Oct. 12, 1948. M. W. HUMPHREYS 2,451,390

HYDRAULIC JACK

Filed Aug. 22, 1946 2 Sheets-Sheet 1

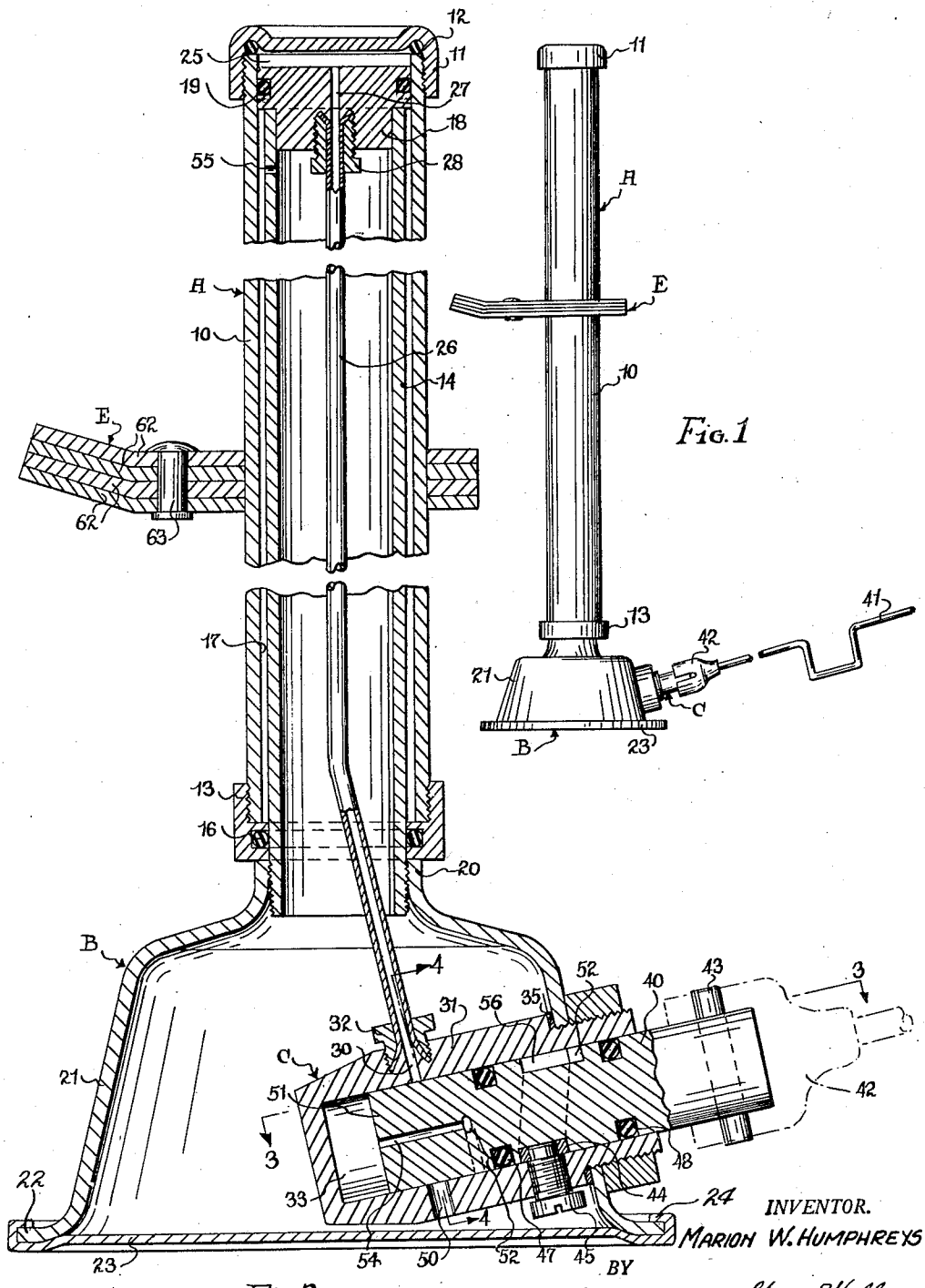


Fig. 1

Fig. 2

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HYDRAULIC JACK

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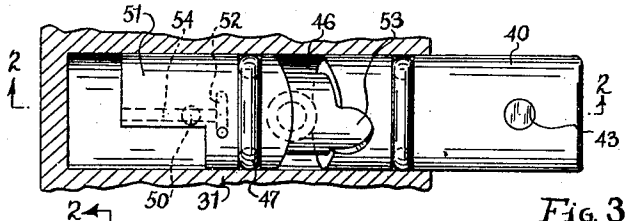


