Oct. 4, 1932. H. W. BOLENS 1,880,732

HYDRAULIC JACK

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Fig. 2.

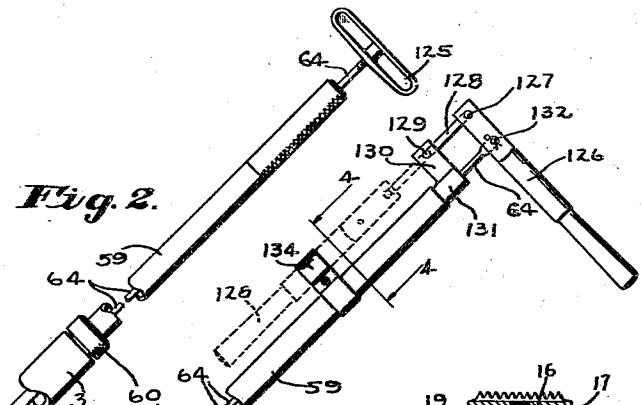



Fig. 1.

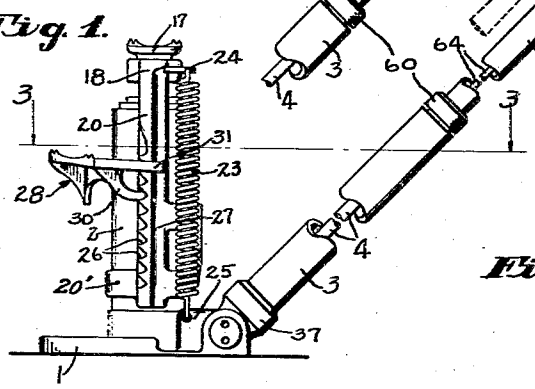



Fig. 5.

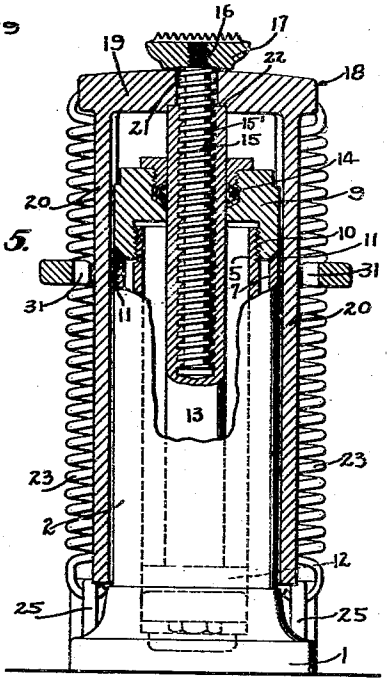



Fig. 4.

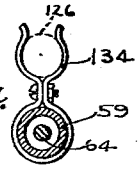



Fig. 3.

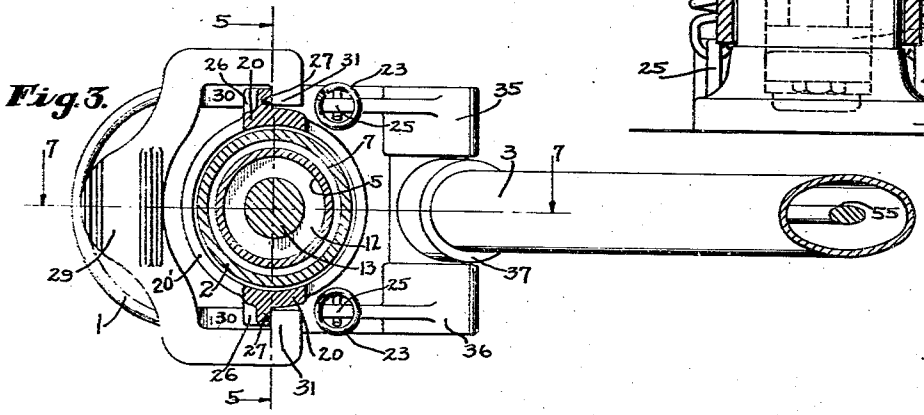
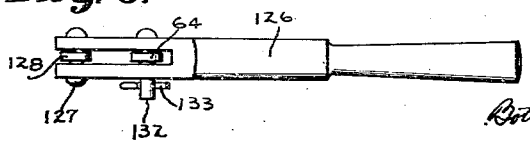



Fig. 6.




