

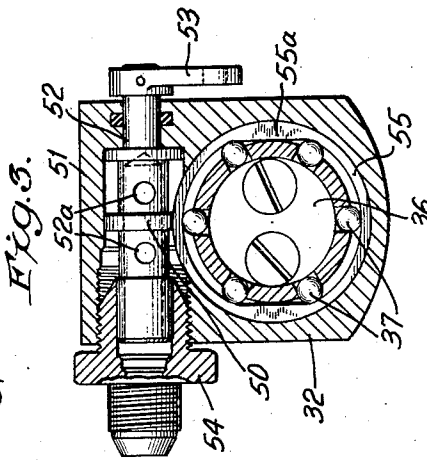
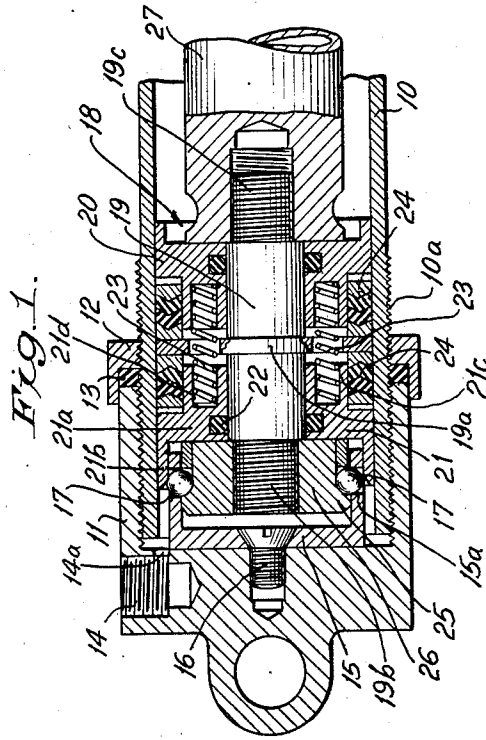
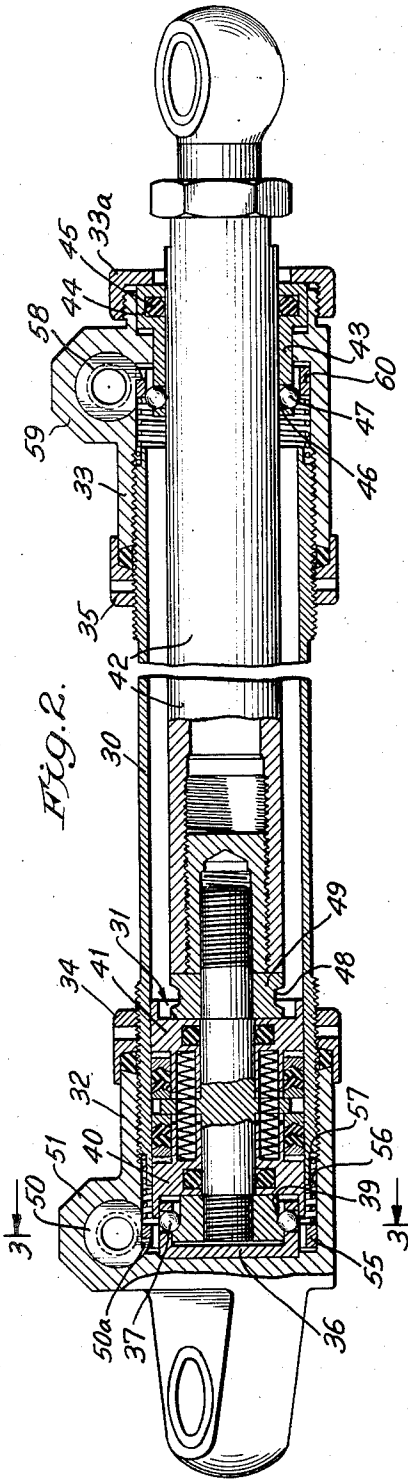
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PISTON LOCKING MEANS FOR FLUID ACTUATED JACKS

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PISTON LOCKING MEANS FOR FLUID  
ACTUATED JACKS

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1

This invention relates to fluid-actuated motors or jacks of the cylinder and piston type and it relates particularly to mechanisms for locking the pistons of such fluid-actuated jacks at one or both ends of the piston stroke.

This is a continuation-in-part of our application Serial No. 478,574, filed March 9, 1943, now Patent No. 2,393,962, dated February 5, 1946.