Fig. 3

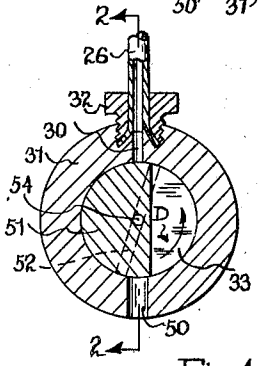


Fig. 4

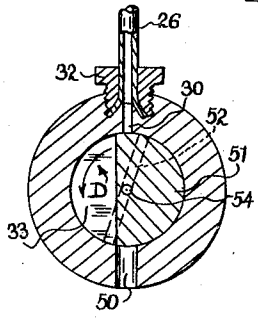


Fig. 5

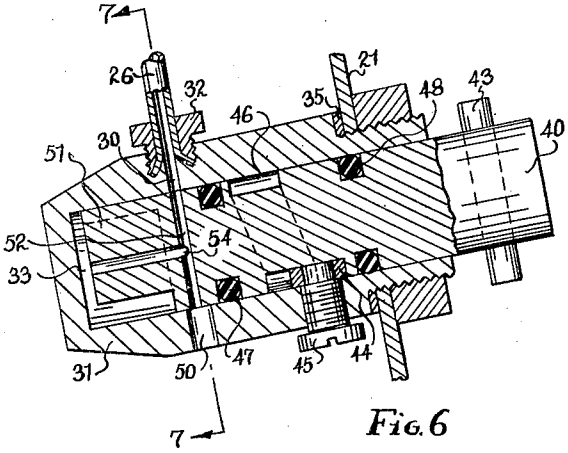


Fig. 6

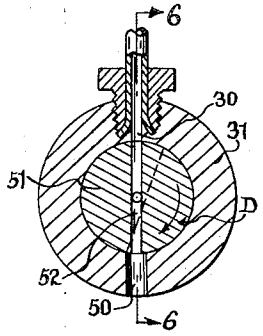


Fig. 7

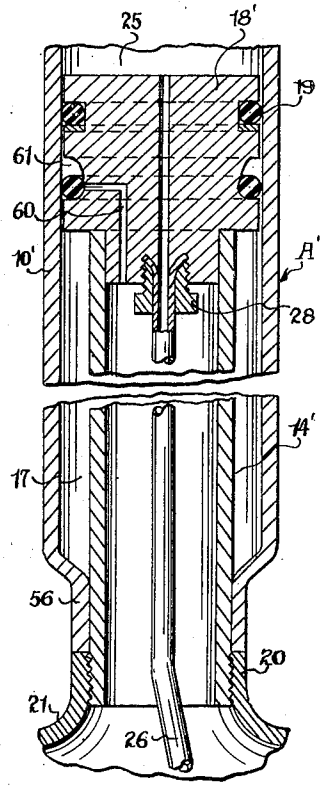


Fig. 8

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HYDRAULIC JACK

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Application August 22, 1946, Serial No. 692,205

1 Claim. (Cl. 103—157)

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The present invention relates to hydraulic jacks, particularly automobile jacks, and to hydraulic pumps especially adapted for use in hydraulic jacks and the like.

One of the principal objects of the invention is the provision of a novel and improved hydraulic jack comprising a simple and inexpensive pump for supplying the pressure liquid, and readily operable means for permitting the return of the liquid from the lifting cylinder or motor to the liquid reservoir.

Another object of the invention is the provision of a jack of the character referred to, which jack is simple in construction, self-contained, will not leak liquid, and has only one manually operable member selectively movable for raising and lowering the jack.

Another object of the invention is the provision of a novel and improved liquid pump of the reciprocating piston type especially adapted for use in jacks and the like and including by-pass means selectively operable by movement of the piston actuating means for permitting the return of liquid from the lifting cylinder or motor to the reservoir.

