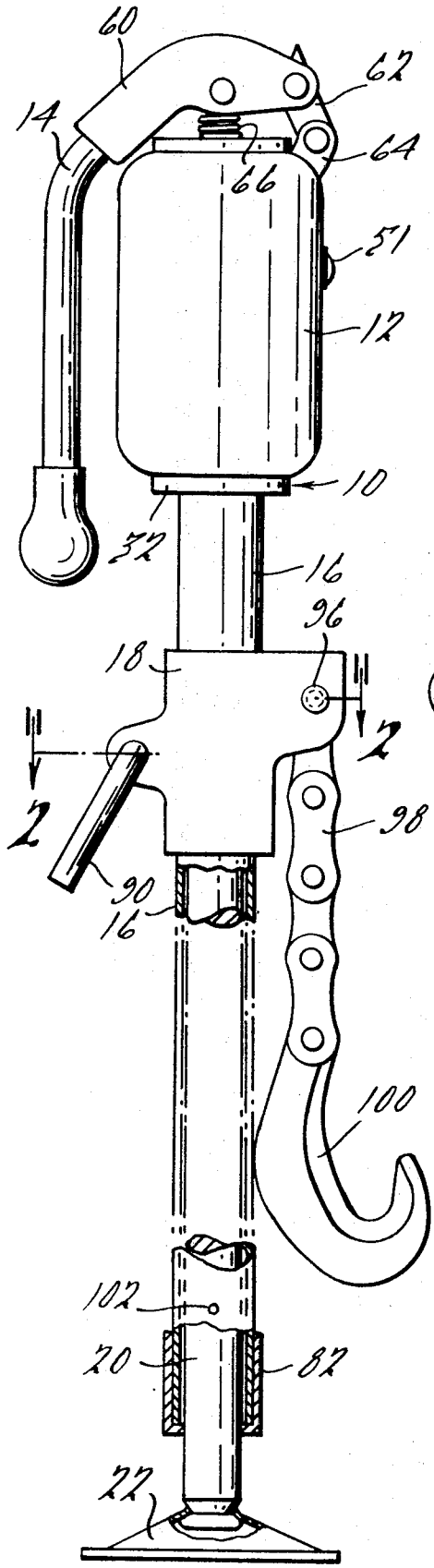
Oct. 26, 1971 L. D'AMICO TROTTA 3,615,157

HYDRAULIC JACK

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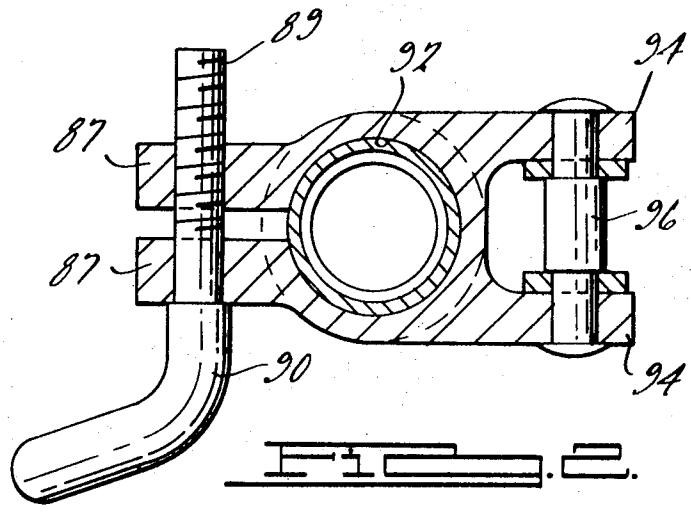


FIG. 2.

FIG. 1.

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FIG. 3.

