Jan. 13, 1948. J. J. MUELLER 2,434,282

HYDRAULIC JACK

Filed March 2, 1944 2 Sheets-Sheet 1

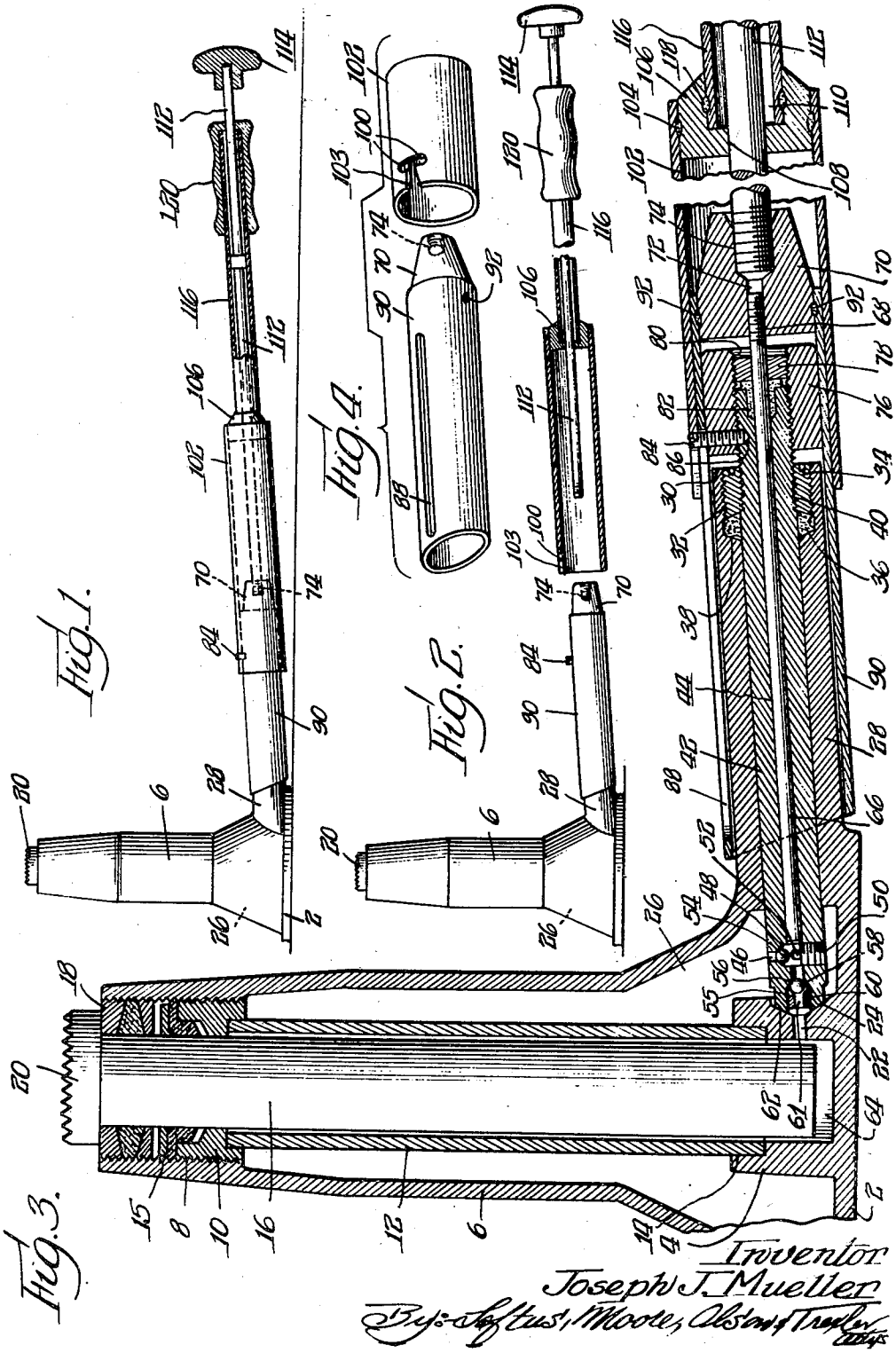

Fig. 1.

