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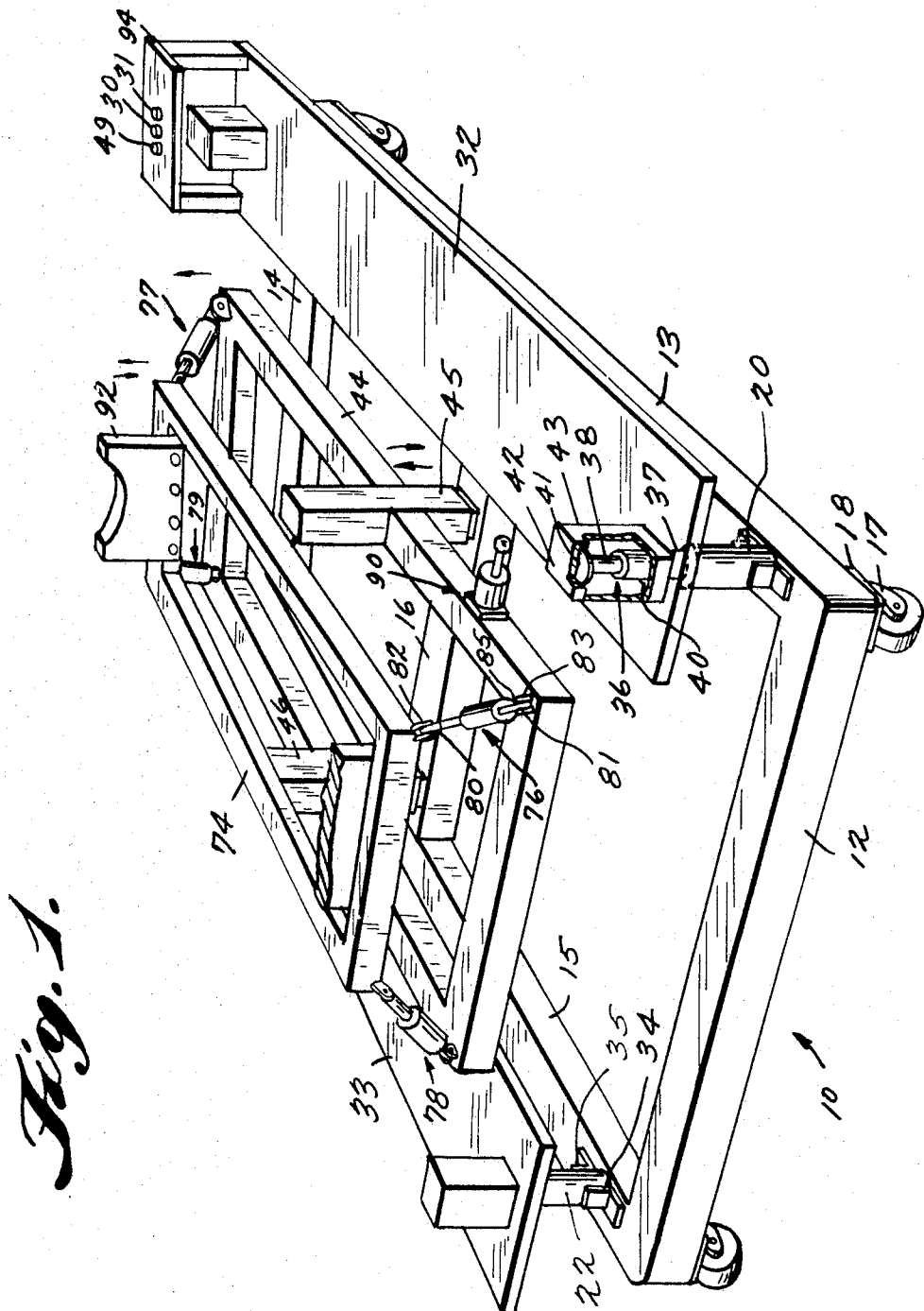
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3,524,556