An object of the present invention is to provide locking means for the pistons of fluid-actuated jacks in which the locking means is effective only at the end of the stroke of the piston and does not exert frictional forces or wearing stresses on the piston or cylinder during the movement of the piston in the cylinder.

Another object of the invention is to provide locking means for the pistons of fluid-actuated jacks in which the locking means automatically locks the piston to the cylinder at at least one end of its stroke and in which the locking means can be released either manually or by fluid pressure to permit movement of the piston to the opposite end of its stroke.

Other objects of the invention will become apparent from the following description of typical forms of devices embodying the present invention.

In accordance with the present invention, we have provided the piston and the cylinder of a fluid-actuated jack with recesses for reception of one or more locking members such as, for example, balls when the piston is at one end of the cylinder. Cooperating with the locking members or the balls is a piston member that moves relatively to the piston and the cylinder to enter one of the recesses at the end of the piston stroke, only, to force the locking member into the recesses. This piston member can be retracted by means of fluid pressure to release the piston for movement relatively to the cylinder.

Sometimes the means for supplying fluid pressure, for example a hydraulic system of an airplane, becomes disabled and for that reason it is unable to supply fluid pressure for unlocking and advancing the piston. If this occurs, for example, when the hydraulic jack associated with retractable landing gear is in its retracted position, it is impossible to lower the landing gear. Therefore, the present invention includes mechanism associated with the piston locking mechanism whereby the locking mechanism can be released manually in order to permit movement of the piston under gravity or other forces.

For a better understanding of the present in-

2

vention, reference may be had to the accompanying drawings, in which,

Figure 1 is a view in longitudinal section and partially broken away of a typical form of locking mechanism embodying the present invention;

Figure 2 is a view in longitudinal section of a modified form of hydraulic jack including fluid responsive and manually operable mechanism for locking and unlocking the piston; and

Figure 3 is a view in cross section taken on line 3—3 of Figure 2.

Figure 1 of the drawings illustrates one form of piston lock embodying the invention. In this device, a cylinder 10 is provided with a threaded end portion 10a for receiving an internally threaded cap 11 of generally cup-like form. The cap 11 is retained in sealing engagement with the cylinder 10 by means of a threaded ring 12 and a sealing ring 13. The cap 11 is provided with a coupling 14 which communicates with the interior of the cylinder 10 through an aperture 14a so that fluid under pressure can be admitted in the cylinder.

As illustrated, the cap 11 is provided with a cup-shaped member 15 secured to the end of the cap in any suitable way, such as by the set screw 16. The member 15 is provided with one or more apertures 15a for receiving the locking balls 17. The apertures 15a taper in diameter from slightly larger than the diameter of the balls 17 at their outer periphery to slightly less than the diameter of the balls 17 at their inner periphery so that the balls cannot fall into the cylinder.

The side wall or flange of the member 15 is spaced from the cylinder 10 a sufficient distance that the balls 17 can be retracted fully, but cannot escape from between the member 15 and the cylinder 10.

A piston 18 is slidably mounted in the cylinder 10. This piston may include a cylindrical core member 19 having a centrally disposed flange 19a and oppositely threaded reduced end portions 19b and 19c. The center portion of the member 19 is adapted to receive a pair of annular piston members 20 and 21. The member 21 includes a disc-like portion 21a which is sealed to the core member 19 by means of a sealing ring 22 and is provided with an axially projecting flange 21b that engages the wall of the cylinder 10. The member 21 also includes an oppositely directed flange member 21c slidably engaging the body of the core member 19 and is provided with a plurality of bores 21d for receiving the coil springs 23.

The flange member 21c is of less diameter than

the interior of the cylinder 10 so that suitable packing 24 can be positioned therebetween.

The leading edge of the flange 21b is beveled so that it can enter the space between the cylinder 10 and the member 15 and urge the balls 17 radially inwardly. The inward movement of the balls 17 locks the piston 18 to the cylinder by forcing the balls inwardly behind a flange 25 on a member 26 that is threaded on the reduced portion 19b. The flange 25 has an inclined inner and outer surface, the inner surface joining with a surface of reduced diameter on the member 26 providing a recess for reception of the balls 17.

The opposite end of the piston 18 is connected to a piston rod 27 by means of the threaded reduced portion 19c.

The piston member 20 is supported on the core member 19 in a manner similar to the member 21 and is normally urged against the end of the piston rod 27 by means of the springs 23.

Clearance between the packing 24 and the members 20 and 21 is provided to permit relative movement of the members 20 and 21 and the core member 19.

