Sept. 21, 1971 H. S. MANKEY 3,606,952

ORDNANCE LOADING SYSTEM

Filed March 24, 1969 3 Sheets-Sheet 1

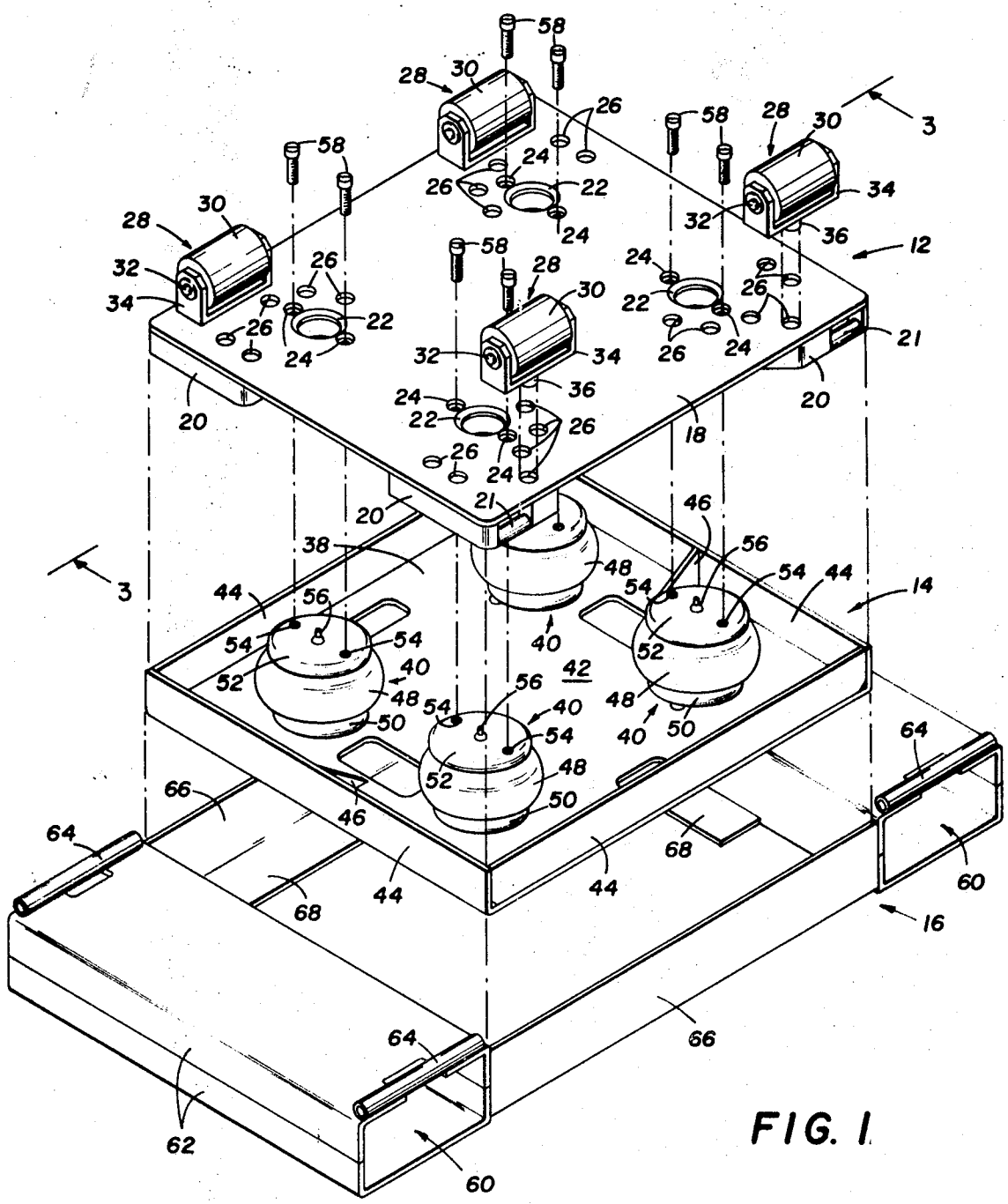

FIG. 1

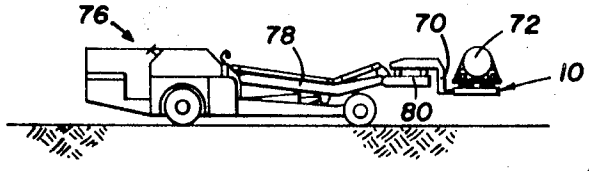

FIG. 2

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ORDNANCE LOADING SYSTEM

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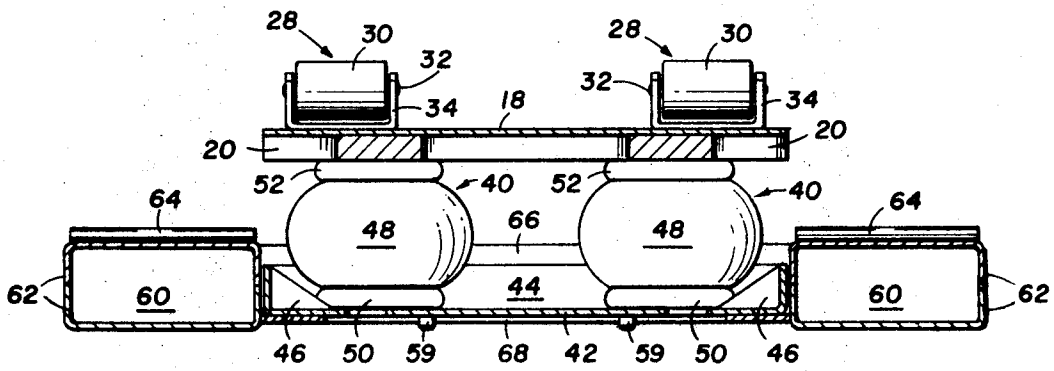

