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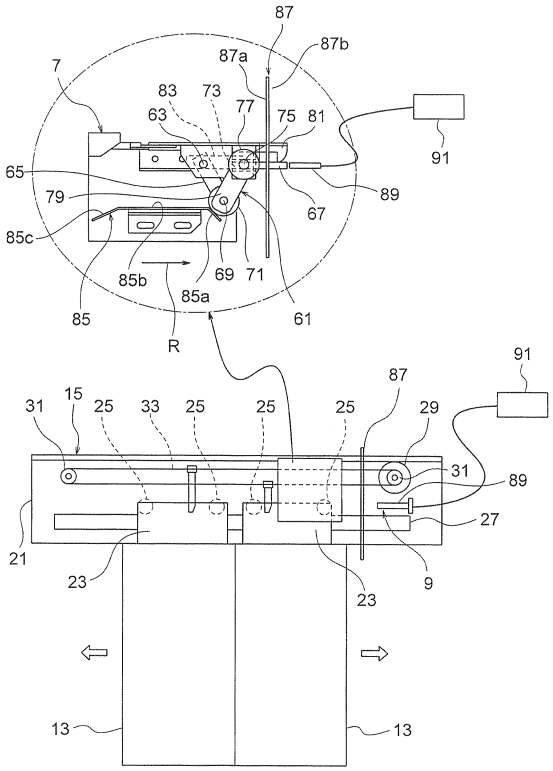
(54) **ELEVATOR DEVICE**

(57) Provided is an elevator device capable of improving safety by ensuring consistency between determination of landing and determination of lock release for doors and, in addition, capable of facilitating space-saving. An elevator device (1) includes: a car (5) to be raised and lowered in a hoistway (3); a lock control mechanism (7) for doors; and a car-landing detection mechanism (9). The elevator device further includes a plurality of bodies (87) to be detected, which are respectively fixed to the hoistway and provided on corresponding floors. The plurality of bodies to be detected constitute both the lock control mechanism for doors and the car-landing detection mechanism. The lock control mechanism for doors includes a movable body (61) provided to be raised and lowered together with the car and moved due to presence of the plurality of bodies to be detected so as to perform switching between a locked state and an unlocked state of the doors. The car-landing detection mechanism includes at least one sensor (89) provided to be raised and lowered together with the car, for detecting the presence of the plurality of bodies to be detected.

FIG. 2



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Description

Technical Field

[0001] The present invention relates to an elevator device, and more particularly, to an elevator device having a lock control function for doors and a car-landing detection function.

Background Art

[0002] In recent years, with the spread of machine room-less elevator devices each including a hoisting machine provided in a hoistway, space-saving for elevator equipment in the hoistway has been requested. On the other hand, for elevator devices, the ensuring of safety and the ensuring of reliable functions are required to be primarily considered. Specifically, there is a request for achieving space-saving while ensuring the safety and the functionality.

[0003] As mechanisms for ensuring the safety or the like, there are known the following mechanisms. First, an elevator device is provided with a landing detection mechanism which detects the landing of a car on a floor. As the landing detection mechanism, there is known a landing detection mechanism disclosed in, for example, JP 2002-29668 A. In the landing detection mechanism, a photoelectric switch mounted to a car detects a plate mounted onto a wall of a hoistway, and hence the landing detection mechanism recognizes the arrival of the car at a corresponding floor. Further, JP 2007-320717 A discloses a technology for providing distance detecting means to a car, forming a sill on the side of a landing in a projecting manner, and detecting the position of the sill based on a distance detected by the distance detecting means to conclusively determine the landing.

[0004] Independently of the above-mentioned mechanism, the elevator device is also provided with a mechanism for locking a door of the car so as to prevent a passenger from manually opening the doorwhen the car stops between floors under an emergency situation such as a power outage or an earthquake. As the above-mentioned mechanism, there is known a lock control mechanism for a door disclosed in, for example, JP 2008-528399 A. The above-mentioned mechanism includes a roller and a first latch, which are provided to a car frame, a second latch provided to the door, and plates provided to the hoistway. In a state in which the second latch provided to the door is held in engagement with the first latch provided to the car frame, the door is locked so as not to be opened/closed. Only when the roller comes into engagement with the plate provided to the hoistway, the first latch provided to the car frame is disengaged from the second latch provided to the door to place the door into an openable state. By using the mechanism described above, in the case where the car makes an emergency stop between floors, the door of the car is locked so as not to be opened/closed. In this manner, the door is prevented from being unnecessarily opened, thereby protecting the passenger.

[0005] In the conventional elevator devices, however, it is necessary to provide components of the landing detection mechanism and the lock control mechanism for a door to both the car side and the hoistway side as exemplified above. In addition, the components provided on the hoistway side are provided to almost all the floors. Therefore, there is a problem in that a large space in the hoistway is occupied by the installation of the above-mentioned mechanisms. Moreover, in the case where the lock control mechanism for a door has not unlocked the door of the car under a situation in which the landing detection mechanism is to open the car door based on the recognition of the landing of the car, there arises a problem in that the door of the car is not normally opened, resulting in trapping of the passenger therein. Therefore, in general, the above-mentioned problems are coped with by setting a lock release range for the lock control mechanism for a door to be larger than a landing approval range for the landing detection mechanism. From another point of view, however, the setting as described above means the presence of the range in which the door can be opened even though the car has not landed. In the end, it can be said that the consistency between the landing approval range and the lock release range for a door is not ensured.

Citation List

Patent Literature

[0006]

[PTL 1] JP 2002-29668 A
[PTL 2] JP 2007-320717 A
[PTL 3] JP 2008-528399 A

Summary of Invention

Technical Problems

[0007] The present invention has been made in view of the above-mentioned problems, and therefore has an object to provide an elevator device capable of improving safety by ensuring consistency between determination of landing and determination of lock release for doors and, in addition, capable of facilitating space-saving.