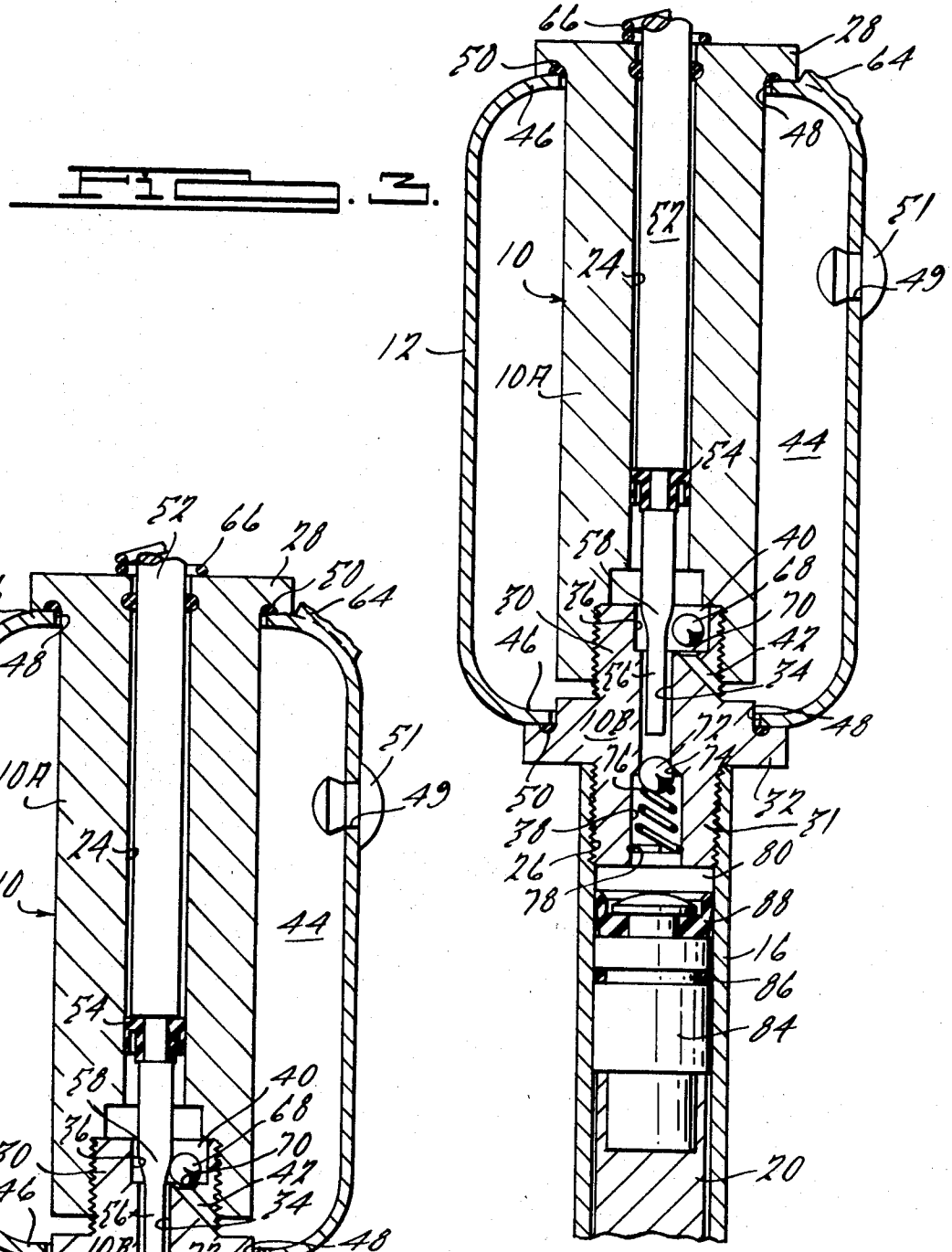


FIG. 4.

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3,615,157

HYDRAULIC JACK

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Int. Cl. B66f 3/24
U.S. Cl. 254—93 H 3 Claims

ABSTRACT OF THE DISCLOSURE

There is herein disclosed a hydraulic jack for use with automobiles or the like, having a pump handle connected to a piston for pumping hydraulic fluid from a reservoir to a lifting cylinder. The lifting cylinder surrounds a stationary, ground supported piston and carries a hook for connection to an automobile bumper or the like.

SUMMARY OF THE INVENTION

This invention relates generally to lifting devices and, more particularly, to a new and improved hydraulic jack which consists of a minimum number of parts so as to give the device a design which is compact in nature and highly reliable in operation.

