April 3, 1951 W. T. STEPHENS 2,547,055

MANUALLY OPERATED RECIPROCATING PUMP

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Fig. 1.

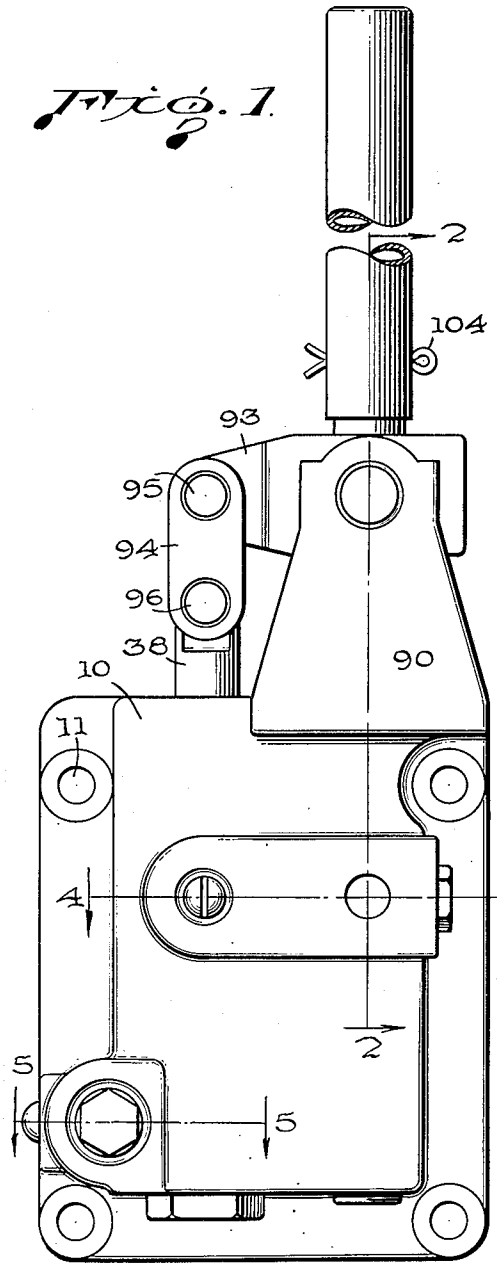
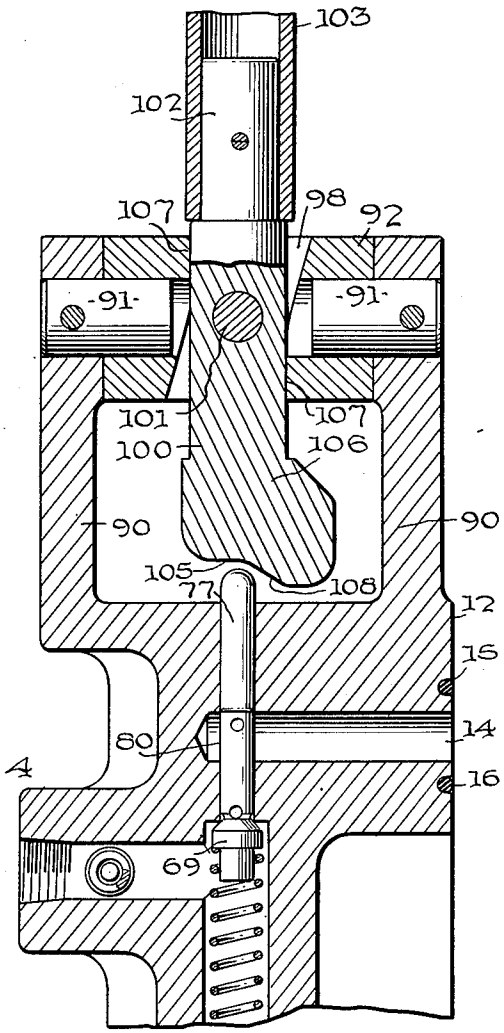


Fig. 2.



