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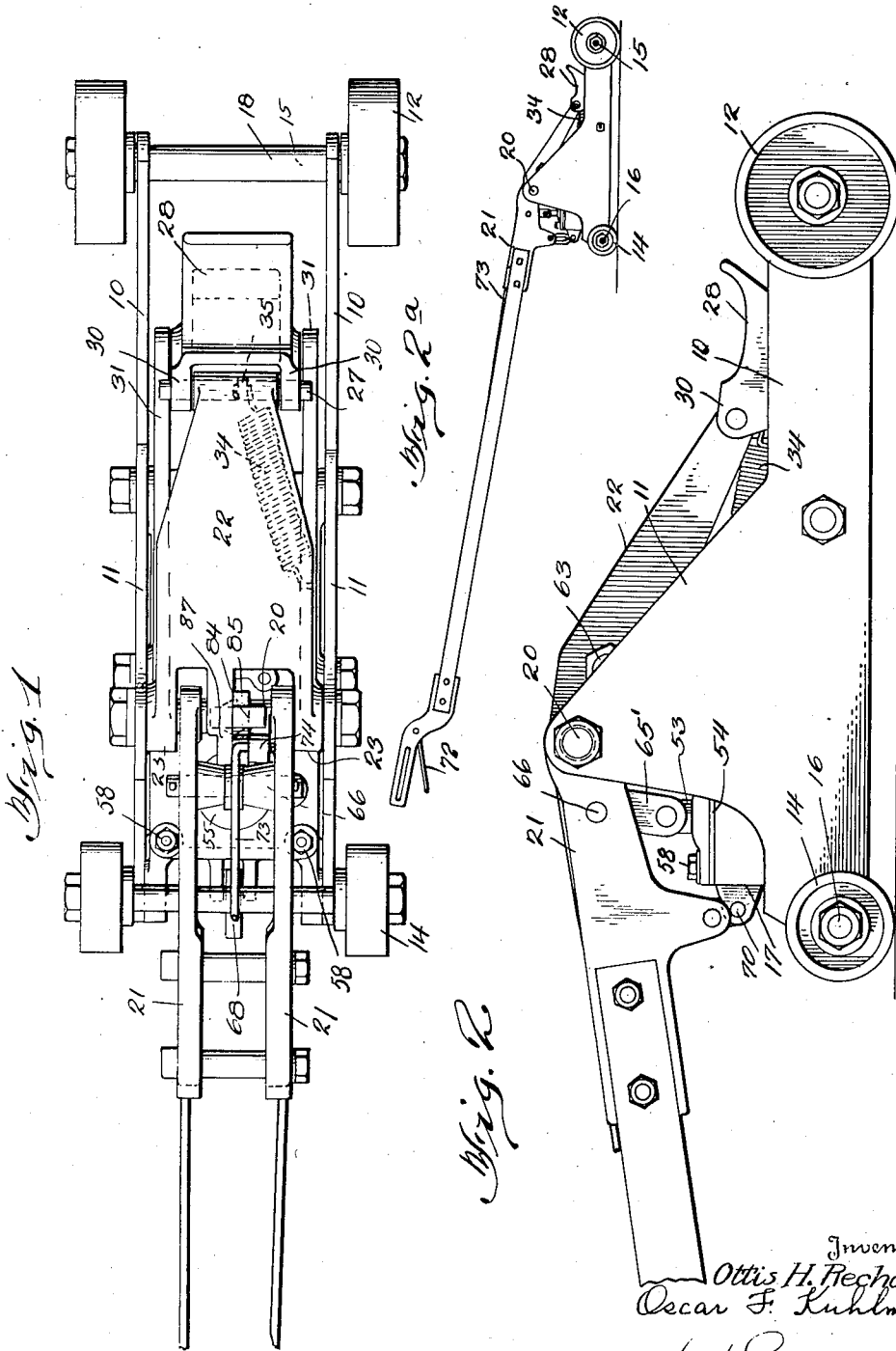
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SERVICE JACK