ORDNANCE LIFT

Filed April 19, 1967

2 Sheets-Sheet 1



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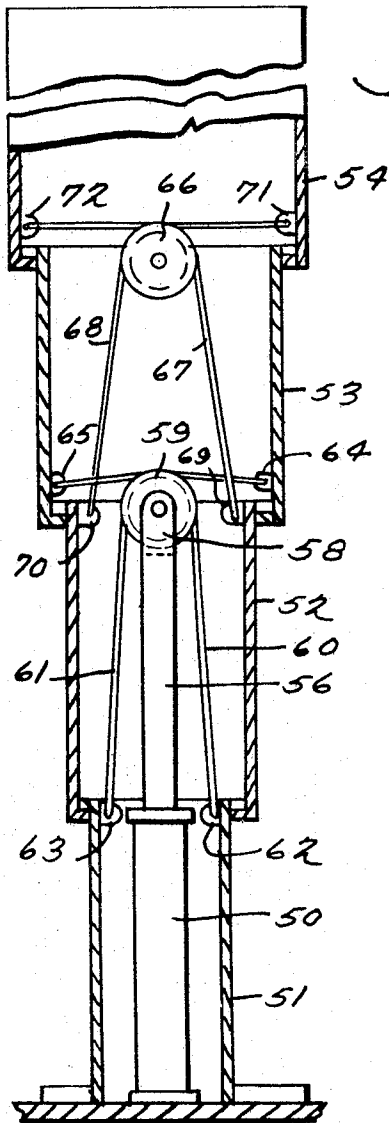


Fig. 2

Fig. 4.

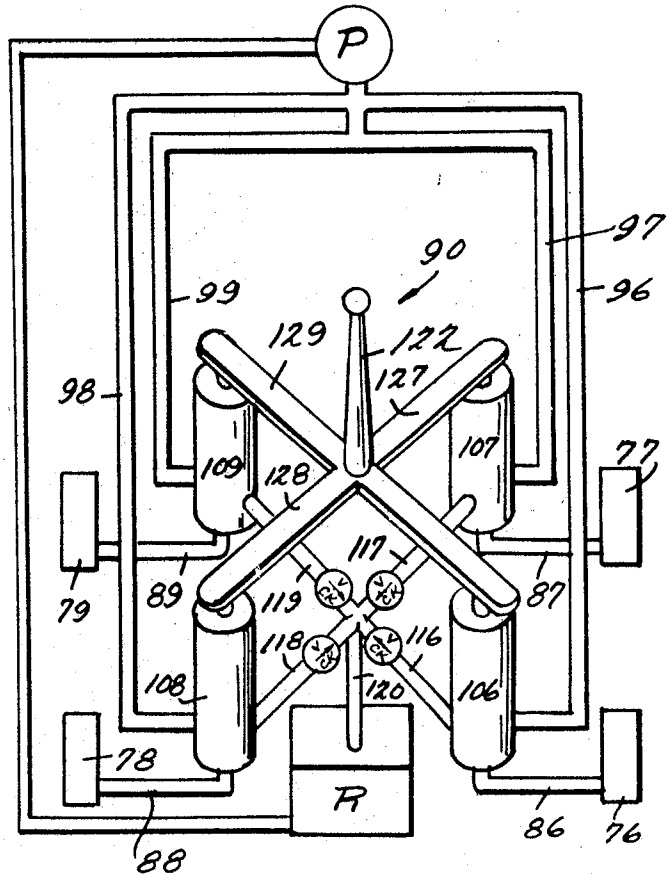
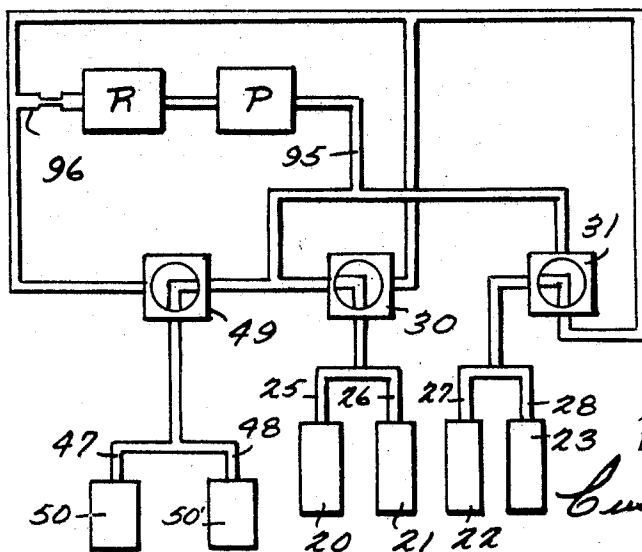


Fig. 3.

