June 23, 1936. E. M. PFAUSER 2,044,857

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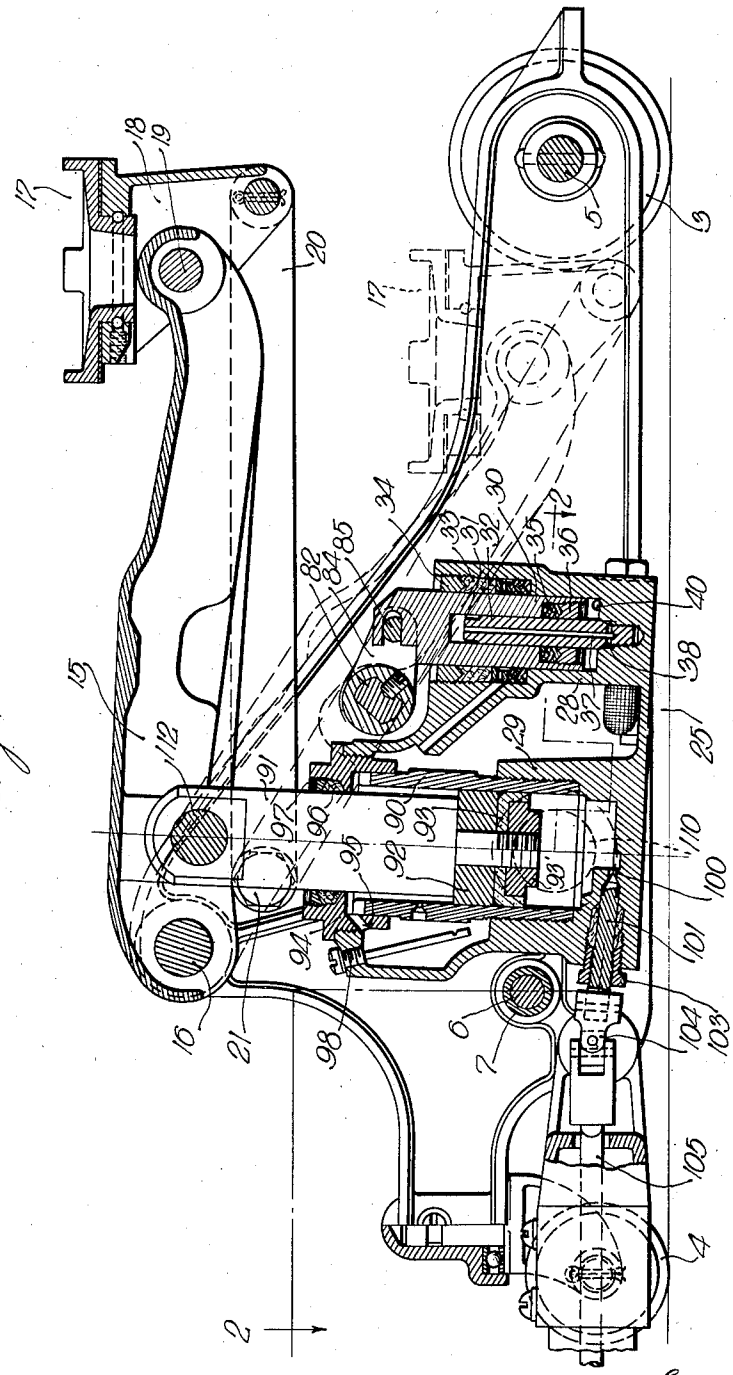


Fig. 1.

