



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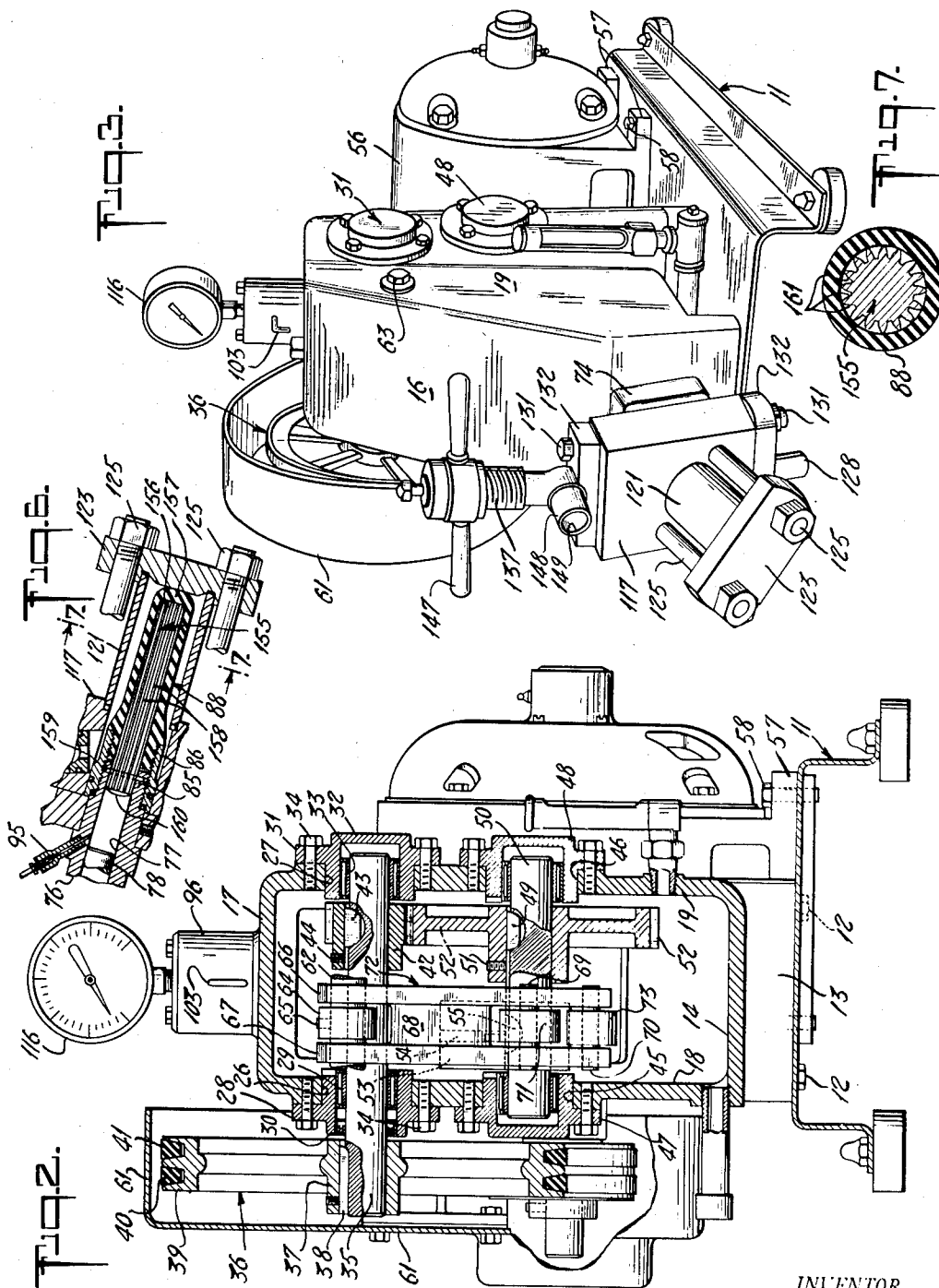
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2 Sheets-Sheet 2



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PUMPS

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Application June 23, 1950, Serial No. 169,840

12 Claims. (Cl. 103—44)

This invention relates to improvements in pumps in which the fluid medium being pumped is isolated from a power pulsed liquid by a diaphragm in the form of an expandable and contractible bulb.

