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(54) Elevator, and also a system and a method for enabling embarkation and disembarkation of a vessel

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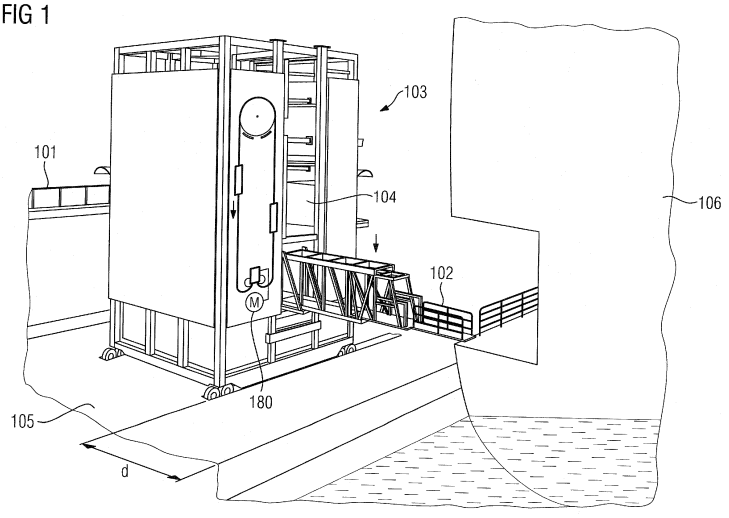
The elevator (104) comprises:

- a first (102) and a second exit (101), of which at least the first exit (102) can be fastened to the entrance of the vessel (106) or which leads to an access platform connecting to the vessel (106);
- between the first and second exit in the vertical direction, a movable platform (411), which is most preferably a part of the elevator car (410);
- drive means (490) for displacing the platform (411) in the vertical direction;
- a speed reference unit (493) for controlling the drive means (490) such that the moving speed of the platform (411) can be decelerated at the point of a first deceleration point (p1) from the nominal speed of the platform via an initial smoothing curve for deceleration (p2) to a predetermined maximum value of deceleration and after this at the point of a second deceleration point (p3) by reducing the deceleration via a final smoothing curve to zero (p4).

The speed reference unit (493) is configured to displace at least one of a first and a second deceleration point (p1, p3) when the distance of the first exit (102) from the second exit (101) changes.

The patent application comprises an independent claim also for a system and a method for enabling embarkation and disembarkation of a vessel.

FIG 1



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Description

Field of the invention

[0001] The invention relates more generally to the transporting of people and objects and more particularly to the field of elevator technology.

Technical background

[0002] A quay is an embankment reinforced with masonry, which is generally situated in a harbor or on the banks of a river or canal, and which is used for loading and unloading cargoes of ships. The basin water in front of a quay is generally so deep that vessels (e.g. ships and ferries) can moor to the quay.

[0003] Transferring people and transferring goods from shore to vessel and *vice versa* must generally be implemented along an access platform.

[0004] More particularly when the transfer of people or the transfer of goods from shore must be implemented onto, or off, a vessel moored to a quay, it is generally endeavored to use structures that can be moved along the quay, which are often connected as a part to the operation of a ship terminal.

[0005] On a quay it is generally endeavored to use a type of movable access platform, which can be moved in the direction of the quay. Moving an access platform is simpler than moving a large vessel. Since vessels nowadays often have multiple decks, it is generally endeavored to implement the access platform as an access tower.

[0006] In this way it is possible to take into account, on the one hand, the fact that vessels can be of different sizes and, on the other hand, that the exit or entrance to a vessel can be from some certain level or from more than one level. One example of a modern access tower is the Italian company V.T.P. Engineering's "MBT Multipurpose Boarding Tower", a prototype of which has been constructed on quay 117 of the passenger terminal of the Port of Venice.

[0007] When designing an access platform or an access tower, it must be taken into account that the exits and entrances (hereinafter "entrance" refers to both) of a vessel can be situated at a different height in each floating structure and accesses from the quay to an entrance must therefore in principle be adjustable. On the other hand, it must also be taken into account that owing to the variation in the height of the water, the height of at least one necessary entrance can vary.

[0008] Variation in the height of a water surface resulting from evaporation of the water or rain is generally very slow, but in particular the variation in the height of a water surface resulting from tidewater can be large and relatively fast. The vertical change in position can be up to six meters and can occur while a vessel is connected to an access platform or access tower. This is the case e.g. for ship terminals on the sides of some Norwegian fjords.

