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LIFTING MECHANISM

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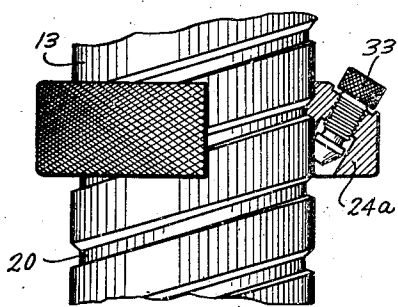
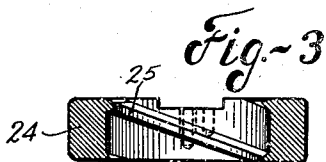
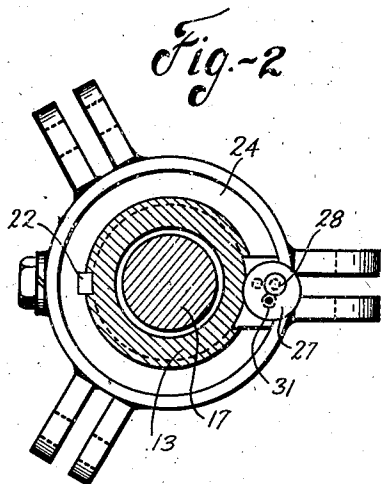
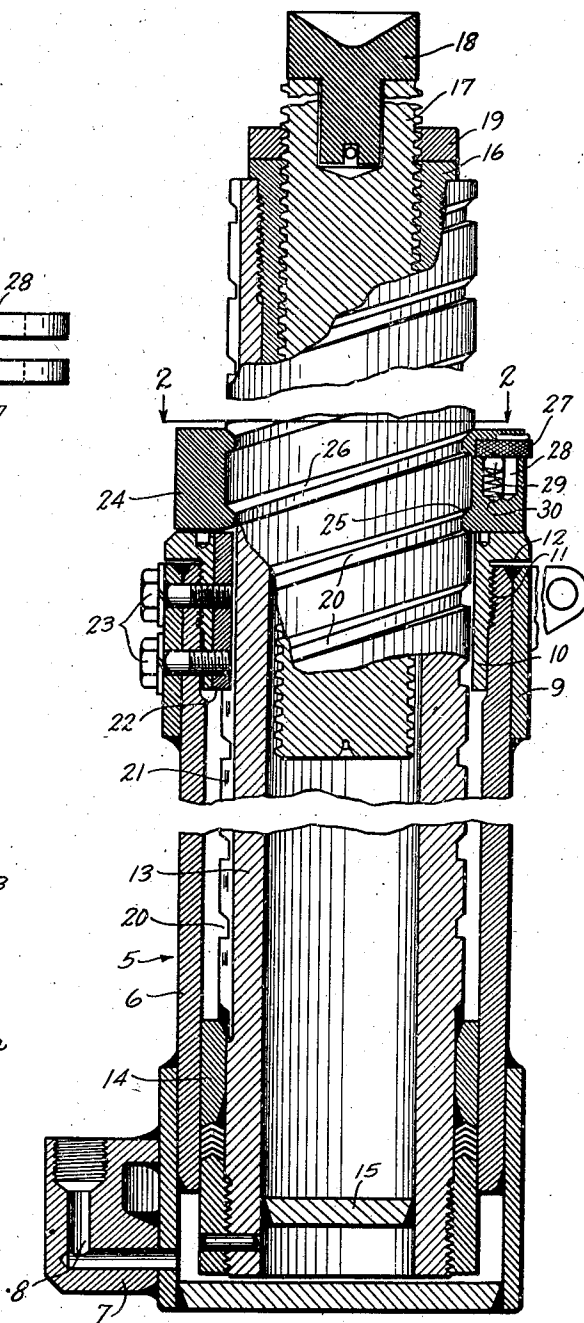


Fig.-4

Fig.-1



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LIFTING MECHANISM

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1

This invention relates to lifting mechanisms and more particularly to means for positively locking the lifting element in an elevated load supporting position. In hydraulic lifts it has been customary heretofore to retain the lifting element, or ram, in an elevated position by closing the cutoff valve to prevent the escape of oil or other fluid from the cylinder, and in the event of the escape of fluid from the cylinder, due to a leaky valve or otherwise, the ram and the load thereon will move downwardly.

One object of the invention is to provide means for positively retaining the ram in its elevated position.

A further object of the invention is to provide a positive lock for the ram which will automatically lock the same against downward movement immediately upon a decrease in the supporting pressure.

