Oct. 27, 1931. A. L. JOHNSON 1,829,656

LIFTING JACK

Filed Aug. 24, 1927 2 Sheets-Sheet 1

Fig. 2.

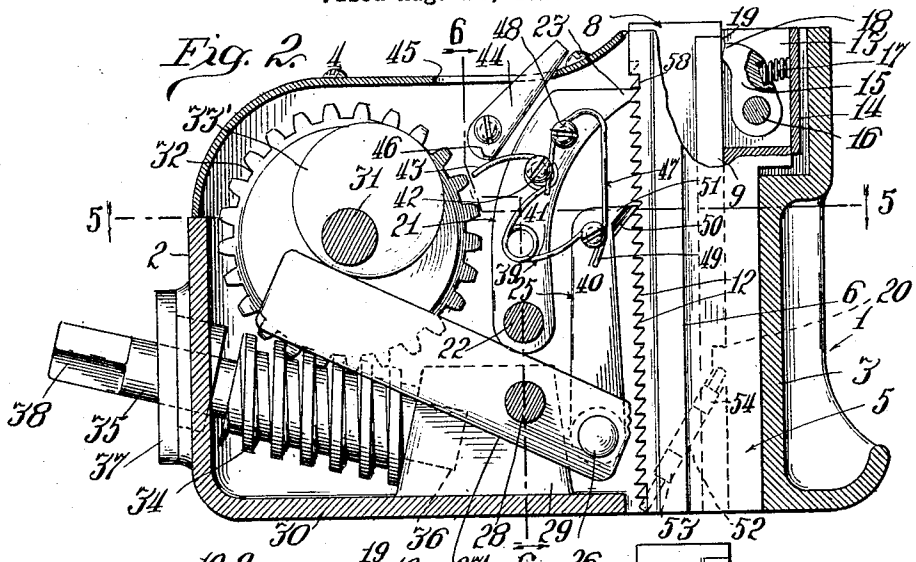


Fig. 1.

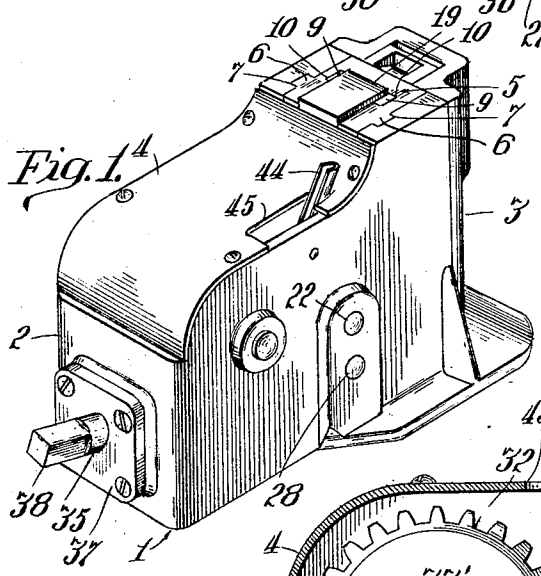
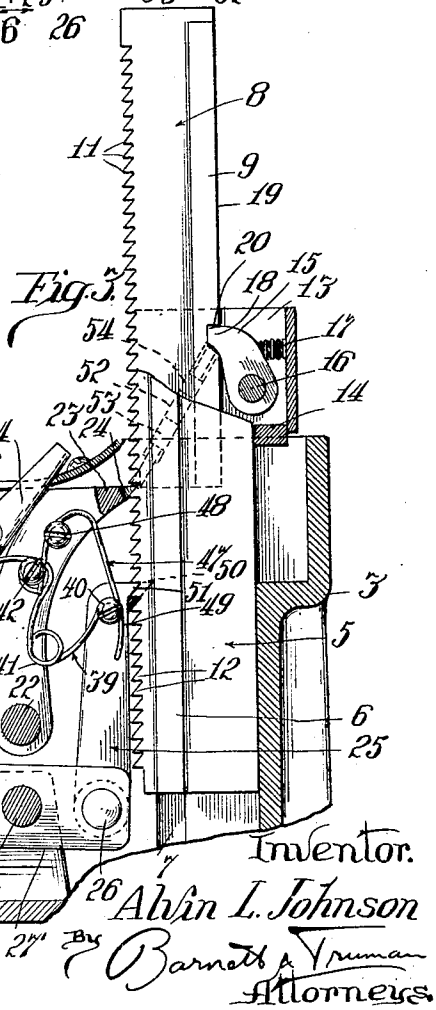


Fig. 3.