Solution to Problems

[0008] In order to achieve the above-mentioned object, according to the present invention, there is provided an elevator device, including: a car to be raised and lowered in a hoistway; a lock control mechanism for doors; and a car-landing detection mechanism, the elevator device further including a plurality of bodies to be detected, which are respectively fixed to the hoistway and provided

on corresponding floors, the plurality of bodies to be detected constituting both the lock control mechanism for doors and the car-landing detection mechanism, the lock control mechanism for doors including a movable body provided to be raised and lowered together with the car and moved due to presence of the plurality of bodies to be detected so as to perform switching between a locked state and an unlocked state of the doors, the car-landing detection mechanism comprising at least one sensor provided to be raised and lowered together with the car, for detecting the presence of the plurality of bodies to be detected.

Advantageous Effects of Invention

[0009] According to the elevator device of the present invention, it is possible to improve safety by ensuring the consistency between the determination of landing and the determination of lock release for doors and, in addition, to facilitate space-saving.

Brief Description of Drawings

[0010]

[FIG. 1] A side view of an elevator device according to an embodiment of the present invention, for illustrating a state in which a car lands on a floor.
[FIG. 2] A front view for illustrating the car.
[FIG. 3] A view for illustrating a process of an operation relating to a lock control mechanism for doors.
[FIG. 4] Another view for illustrating the process of the operation relating to the lock control mechanism for doors.
[FIG. 5] A view for schematically illustrating a car-landing detection mechanism according to a second embodiment of the present invention.
[FIG. 6] A view for schematically illustrating a car-landing detection mechanism according to a third embodiment of the present invention.
[FIG. 7] A view for schematically illustrating a car-landing detection mechanism according to a fourth embodiment of the present invention.

Description of Embodiments

[0011] In the following, an elevator device according to embodiments of the present invention is described with reference to the accompanying drawings. Note that, in the figures, the same reference symbols represent the same or corresponding parts.

First Embodiment

[0012] FIG. 1 is a side view of an elevator device according to this embodiment, for illustrating a state in which a car lands on a floor. FIG. 2 is a front view for illustrating the car. An elevator device 1 includes a car 5 to be raised and lowered in a hoistway 3, a lock control mechanism 7 for doors, and a car-landing detection mechanism 9.

[0013] The car 5 includes a car main body 11, a pair of right and left door panels 13, and a door device 15 for opening/closing the door panels. The car main body 11 includes a cage 17. The cage 17 is formed by cage components provided inside a known car frame (not shown), such as a ceiling, side walls, a rear wall, wing walls, and a floor. On the front side (landing side) of the cage 17, a doorway 19 through which a user enters/exits the cage 17 is provided.

[0014] The door device 15 includes a door beam 21, a pair of right and left door hangers 23, a plurality of rollers 25, a rail 27, a driving motor 29, a pair of right and left pulleys 31, and a drive belt 33. The pair of door panels 13 are respectively mounted to lower ends of the pair of corresponding door hangers 23 so as to be supported in a suspended manner. A pair of right and left rollers 25 is mounted to each of the door hangers 23. The rail 27, which extends horizontally, is provided to the door beam 21. The plurality of rollers 25 are rollably brought into engagement with an upper surface of the rail 27 so as to be guided along the rail 27.

[0015] Above the rail 27 on the door beam 21, the pair of pulleys 31, which are widely separated away from each other in a horizontal direction, arerotatablyprovided. The driving motor 29 is connected to one of the pulleys 31 so that power can be transmitted thereto. Around the pair of right and left pulleys 31, the drive belt 33 is looped. Further, the pair of door hangers 23 described above is supported by the drive belt 33.

[0016] In the door device 15, a driving force of the driving motor 29 is transmitted to the drive belt 33 through the pair of pulleys 31 to drive the drive belt 33 in a circulating manner. As a result, the pair of door panels 13 supported by the pair of door hangers 23 is driven in an opening/closing direction.

[0017] On the bottom of the pair of door panels 13, guide shoes 35 each projecting downward are respectively provided. A sill 39 including a guiding groove 37 is provided below the pair of door panels 13. By the engagement between the guide shoes 35 and the guiding groove 37, a lower part of the pair of door panels 13 is guided by the sill 39.

[0018] On the landing side, a pair of door panels 41, a door beam 43, a pair of door hangers 45, rollers 47, a rail 49, guide shoes 51, a guiding groove 53, and a sill 55, which are similar to those provided on the car side, are also provided. In synchronization with the opening/closing of the door panels 13 on the car side, the door panels 41 on the landing side are opened/closed.

[0019] Next, the lock control mechanism 7 for doors is described. The lock control mechanism 7 for doors mainly includes a component provided integrally with the car main body 11, components provided so as to move integrally with each of the door panels 13, and components provided integrally with the hoistway 3.

[0020] As the component provided integrally with the

car main body 11, there is provided a lever assembly 61 functioning as a movable body described below. The lever assembly 61 is mounted to the door beam 21 of the door device 15 which is integral with the car main body 11 and has a first hinge point 63 which is static on the door beam 21. The lever assembly 61 basically includes three levers. A first lever 65 and a slider rod 67, which are two of the above-mentioned levers, are coupled to the first hinge point 63 in a hinged manner.

[0021] At an end of the first lever 65, which is on the side opposite to the first hinge point 63, there is provided a second hinge point 69 to which a first roller 71 is mounted. A slider 73 is mounted to the slider rod 67. The slider 73 is provided slidably along a longitudinal direction of the slider rod 67. A third hinge point 75 is provided to the slider 73. A second roller 77 is mounted to the third hinge point 75. A second lever 79, which is the remaining one of the three levers, has one end which is connected to the first lever 65 by the second hinge point 69 and another end connected to the slider 73 by the third hinge point 75. A first latch 81 is provided to the slider rod 67 so as to be integral therewith.

[0022] In the lever assembly 61 having the configuration described above, the slider 73 slides with respect to the slider rod 67 to change a distance between the third hinge point 75 and the first hinge point 63. Along with the change in distance, the position of the second hinge point 69 with respect to the first hinge point 63 changes. In addition, an angle formed between the first lever 65 and the second lever 79 also changes.

[0023] As the components provided so as to be movable integrally with each of the door panels 13, there are provided a second latch 83 and a cam 85. The second latch 83 and the cam 85 are mounted to a corresponding one of the door hangers 23 of the door device 15.

