March 13, 1951 J. S. PILCH 2,544,805

CONTROL MECHANISM FOR HYDRAULIC PUMPS

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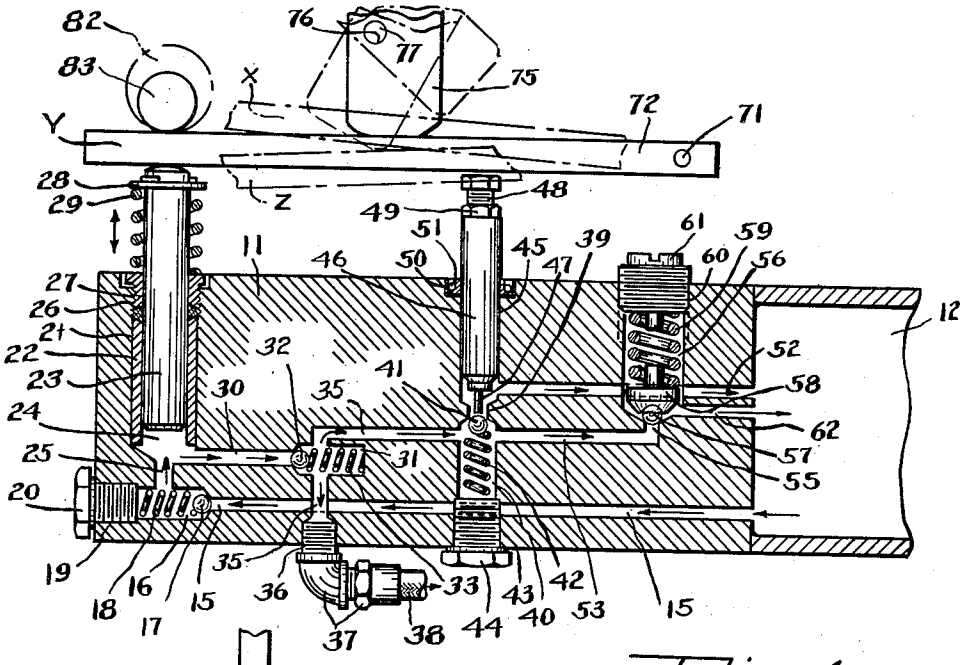


Fig. 1.

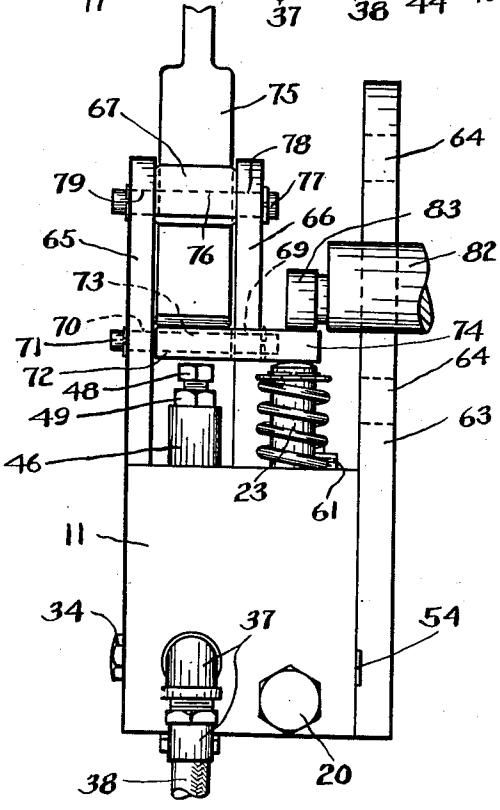


Fig. 4.

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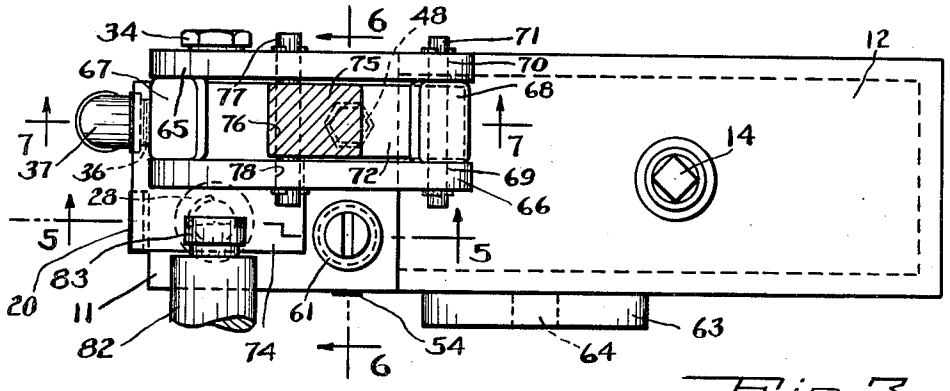


Fig. 3.