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Fig. 6.

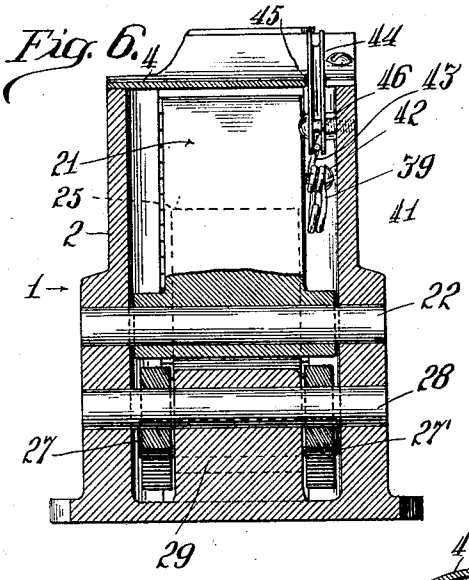
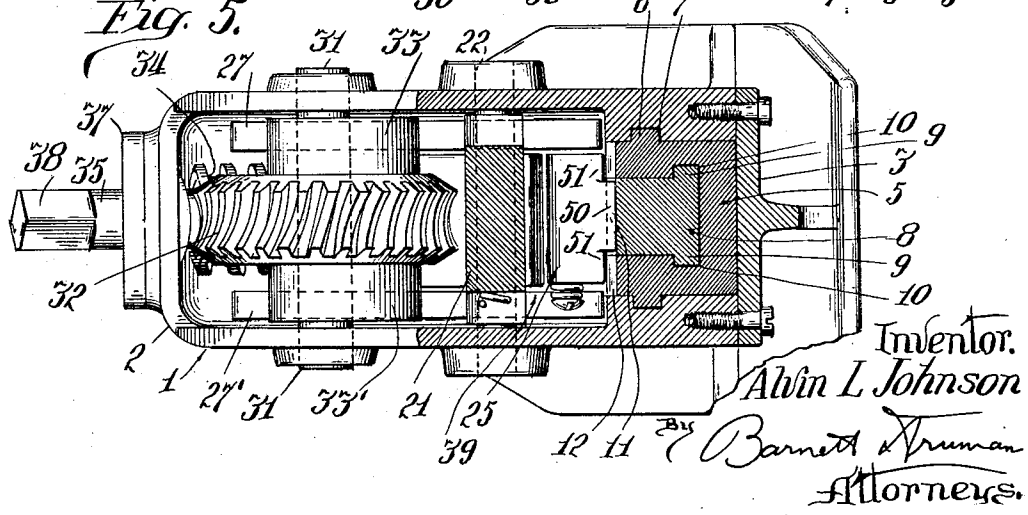


Fig. 4.

Fig. 5.



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UNITED STATES PATENT OFFICE

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LIFTING JACK

Application filed August 24, 1927. Serial No. 215,103.

This invention relates to improvements in a lifting jack adapted to handle heavy loads, and having a low clearance when depresesd and a comparatively high lift when elevated. The improvements relate to a jack of the double ratchet-bar type embodying a pair of telescoping ratchet bars which are successively elevated or lowered by a reciprocating pawl mechanism.

The principal object of the invention is to provide an improved jack of the double ratchet bar type, as disclosed more in detail in the description which follows.

Another object is to provide improved means for automatically locking and unlocking the inner ratchet bar with respect to the outer ratchet bar, when this inner ratchet bar is extended vertically from its telescoped position within the outer bar.

Another object is to provide an improved form of locking pawl adapted to sustain the ratchet bars in any of their elevated positions without releasing the locking means between the two bars.

Another object is to provide an improved form of driving means for operating the lifting pawl, comprising worm gearing and rotary cams whereby a greatly increased mechanical advantage is obtained adapting the jack for handling heavy loads.

Numerous other objects and advantages of this invention will be apparent from the following detailed description of one approved form of the apparatus.

In the accompanying drawings:

Fig. 1 is a perspective view of the assembled jack with the ratchet bars in their completely lowered positions.

Fig. 2 is a vertical section through the jack, parts being broken away, showing the ratchet bars in lowered position.

Fig. 3 is a view similar to Fig. 2 showing the inner ratchet bar completely elevated and the outer ratchet bar partially elevated.

