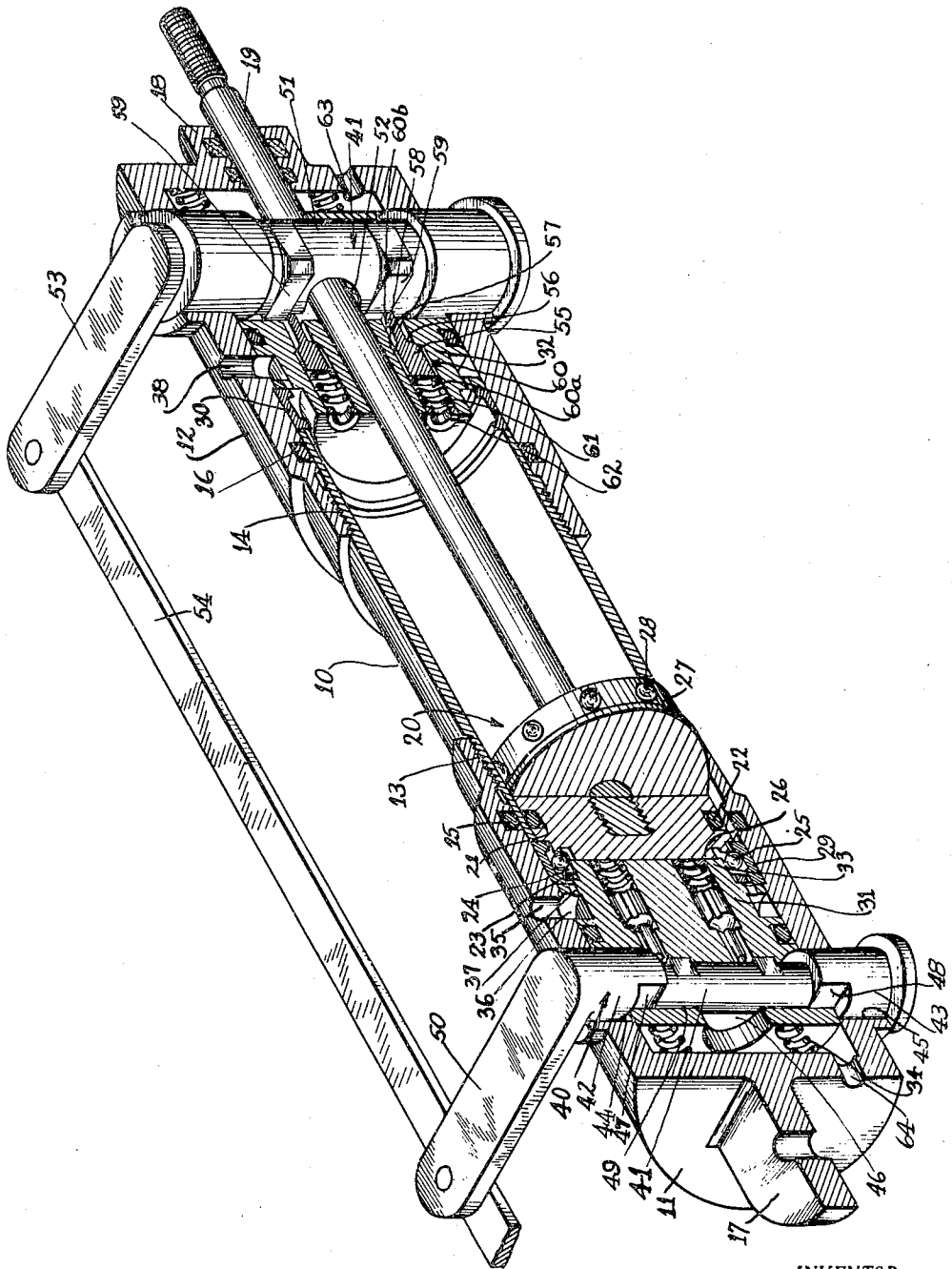
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SERVOMOTOR WITH PISTON OPERATED LOCKING MEANS

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SERVOMOTOR WITH PISTON OPERATED LOCKING MEANS

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This invention relates to improved types of hydraulic jacks suitable for use in lifting and hoisting mechanisms. More particularly, the invention relates to an improved type of hydraulic jack in which the piston can be locked at opposite ends of its stroke and which can be released either manually or by means of hydraulic pressure for movement to the opposite end of its stroke.

