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(54) Improvements in load handling vehicles

Handhabungsfahrzeug

Véhicule de manutention

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Description

This invention relates to load handling vehicles of the kind comprising a lifting mast and a lifting carriage moveable up and down the mast, the carriage having mounted thereon load-engaging means.

Load handling vehicles of this kind, especially those which are designed to pick up and carry a load in front of the vehicle (so-called "front loaders"), generally have the mast located close to but in front of the front axle of the vehicle. The mast usually comprises two or more telescopic sections to increase the lifting height. One common vehicle of this kind is a container handling vehicle in which the load-engaging means mounted on the carriage comprises a frame having locks for engaging the uppermost corner fittings of a freight container.

Locating the mast in front of and below the front axle line is necessary to simplify mounting of the carriage and to enable the load-engaging means to pick up loads from ground level. In consequence, the load is carried in front of the vertical plane containing the front axle line, creating a moment about the front wheels which must be compensated by a counter-weight. One advantage of such an arrangement is that lateral stability of the vehicle is improved by carrying the load in front of the front axle, and while this is important for a lift truck with a narrow track, this is not such an important factor in large trucks having wide front tracks, such as container handling vehicles, which are quite stable laterally. With these vehicles, fore-and-aft stability is more important, especially in the travelling position with a load at the top of the mast when extended. It will be appreciated that fore-and-aft stability is adversely affected where the load is carried in front of the front axle.

One further disadvantage of this arrangement, especially with large trucks, is the weight of the mast itself. The greater the height to which these trucks must reach, the greater the number of sections needed in the telescopic mast, and the heavier the mast becomes. In certain large trucks the mast can comprise as much as 20% of the overall weight of the vehicle, and this weight must be counter-balanced if it falls in front of the front axle line, reducing the lifting capacity of the truck and leading to increased tyre and pavement wear.

Various proposals have been made for lift trucks which can retract a load into a position close to the front axle after the load has been picked up. Examples are shown in US-A-4395190, GB-A-862,146 and GB-A-966,227. All these prior patents show relatively small lift trucks which support a load on top of the lifting forks, and in which the weight of the mast is not a significant factor.

US-A-3633777 discloses a cargo container handling assembly which includes a container mating structure and a slewing structure for enabling the container mating structure to be seated properly on a container.

DE-A-3300018 discloses a container handling vehicle in which the lifting mast is tiltably mounted on a bearing located over the front axle.

The present invention provides a load handling vehicle having means for suspending a load in which the mast is located in a more rearward position than previously by providing means for shifting the suspended load rearwardly once it has been lifted to clear the front wheels, to a point where it is suspended over the wheels. This results in a load handling vehicle having greater fore-and-aft stability, and a reduced laden and unladen weight on the drive axle, thus extending the life of the tyres, the axle and the pavement, and reducing initial and running costs.

According to the present invention, there is provided a load handling vehicle comprising a chassis, front and rear wheels, a lifting mast mounted on the chassis, a carriage moveable up and down the mast, load-engaging means adapted to suspend a load therefrom connected to the carriage for movement relative thereto, and drive means operable to move the load-engaging means relative to the carriage longitudinally of the chassis; characterized in that the mast is mounted on the chassis with its axis substantially coincident with or behind the plane containing the front axle of the vehicle, in that the load-engaging means is movable between a load pick-up and set-down position in which the rearmost extremity of the load-engaging means is disposed forwardly of the front wheels of the vehicle, and a retracted travelling position in which the load-engaging means is disposed rearwardly of the load pick-up and set-down position and extends at least partially over the front wheels, and in that the vehicle further comprises sensing means operable when a load is being carried by the vehicle to prevent operation of the drive means to retract the load-engaging means into the travelling position until the carriage has been raised sufficiently to enable the load to clear the front wheels.

The preferred mechanism for the drive means comprises one or more hydraulic jacks mounted between the load-engaging means and the carriage. Preferably, the carriage incorporates a gantry and the load-engaging means comprises a lifting frame freely suspended from the gantry by rods or chains, and the hydraulic jacks are mounted to move the lifting frame outwardly or inwardly relative to the gantry between the handling position and the travelling position on operation thereof. However, other forms of load-engaging means and drive means can be employed.

