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(72) Inventor: **Kleiss, René Johannes Gerardus**  
**3121 KL Schiedam (NL)**

(74) Representative: **van Westenbrugge, Andries**  
**Postbus 29720**  
**2502 LS Den Haag (NL)**

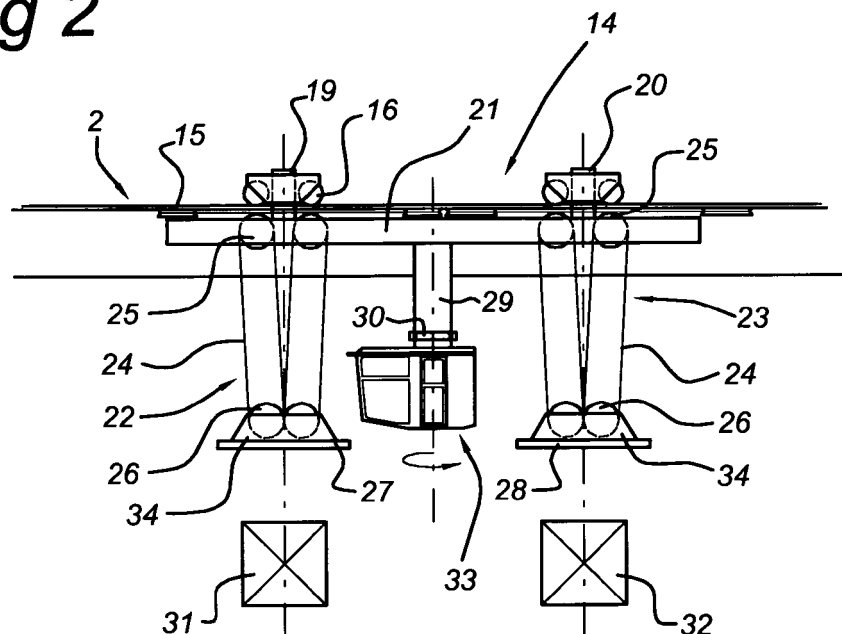
(71) Applicant: **Kalmar Industries B.V.**  
**3081 AD Rotterdam (NL)**

(54) **Ship to shore container crane and method of operating such crane**

(57) A ship to shore container crane comprises a gantry structure (1), a boom (2) supported with respect to said gantry structure (1), said boom (2) in an operating position extending between a ship facing end (6) and a shore facing end (7), trolley means (14) displaceably supported along the boom (2) in said operating position, two coupling means (27, 28), at least two cable hoisting

means (22, 23) extending between the trolley means (14) and a respective coupling means (27, 28), as well as an operator's cabin (33) suspended from said trolley means (14). In a direction parallel to the boom (2), one of said cable hoisting means (22) is positioned on one side of the control cabin (33), and the other cable hoisting means (23) is positioned on the opposite side of the cabin (33).

**Fig 2**



## Description

**[0001]** The invention is related to a ship to shore container crane comprising a gantry structure, a boom supported with respect to said gantry structure, said boom in an operating position extending between a ship facing end and a shore facing end, trolley means movably supported along the boom in said operating position, two coupling means such as two spreaders, at least two cable hoisting means extending between the trolley means and a respective coupling means, as well as an operator's cabin suspended from said trolley means.

**[0002]** Such a crane is disclosed in World Cargo News, July 1997, pp 23, 24. According to said publication, two separate trolleys are provided on the same boom, which trolleys can be operated independently from each other. This means that simultaneously two containers can be unloaded or loaded, resulting in shorter handling periods for load or unloading of a container ship. Although this proposal seems to be attractive, it nevertheless introduces other problems. For instance, anti-collision means should be provided so as to avoid collisions between the trolleys and the lifted containers which are being loaded/unloaded. Furthermore, this proposal introduces control problems related to the operation; in case each trolley is driven by its own driver, precautions should be taken to avoid interference of their tasks. On the other hand, operating both trolleys by one driver only seems unrealistic having regard to the fact that the independency of the trolleys may bring them in remote positions with respect to each other. Such remote positions however would forbid control by one operator only.

