June 12, 1928. 1,673,386

C. L. ZABRISKIE

HYDRAULIC JACK

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Fig. 1.

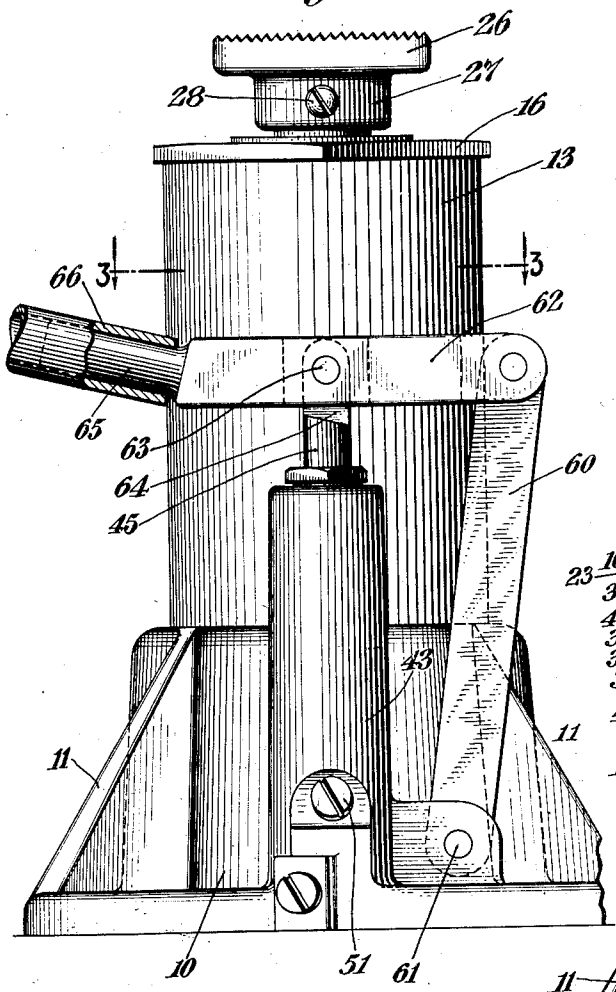
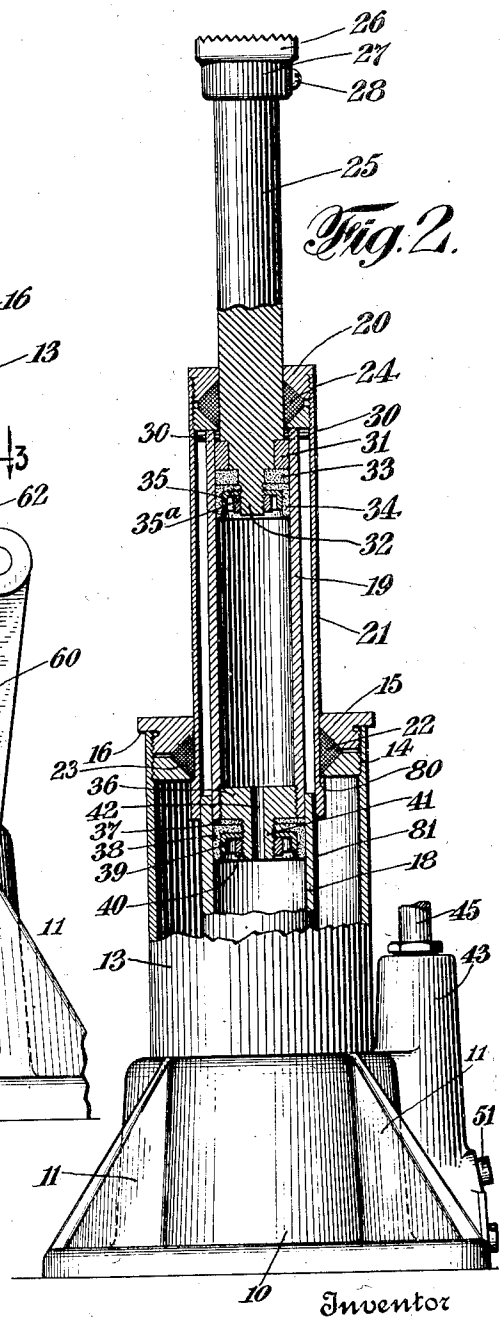


Fig. 2.