Fig. 4.

Fig. 2.

Fig. 3.

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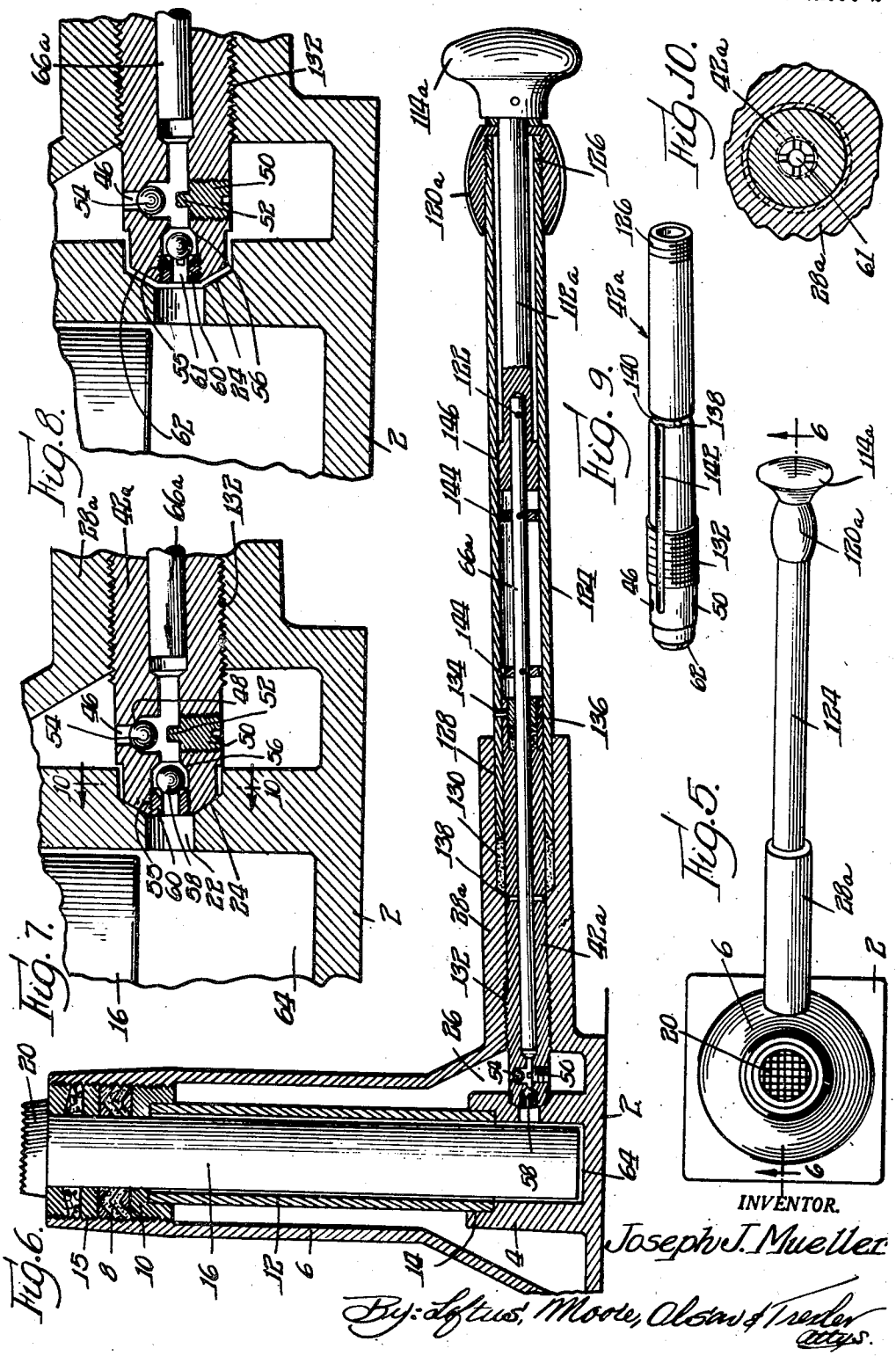

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# UNITED STATES PATENT OFFICE

2,434,282

## HYDRAULIC JACK

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9 Claims. (Cl. 60—52)

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This invention relates to pushing and pulling devices including jacks, and particularly hydraulically operated automobile jacks.