**[0003]** The object of the invention is therefore to provide a ship to shore container crane of the type described before by means of which a reduced handling period for loading or unloading of a container ship can be obtained, and which on the other hand provides the possibility to exert the required control on said containers. This object is obtained in that, in a direction parallel to the boom, one of the cable hoisting means is positioned on one side of the control cabin, and the other cable hoisting means is positioned on the opposite side of the cabin.

**[0004]** A first advantage of the crane layout according to the invention is the close proximity of the cabin, and thus of the operator or driver, with respect to the coupling means, such as spreaders, hooks etc., and containers suspended from the adjacent trolleys. This proximity offers a sufficient view of the operator on the container and spreader which are being positioned and coupled or uncoupled. In this connection, the distance between the cable hoisting means is preferably relatively small, e.g. in the order of 2-5 times the width of a container. Said width should be large enough to provide a safe distance between the operator's cabin and a lifted spreader/container, but small enough to provide the required view for the operator on both spreader/container combinations.

**[0005]** In particular, this control is possible through one operator only. Such single operator control is further pro-

moted by providing a cabin which is rotatable about an essentially vertical axis. The cabin is thus rotated towards the spreader/container being handled; subsequently the cabin can be rotated towards the other spreader/container.

**[0006]** A further important advantage of this embodiment is that, under the control of one operator only, two containers can be handled quasi-simultaneously, which leads to the desired, more efficient process of loading/unloading of a ship.

**[0007]** The trolley means may comprise two interconnected trolleys, each of said trolleys being provided with a respective cable hoisting means. In particular, the trolleys may be interconnected e.g. through a beam structure or any other suitable connection, the cabin being suspended rotatably between the trolleys, e.g. from the middle of the beam. Alternatively, the trolley means may comprise a single, unitary trolley from which the hoisting means with the cabin in between are suspended.

**[0008]** The invention is moreover related to a method of handling containers by means of a ship to shore container crane comprising a gantry structure, a boom supported with respect to said gantry structure, said boom in an operating position extending between a ship facing end and a shore facing end, trolley means movably supported along the boom in said operating position, two coupling means such as spreaders and at least two cable hoisting means extending between the trolley means and a respective coupling means or spreader.

**[0009]** According to the invention said method comprises the steps of:

- positioning one of said coupling means with respect to a container,
- coupling said container to said one coupling means,
- lifting said container to a height above neighbouring obstacles, such as neighbouring containers,
- after lifting said container coupled to said one coupling means, positioning the other coupling means with respect to another container,
- coupling said other container to said other coupling means,
- lifting said other container to a height at least above neighbouring obstacles, such as neighbouring containers,
- moving both lifted containers simultaneously to above a target location.

**[0010]** As already indicated, two containers can be handled quasi-simultaneously. However, the phases of picking up and depositing the containers are carried out separately, so as to enable accurate positioning and coupling of the spreader onto the container. Conversely, also the process of depositing the containers is carried out separately. Between these phases however, the process of moving the containers between ship and shore is carried out simultaneously for both containers, which leads to an appreciable reduction in handling time of a shipload

of containers.

**[0011]** This gain in handling time is also made possible by the fact that the handling process can be carried out simultaneously both under automatic, preprogrammed control and under operator control. This can play a role for instance under the circumstance that the process of lifting one of the spreader with container is continued while the other spreader is positioned on the other container. Said step of lifting the one spreader with container can then be carried out under programmed, automatic control, while the process of positioning and coupling the other spreader and container can be carried out under operator control, thus alleviating the operator's task of handling two containers.

**[0012]** With the aim of avoiding collisions between the hoisted spreaders/containers, the method according to the invention may comprise the steps of:

- lifting said coupling means or spreaders, hooks etc. with respective containers to different height levels,
- moving said coupling means with the respective containers to above or near said target location while maintaining said different height levels.

**[0013]** With the aim of depositing containers, the method according to the invention may comprise the steps of:

- lowering one of the coupling means with container coupled thereto,
- positioning said one coupling means with container with respect to the target location,
- placing the container on said target location,
- disconnecting said one coupling means from the container,
- lifting said one coupling means away from the container,
- after lifting said one coupling means away, lowering the other coupling means with container coupled thereto,
- positioning said other coupling means with container with respect to the other target location,
- placing the container on said other target location,
- disconnecting said other coupling means from the container,
- lifting said other coupling means away from the container.