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By Leech & Radue

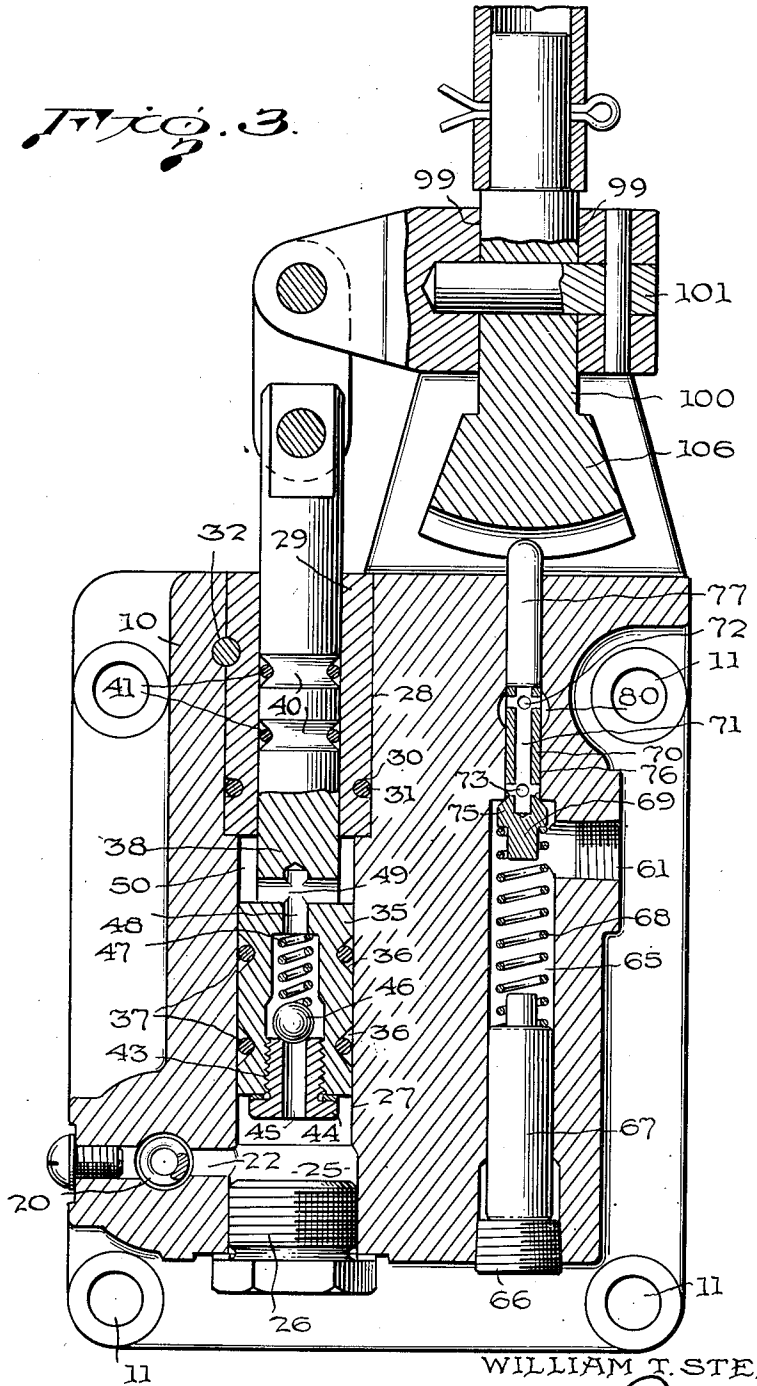
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MANUALLY OPERATED RECIPROCATING PUMP

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Fig. 3.



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Fig. 4

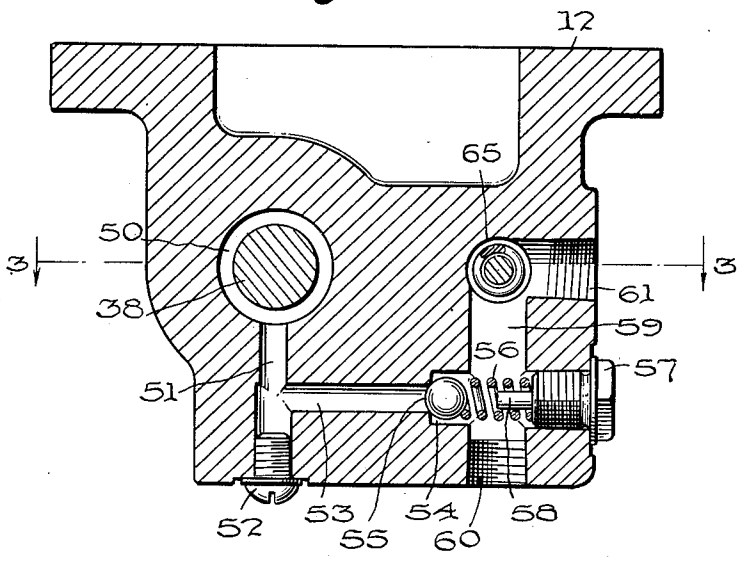
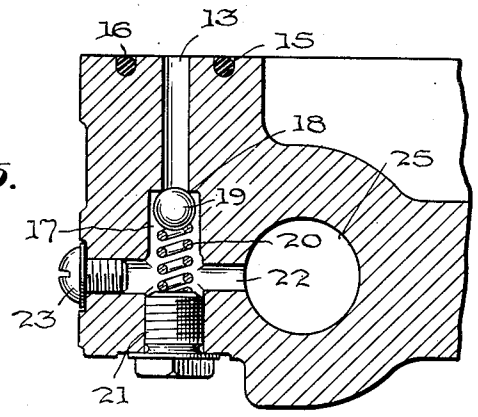