With the piston 18 in the position shown in Figure 1, the supply of fluid under pressure to the coupling 14 will urge the piston member 21 to the right relatively to the core member 19, compressing the springs 23. Movement of the member 21 relatively to the core member 19 frees the balls 17 for outward movement, thereby freeing the entire piston 18 for movement to the right.

Upon return movement of the piston 18 to the position shown in Figure 1, the flange 25 will strike the balls 17 first and displace them outwardly. In this position, the balls 17 obstruct the movement of the member 21 so that it is stopped until the flange 25 passes beneath the balls 17. When the flange 25 has passed the balls 17, the springs 23 urge the member 21 to the left and force the balls 17 radially inward behind the flange 25 to lock the piston 18 to the cylinder.

The above described locking mechanism can be unlocked only by the pressure of the fluid applied to the cylinder 10. For that reason, the piston 18 cannot be unlocked for travel unless there is sufficient fluid pressure to displace the piston member 20 or 21.

Under certain conditions, for example, when the hydraulic or fluid pressure system is damaged or rendered ineffective to supply fluid under pressure, it may be desirable to provide a mechanism for releasing the piston manually to allow it to move relatively to the cylinder under the influence of gravity or other forces.

A typical form of manually and fluid-pressure released cylinder lock is illustrated in Figures 2 and 3 of the drawings.

The cylinder 30 and the piston 31 disclosed in Figures 2 and 3 are similar to the corresponding elements disclosed in Figure 1. The cylinder is provided with closure caps 32 and 33 at its opposite ends which are threaded on the ends of the cylinder and are sealed thereto by suitable gaskets and locking rings 34 and 35. The cap 32 is provided with a cup-like ball retainer 36 having an apertured flange for receiving the balls 37 that cooperate with the recess 39 in the piston 31 to lock the piston to the cylinder 30. The balls 37 may be urged into the recess 39 by the piston member 40 of the piston 31, as described above.

The cap 33 has an aperture in its end for the

piston rod 42 and has an annular sleeve member 43 therein in which the piston rod 42 is slidably received. The member 43 is retained in the cap 33 by means of a locking ring 33a threaded on the cap 33 and is provided with an annular groove 44 for receiving a sealing gasket or ring 45 to prevent leakage around the piston rod 42.

The inner end of the member 44 is provided with a plurality of perforations or apertures 46 for receiving the locking balls 47. These balls cooperate with a recess or groove 48 in a ring like member 49 secured between the inner end of the piston rod 42 and the piston 31 to lock the piston 31 to the cylinder 30. The balls 47 may be urged into the groove 48 by means of the piston member 41, in the manner described above.

In order to permit manual release of the piston 31 when it is in the position illustrated in Figure 2, a cam element 50 is rotatably supported in a boss 51 on the cap 32 by means of a shaft 52. The shaft extends through one end of the boss 51 and may be provided with a lever 53 or any equivalent construction whereby the shaft 52 and the cam 50 thereof may be rotated. As best shown in Figure 3, the shaft 52 is hollow throughout a portion of its length and is provided with a plurality of apertures 52a which communicate with the interior of the cylinder 30. The left-hand end of the shaft 52 is journaled in a coupling member 54 which is threaded into the boss 51 and through which fluid can be introduced through the shaft 52, and the apertures 52a, into the interior of the cylinder.

The cam member 50 is provided with a tooth 50a which engages a ring 55 that is slidably mounted in the cap 32 between the member 36 and the inner wall of the cap 32. A spring 56 engages a shoulder 57 near the end of the cylinder and urges the ring 55 to the left, as viewed in Figure 2. As shown in Figure 3, the ring member 55 is provided with two or more straight internal walls 55a, which are adapted to engage the end of the piston member 40. Thus upon the movement of the shaft 52 by means of the lever 53, the ring member 55 is shifted axially to the right, thereby displacing the piston member 40 to the right and releasing the locking balls 37. The piston 31 and piston rod 42 are then free to move relatively to the cylinder.

The manual releasing mechanism in the right-hand end of the cylinder is similar to that described above inasmuch as it includes the releasing cam member 58 which is rotatably mounted in a boss 59 on the cap 33. The cam member 58 moves the releasing ring 60 that is slidably mounted within the cylinder cap 33 to displace the piston member 41.

As illustrated, the ring 60 may be positioned behind the balls 47 to prevent them from falling out of the apertures or recesses 46 while the piston rod 42 limits the inward movement of the balls.

