

March 16, 1954

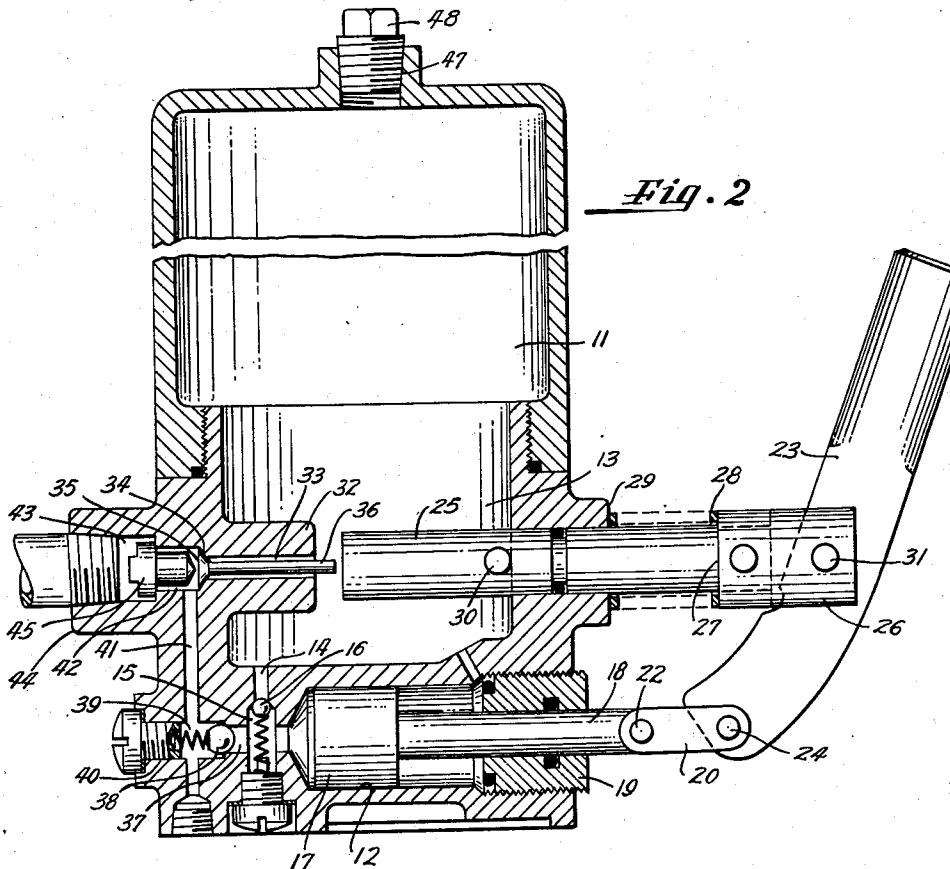
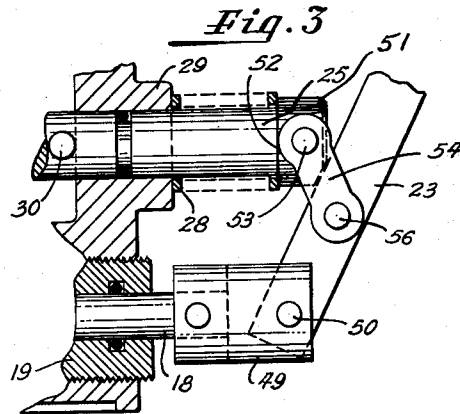
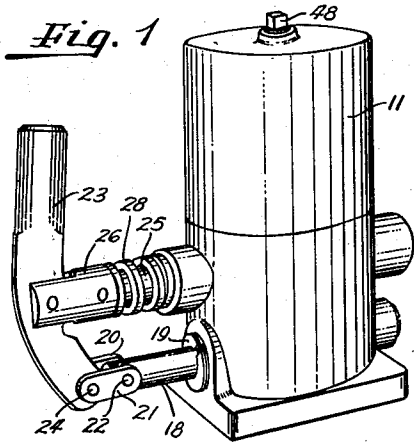
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2,672,014