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ORDNANCE LIFT

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ABSTRACT OF THE DISCLOSURE

A lift comprising a mobile rectangular base frame provided with vertically adjustable platforms along its lateral edges and a centrally mounted, vertically adjustable frame. The two platforms and the frame may be vertically adjusted, independently of one another, by elevating means controlled from one of the platforms. A second frame, which carries the load, is mounted on the first frame by means of extensible elements which may be actuated together, individually or in pairs, whereby the attitude and elevation of the second frame can be adjusted relative to the first frame.

BRIEF DESCRIPTION OF THE INVENTION

The present invention relates to a lift and more specifically, to an ordnance lift adapted to implement and simplify the loading of bombs, rockets and similar weapons onto the wings of airplanes. Of course, the lift is well suited for other tasks and the use of the lift is in no way restricted to the handling of various armaments.

The lift comprises a mobile rectangular base frame provided with a pair of vertically adjustable platforms mounted adjacent the lateral edges of the base frame on extensible hydraulic piston and cylinder assemblies, and a first vertically adjustable frame centrally mounted on the base frame by means of hydraulic telescopic jacks. A second frame provided with load supports is mounted on said first frame, by means of four extensible elements, and a control means is provided for operating the elements together, in pairs, or individually, so that the second frame may be adjusted with respect to the first frame both as to height and attitude. A control means is also provided for actuating the hydraulic piston and cylinder assemblies for either of said platforms or the hydraulic jacks for the first frame, whereby the platforms and the first frame may be vertically adjusted relative to one another.

One object of the present invention is to provide a lift with a load support which can be lowered to a height where it may be easily loaded or unloaded by means of a conventional forklift truck. Another object of the present invention is to provide a lift with a platform on either side of the load supports so that the load is readily accessible from either side. Another object of the invention is to provide a lift with vertically adjustable platforms, whereby the height of the worker can be adjusted relative to the height of the wing and the armaments on the lift, so he may effectively proceed with the arming of the airplane. Another object is to provide a lift with lateral platforms which are individually actuated so that the height of each platform can be adjusted as necessitated. A further object of the present invention is to provide load supports for the armament, which can be adjusted to various attitudes, so as to properly align the armament with the mounting means located on the wing of the airplane.

Other objects and advantages of the present invention will become more apparent after reading the following disclosure in combination with the accompanying drawings in which:

FIG. 1 is a perspective view, partially in section, of the ordnance lifter of the present invention;

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FIG. 2 is an elevational cross-sectional view of one of the telescoping jack assemblies used to elevate the first frame;

FIG. 3 is a schematic view of the control system for operating the hydraulic jacks and cylinders mounted on the base structure; and

FIG. 4 is a schematic view of the control system used to elevate and adjust the second platform relative to the first platform.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIG. 1, the ordnance lifter of the present invention comprises a rectangular base frame 10 made up of channel members 12, 13, 14 and 15 and a centrally located channel member 16 extending between lateral channel members 13 and 15. The channel members are made of iron, steel or similar materials and although as shown, the members are welded together at the joints, it is contemplated that the members could also be joined by means of rivets, bolts or other means well known in the art. Mounted at the corners of the base frame are swivel casters 17 provided with plate 18, which may be welded or bolted to the frame.

As shown in FIGS. 1 and 3, four hydraulic cylinders 20, 21, 22 and 23, with telescoping pistons, are mounted near the corners of the base frame on the lateral side members 13 and 15. The hydraulic cylinders 20, 21, 22 and 23 are connected by hydraulic lines 25, 26, 27 and 28, respectively, to control valves 30 and 31 which, although as shown, are located on platform 32, could just as easily be mounted on platform 33. The bases of the hydraulic cylinders 20, 21, 22 and 23 are welded to the base frame and when needed, additional brackets, such as brackets 34 and 35, may also be provided to support the hydraulic cylinders.

All of the piston and cylinder assemblies 20, 21, 22 and 23 are identical in construction and are mounted on the base structure and secured to the platforms in the same way. Therefore, to avoid repetition, the following description of hydraulic cylinder 20 applies also to cylinders 21, 22 and 23. As shown in FIG. 1, telescoping piston 36 comprises a sleeve 37, which is mounted within the cylinder 20, and a piston element 38 mounted within the sleeve. The hydraulic fluid is admitted to the cylinder 20 through an inlet-exhaust port in the base of the cylinder with the hydraulic pressure on the bottom face of the piston and the lower surface of the sleeve causing extension of the sleeve 37 and piston 38 which, in turn, raises the platform.