FIG. 3

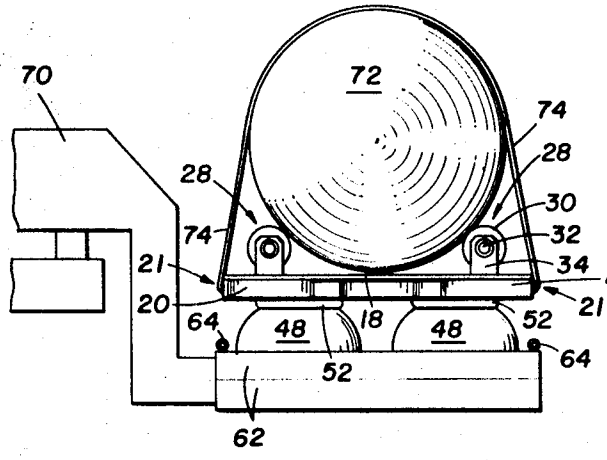

FIG. 4

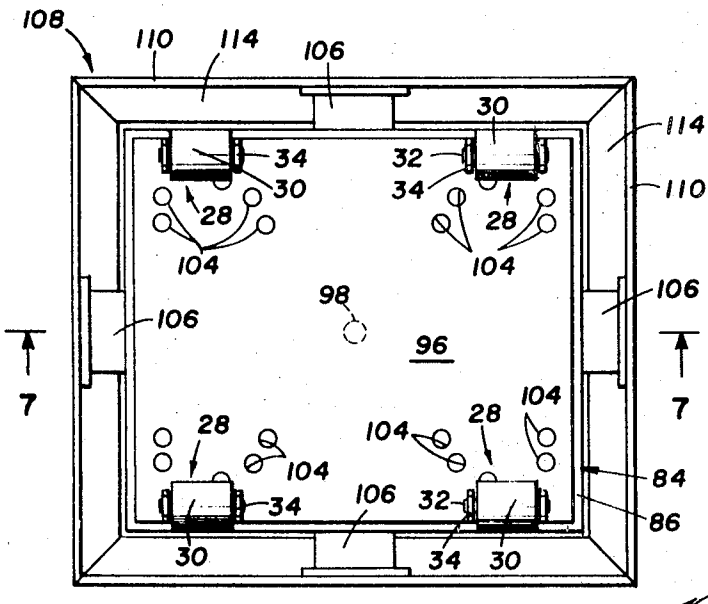

FIG. 5

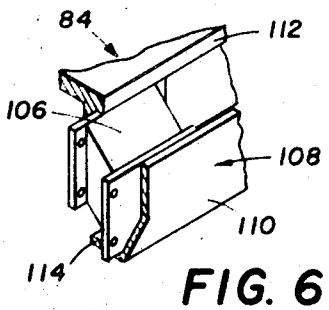

FIG. 6

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ORDNANCE LOADING SYSTEM

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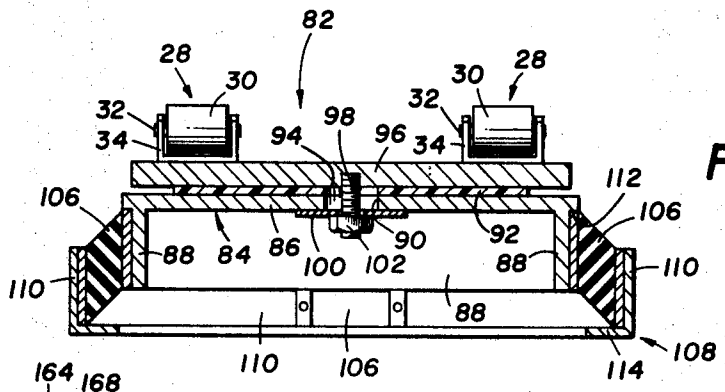

