Aug. 7, 1945. C. V. HANSEN 2,381,664

HYDRAULIC LIFT

Filed Jan. 13, 1944 3 Sheets-Sheet 1

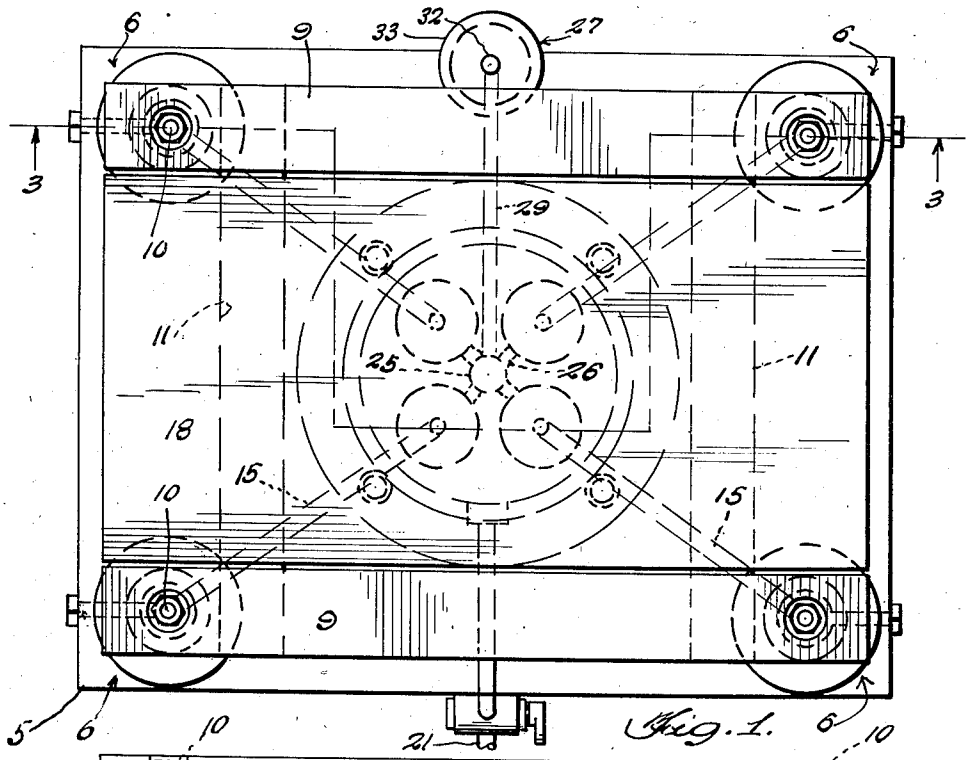


Fig. 1.

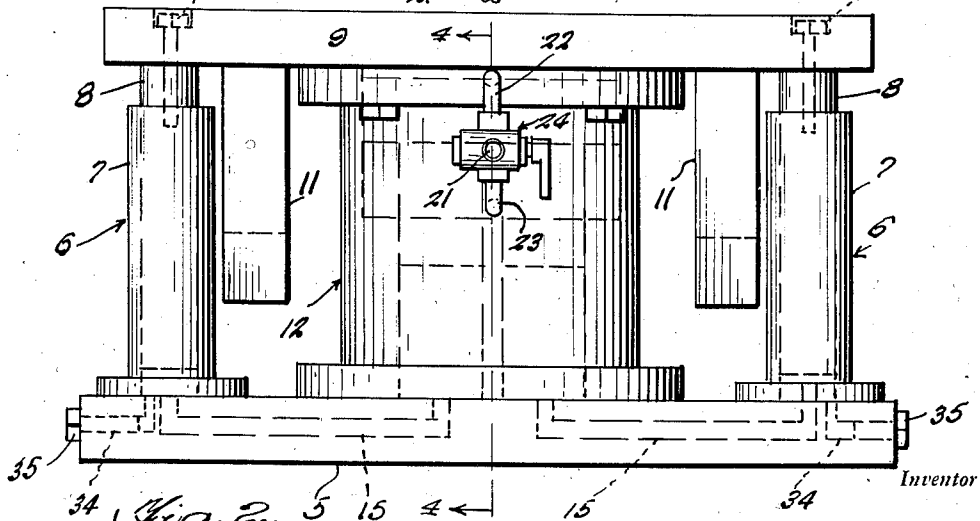


Fig. 2.