Fig. 5.



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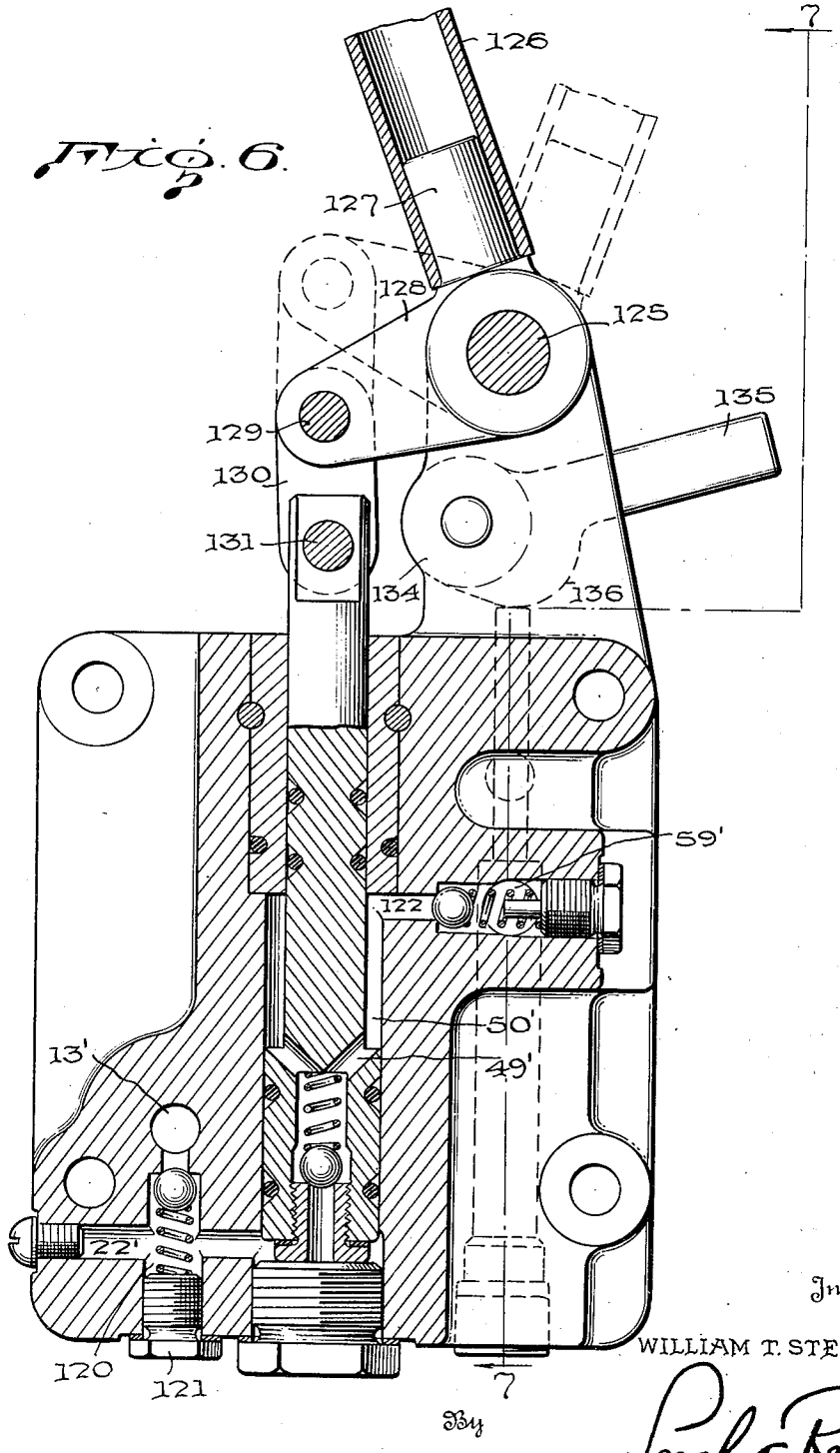
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MANUALLY OPERATED RECIPROCATING PUMP

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Fig. 6.



