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(54) **GANTRY CRANE FOR HANDLING CONTAINERS**

PORTALKRAN ZUM HANDHABEN VON KONTAINERN

GRUE À PORTIQUE DE MANUTENTION DE CONTENEURS

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Description

Object of the invention

[0001] The object of the present invention is a gantry crane for handling containers, comprising a number of known elements such as a gantry provided with lateral legs with means for traveling on rails, longitudinal guides or tracks and at least one crossbeam attached to the lateral legs; a trolley movable along the crossbeam, said trolley carrying at least one motorized drum on which the hoisting cables of a container carrier rig are wound in a first direction; it presents the particular feature of comprising a counterweight system to the container carrier rig in order to reduce the energy consumption of the crane and the size of the motors and/or associated equipment to handle said containers.

Scope of the invention

[0002] This invention is applicable in the field dedicated to the fabrication, modification and modernization of gantry cranes for the handling and stacking of containers.

Prior art

[0003] Gantry cranes used for the handling and stacking of containers are currently widely known in the market. Such gantry cranes comprise a frame provided with a side legs with means for traveling on rails, longitudinal guides or tracks and at least one crossbeam, attached to the upper end of the side legs of the gantry.

[0004] Mounted on said crossbeam is a movable trolley which carries elements of the crane itself such as cables, motors, gearboxes, etc. and at least one motorized drum on which the hoisting cables of a container carrier rig are wound in a first direction, and whose purpose is to hold the container(s) during their lifting and handling.

[0005] This container carrier rig is composed of several known elements in the field of container cranes such as "headblock" and "spreader"; generally, its weight, depending on the characteristics and size of the crane, can be comprised between about 5 and 15 tons so that its displacement, either with container or without container, requires a substantial energy consumption, in addition to that used for the lifting and handling of containers. While it is true that certain hoisting devices, moving only in a vertical direction, such as elevators or hoists, have counterweights to, at least, partially compensate for the weight of the cab and/or authorized load; such devices or counterweight means are not applicable to the gantry cranes mentioned since their hoisting system combines a motion in a vertical direction and a motion in an horizontal direction, said hoisting system being located on the movable trolley along the crossbeam of the gantry.

[0006] The applicant of the present invention is not aware of any gantry cranes for handling containers which have a main lift system mounted on a trolley movable on

a gantry beam and which have means for compensating at least the weight of the container carrier rig suspended only from the movable trolley by the hoisting cables, without a counterweight system that does not constitute a hindrance to the operation and purpose of the crane.

Description of the invention

[0007] In order to solve the problems mentioned above, a gantry crane for handling containers has been devised which comprises: a frame provided with side legs with means for traveling on rails, longitudinal guides or tracks and at least one crossbeam attached to the lateral legs; a trolley movable along the crossbeam and a main hoisting system mounted on the movable trolley and provided with at least one motorized drum and hoisting cables of a container carrier rig; wound in a first direction on a motorized drum; it is characterized by comprising a counterweight system of the container carrier rig.

[0008] Said counterweight system to the container carrier rig comprises at least: a counterweight; a counterweight cable having a first end wound onto a motorized drum in a second direction, opposite the first winding direction of the hoisting cables; and a second end attached to the movable trolley, or wound on a motorized drum in said second direction; first return pulleys of the counterweight cable arranged at opposite ends of the crossbeam of the gantry; at least one second return pulley of the counterweight cable mounted on the movable trolley; said counterweight cable forming a loop of variable length which comprises a horizontal section arranged along the gantry beam and at least one vertical end section arranged on one of the sides of the gantry and from which a counterweight is suspended by means of a pulley.

[0009] Another objective of the invention is to develop a counterweight system that allows suspending from a single counterweight cable two counterweights arranged on opposite sides of the gantry so that said counterweights do not contribute to the destabilization of the gantry.

[0010] To this end, a height compensator is incorporated into the counterweight system, suitable to ensure that the two counterweights, arranged at opposite sides of the gantry and at the same height, are traveling in parallel, in the same direction, and at the same speed during the traveling of the movable trolley along the crossbeam of the gantry in either direction when the hoist drum rotates, preventing both counterweights from moving at different speeds and/or in opposite directions.