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Fig. 3.

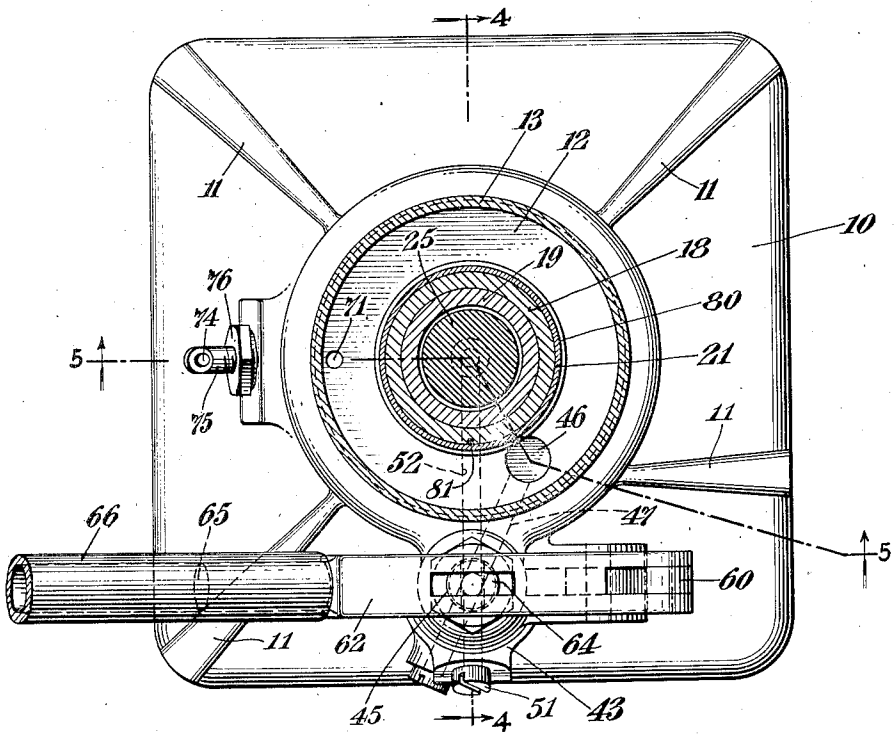
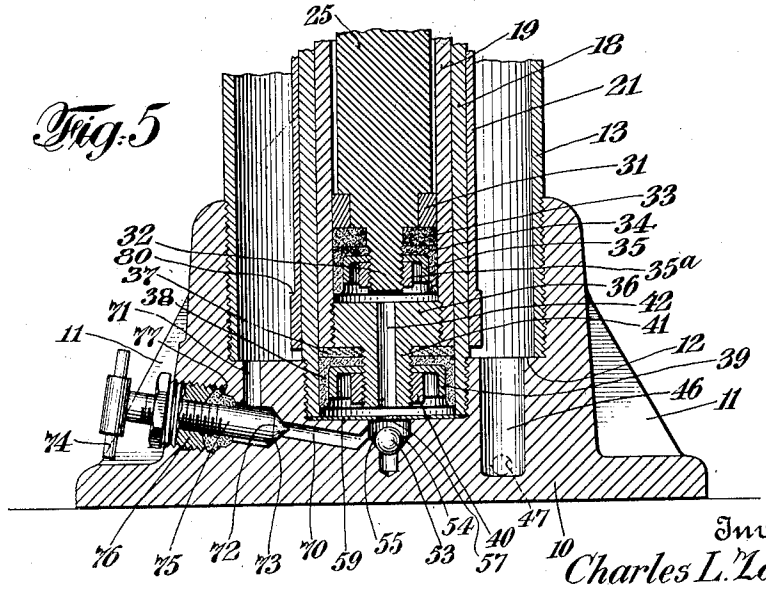