Suitable mechanical, electrical or hydraulic sensing means are provided to prevent retraction of the jacks on pick-up of a load until the carriage has been lifted such that the load clears the front wheels. Similar sensing means can be additionally provided to prevent the carriage being moved downwardly of the mast when a load is being carried in the travelling position into a position in which the load fouls the front wheels. These ensure that the load can be dropped to a point below the level of the front tyres only when the hydraulic jacks have been operated to move the lifting frame forwardly of the

gantry out of the travelling position and into the handling position. These sensing means can be interlocks or warning devices.

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

Fig. 1 is a scrap view, partly in section, of a known mounting arrangement of a lift truck mast;
Fig. 2. is a similar view showing a mounting arrangement according to the invention;
Fig. 3. is a diagrammatic side elevation of a load handling vehicle according to the invention adapted for lifting and transporting standard freight containers;
Fig. 4. is a side view of a lift truck according to the invention fitted with a piggy-back attachment for handling intermodal loads such as swap bodies; and
Fig. 5. is a diagram illustrating the effect of the lifting apparatus according to the invention on the centre of gravity of the truck.

Referring to the drawings, Fig. 1 shows a known arrangement in which a lifting mast 50 is mounted at its lower end to a chassis 51 of a vehicle by means of a bracket 52 and a pin 53. Pin 53 is aligned with the front axle 54 which supports wheels 55, but as will be seen in Fig. 1, the vertical axis 56 of the mast 50 is spaced by a distance x from the front axle line 57. Since the weight of the mast can be substantial, for example 12-16 tons, this in itself creates a substantial moment about the front wheels 55. This moment is increased by the presence of a load on the lifting carriage.

Fig. 2 shows a mounting arrangement according to the invention. In this arrangement, a mast 60 is mounted on a pin 61 disposed immediately above and in the vertical plane containing the front axle line 62. Wheels 63 thus carry the weight of the mast 60 directly and no counter-balancing is necessary to compensate for the weight of the mast.

The means by which the load is controlled in this arrangement is illustrated in Figs. 3 and 4. Fig. 3 shows a front loading container handling vehicle having a chassis 10, front wheels 11, rear wheels 12, and an operators' cab 13. A lifting mast assembly 14 is disposed substantially over the front axle line 15 of the vehicle. This mast assembly 14 is of conventional construction, being telescopic to provide maximum lifting height and being extended by a pair of hydraulic lift jacks which are not shown in the drawings. The mast assembly 14 is pivotally mounted at its lower end to the chassis 10, for example as shown in Fig. 2, and can be tilted through a small angle by a pair of hydraulic tilt jacks (one shown 17) connected between the mast assembly 14 and the support 18 for the operators' cab 13. A carriage 20 is adapted to move up and down the mast assembly 14, on extension and retraction of the lift jacks by means of reeving chains, also in conventional manner. Carriage 20 has mounted thereon a gantry 21.

Gantry 21 is provided with channel section supports 22,23 at each corner thereof within which are mounted spherical bearings 24,25. These bearings receive matching spherical fittings provided on the upper ends of suspension rods 26,27, which are suspended from each corner of the gantry 21. The lower ends of the suspension rods 26,27 are provided with identical spherical fittings received in matching spherical bearings 28,29 mounted in an upper frame member 32 of a load-engaging lifting frame 30. The lifting frame 30 is thereby suspended by the suspension rods 26,27 from the gantry 21 and the spherical bearings permit free swinging movement of the lifting frame 30 relative to the gantry 21. Chains or cables may be used to suspend the lifting frame 30 as an alternative to the suspension rods 26, 27.

Lifting frame 30 comprises a lower frame member 34, the upper frame member 32 mounted on the lower frame member 34, and a housing 35 mounted on the upper frame member 32. The lifting frame 30 is designed to be engageable with a standard container 31 by means of twistlocks 33 located at each corner of the lower frame member 34. In the course of a lifting operation, the vehicle is driven up to a container 31 and the carriage 20 and mast assembly 14 are lowered such that the lifting frame 30 rests on top of the container 31 with the twistlocks 33 disposed within the corner fittings of the container 31. The twistlocks 33 are then operated to engage the container 31, and the container 31 can then be lifted by causing the carriage 20 to move up the mast assembly 14 by operation of the lift cylinders. Once the container 31 is in the raised position, the vehicle can be driven to its new position where the container 31 is lowered in the reverse of the lifting sequence.