**[0014]** In this connection, a time gain can be obtained by the steps of:

- lowering the coupling means with respective container simultaneously,
- continuing the step of lowering the coupling means with container to be placed first on the target location while interrupting the step of lowering of the other coupling means with container,
- continuing the step of lowering said other coupling means with container after the container to be placed

first has been placed on the target location and the respective coupling means has been uncoupled from said container and lifted away.

The method according to the invention can preferably be carried out by means of a ship to shore container crane comprising an operator's cabin which is rotatable about an essentially vertical axis and which, in the longitudinal direction of the boom, is located between both cable hoisting means of the spreaders, comprising the step of;

- rotating the cabin towards the spreader which is to be coupled to, or to be uncoupled from, the respective container.

**[0015]** Thus, the operator has always the required view for handling the spreaders and containers, by rotating the cabin towards a respective spreader before positioning said spreader on a respective container. Furthermore, the cabin can be rotated towards a respective spreader with container coupled thereto before positioning said respective spreader with container with respect to the target location.

**[0016]** The invention will now be described further with reference to an embodiment of the invention shown in the drawings.

**[0017]** Figure 1 shows a ship to shore container crane according to the invention in side view.

**[0018]** Figure 2 shows an enlarged view of the trolley means with double cable hoisting means and rotatable cabin according to the invention.

**[0019]** Figure 3 shows a front view of said trolley means.

**[0020]** The ship to shore container crane as shown in figure 1 comprises, in a known way, a gantry structure 1 and a boom 2 supported on said gantry structure 1. Said boom 2 comprises a fixed boom part 3 as well as a rotatable pivoting boom part 4. By means of the support structure 5, this pivoting boom part 4 is supported. In figure 1, the boom 2 is shown in full lines in its operating position extending between a ship facing end 6 and a shore facing end 7.

**[0021]** The gantry structure 1 is supported on a quay 8 by means of rails 9 and wheels 10 so as to be displaceable along a ship 11 moored to the quay 8. The ship 11 carries a load 17 which consists of a large number of containers 18 stacked upon and next to each other in a known way. As shown in the cross-section of figure 3, the boom 2 comprises two boxlike girders 12, 13, onto which the trolley structure 14 is displaceably supported. This is obtained in a known way by means of rails 15 mounted on said boxlike girders 12, 13 and wheels 16 mounted to the trolley structure 14.

**[0022]** The trolley structure 14 consists of two pairs of trolleys 19, 20 which are interconnected by the beam 21. This layout can also be considered to represent a single, unitary trolley. In figures 2 and 3 this beam is shown as a box type beam, but the construction of said beam can be of any type, such as a lattice structure. From the beam

21, two cable hoisting means 22, 23 are suspended, each comprising cables 24 shored over the trolley sheaves 25 and sheaves 26 which are accommodated in the head block 34 mounted to the spreader 27. Such cable hoisting means 22, 23 are known per se, and will therefore not further be described. Furthermore, an operator's cabin 33 is suspended from the beam 21 by means of column 29. According to the invention, said cabin 33 is rotatable about a vertical axis through the slewing ring 30.

[0023] The operation of the ship to shore container crane according to the invention will now be further described. As shown in figure 1, the trolley structure 14 is put in a position above the container load 17 of the ship 11. As the trolley structure 14 is travelling towards the ship facing end 6 of the boom 2, the cabin 33 is rotated such that the operator is facing said ship facing end 6 as well. Thereby, the operator has the required view on the spreader 28 situated on the ship facing side of the trolley structure 14. Said spreader 28 is then lowered by the corresponding cable hoisting means 23, and the spreader 28 can be positioned just above the container 32 in question under operator control. Subsequently, the spreader 28 is coupled in a known way to said the container 32, in such a way that said spreader 28 together with container 32 can be lifted by means of said cable hoisting means 23.