Filed Jan. 26, 1932

2 Sheets-Sheet 1



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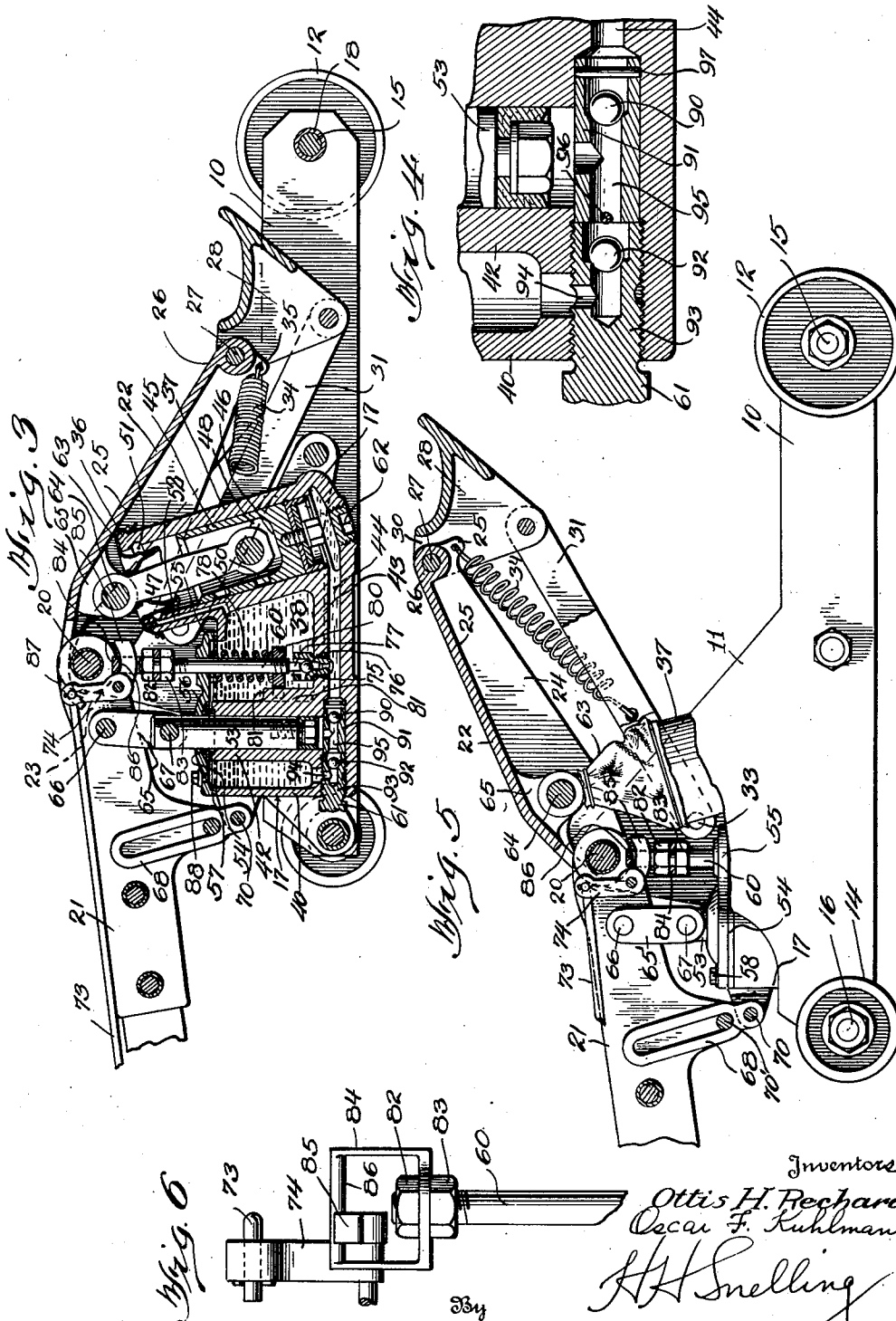
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UNITED STATES PATENT OFFICE

2,032,309

SERVICE JACK

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28 Claims. (Cl. 254—2)

This invention relates to improvements in hydraulic jacks and the object in general is to provide a light, compact jack of relatively great speed, operating flexibility and power but one which cannot be injured either by overloading or by driving the lifting lever above a predetermined height.

A specific object of the invention is the provision of a single element which performs three functions: first it automatically prevents overloading the jack; second, without putting any strain on any of the parts, it prevents the lever arm rising above a predetermined height, and third, it causes the load to be lowered when actuated by a release lever on the jack handle.

Another object of the invention is to provide a hydraulic jack wherein the ram is so positioned with relation to the lifting lever that it exerts maximum lifting force at the time when the lever has made one half of its upward swing.