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Fig. 9.

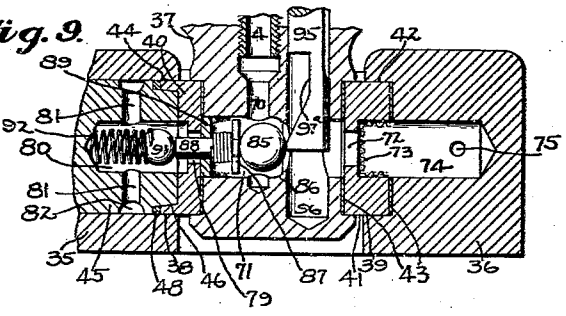



Fig. 8.

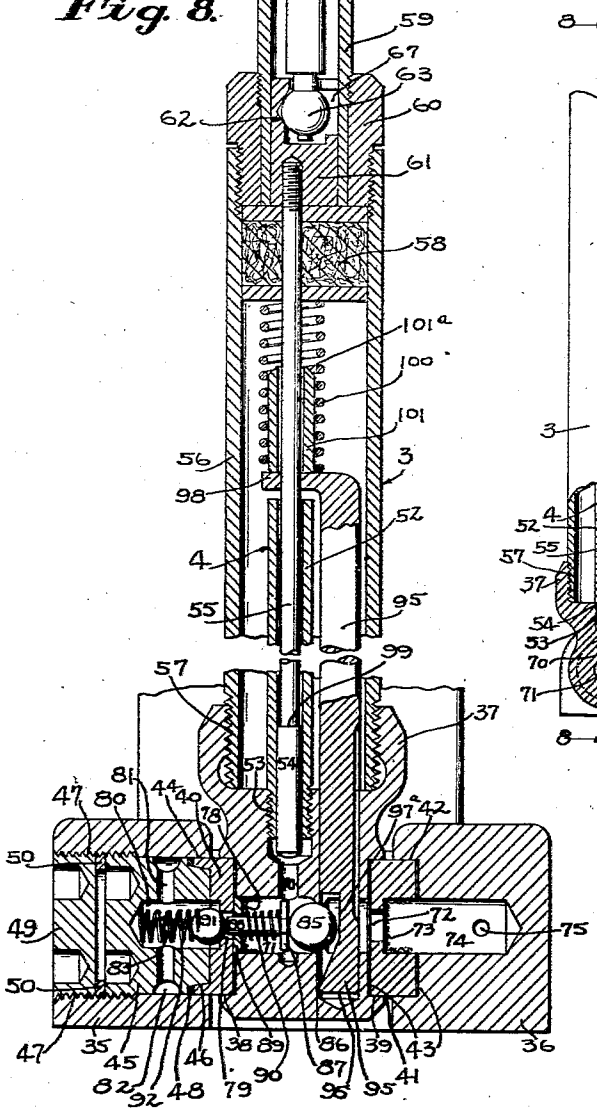
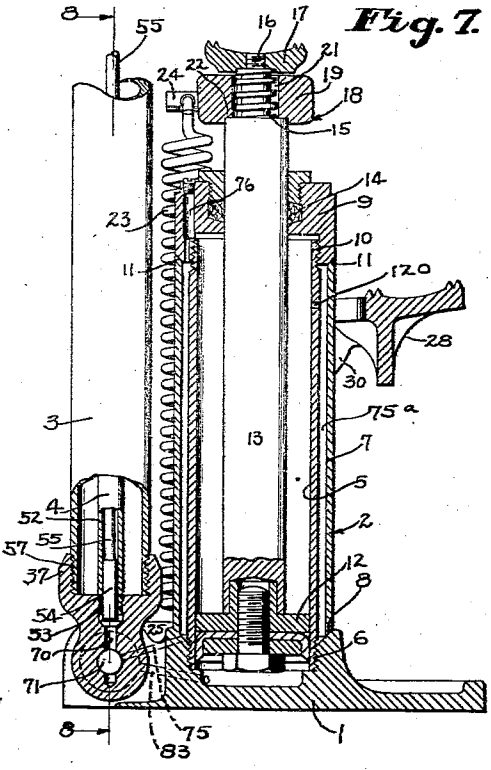



Fig. 7.