A fully loaded container imposes substantial loads on the lifting mechanism of a front loading vehicle and since the load is carried in front of the vehicle at all times, usually in a fully raised position to improve visibility for the driver, a loaded vehicle may have a reduced safety factor. This imposes certain limitations on the size of the load and the manouverability of the vehicle when it is carrying a container. In order to improve the stability of the vehicle in its travelling mode, the invention provides for repositioning of the load after lifting into a more stable position permitted by the location of the mast assembly 14 above the front axle. For this purpose a pair of hydraulic jacks (one shown 40) are provided to perform a significant outward and inward reaching movement of the lifting frame 30. Jacks 40 each have one end 41 pivotally mounted to the gantry 21, and the other end connected to an attachment point 43 on the housing 35 of the lifting frame 30. Jacks 40 can be retracted and extended in order to shift the position of the lifting frame 30 relative to the mast outwardly and inwardly about rods 26,27 in a direction longitudinally of

the vehicle. The extent of this movement is shown by the broken lines in Fig. 3 which represent the limits of angular displacement of the suspension rods 26,27. This enables a container 31 to be picked up from a rest position in the normal way, and then by retraction of the jacks 40, moved rearwardly into a travelling mode in which the container 31 is suspended over the front wheels 11. This brings the load centre closer to the vertical centre of gravity of the vehicle and improves stability while travelling. This also means that the mast assembly 14 can be located in the desired position in the chassis 10 since the vehicle can be made to "reach" for containers in the normal lifting position. These various positions are shown in Fig. 3. In the normal lifting and lowering position, position 'A', containers can be picked up and lowered, and during these operations a standard freight container 31 will clear the front wheels 11. After lifting to the level shown in Fig. 3, the hydraulic jacks 40 are retracted to pull the container 31 inwardly, such that the container 31 and the rear part of lifting frame 30 are disposed substantially over the front wheels 11. This position, position 'B', provides much greater stability for travelling than the unretracted position 'A' equivalent to the travelling position of conventional front loading lift trucks, and substantially reduces the axle load.

An interlock mechanism is provided to prevent retraction of the jacks 40 when a container 31 has been picked up until the carriage 20 has been raised sufficiently to enable the container 31 to clear the front wheels 11 of the vehicle. Since in the travelling position the container 31, as stated, is supported above the front wheels 11, an interlock mechanism is preferably also provided to prevent the carriage 20 from being lowered beyond a point at which the container 31 fouls the front wheels 11. These interlock mechanisms comprise a mechanical, electrical, hydraulic or similar sensor which in the latter case is connected to the lifting mechanism. Instead of an interlock, a warning device such as a bell or a light may be provided for the operator so that this function can be performed manually.

A further outward movement of the hydraulic jacks 40 into position 'C' is possible in order to assist in positioning the lifting frame 30 when lifting and lowering is carried out. For the same purpose, jacks 40 may be operable independently to cause an angular movement (slew) of the lifting frame 30 relative to the vehicle.

Fig. 4 shows a "piggy-back" and container handling vehicle 70 fitted with a telescopic mast assembly 71 with its vertical axis disposed directly over the front wheels 72. In this case, a carriage 73 supports inverted forks 74 on which is slidably mounted a "piggy-back" and intermodal attachment 75 for loads such as swap bodies and semi-trailers. Attachment 75 is slidable outwardly along the forks 74 from the position shown in Fig. 4 by means of a pair of hydraulic cylinders (one shown in broken lines at 76) into a load pick-up position, and can be retracted into the travelling position shown in Fig. 4 by the same cylinders.

Fig. 5 shows diagramatically the effect of this arrangement on the vertical centre of gravity of the vehicle. The load pick-up position of a container is shown in full lines 80, the load centre of the container being shown at a. In this condition the vertical centre of gravity of the vehicle is located at a' In the retracted travelling position of the container, shown in broken lines, the load centre lies at b and the vertical centre of gravity of the vehicle moves rearwardly to b'. The front axle line of the vehicle is shown at 81, coinciding with the vertical axis 82 of the mast assembly 83. The front and rear wheels are denoted by reference signs 84 and 85 respectively.

Claims

1. A load handling vehicle comprising a chassis (10), front and rear wheels (11,12;63;72;84,85), a lifting mast (14;60;71;83) mounted on the chassis (10), a carriage (20;74) moveable up and down the mast (14;60;71;83), load-engaging means (30;75) adapted to suspend a load therefrom connected to the carriage (20;74) for movement relative thereto, and drive means (40) operable to move the load-engaging means (30;75) relative to the carriage (20;74) longitudinally of the chassis (10); characterized in that the mast (14;60;71;83) is mounted on the chassis (10) with its axis substantially coincident with or behind the plane containing the front axle (15) of the vehicle, in that the load-engaging means is movable between a load pick-up and set-down position (A) in which the rearmost extremity of the load-engaging means (30;75) is disposed forwardly of the front wheels (11;63;72;84) of the vehicle, and a retracted travelling position (B) in which the load-engaging means (30;75) is disposed rearwardly of the load pick-up and set-down position (A) and extends at least partially over the front wheels (11;63;72;84), and in that the vehicle further comprises sensing means operable when a load is being carried by the vehicle to prevent operation of the drive means (40) to retract the load-engaging means (30;75) into the travelling position (B) until the carriage (20;74) has been raised sufficiently to enable the load to clear the front wheels (11;63;72;84).