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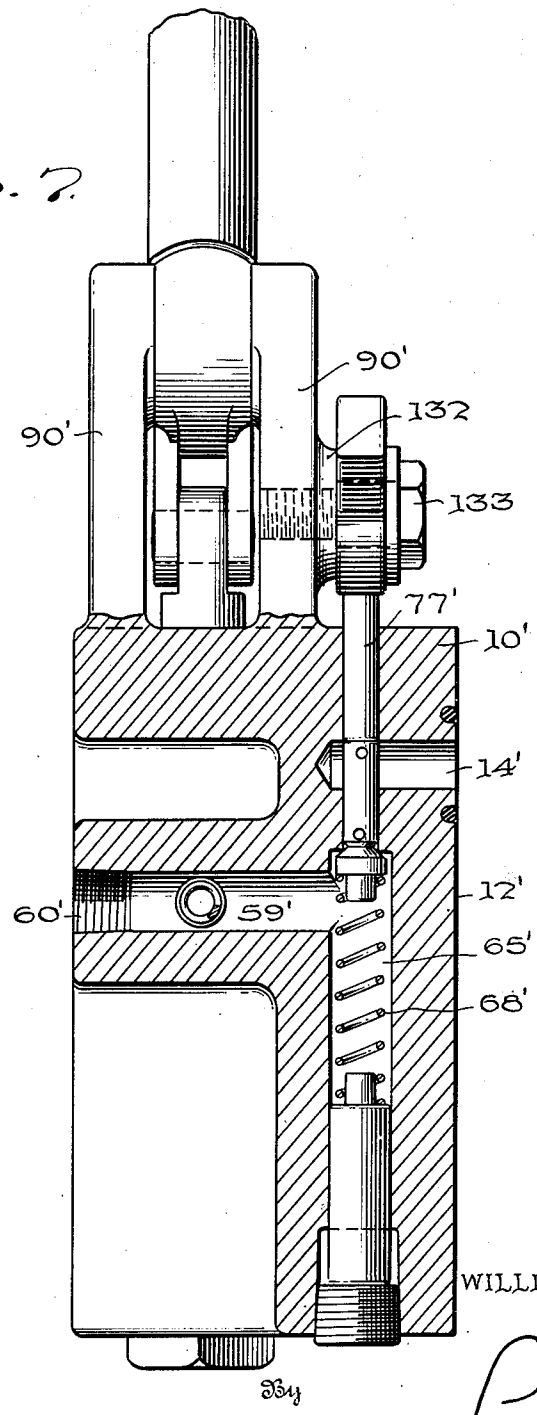
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MANUALLY OPERATED RECIPROCATING PUMP

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Fig. 7.



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UNITED STATES PATENT OFFICE

2,547,055

MANUALLY OPERATED RECIPROCATING PUMP

William T. Stephens, Painesville, Ohio, assignor, by mesne assignments, to Hydraulic Equipment Company, Cleveland, Ohio, a corporation of Ohio

Application May 19, 1945, Serial No. 594,657

11 Claims. (Cl. 103—41)

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This invention relates to pumps and more particularly to manually operable pumps of relatively small capacity intended for the operation of hydraulic apparatus and comprising a single plunger, double-acting, single-stage type.

It is a general object of the present invention to provide a novel and improved manually operable plunger type of pump adapted for interchangeable association with various sizes, shapes and styles of reservoirs or storage tanks.

More particularly it is an object of the invention to provide a manually operable, single plunger, double-acting, single-stage hydraulic pump of extremely simple construction wherein a single lever serves both for the pumping and for the release of high pressure liquid.

An important feature of the invention resides in the arrangement of the ports, passages, valves and the like leading to a compact simple structure in a one-piece housing adapted to be mounted directly on the face of a reservoir.

Another important feature resides in the construction of the pump chamber, plunger and plunger guide whereby a double acting effect is obtained in a simplified manner.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and the following specification wherein are disclosed two exemplary embodiments of the invention with the understanding that such changes and substitutions of parts from one embodiment to the other may be made therein as fall within the scope of the appended claims without departing from the spirit of the invention.

