June 8, 1965 G. F. QUAYLE 3,188,107

LIFT TRUCK

Filed May 17, 1962 5 Sheets-Sheet 1

Fig. 2.

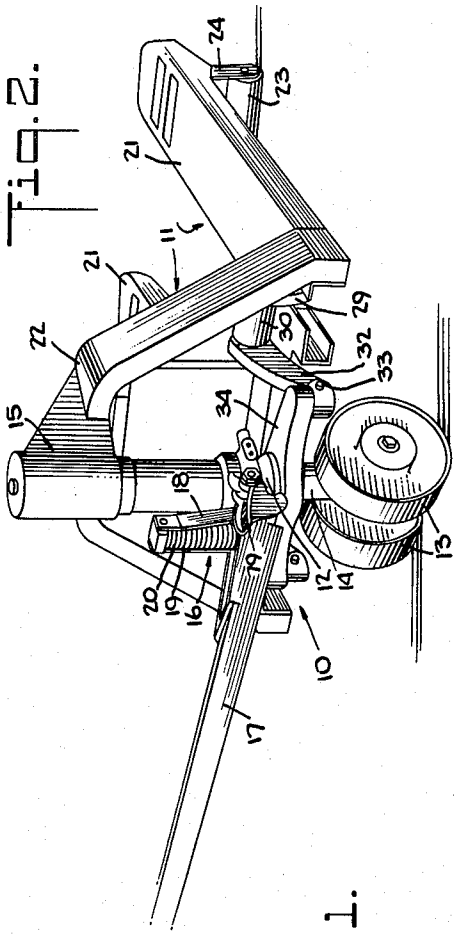


Fig. 3.

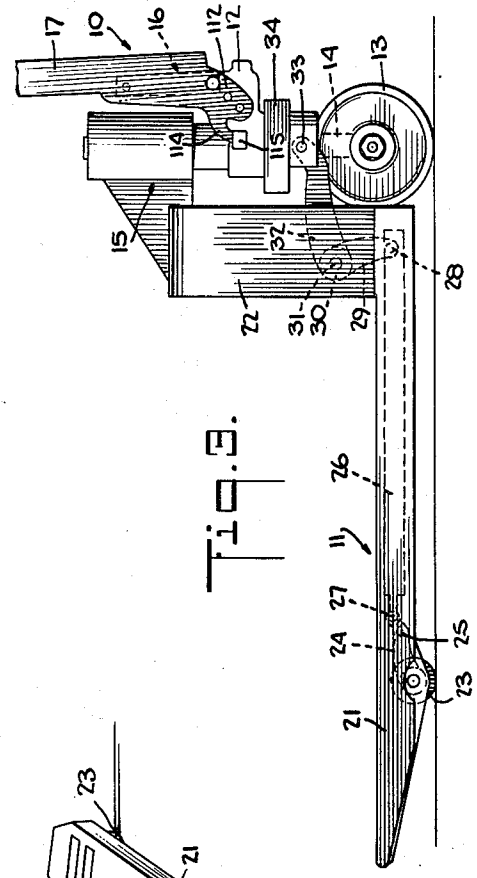
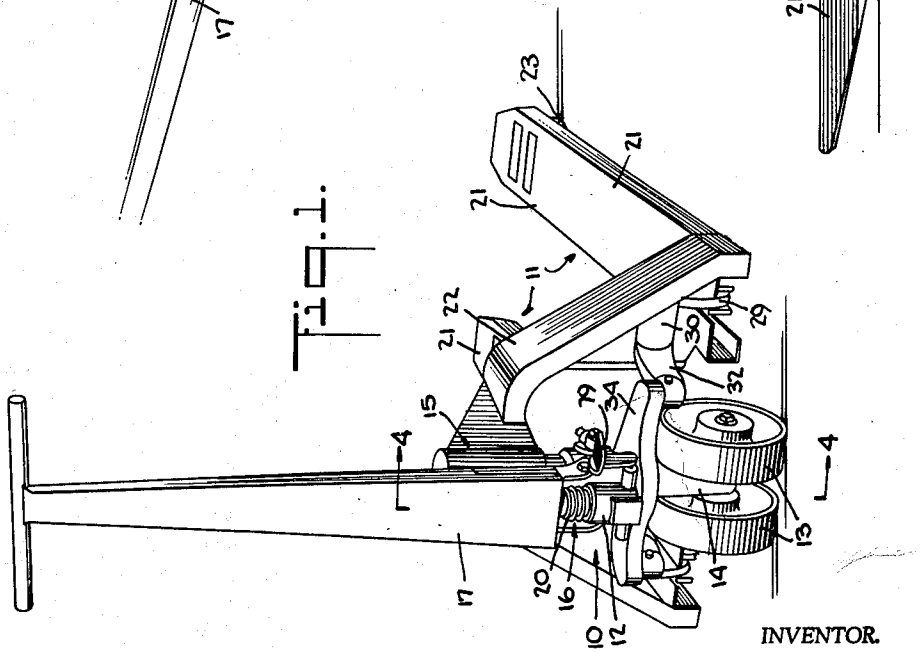


Fig. 1.