[0009] It is often desired to use an elevator for the vertical transfer needed between an access platform, or an access tower, and the ship terminal. Thus, from the elevator is a passageway to an entrance of the vessel. The entrance or exit of the elevator (hereinafter also the "exit" of an elevator refers to both) is either attached to the entrance of the vessel or to an access platform connected to the vessel. As the vessel rises and falls with the tide, the level position of the exit also changes.

[0010] International patent application publication WO 2009/067076 A1 describes an elevator with variable level positions. With end position switches or with contactless optical or electronic sensors, the position of the elevator in relation to the entrance of the vessel is detected and it is ensured that the elevator stops in its top position at the new level position.

[0011] When using the solution presented in patent application publication WO 2009/067076 A1, the elevator must be stopped quickly after the level position has changed. Consequently, a passenger can in certain situations experience an unpleasantly abrupt stop. An abrupt stop can also be dangerous for passengers.

Aim of the invention

[0012] The aim of the invention is make embarkation or disembarkation of a vessel pleasanter or safer.

[0013] This aim can be resolved with an elevator according to claim 1 and with a system according to claim 7 and with a method according to claim 8 for enabling embarkation and disembarkation of a vessel.

[0014] The dependent claims describe preferred embodiments of the elevator, of the system and of the method.

Advantages of the invention

[0015] The elevator comprises i) a first and a second exit, of which at least the first exit can be fastened to an entrance of a vessel or which leads to an access platform connecting to the vessel, ii) between the first and second exit in the vertical direction, a movable platform, which is most preferably a part of the elevator car, iii) drive means for displacing the platform in the vertical direction, and iv) a speed reference unit for controlling the drive means such that the moving speed of the platform can be decelerated at the point of a first deceleration point from the nominal speed of the platform via an initial smoothing curve for deceleration to a predetermined maximum value of deceleration, and after this at the point of a second deceleration point by reducing the deceleration via a final smoothing curve to zero.

[0016] When the speed reference unit of the elevator is configured to displace at least one of a first and a second deceleration point when the distance of the first exit from the second exit changes, the speed reference of the elevator can also be changed when the level position changes. As a consequence, sudden stopping of the el-

evator after the level position has just changed can be avoided, as a result of which ride comfort and passenger safety can be increased.

[0017] When the speed reference unit is configured to displace at least one of a first and a second deceleration point by scaling the reference speed instruction by the relative change in distance, changing of the speed reference can be implemented relatively simply and in such a way that also the changed speed reference is reliable.

[0018] When the speed reference unit is configured to displace at least one of a first and a second deceleration point by displacing them by the absolute change in distance with respect to the reference speed instruction, changing of the speed reference can be implemented in an extremely simple manner.

[0019] The speed reference unit can be configured to displace at least one of a first and a second deceleration point on the basis of at least one item of the run data of the drive means. In this way it is possible to automate the changing of the speed reference. It is particularly advantageous in this case to use the means for setting or adjusting the height of the first exit as the drive means. The speed reference of the elevator is directly changed as the height of the exit changes and abrupt stopping no longer occurs as it possibly would when using the arrangement described in patent application publication WO 2009/067076 A1.

[0020] The speed of the rotor, the rotation distance of the rotor, or a combination of these, can be used as at least one item of the operating data of the drive means. By integrating the speed of the rotor it is possible to calculate the distance by which the height of the first exit has changed. When the second exit is fixed (or if the height of the second exit can be adjusted but it is not changed), the change directly corresponds to the change by which the distance of the first exit from the second exit changes. The movement data of the rotor can be ascertained e.g. by the aid of a type of pulse encoder that gives a predetermined quantity (e.g. 2048 units) of pulses during one revolution rotated by the rotor. The pulse quantity data is proportional to the rotation distance of the rotor.

[0021] The system for enabling embarkation and disembarkation of a vessel comprises i) a first access, more particularly an access platform or corresponding, which can be fastened to an entrance of a vessel or which leads to an access platform connecting to the vessel, ii) a second entrance, more particularly a terminal platform or terminal tower or corresponding, iii) means for adjusting the distance of the first entrance from the second entrance; and iv) an elevator of any of the types described above, the speed reference unit of which is configured to displace at least one of a first and a second deceleration point when the distance of the first exit from the second exit changes.