The invention resides in certain constructions and combinations and arrangements of parts and further objects and advantages will be apparent to those skilled in the art to which the invention relates from the following description of the preferred embodiment described with reference to the accompanying drawings forming a part of this specification in which similar reference characters designate corresponding parts, and in which

Fig. 1 is a perspective view of an automobile jack embodying the present invention;

Fig. 2 is an enlarged vertical sectional view through the jack approximately on the center line of the pump and lines 2—2 of Figs. 3 and 4;

Fig. 3 is a detached plan view of the piston as shown in Fig. 2;

Fig. 4 is a sectional view approximately on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view similar to Fig. 4 but showing the parts in a different operating position;

Fig. 6 is a fragmentary sectional view approximately on the line 6—6 of Fig. 7 and similar to a part of Fig. 2 but showing the pump piston in a different operating position;

Fig. 7 is a sectional view approximately on the line 7—7 of Fig. 6; and

Fig. 8 is a fragmentary sectional view similar

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to a part of Fig. 2 but showing a modified construction.

Although the invention is applicable to devices of different character and may be embodied in various structures, it is particularly applicable to automobile jacks and is herein shown and described as embodied in a manually operable hydraulic automobile jack of specific construction.

Briefly described, the jack shown in the drawings comprises a tubular-like lifting assembly A closed at its upper end and slidably supported for vertical movement upon the upper tubular part of a column-like base member or assembly B also closed at its upper end, the lower part of which is bell-shaped and forms a reservoir for oil or other suitable liquid. The lifting assembly A is raised and lowered upon its supporting column-like base B by the admission and exhaust of pressure liquid to and from the interior of the lifting assembly A about the supporting column B. Pressure fluid is supplied to the interior of the assembly A above the top of the base B by a manually operable pump C located in the base B. The pump C also includes means for controlling the escape of fluid from the interior of the lifting assembly to lower the jack.

The lifting assembly A comprises a tubular member 10 closed at its upper end by a cup-shaped cap 11, the downwardly extending flange of which surrounds and has threaded engagement with the upper end of the tube 10. Packing 12 interposed between the upper end of the tube 10 and the interior of the cap 11 prevents the leakage of any liquid through the threaded connection between the tube 10 and the cap 11. The lower end of the tube 10 is provided with a flange ring 13, the upwardly extending flange of which surrounds and is threaded upon the lower end of the tube 10. The interior of the ring 13 below the tube 10 slides upon a tubular member 14 forming a part of the supporting column B and is provided with an internal groove for the reception of an O-ring type packing 15, which packing ring seals or closes the lower end of a chamber 17 intermediate the tubular members 10, 14.

In addition to the vertically positioned tubular member 14, the supporting column for the lifting assembly A comprises a plug-like member 18 threaded into the upper end of the tube 14 and provided with an annular external flange, the lower side of which engages the upper end of the tube 14. The external flange on the member 18 forms with the interior of the tube 10 of the lifting assembly A a sliding fit and is pro-

vided with an external groove within which a packing or seal 19 is positioned. The seal shown is similar to the seal 16 previously referred to and closes the upper end of the chamber 17.

The lower end of the tubular member 14 is threaded into an upwardly extending flange 20 of the bell-shaped member 21 of the base B and the shoulder formed thereby is adapted to be engaged by the lower side of the member 13 to form a lower stop for the lifting assembly A. The bell-shaped member 21 is provided with an external flange 22 and the bottom is closed by a plate 23 fixedly secured thereto in any conventional manner. As shown, the plate 23 has an inwardly extending flange 24 which overrides the flange 22 of the bell-shaped member. Pressure fluid is supplied to and exhausted from the interior of the lifting assembly A above the supporting column B, which chamber is designated herein by the reference character 25 and is in effect the power cylinder, by a pipe or tube 26, the upper end of which extends into and communicates with a counterbored aperture 27 through the center of the plug 18. The pipe 26 is fixedly secured within the lower end of the aperture 27 by a suitable fitting 28. The lower end of the pipe 26 is connected in a similar bore 30 in the cylinder 31 of the pump C by a fitting 32 similar to the fitting 28.

