L. T. JOHNSON.

LIFTING JACK.

APPLICATION FILED MAR. 23, 1921.

1,418,651.

Patented June 6, 1922.

3 SHEETS—SHEET 3.

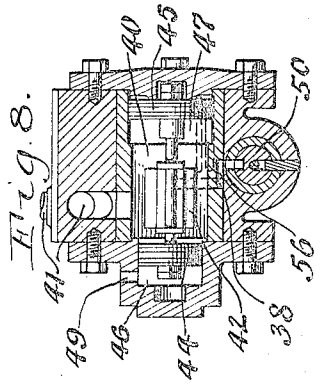



Fig. 8.

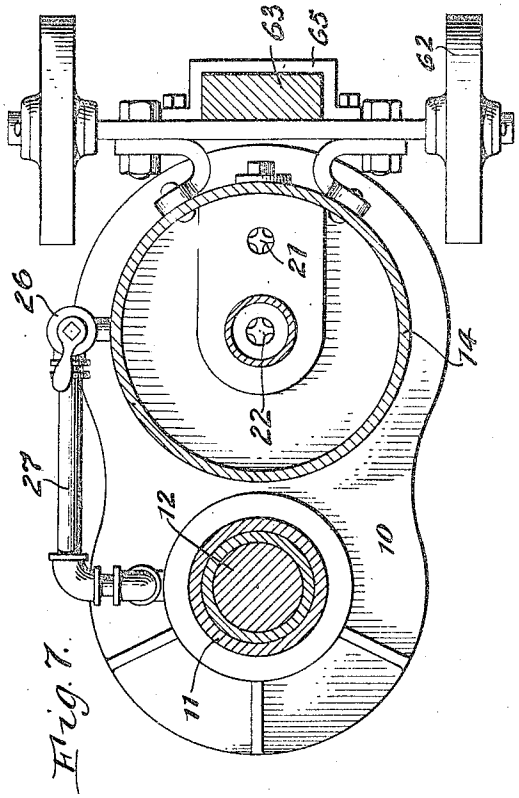



Fig. 7.

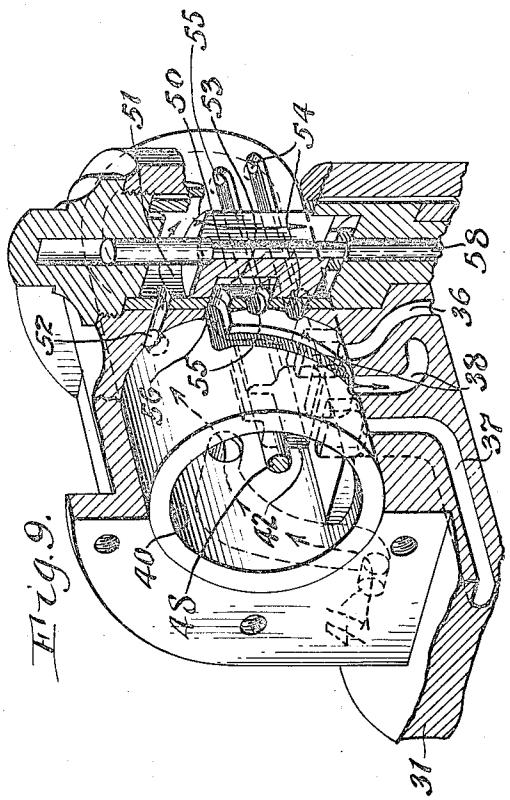



Fig. 9.

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3 SHEETS—SHEET 2.