The piston elements 37 and 38 extend through an aperture 40 in the platform 32 and element 38 is provided with a plate 41 at its upper extremity, which is welded or bolted to the upper end 42 of a metallic housing 43. Housing 43 is mounted over the aperture 40 and welded to the upper surface of platform 32.

When the telescoping piston 36 is retracted within the cylinder 20, the cylinder 20 is received within the housing 43 on the platform 32, thereby enabling the platform 32 to be lowered into contact with the base structure 10. From this lowered position, the operator may easily step on or off the platform. Although the metallic housing 43 has a rectangular cross section, it is contemplated that the housing could also be cylindrical in form, or of some other suitable configuration which will accommodate cylinder 20.

Rectangular frame 44, which may be made of iron, steel or other similar materials, is mounted on the upper sleeves of telescoping hydraulic jack assemblies 45 and 46 which are anchored to cross member 16. The jacks 45 and 46 are provided with hydraulic cylinders 50 and 50' which are connected by hydraulic lines 47 and 48, respectively, to control valve 49 located on platform 32.

FIG. 2 shows one form of a telescoping hydraulic jack which may be used in the present invention. The jack is fully extended and comprises a hydraulic cylinder 50 mounted within the telescoping rectangular sleeve element 51. The upper end 58 of the driven piston 56 supports two idler pulleys 59, about which are trained cables 60, 61 anchored to lugs 62 and 63 on sleeve member 51 and anchored to lugs 64, 65 on sleeve member 53. Sleeve member 53 also has two idler pulleys 66 mounted at the upper end thereof on a shaft which is rotatably supported in the sleeve member. Cables 67, 68 are trained about pulleys 66 and are anchored to lugs 69, 70 on the sleeve member 52 and anchored to lugs 71, 72 on the sleeve member 54. The cables 60, 61, 67 and 68 are secured to the lugs by any suitable means such as by welding. The sets of lugs are laterally spaced with respect to each other, in such a manner that the cables do not interfere with each other and the upper flanges and a portion of the side walls of the telescoping sleeves are notched to permit the cables and lugs of the various sleeves to pass by the upper portions of other sleeves when the jack assembly is extended or retracted.

The pulleys 59 and 66 and the cables 60, 61 and 67, 68 act as a linear motion amplifying device so that energization of the actuator 50 to elevate the piston 56 vertically positions the telescoping jack assembly at a height above the upper portion of piston 56. As piston 56 is extended, cables 60 and 61 elevate sleeve 53. Sleeve 53 has pulleys 66 mounted therein and acts as a second piston, elevating sleeves 52 and 54 which are connected by cables 67 and 68 that are trained over pulleys 66. The interlocking flanges of the sleeve members prevent any of the sleeves from being elevated too far. The operation of the controls for actuating the hydraulic jacks will be discussed in detail hereinafter.

Rectangular frame 74 is mounted on frame 44 by means of four extensible hydraulic piston and cylinder assemblies 76, 77, 78 and 79, which are pivotally mounted on and extend between respective corners of the two frame members. The outside dimensions of frame 74 are smaller than the inside dimensions of frame 44 and, therefore, the extensible hydraulic piston and cylinder assemblies extend diagonally upwardly and inwardly from the corners of frame 44. Each piston and cylinder assembly is provided with lugs 80 and 81 at each extremity. Each lug 80 is mounted on the piston and is pivotally connected to a bracket 82, which is welded to the lower corner of frame 74. Each lug 81 is mounted on the cylinder and is pivotally connected to a bracket 83, which is welded to the upper surface of frame 44. A pin 85 passes through aligned apertures in each bracket and lugs thereby pivotally mounting the piston and cylinder assembly on the respective frames. The piston assemblies are conventional and have inlet-exhaust ports which are connected, by hydraulic lines 86, 87, 88 and 89, to a control means 90 mounted on frame 44. The control means, in turn, is connected to a source of hydraulic fluid, under pressure, and to an exhaust reservoir. A more detailed discussion of the operation of the piston members in conjunction with the control means which cooperate so as to elevate and change the attitude of frame 74 will follow.