[0022] Method for enabling embarkation and disembarkation of a vessel between (I) a first access, more particularly an access platform or corresponding, which can be fastened to an entrance of the vessel or which leads to an access platform connecting to the vessel and (II) a second access, more particularly a terminal platform or terminal tower or corresponding, in which method means for adjusting the distance of the first access from the second access are additionally used. In the method an elevator of any of the types described above is used, the speed reference unit of which is configured to displace at least one of a first and a second deceleration point when the distance of the first exit from the second exit changes.

List of drawings

[0023] The invention will be described in more detail by referring to the embodiments presented in the drawings FIG 1 - 3 below. The drawings present:

FIG 1 an elevator for boarding/unboarding a vessel;

FIG 2 a speed profile of the elevator; and

FIG 3 control of the elevator with a signal coming from the hoist of the access platform.

[0024] In all the FIGs the same reference numbers refer to the same technical features.

Detailed description of the invention

[0025] FIG 1 presents a system 103 for enabling embarkation of a vessel, for transferring from a terminal 101 onto the vessel 106. The system comprises an elevator 104, which connects the exit on the terminal 101 side and the exit on the vessel 106 side.

[0026] The system 103 preferably comprises a device 105 to be driven along the quay, which device is disposed at a distance d from the edge of the quay 105, such as e.g. the aforementioned "MBT Multipurpose Boarding Tower".

[0027] When a vessel 106 moors to the quay 105, an elevator 104 must be used for enabling transfer, or the transfer of goods, from the terminal 101 into the elevator 104 and from the elevator 103 onto the vessel 106 and *vice versa* in such a way that the exit of the elevator 104 on the vessel 106 side, such as a section leading to the access platform 102, comes to a height that gives access from it to the deck of the vessel 106 or to an entrance on the vessel 106. The elevator 104 is stopped for this purpose preferably at the level of the access platform 102 or such that there is access from it to the vessel 106 without proceeding up/down steps. The system 103 can comprise a number of elevators 104 to be operated side by side, e.g. the "MBT Multipurpose Boarding Tower" is implemented as a system with three elevators 104 side by side.

[0028] The access platform 102 is operated with a hoisting machine, the motor 180 of which is presented in FIG 1. The height of the access platform 102 is adjusted

with the hoisting machine.

[0029] In this case the level position data in the control of the elevator 104 can be changed always when the motor 180 is operated, e.g. always when the height of the access platform 102 changes. FIG 2 presents one speed reference 30 of an elevator. The speed reference 30 can be divided into the following phases: P1 = startup smoothing curve; P2 = essentially constant acceleration; P3 = smoothing curve to nominal speed; P4 = nominal speed; P5 = initial smoothing curve of deceleration; P6 = constant deceleration; P7 = smoothing curve for arrival at level.

[0030] At the finish of the initial smoothing curve P5 of deceleration, the deceleration of the moving platform 411 of the elevator car 410 has achieved the maximum value for deceleration during constant deceleration.

[0031] At the point of the second deceleration point P7 of the speed reference, the speed of the moving platform 411 of the elevator car 410 is reduced via a final smoothing curve to zero.

[0032] In principle the deceleration can be implemented softly also by omitting the constant deceleration phase P6 from between the deceleration points P5 and P7, by joining the initial smoothing curve and the final smoothing curve (i.e. deceleration point P5 and deceleration point P7 from the speed reference) to follow each other immediately, in which case the speed profile would be the shape of a downward-sloping S-curve. It is good if there is a final smoothing curve so that a soft stop of the moving platform 411 is achieved.

[0033] According to what is presented above, the deceleration points P5 and P7 are magnitudes dependent on position. The first deceleration point P5 can be defined in the speed reference as the point of the path of movement of the elevator car 410 at which deceleration is started and the second deceleration point P7 can be defined in the speed reference as the point of the path of movement of the elevator car 410 at which the final smoothing curve to zero is started.

[0034] The speed reference 30 presented in FIG 2 is given only as an example. In practice the speed reference comprises at least a subset of points P1 - P7.

[0035] FIG 3 presents how the operating mode of the elevator 104 is changed with the data coming from the hoisting machine of the access platform 102, more particularly from the motor 180. If the system 103 has a number of elevators 104 operating side-by-side, similar or corresponding changes to each other can be made in the operating mode of all the elevators 104 in the system 103.

