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HYDRAULIC JACK

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2 Sheets-Sheet 1

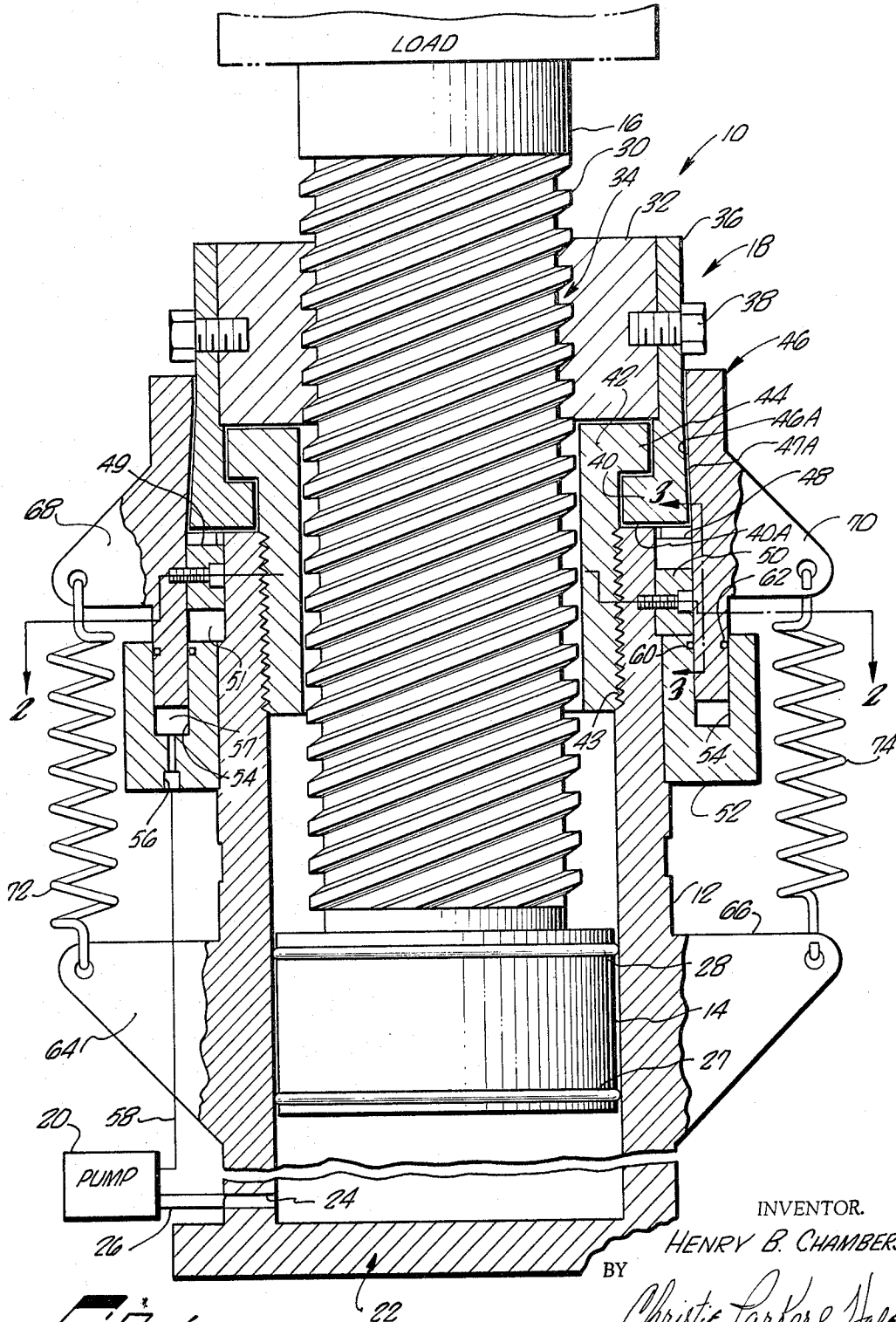


FIG. 1

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FIG. 2.

