Sept. 7, 1943. W. STUEBING, J R 2,329,145

LIFT TRUCK

Filed Aug. 20, 1941 3 Sheets-Sheet 1

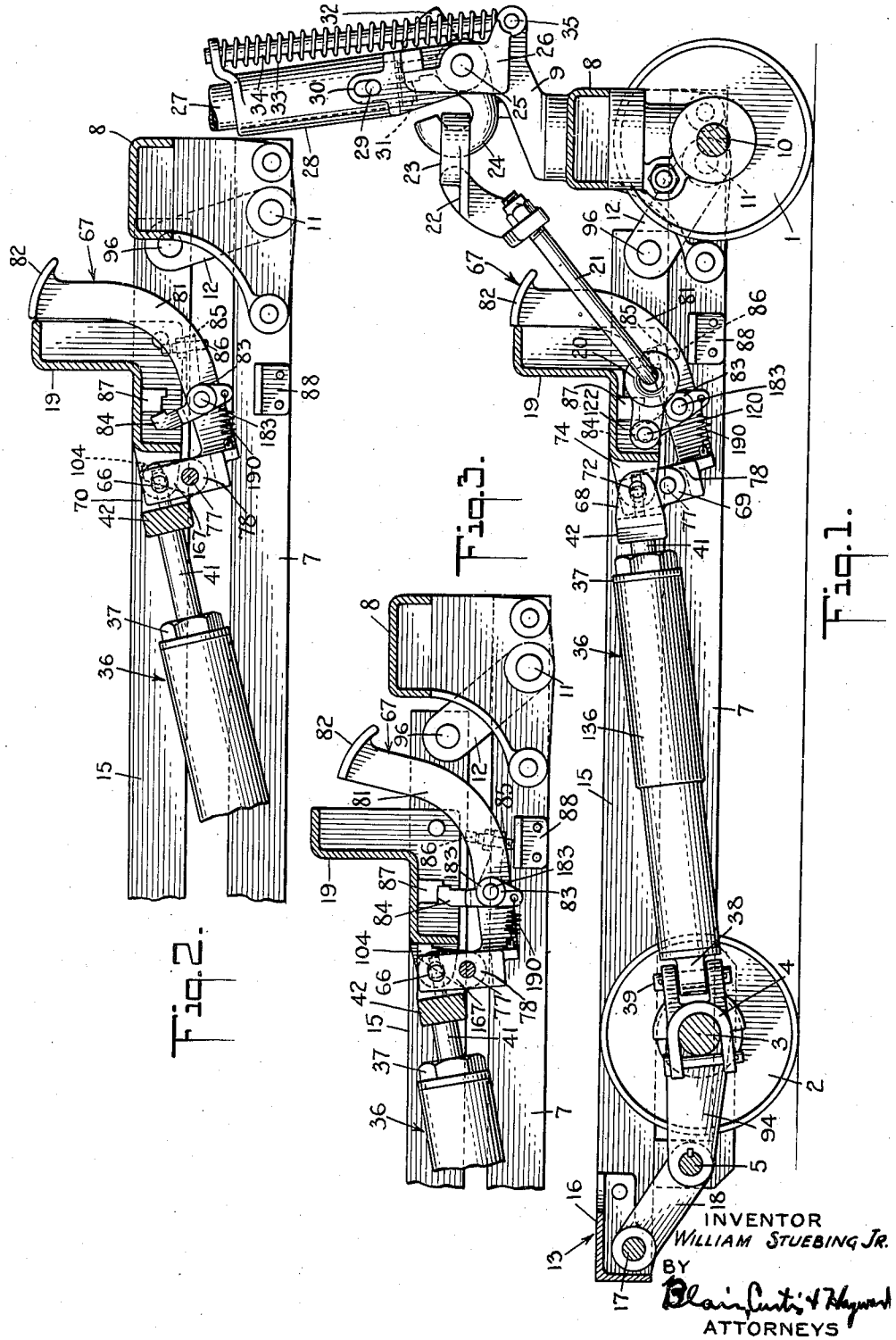

Fig. 1.