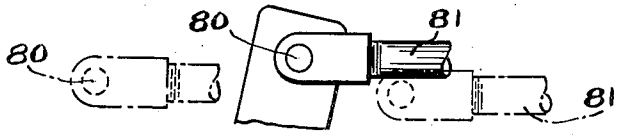
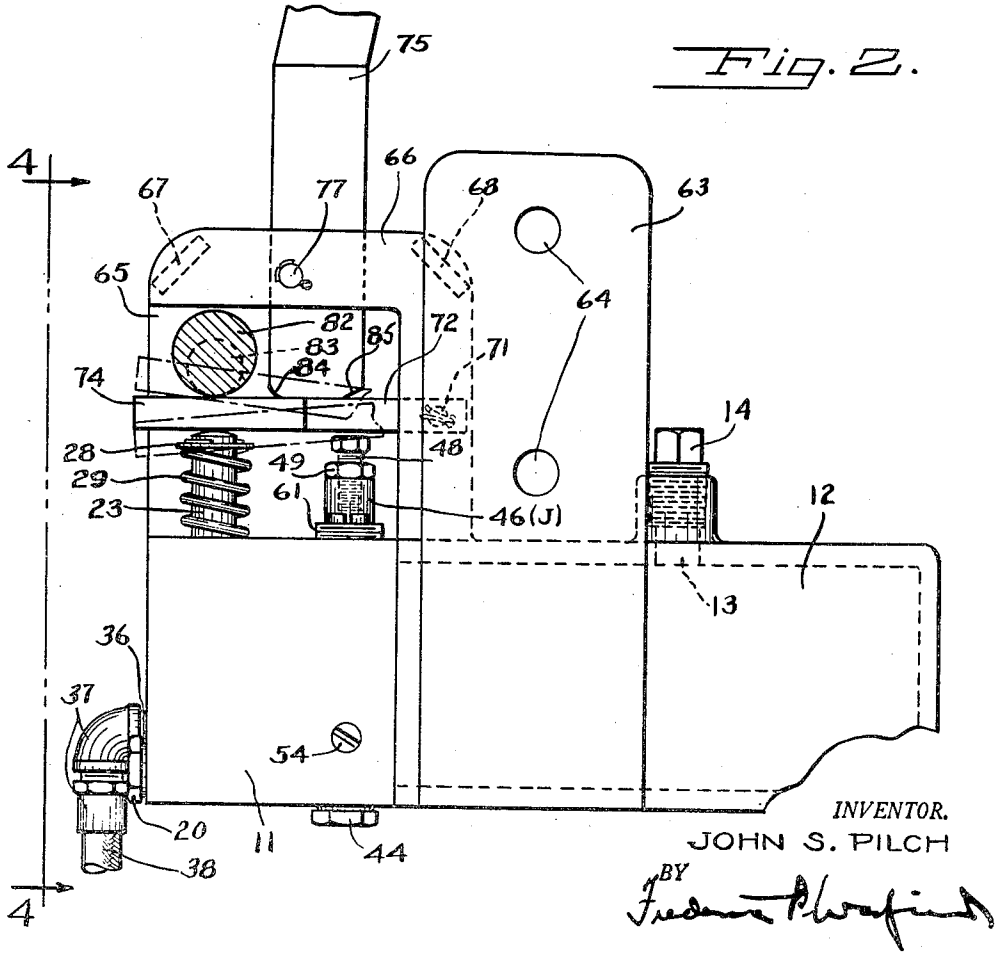


Fig. 2.



