Feb. 28, 1950 J. J. MUELLER 2,498,698

HYDRAULIC JACK

Filed Jan. 28, 1944 2 Sheets-Sheet 1

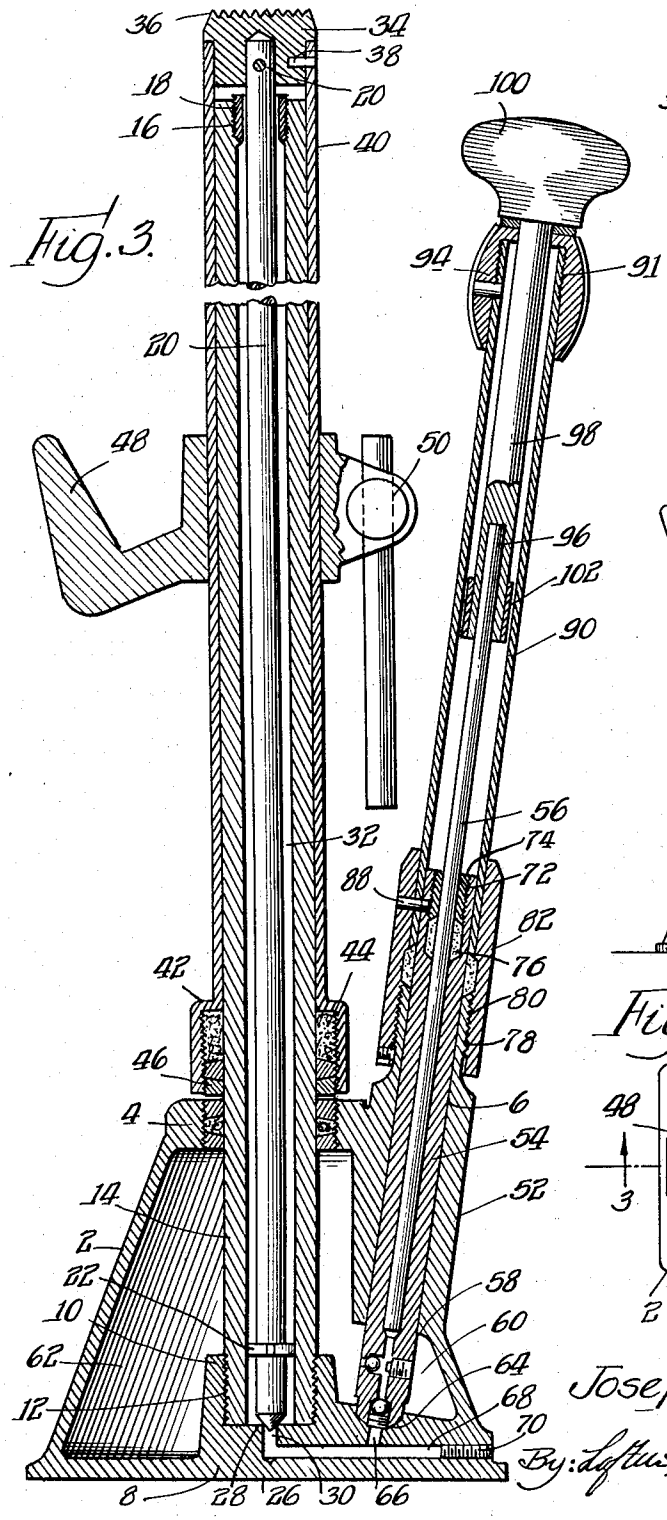


Fig. 3.

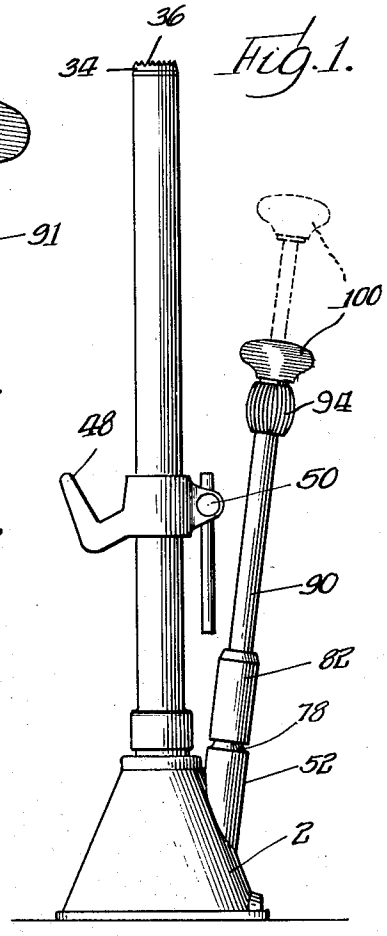


Fig. 1.