RECIPROCATING HAND PUMP AND RESERVOIR UNIT

Filed July 16, 1951

2 Sheets-Sheet 1



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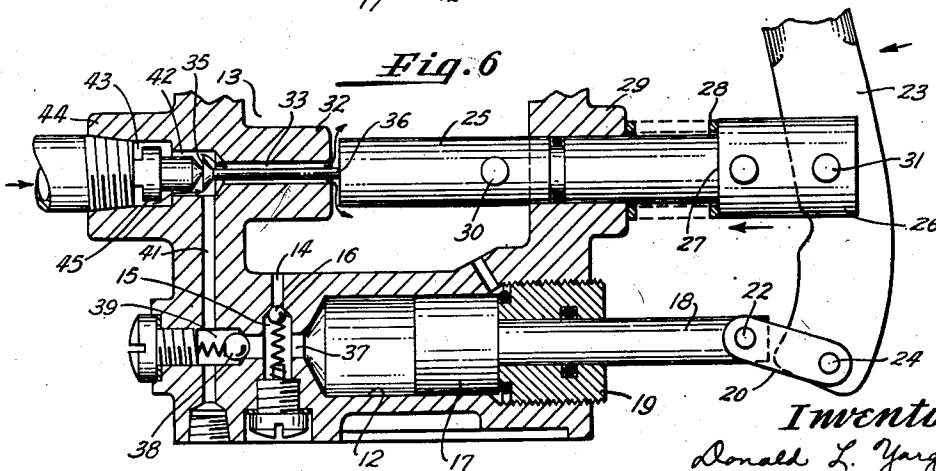
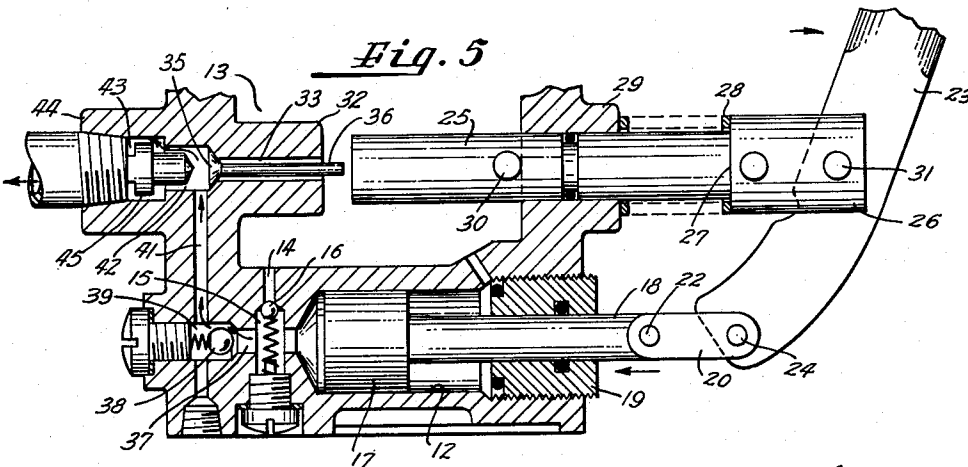
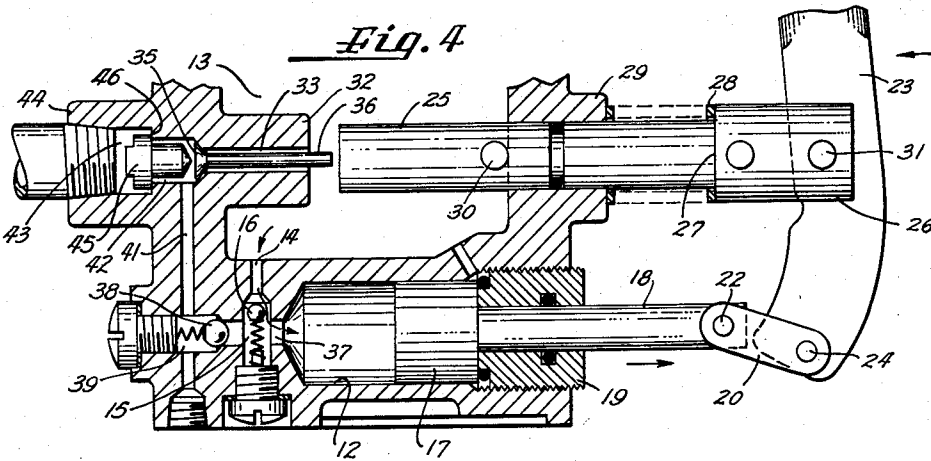
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RECIPROCATING HAND PUMP AND RESERVOIR UNIT

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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RECIPROCATING HAND PUMP AND  
RESERVOIR UNIT

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Application July 16, 1951, Serial No. 236,963

7 Claims. (Cl. 60—52)

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This invention relates to a hand operated piston pump, and in particular to a pump of that type for operating hydraulic equipment, such as hydraulic lifts for dump trucks or farm machinery.