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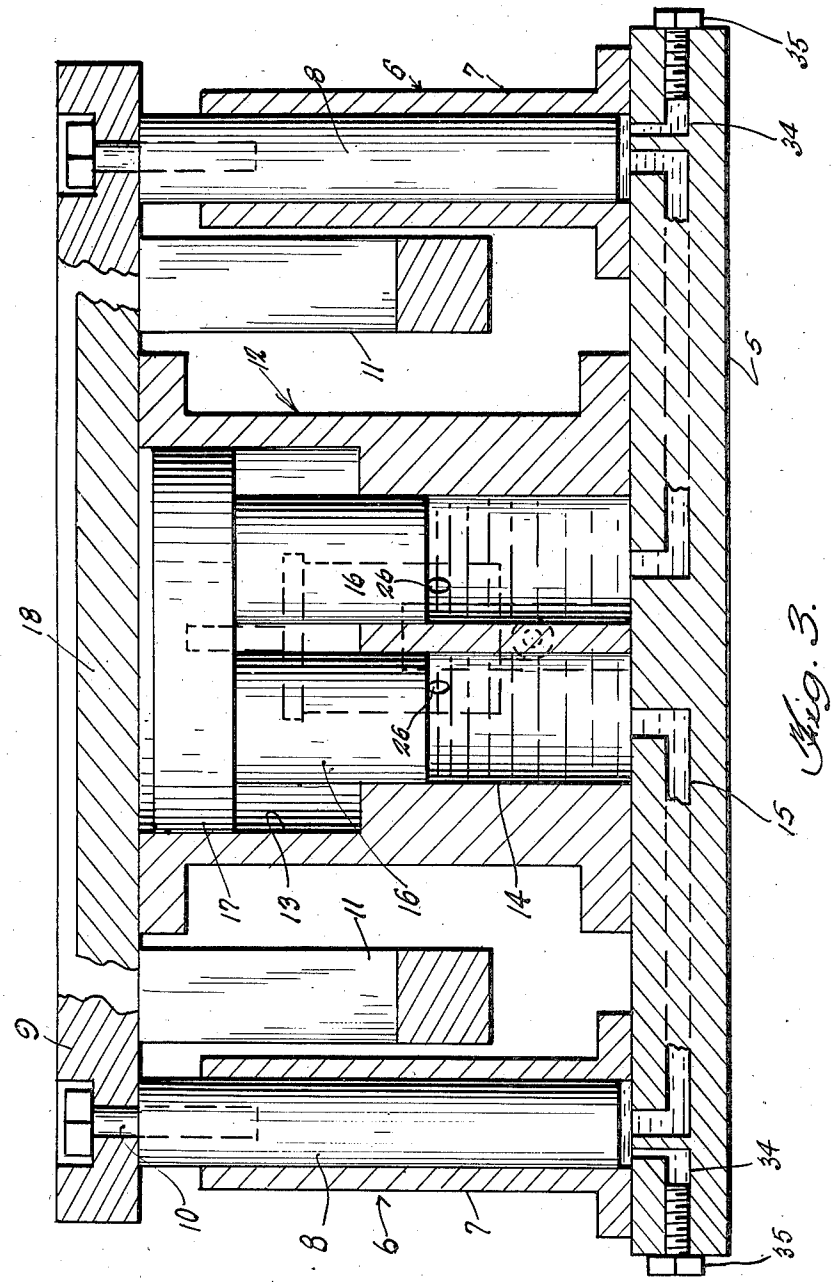


Fig. 3.

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Filed Jan. 13, 1944 3 Sheets-Sheet 3