Among the objects of the present invention is to provide an hydraulically operated jack wherein the base is formed as an integral casting which is provided with but two bores, one bore in which is disposed the ram cylinder and ram which lifts the load, and in the other bore is disposed a high pressure pump cylinder and piston and the by-pass valve, whereby leakage of high pressure liquid is confined so that it escapes into the liquid reservoir formed in the base, preferably concentric about the ram cylinder, and whereby, since there are only two bores in the otherwise integral, imperforate base, the possibility of oil leakage otherwise to exterior surfaces of the jack is completely eliminated.

Another object of the invention resides in providing an hydraulic jack for automobiles wherein the pump cylinder is disposed substantially at right angles to the longitudinal axis of the ram cylinder and relatively close to the ground so that the jack may be placed under a low car and the pumping mechanism effectively operated from a point clear of the projecting portions at the base of the car and whereby also the by-pass valve for lowering the car may likewise be operated.

Yet another object of the invention resides in providing a jack mechanism wherein a portion of the operating handle of the jack is detachable from the remaining portions of the jack, whereby an otherwise extended and relatively long jack operating handle mechanism may be completely removed so as to provide a structure which is much less bulky and may be readily packed and shipped.

Another object of the invention resides in providing an hydraulic jack with a high pressure cylinder and piston and by-pass valve unitary structure which may be removed from the jack base as a unit and which is provided with a handle operating mechanism not only for actuating the high pressure pump piston but also for opening and closing the by-pass valve with respect to its seat on the jack body, and in addition means is provided so that a portion of this handle is detachable from the jack to facilitate packing or storage of the jack.

Yet another object of the invention resides in providing a hydraulic jack with a high pressure pump cylinder and piston and by-pass valve formed as a unitary structure, together with actuating mechanism therefor wherein the actuating mechanism is readily detachable from and attachable to the pump cylinder and by-pass valve to facilitate storing or packing.

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Other and further objects will be apparent from a perusal of the following specification when taken in connection with the accompanying drawings, wherein:

Figure 1 is an elevational view showing, partly in section, the completely assembled hydraulic jack with the handle extension in operating position;

Figure 2 is a view similar to Figure 1 showing the jack with the handle extension removed and to the right;

Figure 3 is an enlarged cross sectional view of the jack taken on a single plane through the central axis of the ram cylinder and pump cylinder, the pump piston and its connecting rod alone not being shown in section, and with the handle extension being broken away;

Figure 4 shows perspective views of associated parts of the handle extension structure;

Figure 5 is a plan view of a modified type of jack;

Figure 6 is a view of a modified type of jack construction shown in cross section, taken on the line 6—6 of Figure 5, wherein the handle is not removable;

Figures 7 and 8 are enlarged, detailed, fragmentary views of the valve mechanism, showing different operating positions;

Figure 9 is a detailed perspective view of the high pressure cylinder; and

Figure 10 is a cross sectional view taken on the line 10—10 of Figure 7.

Referring now to the drawings in detail, the jack shown in Figs. 1 to 3 comprises preferably an integral casting having a base 2 provided with a centrally disposed, upstanding annular wall 4 forming a central well and also having a concentrically disposed surrounding outside wall 6, which upstands a considerable distance. This wall 6 is threaded internally as at 8 at its upper end. The top of the outside walls 6 is open to threadedly receive an internal clamping ring 10 which holds a cylinder 12 between it and a countersunk portion 14 on the internal wall of the well 4. This cylinder 12 is the ram cylinder. In addition, above the ring 10 there is provided a packing member 15 and the slidable ram 16. A suitable threaded ring 18 clamps this packing 15 between it and the threaded ring 10.

The ram 16 is provided on its top with a load supporting, serrated surface 20. The space between the ram cylinder 12 and the exterior walls 6 of the jack forms and provides a reservoir 26.

