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HYDRAULIC JACK

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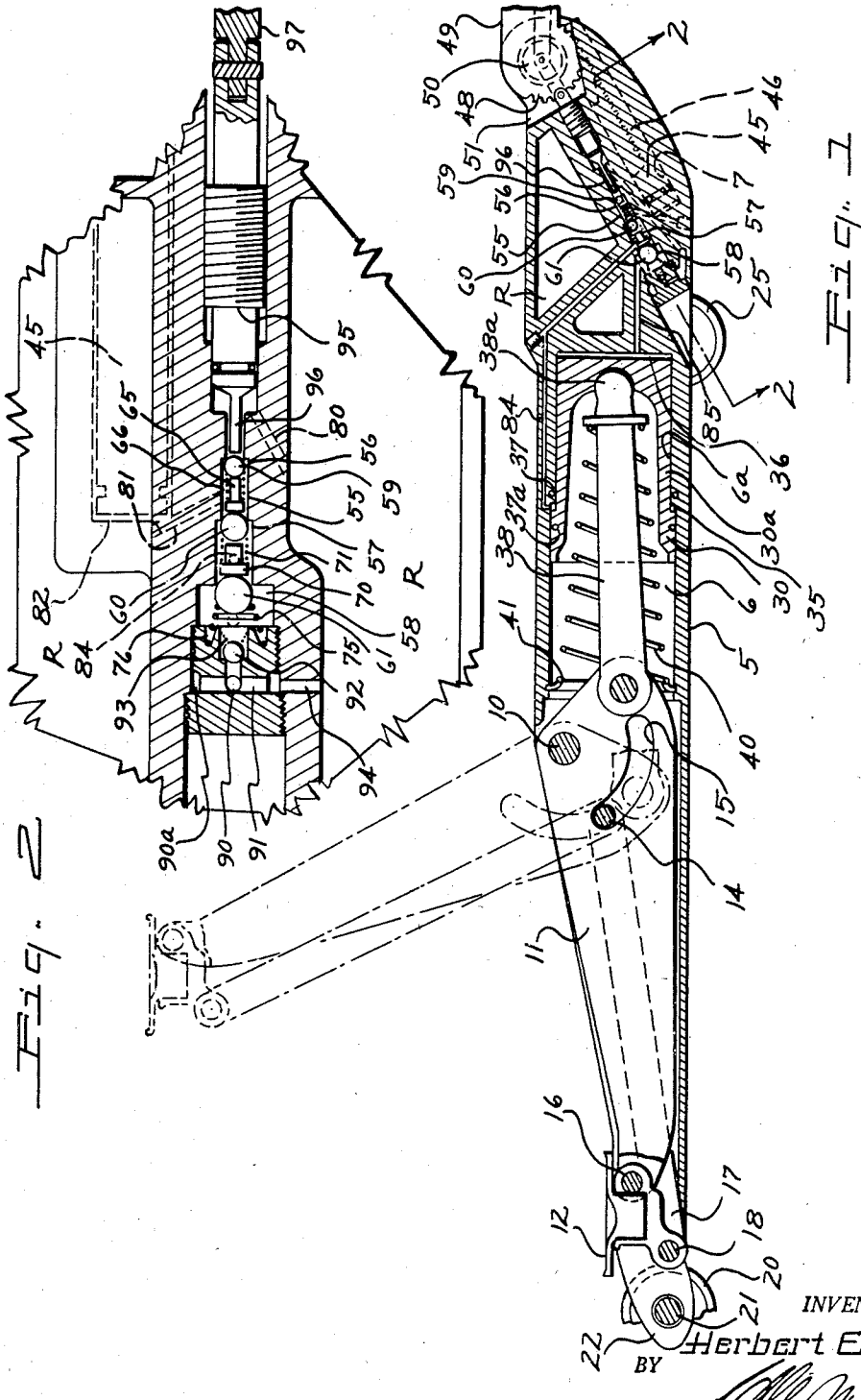


Fig. 2

Fig. 1

INVENTOR.
Herbert E. Page
BY
Atty.

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HYDRAULIC JACK

Herbert E. Page, Alhambra, Calif.

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2 Claims. (Cl. 254—10)

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My present invention has to do with hydraulic jacks and has as an object the provision of an improved hydraulic jack of simple and economical construction which is capable of application of pressure to the lifting piston at one pressure-volume ratio to relatively quickly move the work-engaging arm into initial contact with the work to be lifted and at a different pressure-volume ratio for lifting the load. I am aware that, in the prior art, there are hydraulic jacks which operate by virtue of such different pressure-volume ratios for initial contact and subsequent load lift, but my present improvements provide a vastly more simple and economical structure for accomplishing the purpose for which prior art jacks have required a more expensive and complicated structure.