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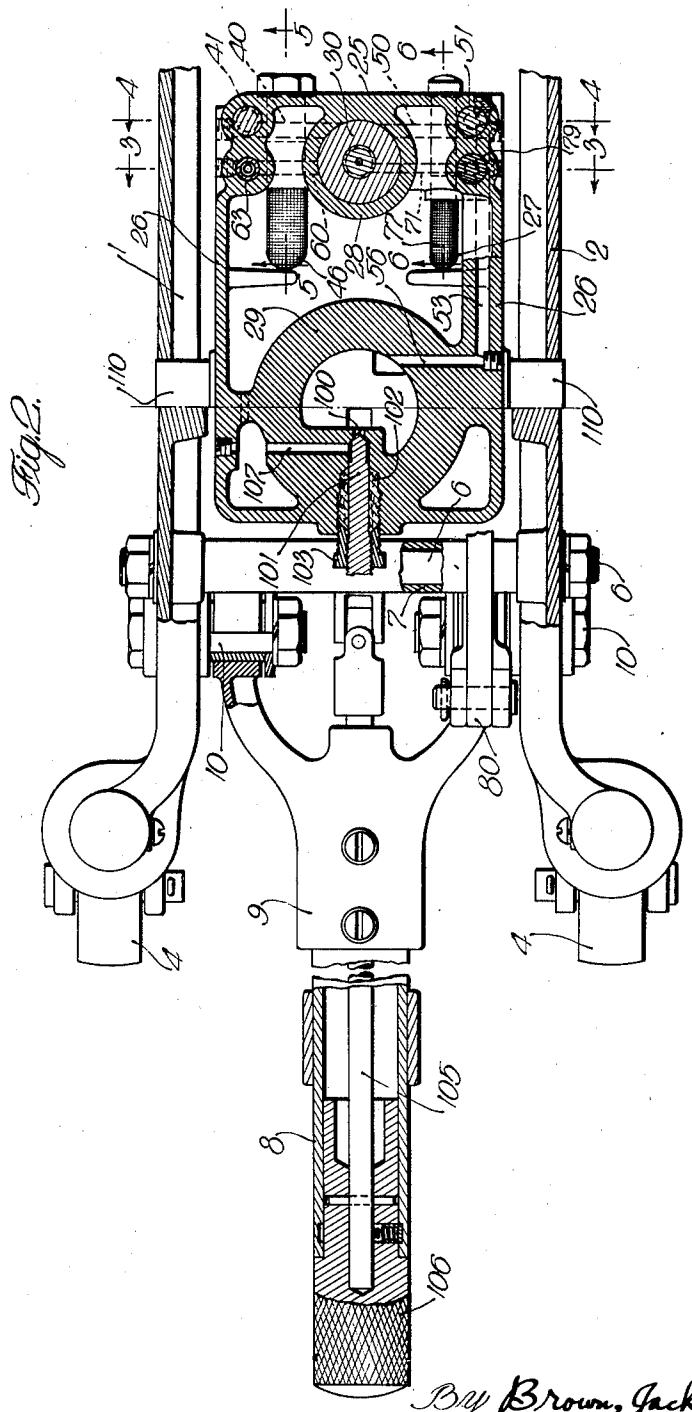


Fig. 2.

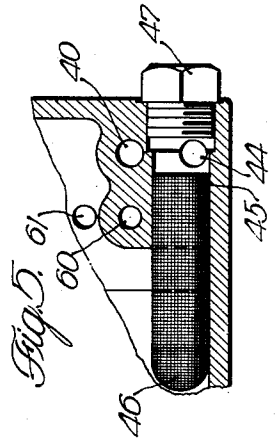


Fig. 5.

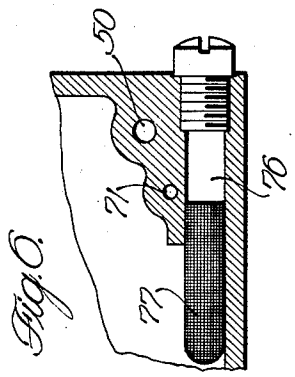


Fig. 6.

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Fig. 3.