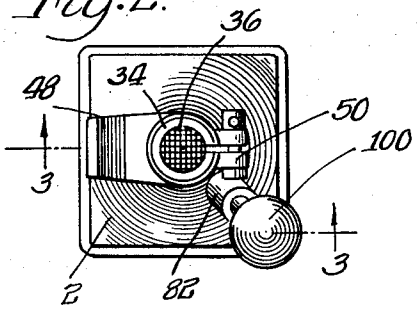


Fig. 2.

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Feb. 28, 1950 J. J. MUELLER 2,498,698

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Filed Jan. 28, 1944 2 Sheets-Sheet 2

Fig. 4.

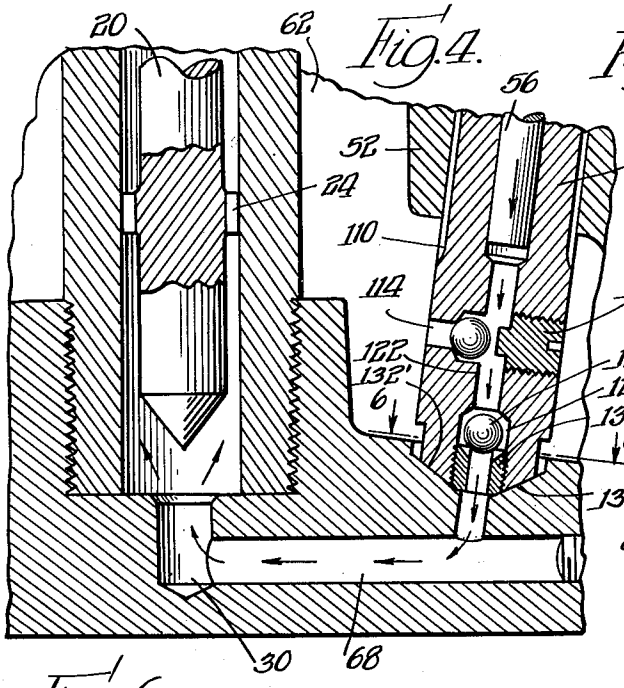


Fig. 5.

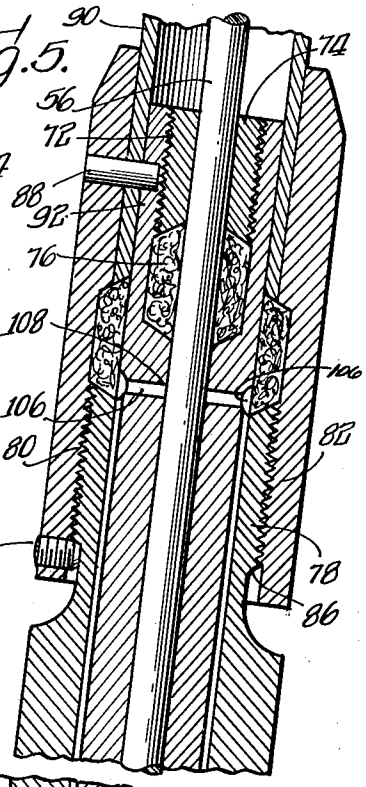


Fig. 6.