[0036] The elevator car 410 can drive away from the level on the vessel 106 side always when it is known that this level position is changing.

[0037] The elevator car 410 of the elevator 104 is suspended on a rope 470 that passes around a wheel 450. The wheel 450 is suspended e.g. with a bracket 452 on a fixed structure 451 such as, in the case of the present arrangement 103, preferably on a harbor tower.

[0038] The elevator car 410 is able to travel suspended on the rope 470 upwards or downwards driven by the motor 490. For stopping the elevator car 410, brakes 455 can be used, which act e.g. on the wheel 450 preventing its rotation.

[0039] When the elevator moves the elevator car 410 is connected to the counterweight 430 via the rope 480. By pulling from the rope 480 the elevator car 410 can be lifted or lowered at the same time moving the counterweight 430 in the opposite direction.

[0040] The rotational movement of the motor 490 is conducted along the rope 480 via the rollers 491 for moving the elevator car 410 and the counterweight 430. The speed of the motor 490 is controlled by the speed reference unit 493, in which the speed reference of the elevator 410 is recorded. The speed reference is in this case the speed reference 30, or a speed reference similar to this, and comprises at least a subset of points P1 - P7.

[0041] When the level position of the exit of the access platform 102 or of the elevator 104 on the vessel 106 side changes, i.e. when the motor 180 is operated, information about this is transmitted to the speed reference unit 493 of the elevator 104.

[0042] The speed reference unit 493 of the elevator 104 scales the speed reference 403 on the basis of the data of the change in level position to be narrower or wider and/or displaces at least some of the positions of the points P1 - P7 in the speed reference, e.g. to the right or to the left, in such a way that the elevator car 410 is able to stop as close as possible to the changed level position of the exit of the access platform 102 or of the elevator 104 on the vessel 106 side.

[0043] When driving the elevator car 410 towards the exit (e.g. to the access platform 102), the position of the first deceleration point P5 can be calculated or determined on the basis of the run data of the drive means 180. The position of the second deceleration point P7 can be marked to a constant distance in the proximity of the exit in such a way that the final smoothing curve (deceleration point 7) of deceleration starts when the elevator car 107 arrives at the second deceleration point.

[0044] The invention must not be regarded as being limited only to the claims below but instead should be understood to include all legal equivalents of said claims.

Claims

1. Elevator (104), which comprises:

- a first (102) and a second (101) exit, of which at least the first exit (102) can be fastened to an entrance of a vessel (106) or which leads to an access platform connecting to the vessel (106);
- between the first and second exit in the vertical direction, a movable platform (411), which is most preferably a part of the elevator car (410);
- drive means (490) for displacing the platform

(411) in the vertical direction;
- a speed reference unit (493) for controlling the drive means (490) such that the moving speed of the platform (411) can be decelerated at the point of a first deceleration point (P5) from the nominal speed of the platform via an initial smoothing curve for deceleration to a maximum value of deceleration, and after this at the point of a second deceleration point by reducing the deceleration via a final smoothing curve to zero (P7);
and wherein
- the speed reference unit (493) is configured to displace at least one of a first and a second deceleration point (P5, P7) when the distance of the first exit (102) from the second exit (101) changes.

2. Elevator (104) according to claim 1, wherein the speed reference unit (493) is configured to displace at least one of a first and a second deceleration point (P5, P7) by scaling the reference speed instruction (30) by the relative change in distance.

3. Elevator (104) according to claim 1 or 2, wherein the speed reference unit (493) is configured to displace at least one of a first and a second deceleration point (P5, P7) by displacing them by the absolute change in distance with respect to the reference speed instruction.

4. Elevator (104) according to the preceding claim, wherein the speed reference unit (493) is configured to displace at least one of a first and a second deceleration point (P5, P7) on the basis of at least one item of the run data of the drive means (180).

5. Elevator (104) according to claim 4, wherein the drive means (180) is the means for setting or adjusting the height of the first exit (102).

6. Elevator (104) according to claim 4 or 5, wherein the speed of the rotor, the rotation distance of the rotor, or a combination of these, is used as at least one item of the operating data of the drive means (180).