Fig. 2.

Fig. 3.

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LIFT TRUCK

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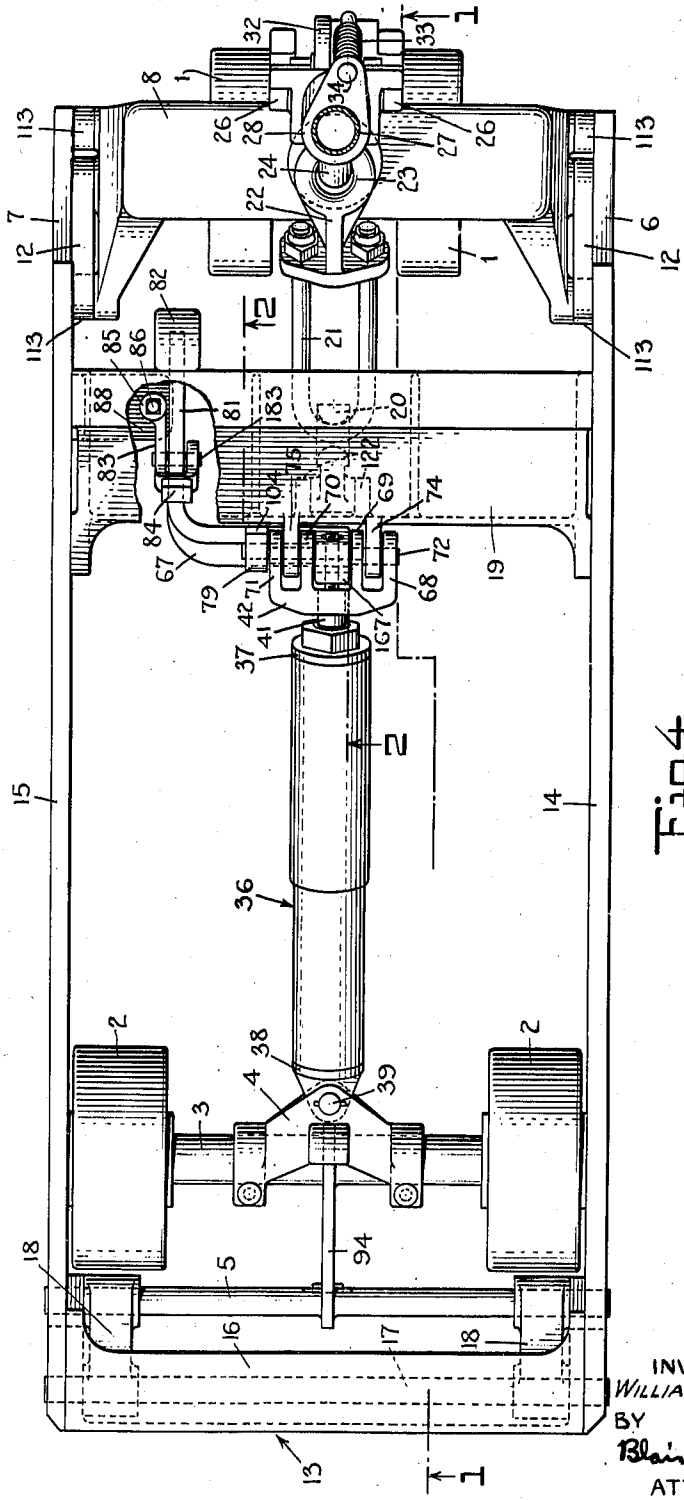

Fig. 4.

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LIFT TRUCK

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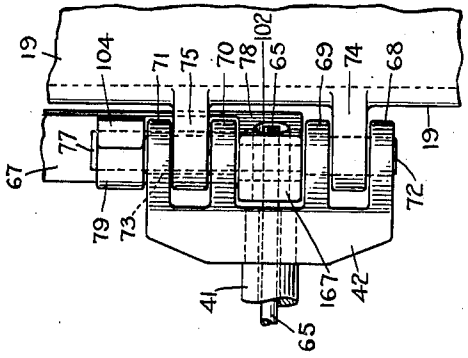

Fig. 6.