[0024] The cam 85 includes a pair of inclined portions 85a and 85c, and a flat portion 85b coupling the inclined portions to each other. The cam 85 is provided so that the inclined portion 85a is located on the side in a door-opening direction and the flat portion 85b extends horizontally.

[0025] As the components provided integrally with the hoistway 3, there are provided a plurality of plates 87 functioning as bodies to be detected, which are described below. Each of the plates 87 is fixed on an inner wall surface of the hoistway 3 above a doorway on a corresponding floor and is provided at a position so that the lever assembly 61 faces a corresponding one of the plates 87 only when the car 5 lands on any one of the floors.

[0026] Next, an operation of the lock control mechanism 7 for doors is described with reference to FIGS. 2 to 4. FIGS. 3 and 4 are views for illustrating an operation process relating to the lock control mechanism for doors. First, when the car 5 lands on any one of the floors, a state, in which the plate 87 on the corresponding floor faces the lever assembly 61, is obtained as illustrated in FIG. 2. In this state, when the door panels 13 are driven in the door-opening direction as indicated by the arrow R by the action of the door device 15, the cam 85 and the second latch 83 move in the door-opening direction together with the door panels 13. At this time, the first roller 71, which is held in abutment on the cam 85, is pushed by the cam 85 to move in the door-opening direction as well. Further, by the movement of the second hinge point 69 and the change in the degree of inclination of the second lever 79, which occur along with the movement of the cam 85, the second roller 77 moves in the door-opening direction as well.

[0027] When the second roller 77 moves in the door-opening direction by a predetermined distance, the second roller 77 comes into abutment on a surface 87a of the plate 87 as illustrated in FIG. 3. When the door panels 13 are further driven in the door-opening direction R in this state, the cam 85 also moves in the door-opening direction R. Due to the abutment between the second roller 77 and the plate 87 and the presence of the inclined portion 85a in the cam 85, on which the first roller 71 comes into abutment, the second roller 77 moves upward along the surface 87a of the plate 87 as indicated by the arrow T as illustrated in FIG. 4. The entire lever assembly 61 rotates about the first hinge point 63 as indicated by the arrow S. At this time, the first latch 81 also rotates together with the lever assembly 61. As a result, the first latch 81 is disengaged from the second latch 83. Therefore, subsequently, the door panels 13 can further move in the door-opening direction R. Specifically, the lock control mechanism 7 for doors is placed in an unlocked state. Therefore, the lock of the door is released.

[0028] On the other hand, in a state in which the car 5 does not land on any one of the floors (is located between the floors), specifically, in a state in which none of the plates 87 faces the lever assembly 61, when the door panels 13 are moved in the door-opening direction R, the following operation occurs. First, when the door panels 13, which are in a fully-closed state, are driven in the door-opening direction indicated by the arrow R by the action of the door device 15, the door panels 13, the cam 85, the second latch 83, the first roller 71, and the second roller 77 first move in the door-opening direction as in the case described above. However, the second roller 77 does not come into abutment on any of the plates 87. Therefore, the lever assembly 61 cannot sufficiently rotate in the direction indicated by the arrow S. Therefore, the second latch 83 is not eventually disengaged from the first latch 81. Specifically, the lock control mechanism 7 for doors is maintained in a locked state. Thus, in a state in which none of the plates 87 faces the lever assembly 61, the door panels 13 can only slightly move in the door-opening direction as an initial operation and are maintained in a closed state.

[0029] As described above, the plurality of plates 87 are fixed to the hoistway and are respectively provided to the corresponding floors so as to function as the bodies to be detected, which constitute the lock control mechanism 7 for doors. The lever assembly 61 is provided so

as to be raised and lowered together with the car 5 and is moved by the presence of the plate 87, and hence functions as a movable body for performing switching between a locked state and an unlocked state of the door panels 13.

[0030] Next, the car-landing detection mechanism 9 is described. The car-landing detection mechanism 9 includes the plurality of plates 87 described above and at least one sensor 89. The sensor 89 is provided so as to be raised and lowered together with the car 5 and is fixed to the door beam 21 of the door device 15 in this embodiment. The sensor 89 is arranged so as to face a back surface 87b of the plate 87 when the car 5 lands on any one of the floors.

[0031] The sensor 89 detects the presence of the plates 87. In this embodiment, a photodetection sensor is used. The sensor is not limited to the photodetection sensor. Therefore, as another example, in the case where an erroneous operation caused due to external light is a concern in a hoistway having a see-through structure or the like, the use of a magnetic detection sensor is effective. The plates 87 are targets to be detected for both the sensor 89 and the lever assembly 61, and therefore constitute both the lock control mechanism 7 for doors and the car-landing detection mechanism 9. The plates 87 are connected to an elevator control panel 91. The result of detection is transmitted to the elevator control panel 91.

[0032] Next, the relationship between the car-landing detection mechanism and the lock control mechanism for doors is described. As illustrated in FIG. 2, the lock control mechanism 7 for doors and the car-landing detection mechanism 9 are arranged on the sides opposite to each other in a front-back direction of the plate 87 across a corresponding one of the plates 87 when the car 5 lands on any one of the floors. The lock control mechanism 7 for doors and the car-landing detection mechanism 9 are mounted to the same device among the devices constituting the car 5, specifically, are mounted to the door device 15. Further, the lever assembly 61 of the lock control mechanism 7 for doors and the at least one sensor 89 of the car-landing detection mechanism 9 are provided at the positions at the same height in a vertical direction and face each other.