A further object of the invention is to provide a locking device which will be in locking position at all times during the elevation of the ram but will permit the ram to move upwardly with relation thereto.

A further object of the invention is to provide such a locking device which may be moved to and retained in a position near the upper end of the ram to permit the latter to move downwardly.

Other objects of the invention may appear as the mechanism is described in detail.

In the accompanying drawing Fig. 1 is a vertical section taken centrally through a lifting mechanism equipped with my invention, partly broken away, and showing the ram partly in elevation; Fig. 2 is a section taken on the line 2—2 of Fig. 1; Fig. 3 is a vertical section taken centrally through the locking device; and Fig. 4 is a detail view, partly in section, of another form of retaining device.

In the drawing I have illustrated one embodiment of my invention and have shown the same as applied to a hydraulic vehicle lift of a well known type which is designed primarily for use with airplanes, and when used for that purpose two or more lifts, or jacks, are usually employed. It will be understood, however, that the invention may take various forms and may be utilized in connection with lifting mechanisms, or jacks, of various kinds.

As here shown, the lifting mechanism comprises a cylinder 5 which consists of a tubular body portion 6 closed at its lower end by a cap-like structure 7 rigidly secured thereto and provided with a fluid inlet 8. At its upper end the body portion 6 is reinforced by an external sleeve

2

9 rigidly secured thereto and has mounted within the same a bushing 10 to form a bearing for the ram. As here shown, this bushing is screw threaded into the upper end of the body 6, as shown at 11, and is provided with an annular projection or flange 12 which overhangs the upper edges of the body portion 6 and the sleeve 9. The main lifting element or ram 13 is mounted in the bearing 10 for vertical movement within the cylinder. It is of a diameter somewhat less than the internal diameter of the cylinder and is provided at its lower end with an enlargement 14 fitting snugly within the body portion of the cylinder and constituting in effect a piston head. The ram in the present instance is tubular in form and is closed at its lower end by a bottom wall 15. At its upper end the ram has mounted therein a bushing 16 having an internal thread to receive and adjustably support a supplemental lifting element 17 which is provided at its upper end with a work engaging member 18 and is held in adjusted positions by a locking nut 19.

The ram is provided in its external surface with a spiral groove 20 which preferably extends for substantially the full length of the ram above the piston head 14 and forms on the ram a spiral rib, which, in the present instance, is of a width greater than the width of the groove. The ram is held against rotation in the cylinder and for this purpose is, in the present instance, provided with a vertical groove 21 which extends from the piston head 14 to the upper end of the ram. A spline 22 rigidly mounted within the upper end of the cylinder extends into the groove 21 and thus prevents the rotation of the ram without interfering with its vertical movement. As here shown, the spline is seated in a groove in the bearing bushing 10 and is rigidly secured therein by screws 23 extending through the sleeve 9, body portion 10 and bushing, and thus serving to rigidly lock the bushing against rotation as well as to support the spline in the groove 21. Rotatably supported on the cylinder is a locking device 24 having a part extending into the spiral groove 20 of the ram and having sliding engagement with the lower wall of that groove, so that as the ram moves upwardly the locking device will be caused by gravity to follow downwardly along the groove and to thus rotate about the ram in contact with or close to the cylinder. When fluid escapes from the cylinder or the supporting pressure on the ram is otherwise relieved the upper wall of the groove 20 will engage the locking device, in whatever position it may then occupy, and the ram will be thus locked against downward movement.

3

Preferably the locking device 24 comprises an annular element extending about the ram and normally supported on the flange 12 of the bushing 10, this flange forming the top surface of the cylinder. This annular member is provided on its inner surface with an inclined or spiral rib 25 which is parallel with and extends into the spiral groove 20. There are preferably two of these spiral ribs each extending for approximately one-half of a convolution, due to the relatively narrow width of the annular member. The lower edge of each rib 25 is chamfered so that it has free sliding contact with the lower wall of the groove 20 as the ram is moved upwardly and the locking device will therefore follow down along the groove and will remain in contact with or close to the upper end of the cylinder. When the ram tends to move downwardly the upper surface of the spiral groove will be brought into contact with rib or ribs 25 and the frictional contact between the rib and the wall of the groove and between the annular member and the upper end of the cylinder will prevent the rotation of the locking device and it will therefore positively lock the ram against downward movement. To increase the frictional contact between the locking device and the ram, the upper surface of the rib 25 of the locking device is chamfered and the upper wall of the groove 20 is chamfered, as shown at 26. The angularity of the chamfered surfaces being such as to provide a relatively great frictional contact between the same.