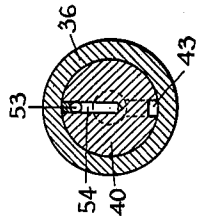

Fig. 8.

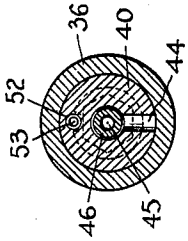

Fig. 7.

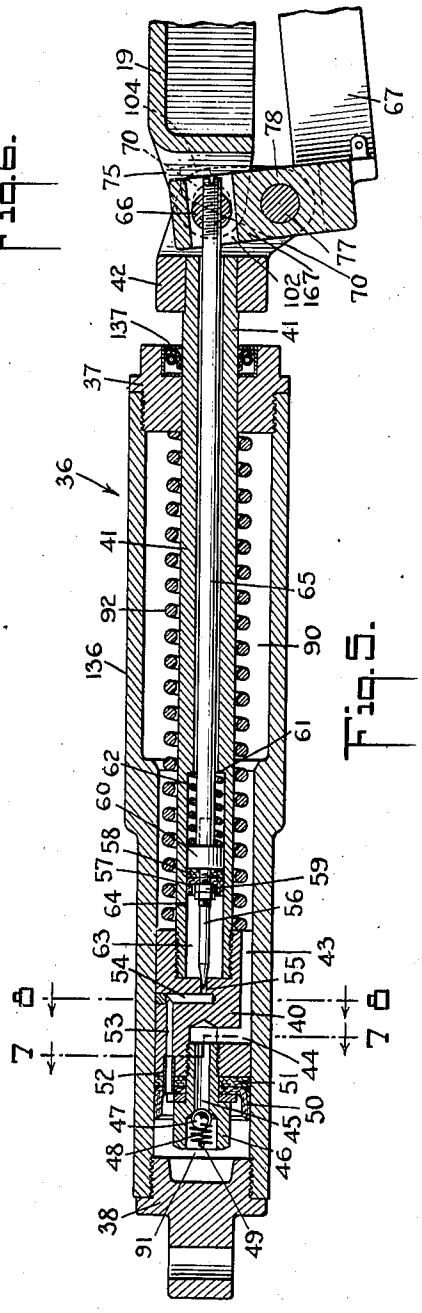

Fig. 5.

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2,329,145

LIFT TRUCK

William Stuebing, Jr., Cincinnati, Ohio

Application August 20, 1941, Serial No. 407,536

8 Claims. (Cl. 254—10)

This invention relates to lift trucks, and more particularly to hand operated lifting and holding mechanism where the lifting operation is performed by a releasable connection between the steering handle and the lifting frame, and where the load is reliably held in an elevated position and may be released.

This application is related to my copending applications, Serial No. 370,090, filed December 14, 1940, now Patent No. 2,280,104, and Serial No. 379,553, filed February 19, 1941, patented September 2, 1941, as Patent No. 2,254,331, and to my United States Patent No. 2,224,166, issued December 10, 1940, and certain features of the various embodiments are applicable to the other embodiments. The present invention is directed particularly to the lifting of the load, the holding of the load in the elevated position, and the releasing of the load.

An object of this invention is to provide a manually operated mechanism for lifting articles when, for example, they are supported upon movable platforms and it is desired that the articles be moved to another location. A further object is to provide a mechanism of the above character which is sturdy and simple in construction and which is efficient and dependable in operation. A further object is to provide apparatus which is light in weight and economical to manufacture and which may be used with safety under a wide variety of conditions. A still further object is to provide mechanism which may be used in a thoroughly practical and dependable manner to lift manually material such as a large article or a number of small articles by a simple lifting operation, and then without delay to convey manually the lifted material to another location. These and other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combination of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the drawings in which one embodiment of the invention is disclosed:

Figure 1 is a vertical section on the line 1—1 of Figure 4 showing the chassis construction and lifting mechanism and with the lifting frame in its lower position;