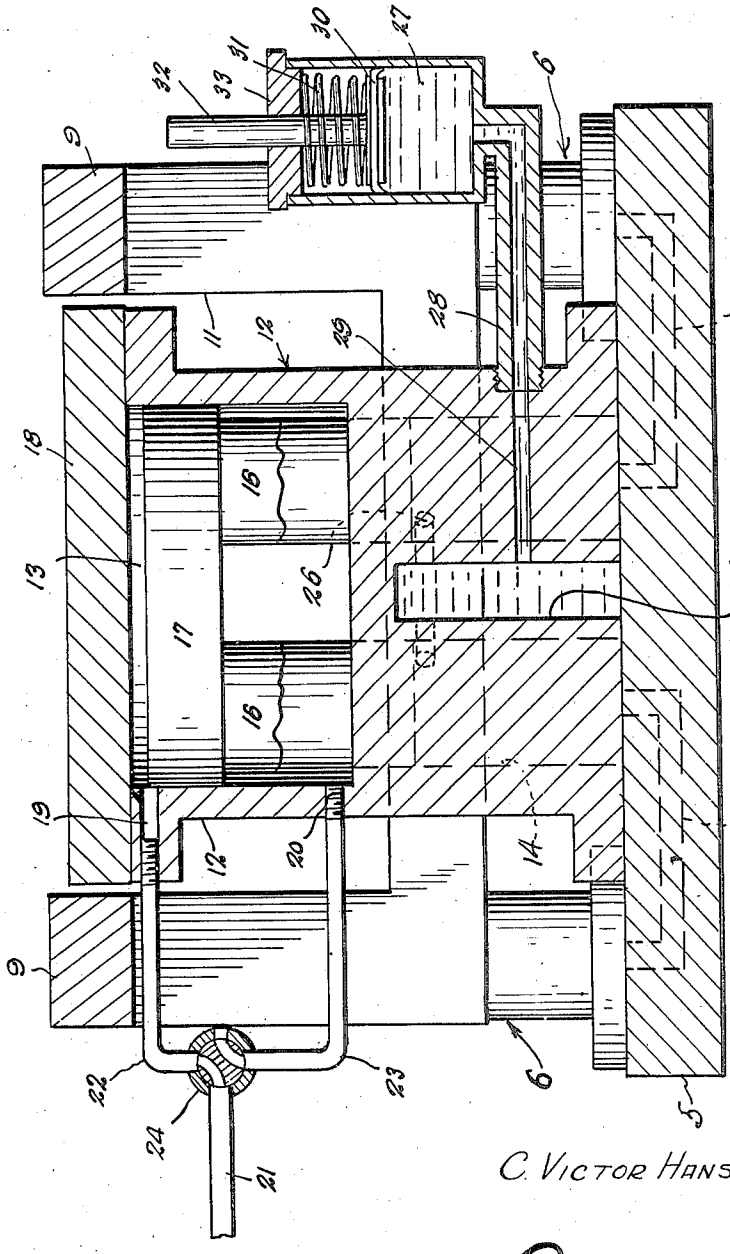


Fig. 4.

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UNITED STATES PATENT OFFICE

2,381,664

HYDRAULIC LIFT

Carl Victor Hansen, Cedar Falls, Iowa

Application January 13, 1944, Serial No. 518,141

5 Claims. (Cl. 22—48)

This invention relates to hydraulic lifts embodying a lift frame mounted on the vertically movable pistons of a plurality of similar hydraulic jacks.

The primary object of the present invention is to provide means for forcing the power transmission liquid into the cylinders of the hydraulic jacks so that exactly the same pressure will be applied to the pistons of all of the jacks and said pistons of the hydraulic jacks will be caused to move exactly the same distances.

In carrying out the above object, I provide a hydraulic lift including a plurality of similar pumps for forcing the power transmission liquid into the jack cylinders, a single common actuator being provided for the pistons of all of the pump cylinders, and means being provided to automatically keep the pump cylinders filled with power transmission liquid to compensate for any power transmission liquid lost from any of the jack cylinders by reason of leakage or the like.

A further more specific object of the present invention is to provide a hydraulic lift of the above character involving a minimum number of movable parts that are durable and compactly arranged so as to be effectively protected against access of foreign matter thereto that may cause undue wear thereof.

In a preferred embodiment of the invention, the pistons of the pumps are preferably carried by a single operating piston movable in a master cylinder and reciprocable by fluid under pressure.

Other objects and features of the invention will become apparent from the following description when considered in connection with the accompanying drawings, and the invention consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the drawings, and claimed.

In the drawings, wherein like reference characters indicate corresponding parts throughout the several views:

Figure 1 is a top plan view of an embodiment of the invention suitable for use as a power lift for molding machines.

Figure 2 is an elevational view thereof.

Figure 3 is a longitudinal vertical section taken on line 3—3 of Figure 1, and partly broken away.

Figure 4 is a vertical transverse section taken on line 4—4 of Figure 2.

Referring in detail to the drawings, the illustrated embodiment of the invention includes a rectangular base plate 5 having a plurality of similar hydraulic jacks mounted thereon, one at each corner of the base plate. Each jack 6 includes a vertical cylinder 7 suitably secured upon the base plate 5, and a vertically movable piston 8 operable in and projecting upwardly from the associated cylinder 7. A lift frame is mounted upon the jacks 6, said frame including a pair of spaced parallel horizontal side frame bars 9 bolted at their ends upon the upper ends of the jack pistons 8 at the corresponding sides of the base plate, as at 10, said frame bars 9 being rigidly connected near opposite ends thereof by means of transverse frame members 11 of substantially U-shape. The connecting members 11 of the frame are affixed at their ends to the under sides of the frame bars 9 inwardly of the jacks, and they extend downwardly and then transversely from one frame bar 9 to the other at a point considerably below the frame bars 9.