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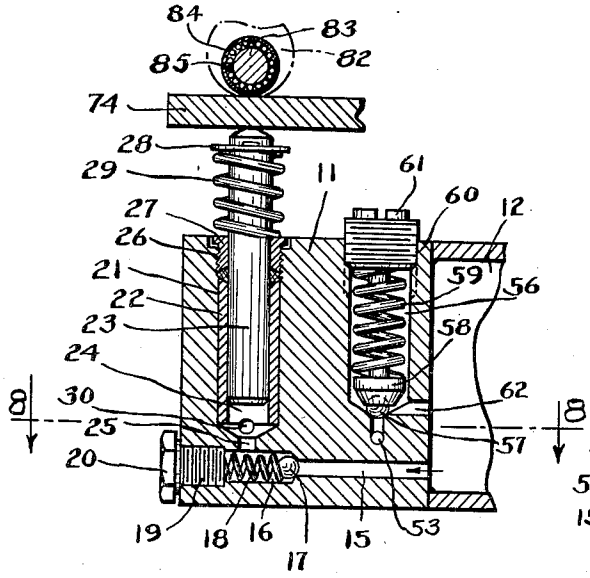


Fig. 5.

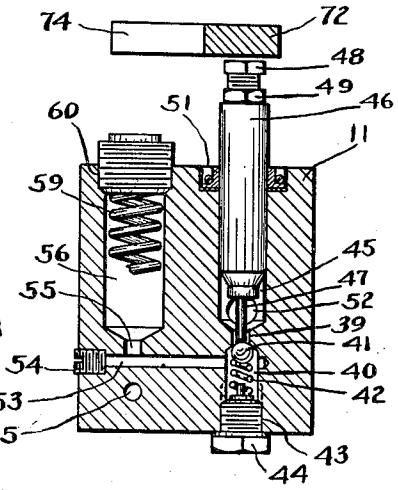


Fig. 6.

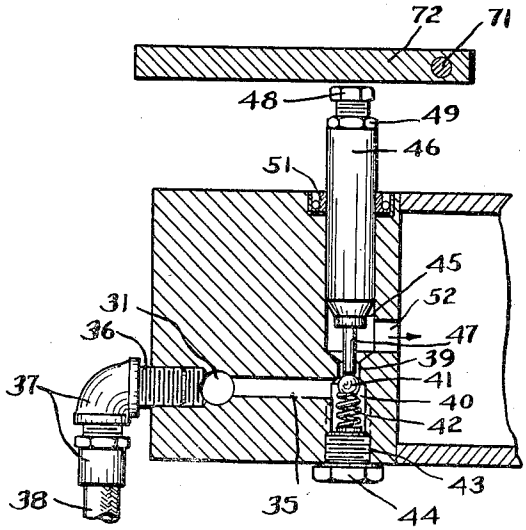


Fig. 7.

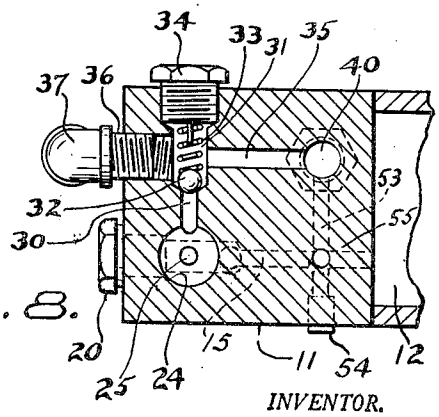


Fig. 8.

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UNITED STATES PATENT OFFICE

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CONTROL MECHANISM FOR HYDRAULIC PUMPS

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Application January 8, 1947, Serial No. 720,898

5 Claims. (Cl. 103—23)

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The present invention relates to devices for pumping fluid for the hydraulic operation of some mechanism, especially mechanism of the type commonly used with trucks or with tractors and loaders, and more particularly the combination of such a device with control valves therefor.

It is one of the objects of the invention to provide a hydraulic pressure system suitable for operation by the power plant of a truck or other machine and having means for connecting it with such source of power that shall be of maximum simplicity both in construction and in the operation of connecting and disconnecting the pump to and from its source of power.

Another object is to provide a hydraulic pump and control mechanism therefor provided with a single control member adapted for manual operation which can be used to connect the pump to its source of power for operating it, disconnect the pump from the source of power without releasing the hydraulic pressure, and release the pressure, these operations being performed in any desired order.