Figure 2 is a fragmental view similar to the right-hand portion of Figure 1 but on the line 2—2 of Figure 4 and showing the lifting frame in its elevated position;

Figure 3 is similar to Figure 2 but shows the lifting frame as it is descending from the elevated position of Figure 2 toward the lower position of Figure 1;

Figure 4 is a plan view with a portion of the lifting frame broken away to show the mechanism associated with the releasing treadle which is operated to release the load;

Figure 5 is a vertical section of the mechanism which holds the frame in elevated position and which controls the descent of the lifting frame;

Figure 6 is a fragmentary plan view of the attaching and control mechanism at the right of Figure 5;

Figure 7 is a sectional view on the line 7—7 at the left-hand portion of Figure 5; and

Figure 8 is a sectional view on the line 8—8 of Figure 5.

In operating lift trucks, accidents have occurred in which operators have been injured and materials damaged due to defects or undesirable features in the trucks or due to careless operation. For example, with some prior types of lift trucks the steering handle is utilized to perform the lifting operation, and the steering handle is then used to steer the truck without disconnecting the lifting mechanism from the steering handle. With this type of truck the lifting frame and the load are held in the elevated position by some type of latch mechanism and frequently this latch mechanism has become accidentally disengaged while the truck is being moved. When this occurs, the load and the lifting frame may fall rapidly and unexpectedly, and the steering handle is swung upwardly to cause what is known as a "flying handle." Such a "flying handle" moves with great speed and force, and the unsuspecting operator is frequently hit and sometimes injured severely.

It is desirable that the load descend gently when it is released, and lift trucks are provided with checks which do not interfere with the lifting operation, but which are designed to limit the speed of descent of the lifting frame. However, lift trucks of this type are subjected to severe abuse, and there is no way of insuring that they will receive proper servicing. As a result of this, the check on a lift truck may become defective or the oil may leak from a hydraulic check, and the check is rendered inoperative. In addition to this, some operators have a tendency to misuse the truck, and a load is sometimes lifted which is in excess of the load which the check will handle. Thus, at times an operator lifts a load and moves it, but when the load is

released, the check is not effective and the load falls to the floor causing damage to the equipment or the load, and in fact, even causing injury to the workman. It is an object of this invention to provide a lift truck which is efficient in operation and which is free of difficulties of the above character.

Referring to Figure 1 of the drawings, a lower frame is provided with a pair of front wheels 1 having an axle 10 and a pair of rear wheels 2 having an axle 3, and a pair of lower rails 6 and 7 (see also Figure 4). The front ends of lower rails 6 and 7 are joined together by a head 8 which carries a swiveled fork 9 in which axle 10 is mounted. Lower rails 6 and 7 provide a mounting means for four links, there being at the front a pair of links 12 carried at their lower ends by a pair of pins 11, and at the rear a pair of links 18 carried at their lower ends by a shaft 5. Shaft 5 extends through and is keyed to a locking brace 94 the forward end of which is welded to axle 3 with the axle extending through a hole in the end of the locking brace. The upper end of each of links 12 and 18 is pivotally connected to the lifting frame 13 which is elevated to engage and lift the load. Lifting frame 13 is formed by two upper rails 14 and 15, a rear tie-bar 16, and a forward saddle 19. Tie-bar 16 supports a shaft 17 (see Figure 1) similar to shaft 5 and upon which links 18 are pivoted. Links 12 are connected to the lifting frame by a pair of pivot pins 96. Referring again to Figure 4, head 8 is attached to lower rails 6 and 7 by four rigid pins, each pin carrying a spacing collar 113 providing space for links 12 between the sides of the lower rails and the head.

When it is desired to lift a load, the lifting frame is pulled forwardly and upwardly, and it swings through an arcuate path from the position shown in Figure 1 toward the position of Figure 2, with the four links 12 and 18 cooperating to provide a rigid support for the lifting frame. The lifting frame is also connected to the lower frame by a latch-check unit 36 to be described in detail below, which is expansible longitudinally and which is effective as a latch to hold the lifting frame in any elevated position and which is also effective as a check to limit the speed of descent of the lifting frame.