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Patented Oct. 4, 1932 1,880,732

# UNITED STATES PATENT OFFICE

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## HYDRAULIC JACK

Application filed April 2, 1928. Serial No. 266,495.

This invention relates to an improvement in hydraulic jacks especially, although not necessarily, designed for use with automobiles or other motor vehicles.

One object of the invention is to provide a hydraulic jack having novel lifting mechanism adjustable over a wide range so as to be capable of engaging and lifting objects located at various distances from and even very close to the floor, ground, or other supporting structure on which the jack rests. Along with this advantage the lifting mechanism is so constructed and so organized with the jack as to have little or no overturning moment whereby the jack possesses a very high stability.

Another object of the invention resides in the provision of a hydraulic jack of this character of the type having hydraulically operable lifting mechanism and a handle connected thereto and carrying the pump for actuating the lift mechanism and wherein provision is made for preventing ingress of any appreciable quantity of the oil or other operating fluid employed into the handle and for draining from the handle any oil that may find its way thereinto.

Another object is to provide a hydraulic jack of this character having novel knock-down operating mechanism for the pump which multiplies the power applied to the pump and to the jack to facilitate the lifting of heavy objects such as heavy motor trucks or the like and yet is foldable into a compact space so as to be conveniently stored in the tool box of the vehicle, under a seat thereof, or in a similar place.

A further object of the invention is to provide a hydraulic jack having these advantages and capacities and which is of simple and durable construction, reliable and effective in operation, and easy and comparatively inexpensive to manufacture.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, and reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a view in side elevation showing a hydraulic jack constructed in accordance with the present invention;

Figure 2 is a fragmentary view in side elevation showing another type of handle and operating means that may be employed for the pump of the jack;

Figure 3 is a view in horizontal section taken on line 3—3 of Figure 1;

Figure 4 is a detail view in section taken on line 4—4 of Figure 1;

Figure 5 is a view taken partly in section on line 5—5 of Figure 3, but having a number of the elements of the jack shown partly or wholly in elevation for the sake of simplicity in illustration;

Figure 6 is a detail view of the operating lever of Figure 1, the lever and associated parts being shown in top plan;

Figure 7 is a view taken on line 7—7 of Figure 3, parts being broken away and parts being shown in elevation for the sake of simplicity in illustration, the handle in Figure 7 being swung up to a vertical position;

Figure 8 is a somewhat enlarged view in transverse vertical section taken in the plane of line 8—8 of Figure 7; and

Figure 9 is a fragmentary detail sectional view similar to Figure 8 but showing a different position of the parts to illustrate the action of the trip rod in unseating the valves and in blocking the opening in the mounting member.

Referring to the drawings, it will be seen that a hydraulic jack embodying the present invention comprises a base 1 carrying the hydraulically operable lift mechanism designated generally at 2 and also a swivelled handle 3 containing the pump 4 for operating the jack.

The hydraulically operable lift mechanism includes an inner or jack cylinder 5 having its lower end threaded into a recess provided therefor in the base 1 as indicated at 6 (see Figure 7). Surrounding the inner cylinder 5 and in spaced relation thereto is an outer or reservoir cylinder 7 having its lower end bevelled and ground or machined to engage and

have a fluid tight fit with a bevelled seat provided therefor on the base 1 as indicated at 8. A head 9 is provided and is threadedly connected to the inner or jack cylinder 5 as indicated at 10. This head 9 also bears down on the outer or reservoir cylinder 7, there being a bevelled and ground or machined joint 11 between the head 9 and the upper end of the cylinder 7. A piston 12 is fitted in the jack cylinder 5 and has a piston rod 13 connected thereto and slidably fitted through a stuffing box 14 provided in the head 9.