These and other objects of the invention will readily appear to those skilled in the art to which it appertains by a consideration of one embodiment thereof as set forth in the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a view of the device partly in section as a whole showing the functional relationship of the parts;

Fig. 2 is a side elevation of a combined pump and control valve;

Fig. 3 is a top plan view of the same;

Fig. 4 is an end elevation taken in the direction indicated by the line 4—4 of Fig. 2;

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

Fig. 6 is a transverse vertical section taken on the line 6—6 of Fig. 3;

Fig. 7 is a vertical section taken on the line 7—7 of Fig. 3; and

Fig. 8 is a horizontal section taken on the line 8—8 of Fig. 5.

The basic element of the structure is a block 11 of machine steel or other suitable material having a plurality of valves and passages. Either formed integrally therewith or secured thereto as by welding is a tank or reservoir 12 for the oil or other operating fluid. For the purpose of filling the tank with oil a suitable orifice 13 may be provided in the top of the tank 12 which is preferably tapped for the reception of a threaded plug 14

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by means of which the tank can be tightly closed after it has been filled.

An aperture 15 may be drilled through the block 11 near the bottom thereof and in that portion of the block nearest to the observer (Figs. 1 and 5). While this aperture extends from outside the block clear through and into the tank 12 it is of different diameters in different parts thereof. Extending from the tank to nearly the left hand end of the aperture it is of small diameter and constitutes a suction or intake passage 15 for the pump. For a short distance beyond the suction passage the aperture is of larger diameter and constitutes a valve chamber 16. At the point where the suction passage 15 opens up into the larger diameter of the valve chamber there is provided a valve seat which cooperates with a ball 17 of the valve. Positioned within the valve chamber 16 there is a spring 18 for holding the ball 17 against its seat. From the end of the valve chamber 16 to the outside of the block 11 the aperture is of a still larger diameter and may be designated by the reference character 19 and is preferably tapped for the reception of a threaded closure plug 20 which seals the aperture against the leakage of oil and at the same time presses against one end of the spring 18 which pressure is tranmitted at the other end of the spring to the ball 17 whereby the valve is kept closed until the pressure in the passage 15 rises above that in the valve chamber.

For the pump and associated parts an aperture 21 is provided in the block 11 which aperture extends vertically from the top of the block down into the valve chamber 16. Like the aperture for the intake passage this aperture is also substantially the same in its actual construction as in the sketch of Fig. 1 and is of different diameters throughout different portions thereof. The intermediate portion of the aperture has a diameter that is intermediate the diameters of the two end portions of the aperture and is preferably provided with a sleeve or lining 22 serving as a guide or bearing for a plunger or piston 23. The interior of the sleeve of lining 22 constitutes a pump chamber 24 which is connected to the valve chamber 16 by a passage 25. This passage 25 is the lower end portion of the vertical aperture 21 and is of much smaller diameter than the intermediate portion thereof. This passage 25 is so short and consequently the pump chamber 24 is so close to the valve chamber 16 that all three are for all practical purposes different parts of the pump chamber. The upper portion 26 of the aperture 21 is somewhat larger in diam-

eter than the intermediate portion of the aperture and may be provided with a packing and gland 27 to render the plunger or piston 23 tight against the leakage of oil. The upper end of the plunger may be provided with a collar 28 and between this collar 28 and the upper surface of the block 11 is positioned the spring 29 which presses against the collar 28 and tends to move the collar and the plunger upwardly except as a greater force presses against the plunger and moves it downwardly.

A third aperture 30, which is disposed horizontally, extends transversely through the block 11 and like the two apertures which have just been described is of three different diameters from one end to the other. The smaller end of the aperture constitutes the discharge passage 30 from the pump chamber 24 into a portion of the aperture which constitutes a valve chamber 31. Positioned within the valve chamber 31 there is a ball or check valve 32 which is pressed by a spring 33 against a seat which seat may be that portion of the aperture which changes its diameter from that of the passage 30 to that of the valve chamber 31. That portion of the aperture which is nearest to the rear of the block 11 is of still larger diameter and is tapped for the reception of a threaded closure plug 34.