FIG. 7

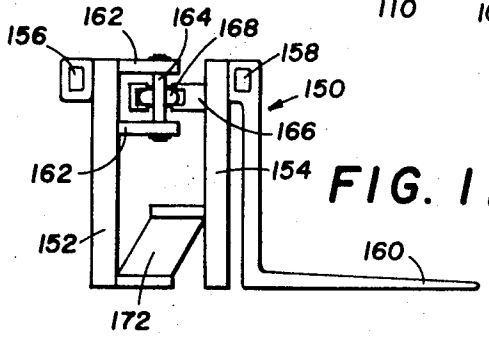

FIG. 11

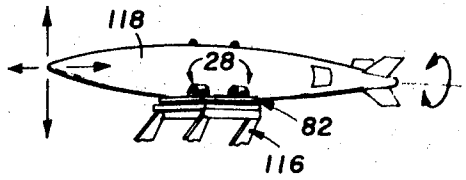

FIG. 8

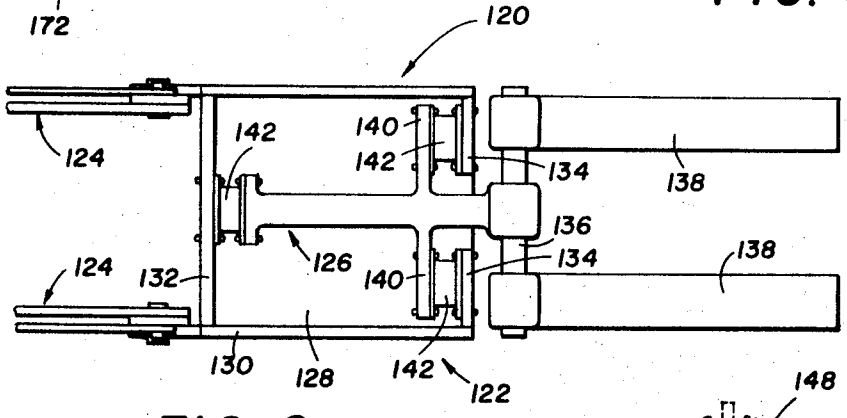

FIG. 9

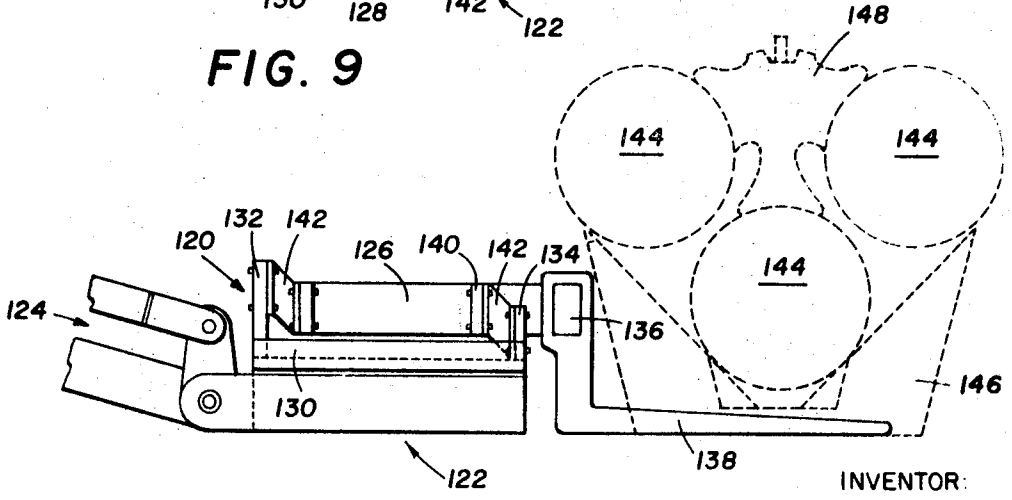

FIG. 10

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United States Patent Office 3,606,952
Patented Sept. 21, 1971

3,606,952

ORDNANCE LOADING SYSTEM

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Filed Mar. 24, 1969, Ser. No. 809,638
Int. Cl. B25j 3/00; B66f 3/18
U.S. Cl. 214—1D 10 Claims

ABSTRACT OF THE DISCLOSURE

An ordnance loading system that permits manual final positioning of the ordnance. The ordnance is supported on the lift boom of a low profile lift truck by a plurality of flexible support members, such as pneumatic springs, rubber shear pads, etc. The lift truck is operated to vertically and horizontally position the ordnance after which the position of the ordnance is manually finally adjusted against the action of the flexible support members.

BACKGROUND OF THE INVENTION

The main difficulty encountered in loading bombs and other ordnance into aircraft stems from the fact that the bombs, which often weigh as much as several tons, must be very accurately positioned before they can be attached to the aircraft. In the past, bomb loading lift trucks and lift tables have been equipped with hydraulic motors which rotate the bombs about as many as three axes and shift the bombs in as many as three directions in order to achieve the required positioning. Bomb loading systems of this type operate satisfactorily but are slow in operation and expensive to purchase.

SUMMARY OF THE INVENTION

A vertical and horizontal positioning device and at least one resilient member for supporting the article on the positioning device and for permitting relative motion between the article and the positioning device. More particularly, a vehicle including a lifting mechanism, an article receiving device and a plurality of resilient members for supporting the article receiving device on the lifting mechanism of the vehicle.

DESCRIPTION OF THE DRAWINGS