The principal object of the invention is the provision, in a pump, of a chamber comprised in part of a cylinder and in part of an expandable and contractible bulb, said cylinder and said bulb being in axial alignment and inclined to the horizontal with the bulb lowermost so that as liquid enters, the air therein is automatically displaced upwardly, a piston in the cylinder and means to reciprocate it, a body of oil in which said cylinder is submerged, a hole in said cylinder which is uncovered by the end of the piston as the latter is moved outwardly on its reciprocal stroke, thereby allowing air to move out of and oil to enter said cylinder and the interior of said bulb, and the provision of a separate chamber, about the exterior of said bulb, said chamber having inlet and discharge valves.

Another object of the invention is the provision of a quickly demountable chamber to facilitate the cleaning out of the chamber, the inlet and discharge valves and the outer surface of the bulb, when it is desired to change the pump over to pump a different medium.

A further object of the invention is the provision of a solid filler within said bulb having a diameter slightly smaller than the interior of the bulb to insure maximum volumetric efficiency.

Yet another object of the invention is the provision of a cylinder and piston arrangement of the character described, including the hole in the cylinder wall which is uncovered by the piston as it approaches its maximum travel outwardly on its suction stroke, the cylinder and piston being submerged in a bath of oil, wherein an accurately measured body of oil pulses the bulb each time the piston moves inwardly on its compression stroke, and this obtains at all times because with this arrangement the measured body of oil cannot vary to the slightest degree.

Another object of the invention is the provision in a pumping device of the character described, of a conduit leading from the interior of said cylinder, at a point not covered by the piston on its compression stroke, to a gauge for indicating the pressure of said compression stroke, check valve means being between the conduit and the gauge to obviate fluctuations, and means by passing said valve to be made effective when desired.

Other objects and advantages of the invention will be apparent to those skilled in the art upon a study of this specification and the accompanying drawings.

Referring to the drawings which show by way of example, one embodiment of the invention:

Figure 1 is an elevation, partly in section, showing a complete motor driven form of the invention;

Figure 2 is a sectional elevation, taken along the line 2—2 of Figure 1;

Figure 3 is a perspective view of the pump, as seen

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from the end on which the isolated pumping chamber is secured;

Figure 4 is an enlarged sectional elevation showing the pressure gage, its check valve, and means to by-pass the latter;

Figure 5 is a cross-sectional view of a modification of the expandable and contractible bulb and showing a perforate member therein;

Figure 6 is a longitudinal cross-sectional view of the bulb and a portion of the cylinder like that shown in Figure 1 with the exception that a solid member is positioned in the bulb and secured in the cylinder; and

Figure 7 is an enlarged sectional view taken along the line 7—7 of Figure 6.

Referring first to Figures 1 and 2, a casing 10 has feet 13 secured to a base 11 by means of cap screws 12. The casing includes a bottom wall 14, side walls 15 and 16, a top wall 17, and end walls 18 and 19.

The side wall 15 has a rectangular opening 20 formed therein which is provided with a closure plate 21, which is secured onto the wall 15, with a suitable gasket (not shown) therebetween, by means of cap screws 22 engaging tapped holes in said wall about the opening 20. The closure plate 21 has a protruding extension 23, the cross-section of which is in the form of an inverted L, and the upper web of this extension has a tapped filler hole which is closed by a threaded plug 24 which may be removed when it is necessary to put oil into the casing 10. The proper oil level is indicated by the numeral 93 in Figure 1.

Formed in the end walls 18 and 19 are aligned holes 26 and 27 respectively. Mounted in the hole 26 is a flanged open bushing 28 carrying a roller bearing 29. Mounted in the hole 27 is a flanged bushing 31 having a closed end 32 and carrying a roller bearing 33. These flanged bushings are secured to the end walls by means of cap screws 34 engaging threaded holes in said end walls.

Supported by the bearings 29 and 33, is a shaft 35 which has a portion extending through the bushing 28, a running seal 30 being provided between the shaft and the outer end of the bushing to prevent any loss of oil therethrough from the interior of the casing 10.