An object of this invention is to provide a novel pump having a closed cycle of operation wherein the fluid discharged under pressure during one step in the operating cycle is drawn back into the pump during a later step in the operating cycle.

A further object of this invention is to provide a lever-actuated piston pump in which completion of the lever movement for retracting the piston draws back into the pump reservoir the fluid which was discharged in the preceding power stroke of the piston.

A still further object of this invention is to provide a lever-actuated piston pump in which a plurality of valves are arranged to permit the discharge of fluid under pressure during the power stroke of the pump piston, to draw fluid from the pump reservoir into the pump cylinder in response to retraction of the pump piston, and to return to the pump reservoir the fluid which was discharged in the previous power stroke of the pump piston in response to completion of the lever movement by which the pump piston is retracted.

Other and further objects and advantages of the invention will be apparent from the following description of a preferred embodiment thereof.

In the drawings:

Figure 1 is a perspective view of the pump according to one embodiment of the present invention.

Fig. 2 is a vertical sectional view of the pump of Fig. 1.

Fig. 3 is a fragmentary sectional view of a second embodiment of the pump which incorporates a different lever arrangement for operating the pump.

Fig. 4 is a fragmentary sectional view of the first form of the invention, showing the pump parts when the pump piston is retracted.

Fig. 5 is a section similar to Fig. 4 and showing the positions of the pump parts at the completion of the power stroke of the piston.

Fig. 6 is a section similar to Figs. 4 and 5 showing the operation of the pump when the handle is actuated beyond the fully retracted position of the piston.

In the form of the invention shown in Figs. 1 and 2, the pump includes an oil reservoir 11 and a pump cylinder 12 mounted below the reservoir. The pump cylinder is adapted to communicate

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with the oil reservoir through an intermediate chamber 13 and downwardly extending aligned conduits 14, 15 normally closed by a spring pressed ball valve 16. Within the pump cylinder 12 there is provided a pump piston 17 carried on a reciprocable stem 18 which passes through a stuffing box 19 at the rear of the pump cylinder. A pair of spaced parallel links 20, 21 are pivotally connected at cross pin 22 to the stem 18 beyond the pump casing. An upwardly extending handle 23 is pivotally connected at cross pin 24 to the links 20, 21.

Above the pump cylinder there is provided a reciprocable plunger 25 which extends rearwardly beyond the pump casing and which carries at its rear end an enlarged bifurcated member 26 which provides a transverse shoulder 27 at its forward end. A coil spring 28 is interposed between the plunger shoulder 27 and a boss 29 formed on the pump casing to normally urge plunger 25 to its retracted position. A transverse pin 30 is attached to plunger 25 to limit rearward movement thereof by engaging the interior of the casing adjacent the aperture through which plunger 25 extends. Handle 23 extends between the furcations of member 26 and is pivotally connected thereto by means of a cross pin 31 extending between the furcations. Normally cross pin 31 forms the fulcrum about which handle 23 is adapted to swing.

Aligned with the plunger 25 there is provided an interior boss formation 32 of the pump casing through which extends a cylindrical bore 33. A frusto-conical seat 34 is formed at the forward end of bore 33 and forms a valve seat for release poppet valve member 35, which is of complementary conical shape to normally abut snugly against the seat 34. A rearwardly extending stem 36 is connected to valve member 35 and is loosely received within the bore 33 to permit the passage of oil therethrough. Stem 36 is interposed in the path of movement of plunger 25 when the latter is actuated to its extreme forward position.

Extending forwardly of the pump cylinder 12 and communicating therewith is a horizontal conduit 37 which intersects the vertical conduit 15. A spring pressed ball valve 38 is positioned to normally close the forward end of conduit 37. Beyond the forward end of conduit 37 there is provided another horizontal conduit 39 which intersects conduit 37 at the seat for ball valve 38. At its other end conduit 39 is closed by a suitable closure member extending through the casing aperture 40.