A more complete understanding of the invention may be had by referring to the following detailed description when taken in conjunction with the drawings wherein:

FIG. 1 is a perspective, exploded view of a first embodiment of the invention;

FIG. 2 is a reduced view showing the use of the device shown in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 in FIG. 1 showing the device in its assembled state;

FIG. 4 is an end view of the device shown in FIG. 3 showing the use of the device;

FIG. 5 is a top view of a second embodiment of the invention;

FIG. 6 is a partial, sectional, perspective view of the device shown in FIG. 5;

FIG. 7 is a sectional view taken along the line 7—7 in FIG. 5 in the direction of the arrows;

FIG. 8 is a reduced view showing the use of the device shown in FIG. 5;

FIG. 9 is a top view of a third embodiment of the invention;

FIG. 10 is a side view of the device shown in FIG. 9, and

FIG. 11 is a side view of a fourth embodiment of the invention in which certain parts have been broken away more clearly to illustrate certain features of the invention.

DETAILED DESCRIPTION

Referring now to the drawings, wherein like reference numerals designate like parts throughout the several views, and referring particularly to FIG. 1 thereof, there is shown a first embodiment **10** of the invention comprised of an upper assembly **12**, a middle assembly **14** and a lower assembly **16**. The upper assembly **12** includes an ordnance receiving plate **18** mounted on a generally X-shaped frame **20** which has a bomb tie-down member **21** formed in each of its corners. The plate **18** has four relatively large valve receiving holes **22** formed through it and has four pairs of cap screw receiving holes **24** formed through it adjacent the valve receiving holes **22**. The plate **18** also has a plurality of roller receiving holes **26** formed through it which are positioned in four groups, each group comprising an array of roller receiving holes **26** spread around one of the valve receiving holes **22**.