[0033] An operation of the elevator device according to this embodiment, which is configured as described above, is described. When the car 5 lands on any one of the floors and hence the plate 87 faces the sensor 89 , the car-landing detection mechanism 9 approves the landing of the car. Based on the approval, control for opening the door panels 13 is performed. Whenever the plate 87 faces the sensor 89, the lever assembly 61 of the lock control mechanism 7 for doors similarly faces the plate 87. Therefore, when the door panels 13 are to be opened, the lock control mechanism 7 for doors is placed in the unlocked state. As a result, a final open state of the door panels 13 is obtained. Even when the door panels 13 are opened, for example, manually in case of emergency, the plate 87 faces both the sensor 89 and the lever assembly 61 as long as the car 5 lands on any one of the floors. Therefore, the unlocked state of the lock control mechanism 7 for doors is obtained. Thus, the door panels 13 can be opened. On the other hand, in a state in which the car 5 does not land on any of the floors, none of the plates 87 is present in front of the lever assembly 61. Therefore, the lock control mechanism 7 for doors is maintained in the locked state. Even if the door panels 13 are intended to be opened manually in case of emergency, the door panels 13 do not come into the final open state. In this manner, the door panels are prevented from unintentionally opened in a non-landing state.

[0034] As described above, according to the elevator device of this embodiment, the car-landing detection mechanism and the lock control mechanism for doors use the plurality of bodies to be detected, which are common thereto. In this manner, the number of components, which are provided in large number to each floor, is significantly reduced to facilitate space-saving. In addition, the car-landing detection and the lock control for doors are performed depending on their relationship with the single body to be detected. Therefore, the consistency between the determination of landing and the determination of lock release for doors is ensured to improve safety.

[0035] Moreover, the lock control mechanism for doors and the car-landing detection mechanism are provided on the sides opposite to each other in the front-back direction of the plate across the plate. Thus, the lock control mechanism for doors, the body to be detected, and the car-landing detection mechanism can be arranged in one row. Accordingly, the arrangement which allows the effective use of a space of a clearance between the car and the landing or the like can be realized. Also by the arrangement described above, the space-saving can be further facilitated.

[0036] Further, the lock control mechanism for doors and the car-landing detection mechanism are mounted to the same device among the devices constituting the car. Therefore, the positions of the movable body of the lock control mechanism for doors and the sensor of the car-landing detection mechanism can be determined at the time of shipping. At the time of installation, the positioning of the lock control mechanism for doors, the car-landing detection mechanism, and the bodies to be detected can be completed by simply adjusting the bodies to be detected provided in the hoistway. As a result, laborsaving can be achieved at the time of installation. In addition, a large part of the positional adjustment is ensured in a factory before the shipping, and therefore accuracy can be significantly improved. Further, the door device is often provided above the door panels and arranged above the doorway through which the passenger enters/exits. If the lock control mechanism for doors and the car-landing detection mechanism are both mounted to the door device as in this embodiment, even when the

car is inclined toward the landing, the degradation of landing accuracy can be minimized. In addition, by using the clearance between the front of the door device on the car side and the doors on the landing side, the space-saving can be realized.

[0037] The lever assembly of the lock control mechanism for doors and the at least one sensor of the car-landing detection mechanism are provided at the positions which are at the same height in the vertical direction. Therefore, a length of the plate corresponds to both a door lock-release range and a landing approval range. Thus, the door lock-release range and the landing approval range can be more reliably set identical with each other. Specifically, a problem of the presence of the range in which the doors can be opened even though the landing has not achieved can be prevented.

Second Embodiment

[0038] Next, referring to FIG. 5, a second embodiment of the present invention is described. FIG. 5 is a view for schematically illustrating a car-landing detection mechanism according to the second embodiment. In this embodiment, the car-landing detection mechanism of the first embodiment described above is configured as described below. The configuration of the remaining part is the same as that of the first embodiment. A car-landing detection mechanism 109 includes a plurality of plates 187 functioning as the bodies to be detected, and a pair of sensors 189a and 189b. Each of the plates 187 is provided integrally with the hoistway 3 and provided so as to face the lever assembly 61 and the sensors 189a and 189b when the car 5 lands on a corresponding floor. The sensors 189a and 189b are provided so as to be raised and lowered together with the car. In this embodiment, it is assumed that the lever assembly 61 and the sensors 189a and 189b are provided at the same height.

[0039] Each of the plates 187 includes a plurality of target portions to be detected, which respectively correspond to the sensors. Specifically, a first target portion 193a corresponding to the first sensor 189a and a second target portion 193b corresponding to the second sensor 189b are provided on a back surface 87b of the plate 187. An upper end 195a of the first target portion 193a is located at a position above an upper end 195b of the second target portion 193b, whereas a lower end 197a of the first target portion 193a is located at a position above a lower end 197b of the second target portion 193b. The car-landing detection mechanism 109 identifies a state in which at least one of the first target portion 193a and the second target portion 193b is detected, as a state in which the car is present within a range of landing.

[0040] According to the second embodiment, besides the advantages obtained in the first embodiment, the plurality of sensors have different detection timings in accordance with a direction in which the car is raised/lowered. Therefore, there is also provided an advantage in that the occurrence of a failure in the plurality of sensors and the identification of the failed sensor can bemonitored by using the difference in detection timing.

Third Embodiment

[0041] Next, referring to FIG. 6, a third embodiment of the present invention is described. FIG. 6 is a view for schematically illustrating a car-landing detection mechanism according to the third embodiment. In this embodiment, the car-landing detection mechanism of the first embodiment described above is configured as described below. The configuration of the remaining part is the same as that of the first embodiment. A car-landing detection mechanism 209 includes a plurality of plates 287 functioning as the bodies to be detected, and a pair of sensors 289a and 289b. Each of the plates 287 is provided integrally with the hoistway 3 and provided so as to face the lever assembly 61 and the sensors 289a and 289b when the car 5 lands on a corresponding floor. The sensors 289a and 289b are provided so as to be raised and lowered together with the car. In this embodiment, it is assumed that the lever assembly 61 and the sensors 289a and 289b are provided at the same height.

[0042] Each of the plates 287 includes a plurality of target portions to be detected, which respectively correspond to the sensors. Specifically, a first target portion 293a corresponding to the first sensor 289a and a second target portion 293b corresponding to the second sensor 289b are provided on a back surface 87b of the plate 287. An upper end 295a and a lower end 297a of the first target portion 293a are respectively aligned with an upper end 295b and a lower end 297b of the second target portion 293b in terms of the vertical position. In this embodiment, the upper end 295a of the first target portion 293a and the upper end 295b of the second target portion 293b both reach an upper end of the plate 287, whereas the lower end 297a of the first target portion 293a and the lower end 297b of the second target portion 293b both reach a lower end of the plate 287. The car-landing detection mechanism 209 identifies a state in which the first target portion 293a and the second target portion 293b are both detected, as a state in which the car is present within a range of landing.