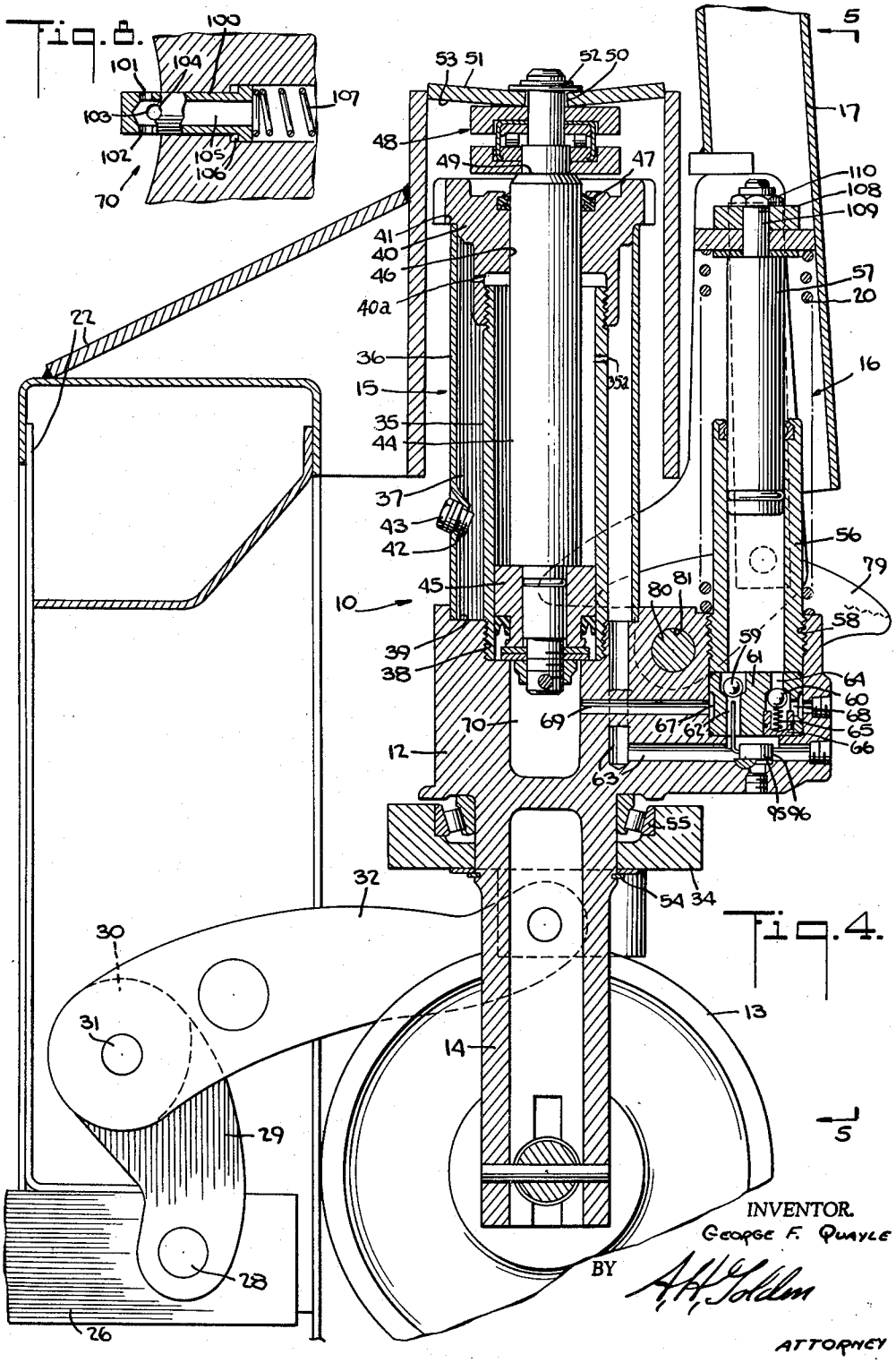


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LIFT TRUCK

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LIFT TRUCK

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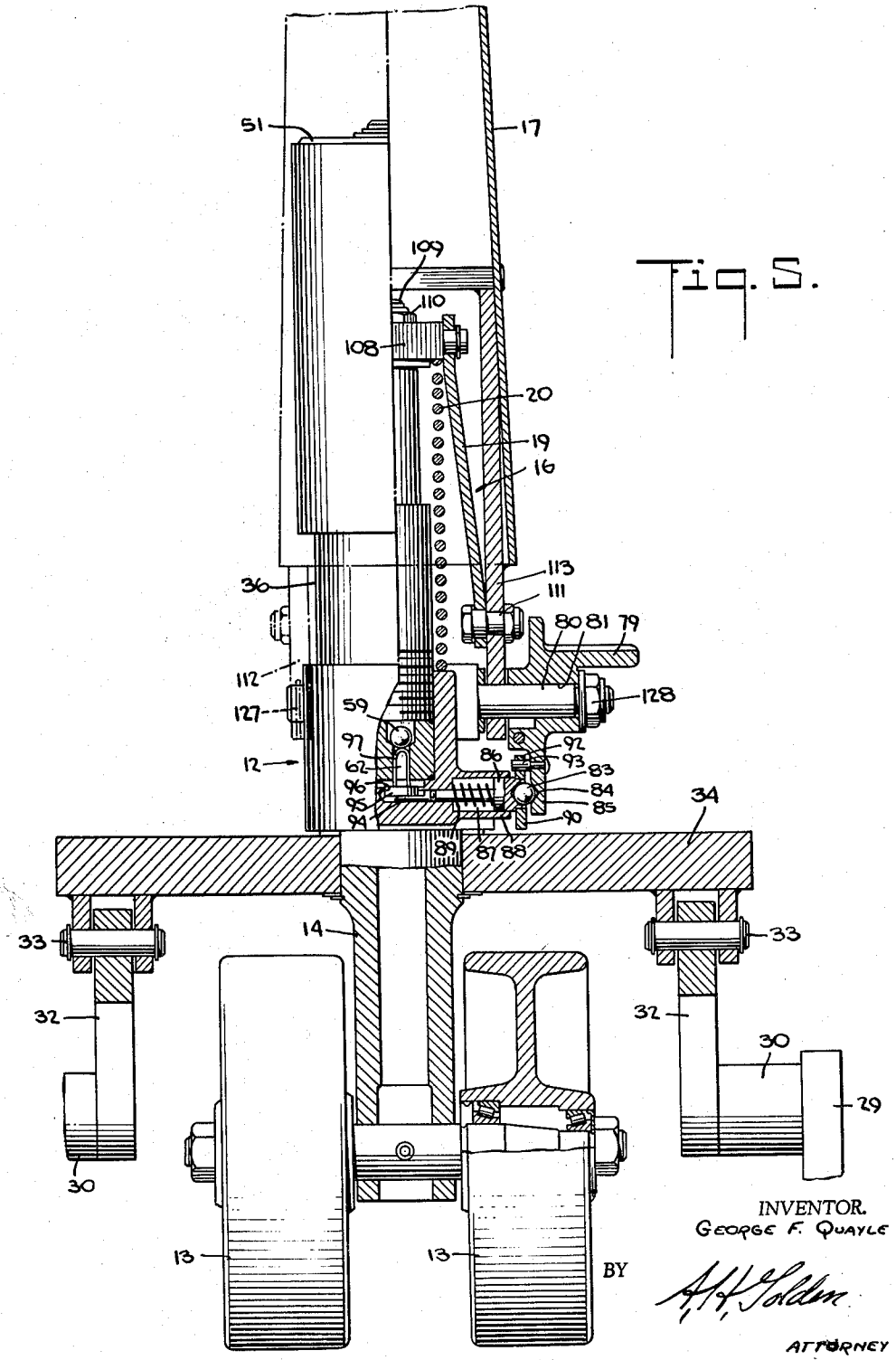


Fig. 5.

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LIFT TRUCK

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Fig. 5.