Mounted upon the base plate 5 intermediate the ends thereof is a cylinder block 12 having a large master cylinder 13 at the top portion thereof and formed in its lower portion with a plurality of smaller pump cylinders 14 corresponding in number to the number of hydraulic jacks 6. Each pump cylinder 14 is connected at the bottom with one of the jack cylinders at the bottom of the latter by means of a passage 15, whereby the power transmission fluid may be forced from a pump cylinder into each jack cylinder. A plurality of pump pistons 16 are suitably carried by and depend from a master piston 17 operating in master cylinder 13, said pump pistons 16 corresponding in number to and working in the pump cylinders 14. Thus, the master piston 17 constitutes a single common actuator for all of the pump pistons. A table top or platform 18 is placed and secured upon the top of the cylinder block 12 and extends beyond opposite sides of the latter so as to completely fill the space between the frame bars 9. The table or platform 18 thus forms a head for closing the upper end of the master cylinder 13, said cylinder 13 being provided with combined inlet and outlet ports 19 and 20, respectively, near the top and bottom thereof. A pipe 21, which extends from any suitable source of supply of fluid under pressure, is provided with branches 22 and 23 respectively communicating with the ports 19 and 20, and associated with these branches is a control valve 24 of any well known or preferred construction by means of which fluid under pressure may be admitted to either port 19 or 20 while simultaneously permitting fluid to be exhausted through the other port. This is a conventional arrangement per se for causing reciprocation of a piston under

fluid pressure. Accordingly, the master piston 17 may be forced downwardly for actuating the pump pistons 16 to simultaneously force power transmission liquid from the pump cylinders 14 into the jack cylinders 7, or for elevating piston 17 and pump pistons 16 for simultaneously removing pressure from the power transmission fluid and allowing the jack pistons 8 to lower for lowering the lift frame.

In constructions of the present kind, employing a lift frame simultaneously operated by a plurality of hydraulic jacks supporting the lift frame at different points, it is very necessary and desirable to apply the same pressure simultaneously to all of the jack pistons and to cause exactly the same travel of all of said jack pistons. In order to accomplish this, it is not only necessary to have the pump pistons of exactly the same size and the jack pistons of exactly the same size, but to also have exactly the same amount of power transmission fluid in each pump cylinder and the passage placing the same in communication with a jack cylinder. In order to do this by compensating for loss of any power transmission fluid from any of the pump or jack cylinders, I provide the cylinder block 12 with a central chamber 25 between the pump cylinders 14 and extending to a height above the point where the lower ends of the pump pistons are located at their uppermost limits of travel, passages 26 being provided to afford communication at these points between the pump cylinders 14 and chamber 25. Also, a liquid reservoir 27 is supported by the cylinder block 12 at one side of the latter and has a bottom outlet 28 communicating with one end of a passage 29 in the block 12 whose other end communicates with the chamber 25. Reciprocable in the reservoir 27 is a plunger 30 yieldingly urged downwardly by a helical compression spring 31 to force power transmission liquid from the reservoir 27 into the pump cylinders when the passages 26 are opened upon the pump pistons 16 reaching their upward limit of movement on each stroke thereof. Thus, the pump cylinders will be automatically kept filled with power transmission liquid, a slight excess of liquid being forced back into the chamber 25 when the pump pistons 16 are forced downwardly, until they close the passages 26. In this way, exactly the same amount of power transmission fluid is provided for operating each jack piston at all times, thereby insuring uniform application of pressure to the jack pistons and corresponding equal travel thereof. The plunger 30 may be guided by means of a stem 32 fixed thereto and slidable through a top closure 33 for the reservoir 27. Also, the base plate 5 may have bleed passages 34 normally closed by removable screw plugs 35, whereby air may be bled from the jack cylinders when the apparatus is initially filled with power transmission fluid. It will be noted that the apparatus involves a minimum number of movable parts that are arranged so as to be effectively protected against foreign matter readily falling thereon, such as might cause undue wear of said parts. Also, the construction is simple and compact, and it is such as to insure efficient and reliable operation with a minimum amount of care or repair service. Obviously, the distance of travel of the master piston 17, as well as the speed of travel thereof, may be readily controlled through proper manipulation of the control valve 24, thereby readily regulating the degree of movement and speed of travel of the lift frame by the lifting jacks 6.

