United States Patent

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[33] **Great Britain**
[31] **No. 40380/67**

[54] **LIFTING APPARATUS**
9 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **214/620,** 214/730; 294/67
[51] **Int. Cl.** **B66f 9/14**
[50] **Field of Search** 214/620, 392, 394, 621, 650SG, 730; 294/67.4, 67.4A

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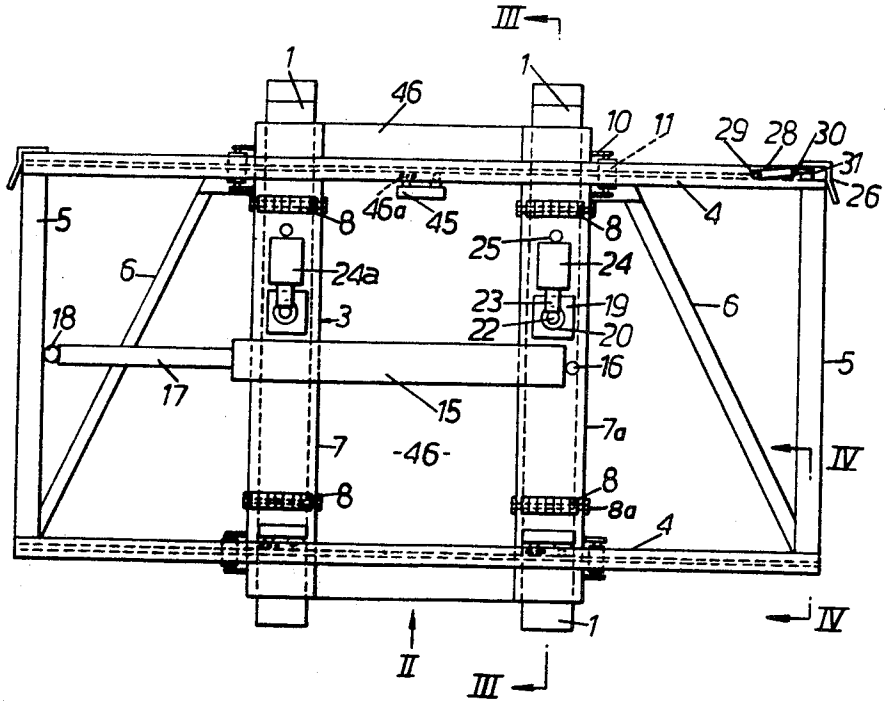
ABSTRACT: A load lifting attachment for a fork lift device comprising elements engaged by the forks, a frame mounted for relative movement on the elements, lifting devices on the frame and operable to engage a load from above, and power operated means to slew the elements on the forks, to move the frame transversely of the elements, and to cause the lifting devices to engage the load.



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SHEET 1 OF 2

FIG.4

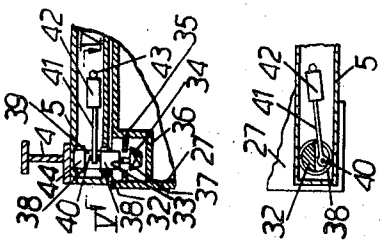


FIG.5.