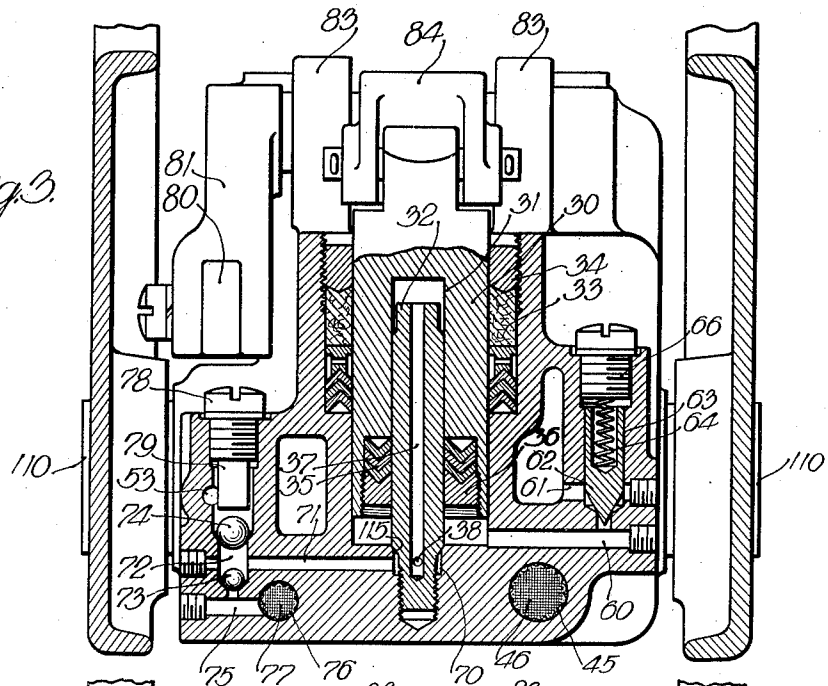
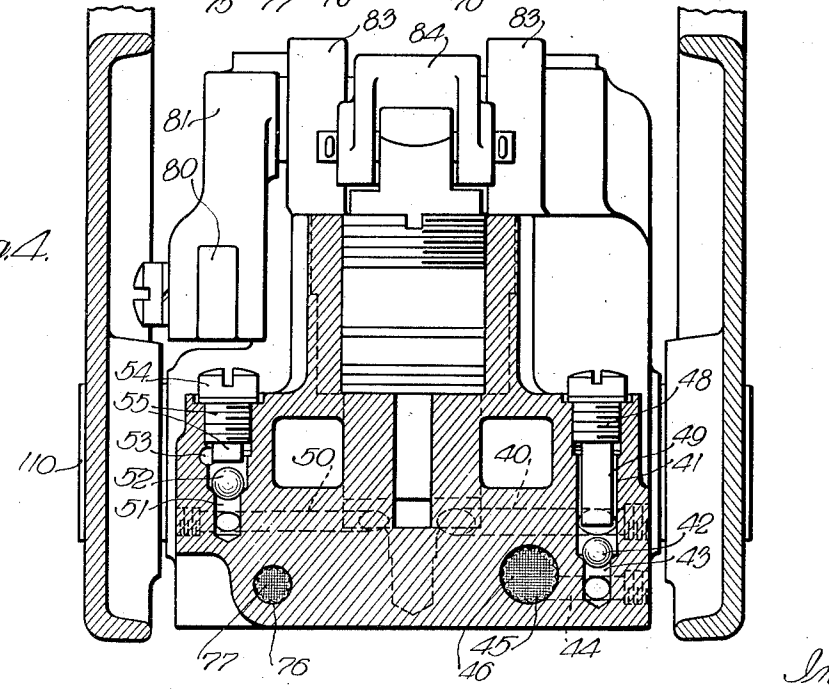


Fig. 4.