A portion of the wall 4 is provided with a relatively short, radially extending passageway 22 which connects with a conical valve seat 24 formed in the outer face of the well wall 4. This port 22 is disposed substantially at right angles to the longitudinal central axis of the ram cylinder 16. The valve seat 24 opens into the reservoir 26. In addition, the integral base casting is provided with a sleeve-like extension 28 the central axis of which registers with the central axis of the radially disposed passage 22. In general this sleeve-like extension 28 is disposed more or less at right angles to the longitudinal axis of the ram cylinder 16. It forms preferably slightly less than a right angle with this longitudinal axis of the ram cylinder 16 so as to give the end of the pump operating member an elevation from the ground when the jack base lies on the ground. This integral sleeve 28 terminates as at 30 and is internally threaded as at 32 to accommodate the threaded packing ring 34 which confines the packing 36 against an inner wall 38 of the threaded internal countersunk portion of this sleeve-like extension 28. This packing ring 34 is in turn internally threaded as at 40 for reasons hereinafter set forth.

This integral basal sleeve 28 is provided with a central bore to receive a high pressure pump cylinder 42. This cylinder is substantially elongated and is in turn provided with a central bore 44. The inner end of the pump cylinder 42 is provided with a radially disposed passage 46 terminating in a valve seat 48 of larger diameter than the bore 46 A retaining plug 50 closes the opposite end of the bore. This retaining plug 50 is provided with a centrally disposed, projecting pin 52 adapted to engage a ball valve 54 when the valve moves away from its valve seat 48 whereby to keep the ball substantially close to the seat while permitting it to unseat. In addition, the end of the cylinder 42 is provided with a longitudinal threaded bore 55 which is preferably of larger dimensions than the central bore 44 of the pump cylinder 42 and this bore 55 is provided with a valve seat 56 onto which seats a ball valve 58. A centrally apertured, threaded plug 60 closes the end of the bore 55 and is suitably shaped to keep the ball relatively close to its seat while permitting the ball to unseat and to pass fluid through the central aperture 61 of this plug.

In addition, one of the wall portions of this pump cylinder 42 is formed as a valve. In the present instance the end 62 is conically formed, surrounding the plug 60 so as to seat against the conical valve seat 24 formed in the wall of the well 4 and concentrically surrounding the central radial conduit 22.

Means is hereinafter provided for shifting the combined pump cylinder 42 and valve 62 away from its seat 24 to provide a by-pass valve structure whereby to form a direct communication from the passage 22 directly into the reservoir 26 so that the chamber 64 beneath the ram 16 may be connected with the reservoir directly.

It will thus be seen that the packing 36 serves to prevent the escape of any oil in the reservoir 26 between the outer annular face of the pump cylinder and the inner wall of the sleeve 28.

The high pressure pump cylinder 42 is provided with a relatively long, rod-like pump piston 66 which is adapted to reciprocate in the bore 44 of the pump cylinder. This rod is threaded on its outer end as at 68 to connect with a head 70 having a central threaded bore 72 and a connected larger threaded counterbore 74. An internally



threaded collar 76 engages the threads 40 on the outer end of the pump cylinder 42 beyond the end 38 of the barrel-like extension 28 of the base. An externally threaded and centrally bored ring 78 has its outer threads engaging the internal threads 80 of the collar 76 whereby to compress a packing 82 around the pump piston 66 to prevent leakage of oil therepast. The head 76 is likewise cross bored to receive a threaded pin 84, the inner end of which engages the pump cylinder 42 as at 86. The outer portion of this pin 84 passes through a slot 88 on a guide sleeve 90 surrounding the sleeve-like extension 28 of the base. The function of this sleeve is to prevent the piston 66 from being flexed or bent laterally when the piston is drawn outwardly relatively to the piston bore 44 in the operation of the pump. The outer end of the sleeve 90 is welded to the outer face of the head 70 as at 92. The outer end of the pin 84 projects through a bayonet slot 100 in another sleeve 102 which surrounds the outer end of the sleeve 90. This outer sleeve 102 encloses the head 70 and is welded as at 104 to a collar 106 having an internal bore 108 and a countersunk portion 110 connected therewith. The bore 108 of this collar receives a rod 112, the inner end of which is threaded to engage the threads 74 in the head 70. The outer end of this rod 112 is provided with a handle 114 whereby the piston 66 may be reciprocated in its cylinder through the threaded connection of the rod with the head 70 which in turn is threaded to the outer end of the piston 66. The pin 84 is normally confined in the wider portion of the bayonet slot 100 of the sleeve 102 but may pass through the open-ended slot 103 of this bayonet slot when in registry therewith, whereby the pin is disconnected from the sleeve 102.