Lifting means is carried by the rod 13 of the piston 12 and may include a lift screw 15 engaged in a threaded socket 15′ provided in the upper end of the piston rod 13 (see Figure 5). The upper end of the lift screw is reduced and releasably secured as at 16 to a lifting shoe 17. While the shoe 17 may be taken off for purposes of assembly and disassembly preferably it is rigidly secured to the upper end of the screw 15 when the jack is in use. By turning this shoe 17 the screw 15 may be rotated in its threaded bearing 15′ and caused to project above the upper end of the piston rod 13 to the extent necessary for engaging relatively high objects. By turning the screw 15 to cause it to move down into the socket of the piston rod 13 the shoe 17 is appropriately lowered.

The lifting mechanism also includes an inverted U-shaped supporting bar designated generally at 18 and having a body portion 19 and downwardly extending parallel legs 20 integral with the ends of the body portion 19 and located adjacent diametrically opposite portions of the cylinders 5 and 7. The lower end of the legs 20 are connected by a ring 20′ which slidably embraces the cylinder 7 and aids in maintaining the legs 20 parallel to the axis of the cylinder. The body portion 19 is formed with a central opening 21 counter-sunk around its lower end as at 22 to receive and abut against the upper end of the piston rod 13. The screw 15 passes loosely through the opening 21. If desired, the body portion 19 may be appropriately fastened to the piston rod 13 but the interfitting abutting relation described and shown in Figures 5 and 7, together with the action of retractile coil springs 23 with which the jack is provided is sufficient to maintain these parts properly assembled. As illustrated in Figures 1, 5 and 7, the springs 23 have their upper ends connected to pins 24 rigid with the body portion 19 and projecting laterally therefrom. The lower ends of the springs 23 are connected with apertured ears 25 integral with the base 1. These springs are under tension when the piston 12 is in its lowermost position in the cylinder 5 and so operate to force the body portion 19 of the supporting bar 18 down onto the piston rod 13. The primary function of these springs, however, is to automatically retract or lower the lifting mechanism and piston 12 when the fluid below the piston is permitted to flow out from beneath the same.

Each leg 20 is provided with a vertical series of teeth 26 and with a lengthwise shoulder or guide 27 behind the teeth 26 (see Figures 1 and 3). An adjustable lifting lug 28 is provided and has a portion 29 so shaped and serrated as to be adapted to engage the axle or other part of an automobile or other similar motor vehicle. This lug 28 is also provided with a pair of supporting fingers 30 and a pair of retaining hooks 31, there being one supporting finger for each series of teeth 26 and one retaining hook for each shoulder 27. Each finger 30 bears on a selected tooth 26 and each retaining hook 31 engages a portion of its shoulder 27 adjacent the tooth 26 engaged by the finger 30. When a load is placed on the lug 28 the lug tends to rock on the fingers 30 engaged by the teeth 26 but this rocking tendency is counteracted by the hooks 31. A consideration of this action and an inspection of Figure 1 of the drawings will make it clear that the fingers 30 exert a lateral or horizontal thrust to the right, as viewed in Figure 1, while the hooks 31 exert a lateral or horizontal thrust toward the left in Figure 1. While the lug 28 may be supported in a horizontal position preferably it is designed to be angled slightly upwardly and outwardly from the legs 20 when it is supported on any of the teeth of the legs. The lug is located entirely within the outline or confines of the base. In other words, a perpendicular dropped from the outer extremity of the lug would intersect the base as will be understood from Figures 1 and 3. This is made possible by the construction whereby the lug partially embraces the cylinder and is engaged with supporting means located mid-way between the ends of the base. With the lug 28 so supported on the base the jack has a very low overturning moment and thus has marked stability so that even very heavy loads applied on the lug 29 do not tend to tilt or overturn the jack.