The upper assembly **12** also includes four ordnance supporting roller assemblies **28** each of which is selectively positioned in one of the holes **26**, depending upon the size of the ordnance to be supported. Each roller assembly **28** includes a roller **30**, a pin **32** that rotatably supports the roller **30** and a yoke **34** that supports the pin **32**. A pivot **36** extends downwardly from the bottom of the yoke **34** for insertion into a selected roller assembly receiving hole **26**. The pivots **36** have a slightly smaller diameter than the holes **26** so that the roller assemblies **28** are free to pivot about the pivots **36**.

The middle assembly **14** includes a frame **38** and four pneumatic springs **40** positioned on the frame **38**. The frame includes a plate **42** and side walls **44** which extend upwardly from the plate **42** and which are reinforced by a pair of brace members **46**. The pneumatic springs **40** are each comprised of a flexible, air-filled bag **48** and a pair of attaching members **50** and **52** which are positioned at the upper and lower ends of the air bag **48**, respectively. The upper attaching member **52** of each pneumatic spring **40** has a pair of threaded cap screw receiving holes **54** formed in it and has a valve **56** for its bag **48** extending through it.

The upper assembly **12** is assembled onto the middle assembly **14** with the generally X-shaped frame **20** of the upper assembly **12** positioned on the upper attaching members **52** of the pneumatic springs **40**. The valves **56** of the pneumatic springs **40** extend through the valve receiving holes **22** of the plate **18** and a cap screw **58** is passed through each of the cap screw receiving holes **24** of the plate **18**. The screws **58** extend into threaded interengagement with the cap screw receiving holes **54** of the pneumatic springs **40** and serve to secure the upper assembly **12** to the middle assembly **14**.

The combination of the upper assembly **12** and the middle assembly **14** comprises a bomb receiving subassembly which may be used without further attachments as a bomb receiving adapter for bomb positioning tables. As is shown in FIG. 3, a plurality of locating pins **59** extend from the bottom of the plate **42** of the middle assembly **14**. The pins **59** may be used to position the subassembly comprised of the upper assembly **12** and the middle assembly **14** on a lift table.

Referring again to FIG. 1, the lower assembly **16** includes a pair of fork lift receiving chambers **60** each formed from a pair of U-shaped members **62** which are positioned in facing relationship and welded together to form the chambers **60**. A bomb tie-down member **64** is secured to the upper side of each end of each of the fork lift receiving chambers **60** for use in securing bombs to the first embodiment **10**. The lower assembly **16** further includes a pair of side members **66** which are welded to the fork lift receiving chambers **60** and a plurality of brackets **68**, some of which are welded to the chambers

60 and others of which are welded to the sides 66. The sides 66 and the brackets 68 are positioned to slidably receive and to thereafter support the sub-assembly comprised of the middle assembly 14 and the upper assembly 12, with the side walls 44 of the middle assembly positioned within the sides 66 of the lower assembly and within the chambers 60 thereof.

Referring now to FIG. 4, the use of the first embodiment 10 of the invention shown in FIG. 1 is illustrated. The first embodiment 10 is positioned on the forks 70 of a fork lift truck with the forks 70 extending into the fork lift receiving chambers 60 of the lower assembly 16. The first embodiment 10 in turn receives a bomb 72 or other large ordnance which is positioned on the roller assemblies 28 of the upper assembly 12. During transportation the bomb 72 is secured by straps 74 which are attached either to the bomb tie-down members 21 or to the bomb tie-down members 64, depending on whether it is desired to support the bomb 72 resiliently on the pneumatic springs 40 or rigidly, respectively.

Referring now to FIG. 2, the first embodiment 10 is shown mounted on a low profile lift truck 76 having a lifting mechanism 78. A vertical axis pivoting mechanism 80 is mounted on the end of the lifting mechanism 78 of the low-profile lift truck 76 and the forks 70 extend from the pivoting mechanism 80. In use, the bomb 72 is transported to an aircraft by the low-profile lift truck 76 and is raised into vertical alignment with the bomb receiving portion of the aircraft by the lifting mechanism 78. The bomb 72 is then swung sideways into horizontal alignment with the bomb receiving portion by use of the vertical axis pivoting mechanism 80 on the lifting mechanism 78. Final positioning of the bomb 72 with respect to the aircraft is accomplished by rotating the bomb on the roller assemblies 28 and by manually adjusting the position of the bomb against the action of the pneumatic springs 40. The springs 40 allow sufficient rocking and tilting motion of the bomb 72 under manual pressure applied to the bomb for the bomb 72 to be secured to the bomb receiving portion of the aircraft without the use of hydraulically controlled bomb positioning mechanisms on the lift truck 76.