A pulley 36 has a hub 37 mounted on the extending portion of the shaft and is keyed thereon by means of a key 38 disposed in matched key slots in the shaft and the hub, and secured by set screws or in any other suitable manner. The pulley 36 has spokes extending outwardly to a rim portion 39 which has shives formed therein to accommodate V belts 40 and 41.

Mounted on the shaft 35 within the casing 10, is a pinion 42, and a "Woodruff" key 43 in the shaft engages a key slot in the pinion. A set screw 44 prevents the pinion from shifting axially.

Spaced apart from the holes 26 and 27, in the end walls 18 and 19, are aligned holes 45 and 46 respectively, and mounted in the holes 45 and 46 are flanged bushings 47 and 48, which may be identical with the bushing 32. The bushings 47 and 48 also carry roller bearings like the roller bearing 33, and supported in the roller bearings in bushings 47 and 48 is a shaft 50 upon which a gear 52, meshing with the pinion 42, is mounted. The gear 52 has a key slot which engages a "Woodruff" key 49 in the shaft 50, and a set screw 51 engaging the shaft prevents the gear from shifting axially.

A cam or eccentric 53 engages a key 55 in the shaft and is secured on the shaft against axial movement by a set screw 54.

An electric motor 56 has feet 57 secured to the base 11 by means of bolts 58, and mounted on the shaft 59 of this motor is a pulley 60 with grooves therein to accom-

modate the belts 40 and 41. A belt guard 61 spans the pulleys 36 and 60 and the belts 40 and 41 thereon.

A shaft 62 is supported in bushings 63 mounted in aligned threaded holes in the walls 18 and 19, and a collar member 64 is secured against axial movement on the shaft 62 by a set-screw 65 engaging the shaft. A bar member 66 has a bearing on its upper end journaled on the shaft 62 adjacent to one end of the collar member, while a second bar member 67 is similarly journaled on the shaft 62 adjacent to the other end of the collar member 64.

Between the bar members 66 and 67, is a spacer block 68. Preferably the bar members and the block 68 are made unitary to insure alignment of the holes which are journaled on the shaft 62, and the two sets of aligned holes which accommodate spaced shafts 69 and 70, which respectively carry rollers 71 and 73. The unitary structure comprising bar members 66, 67 and the spacer block 68 is termed herein, yoke 72. The roller 71 bears against the eccentric 53, so that, as the shaft 50 rotates, the yoke 72 (which is urged toward the eccentric by means to be presently described) swings back and forth through an arc, the axis of which coincides with the axis of the shaft 62.

The casing 10 has a boss 74 which is at the junction of the bottom wall 14, the wall 16 and the end walls 18 and 19. Formed in the boss 74 is a bored hole 75. A cylinder member 76 has an interior bore 77 into which a piston 78 is reciprocally mounted. In small sizes the piston may have several spaced grooves therein, or in the large sizes the piston may be provided with piston rings, to effect a running seal with the bore 77 in the cylinder. The piston is also provided with a groove, adjacent to its outer end, to accommodate a snap ring 79 for retaining a washer 80 thereon, against which one end of a spring 81 presses.

The cylinder member has a portion 82 upon which the spring 81 is positioned. The other end of the spring abuts a shoulder formed by an enlarged portion 83 of the cylinder member, and the other end of this enlarged portion abuts the boss 74. The cylinder member 76 has a portion, adjoining the portion 83, which fits in the bore 75 in the boss 74, and a set screw 84 secures the same in said bore—thus the cylinder member is secured in the casing 10. The cylinder member 76 also has an externally threaded portion 85 extending outwardly from the boss 74, which is threadedly engaged by an internally threaded bushing 86, suitable sealing means being provided therebetween. The threaded shank 87, of a hollow pulsing member or bulb 88, also engages the internal threads of the bushing 86. The interior of the bulb 88 is preferably the same diameter as the cylinder bore. The bulb 88 has a portion 89 which reinforces it and forms a shoulder which abuts the outer end of the bushing 86.

The outer end of the piston 78 is urged against the roller 73 by the spring 81, so that as the motor 56 rotates, the shaft 35 is rotated via the belts 40, 41 and the pulley 36. As the shaft 35 rotates, the pinion 42 thereon rotates the gear 52 which is keyed on to the shaft 50, consequently the cam 53 rotates in unison therewith.

