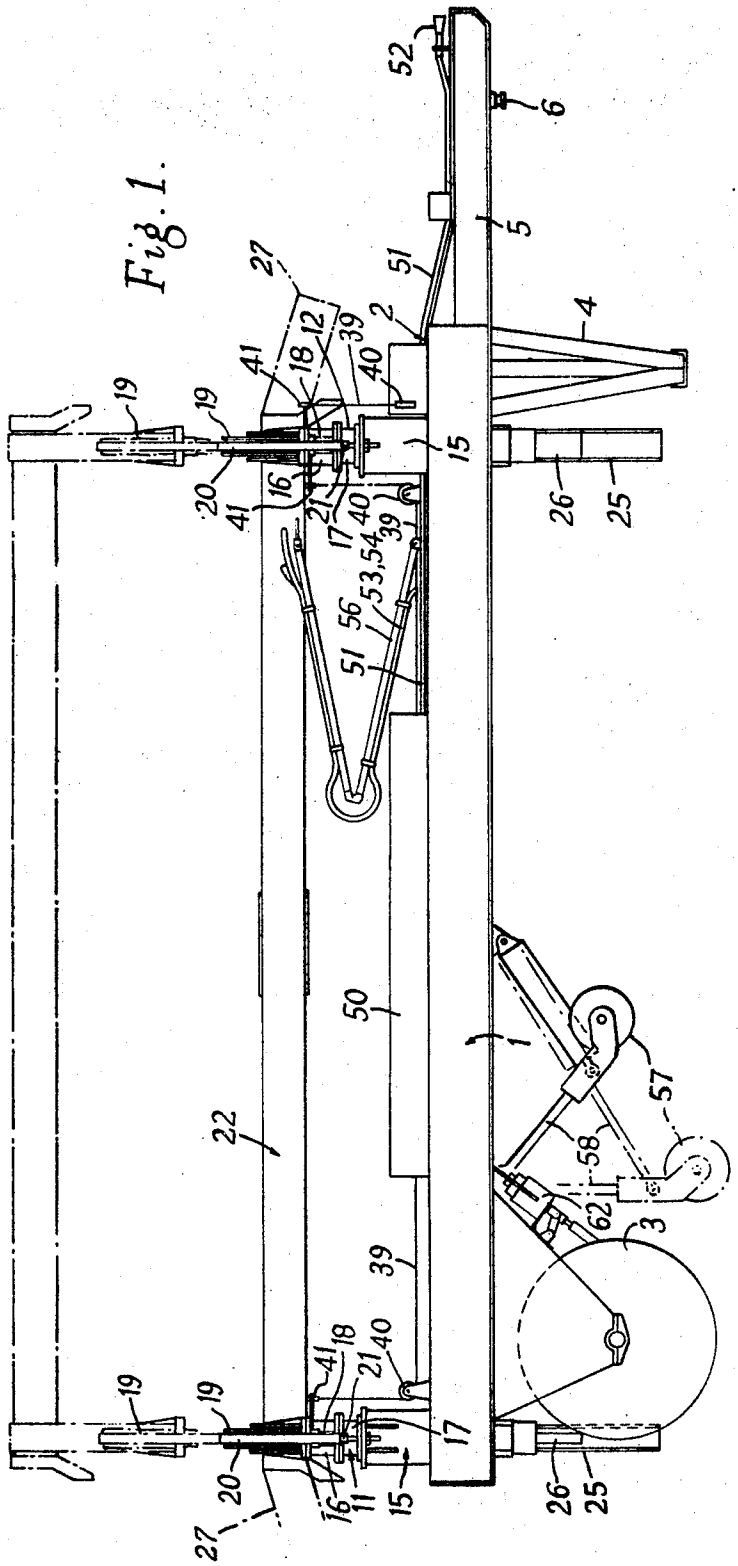
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CARRIER DEVICE

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Fig. 1.