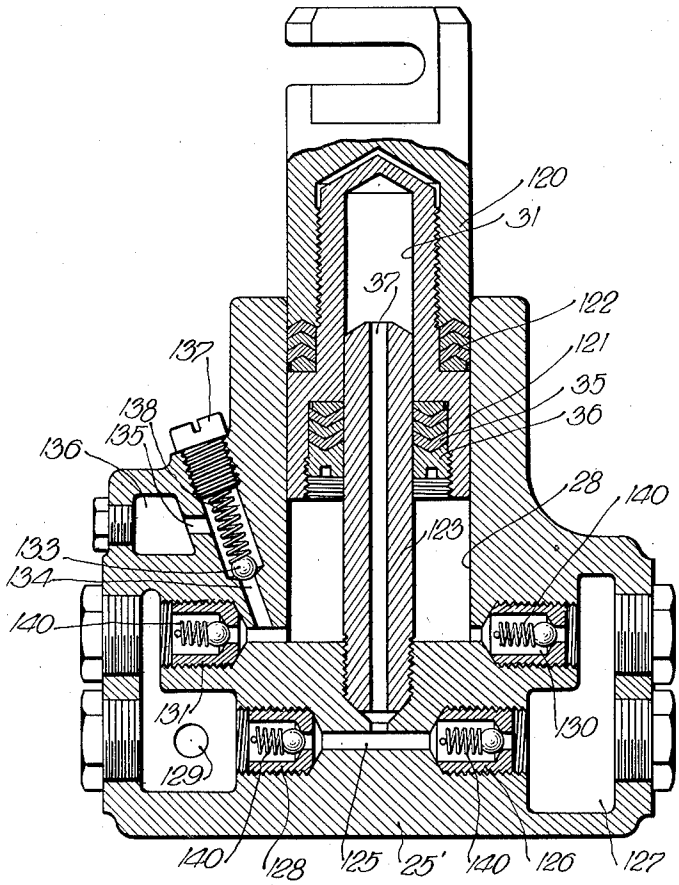
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Fig. 7.



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Patented June 23, 1936

2,044,857

UNITED STATES PATENT OFFICE

2,044,857

PUMP

Edward M. Pfauser, Milwaukee, Wis., assignor to Blackhawk Mfg. Co., Milwaukee, Wis., a corporation of Wisconsin

Application September 2, 1933, Serial No. 687,969

1 Claim. (Cl. 103—11)

This application is a continuation in part of my copending application Serial No. 553,105, filed July 25, 1931.

The present invention relates to hydraulic automobile jacks, and more particularly to such jacks as are adapted for use in garages or the like for lifting and holding or moving an automobile.

Jacks of the type here contemplated are generally mounted on a low wheeled frame and provided with a hydraulic ram and pumping means for actuating the same. In my jack the pumping means is arranged to produce a comparatively rapid movement of the ram when the jack is under no load, as when it is being elevated towards engagement with an automobile axle, and at a slower rate when the jack is lifting a heavy load. A jack operating in this manner is shown in my Patent No. 1,873,473, issued August 23, 1932, upon which the present jack is an improvement.

It is one of the principal objects of the present invention to provide a simple and rugged jack which will operate very rapidly under no load and will automatically slow down and develop the proper power for lifting when the load is encountered. The automatic slow down means is required because, due to the fast contacting speed, little power was available. In a preferred embodiment of my invention this is accomplished by providing two pumps, located one within the other, operated by a common handle. The pumps comprise a speed pump and a power pump, both of which are used when the ram is being actuated to bring the lifting saddle into initial engagement with the load to be lifted, and only one, the power pump, is used for the actual lifting operation. Compactness is obtained by locating the cylinders one within the other. The inner cylinder is the high pressure or power cylinder, thus reducing leakage, since any leakage from the inner cylinder must be by way of the outer cylinder. The outer larger pump is automatically by-passed at a certain predetermined load, allowing the smaller pump to function as the power pump for actually raising the capacity loads.

It is a further object of the present invention to provide a hydraulic jack of the kind here involved wherein the valves are easily accessible for inspection or cleaning, without dis-assembly of the jack.

It is a further object of the present invention to provide an improved means for mounting the ram and pump structure on the wheeled frame.

The present jack is provided with a lifting arm pivoted on the frame and adapted to be swung about its pivot by the ram, to lift the load. I provide an arrangement wherein there is a direct pivotal connection between the ram and the lifting arm. Since the center of this pivot moves in an arc of a circle as the arm is actuated, it is necessary to provide some arrangement for preventing binding of the ram plunger. I accomplish this without the use of links or pin and slot connections between the ram and the lifting arm, since these are objectionable. Instead, I provide the ram structure with a pair of trunnions for mounting the same in the frame in such a manner as to permit a small tilting of the ram structure as the lifting arm is swung about its pivot by the ram.

The attainment of the above and further objects of the present invention will be apparent from the following specification, taken in conjunction with the accompanying drawings forming a part thereof.