[0024] Subsequently, the cabin 33 is rotated over about 180°, in such a way that the operator gets the required view of the spreader 27 positioned on the shore of facing end of the trolley structure 14. Next, the operator is able to position said spreader 27 just above the container 31 in question, and to couple said spreader 27 to said container 31. In this respect, it is important to note that the other container 32 has been lifted to such a height that it cannot collide with neighbouring structures when moving the trolley structure 20 somewhat along the beam in the process of positioning the shore facing spreader 27. The further lifting of the other container 32 can however largely be carried out under automatic control, which means that the operator, after initiating the lifting process of said other container 32, can turn his attention towards the process of coupling the shore facing spreader 27 to the container 31 in question.

[0025] After coupling the shore facing spreader 27 to the container 31, they can be lifted by means of the cable hoisting means 22, and subsequently both containers 31, 32 can be moved simultaneously along the boom 2 towards the shore 8. With the aim of avoiding possible collisions between the containers 31, 32 while moving them along the boom 2, they are preferably lifted to different heights in such a way that any swinging motion of these containers 31, 32 will not lead to collisions.

[0026] As soon as the trolley structure 14 approaches the quay 8, the process of lowering the containers 31, 32 will be started. The operator's cabin 33 will be in such a position that the operator faces the quay, which makes that he will be able to control the lowering of the spreader 27 together with the container 31. During this positioning

of the spreader 27 with container 31, the process of lowering the other spreader 28 with container 32 will be temporarily halted. This means that the operator can concentrate on placing the container 31 at the desired location on the quay 8.

[0027] After said container 31 has been placed in the proper position at the target location, the spreader 28 is uncoupled and lifted the way. Subsequently, the cabin 33 is rotated such that the operator can view the ship facing spreader 28 with container 32. The operator can now concentrate on positioning said container 32 on the desired location. After the container 32 has been positioned in such a way, the spreader 28 is uncoupled and lifted away. Subsequently, both spreaders 27, 28 can be lifted fully under automatic control, and a new cycle of unloading two containers from the shipload 17 can be commenced.

[0028] It will be clear that the process of loading a ship with containers will take place in the opposite order, however with the same advantage of handling two containers by one operator within a relatively short cycle time. Furthermore it should be noted that the order of handling the containers 31, 32 need not always occur in the way described before. Thus, it is possible to couple the shore facing spreader 27 firstly, in which case the cabin is firstly oriented towards the shore facing end 7. Also, it is possible to firstly deposit the container 32 coupled to the ship facing spreader 28, in which case the cabin 33 is firstly rotated towards the ship facing end 6.

[0029] Although in the description before reference is made to coupling means carried out as spreaders, also other coupling means can be used such as hooks. Furthermore, as addressed before the hoisting means can be connected to a head block 34 each, known per se, which head blocks 34 each comprise a number of sheaves 26 over which the several loops of the hoisting means are guided. Onto said head blocks 34, the coupling means such as spreaders 27, 28 can be mounted.

## Claims

1. Ship to shore container crane comprising a gantry structure (1), a boom (2) supported with respect to said gantry structure (1), said boom (2) in an operating position extending between a ship facing end (6) and a shore facing end (7), trolley means (14) displaceably supported along the boom (2) in said operating position, two coupling means (27, 28), at least two cable hoisting means (22, 23) extending between the trolley means (14) and a respective coupling means (27, 28), as well as an operator's cabin (33) suspended from said trolley means (14), **characterised in that**, in a direction parallel to the boom (2), one of said cable hoisting means (22) is positioned on one side of the control cabin (33), and the other cable hoisting means (23) is positioned on the opposite side of the cabin (33).

