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TWO-SPEED HYDRAULIC PUMPS

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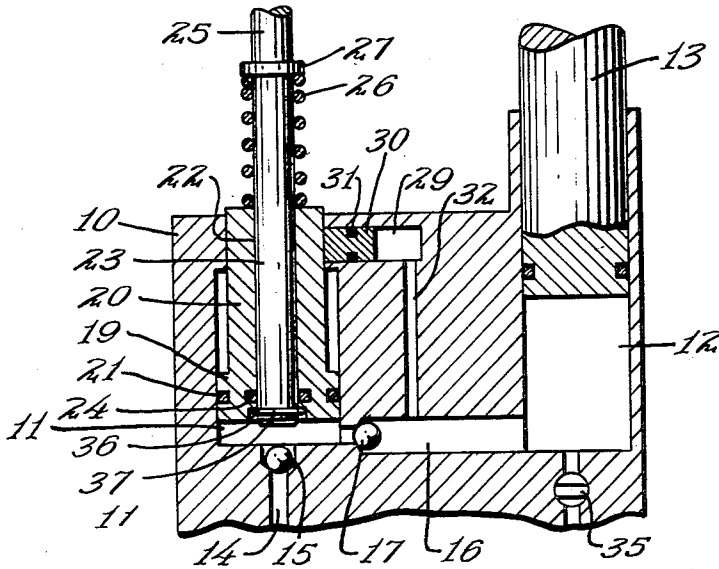


FIG. 1

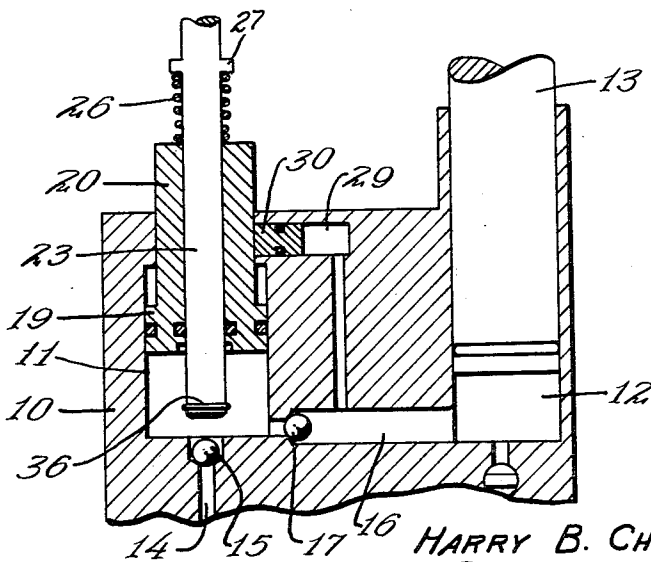


FIG. 2

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TWO-SPEED HYDRAULIC PUMPS

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5 Claims. (Cl. 103—37)

This invention relates to an improvement in two-speed hydraulic pumps and deals particularly with a simple and effective apparatus for pumping a greater or lesser hydraulic force to operate this member.

In a typical form of my apparatus, the apparatus includes a combined high and low pressure piston which is designed to force hydraulic fluid from a suitable source of supply to a member to be operated upon, such as a movable piston. When the movable piston is operated against a light pressure, the low pressure piston functions to move the driven piston at a relatively high rate of speed. However, as the resistance to movement of the driven piston increases, the low pressure piston ceases to function and hydraulic pressure is forced by a relatively high pressure piston pump, to drive the driven piston at a lower rate of speed.

A feature of the present invention resides in the provision of a piston pump which includes a relatively large diameter piston pump which is movable in a cylinder to draw the fluid from a suitable reservoir and to direct it against the member to be moved. The low pressure pump is provided with an axial recess therethrough which accommodates a relatively smaller diameter pump piston. A spring means is interposed between the two pump pistons so that both pistons are normally operated in unison. However, when the pressure against which the pumps are working exceeds the spring pressure, the large diameter low pressure pump ceases to operate and the reciprocation of the high pressure pump piston creates the necessary pressure to accomplish the desired result.