In the drawings:

Figure 1 is a longitudinal section through my improved jack;

Figure 2 is a sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a sectional view taken along the line 3—3 of Figure 2;

Figure 4 is a sectional view taken along the line 4—4 of Figure 2;

Figure 5 is a fragmentary sectional view taken along the line 5—5 of Figure 2;

Figure 6 is a fragmentary sectional view taken along the line 6—6 of Figure 2; and

Figure 7 is a sectional view illustrating a modified pump construction.

Reference may now be had more particularly to Figures 1 and 2 of the drawings. The jack includes a wheeled supporting frame comprising side members 1 and 2 supported by a pair of front wheels 3 and a pair of rear dirigible wheels 4. The side members 1 and 2 are held in fixed spaced relationship at their front ends by an axle 5, and at their rear ends by a frame tie rod 6 and spacer 7. A jack operating and pulling handle 8, having a yoke 9 at its forward end, is pivoted between the side members by bolts 10—10.

A lifting arm 15 is pivoted to the side members 1 and 2 by a swivel pin 16 that extends between the two side members. The lifting arm is located between the side members, and supports, at its forward end, a saddle 17 carried by a saddle bracket 18 pivoted about a pin 19. The saddle supports and elevates the load. A pair of links

20 are pivoted on the inner sides of the side members 1 and 2 about pivot pins 21, and are pivoted at their opposite ends to the saddle bracket 18 so as to tilt the saddle bracket with respect to the arm 15 and thus maintain the saddle 17 horizontal as the arm 15 swings about its swivel pin 16.

The jack includes a hydraulic pump and ram structure for actuating the arm 15. This structure includes a cast metal base 25 having integral side walls 26 defining a sump 27 and constituting an enclosure for a pump cylinder 28 and the head 29 of a ram, all constituting a unitary casting.

The pump is an automatically variable capacity pump and includes a plunger 30 that slides in the pump cylinder 28. The pump plunger 30 is provided with a centrally located longitudinally extending bore 31 which fits over a stationary plunger 32 that is threaded in the base 25 and constitutes a guide for the plunger 30. The bore 31 constitutes a movable cylinder for the stationary plunger 32. Packing 33 and a packing nut 34 provide a seal for preventing the outward leakage of oil from the pump cylinder 28. Packing 35 and a packing nut 36 threaded into the plunger 30 provide a seal for preventing the outward leakage of oil from the bore 31 constituting the second pump cylinder. The stem of plunger 32 has an axially extending passageway 37 terminating in a radial passageway 38 for conveying fluid to and from the cylinder 31.

An intake port for the cylinder 28 is indicated at 40. This port extends from the interior of the cylinder 28, adjacent the bottom thereof, to a vertically extending intake valve chamber 41 which has a ball valve 42 that controls communication between the port 40 and a duct 43 that extends downwardly to a duct 44 that opens in an intake passageway 45 extending to the sump 27. A screen 46 prevents the entrance of foreign matter from the sump to the valve chamber by way of the intake passageway 45. A plug 47 closes the intake passageway 45. A check valve plug 48 closes the intake valve chamber 41 and, through a spacer 49, controls the extent of opening of the intake check valve 42.

The discharge of the pump cylinder 28 is by way of a port 50 that extends from the lower interior of the cylinder 28 to a discharge valve chamber 51 which, through a ball check valve 52 controls communication between the discharge port 50 and a port 53. A plug 54 and a spacer 55 close the discharge valve chamber and limit the extent of opening of the discharge check valve 52. The port 53 constitutes a passageway in the metal of the base 25, extending downward and lengthwise along one of the sides of the casting, and opens into an intake port 56 that extends to the ram.

The pump cylinder 28 is also provided with a high pressure overflow port 60 that communicates with a port 61 by way of a spring-pressed overflow valve 62 in an overflow valve chamber 63. A spring 64 controls the pressure at which the valve 62 opens. A plug 66 closes the overflow valve chamber 63 and also adjusts the compression on the spring 64, thereby adjusting the pressure at which the valve 62 opens. The port 61 opens into the sump 27.