FIG.3

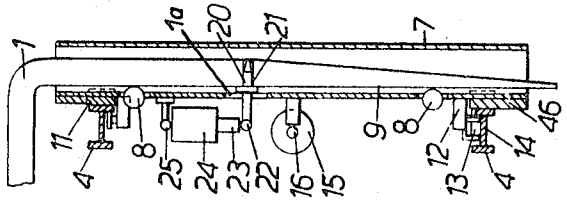
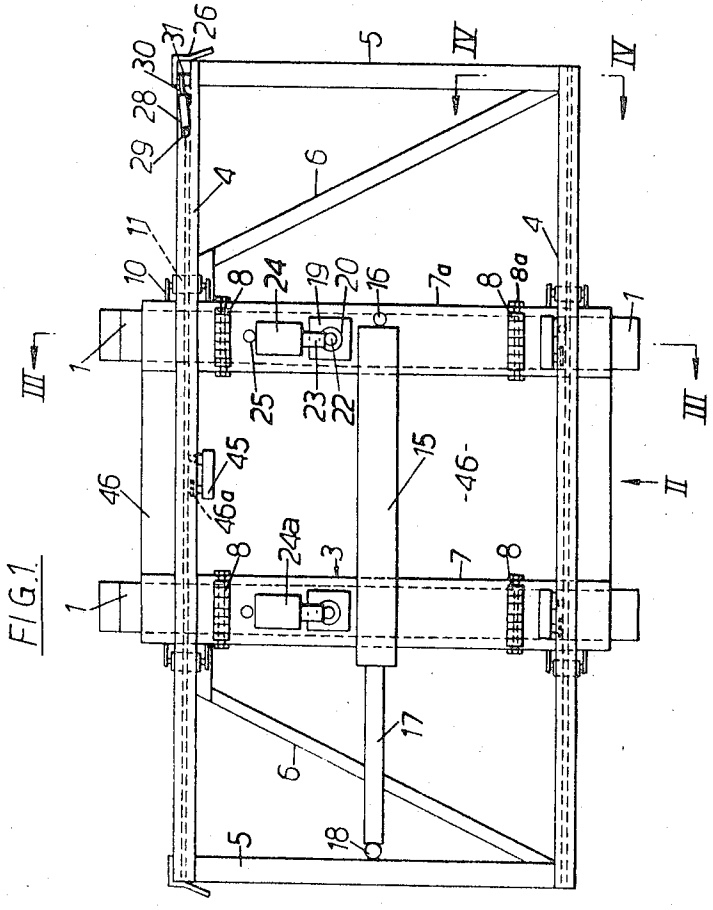


FIG.1.



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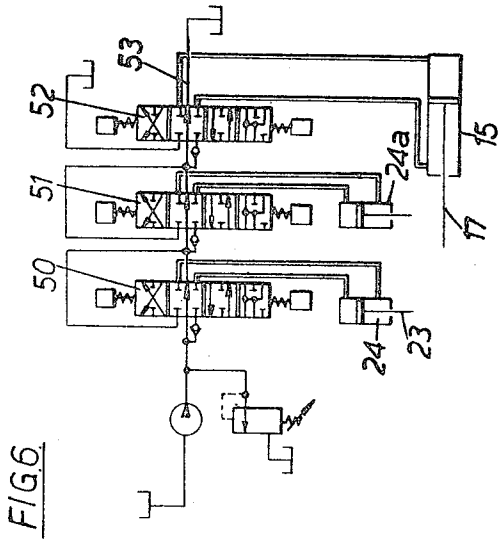

FIG.6

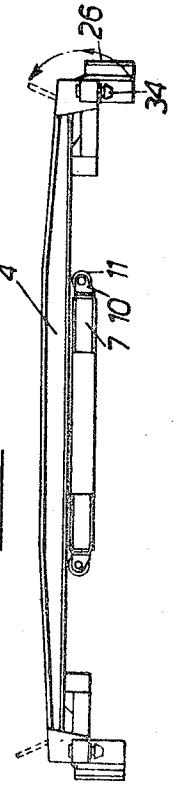

FIG.2

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LIFTING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to load lifting apparatus, particularly to an attachment for use with fork lift vehicles, front loaders or side loaders, in lifting and maneuvering large loads such as railway truck containers or road vehicle containers, which require to be lifted from one vehicle onto a support or another vehicle. Such containers, usually in the form of a boxlike wagon body, have at their four top or bottom corner castings having cavities into which engaging means can be fastened for lifting the load. The apparatus can be used with any such load which has to be raised from above, such as tanks, boxes, crates or post pallets provided with the spaced members having cavities into which engaging means can be fastened.

2. Description of the Prior Art

When mechanically handling such loads it has been found difficult to arrange a lifting device which can be easily aligned with the load for picking up the load and which can position the load accurately for setting down, particularly bearing in mind that such loads can be many tons weight and of the size of a conventional railway goods wagon body, and that the center of gravity of a load may be eccentrically disposed in the bulk of the load.

The main object of the present invention is to provide an attachment for use with a fork lift truck, or like machine, which may be a side loader, in which the aforesaid disadvantage is minimized and balanced movement of the load can be controlled easily

SUMMARY

According to the present invention a load lifting apparatus is provided, for use in lifting a load by the engagement of lifting devices of the apparatus with appropriately shaped devices of the load preferably the upper portion of the load, said apparatus comprising an element or elements with which lifting means such as forks, carried by the carriage of a fork lift truck or like machine, can be operatively demountably engaged, a substantially horizontal main frame operatively connected to the element or elements, a bearing member or members between the element or elements and the frame to facilitate relative movement between them in a substantially horizontal direction, power operated means operable to slew the frame with respect to the lifting means in a substantially horizontal direction, and spaced lifting devices carried by the frame and operable by power operated means to engage the devices on the load for lifting the load by operation of the forks or like lifting means.