At one end of the base a pair of lugs designated at 35 and 36 is provided (see Figures 3, 8 and 9). On these lugs a swingable mounting member designated generally at 37 is swivelled or pivoted for movement about a horizontal axis. This mounting member carries the pump 4 and the operating and control mechanism therefor as will be hereinafter more fully described. As clearly shown in Figure 8, the opposite sides of the lower portion of the mounting member 37 have recesses 38 and 39 formed therein and receiving the adjacent end portions of trunnions 40 and 41, respectively. The trunnion 41 also has a portion received in a recess 42 provided in the lug 36 and suitable washers 43 are provided between the ends of the trunnion 41 and the recesses in which it is fitted. The trunnion 40 has a portion there-

of fitted for axial adjustment in an opening 44 formed in the lug 35. Axial adjustment of the trunnion 40 is effected by a follower 45 having one end reduced and interfitted with the flanged outer end of the trunnion 40 as at 46 and having the periphery of its other end portion threadedly connected as at 47 with the wall of the opening 44. A washer 48 may be provided for packing the joint between the follower 45 and its trunnion 46. The follower 45 is secured in adjusted position by means of a lock nut 49 threadedly connected with the lug 35 and bearing against a washer 50 interposed between the lock nut and the follower. With this construction the connecting member is swivelled on the jack base but the swivelled connection may be sufficiently tight to hold the connection member against accidental displacement in any angular adjustment and of course is entirely oil tight.

The hand operated pump 4 (see Figures 7 and 8) comprises a pump barrel 52 the lower end of which is threaded into the connecting member 37 as indicated at 53. A plunger 54 is operatively fitted in the barrel 52 and is carried at the lower end of a plunger rod 55. The pump is enclosed in a combined housing and tubular handle section 56 also threadedly connected with the member 37 as indicated at 57. The upper end of this housing section 56 is closed by a packing arrangement 58 through which the plunger rod 55 is slidably fitted. Above the packing 58 the combined housing and handle is reduced and consists of a smaller tubular section 59, the lower end of which has a releasable threaded connection with a coupling member 60 threaded into the lower housing section 56. This housing so constituted serves to encase the pump and its controls and also provides a handle for regulating the angular position of the pump. The upper end portion of the plunger rod 55 is always above the packing 58 and is threaded into a combined coupling and guide 61 which has a socket 62 receiving a ball 63 carried at the lower end of an operating rod 64, slidably fitted in and projecting exteriorly of a bearing 65 in the housing section 59. The coupling 61 is provided with an entrance slot 67 to its socket 62 to permit of the assembly and disassembly of the ball 63 therewith. With this construction when the section 59 is unthreaded from the coupling 60 and the socket member 61 pulled out beyond the coupling 60 the operating rod 64 and the section 59 may be tilted over to the side and the ball 63 pulled out of the socket 62.

The lower end of the pump barrel 52 freely communicates through a port 70 with an intermediate portion of a transverse passage 71 extending through the connecting member 37 and communicating at one end with a port 72 in the trunnion 41. The port 72 communicates through a thimble screen 73 with a passage 74 extending axially through the lug 36 and in open communication with an inclined passage 75 extending at an angle through the lug 36 and base 1 and terminating at the bottom of the space 75[a] between the cylinders 5 and 7 which provides a reservoir for the oil or other operating fluid employed (see Figure 7). The reservoir 75[a] communicates through a passage 76 in the cylinder head 9 with the interior of the upper end of the cylinder 5 above the piston 12.

The other end of the passage 71 communicates through a thimble screen 78 with a port 79 provided in the trunnion 40 and communicating with an axial passage 80 in the follower 45. The passage 80 communicates through radial ports 81 with an external annular groove 82 formed in the periphery of the follower 45 and sufficiently wide to be in communication in any adjustment of the follower with a passage 83 extending through the lug 35 and the base 1 into the space in the cylinder 5 below the piston 12.