This and other objects are accomplished in a construction which is so reduced in the number and character of its component parts so as to approach the ultimate in structural simplicity to thereby create an economy in its manufacture, installation and maintenance. The device includes a piston housing which is spacedly surrounded by a wall to define an annular-shaped fluid reservoir therebetween. A piston is reciprocated within a bore of the housing to draw fluid from the reservoir and deliver it to a lifting cylinder. The opposite ends of the housing are provided with flanges that are sealed with respect to the reservoir wall by conventional O-rings.

Passages exist between the housing and the reservoir and between the housing and the lifting cylinder. A pair of check valves control the flow of fluid through the passages. Reciprocation of the piston is accomplished by a conventional pump handle. When the handle and piston are raised, fluid is drawn from the reservoir past a first check valve to fill the piston bore in the housing. At this time the second check valve remains closed. Downward movement of the handle will cause the piston to displace fluid past the second check valve to the lifting cylinder. At this time the first check valve remains closed. Downward movement of the handle is yieldably resisted toward the end of its stroke by a spring. In pumping up the lifting cylinder, downward movement of the handle is stopped when the spring is encountered. Further downward movement of the handle against the spring is operable to relieve pressure in the lifting chamber and permit return flow of fluid to the reservoir. This function results from the provision of a special valve displacing element on the piston which will unseat the balls of both check valves.

The formation and location of the reservoir in the foregoing manner renders the unit highly compact, minimizes the danger of damages to the reservoir defining wall, simplifies the formation of connecting passages between the reservoir and housing, enables the housing to be inexpensively machined in two parts and reduces other manufacturing costs.

The structure of the present invention also eliminates a separate pressure relief valve by use of a valve displacement member on the pumping piston. This valve displacement member also greatly simplifies the lowering of the jack.

The various objects and advantages and the novel details of construction of one commercially practical embodiment of the invention will become more apparent as this description proceeds, especially when considered in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view, with parts broken away, of a preferred embodiment of the present invention;

FIG. 2 is an enlarged sectional view of the structure illustrated in FIG. 1, taken substantially along the line 2—2 thereof;

FIG. 3 is an enlarged vertical sectional view of a portion of the structure depicted in FIG. 1; and

FIG. 4 is a view of the structure illustrated in FIG. 3, showing another position of the parts.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, a hydraulic jack made in accordance with the present invention is illustrated as having a two-part pump housing **10** surrounded by a reservoir member **12**, a pump handle **14** mounted on the reservoir member **12** and a lifting cylinder **16** on which the reservoir member is mounted. A bracket **18** is adjustably secured on the lifting cylinder **16** which surrounds and is telescopically fitted on a supporting post **20** having a ground supported base **22** at its lower end. The hydraulic jack illustrated herein is primarily intended for use with an automobile for lifting one end of the automobile to change a flat tire. For this purpose, the base **22** is positioned on the ground with the lifting cylinder in a vertical attitude. The pump handle **14** is manually reciprocated to pump hydraulic fluid to the lifting cylinder **16**. This produces vertical movement of the lifting cylinder with respect to the supporting post **20**. The vehicle to be lifted is connected to the bracket **18** so that the elevation of the lifting cylinder will lift the vehicle.

Referring now to FIGS. 3 and 4, the construction of the pump housing **10** and its associated parts are illustrated in detail. The housing **10** includes an elongated generally cylindrical housing member **10A** and a smaller externally threaded housing member **10B**. The housing member **10B** is particularly suited for high production manufacture on automatic screw machines, or the like. The housing member **10A** is formed with a cylindrical bore **24** extending from one end thereof to the other. A threaded counterbore **26** is located at the lower end of the bore **24**, while a radially outwardly extending annular flange **28** is formed at the upper end of the housing member **10A**. The housing member **10B** has an externally threaded portion **30** which is threaded into the counterbore **26** to join the housing members **10A** and **10B** together.