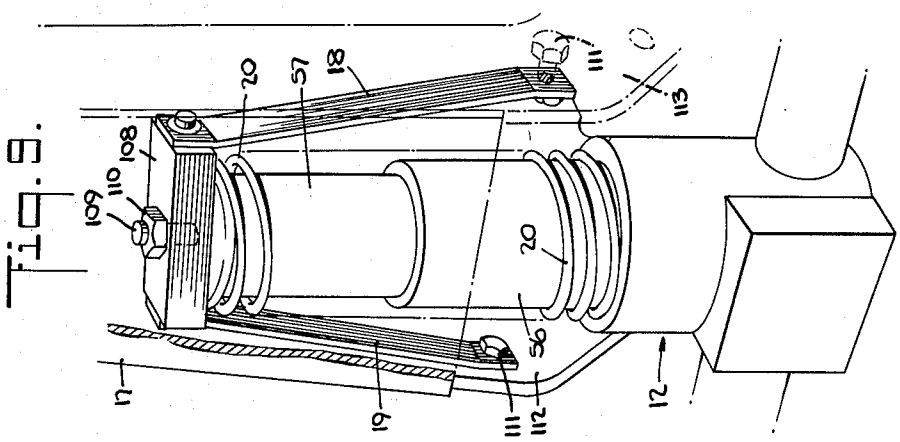


Fig. 6.

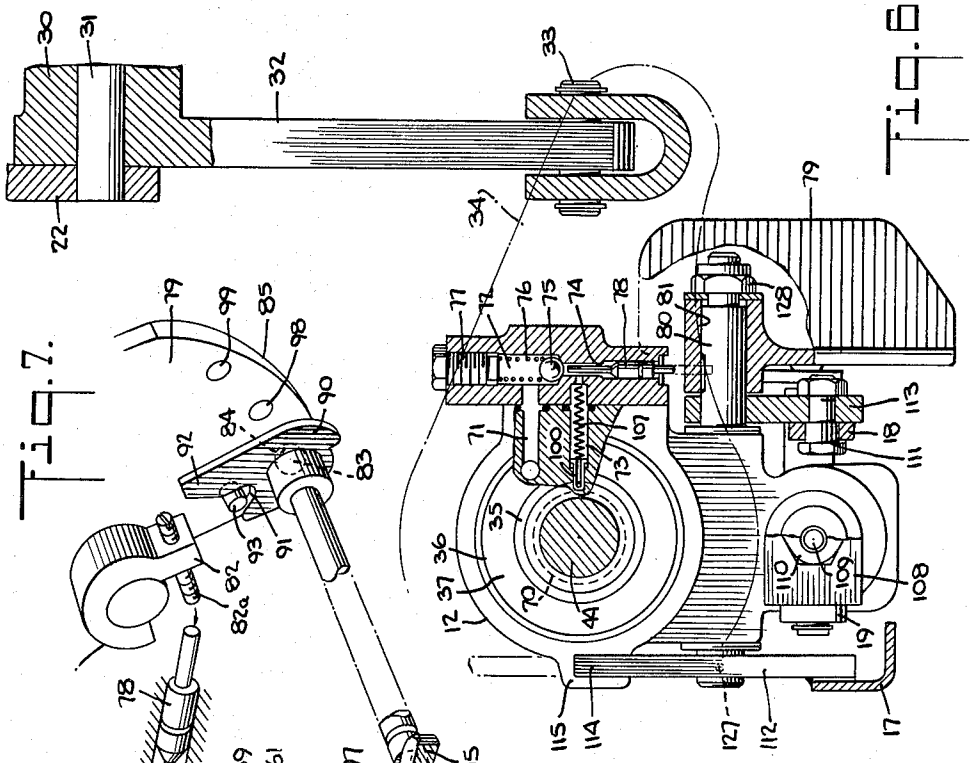


Fig. 7.

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LIFT TRUCK

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Fig. 10.

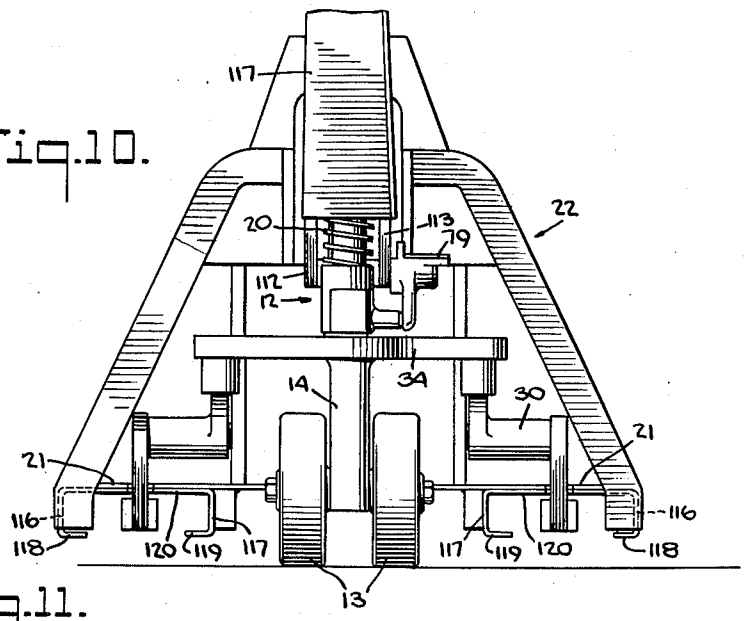


Fig. 11.

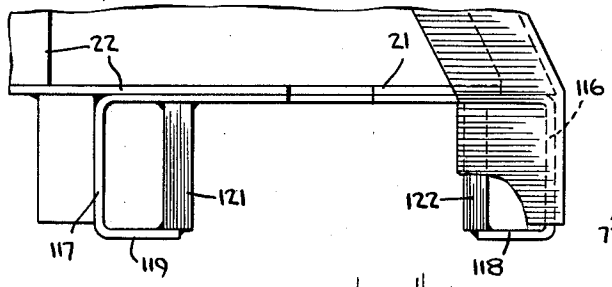


Fig. 13.

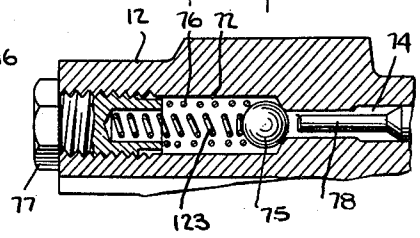


Fig. 14.