The mechanism for performing the lifting operation is of the character shown in my patent referred to above though the operation and the leverage arrangement are different. Accordingly, on the under side of the central portion of saddle 19 is a swinging double-eye link 20 which is pivoted on a pin 120 carried by a pair of ears 122 integral with saddle 19. Extending through the forward eye of link 20 is a hairpin loop 21 which is rigidly attached at its upper end to a doughnut link 22 having an eye portion 23. Extending through eye portion 23 is a lifting hook 24 which is rockably mounted on a pivot pin 25 carried by the upper bifurcated end 26 of fork 9. Lifting hook 24 is provided with a segment portion 32, and extending upon opposite sides of this segment portion and pivoted on pin 25 are two downwardly extending ears of a steering handle sleeve 28.

Sleeve 28 carries the steering handle 27, and limited longitudinal movement is provided by virtue of a pin 29 which is rigidly mounted in the extreme end of handle 27 and the opposite ends of which extend through a pair of elongated slots 30 in sleeve 28. Rigidly mounted in the lower end of handle 27 is a plug having a downwardly extending tooth 31 which engages the segment portion 32 of the lifting hook 24. With the elements positioned as shown, tooth 31 lies to the left of the segment portion 32, and when the handle is swung downwardly (clockwise), the lifting hook 24 is swung about the pivot pin 25 with the result that the lifting frame is elevated upon the links 12 and 18. However, when the handle 27 is slid upwardly or forwardly within the sleeve 28 so that pin 29 is positioned at the other extreme end of slots 30, the extreme end of tooth 31 rides upon the arcuate surface of segment 32. In this way, the steeering handle is disconnected from the lifting mechanism, and it is held in extended position by the engagement between the arcuate end of tooth 31 and the arcuate surface of segment 32. A balancing spring 33 balances the weight of the handle and is mounted on a rod 34 which is pivoted at its lower end on a pin 35 and which extends through a bracket at the upper end of sleeve 28.

The lifting frame is moved from the position shown in Figure 1 to the position shown in Figure 2, and the links 12 and 18 swing through an arc of substantially 40°. This arc is from the position of Figure 1, where the links extend substantially 30° from the horizontal, to the position of Figure 2, where the links extend substantially 70° from the horizontal. The mean lifting force applied through link 20 in raising the lifting frame is substantially at right angles to a line bisecting the arc through which the links swing. In this way the lifting effort exerted upon the steering handle is utilized efficiently, and the leverage is so adjusted that the load may be lifted without difficulty. In this embodiment the movement of the steering handle is substantially 100°, and the lifting effort exerted by the operator in lifting a load does not vary materially throughout the swinging of the steering handle.

During use the lifting frame is elevated until it engages and supports the load; the lifting frame may be fully elevated as shown in Figure 2, but in practice it is generally necessary to lift the load only sufficiently to free the load from the floor. After being elevated any desired amount, the latching or holding mechanism is automatically operative, and the lifting frame is held from descending. After the load is moved to the new location, the latching mechanism is released and the lifting frame returns to the position of Figure 1, thereby releasing the load, and the descent of the load is not rapid enough to cause injury.

Referring to the central portion of Figure 1, the latch-check 36 is pivotally supported at the left by pin 39 carried by a bracket 4 which is rigidly clamped to the rear axle 3, and at the right the latch-check is connected to saddle 19 by a bracket 42 pivoted to the saddle (see Figure 6). Extending from saddle 19 is an ear 74, and a pivot pin 72 extends through this ear and a pair of similar ears 68 and 69 integral with bracket 42. Similarly, a pin 73 extends through an ear 75 extending from saddle 19 and a pair of ears 70 and 71 integral with bracket 42.