Many different types of hydraulic jacks have been manufactured heretofore for use in aircraft and the like for operating retractable landing gears, wing flaps and the like. Some of these hydraulic jacks are provided with mechanisms for locking the piston to the cylinder of the jack at opposite ends of its stroke so that the jack can be operated only under the control of the operator.

It has been found that these locking types of jacks are not entirely satisfactory under all conditions of use. For example, when the hydraulic system is damaged, the hydraulic fluid may be lost so that the jack cannot be released for extension or retraction.

In my copending joint application, Serial No. 562,832, filed November 10, 1944, now Patent No. 2,434,828, a hydraulic jack is disclosed which is provided with a hydraulic lock-releasing mechanism and a manual lock release so that the piston can be unlocked to permit gravity or manual operation of the piston and the cylinder.

The present invention constitutes an improvement over the manual and hydraulic release system disclosed in application Serial No. 562,832.

In accordance with the present invention, I have provided a hydraulic jack that includes the usual cylinder, a piston reciprocable therein, and cooperating locking elements on the piston and the cylinder which may be actuated by locking pistons mounted in the ends of the cylinder to latch or lock the piston to the cylinder.

The locking pistons are so arranged with respect to the reciprocating piston that upon application of fluid pressure to the cylinder at the end where the piston is locked, the locking piston is displaced to release the operating piston. The fluid pressure then acts to drive the operating piston to the opposite end of its stroke where it is again locked against movement.

In accordance with the present invention, I have provided manually operable means, preferably including cam elements which can be actuated to displace the locking pistons at both ends of the cylinder simultaneously so that the operating piston can be released for movement

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manually or under the force of gravity for travel from one locked position toward the opposite end of the cylinder.

Inasmuch as the cylinder will normally contain fluid on one side of the piston, I have provided valve elements at both ends of the cylinder which also are actuated by the manual operated members to permit the free flow of fluid into and out of the cylinder on both sides of the operating piston. In this way, resistance to movement of the operating piston is reduced to a minimum and the jack can be operated manually or by gravity with a minimum of resistance.

For a better understanding of the present invention, reference may be had to the accompanying drawing in which the single figure is a perspective view of a typical form of hydraulic jack embodying the present invention shown partly in longitudinal section and partly broken away.

The form of hydraulic jack illustrated in the drawing is typical of the invention and, as illustrated, includes locking elements at both ends of the cylinder. It will be understood, however, that in a lifting jack, one of the locking elements can be omitted if desired and only the locking element retained which holds the jack in retracted position.

The form of jack illustrated includes a cylinder 10 which is provided with end closure caps 11 and 12 at its opposite ends, these caps being arranged in fluid-tight relationship to the cylinder 10 by means of threaded connections 13 and 14 and suitable fluid-tight seals or packings 15 and 16. The end closure 11 is provided with a lug 17 by means of which the cylinder 10 may be supported. The end closure cap 12 is provided with a packed bushing 18 which slidably receives the piston rod 19. A piston member 20 is mounted on the inner end of the piston rod 19 for reciprocation in the cylinder. The piston 20 may consist of a cylindrical member having a groove 21 in its periphery for receiving a toroidal rubbery ring 22 which acts as a piston ring to prevent leakage around the piston 20. One end of the piston 20 is provided with an annular flange 23 having a plurality of apertures 24 therein for receiving a number of balls 25 that are used for locking the piston 20 at the left-hand end of its stroke as viewed in the drawing. The balls 25 are retained in the recesses 24 by means of an underlying disk-like projection 26 on the piston.

The other end of the piston is provided with another ball-receiving flange 27 receiving loosely a plurality of balls 28 which are adapted to lock

the piston 20 to the right-hand end of the cylinder.

The balls 25 cooperate with a ring-like channel member 29 fixed within the left-hand end of the cylinder 24, while the balls 28 cooperate with a similar ring-like channel member 30 at the right-hand end of the cylinder. The balls are so arranged that they can pass by the flanges of the channel members 29 and 30 but are forced into these channels by means of the locking piston elements 31 and 32 which are slidably mounted in the caps 11 and 12. Only one of the locking pistons 31 will be described inasmuch as the pistons 31 and 32 are similar.