[0043] According to the third embodiment, besides the advantages obtained in the first embodiment, the following advantages are provided. First, in a normal state, the detection timing is the same for the plurality of sensors. Therefore, by using the same detection timing, the occurrence of a failure in the plurality of sensors can be monitored. Further, even when, for example, one of the sensors is constantly placed in an ON state due to a failure, the presence of the car within the range of landing is not approve d as long as the same detection state is not obtained from the plurality of sensors. Therefore, the range of landing can be prevented from being erroneously approved as being larger than the correct range of landing based only on the detection state of the failed

sensor.

Fourth Embodiment

[0044] Next, referring to FIG. 7, a fourth embodiment of the present invention is described. FIG. 7 is a view for schematically illustrating a car-landing detection mechanism according to the fourth embodiment. In this embodiment, the car-landing detection mechanism of the first embodiment described above is configured as described below. The configuration of the remaining part is the same as that of the first embodiment. A car-landing detection mechanism 309 includes a plurality of plates 387 functioning as the bodies to be detected, and a pair of sensors 389a and 389b. Each of the plates 387 is provided integrally with the hoistway 3 and provided so as to face the lever assembly 61 and the sensors 389a and 389b when the car 5 lands on a corresponding floor. The sensors 389a and 389b are provided so as to be raised and lowered together with the car. In this embodiment, it is assumed that the lever assembly 61 and the sensors 389a and 389b are provided at the same height.

[0045] Each of the plates 387 includes a plurality of target portions to be detected, which respectively correspond to the sensors. Specifically, a first target portion 393a corresponding to the first sensor 389a and a second target portion 393b corresponding to the second sensor 389b are provided on a back surface 87b of the plate 387. Upper ends of the first target portion 393a and the second target portion 393b both reach an upper end of the plate 387, whereas lower ends of the first target portion 393a and the second target portion 393b both reach a lower end of the plate 387.

[0046] Different types of sensors are employed respectively for the sensors 389a and 389b. As an example, the first sensor 389a is a magnetic detection sensor, whereas the second sensor 389b is a reflected-light detection sensor. Correspondingly, the first target portion 393a is made from a magnet plate, whereas the second target portion 393b is made from a reflective plate which reflects, to the second sensor 398b as reflected light, light having a constant frequency emitted from the second sensor 389b.

[0047] According to the fourth embodiment, besides the advantages obtained in the first embodiment, the plurality of different types of sensors are provided so as to reduce the effects to be imparted simultaneously to the plurality of sensors under various installation environments. As a result, more stable landing detection can be ensured. The fourth embodiment may be carried out by configuring the plurality of sensors of the second or third embodiment with different types of sensors.

[0048] Although the contents of the present invention have been specifically described above referring to the preferred embodiments , it is apparent that those skilled in the art can use various modified modes based on the basic technical idea and teaching of the present invention.

Reference Signs List

[0049] 1 elevator device, 3 hoistway, 5 car, 7 lock control mechanism for doors, 9, 109, 209, 309 car-landing detection mechanism, 11 car main body, 13 door panel, 15 door device, 61 lever assembly (movable body), 87, 187, 287, 387 plate (body to be detected), 89, 189a, 189b, 289a, 289b, 389a, 389b sensor

Claims

1. An elevator device, comprising:

a car to be raised and lowered in a hoistway;
a lock control mechanism for doors; and
a car-landing detection mechanism,
the elevator device further comprising a plurality of bodies to be detected, which are respectively fixed to the hoistway and provided on corresponding floors,
the plurality of bodies to be detected constituting both the lock control mechanism for doors and the car-landing detection mechanism,
the lock control mechanism for doors comprising a movable body provided to be raised and lowered together with the car and moved due to presence of the plurality of bodies to be detected so as to perform switching between a locked state and an unlocked state of the doors,
the car-landing detection mechanism comprising at least one sensor provided to be raised and lowered together with the car, for detecting the presence of the plurality of bodies to be detected.

2. An elevator device according to claim 1, wherein:

the plurality of bodies to be detected comprise plate-like members; and
the lock control mechanism for doors and the car-landing detection mechanism are provided on sides opposite to each other in a front-back direction of the plurality of bodies to be detected across the plurality of bodies to be detected.

3. An elevator device according to claim 1 or 2, wherein the lock control mechanism for doors and the car-landing detection mechanism are mounted to the same device among devices constituting the car.

4. An elevator device according to claim 3, wherein:

the car comprises a car main body, door panels, and a door device for opening and closing the door panels; and
the lock control mechanism for doors and the car-landing detection mechanism are both

mounted to the door device.

5. An elevator device according to any one of claims 1 to 4, wherein the movable body of the lock control mechanism for doors and the at least one sensor of the car-landing detection mechanism are provided at positions at the same height in a vertical direction.

6. An elevator device according to any one of claims 1 to 5, wherein:

the car-landing detection mechanism comprises a plurality of the sensors;
each of the plurality of bodies to be detected comprises a plurality of target portions to be detected, which respectively correspond to the plurality of the sensors;
the plurality of target portions to be detected comprise a first target portion and a second target portion;
an upper end of the first target portion is located above an upper end of the second target portion, whereas a lower end of the first target portion is located above a lower end of the second target portion; and
the car-landing detection mechanism identifies a state in which at least one of the first target portion and the second target portion is detected, as a state in which the car is present within a range of landing.