[0011] Winding the counterweight cable on a motorized drum in a direction opposite to the winding direction of the hoisting cables allows the counterweight to counteract the weight of the container carrier rig (spreader + headblock), fulfilling the objective of significantly reducing the energy required to move said rig, regardless of the fact that it is empty or holding a container.

[0012] The advantages derived from using the counterweight system to the container carrier rig, acting on

the motorized drum mounted on the movable trolley, are the use of smaller motors and/or associated equipment for handling these containers and a significant reduction in the energy consumption of the crane.

[0013] KR 101 058 594 B1 provides a system and method for lading/unloading containers.

[0014] GB 2 168 310 A describes a dredger using a counter-balance for reducing effective dead weight on a grab.

[0015] JP 2012 126528 A describes a quay crane of an energy-saving type capable of lessening the capacity of a motor for rotating main winding drums.

Description of the figures

[0016] To complement the description being made, and in order to make it easier to understand the characteristics of the invention, the present specification is accompanied by a set of drawings in which, with illustrative and non limitative character, the following has been represented:

- Figure 1 shows a schematic view of a gantry crane for handling containers, with a single hoist drum, known in the prior art.
- Figure 2 shows a perspective view of a gantry crane for handling containers according to the invention, provided with a motorized drum in the movable trolley and with a counterweight system to the container carrier rig.
- Figure 3 shows a schematic perspective view of the counterweight system of Figure 2.
- Figure 4 shows a perspective view of an alternative embodiment of the gantry crane of Figure 2, with the counterweight system and provided with two motorized drums.
- Figure 5 shows a schematic view of an alternative not claimed example of a counterweight system, with one single counterweight and one end of the counterweight cable attached to the movable trolley.

Preferred embodiment of the invention

[0017] In the embodiment shown in Figure 1, a conventional gantry crane known in the prior art, schematically represented, is provided with a frame (1), with lateral legs (11) comprising motorized traveling means (12) motor and a crossbeam (13) attached to the lateral legs (11), a movable carriage (2) mounted on the crossbeam (13) and carrying a main hoisting system (3) which, in this case, has a motorized drum (31) on which hoisting cables (32) of a container carrier rig (33), suitable for clamping the container (C) to be transported, are wound in a first direction.

[0018] In the embodiment shown in Figures 2 and 3, the gantry crane comprises a counterweight system (4) according to the invention, which comprises a counterweight cable (41) with a first end and a second end wound

on a same motorized drum (31) in a second direction, opposite the winding direction of the hoisting cables (32), said counterweight cable (41) being guided into a first set of return pulleys (42), arranged at opposite ends of the crossbeam (13) of the gantry (1), and a second set of pulleys (43) mounted on the movable trolley (2) so that the counterweight cable (41) forms a loop of variable length which comprises a horizontal section (44) disposed along the crossbeam (13) of the gantry (1) and two vertical sections (45) arranged on opposite sides of the gantry (1), a counterweight (46) being suspended from each end vertical section (45) by means of the corresponding pulley (47).

[0019] Due to the winding of the counterweight cable (41) and the hoisting cables (32) on the motorized drum (31) in opposite directions, the weight of the container carrier rig (33) is offset by the weight of the counterweights (46). Thus, when the hoisting cables (32) unwind, the counterweight cable ends (41) wind on the motorized drum (31), simultaneously producing the drop of the container carrier rig and the rise of the counterweights (46) and vice versa.

[0020] The layout of this counterweight system allows lifting or lowering the container carrier rig (33) and moving the movable trolley (2) on the gantry without the counterweights interfering with the movements of the crane.

[0021] To ensure that the vertical portions (45) of the loop formed by the counterweight cable (41) are of equal length when the movable trolley (2) travels to either side of the gantry, the crane comprises on the crossbeam (13) a height compensator for said vertical end sections (45).