Other objects of the invention will be made apparent by the following description when taken with the accompanying drawings in which:

Figure 1 is a plan.

Figure 2 is a side elevation, omitting the handle.

Figure 2^a is a full side view.

Figure 3 is a longitudinal vertical section.

Figure 4 is a sectional detail of my improved check valve.

Figure 5 is a side view partly in section showing the jack at about half elevated position.

Figure 6 is a detail of the safety valve operating mechanism.

The main frame, consisting of two spaced side members which may be steel stampings or plates but are preferably built up by welding to the front portions of strips 10 the triangular plates 11, is supported at front and rear by wheels 12 and 14 on axles 15 and 16 respectively, extending thru the ends of the strips 10. The side plates are held in spaced relation at the front by the main body 17, at the rear by the pipe spacer 18 on axle 15 and at the apex by main pivot bolt 20, on which latter is pivoted the forwardly extending handle 21 and the rearwardly extending lifting lever or arm 22.

This lever arm 22, which for strength is a channel-shaped structure, is pivoted on the main pivotal axis 20 by means of two lugs 23 which are forward extensions of the depending flanges 24. These flanges as well as the web 25 converge toward the other end into an integral transverse journal 26 which carries the bolt 27 for pivoting the saddle or rest plate 28 by means of downwardly and rearwardly extending ears 30, which

are integral extensions of the concave supporting plate of the saddle. As the lifting lever swings about the pivot 20 the upper surface of the rest plate 28 is maintained in a horizontal position by means of the drags 31 pivoted to the lowest corners of the saddle and at their forward ends to the inner side of the triangular plates 11 by studs 33, the constantly horizontal position of the saddle being due to what is known as the parallel motion linkage relation of the drags and the lifting arm. Near the middle of one drag link 31 is connected one end of a strong spring 34, the other end being connected to the rear of the lever 22 by a depending ear 35, this spring tending to return the lifting lever to its lowest position with the rest plate 28 in front of the rear ground wheels 12 and somewhat below the level of the top of these wheels. In this position the lower edges of the flanges 24 rest on the drag links 31 and the web 25 may or may not rest on the lip 36 of the ram cylinder 37.

It will be seen in Figure 3 that the cylinder 37 is an integral part of the body 17 which includes the reservoir 38 within which toward the front wall 40 rises the vertical pump cylinder 42 integral with the reservoir floor 43. The ram cylinder, the pump cylinder and the reservoir are all interconnected by the central bore 44 in the floor. Thus one single casting contains the entire hydraulic unit eliminating all pipes and fittings and making the jack substantially leak proof since as will be more fully pointed out presently, all possible leakage is drained back into the reservoir 38.

Any oil that may be forced up around the skirt 45 of the ram 46 will flow over the lip of the skirt into the cavity 48 around the connecting rod 47 but as the ram rises all but a small portion of this oil will flow out the ports 50 of the skirt into the groove 51 near the top of the cylinder 37 from which it drains by way of the passage 52 back into the reservoir. The leakage that may occur while the ram is in its raised position will of course be trapped by the same groove 51 and flow directly thru the passage 52, the flow being aided by the tilted position of the cylinder. Should any oil leak by the pump piston 53 it cannot get outside because of the heavy packing 54 around the piston in the cover 55 but due to the spacing ring 56 such leakage flows over the lip of the pump cylinder 42 directly back into the reservoir. The latter is further made oil tight by positioning a gasket 57 between the rim and the cover which latter is secured in place by a plurality of bolts 58. No leakage occurs around the release rod 60 be-

cause its stroke is too short to carry any oil to the cover 55 which fits it rather snugly and also being centrally located it would be necessary to tip the jack over before any oil could flow out around the rod. Since the opposite ends of the central bore 44 are made oil tight by means of the plugs 61 and 62 it is apparent that I have provided a practically leak proof hydraulic unit.

In order to make the cylinder 37 dust proof I secure around its top one end of a fabric sleeve 63 the other end being secured to the connecting rod 47 just below the upper end where it makes connection with the lifting lever 22 such connection being by means of a pin 64 in the lugs 65 depending from the web 25. Altho the pivot pin 64 extends thru both vertical flanges of the lifting arm or lever, these lugs 65 are highly advantageous for reason of strength and I place cotters between the lugs and flanges to hold the pivot pin in place to save heading the ends. A sleeve similar to 63 may be provided to cover the pump piston 53 where the jack is to be used in very dusty locations but for most places the benefit derived does not warrant this extra expense.

