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PRESSURE STABILIZER FOR RECIPROCATING PUMPS OR COMPRESSORS

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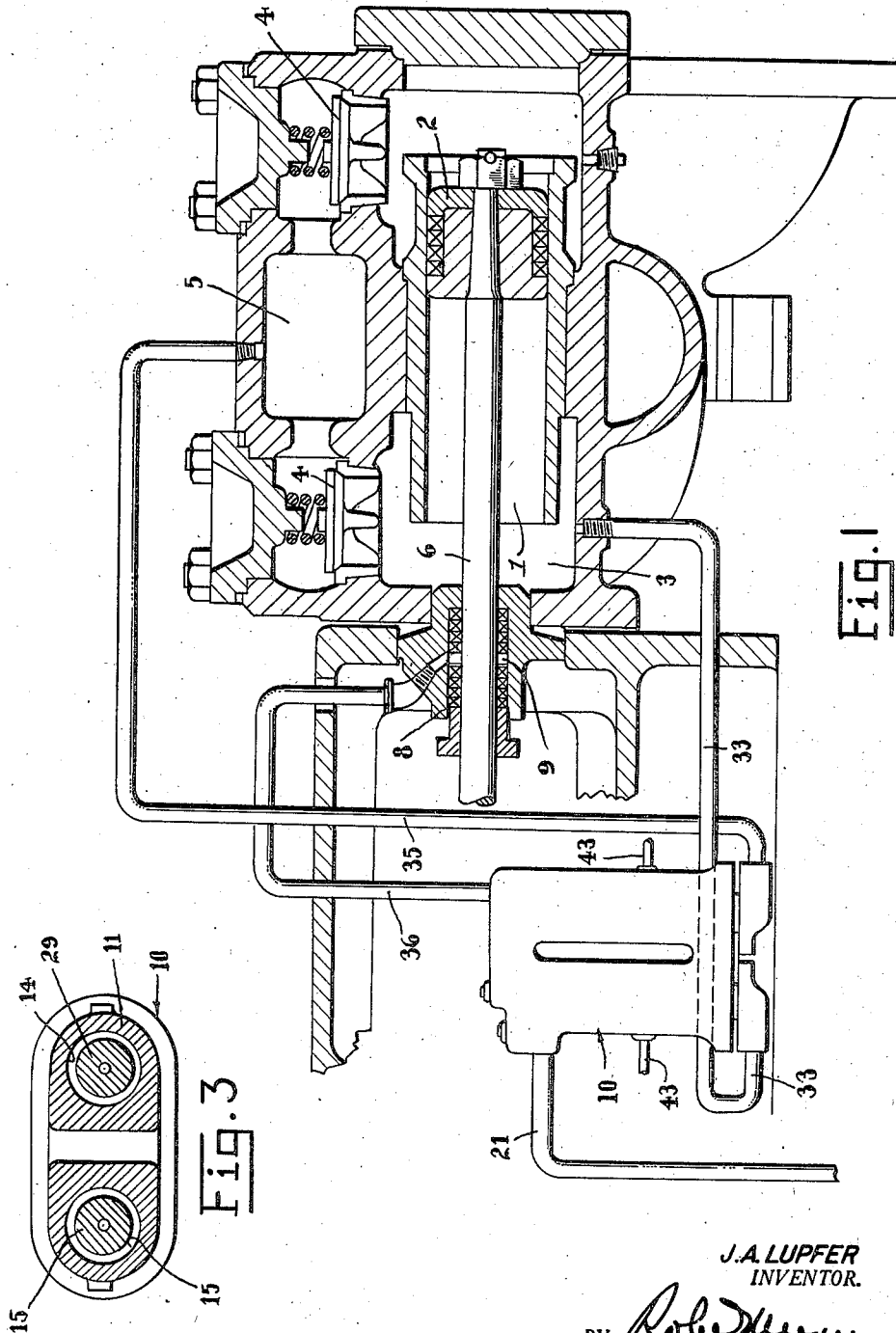


Fig. 1

Fig. 3

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PRESSURE STABILIZER FOR RECIPROCATING PUMPS OR COMPRESSORS

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1

This invention relates to pumps, compressors, or like mechanisms, and the primary object of the present invention is to provide a pressure stabilizer for stabilizing or leveling out the pulsations in the discharge of reciprocating pumps, compressors, or the like, which pressure stabilizer will act or operate to pump a secondary fluid under operating pressures of the fluid pumped by the pump or compressor.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a pressure stabilizer for reciprocating pumps or compressors of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a longitudinal section through a reciprocating pump or compressor showing the improved pressure stabilizer in side elevation and associated therewith;

Figure 2 is a vertical section through the pressure stabilizer;

Figure 3 is a horizontal section taken on the line 3—3 of Figure 2; and

Figure 4 is an edge elevation of the pressure stabilizer.