[0022] Said height compensator, referenced as a whole as (5), comprises a belt (51) mounted on freely rotatable pulleys (52) arranged in the two opposite ends of the crossbeam (13) of the gantry (1), said belt comprising a first branch (51 a) fixed to the movable trolley (2) of the crane, and a second branch (51 b) fixed to the horizontal section (44) of the counterweight cable loop.

[0023] Thus, when the movable trolley (2) travels toward either side, the height compensator (5) ensures that the two vertical sections (45) retain their length if the drum does not rotate or change it in an identical manner when the motorized drum is turning to perform the lifting or lowering of the container carrier rig.

[0024] In the embodiment shown schematically in Figure 4, the gantry crane comprises two motorized drums (31, 31 a), one of the counterweight cable ends (41) being wound on each of them. The relative position between the drums may be different and, therefore, their placement on the movable trolley may also be different.

[0025] In the not claimed example shown in Figure 5, the counterweight system comprises only one counterweight (46), one end of the counterweight cable (41) being wound on the motorized drum (31) and the opposite end of the counterweight cable (41) being attached to the movable trolley (2).

[0026] Obviously, in this case, by using a single counterweight (46) it is not necessary to use a height com-

pensator (5) similar to that described in Figures 2 and 3.

[0027] In the case where the crane comprises two motorized drums, the counterweight system can be doubled by coupling to each motorized drum a counterweight system analogous to that shown in Figure 5. The latter layout allows choosing to position on the lateral legs both ends of the vertical sections from which two separate counterweights are suspended by means of their respective pulleys.

[0028] Having sufficiently described the nature of the invention, as well as a preferred embodiment, it should be noted that, for all intents and purposes, the materials, shape, size and arrangement of the elements described can be modified, provided that this does not involve an alteration of the essential characteristics of the invention claimed below.

Claims

1. Gantry crane for container handling; comprising:

- a gantry (1) provided with lateral legs (11) fitted with displacement means (12) on rails, longitudinal guides or tracks and at least one crossbeam (13) attached to the lateral legs (11);
- a trolley (2) movable along the crossbeam (13),
- a main hoisting system (3) mounted on the movable trolley (2) and provided with, at least, one motorized drum (31, 31 a) and with hoisting cables (32) of a container carrier rig (33), wound in a first direction on a motorized drum (31, 31 a); **characterized in that** it comprises a counterweight system (4) of the container carrier rig (33) comprising, at least:
 - a counterweight (46),
 - a counterweight cable (41) which comprises a first end wound onto a motorized drum (31, 31 a) in a second direction, opposite the first winding direction of the hoisting cables (32); and a second end attached to the movable trolley (2), or wound in said second direction onto a motorized drum (31, 31 a);
 - a first set of return pulleys (42) for the counterweight cable (41) arranged at opposite ends of the crossbeam (13) of the gantry;
 - at least a second return pulley (43) for the counterweight cable (41) mounted on the movable trolley (2);

said counterweight cable (41) forming a loop of variable length which comprises a horizontal section (44) arranged along the crossbeam (13) of the gantry and at least one vertical end section (45) from which a counterweight (46) is suspended by means of a pulley (47);

in that:

- the counterweight cable loop (41) comprises two vertical end sections (45) arranged on opposite sides of the gantry (1);
- two separate counterweights (46) are suspended from said vertical sections (45) by means of respective pulleys (47); and
- it comprises on the crossbeam (13) of the gantry a height compensator (5) for the vertical end sections (45) of the counterweight cable loop (41) during the traveling of the movable trolley (2);

and **in that** the height compensator (5) comprises a belt (51) mounted on freely rotatable pulleys (52) arranged at two opposite ends of the crossbeam (13) of the gantry (1); said belt (51) presenting a first branch (51 a) fixed onto the movable trolley (2), and a second branch (51 b) fixed onto the horizontal section (4) of the counterweight cable loop.