When the ram is to be lowered the locking device 24 is moved to a position near the upper end of the ram, by manually rotating the same about the ram, and is retained in that position to permit the ram to be lowered. Any suitable means may be provided for retaining the locking device in a position near the upper end of the ram and spaced from the upper end of the cylinder, but, as shown in Figs. 1 to 3, a disk 27 is pivotally mounted in a recess in the upper edge of the annular member 24 on an eccentric axis by means of a pivot pin 28, so that the disk can normally be supported out of contact with the ram but may be moved about its axis into the spiral groove 20 to support the locking device on the ram in spaced relation to the cylinder. The disk is of relatively thin flat construction and when inserted in the groove will so engage the walls thereof as to prevent the locking device moving downwardly by gravity. Preferably a detent is provided to retain the eccentrically mounted disk in the position to which it has been moved and, as here shown, a spring pressed ball 29 is mounted in a recess 30 in the annular member 24 and the disk 27 is provided with spaced recesses 31 to receive the detent and yieldably resist the movement of the disk.

In Fig. 4 there is shown a modified form of device for retaining the follower nut in its elevated position, this device comprising a set screw extending through the nut and adapted to engage the ram. As here shown, the set screw, 33, is mounted in the nut 24a in an inclined position and the inner end of the nut may be caused either to enter the groove in the ram or to engage the outer surface of the spiral rib.

It will be apparent therefore that when fluid is admitted to the lower end of the cylinder the ram will be forced upwardly but will be held against rotation and the locking device, which constitutes a follower nut, will move downwardly along the spiral groove and remain in contact with or close to the upper end of the cylinder, thus permitting the upward movement of

4

the ram and maintaining the projection or rib 25 always in a locking position with relation to the ram. When the ram has been elevated to the desired height the usual cutoff valve is closed to maintain a continuing support for the ram but should there be any leakage of fluid from the cylinder or should the fluid pressure be otherwise decreased, the tendency of the ram to move downwardly under its load will cause the upper wall of the spiral groove to engage the rib of the locking device and will create such frictional contact between the upper wall of the groove and the rib and between the locking device and the upper end of the cylinder as to prevent the rotation of the locking device and thereby lock the ram against downward movement, this locking operation taking effect instantly upon the relief of the supporting pressure on the ram. When the ram is to be lowered and while it is supported by the fluid within the cylinder the locking device or follower nut is run upward on the ram to a position spaced from the upper end of the cylinder a distance sufficient to permit the ram to be lowered, and is retained in that position by the retaining device 27 or 33. Should the lift be used, merely as a jack, in an inclined or horizontal position, in which the annular member or follower nut would not be retained by gravity in a position close to the cylinder, the nut may of course be moved to locking position with relation to the cylinder in any suitable manner, as by hand.

While I have shown and described one embodiment of my invention I wish it to be understood that I do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A mechanism comprising an upright tubular element, an elongate element mounted for vertical movement in and projecting beyond the upper end of said tubular element and having an exterior spiral groove, and a locking member extending about the projecting portion of said elongate element and having a part extending into said spiral groove to cause said locking member to rotate about said elongate element under the influence of gravity as said elongate element moves upwardly with relation to said tubular element, and to be pressed into locking relation to said tubular element by a downward force exerted thereon by said elongate element.

2. A mechanism comprising an upright tubular element, an elongate element mounted for vertical movement in and projecting beyond the upper end of said tubular element and having an exterior spiral groove, and an annular member rotatable about the projecting portion of said elongate element and normally held by gravitation substantially in contact with an upwardly facing surface of said tubular element, said annular member having a part extending into said spiral groove to slidably engage the lower surface thereof and cause said annular member to rotate about said elongate member substantially in contact with said surface of said tubular element as said elongate element moves upwardly and to be engaged by the upper surface of said groove and press said annular member into rotation preventing engagement with said tubular element when said elongate element tends to move downward.

3. In a mechanism comprising an upright tu-

5

bular element and an elongate element mounted for longitudinal movement in said tubular element and held against rotation, said elongate element having a spiral groove, an annular member extending about said elongate element, supported normally by said tubular element and having a part extending into said spiral groove, said part being adapted to engage the upper wall of said groove and to be pressed into rotation preventing engagement with said tubular element when said elongate element tends to move downwardly and to thus lock said elongate element against such downward movement, and to slide along the lower wall of said groove and rotate said annular element as said elongate element moves upwardly, said annular member tending to move by gravity toward said tubular element, said annular member being movable lengthwise of said elongate element to a position spaced from said tubular element to permit the downward movement of said elongate element, and a device carried by said annular member and movable into engagement with said elongate element to retain said annular member in said spaced position.