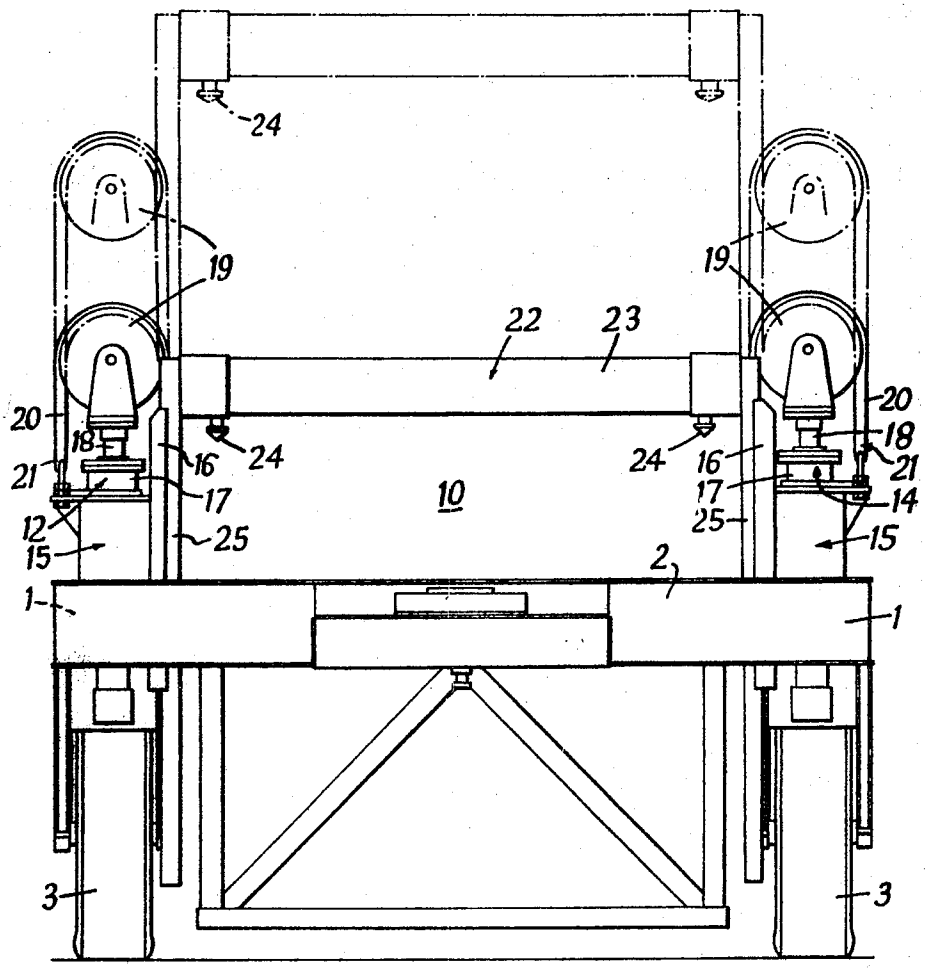


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Fig. 2.