2. A load handling vehicle as claimed in Claim 1, wherein the drive means (40) comprise one or more hydraulic jacks mounted between the carriage (20;74) and the load-engaging means (30;75).

3. A load handling vehicle as claimed in Claim 1, wherein the carriage (20) incorporates a gantry (21) and the load-engaging means (30) comprises a lifting frame for suspending a load connected to the gantry (21).

4. A load handling vehicle as claimed in Claim 3, wherein the lifting frame is freely suspended from the gantry (21) by rods or chains (26,27).

5. A load handling vehicle as claimed in Claim 1 or 2, wherein the load-engaging means (30;75) comprises a container or piggy-back load handling attachment.

6. A load handling vehicle as claimed in Claim 1, further comprising further sensing means associated with the carriage (20;74) operable when a load is being carried by the vehicle to prevent lowering of the carriage (20;74) with the load-engaging means (30;75) disposed in the travelling position (B), beyond a point at which the load contacts the front wheels (11;63;72;84).

7. A load handling vehicle as claimed in Claim 6, wherein the sensing means comprise an electrical or hydraulic interlock.

8. A load handling vehicle as claimed in Claim 6, wherein the sensing means comprise a warning device.

Patentansprüche

1. Lastenförderfahrzeug mit einem Chassis (10), Vorder- und Hinterrädern (11,12; 36; 72; 84, 85), einem Hubmast (14; 60; 71; 83), der an dem Chassis (10) befestigt ist, einer Transporteinrichtung (20; 74), die entlang des Mastes (14; 60; 71; 83) nach oben und nach unten verfahrbar ist, einer lastergreifenden Einrichtung (30; 75), die ausgelegt ist, eine Last davon, die an der Transporteinrichtung (20; 74) angeschlossen ist, für eine relative Bewegung dazu zu halten, und mit Antriebseinrichtungen (40), die betätigbar sind, um die lastergreifende Einrichtung (30; 75) relativ zur Transporteinrichtung (20; 74) in Längsrichtung des Chassis (10) zu bewegen;
dadurch gekennzeichnet,
daß der Mast (14; 60; 71; 83) an dem Chassis (10) montiert ist, wobei seine Achse im wesentlichen mit der Ebene übereinstimmend oder hinter dieser Ebene angeordnet ist, die die Vorderachse (15) des Fahrzeugs enthält, das die lastergreifende Einrichtung zwischen einer Lastaufnahme- und einer Lastabsetzposition (A) bewegbar ist, in welcher das äußerst rückwärtige Ende der lastergreifenden Einrichtung (30; 75) vor den Vorderrädern (11; 63; 72; 84) des Fahrzeugs angeordnet ist, sowie einer rückgezogenen Fahrposition (B), in welcher die lastergreifende Einrichtung (30; 75) rückwärts der Lastaufnahme- und Lastabsetzposition (A) angeordnet ist und zumindest teilweise über die Vorderräder (11; 63; 72; 84) hervorragt, und daß das Fahrzeug des weiteren Sensoreneinrichtungen aufweist, die betätigbar sind, wenn eine Last von dem Fahrzeug getragen wird, um den Betrieb der Antriebseinrichtungen (40) zu verhindern, die lastergreifende Einrichtung (30; 75) in die Fahrposition (B) zurückzuziehen bis die Transporteinrichtung (20; 74) ausreichend angehoben worden ist, um es zu ermöglichen, daß die Last von den Vorderrädern (11; 63; 72; 84) frei ist.

2. Lastenförderfahrzeug wie in Anspruch 1, worin die Antriebseinrichtung (40) einen oder mehrere Hydraulikzylinder aufweisen, die zwischen der Transporteinrichtung (20; 74) und der lastergreifenden Einrichtung (30; 75) befestigt ist bzw. sind.