A vertical conduit 41, closed at its lower end,

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intersects conduit 33 and extends upwardly therefrom to intersect the horizontal conduit 42 extending in alignment with bore 33 at the other side of valve member 35. A discharge port 43 in the pressure line is formed in a boss member 44 at the forward side of the pump casing. A check valve 45 is normally urged by the pressure in the discharge line to a position where it is seated against a shoulder 46 formed at the intersection of discharge port 43 and the conduit 42 to block communication therebetween.

In the operation of the device, the oil reservoir 11 is filled to a desired level through the hole 47 formed in the top thereof. After insertion of the closure member 48 into hole 47 the pump is ready to function under the actuation of handle 23.

To fill the pump cylinder 12 with oil the handle is moved angularly about its normal fulcrum 31 toward the pump casing to retract piston 17. The retraction of piston 17 creates a pressure differential between the oil reservoir and cylinder 12 sufficient to overcome the spring bias on ball valve 16 and open the latter. Oil flows downwardly through conduit 15 to fill the pump cylinder 12 in front of piston 17.

To discharge the oil from cylinder 12 the handle is moved angularly about its fulcrum in the opposite direction, away from the pump casing. Through its pivotal linkage with the handle the piston 17 is pushed forwardly to expel the oil from the cylinder. The resulting oil pressure behind ball valve 33 opens the latter against the action of its normal spring bias. The oil then rises up through conduit 41 and opens check valve 45 to flow therebeyond to the discharge port 43 in the pressure line. During this action ball valve 16 is seated by its spring bias and by the oil pressure from the forward movement of piston 17 to close conduit 15. In like manner release poppet valve 35 is also seated during this action.

After completion of the forward movement of piston 17, the handle is again moved toward the pump casing to retract the piston and refill the cylinder 12. In order to relieve the oil pressure on the operating cylinder connected to the outlet of discharge port 43, the poppet valve 35 is opened after the piston has been fully retracted. After the retracted piston 17 abuts against the stuffing box 19 the manual movement of handle 23 toward the pump casing is continued. As a result of this further angular movement of the handle, the coil spring 28 is compressed and plunger 25 is pushed forwardly to engage stem 36 and unseat valve member 35, which in turn pushes open check valve 45. During this further angular movement of handle 23, the pin 24 becomes the fulcrum about which it moves angularly and its normal fulcrum pin 31 is pushed forwardly in unison with plunger 25. The opening of release valve 35 and check valve 45 permits oil under pressure to flow back through discharge port 43, conduit 42, and bore 33 into the intermediate chamber 13 communicating with the oil reservoir. Thus, it will be seen that there is provided a sealed system in which the oil discharged by the pump during forward movement of the pump piston is returned to the oil reservoir in response to completion of the handle movement for retracting the pump piston.

In the form of the invention shown in Fig. 3 the internal valve and conduit arrangement is the same as in the form shown in Fig. 2. How-

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ever, the lever arrangement for operating the pump piston and the plunger for opening the release poppet valve is different.

As shown in the drawing, a bifurcated member 49 is rigidly secured to the rear end of piston stem 18. A cross pin 50 on the member 49 forms a pivotal connection for handle 23 to the piston stem.

Plunger 25 extends rearwardly through the pump casing and is attached at its rear end to an enlarged member 51 which provides a shoulder 52 at its forward end. Coil spring 28 is under compression between shoulder 52 and casing boss 29 to normally bias plunger 25 to its retracted position. Adjacent its rear end member 51 carries a cross pin 53. A pair of spaced parallel links 54 are connected at one end to the cross pin 53 and at their other ends are connected to the handle 23 through a cross pin 55. Normally cross pin 53 forms the fulcrum about which handle 23 swings through its linkage therewith by links 54.

In the operation of this form of the invention, to draw oil into the pump cylinder the handle 23 is moved angularly about cross pin 53 toward the pump casing to retract the pump piston.

To discharge the oil from the pump cylinder the handle 23 is moved angularly about cross pin 53 in a direction away from the pump casing to push the pump piston forwardly within the pump cylinder.