Fig. 4 is a view similar to Figs. 2 and 3, but illustrating the jack at that stage of the lowering operation when the outer ratchet bar has been completely lowered and the inner bar has just been unlocked so that it may be lowered within the outer bar.

Fig. 5 is a horizontal section taken substantially on the line 5—5 of Fig. 2.

Fig. 6 is a vertical section taken substantially on the line 6—6 of Fig. 2.

The standard 1 consists of a hollow casting which may be made up of any number of parts suitably secured together for convenience in machining and assembly. As here shown, the standard consists of a main casting 2, a back plate 3, and a cover plate 4 that may be removed to permit access to the operating mechanism. A ratchet bar 5 of rectangular cross section is guided and supported for vertical movement within a correspondingly shaped vertical recess at the rear of the housing. The two sides and the rear face of this ratchet bar are guided against the side and rear walls of the housing or standard, and side ribs 6 guided in slots 7 in the standard support the ratchet bar against tilting into the open forward portion of the housing. An inner ratchet bar 8 fits telescopically within the outer ratchet bar 5, the inner bar having side ribs 9 guided within vertical grooves 10 in the ratchet 5. Ratchet teeth 11 having horizontal lower faces and downwardly sloping upper faces are formed along the front side of the ratchet bar 8, and corresponding teeth 12 are formed in the two forwardly facing side portions of the outer ratchet bar 5. When the two ratchet bars are telescoped, as shown in Fig. 2, the ratchet teeth 11 and 12 will be in alignment across the entire forward face of the two telescoped bars.

In a housing or pocket 13 formed in an extension 14 on the upper rear face of the outer ratchet-bar 5, is a pawl or dog 15 pivoted at its lower end on a transverse shaft 16, and urged forwardly by the compression spring 17 so that the nose 18 of the pawl will normally be forced against the rear face 19 of the inner ratchet bar 8. When the inner ratchet bar has been elevated to approximately the position shown in Fig. 4, the dog 15 will spring outwardly into the notch or recess 20 formed in the lower rear face of bar 8, as shown in Fig. 3. When the two ratchet bars are further elevated from the standard (as shown in Fig. 3) the load sus-

tained by the inner ratchet bar 8 will be transmitted through locking dog 15 to the outer ratchet bar 5 and thence through the pawls hereinafter described to the standard 1.

The locking pawl 21 is pivoted at its lower end on a shaft 22 journaled at its ends in the side walls of the casting 2. The horizontally extending tooth 23 at the upper end of pawl 21 is of a width sufficient to engage both sets of ratchet teeth 11 and 12 on the respective bars 8 and 5. A small notch 24 is cut out of the central portion of tooth 23 for a reason hereinafter described. The lifting pawl 25 is pivotally mounted at its lower end on a transverse shaft 26 which is mounted in the shorter arms of a pair of similar operating levers 27 and 27′. A transverse shaft 28, positioned substantially beneath the shaft 22, is pivoted at its ends in the side walls of the casing 2, and is intermediately supported in a boss or lug 29 projecting upwardly from the bottom or base portion 30 of the standard or casing. The operating levers 27 and 27′ are each intermediately pivoted on this shaft 28, at the two sides of the lug 29 and between this lug and the side walls of the casing. A transverse shaft 31, also mounted in the side walls of casing 2, carries a rotatable unit consisting of a centrally positioned worm wheel 32, and a pair of similar circular cams 33 and 33′ similarly positioned eccentrically to the shaft 31 at the two sides of the worm wheel 32. The worm wheel and cams are secured together to rotate as a unit. A driving worm 34 is mounted on an upwardly inclined drive shaft 35, pivoted at its lower inner end 36 in the lug 29, and having a bearing where it projects through the front wall of the housing in a cover plate 37. The outer end 38 of the shaft 35 has a square or other irregular cross section adapting it for engagement by an operating crank or handle. It will be apparent that rotation of the shaft 35 (in either direction) will, through the worm gearing 34 and 32, cause rotation of the cams 33 and 33′. Since these cams engage against the upper side of the longer arms of levers 27 and 27′, the rotation of the cams will cause the levers to be oscillated about their fulcrum shaft 28, thereby causing the lifting pawl 25 to be reciprocated up and down substantially parallel with the toothed faces of the bars 5 and 8. The worm and cam mechanism just described constitutes a simple and effective means for securing a large mechanical advantage for operating the levers 27 and 27′, whereby heavy loads may easily be handled by this jack. Other power-multiplying means might be substituted, or this cam mechanism might be omitted and simply a long lever extension be provided attached to the longer arms of the levers 27 and 27′.