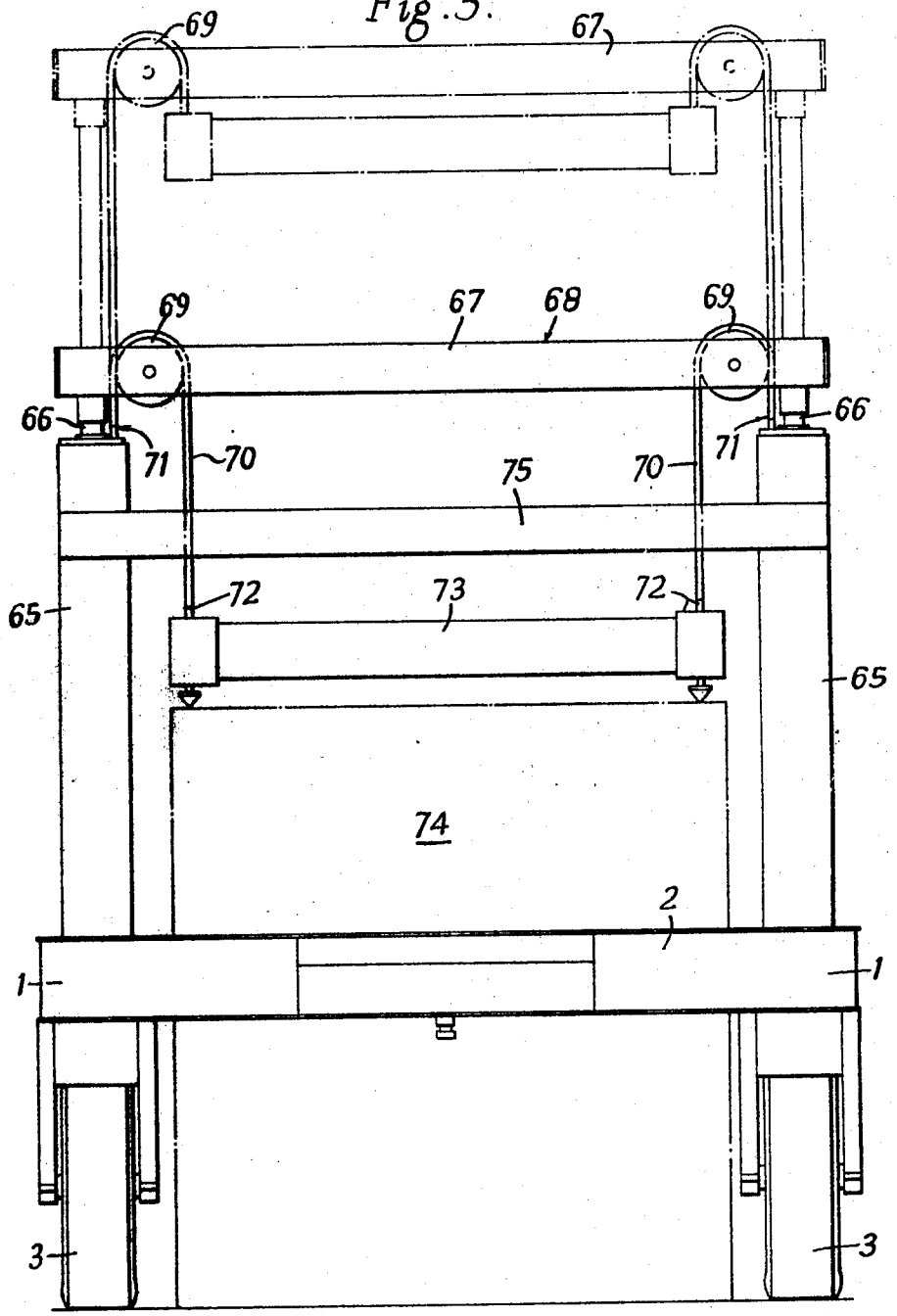


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CARRIER DEVICE

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Fig. 3.