A tube 116 is welded as at 118 to the inner face of the counterbore 110 of the collar 106. This tube 116 surrounds the rod 112 and extends outwardly from the main body of the pump means and is provided with a turnable handle 120. Thus by turning the handle 120 the tube 116 is turned, the ring 106 is turned, the sleeve 102 is turned, and through the bayonet slot and pin connection 84 which in turn is connected to the cylinder 42, the pump cylinder 42 is turned so that the threads 40 will unscrew from the threaded ring 32 threadedly mounted in the outer end of the stationary sleeve 28. By means of this threaded connection 40 and the above described turning movement, the combined pump cylinder and by-pass valve 62 is backed away from the by-pass valve seat 24 whereby to open the by-pass valve. A turning movement in the opposite direction reseats the by-pass valve.

In order to detach the relatively long handle from the sleeve 90 and head 70 which are connected to the extension 28 and pump cylinder 42, so as to leave the jack construction substantially as shown in Figure 2, the handle 120 is turned in the appropriate direction to center the pin 84 with the slot 103 of the bayonet joint. Thereupon the sleeve is pulled outwardly away from the pin 84, completely to detach this sleeve from the pin as shown in Figure 2. This sleeve, through its welded connection 104, will then carry with it the collar 106. Prior to this, however, the rod and handle 112 and 114 must be turned in the appropriate direction to unscrew the rod 112 from its threaded connection 74 with the head 70, thereby permitting the rod and handle assembly shown in Figure 2 to be detached as a unit from the jack unit shown in Figure 3. This

considerably shortens the jack for storage purposes and completely removes the outer portion of the pump operating and by-pass operating mechanism.

When it is desired to remove the pump cylinder and by-pass valve as a unit, starting with the assembly shown in Figure 2, the pin 34 is completely removed first. Next the sleeve 30 can be withdrawn bodily from the barrel or lateral extension 28 of the jack base. Then by means of a special wrench which fits wrench sockets in the end of the ring 34, this ring may be removed, the ring may be unscrewed from the barrel 28 and the unscrewing of this ring carries with it the combined pump cylinder and by-pass valve structure as a unit from the barrel-like extension 28 of the jack. The pump cylinder in turn may be removed from the ring by unscrewing after it has been withdrawn from the barrel.

When the complete structure is assembled, as shown in Figures 1 and 3, it will be understood that upon reciprocation of the handle 114 the high pressure pump piston 66 will be reciprocated in a manner such that on the outstroke oil or liquid will be drawn through the port 46, past the ball valve 54, into the high pressure pump chamber 44. In this outward movement the ball valve 56 will seat. Upon the inward movement of the pump piston 66 the ball valve 54 will close and the ball 58 will open, thereby permitting this liquid to be passed through opening 61, see Figure 3, in the plug and thence through the radial passage 22 to the chamber 64 beneath the ram, whereby to force the ram upwardly as the pumping progresses. When it is desired to lower the ram, the handle 120 is turned in the proper direction whereby to back off the threaded connection 40 with the threads of the ring nut 32 in turn connecting with the stationary sleeve 26, whereby to back the by-pass valve 62 from its seat 24 so as to permit the liquid in the chamber 64 to pass through conduit 22, thence in the passage now formed by the valve 62 spaced away from its seat 24 so that the liquid will flow directly into the reservoir 26.