Frame 74 is made of such a width, that sufficient clearance is left between the upper sleeve members of jack assemblies 45, 46 and the frame 74 whereby movement of the frame is not restricted by the telescoping sleeves of the jack. The frame 74 is also provided with a suitable means for receiving the armament to be handled and loaded onto the airplane. As shown in FIG. 1, one form that the support may take is that of a cradle 92 into which the armament may be deposited by the forklift and from which the armament may be readily attached to the airplane wing.

With regard to the operation of the present invention, a control panel 94 is mounted on one end of platform 32, which enables the operator of the lift to raise or

lower either platform 32, platform 33 or frame 44. The controls may be of any suitable form well known in the art, and are arranged as diagrammatically shown in FIG. 3.

As shown in FIG. 3, the hydraulic fluid is pumped by pump P from a reservoir R through hydraulic line 95 into valves 30, 31 and 49. Actuation of valve 49, as shown in FIG. 3, places supply line 95 in communication with lines 47 and 48 permitting hydraulic fluid, under pressure, to flow to cylinders 50, 50' thereby causing the piston 56 within each assembly to move upwardly, extending the telescoping jack members. Upon movement of the valve, so that lines 47 and 48 are in communication with exhaust line 96, fluid is permitted to flow from the cylinders 50, 50', whereby piston 56 and the hydraulic jack assemblies 45 and 46 are lowered. The valve 49 or exhaust line 96 is provided with a restriction therein, which allows fluid to escape from the cylinder at a limited rate, thereby preventing the jack assemblies from lowering too fast. Valves 30 and 31 operate in the same manner as valve 49 whereby positioning of the valve in one position permits fluid, under pressure, to flow from supply line 95 to the respective piston and cylinder assemblies through hydraulic lines 25, 26 or 27, 28 and positioning of the valve in another position permits fluid to flow from the hydraulic piston and cylinder assemblies through lines 25, 26 or 27, 28 to exhaust line 96 and into the reservoir. As with valve 49, valves 30 and 31 or exhaust line 96 are also provided with a restriction, which allows fluid to escape from the cylinder at a limited rate, to prevent the platforms from lowering too fast.

The control for actuating cylinders 76, 77, 78 and 79 is mounted on frame 44. However, if desired, this control could also be mounted on the platform along with the other valve members. The control 90 may be of any one of numerous valves disclosed in the prior art, and is merely shown diagrammatically in FIG. 4 to help illustrate the manner in which the attitude and elevation of frame 74 may be controlled by the valve.

As shown in FIG. 4, hydraulic fluid is pumped from reservoir R through pump P to supply lines 96, 97, 98 and 99 located within the control 90. These supply lines communicate with respective valve assemblies 106, 107, 108 and 109 within the control 90, which regulate the flow of hydraulic fluid to and from piston and cylinder assemblies 76, 77, 78 and 79 through lines 86, 87, 88 and 89, respectively. The valve assemblies are all also provided with exhaust lines 116, 117, 118 and 119, which are joined to a common exhaust line 120 that leads from control 90 to the reservoir. Valve assemblies 106, 107, 108 and 109 are operated by a common lever or control stick 122 which permits each valve assembly to be actuated independently, pairs of valve assemblies to be actuated or all four valve assemblies to be actuated at the same time. This is accomplished by mounting lever 122 in a ball socket, or similar mounting, which permits the lever to be tilted at any angle with respect to the horizontal. In this way, extensions 126, 127, 128 and 129 may be tilted so that only one of the members comes in contact with a valve assembly, or so that two of the members will come in contact with two valve assemblies. By mounting the ball socket in a spring-biased sleeve or similar member, which permits reciprocal motion in the vertical direction, all the valve assemblies could be activated simultaneously by pushing directly down on the lever 122. In this way, one or two of the piston and cylinder assemblies 76, 77, 78 or 79 can be extended or retracted to change the attitude of frame 74, or all of the valves can be actuated simultaneously to elevate or lower the entire frame.