Power operated means may be provided to effect a movement of the frame relative to the element or elements in a substantially horizontal direction transversely of the forks or like lifting means.

One or more power operated slewing devices may be provided on the element or elements or between or outside the element or elements.

In a preferred construction guide elements are mounted on the frame for engagement with the load for guiding the attachment into accurate engagement with the load. The guide elements are movably mounted on the frame and power operated means are provided to withdraw the guide elements from the load engaging position into an inoperative position. The guides at the side of the frame nearest the carriage are the more important and longer than the guide elements remote from the chassis but the latter may be omitted.

The power operated means for transverse movement of the load when suspended from the frame may be one or more hydraulic rams extending along the frame transversely of the lifting means, the cylinder or piston of the ram being secured to the element or one of the elements and the piston or cylinder respectively being secured to the frame.

The power operated means for slewing the load may comprise one or more and preferably a pair of spaced hydraulic rams connected between the said element or elements and the forks, the connections being of a character permitting universal movement between each part of the ram and the forks or the element or elements.

The said element or elements preferably include channels disposed to receive the horizontal forks or prongs of a fork lift device, and have apertures therein through which pins or like locking means can be engaged in apertures in the forks in register therewith, the free ends of the pins or the like being connected by joints e.g. universal joints one to each hydraulic ram for slewing the load.

Although the attachment is highly suitable for fork lift means, it will be understood that it could be carried, for raising and lowering loads, by other suitable lifting means such as a crane, when it is preferably connected to the crane hook or the like by links, chains or cables removably secured to spaced points on the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more fully understood an embodiment in accordance therewith will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 is a plan view of a load lifting apparatus;

FIG. 2 is a side elevation looking in the direction of the arrow 11 in FIG. 1;

FIG. 3 is a cross section along the line 111–111 of FIG. 1 looking in the direction of the arrow;

FIG. 4 is a cross section on the line 1V–1V of FIG. 1;

FIG. 5 is a cross section on the line V–V of FIG. 4; and

FIG. 6 is a diagrammatic layout of the hydraulic arrangement of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings the apparatus is described as being used with the forks of a fork lift truck as shown at 1 in the drawings, but it will be understood that it can be used with any other lifting means which can be inserted in the frame as will be described hereinafter.

The apparatus comprises a frame 3 made up of longitudinal members 4 and end side pieces 5 with bracing members 6. Secured to the longitudinal members 4 are two transverse channel elements or box members 7, 7*a* disposed to receive the forks 1. Supported on the channel members 7, 7*a* are rollers 8 journaled in brackets 8*a* on the members 7 and formed of sections of rollers and constituting bearing members between the channel members 7, 7*a* and the forks 1. The rollers may however be replaced by balls or members making sliding contact.

As can be seen from FIG. 3 the rollers 8 make rolling engagement with the top surface 9 of the forks 1 and when the apparatus is used for lifting a load as will be described the load is transferred from the frame 3 to the forks 1 through the rollers 8. Secured to the outside of the channels are brackets 10 in which are journaled rollers 11 bearing on the underside of the side frame members 4.

The channel or box members 7 have brackets 12 in which are journaled rollers 13 in rolling engagement with the portions 14 of the longitudinal members 4.

A hydraulic ram cylinder 15 disposed longitudinally of the frame, i.e. parallel to the frame members 4, is connected by a universal joint member 16 and is supported on the other channel member 7; the piston 17 of the ram is journaled by a universal joint 18 to the adjacent frame side member 5. It will be seen that when the piston rod 17 is moved by hydraulic pressure within the cylinder 15 the frame 3 can be moved from right to left or vice versa of FIG. 1 on the rollers 11 and 13.