Referring now to FIG. 7, a second embodiment 82 of the invention is shown. The second embodiment 82 includes a box frame 84 comprised of a plate 86 and a plurality of side walls 88 extending downwardly from the plate 86. The plate 86 has an elongate slot 90 formed in it and has a low friction pad 92 formed from a fluorinated polyolefin, such as polytetrafluoroethylene which is sold under the trademark "Teflon," mounted on it. The pad 92 has a slot 94 formed in it that is similar in shape to the slot 90 formed in the plate 86.

A plate 96 is mounted on the low friction pad 92 and is supported thereon for sliding motion with respect to the plate 86. The plate 96 is secured on the second embodiment 82 by a stud 98 extending through the slots 94 and 90, an enlarged retaining washer 100 having a diameter larger than the length of the slot 90 and a nut 102 mounted on the stud 98. As is shown in FIG. 5, the plate 96 has a plurality of roller receiving holes 104 formed in it which are similar to the roller receiving holes 26 formed in the plate 18 of the first embodiment shown in FIG. 1. Four of the roller assemblies 28 used in the first embodiment are positioned in selected ones of the holes 104 for receiving a bomb or other ordnance on the second embodiment 82.

The second embodiment 82 differs from the first embodiment principally in that the box frame 84 is not supported on pneumatic springs similar to the springs 40 of the first embodiment, but rather is supported on four rubber shear pads 106 which in turn are supported on a lower rack 108 formed from four lengths of angle iron 110 that are welded together in the form of a rectangle. As is shown in FIG. 6, the shear pads 106 are positioned between an edge 112 on the box frame 84 and a lower

edge 114 of the angle irons 110 of the lower rack 108. The shear pads 106 operate similarly to the pneumatic springs 40 in that they allow manual final positioning of an ordnance mounted on the roller assemblies 28 of the second embodiment 82.

Referring now to FIG. 8, the use of the second embodiment 82 is illustrated. The second embodiment is positioned on a lift table 116 which is in turn mounted on a lift truck (not shown). A bomb or other ordnance 118 is mounted on the roller assemblies 28 of the second embodiment 82 and the lift truck and the lift table 116 are used to horizontally and vertically position the bomb 118 with respect to the bomb receiving portion of an aircraft. The roller assemblies 28 permit rotational positioning of the bomb 118 and the low friction pad 92 of the second embodiment 82 permits lateral positioning of the bomb 118. Final adjustment of the positioning of the bomb 118 with respect to the bomb receiving portion of the aircraft is accomplished by manually adjusting the position of the bomb 118 against the action of the shear pads 106.

Referring now to FIGS. 9 and 10, there is shown a third embodiment 120 of the invention which comprises a modification to a conventional low profile lift truck design that allows manual final positioning of members carried on the lift truck. The third embodiment 120 includes a frame assembly 122 secured to the lifting portions 124 of a lift truck and a T-bar 126. The frame assembly 122 is comprised of a lower plate 128, a pair of side plates 130, a rear plate 132, and a pair of front plates 134 all of which extend upwardly from the plate 128. The T-bar 126 includes a lift fork receiving arm 136 which receives a pair of lift forks 138 and a pair of laterally extending arms 140. The T-bar 126 is secured on the frame 122 by three rubber shear pads 142 which are positioned between the laterally extending arms 140 of the T-bar 126 and the front plates 134 of the frame 122 and between the T-bar 126 and the rear plate 132 of the frame 122.