The valve assemblies 106, 107, 108 and 109, within control 90, may be of any form wherein either the supply or exhaust lines can selectively be placed in communication with the hydraulic piston and cylinder assemblies. One form that the individual valve assemblies might take

is a hollow cylindrical housing with a piston therein. The piston would be spring-biased upwardly and have a central bore therein. The cylinder would be closed at both ends and have a supply port at the upper portion thereof, an exhaust port located below the supply port and a port in the bottom which communicates with an extensible hydraulic piston and cylinder assembly. In its uppermost position, when the valve is not being actuated, the piston would cover the supply port, but the exhaust port would be uncovered permitting communication between the exhaust port and the port leading to an extensible hydraulic piston and cylinder assembly. When the piston is partially depressed, it would be of such a length that both the exhaust and supply ports would be covered by the piston. It is in this position that a suitable means can be arranged for locking the piston against axial movement if it were desired to prevent flow to or from the hydraulic piston and cylinder assembly. Further, depression of the piston would uncover the supply port while still covering exhaust port, thereby permitting communication through the hole in the piston, between the supply lines and the hydraulic piston and cylinder assemblies. Of course, the piston would be provided with suitable sealing rings around the periphery thereof to prevent leakage of the fluid. While the preferred form of the valve has been described to illustrate the various forms which the valve may take it, it is to be understood that any valve structure of this sort could be utilized, if desired.

The present invention, as illustrated and described, utilizes hydraulic controls and hydraulic piston and cylinder assemblies. It is contemplated that pneumatic, electrical and mechanical systems or combinations thereof could also be utilized to actuate the various components of the present invention. Further, while the preferred form of the invention has been shown and described, it is to be understood that all suitable modifications and equivalents may be resorted to.

What is claimed is:

1. A lift comprising:

a mobile base frame, elevating means mounted adjacent lateral edges of said mobile base frame, first and second platforms mounted on said elevating means; elevating means centrally mounted on said mobile base frame, a first horizontally extending rectangular frame mounted on said centrally located elevating means and a second rectangular frame mounted on said first frame by four extensible elements, said four extensible elements extending between and pivotally mounted on the respective corners of said first and second frames;

means for actuating said extensible elements together, in pairs, and individually whereby said second frame can be elevated relative to said first frame and the attitude of said second frame changed relative to said first frame; and

load support means carried on said second frame.

2. The lift of claim 1 wherein the elevating means mounted adjacent the lateral edges of the base frame comprise hydraulic cylinders mounted on the upper surface of said base frame and wherein said first and second platforms are provided with means which receive the hydraulic cylinders when the platforms are in their lowermost position.

3. The lift of claim 2 wherein control means are provided on one of said platforms for independently actuating the elevating means for each of said platforms and the first frame whereby the relative height of the first platform, the second platform and the first frame may be adjusted.

4. A lift comprising:

a mobile base frame, elevating means mounted adjacent lateral edges of said base frame, first and second platforms mounted on said elevating means; elevating means centrally mounted on said base frame, a first horizontally extending frame mounted on said centrally located elevating means and a second frame mounted on said first frame by four extensible elements, said four extensible elements extending between and pivotally mounted on said first and second frames with the pivotal mountings on said first and second frames respectively being spaced apart from each other in rectangular patterns;

means for actuating said extensible elements together, in pairs, and individually whereby said second frame can be elevated relative to said first frame and the attitude of said second frame changed relative to said first frame; and

load support means carried on said second frame.

5. The lift of claim 4 wherein the elevating means mounted adjacent the lateral edges of the base frame comprise hydraulic cylinders mounted on the upper surface of said base frame and wherein said first and second platforms are provided with means which receive the hydraulic cylinders when the platforms are in their lowermost position.

6. The lift of claim 5 wherein control means are provided on one of said platforms for independently actuating the elevating means for each of said platforms and the first frame whereby the relative height of the first platform, the second platform and the first frame may be adjusted.

7. A lift comprising:

a mobile base frame, elevating means mounted adjacent lateral edges of said mobile base frame, first and second platforms for operating personnel mounted on said elevating means;

elevating means centrally mounted on mobile base frame, a first frame mounted on said centrally located elevating means and a second frame having load support means thereon mounted on said first frame by four extensible elements, said four extensible elements extending between and pivotally mounted on said first and second frames;

means for actuating said extensible elements together, in pairs and individually whereby said second frame can be elevated relative to said first frame and the attitude of said second frame changed relative to said first frame; and

control means on one of said platforms for independently actuating said elevating means for each of said platforms and said first frame whereby the relative height of said first platform, said second platform and said first frame can be adjusted.

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