The jack handle 21 is connected to the pump piston 53 by the links 65' pivoted at 66 and 67 and is limited in upward movement with respect to the body 17 by the spotting link 68 pivoted on pin 70 carried by lugs extending forwardly from the front wall 40 of the reservoir. The link 68 is useful when it is desired to move the jack from place to place about the garage, the link being used to raise the smaller front wheels off the floor by an upward movement of the handle which allows the jack to rest on the rear wheels only so as to be guided and spotted with ease. At the end of the handle is provided a hand grip and a hand lever 72 the latter connected by rod 73 to the bell crank 74 which may be operated to raise the release rod 60 irrespective of the position of the handle.

The rod 60, located directly under the main pivot 20, is part of a combination safety release and control valve device comprising a valve cage 75 screwed into the floor 43 making a junction with the passageway 44 and within which cage is carried a ball valve 76 resiliently held in its seat by the end 77 of the rod 60 around which is the spring 78, compressed between the cover 55 and the adjustable bifurcated member 80, the latter being attached to the release rod in any chosen manner preferably by the threads as shown in Figure 3. On the base of the pump cylinder 42 is provided a vertical, radial fin 81 which is straddled by the fork of the member 80 and prevents this spring adjusting member 80 from turning with the rod 60 but allows it to reciprocate freely therewith. Adjustably secured to the top of the rod between two lock nuts 82 and 83 is a stirrup shaped member 84 thru which extends the curved arm 85 of the above mentioned bell crank lever 74. When actuated by the hand lever 72 the curved surface of the lever 74 engages the cam surface 86 of the stirrup 84 and raises the release rod 60 against the tension of the spring 78 and thus allows the ball valve 76 to rise should there be any pressure below it. The cam surface 86 is wide enough to accommodate also the finger like cam 87 which is an integral forward extension of the web 25 of the lifting arm so that this cam extension 87 turns with the lifting arm about the pivot 20 and when the saddle or rest plate 28 at the end of the lifting arm reaches its maximum predetermined height the cam 87 engages the surface 86 and raises the rod 60 slightly to release

the valve 76 momentarily which allows the excess oil to flow from the passage 44 back into the reservoir.

Operation.—The reservoir 38 is first filled to the proper level with a light grade of oil which is poured in thru an opening in the cover 55 after which the opening is closed by the plug 88 which seals up the reservoir. The jack now is moved to the desired place and by means of the handle 21 is spotted under the load to be lifted, for example an automobile, the axle of which is to be engaged by the saddle 28 as the lifting arm 22 is raised.

On the upward stroke, the handle lifts the plunger 53 which action creates a suction in cylinder 42 drawing ball 90 forwardly against its seat in the rear half of the valve cage 91 and releasing ball 92 from its seat in the cage end of the plug 93 so that it engages the retaining pin 96 which prevents ball 92 from closing the passage 95. A charge of oil from the reservoir 38 is thus delivered thru passage 94 around the ball 92, thru passage 95 and into the pump cylinder 42. On the down stroke of the handle the plunger 53 forces the oil from the pump cylinder, thus forcing ball 92 into its seat and also forcing ball 90 out of its seat against the pin 97 which prevents the passage 44 being closed. The oil therefore passes thru passage 44 into ram cylinder 37 where it raises the ram 46 and consequently the lifting arm 22. Continued up and down movement of the handle will thus force a sufficient quantity of oil under the ram 46 to raise the arm to its maximum predetermined height at which time the cam extension 87 engages the cam surface 86 of the stirrup and raises the rod 60 from the ball 76 which, being forced upward by the oil under pressure in passage 44, allows the oil to flow from under the ram 46 thru the passage 44 and back into the reservoir 37. This flow into the reservoir continues until the arm 22 lowers a sufficient amount to disengage the cam 87 from the cam surface 86 which allows the rod 60 under the urge of its spring to press the ball 76 back into its seat. Thus continued pumping will in no way injure the jack since the valve 76 is always opened as soon as the lifting arm reaches a certain predetermined limit. This limit can be varied thru a reasonable range by raising or lowering the member 84 which may be done by first loosening the nuts 82 and 83 and then moving them up or down on the rod 60 to the desired position where they are again clamped against the lower half of the stirrup.