A suitable reversing mechanism is provided for holding both pawls 21 and 25 yieldably in engagement with the ratchet teeth on the bars when the jack is being elevated, and for alternately moving these pawls into and out of engagement with the teeth when the jack is being lowered. While many different forms of reversing mechanisms might be used and are well known in this art, the simple form here disclosed comprises a spring 39 which is secured at one end 40 to the upper end portion of lifting pawl 25, is bowed downwardly at 41, has a second upwardly extending portion pivotally secured to locking pawl 21 at 42, from which latter point extends a rearwardly projecting end portion 43. A small cam lever 44 projects outwardly through a slot 45 in the cover plate 4. When this lever 44 is moved to the position shown in Figs. 1, 2 and 3, the cam portion 46 adjacent the lower end of the lever will bear upon the projecting arm 43 of the spring in such a manner as to place all portions of the spring 39 under tortion so that both pawls 21 and 25 will be held yieldably in engagement with the ratchet teeth on the lifting bars. As the lifting pawl 25 is moved upwardly, it will engage one of the ratchet teeth on one of the bars and carry the bar upwardly with it. During this movement of the bar the locking pawl 21 will spring outwardly over the ratchet teeth against the tension of the spring 39. When lifting pawl 25 is moved downwardly by the opposite swinging movement of the levers 27 and 27′, this pawl will snap over the ratchet teeth but the bars will not be permitted to descend since the locking pawl 21 will be held in engagement with one of the teeth by the spring 39.

A second torsion spring 47 is anchored at 48 on the upper end of locking pawl 21, and has a lower end 49 pressing outwardly against the pin on lifting pawl 25. When the spring 39 is held under tension, as shown in Figs. 1, 2 and 3, this spring 39 will overcome the spring 47 so as to continuously hold the lifting pawl 25 yieldably in engagement with the ratchet teeth. When the cam lever 44 is thrown to the reversing position shown in Fig. 4, the tension on spring 39 will be so released that when lifting pawl 25 is in its lowermost position, the spring 47 will be effective to move this pawl out of engagement with the ratchet teeth and hold it out, but at this time the spring 39 will hold the locking pawl 21 in engagement with the ratchet teeth. As the lifting pawl 25 is moved upwardly, it will be held out of engagement with the teeth until it nears the upper end of its travel, at which time the spring 39 will become effective to move the pawl 25 into engagement with the ratchet teeth and as the further upward movement of this pawl slightly elevates the bars the load will be released from the locking pawl 21 and the spring 39 will now be under such tension as to throw this locking pawl back out of engagement with the ratchet teeth. As the pawl 25 is lowered, it will re-

main in engagement with the ratchet teeth carrying the load and the locking pawl 21 will not be moved back into engagement with the ratchet teeth until the pawl 25 has neared the lower limit of its travel. At this point the springs will become effective to move the locking pawl 21 into engagement with the teeth to as to accept the load, and further movement downward of the lifting pawl 25 will release it from the load, after which the spring 47 will move this pawl out of engagement with the teeth. In this manner, successive reciprocations of the lifting pawl will result in successive downward movements of the bars which carry the load.

The mechanism whereby this continuous operation of the lifting and locking pawls is made effective to successively elevate or lower the inner and outer ratchet bars 8 and 5, will now be described.

The pawl 25 is provided with a long central tooth 50 to engage the ratchet teeth 11 of inner bar 8, this tooth 50 being of insufficient width to engage the teeth 12 on bar 5 at either side of the teeth 11. Pawl 25 also has a pair of aligned teeth 51, one at either side of tooth 50, adapted to engage the teeth 12 on the outer ratchet bar 5. When the inner bar 8 is telescoped within the outer bar 5, as in Figs. 2 and 4, the engagement of the central tooth 50 with the teeth 11 on the inner bar will prevent the engagement of the shorter teeth 51 with the teeth 12 on bar 5. However, when the bar 8 has been elevated, as shown in Fig. 3, the central tooth 50 will be permitted to pass into the slot formerly occupied by the bar 8, thus permitting the shorter teeth 51 to come into engagement with the ratchet teeth 12 on the outer bar 5.