The remaining objects are subordinate to the above-mentioned objects and will become apparent from the following explanation of a preferably preferred example of my invention, for which purpose I shall refer to the accompanying drawing, in which:

Fig. 1 is a longitudinal section; and

Fig. 2 is an enlarged fragmentary plan section taken on line 2—2 of Fig. 1.

In the drawing I show a body 5 which may be formed of a single casting providing a work cylinder 6, a pump cylinder 7, and a fluid reservoir R.

Pivotally secured to the body by cross pin 10 there is a conventional lifting arm 11 pivotally carrying a conventional work-contacting saddle 12. The arm 11 is adapted to be swung between the full and dash line positions shown in Fig. 1 and has an arcuate guide slot 15 through which a cross pin 14, secured at its ends in the body, projects. To maintain the saddle horizontal by rotating it about its pivotal connection 16 to the lifting arm, as the latter is moved, I provide a bar 17 which is pivotally connected at one end by cross pin 18 to the saddle and pivotally connected at its opposite end to the pin 14.

Rollers 20 are carried by an axle 21 mounted at its ends in the side extensions 22 of the body, and, in the conventional manner, rollers 25 mounted on an axle, not shown, are disposed at the underside of the opposite end of the body, so that the jack may be rolled from one location to another.

Cylinder 6 has a reduced diameter inner end portion 6a and a piston 30, having a reduced diameter portion 30a, reciprocates in said cylinder, the opposite shoulders provided by the intersecting different diameter portions of the cylinder and piston providing a pressure chamber 35 annularly of the piston sealed by seal rings 37, 37a,

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and the inner end of the piston forms with the inner end portion of the cylinder a main pressure chamber 36.

A connecting rod 38 has a spherical inner end 38a which fits in a corresponding socket in the inner end wall of the hollow piston and is pivotally connected at its outer end to the lower end of the lifting arm 11 by a pivot pin 39.

A compression spring 40, which bears at its outer end against a ring 41 in the outer end of the cylinder and at its inner end against an annular flange on the rod 38, normally urges the piston inwardly of the cylinder.

A pumping piston 45 is reciprocally mounted in cylinder 7, the outer end of the latter piston providing a rack 46 which is actuated by pinion 48 secured on the end of an operating lever 49, the pinion being mounted on a spindle 50 extending transversely of the recess 51 provided in the inner end of the body, said spindle being journaled at its ends in the side walls of the recess.

A valve bore 55 is provided in the body and has different diameter portions providing three valve chambers 56, 57, 58 and valve seats against which seats ball check valves 59, 60, 61, respectively, are adapted to seat. A floating valve-actuating member 65 is disposed between balls 59 and 60, said member carrying around its end portion a compression spring 66 bearing at its respective ends against ball 59 and the annular shoulder provided by the enlarged portion of member 65. A floating valve-actuating member 70 is disposed between balls 60, 61, there being a compression spring 71 interposed between the shoulder provided by the enlarged portion of member 70 and the ball 60.

Ball 61 is urged seated by a relatively strong compression spring 75 which bears at its other end in a recess provided in the inner end of a threaded plug 76.

A port 80 provides communication between the reservoir R and bore 55 at the right of ball 59; a port 81 provides communication between the pressure chamber 82 provided by the piston 45 in cylinder 7, and the bore 55 at a point between the balls 59 and 60; a port 84 provides communication between the chamber 35 and the bore 55 at a point between balls 60 and 61; and a port 85 (Fig. 1) provides communication between chamber 36 and bore 55 at the left of ball 61.

The significance of the ports and valve members described will be understood from the following description of operation.

As the lever 49 is oscillated to operate pinion 48 and rack 46, piston 45 is reciprocated in cylinder 7. On each suction stroke of that piston, fluid will be drawn into chamber 82 from the

reservoir through port 80, bore 55 and port 81 past ball valve 59 and, until the arm 11 is raised sufficiently to initially contact the saddle 12 with the work to be lifted, on each pressure stroke of piston 45 the fluid thus drawn into chamber 82 by each suction stroke of said piston will be forced into chamber 35 through port 81, bore 55 and port 84 past ball valve 60. Spring 75, being relatively strong, will maintain ball 61 seated until the saddle 12 meets sufficient resistance to further upward movement to cause the ball 61 to unseat against the pressure of the spring 75. Thus the initial pressure is all communicated to the relatively small chamber 35 to quickly move the arm 11 until the saddle initially contacts the work, after which each pressure stroke of the pumping piston will force fluid past both valves 60, 61 into both chambers 35, 36 to lift the load after the initial contact has been thus established.