The housing member **10B** has a threaded portion **31** formed at its lower end which is threaded into the upper end of the lifting cylinder **16**. A radially outwardly extending annular flange **32** is provided on the housing member **10B** between the threaded portions **30** and **31** thereof. An axially extending bore **34** extends through the housing member **10B** in axial alignment with the bore **24**. The

bore **34** is formed with a counterbore **36** at its upper end and a counterbore **38** at its lower end. A recess **40** is formed in the housing portion **30** and projects from one side of the counterbore **36**, while a passage **42** in the housing portion **31** provides communication between the recess **40** and the outer periphery of the housing member **10B** in a location beneath the housing member **10A**.

It will be seen that the reservoir member **12** surrounds the housing **10** to define a generally annular reservoir **44** therebetween. This is accomplished by the formation of radially inturned annular walls **46** which are located at the opposite ends of the reservoir member **12** and have axially aligned openings **48**. The housing **10** extends axially between the two openings **48** with the flanges **28** and **32** being engageable with the outer sides of the walls **46** in locations surrounding the openings **48**. O-rings **50** are positioned at such locations to provide a fluid-tight seal between the housing **10** and the reservoir member **12**. The reservoir **44** is filled with hydraulic fluid through an opening **49** in the member **12** which is normally closed by a rubber plug **51**. From the reservoir **44** fluid flows through the passage **42** to the pocket **40** and counterbore **36**, as well as to the lower end of the bore **24**. From this location hydraulic fluid is pumped downwardly by a piston **52** which is slidably disposed within the cylinder bore **24**. The piston **52** carries a lip seal **54** and has a reduced diameter portion **56** depending from its lower end into the bore **34**. The piston portion **56** is of sufficiently smaller diameter than the bore **34** to permit fluid to flow freely around it in the bore **34**. The piston **52** has a conical shoulder **58** disposed immediately above the reduced diameter portion **56**.

The piston **52** is designed to be reciprocated by the handle **14** which is secured to a fitting **60**. The fitting **60** is piovtally connected to the upper end of the piston **52** and to a link **62** which is pivotally mounted on a boss **64** welded to the outer surface of the reservoir member **12**. The fitting **60** is engageable with a spring **66** surrounding the piston **52** and seated against the upper end of the housing member **10A**. The handle **14** is intended to be moved downwardly in a pumping stroke until the fitting **60** engages the spring **66**, which yieldably resists further downward movement of the handle. The handle **10** is then lifted for another pumping stroke.

In order for the pumping movement of the piston **52** to effect lifting movement of the cylinder **16**, a pair of check valves are required. One of said check valves comprises a ball **68** positioned in the pocket **40** and adapted to seat against an annular valve seat **70** surrounding one end of the passage **42**. The second check valve comprises a ball **72** disposed in the counterbore **38** and engageable with an annular valve seat **74** formed around one end of the bore **34**. The ball **72** is normally urged into contact with the valve seat **74** by a spring **76** which is seated within a groove **78** of the bore **38**. During the upward movement of the handle **14**, the ball **72** will be held closed while the ball **68** will be drawn upwardly by a sucking or vacuum action of the piston **52**. This permits fluid to flow from the reservoir **44** through the passage **42** into the counterbore **38** in the lower end of the bore **24**. As the piston **52** begins its downward stroke, the pressure which it creates will cause the ball **68** to close against its seat **70** while the resulting pressure of fluid within the bore **34** will displace the ball **72** from its seat, permitting fluid to flow past the ball **72** to an expansion chamber **80** formed within the lifting cylinder **16**.

As the lifting cylinder **16** rises, it movement is guided by a guide member **82** of a generally flanged sleeve shape secured to the lower end of the lifting cylinder **16**. The lifting cylinder is also guided by a piston **84** fixed to the upper end of the stationary post **20** and smoothly and glidably engaging the inner peripheral surface of the lifting cylinder **16**. The piston **84** is fitted with an O-ring **86** and a lip seal **88** which prevents the downward flow of fluid out of the expansion chamber **80**.