When it is desired to lower the load it is only necessary to press the small hand lever 72 against the larger grip which action as explained above turns the bell crank lever 74 about its pivot bringing the arm 85 into engagement with the stirrup which raises the rod and releases the valve 76 allowing the oil to flow from under the lifting ram back into the reservoir as long as the small hand lever is engaged by the operator. The curved arm 85 is made sufficiently long so that it may operate rod 60 in any position of the handle 21.

The tension of the spring 78 may be adjusted by screwing the rod 60 into or out of the bifurcated member 80 and by this means the maximum load which the pack will raise may be predetermined for if the operator should attempt to raise a greater load the pressure built up under the lifting ram by continued pumping will be equalled in the passage 44 and will raise the ball 76 from its seat against the predetermined tension of the spring 78 and all the oil that is pumped after the

chosen maximum weight has been lifted will return to the reservoir.

The ram cylinder 46 is tilted at such an angle to the vertical that when the lifting arm has swung to a position halfway thru its arc of travel a maximum lifting force is exerted by the load support 28, that is, the axis of the ram cylinder is normal or at right angles to the line from the main pivot to the saddle or rest plate when the latter is halfway between minimum clearance and maximum lift.

What we claim is:

1. In a hydraulic jack having a ram, a single casting comprising a ram cylinder, a pump cylinder and a reservoir, the bottom of the reservoir being integral with the bases of the two cylinders, said casting having a single bore therein for connecting the pump and ram cylinders, and valves in one end of said bore for controlling the flow of fluid between the reservoir, the pump and the ram.

2. In a hydraulic jack having a lifting plate driven by a ram and a pump plunger operated by the jack handle, a ram cylinder, a pump cylinder, a reservoir surrounding the pump cylinder, a floor for said reservoir integral with the bases of said cylinders and having a single straight bore therein interconnecting said pump cylinder, ram cylinder and reservoir, valve means in said bore permitting oil to be drawn into said pump cylinder only from the reservoir, and permitting oil to be driven from said pump cylinder only into said ram cylinder, and a valved passageway located between the two cylinders establishing communication between said bore and said reservoir whereby the oil may be allowed to flow from said ram cylinder back into said reservoir.

3. In a hydraulic jack, a hydraulic unit consisting of a single casting containing a ram cylinder, a pump cylinder spaced from said ram cylinder, a reservoir substantially surrounding said pump cylinder, and a cover for the reservoir having an apertured recess registering with the bore of the pump cylinder, the recess being on the under side of the cover and cooperating with the top of the pump cylinder to form an annular packing gland to accommodate packing for the pump plunger.

4. In a jack, a wheeled truck, an upright pump, and a nearly upright ram carried on said truck, and a load raising arm pivoted on a transverse pin located between and above the pump and ram, the axis of said ram being tilted toward the transverse pin whereby the raising arm is turned above its horizontal position when at right angles to the axis of the ram, and whereby the load engaging end of the lifting arm may be brought to a lower level than would be possible if the ram cylinder were upright, said position being at about halfway of its arc of travel.

5. In a fluid pressure operated jack, a truck frame, a lifting lever pivoted to said truck frame, a pump handle pivoted to the frame on the same axis as the lever, a hydraulic unit carried by the frame and including lowering means directly beneath the common axis of lever and handle, pump means on one side of the lowering means and raising means on the other side of the lowering means.

6. In a hydraulic jack, a pivoted arm adapted to engage and elevate a load, a ram for moving the arm about its pivot to elevate the load carried thereby, means for forcing fluid to the ram, release mechanism to permit escape of fluid from behind the ram, said mechanism being lo-

cated between said means and said ram and below the arm, and means rigidly carried by the pivoted arm for engaging the release mechanism when the lifting arm has reached a certain height, in order to prevent further elevation of the load.

7. In a jack, a wheeled frame, a main shaft carried by the frame, a handle pivoted on said main shaft, a load lifting arm also carried by said shaft, and a hydraulic unit including a pump and a ram carried by the frame, said pump and ram being in operative engagement with the handle and with the load supporting arm for elevating the arm upon movement of the handle.