During the initial movement of piston 30 to establish contact of the work-engaging saddle with the work to be lifted, make-up fluid will be drawn into chamber 36 from the reservoir through ports 90 and 91 in plug 76 and port 85, past a ball valve 92 which latter is urged seated by a spring 93. Ports 90 extend radially through the reduced diameter portion of plug 76 to communicate with the annular chamber 90*a*, which latter in turn communicates with the reservoir through port 94.

To lower the jack, the fluid pressure in chambers 35, 36 may be released by screwing inwardly on the valve-actuating screw 95, whose stem 96 engages ball 59 to push the latter off its seat and that in turn unseats balls 60, 61 through the medium of the actuating members 65, 70. An operating link 97 is pivotally connected to the member 95. When the member 95 is rotated in the opposite direction, its stem 96 disengages the ball 59 and the springs 66, 71 and 75 return the ball valves to their seats.

The spring 40 positively returns the piston 30 to its inner position shown in the drawing after the arm 11 ceases to be swung downwardly by the load.

By virtue of the gradually increasing diameters of the valve chambers 56, 57 and 58 and ball valves 59, 60 and 61, the valve elements may be readily assembled in bore 55 by dropping them into the outer or left-hand end of bore 55 before applying the plug 76, since the balls will, by virtue of their different sizes, automatically find their appropriate seats. This structure simplifies assembly and repair.

While, in the foregoing, I have resorted to considerable detail of structure and association of parts in describing a particular example of my invention, I wish it to be understood that I have done so merely to make my invention understood and that I do not limit my invention to such details. On the contrary, my invention is only to be limited as appears in the appended claims.

I claim:

1. A hydraulic jack comprising a body providing a fluid reservoir and bores providing a work cylinder and a pumping cylinder, a lifting arm pivotally mounted on the body to swing relative thereto into and out of work-engaging position, said work cylinder having an inner portion of relatively reduced diameter, a work piston reciprocally mounted in the work cylinder, said piston having a relatively large diameter outer end portion and a reduced diameter inner end portion providing an inwardly facing annular shoulder, seal ring means cooperating with the work cylinder and work piston to provide an auxiliary pressure chamber annularly of the smaller diameter portion of the work piston to which chamber said shoulder is exposed, the inner end of the work piston forming with the inner end portion of the work cylinder a main pressure chamber, a connecting rod whose opposite ends engage the work cylinder and arm, a pumping piston reciprocally mounted in the pumping cylinder and providing therewith a pressure-generating chamber, a valve bore in the body, said valve bore providing a valve seat at its inner end, a valve seat at its outer end, and an intermediate valve seat, inner, outer and intermediate check valve means cooperating with said respective seats, spring means yieldably urging each of the check valves seated towards the pressure-generating chamber, the spring means urging the outer check valve seated being relatively stronger than the spring means urging the other check valve means seated, a port providing communication between the reservoir and the inner end of the valve bore, a port providing communication between the pressure-generating chamber and the valve bore at a point between the inner and intermediate check valves, a port providing communication between the outer end of the valve bore and the main pressure chamber, a port providing communication between the auxiliary pressure chamber and the valve bore at a point between the outer and intermediate check valves, a make-up fluid port providing communication between the reservoir and the main pressure chamber, a check valve controlling the latter port and seating towards the reservoir, and means for actuating the pumping piston.

2. In a hydraulic jack having a body presenting a fluid reservoir, an auxiliary fluid pressure chamber and a main fluid pressure chamber, a work-engaging arm pivotally mounted on the body to swing relative thereto, arm-actuating means having portions exposed to and movable in response to pressure in said chambers, and pressure-generating means, means controlling communication of fluid from the pressure-generating means to said chambers including a bore extending through the body, said bore providing an inner valve chamber, an outer valve chamber of larger diameter than the inner valve chamber and an intermediate valve chamber of a diameter intermediate the diameters of the other valve chambers, each of said valve chambers providing a valve seat, ball valve means of different diameters cooperating with said respective seats to control the inlets to the respective chambers, ball valve-engaging members floatingly disposed in the bore between the ball valve means, a plug closing the outer end of the bore, a plug threadedly mounted in the other end of the bore and having a portion engageable against the innermost ball valve means in response to rotation of the last-mentioned plug relative to the body, means providing fluid communication from the reservoir to the inner valve chamber, said means being controlled by the ball valve in the inner valve chamber, a body port providing communication between the inner valve chamber and the pressure-generating means, a body port providing communication between the intermediate valve chamber and the auxiliary pressure chamber, and a body port providing communication between the outer valve chamber and the main pressure chamber.

HERBERT E. PAGE.