Fig. 5



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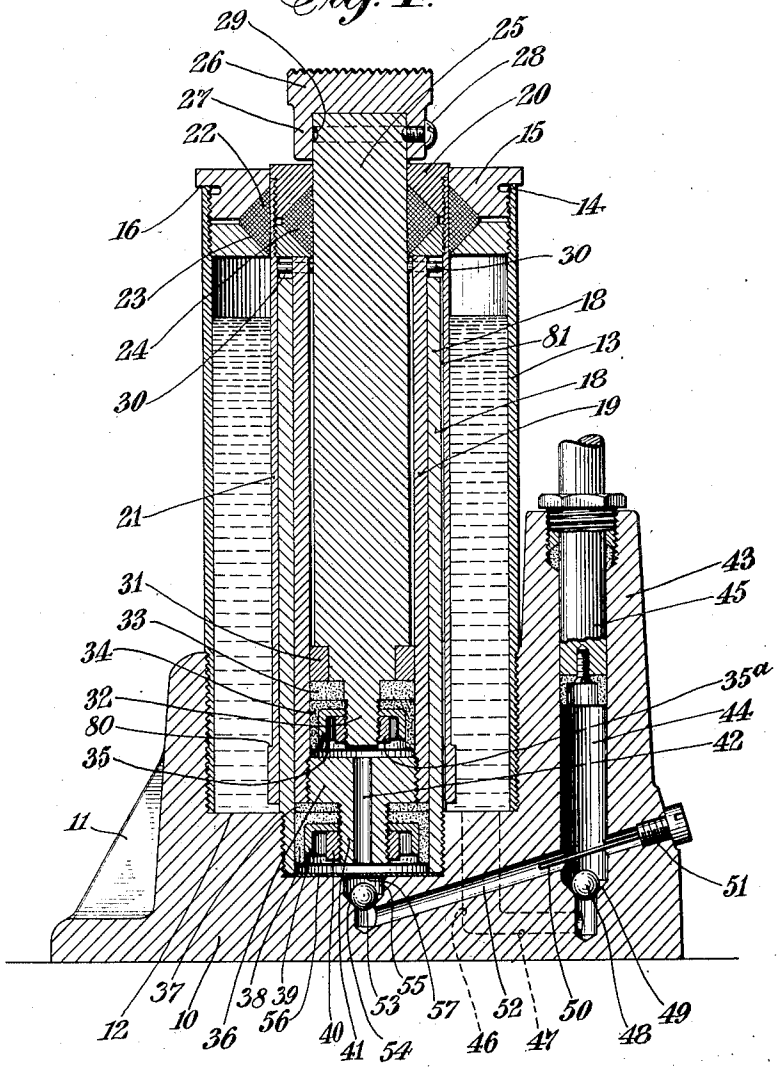
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Fig. 4.



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UNITED STATES PATENT OFFICE.

CHARLES L. ZABRISKIE, OF NEW YORK, N. Y., ASSIGNOR TO CHARLES P. ROGERS AND COMPANY (INC.), A CORPORATION OF NEW YORK.

HYDRAULIC JACK.

Application filed March 20, 1925. Serial No. 16,894.

The present invention is applicable to hydraulic jacks of various kinds but is particularly adapted for embodiment in a portable lightweight high power jack of the general character disclosed in my copending application Ser. No. 754,005, filed December 5, 1924.

An object of the invention is to provide a jack formed with a plurality of telescoping lifting plungers which may be telescoped to a relatively small collapsed position in order to facilitate the insertion of the tool under car axles and similar low articles to be lifted. Another object is to provide a jack in which the exposed surfaces of all of the lifting plungers are kept free of oil or other fluid lifting medium by a simple and practical arrangement of wiping collars. A further object is to safely retain the lifting plungers against being torn forcibly form their guides by the extremely high hydraulic pressures frequently necessary in elevating heavy loads.

All of the plungers assist in the lifting action, each offering an effective surface area to the lifting force of the motive medium and each sustaining its share of the load up until the time that it reaches its fully projected position.