3. Lastenförderfahrzeug wie in Anspruch 1, worin die Transporteinrichtung (20) einen Kranteil (21) enthält und die lastergreifende Einrichtung (30) einen Hubrahmen aufweist zum Halten einer an dem Kranteil (21) angeschlossenen Last.

4. Lastenförderfahrzeug wie in Anspruch 3, worin der Hubrahmen mittels Stäben oder Ketten (26, 27) von dem Kranteil (21) frei getragen wird.

5. Lastenförderfahrzeug wie in Anspruch 1 oder 2, worin die lastergreifende Einrichtung (30; 75) einen Container oder einen Huckepack-Lastförderanschluß aufweist.

6. Lastenförderfahrzeug wie in Anspruch 1, des weiteren enthaltend weitere Sensoreinrichtungen, die der Transporteinrichtung (20; 74) zugeordnet sowie betätigbar sind, wenn eine Last von dem Fahrzeug getragen wird, um ein Absenken der Transporteinrichtung (20; 74) mit der lastergreifenden Einrichtung (30; 75) in der in Fahrposition (B) angeordneten Position über einen Punkt hinaus zu verhindern, bei dem die Last die Vorderräder (11; 63; 72; 84) berührt.

7. Lastenförderfahrzeug wie in Anspruch 6, worin die Sensoreinrichtungen eine elektrische oder hydraulische Verriegelung aufweisen.

8. Lastenförderfahrzeug wie in Anspruch 6, worin die Sensoreinrichtungen eine Warnvorrichtung enthalten.

Revendications

1. Véhicule de manutention comprenant un châssis (10), des roues avant et arrière (11, 12 ; 63; 72 ; 84, 85), un mât de levage (14 ; 60 ; 71 ; 83) monté sur le châssis (10), un chariot (20 ; 74) adapté à être monté et descendu le long du mât (14 ; 60 ; 71 ; 83), un moyen d'engagement de charge (30 ; 75),

adapté à suspendre une charge, relié au chariot (20 ; 74) pour se déplacer relativement à celui-ci, et un moyen de commande (40) adapté à déplacer le moyen d'engagement de charge (30 ; 75) relativement au chariot (20 ; 74) dans le sens de la longueur du châssis (10) ; caractérisé en ce que le mât (14 ; 60 ; 71 ; 83) est monté sur le châssis (10) avec son axe coïncidant sensiblement avec le plan contenant l'essieu avant (15) du véhicule ou son axe derrière ce plan, en ce que le moyen d'engagement de charge est mobile entre une position de levage et de pose de charge (A) dans laquelle l'extrémité la plus vers l'arrière du moyen d'engagement de charge (30 ; 75) est située en avant des roues avant (11; 63; 72 ; 84) du véhicule, et une position de déplacement rétractée (B) dans laquelle le moyen d'engagement de charge (30 ; 75) est situé en arrière de la position de levage et de pose de charge (A) et s'étend au moins en partie au-dessus des roues avant (11; 63; 72 ; 84), et en ce que le véhicule comprend en outre un moyen de détection adapté, lorsqu'une charge est transportée par le véhicule, à empêcher le fonctionnement du moyen de commande (40) pour rétracter le moyen d'engagement de charge (30 ; 75) dans la position de déplacement (B) jusqu'à ce que le chariot (20 ; 74) ait été suffisamment levé pour permettre à la charge de dégager les roues avant (11; 63; 72 ; 84).

2. Véhicule de manutention selon la revendication 1, dans lequel le moyen de commande (40) comprend un ou plusieurs vérins hydrauliques montés entre le chariot (20 ; 74) et le moyen d'engagement de charge (30 ; 75).

3. Véhicule de manutention selon la revendication 1, dans lequel le chariot (20) comprend un portique (21) et le moyen d'engagement de charge (30) comprend un châssis de levage, pour suspendre une charge, relié au portique (21).

4. Véhicule de manutention selon la revendication 3, dans lequel le châssis de levage est librement suspendu au portique (21) par des barres ou des chaînes (26, 27).

5. Véhicule de manutention selon la revendication 1 ou 2, dans lequel le moyen d'engagement de charge (30 ; 75) comprend un organe de prise pour manutention de conteneurs ou remorques de ferroutage.

6. Véhicule de manutention selon la revendication 1, comprenant en outre un autre moyen de détection associé au chariot (20 ; 74) adapté, lorsqu'une charge est transportée par le véhicule, à empêcher l'abaissement du chariot (20 ; 74) avec le moyen d'engagement de charge (30 ; 75) situé dans la position de déplacement (B), au-delà d'un point auquel la charge contacte les roues avant (11; 63; 72 ; 84).