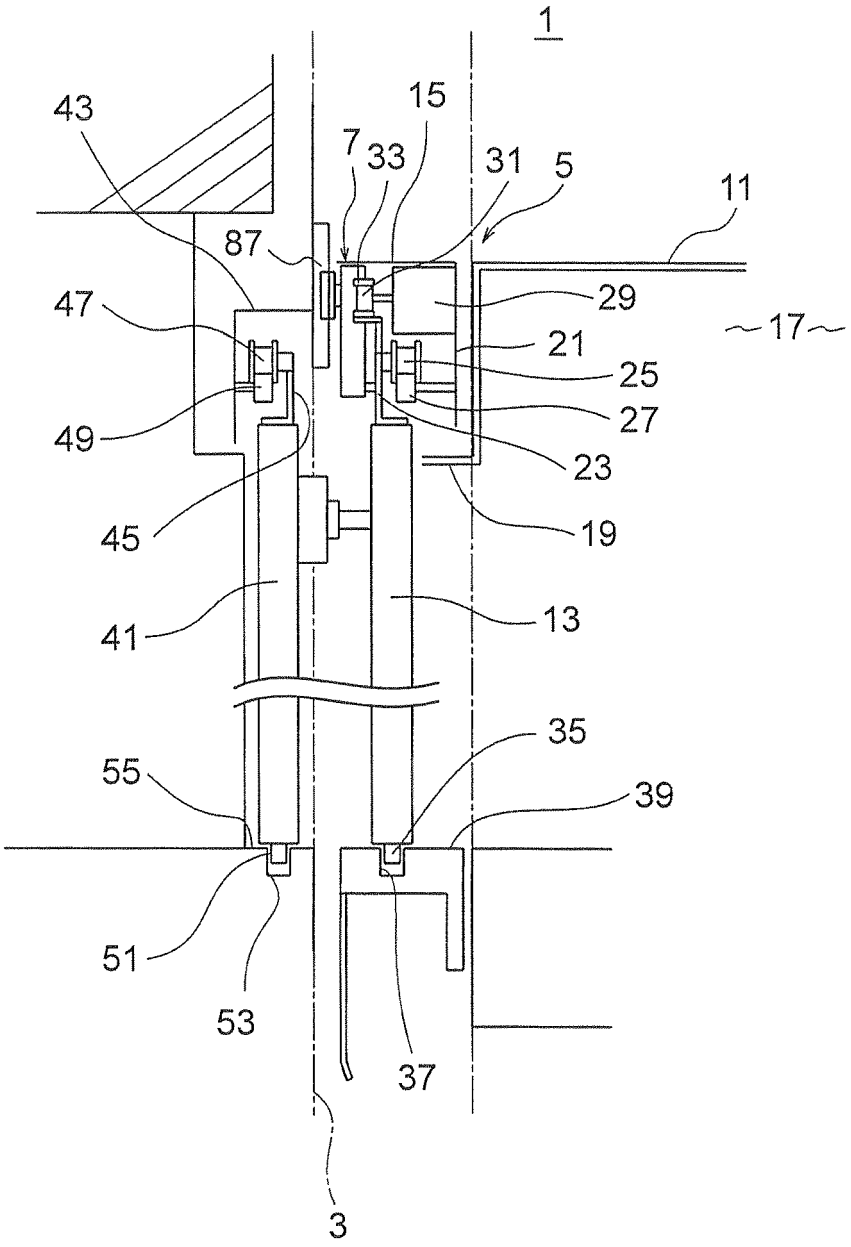
7. An elevator device according to any one of claims 1 to 5, wherein:

the car-landing detection mechanism comprises a plurality of the sensors;
each of the plurality of bodies to be detected comprises a plurality of target portions to be detected, which respectively correspond to the plurality of the sensors;
positions of upper ends of the plurality of target portions to be detected are aligned with each other, whereas positions of lower ends of the plurality of target portions to be detected are aligned with each other; and
the car-landing detection mechanism identifies a state in which the first target portion and the second target portion are both detected, as a state in which the car is present within a range of landing.

8. An elevator device according to any one of claims 1 to 7, wherein:

the car-landing detection mechanism comprises a plurality of the sensors;
each of the plurality of bodies to be detected comprises a plurality of target portions to be detected, which respectively correspond to the plurality of the sensors; and
the plurality of the sensors comprise sensors of types different from each other.

FIG. 1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39
51
53
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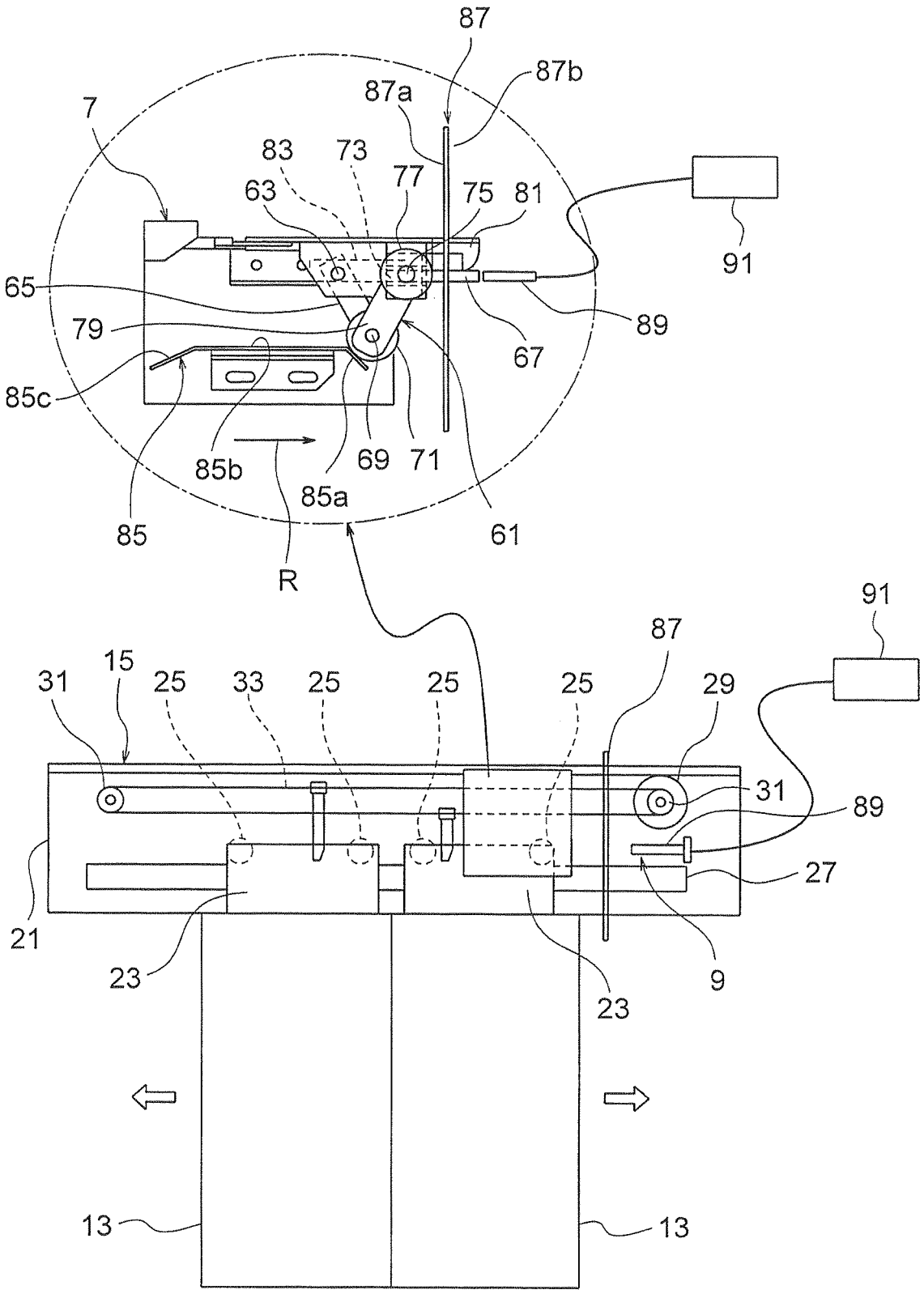
3