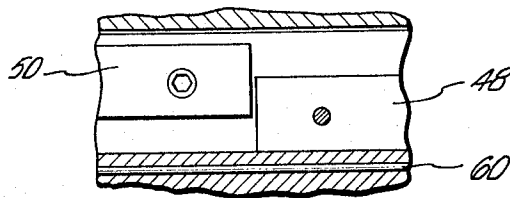
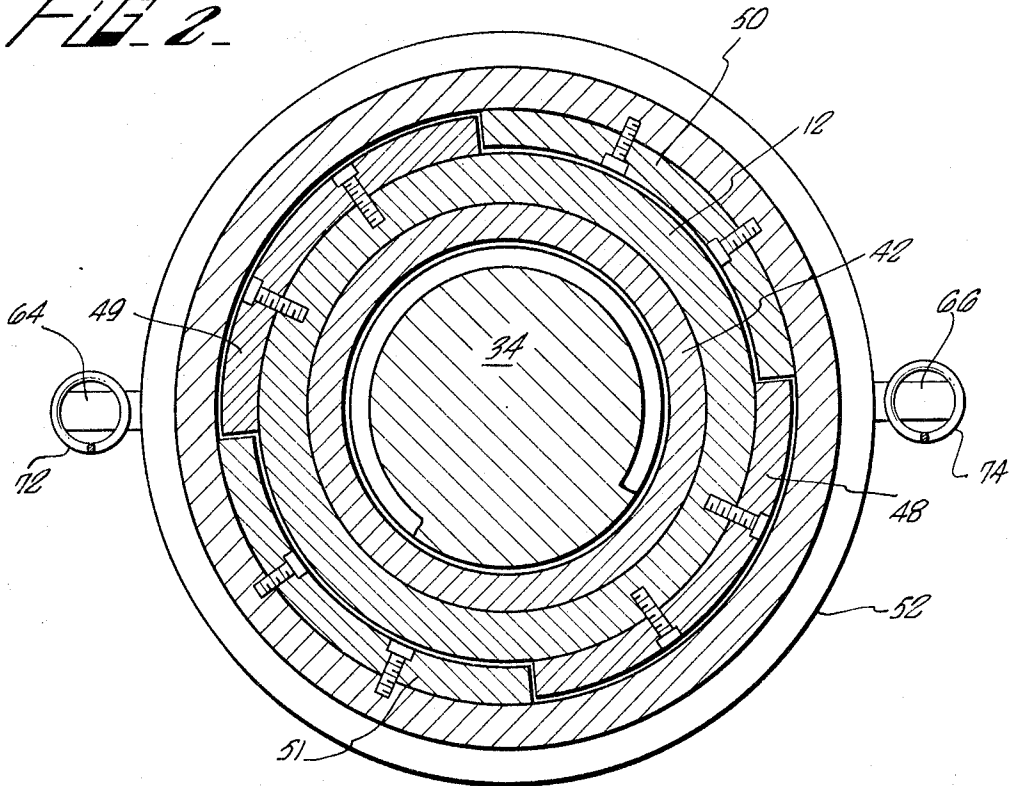


FIG. 3.

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HYDRAULIC JACK

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6 Claims. (Cl. 92—17)

This invention relates to hydraulic jacks which have a safety lock operable upon a loss of hydraulic pressure.

The hydraulic jack is used extensively in many industries today to elevate weights of considerable magnitude. It is often desirable to retain an elevated load in position for extended periods without a lowering of the hydraulic jack. The need for a safety lock on hydraulic jacks is quite apparent for the safety of individuals working about the jack and the load, and for this reason there are a number of known locks which are actuated automatically with a loss of fluid pressure. The known safety locks have disadvantages which limit the use of the type of load which may be safely placed upon the hydraulic jack knowing that a loss of fluid pressure is entirely possible.

The known safety locks used in combination with hydraulic jacks have used such things as sliding ratchets, locking balls, or pins which prevent movement of the ram with relation to the jack cylinder. One disadvantage in using a safety lock is the usual requirement of physically releasing the lock which causes some difficulty in resetting the jack. Another disadvantage of a ratchet-type safety lock is that it permits the ram to slip a finite amount after pressure failure before the ram is locked against additional movement. Further, the ratchet or similar type locks, must be reset against the force of the load resting on the jack, which can be difficult unless the load is removed.