7. System (103) for enabling embarkation and disembarkation of a vessel, **characterized in that** the system comprises

- a first access (102), more particularly an access platform or corresponding, which can be fastened to an entrance of a vessel (106) or which leads to an access platform connecting to the vessel (106);
- a second access (101), more particularly a terminal platform or terminal tower or corresponding;
- means (180, 181) for adjusting the distance of the first access (102) from the second access (101); and
- an elevator (104) according to any of claims 1 - 6, the speed reference unit (493) of which is configured to displace at least one of a first and a second deceleration point (P5, P7) when the distance of the first exit (102) from the second exit (101) changes.

8. Method for enabling embarkation and disembarkation of a vessel
between
a first access (102), more particularly an access platform or corresponding, which can be fastened to an entrance of a vessel (106) or which leads to an access platform connecting to the vessel (106)
and
a second access (101), more particularly a terminal platform or terminal tower or corresponding,
in which method means (180, 181) for adjusting the distance of the first access (102) from the second access (101) are additionally used;
in addition to which in the method an elevator (104) according to any of claims 1 - 6 is used, the speed reference unit (493) of which is configured to displace at least one of a first and a second deceleration point (P5, P7) when the distance of the first exit (102) from the second exit (101) changes.

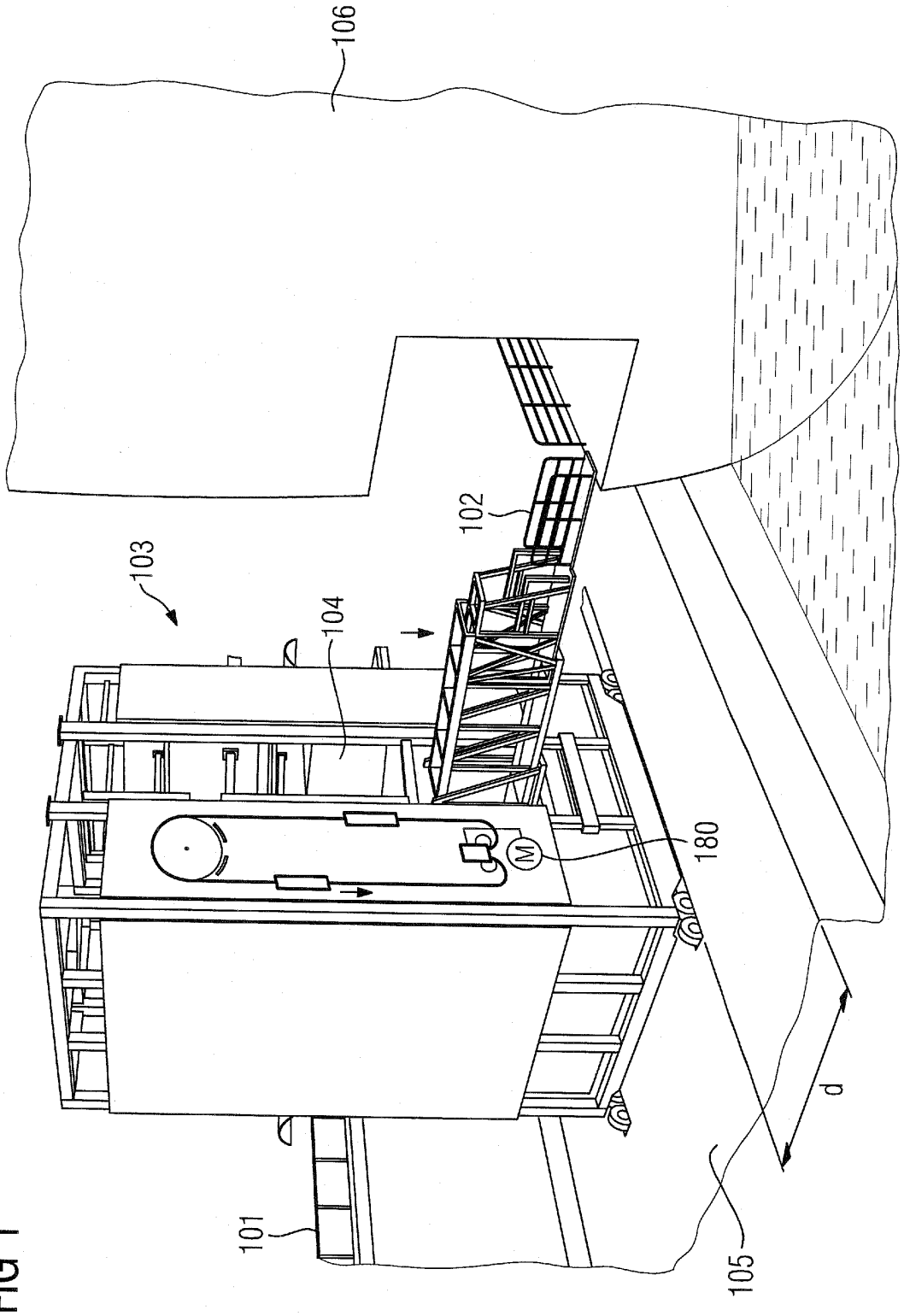
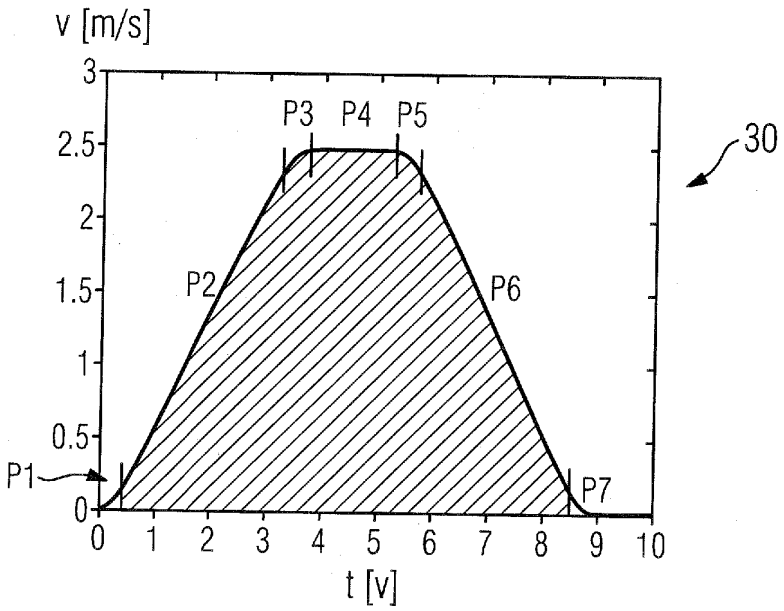