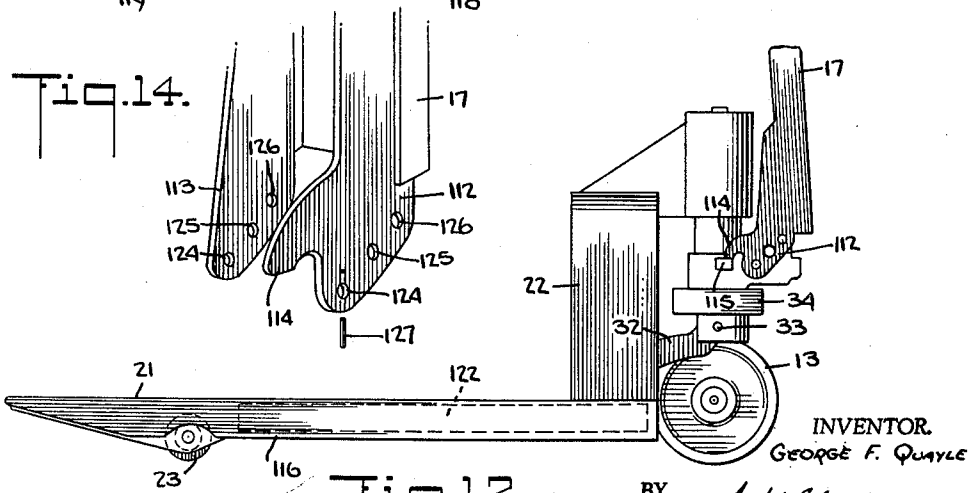


Fig. 12.

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United States Patent Office 3,188,107 Patented June 8, 1965

3,188,107

LIFT TRUCK

George F. Quayle, Philadelphia, Pa., assignor, by mesne assignments, to Yale & Towne, Inc., New York, N.Y., a company of Ohio

Filed May 17, 1962, Ser. No. 195,634
6 Claims. (Cl. 280—43.23)

This invention relates to a hydraulic lift truck of the hand type in which a pump for supplying fluid under pressure to a lift ram for raising an elevating or load frame, is actuated by vertical pumping movement of a pivotally mounted steering handle.

The purpose of this invention is to provide a simple, low cost, lightweight truck of this type which requires relatively few parts, which may be easily assembled or disassembled to facilitate maintenance and fabrication, and which, at the same time, provides excellent counterbalancing of the weight of the steering handle to facilitate operation of the pump and steering of the truck, and which also permits the capacity of the truck to be easily increased through minor structural additions and adjustments.

To this end, the lifting head on which one end of the load or elevating frame is supported and lifted, includes a simple frame member on which a vertically extending lift ram and pump cylinder are supported, with the frame member closing the lower ends of the lift ram and pump cylinder and providing a passage for the flow of fluid between the pump and lift ram. The steering handle is pivotally mounted on this frame adjacent the lower end of the pump cylinder, and is connected through a simple linkage to the upper end of the pump piston, so that the piston may be reciprocated through vertical pumping movement of the steering handle.

As an important feature of the invention, the weight of the steering handle is very effectively counterbalanced by a heavy coil spring which surrounds the vertical pump cylinder and is connected at its upper end to the upper end of the pump piston so that the weight of the steering handle is counterbalanced by the spring acting through the pump piston and connecting linkage. This arrangement not only provides very excellent counterbalancing of the steering handle, but also allows the spring to be readily replaced, while at the same time maintained in a position where it will not interfere with the operation of the truck, and where it will be relatively unobtrusive because the spring and pump do not occupy substantially greater space than the pump alone.

As a feature of the invention, the pump cylinder is threaded into a vertical opening in the frame member and the check valves controlling the flow of fluid between the pump cylinder and the reservoir, as well as the flow of fluid between the pump cylinder and the lift ram are carried by a simple insert which is clamped in the bottom of the opening by the lower end of the pump cylinder. A novel arrangement is provided for opening the check valve between the pump cylinder and the reservoir to allow free vertical movement of the steering and pumping handle to facilitate steering of the truck through the handle.

As a further feature, the lift ram cylinder is threaded into a vertical opening in the frame member to permit easy removal of the lift ram cylinder and lift ram piston for replacement or repair. A second reservoir cylinder surrounds the lift ram cylinder and is spaced therefrom to provide an annular reservoir surrounding the lift ram cylinder. The reservoir cylinder is held assembled on the frame member by a simple bushing or cap member which is threaded on the upper end of the lift ram cylinder and engages the upper edge of the reservoir cylinder to clamp the reservoir cylinder against the frame

member. The reservoir cylinder may, therefore, be easily removed for replacement or repair by removal of the bushing or cap member threaded on the upper end of the lift ram cylinder. The reservoir is connected to the lift ram cylinder and the pump cylinder through passages in the frame member, and a spring pressed relief valve is provided in the passage between the reservoir and the lift ram cylinder to prevent flow of fluid from the lift ram cylinder to the reservoir, unless the load on the lift ram is excessive or the relief valve is actuated by operation of a foot pedal to relieve fluid pressure in the lift ram cylinder to lower the elevating frame. A novel valve arrangement responsive to the rate of flow of fluid from the lift ram cylinder to the reservoir is provided to prevent too rapid lowering of the elevating frame under a heavy load.

As still another feature of the invention, the elevating frame is in the form of parallel forks with each fork formed by opposed, spaced channel members connected together by an upper web. The capacity of the truck may be easily increased substantially by merely welding vertical extending plates between the lower flanges of the channel members and the upper connecting web, inserting another spring in the relief valve to increase the loading on the valve, and changing the pivot connection of the steering handle to the pump to give additional mechanical advantage.

The invention and its advantages having been broadly described, a more detailed description of one embodiment of the invention is given hereafter by reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of a lift truck constructed in accordance with the invention showing the elevating or load frame in a lowered position;

FIG. 2 is a perspective view, similar to that of FIG. 1, but showing the load frame in a raised position;

FIG. 3 is a side elevational view of the truck as shown in FIG. 1;

FIG. 4 is a sectional view of the truck taken on the line 4—4 of FIG. 1;

FIG. 5 is a view taken on the line 5—5 of FIG. 4, with parts broken away to show the foot treadle for actuating the relief valve;

FIG. 6 is a partly sectional plan view showing the relief valve and the valve for controlling the rate of lowering of the elevating frame when the relief valve is opened;

FIG. 7 is a perspective view showing the mechanism for actuating the relief valve and for opening the check valve between the pump cylinder and the reservoir to free the pumping and steering handle for vertical pivotal movement during steering;

FIG. 8 is an enlarged sectional view showing the valve for controlling the speed of lowering of the elevating frame;

FIG. 9 is a perspective view with parts broken away showing the pump, counterbalancing spring and the connection of the steering handle to the pump piston;

FIG. 10 is a rear end view of the truck showing the shape of the forks of the load frame;

FIG. 11 is an enlarged sectional view of one of the forks, showing plates welded between the flanges of the opposed channels forming the forks, to increase the capacity of the truck;

FIG. 12 is a side elevational view of the truck showing the extent of the reinforcing plates shown in FIG. 11;

FIG. 13 is a sectional view of the relief valve showing the use of an additional spring to increase the loading on the relief valve when the capacity of the truck is increased; and

FIG. 14 is a perspective view of the lower end of the steering handle showing the plurality of holes which permit the pivotal connection of the handle to the pump

piston to be changed to increase the mechanical advantage when the capacity of the truck is increased.