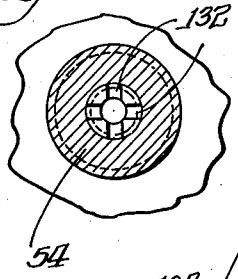
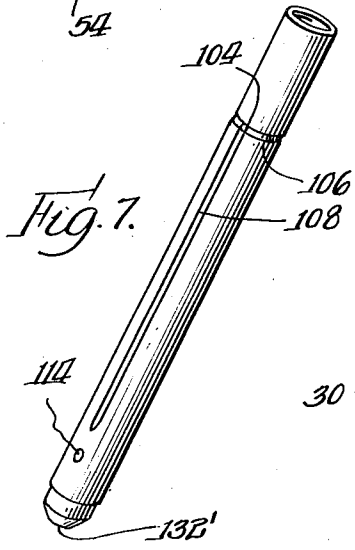
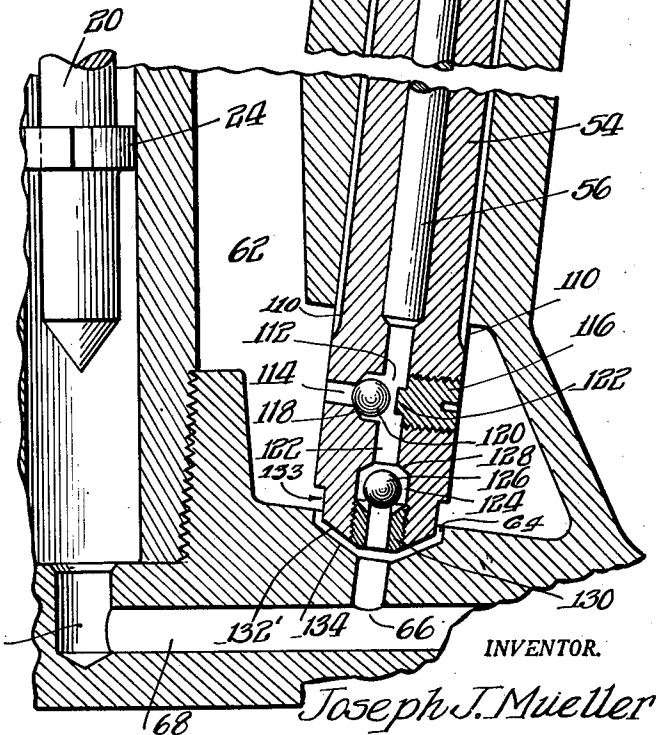


Fig. 7.





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Patented Feb. 28, 1950 2,498,698

UNITED STATES PATENT OFFICE

2,498,698

HYDRAULIC JACK

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Application January 28, 1944, Serial No. 520,008

10 Claims. (Cl. 60—52)

1

This invention relates to hydraulic jacks and other pushing and pulling devices.

Among the objects of the present invention are to provide an hydraulic jack wherein the pumping cylinder is shiftably mounted and includes a valve portion cooperating with a stationary valve seat and arranged to by-pass the high pressure liquid from the ram cylinder back into the reservoir, whereby the provision of a separate release or by-pass valve is eliminated; to provide an hydraulic jack wherein the base is provided with two main bores, one of said bores receiving the ram cylinder and ram and the other of said bores receiving the high pressure cylinder and piston, the usual check valve mechanism for automatically transferring liquid from the reservoir to the pump cylinder and thence to the ram cylinder, and likewise by-pass valve mechanism for by-passing liquid from the ram cylinder back into the reservoir, together with means projecting through the second mentioned bore and extending exteriorly of the jack for operating both the pump piston and the by-pass valve mechanism; to provide an hydraulic jack or other hydraulic pushing or pulling device wherein the by-pass valve is mounted in the same bore in which the high pressure pump is mounted, and wherein the mechanism for actuating the by-pass valve projects from said bore exteriorly of the jack and is operable independently of the movement of the high pressure pump piston; to provide an hydraulic jack wherein the by-pass valve is mounted in the same bore with the high pressure pump cylinder and piston and is operated exteriorly of and projects exteriorly from said bore, being provided with a micrometric adjusting mechanism actuated independently of the pump piston whereby a very fine opening of the by-pass may be provided to provide a nice control for the descent of the hydraulic ram; to provide an hydraulic jack mechanism or the like wherein the by-pass valve is associated with the high pressure pump cylinder but is operable by means projecting through and exteriorly of the bore in which the pump cylinder is located, whereby the provision of a separate bore is eliminated and whereby the ram cylinder may be relieved of its pressure without a compression movement of the high pressure pump piston; to provide an hydraulic jack providing two main bores, the one housing the ram cylinder and ram, the other housing the high pressure pump cylinder and piston, the check valve mechanism, the by-pass valve and its actuator, the latter extending through said second bore to the exterior of the