Any number of telescoping plungers may be utilized, but a preferred embodiment of the invention includes only two, nested within a hollow guide standard which in turn is centrally disposed within an annular oil reservoir. The nested plungers each present effective lifting surfaces to the oil which is pumped from the reservoir into the guide standard. The ratio of effective lift of the two plungers may be predetermined in any desired and suitable manner but preferably the plunger which is capable of the greatest projection has also the greatest effective lifting area and works against the least friction in order that the difference in the loads which may be lifted by both plungers acting cooperatively will not unduly exceed the loads which may be lifted by the plunger capable of greatest projection. Preferably the plunger having the shortest throw slides within the guide standard and carries an oil wiping sleeve arranged exteriorly of the standard and wiped by a packing collar in an annular cap for the oil reservoir. The inner plunger is preferably solid and guided in the outer one and may have is exposed surface kept free of oil by a wiping ring in the outer plunger cap through which the inner plunger moves to fully projected position.

The invention may be more fully understood from the following description in connection with the accompanying drawings, wherein

Fig. 1 is a view in side elevation showing the jack in collapsed position;

Fig. 2 is a view mainly in vertical section showing the jack in its fully extended or projected position;

Fig. 3 is a transverse sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a view in vertical section on the line 4—4 of Fig. 3;

Fig. 5 is a similar view on the staggered line 5—5 of Fig. 3.

The base of the jack may be of more or less conventional shape, including a heavy metallic casting 10 formed with external strengthening webs 11 and having a socket 12 therein which is internally threaded to receive the lower threaded end of an upstanding cylindrical oil reservoir 13. This reservoir preferably comprises a length of pipe of suitable diameter, internally threaded at its upper end as indicated at 14 to accommodate an annular closure cap 15. The cap 15 is formed with a shoulder 16 which bears against the top of the reservoir when the cap is screwed home. This cap limits the upward travelling movement of the jack plungers and therefore should be very firmly secured in place within the top of the reservoir. Any suitable means (not shown), may supplement the screw threads to prevent forcible displacement of the cap under the high hydraulic pressures to which the plungers are subjected. A threaded socket 17 countersunk in the bottom of the socket 12 receives the lower threaded extremity of an upstanding cylindrical guide standard 18 terminating slightly below the cap 15 and of an external diameter which is slightly less than the external diameter of the cap.

The primary plunger 19 is of hollow cylindrical shape and is mounted for sliding movement within the standard 18. A collar 20 engaged by the upper end of plunger section 19 is exteriorly threaded for engagement with the upper end of a depending wiper or guard sleeve 21 sliding on the exterior of the standard 18. As the plunger

19 moves upwardly the exterior surface of sleeve 21 is wiped on a packing ring 22 accommodated in a V-shaped packing ring groove 23 in the inner surface of cap 15. Collar 20 carries a similar internal packing ring 24 which acts as a wiper for a solid cylindrical plunger 25 slidably mounted within hollow plunger 19 and carrying at its outer end a toothed or ribbed platform 26 for engagement under an article to be lifted by the jack. Platform 26 preferably is formed with a depending flange 27 and a set screw 28 projecting through the flange works in a groove 29 in the upper end of plunger 25.

A plurality of radially disposed pins 30 are loose in openings at the upper end of plunger 19, said pins being of a length to conveniently extend from the wiping sleeve to the plunger 25 over the upper edge of the standard 18. Plunger 25 is of slightly smaller diameter throughout the major portion of its length than the internal diameter of plunger 19 and carries an outwardly projecting annular ring 31 near its lower end which is engageable with the pins 30 to limit the outward projection of plunger 25. It will be evident that oil wiped from the plunger 25 by wiper 24 is free to escape around and above the pins 30, into the annular space between primary plunger 19 and guard cylinder 21. The end of the plunger 25 is reduced at 32 below the ring 31 to accommodate a plurality of annular packing gaskets and washers. A flat gasket 33 is held by a gasket 34 which is of greater diameter than the interior diameter of plunger 19 and consequently has its peripheral edges turned over and wiping the interior of plunger 19. A cup shaped washer 35 holds the gasket 34 firmly against the walls of section 19 and a retaining nut 35^a is screwed onto the lower end 32 of section 25 and holds all of the gaskets in place. The entire area of the lower end of solid plunger 25 is thus used as an effective lifting surface when oil is forced thereunder.

Plunger 19 on the other hand operates on differential oil pressures. A plug 36 is screwed into the hollow lower end, said plug having a passage 42 therethrough for the free flow of oil. Hence the effective lifting area of plunger 19 is only the outer annulus, that is, its own total lifting area minus the lifting area of plunger 25. In the present case the areas of the upper and lower surfaces of the plug 36 are equal, so the effective lifting area of plunger 19 is equal to the cross sectional area of the cylindrical wall of the plunger itself and is obviously less than that of plunger 25.