Referring to Figure 5, latch-check 36 is provided with a cylinder 136, the left-hand end of which is closed by a threaded plug 38 and the right-hand end of which is closed by a threaded plug 37. Cylinder 136 is filled with a suitable oil, and a piston 40 is slideably mounted in the cylinder with a leather cup 50 and a backing washer 51 providing a seal at the piston so that the cylinder is divided into a left-hand chamber 91 and a right-hand chamber 90. A hollow piston

rod 41 is threaded to the piston and extends beyond the right-hand end of the cylinder through plug 37 where the piston rod is connected to bracket 42; a suitable packing gland 137 prevents oil leakage from the cylinder along the piston rod. A compression spring 92 is coiled about piston rod 41 with one end bearing against plug 37 and with the other end bearing against piston 40 so that there is a tendency for the piston to move leftwards toward the position shown.

Chambers 90 and 91 are connected by means of two valved passageways through the piston, and oil is permitted to flow through these passageways in a controlled manner to limit the movement of the piston along the cylinder. One of these passageways is an oil inlet passageway and is formed by passages 43, 44, and 45, with a one-way ball valve 47 normally closing the left-hand end of passage 45. Ball valve 47 is held seated by a spring 48, the left-hand end of which bears against a pin 49 rigidly mounted in the valve nipple 46. Ball valve 47 is readily unseated by oil pressure at the right of the valve to permit the oil to move to the left through the passageway from chamber 90 to chamber 91, but oil cannot flow to the right through the valve from chamber 91 to chamber 90. Near the top of the piston an outlet passageway is provided by the opening through a nipple 52 and passages 53, 54, and 55 to an escapement chamber 63, and the escapement chamber is connected through a radial restricted opening 64 to chamber 90.

Chamber 63 is formed by the enlarged opening in the end of piston rod 41, and at the right the chamber is sealed by a leather cup 57 and a washer 58 which are clamped by nuts 59 to a valve piston 60. Projecting to the left from valve piston 60 is a needle valve 56, which is normally held seated in the end of passage 55 by a spring 62 at the right of the piston and exerting a force against the left-hand side of the piston with the right-hand end of the spring seated on a ledge 61. A valve rod 65 is rigidly connected to piston 60 and extends to the right beyond the end of piston rod 41 so that the needle valve may be opened by drawing the valve rod to the right.

When the lifting frame is being elevated, a force is exerted tending to move piston 40 to the right and to extend piston rod 41 from the cylinder, and the oil from chamber 90 unseats ball valve 47 and flows through passages 43, 44, and 45 into chamber 91. However, when the lifting frame starts to descend, a force is exerted in the opposite direction, and ball valve 47 is held closed so that the piston cannot be moved unless oil is permitted to escape from chamber 91 through the outlet passageway. When the needle valve 56 is opened, oil flows to the right through passages 53, 54, and 55 into chamber 63 and escapes through the restricted opening 64, and the size of this opening limits the speed of descent.

As indicated above, needle valve 56 is normally held closed by spring 62, and the needle valve is opened by depressing a foot lever 67 (see Figure 2). This foot lever is rockably mounted on a pivot pin 77 which in turn is carried by three pivot extension portions of bracket 42 which extend downwardly from ears 69, 70, and 71. Bracket 42 is in turn mounted upon saddle 19 which is part of the lifting frame so that foot lever 67 is actually carried by and moves with the lifting frame. Foot lever 67 is provided with an upwardly extending arm 81 at the upper end of which is a treadle portion 82. Referring to Figure 6, the foot lever is provided with a knuckle 78 positioned between the bottom edges of ears 69 and 70 and a knuckle 79 at the side of ear 71, and extending upwardly from knuckle 78 is an operating arm 167 (see also Figure 5). Operating arm 167 supports a transversely extending pin 66 (shown in cross-section in Figure 5) through which is threaded the end of valve rod 65, and the operating arm has a cylindrical opening 102 therethrough to permit free rocking movement between the operating arm and the valve rod.

When foot lever 67 (see Figure 2) is depressed, it swings about pin 77 carrying pin 66 and valve rod 65 to the right and opening the needle valve. The rocking movement of the foot lever 67 is limited by a stop 104 extending upwardly from knuckle 78 (see also Figure 6).