In the embodiment shown, the pump C comprises the one-piece cylinder member 31, previously referred to, having a cylindrical aperture or bore 33, the left-hand closed end of which constitutes the cylinder chamber of the pump. The right-hand end of the cylinder member 31, which is threaded, is of reduced diameter and projects outwardly through a suitable aperture in the bell-shaped base member 21, to which it is detachably secured by a nut 34 threaded upon the outer end. A packing washer 35 interposed between the shoulder formed by the reduced end of the cylinder member 31 and the inner side of the bell-shaped member 21 prevents the leakage of liquid around the cylinder member. The cylinder is in effect a part of the base member or assembly B and, as an alternative construction, the tubular part 14, the bell-shaped part 21, the bottom member 23, and the pump cylinder 31 may be formed in one piece.

The piston 40 of the pump C is formed of a solid, cylindrical member located in the outer end of the aperture 33 within which it is both rotatable and reciprocable. The piston is adapted to be manually rotated by a hand crank 41 detachably connected thereto by a socket 42 having apertures 180° apart adapted to receive opposite ends of a pin 43 projecting from and fixedly secured within a transverse aperture adjacent to the outer end of the piston 40. The piston 40 is reciprocated within the cylinder member 31 upon rotation of the piston by a roller 44 rotatably supported on the inner end of a member 45 fixedly secured within a radial aperture in the cylinder member 31, which roller 44 engages within a continuous, inclined cam groove 46 in the piston 40. A pair of seals 47, 48 similar to the seal 19, previously referred to and located within suitable grooves at opposite sides of the cam groove 46, prevent the escape of liquid about the piston.

The valving for the fluid pressure pump C comprises in addition to the aperture or port 30, previously referred to, a radial aperture or port 50 in the cylinder member 31 opposite to the aperture 30 and communicating with the liquid reservoir in the base B. The inner or left-hand end of the piston 40 is flattened on one side to provide an end portion 51, semi-circular in cross-section and of sufficient length that it always covers one or both of the ports 30, 50 as the piston reciprocates through its normal predetermined stroke effected by the roller 44 in cooperation with the cam groove 46. The high and low parts of the cam groove 46 lie in the plane of the flat surface of the portion 51 of the piston, with the result that as the piston is rotated it reaches the opposite ends of its stroke as the one port opens and the other closes. The pump is reversible and can be used to pump the lifting assembly A both up and down; however, it is normally intended to pump pressure fluid into the chamber 25, other means hereinafter being provided for permitting the return of liquid to the reservoir for the purpose of lowering the lifting assembly A or jack.

When rotated from the position shown in Figs. 2 and 4, with both ports 30, 50 closed, in the direction indicated by the arrow D, Figs. 4 or 5, initial movement of the piston 40 opens the port 30. The port 30 remains open to the chamber 33 and as the rotation of the piston continues the piston moves toward the bottom of the chamber 33 forcing the liquid therein through the port 30 and the conduit 26 into the chamber 25 raising the lifting assembly A. When the piston has been rotated 180°, see Fig. 5, the port 30 is again closed by the portion 51 of the piston, the port having closed shortly before reaching the 180° position. Continued rotation of the piston opens the intake port 50 and causes the piston to move toward the position shown in Fig. 2 which draws fluid into the chamber 33. When the piston reaches the position shown in Fig. 4, the cycle of operation is completed.

As previously stated, the piston may rotated in the opposite direction to lower the jack; however, the liquid in the chamber 25 is preferably allowed to return to the reservoir in the base of the jack by connecting the ports 30, 50 through an aperture 52 in the piston 40 adjacent to but spaced slightly to the rear of the end 51, which aperture is adapted to be moved in line with the ports 30, 50 by pushing the piston forward to the position shown in Fig. 6 about the time the port 50 opens, that is, with the piston slightly advanced with respect to the position shown in Fig. 5. The forward movement of the piston is permitted by an aperture or recess 53 in the rear or right-hand wall of the cam groove 46 adapted to receive the roller 44. As shown, the aperture 52 passes transversely through the center of the piston and is connected to the chamber 33 in front of the piston by a longtitudinally extending conduit 54 in the center of the piston. The diagonal relationship between the aperture or conduit 52 and the flat face of the piston causes the chamber 33 to be connected with the port 50 at the time the piston is pushed forward into the position shown in Fig. 6, whereby pressure is prevented from building up in front of the piston. Pressure within the chamber 33 normally maintains the front or left-hand wall of the cam groove 46 in engagement with the roller 44 and prevents the recess in the rear or right-hand wall of the cam groove from entering into the normal operation of the pump.

