Nov. 28, 1950 D. C. WALMSLEY 2,531,794

PUMP

Filed April 20, 1945

FIG. 1

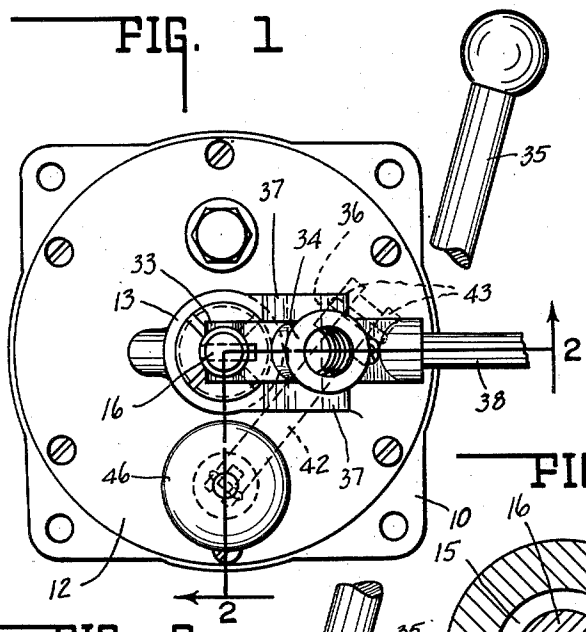


FIG. 3

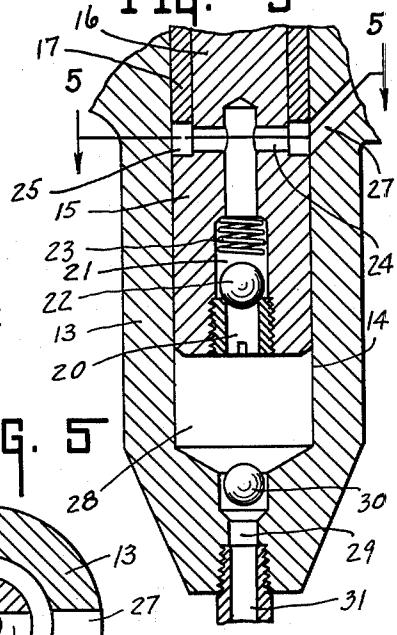


FIG. 5

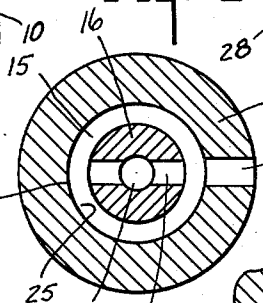


FIG. 2

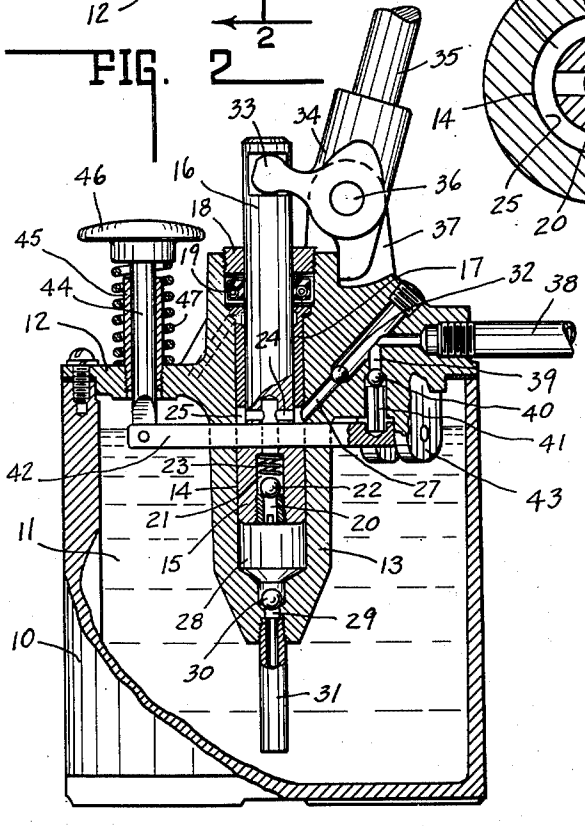
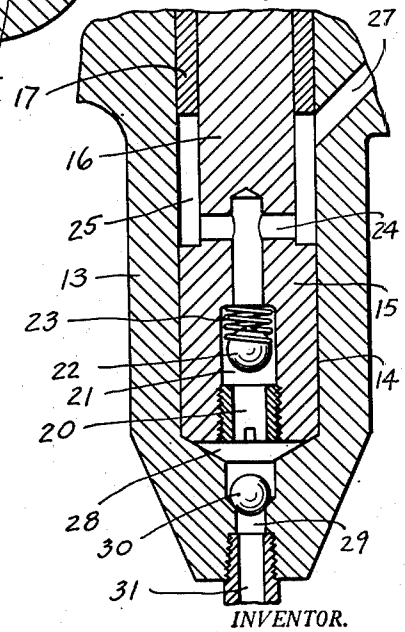


FIG. 4



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PUMP

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3 Claims. (Cl. 103—41)

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This invention relates to a pump, particularly a hydraulic pump adapted for use in hydraulic lifts of various kinds such as hydraulic lift trucks, jacks or the like, particular reference being made to my copending application Serial No. 593,069, filed May 10, 1945, now Patent No. 2,483,356, dated November 15, 1949, entitled "Hydraulic Lift Truck."