Referring more particularly to the drawings, the reciprocating pump or compressor comprises the cylinder 1 in which a piston or plunger 2 operates for pumping or compressing the fluid. The cylinder 1 has a pulsating chamber 3 therein as is usual in reciprocating mechanisms of this type. The fluid pumped or compressed enters the cylinder through the intake ports (not shown) where its pressure is increased and it is discharged through the discharge valves 4 into the discharge line 5. The piston rod 6 extends out of the cylinder 1 in the usual manner through one end of the cylinder, and it has packing 8 thereabout which, in Figure 1 of the drawings, is shown as including lantern gland 9.

The pressure stabilizer or impulse leveling mechanism is generically shown at 10, and it comprises a housing 11 having cylinder bores 12 and 14 therein. A piston structure 15 is mounted in the cylinder 12 for reciprocatory movement therein and it includes an upper head 16, the outer surface 17 of which is opposed to the outer surface 18 of the larger piston head 19 so that the head 19 is opposed to the head 16. The housing 11 is provided with an intake port and passage 20 which

2

has communication through a suitable conduit 21 with a source of supply (not shown) of a secondary fluid. An intake valve 22 is interposed in the intake passage 20 and is spring seated by means of the spring 23 to prevent discharge pressure fluid from the cylinder 12 passing backwards through the intake passage 20.

As clearly shown in Figure 2 of the drawings, the intake passage 20 opens into the cylinder 12 outwardly of the piston head 16, so that on the suction stroke of the piston 15, secondary fluid will be drawn into the cylinder 12, and on the pressure stroke of the piston 15, the pressure of such secondary fluid will be increased and it will be forced outwardly through the connecting discharge passage 24. A discharge valve 25 is interposed in the passage 24 and is spring pressed by a spring 26 to prevent its being unseated by secondary fluid drawn into the cylinder 12 on the suction stroke of the piston 15.

The passage 24 has communication with the discharge passage 27 which forms the final discharge for the secondary fluid from the stabilizing structure 10, and it also has communication with a passage 28 which serves as both an intake and discharge passage for the secondary fluid into and from the cylinder 14. A piston 29 reciprocates in the cylinder 14 and it has an upper head 30, the area of which is slightly smaller than the active area of the piston head 31 formed upon the end of the piston 29 opposite to the end on which the piston head 30 is formed.

The cylinder 12 at its end in which the piston head 18 reciprocates is connected by a passage 32 and a suitable conduit 33 with the pulsation chamber of the cylinder 1 of the pump or compressor structure, while the lower end of the cylinder 14 in which the piston head 31 reciprocates is connected by a suitable passage 34 and conduit 35 with the discharge line 5 of the primary pump or compressor.

The final discharge 27 of the stabilizer structure has a conduit 36 connected thereto which may lead to any suitable source of use for the secondary fluid, but in Figure 1 of the drawings, this conduit is shown as discharging the secondary fluid into the lantern gland 9 so as to build up a counteracting pressure in the packing 8 to prevent leakage of fluid from the cylinder 1 of the compressor or pump structure. The invention is not limited to this particular use of the secondary fluid, but it may be employed for any of many uses where a liquid or gas of relatively high pressure is desired.

In operation, upon the suction stroke of the pis-

ton 2, the suction pressure in the pulsation chamber 3 will be transmitted to the cylinder 12 outwardly of the piston head 18 and will draw the piston 15 downwardly at the cylinder 12, creating a suction action for drawing secondary fluid into the cylinder 12. Upon the discharge stroke or upon the increase of pressure in the pulsating chamber, this increased pressure will force the piston 15 in the opposite direction, tending to compress or increase the pressure of the fluid in the cylinder 12, outwardly of the smaller piston head 16 and force the secondary fluid at its increased pressure through the discharge valve structure 25 into the passage 24.