The pressure fluid reservoir within the base assembly B, including the tubular member 14, is preferably only partially full of liquid and is of a sufficient size that it can be sealed from the outside atmosphere. Preferably, the volume thereof can be increased by forming one or more radial apertures 55 in the sides of the tubular

member 14 adjacent to the top, thus making the chamber 17 intermediate the outer and inner tubular members 10 and 14 a part of the reservoir. If the holes 55 in the tubular member 14 are dispensed with, the seal 16 serves no particular function and can be omitted. In this event, the ring member 13 can also be omitted and the lower end of the tube 10 drawn in to engage the exterior of the tube 14 in a manner similar to that shown at 56 in the alternative construction shown in Fig. 8 wherein the duplicate parts are designated by the same reference characters and the corresponding parts by the same reference characters with a prime mark affixed thereto.

As a further alternative construction, the upper part of the liquid reservoir in the base assembly may be automatically opened to atmosphere and closed as the lifting assembly is raised and lowered. As shown in Fig. 8, this may be accomplished by a conduit 60 in the member 18' corresponding to the member 18 of the embodiment shown in Figs. 1 to 7, the upper end of which conduit opens into an annular groove 61 and is normally closed by an O-ring type packing or seal located in the groove 61. The groove 61 is in the circumference of the member 18', is wider than the O-ring, and as the lifting assembly A' is raised, the engagement between the O-ring and the interior of the tubular member 10' rolls the O-ring away from the end of the conduit 60, thus opening the liquid reservoir to atmosphere through the chamber 17 intermediate the tubular members 10', 14' and the clearance between the lower end of the member 10' and the tube 14'. As the lifting assembly A' is lowered, the O-ring is returned to the position shown and the conduit 60 sealed to prevent the escape or liquid therethrough when the jack is laid in a horizontal position. As the lifting assembly A' is being lowered, an operation that normally takes place with the jack in its upright or vertical position, any appreciable pressure within the liquid reservoir will relieve itself by temporarily lifting the O-ring away from the end of the conduit 60.

The jack can be placed under the object to be raised with the upper end of the lifting assembly A in position to engage the object or the lifting assembly can include other means for engaging the object to be raised. The lifting assembly preferably includes vertically adjustable means for engaging underneath the object to be raised, thus better adapting the jack for lifting articles of different height from a given surface. This is particularly advantageous in the case of an automobile jack because the axle of the automobile or other part to be engaged by the lifting assembly will be at different heights above the ground for different automobiles, etc. In the embodiment shown, the lifting assembly A includes a member E comprising a plurality of plate-like members 62 loosely connected together by a rivet 63 and slidable upon the tubular member 10. The construction is such that by raising the projecting end of the member E until the apertures through which the tubular member 10 projects align themselves, the member E can be freely moved along the tube 10 but when a force is applied to the top of the projecting end of the member E, the plate-like members 62 tend to pivot about the tube 10 and tightly engage the same. For a given movement of the lifting assembly A, the adjustability of the member E greatly extends the range of the jack.

From the foregoing disclosure of the present invention, it will be apparent that the objects heretofore enumerated and others have been accomplished and that there has been provided a simple and inexpensive hydraulic jack which is self-contained and will not leak fluid. While two preferred embodiments of the invention have been described in considerable detail, the invention is not limited to the particular construction shown which may be varied in many respects without departing from the invention and it is my intention to hereby cover all adaptations, modifications and uses thereof which come within the practice of those skilled in the art to which the invention relates and within the scope of the appended claim.

Having thus described my invention, I claim:

A liquid pump comprising a member having an annular aperture therein closed at one end and annularly spaced inlet and outlet ports opening into said aperture adjacent to but spaced from said closed end, a piston rotatable in said aperture, valving means associated with said piston for alternately connecting said ports with the portion of said aperture intermediate the closed end thereof and said piston upon rotation of said piston, and means comprising a cooperating cam groove and roller associated with said member and said piston for reciprocating said piston through a predetermined stroke upon rotation thereof, said cam groove having a recess or aperture in one side thereof permitting movement of said piston beyond said predetermined stroke and said piston having an aperture therein effective upon axial movement of said piston beyond said predetermined stroke for connecting said ports together.

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