Referring to the drawings and in particular to FIGS. 1, 2 and 3, the lifting head of the truck is generally designated by the reference numeral 10, while the load or elevating frame is generally designated by the reference numeral 11.

The lifting head 10 includes a frame member 12, ground engaging supporting wheels 13 mounted on a downwardly directed extension 14 of the frame member 12, a vertically extending lift ram assembly 15 and a vertically extending pump assembly 16 mounted on the upper side of the frame member 12, and an elongated steering handle 17 pivotally attached at its lower end to the frame 12, between the lift ram assembly 15 and the pump assembly 16. As will be described in more detail hereafter, the elevating frame 11 is pivotally attached to the lifting head, so that the lifting head 10 may be rotated relatively to the elevating frame 11 by means of the handle 17 to effect steering of the truck.

The steering handle 17 is connected to the upper end of the pump assembly 16 through links 18 and 19 so that the pump assembly 16 may be actuated through vertical pumping movement of the handle 17 to supply fluid under pressure to the ram assembly 15 to raise the rear end of the elevating frame 11. As an important feature of the invention, a heavy coil spring 20 surrounds the pump assembly 16 and acts through the piston of the pump assembly 16 and connecting links 18 and 19 to counterbalance the weight of the handle 17.

This arrangement not only provides very excellent counterbalancing of the weight of the handle, but also allows the spring 20 to be readily replaced, while at the same time maintained in a position where it will not interfere with the operation of the truck and where it will be relatively unobtrusive because the spring and pump do not occupy greater space than the pump alone. The lower end of the steering handle 17 is of channel shape, with the channel opening toward the pump assembly 16, and when the handle 17 is in a vertical position, as shown in FIGS. 1 and 3, the channel shaped lower end portion of the handle 17 surrounds the pump assembly 16, including the counterbalancing spring 20 and the links 18 and 19, thereby protecting these elements against damage.

The load or elevating frame 11 includes laterally spaced, horizontally extending forks 21 and a vertically extending frame section 22 through which the rear ends of the forks are connected to the upper end of the lift ram assembly 15, so that the rear end of the elevating frame 11 may be raised by operation of the lift ram assembly 15.

The forward end of each of the forks 21 is provided with a supporting roller 23 which is mounted on links 24 which in turn are pivotally attached at 25 to the forks. As best shown in FIG. 3, an elongated link 26 extending longitudinally through each fork 21 is pivotally attached at 27 to the links 24 and is pivotally attached at 28 to the end of a lever 29. Lever 29 in turn is secured to one end of a bearing 30 which is journalled for rotation on a shaft 31 secured to the frame section 22. A second lever 32 is secured to the opposite end of the bearing 30 and is pivotally attached at 33 to the outer end of a horizontal plate 34. The plate 34 is rotatably mounted on the extension 14 of the frame member 12 above the wheels 13.

When the rear end of the elevating frame 11 is raised through operation of the lift ram assembly 15, the levers 32 and 29 are rotated in a clockwise direction, as viewed in FIG. 3, as the shaft 31 moves upwardly with the elevating frame. This rotation of the levers 32 and 29 is transmitted through the links 26 to the links 24 causing the links 24 and the rollers 23 carried thereby to pivot downwardly to support the front ends of the forks 21 as the rear end of the elevating frame 11 is raised. In utilizing the truck to pick up a pallet, the forks 21, while in the lowered position as shown in FIG. 1, are inserted through the pallet and then raised to the position shown in FIG. 2 to lift the pallet a few inches from the ground so that it may be transported by the truck.

Referring now to FIG. 4, the lift ram assembly 15 includes a vertically extending lift ram cylinder 35 and an outer cylinder 36 which is concentric with the lift ram cylinder 35, but is of larger diameter than the lift ram cylinder so as to form an annular fluid reservoir 37 between it and the outer surface of the lift ram cylinder. The lower end of the lift ram cylinder 35 is threaded and the lift ram cylinder is secured to the frame 12 by being threaded into a vertical bore 38 in the upper surface of the frame 12. The lower end of the cylinder 36 is received in an annular seat 39 formed in the upper surface of the frame member 12, concentric with the bore 38, and the cylinder 36 is held assembled by a bushing or cap member 40 which is threaded on the upper end of the lift ram cylinder 35 and has an annular shoulder 41 which engages the upper edge of the cylinder 36 to clamp the cylinder in the annular seat 39. A passage 42 is provided in the side of the cylinder 36 to permit filling of the reservoir 37 with fluid. The passage 42 is normally closed by plug 43.

A piston 44, having a piston head 45, is slidably mounted in the lift ram cylinder 35 with the upper end of the piston 44 extending through a bore 46 in the bushing or cap member 40. The bushing or cap member 40 is provided with a suitable seal 47 which has sliding engagement with the surface of the piston 44. By this arrangement, the lift ram cylinder 35, the cylinder 36 and the piston 44 may be easily disassembled for replacement or repair by merely removing the bushing or cap member 40 and unscrewing the lift ram cylinder 35 from the bore 38. A small hole 35*a* through the lift ram cylinder 35 automatically limits upward movement of the piston 44 by allowing flow of fluid from below the piston directly to the reservoir 37 after the piston head 45 moves upwardly past the opening 35*a*. A small passage 40*a* in the bushing or cap member 40 allows any fluid which has leaked past the piston head 45 to be returned to the reservoir 37.

A thrust bearing assembly 48 surrounds the upper end of the piston 44 and seats on an annular shoulder 49 formed on the piston 44 adjacent the upper end. The upper end of the piston 44 extends through an opening 50 in a plate 51 which forms a part of the frame section 22, and the frame section 22 is supported on the upper end of the piston rod 44 through the plate 51 which bears against the upper surface of the thrust bearing assembly 48. A split ring retainer 52 holds the plate 51 assembled to the upper end of the piston rod 44, while the bearing assembly 48 allows steering rotation of the lifting head 10 relatively to the elevating frame 11. The piston 44 may be easily disconnected from the plate 51, and therefore, from the elevating frame 11 by removing the split ring retainer 52.

It will be noted that the lower surface 53 of the plate 51 which bears against the upper surface of the bearing assembly 48 is convexed and the opening 50 oversized relatively to the upper end of the piston 44, so that the lift head assembly 10 may rock slightly relatively to the elevating frame 11, as the elvating frame 11 is raised through operation of the lift ram assembly 15 and the lower end of the lifting head assembly 10 is pulled and pushed slightly toward and away from the lower portion of the elevating frame 11 by rotation of the levers 32.