2

jack, and a third relatively smaller boring connecting the ram cylinder with the pump cylinder, which third boring extends to the exterior face of the jack and is plugged thereat whereby the number of internal borings within the jack base which extend to the exterior of the jack is reduced to three, whereby to cut down the likelihood of leakage of high pressure liquid to the exterior surface of the jack; to provide an hydraulic jack wherein the control mechanism for the by-pass valve is mounted on the same extension handle on which the high pressure pump piston is mounted, whereby to provide a compact control mechanism both for the by-pass valve and the pump piston, both of which are mounted in a common bore in the base; to provide a simple means for preventing the escape of liquid from the high pressure pump cylinder and for returning the same back into the reservoir; to provide a simple construction of pump cylinder including internal borings adapted to receive the usual type of check valve mechanism and whereby also a portion of the pump cylinder, preferably the bottom end thereof, is formed as a release valve, and in further arranging the pump cylinder in a shiftable manner relative to the base, whereby the pump cylinder functions also as a by-pass valve; to provide these and other objects of invention as will be apparent from a perusal of the following specification when taken in connection with the accompanying drawings, wherein:

Figure 1 is a perspective side view of one form of my hydraulic pushing and pulling device, herein shown as a jack for lifting;

Figure 2 is a plan view of the jack as shown in Fig. 1;

Figure 3 is a section taken on the line 3—3 of Figure 2;

Figure 4 is an enlarged sectional view of the lower portion of the jack shown in Figure 3;

Figure 5 is a similar view showing the release valve relieved from its seat to pass the liquid from the ram cylinder back into the reservoir;

Figure 6 is a sectional view taken on the line 6—6 of Figure 4; and

Figure 7 is a perspective view of the outer wall of the pump cylinder.

Referring now to the drawings in detail, the hydraulic jack herein shown is for purposes of exemplification only, and not by way of limitation upon the invention. The jack comprises a basal casting 2, preferably formed as a single integral casting and providing a main bore 4 and a second bore 6. The base 8 of the casting is

provided with a central upstanding boss 10 forming a central well. The interior walls of the boss 10 are threaded as at 12 to receive the elongated, centrally bored ram cylinder 14. The upper, inner wall of the ram cylinder is threaded as at 16 to receive therein a corresponding threaded guide bearing 18 which is formed as a hollow sleeve. The ram cylinder 14 receives therein a ram piston valve rod 20, the lower portion of which is provided with a guide ring 22 which, as shown in Figure 4, is provided with passageways 24 therethrough to permit liquid to flow therethrough. The extreme lower end of this valve rod 20 is conically formed as at 26 to close upon a valve seat 28 formed in the casting about the central longitudinally disposed axial bore 30 of the base, which bore 30 registers with the space 32 between the valve rod 20 and the inner wall of the ram cylinder 14. Above the bearing 18 the valve rod 20 is pinned to a lifting ram head 34 provided with a roughened ram top 36 to receive a load. In addition this head 34 has pinned thereto as at 38 an outer sleeve 40 constituting a ram which extends downwardly and at its base is enlarged as at 42 to receive a packing 44 which packing snugly rests against the outer wall of the stationary ram cylinder 14 and seals the same. The packing includes the usual packing closure members 46 which threadedly engage the interior threaded wall of this enlarged portion 42. In addition the sleeve 40 has an adjustably shiftable load carrying member 48 which may be clamped by means of the mechanism shown at 50 vertically adjustably on the ram sleeve 40 whereby a second load carrying member is provided for the ram head 36. This second load carrying member is shaped to receive a bumper therein.

The second bore 6 of the base is disposed with its axis located at an acute angle with respect to the longitudinal axis of the first mentioned bore 4, and this bore 6 is formed in a lateral sleeve-like enlargement 52 which is integral with the base 2. This bore is utilized as a means to house therein the high pressure pump cylinder 54 and its piston 56 which reciprocates within the pump cylinder 54. This bore terminates as shown at 58 to provide a lateral extension 60 of the fluid reservoir 62 which is disposed within the base 2 concentrically surrounding the ram cylinder 14.

An internal wall of the base opposite the lower end of this bore 6 is provided with a release valve seat 64 and this seat communicates with a short conduit or passage 66 which forms a restricted extension of the bore 6 and is coaxial with the central axis of this bore 6.