FIG. 2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71
85a
85
61
R
91
87
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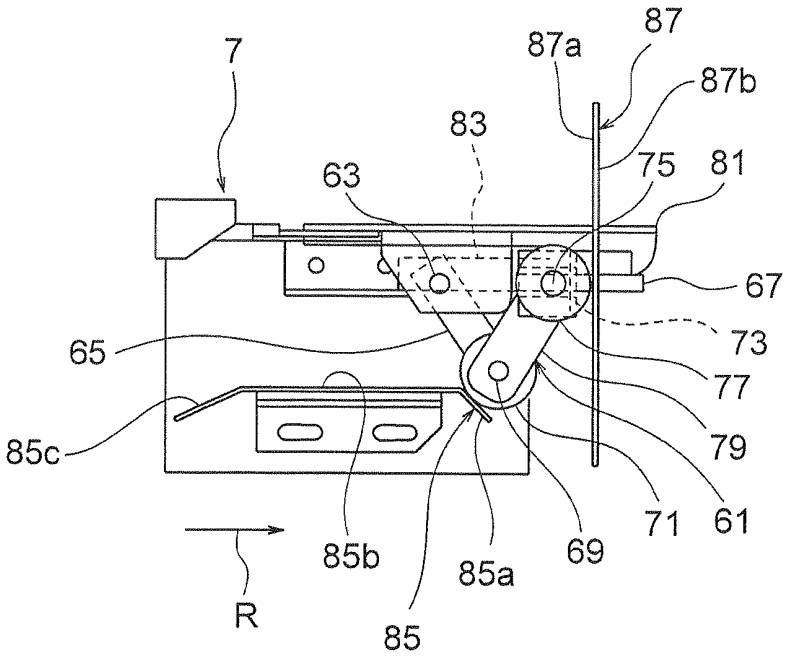
23
23
9
13
13

FIG. 3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87b
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73
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79
85c
71
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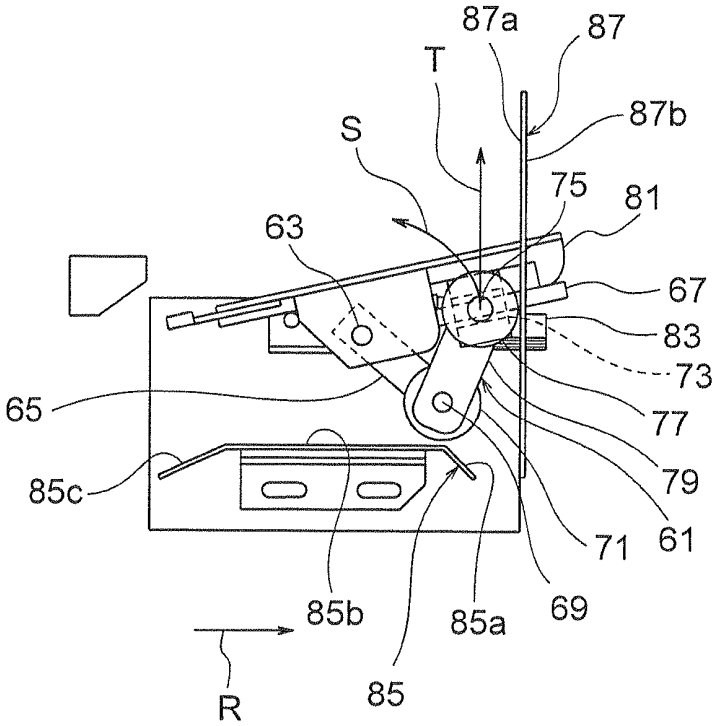
69
85b
85a
R
85