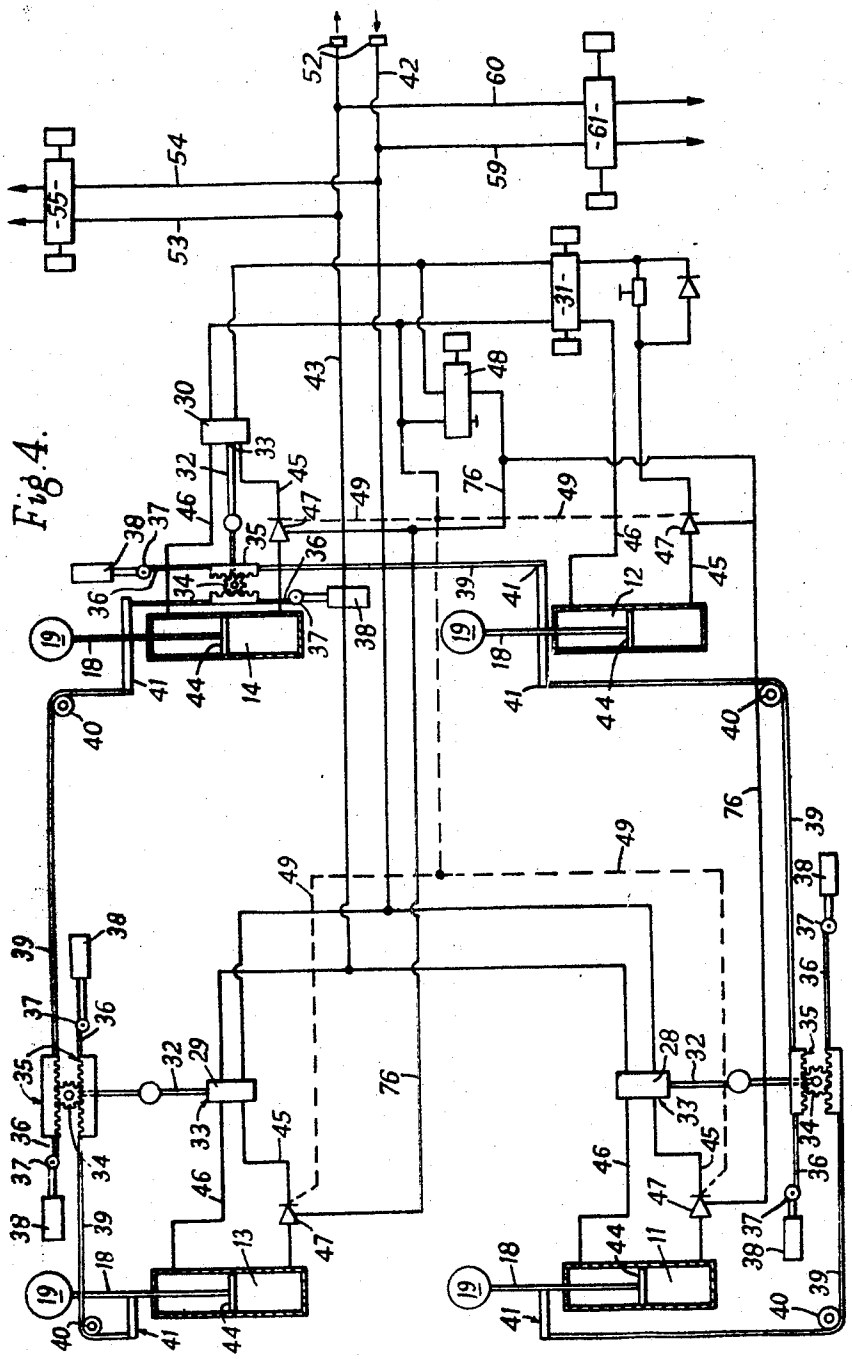


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Fig. 4.



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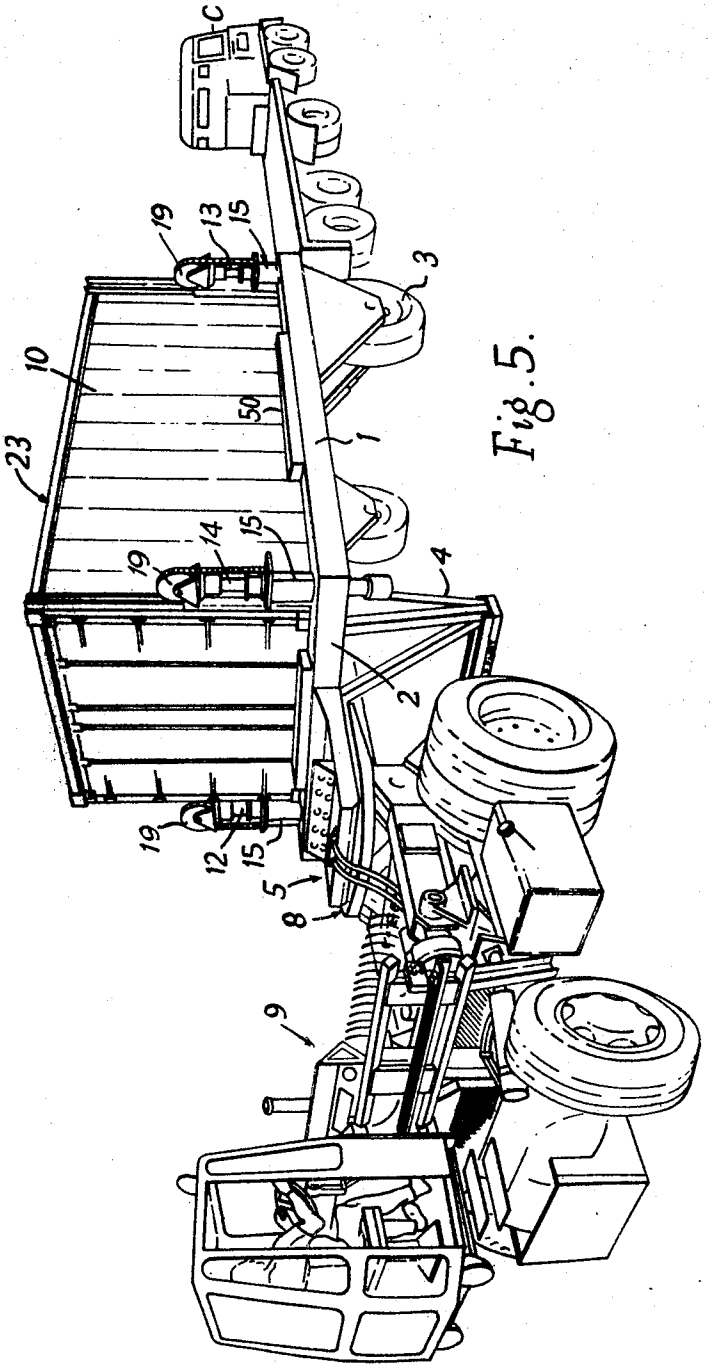


Fig. 5.

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CARRIER DEVICE

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Int. Cl. B60p *1/02*; B66d *3/08*; B66b *11/04*
U.S. Cl. 214—390 16 Claims

ABSTRACT OF THE DISCLOSURE

A carrier device for moving containers or other articles comprising a bifurcated vehicle having arms for extending along each side of the article to be raised and lifting means vertically movably mounted on the arms adapted to raise the article so that it can be moved with the vehicle. The arms are supported by wheels and as the lifting means are carried by the arms the height of the device can be kept within or near the height of the raised article.