In addition the base is provided with a lateral or radially disposed, relatively small bore 68 which extends from the bore 30 to the exterior of the jack at which it is plugged by means of the threaded plug 70 whereby this bore is closed. The pump cylinder extends upwardly and at its top is provided with an internal thread 72 to receive a threaded plug 74 to enclose a packing 76 which is adapted frictionally to grip the outer wall of the high pressure pump piston 56 to seal off the lubricant or other fluid which may attempt to escape therepast.

In addition the tubular portion 52 of the main base casting extends upwardly as at 78 and is threaded exteriorly as at 80 to threadedly receive the inner threaded walls of a short sleeve 82. A stop plug 84 is threaded through a bore in the lower portion of this sleeve 82 and is adapted to

contact the lowermost thread portion 86 of this sleeve, whereby to prevent the sleeve from being screwed outwardly beyond a predetermined point relative to the tubular housing 52.

This sleeve 82 at its upper end is pinned as at 88 to an elongated sleeve 90, and in addition this pin 88 passes inwardly through and is pinned likewise to the upper end 92 of the high pressure pump cylinder 54. The upper end of the sleeve 90 has pinned thereto a turning handle 94 which in turn is also threaded at 91 to the upper end of this sleeve 90. In addition the upper end 96 of the high pressure piston is force fitted into a socket in the lower end of a handle extension 98, the outer end of which is provided with a knob 100 for reciprocation of the piston, and there is a guide sleeve or bearing 102 disposed between the outer surface of the lower portion of the handle extension 98 and the inner wall of the sleeve 90 to assist in maintaining alignment during reciprocation of the high pressure pump piston.

In addition the outer wall of the pump cylinder is provided at its upper surface with an annular groove 104, see Figure 7, which in turn is provided with internal radially disposed bores 106, the inner ends of which at 108 connect with the outer wall of the high pressure pump piston. The annular groove 104 communicates with a longitudinal groove 108, the lower portion of which extends downwardly and terminates as at 110 at that portion of the outer wall of the high pressure pump cylinder which is disposed below the tubular housing or sleeve 52. That is, it is disposed within the reservoir 62 so that during the pumping movement any lubricant which moves upwardly around the piston will flow outwardly through the channels 106 to the annular groove 104, thence down the longitudinal groove 108 and back into the reservoir.

The high pressure pump cylinder is bored longitudinally of its central longitudinal axis to receive the pump piston 56 and this bore extends, as at 112, in a restricted manner beyond the lowermost point at which the pump piston in its extreme downward position rests, and the lower portion of the restricted bore 112 communicates with an internal radial bore 118 which in turn is provided with the restricted portion 114 communicating with the reservoir 62. This bore is closed by the plug 116. The bore at 118 is provided with a valve seat against which a check valve ball 120 is adapted normally to seat on the downward movement of the piston, and the plug 16 is provided with a lug 122 to keep the ball 120 approximately close to its seat but to permit it to move therefrom to permit liquid to be drawn from the reservoir into the pump cylinder chamber. In addition, the lower portion of the pump cylinder 54 is provided with a bore 122 which forms a continuation of the bore 112 but is disposed below the ball 120 and this continuation 122 is enlarged as at 124 to receive an additional check valve ball 126. A valve seat 128 is provided against which the ball normally seats upon the upward movement of the high pressure pump piston so as to prevent liquid being drawn from the ram cylinder into the pump cylinder. In addition, the outer end of the bore 124 is threaded to receive a hollow plug 130 having radial passages 132, as shown in Figure 6, to permit the ball 126 to rest on the plug while at the same time permitting the free passage of liquid therethrough while the ball is so resting.

In addition, this plug keeps the ball relatively close to its valve seat while permitting it to shift away therefrom.

The lower portion of the high pressure pump cylinder has its lower portion formed conically to provide a release valve **132'** to register with a similarly formed conical valve seat **134** formed in the wall of the base concentrically about the conduit **66**. The lower outer wall of the release valve **132'** is of smaller diameter as at **133** to assist the flow of liquid when the release valve is open as in Figure 5. This conduit, as hereinbefore explained, connects with the laterally formed conduit **68** which in turn connects with the axially disposed conduit **30** of the ram cylinder.