Patentansprüche

1. Portalkran zum Handhaben von Containern, umfassend:

- ein Portal (1) mit Seitenbeinen (11), die mit Verlagerungsmitteln (12) auf Schienen, Längsführungen oder Spuren angebracht sind, und mindestens einem Querträger (13), der an den Seitenbeinen (11) befestigt ist;
- einen Transportwagen (2), der entlang des Querträgers (13) beweglich ist;
- ein Haupt-Hubsystem (3), das auf dem beweglichen Transportwagen (2) gelagert ist und mit mindestens einer motorisierten Walze (31, 31 a) und mit Hebeseilen (32) einer Containertragevorrichtung (33), die in einer ersten Richtung auf eine motorisierte Walze (31, 31 a) gewickelt sind, ausgestattet ist; **dadurch gekennzeichnet, dass** er ein Gegengewichtssystem (4) der Containertragevorrichtung (33) umfasst, welches zumindest umfasst:
 - ein Gegengewicht (46),
 - ein Gegengewichtskabel (41), das ein auf eine motorisierte Trommel (31, 31 a) in einer zweiten Richtung, entgegengesetzt zur ersten Wickelrichtung der Hebeseile (32), gewickeltes erstes Ende und ein am beweglichen Transportwagen (2) befestigtes oder in der zweiten Richtung auf eine motorisierte Walze (31, 31 a) gewickeltes zweites Ende umfasst;
 - einen ersten Satz von Umlenkrollen (42) für das Gegengewichtskabel (41), der an gegenüberliegenden Enden des Querträgers (13) des Portals angeordnet ist;
 - mindestens eine zweite Umlenkrolle (43) für das Gegengewichtskabel (41), die am bewegli-

chen Transportwagen (2) gelagert ist;

wobei das Gegengewichtskabel (41) eine Schleife mit variabler Länge bildet, welche einen horizontalen Abschnitt (44), angeordnet entlang des Querträgers (13) des Portals, und mindestens einen vertikalen Endabschnitt (45), von dem ein Gegengewicht (46) mittels einer Rolle (47) herabhängt, umfasst; und dass:

- die Gegengewichtskabel-Schleife (41) zwei vertikale Endabschnitte (45) umfasst, die auf gegenüberliegenden Seiten des Portals (1) angeordnet sind;
- zwei getrennte Gegengewichte (46) von den vertikalen Abschnitten (45) mittels entsprechender Rollen (47) herabhängen; und
- er auf dem Querträger (13) des Portals einen Höhenkompensator (5) für die vertikalen Endabschnitte (45) der Gegengewichtskabel-Schleife (41) während der Fortbewegung des beweglichen Transportwagens (2) umfasst;

und dadurch, dass der Höhenkompensator (5) einen Riemen (51) umfasst, der auf frei drehbaren Rollen (52), die an zwei gegenüberliegenden Enden des Querträgers (13) des Portals (1) angeordnet sind, gelagert ist; wobei der Riemen (51) einen ersten Abzweig (51 a), der auf dem beweglichen Transportwagen (2) befestigt ist, und einen zweiten Abzweig (51 b), der auf dem horizontalen Abschnitt (4) der Gegengewichtskabel-Schleife befestigt ist, aufweist.

Revendications

1. Grue à portique de manutention de conteneurs ; comprenant :

- un portique (1) muni de pieds latéraux (11) équipés de moyens de déplacement (12) sur des rails, des guides longitudinaux ou des pistes et d'au moins une entretoise (13) fixée aux pieds latéraux (11) ;
- un chariot (2) mobile le long de l'entretoise (13),
- un système de levage (3) monté sur le chariot mobile (2) et muni d'au moins un tambour motorisé (31, 31a) et présentant des câbles de levage (32) d'une plate-forme de porte-conteneur (33), enroulés dans une première direction sur un tambour motorisé (31, 31a) ; **caractérisé en ce qu'il** comprend un système de contrepoids (4) de la plate-forme de porte-conteneur (33) comprenant, au moins :
- un contrepoids (46),
- un câble de contrepoids (41) qui comprend une première extrémité enroulée sur le tambour mo-

torisé (31, 31a) dans une seconde direction, opposée à la direction d'enroulement des câbles de levage (32) ; et une seconde extrémité fixée au chariot mobile (2), ou enroulée dans ladite seconde direction sur le tambour motorisé (31, 31a) ;