It is an object of the present invention to provide a piston, diaphragm, or other suitable means which is engageable with the peripheral surface of the low pressure piston and which is frictionally engaged with the low pressure piston by the pressure of the pump. When the pressure being pumped by the pump exceeds a predetermined amount, this member will be forced against the low pressure piston with sufficient force to hold the low pressure piston from movement during reciprocation of the inner high pressure piston.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

FIGURE 1 is a section view through a two-speed hydraulic pump, showing diagrammatically the arrangement of parts in one position thereof.

FIGURE 2 is a view similar to FIGURE 1 showing the high pressure portion of the pump in operation.

In view of the simplicity of the present apparatus, the pump is shown diagrammatically. The pump is shown in conjunction with a work piston and cylinder to which the hydraulic fluid under pressure is delivered. Obviously, the member being actuated may vary. Furthermore, the device is shown in conjunction with a piston which operates in one direction only under pressure. As is obvious, means could be provided for controlling the flow of fluid from the pump to selectively drive the driven member in either direction.

As illustrated, the pump includes a pump body 10 having a pump cylinder 11 and a driven piston cylinder 12. The cylinder 12 can be considered to comprise a ram

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chamber designed to slidably support a ram 13. The ram 13 is moved in an upward direction as viewed in the figures when fluid under pressure is directed to the ram chamber 12. The pump body 10 is provided with an inlet passage 14 which communicates with a source of fluid supply such as a reservoir or the like. A check valve 15 is provided in the inlet passage 14 to permit the fluid to be drawn into the pump cylinder 11 but to prevent the return flow of fluid to the reservoir. A passage 16 connects the lower end of the pump cylinder 11 to the ram chamber 12, and a check valve 17 controls the flow of fluid through the passage 16, the check valve 17 permitting a flow of fluid from the pump chamber 11 to the ram chamber 12, but preventing a reverse flow. The check valves 15 and 17 are normally provided with the usual biasing springs to hold them closed when not being forced open, the springs being omitted to simplify the showing.

A low pressure piston 19 is slidably supported in the pump cylinder 11 and includes a relatively large diameter stem 20 which extends from the cylinder at one end thereof. The piston 19 is provided with a suitable seal such as 21 to seal the piston with respect to the wall of the cylinder. The piston 19 and its stem 20 are provided with an axial bore 22 which is designed to accommodate a high pressure piston 23. Suitable sealing means such as 24 are provided between the piston 23 and the bore 22 so as to form a seal therebetween. The high pressure piston 23 includes an operating stem 25 which is reciprocated in a vertical direction by any suitable means, not illustrated in the drawings. A spring 26 is interposed between the upper end of the stem 20 and a shoulder 27 on the operating rod 25 and the reciprocating movement of the rod 25 is normally transmitted through the spring 26 to the piston stem 20 so that the piston 19 will reciprocate in unison with the rod 25.

A cylinder 29 is provided in the body 10, the axis of which preferably intersects the axis of the cylinder 11. A pressure plug 30 is slidably supported in the cylinder 29, and is sealed from the walls thereof by a suitable sealing means 31. A passage 32 provides communication between the connecting passage 16 and the cylinder 29. As a result, the interior of the cylinder 29 and the end of the pressure plug 30, is at all times equal to the pressure in the ram chamber 12 or approximately equal thereto.

In the operation of the apparatus, the operating rod 25 is reciprocated by any suitable means, to cause a similar reciprocation of the high pressure piston 23. The downward force on the rod 25 is normally communicated through the spring 26 to the top of the piston stem 20, thus causing movement of the piston 19 in unison with the high pressure piston 23. As a result, the hydraulic fluid is pumped at a relatively high rate of volume from the reservoir into the ram cylinder to move the ram cylinder upwardly. When the pressure within the cylinder 11 exceeds the force of the spring 26, the high speed pump 23 moves downwardly independently of the low speed pump 20. At the same time, the pressure within the cylinder 11 and ram chamber 12 increases so that the force within the connected cylinder 29 causes sufficient pressure against the pressure plug 30 to hold the stem 20 of the piston 19 from motion. In other words, the build-up of pressure within the pump cylinder serves not only to increase the force tending to compress the spring 26, but also increases the friction caused by the plug 30 against the piston stem 20. As a result, the pressure plug will lock the low pressure piston in position, and permit the independent reciprocation of the high pressure pump 23. As a result, the ram 13 will be moved with greater force and at a relatively slower speed.