Communication with the inner pump cylinder 31 is, as previously stated, by way of the axial passageway 37 and the radial passageways 38. The passageways 38 open into an annular passageway 70 which, by way of a port 71, communicates with a valve chamber 72 provided with an intake check valve 73 and a discharge check valve 74. The inlet check valve 73 controls communication with a port 75 that extends to an intake passageway 76 which, through a screen 77, receives liquid from the sump 27. The discharge side of the valve chamber 72 communicates with the port 53 that extends to the inlet side of the ram cylinder. A plug 78 and spacer 79 close the end of valve chamber 72 and limit the extent of opening of the discharge valve 74.

The pump is actuated by reciprocating the handle 8. For this purpose there is provided a link 80, one end of which is drawn to and fro as the yoke 9 is reciprocated. The other end of the link is pinned to and actuates a crank 81 that is suitably keyed to a shaft 82. The shaft 82 is journaled between a pair of bearings 83—83 in the casting 25. Between the bearings 83 the shaft 82 carries a crank arm 84, keyed thereto, for actuating the pump plunger 30. The crank arm 84 is connected to the pump plunger by a pin and slot connection indicated at 85.

The ram head 29 is internally threaded, and has a ram cylinder 90 threaded thereinto and suitably gasketed to form a liquid-tight seal. A ram plunger 91 extends into the cylinder 90 and carries a metal disc 92 and a plunger cup 93 at its lower end, said disc and cup being held in place by an internally threaded nut 93' that also constitutes a spreader for the cup 93. The plunger 91 extends through a pump cap 94 that is threaded into the casting 25. The cap 94 makes a liquid tight seal with the casting 25. A suitable opening 95 is provided in the pump cap 94 for permitting communication between the oil reservoir of the casting 25 and the space between the inside of the cylinder 90 and the plunger 91 above the disc 92. The plunger 91 extends through the pump cap 94, being suitably sealed against the escape of oil as by means of a packing 96 and a packing gland nut 97. An oil level plug gauge 98 is provided for determining the oil level within the sump 27.

The ram head 29 is provided with a discharge port 100 controlled by a release valve spindle 101 that extends through a packing 102 and a release valve packing nut 103. The nut 103 is threaded externally and internally, the external threads threading into the casting 25, and the internal threads receiving threads from the release valve spindle 101. When the nut 103 is in position, the spindle may be moved longitudinally by rotating the same, whereby it threads into or out of the nut 103 and thus opens or closes the discharge port 100. The release valve spindle is connected to one side of a universal joint 104, the opposite side of which is connected to a control rod 105 that extends through the handle 8 and terminates in a knurled control knob 106. By turning this knob, the rod 105 and the release valve spindle 101 are turned. The release valve spindle thus opens the port 100 to an extent determined by the extent of turning of the knob 106. The extent of opening of the port 100 determines the rate of discharge of fluid from the ram cylinder and therefore determines the rate of descent of the ram. The port 100 communicates with a port 107 that communicates with the sump 27.

The side walls 26—26 of the casting 25 are provided with trunnions 110—110 that extend through circular openings in the side members 1—2, thus mounting the combined ram and pump structure between the side members in such a manner as to permit a limited amount

of pivoting of this structure. The ram plunger 91 is connected to the lifting arm 15 by means of a plunger cross pin 112, so that upon outward movement of the plunger within the cylinder 90 the lifting arm 15 is turned upward about its swivel pin 16. The plunger cross-pin 112 moves in an arc of a circle, the center of which is the pin 16. As the lifting arm 15 moves from its lower extreme position, indicated in dotted lines in Figure 1, to the intermediate position indicated in full lines, and upward to its uppermost position, the center of the plunger cross-pin 112 shifts slightly first to the right, to the position shown in Figure 1, and then to the left. The entire casting 25 can rock about its trunnions 110 to accommodate this movement of the plunger cross-pin 112.