From the foregoing description, it is believed that the construction and operation, as well as the advantages, of the present invention will be readily understood and appreciated by those skilled in the art. Obviously, while the invention is well adapted for use as a power lift for molding machines, it will be evident that the same is capable of general application to any machine where it is desired to produce an absolutely equal pressure in two or more lifting cylinders or two or more cylinders of two or more lifting jacks. Minor changes in the adaptation and arrangement of parts, as well as in the details of construction illustrated and described may therefore be made, such as fairly fall within the spirit and scope of the invention as claimed.

What I claim as new is:

1. A hydraulic lift comprising a plurality of spaced hydraulic lifting jacks having vertically movable pistons, a lift frame supported on said pistons, a plurality of pumps arranged between and adapted for supplying power transmission fluid under pressure to said lifting jacks, there being one pump for each jack, and each pump including a vertically movable piston, a single actuator for all of the pump pistons, and power means for moving said actuator, said actuator comprising a master piston having the pump piston connected directly to the bottom face thereof, and a master cylinder for said master piston, and means for controlling the admission of fluid under pressure to opposite ends of said master cylinder.

2. A hydraulic lift comprising a plurality of spaced hydraulic lifting jacks having vertically movable pistons, a lift frame supported on said pistons, a plurality of pumps for supplying power transmission fluid under pressure to said lifting jacks, there being one pump for each jack, and each pump including a vertically movable piston, a single actuator for all of the pump pistons, and power means for moving said actuator, and means for automatically filling the pump cylinders with power transmission fluid upon completion of the retraction strokes of said pump pistons, said last-named means comprising a reservoir for power transmission fluid, a spring-actuated plunger for yieldingly forcing the power transmission fluid from said reservoir, and passages opening into the pump cylinders and constantly communicating with said reservoir, said passages being located so as to be uncovered by the pump pistons when the latter approach their limit of retracting movement.

3. A hydraulic lift comprising a base plate, a plurality of hydraulic jacks mounted on said base plate, one at each corner of the latter and each including a vertically movable piston, a lift frame mounted upon the pistons of said lifting jacks, a cylinder block mounted upon the base plate intermediate the ends of the latter and having an upper master cylinder and a plurality of lower pump cylinders, pistons in said pump cylinders, there being one pump cylinder for each hydraulic jack, passages in the base plate providing communication between each pump cylinder and one lifting jack, a power piston connected to the pistons in the pump cylinders and operable in the master cylinder, and means to control the admission of fluid under pressure to opposite ends of said master cylinder.

4. A hydraulic lift comprising a base plate, a plurality of hydraulic jacks mounted on said base

plate, one at each corner of the latter and each including a vertically movable piston, a lift frame mounted upon the pistons of said lifting jacks, a cylinder block mounted upon the base plate intermediate the ends of the latter and having an upper master cylinder and a plurality of lower pump cylinders, there being one pump cylinder for each hydraulic jack, passages in the base plate providing communication between each pump cylinder and one lifting jack, a power piston operable in the master cylinder, and means to control the admission of fluid under pressure to opposite ends of said master cylinder, said lift frame comprising spaced parallel side frame bars and U-shaped transverse members connecting said side frame bars at points between the cylinder block and the lifting jacks, and a platform mounted on the cylinder block, said platform closing the upper end of the master cylinder and substantially closing the space between the side frame bars.

5. A hydraulic lift comprising a base plate, a plurality of hydraulic jacks mounted on said base plate, one at each corner of the latter and each including a vertically movable piston, a lift frame mounted upon the pistons of said lifting jacks, a cylinder block mounted upon the base plate intermediate the ends of the latter and having an upper master cylinder and a plurality of lower pump cylinders, pistons in said pump cylinders, there being one pump cylinder for each hydraulic jack, passages in the base plate providing communication between each pump cylinder and one lifting jack, a power piston connected to the pistons in the pump cylinders and operable in the master cylinder, and means to control the admission of fluid under pressure to opposite ends of said master cylinder, said cylinder block having a central chamber and passages connecting the top of said chamber with the pump cylinders directly below the lower ends of the pump pistons when the latter are at their upward limit of movement, and means for automatically maintaining said chamber filled with power transmission fluid and forcing the same into the pump cylinders when said passages are uncovered by the pump piston.

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