This invention relates to carrier devices and is more particularly directed to a carrier device for moving containers or other articles.

Carrier devices for moving heavy articles are well known which straddle the article and then lift it to a raised position so that the article can be moved with the vehicle. A disadvantage with such known devices is that the operating mechanism must necessarily be higher than the article to be lifted and in certain circumstances this can be an embarrassment, especially if the article is to be used in confined spaces such as on board ships or other transport vehicles or in warehouses.

According to the present invention a carrier device for moving containers or other articles comprises a bifurcated vehicle having arms for extending along each side of the article to be raised and lifting means carried by the arms adapted to raise the article so that it can be moved with the vehicle.

As the lifting means are carried by the arms the height of the device can be kept low enough to enable it to work in spaces which are only a little higher than the article itself when in the raised position.

Preferably the arms of the bifurcated vehicle are supported on wheels so that the load on them is carried directly to the supporting surface.

In a preferred arrangement the lifting means includes a pair of lifting devices one of which is mounted on each arm and means for operating the devices in synchronism.

Thus, it is merely necessary to move the vehicle so that it extends along each side of the article to be raised, connect the lifting devices to the article and then to operate them so that the article is raised from the ground; the vehicle can now be driven away with the article to a desired location.

In a convenient arrangement the pair of lifting devices are arranged at or towards the outer ends of the arms and a further pair of lifting devices are provided at or towards the inner ends of the arms, means being provided to operate the devices in synchronism. With this arrangement each corner of, for example, a container can be acted upon by an individual lifting device and with articles such as containers, the appropriate lifting provisions can be utilised.

Preferably a lifting frame is provided between the arms to which the article to be raised is connected and means may be included for causing the lifting frame to be raised to a position in which it is above the lifting devices themselves.

Thus, with this arrangement only the lifting frame is

above the article to be lifted and such a frame can be kept relatively flat so that it does not cause excessive additional height above the article.

In a preferred arrangement the lifting frame has downwardly projecting extensions which are connected to the lifting devices, and the downwardly projection extensions can also act as guides to locate the frame in relation to the arms on the vehicle.

It will therefore be appreciated that the lifting frame is lifted from the bottom of the downwardly projecting extensions and thus all the lifting gear can be arranged below the level of the upper side of the lifting frame.

In an alternative arrangement each pair of lifting devices may be connected together by transverse lifting members which are raised by the lifting devices and which raise the lifting frame. This arrangement is particularly useful for extra heavy duty loads but is of course slightly higher when carrying the article because of the transverse members above the lifting frame.

The flexible member may be in the form of a chain or cable arranged to pass over a wheel carried on the upper end of the vertically moveable member.

Means may be included for compensating for the load between the lifting devices if the container or article is unbalanced and when fluid operated rams are used compensating means may be included to ensure that the rams move in unison in spite of the possible disparity in ram pressures.

With this arrangement the compensating means may include a coupling to each ram which transmits the amount of movement thereof to a compensating control valve which controls fluid flow to the rams concerned.

Each coupling may include a rack which acts on one side of a pinion, the other side of which is also contacted by a rack coupled to another ram and the pinion being carried by a lever so that out of phase movement of the racks will cause movement of the lever which is connected to the compensating control valve.

The invention may be performed in various ways but two embodiments will now be described by way of example and with reference to the accompanying drawings in which:

FIGURE 1 is a side elevation of a carrier device according to the invention,

FIGURE 2 is an end elevation of the device shown in FIGURE 1,

FIGURE 3 is an end elevation of an alternative construction,

FIGURE 4 is a diagrammatic view of part of the hydraulic control circuit, and,

FIGURE 5 is a pictorial view of an arrangement as shown in FIGURES 1 and 2 in use.

In the first arrangement to be described and as shown in FIGURES 1 and 2 the carrier device is in the form of a trailer vehicle having a lower frame comprising a pair of horizontally displaced heavily constructed arms **1** which are joined at one end by a connecting portion **2** which is of similar heavy construction. The other ends of the arms **1** are spaced but not connected by an transverse member, this construction providing the bifurcated vehicle previously referred to. Each of the arms **1** carries a road wheel **3** towards its outer end and the connecting portion **2** is provided with a support device in the form of a heavily constructed downwardly extending frame **4** so that when the trailer is not in use it will rest in a substantially horizontal position. The towing end of the trailer is provided with a tow bar **5** and towing pin **6** and plate **7** to co-operate with a fifth wheel plate **8** carried on a tractor vehicle **9** as shown in FIGURE 5.