Each of the channels 7, 7*a* has an aperture 19 and a removable pin 20 is engaged in a slot 21 in the forks 1 and extends through the aperture 19; the upper end of the pin 20 is connected by a universal joint 22 to the piston 23 of a hydraulic

ram cylinder 24 itself connected by a universal joint 25 to the channel member 7, 7a. Thus operation of the ram 24 will move the channels 7, 7a longitudinally of the forks 1. While one of these rams 24 and its operation has been described with reference to one of the channel members 7, 7a it will be seen from FIG. 1 that the other channel member is similarly constructed. Thus by operation of one of the cylinders 24, 24a while the other remains fixed, the frame 3 can be slewed with respect to the forks taking up the spaces between the sides of the forks 1 and the interior side walls of the members 7, 7a; or the rams 24, 24a could be operated in opposite directions to increase the slewing effect, or both the rams 24, 24a can be operated in the same direction thereby moving the frame 3 along the forks 1.

As seen in the top right hand corner of FIG. 1 a guide element 26 is secured to the frame 3 and as seen in FIG. 2 this guide element can be rotated about a horizontal axis, but in the lowered position shown in FIGS. 1 and 2 it extends below the frame, or it may be rotated about a vertical axis thus moving it out of contact with a load such as a transport container the same area in plan as the frame 3. A similar guide element is shown at the top left hand corner of FIG. 1 and also they are provided, although not shown, at the bottom left and bottom right hand corners of FIG. 1, all the guide elements being operated as described for the element 26.

For engaging a load such as a bulk boxlike container used for road-rail transport having an area equal to the frame 3, assuming that the apparatus is mounted on the forks as shown in the drawings, the vehicle supporting the attachment above the load with the forks raised, is moved to alongside the load and the attachment is supported on the forks at a height such that the outer guides elements (bottom of FIG. 1), if fitted, or the frame itself is three to four inches above the load and the end shift ram 15 is operated to bring the apparatus within two or three inches in a longitudinal direction of its being in register sideways of the load should the driver have stopped the vehicle in accurate alignment with the load. The slewing and side shift rams 24, 24a are then operated to put them into the float position that is to say the rams are depressurized and permit the pistons to move freely in their cylinders. The apparatus is then traversed over the load until the inner guide elements 26 strike the side corners of the container nearest the vehicle; if the frame is not parallel to the side of the container operation of the rams 24, 24a or one of them causes the frame to swing about the pins 20, and since one guide element 26 is already in contact with the container, the other corner of the frame will swing towards the load until the other guide element 26 strikes the other end of the load, thus bringing the frame into register with the load. The apparatus is then dropped onto the top of the container. During this operation the guide elements 26 at the bottom of FIG. 1 are raised so that the apparatus can move across the top of the load. When the load is lowered the guide elements are lowered also and assist in correctly aligning the frame on the top of the load. The lowering of the guide elements is by means of rams 28 connected by universal joints 29 to the frame members 4 and their rods 30 are connected to pins 31 on the guide elements 26. The twist locks (to be described) are then operated to engage the load and the controls are operated to pressurize rams 24, 24a to prevent any slewing of the frame on the forks. The container is then lifted and brought onto the platform of the side loader vehicle by retracting the mast carrying the forks into the transverse recess across the vehicle.

In each corner of the frame 3, as seen in FIGS. 4 and 5, are the lifting devices shown as rotatable lugs 32 but they may be swinging hooks in the corners of the frame 3 and having pins 33 integral therewith to the lower end of which are the actual lifting members 34. The lifting members 34 are downwardly tapered and transversely of FIG. 4 are of a thickness to enable them to pass through an aperture in the plate 35 in the shaped elements 36 formed in the corner of the load. When the lugs 32 are rotated after the member 34 has passed through the plate 35, their upper extended edges 37 engage under the plate 35 and enable the apparatus to lift the load. The lugs 32 are journaled in bearings 38 in the side frame members 5 and they have a cut away portion 39 in which is a pin 40 on which is engaged the rod 41 of a ram 42 secured inside the member 5 by a universal joint 43. The ram 41, 42 as can be seen from FIG. 5 is positioned at an angle to the longitudinal axis of the frame member 5 and therefore when it is operated by drawing the rod 41 to the right in FIG. 5, the lug 32 will be rotated. The upper portion 44 of the lug 32 may be quadrant shaped, that is one quarter of a circle segment, and the aperture in the bearing 8 is a half circle segment so that this will permit the rod 41 to rotate the lug 32 through 90° thereby moving it from the position where the member 34 can pass through the plate 35 to the position where it engages underneath the plate 35 as seen in FIG. 4 for lifting the load.