Plug 36 carries a depending threaded extension 41 upon which is a set of gaskets 37, 38, 39, held by a nut 40, the arrangement of the gaskets and nut being similar in all respects to that described above for preventing leakage of oil around plunger 25.

An offset upstanding extension 43 integral with the base casting 10 is vertically bored at 44 to form the cylinder of a pump, the pump piston being indicated at 45. This pump is used to pump oil from the reservoir into the socket 17 under the jack plungers. The mechanism for operating the pump may be generally conventional, including a link 60 having one end pivoted at 61 to the base casting 10 and its other end pivoted to the end of a lever 62, said lever having its intermediate portion pivotally connected at 63 to an extension 64 of the upper end of the pump piston 65. Lever 62 preferably includes a rounded or flattened extension 65 at its free end for receiving a hollow operating handle 66.

As shown in Figs. 3, 4 and 5, an oil passage from the reservoir to the pump opens out at the bottom of the reservoir and includes a vertical portion 46 and a horizontal portion 47, the latter terminating at the bottom of pump cylinder 44. As the oil is drawn upwardly from the passage 47 into the cylinder 44 on the intake stroke of the pump piston 45 it raises a ball check 48 seated on a tapered shoulder 49 at the lower end of the cylinder. This check prevents back flow of the oil and is capable of upward movement to an extent limited by a pin 50 carried by a plug 51 screwed into the outer end of a downwardly sloping oil passage 52 leading from the pump to the well 55 immediately below socket 17. As the oil is forced through passage 52 on the expelling stroke of the pump piston, it lifts a ball check 53 mounted on an annular seat 54 in the bottom of the well. A cage plate 56 fitting the bottom of the socket 17 is provided with an opening 57 therein in alignment with the oil passage 42 to limit the upward movement of the ball check 53.

As shown in Fig. 5, the oil return passage to the reservoir includes a horizontal portion 70 communicating with the well 55 and normally closed by a needle valve 72 working against a bevelled seat 73 and manually operable by a handle 74 at the outer end of stem 75. The valve stem works through a plug 76 screwed into the enlarged outer end of passage 70 and is suitably packed at 77. Retraction of the needle valve permits free return flow of oil, from under the plungers, through passage 70 and a vertical passage 71 back to the reservoir.

By inclining the passages 70, 52 downwardly toward the center of the jack, I economize considerable space and reduce the height of the collapsed tool to a minimum, thereby facilitating its use in a number of otherwise awkward and inaccessible places. This is particularly advantageous when the jack is designed for automobiles having bal-

loon tires, because when punctured or otherwise deflated they bring the axle unusually close to the ground.

In using the jack, the needle valve 72 is tightly closed and the pump handle 66 operated, causing the pump to withdraw oil from the reservoir and deliver it under the plungers. If there is a load on the jack when operation is started the two plungers will cooperatively lift it, their share of the work being proportional to their effective lifting areas, subject, of course, to such minor factors as their individual weights and frictions. Assume for purposes of illustration that ratio of the effective lifting surfaces of plunger 25 and 19 is 4 to 3. In raising a 7,000 pound load, plunger 25 will lift 4,000 pounds of it and plunger 19, 3,000 pounds, at practically constant hydraulic pressure, the lifting being done by pumping in the required amount of oil against that pressure. As soon as the plunger 19 reaches the limit of its outward movement, it becomes ineffective, being checked by the engagement of a shoulder 80 on the lower end of wiping sleeve 21 with the cap 15. The entire load must then be further elevated by the plunger 25 by increase of hydraulic pressure, the increase being three-quarters in the case supposed above. It will thus be evident that the jack is capable of lifting heavier loads to a height equal to the extreme projection of plunger 19 than can be lifted to a height equal to extreme projection of plunger 25. Any loads which can be lifted by the plunger 25 alone can be carried to the full height of the completely extended tool, while heavier loads may only be raised to the height of fully projected plunger section 19.