Still referring to FIG. 4, it can be seen that the vertical axis of the lift ram cylinder 35 and the vertical axis of the extension 14, on which the plate 34 is rotatably mounted, extend through the axis of rotation of the supporting wheels 13. The lifting head 10, therefore, may be rotated relatively to the elevating frame 11 about the vertical axis of the lift ram cylinder 35 to effect steering of the truck. The plate 34 is held assembled on the extension by means of a retainer 54. An anti-friction

bearing 55 between the plate 34 and the frame member 12 allows lifting head 10 to be easily rotated relatively to the plate 34 during steering of the truck.

The pump assembly 16 includes a pump cylinder 56 and a pump piston 57 which is slidably received in the pump cylinder 56. The lower end of the pump cylinder 56 is threaded, and the pump cylinder 56 is secured to the frame member 12 by being threaded into a vertical bore 58 extending inwardly from the upper surface of the frame member 12. A ball check valve 59 for allowing flow of fluid from the reservoir 37 to the pump cylinder 56, while preventing reverse flow, and a spring pressed ball check 60 for allowing flow of fluid from the pump cylinder to the lift ram cylinder 55, while preventing reverse flow, are both carried by a simple insert 61 which is received in the bottom of the bore 58 and clamped by the lower end of the pump cylinder 56 when the end thereof is threaded into the bore 58. The pump cylinder 56 and insert 61 may be easily disassembled for replacement or repair by merely unscrewing the pump cylinder 56 from the bore 58. The provision of the separate removable insert 61 also permits this member to be cast from high grade material to insure that the porosity of the casing will not affect operation of the valves.

The ball check 59 is carried in an enlarged section of a passage 62, which extends through the insert 61 and communicates with a passage 63 to the reservoir 37. On the upstroke of the pump piston 57, fluid is drawn from the reservoir 37, through the passage 63 in the frame member 12, through the passage 62 in the insert 61 by unseating the ball check 59, and into the pump cylinder 56.

Spring pressed ball check 60 is carried in an enlarged portion of a passage 64 formed through the insert 61 and is held in a seated position by a spring 65 carried by a spring seat 66 which is secured in the lower end of the enlarged section of the passage 64. An annular groove 67 is provided in the outer cylindrical surface of the insert 61 and communicates with the enlarged section of the passage 64 through a port 68. A passage 69 formed in the frame 12 communicates at one end with the groove 67 and at the other end with a chamber 70 formed in the frame member 12 below the lift ram cylinder 35. On the downstroke of the pump piston 57, fluid in the pump cylinder 56 unseats the ball check 60, by yielding of the spring 65, and passes through the port 68, the groove 67 and the passage 69 to the chamber 70, and forces the lift ram piston 44 upwardly to raise the rear end of the elevating frame 11. During the downstroke of the pump piston 57, flow of fluid to the reservoir 37 is prevented by seating of the ball check 59, while return flow of fluid from the lift ram cylinder 35 to the pump cylinder 56, on the upstroke of the pump piston 57, is prevented by seating of the ball check 60.

As best shown in FIG. 6, a passage 71 is provided in the frame member 12 connecting the reservoir 37 with an enlarged bore 72 extending inwardly from one side of the frame member 12, and a second passage 73 is formed in the frame member 12 connecting the chamber 70 and a small bore 74 which extends inwardly from the opposite side of the frame member 12 from the bore 72 and communicates with the bore 72. Passage of fluid from the chamber 70 below the lift ram cylinder 35 through the passage 73, the bore 74, the bore 72 and passage 71 to the reservoir 37 is normally prevented by a ball check 75 which is mounted in the bore 72 and held in a position closing the bore 74 by a spring 76 which bears at one end against a plug 77 which is threaded in the outer end of the bore 72. The ball check valve 75 serves the dual function of a relief valve to allow passage of fluid from the lift ram cylinder 35 to the reservoir 37 in the event it is attempted to lift a load which is excessive for the rating of the truck, and as a release valve which may be opened to allow passage of fluid from the lift ram cylinder 35 to the reservoir 37 to allow the elevating frame 11 to lower. The ball check valve 75 is adapted to be opened so as to release the pressure in the lift ram cylinder 35 by a plunger 78 which is slidably mounted in the bore 74, and is adapted to engage and move the ball check 75 away from the end of the bore 74. The plunger 78 is adapted to be moved in a direction to open the ball check valve 75 by pivotal movement of a foot treadle 79.

As best shown in FIGS. 4, 5 and 6, the foot treadle 79 is mounted on the outer end of a shaft 80 which extends through and is journalled in a bore 81 extending horizontally through the frame member 12 between the lift ram assembly 15 and the pump assembly 16. As will be described in detail hereafter, the shaft 80 also provides the pivotal connection of the steering handle 17 to the frame member 12. Referring now to FIG. 7, the treadle 79 is provided with a projection 82 having an adjustable screw 82a which engages and moves the plunger 78 in a direction to open the ball check 75 to allow lowering of the elevating frame 11 when the treadle is rotated in a clockwise direction, as viewed in FIG. 7. As best shown in FIG. 5, the treadle 79 is held in the non-releasing position of FIG. 7 by engagement of a spring pressed ball detent 83 with a recess 84 in the side of a flange 85 formed integrally with the treadle 79. The ball detent 83 is carried in a recess in the end of a plunger 86 which is mounted in a bore 87 formed in a projection 88 extending from the side of the frame member 12. A spring 89 carried in the bore 87 urges the plunger in a direction to yieldingly hold the ball detent 83 in engagement with the recess in the flange 85. In this position of the treadle 79, as shown in FIGS. 5 and 7, vertical pumping movement of handle 17 effects operation of the pump assembly 16 to raise the elevating frame 11.

Referring now to FIGS. 5 and 7, a lever 90 is secured to the outer end of the plunger 86 and has a recess 91 providing a projection 92. The projection 92 is engaged by a pin 93, secured to the flange 85 of the treadle 79, to cause rotation of the lever 90 and the plunger 86 when the treadle 79 is rotated, in the counterclockwise direction as viewed in FIG. 7, to an intermediate position. This rotation of the plunger 86 is transmitted through a flat portion 94 formed on the inner end of the plunger 86 to a disc member 95 carried in a cylindrical recess 96. The recess 96 is formed in the frame member 12 below the ball check 59, as shown in FIGS. 4 and 5. The disc member 95 has an upstanding U-shaped member 97 secured thereto which extends upwardly within the bore 62 below the ball check 59, and upward movement of the disc member 95 by rotation of the plunger 86 results in an unseating of the ball check 59, allowing the free flow of fluid from the pump cylinder 56 to the reservoir 37 through the bore 62 and passage 63, so that vertical pumping movement of the handle 17 is ineffective to pump fluid to the lift ram cylinder 35 and the handle 17 may be moved freely in the vertical direction to facilitate steering of the truck.