In said drawings:

Fig. 1 is a front elevation of a manually operable hydraulic pump constructed in accordance with the present invention;

Fig. 2 is a fragmentary vertical section through the axis of oscillation of the pump handle taken on line 2—2 of Fig. 1 and shown on an enlarged scale;

Fig. 3 is a vertical section in a plane through the axes of the pump plunger and release valve plunger and taken on line 3—3 of Fig. 4;

Fig. 4 is a horizontal section taken on line 4—4 of Fig. 1 and showing the pump discharge valve;

Fig. 5 is a fragmentary horizontal section taken on line 5—5 of Fig. 1 and showing the fluid inlet passage and valve;

Fig. 6 is a view similar to Fig. 3 of a modified

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construction in which an independent lever is used for releasing the high pressure fluid, and

Fig. 7 is a section on broken line 7—7 of Fig. 6.

The pump of the present invention is intended for use with hydraulic systems wherein a ram or jack type of device is used for manipulating machine parts, moving large valves, actuating hoists and the like in such locations or with portable equipment where power driven pumps are not available or desirable. Such pumps should be of rugged construction, simplified design and having long life and ease of manipulation. It has heretofore been the practice to design and construct such a pump with its body or housing integral with a tank or reservoir for holding a quantity of fluid to be handled by the pump. This seriously limits the field of use of the pump to operating apparatus within the capacity of the tank. Heretofore endeavors have been made to increase tank capacity by some auxiliary means which were costly, elaborate and cumbersome.

In accordance with the present invention the pump is made as a separate unit arranged to be secured against one side face of any size tank. The pump housing and the tank wall are provided with mating openings for delivery of fluid to the pump and for the discharge of high pressure fluid from the release valve back to the tank.

Referring now to the drawings and particularly to Figs. 1 to 5, inclusive, the pump housing 10 will be seen to comprise an irregular casting generally rectangular in shape and provided in its marginal flanges with four reinforced bolt holes 11 whereby the same may be attached to a suitable reservoir or tank not shown. The rear face 12 of the housing is provided with plane areas suitably surfaced for conforming to the surface of the tank and at 13, Fig. 5, the face 12 is perforated by an inlet bore or passage while at 14 is shown a release passage for high pressure fluid likewise passing through the surface 12. Each of the inlet and release passages has its port at the face 12 surrounded by an annular channel or groove 15 within which is arranged a ring 16 of swellant packing material insuring against leakage of liquid when the pump housing is bolted against the tank wall and the openings 13 and 14 mated with corresponding openings in the tank wall.

The inlet passage 13 as seen in Fig. 5 is counterbored at 17 to provide an inlet valve seat 18 on which a valve ball 19 is pressed by means of

spring 20 positioned by plug 21. An intersecting transverse passage 22 whose outer end is appropriately plugged at 23 leads into the vertical bore or pump chamber 25 near the bottom of the same.

As seen in Fig. 3 this vertical bore extends from top to bottom of the housing and the enlargement 25 is internally threaded to receive the bottom plug 26. Above that the bore portion 27 accommodates the pump plunger with a working fit, while an enlarged counter-bore 28 at the top receives a sealing and guiding bushing 29 in the form of an annular element circumferentially grooved at 30 to receive a swellant packing 31 to seal the bushing in the bore 28. The bushing may be held in position as by a tapered pin 32.

The pump plunger comprises head 35 sized to work closely in the bore 27 and circumferentially grooved as at 36 to receive appropriate packing rings 37 to prevent leakage past the plunger. The reduced diameter rod 38 integral with the plunger has a close fit in the bore of the bushing 29 and is itself grooved as at 40 to receive packings 41 insuring fluid tightness in the bushing bore. The piston and rod assembly is drilled from the bottom end to form a stepped bore, the large lower portion of which is threaded at 43 to receive the combined plug and valve seat 44 drilled longitudinally at 45 for the passage of liquid and being arranged to seat on its upper end the valve ball 46 in a continuation of the bore in the plunger. This ball is normally held closed by spring 47 but when opened discharges liquid into the smaller continuation 48 of the bore connected by laterals 49 to the surface of the plunger rod just above the plunger head.