Next, the handle 23 is again moved angularly about cross pin 53 in a direction toward the pump casing to again retract the pump piston and draw oil into the pump cylinder to be discharged in the next forward movement of the pump piston. To open the release poppet valve the handle movement toward the pump casing is continued until the plunger 25 is pushed forwardly, against the urging of coil spring 28, to unseat the release poppet valve in the manner described in connection with Fig. 2. This action occurs after the pump piston has been fully retracted, and during this action the fulcrum about which handle 23 swings is the cross pin 50, by which the handle is pivotally connected to the piston stem. The cross pin 53, which normally is the fulcrum about which the handle swings, is pushed forwardly in unison with the plunger 25 during this continued movement of the handle toward the pump casing to open the release poppet valve.

While there have been described preferred embodiments of the present invention it is to be understood that variations and modifications of the described forms may be resorted to without departing from the spirit and scope of the invention.

#### I claim:

1. A pump comprising a pump cylinder, a piston reciprocable within said cylinder, a reservoir containing pump fluid, means responsive to retraction of said piston for effecting communication between said reservoir and said pump cylinder to fill the latter with fluid forward of the piston, said piston being operative upon forward movement to expel fluid from said pump cylinder into a discharge line, valve means normally blocking communication between said discharge line and said reservoir, a reciprocable plunger normally biased away from engagement with said valve means, and a lever pivotally connected intermediate its ends to said plunger and at one end pivotally linked with said pump piston, said lever being operative upon angular move-

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ment in one direction about its connection to said plunger to move said piston forward within said pump cylinder to expel fluid therefrom into said discharge line, said lever being operative upon angular movement in the opposite direction about its connection to said plunger to retract said piston, said lever being operative after full retraction of said piston and upon continued angular movement in said opposite direction to pivot about its connection to said piston and to move said plunger into engagement with said valve means to open the latter and permit fluid from said discharge line to return to said reservoir.

2. A pump comprising a pump cylinder, a piston reciprocable within said cylinder, a reservoir containing pump fluid, means effecting communication between said reservoir and said pump cylinder during retraction of the piston to fill the latter with fluid forward of the piston, a discharge line adapted to communicate with the pump cylinder forward of the piston, a check valve normally blocking communication between the pump cylinder and said discharge line and operative to open upon forward movement of the piston to pass fluid from the pump cylinder to said discharge line, a passage effecting communication between said discharge line and said reservoir and connected to said discharge line after said check valve, valve means in said passage normally blocking communication between said discharge line and said reservoir, movable piston-operating means operatively connected to said piston for reciprocating the piston, said piston-operating means being operative when moved in one direction to move the piston forward in said pump cylinder to effect opening of said check valve and to expel fluid from the pump cylinder to said discharge line, said piston-operating means being operative when moved in the opposite direction to retract the piston to effect closing of said check valve and to draw fluid from said reservoir into the pump cylinder, means for limiting retracting movement of said piston beyond a predetermined position, and means actuated by said piston-operating means in response to engagement of said piston with said limiting means and upon continued movement of said operating means in the same direction after retraction of the piston to said predetermined position to effect opening of said valve means between said discharge line and said reservoir for the return of fluid from said discharge line to said reservoir while said check valve is closed.

3. The pump of claim 2, wherein said piston-operating means includes a lever connected to the piston and movable in opposite directions to effect movement of the piston, and wherein there is additionally provided a reciprocable plunger pivotally linked with said lever and movable thereby to engage and open said valve means upon said continued movement of the lever after retraction of the piston.

4. A pump comprising a pump cylinder, a piston reciprocable within said pump cylinder, a reservoir containing pump fluid, means effecting communication between said reservoir and said pump cylinder during retraction of the piston to fill the pump cylinder with fluid forward of the piston, a discharge line adapted to communicate with the pump cylinder forward of the piston, a check valve normally blocking communication between the pump cylinder and said discharge line and operative to open upon forward movement of the piston to pass fluid from the pump