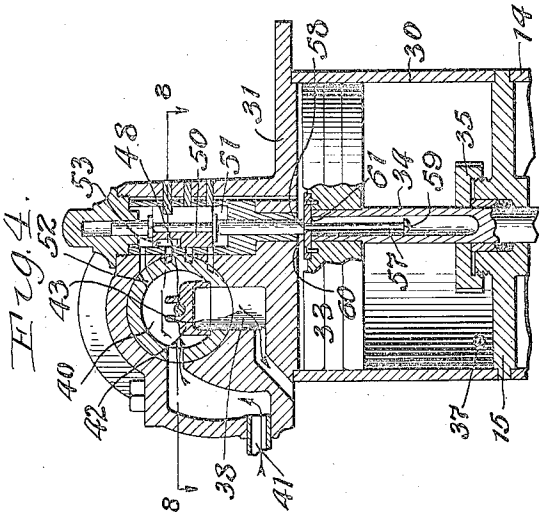


Fig. 4.

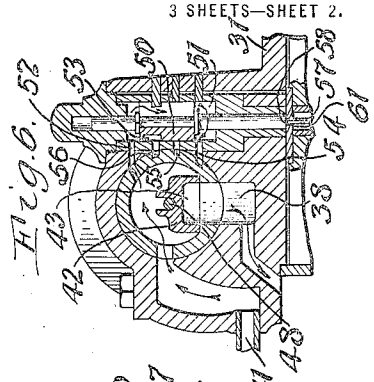


Fig. 6.

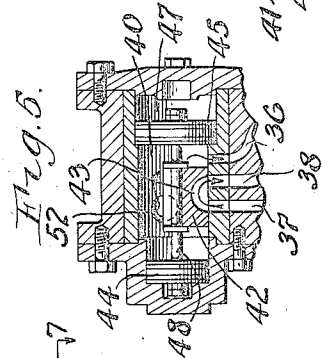


Fig. 5.

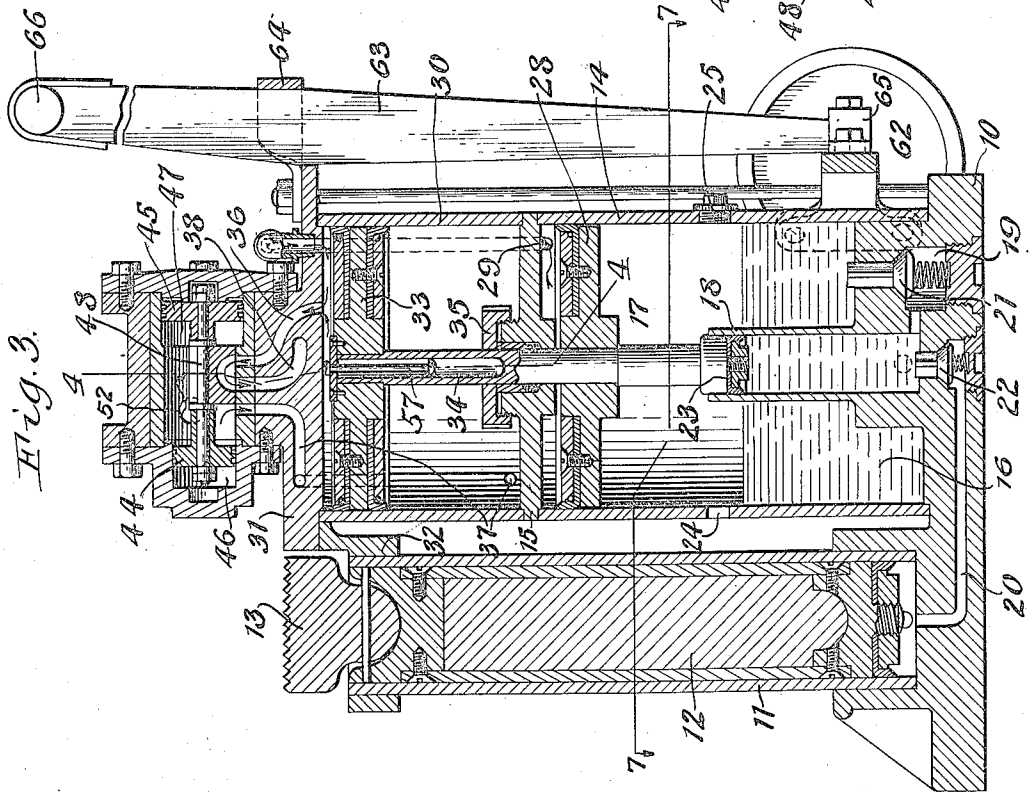


Fig. 3.