The piston 31 is a generally cylindrical block of metal or other material having a reduced projecting end portion 33 of generally disk-like shape which is of sufficiently small diameter to be received within the flange 23 on the piston 20. The diameter of the projection 33 is such, however, that it cannot enter completely the flange 23 until the balls 25 are opposite the channel member 29. Then the locking piston 31 is forced to the right by means of the springs 34 which are interposed between the inner end of the closure 11 and the outer end of the piston 31. When the piston 31 moves to the right, it forces the balls 25 outwardly in a radial direction into the channel member 29 and locks the piston to the cylinder. In order to release the piston 20 for movement to the right, the closure cap 11 is provided with a fluid inlet port 35 which overlies an annular channel 36 formed in the periphery of the piston 31. The channel 36 communicates with the space in which the balls 25 are received through a plurality of small passages 37 so that the piston 20 and the locking piston 31 are subjected to fluid pressure, tending to urge them apart. Thus, when fluid under pressure is introduced through the port 35, the locking piston 31 is urged to the left and the balls 25 are released for movement inwardly to unlock the piston 20 and allow the fluid under pressure to push the piston 20 to the right. The piston 20 is locked at the end of its stroke to the right by the movement of the balls 28 partially in the channel 30 under the action of locking piston 32.

The balls 28 can be released from the channel 30 by introducing fluid under pressure into the cylinder through the port 38 in the end closure 12.

It is sometimes desirable to release the piston 20 for movement by gravity or manually from one end of the cylinder 10 to the other. In accordance with the present invention, the piston 20 can be released manually by means of the cam elements 40 and 41 which are mounted in the closure caps 11 and 12 respectively. The cam member 40 includes a generally cylindrical body portion 40*a* and enlarged cylindrical end portions 42 and 43 that are rotatably mounted in suitable openings 44 and 45 in the end closure cap 11. The cam member 40 extends loosely through a transverse opening 46 in the piston 31 and is provided with flats or cam portions 47 and 48 which engage the wall 49 bounding the opening 46. When the cam member 40 is rotated, as by means of the lever 50, the piston 31 is displaced to the left to free the locking balls 25 and release the piston 20 for movement to the right.

The cam 41 which performs a similar function at the other end of the cylinder includes a cylindrical portion 51 having an enlarged opening 52 therein through which the piston rod 19 passes. The opening 52 is sufficiently large to permit about a 45° or slightly greater rotation of the cam 41. The cam 41 is journaled in the end closure cap 12 and is provided with cam flats, not shown, which engage the piston 32 to urge it to the right. The cam 41 is also provided with a lever 53 which is connected by means of a link 54 to the lever 50 of the cam 40. Thus, when the link 54 is shifted, for example, to the left as viewed in the drawing, the cams 40 and 41 are rotated as to retract the locking pistons 31 and 32 and release the piston 20 for movement along the cylinder.

Inasmuch as the cylinder contains the fluid that moved the piston from one end of the cylinder to the other, such fluid restricts the free movement of the piston. Therefore, in order to facilitate the flow of liquid from and into the cylinder in accordance with the movement of the piston 20, I have provided each of the locking pistons 31 and 32 with fluid release valves. Inasmuch as the valve structures in the pistons 31 and 32 are the same, only the valves in the piston 32 will be described in detail. Each of these valves includes a valve plug 55 which has a conical surface 56 thereon engaging a conical valve seat 57 in the piston 30. The valve plug 55 has a stem 58 which is disposed adjacent the flat cam surfaces 59 carried on the cam member 41. The valve seats 57 are located within the piston 32 about midway of the length of the passages 60 extending through the piston 32 and is at the junction of an enlarged section 60*a* and a reduced section 60*b* of the passage 60. The valve plug 55 is normally urged against the seat 57 by means of a coil spring 61 which is retained in the enlarged section 60*a* of the passages by means of the threaded retaining ring 62. The end closure cap 12 is provided with a relief port 63 which communicates with the interior of the cylinder 10 through the passage 60 in the piston 31. The valve plugs 55 are so arranged that when the manually operated cams 41 and 42 are rotated to displace the locking pistons 31 and 32, the valve plugs 55 in both of these pistons are unseated thereby permitting free flow of liquid between the interior of the cylinder 10 and the port 63 in the cap 12 and the port 64 in the cap 11 which may, for example, be connected to the return line of a hydraulic system. Thus, when the link 54 is moved endwise, both of the locking pistons 31 and 32 are displaced outwardly and the valves therein are opened so that the piston 20 can be stroked easily by gravity or manually from one end of the piston to the other. The piston can be released also by hydraulic pressure applied through the port 35 or the port 38, depending upon the position of the piston 20.