4. In a mechanism comprising an upright tubular element and an elongate element mounted for longitudinal movement in said tubular element and held against rotation, said elongate element having a spiral groove, an annular member extending about said elongate element, supported normally by said tubular element and having a part extending into said spiral groove, said part being adapted to engage the upper wall of said groove and to be pressed into rotation preventing engagement with said tubular element when said elongate element tends to move downwardly and to thus lock said elongate element against such downward movement, and to slide along the lower wall of said groove and rotate said annular member as said elongate element moves upwardly, said annular member tending to move by gravity toward said tubular element, said annular member being movable lengthwise of said elongate element to a position spaced from said tubular element and a substantially flat element mounted on said annular member in a plane intersecting said elongate element and movable into said groove to retain said annular member in said spaced position.

5. A lock for a mechanism of the type which includes an upright tubular element and an element mounted in said tubular element for longitudinal movement with relation thereto and projecting beyond the upper end thereof, said lock comprising a member supported normally by a fixed part of said tubular element and rotatable about the projecting portion of said movable element, said rotatable member and said movable element having cooperating parts operable upon the upward movement of said movable element to cause said rotatable member to rotate under the influence of gravity in close proximity to said fixed part while said movable element moves upwardly with relation thereto, and to press said rotatable member into rotation preventing engagement with said fixed part when said movable element tends to move downwardly, and thereby prevent said downward movement.

6. A mechanism comprising an upright tubular element, an elongate element mounted for longitudinal movement in and projecting beyond one end of said tubular element and held against rotation therein, an annular member rotatably mounted about the projecting portion of said

6

elongate element and held by gravity substantially in contact with a fixed part of said tubular element, said elongate element and said annular member having interengaging spiral parts to cause said annular member to rotate about said elongate element in close proximity to said fixed part of said tubular element as said elongate element moves upwardly and to be moved into rotation preventing engagement with said fixed part when said elongate element tends to move downwardly.

7. In a jack device of the class described, in combination, a supporting member, a ram member associated therewith for raising and lowering movements vertically relative thereto, means for preventing rotation of said ram member relative to said supporting member while permitting said raising and lowering movements of said ram member relative to said supporting member, a lock member associated with said ram member for rotation relative thereto about a substantially vertical axis, said ram member and said lock member having parts including cooperating helical surfaces whose helix angle is such that, upon raising movement of said ram member relative to said supporting member, the weight of the lock member will cause rotational movement of said lock member downward by gravity relative to the ram member until the lock member engages the supporting member, said lock member being cooperable with said supporting member to prevent rotation of said lock member relative to said supporting member upon such engagement, whereby to prevent unauthorized lowering movement of the ram member relative to the supporting member upon such engagement.

8. In a jack device of the class described, in combination, a supporting member, a ram member associated therewith for lifting and lowering movements relative thereto, a lock member associated with said ram member for rotation relative thereto about a substantially vertical axis, said ram member and said lock member having parts including cooperating helical surfaces whose helix angle is such that, upon lifting movement of said ram member relative to said supporting member, the weight of the lock member will cause rotational movement of said lock member downward by gravity relative to the ram member until the lock member engages the supporting member, said lock member being cooperable with said supporting member and said ram member to prevent unauthorized lowering movement of the ram member relative to the support upon such engagement, and means on one of said lock or ram members movable into and out of engagement with the helical surfaces on the other member for preventing relative rotation of said lock and ram members when said means is so engaged, whereby to maintain said lock member in a fixed position respecting said ram member, regardless of lifting or lowering movements of the ram, when said means is so engaged.

9. In a jack device of the class described, in combination, a supporting member, a ram member associated therewith for lifting and lowering movements relative thereto, a lock member associated with said ram member for rotation relative thereto about a substantially vertical axis, said ram member and said lock member having parts including cooperating helical surfaces whose helix angle is such that, upon lifting movement of said ram member relative to said supporting member, the weight of the lock

7

member will cause rotational movement of said lock member downward by gravity relative to the ram member until the lock member engages the supporting member, said lock member being co-operable with said supporting member and said ram member to prevent unauthorized lowering movement of the ram member relative to the

8

support upon such engagement, and an eccentric member pivoted on said lock member and movable into and out of engagement with the helical surfaces on the ram member for preventing relative rotation of said nut and said ram member when said eccentric member is so engaged.

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