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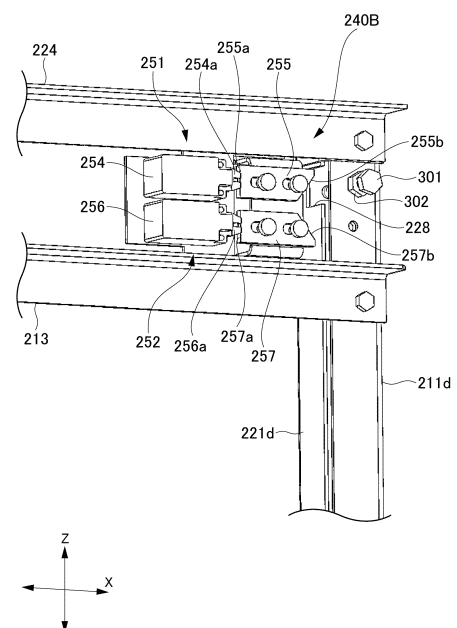
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(54) **HANDRAIL AND ELEVATOR**

(57) A plurality of support posts for a handrail are fixed to the upper section of an elevator car. A plurality of sliding posts are slidably engaged with each of the plurality of support posts and are capable of protruding further upward than the upper sections of the plurality of support posts. A rail section is fixed to the plurality of sliding posts. As a result of a first switch section and a second switch section interfering with a sliding post for switching which is one of the plurality of sliding posts, it becomes impossible to turn the first switch section and the second switch section on. When in an expanded state in which the plurality of sliding posts are extended out from the upper sections of the plurality of support posts, the first switch section interferes with the sliding post for switching, and interference between the second switch section and the sliding post for switching is avoided.

FIG. 4



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Description

Technical Field

[0001] The present invention relates to a handrail and an elevator including the handrail.

Background Art

[0002] When inspecting a device installed in a hoistway of an elevator, a worker may get on an upper section of an elevator car to perform work. Therefore, a handrail for ensuring the safety of the worker is provided on the upper section of the elevator car. The handrail provided on the upper section of the elevator car is described in Patent Literature 1, for example.

[0003] Patent Literature 1 discloses a car handrail that is foldably disposed on an upper section of a car of an elevator. The car handrail includes one side section and the other side section arranged along the car side section. One side section is fixed to one arm section arranged along one car side section, and the other side section is fixed to the other arm section arranged along the other car side section. In a state where the car handrail is folded, one side section is connected to the other arm section. As a result, a force generated when a door is opened and closed is received by both the one arm section and the other arm section.

Citation List

Patent Literature

[0004] Patent Literature 1: JP 2016-147727 A

Summary of Invention

Technical Problem

[0005] However, in the car handrail described in Patent Literature 1, it is difficult to secure a space in which a worker rides in the upper section of the elevator car when the car is assembled from the folded state. Therefore, it is necessary to perform the assembly work of the car handrail without getting on the upper section of the elevator car until the space for the worker to get on can be secured, and the assembly work is complicated.

[0006] In consideration of the above problems, an object of the present invention is to provide a handrail capable of easily performing assembly work at an upper section of an elevator car, and an elevator including the handrail.

Solution to Problem

[0007] In order to solve the above problems and achieve the present object, a handrail of the present invention includes a plurality of support posts, a plurality

of sliding posts, a rail section, a first switch section, and a second switch section. The plurality of support posts is fixed to an upper section of an elevator car. The plurality of sliding posts are slidably engaged with each of the plurality of support posts, and can protrude further upward than the upper sections of the plurality of supports. The rail section is fixed to the plurality of sliding posts. As a result of a first switch section and a second switch section interfering with a sliding post for switching which is one of the plurality of sliding posts, it becomes impossible to turn the first switch section and the second switch section on. When in an expanded state in which the plurality of sliding posts are extended out from the upper sections of the plurality of support posts, the first switch section interferes with the sliding post for switching, and interference between the second switch section and the sliding post for switching is avoided.