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3 SHEETS—SHEET 1.

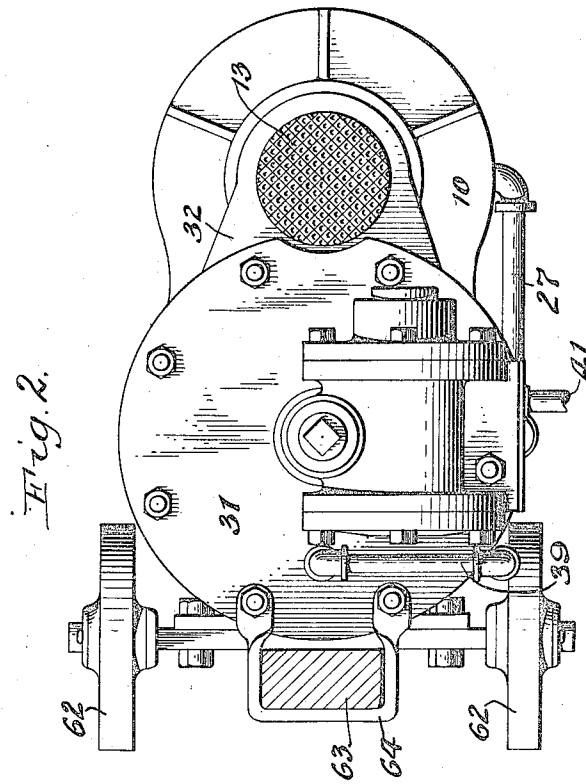



Fig. 2.