A fourth aperture 35 (Fig. 7) is provided in the block 11 and extends from the left hand end (as seen in Fig. 2) of the block 11, through the valve chamber 31 of the discharge valve 32, and thence toward the tank 12 until the aperture connects with the valve chamber of the release valve I. Thus, the two branches 35, extending on opposite sides of the discharge valve chamber 31, are provided as schematically shown in Fig. 1. That portion of the discharge passage 35 which is shown as extending downwardly in Fig. 1 is actually extending to the left in Fig. 7. Both Fig. 1 and Fig. 7 show this portion of the discharge passage 35 correctly as being of larger diameter tapped for the reception of a pipe or conduit 36 which by means of pipe fittings 37 is connected to a hose 38 which is usually called a pressure hose or pressure line. This pressure line or hose leads directly to the hoist or other device to be operated (not shown in the drawings).

The other branch of the discharge passage 35 leads directly into the valve chamber of the release valve which will now be described.

A fifth aperture for the release valve is disposed vertically. The position of this aperture in a front to rear direction is such that it is the same distance from the rear of the block 11 as is the passage 35; in a left to right direction it is close to where the block 11 adjoins the tank 12 (as seen in Fig. 7 but not as shown in the sketch of Fig. 1).

The parts assembled in this aperture which are now to be described together constitute the manually operable release valve. The aperture consists of five different portions each having a different diameter. An intermediate portion 39 is of the smallest diameter. Just below this portion 39 there is a portion of larger diameter which constitutes the release valve chamber 40, the junction between the smaller portion 39 and the larger portion 40 providing a valve seat which cooperates with a ball 41 to constitute the valve. A spring 42 is positioned in the valve chamber 40 beneath the ball 41 and presses upwardly thereon to keep the valve normally closed. The lower end 43 of the aperture is of still larger diameter and may be tapped for the reception of a closure plug 44.

Above the intermediate portion 39 there is a larger intermediate portion 45 which receives and acts as a guide for an operating member 46 which extends above the top of the block 11 a sufficient distance to permit its being operated by manual means. The lower end of the operating member 46 is provided with a pin 47 of a sufficiently small diameter so that it can readily pass through the intermediate portion 39 of the aperture and rest against the ball 41. When the operating member 46 is pressed downward the pin 47 opens the valve 41, and conversely when the pressure is removed the spring 42 moves the ball 41 upward and the valve is closed.

In order to provide an adjustable length to the upper end of the operating member 46 the upper end of the operating member 46 is provided with a threaded opening in which there is positioned a machine screw 48 which can be adjusted in different positions and which is provided with a locknut 49 for holding it in its adjusted position.

The fifth and upper portion of the aperture is in the nature of a recess 50 for a seal 51 the purpose of which is, first, to act as a wiper to keep the dirt out and, secondly, to prevent leakage of the oil along the operating member 46.

The movement of the operating member 46 is controlled by the movement of the lever 72 which will be described more fully hereinafter.

An aperture 52 extends from the portion 45 of the aperture occupied by the plunger 46 and extends from beneath the plunger to and into the tank 12 and may be appropriately called the release valve discharge passage. Since the release valve chamber 40 is connected at all times with the discharge passage to the hoist or other mechanism to be operated, it is obvious that a movement of the operating member 46 to open the valve 41 will release the pressure and permit the reverse movement of the mechanism to which the pressure hose 38 is connected.

Still another aperture provides a passage 53 which extends from the release valve chamber 40 to a high pressure relief valve 57. In the schematic showing of Fig. 1 the passage H extends in a straight line and amounts to a continuation of the passage 35 while in the actual construction the pasage 53 extends at right angles to this direction. This is best seen by reference to Fig. 6. After the passage 53 has been made by the process of drilling from the front of the block 11 toward the rear thereof, the outer end of the hole made by drilling may be sealed by means of a plug 54 (Fig. 4 and Fig. 6).

For the purpose of housing the parts of the high pressure relief valve a vertically disposed aperture is provided which has three different portions of three different diameters. A lower portion 55 intersects or joins with the passage 53. A much larger intermediate portion 56 provides a valve seat at the junction of the two portions 55 and 56 which cooperates with the ball or valve 57. Positioned within the intermediate portion 56 there is a ball or valve guide 58 and a spring 59 which holds the ball against its seat until the pressure in the passage 55 becomes greater than the pressure above the ball and it is automatically lifted off its seat. The upper and largest portion of the vertical aperture indicated by the reference character 60 may be tapped for the reception of a threaded closure plug 61. This serves two purposes one being to hold the spring down against the ball or valve guide to provide means for adjusting the pressure

and the other being to close the aperture against oil leakage. A discharge passage 62 for the high pressure relief valve is connected between the valve chamber 56 and the tank 12.