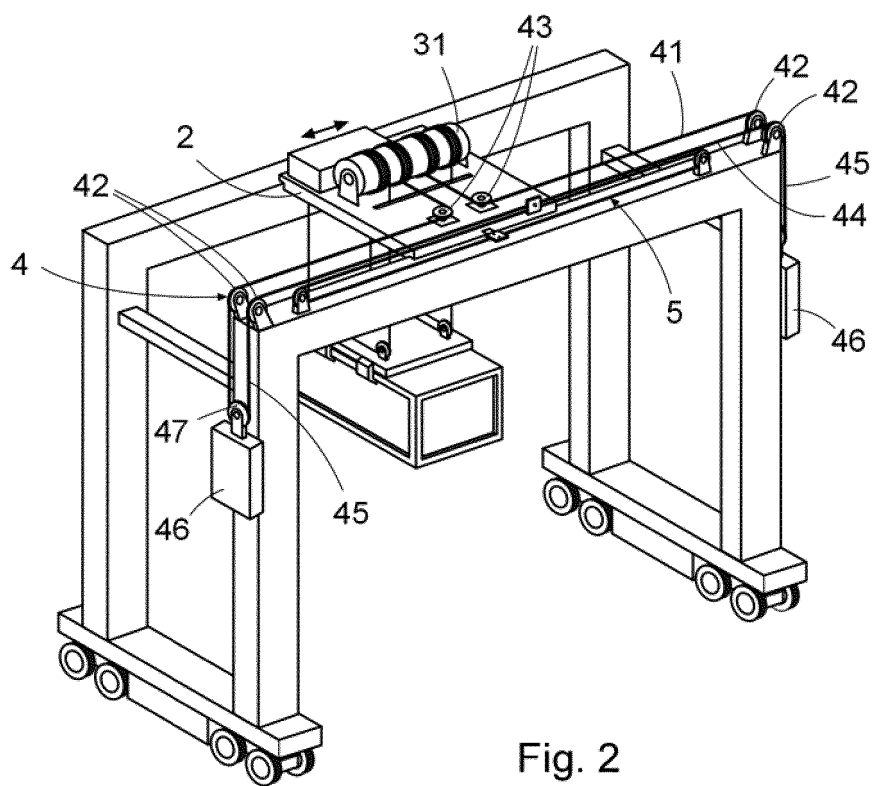
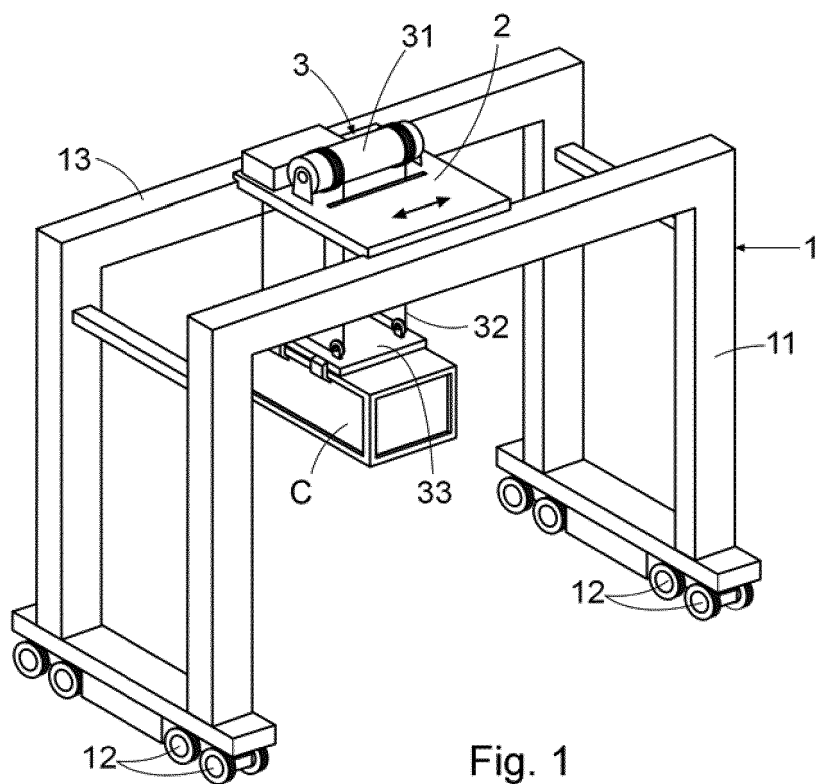
- un premier ensemble de poulies de renvoi (42) pour le câble de contrepoids (41) agencé sur des extrémités opposées de l'entretoise (13) du portique ;
- au moins une seconde poulie de renvoi (43) pour le câble de contrepoids (41) montée sur le chariot mobile (2) ;