The carrier device being described is for use with containers and the dimensions of the arms **1** are thus ar-

ranged so that they can be passed along each side of a container indicated at **10** in FIGURE 5 which is to be raised. Each arm **1** carries two hydraulically operated rams **11, 12, 13, 14** which are mounted in support structures indicated at **15** which are carried adjacent each end of the arm concerned. Thus, the support structure **15** at the outer end of the arm **1** is arranged longitudinally of the arm beyond the supporting wheel **3**. Each support structure **15** comprises a mounting which carries the rams **11, 12, 13, 14** in a substantially vertical attitude and a channel section guide rail **16** which extends parallel to the ram in the inside of the arm **1**. Each ram cylinder **17** is arranged to be rigid with the arm **1** and the movable piston carries a vertically extending rod **18** the upper end of which carries a pulley wheel **19**. The wheel **19** is arranged so that it can pivot slightly about a vertical axis and can rotate about a substantially horizontal axis which is substantially parallel with the longitudinally extending direction of the arm **1** on which it is carried, and a heavy duty flexible element such as a roller chain **20** is passed over the pulley, one end **21** being rigidly secured to the ram support **15**. The other end of the chain, on the inside of the arm **1** is connected to a lifting frame **22** as set forth in more detail hereinafter.

The lifting frame **22** which is carried between the pulley wheels **19** on the side arms **1** is in the form of a cross braced upper frame portion **23**, the corners of which carry twist-lock connection arrangements **24** of known for engaging the appropriate twist-lock connections on the upper end of the corners of a container **10**. Downwardly projecting extensions are fixed to each corner of the lifting frame **22** and are in the form of channel section legs **25** which co-operate with the channel section guides **16** on the inside of the arms and thus act to locate the frame **22** against longitudinal and transverse movement within the arms **1** themselves. The other lower ends **26** of the chains **20** which pass over the pulley wheels **19** are connected to the lower ends of the legs **25** of the lifting frame **22**, so that when the rams **11, 12, 13, 14** are operated the ram connecting rods **18** will rise applying a two to one purchase against the chains **20** which in turn lift the lifting frame **22** through the media of the downwardly projecting legs **25**. To lift a container **10** therefore, which may weigh 20 tons or more, it is merely necessary to move the carrier device into position with its arms **1** along each side of the container **10**, lower the upper frame into position as shown in FIGURES 1 and 2, operate the twist-lock mechanism **24** by suitable hydraulic or electrical apparatus and then again operate the fluid rams **11, 12, 13, 14** so that the lifting frame **22** is raised carrying with it the container. The dimensions of the rams and the downwardly extending legs are arranged so that when the container is raised from the ground and the device is in a mobile form the lifting frame is higher than the extended rams and pulleys and the only additional height to the container is that the thickness of the upper lifting frame itself as shown in FIGURES 1 and 2 and will be clearly seen in FIGURE 5. The container can now be moved as required and can, for example, be loaded onto another vehicle again as shown in FIGURE 5.

If required the lifting frame could be provided with angled extensions as shown in broken lines at **27** in FIGURE 1.

With this arrangement twist-lock arrangements could again be provided and the shaped lifting frame could thus be used with containers of two different sizes. It would of course be necessary to provide the required clearance for the container between the arms **1, 1** adjacent the connecting portion **2**.

In order to compensate for out of balance loading of the container **10** compensating means are provided to ensure uniform elevation of each ram **11, 12, 13, 14** in spite of disparity in ram pressures and the four hydraulic rams are thus connected by a signalling system as shown in FIGURE 4 so that three of the rams **11, 13, 14** are caused to follow the displacement of the remaining one **12** by

employing the established principle of mechanical position feed back in the sense that the master ram **12** can be caused to displace as an open loop device with the remaining three rams **11, 13, 14** acting as position servo mechanisms which move in correspondence with the displacement of the master ram. Thus, the control of hydraulic fluid rams **11, 13, 14** is through respective servo control valves **28, 29, 30** which are operated in accordance with the movement of the master ram **12** which is in turn controlled by a solenoid operated fourway direction valve **31**. Each servo-control valve **28, 29, 30** is operated by means of a centrally pivoted lever indicated diagrammatically at **32** one end **33** of which is connected to the valve spool (not shown) and the other end of which carries a sprocket **34** arranged between a pair of roller chains indicated diagrammatically at **35** which thus act as racks. The opposite displaced ends of the chains are connected to cables **36** which pass around pulleys **37** carried by the connecting rods of pneumatic cylinders **38** and the other ends of the chains **35** are connected to 5 cwt. (hundredweight) cables **39** which pass around rollers **40** and are connected at **41** to the connecting rods **18** of the appropriate hydraulic rams **11, 12, 13, 14**. Out of phase movement of the hydraulic rams, created by unbalance of the container **10** is therefore communicated to the sprocket **34** carried on the lever **32** which will tend to move in one direction or the other and which thus acts on the valve spool to cut off the fluid flow to the appropriate ram, thus ensuring that the container **10** will always be lifted horizontally.