The internal passages and parts having been described the external construction will now be described. A plate 63 of iron or other suitable material is formed integrally with the tank 12 or secured thereto as by welding and is provided with a plurality of holes 64 whereby it may be fastened to some part of the frame of a truck or tractor. A rear plate 65 is welded or otherwise suitably secured to the top rear of the block 11 and may extend toward the right part way above the tank. An L plate 66, complementary and parallel to the rear plate 65 may be secured to the block 11 about midway between the rear plate 65 and the front of the block 11. The lower left end portion of this plate has been cut away so that it is L-shaped. In order to increase the strength of the frame work, and attain greater stiffness and rigidity a pair of transverse members 67 and 68 may be provided which extend between the rear plate 65 and the L-plate 66 at the upper left hand and the upper right hand corner respectively of the structure and may be suitably welded to both of the plates. These stiffening members 67 and 68 also serve as stops, as will be described hereinafter.

There is provided in the vertical leg of the L-plate 66 about midway between the top and the bottom an aperture 69 which is in alinement with a similar aperture 70 in the plate 65. Extending between these two apertures 69 and 70 there is provided a cylindrical member 71. The operating lever 72 is provided at one end thereof with an aperture 73 through which the member 71 extends, the whole arrangement providing for a swinging movement of the operating lever 72 around the member 71 as a pivot. The operating lever 72 extends from its pivotal support toward the left about as far as the end of the device, that is, the end of the block 11. At the right hand end of the operating lever 72 its width is slightly less than the space between plates 65 and 66 but at the other end there is a lateral extension 74 so that the operating lever as a whole is L shaped.

The right hand portion of the operating lever 72 is positioned above the screw 48 at the upper end of the operating member 46 and in the lower position of the lever 72 it pushes the operating member 46 downwardly and opens the release valve 41. In the other two positions of the operating lever 72, namely, the horizontal position and the upper position, the lever 72 is above the member 46 and there is no operation of the release valve 41.

The lateral extension 74 of the lever 72 is over the end of the plunger 23 of the pump. The end of the plunger 23 is pushed against the lever 72 at all times by the action of the spring 29. If the operator of the device sets the operating lever 72 is either the horizontal or the lower position the plunger 23 takes up a corresponding position but except for this initial movement there is no movement of the plunger 23 produced by the lever 72 while it is in either of these positions.

The control arm 75 which cooperates with the lever 72 is provided with an aperture 76 through which extends a cylindrical member 77 supported in two apertures, one 78 in the L-plate 66 and the other 79 in the rear plate 65. The upper end of the control arm 75 is pivotally connected at 80 to a control rod 81 which extends

to within convenient reach of the operator. The cross section of the control arm 75 is rectangular as will be seen by referring to Fig. 3. Furthermore it will be observed that the pivotal support 76 of the control arm 75 is not in the center of the arm but to one side thereof, to the left as seen in Fig. 1 and Fig. 2. It will also be observed that the lower left-hand corner (as seen in Fig. 2) of the control arm is rounded, as indicated at 84, while the lower right-hand corner (as seen in Fig. 2) is cut at an angle, as indicated at 85 but is not rounded.

In order to facilitate a concise statement of the operation, the mechanism to be operated will be hereinafter designated as a trunk hoist or the hoist of a tractor loader although it is to be understood that the invention is by no means restricted solely to such mechanism for its utility and its value.

It will be observed by referring to Fig. 1 and Fig. 2 that the operating lever 72 may be moved into any one of three different positions. The upper position is shown in dotted lines and is indicated by the reference character X; the next or horizontal position is shown in full lines and is indicated by the reference character Y; and the lower position is shown in dotted lines and is indicated by the reference character Z. The upper position, X, may also be called the pumping position or the hoisting position. The horizontal position, Y, may be called the holding position; and the lower position, Z, may be called the releasing position or the lowering position.