2. Crane according to claim 1, wherein the cabin (33) is rotatable about an essentially vertical axis.
3. Crane according to any of the preceding claims, wherein the cabin (33) is rotatable back and forth over at least 180 degrees. 5
4. Crane according to any of the preceding claims, wherein the cabin (33) is rotatable over at least 360 degrees. 10
5. Crane according to any of the preceding claims, wherein the cabin contains a rotatable seat.
6. Crane according to any of the preceding claims, wherein the trolley means comprise a single, unitary trolley. 15
7. Crane according to any of claims 1-5, wherein the trolley means (14) comprise two interconnected trolleys (19, 20), each of said trolleys (19, 20) being provided with a respective cable hoisting means (22,23). 20
8. Crane according to claim 4, wherein the trolleys means (19, 20) comprise a beam structure (21), the cabin (33) being suspended rotatably from said beam structure (21). 25
9. Crane according to claim 7 and 8, wherein the two trolleys (19, 20) are interconnected through the beam structure (21). 30
10. Crane according to any of the preceding claims, wherein the distance between the cable hoisting means is equal to 2-5 times the width of a container. 35
11. Crane according to any of the preceding claims, wherein each hoisting means (22, 23) comprises a respective head block (34). 40
12. Crane according to any of the preceding claims, wherein each cable hoisting means (22, 23) extends between the trolley means (14) and a respective spreader (27, 28). 45
13. Method of handling containers by means of a ship to shore gantry crane comprising a gantry structure (1), a boom (2) supported with respect to said gantry structure (1), said boom (2) in an operating position extending between a ship facing end (6) and a shore facing end (7), trolley means (14) displaceably supported along the boom (2) in said operating position, two coupling means, such as two spreaders (27, 28) and at least two cable hoisting means (22, 23) extending between the trolley means (14) and a respective spreader (27, 28), said method comprising the steps of: 50
  - positioning one (28) of said coupling means with respect to a container (32),
  - coupling said container (32) to said one coupling means (28),
  - lifting said container (32) to a height above neighbouring obstacles, such as neighbouring containers (18),
  - after lifting said container (32) coupled to said one coupling means (28), positioning the other coupling means (27) with respect to another container (31),
  - coupling said other container (31) to said other coupling means (27),
  - lifting said other container (31) to a height at least above neighbouring obstacles, such as neighbouring containers (18),
  - moving both lifted containers (31, 32) simultaneously towards a respective target location.
14. Method according to claim 13, comprising the step of: 55
  - continuing the lifting of said one coupling means (28) with container (32) while positioning the other coupling means (27) on said other container (31) and/or lifting the other coupling means (27) with the other container (31).
15. Method according to claim 13 or 14, comprising the steps of:
  - lifting said coupling means (27, 28) with respective containers (31, 32) to different height levels,
  - moving said coupling means (27, 28) with the respective containers (31, 32) to above or near said target location while maintaining said different height levels.
16. Method according to any of claims 13-15 of handling containers (31, 32) by means of a ship to shore container crane comprising an operator's cabin (33) which is rotatable about an essentially vertical axis and which, in the longitudinal direction of the boom (2), is located between both cable hoisting means (22, 23) of the coupling means (27, 28), comprising the step of:
  - rotating the cabin (33) towards the spreader (27, 28) which is to be coupled to, or to be uncoupled from, the respective container (31, 32).
17. Method according to claim 16, comprising the step of:
  - rotating the cabin (33) towards a respective coupling means before positioning said coupling means on a respective container.

**18.** Method of handling containers by means of a ship to shore container crane comprising a gantry structure (1), a boom (2) supported with respect to said gantry structure, said boom (2) in an operating position extending between a ship facing end (6) and a shore facing end (7), trolley means (14) displaceably supported along the boom (2) in said operating position, two coupling means, such as spreaders (27, 28), two containers (31, 32), each of said containers being coupled to a respective coupling means, and at least two cable hoisting means (22, 23) extending between the trolley means and a respective coupling means, said method comprising the steps of:

- lowering one of the spreaders (27) with container (31) coupled thereto,
- positioning said one coupling means (27) with container (31) with respect to the target location,
- placing the container (31) on said target location,
- disconnecting said one coupling means (27) from the container (31),
- lifting said one coupling means (27) away from the container (31),
- after lifting said one coupling means (27) away, lowering the other coupling means (28) with container (32) coupled thereto,
- positioning said other coupling means (28) with container (32) with respect to the other target location,
- placing the container (32) on said other target location,
- disconnecting said other coupling means (28) from the container (32),
- lifting said other coupling means (28) away from the container (32).

**19.** Method according to claim 18 of handling containers by means of a ship to shore container crane comprising an operator's cabin (33) which is rotatable about an essentially vertical axis and which, in the longitudinal direction of the boom (2), is located between both cable hoisting means (22, 23) of the coupling means (27, 28), comprising the step of:

- rotating the cabin (33) towards a respective coupling means with container coupled thereto before positioning said respective coupling means with container with respect to the target location.