Between the channel members 7, 7a there is a plate 46 secured to the channels as by welding or other suitable means, and mounted on the plate 46 are brackets 45 carrying rollers 46a running within the channels along the sides of the members 4.

Referring to FIG. 6 this shows the hydraulic circuit controlling the rams of the apparatus and for the sake of clarity the rams 24,24a in FIG. 1 have been shown as 24 and 24a in FIG. 6. The valves 50, 51 and 52 are three identical four positioned valves, the fourth position being a detent position giving a float condition, that is to say both cylinder ports and pressure port are connected to the tank line 53 and the valves are spring centered to neutral positions from both the working positions.

By selecting the valves 50 and 51 in the same direction the cylinders 24 and 24a are actuated together and thus the apparatus rolls in or out of the forks 1. If the valves 50 and 51 are selected in the opposing directions the cylinders 24 and 24a are again actuated, but this time one is extended and one retracted and thus a slewing action is achieved, the rollers 8 assisting this operation. Alternatively the valves 50 and 51 may be operated independently.

By selecting the valve 52 the cylinder 15 is actuated and the frame 3 moves sideways on the channel members 7. By selecting the fourth detent position on any of the valves the cylinder can be extended or retracted by external forces such for example as when the apparatus engages a load.

For mounting the apparatus onto the load the forks 1 are inserted into the channel members 7 and the hydraulic connections for all the rams are made with suitable connecting points on the vehicle, the hydraulic connections being flexible tubes with plug and socket type connections for preference of the type which when they are engaged fully in position will automatically open valves in the connections and connect the connecting flexible tubes into the pressure fluid line. The pins 20 are then inserted through the apertures 19 into the slots 21 in the forks and the apparatus is ready for use. The lifting vehicle, for example a side loader carrying the apparatus on the forks of its mast, is positioned alongside the container and the mast of the vehicle is traversed out sideways of the vehicle with the apparatus just clear of the top of the container and the valves 50, 51 in the detent position. Thus when the guide elements 26 contact the container corners they centralize the apparatus against it, pushing cylinders 24 and 24a in or out. The container is then attached, the valves return to neutral and the load is ready to lift. If when starting to lift the container is found to be end heavy, indicated by a sloping container, then the container is not fully lifted but returned to the floor. The detent position is selected on the valve 52 and the vehicle is driven slowly from left to right or right to left of FIG. 1 towards the heavy end of the load. The valve 52 is then returned to neutral and the load is lifted. When putting the container down it can be accurately positioned by means of manipulating the three said valves.

On the vehicle there are also valve controls for the cylinders 28, one for each corner of the vehicle, and for the hydraulic system of the vehicle enabling the mast to be moved transversely of the vehicle in the recess therein as is conventional with

side loaders, to enable the fork carriage to be moved up and down on the mast of the side loader and to enable the forks to be tilted about a horizontal axis

All the valves are controlled from the driver's cab on the vehicle which are preferably disposed on a console on the cab on the side of the cab nearest the loading apparatus thus facilitating the driver's control since he can watch the loading operation and operate the valves to control the whole movement of the load. The valves may be combined in a minimum of control levers or the like which can be moved forwards, backwards, left-sidewards or right-sidewards according to the direction in which the load is to be moved.

The valves may be disposed on the apparatus and actuated by remote controls as on the driver's cab as already stated herein.

It will thus be seen that by means of the apparatus of the invention accurate disposition of the apparatus with respect to the load can be effected from the driver's cab and the load can be adjusted to any known position.

Although the invention has been described with regard to conventional forks in which the forks extend from the lower ends of vertical members connected to the carriage on the mast, nevertheless the forks **1** may extend from the top ends of the arms i.e., the conventional forks are inverted in the mast carriage thereby enabling the load to be lifted with the carriage in its lowermost position.

All bearing surfaces may be of any suitable material such as steel, bronze or suitable plastic material.

In another construction the frame **3** may be H-shaped the uprights of the H being the members **5** in FIG. **1** and the horizontal bar of the H extending between them: this H-frame replacing the two members **4** by a single central member extending from left to right in FIG. **1** may be slung under the tunnels **7** with rollers carried by brackets on the underside of the tunnels and running in grooves on the vertical sides of the cross bar or, where the cross bar is an I-beam, between the upper and lower flanges of the beam, the rollers preferably being provided on both sides of the beam.