From the preceding description of a typical form of hydraulic cylinder embodying the present invention, it will be apparent that the cylinder which has been provided may be actuated either hydraulically or manually. The piston is locked at each end of its stroke so as to prevent inadvertent extension or retraction of the piston rod due to failure of the hydraulic pressure. Nevertheless, the piston can be released manually and shifted from one end of the cylinder to the other manually or by gravity with little resistance from the hydraulic fluid present in the system.

It will be understood, of course, that the hydraulic jacks embodying the present invention are susceptible to considerable modification in shape, size, and in the details of the cooperating elements. Therefore, the form of the invention

described above should be considered as illustrative only of the invention and not as limiting the scope of the following claims.

I claim:

1. A hydraulic motor comprising a cylinder having closures at its ends, a piston reciprocable axially of said cylinder, means for supplying liquid to one end of said cylinder to move said piston toward the opposite end of said cylinder, movable locking means at said opposite end for releasably locking said piston for movement to said opposite end, manually operable means for moving said locking means to unlock said piston for movement toward said one end, fluid discharge ports at both ends of said cylinder, normally closed valve means at both ends of said casing for preventing discharge of fluid through said discharge ports, and means connected with said manually operable means for opening said valve means to permit the flow of fluid through said ports upon operation of said manually operable means to unlock said piston.

2. A hydraulic jack comprising a cylinder having closures at its ends, a piston reciprocable axially of said cylinder, means for supplying liquid to one end of said cylinder to move said piston toward the opposite end of said cylinder, movable locking means at said opposite end for locking said piston to said opposite end, means responsive to hydraulic pressure supplied to said opposite end for moving said locking means to unlock said piston, manually operable means for moving said locking means to unlock said piston, normally closed valve means at the ends of said cylinder, and means connected to said manually operable means for opening said valve means in response to operation of said manually operable means to free the piston for reciprocation in said cylinder.

3. A hydraulic jack comprising a cylinder having closures at its opposite ends, a piston slidable axially of said cylinder, means for supplying fluid to opposite ends of said cylinder for reciprocating the piston therein, movable locking means at opposite ends of said cylinder for locking the piston to the ends of said cylinder, means responsive to hydraulic pressure for moving said locking means to unlock said piston, manually operable means associated with said locking means for moving said locking means to unlock said piston, discharge passages at opposite ends of said cylinder, normally closed valve means associated with said locking means and interposed between the interior of said cylinder and said discharge passages, and means associated with said manually operated means for opening the valve means at both ends of said cylinder to prevent flow of liquid from and into opposite ends of said cylinder upon actuation of said manually operated means to unlock said piston.

4. A hydraulic jack comprising a cylinder having closures at its ends, a piston reciprocable axially of said cylinder, means for admitting fluid under pressure into opposite ends of said cylinder to reciprocate said piston, an internal recess adjacent each end of said cylinder, radially movable locking members carried by said piston and engageable in said recesses to lock said piston to the ends of said cylinder, locking pistons movably mounted in the ends of said cylinder and engageable with said locking members to urge them into said recesses, said locking pistons being movable in response to fluid pressure to release said locking members from said recesses, manually operable means for moving said locking pistons to release said locking members, valve means in said locking pistons, said valve means being normally closed to prevent flow of fluid through said locking pistons, and means connected to said manually operable means and operable therewith to open said valve means and allow the flow of fluid through said locking pistons when said manually operable means is operated to release said locking means.

5. A hydraulic jack comprising a cylinder having closures at its ends, a piston reciprocable axially of said cylinder, means for admitting fluid under pressure into opposite ends of said cylinder to reciprocate said piston, an internal recess adjacent each end of said cylinder, radially movable locking members carried by said piston and engageable in said recesses to lock said piston to the ends of said cylinder, locking pistons movably mounted in the ends of said cylinder and engageable with said locking members to urge them into said recesses, said locking pistons being movable in response to fluid pressure to release said locking members from said recesses, interconnected manually operable cam means at opposite ends of said cylinder for moving said locking pistons to release said locking members, valve means in said locking pistons, said valve means being normally closed to prevent the flow of fluid through said locking pistons, and means connected to said cam means and operable therewith to open said valve means and allow the flow of fluid through both of said locking pistons when said cam means is operated to release said locking means.

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The following references are of record in the file of this patent:

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Number	Country	Date
341,511	Italy	June 27, 1936