The operation of the device is such that upon reciprocation of the handle **100**, as shown in dotted lines in Figure 1, the high pressure pump piston **56** will be operated on the upstroke to draw liquid from the reservoir past the ball valve **120** into the high pressure pump cylinder, the ball **120** being drawn from its seat **118** and the ball **126** being pulled to its seat **128**. Upon the downward movement of the pump piston this liquid will be forced under high pressure past the ball **126** which is now forced from its seat, the ball **120** being forced onto its seat **118**. Thus the liquid will be transferred via the passages **124**, **66**, **68** and **30** into the ram cylinder to raise the ram, as shown in Figure 4. At this time the by-pass valve **132'** will be closed on its seat. Upon a series of reciprocations the ram will be advanced upwardly to raise the load.

When it is desired to by-pass or release the liquid in the ram cylinder back into the reservoir whereby to lower the jack, the handle **94** is turned, which by means of the connection **88** turns the high pressure pump cylinder **54** relatively to its threaded connections **80**, whereby to raise the release valve **132'** from its seat **134**. It will be noted that this is a micrometric adjustment so that the ram may be lowered gradually and without shock. In addition, it will be noted that the opening of this release valve is independent of any reciprocal movement, and particularly any compressive movement of the high pressure piston, so that it will not be necessary to increase the pressure within the ram cylinder in order to open the by-pass valve.

It will be further evident that by arranging the release valve and the check valves in the same cylinder in which the high pressure pump cylinder and piston are located, and particularly by arranging so that the release valve may be operated exteriorly of the jack from and through the very bore in which the high pressure pump cylinder is disposed, I have been able to eliminate the use of a separate bore for the release valve, am able to eliminate the use of the high pressure pump piston as an actuator for this release valve, and am able to position the release valve actuator at a point where it can be readily actuated and by the same handle which actuates the high pressure pump piston, or relatively close thereto.

It will also be evident that by thus arranging the valve elements of this hydraulic jack I am able to greatly simplify and reduce to three the number of borings that are required to be made through the base of the casting internally thereof to the exterior thereof, whereby to cut down the danger of leakage of high pressure oil from the interior of the jack to the exterior face of the jack.

It will be evident, by reference to Figure 3,

that the conical valve on the lower end of the rod **20** is adapted to seat against the seat **28** surrounding the passage **30** so that when the ram descends to its lowermost position, escape of liquid from the ram cylinder **32** back through the passages **68**, **66**, and thence into the reservoir **60**, is prevented when the release valve **132'** is open. Thus this valve eliminates drainage of the liquid in the ram cylinder **32** when the ram is in its lowermost position so that the amount of pumping necessary to start the ram on its upward stroke will be cut down to a minimum.

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.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. In an hydraulic jack, a base, means mounted upon the base and cooperating therewith to form a ram cylinder and a liquid reservoir, a ram telescoping the ram cylinder, said base having means forming a tubular wall disposed angularly of said ram cylinder and forming a bore opening into the reservoir, said base in line with said bore providing an internally formed valve seat disposed in said reservoir, means formed in said base connecting the central portion of said valve seat with the ram cylinder, a pump cylinder having an internal central bore extending therethrough from end to end, said pump cylinder being shiftably mounted in said basal bore and having its lower end projecting into the reservoir, a piston reciprocable in said pump cylinder bore, said pump cylinder having that portion which projects into the reservoir provided with a valved passage connecting the reservoir with that part of the central bore in which the piston reciprocates, and the outer wall of said pump cylinder inwardly of said valved passage being formed integrally as a release valve to close upon said internally formed valve seat to prevent liquid passage from said ram cylinder to said reservoir, the lowermost end of the central bore of said pump cylinder and of said release valve connecting with said valved passage, means disposed exteriorly of said pump cylinder and beyond the outer end of the angularly disposed bore of said jack for reciprocating the piston and for shifting said pump cylinder and its integral release valve for moving said valve from said internally formed valve seat so as to return liquid from said ram cylinder back to said reservoir.