The annular chamber 50 above the plunger and surrounding its rod is connected to the pump discharge valve by means of passage 51 (see Fig. 4), closed at the front face of the housing by plug 52, and by intersecting transverse passage 53, counterbored as at 54 to provide a seat for the discharge valve ball 55 positioned by spring 56 compressed and centered by plug 57, in an extension of bore 54, and equipped with centering stud 58. An intersecting bore 59 receives the discharge from the valve and delivers it to the work port 60 or the optional work port 61 in the side face of the housing. One of these should be plugged and the other connected to the ram or other operated mechanism. This bore 59 also intersects a vertical bore 65 seen in Figs. 3 and 4. Like the main pump bore this one extends from top to bottom of the housing and is plugged at the bottom by a suitable pipe plug 66 which supports the spacer and centering device 67 for spring 68 which normally holds the high pressure release valve 69 in a closed condition.

Valve 69 is of poppet type and comprises a stem 70 drilled longitudinally as at 71 and laterally as at 72 and 73, the latter bores being just at the neck adjacent the poppet head 75 of the valve, which seats at the junction of bore 65 and a smaller continuation 76 which passes through the upper face of the pump housing.

When the release valve is unseated by pressure on the operating pin 77, movable in the upper end of bore 76 and with its outer end extending beyond the top surface of the housing, high pressure liquid passes beneath the head through the passages 73, 71 and 72 into lateral bore 80 which in Fig. 2 will be seen to join release port 14 previously defined.

For manipulating the plunger of the pump two integral arms 90 straddle operator 77 and extend upwardly from the housing to support aligned bearing pins 91 appropriately fastened in position and journalling the spider 92 which has a lateral extension or pump lever 93 integral therewith. The outer end of this lever is attached by clevis 94 through pivot pins 95 and 96 with the top of the pump rod 38 to operate the pump when the spider is oscillated about bearing pins 91.

The spider 92 is centrally and transversely perforated by slot 98 having flat parallel side walls 99 between which is closely fitted the rectangular section 100 of a lever stub. The slot 98 is shaped as seen in Fig. 2 to permit the stub limited clockwise rotation, from the position indicated, about the pivot 101 arranged in the spider transversely to both the slot and the axis of pins 91. The stub 100 where it works in the slot is rectangular in cross-section, but its upper end 102 is cylindrical for convenience in receiving the handle or main portion 103 of the pump lever in the form of a hollow tube having a close fit over the section 102 and removably attached thereto by means of cotter pin 104.

The lower end of the stub 100 fans out into a sector-like portion 106 as viewed in Fig. 3 which transverse section has the peculiar cam shape seen in Fig. 2 with a face 105 normally clearing the rounded upper end of release valve operator 77 when the lever is in its normal or vertical position with the side portions of the stub resting against the stop walls 107 in the slot 98. This is the pumping position of the lever, and it may be operated freely without disturbing the release valve operator 77. When the hand lever, however, is moved in the clockwise direction, as viewed in Fig. 2, the arcuate cam surface 108 engages the pin 77, pushes it downwardly and opens the release valve 69 to permit liquid from the operated apparatus to return to the tank via passage 80 and port 14. The sector-like portion 106 is of such length that anywhere within the limits of the pump stroke, as determined by the engagement of the plunger with either the stop plug 26 or the guide bushing 29, lateral movement of the lever will engage the cam with the release pin 77. Thus it is not necessary to stop the pump plunger or handle in any particular position in order to be able to engage the release valve operator.

The construction of the pump plunger, connecting rod and pump chamber provides a double acting pump, that is, one which discharges liquid on both strokes of the plunger. This is done without providing both inlet and discharge valves for each end of the pump chamber by using the check valve 46 in the plunger. The operation is as follows:

On a lift stroke fluid is drawn in beneath the plunger through the intake valve 19 in the usual manner to fill the chamber below the plunger. On the down stroke of the plunger the intake valve closes and the liquid previously drawn in is forced to pass to the upper side of the plunger through check valve 46. The displacement beneath the plunger is much greater than that above the same because of the large diameter of the plunger rod 38 and thus the liquid displaced by the downwardly moving plunger cannot all be received in the chamber 50 above the plunger and is therefore forced out through the pump discharge valve 55. On the next lift stroke the liquid which now fills chamber 50 is discharged by displacement by the rising plunger at the same time that the space beneath the plunger is again being filled with liquid. In order to provide substan-

tially uniform discharge from the pump it is preferred that the area of the annulus between the cylinder bore and the plunger rod be approximately one-half of the area of the plunger bore.

When the pump is used for operating a ram or hoist the latter may be retained in any lifted position while under load merely by stopping the plunger operation for then the discharge valve 55 of the pump prevents the return of liquid to the pump while the release valve 69 remains seated and prevents liquid being returned to the tank. Whenever it is desired to lower the hoist or ram, the pump lever is tilted to engage the cam surface thereon with the release valve operator 77. The rate of lowering can be regulated by the amount of lateral movement given to the pump lever. This whole arrangement materially simplifies the operation of a manually manipulated hydraulic hoist or the like.