It will also be observed, referring particularly to the showing of Fig. 1 and Fig. 2, and bearing in mind that the control arm 75 is pivotally supported at the point 77 which is off from the center line of the control arm, that when the control arm 75 is in the vertical position, i. e., the full line position, the bottom of the control arm rests squarely against the upper surface of the operating lever which is in the full line horizontal position. In this position the pressure of the spring acting through the lever 72 against the bottom of the control arm 75 serves to lock the parts in place.

If the control arm is moved at its upper end toward the left, thus moving its lower end toward the right, the general result will be that the lowermost portion of the end of the control arm 75 will be moved upward a slight distance and the operating lever will be permitted under the action of the spring 29 of the pump to move upward into the upper or pumping position, X.

A full detailed description of the pumping structure and its operation will now be given. A shaft 82 which is either a part of the power plant of the tractor or suitably connected therewith has a cylindrical cam 83 somewhat similar to an ordinary eccentric or crank pin extending from the end thereof. The cam 83 is surrounded by a shell 84, rotatably supported on the cam by ball bearings 85 which permit the shell to contact the lever 72 without rotating with respect thereto. This eliminates the necessity of lubricating these parts and at the same time minimizes wear thereof. The shaft 82 may be arranged for continuous rotation without affecting the operation of the control device.

The shaft 82 and cam 83 are so arranged that the axis of these parts extends transversely of the operating lever 72 and the cam 83 lies in a position just above the lever. When the operating lever 72 is in the horizontal holding position, Y, the cam 83 just touches or just fails to

reach the upper surface of it. Because of the difficulty of fabricating the parts to exact dimensions the clearance is usually about one-eighth inch. Therefore, whenever the operating lever 72 is in either of the two lower positions the cam 83 rotates around, above the operating lever, without touching it or influencing it in any way. However, whenever the control arm 75 is moved to the left at the top, i. e., toward the right at the bottom, into the pumping position, X, then the cam 83 will alternately depress the operating lever 72 to a horizontal position and permit it to rise under the action of the spring 79.

In describing the operation of the device let it be assumed in order to make the description specific and more concise that the device is being used in connection with a truck hoist. Let it be assumed that the truck hoist has been operated so as to bring the scoop of the hoist in position under a pile of dirt or other material that it is desired to lift and deposit elsewhere. The first operation would then be to operate the hoist of the scoop so as to lift the scoop and its load. For this purpose the control rod is moved, at its upper end toward the left, position X, which means toward the right at its lower end. This permits the operating lever 72 to rise above the horizontal position and it does so rise as the rotation of the shaft 82 and the movement of the cam 83 permits it to rise and then forces it down alternately thus causing the plunger 23 of the pump to pass through a reciprocating movement. As the pump reciprocates, fluid under pressure is forced through the pressure line 38 and the hoist is gradually operated until it has reached the desired position.

When the hoist has been raised to the desired position, the operator moves the control rod toward the right (as seen in Fig. 1 and Fig. 2) whereby the lower end of the control arm 75 is moved into the intermediate position, Y, thus forcing the operating lever 72 down into the horizontal position, Y, in which position the cam 83 is no longer capable of reaching the operating lever and the pumping operation ceases. Since the pressure of the oil in the discharge passage holds the discharge check valve 32 closed and the other valves are all normally closed, the oil in the hoist is unable to escape and the hoist will remain indefinitely in the raised position to which it has been moved. When the tractor has been manipulated to bring the load carried by the hoist into the desired position the third step in the operation takes place.

To lower the hoist the operator moves the operating rod 81 toward the right (Fig. 2) which moves the upper end of the control arm 75 in the same direction and the lower end of the control arm toward the left, preferably until the lower right hand corner of the control arm 75 has reached its dead center with reference to the pivotal support 77 of the control arm, the spring 29 pushing upward against the operating lever 72. The distance through which the spring 29 is able to move the operating lever upward and to swing the control arm on its pivot 77 is limited by the control arm 75 striking against the stop 68. In this position the lower surface of the operating lever 72 presses down against the head of the machine screw 48 which constitutes the upper end of the operating member 46, thus opening the release valve 41 and permitting the oil in the hoist, and in the discharge passage 35 to the hoist, to flow out through the discharge passage 52 of the release valve into the tank 12. After the hoist has been lowered the desired amount the control rod 81 and the control arm 75 may again be moved into the middle or holding position, Y.