Foot lever 67 carries a bell crank 83 which is rockably mounted upon a stud pin 133 and has an upwardly extending arm 84 and a horizontally extending arm 85. Arm 85 carries an adjustable set screw 86 which is locked in position by a locking nut, and a spring 190 holds arm 84 against a lug 87 extending downwardly from saddle 19, the other end of the spring being attached to foot lever 67. Bell crank 83 is for the purpose of locking foot lever 67 in the depressed position shown in Figure 3 so that needle valve 56 is held open until the lifting frame has completely returned from its elevated position. Accordingly, when foot lever 67 is depressed to the position shown in Figure 3, spring 190 swings the bell crank clockwise with arm 84 engaging beneath lug 87, and this engagement holds the foot lever depressed. Rigidly mounted upon the lower side frame 7 is a horizontally extending bracket 88 which is positioned so that it is engaged by set screw 86 as the lifting frame moves from the elevated position. As set screw 86 engages bracket 88, the bell crank is swung counterclockwise about its pivot 133, and arm 84 is moved to the left of lug 87 so that the foot lever is no longer held depressed but returns to the position shown in Figure 1.

As pointed out above, the links 12 and 13 swing through an arc from about 30° to 70° from the horizontal, and the lifting force is applied along the line which is substantially at right angles to a line bisecting this arc. By using the latch-check unit, it is not necessary to raise the links to a vertical position, and in fact, the lifting frame is supported by the links and the latch-check unit, with the latch-check unit exerting a supporting force substantially at right angles to the links (see Figure 2). Actually, the force which the operator must exert upon the lifting handle varies depending upon the angle or arc between links 12 and 13 and the horizontal and upon whether or not the force is being applied to the links along lines at right angles to the links. This variation, depending upon the arc or angle, is a trigometric function of this arc or angle, it being the tangent thereof. In the present embodiment, during the lifting of the load this arc or angle starts at approximately 30°, where the tangent is .577, and as the links are swung upwardly increasing this angle, the tangent changes at a relatively slow rate. To perform the complete lifting operation, the lifting handle is swung from a vertical position to below the horizontal position, and thus through an arc of substan-

tially 100°, while the links swing between 30° and 70°. With this arrangement, and with the releasable direct mechanical connection between the lifting handle and the lifting frame, the variation during the lifting operation in the force necessary to lift a load is at a minimum, and the lifting ability of the operator and the mechanical elements are used efficiently at all times.

The operator may lift the load in a single lifting operation, or he may stop at any point to change his position with respect to the steering handle. In any event, the latch-check holds the lifting frame at whatever height the load has reached until the lifting frame is released. If the latch-check unit should be rendered ineffective, as for example, if the oil should be lost, the latch-check will not hold, and the operator will be immediately aware of this defect. Thus, the operator will not lift a load and then release it to find that the descent is not checked. When the operator has moved a load to a new location and desires to release the load, he merely depresses the foot lever, and the bell crank holds the foot lever depressed until the lifting frame fully descends. In this manner the operator is relieved of the responsibility of holding the foot lever down, and he may give his entire attention to steadying and guiding the load as the load descends.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings, is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a manually operated lift truck, the combination of: a chassis comprising a supporting frame having mounted thereon a set of wheels and a steering handle; a lifting frame mounted upon said chassis and adapted to be moved to and from an elevated position where it engages and lifts a load; means to elevate said lifting frame by swinging said steering handle comprising linkage means forming a releasable direct mechanical connection between said steering handle and said lifting frame; means to hold said lifting frame in its elevated position so that the load may be moved to a new location by moving the truck comprising a unitary mechanism which is effective to hold the lifting frame at substantially any point in its upward movement; and releasing means mounted upon said lifting frame and adapted to be operated to render said unitary mechanism ineffective to hold the lifting frame.