7. Véhicule de manutention selon la revendication 6, dans lequel le moyen de détection comprend un mécanisme de verrouillage réciproque électrique ou hydraulique.

8. Véhicule de manutention selon la revendication 6, dans lequel le moyen de détection comprend un dispositif d'alarme.

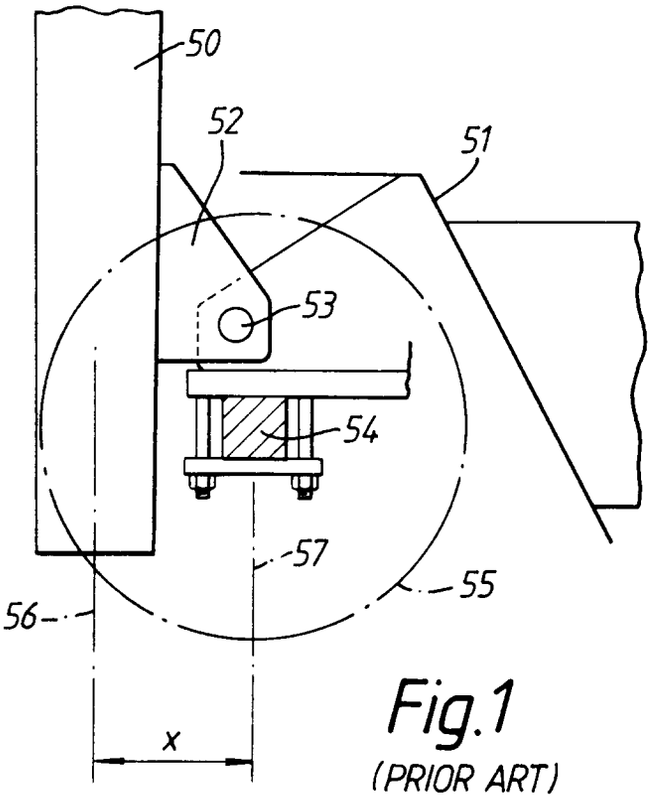

Fig.1
(PRIOR ART)