Referring to the modified construction as shown in Figures 5 to 10, inclusive, wherein the operating handle extension is not removable but is part of the permanent structure of the jack, in this modified device the jack body, ram cylinder, and the valve operating mechanism is approximately the same as in my first form shown in Figures 1 to 4 inclusive, but as will be noted, the high pressure piston 66a is directly connected to the handle operating rod 112a by the pin 122. An outer sleeve 124 is externally threaded at its outer end as at 126 to receive a knob 120a, and its opposite end is positioned in an internal bore 128 of the extension 28a of the jack body. A packing 130 is disposed between the end of the sleeve 124 and the end of the bore 128 to prevent leakage of fluid from the reservoir 26.

Disposed in the sleeve 124 and the extension sleeve 28a is the high pressure cylinder 42a, as shown in Figures 6 and 9, having threaded engagement as at 132 with the extension sleeve 28a, the opposite end of the cylinder being connected by a pin 134 to the outer sleeve 124 and being rotatable therewith. A packing gland 136 is situated at the end of the high pressure cylinder to prevent leakage of fluid. A cross bore 138 and an annular groove 140 connect with a longitudinal groove 142 to form a return conduit for any fluid that might escape around the outer surface of the high pressure piston 66a.



A pair of guide washers 144 in combination with the head 146 act to guide the high pressure piston 66a as it is drawn outwardly when in operation.

It will be understood that operation of this device is the same as that shown in Figures 1 to 4 inclusive, and that upon reciprocation of the handle 114a the valves operate to control the flow of fluid to raise the ram piston 16. Upon rotation of the knob 120a the sleeve 124 will rotate the cylinder 42a through the pin 134 and move the end of the cylinder 62 away from the valve seat 24, due to the threaded engagement 132 with the extension 28a, to release the fluid past the valve 62 and into the chamber 26, to lower the jack.

Obviously the invention is not limited to the specific details of construction disclosed herein but is capable of other modifications and changes without departing from the spirit and scope of the appended claims.

The invention is hereby claimed as follows:

1. An hydraulically actuated jack comprising an upright casting having an internal, centrally disposed, upstanding integral wall providing a well, a cylinder having its lower end mounted on the walls forming said well, said cylinder passing through a first bore formed in the casting, a ram in said cylinder, a portion of the integral wall of said well having a relatively short lateral passage extending laterally thereof and therethrough and substantially at right angles to the longitudinal central axis of said ram cylinder, the outer wall of said well concentrically about the central axis of said short lateral passageway being formed with a valve seat, said casting being provided with an integral relatively long, sleeve-like extension forming a second bore in the casting, the longitudinal central axis of which second bore registers with the central axis of said relatively short passage, said two bores constituting the only bores formed in the casting, a sleeve-like high pressure pump cylinder in said second bore and a pump piston in said pump cylinder, the inner end of said pump cylinder being provided with passageways and valve means controlling the same, the inner end of said pump cylinder being formed as a valve to seat upon said valve seat, and means carried by the outer end of said pump cylinder beyond the outer end of said long sleeve-like extension for reciprocating said piston and for shifting the inner end of said cylinder away from the valve seat.

2. In an hydraulic jack, in combination with a base having a bore, a ram cylinder in the bore, and a ram in the cylinder, the base being hollowed to provide a liquid reservoir, said base having a projecting, elongated sleeve integrally formed therewith and carrying a threaded portion, a pump cylinder mounted in said sleeve and threadedly engaging said threaded portion of said sleeve, a second sleeve telescopingly surrounding the first sleeve, a centrally apertured head threadedly engaging the threaded outer portion of said pump cylinder, detachable means interconnecting said second sleeve, the head and the pump cylinder, a second centrally apertured head connected to said second sleeve, a piston in said pump cylinder and connected to said second head, a piston operating rod threadedly connected to said second head and having a central axis registering with and extending in the line of the central axis of the piston, a third sleeve surrounding the second sleeve, a third head connected to said third sleeve, said third head re-

ceiving the piston operator therethrough, and a fourth sleeve connected to the third head and surrounding the piston operator, a handle connected to said last named sleeve for turning the latter, a handle connected to the outer end of the piston operator, and detachable means interconnecting the third sleeve with the second sleeve, said second sleeve having a slidable connection with said first mentioned sleeve.