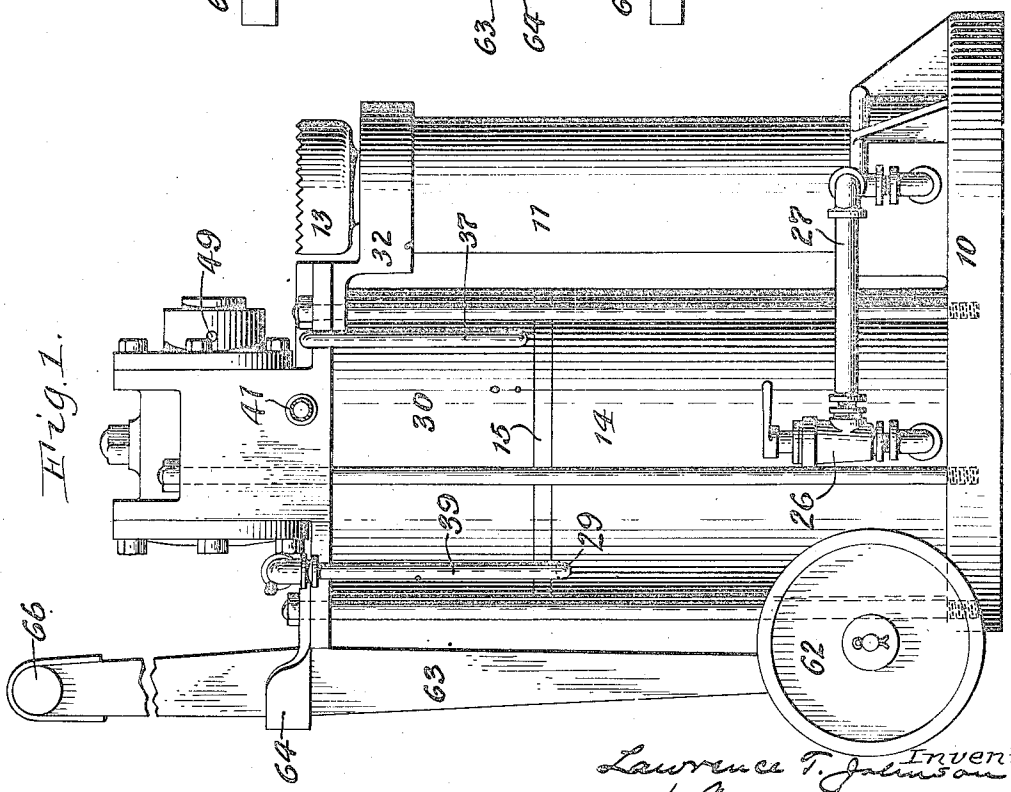



Fig. 1.

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# UNITED STATES PATENT OFFICE.

LAWRENCE T. JOHNSON, OF BUFFALO, NEW YORK.

## LIFTING JACK.

1,418,651. Specification of Letters Patent. Patented June 6, 1922.

Application filed March 23, 1921. Serial No. 454,749.

*To all whom it may concern:*

Be it known that I, LAWRENCE T. JOHNSON, a citizen of the United States, residing in Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Lifting Jacks, of which the following is a specification.

This invention relates to a hydro-pneumatic lifting jack and has for its main object the production of a lifting jack of this character which is a unitary structure, which is compact and capable of being readily transported, and which can be easily operated for raising and lowering very heavy loads such as railroad cars and the like when the same require repairing and for other purposes.

In the accompanying drawings: Figure 1 is a side elevation of the preferred embodiment of my invention. Figure 2 is a top plan view thereof, partly in section. Figure 3 is a vertical longitudinal section of the lifting jack. Figure 4 is a fragmentary vertical transverse section taken on line 4—4, Fig. 3. Figure 5 is a fragmentary vertical longitudinal section of the air controlling valve mechanism similar to that shown in Fig. 3, but in a different position. Figure 6 is a view similar to Fig. 4 but showing its parts in a different position. Figure 7 is a horizontal section taken on line 7—7, Fig. 3. Figure 8 is a horizontal section taken on line 8—8, Fig. 4. Figure 9 is a fragmentary sectional perspective view of the air controlling valve mechanism.

Similar characters of reference refer to like parts throughout the several views.

The main supports of this lifting jack may be variously constructed but as shown in the drawings the same preferably consist of a lower base 10 of metal which rests horizontally on the ground or floor when in its operative position. On the front end of this base is arranged an upright hydraulic lifting or hoisting cylinder 11 which may be secured at its lower end to the base in any suitable manner. Within this lifting cylinder is arranged a vertically movable lifting or hoisting piston or plunger 12 provided at its upper end with a lifting head 13 which is adapted to engage with the load to be raised. The raising of the lifting piston and the load carried thereby is effected by introducing a liquid such as water or oil into the lower end of the lifting cylinder so that the hydraulic pressure raises the lifting piston and upon discharging the liquid from the lifting cylinder the piston therein and the load supported by the same will be lowered by gravity. Upon the rear part of the base are mounted the means whereby the pressure liquid is supplied to the lifting cylinder, these means in their preferred form being constructed as follows:

14 represents an upright cylindrical wall which is secured at its lower end to the rear part of the base so that the latter forms a closure or head for the lower end of the same while the upper end of the same is closed by a partition 15. The space within the lower part of the chamber forms a liquid supply tank 16 and the space within the upper part thereof forms the motor cylinder 17 of an auxiliary motor which is preferably operated pneumatically. Centrally within the liquid tank is arranged an upright pressure pump cylinder 18 which has its lower end rigidly mounted on the base and placed in communication with the lower part of the liquid supply tank by an inlet passage 19 and also connected with the lower end of the lifting chamber by an outlet passage 20. Liquid is permitted to flow only from the tank to the pressure cylinder through the inlet conduit 19 but prevented from moving in a reverse direction by a check valve 21 in this passage and similarly liquid is only permitted to flow from the pressure cylinder through the outlet conduit and to the lifting cylinder but held against a return movement therein by a check valve 22, which check valves may be of any suitable construction although those shown in Fig. 3 of the drawings are of the spring operated type. The liquid is drawn from the tank into the pressure cylinder and expelled therefrom into the lifting cylinder by a pressure pump piston or plunger 23 which reciprocates within the pressure cylinder. Liquid may be supplied to the tank through one or more filler and vent openings 24 in the wall 14, one at least of these openings being left open to permit free entrance and escape of air and thus avoid interference with the movement of the liquid therein while some of these openings may be closed by a plug 25, as shown in Fig. 3. The diameter of the pressure cylinder and piston is less than that of the lifting cylinder piston whereby a powerful lifting effect is produced by the pressure pump upon the hoist as the water is delivered by the pump into the cylinder of the hoist,

the parts being so proportioned that a plurality of reciprocations of the pump piston are necessary to elevate the hoisting piston its fullest extent. When it is desired to again lower the piston of the hoist the liquid is discharged from the latter and preferably returned to the tank so that it can be used repeatedly by an opening or valve 26 in a return pipe 27 which connects the lower end of the lifting cylinder with the lower end of the supply tank, as shown in Figs. 1, 2 and 7.

The reciprocating movement of the pump piston or plunger may be effected in any suitable manner, but is preferably effected by a pneumatic motor mechanism which as shown in the drawings is constructed as follows:

28 represents the piston of the auxiliary pneumatic motor which reciprocates in the auxiliary motor cylinder 17 and is operatively connected with the pressure piston. This piston is depressed for causing the pressure piston to expel the liquid from the pressure cylinder of the pump into the hoisting cylinder by introducing compressed air into the auxiliary motor cylinder through a port 29 in the wall of cylinder 17. The auxiliary motor only operates to assist in depressing the pump piston, an additional main pneumatic motor being provided which preferably operates in conjunction with the auxiliary motor to depress the pump piston but acts solely to raise the latter. This main motor comprises a main motor cylinder 30 mounted on top of the auxiliary cylinder and having its upper end closed by a head or cover 31. For the sake of greater stability this upper head is connected with the upper end of the hoisting cylinder by a bracket 32 as shown in Figs. 1, 2 and 3. The partition 15 is preferably interposed between the auxiliary and main cylinders and serves as heads for the opposing ends of the same. Within the main cylinder is arranged a main motor piston 33 which is connected with the auxiliary motor piston and the pump piston by a connecting rod 34 passing through a stuffing box 35 arranged on the partition. Compressed air is supplied to upper and lower ends of the main motor cylinder through ports 36, 37 for the purpose of depressing and raising the main motor piston, and these ports are alternately connected with an exhaust port 38 leading to the atmosphere for the purpose of carrying away the spent pressure fluid from either side of the main motor piston while the opposite side thereof is subjected to the action of the live pressure fluid. The port 29 in the upper end of the auxiliary motor is connected by a pipe or conduit 39 with the upper end of the main motor cylinder so that the pressure medium is simultaneously supplied to and exhausted from the upper ends of the auxiliary and main motor cylinders.

Various air controlling valve mechanisms may be employed, that shown in the drawings being actuated automatically by motion derived from the motor pistons and constructed as follows:

40 represents a main valve chamber connected by a pipe 41 with a compressed air supply and containing a main horizontally slidable valve 42 having an exhaust cavity 43 in its underside and so constructed that in one position compressed air is permitted to pass from the main valve chamber to the underside of the main motor piston while the spent air is permitted to pass from the upper sides of the main and auxiliary pistons to the exhaust port, as shown in Fig. 3 while in the other position of the main air valve, as shown in Fig. 5, the live or compressed air is permitted to enter the upper ends of the main and auxiliary motor cylinders for depressing the pistons therein and forcing the pump plunger downwardly, while the spent air below the main motor piston is permitted to escape through the exhaust. This main air valve 42 is actuated by means of two pistons 44, 45 of different areas reciprocating in cylinders 46, 47 at opposite ends of the valve chamber and connected with each other and with the main slide valve 42 by a shifting rod 48. The outer end of the small piston cylinder 46 in which the small shifting piston moves is connected constantly with the outer atmosphere through an exhaust port 49. 50 represents a vertically slidable auxiliary air valve arranged in a vertical auxiliary valve chamber 51 which is constantly in communication with the main slide valve chamber by a passage 52. The auxiliary slide valve is provided with a cavity 53 whereby compressed air from the main valve chamber between the pistons therein is either admitted to the outer end of the cylinder 47 containing the large valve shifting piston 45 or the compressed air is cut off from the same and instead connected with the exhaust leading to the atmosphere. When air is admitted to the outer end of the cylinder 47 the piston 45 is moved toward the center of the valve chamber 40, as shown in Fig. 5, whereby the main air valve 42 is shifted so as to admit compressed air to the upper sides of the main and auxiliary motor pistons and exhaust the air from the underside of the main motor piston. When cutting off the compressed air from the outer end of the cylinder 47 and connecting the same through the exhaust with the atmosphere the pressure of the air within the main valve chamber 40 being greater against the large piston 45 than against the small piston 44 will cause the large piston to move away from the center of the main valve chamber and

shift the main slide valve 42 into the position shown in Fig. 3, whereby the compressed air is admitted to the underside of the main motor piston and exhausted from the upper sides of the main and auxiliary motor pistons. The supply of the compressed air to and the exhausting of the spent air from the outer end of the cylinder is effected by the movement of the auxiliary slide which when elevated, as shown in Fig. 6, permits compressed air to pass from the auxiliary valve chamber through the port 54 to the outer end of the large cylinder 47 while in Fig. 9 the auxiliary slide valve is shown in its lowered position in which the port 54 is covered and compressed air is cut off from the outer end of the cylinder 47 and instead the cavity 53 connects a branch exhaust passage 55 leading to the outer end of the cylinder 47 with a branch exhaust passage 56 leading to the main exhaust 38.

The shifting of the auxiliary slide valve is effected by a vertically sliding shipper rod 57 which is connected with the auxiliary slide valve and is provided with upper and lower tappets 58, 59, which are adapted to be engaged by upper and lower shoulders 60, 61 on the motor piston rod 34. During the main part of the upward movement of the motor pistons the shipper rod 57 and the auxiliary air slide valve remain in their depressed position, as shown in Fig. 9, which causes the compressed air to be admitted under the main motor piston and exhausted from the upper sides of the main and auxiliary motor pistons. During the last part of the upward movement of the main and auxiliary motor pistons the upper shoulder 60 of the piston rod 34 engages the upper tappet 58 of the shipper rod and begins to shift the latter upwardly, as shown in Fig. 4, and when completing this upward movement the auxiliary slide valve has been fully raised, as shown in Fig. 6, so that now compressed air is admitted to the outer end of the cylinder 47 and the main slide valve is shifted so as to cause compressed air to bear down on the main and auxiliary motor pistons and spent air to be exhausted from underneath the main motor piston. The rod 34 now travels downwardly independently of the shipper rod 57 until it is about to effect the last part of its stroke in that direction when the lower shoulder 61 of the rod 34 engages the lower tappet 59 and draws the same together with the auxiliary air slide valve downwardly into a position to again reverse the air connections which will reverse the main slide valve and cause the main and auxiliary motor pistons to again ascend.