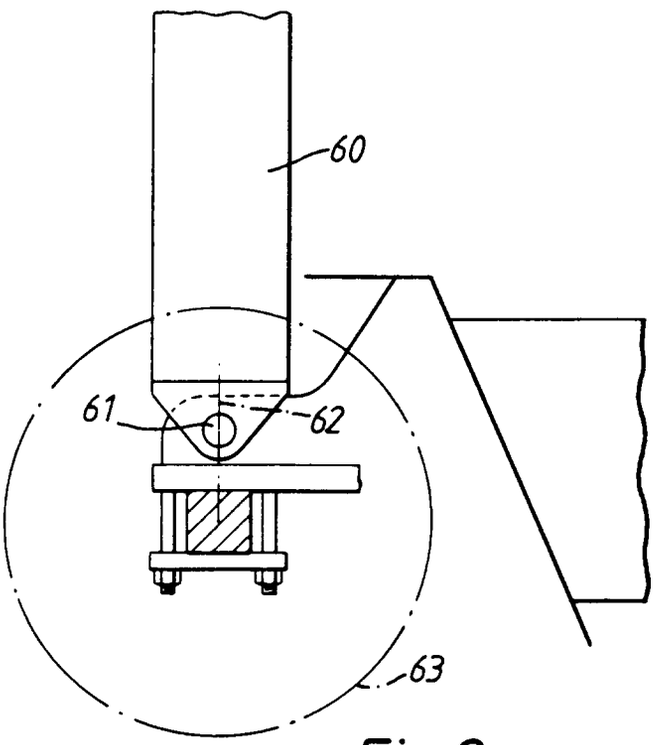

Fig.2

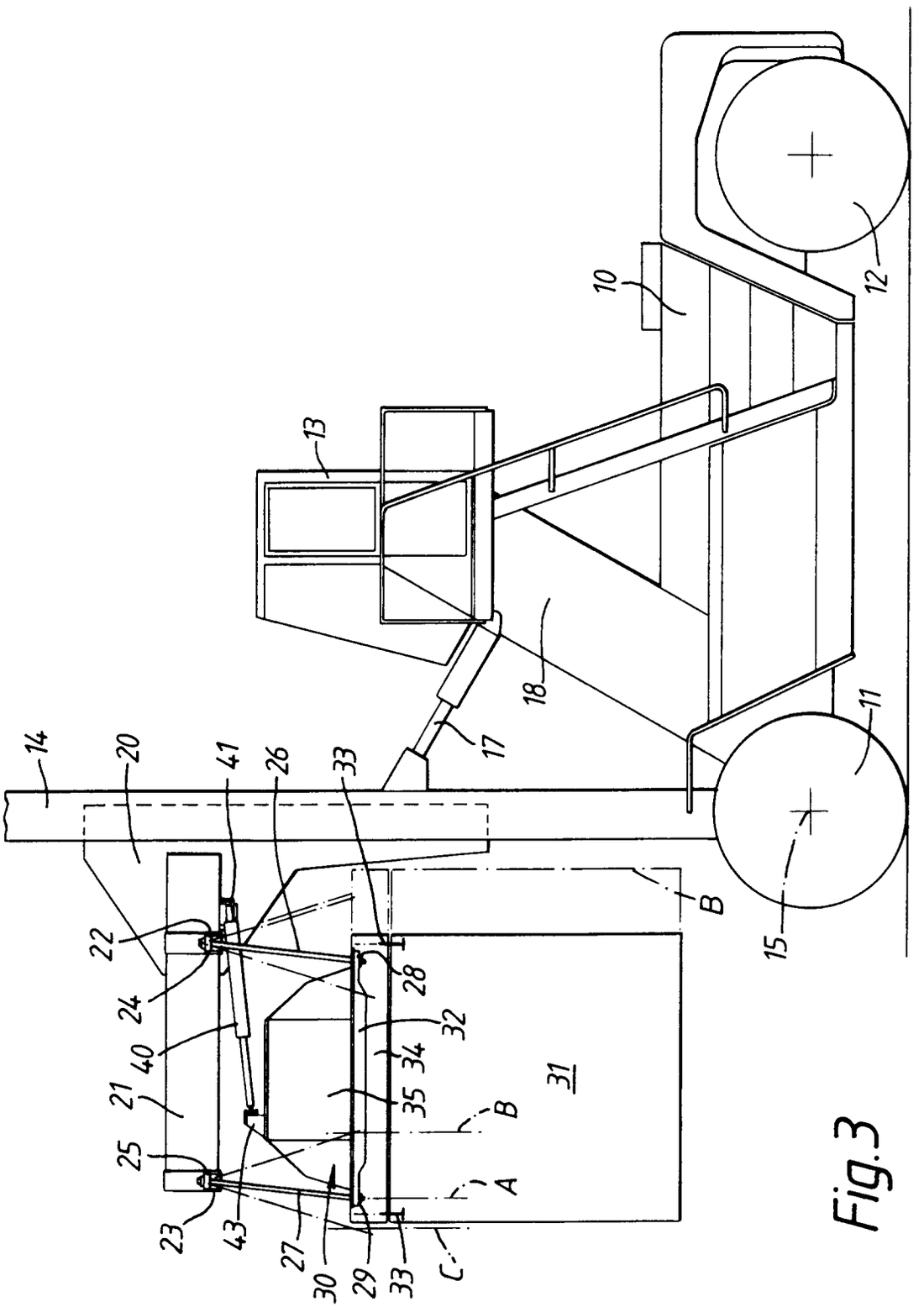
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Fig.3