ledit câble de contrepoids (41) formant une boucle d'une longueur variable qui comprend une section horizontale (44) agencée le long de l'entretoise (13) du portique et au moins une section d'extrémité verticale (45) depuis laquelle un contrepoids (46) est suspendu au moyen d'une poulie (47) ;

en ce que :

- la boucle de câble de contrepoids (41) comprend deux sections d'extrémité verticales (45) agencées sur des côtés opposés du portique (1) ;
- deux contrepoids séparés (46) sont suspendus depuis lesdites sections verticales (45) au moyen de poulies (47) respectives ; et
- il comprend sur l'entretoise (13) du portique un correcteur de niveau (5) pour les sections d'extrémité verticales (45) de la boucle de câble de contrepoids (41) pendant le voyage du chariot mobile (2) ;

et en ce que le correcteur de niveau (5) comprend une courroie (51) montée sur des poulies à rotation libre (52) agencées sur deux extrémités opposées de l'entretoise (13) du portique (1) ; ladite courroie (51) présentant une première branche (51a) fixée sur le chariot mobile (2), et une seconde branche (51b) fixée sur la section horizontale (4) de la boucle de câble de contrepoids.



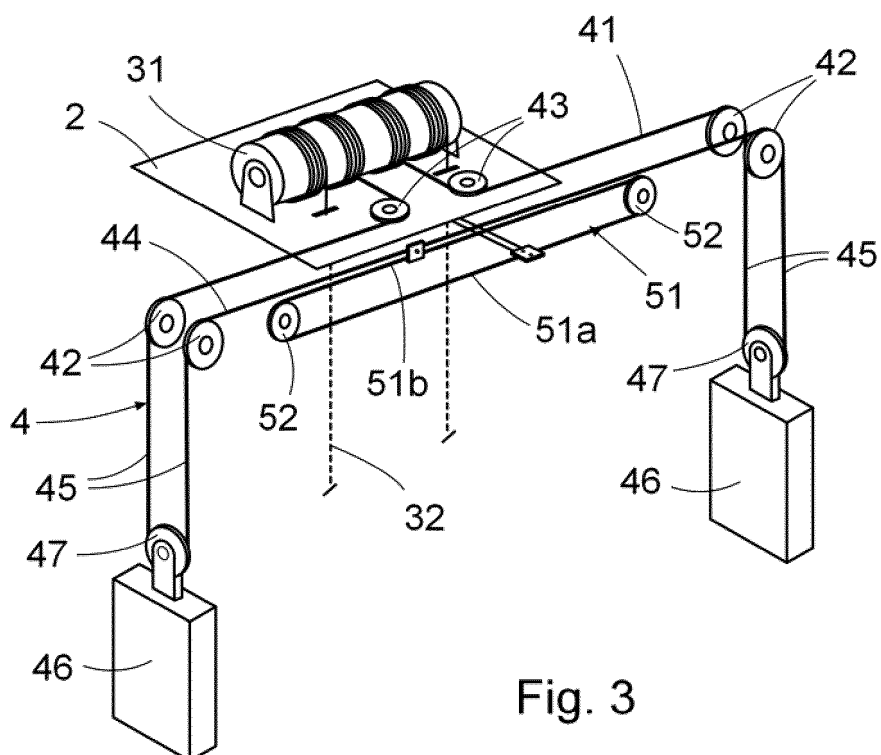


Fig. 3

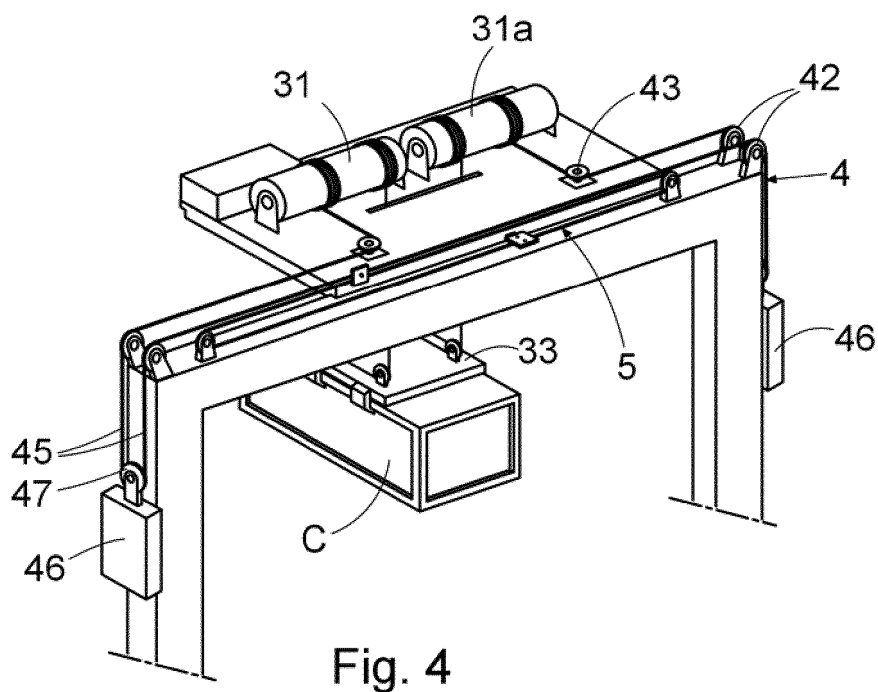


Fig. 4

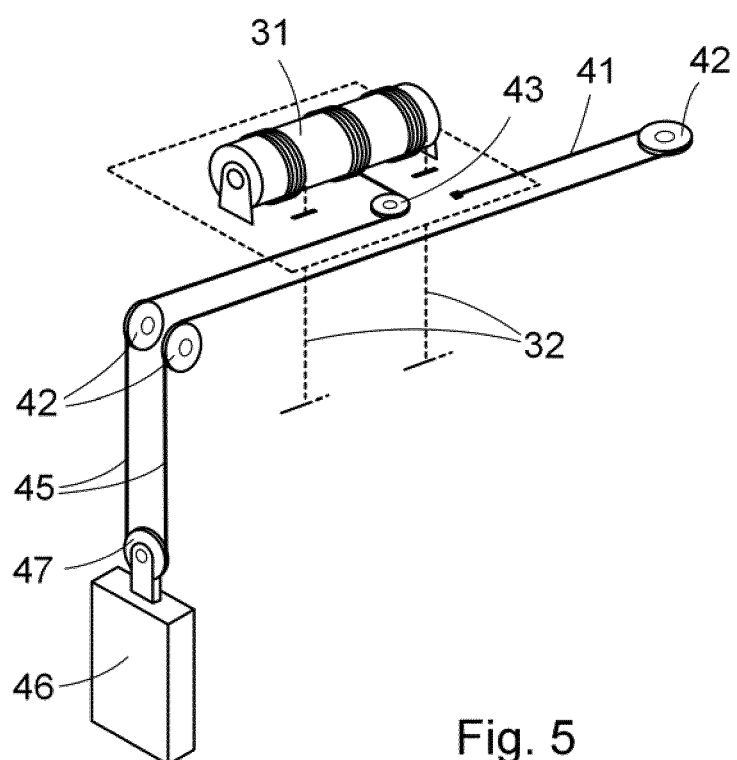


Fig. 5

REFERENCES CITED IN THE DESCRIPTION

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