As the cam 53 rotates, the yoke 72, through the medium of the roller 71, swings about the axis 62, and in turn the roller 73 carried thereby, acts against the end of the piston 78 and causes it to reciprocate in the cylinder 76.

The extreme inward position attained by the end of the piston is designated by dotted lines 90, and the extreme outward position of the inner end of the piston is indicated by dotted lines 91.

A radial hole 92 is formed in the cylinder wall in such a position that it is uncovered by the piston when the latter is in its extreme outer position. Several other holes like the hole 92 may be formed in the cylinder wall in the same plane and these may be joined by an

internal annular groove in the cylinder wall, so that when the casing 10 is filled with oil up to the level designated by the numeral 93, the pump will be self-priming because during each stroke of the piston the hole 92 is uncovered by the piston.

Due to the fact that the cylinder 76 and the bulb 88 are angularly disposed with respect to the horizontal, each time the hole 92 is uncovered oil may enter the cylinder and the bulb, and the air therein will also pass out through the hole 92 as the oil enters and displaces it.

As the piston is reciprocated in the cylinder, the bulb 88 pulses in unison with the movement of the piston.

Communicating with the interior of the cylinder beyond the extreme inward position of the piston (the position indicated at 90) is a stepped hole 94. This stepped hole has a threaded portion which is engaged by a fitting 95.

Mounted on the upper surface 17 of the casing 10 is a boss 96, with a sealing gasket 97 therebetween. Beneath the boss 96 the wall 17 has a clearance hole 98 formed therein. Communicating with this hole is a vertical passage 99 which communicates with a cross-passage 100. A portion of this cross-passage is provided with threads 101 which are threadedly engaged by the threaded stem 102 of a valve member 103. The passage 100 has a seat which is engaged by the conical point 104 of the valve. Beyond this seat is a short passage 105 communicating with a vertical passage 106 formed in the boss 96.

Communicating with the passage 106 is a threaded passage to accommodate a retaining member 107 for retaining a spring 108 in the passage 106. The lower end of the passage 106 communicates with a passage 109, a ball check valve 110 being provided therebetween, and the ball is urged downwardly on its seat by the spring 108.

The passage 109 communicates with a threaded passage 111 which accommodates a fitting 112. Extending from the fitting 112 to the fitting 95 is a tube 113 which conducts or leads the pressure generated in the cylinder, by the piston, up to the passage 106. The retaining member 107 has a central passage therein and communicating with it is a tapered threaded hole 114 which accommodates the shank 115 of a pressure gauge 116.

Now when the valve 103 is closed the pulsations of the fluid pressure in the cylinder are imparted to the gauge 116, and the ball check valve 110 prevents the pressures of the pulsations from falling, so that the pressure reads practically steady on the gauge. This is due to the fact that when pressure is imposed on the gauge by one pulse, and the piston in the pump is moving outwardly to begin another stroke, this pressure between the ball check and the gauge is, by the check, prevented from falling, and consequently it is, in effect, practically steady.

Now if it is desired to have the gauge move in time with the pulsations, the valve 103 may be opened so that the pulsations are imparted to the gauge via the tube 113 and the hand on the gauge moves in unison with the pulsations.

Isolated fluid medium pump circuit

As pointed out hereinabove, the fluid medium being pumped is completely isolated from the piston, cylinder, pump arrangement described above, and the elements constituting the isolated circuit are quickly demountable to facilitate cleaning.

The elements hereinafter described constituting said circuit may be formed of materials which are compatible with and not attacked by the fluid to be handled.

A block member 117 has an interior bore 118. This block member is positioned in contact with the boss 74, and a seal is effected with the exterior of the bushing 86 and a sealing ring 119 set into a suitable groove in the bushing 86. Since the bushing 86 is also in contact with the fluid in said circuit it may be made of a material compatible with and not attacked by the fluid being handled.

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The outer end of the bore 118 is counterbored to accommodate a packing ring 120 and the left end of a tubular member 121 (as seen in Figure 1). The right end of the tubular member 121 extends into an annular groove 122 formed in a cap member 123. A sealing ring 124 is positioned at the bottom of the annular groove 122 to effect a seal between the right end of the tubular member 121 and the cap member 123.