For convenience in transporting the lifting jack the same is provided with a pair of supporting wheels 62 which are so mounted on the lower rear part of the base that when the latter rests on the ground the wheels will be raised therefrom, as shown in Fig. 3, and thereby enable the lifting jack to rest with its full weight on the ground for holding the same in place. When, however, the lifting jack is to be transported the same is tilted backwardly until its weight rests on the wheels 62 after which the same may be trundled around with ease to wherever the same is required. To facilitate handling of the lifting jack at this time, a transporting pole or bar 63 is provided which is detachably seated at its rear end in sockets 64, 65 on the motor cylinders and provided at its front end with a handle 66.

I claim as my invention:

1. A lifting jack comprising a base, a hydraulic lifting cylinder mounted on said base, a lifting piston arranged in said cylinder, a hydraulic pressure cylinder mounted on said base and connected with said lifting cylinder, a pressure piston arranged in said pressure cylinder, a pneumatic motor for operating said pressure piston and mounted on said base and an automatically operating valve mechanism for causing said pneumatic motor to operate continuously at will.

2. A lifting jack comprising a lifting cylinder, a lifting piston arranged in said lifting cylinder, a combination chamber one end of which forms a liquid supply tank and the other an auxiliary motor cylinder, a hydraulic pressure cylinder having an inlet communicating with said supply tank and an outlet communicating with said lifting cylinder, a pressure piston arranged in said pressure cylinder, an auxiliary motor piston arranged in said auxiliary motor cylinder and connected with said pressure piston, a main motor cylinder, and a main motor piston arranged within said main motor cylinder and connected with said auxiliary motor piston.

3. A lifting jack comprising a lifting cylinder, a lifting piston arranged in said lifting cylinder, a combination chamber one end of which forms a liquid supply tank and the other an auxiliary motor cylinder, a hydraulic pressure cylinder having an inlet communicating with said supply tank and an outlet communicating with said lifting cylinder, a pressure piston arranged in said pressure cylinder, an auxiliary motor piston arranged in said auxiliary motor cylinder and connected with said pressure piston, a main motor cylinder, a main motor piston arranged within said main motor cylinder and connected with said auxiliary water piston, and means for admitting a pressure fluid to and exhausting the same from said auxiliary motor cylinder and from opposite ends of said main motor cylinder.

4. A lifting jack comprising a base, an

upright lifting cylinder mounted on one part of said base, a lifting piston arranged in said lifting cylinder, a combination chamber mounted on another part of said base and having its lower part forming a liquid supply tank and its upper part forming an auxiliary motor cylinder, a main motor cylinder mounted on top of the auxiliary motor cylinder, said auxiliary and main motor cylinders being separated by a partition, a pressure cylinder arranged within said tank and connected by a valved inlet conduit with said tank and by a valved outlet conduit with said lifting cylinder, a pressure piston arranged in said pressure cylinder, an auxiliary motor piston arranged in said auxiliary motor cylinder and connected with said pressure piston, a main motor piston arranged in said main motor cylinder, a rod connecting said auxiliary and main motor pistons, and a stuffing box which is arranged on said partition and through which passes said rod.

5. A lifting jack comprising a base, an upright lifting cylinder mounted on one part of said base, a lifting piston arranged in said lifting cylinder, a combination chamber mounted on another part of said base and having its lower part forming a liquid supply tank and its upper part forming an auxiliary motor cylinder, a main motor cylinder mounted on top of the auxiliary motor cylinder, said auxiliary and main motor cylinders being separated by a partition, a pressure cylinder arranged within said tank and connected by a valved inlet conduit with said tank and by a valved outlet conduit with said lifting cylinder, a pressure piston arranged in said pressure cylinder, an auxiliary motor piston arranged in said auxiliary motor cylinder and connected with said pressure piston, a main motor piston arranged in said main motor cylinder, a rod connecting said auxiliary and main motor pistons, a stuffing box which is arranged on said partition and through which passes said rod, and a valve mechanism actuated by motion derived from said motor pistons and operating to admit pressure fluid into and exhausting the same from said auxiliary motor cylinder and opposite ends of said main motor cylinder.

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