FIG 1

FIG 2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P7
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0 1 2 3 4 5 6 7 8 9 10
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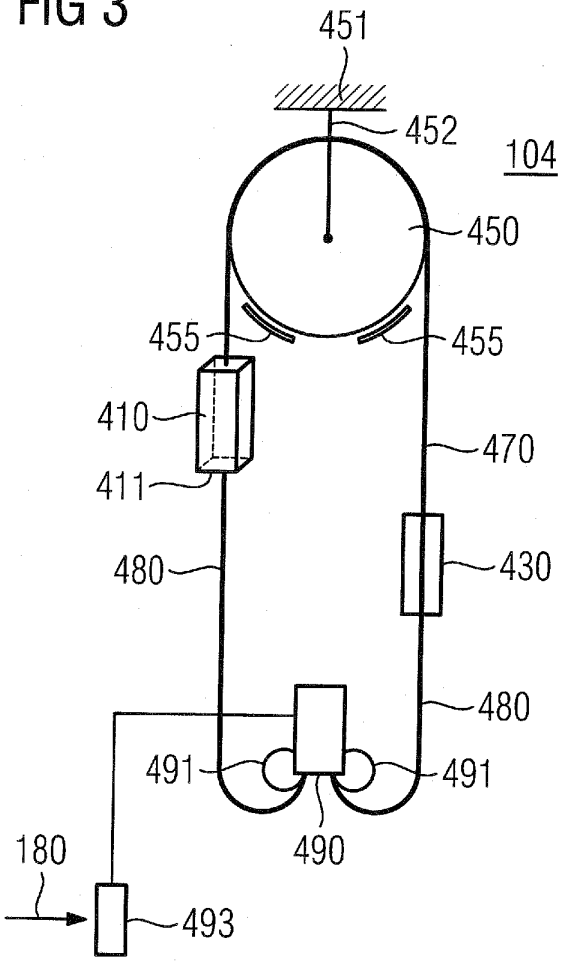
FIG 3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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2009067076 A1 **[0010] [0011] [0019]**