The pump of this invention is of simplified character particularly adapted for manual operation, although capable of being otherwise driven, and is of a double acting type, wherein each stroke is effective to pump a charge of fluid, such as oil, glycerin or the like. This is accomplished by providing dual chambers in association with a single ram such that the primary chamber will be emptied while the secondary chamber is filled and a charge of fluid pumped upon one stroke of the ram, and the secondary chamber emptied and a charge of fluid pumped while the primary chamber is filled upon the reverse stroke of the ram.

A further feature of the invention resides in providing a single valve which will function both as a relief or safety valve and a pressure release valve. Thus, the valve will open upon a predetermined pressure being developed, or through manual actuation may be opened to permit complete pressure release for returning the hydraulically actuated mechanism to inoperative position.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

Fig. 1 is a plan view of the pump with the actuating handle removed.

Fig. 2 is a section taken on the line 2—2 of Fig. 1, with portions broken away.

Fig. 3 is an enlarged section illustrative of the dual chambers showing the ram at the end of one stroke.

Fig. 4 is the same as Fig. 3, showing the ram at the end of the reverse stroke.

Fig. 5 is a section taken on the line 5—5 of Fig. 3.

In the drawings there is shown a pump housing 10 for providing a fluid containing reservoir 11, to which the head 12 is removably secured. The pump mechanism is carried by the head 12 as will be hereinafter described.

The head 12 is formed with a depending boss 13 extending downwardly into the reservoir 11 and upwardly from the top of the head, being internally bored to provide a cylinder indicated at 14. Within said cylinder a ram 15 is mounted

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for reciprocation. Said ram is actuated through a rod 16 extending upwardly therefrom through the head 12. The rod 16 is supported and has its bearing in the cylindrical bearing sleeve 17 carried in the bore of the upwardly extending boss portion of the head. Surrounding the actuating rod 16 and between the upper end of the sleeve 17 and the cap 18, which is screw threaded into the bore, there is a fluid seal 19 arranged to wipe the rod free of fluid and prevent escape thereof.

The ram 15 is provided with a port 20 extending centrally and longitudinally thereof throughout that portion below the rod 16. The port 20 includes an enlarged pocket 21 for receiving a ball check valve 22. Immediately above and spaced from the ball valve, there is provided a light spring 23 to prevent the ball from seating against the shoulder in the upper portion of the enlarged pocket 21. Above the ram there is provided a laterally extending port 24 communicating with the upper end of the port 20 and a chamber 25. Said chamber may be referred to as the secondary chamber and is located between the ram and bearing sleeve 17. It is at all times in communication with the discharge port 27.

Below the ram there is provided a chamber 28 within the cylinder 14, which may be referred to as the primary chamber. Chamber 28 communicates with an intake port 29 which is provided with a suitable shoulder to support a ball check valve 30. The intake port 29 is in communication with a suction tube 31 secured to the lower end of the cylinder boss 13 and extending downwardly adjacent the bottom of the reservoir 11. The discharge port 27 is provided with a shoulder for retaining a ball check valve 32. The actuating rod 16 of the ram has an operative connection through the head 33 with a bell crank socket 34 having a handle 35 secured therein to extend upwardly therefrom. Said pump handle extends upwardly from the pump for manual manipulation back and forth about the fulcrum 36 of the bell crank socket, said socket being fulcrumed on the ears 37 extending upwardly from the head 12.

In operation, when the handle 35 is actuated to force the ram downwardly from the position shown in Fig. 3 to that shown in Fig. 4, the fluid trapped in the primary chamber 28 is forced upwardly through the port 20, past the check valve 22, through the port 24, into the secondary chamber 25. The chambers 25 and 28 are so formed that the primary chamber 28 will have an effective capacity twice that of the secondary chamber 25. Thus, by such downward stroke of the

ram, the fluid will be forced into the secondary chamber 25, and since said chamber has only half the effective capacity of the chamber 28, the excess half of the fluid will be forced through the port 27 past the check valve 32 through the outlet pipe 38. On the reverse or upward stroke of the ram, the secondary chamber 25 will be reduced to zero effective capacity, from that shown in Fig. 4 to that of Fig. 3, and since the fluid remaining therein cannot return past the check valve 22, it will also be forced through port 27 past check valve 32 and through the pipe 38. Therefore, the pump is double acting, the downward stroke filling the secondary chamber 25 and forcing the excess or one charge of fluid from the pump, while the upward stroke forces the remaining or second charge of fluid therefrom.