2. In a manually operated lift truck, the combination of: a chassis comprising a supporting frame having mounted thereon a set of wheels and a steering handle; a lifting frame supporting mechanism comprising a plurality of links each of which is rockably mounted at one end upon said chassis so that the links may be swung through parallel vertical arcs which arcs extend substantially between 30° and 70° from the horizontal; a lifting frame mounted upon the upper ends of said links so that as said links are swung through their arcs the lifting frame is elevated; and elevating mechanism comprising a releasable linkage assembly forming a direct mechanical connection between said lifting frame and said steering handle so that the lifting frame may be elevated by swinging said steering handle through an extended arc, said elevating mechanism exerting a lifting force which is substantially at right angles to said links during at least, a portion of the elevating operation.

3. In lift truck apparatus, the combination of: a chassis; a lifting frame mounted upon said chassis and adapted to move upwardly and longitudinally of the truck to thereby engage and lift the load; a checking and latching mechanism operatively connected between said base frame and said lifting frame to thereby regulate the movement of the lifting frame downwardly, said mechanism being automatically operative as a latching means to prevent the descent of the lifting frame and releasable so as to be ineffective as a latching means to thereby permit the controlled descent of the lifting frame; a treadle rockably mounted on said lifting frame and having an operating arm which is effective when depressed to release said mechanism as a latching means; a latch pivotally mounted on said treadle and adapted to hold said treadle in its depressed position; spring means to move said latch toward its latching position; and releasing means to release said latch when the lifting frame has returned from its elevated position.

4. In a manually operated lift truck, the combination of: a chassis; a lifting structure mounted on said chassis to be moved to and from an elevated position to thereby lift a load; and a latch-check unit operatively connected between said chassis and said lifting structure and effective selectively to prevent or control the descent of said lifting structure comprising, a cylinder, a piston mounted to move longitudinally along said cylinder and having a piston rod extending from the end of said cylinder, means constituting a passageway through said piston and including a valve mechanism, a bracket means mounted on the end of said piston rod and pivoted to said lifting structure to provide the mechanical connection between said lifting structure and the latch-check unit, and a valve releasing mechanism to open said valve mechanism including a foot lever rockably mounted on said bracket.

5. Apparatus as described in claim 4 wherein said piston is provided with a ball valve through which fluid may pass from one end of said cylinder to the other during the elevating of said lifting structure and said valve mechanism is in the form of a needle valve which is opened by a valve-operating rod extending through the center of said piston rod and attached to said foot lever.

6. In a manually operated lift truck, the combination of: a chassis; a lifting structure mounted on said chassis to be moved to and from an elevated position to thereby lift a load; and a latch-check unit operatively connected between said chassis and said lifting structure and effective selectively to prevent or control the descent of said lifting structure comprising, a casing, an operating member mounted to move within said casing and constituting with said casing the effective impediment means of the latch-check unit, an operating rod extending from said casing and having mounted on the extreme end thereof a bracket pivoted to said lifting structure to provide the mechanical connection between said lifting structure and the latch-check unit, and releasing mechanism to control the releasing of said latch-check unit including a lever rockably mounted on said bracket means.

7. Apparatus as described in claim 6 wherein said releasing means includes a latch which is

rendered effective upon the actuating of said lever to hold said lever in actuated position, and latch-releasing means which is effective when said lifting structure returns from its elevated position to render said latching means ineffective.

8. In a manually operated lift truck, the combination of: a chassis having mounted thereon a steering handle; a lifting structure mounted on said chassis to be moved to and from an elevated position to thereby lift a load, means to elevate said lifting structure by swinging said steering handle comprising, an idler link having two eyes one of which is attached to said lifting structure, an intermediate linkage member having a lower U-shaped portion which is looped into the other of said eyes of said idler link and having an upper eye, and a segment hook member having a hook portion extending through the last-named of said eyes and a segment portion having a releasable latching connection with said steering handle; means to hold said lifting structure in its elevated position so that the load may be moved to a new location by moving the truck comprising a unitary mechanism which is effective to hold the lifting structure at substantially any point in its upward movement; and releasing means mounted upon said lifting structure and adapted to be operated to render said unitary mechanism ineffective to hold the lifting structure.

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