In the embodiment of Figs. 6 and 7 the provision of a separate operating toggle or release valve operating lever to some extent simplifies the pump construction since it removes the need or desirability of having the axis of the pump plunger and of the release valve lie in a plane parallel to the back face of the pump. The pump housing can thus be reduced in height and thickness as shown. Since most of the parts in Figs. 6 and 7 are identical in construction and operation to those in Figs. 1 to 5, inclusive, no description will be given except where necessary to define slight differences in arrangement. The housing 10' is again a simple casting with a flat back wall 12' for mounting against the wall of a reservoir or tank. The inlet passage to the pump is seen at 13' but the pump inlet valve is contained in a vertical bore 120 closed by a bottom plug 121 and the transverse passage 22' intersects it in quite a similar manner as in the construction of Figs. 1 to 5.

The pump bore and plunger are not substantially different from those in the preferred embodiment except for the slight inclination of the passages 49' between the plunger-carried valve and the space 50' above the plunger. These passages 49' are upwardly and outwardly inclined to offer somewhat less resistance to the flow of fluid through them.

The discharge valve from the pump shows some simplification in arrangement in that a single direct horizontal passage 122 connects the top of space 50', above the plunger, directly to the discharge valve housing. The outlet from this valve is by way of passage 59' and but a single front discharge opening 60' is provided. The passage 59' intersects the release valve bore 65' which is closer to the rear face 12' of the housing than is the plunger bore. Its restricted upper portion intersects the release passage 14' which returns to the tank and the valve operating plunger 77' extends up through the top wall of the housing behind the closely spaced legs 90' for mounting the pivot 125 for the pump operating lever. This operating lever, having a separable handle 126, comprises a simple casting in the form of a bell crank having a stud 127 to receive the movable extension 126 and an arm 128 pivoted by means of pin 129 to links 130 which in turn are pivoted at 131 to the pump plunger rod. The bell crank lever is provided centrally with a hub bored to journal on the pin 125 and sized to closely fit between the bossed upper ends of the legs 90'. The rear leg is provided with an added boss 132, near its attachment to the housing, which is horizontally drilled to receive the threaded end of a shoulder bolt 133 on which is journalled the hub

134 of release lever 135 which has a cam-like lower surface 136 adapted to engage the flat upper end of release pin 77' when the lever 135 is rotated in a clockwise direction as seen in Fig. 6. The spring 68' for the release valve is sufficiently strong to maintain the lever 135 in its normally lifted position and the shape of the cam is such that the pin cannot be maintained in the valve opening position except when pressure is applied to the lever.

I claim:

1. In a hand pump of the type described, in combination, a housing having a vertical wall for engagement with a well of a liquid reservoir, a pump chamber parallel to said wall, a double acting plunger in said chamber, a valve in said plunger, an offset inlet valve adjacent the lower end of said chamber, an offset discharge valve adjacent the upper part of said chamber, a passage from each valve through the said wall, a sealing ring inset in said wall and surrounding the port of each passage and a discharge port connected to the discharge valve passage and positioned independent of said wall.

2. In a hand pump of the type described, in combination, a housing having a vertical wall for engagement with a well of a liquid reservoir, a pump chamber parallel to said wall, a double acting plunger in said chamber, a valve in said plunger, an offset inlet valve adjacent the lower end of said chamber, an offset discharge valve adjacent the upper part of said chamber, a passage from each valve through the said wall, a sealing ring inset in said wall and surrounding the port of each passage, a second valve in the passage leading from the discharge valve to the wall port and a power port for delivering fluid intermediate said last mentioned valves.

3. In a double acting pump of the type described, in combination, a housing having a bore extending entirely through the same, the center portion of the bore comprising the pump barrel, a piston operable in said barrel and having a rod of large diameter, a plug closing the bottom of the barrel and constituting a stop for the piston, the upper end of the bore being enlarged, a bushing in said enlargement forming a guide for the rod and an upper stop for the piston, sealing means between the bore enlargement and the bushing, and offset inlet and discharge valves communicating respectively with the two sides of the piston.