Bolts, such as the bolts 125, extend through clearance holes formed in the cap member and clearance holes formed in the block member 117 and threadedly engage holes (not shown) formed in the boss 74.

Communicating with the bore 118 is an inlet passage 126, and also communicating with the bore 118 is an outlet passage 127. Mounted in the passage 126 is a fitting 128 having a fluid passage 129 therein the upper end of which forms a seat for a ball valve 130. The fitting is grooved to accommodate a suitable packing ring, as shown, and above the ball 130 a suitable stop pin is provided to prevent the ball from leaving the seat too far due to the movement of fluid upwardly through the passage 129. The fitting is secured onto the block member 117 by means of bolts, such as the bolt 131 shown in Figure 3, passing through a flange member 132.

Mounted in the passage 127 is a cage 133 having suitable passages therein and sealing rings engaging the walls of the bore 127 and having a short fluid passage terminating in a valve seat upon which is seated a ball valve 134.

A cross-pin 135 in the cage 133 limits the extreme upward movement of the ball 134.

A flanged bushing 136 has a depending portion which extends into and is sealed to the wall of the upper passage in the cage 133. A body 137 has a passage 138 therein, the lower end of which is counterbored to accommodate the flange on the bushing 136 and further counterbored to accommodate a sealing ring which effects a seal between the bushing 136 and the passage. The upper end of the bushing forms a seat upon which a valve member 139 seats. The lower end of this valve member is fluted to provide fluid passages.

A stem member 140 is positioned in the passage 138 and is sealed to the passage by means of a packing ring 141. The lower end of the stem 140 is somewhat conical in form and bears on the center of the upper surface of the valve member 139. The stem 140 has its upper portion 142 of reduced diameter, and positioned on the shoulder between the surfaces of 140 and 142 is a washer 143. The upper portion 144 of the body 137 is externally threaded and is threadedly engaged by internal threads formed in a bonnet 145. Within the bonnet and having one end bearing against the upper end thereof and the other bearing against the washer 143 is a spring 146. The bonnet is provided with handles 147.

The body has a lateral boss 148 which has a passage 149 therein communicating with the valve member 139, so that when the valve is raised by fluid pressure the fluid may discharge via the passage 149.

Operation of the isolated fluid medium pump circuit

The fluid to be pumped is connected to the fitting 128, and as the bulb 88 pulses due to the repetitive action of the piston 78 against the oil in the cylinder bore 77 the bulb 88 expands and contracts. During the contraction the fluid enters the passage 129, raises the inlet check ball 130, and the fluid enters the annular space 118 and the space within the tubular member 121. During each expansion of the bulb 88 the inlet valve 130 closes. As the chamber 118 and the space within the tube 121 fills with the fluid it enters the cage 133 and raises the ball 134 during each expansion pulse of the bulb 88, and as the bulb continues to pulse each contraction lets some of the fluid in past the valve 130, and each expansion of the bulb 88 causes fluid to pass the valve 134.

Now as soon as the pressure builds up in the space between the valve 134 and the valve 139 to a pressure

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sufficient to raise the shank 140 against the pressure of the spring 146, the fluid will pass between the valve 139 and its seat on the bushing 136 and out into the passage 149. Any vessel or other means to receive the fluid, connected to the boss 148, will receive the fluid discharged via the passage 149.

When it is desired to clean this circuit out the bolts 125 and the bolts 131 may be removed and the entire assembly is easily taken apart and cleaned.

Figure 5 shows a modification of the bulb, wherein the bulb per se is designated by the numeral 88a. It is mounted in the device in the same manner as the bulb 88 and may be provided with embracing members 150 which may be in the form of spring rings which provide localized zones in the wall of the bulb preventing the latter from expanding unduly in such zones. These spring rings may be formed by forming helical springs and joining the ends together so that the ring thus formed has such inner diameter that it snugly engages the bulb 88a. I have also used other spring rings formed of solid material in cases where the pressures employed are high. In order to retain these rings on the bulb the bulb is moulded with annular grooves therein into which the rings are snapped.