FIG. 10 illustrates the use of the third embodiment 120. A plurality of bombs 144 are secured on a bomb supporting rack 146 of the type disclosed in the copending application of William N. Oswald filed May 22, 1967, Ser. No. 639,946, which is in turn supported on the lift forks 138 of the third embodiment 120. The bombs 144 are attached to a mer rack 148 which is used to secure the bombs to an aircraft. The lift truck of which the lifting portions 124 form a part is moved to the vicinity of an aircraft and the lifting portions 124 are used to elevate the third embodiment 120 to the vicinity of the bomb receiving portion of the aircraft. The bombs 144 and the mer rack 148 are then manually finally adjusted against the action of the shear pads 142 to position the bomb attaching portion of the mer rack 148 in alignment with the bomb receiving portion of the aircraft.

Referring now to FIG. 11, there is shown a fourth embodiment 150 of the invention which comprises an assembly adapted for attachment to a conventional lift truck to allow manual positioning of apparatus carried on the lift truck. The fourth embodiment 150 includes a rear plate 152 and a front plate 154 both of which extend vertically. The rear plate 152 includes a hook 156 adapted for attachment to the fork receiving portions of a conventional lift truck. The front plate 154 includes a bar 158 adapted to receive conventional lift forks 160.

A pair of brackets 162 extend from the rear plate 152 toward the front plate 154 and a pivot pin 164 extends between the brackets 162. A bracket 166 extends from the front plate 154 toward the rear plate 152 and is connected to the pivot pin 164 by a spherical bearing 168 which allows horizontal and vertical pivoting of the front plate 154 with respect to the rear plate 152. A pair of shear pads 172 (only one of which is shown) are positioned between the front plate 154 and the rear plate 152 to allow manual adjustment of the positioning of

apparatus carried on the forks **160** with respect to the rear plate **152**.

In use, the fourth embodiment **150** is attached to a conventional lift truck by engaging the hooks **156** with the fork receiving bar of the lift truck. Conventional lift forks **160** are then secured to the bar **158** of the fourth embodiment **150** in the manner in which they are normally secured to the fork receiving bar of the conventional lift truck. The lift truck is then used to receive and elevate apparatus in the conventional manner. However, because the fourth embodiment **150** is connected between the lift truck and the forks **160**, the positioning of the apparatus carried on the forks **160** can be manually adjusted with respect to the lift truck against the action of the shear pads **172**.

Although only four embodiments of the invention are shown in the drawings and described in the foregoing specification, it will be understood that the invention is not limited to the specific embodiments described, but is capable of modification, rearrangement and substitution of parts and elements without departing from the spirit of the invention.

What is claimed is:

1. A system for loading ordnance into aircraft including:

a low profile lift truck having a lift boom;

means for receiving the ordnance;

a resilient coupling between the receiving means and the lift boom for floatingly supporting the receiving means and the ordnance so that the ordnance can be mutually manipulated against the action of the coupling to facilitate coupling the ordnance to the aircraft;

means for permitting pivotal movement of the ordnance receiving means about a vertical axis, and

means for permitting pivotal movement of ordnance supported on the ordnance receiving means about a horizontal axis.

2. The system for loading ordnance into aircraft according to claim **1** wherein the resilient coupling comprises at least one spring for supporting the ordnance receiving means on the lift boom.

3. The system for loading ordnance according to claim **2** wherein the resilient coupling comprises a plurality of fluid springs each connected between the lift boom and the ordnance receiving means.

4. The system for loading ordnance according to claim **3** wherein each of the fluid springs comprises an air filled flexible bag.

5. The system for loading ordnance according to claim **4** wherein the means for permitting pivotal movement of ordnance about a horizontal axis comprises a plurality of rollers for supporting ordnance on the ordnance receiving means.

6. The system for loading ordnance according to claim **1** wherein the resilient coupling comprises a plurality of shear pads for supporting the ordnance receiving means on the lift boom.

7. The system for loading ordnance according to claim **6** wherein the shear pads are positioned at spaced points around the periphery of the ordnance receiving means.

8. The system for loading ordnance according to claim **6** wherein the ordnance receiving means includes a horizontally disposed plate supported on the shear pads.

9. The system for loading ordnance according to claim **8** wherein the means for permitting pivotal movement of ordnance about a horizontal axis comprises a plurality of rollers for supporting ordnance on the horizontally disposed plate.

10. The system for loading ordnance according to claim **8** wherein the means for permitting pivotal movement of the ordnance receiving means about a vertical axis comprises a body of low friction material for supporting the plate on the shear pads.

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U.S. Cl. X.R.

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