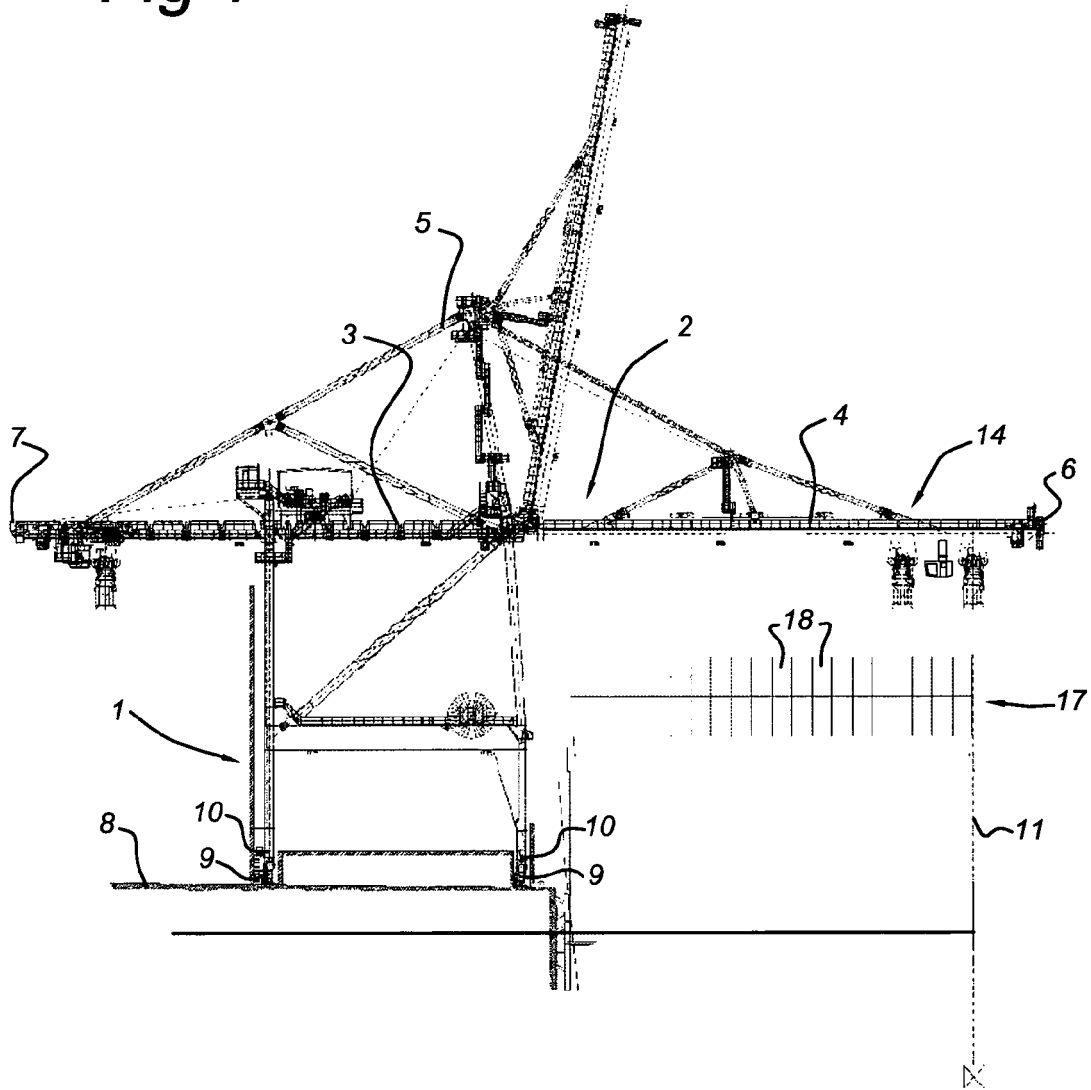
**20.** Method according to claim 18 or 19, comprising the step of;

- moving both disconnected coupling means (27, 28) simultaneously away from the target location.