A tubular member 151 having an outer diameter slightly smaller than the diameter of the bore 77 (the diameter of the bore 77 minus a few thousandths of an inch) is positioned partially in the cylinder 76 and extends substantially to the end of the interior cavity in the bulb 88a. The end 152 of the tubular member is spaced apart from the point 90 which represents the extreme inward position of the piston. The tubular member is secured in the cylinder by means of a pin 153 which passes through aligned holes formed in the cylinder and in the tubular member.

The opposite end 153 of the tubular member may be cupped or provided with a curved closure cap. The wall of the tubular member 151, at least within the confines of the thinnest walls of the bulb 88a, is provided with a plurality of perforations 154.

Since the tubular member 151 is substantially equal to the inner diameter of the bulb 88a, the bulb can only expand outwardly when the oil pressure in the interior of the tube 152 rises due to the movement of the piston toward the point 90. As the pressure rises it is imposed upon the interior wall of the bulb 88a via the perforations 154.

Now on the suction stroke the material of the bulb 88a returns to its normal state of repose in contact with the outer wall of the tubular member 151, and in doing so creates suction in the space 118 so that fluid, in the secondary circuit, may enter the space 118 via the passage 129 and the valve 130.

Applicant has found that by the arrangement just described the life of the bulb 88a is not impaired to the slightest degree because of the fact that the bulb only expands outwardly. The long life is also due to the fact that the bulb cannot possibly be distorted in a deleterious manner because at no time is it in shear.

Referring now to Figures 6 and 7, a rod 155 has the outer end 156 rounded and adapted to be contacted by the end 157 of the bulb 88. Extending longitudinally along the rod 155 is a plurality of flutes 158. For example, the rod 155 may be formed of pinion stock of such diameter that it fits the interior bore 77 of the cylinder 76. This rod is secured in the cylinder by means of a pin 159 passing through aligned holes formed in the cylinder 76 and a corresponding hole formed in the rod 155 itself. The upper end 160 of the rod 155 is spaced apart from the piston 78 when the latter is in its innermost position.

With this arrangement the bulb 88 and the lower end of the cylinder 76 contain a minimum quantity of oil or other fluid medium, and when the pump has been at rest for a long period of time some air may get into the spaces 161 between the flutes, and due to the flutes this air is

also a minimum, as compared to the arrangement shown in Figure 1, where the entire bulb and lower end of the cylinder are filled with oil.

With the arrangement shown in Figures 6 and 7 as the pressure on the oil in the cylinder rises due to the inward motion of the piston, the wall of the bulb 88 expands outwardly, thereby causing some of the fluid in the secondary circuit to discharge via the valve 134. As the piston 78 moves toward its extreme outward position 91, the bulb contracts due to its inherent elasticity until it encounters the flutes 158 formed on the member 155, thereby creating a suction in the space 118. Thus, the walls of the bulb 88 lie in natural repose until the piston begins to build up pressure within the spaces between the flutes on its return compression stroke.

Both the form shown in Figure 5 and the form shown in Figure 6 localize the distorting of the bulb 88 to an outward direction only, and since the bulb is devised for being distorted or displaced outwardly, and also since the walls of the bulb lie in normal repose between compression strokes, pumps employing this arrangement give long and trouble-free service.

Although I have herein shown and described by way of example one embodiment of my new and improved pumps and a modification of the expandable and contractible bulb employed therein, it will be understood that I am not to be limited to the exact forms herein shown and described, as many changes may be made in the arrangements herein shown and described within the scope of the following claims.

What is claimed is:

1. In a pump of the character described, a casing forming a crank-case and adapted to contain a body of oil, a cylinder extending into said casing from the exterior thereof, a piston reciprocally carried in said cylinder, a passage formed in said cylinder and adapted to be uncovered by said piston when the latter is in its extreme outward position, thereby placing the interior of said cylinder into communication with said oil once during each stroke of the piston, and to be closed by the piston on its inward stroke, power-driven means in said crank-case including a member acting against and adapted to reciprocate said piston in said cylinder, a second casing detachably secured to said first casing and forming a pressure vessel, an expansible and contractible hollow member positioned in said pressure vessel and having its interior communicating with the interior of said cylinder and adapted to contain oil which enters said cylinder, and inlet and exhaust valves in said pressure vessel via which a fluid to be pumped may pass into and out of said pressure vessel.