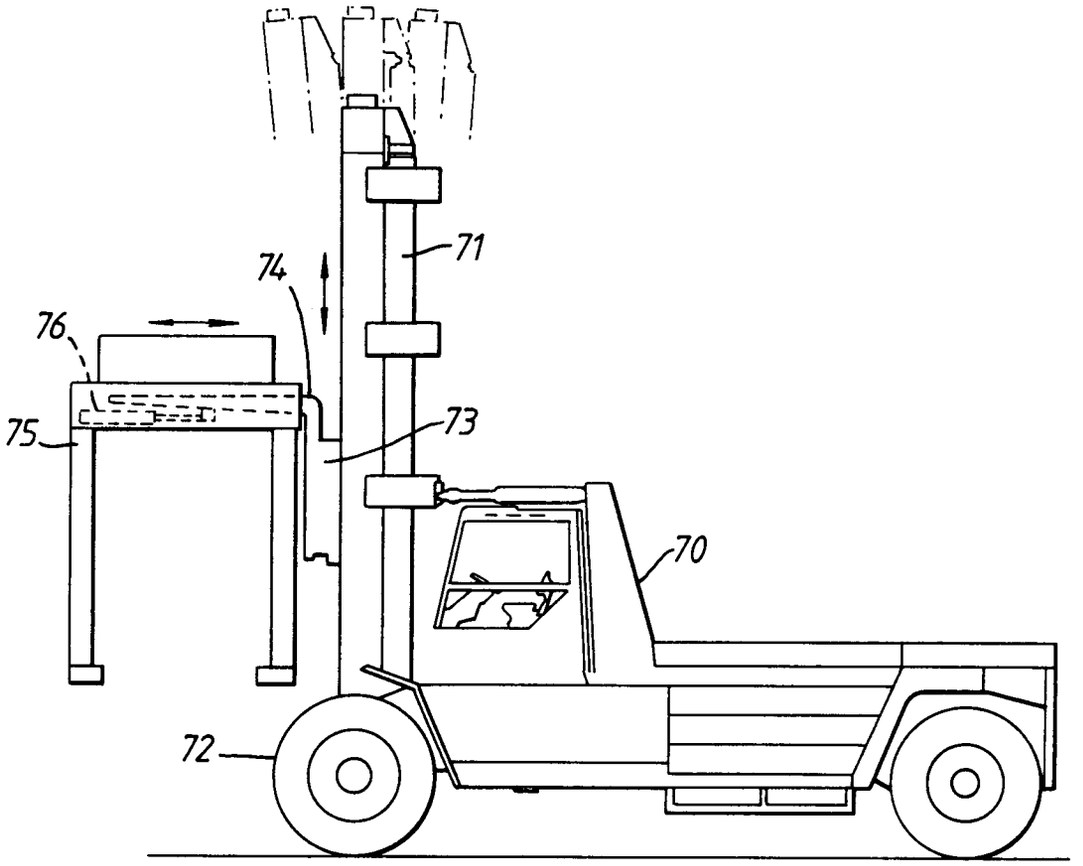

Fig.4

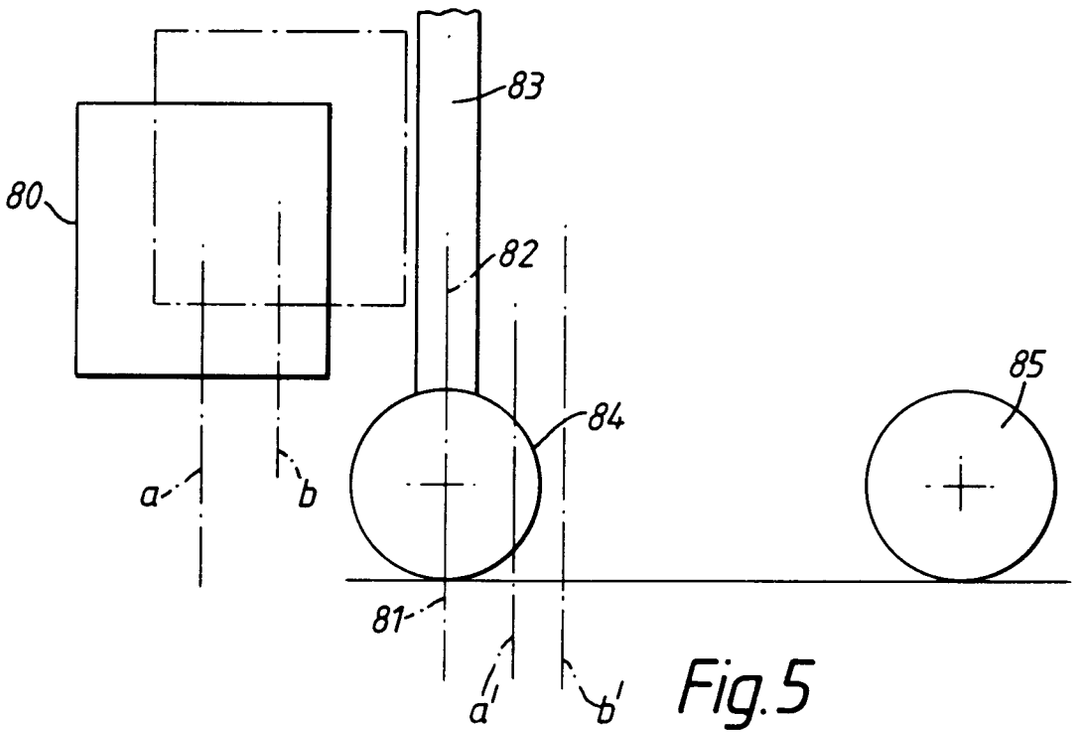

Fig.5