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cylinder to said discharge line, a passage effecting communication between said discharge line and said reservoir and connected to said discharge line after said check valve, valve means in said passage normally blocking communication between said discharge line and said reservoir, a reciprocatory plunger normally biased away from engagement with said valve means and mounted for movement toward said valve means to engage and open said valve means for effecting communication between said discharge line and said reservoir, and a lever pivotally linked intermediate its ends to said plunger and at one end pivotally linked with said piston, said lever upon angular movement in one direction about its connection with said plunger moving said piston forward in the pump cylinder to effect opening of said check valve and to expel fluid from the pump cylinder to said discharge line, said lever upon angular movement in the opposite direction about its connection to said plunger retracting said piston and effecting closing of said check valve, said lever after full retraction of said piston and upon continued angular movement in said opposite direction pivoting about its connection to said piston and moving said plunger into engagement with said valve means to open the latter and permit the return of fluid from said discharge line to said reservoir while said check valve remains closed and while said piston is retracted.

5. A pump comprising a pump cylinder, a piston reciprocable within said cylinder, a reservoir containing pump fluid, means effecting communication between said reservoir and said pump cylinder during retraction of said piston to fill the pump cylinder with fluid forward of the piston, a discharge line adapted to communicate with the pump cylinder forward of the piston, a check valve normally blocking communication between the pump cylinder and said discharge line and operative to open upon forward movement of the piston to pass fluid from the pump cylinder to said discharge line, a passage effecting communication between said discharge line and said reservoir and connected to said discharge line after said check valve, valve means in said passage normally blocking communication between said discharge line and said reservoir, movable piston-operating means operatively connected to said piston for reciprocating the piston, said piston-operating means being operative when moved in one direction to move the piston forward in said pump cylinder to effect opening of said check valve and to expel fluid from the pump cylinder to said discharge line and operative when moved in another direction to retract the piston to effect closing of said check valve and to draw fluid from said reservoir into the pump cylinder, means for limiting retracting movement of said piston beyond a predetermined position, and means actuated by said piston-operating means in response to engagement of said piston with said limiting means and upon continued movement of said piston-operating means in said other direction after retraction of the piston to said predetermined position to open said valve means between said discharge line and said reservoir for the return of fluid from said discharge line to said reservoir while said check valve is closed.

6. A pump comprising a pump cylinder, a piston reciprocable within said pump cylinder, a discharge line connected to receive fluid expelled from said pump cylinder, a reservoir containing pump fluid, means effecting communication be-

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tween said reservoir and said pump cylinder during retraction of said piston to fill said pump cylinder forward of the piston, movable piston-operating means connected with said piston for reciprocating the piston in the pump cylinder, said piston-operating means upon movement in one direction moving the piston forward in said pump cylinder to expel fluid from the pump cylinder into said discharge line, said piston-operating means upon movement in another direction retracting the piston to fill the pump cylinder from the reservoir, means for limiting retracting movement of said piston beyond a predetermined position, and means actuated by said piston-operating means in response to engagement of said piston with said limiting means and upon continued movement of said piston-operating means in said other direction after retraction of the piston to said predetermined position to effect communication between said discharge line and said reservoir for the return of fluid from said discharge line to said reservoir while the piston is retracted.

7. A pump comprising a pump cylinder, a piston reciprocable within said cylinder, a reservoir containing pump fluid, means effecting communication between said reservoir and said pump cylinder during retraction of the piston to fill the cylinder with fluid forward of the piston, a discharge line communicating with the pump cylinder forward of the piston, a first check valve normally blocking communication beneath the pump cylinder and said discharge line and operative to open upon forward movement of the piston to pass fluid from the pump cylinder to said discharge line, a passage effecting communication between said discharge line and said reservoir, valve means in said passage normally blocking communication between said discharge line and said reservoir, a discharge conduit communicating with said discharge line, a second check

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valve normally blocking communication between said discharge conduit and said discharge line and operative to open upon forward movement of said piston to discharge fluid from the pump cylinder, and movable piston-operating means operatively connected to said piston for reciprocating the piston, said piston-operating means being operative when moved in one direction to move the piston forward in said pump cylinder to effect opening of said first check valve and to expel fluid from the pump cylinder to the discharge line, said piston-operating means being operative when moved in the opposite direction to retract the piston to effect closing of said check valve and to draw fluid from the reservoir into the pump cylinder and being operative upon continued movement in the same direction after retraction of the piston to effect opening of said valve means and said second check valve for the return of fluid from the discharge conduit to said reservoir while the first check valve is closed.

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