2. In a pump of the character described, a casing forming a crank-case adapted to contain a body of oil, a cylinder communicating with said casing, a piston in said cylinder, means in said crank-case to reciprocate said piston in said cylinder, inlet means in said cylinder, a pressure vessel secured on said casing, a hollow tubular expansible and contractible member having one end closed and having the other end in communication with the interior of said cylinder, a non-contractible member secured in the end of said cylinder and extending into said tubular member, said non-contractible member having an outer diameter substantially equal to the inner diameter of said hollow member and formed to provide predetermined zones in the interior of said hollow member which are initially influenced by the pressure of the oil in said cylinder, an inlet valve for leading a second fluid into said pressure vessel, and a discharge valve via which said second liquid is discharged from said pressure vessel.

3. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in

said reservoir and to be closed by the piston on its inward stroke, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible hollow member having its interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, a rigid insert within said elongated member to limit the contraction thereof, and inlet and outlet valves controlling flow to and from a space between the housing and said elongated member.

4. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, said elongated member contracting due to its inherent elasticity to create a suction in the space between it and said housing so as to lie in natural repose in the absence of pressure in its interior, and inlet and outlet valves controlling flow to and from a space between the housing and said elongated member.

5. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder comprising a spring urging said piston outwardly and cam means for driving said piston inwardly, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, said elongated member contracting due to its inherent elasticity to create a suction in the space between it and said housing so as to lie in natural repose in the absence of pressure in its interior, and inlet and outlet valves controlling flow to and from a space between the housing and said elongated member.

6. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, said elongated member contracting due to its inherent elasticity to create a suction in the space between it and said housing so as to lie in natural repose in the absence of pressure in its interior, a rigid insert within said elongated member to limit the contraction thereof, and inlet and outlet valves controlling flow to and from a space between the housing and said elongated member.

7. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to re-

reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending outwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, said elongated member contracting due to its inherent elasticity to create a suction in the space between it and said housing so as to lie in natural repose after the piston uncovers said passage and until the piston begins to build up pressure in its interior, and inlet and outlet valves controlling flow to and from a space between the housing and said elongated member.

8. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, inlet and outlet valves controlling flow to and from a space between the housing and said elongated member, and a spring loaded valve connected to and receiving liquid from said space between the housing and said elongated member through said outlet valve.

9. A pump comprising a casing forming an oil reservoir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, inlet and outlet valves controlling flow to and from a space between the housing and said elongated member, a pressure gauge, a connection between said pressure gauge and the lower end of said cylinder, a check valve in said connection, and means providing bleeding of oil from said pressure gauge back to said oil reservoir.

10. A pump comprising a casing forming an oil reser-

voir, a cylinder in said casing, a piston arranged to reciprocate in said cylinder, a passage formed in the wall of said cylinder, said passage being submerged below the oil level in said reservoir and arranged to be uncovered by the piston on its outward suction stroke to provide communication between the interior of the cylinder and oil in said reservoir and to be closed by the piston on its inward stroke to provide a trapped volume of oil, said cylinder extending downwardly from said passage, means for reciprocating the piston in the cylinder, an elongated expansible and contractible member having a hollow interior communicating with the interior of the lower end of said cylinder, a housing enclosing said elongated member, inlet and outlet valves controlling flow to and from a space between the housing and said elongated member, a pressure gauge, a connection between said pressure gauge and the lower end of said cylinder, a check valve in said connection, and adjustable means providing bleeding of oil from said pressure gauge back to said oil reservoir.

11. A pump comprising a hollow elongated expansible and contractible elastic member having walls of substantial thickness and rigidity, a housing enclosing said elongated member, said elongated member contracting due to its inherent elasticity to create a suction in the space between it and said housing so as to lie in a definite position of normal repose in the absence of pressure in its interior, inlet and outlet valves controlling flow to and from a space between the housing and said elongated member, means for intermittently and cyclically forcing the same quantity of liquid into the interior of said elongated member in each of successive cycles and means for releasing the liquid therefrom in each cycle so that said elongated member then returns to said definite position of normal repose in each cycle prior to the next forcing of liquid into its interior.

12. A pump according to claim 11 provided with a rigid insert within said elongated member to limit the contraction thereof.

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