The outlet pipe 38 through which the fluid is discharged, is also in communication with a relief port 39. Said relief port is in the form of a bore extending outwardly in the head 12 in communication with the reservoir whereby fluid may normally flow back through the pipe 38 into the reservoir. Port 39 is provided with a ball seat against which a ball valve 40 may be forced by a plunger 41. Thus when the plunger is forced upwardly it causes the ball valve 40 to seat and thereby prevent return passage of fluid through the port 39 into the reservoir. The plunger 41 is squared so that when it is lowered to permit the ball 40 to unseat, fluid may pass between the cylindrical wall of the port and the squared walls of the plunger. The plunger is carried upon a lever 42. Said lever is pivoted at one end to the downwardly extending ears 43 formed on the head 12 and is provided with a seat for the plunger 41 adjacent its pivotal connection therewith. The free end of the lever is pivotally connected to a stem 44 extending upwardly through the head for reciprocation in an upstanding bearing sleeve 45 secured to said head. Said stem 44 is provided with a hand or foot button 46 at its upper end and is normally retained in its upper position by the spring 47 surrounding the sleeve and mounted between the button and head 12. The spring 47 normally maintains the stem 44 and lever 42 in its upper position, in which position the lever causes the plunger 41 to hold the ball valve 40 in closed position, preventing return passage of fluid through pipe 38 or by-passing of fluid therethrough from the port 27.

Spring 47 in association with the ball valve 40 acts as a relief valve. Thus, if the fluid in the pipe 38 exceeds a predetermined pressure, the valve 40 will be opened against the tension of spring 47, but upon the pressure dropping below the predetermined amount, spring 47 will close the valve 40. The same arrangement also serves as a manual release of the hydraulic lift.

As a hydraulic release for the lift, when it is desired to lower the lift, jack or the like, it is only necessary to press down upon the button 46, overcoming tension of spring 47 and thereby opening the ball valve 40. With said valve open, the fluid, which has been pumped into the lift mechanism, is released back to the reservoir. It is to be understood that the pipe 38 connects with a suitable hydraulic cylinder mechanically connected with the lift mechanism as is well understood, and as disclosed in the above-mentioned copending application.

From the foregoing it will be observed that through an arrangement of the ram with its related ports and reduced portion, a primary chamber having substantially twice the capacity of a secondary chamber provides a double acting pump, one charge of fluid being forced to the lift when the plunger is moved in one direction and a similar charge of fluid being forced thereto when the plunger is moved in the opposite direction. Due to the fact that the pressure on the large area at the bottom of the ram is fifty percent counterbalanced by the pressure per unit area of the shoulder defining chamber 25, the pressure per square inch in said chambers is always the same, whereby the push and pull pressures required of the operator in manipulating the pump handle 35 are equalized. It will also be observed that through a simple arrangement of the valve 40 controlled by the lever and manually actuated button 46, a dual purpose arrangement is provided which serves both as a safety or relief valve and a release for the hydraulic lift.

The invention claimed is:

1. In a pump including a housing carrying a head thereon and containing a supply of fluid, an outlet conduit in said head through which said fluid is pumped under pressure and a by-pass formed in said head between said outlet conduit and the interior of said housing, the combination therewith of a valve in said by-pass, a plunger for retaining said valve closed when moved to one position and permitting it to open when moved to another position, a lever operatively connected to said plunger having one end thereof pivotally connected with said head, a manually actuated stem pivotally connected to the other end of said lever extending upwardly through said head, and a spring between said head and stem to yieldingly retain said lever and plunger in valve closing position under spring tension, whereby said lever may be manually depressed against the tension of said spring to permit opening of said valve for returning the fluid under pressure to said housing.

2. In a pump including a housing for containing a supply of fluid, an outlet conduit, means for forcing fluid from said supply through said conduit, and a by-pass from said outlet conduit to said supply, the combination therewith of a pressure relief valve seated in said by-pass in a direction to be opened by back pressure exerted thereon from said outlet conduit, a lever pivotally mounted in said pump housing having one end portion thereof engaging said valve in a direction to move it to closed position, a manually controlled member connected with said lever and extending exteriorly of said housing, and a control spring interposed between said housing and one end portion of said member for normally retaining said member and lever in valve closing position under spring tension and permitting opening of said valve upon back pressure in said outlet conduit and upon manual force on said member overcoming said spring tension.

3. In a pump including a housing for containing a supply of fluid, an outlet conduit, means for forcing fluid from said supply through said conduit, and a by-pass from said outlet conduit to said supply, the combination therewith of a valve seat in said by-pass, a relief valve movable into and out of seating and closing engagement with said valve seat, said valve being movable from said seat to open position in the direction of back pressure in said outlet conduit, a lever pivotally mounted within said pump housing engaging said valve in a direction to move it to closed position on said seat, a spring operably connected with said lever and housing to bias said

lever in said valve closing direction, and a manually actuated member extending through said housing into engagement with said lever for manually moving said lever against the tension of said spring in a direction to permit said valve to open.

DAVID C. WALMSLEY.

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