It will be noted from FIG. 4, that the vertical axis of the disc member 95, and the vertical axis of the insert 61 containing the ball check 59 are aligned, so that insert 61 and disc member 95 may be assembled in any rotated position relatively to the frame 12. Thus, neither the insert 61 nor the disc member 95 has to be assembled in any particular rotated position relatively to the frame 12 in order for the U-shaped member 97 to properly extend within the bore 62. In assembling the insert 61 and the disc member 95, the disc member 95 is first dropped into the cylindrical recess 96 and the insert 61 then placed over the disc member 95 so that the U-shaped member 97 extends into the bore 62. Because the vertical axis of the insert 61 and the vertical axis of the disc member 95 are aligned, the insert 61 and the disc member 95 will function properly regardless of the rotated position of these elements as a unit relatively to the main frame 12. This, of course, facilitates assembly of the insert 61 and the disc member 95.

The treadle 79 is releasably held in the free handle

position, in which the ball check 59 is unseated by the U-shaped member 97, by engagement of the ball detent 83 in a recess 98 in the flange 85, spaced from the recess 84.

If the treadle 79 is rotated further in the clockwise direction, as viewed in FIG. 7, the end of the adjustable screw 82*a* engages and moves the plunger 78 to open the ball check valve 75 to release fluid from the lift ram cylinder 35 and allow lowering of the elevating frame. The foot treadle 79 is releasably held in this lowering position by engagement of the ball detent 83 with a recess 99 formed in the flange 85, spaced from the recess 98.

When the ball check 75 is opened by the plunger 78, flow of fluid from the lift ram cylinder 35 through the passage 73 is controlled by a spring pressed valve spool 100, as best shown in FIGS. 6 and 8. As best shown in FIG. 8, the end of the valve 100 which normally extends into the chamber 70 is provided with four lateral ports 101, 102, 103 and 104, which communicate with a longitudinal extending passage 105 through the valve spool 100 which communicates with the passage 73. The ports 103 and 104 are offset in the longitudinal direction from the ports 101 and 102. During normal operation, the spool 100 is urged to the position shown in FIG. 8 against a hardened washer 106 by a spring 107. In this position, the four ports 101, 102, 103 and 104 communicate with the chamber 70. If, however, there is too rapid a flow of fluid with a resulting rapid lowering of the elevating frame 11, the fluid forces the spool 100 to the right, as viewed in FIG. 8, by yielding of the spring 107, whereby the ports 103 and 104 are closed and the fluid is restricted to flow through ports 101 and 102, thereby slowing down the rate of flow of fluid from the lift ram cylinder 35 to prevent the elevating frame 11 from lowering too rapidly under a heavy load.

Referring now to FIG. 9, the links 18 and 19, through which the pump assembly 16 is actuated through vertical pumping of the handle 17, are pivotally attached at their upper ends to the ends of a cross head 108 which is secured to the upper end of the pump piston 57 through a stud 109, and a retaining nut 110 which is threaded on to the outer end of the stud 109. The lower ends of the links 18 and 19 are connected by means of bolts 111 to flanges 112 and 113 of the lower end of the steering handle 17.

The counterbalancing spring 20 surrounds the pump cylinder 56 and bears at its lower end against the surface of the frame member 12 surrounding the pump cylinder 56, and bears at its upper end against the cross head 108. The spring 20 is of sufficient strength that acting through the pump piston and connecting links 18 and 19, it counterbalances the weight of the steering handle 17. It has been found that by having the counterbalancing spring act through the pump piston and connecting links that better counterbalancing action is obtained than if the spring acts directly against the handle.

As best shown in FIGS. 3, 12 and 14, the flange 112 of the lower end of the steering handle 17 is provided with a projection 114 which engages a stop lug 115 formed on the side of the frame member 12 to limit forward pivotal movement of the steering handle 17 to the substantially vertical position so as to prevent the handle damaging the pump assembly 16.

Referring now to FIGS. 10 and 11, each of the forks 21 is formed by laterally spaced, opposed channel members 116 and 117 having lower flanges 118 and 119 and an upper common web or flange 120. As best shown in FIG. 11, the capacity of the elevating frame 11 may be materially increased by welding vertical plates 121 and 122 between the flanges 119 and the web 120. As shown in FIG. 12, the plates 121 and 122 extend for a substantial portion of the length of the forks 21. As shown in FIG. 13, the loading on the relief valve 75 may be increased by removing the plug 77 and inserting a second spring 123 in the bore 72 to increase the permissive load that the truck may lift without the relief valve 75 opening.

As shown in FIG. 14, the flanges 112 and 113 of the lower end of the handle 17 are each provided with three openings 124, 125 and 126. The lower openings 124 are utilized for mounting the handle on the shaft 80, as best shown in FIG. 5, with the flange 112 secured to the shaft 80 by a pin 127. The opposite flange 113 and the treadle 79 are retained on the shaft 80 by means of a nut 128 threaded on the opposite end of the shaft 80, as shown in FIGS. 5 and 6.

The intermediate openings 125 are utilized for connecting the lower ends of the links 18 and 19 to the handle 17 by the bolts 111 to give increased mechanical advantage in actuating the pump assembly when the capacity of the truck has been increased by the addition of the plates 121 and 122. The openings 126 are utilized for connecting the lower ends of the links 18 and 19 to the handle 17 when the plates 121 and 122 are not used, to give faster operation of the pump when lighter loads are being handled.

From the preceding description, it can be seen that there is provided a simple, low cost, lightweight hydraulic lift truck of the hand type in which the lift ram assembly, the pump assembly, valves and counterbalancing spring may be easily assembled and disassembled to facilitate maintenance and fabrication. At the same time, the structure provides excellent counterbalancing of the weight of the steering handle to facilitate operation of the pump and steering of the truck, and allows the capacity of the truck to be increased materially through minor structural additions and adjustments.

While one embodiment of the invention has been shown and described, it will be appreciated that this is for the purpose of illustration, and that changes and modifications may be made therein without departing from the spirit and scope of the invention.