The communication between one end of the passage 71 and the reservoir 75[a] and the upper end of the cylinder 5 is controlled by an intake ball valve 85 coacting with a seat 86 provided in the passage 71, the ball valve being held against its seat by means of a spider 87 slidably fitted in the passage 71 and having a pin 88 connected thereto and sliding through a fixed spider 89 also mounted in the passage 71. A coil spring 90 is interposed between the spiders 87 and 89 and forces the spider 87 against the ball valve 85 and in turn forces the ball valve 85 against its seat 86. The pin 88 terminates in slightly spaced relation to a discharge ball valve 91 which coacts with a seat provided therefor around the port 79 of the trunnion 40 to control communication between the other end of the passage and the lower end of the cylinder 5. A coil spring 92 engages the valve 91 to hold it against its seat.

To provide for the release or unseating of the valves 85 and 91, a trip rod 95 is provided and has its lower end slidably fitted in a longitudinal opening 96 formed in the connecting member 37, intersecting the passage 71 and located on the side of intake valve 85 remote from the pump 4 (see Figures 8 and 9). The lower portion of this trip rod 95 is formed with a cam or inclined surface 97 positioned to engage and unseat the ball valve 85 when the trip rod 95 is raised. When the ball valve 85 is unseated, it displaces the spider 87 and the pin 88 to the left as viewed in Figure 8 and such displacement of the pin 88 causes the pin to engage the ball valve 91 and displace it from its seat, as shown in Figure 9. Above the cam 97 the release bar has a notch or recess 97[a] affording the clearance necessary to permit the valve 85 to seat when the trip rod 95 is in its lowermost position.

At its upper end, the trip rod 95 is provided with a lateral extension 98 apertured to slidably receive the plunger rod 55. The juncture of the plunger rod 55 and plunger 54 presents a shoulder 99 which, when the plunger rod is raised to its extreme upper position, is engageable with the lateral extension 98 of the trip rod 95 to raise the trip rod and cause it to unseat the valves. Ordinarily the trip rod is held in its lowermost and inactive position by means of a coil spring 100 encircling the plunger rod 55 and engaging the packing 58 at one end and the lateral extension 98 at its other end. A sleeve 101 loosely embraces the plunger rod 55 and is interposed between the plunger rod and the lower portion of the spring 100 to prevent the spring from buckling. The upper end of this sleeve 101 is bevelled off as at 101ª to facilitate the sliding of the sleeve past the convolutions of the spring. As will be understood from Figures 8 and 9, the lower portion of the trip rod completely obstructs or blocks the opening 96 when the trip rod is raised so as to prevent the oil from flowing up into the housing 56. This obviates any possibility of the oil leaking out when the jack is stored. The trip rod is provided with a longitudnal draining groove 94 which bridges the wall of the opening 96 when the trip rod is lowered and permits any oil that may have found its way into the housing 56 to drain back into the passage 71. There is no tendency for the oil to flow through the opening 96 into the housing 56 except when the valves are tripped and the springs 23 or load on the jack are forcing the jack piston 12 down to move the oil quickly back into the reservoir and at such time the lower end of the draining groove 94 is drawn up out of the passage 71 and closed by the wall of the opening 96 while the notch 97ª is still within the confines of the opening 96 and consequently the opening 96 is completely blocked as shown in Figure 9.

With this construction, when the plunger 54 is moved downwardly in the barrel 52, it forces the fluid, usually oil, down through the ports 70 into the passage 71. The pressure of the fluid and the force of the spring 90 seats the valve 85 but the pressure of the fluid unseats valve 91 to permit the fluid expelled by the pump to pass from the passage 71 through the port 79, passage 80, port 81, groove 82, and passage 83 into the lower end of the jack cylinder 5 and beneath piston 12, thus moving the piston 12 upwardly. On the upstroke of the plunger 54, the spring 92 and the pressure combine to seat the valve 91 but the suction induced by the plunger 54 opens the valve 85 and draws the oil from the reservoir and from the upper end of the cylinder 5 above the piston 12 through the port 72 and passage 71 past the valve 85 and up into the pump barrel through the port 70.