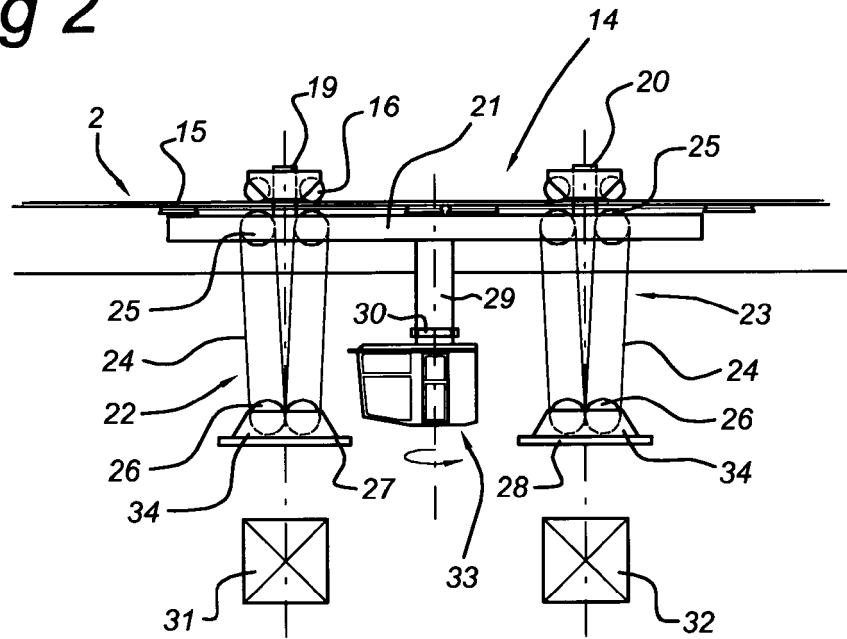
**21.** Method according to any of claims 18-20, comprising the steps of:

- lowering the coupling means (27, 28) with respective container (31,32) simultaneously,
- continuing the step of lowering the coupling means (27) with container (31) to be placed first on the target location while interrupting the step of lowering of the other coupling means (28) with container (32),
- continuing the step of lowering said other coupling means (28) with container (32) after the container (31) to be placed first has been placed on the target location and the respective coupling means (27) has been uncoupled from said container (31) and lifted away.

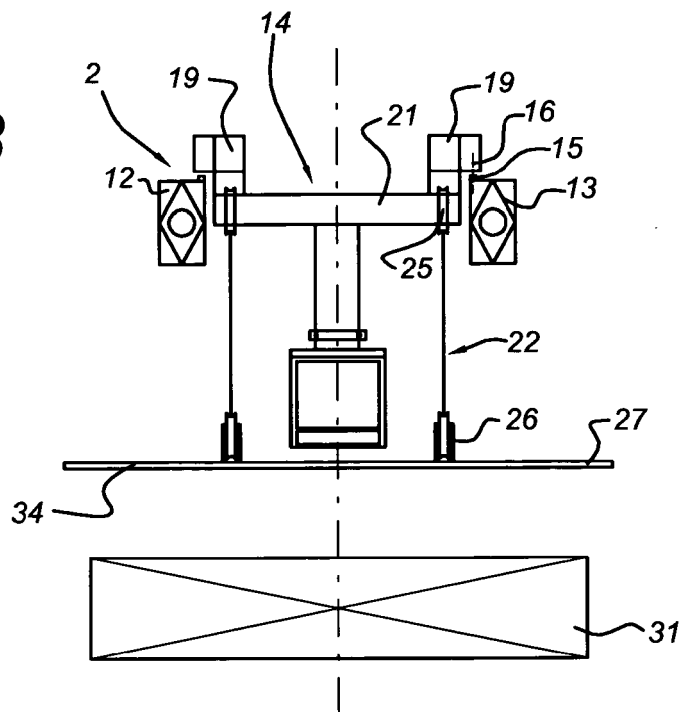
*Fig 1*



*Fig 2*



*Fig 3*





European Patent  
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# EUROPEAN SEARCH REPORT

Application Number  
EP 06 12 5258

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                         |                                  |                                         |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                         |                                  | B66C<br>B65G<br>B63B                    |
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| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons</p> <p>&amp; : member of the same patent family, corresponding document</p> |                                                                                                                                         |                                  |                                         |

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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
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