While in the description, mention is made of the vertical movement of the pistons and the ram, it should be understood that this description is only in relation to the particular showing and in reference to the particular drawings, as the pistons may move in any desired direction. Furthermore, while means is shown for moving the ram 13 in one direction, means could be provided for moving the ram in opposite directions, and suitable means, such as the relief valve 35 could be provided for permitting the ram to return to its original position.

The piston 19 may be stopped at any point in the stroke of the piston. In this case, the piston 19 will remain stationary until the pressure in cylinder 11 is great enough to overcome the friction of plug 39 on the stems 29 of piston 19 and the pressure of spring 26. When this pressure is attained, piston 19 will move (gradually or rapidly depending on the pressure in cylinder 11) toward the end of the cylinder that is opposite the intake valve and will continue to move until the piston 19 engages the upper end of the pump body 10. Thus the piston 19 will gradually retract to the upper end of the cylinder even if the high pressure piston 23 is operated with a stroke of reduced length.

As indicated, the piston 19 may be positively moved in an upward direction with the piston 23 by any suitable means, such as by a head or a shoulder on the lower end of piston 23. In the drawings, a snap ring 36 is provided in a groove 37 at the lower end of piston 23 forming the shoulder in question. When the pistons do not move in unison, the piston 19 is held at the top of its stroke.

In accordance with the patent statutes, I have described the principles of construction and operation of my improvement in two-speed hydraulic pumps, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A two speed hydraulic pump, the pump including a pump body including a pump cylinder, a low pressure piston slidably supported in said cylinder, said pump body including an inlet to and an outlet from, one end of said cylinder, said body including a pressure chamber in the wall of said cylinder, said chamber having an end communicating with said pump cylinder, a friction member in constant engagement with said piston and movably supported in said chamber for movement toward and away from said piston, passage means connecting said outlet to said fluid actuated member and to the other end of said chamber, a check valve in said inlet preventing a reverse flow of fluid from said cylinder, a second check valve means in said outlet prevent a reverse flow of fluid through said passage means, said low pressure piston having an axial passage therethrough, a high pres-

sure piston slidably supported in said axial passage, spring means interposed between said pistons for transmitting movement of said high pressure piston toward said one cylinder end to said low pressure piston, said friction member being operable upon an increase in pressure in said passage means to engage against said low pressure piston to resist movement thereof.

2. The structure of claim 1 and in which said low pressure piston includes a stem portion extending from the other end of said pump cylinder and against which said friction member engages.

3. The structure of claim 1 and in which said friction member includes a plug slidably supported in said chamber.

4. A two-speed hydraulic pump including a pump body including a pump cylinder, a low pressure piston slidably supported in said pump cylinder, an axial aperture through said low pressure piston, a high pressure piston slidably through said axial aperture, a spring interposed between portions of said low pressure piston and said high pressure piston through which force is transmitted to urge said low pressure piston toward said one end of said pump cylinder, an inlet passage to said one end of said pump cylinder, a check valve in said inlet passage to prevent a reverse flow from said pump cylinder to said inlet passage, an outlet passage from said one end of said pump cylinder, a second check valve in said outlet passage controlling the reverse flow of fluid to said pump cylinder, a second cylinder in the wall of said pump cylinder having its axis intersecting the pump cylinder axis, a pressure plug member in said second cylinder and frictionally engageable at all times against said low pressure piston, and a by-pass leading from said outlet to said second cylinder to communicate fluid pressure to said plug member and to urge said pressure plug member toward said low pressure piston.

5. The structure of claim 4 and in which said low pressure piston includes a piston stem extending from the other end of said pump cylinder, said pressure plug member being engageable against said piston stem.

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