8. The device of claim 7 including lowering mechanism directly beneath the main shaft and means carried by the handle to operate the lowering mechanism at any position of the handle and means carried by the load lifting arm for independently operating said lowering mechanism at a chosen upper limit of the arm.

9. In a hydraulic jack, a body including a reservoir, a pump and a ram, a continuous passageway from the ram to one side of the body, a valve cage in said passageway in communication with the pump, a second valve cage in said passageway insertable from outside the reservoir and closing the free end of the passageway and establishing communication with the reservoir, valves in said cages and a third valve for establishing communication between the reservoir and the passageway.

10. In a hydraulic jack, a load lifting arm, hydraulic mechanism including an upright pump and a ram for elevating said arm, a pressure operated relief valve adapted to be opened by fluid pressure, spring-pressed means between the pump and ram for holding said valve to its seat, said seat being located between the pump and the ram, means for adjusting the pressure of the spring on the valve whereby said valve opens at any predetermined pressure, means for temporarily opening the relief valve when the lifting arm has reached a chosen height, a manually operated lever for lifting the relief valve spring, and means for adjusting at will the maximum height of the lifting arm.

11. In a non-leakable hydraulic jack, a frame, a hydraulic unit carried by the frame, a load lifting arm, a reservoir, an upright pump cylinder rising from the floor of the reservoir, a pump plunger within said cylinder operatively connected with said handle, hydraulic elevating means operatively connected with said pump and said lifting arm, a cover for said reservoir having an opening therethru for snugly receiving said pump plunger, packing surrounding the pump and spring means compressed between the top of the pump cylinder and the packing for holding the packing in place.

12. In a hydraulic jack, a lifting arm of channel-shaped construction having depending flanges extending beyond the web at one end, said extensions being journaled for receiving a pivoting shaft and being parallel for part of the length of the arm but converging with the web the rest of the way into a transverse journal, a saddle having two ears forking said journal, a shaft passing thru said ears and journal, a journaled lug on the lower side and intermediate the ends of said arm for cooperating with a lifting ram.

13. In a jack, a substantially leak proof hydraulic unit consisting of a ram cylinder, an upright pump cylinder and a reservoir in a single

casting having a valved bore for interconnecting said cylinders and reservoir, the top inner periphery of the ram cylinder having a groove connected with a bore in the cylinder wall leading to the reservoir whereby any leakage by the ram will be trapped in said groove and flow into the reservoir, said pump cylinder being within the reservoir whereby any leakage by the pump plunger flows directly into the reservoir, an apertured cover for said reservoir one of the apertures registering with the bore of the pump cylinder and counter bored on the under side whereby said cover cooperates with the top of the cylinder to form a packing gland for the pump.

14. In a wheeled hydraulic jack, a pump cylinder, a valve operating rod, a ram cylinder, a shaft supported adjacent the upper end of said rod, a lifting arm pivoted on said shaft and extending over said ram cylinder, an operating tongue pivoted to said shaft and extending over said pump cylinder, a plunger in the pump cylinder linked to the tongue, a ram in the ram cylinder linked to the lifting arm, an adjustable stirrup on said rod and camming means on said arm positioned to engage said stirrup only when the arm is at a certain angular position.

15. In a jack, a casting for a hydraulic unit comprising a reservoir, an upright pump cylinder rising from the floor of the reservoir, a forwardly tilted ram cylinder forming the rear wall of the reservoir, the reservoir floor having a substantially straight bore therein reaching from outside the front wall to the ram cylinder, a pump bore opening into said bore, the reservoir communicating with said straight bore, a valve in the straight bore and located between the reservoir opening and the pump bore opening, a second valve in the straight bore and located between the pump bore and the ram cylinder and a third valve between the ram cylinder and said last named valve, said first and second named valves being held in a cage fitted into said straight bore from outside the reservoir.

16. In a jack, a pivoted load lifting arm, an arm raising means lowering mechanism located under the pivot of said arm, said lifting arm being of channel shaped construction having depending flanges extending beyond the web at one end of the arm, said flanges having aligned bores at the extended ends for receiving a pivoting shaft, and a continuation of the web spaced between said extended ends for projecting over said shaft whereby upon load raising movement of said arm about its pivot said continuation describes an arc about said shaft and engages the lowering mechanism to prevent further turning of the arm.