A severe limiting weakness of the prior art safety locks lies in the particular size and arrangement of the lock, since the particular area of the lock limits the size of load which may safely be supported by the jack. It must be presumed that the largest load subjected upon the jack will at some time be supported by the safety lock, and in a great many cases, the size of the prior art ratchet pin, or ball type safety locks have been considerably smaller than the supporting ram, piston, or cylinder arrangement for the entire jack, which inherently unduly limits the size of a load safely carried by the safety lock portion of the jack.

In accordance with my present invention, I have eliminated many of the undesirable features and disadvantages of the prior art hydraulic jack safety locks. I provide a safety lock which automatically is substantially instantaneously engaged with a loss of fluid pressure upon the jack and is equally automatically disengaged with the recovery of fluid pressure. Thus, there is virtually no slippage or jerking with my lock as occurs with ratchet-type locks. The particular arrangement of the safety lock constructed according to my invention allows a maximum load to be supported by the lock, and the supporting elements include the ram and the cylinder, thus performing dual functions with a minimum number of parts. Additionally, a part of the safety lock includes a stop for the piston which further increases the usefulness of my invention.

A hydraulic jack constructed according to my invention includes a ram mounted on a piston that slides in a cylinder. Pressurized fluid is applied to one side of the piston to move the ram and a load in a first direction. A means for preventing the movement of the ram in a second direction after a loss of pressurized fluid is mounted upon the ram and includes a friction lock, which is urged into an inactive position by the pressurized fluid.

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The movement preventing means is engageable with the ram in any position. A resilient element urges the lock toward an active position.

Other advantages and features of my present invention will become apparent after considering the following specification and drawings in which:

FIG. 1 is a vertical cross-sectional view of a hydraulic jack having a locking mechanism constructed according to the present invention;

FIG. 2 is a cross-sectional view of the hydraulic jack illustrated in FIG. 1 with the section taken along line 2—2; and

FIG. 3 is a partial cross-sectional view illustrating a keying mechanism associated with the lock with the section taken along line 3—3 of FIG. 1.

Referring now to all the figures, a hydraulic jack 10 includes a vertical cylinder 12 having a piston 14 slidably disposed therein. A threaded ram 16 is mounted on the top of the piston 14 and extends upwardly out of the cylinder 12 to engage a load (shown only in phantom line). A friction locking mechanism 18, constructed according to my invention, allows the ram 16 to move upwardly to lift a load under the force of a pressurized fluid provided by a pump 20, and with the loss of pressurized fluid, the locking mechanism automatically holds the ram in place without dropping the load.

The cylinder is in the form of a tube having an integrally formed closed bottom 22. An opening 24 through the wall of the cylinder 12 is in communication with a conduit 26 leading from the pump such that pressurized fluid may flow into the interior of the cylinder 12 to force the piston 14 and ram 16 upwardly. The piston 14 is cylindrical in form and has two piston rings 27, 28 mounted near the extremities of the piston.

The ram 16 is generally cylindrical in shape and has a continuous helical groove formed along its entire length in the shape of Acme threads 30.

A ring 32 has inwardly directed threads 34, which mate with the threads 30 on the ram 16. An annular skirt 36 surrounds the ring 32 and is secured to it by a plurality of bolts 38. An inwardly extending annular flange 40, formed integrally with the bottom of skirt 36, has a lower surface 40A which abuts the upper end of the cylinder 12. Thus, the skirt 36 attached to ring 32 may support the ram 16 in any position since the skirt is supported by the cylinder 12. An insert 42 is attached to the upper end of the cylinder 12 by the threads 43, and includes an outwardly extending lip 44 which normally abuts the bottom of ring 32 and the top surface of flange 40. With this arrangement, the ring 32 and skirt 36 are free to rotate upon axial movement of the ram 16, but are prevented from moving in any direction parallel to the movement of the ram. The bottom surface of the lower portion of insert 42 which defines threads 43 serves as a positive stop to limit upward travel of piston 14 as shown in FIG. 1.