FIG. 4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87b
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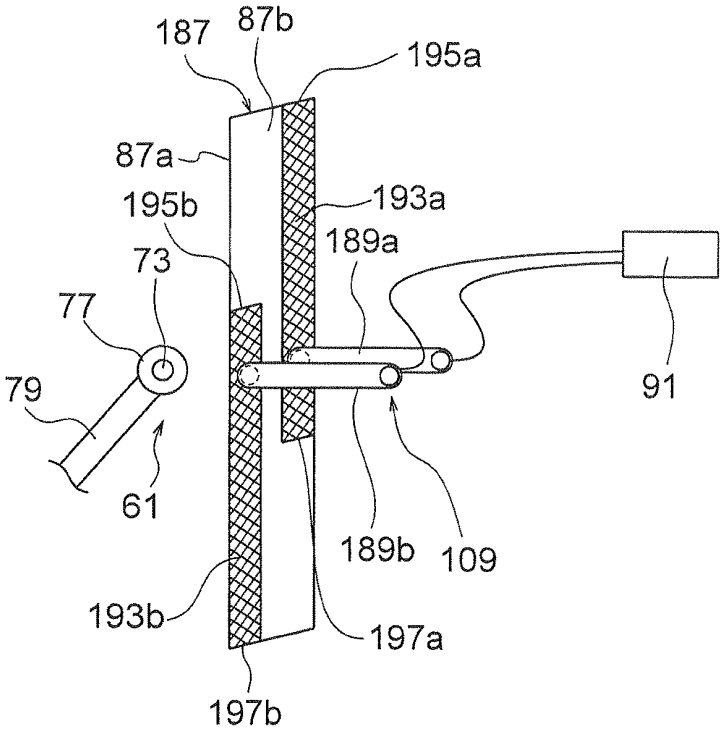
85b
85a
R
85

FIG. 5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189a
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193b
197a
197b

FIG. 6

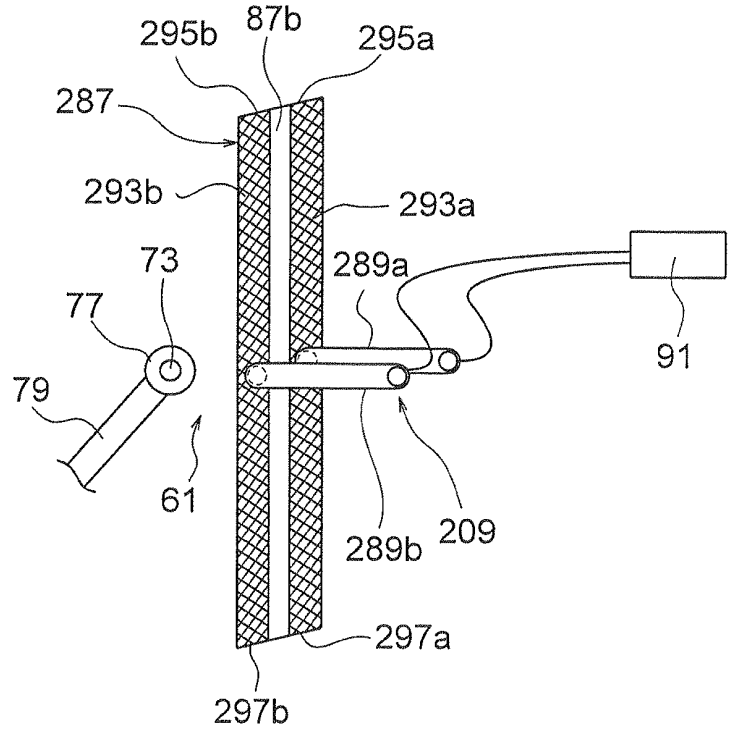
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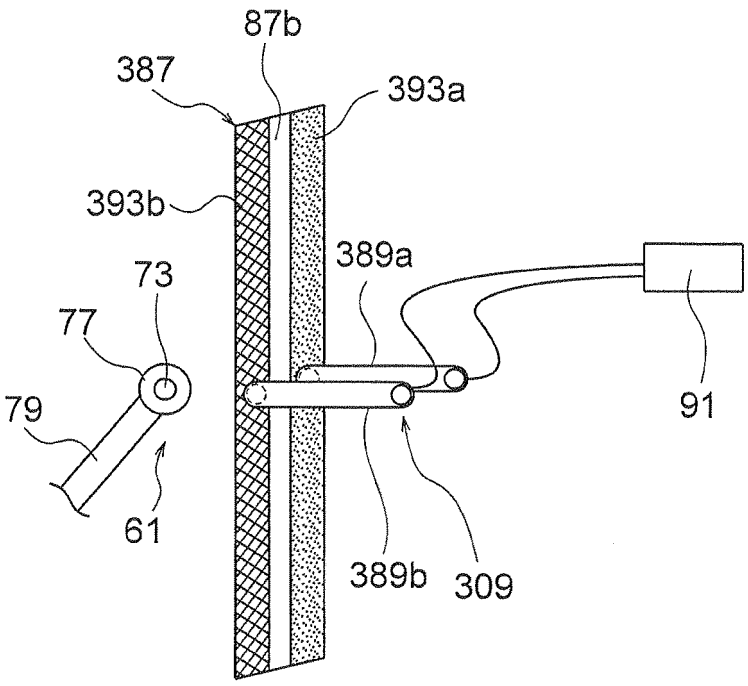
FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/064252

A. CLASSIFICATION OF SUBJECT MATTER
B66B13/18(2006.01)i, *B66B3/02*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B66B13/18, B66B3/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 4292207 B2 (Mitsubishi Electric Corp.), 08 July 2009 (08.07.2009), paragraphs [0012] to [0025]; fig. 1 to 15 & EP 1841682 A & WO 2006/080094 A1 & CN 101031497 A	1-8
A	JP 2003-118957 A (Mitsubishi Electric Building Techno-Service Co., Ltd.), 23 April 2003 (23.04.2003), paragraphs [0020] to [0032]; fig. 1, 3 (Family: none)	1-8
A	JP 4072188 B2 (Inventio AG.), 09 April 2008 (09.04.2008), entire text; all drawings & US 5844180 A & EP 751088 A1 & DE 59606480 D	1-8

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 January, 2011 (31.01.11)	08 February, 2011 (08.02.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/064252

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 02-075578 A (Toshiba Corp.), 15 March 1990 (15.03.1990), page 2, upper right column, line 4 to lower left column, line 13; fig. 1 to 10 (Family: none)	1-8
A	JP 2007-031084 A (Mitsubishi Electric Corp.), 08 February 2007 (08.02.2007), paragraphs [0008] to [0010]; fig. 1 to 2 (Family: none)	1-8

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002029668 A **[0003] [0006]**
- JP 2007320717 A **[0003] [0006]**
- JP 2008528399 A **[0004] [0006]**