If the jack is operated under no load or an extremely light load plunger 25 will start up first due to its having greater effective area and less friction than 19, but if there is any load on 25 in excess of friction differential, the slower starting plunger 19 will immediately get under way and the two plungers will move together.

A groove 81 in the exterior of the guide standard 18 provides communication between the reservoir (maintained at atmospheric pressure through any suitable vent, not shown) and the space between the sleeve 21 and plunger 19. The latter space is thus subject to neither unduly low pressures as the plunger 19 rises nor excessively high pressures as it falls. Instead, oil or air or both are breathed in and out through passage 81.

I claim:

1. A hydraulic jack, including an oil reservoir, a hollow guide standard centrally disposed within the reservoir, a hollow lifting plunger guided for vertical movement within the standard, a second lifting plunger guided within said hollow plunger, an annular cap closing the reservoir, an apron carried by the hollow plunger arranged exteriorly of the standard and wiped by the cap, means on said apron for limiting upward movement of said hollow plunger and a pump for withdrawing oil from the reservoir and delivering it within the standard under the plunger.

2. A hydraulic jack, including an oil reservoir, a hollow guide standard centrally disposed within the reservoir, a hollow lifting plunger guided for vertical movement within the standard, a second lifting plunger guided within said hollow plunger, an annular cap closing the reservoir, an apron carried by the hollow plunger arranged exteriorly of the standard and wiped by the cap, and a pump for withdrawing oil from the reservoir delivering it within the standard under the plunger, and means on said apron for limiting upward movement of said hollow plunger comprising an annular exterior shoulder adjacent its lower end engageable with the cap.

3. A device of the class described in claim 1, wherein the standard is formed with a breather groove communicating the space between the hollow plunger and apron and the reservoir.

4. A hydraulic pack, including a base, a cylindrical oil reservoir supported on the base, a hollow cylindrical guide standard supported centrally of the reservoir, a pump for withdrawing oil from the reservoir and delivering it into the standard, a hollow lifting plunger having sliding guided movement within the standard, a solid plunger guided for sliding movement within the hollow plunger, a plurality of radial interiorly projecting pins removably disposed within openings at the upper end of the hollow plunger and an annular shoulder adjacent the lower end of the solid plunger engageable with the pins to check upward movement of the solid plunger.

5. A device of the class described in claim 4 wherein a cap is provided for the reservoir and a wiping sleeve fixed to the hollow plunger rides on the outside of the standard and is engageable with the cap to check the upward movement of the hollow plunger.

6. A lifting jack of the type including a reservoir, a cylindrical standard therein, a primary hollow plunger telescoping within said standard, a secondary plunger telescoping within said primary plunger and means for forcing fluid from the reservoir into the standard to lift the hollow plunger and, through the hollow thereof to lift the secondary plunger and for returning the fluid to the reservoir, in combination with a guard cylinder telescoping over the exterior of said cylindrical standard and exteriorly closing in said primary plunger and the telescoping joints between the standard and the hollow plunger and between the latter and the sec-

ondary plunger, a wiper ring at the upper end of said guard cylinder adapted to wipe the outer surface of the secondary plunger, and a wiper ring closing in the top of the reservoir and adapted to wipe the outer surface of said guard cylinder.

7. A lifting jack of the type including a reservoir, a cylindrical standard therein, a primary hollow plunger telescoping within said standard, a secondary plunger telescoping within said primary plunger and means for forcing fluid from the reservoir into the standard to lift the hollow plunger and, through the hollow thereof to lift the secondary plunger and for returning the fluid to the reservoir, in combination with a guard cylinder telescoping over the exterior of said cylindrical standard and exteriorly closing in said primary plunger and the telescoping joints between the standard and the hollow plunger and between the latter and the secondary plunger, a wiper ring at the upper end of said guard cylinder adapted to wipe the outer surface of the secondary plunger, and a wiper ring closing in the top of the reservoir and adapted to wipe the outer surface of said guard cylinder, the parts enclosed by the guard cylinder being provided with drainage and vent passages for flow of fluid to the reservoir from the annular spaces between the secondary and primary plungers and between the guard cylinder and the primary plunger.

Signed at New York, in the county of New York, and State of New York this 19th day of March, A. D. 1925.

CHARLES L. ZABRISKIE.