17. In a hydraulic jack, having a ram cylinder, a pump cylinder and a reservoir, a single continuous conduit connecting the reservoir with said ram cylinder, said pump cylinder communicating with said conduit at a point intermediate the ram cylinder and the point of communication of the conduit with the reservoir, a valve in the conduit between said points, and a second valve in said conduit between said ram cylinder and said pump cylinder.

18. The device of claim 17 in which said valves are removable from one end of the conduit.

19. The device of claim 9 in which said passageway is located in the floor of the reservoir reaching from outside the reservoir to the inside of the ram, said passageway being counterbored from the outer end to form an annular shoulder at a point between the pump and said third valve,

said counter bore being threaded at its outer end, the first mentioned valve cage having a sliding fit in said counter bore and engaging said shoulder and said second mentioned valve cage having a threaded engagement with the counter bore and abutting said first mentioned valve cage to hold the same in place.

20. In a hydraulic jack, a reservoir, an apertured cover for said reservoir, a cylinder fixed within the reservoir and having its free end substantially abutting the inner surfaces of said cover, a plunger in said cylinder and extending thru and closing the aperture in said cover, the inner side of said cover being recessed around said aperture whereby to cooperate with said cylinder top to form a packing gland for said plunger.

21. In a hydraulic jack having a ram, a pump and a lifting lever, said lever being pivoted on a horizontal axis located above and between said pump and ram: a single casting comprising a ram cylinder, a pump cylinder and a reservoir, the bottom of the reservoir being integral with the bases of the two cylinders, the pump cylinder being substantially vertical and the top of the ram cylinder being tilted toward the top of the pump cylinder whereby permitting the lifting lever to move to a lower level.

22. In a hydraulic jack, a pump cylinder, a valve operating rod, a ram cylinder, a shaft supported adjacent the end of said rod, a lifting arm pivoted on said shaft, a pump operating handle pivoted to said shaft, a plunger in the pump cylinder linked to the handle, a ram in the ram cylinder linked to the lifting arm, a cam surface on said valve operating rod, and camming means on said lifting arm positioned to engage said surface to operate the valve only when the arm is at a certain angular position.

23. In a hydraulic jack, a pump having an upright cylinder, a ram, a reservoir surrounding the pump cylinder, a cover for said reservoir having an aperture in registry with the pump cylinder and an aperture between the first mentioned aperture and the ram cylinder, a valve for admitting fluid from the ram to the reservoir, a valve operating rod rising from the floor of the reservoir and extending thru the second mentioned aperture, a horizontal shaft supported above the rod, a handle pivoted on said shaft and linked to the pump, a lifting lever pivoted on said shaft and linked to the ram and means on the lever for engaging said rod at a predetermined position of the lever as it moves about its pivot whereby to release the valve to prevent further movement of the ram and lever.

24. In a hydraulic jack having a pump and a ram; a horizontal shaft above said pump and ram, a handle pivoted on the shaft for operating the pump, a lifting lever pivoted on said shaft, a valve for controlling the ram, a rod for operating the valve, a cam surface at the top of the rod and adjacent said shaft, a bell crank carried by the handle and having one arm adjacent said surface, and means on the handle for actuating the bell crank to bring said arm against the surface to operate the valve at any position of the handle.

25. The device of claim 24 in which a lug is carried by the lifting lever and adapted to be moved against said surface to operate the valve as the lever approaches a predetermined limit of travel.

26. The device of claim 24 in which a stirrup shaped member is adjustably connected to the

top of said rod, said surface being on said member and in which said arm reciprocates in the opening thru said member.

5 27. In a jack, a wheeled frame, a main shaft carried by the frame, a handle pivoted on the shaft, a load lifting arm pivoted on the shaft, a hydraulic unit carried by the frame and having a pump and ram located respectively below the handle and arm, a valve below the shaft and
10 between the pump and ram for lowering the ram, mechanism located adjacent the shaft for operating the valve, means carried by the arm for operatively engaging said mechanism as the arm raises to a predetermined height, and means

carried by the handle for engaging said mechanism at any position of the handle.

28. In a hydraulic jack having front and rear wheels, an axle for two of the wheels, a frame consisting of two side plates supported on the front and rear wheels, a hydraulic unit between
5 said plates and supported at one end on said axle and at the other end on said side frames, a main shaft carried in said side plates and located above said unit, a lifting arm pivoted on the main shaft
10 and extending over said other end and handle on said main shaft and extending over said axle.

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