4. In a double acting pump of the type described, in combination, a housing having a bore extending entirely through the same, the center portion of the bore comprising the pump barrel, a piston operable in said barrel and having a rod of large diameter, a plug closing the bottom of the barrel and constituting a stop for the piston, the upper end of the bore being enlarged, a bushing in said enlargement forming a guide for the rod and an upper stop for the piston, sealing means between the bore enlargement and the bushing, offset inlet and discharge valves communicating respectively with the two sides of the piston and a check valve in said piston adapted to deliver fluid from the bottom of the barrel to the rod side of the piston.

5. In a double acting pump of the type described, in combination, a housing having a bore extending entirely through the same, the center portion of the bore comprising the pump barrel, a piston operable in said barrel and having a rod of large diameter, a plug closing the bottom of the barrel and constituting a stop for

the piston, the upper end of the bore being enlarged, a bushing in said enlargement forming a guide for the rod and an upper stop for the piston, sealing means between the bore enlargement and the bushing, offset inlet and discharge valves communicating respectively with the two sides of the piston, a check valve in said piston adapted to deliver fluid from the bottom of the barrel to the rod side of the piston, a seat member for said check valve extending below the bottom of said piston and adapted to cooperate with said plug to limit the piston movement.

6. In a pump, in combination, a housing, a pump cylinder therein, a piston operable in said cylinder, a discharge passage from the pump, a release valve adapted to vent liquid from said passage, a rod coaxial with said piston for actuating the same, an operator for said valve, said rod and operator extending through one outer face of said housing, a lever pivoted for oscillation above said face and positively connected to said rod to operate the pump, means on said lever normally out of engagement with said operator, said means being so constructed and arranged that it will move said operator on tilting the lever in one direction from its normal plane of oscillation.

7. In a pump, in combination, a housing, a pump cylinder therein, a piston and rod movable in said cylinder, a discharge passage from the pump in said housing, a release valve for said passage, an operator for said valve protruding from the same face of the housing as said piston rod, a lever pivoted for oscillation above said face, means connecting said lever to said rod for operating the pump piston in both directions, cam means on said lever for actuating said operator in any pumping position of the lever, and means pivoting the lever for movement to or from operator actuating position.

8. In a pump, in combination, a housing, a pump cylinder therein, a piston and rod movable in said cylinder, a discharge passage from the pump in said housing, a release valve for said passage, an operator for said valve protruding from the same face of the housing as said piston rod, arms extending from the housing and straddling the said operator, a spider journalled between said arms for oscillation on an axis transverse to a plane through the axes of the cylinder and operator, a lever on said spider linked to said rod to operate the pump and a stub pivoted in said spider on an axis at right angles to the spider axis, a sector on said stub having an arcuate extent greater than the maximum oscillation of the spider and a cam face on said sector adapted to actuate the operator in any position of the spider when said stub is tilted about its axis.

9. In a pump, in combination, a housing, a pump cylinder therein, a piston and rod movable in said cylinder, a discharge passage from the pump in said housing, a release valve for said passage, an operator for said valve protruding from the same face of the housing as said

piston rod, arms extending from the housing and straddling the said operator, a spider journalled between said arms for oscillation on an axis transverse to a plane through the axes of the cylinder and operator, a lever on said spider linked to said rod to operate the pump, a stub pivoted in said spider on an axis at right angles to the spider axis, a sector on said stub having an arcuate extent greater than the maximum oscillation of the spider and a cam face on said sector adapted to actuate the operator in any position of the spider when said stub is tilted about its axis and a removable actuating handle attached to said stub opposite its pivot from the said sector.

10. In a pump of the type described, in combination, a housing having a flat wall for engagement with a wall of a fluid tank, a pump barrel formed by a bore in said housing parallel to said wall, a release valve bore in said housing parallel to the pump barrel, a release valve longitudinally movable in said bore, a fluid discharge port opening from said valve bore intermediate its closed ends, an outlet valve from the pump barrel arranged to discharge into said bore, a lever and means mounting said lever on said housing to be optionally movable in a plane containing the axes of said barrel and bore to operate the pump or laterally of said plane in any pumping position to actuate said release valve.

11. In a pump of the type described, in combination, a housing having a cylinder therein, a piston operable in said cylinder, a lever, means pivoting said lever on the housing for normal oscillation substantially in a plane, means connecting said lever to said piston for actuating the latter, a poppet type release valve in said housing for liquid pumped by said piston, an operating pin for said valve extending outwardly from said housing not greatly removed from said plane, and cam means arranged on said lever transversely of said plane to operate the release valve when the lever is tilted out of said plane, said cam means being extended along an arc about said pivot means to be effective in any pumping position of the lever.

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