A sleeve 46 is tubular in shape and has an internal annular downwardly diverging tapered portion 46A formed thereon which mates with an external annular downwardly diverging tapered portion 47A on the skirt 36. The sleeve 46 is movable axially and normally is held with its tapered portion 46A spaced from the mating tapered portion 47A on the skirt 36. A pair of arcuately shaped keys 48, 49 are attached to the inside diameter of the sleeve 46 by a plurality of bolts. A pair of arcuately shaped mating keys 50, 51 are attached to the uppermost portion of the cylinder 12. As best illustrated in FIGS. 2 and 3, the mating keys 48, 49, 50, and 51 occupy the annular space between the cylinder 12 and the sleeve 46. The respective keys are approximately 180° apart and are in interlocking relationship to thereby prevent the sleeve 46 from rotating with relation to the cylinder 12. As best

illustrated in FIGS. 1 and 3, the keys 48-51 allow axial movement of the sleeve 46 with relation to the cylinder 12 and the skirt 36.

A second cylinder 52 is in the shape of an annulus having an annular shaped groove 54 formed therein with the lowermost portion of the sleeve extending therein in telescoping relationship. A port 56 formed in the floor of the groove 54 allows the annular shaped well 57 to be in communication with the pump 20 by means of a fluid conduit 58. Thus, when the annular well 57 has pressurized fluid therein, the lower portion of sleeve 46 is urged upwardly to allow rotation of the ring 32 and the skirt 36. A pair of O-ring seals 60, 62 are respectively inserted within the cylinder 52 on opposite sides of the lower portion of the sleeve 46.

A pair of outwardly extending triangular shaped ears 64, 66 are welded to opposite sides of the cylinder 12. A pair of outwardly extending triangular shaped ears 68, 70 are welded on opposite sides of the sleeve 46 in vertical alignment with ears 64, 66. A pair of tension coil springs 72, 74 are respectively mounted between ears 64, 68 and 66, 70 to urge the sleeve 46 toward contact with the skirt 36 so that the mating tapered portion 46A and 47A are in frictional engagement to thereby prevent rotation of the ring 32.

In operation, the hydraulic jack 10, constructed according to my present invention, may be inserted beneath a load schematically illustrated in FIG. 1 which may be such things as bridge spans, aircraft frames, and the like. The pump 20 is energized by an external power source (not shown) to supply pressurized fluid within the cylinder 12 and within the annular well 57. This pressurized fluid moves the piston 14 and ram 16 upwardly until the ram abuts the load, and during this movement, the ring 32 and skirt 36 are rotated as the ram 16 progressively advances upwardly. The annular well 57 is also filled with pressurized fluid causing the sleeve 46 to be urged upwardly against the tension of springs 72 and 74 to allow the rotation of ring 32 and skirt 36.

Assuming that the pressurized fluid dispensed by the pump 20 suddenly fails, the load is no longer supported by the fluid pressure acting on the piston, but rather by the ram and the ring 32 acting upon the insert 42 and the flange portion 40 of the skirt 36 abutting the uppermost portion of the cylinder 12. The loss in pressure within the well 57 permits tension springs 72 and 74 to move the sleeve 46 downwardly to frictionally engage the skirt 36. Thus, the construction of the sleeve 46 prevents rotation of the ring 32 during those periods when the pressurized fluid does not exert a force upon the piston 14, and the ram is locked against longitudinal movement.

It should be noted that the tapered mating surface of the skirt 36 and sleeve 46 allow the ram to be locked in any position, not requiring further rotation of the ring to perform the locking function.

Once the pressurized fluid again exists beneath the piston 14 and well 57, the sleeve is raised, the frictional engagement between the sleeve 46 and skirt 36 no longer exists, and the load is supported by the fluid pressure.

What is claimed is:

1. In a hydraulic jack including a ram mounted on a piston that is slidably disposed in a cylinder and operated by a pressurized fluid subjected on one side of the piston to move the ram in a first direction, the improvement comprising:

the ram has a continuous helical groove formed thereon,

a ring rotatably mounted on the ram engages the ram groove,

the ring is restrained from moving with the ram but may freely rotate thereon,

the ring includes a portion which abuts the cylinder in supporting fashion,

a lock disposed adjacent to the ring,

a means for urging the lock out of engagement with the

ring including a second cylinder disposed in telescoping relationship with the ring,
a fluid conduit communicating with the second cylinder and the pressurized fluid acting on the piston, and
means for urging the lock into engagement with the ring.