As mentioned above, the arrangement as set forth is provided between each of the rams on each arm **1** and also between the pairs of rams on the opposite arms thus ensuring that the container is not tipped in any direction when the rams are operated.

The cables **39** pulleys **40** and connections **41** are shown in FIGURE 1 but the remainder of the compensating mechanism is enclosed within the casing on each arm **1** indicated at **50** into which pass the various pressure fluid lines indicated at **51** the connection to the tractor vehicle being at **52**.

In FIGURE 4 the main pressure fluid supply line is indicated at **42** and the main relief line at **43**. It will be seen that the servo valves **28, 29, 30** and the main control valve **31** can switch pressure fluid from the line **42** to the appropriate side of the piston **44** of each of the rams by the lines **45, 46** connecting the other side appropriately to relieve line **43**. The line **45** provides the pressure fluid when the ram is used to raise the load, and controlled locking valves **47** which are in the form of pilot operated check valves are provided in each of these lines so that the rams can be locked in their raised positions. These locking valves **47** are connected by pilot lines **76** to a solenoid operated valve **48** so that the lock valves allow free movement of the rams when raising and also when lowering provided the pilot lines **76** are energised by the valve **48**. The electrical connection is however in parallel with the electrical circuit for the control valve **31**, and when the energising signal is removed when neither the raise nor lower position is selected the lock valves **47** are shut thus sustaining the positions of the rams irrespective of load. The broken lines **49** indicate drain lines from the valves **47**.

As shown in FIGURE 4 pressure fluid lines **53, 54** which carry hydraulic fluid to and from the twist-lock mechanism are provided on the lifting frame which is also operated by an electrically controlled valve **55** of known kind. If desired an indicator lamp system can be included which indicates when all the twist-lock mechanisms are engaged in known fashion, and a pivoted link **56** is provided between the arm **1** and the lifting frame **22** to carry the lines **53, 54** up to the frame under control as shown in FIGURE 1.

If desired a castering wheel **57** can be arranged on each arm **1** on a hydraulically actuated retractable sup-

port 58, the operating fluid being supplied through pipe lines 59, 60 indicated on FIGURE 4, the control again being through a solenoid operated valve 61. These casters can therefore be lowered when the carrier device is not in use and it is desired to move it bodily sideways.

A pneumatic and spring brake 62 is provided on each of the wheels 3 the power of operation again being provided by the tractor vehicle 9.

In an alternative arrangement shown in FIGURE 3 the same reference numerals are used to indicate similar parts but this particular device is intended for use with heavier containers and is therefore more strongly constructed. The ram supports 65 are higher in this construction and the arm piston rods 66 project directly from the upper end of the supports 65. Each of the piston rods 66 is fastened to a transversely extending cross member 67, two such cross members being provided one for each oppositely opposed pair of rams and these cross members 67 themselves are connected lengthways so that an upper frame, indicated generally at 68 is formed.

This upper frame thus provides an extremely rigid construction. Each of the cross members 67 carries a pair of pulley wheels indicated at 69 around which are again wrapped lifting chains 70. One end 71, of each lifting chain is securely fastened to the appropriate ram support 65 and the other end of each chain is secured at 72 to a lifting frame 73. It will be appreciated that each corner of the lifting frame 73 is thus connected to a chain 70 and the frame 73 is again provided with the usual twist-lock connections to again engage a container, in this case indicated in broken lines at 74.

An electrical and hydraulic control system similar to that described with reference to FIGURES 1 and 2 is again provided and it will be seen that when the rams are operated the connecting rods 66 will raise the upper frame 68 thus causing the pulley wheels 69 to raise the lifting frame 73 to which the container is attached. Again a two to one advantage is achieved but in this case the construction tends to be slightly more rigid. A disadvantage is that the frame is above the lifting frame, as shown in broken lines in FIGURE 3 when the container is raised so that the total height is slightly more than the total height of the arrangements shown in FIGURES 1 and 2 although even this increase in height over the container is comparatively shallow.

This kind of construction is suitable for containers up to 40 tons and if required a further stiffening cross member 75 can be included which extends transversely across the device at the towing end to further stiffen the supports 65.

It will be appreciated that guides can again be provided at the sides to prevent the container moving longitudinally or transversely when it has been raised. The device can of course also be used with other articles besides containers, appropriate means for connecting the articles to be lifted to the frame being provided. Again, in certain circumstances the frame itself may not be required, the chains 70 carrying attachments to connect them directly to the article to be raised.