It will be understood that the cylinder and piston with which the locking mechanism is associated may be of any desired size and that the locking mechanism may be provided at one or both ends of the cylinder, as desired. Moreover, the number and size of the locking balls may be modified as desired. Moreover, locking elements other than balls may be used, such as, cylindrical members having rounded ends. Preferably a plurality of such locking members are provided to more uniformly distribute the stresses to which the piston and cylinder are subjected but the

5

locking mechanism can be provided with only one locking member, if desired. Therefore, the forms of the invention described above should be considered as illustrative of the invention and not as limiting the scope of the following claims.

We claim:

1. A piston lock for fluid actuated jacks comprising a cylinder having an internal recess at one end thereof, a piston slidable in said cylinder having an external recess adjacent one end thereof, said recesses being aligned when the piston is at one end of its stroke, a locking member supported loosely in one of said recesses and movable partially into both of said recesses when they are aligned, a piston member slidable axially of said cylinder and said piston for entering said one recess only near the end of said stroke to engage and force said locking member partially into both of said recesses to lock said piston to said cylinder, means normally urging said piston member toward said one recess, said piston member being displaceable axially by fluid pressure against the action of said urging means to release said piston for movement to the opposite end of its stroke, a tubular piston releasing member movably mounted in said cylinder adjacent to said internal recess having a portion for moving said piston member when said piston is locked to said cylinder, a coupling communicating with said tubular piston-releasing member for introducing fluid into said cylinder to displace said piston member to release said piston for movement to said opposite end of its stroke, and manually operable means for moving said piston releasing member to displace said piston member axially and release said piston for movement to said opposite end of its stroke.

2. A piston lock for fluid actuated jacks comprising a cylinder having a member provided with an apertured internal flange member adjacent to one end of said cylinder, said flange being spaced radially from the side of said cylinder to provide an internal recess, a piston slidable axially of said cylinder having a recess in its exterior adapted to enter said flange and move into alignment with the apertures in said flange, locking members loosely mounted in said apertures movable partially into said recess in said piston, a piston member slidable on the exterior of said piston and having a flange adapted to enter the space between said cylinder and said flange member to engage and urge said locking members into the recess in said piston, spring means carried by said piston normally urging said piston member axially toward said flange member, means for introducing fluid under pressure into said cylinder adjacent opposite ends thereof, said piston member being movable axially away from said flange member and relatively to said piston to release said piston in response to the pressure of the fluid introduced into said cylinder adjacent said one end, a shaft rotatably mounted in said one end of said cylinder and extending transversely of said cylinder, means for rotating said shaft, and a cam member on said shaft adjacent to said flange member for moving said flange out of engagement with said locking members upon rotation of said shaft.

3. A piston lock for fluid actuated jacks comprising a cylinder having a member provided with an apertured internal flange adjacent to one end

6

of said cylinder, said flange being spaced radially from the side of said cylinder to provide an internal recess, a piston slidable axially of said cylinder having a recess in its exterior adapted to enter said flange and move into alignment with the apertures in said flange, locking members loosely mounted in said apertures movable partially into recess in said piston, a piston member slidable on the exterior of said piston and having a flange adapted to enter the space between said cylinder and said flange member to urge said locking members into the recess in said piston, spring means carried by said piston normally urging said piston member axially toward said flange member, means for introducing fluid under pressure into said cylinder adjacent opposite ends thereof, said piston member being movable axially away from said flange member and relatively to said piston in response to the pressure of the fluid introduced into said cylinder adjacent said one end to release said piston, a manually actuated cam member movably mounted in said cylinder adjacent to said one end, and means slidable axially of said cylinder in response to movement of said cam member for displacing said piston member axially to release said piston.

4. A fluid actuated jack comprising a cylinder having an internal recess at each end thereof, a piston slidable axially of said cylinder and having external recesses at opposite ends thereof, the recess at one end of the cylinder being aligned with the recess at one end of said cylinder when the piston is at said one end of said cylinder, and the recess at the other end of said piston being aligned with the recess at the other end of the cylinder when the piston is at said other end of said cylinder, locking members supported loosely in said internal recesses at said one and other ends of said cylinder, a pair of piston members slidable relatively to and mounted on the exterior of said piston, means interposed between said piston members normally urging them apart, means on one of said piston members for entering said internal recess at said one end, means on the other piston member for entering said internal recess at said other end to urge said locking members into the aligned recesses when the piston is at one end or the other ends of said cylinder, said piston members being displaceable axially by fluid pressure against the action of said urging means to release said piston for movement axially of said cylinder.

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