3. In an hydraulic jack, the combination of a jack body bored to provide a ram cylinder and a liquid containing reservoir, a ram in the cylinder, said jack body having an angularly disposed elongated sleeve, a passage communicating with the ram cylinder and terminating in a valve seat, a pump cylinder in said first mentioned sleeve, said pump cylinder having a portion forming a by-pass valve to close upon said valve seat, a piston in said pump cylinder, means forming a connection between said pump cylinder and said sleeve to cause said sleeve to shift the by-pass valve against or away from its seat, the inner end of said pump cylinder being formed with passages and valves to connect the reservoir with the pump chamber of the pump cylinder and the pump chamber with the ram cylinder, a reciprocable, elongated piston actuator having an actuating handle on its outer end, means forming a detachable connection between said actuator and the piston, a turnable sleeve surrounding said actuator and a handle therefor for turning the same, and means detachably interconnecting said last mentioned sleeve and said pump cylinder whereby on turning the same said pump cylinder will be shifted relative to the valve seat to relieve the ram cylinder, the detachability of said last mentioned means permitting said actuating handles and a portion of the connections to be removed from the remainder of the jack to render the jack more compact.

4. In an hydraulic jack, the combination of a base having an upstanding ram cylinder and a surrounding liquid reservoir, a ram in the ram cylinder, said jack body forming an elongated sleeve, a pump cylinder disposed in said sleeve and a piston in said pump cylinder, valve means in the pump cylinder cooperating with the piston for passing liquid from the reservoir into the pump cylinder and from the pump cylinder to the ram, a by-pass valve associated with said ram cylinder and said reservoir, said by-pass valve being carried by said pump cylinder, a piston actuator forming a projection of said piston, and means detachably interconnecting said actuator and piston for reciprocating the piston, a turnable sleeve, means interconnecting said last mentioned sleeve with said pump cylinder for turning the latter, whereby to shift said by-pass valve relatively to its seat and to relieve the ram cylinder, and means forming a detachable interconnection between at least two of said sleeves to permit a portion of the piston reciprocating and cylinder turning means to be detached from the remainder of the jack structure to render the jack more compact for storage or shipment.

5. An hydraulic jack comprising a base bored to receive a ram cylinder and providing a surrounding liquid containing reservoir, a ram in the cylinder, said base having a second bore disposed angularly with respect to its first bore, the base having a valve seat around said second bore and connecting the ram cylinder with the reservoir, a pump cylinder having an end formed as a valve adapted to close upon said valve seat, a piston in said pump cylinder, there being valves and



passages to interconnect the reservoir with said pump cylinder and the pump cylinder with the ram cylinder, said base having an extension forming a first sleeve about said pump cylinder, said first sleeve and pump cylinder having interengaging means to cause the shifting of said valve seat with respect to the first valve, a pair of overlapping sleeves, the inner of said overlapping sleeves having a slot therethrough, and the outer overlapping sleeve having a bayonet joint communicating with the end of said pump cylinder, a pair of heads enclosed by said overlapping sleeves, the first of said heads being rigidly connected to the inner overlapping sleeve, the second head being connected to the pump cylinder, and a threaded pin lying in the bayonet slot of the outermost of said overlapping sleeves and lying in the elongated slot of the innermost of said overlapping sleeves and passing through said second head and being connected to the pump cylinder, a fourth sleeve, a detachable piston reciprocator guided in said fourth sleeve and connected to said first head, means interconnecting the fourth sleeve with the outermost of the two overlapping sleeves so that they will turn together, and a turning handle on said fourth sleeve, said threaded pin and bayonet slot forming a connection whereby said outermost of said two overlapping sleeves, said detachable piston reciprocator and pump cylinder turning mechanism may be detached from said jack, its pump cylinder and connected slotted overlapping sleeve whereby to render the jack more compact.

6. In an hydraulic jack, in combination with a base having an upstanding ram cylinder and ram therein, said base having a laterally projecting high pressure pump cylinder, the central axis of which is disposed substantially ninety degrees from the central axis of the upstanding ram, a piston in said pump cylinder and a relatively long piston actuator extending outwardly thereof and connected thereto for reciprocating said piston, a by-pass valve integrally carried by said pump cylinder and a relatively long actuator extending outwardly of said pump cylinder and having a handle thereon for turning said by-pass valve, said handle for said valve turning means and said actuator for said piston reciprocating means being disposed adjacently when the piston is in its innermost position, both of said actuators extending substantially outwardly from the base of the jack substantially at right angles to said ram cylinder whereby said jack may be inserted under an automobile chassis to raise the chassis and whereby said actuators are accessible from a position clear of the body of the automobile.