[0008] In addition, an elevator of the present invention includes an elevator car moving up and down in a hoistway, and a handrail provided on an upper section of the elevator car.

Advantageous Effects of Invention

[0009] According to the handrail having the above configuration, assembly work can be easily performed in the upper section of the elevator car.

Brief Description of Drawings

[0010]

Fig. 1 is a schematic configuration diagram illustrating an elevator according to one embodiment.

Fig. 2 is a perspective view illustrating a reduced state of a handrail according to one embodiment.

Fig. 3 is a perspective view illustrating an expanded state of the handrail according to one embodiment.

Fig. 4 is a perspective view illustrating a switch section of the handrail according to one embodiment.

Fig. 5 is an explanatory view illustrating ON/OFF of a switch unit in the reduced state of the handrail according to one embodiment.

Fig. 6 is an explanatory view illustrating ON/OFF of the switch unit during expansion of the handrail according to one embodiment.

Fig. 7 is an explanatory view illustrating ON/OFF of the switch unit in the expanded state of the handrail according to one embodiment.

Fig. 8 is an explanatory view illustrating ON/OFF of the switch unit during reduction of the handrail according to one embodiment.

Fig. 9 is a table illustrating ON/OFF patterns of the switch unit according to one embodiment and operation conditions of an elevator.

Fig. 10 is an enlarged perspective view illustrating a temporary fixing mechanism of the handrail according to one embodiment.

Fig. 11 is an explanatory view illustrating the temporary fixing mechanism in the reduced state of the handrail according to one embodiment.

Fig. 12 is an explanatory view illustrating a state in which a sliding post is temporarily fixed by the temporary fixing mechanism of the handrail according to one embodiment.

Fig. 13 is an enlarged perspective view illustrating a fixing mechanism of the handrail according to one embodiment.

Fig. 14 is an explanatory view illustrating a fixing work by the fixing mechanism of the handrail according to one embodiment.

Fig. 15 is an enlarged perspective view illustrating the fixing mechanism in the temporarily fixed state of the handrail according to one embodiment.

Fig. 16 is an enlarged perspective view illustrating the slide guide mechanism of the handrail according to one embodiment.

Description of Embodiments

[0011] Hereinafter, an elevator according to one embodiment will be described with reference to Figs. 1 to 16. In the drawings, the same members are denoted by the same reference numerals.

[Configuration of Elevator]

[0012] First, a configuration of an elevator according to one embodiment (hereinafter, referred to as "present example") of the present invention will be described with reference to Fig. 1.

[0013] Fig. 1 is a schematic configuration diagram illustrating a configuration example of an elevator of the present example.

[0014] As illustrated in Fig. 1, the elevator 1 of the present example moves up and down in a hoist-way 110 formed in a building structure. The elevator 1 includes an elevator car 120 on which people and luggage are loaded, a rope 130, a counterweight 140, and a hoisting machine 100. The hoist-way 110 is formed in a building structure, and a machine room 160 is provided at a top section of the hoist-way.

[0015] The hoisting machine 100 is disposed in the machine room 160 and raises and lowers the elevator car 120 by winding the rope 130. In addition, a deflector wheel 150 is provided in the vicinity of the hoisting machine 100. The rope 130 is mounted on the deflector wheel 150.

[0016] The counterweight 140 is set to have substantially the same mass as the mass of the elevator car 120 at the time of no load. Therefore, when no object or person is loaded in the elevator car 120, a tension ratio between the rope 130 on the elevator car 120 side and the rope 130 on the counterweight 140 side is 1. As a result, it is possible to suppress the output of the hoisting machine 100 at the time of no load.

[0017] The elevator car 120 is connected to the counterweight 140 via the rope 130 and moves up and down in the hoist-way 110. A handrail 200 is provided on an upper section of the elevator car 120. In the machine room 160, a control board 170 illustrating a specific example of a control section according to the present invention is disposed. The control board 170 controls driving of the hoisting machine 100 and controls the lifting/lowering operation of the elevator car 120.