2. In a hydraulic jack including a ram mounted on a piston that is slidably disposed in a cylinder and operated by a pressurized fluid subjected on one side of the piston to move the ram in a first direction, the improvement comprising:

the ram having a continuous groove formed thereon, a ring rotatably mounted on the ram and engaging the ram groove,

the cylinder having a groove formed thereon adjacent the ring,

an inwardly extending flange extending from the ring in locking relationship with the cylinder groove,

a lock disposed adjacent the ring,

means for urging the lock out of engagement with the ring when the pressurized fluid is effective upon the piston, and

means for urging the lock into engagement with the ring when the cylinder is devoid of fluid pressure.

3. In a hydraulic jack including a ram mounted on a piston that is slidably disposed in a cylinder and operated by a pressurized fluid subjected on one side of the piston to move the ram in a first direction, the improvement comprising:

the ram having a continuous groove formed thereon, a ring rotatably mounted on the ram and engaging the ram groove,

an outwardly extending flange mounted on the cylinder including a stop portion extending within the cylinder serving to limit the travel of the piston,

an inwardly extending flange mounted on the ring in locking relationship with the cylinder outwardly extending flange,

the inwardly extending flange abutting the cylinder in supporting relationship,

a friction lock disposed adjacent the ring,

means for urging the lock out of engagement with the ring when the pressurized fluid is effective upon the piston, and

means for urging the lock into engagement with the ring when the cylinder is devoid of fluid pressure.

4. In a hydraulic jack including a ram mounted on a piston that is slidably disposed in a cylinder and operated by a pressurized fluid subjected on one side of the piston to move the ram in a first direction, the improvement comprising:

the ram is threaded along a substantial portion of its length,

a ring having inwardly directed threads thereon engaged with the threaded ram and rotatable thereon,

the cylinder having a groove formed thereon adjacent the ring,

an interlocking lip extending from the ring and extending into the cylinder groove,

a tapered skirt formed on the ring,

a tapered sleeve mating with the tapered ring skirt slidably disposed around the ring,

means for urging the sleeve into engagement with the ring skirt and engaging the sleeve, and

means for urging the sleeve out of engagement with the sleeve when fluid pressure is effective upon the piston in operative engagement with the sleeve.

5. In a hydraulic jack including a ram mounted on a piston that is slidably disposed in a cylinder and operated by a pressurized fluid subjected on one side of the piston to move the ram in a first direction, the improvement comprising:

the ram is threaded along a substantial portion of its length,

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a ring having inwardly directed threads thereon engaged with the threaded ram and rotatable thereon, the cylinder having a groove formed thereon adjacent the ring,
 an interlocking lip extending from the ring and extending into the cylinder groove, 5
 a tapered skirt formed on the ring,
 a tapered sleeve mating with the tapered ring skirt slidably disposed around the ring,
 a spring means mounted in tension between the sleeve and the cylinder, and 10
 means for urging the sleeve out of engagement with the sleeve when fluid pressure is effective upon the piston.

6. In a hydraulic jack including a ram mounted on a piston that is slidably disposed in a cylinder and operated by a pressurized fluid subjected on one side of the piston to move the ram in a first direction, the improvement comprising: 15

the ram is threaded along a substantial portion of its length, 20
 a ring having inwardly directed threads thereon engaged with the threaded ram and rotatable thereon, an outwardly extending flange mounted on the cylinder including a portion extending within the cylinder serving as a stop for the piston, 25

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an interlocking lip extending from the ring and extending into interlocking relationship with the cylinder outwardly extending flange and extending in abutting relation with the cylinder in supporting relationship, a tapered skirt formed on the ring,
 a tapered sleeve mating with the tapered ring skirt slidably disposed around the ring,
 a spring mounted in tension between the sleeve and the cylinder,
 an annulus having a groove formed therein with the sleeve extending therein in telescoping relation, and a conduit in communication with the annular groove and with the pressurized fluid subjected upon the piston.

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