It is to be noted that the center line of the ram plunger 92 passes through the center of the trunnions 110—110, as may be seen from Figure 1. Therefore, the reaction of the ram plunger, due to the weight of the load on the saddle 17, will always be in a direction radially of the trunnions, and will produce no tendency to turn the ram and pump structure about the trunnions 110. The only turning of the ram and pump structure 25 will be that due to the small movement of the plunger cross-pin 112 to the left or to the right as it swings about the pin 16 as a center. Also, it is to be noted that the ram exerts its thrust always in substantially a vertical direction, the extent of tilt of the ram plunger from the vertical being very small. During the lifting operation, the center of the ram moves from a position on one side of the vertical, through the vertical position, to the other side of the vertical, thus reducing the maximum deviation from the true vertical. However, it is within the scope of the present invention to mount the ram in any other position, as at a 45° angle, or even horizontal.

An explanation will now be given of the mode of operation of the jack above described. When the pump plunger 30 moves upwardly, oil or other fluid is drawn from the sump 27 by way of the intake passageway 45, passageway 44, intake valve 42 and the port 40 to the cylinder 28. At the same time oil is drawn into the cylinder 31 by way of the intake passageway 76, port 75, inlet check valve 73 and passageways 71 and 37. Upon downward movement of the plunger 30 the oil is forced from the cylinder 31 by way of the passageways 37—71 and the discharge valve 74 to the port 53 that extends to the ram cylinder. At the same time, oil is forced from the pump cylinder 28 by way of the discharge port 50 and discharge check valve 52 to the port 53. This is on the assumption that the overflow release valve 62 remains closed. All of the oil is therefore forced from the cylinders 28 and 31 into the ram cylinder and produces a comparatively large upward movement of the ram plunger per stroke of the pump. When the saddle 17 comes into engagement with the automobile axle to be lifted, the pressure required for lifting the ram is increased and, therefore, the pressure within the cylinders 28 and 31, during the down stroke of the plunger 30, increases. This tends to unseat the valve 62. As long as this pressure is not sufficient to unseat the valve 62, the lifting action of the ram continues as above set forth. The spring 64 is generally set at such a compression that it remains closed at the pressures required to counteract the weight of the jack parts to be lifted and the friction when the jack is not loaded. The hydraulic pressure required to actuate the ram when it encounters a load is sufficient to open the valve 62. Therefore, during the load lifting operation of the ram, the oil within the cylinder 28 overflows through the overflow port 60, past the valve 62, to the port 61 leading to the sump. Therefore, only the oil from the cylinder 31 is forced into the ram cylinder. This permits the operation of the pump with a moderate amount of effort, permitting the building up of a high pressure within the cylinder 31 to produce a powerful, though slow, upward movement of the ram plunger.

Since the cylinder 28 is an integral part of the casting 25, there can be no outward leakage of oil at the base of the pump cylinder and from the cylinder to the sump. This eliminates the necessity for packing between the lower end of the pump cylinder and the sump. At its lower end the plunger 32 is provided with a conical seat 115, accurately ground, which seats on a similar surface accurately centered in the base of the cylinder 28. When the plunger 32 is threaded into position, the conical surfaces come into engagement and provide a liquid-tight seal to prevent any appreciable leakage of liquid from the annular passageway 70 into the cylinder 28. Any small leakage which may occur is not objectionable as in the case where leakage from a pump cylinder means a loss of oil. The present structure is such that regardless of what leakage may develop there can be no ultimate loss of oil, since the leakage is always back into the sump, rather than to the outside of the entire structure. This is an important feature in a portable jack of the kind here involved, which is subjected to rough usage.

In Figure 7 I have illustrated a section, corresponding to the section of Figure 3 or 4, of a modified construction. In this construction the pump intake and discharge valve chambers extend to the sides of the casting, rather than upward to the top thereof. In this construction the intake and discharge valves of the inner and outer cylinders are on the opposite sides of the pump, the corresponding valves of the two cylinders being spaced vertically, rather than horizontally. Insofar as the structure of Figure 7 is similar to that previously described, the same need not be described here. In this construction the plunger that corresponds to the plunger 30 is formed of two parts 120 and 121, threaded together and serving to compress suitable packing 122. The plunger 123 seats in the casting 25' below the threads, rather than above. The passageway 37 in the plunger 123 opens into a port 125 which communicates through an intake check valve 126 with the sump 127, and through a discharge check valve 128 to a discharge outlet 129 which extends to the ram. The discharge outlet 129 corresponds to the port 53 of Figure 2. The cylinder 28 is provided with an inlet check valve 130 and a discharge check valve 131. It is also provided with an overflow check valve 133 which controls communication from the cylinder 28, by way of a port 134, to a port 135 which opens into a chamber 136 in communication with the sump 27. A plug 137 provides for adjustment of the compression of a spring 138 to adjust the pressure at which the overflow valve 133 opens.