2. In an hydraulic jack comprising a base having a substantially centrally disposed ram cylinder, the walls of the base projecting upwardly surrounding the ram cylinder to provide a reservoir and a laterally disposed portion having tubular walls forming a bore disposed angularly to the ram cylinder, the lower portion of said base in line with said angular bore being formed as a valve seat, said base including a passage interconnecting the central portion of said valve seat with said ram cylinder, said angularly disposed bore also connecting with said reservoir, an elongated hollow pump cylinder sleeve mounted in said bore and having its lower end provided with valved passages connecting directly with the reservoir and with the central hollow portion of said sleeve, a pump piston operable in said sleeve, the lower portion of said sleeve being conically formed and bored to connect with said internal bore of said sleeve, the exterior

walls of said jack that form said angularly disposed bore being threaded, a second sleeve engaging said threads, means including a third sleeve connected to said first mentioned sleeve, operably interconnecting said three sleeves, said piston having an extension reciprocable in said first mentioned sleeve and extending through said third sleeve and provided on its outer end beyond said third sleeve with a handle, and a second handle mounted on the outer end of said third mentioned sleeve for turning said pump cylinder sleeve.

3. A unitary high pressure pump cylinder and release valve for an hydraulic jack comprising an elongated metal member having opposed open ends and a centrally formed, interconnecting bore, said bore of said member being formed as a piston receiving chamber and one end of the member about said central bore being formed with a concentric valve seat providing for liquid discharge through said one end of said central bore, a valve for said concentric valve seat for controlling said discharge port, said member relatively adjacent but spaced from said one end having a lateral port through the wall of said member connecting with the internal bore of said member and forming a liquid inlet to said piston chamber, said lateral port including an internally formed valve seat, a valve for the valve seat of said liquid inlet, said one end of said member concentrically surrounding said discharge port being formed as a release valve.

4. A unitary high pressure pump cylinder and release valve for an hydraulic jack comprising an elongated metal sleeve, the bore of the sleeve being formed as a piston receiving chamber and internal wall of the bore of the sleeve adjacent but spaced from one end being formed with a concentric valve seat providing a liquid discharge port through said end of said sleeve, a valve for said concentric seat for controlling said discharge port, said sleeve relatively adjacent said seat having a lateral port through the wall of the sleeve connecting with the bore of said sleeve and forming a liquid inlet, said lateral port including an internally formed valve seat, a valve controlling the valve seat of said liquid inlet, the end of said sleeve concentrically surrounding said discharge port being formed conically to provide a release valve.

5. An hydraulic jack comprising a base, means thereon providing a ram cylinder and a telescoping ram, said base having a sleeve-like extension formed with a longitudinal bore disposed angularly of the axis of said ram cylinder and an internal release valve seat formed in said base in line with but spaced from the inner end of the bore of said sleeve-like extension, means on said base forming a reservoir communicating with said internal valve seat, said valve seat having a central bore connecting with said ram cylinder, a combined pump cylinder and release valve comprising an elongated sleeve shiftably mounted in said bore, said sleeve having a longitudinal passage centrally therethrough and formed for the greater part of its length as a high pressure pump cylinder, a piston reciprocable in said pump cylinder, said central passage being formed from the piston chamber to the adjacent end of the sleeve as a liquid discharge passage, said passage having a concentric valve seat and a valve opening away from said seat on the discharge stroke of said piston, said sleeve between the ends of said piston bore portion and said discharge passage portion of said

central bore having a lateral passage therethrough connecting with the liquid discharge passage of said sleeve, said lateral passage including a valve seat and a valve adapted to move from said seat on suction in the piston chamber, the outer wall of the adjacent end of said sleeve being formed conically and concentrically of said discharge port therein as a release valve, and means for shifting said sleeve to move said release valve to and from its internal release valve seat.

6. An hydraulically actuated jack comprising a base having an upstanding ram cylinder said base having walls surrounding said ram cylinder forming a reservoir, a ram telescoping said ram cylinder, said base having relatively long tubular walls extending angularly with respect to the ram cylinder and providing a bore for the reception of a high pressure pump cylinder, said base having internal bores connecting with the ram cylinder and said base having walls about one of said internal bores providing a release valve seat, the central axis of which registers with the central axis of the bore of said angularly disposed tubular walls, and a relatively long sleeve turnably mounted in said bore of said angularly disposed tubular walls, said sleeve forming a high pressure pump cylinder, the bore of said sleeve extending longitudinally, centrally for the major portion of the length of said sleeve, an elongated piston reciprocable in the bore of said sleeve, the walls of said elongated sleeve below the lower end of said angularly disposed bore of said base being provided with additional bores forming liquid passages interconnecting the reservoir and the bore of the release valve seat, valve means controlling said passages, the innermost end of said elongated sleeve being formed as a release valve to seat upon the release valve seat of said base, elongated tubular means connected to said pump cylinder sleeve and extending substantially therebeyond, handle means connected to said sleeve for turning the same, and an elongated extension means connected to said pump piston and passing through said tubular extension of said pump cylinder and projecting beyond the end of said pump cylinder extension and provided with actuating means for reciprocating said piston in said pump cylinder.