The frame may be made telescopic to adjust its length and/or width to vary its dimensions to suit loads of different sizes, e.g. 20, 30, 35, or 40 feet long. In this case the frame members **4** and/or the members **5** are telescopic and hydraulic cylinders, controlled from the same point as the other controls, may be provided to change the length of the frame members to suit the load dimensions.

In another construction the main frame may be supported by the tunnels which are interconnected to form a second frame, and the main frame is pivoted to the second frame about a pivot with a vertical axis of slew, bearing members such as rollers or slides preferably being provided between the two frames. In this construction the two frames are capable of a relative movement between them by moving one or both of them along slides or roller tracks as in the preceding paragraphs, using the ram **15**.

The apparatus of this invention can readily employed by standard fork lift truck and sideloader vehicles, and can be engaged by the forks and disengaged therefrom by the truck or vehicle driver operating his vehicle in a conventional manner.

The apparatus when fitted to the forks can be operated by the vehicle driver from his driving seat to move it in all directions to position the frame with respect to the load for picking up the load and for adjusting the position of the lifted load.

I claim:

1. A load lifting apparatus for demountable attachment to the forks of a fork lift truck for use in lifting bulk containers from above, comprising a pair of support elements for engagement longitudinally along the arms of said forks, a transverse frame supported by said support elements and movable transversely thereof and having at least one transverse frame member with end frame members across the ends thereof, antifriction members between said support elements and said forks, means for securing each support element to one of said forks and including a power operated device operable to cause relative movement between each said support element and one of said forks generally longitudinally of the forks, a separate power device operable to cause relative movement between said frame and said support elements transversely thereof, load engaging devices one at each end of each said end frame member engageable with spaced members on the upper portions of an associated bulk container, separate power operated devices operable to cause the load engaging devices to be engaged with or disengaged from said container spaced members, guide members engageable with spaced faces on said container to permit the apparatus to be brought accurately into register with the top of the container, and control means operable to cause actuation of each of said power operated devices whereby said load engaging devices can be brought into register with said spaced members on the container by providing movement of said frame across or along the load or slewed about a vertical axis to dispose the load in balance supported beneath the apparatus.

2. An apparatus according to claim **1**, wherein said guide members are moveably mounted on said frame and including separate power operated means for withdrawing said guide members from load engaging position into an inoperative position.

3. An apparatus according to claim **1**, wherein guide members are mounted at opposite sides of said frame, the guide members of one side of said frame being shorter than the guide members at the other side of said frame.

4. An apparatus according to claim **1**, wherein the power operated device operable to cause relative movement between said frame and said support elements transversely thereof comprises at least one hydraulic ram extending along said frame transversely of said elements, the piston and cylinder of said ram being connected to one of said elements and said frame respectively.

5. An apparatus according to claim **1**, wherein said power operated device operable to cause relative movement between each said support element and one of said forks includes a first universal joint connection between said power operated device and the associated fork and a second universal joint connection between said power operated device and the associated element.

6. An apparatus according to claim **1**, wherein each of said elements includes at least one substantially horizontal channel disposed to receive an associated fork and having at least one aperture therein, said means for securing each support element to one of said forks including locking means extending through said aperture and being engaged in an aperture in one of said forks in register therewith, the free end of said locking means being connected by a universal joint to the associated power operated device.

7. An apparatus according to claim **1**, including at least one roller carried by one of said support elements and being in rolling load-bearing engagement with said frame.

8. An apparatus according to claim **1**, wherein said frame is pivotally connected to one of said elements, the pivotal axis being substantially vertical.

9. In combination, a pair of support forks, a detachable load lifting apparatus including a pair of support elements receiving said forks and being supported for movement with respect thereto, independently operable power operated means connected between each of said elements and the associated fork for selectively moving each element with respect to the associated fork in a direction extending generally longitudinally of the fork, a transverse frame substantially horizontally disposed supported by said elements for movements transversely thereof, power operated means connected between one of said elements and said frame for moving said frame transversely of said element, depending, moveable load engaging devices at the corners of said frame engageable with members on the upper spaced portions of an associated bulk container, means for moving said load engaging devices between engaged and disengaged position, and a guide means supported by said frame and being engageable with spaced portions on an associated container to permit the apparatus to be brought accurately into register with the container