A mechanical connection between the lifting cylinder **16** and the automobile to be lifted is achieved by means including the bracket **18**. Referring to FIGS. 1 and 2, it will be seen that the bracket **18** is provided with a pair of spaced ears **87** on one side thereof. A threaded stud **89** passes freely through one of the ears **87** and is threaded into the other of said ears. The stud **89** is formed with an integral shouldered handle portion **90** by which the stud may be rotated to draw the ears **87** together. This causes a central apertured portion **92** of the bracket **18**, surrounding the lifting cylinder to be clamped in a given position on the lifting cylinder **16**. Accordingly, the bracket **18** may be moved to any desired vertical position on the lifting cylinder **16** On the side of the bracket **16** opposite from the ears **87**, a pair of ears **94** are formed with a pin **96** extending therebetween. A chain **98** is hung from the pin **96** and carries a hook **100** at its lower end. The hook **100** is fitted under the bumper of the automobile to be lifted or in any other desired location on the automobile. It will be appreciated that be simply loosening the stud **89** and positioning the hook **100** as desired, the jack can be immediately positioned so that pumping of the handle **14** will effect immedaite lifting of the automobile.

The various positions of the check valve balls **68** and **72** during various phases of the pumping cycle are illustrated in FIGS. 3 and 4. FIG. 3 illustrates the return stroke of the piston **52** in which the ball **68** is drawn upwardly off of its seat but with the ball **72** being in the closed position. FIG. 4 illustrates a further position of the piston **52** in which the downward movement of the piston **52** has been completed and wherein the handle is pushed downwardly against the spring **66** to cause the reduced diameter portion **56** of the piston to contact the ball **72** and physically displace it downwardly away from its seat **74**. The relative spacing between the lower end of piston portion **56** and the piston shoulder **58** is such that when the piston portion **56** unseats the ball **72**, the conical shoulder **58** will also unseat the ball **68** from its seat by a sideways wedging movement. Accordingly, the full downward movement of the handle **14** against the spring **66** will unseat both the check valves and thereby permit a free return flow of fluid from the expansion chamber **80** to the reservoir **44**. This, of course, lowers the jack. The power for producing such return flow is supplied by the weight of the vehicle.

The jack of the present invention preferably incorporates means to prevent damage to the parts from continued pumping after the lifting cylinder **16** has been fully raised. This means comprises a lead filled hole **102** in the wall of the cylinder **116** which rises above the seal **88** only at the end of the upward movement of the cylinder **16**. If the fluid in the cylinder **16** is excessively pressurized with the lifting cylinder in this position, it will force the lead out of the hole **10** and provide a vent for fluid to escape onto the ground. It should be mentioned, however, that the need for this is rather unlikely and the hydraulic fluid is normally contained in a closed system.

From the foregoing, it will be appreciated that the location of the reservoir **44** annularly about the pump housing **10** renders the entire structure highly compact, minimizes the danger of damage to the reservoir, and reduces the cost of manufacture of the product. In particular, reservoir member **12** can be relatively inexpensively fabricated compared to a sheet metal member which forms the entire enclosure for the reservoir. The utilization of the housing flanges **28** and **32** to close the reservoir takes advantage of the existing housing structure in order to complete the formation of the reservoir at a minimum of expense. Also, the formation of the housing **10** in two parts facilitates the assembly of the device and makes it extremely easy to unite the housing with the lifting cylinder **16**. Of course the reduced diameter piston portion **56** and the conical shoulder **58** eliminate the necessity of a third pressure relief valve and render the lowering of the jack highly convenient.

I claim:

1. A hydraulic jack comprising:
a housing defining a bore,
a pump piston disposed within said bore,
a fluid reservoir,
first passage means providing communication from said reservoir to said bore,
a lifting cylinder,
second passage means providing communication from said bore to said lifting cylinder,
a first check valve operable to close said first passage means when said piston is in its pumping stroke,
a second check valve normally closing said second passage means but operable in response to pumping movement of said piston, and
means on said piston for simultaneously displacing and opening said first and second check valves when said piston is moved to a given position.

2. The invention as set forth in claim 1 wherein said second check valve is a spring biased ball.

3. The invention as set forth in claim 1 wherein said first check valve is a ball and said means on said piston includes a conical shoulder operable to displace said ball laterally of the direction of piston movement.

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