When it is desired to lower the piston, the operating rod 64 is pulled outwardly as far as it will move thereby actuating the trip rod 95 and unseating the valves 85 and 91 whereupon the weight carried by the piston of the jack or the springs 23 or both operate to force the piston 12 down and to cause the fluid to pass from below the piston 12 through the ports and passages in the lugs and swivelled connection and past the open valves 85 and 91 back in the reservoir 75ª and above the piston.

After the piston 12 of the jack has been elevated as far as it may be, continued operation of the pump will not result in the building up of excessive pressures in the jack cylinder because of the provision of a minute venting orifice 120 in the inner cylinder 5 which permits the excessive pressure to pass into the reservoir 75ª and thence back to the pump.

To facilitate reciprocation of the operating rod 64 it may be provided with a transverse hand grip 125 but where heavy loads are to be lifted the operating means of Figure 1 is preferably employed and as shown consists of an operating lever 126 having one end bifurcated and fulcrumed as at 127 on a link 128 pivotally supported as at 129 in a slot formed at the outer end of a laterally extending lug 130 integral with a head or collar 131 replacing the guide 65 and shrunk or otherwise secured in the upper end of the handle section 59 and having an axial opening through which the operating rod 64 slidably extends. The lever 126 is pivotally connected to the outer end of the rod 64 by means of a removable pivot pin 132 extending through transverse pivot openings provided in the lever and in the rod 64 and held against accidental displacement by a cotter pin 133. This arrangement permits the operating lever to be readily disconnected from the rod 64 and folded with its link up against the handle section 59 when the jack is knocked down, as illustrated in dotted lines in Figure 1. To secure the parts in folded position a spring clip 134 is mounted on the handle section 59 and has its spring jaws designed to embrace and hold the lever 126, as illustrated in Figure 4. This is of especial advantage in connection with the character of combined handle and housing used whose sections may be disconnected to permit the jack to be made into a compact bundle and stored in the tool box, or under the seat, or the like.

The invention claimed is:

1. A hydraulic jack comprising hydraulically operable lift mechanism, a mounting member connected thereto, a pump carried by the mounting member, there being passages in the mounting member leading from the pump to the hydraulically operable lift mechanism, valve means in said passages constraining the pump, when operated, to elevate the hydraulically operable lift mecha-

nism, a trip cooperable with said valve means to permit the hydraulically operable lift mechanism to lower, a casing for the trip and pump, said mounting member having an opening through which the trip extends, said trip completely obstructing said opening when positioned to trip the valves, said trip having a drain groove bridging the wall of said opening when the trip is in inoperative position and blocked by the wall of the opening when the trip is in operative position.

2. A hydraulic jack comprising a hydraulically operable lift mechanism, a mounting member connected thereto, a pump carried by the mounting member, there being passages in the mounting member leading from the pump to the hydraulically operable lift mechanism, intake and discharge check valves in said passages for causing the pump when operated to elevate the hydraulically operable lift mechanism, said mounting member having an opening on the side of the intake check valve remote from the pump, a trip for the valves extending through said opening, a casing for the pump and trip carried by the mounting member, said trip being effective to close said opening when in position to trip the valves and permitting draining of the casing when in inoperative position.

3. A knock-down operating mechanism for use in swinging a swingably mounted pump of a hydraulic jack and reciprocating the plunger rod thereof and comprising a tubular handle connected to the pump and having a detachable outer section, an operating element for the pump movable through the handle, a detachable connection between the operating element and the plunger rod releasable only when the sections of the handles are detached, an operating lever fulcrumed on the detachable handle section, a releasable connection between the operating lever and the operating element, said operating lever being foldable up against the handle when disconnected from the operating element, and means for releasably securing the operating lever folded against the handle.

4. A knock-down operating mechanism for reciprocating the plunger rod of the pump of a hydraulic jack and comprising a handle, an operating element for the pump associated with the handle, a link pivotally supported on the handle and pivotally connected to the operating lever to provide a fulcrum therefor, a releasable connection between the operating lever and the operating element whereby said operating lever may be folded up against the handle when disconnected from the operating element, and means for releasably securing the operating element folded up against the handle.

In witness whereof, I hereto affix my signature.

HARRY W. BOLENS.