Since the check valves 126, 128, 130 and 131 extend in a horizontal direction, it is necessary to provide springs 140 for holding the balls in

position. The pressure of the springs is merely enough to hold the balls in place.

From the description previously given it is apparent that during the upward or suction stroke of the piston the check valves 128, 131 and 133 will remain closed while the valves 126 and 130 will open. Liquid will be drawn into the cylinder 28 and into the cylinder 31. During the down stroke of the piston the valves 126 and 130 will remain closed, as will also the valve 133 if the pressure is insufficient to open that valve. Fluid from the cylinder 28 and the cylinder 31 will thus be forced past the check valves 128 and 131, and through the port 129, to raise the ram. When the back pressure in the port 129 rises above a predetermined amount, due to the ram encountering its load, the back pressure will cause the check valve 131 to remain closed as the pressure within the cylinder 28 increases, resulting ultimately in an opening of the check valve 133 to cause an overflow of the oil from cylinder 28, through the ports 134 and 135, to the chamber 136 that opens into the sump. At that time oil will still be forced from the cylinder 31 by way of the passageway 37 and the check valve 128 to the port 129. The operation of this pump is, therefore, the same as that of the pump previously described.

From the above description it is apparent that I have provided a hydraulic jack wherein the pump forces a maximum amount of the fluid into the ram, per stroke, upon the initial actuation of the ram and until such time as the ram engages its load. Thereafter, an appreciable portion of the pump fluid is by-passed, thus increasing the power that may be developed, without requiring an excessive force.

The pump of the present hydraulic jack consists, essentially, of two pumps, one within the other, the outer one being used only for obtaining a high speed of operation of the ram, that is, when it is not raising a load, or not raising a heavy load. The high pressure pump is within the lower pressure pump, rather than conversely, so that there is a pressure gradient which tends to reduce leakage from the high pressure pump, since any leakage from the high pressure pump will be into the cylinder of the lower pressure pump, the pressure of which is still above that in the sump.

The jack of the present invention is small, compact and rugged. The automobile axle receiving saddle 17 is swiveled, and the rear casters 4 are provided with ball bearings whereby the jack may be used for moving or turning an automobile, as into and out of its parking place in a garage. The jack is exceedingly low, whereby it may be used on modern low type automobiles, and it has a comparatively great lift, whereby it may be used on the old type automobiles having comparatively high axles. The work saddle 17 is actuated at a very high speed until it comes into engagement with the axle, and thereafter the overflow valve 62 automatically opens to permit an ordinary amount of effort on the handle 8 to develop a very great pressure for lifting the load.

While I have herein shown preferred embodiments of my invention, it is to be understood that the invention is not limited to the precise structures herein set forth, the same being merely illustrative of the principles of the invention.

What I consider new and desire to secure by Letters Patent is:

A double cylinder pump comprising a casting constituting the base of the pump, said casting being formed with a pressure passageway at one side thereof and a sump at the other side separate from said passageway, a pump cylinder disposed therebetween, a pump plunger within the cylinder, the end of the plunger that extends into the cylinder having a longitudinally extending bore constituting a second cylinder, a stationary plunger extending into the second cylinder and having an axial duct for conveying fluid to and from the second cylinder, a conduit leading laterally from said pump cylinder into communication with the sump at said other side of the pump casting, a second conduit in axial alignment with said first conduit and extending from the opposite side of the cylinder to said one side of the pump casting into communication with said pressure passageway, a transverse passageway in the pump casting and communicating intermediately with said axial duct and at its ends with said sump and pressure passageway respectively, check valves in said conduits and at the ends of said transverse passageway, and a valved relief opening extending at an angle with respect to said second conduit and serving to establish communication between said cylinder and said sump.

EDWARD M. PFAUSER.