7. In an hydraulic jack, the combination with a base having a centrally disposed internal upstanding wall forming a well, a sleeve upstanding from said well to form a ram cylinder, said base having a concentrically surrounding, upstanding integral casing disposed in spaced but substantially close proximity to said ram cylinder to form a liquid reservoir, a part of the integral casing surrounding the upstanding wall having an integral laterally projecting, elongated sleeve provided with a threaded portion, and the outer face of said internal wall of said base opposite said sleeve being formed as a valve seat disposed directly in said reservoir, the wall centrally of said valve seat being bored to connect with said ram cylinder, a high pressure pump cylinder disposed in said lateral elongated sleeve and threadedly connected to the threaded portion of said elongated sleeve, a piston reciprocable in said

pump cylinder, said pump cylinder having an integral portion formed on its inner end as a valve conformed to close upon said valve seat, said integral end of said pump cylinder having valve passages interconnecting said reservoir and said ram cylinder upon reciprocation of said piston, and means for turning said pump cylinder through its threaded connection with said elongated sleeve to move said valve relatively to its seat.

8. In an hydraulic jack, in combination with a basal casting having integral inner walls and outer walls, the inner walls providing the bottom portion of a ram cylinder and the outer walls providing a liquid reservoir thereabout, a cylinder mounted in said inner walls, a ram in said cylinder, a valve seat formed on the outer surface of said inner walls and having a passage communicating interiorly with the ram cylinder, the outer wall of the basal casting of the jack having a long integral sleeve-like extension providing a bore the central axis of which coincides with the central axis of said valve seat, a high pressure pump cylinder in said bore, the inner portion of said pump cylinder having an integrally formed valve to close on said valve seat, a piston in said pump cylinder, the longitudinal axis of said pump cylinder being angularly disposed with respect to the longitudinal axis of the ram cylinder, and actuating means for reciprocating said piston, and for turning said pump cylinder from a point beyond the end of the long sleeve-like extension whereby positively to shift the by-pass valve with respect to its seat.

9. In an hydraulic jack, in combination with a one-piece basal casting including a base portion having internally formed and centrally disposed upstanding annular walls forming a well, a sleeve secured to said wall and upstanding therefrom to form a ram cylinder, said base having walls upstanding concentrically around and in spaced relation to said cylinder to provide a reservoir, said base having a sleeve-like, elongated, integral extension projecting angularly to said ram cylinder, said extension substantially corresponding in length to the major portion of the height of said ram cylinder and said extension adjacent its end being internally threaded, a packing and a threaded ring, said threaded ring engaging the internal threads of said extension and serving to hold said packing in position, a relatively long,



tubular member disposed in said extension, said tubular member forming a high pressure pump cylinder, an elongated piston disposed in the bore of said pump cylinder, the outer end of the piston extending beyond the outer end of said pump cylinder, the inner end of the pump cylinder being suitably ported and provided with valves connecting the pump cylinder with the reservoir and with a port leading to the ram cylinder, the inner end of said pump cylinder being formed as a relief valve, the internal walls of the base of said jack being provided with a valve seat, the center of which is in line with the central axis of said pump cylinder, said valve seat being bored and connected to the ram cylinder, means disposed beyond the end of said extension on the base connecting with the high pressure pump piston for reciprocating said high pressure pump piston in the pump cylinder, and a tubular handle surrounding said pump piston reciprocating means and turnable with respect thereto and with respect to said extension of the base and connected with said high pressure pump cylinder for causing the threaded portion of said high pressure pump cylinder to turn with respect to their engaging threads and with respect to the extension of the base for turning the high pressure pump cylinder with respect to its valve seat to seat and unseat the relief valve on the inner end of said high pressure pump cylinder relatively to its valve seat.

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