I now claim:

1. An industrial truck comprising, a lifting head including a frame member, a supporting wheel mounted on the lower side of said frame member, a vertically extending lift ram assembly including a reservoir mounted on said frame member, a vertically extending bore in said frame member, a pump cylinder threaded at its lower end in said bore, a cylindrical insert in said bore clamped against the bottom of said bore by the lower end of said pump cylinder, check valve means in said insert for controlling the flow of fluid from said reservoir to said pump cylinder and from said pump cylinder to said lift ram cylinder, passages in said frame member connecting said valve means with said reservoir and said lift ram cylinder, a pump piston slidably mounted in said pump cylinder, an elongated steering handle pivotally attached at its lower end to said frame member, link means connecting the lower end of said steering handle to the upper end of said pump piston whereby vertical pumping movement of said steering handle effects pumping movement of said pump piston, a spring surrounding said pump cylinder and connected to the upper end of said pump piston, and said spring being of sufficient strength to counterbalance the weight of the handle when acting through said pump piston and link means, a disc member rotatably mounted on said frame below said insert with the axis thereof aligned with the axis of said insert, means extending from said disc member and engageable with the check valve means controlling flow of fluid from said pump cylinder to said reservoir, means for lifting said disc member to cause said projecting means to open said check valve means and allow flow of fluid from said pump cylinder to said reservoir to free said steering handle, a passage in said frame member connecting said lift ram cylinder with said reservoir, a spring pressed relief valve in said passage.

2. An industrial truck comprising, a lifting head including a frame member, a supporting wheel mounted on the lower side of said frame member, a lift ram assembly and reservoir mounted on said frame member, a bore in said frame member, a pump cylinder threaded at its lower end in said bore, a cylindrical insert in said bore clamped

against the bottom of said bore by the lower end of said pump cylinder, check valve means in said insert offset from the axes of said insert for controlling the flow of fluid from said reservoir to said pump cylinder and from said pump cylinder to said lift ram cylinder, passages in said frame member connecting said valve means with said reservoir and said lift ram cylinder, a pump piston slidably mounted in said pump cylinder, means for effecting movement of said pump piston, a disc member rotatably mounted in said frame below said insert with the axis thereof aligned with the axis of said insert, means extending from said disc member and engageable with the check valve means controlling flow of fluid from said pump cylinder to said reservoir, means for lifting said disc member to cause said projecting means to open said check valve means and allow flow of fluid from said pump cylinder to said reservoir.

3. An industrial lift truck comprising an elevating frame, a lifting head equipped with a wheel for said truck, a lift ram mounted in a vertical position on said lifting head, a bearing through which said lift ram supports a front end of the elevating frame for lifting movement relatively to the lifting head while mounting said head for bodily steering rotation in the axis of said ram relatively to said elevating frame, a pump cylinder mounted in a position parallel to the steering axis and forwardly of the lift ram on the lifting head, a pump piston in said cylinder, a spring assembled to the pump cylinder and pressing the pump piston relatively to the cylinder, a steering handle pivoted to the lifting head for swinging between a position extending forwardly from said lifting head, and an upward vertical position substantially aligned with the pump cylinder and piston, a link connecting the steering handle and the pump piston so that the spring pressure of said piston is applied in an upward direction to the steering handle, said spring having that strength which will be effective through the link to counterbalance the weight of the steering handle in the positions to which the truck operator may swing the handle about its pivot incidental to operation and parking of the truck, said link also enabling the steering handle to operate the pump piston as its spring yields, and fluid control means carried by the lifting head for controlling a flow of fluid between the pump cylinder and lift ram.

4. An industrial lift truck comprising an elevating frame, a lifting head equipped with a wheel for said truck, a lift ram mounted in a vertical position on said lifting head, a bearing through which said lift ram supports a front end of the elevating frame for lifting movement relatively to the lifting head while mounting said head for bodily steering rotation in the axis of said ram relatively to said elevating frame, a pump cylinder mounted in a position parallel to the steering axis and forwardly of the lift ram on the lifting head, a pump piston in said cylinder, a coil spring assembled about the pump cylinder and connected to the outer end of the pump piston so as to press said piston in one direction relatively to the cylinder, a steering handle pivoted to the lifting head for swinging between a position extending forwardly from said lifting head, and an upward vertical position substantially aligned with the pump piston, a pair of links arranged at opposed sides of the pump cylinder and connecting the steering handle to the outer end of the pump piston so that the spring pressure of said piston is applied in an upward direction to the steering handle, said coil spring having that strength which will be effective through the pair of links to counterbalance the weight of the steering handle in the positions to which the truck operator may swing the handle about its pivot incidental to operation and parking of the truck, said links also enabling the steering handle to operate the pump piston as said coil spring yields, and fluid control means carried by the lifting head for controlling a flow of fluid between the pump cylinder and lift ram.

5. An industrial lift truck comprising an elevating frame, a lifting head equipped with a wheel for said truck, a lift ram mounted in a vertical position on said lifting head, a bearing through which said lift ram supports a front end of the elevating frame for lifting movement relatively to the lifting head while mounting said head for bodily steering rotation in the axis of said ram relatively to said elevating frame, a pump cylinder mounted in a position parallel to the steering axis and forwardly of the lift ram on the lifting head, a pump piston in said cylinder, a spring assembled to the pump cylinder and pressing the pump piston relatively to the cylinder, a steering handle pivoted to the lifting head for swinging between a position extending forwardly from said lifting head, and an upward vertical position substantially aligned with the pump piston, a portion of the steering handle formed as a channel enclosing the pump cylinder and piston when said handle swings to said substantially aligned position, link means connecting the steering handle and the pump piston so that the spring pressure of said piston counterbalances the steering handle, said link means also enabling the steering handle to operate the pump piston as its spring yields, and fluid control means carried by the lifting head for controlling a flow of fluid between the pump cylinder and lift ram.

6. An industrial lift truck comprising an elevating frame, a lifting head equipped with a wheel for said truck, a lift ram mounted in a vertical position on said lifting head, a bearing through which said lift ram supports a front end of the elevating frame for lifting movement relatively to the lifting head while mounting said head for bodily steering rotation in the axis of said ram relatively to said elevating frame, a pump cylinder mounted in a position parallel to the steering axis and forwardly of the lift ram on the lifting head, a pump piston extending upwardly from said cylinder, a coil spring assembled about the pump cylinder and connected to the upper end of the pump piston so as to press said piston in an outward direction relatively to the cylinder, a steering handle pivoted to the lifting head for swinging between a position extending forwardly from said lifting head, and an upward vertical position substantially aligned with the pump piston, a pair of links arranged at opposed sides of the pump cylinder and connecting the steering handle to the upper end of the pump piston so that the spring pressure of said piston is applied in an upward direction to the steering handle, a channel-shaped portion of the steering handle enclosing the pump cylinder piston, coil spring and pair of links when said handle swings to said substantially aligned upward position, said coil spring having that strength which will be effective through the pair of links to counterbalance the weight of the steering handle in the positions to which the truck operator may swing the handle about its pivot incidental to operation and parking of the truck, said links also enabling the steering handle to operate the pump piston as the coil spring yields, and fluid control means carried by the lifting head for controlling a flow of fluid between the pump cylinder and lift ram.

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