In the arrangements described the carrier device is provided as a trailer for use with a tractor vehicle but it may be convenient to incorporate it in a prime mover, the driving position and steerable wheels being provided at the closed end of the bifurcated chassis.

What I claim is:

1. A carrier device for moving containers or other articles, said device comprising a mobile bifurcated vehicle frame having arms for extending along each side straddling the article to be raised; lifting means mounted for vertical movement on said vehicle frame and being adapted to raise the article so that it can be moved with the vehicle; operating means mounted on said vehicle frame below the highest level to which said lifting means can be raised relatively to said frame; and means connecting said operating means to said lifting means for raising and lowering said lifting means in response to operation of said operating means, said connecting means being completely below said lifting means when the latter is at its said highest level relative said frame.

2. A carrier device as claimed in claim 1 in which said lifting means comprises a lifting frame having downwardly projecting extensions and in which said means connecting said operating means to said lifting means is connected to said downwardly projecting extensions below said lifting frame.

3. A carrier device as claimed in claim 2 in which said downwardly projecting extensions are respectively at opposite sides of said lifting frame, in which there are separate units of said operating means mounted respectively on said arms and respectively connected to said downwardly projecting extensions at opposite sides of said lifting frame, of said separate units of said operating means in synchronism.

4. A carrier device as claimed in claim 3 in which said vehicle frame includes vertically extending guide means which engage and guide said downwardly projecting extensions, and in which said means connecting said operating means to said lifting frame comprise flexible means extending downwardly from a level below said highest level of said lifting frame and are connected to the lower ends of said downwardly projecting extensions.

5. A carrier device as claimed in claim 4 in which said operating means units respectively comprise a power driven vertically movable member and a pulley wheel mounted on the upper end of said member, said flexible connecting means being an elongated flexible element passing over said pulley wheel, one end of said element being secured to said vehicle frame below said pulley wheel and the other end of said element being secured to the lower end of one of said downwardly projecting extensions.

6. A carrier device as claimed in claim 5 in which the vertically movable members are hydraulic rams.

7. A carrier device as claimed in claim 6 including means for controlling said hydraulic arms to compensate for inequality of the load on said hydraulic rams when the container or article is unbalanced.

8. A carrier device as claimed in claim 7 in which the compensating means includes means for balancing the hydraulic pressures between the hydraulic rams.

9. A carrier device as claimed in claim 8 in which the compensating means includes a coupling to each ram which transmits the amount of movement thereof to a compensating control valve which controls fluid flow to the rams concerned.

10. A carrier device as claimed in claim 9 in which each coupling includes a rack which acts on one side of a pinion, the other side of which is also contacted by a rack coupled to another ram, the pinion being carried by a lever and out of phase movement of the racks causing movement of the lever which is connected to the compensating control valve.

11. In a carrier device for lifting and moving containers comprising a bifurcated frame having arms supported on wheels for extending along each side straddling the container and power operated lifting devices on the arms which are operated in synchronism to raise a lifting frame positioned between the arms and adapted for attachment to the top of the container so that the container can be moved, the improvement comprising that said lifting frame has downwardly projecting extensions which are connected to said lifting devices to enable said frame to be raised to a position in which it is above the lifting devices themselves, that the device is a trailer provided with a releasable towing connection at the closed end of the bifurcated frame for attachment to a tractor vehicle, said carrier device comprising power transmission means connectable to the tractor vehicle for transmitting the power for operating the lifting devices.

12. A carrier device as claimed in claim 11 in which the lifting devices are hydraulically operated, and means are incorporated for compensating the load between the lifting devices when the container is unbalanced by balancing the hydraulic pressures in the devices.

13. A carrier device as claimed in claim 12 including hydraulic rams for operating the lifting devices and in which the compensating means includes a coupling to each ram which transmits the amount of movement thereof to a compensating control valve which controls fluid flow to the rams concerned.

14. A carrier device as claimed in claim 13, in which each coupling includes a rack which acts on one side of a pinion, the other side of which is also contacted by a rack coupled to another ram, the pinion being carried by a lever and out of phase movement of the racks causes movement of the lever which is connected to the compensating control valve.

15. A carrier device as claimed in claim 11, in which the downwardly projecting extensions act as guides to locate the frame between the arms.

16. A carrier device as claimed in claim 11, in which each lifting device includes a vertically movable member the upper end of which carries a wheel over which passes a chain or cable one end of which is secured to the lifting frame and the other end of which is secured to the arm.

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U.S. Cl. X.R.

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