The reciprocation of the piston 2 of the main pump or compressor will cause pulsations in its discharge line, and upon the decrease of the pressure in the discharge line occasioned during the suction stroke of the piston 2, the piston 29 will be drawn or forced downwardly in the cylinder 14 so as to draw the pressure fluid from the passage 24 into the cylinder 14. Upon the discharge or compression operation of the piston 2, the pressure increase in the discharge line will be transmitted to the cylinder 14 behind the piston head 31 and force the piston 29 in a reverse direction, compressing or increasing the pressure of the fluid in the cylinder 14 outwardly of the piston head 30 and forcing this fluid at its increased pressure outwardly through the final outlet 27 to the point of use of the high pressure secondary fluid.

Owing to the fact that the piston heads 18 and 31 have a greater active area than the pistons 16 and 30, the pressure of the secondary fluid will be, when it is discharged from the final discharge 27, greater than the discharge pressure of the main pump or compressor, and thus when such high pressure secondary fluid is pumped into the lantern gland 9 it will prevent leakage of the fluid pumped by the pump or compressor from leaking out of the cylinder 4 past the packing 8.

The pistons 16, 18, 30, and 31 all have centrally located frusto-conical projections formed thereon, as indicated at 37, which, as the respective pistons move in compressing or pumping action, restrict the passage of the various liquids or gas as the piston heads near the ends of their strokes, and this reduction in area in the fluid passages serves to cushion the movement of the pistons and prevent slamming or striking of the piston heads against the ends or heads of the cylinders.

The pistons 15 and 29 have passageways 33 and 39, respectively, bored therein which have communication with the interiors of the cylinders 12 and 14, respectively, outwardly of the ends of the piston heads 16 and 30. Transverse passages 40 communicate with the bores 38 and deliver secondary fluid behind the piston rings 42 of the piston heads 18 and 37 for forcing these piston rings into engagement with the cylinder walls and preventing the leakage of the primary fluid or the fluid acted upon by the pump or compressor from leaking past the pistons 19 and 31 and mingling or mixing with the secondary fluid. Drain openings 43 are provided for bleeding off the secondary fluid which leaks from behind the piston rings 42 into the space about the respective pistons 15 and 29.

While in the drawings the piston heads 18 and 31 are shown as having greater area than the piston heads 16 and 30 with the result that the secondary fluid is pumped or compressed to a higher pressure than the discharge pressure of

the primary fluid acted upon by the pump or compressor, it is to be understood that the relative active areas of the piston heads may be reversed with the pistons 19 and 31 having smaller active areas so that the final discharge pressures of the secondary fluid will be lower than the discharge pressure of the fluid acted upon by the pump or compressor without departing from the spirit of the present invention.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. The combination with a reciprocating pump or compressor including a reciprocating piston, a pulsation chamber and a discharge line, of means for stabilizing the discharge pressure of the pump or compressor, said stabilizing means comprising first means acted upon by pressure variances in said pulsation chamber, second means acted upon by pressure in said discharge line, said first means pumping a secondary fluid to said second means for operating the second means to level pulsations in the discharge line.

2. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber and a discharge line, of means for stabilizing impulses in the discharge of primary fluid from the pump or compressor, said means including a cylinder having connection with said pulsation chamber, a first piston in said cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder, a second cylinder having connection with said discharge line, a second piston in said second cylinder acted upon by pressure variances in the discharge line to receive secondary fluid from said first cylinder and discharge it, said second piston acting to level out or stabilize pulsations in the discharge or primary fluid from said reciprocating pump or compressor.

3. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber and a discharge line, of means for stabilizing impulses in the discharge of primary fluid from the pump or compressor, said means including a cylinder having connection with said pulsation chamber, a first piston in said cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder, a second cylinder having connection with said discharge line, a second piston in said second cylinder acted upon by pressure variances in the discharge line to receive secondary fluid from said first cylinder and discharge it, said second piston acting to level out or stabilize pulsations in the discharge of primary fluid from said reciprocating pump or compressor, piston rings carried by said first and second pistons, and means for delivering said secondary fluid behind said piston rings to prevent leakage of primary fluid into the secondary fluid.

4. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber and a discharge line, of means for stabilizing impulses in the discharge of primary fluid from the pump or compressor, said means including a cylinder having connection with said

5

pulsation chamber, a first piston in said cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder, a second cylinder having connection with said discharge line, a second piston in said second cylinder acted upon by pressure variances in the discharge line to receive secondary fluid from said first cylinder and discharge it, said second piston acting to level out or stabilize pulsations in the discharge or primary fluid from said reciprocating pump or compressor, and means on said first and second pistons to restrict the passage of fluids as the pistons near the ends of their strokes to prevent striking of the pistons against the cylinder heads.

5. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber, and a discharge line; of means for stabilizing impulses in the discharge of primary fluid from said pump or compressor; said means including first and second cylinders for pumping a secondary fluid; inlet and outlet valves controlling the flow of said secondary fluid to said first cylinder; said first cylinder connected to said pulsation chamber; a piston in said first cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder; a second cylinder having connection with the discharge line of said pump or compressor; a second piston in said second cylinder acted upon by pressure variances in the discharge line to stabilize pulsations in the discharge of primary fluid from the reciprocating pump or compressor; ports and passages establishing communication between said first and second cylinders whereby secondary fluid discharged from said first cylinder will be acted upon by the piston in the second cylinder to increase the pressure of the secondary fluid; and a final discharge line for the secondary fluid leading from said second cylinder.

6. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber, and a discharge line; of means for stabilizing impulses in the discharge of primary fluid from said pump or compressor; said means including first and second cylinders for pumping a secondary fluid; inlet and outlet valves controlling the flow of said secondary fluid to said first cylinder; said first cylinder connected to said pulsation chamber; a piston in said first cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder; a second cylinder having connection with the discharge line of said pump or compressor; a second piston in said second cylinder acted upon by pressure variances in the discharge line to stabilize pulsations in the discharge of primary fluid from the reciprocating pump or compressor; ports and passages establishing communication between said first and second cylinders whereby secondary fluid discharged from said first cylinder will be acted upon by the piston in the second cylinder to increase the pressure of the secondary fluid; a final discharge line for the secondary fluid leading from said second cylinder; piston rings carried by said first and second pistons; and means for delivering secondary fluid behind said piston rings to prevent leakage of primary fluid into the secondary fluid.

7. The combination with a reciprocating pump or compressor for pumping a primary fluid and

6

including a reciprocating piston, a pulsation chamber, and a discharge line; of means for stabilizing impulses in the discharge of primary fluid from said pump or compressor; said means including first and second cylinders for pumping a secondary fluid; inlet and outlet valves controlling the flow of said secondary fluid to said first cylinder; said first cylinder connected to said pulsation chamber; a piston in said first cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder; a second cylinder having connection with the discharge line of said pump or compressor; a second piston in said second cylinder acted upon by pressure variances in the discharge line to stabilize pulsations in the discharge of primary fluid from the reciprocating pump or compressor; ports and passages establishing communication between said first and second cylinders whereby secondary fluid discharged from said first cylinder will be acted upon by the piston in the second cylinder to increase the pressure of the secondary fluid; a final discharge line for the secondary fluid leading from said second cylinder; and means on said first and second pistons to restrict the passage of fluids as the pistons near the ends of their strokes to prevent the pistons from striking the cylinder heads.

8. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber, and a discharge line; of means for stabilizing impulses in the discharge of primary fluid from said pump or compressor; said means including first and second cylinders for pumping a secondary fluid; inlet and outlet valves controlling the flow of said secondary fluid to said first cylinder; said first cylinder connected to said pulsation chamber; a piston in said first cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder; a second cylinder having connection with the discharge line of said pump or compressor; a second piston in said second cylinder acted upon by pressure variances in the discharge line to stabilize pulsations in the discharge of primary fluid from the reciprocating pump or compressor; ports and passages establishing communication between said first and second cylinders whereby secondary fluid discharged from said first cylinder will be acted upon by the piston in the second cylinder to increase the pressure of the secondary fluid; a final discharge line for the secondary fluid leading from said second cylinder; piston rings carried by said first and second pistons; means for delivering secondary fluid behind said piston rings to prevent leakage of primary fluid into the secondary fluid; and means on said first and second pistons to restrict the passage of fluids as the pistons near the ends of their strokes to prevent the pistons from striking the cylinder heads.

9. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a reciprocating piston, a pulsation chamber and a discharge line, of means for stabilizing impulses in the discharge of primary fluid from the pump or compressor, said means including a cylinder having connection with said pulsation chamber, a first piston in said cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder, a second

cylinder having connection with said discharge line, a second piston in said second cylinder acted upon by pressure variances in the discharge line to receive secondary fluid from said first cylinder and discharge it, said second piston acting to level out or stabilize pulsations in the discharge or primary fluid from said reciprocating pump or compressor, a piston rod for the piston of said pump or compressor, packing for said piston rod, and means for delivering the secondary fluid discharged by said second piston to said packing.

10. The combination with a reciprocating pump or compressor for pumping at primary fluid and including a reciprocating piston, a pulsation chamber, and a discharge line; of means for stabilizing impulses in the discharge of primary fluid from said pump or compressor; said means including first and second cylinders for pumping a secondary fluid; inlet and outlet valves controlling the flow of said secondary fluid to said first cylinder; said first cylinder connected to said pulsation chamber; a piston in said first cylinder and acted upon by pressure variances in said pulsation chamber to draw a secondary fluid into and discharge it from said first cylinder; a second cylinder having connection with the discharge line of said pump or compressor; a second piston in said second cylinder acted upon by pressure variances in the discharge line to stabilize pulsations in the discharge of primary fluid from the reciprocating pump or compressor; ports and passages establishing communication between said first and second cylinders whereby secondary fluid discharged from said first cylinder will be acted upon by the piston in the second cylinder to increase the pressure of the secondary fluid; a final discharge line for the secondary fluid leading from said second cylinder; a piston rod for the piston of said pump or compressor; packing for said piston rod; and means for delivering the secondary fluid discharged by said second piston to said packing.

11. The combination with a reciprocating pump or compressor for pumping a primary fluid and including a pulsation chamber, a reciprocatory piston, a piston rod for said piston, a packing for said rod, and a discharge line; of means for stabilizing or leveling out pulsations in fluid discharged into said discharge line including means acted upon by pressure variances in the pulsation chamber for pumping a secondary fluid; and means acted upon by pressure in the discharge line for receiving the secondary fluid from said pressure variance operated means for pumping secondary fluid into said packing.

12. The combination with a reciprocating pump or compressor for pumping a primary fluid

and including a pulsation chamber, a reciprocatory piston, a piston rod for said piston, a packing for said rod, and a discharge line; of means for stabilizing or leveling out pulsations in fluid discharged into said discharge line including means acted upon by pressure variances in the pulsation chamber for pumping a secondary fluid; means acted upon by pressure in the discharge line for receiving the secondary fluid from said pressure variance operated means for pumping the secondary fluid into said packing; said means acted upon by pressure in the discharge line being subject to action by pressure of the secondary fluid to stabilize pulsations in the discharge fluid from the pump or compressor.

13. The combination with a reciprocating pump or compressor including a reciprocating piston, a pulsation chamber and a discharge line for pumping a primary fluid, of means for pumping a secondary fluid comprising first means acted upon by pressure variances in the pulsation chamber, second means acted upon by pressure in said discharge line, said first means delivering the secondary fluid to said second means under pressure sufficient to operate the second means against pressure in the discharge line during low pressure pulsation created by reciprocation of the piston of the pump or compressor.

14. The combination with a reciprocating pump or compressor including a reciprocating piston, a pulsating chamber and a discharge line together with packing embodied in the pump or compressor structure, of means for pumping a secondary fluid to said packing including first means acted upon by pressure variances in the pulsation chamber, second means acted upon by pressure in the discharge line, said first means delivering the secondary fluid to said second means under pressure sufficient to operate said second means against pressure in the discharge line during low pressure pulsations in the discharge line created by reciprocation of the piston of the pump or compressor to level out pulsations in the fluid pressure in the discharge line, said second means delivering the secondary fluid to said packing.

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