Positioned diagonally within the lower end portion of the inner bar 8 is a channel 52, opening at its lower end into the space directly beneath the lowermost tooth 11, and opening at its upper end into the recess 20. A multi-part plunger is positioned within this channel, consisting of a lower plunger member 53, an upper plunger member 54, and an intermediate compression spring 55. The plunger 53 has a reduced lower portion 56 sliding within a reduced portion of the channel 52 so that the downward movement of the plunger will be limited by the engagement of the larger head portion with the bottom of the larger channel section, as shown in Figs. 2 and 3. The plunger will normally remain in this position with the reduced end portion 56 projecting beneath the lowermost ratchet tooth 11, unless it is engaged and moved upwardly by the tooth 50 on the lifting pawl. When the plunger is pushed upwardly by the pawl 25, the upper end 57 of plunger part 54 will engage the dog 15 and push it out of the locking recess 20, providing the dog 15 is free to move at this time. If not, the spring 55 will be compressed, and will expand to throw out the dog 15 as soon as the load is released from this dog. The central notch 24 in the locking pawl 21, as hereinabove referred to, is provided for the purpose of clearing the lower end 56 of this plunger so that the locking pawl can engage the lowermost tooth on the ratchet bar 8, and corresponding teeth 12 on the outer ratchet bar without operating the dog-releasing plunger.

Assuming that the jack is completely lowered, as shown in Fig. 2, and that cam lever 44 has been moved to the "elevating" position, successive reciprocations of the pawl 25 will cause the central tooth 50 to successively engage teeth 11 of the inner ratchet bar 8 and lift this bar upwardly, step by step, the bar being held in each successively elevated position by the spring pressed locking pawl 21, which also engages with the teeth 11. Enlarged recesses 58 above the upper-most teeth 12 on the outer bar 5 permits freedom of movement to the pawl 21 in engaging and re-engaging the successive teeth 11 on the inner bar 8. When the bar 8 has reached a sufficient height, the spring-pressing dog 15 will snap into the locking recess 20. Further reciprocations of the pawl 25 will cause the outer teeth 51 to engage the teeth 12 of the outer ratchet bar 5, thus elevating this bar from the standard, carrying bodily upward with it the inner bar 8 and the load sustained thereon, the two bars being locked to operate as a unit by the spring pressed dog 15. This position of the parts is shown in Fig. 3, although the jack is not completely elevated, as shown in that view.

When cam lever 44 is thrown to the position shown in Fig. 4, and the pawl 25 is reciprocated, the outer bar 5 will be lowered step by step until the position shown in Fig. 4 is reached, at which time the inner pawl tooth 50 will engage the lower tooth 11 on the inner bar 8 and at the same time will engage the lower end 56 of the plunger and press this plunger upwardly, compressing the spring 55. The outer bar 5 is now completely lowered, and the slight upward movement of inner bar 8 as the pawl 25 lifts upwardly on the lowermost tooth 11, will release the load from the dog 15, and the compressed spring 55 will throw this dog backwardly out of the notch 20, as shown in Fig. 4. The succeeding downward movement of pawl 25 will lower the inner bar 8 into the outer bar 5, the plunger 57 holding the dog 15 out of the recess 20 until the dog engages against the rear face 19 of the bar. Successive reciprocations of the pawl 25 will simply lower the inner ratchet bar 8, the outer bar 5 now being inactive and serving simply as a guide and support for the inner ratchet bar.

It will be noted that during the elevating operation, when the inner bar 8 has reached approximately the position shown in Fig. 4,

the engagement of the lifting pawl with the plunger 56 will temporarily tend to hold the dog 15 out of the locking recess 20. However, on the next downward movement of the pawl 25, the bar 8 will be held in its raised position by the locking pawl 21 and as soon as the plunger 56 is released by the downward movement of pawl 25, the dog 15 will be moved into the recess 20 by the spring 17. The next upward stroke of pawl 25 will cause the teeth 51 to engage certain teeth 12 on the outer bar 5.

I claim:

1. A lifting jack comprising a standard, a pair of vertically movable ratchet bars, a dog movably mounted in one bar and adapted to engage a locking recess in the other bar when a predetermined relative movement has taken place between the bars, a pivoted locking pawl and a vertically reciprocating lifting pawl mounted to engage the teeth on the bars, and a plunger mounted in one of the bars and having a portion projecting into the space adjacent the ratchet teeth so that it will be engaged and moved by the lifting pawl to release the dog, the locking pawl being provided with a cut-away portion to avoid engagement with the plunger.

2. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a locking pawl pivoted in the standard in position to engage the ratchet teeth, a lever intermediately pivoted in the standard, a lifting pawl pivotally mounted on one one arm of the lever in position to engage the ratchet teeth, a rotary cam mounted in the standard above the other arm of the lever, and means for rotating the cam.

3. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a locking pawl pivoted in the standard in position to engage the ratchet teeth, a lever intermediately pivoted in the standard, a lifting pawl pivotally mounted on one arm of the lever in position to engage the ratchet teeth, a rotary cam mounted in the standard above the other arm of the lever, a wormwheel secured to the cam, a rotary driving shaft projecting from the standard, and a worm on the shaft engaging the wormwheel.

4. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a second ratchet bar guided for vertical movement within the first bar, the ratchet teeth on the two bars being in alignment when the bars are telescoped, a spring-pressed dog mounted in the outer bar, the inner bar having a locking recess to receive the dog when the inner bar is elevated to a predetermined point, a locking pawl pivoted in the standard for engaging the teeth of either bar to hold the bars in elevated positions, a lifting pawl positioned to engage the ratchet teeth and means for reciprocating this pawl vertically, and a plunger mounted in the inner bar and having one end projecting into the pawl-engaging space beneath one tooth of the bar and the other end adapted to be projected into the dog-receiving recess to release the dog therefrom.

5. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a second ratchet bar guided for vertical movement within the first bar, the ratchet teeth on the two bars being in alignment when the bars are telescoped, a spring-pressed dog mounted in the outer bar, the inner bar having a locking recess to receive the dog when the inner bar is elevated to a predetermined point, a locking pawl pivoted in the standard for engaging the teeth of either bar to hold the bars in elevated positions, a lifting pawl positioned to engage the ratchet teeth and means for reciprocating this pawl vertically, and a plunger mounted in the inner bar and having one end projecting into the pawl-engaging space beneath one tooth of the bar and the other end adapted to be projected into the dog-receiving recess to release the dog therefrom, the plunger comprising two plunger heads and an interposed compression spring.

6. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a second ratchet bar guided for vertical movement within the first bar, the ratchet teeth on the two bars being in alignment when the bars are telescoped, a spring-pressed dog mounted in the outer bar, the inner bar having a locking recess to receive the dog when the inner bar is elevated to a predetermined point, a locking pawl pivoted in the standard for engaging the teeth of either bar to hold the bars in elevated positions, a lifting pawl positioned to engage the ratchet teeth and means for reciprocating this pawl vertically, and a plunger mounted in the inner bar and having one end projecting into the pawl-engaging space beneath one tooth of the bar and the other end adapted to be projected into the dog-receiving recess to release the dog therefrom, the locking pawl having a cut-away portion to clear the plunger when in engagement with the adjacent ratchet tooth.

7. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a second ratchet bar guided for vertical movement within the first bar, the ratchet teeth on the two bars being in alignment when the bars are telescoped, a spring-pressed dog mounted in the outer bar, the inner bar having a locking recess to receive the dog when the inner bar is elevated to a predetermined point, a locking pawl pivoted in the standard for engaging the teeth of either bar to hold the bars in elevated positions, a lifting pawl positioned to engage the

ratchet teeth and means for reciprocating this pawl vertically, this pawl having a long tooth to engage the teeth of the inner bar and a shorter tooth to engage the teeth of the outer bar after the inner bar has been elevated, and a plunger mounted in the inner bar and projecting at its lower end into the space beneath the lowermost ratchet tooth on the bar, the upper end of the plunger being adapted to be projected into the dog-receiving recess to release the dog therefrom.

8. A lifting jack comprising a standard, a ratchet bar guided for vertical movement in the standard, a second ratchet bar guided for vertical movement within the first bar, the ratchet teeth on the two bars being in alignment when the bars are telescoped, a spring-pressed dog mounted in the outer bar, the inner bar having a locking recess to receive the dog when the inner bar is elevated to a predetermined point, a locking pawl pivoted in the standard for engaging the teeth of either bar to hold the bars in elevated positions, a lifting pawl positioned to engage the ratchet teeth and means for reciprocating this pawl vertically, this pawl having a long tooth to engage the teeth of the inner bar and a shorter tooth to engage the teeth of the outer bar after the inner bar has been elevated, and a plunger mounted in the inner bar and projecting at its lower end into the space beneath the lowermost ratchet tooth on the bar, the upper end of the plunger being adapted to be projected into the dog-receiving recess to release the dog therefrom, the plunger comprising two plunger heads and an interposed compression spring.

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