So far in the present description the control arm 75 functions (1) to allow the lever 72 to rise up into the path of the cam 83 which then does the pumping; (2) to push it beyond the path of the cam 83 so that the cam no longer does any pumping; and (3) to push the screw 48 and the operating member 46 downward to release the oil in the pressure line and permit the hoist to lower. The control arm 75 may also be used for another purpose. It will be noted that as the control arm 75 is rocked back and forth it is also acting as a cam, although of somewhat different form than the cam 83, to oscillate the lever 72. It can therefore be used, whenever the power plant is not operating, i. e., when the engine is not running, to operate the pump, raise the hoist, and do, somewhat more slowly it is true, the same things that the power take-off does when the engine is running. Inasmuch as the depressing of the lever 72 too far will operate the release valve, it is necessary to move the arm 81 in such a manner that the arm 75 never moves to the right of its vertical position, as viewed in Figs. 1 and 2.

The high pressure relief valve 57 as its name indicates operates to open when the pressure in the discharge passage of the pump, or what is the same thing the pressure line to the hoist, is under too great a pressure. This may occur when the pump is operating and the hoist has been moved as far as it will go. There is also another, less obvious, situation where the relief valve performs a valuable function. Assume that the pump is not operating, i. e., that the parts are in the holding position. Suppose furthermore that the truck is being operated as a snow plow and tne scoop at the lower end of the hoist is being operated to move the scoop into a hard mass of snow. If the task is too great for the truck hoist to handle the inertia of the moving parts will cause a considerable shock when they are brought to a stop by the hard snow. This shock is transmitted to the oil in the pressure hose leading to the hoist and is easily capable of bursting the hose. The relief valve 57, by opening under such conditions reduces the maximum pressure enough and sufficiently promptly so that the probability of bursting the hose is rendered almost nil.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a pump, a reciprocating member, an operating member positioned adjacent to one end of said reciprocating member for moving it in one direction of its reciprocating movement, a spring connected with said reciprocating member to press it against said operating member and to move them both in the reverse direction, a power

operated cam for alternately pressing against said operating member in the opposite direction from the spring and releasing said pressure to cause reciprocating movement of said reciprocating member, and a manually operable cam for pressing against said operating member and releasing said pressure to reciprocate said reciprocating member at such times as the power source for said cam is not operating.

2. In combination, a pump having a reciprocating member, an oscillating member positioned so as to be in contact with said reciprocating member at all times, resilient means connected with said reciprocating member to hold it against said oscillating member, a cam positioned on the opposite side of said oscillating member from said reciprocating member, power-operated means connected with said cam for alternately moving said oscillating member and said reciprocating member against the action of said resilient means and permitting said resilient means to move said oscillating member and said reciprocating member back again, a second cam positioned on the opposite side of said oscillating member from said reciprocating member, manually operable means connected with said last-named cam for either moving said oscillating member and said reciprocating member against the action of said resilient means or for permitting said oscillating member and said reciprocating member to move in the opposite direction under the action of said spring.

3. A device as set forth in claim 2 in which the second-named cam is capable of moving the oscillating member and the reciprocating member through a substantially greater distance than said first-named cam.

4. A pump adapted to be operated by means of a power take-off from a constantly driven power source comprising a pump cylinder, a piston positioned in said cylinder, a spring connected with said piston so as to tend to push it out of said cylinder, a rotatable shaft adapted to be connected with said source of power, a sleeve mounted on said shaft and arranged to rotate about an axis spaced from the axis of said shaft, so as to

form an eccentric, a member positioned between said piston and said sleeve whereby said sleeve alternately moves said member and said piston against the action of said spring when said shaft is rotated and permits said member and said piston to move in the opposite direction under the action of said spring, and means for moving said member either into or out of the path of said sleeve.

5. A closed hydraulic pressure system comprising a block, a pump chamber within said block, a piston within said chamber and protruding from said block, a fluid reservoir attached to said block, fluid passages within said block communicating with said pump chamber, an outlet passage from said pump chamber to the outer surface of said block and adapted to receive a high pressure hose connection, inlet and outlet valves in said passages whereby reciprocation of said piston will force fluid out of said outlet passage, and means to control the extent to which said piston protrudes from said block whereby it can be brought into or out of contact with an effectively reciprocating power source.

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