7. In an hydraulic jack, in combination with a base an upstanding ram cylinder thereon, means forming reservoir walls at least partially surrounding said ram cylinder, said base having an upwardly disposed tubular extension formed thereon extending at an acute angle relative to the central axis of the ram cylinder and providing an elongated bore, an internal wall of said base having a valve seat registering with the central axis of this angularly disposed bore, said valve seat communicating with the ram cylinder, a relatively long tubular sleeve mounted in said angularly disposed bore and forming a high pressure pump cylinder, the lower end of said pump cylinder being formed as a valve to seat upon said valve seat, the major portion of the bore of said pump cylinder receiving an elongated rod-like piston therein, the lower portion of said pump cylinder below the zone of reciprocation of the piston thereof being ported to form communication between the reservoir, the ram cylinder and that portion of the pump cylinder in which the piston reciprocates, valves in said ported communications for controlling the same, means interconnecting said tubular, angularly disposed walls of the base and said pump cylinder

for causing longitudinal movement of said pump cylinder with respect to the base upon rotation of said pump cylinder, and a relatively long tubular extension connected to said pump cylinder and extending beyond the tubular, angularly disposed walls of said base substantially upwardly to the upper portions of the ram cylinder of the jack, the upper portion of said tubular extension being provided with a handle for turning the same, and extension means for said elongated piston in said pump cylinder, said extension means terminating in a handle projecting beyond said first mentioned handle for reciprocating said piston in the pump cylinder.

8. In an hydraulic jack, in combination with a base, a ram cylinder, means providing a liquid reservoir substantially about said ram cylinder, a ram for said ram cylinder, said base having internal walls providing a valve seat disposed laterally of said ram cylinder, said valve seat being ported and connecting with said ram cylinder, said jack base having a relatively long integral sleeve-like extension disposed angularly with respect to the central axis of the ram cylinder and the central axis of which coincides with the central axis of the valve seat, providing a relatively long bore for a high pressure pump cylinder, a relatively long elongated hollow sleeve in the form of a high pressure pump cylinder disposed in said bore, the external lower end of said relatively long pump cylinder sleeve being formed as a valve to close on said valve seat, a relatively long piston reciprocable in a major portion of the central bore of said high pressure pump cylinder, means interconnecting said base and said high pressure pump cylinder whereby upon rotation of said pump cylinder the same is adapted to move longitudinally with respect to the base, said pump cylinder having a sleeve-like extension projecting beyond the outer end of said tubular walls forming said angular bore for turning the pump cylinder, and said pump piston having an extension passing through said pump cylinder extension and provided beyond the outer end of said last mentioned extension with a handle for reciprocating said piston.

9. In an hydraulic jack, in combination with a base having integral inner walls and outer walls, a ram cylinder extending upwardly from the base and the outer walls, means providing a liquid reservoir for said ram cylinder, a ram for said ram cylinder, a valve seat formed on an outer surface of an inner wall of the base and having a passage communicating interiorly with the ram cylinder, the outer wall of the reservoir having a relatively 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 release 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 cylinder from a point beyond the end of the long sleeve-like extension whereby positively to shift the release valve with respect to its valve seat.

10. In an hydraulic jack, the combination with a base, a sleeve upstanding from said base to form a ram cylinder, walls associated with said base disposed in substantially surrounding, upstanding spaced relation to said ram cylinder to form a liquid reservoir, a part of the reservoir walls surrounding said ram cylinder wall having an integral laterally projecting, elongated sleeve provided with a threaded portion, a wall of said base opposite the inner end of 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 having means 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, and means for turning said pump cylinder through its threaded connection with said elongated sleeve to move said valve relatively to its seat.

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