[Configuration of Handrail]

[0018] Next, a configuration of the handrail 200 will be described with reference to Figs. 2 and 3.

[0019] Fig. 2 is a perspective view illustrating a reduced state of the handrail 200. Fig. 3 is a perspective view illustrating an expanded state of the handrail.

[0020] The handrail 200 installed on the upper section of the elevator car 120 (see Fig. 1) can be in the reduced state illustrated in Fig. 2 and the expanded state illustrated in Fig. 3. When the elevator 1 is normally operated, the handrail 200 is brought into the reduced state. As a result, the handrail 200 can be prevented from interfering with the machine room 160 of the hoist-way 110. Meanwhile, when the elevator 1 is maintained and inspected, the handrail 200 is brought into an expanded state. As a result, a worker can hold the handrail 200 when working in the upper section of the elevator car 120.

[0021] In Figs. 2 and 3, an X-axis direction indicates an entrance/exit direction of the elevator, a Y-axis direction indicates a width direction of an entrance of the elevator, and a Z-axis direction indicates a height direction of the elevator. The X-axis direction and the Y-axis direction correspond to horizontal biaxial directions which are two axial directions parallel to a horizontal plane, and the Z-axis direction corresponds to a vertical direction which is a direction orthogonal to the horizontal plane. In addition, the entrance/exit direction of the elevator corresponds to a depth direction when the hoist-way is viewed from the elevator landing, that is, the direction in which a person enters and exits, and the width direction of the entrance of the elevator corresponds to a direction in which a door of the elevator opens and closes.

[0022] The handrail 200 includes a support unit 201 fixed to an upper section of the elevator car 120 (see Fig. 1), and a first movable unit 202A and a second movable unit 202B movably connected to the support unit 201.

(Support Unit)

[0023] The support unit 201 includes six support posts 211a, 211b, 211c, 211d, 211e, and 211f, two reinforcing sections 212 and 213, and a reinforcing connection section 214 that connects the two reinforcing sections 212 and 213. The support unit 201 also includes a post connection section 215 that connects the support post 211a and the support post 211d.

[0024] The support posts 211a, 211b, and 211c are

arranged at appropriate intervals in the X-axis direction. The support posts 211d, 211e, and 211f are arranged at appropriate intervals in the X-axis direction. Hereinafter, a side of the support post 211b as viewed from the support post 211a is referred to as a back side in the X-axis direction, and a side opposite to the support post 211b as viewed from the support post 211a is referred to as a front side in the X-axis direction.

[0025] In the Y-axis direction, the support post 211a faces the support post 211d, the support post 211b faces the support post 211e, and the support post 211c faces the support post 211f. Hereinafter, a side of the support post 211d as viewed from the support post 211a is defined as a right side in the Y-axis direction, and a side opposite to the support post 211d as viewed from the support post 211a is defined as a left side in the Y-axis direction.

[0026] Each of the support posts 211a to 211f is formed in a rectangular cylindrical shape. One of the four side surfaces of each of the support posts 211a to 211f is opened, and a cross section thereof parallel to the horizontal plane is formed in a substantially C shape. The opening surfaces of the support posts 211a to 211f face the back side in the X-axis direction.

[0027] The support posts 211a to 211f extend along the Z-axis direction. A fixing member 217 is provided at a lower section which is one end of each of the support posts 211a to 211f in the Z-axis direction. The fixing member 217 of each of the support posts 211b, 211c, 211e, and 211f is fixed to the upper section of the elevator car 120.

[0028] A reinforcing base 218 is attached to each of the fixing members 217 of the support posts 211a and 211d. The reinforcing base 218 is formed of a plate body bent in a substantially L shape. The reinforcing base 218 includes a mounting plate section having a plane substantially perpendicular to the Y-axis direction and a reinforcement plate section having a plane substantially perpendicular to the X-axis direction.

[0029] The fixing members 217 of the support posts 211a and 211d are fixed to the upper section of the elevator car 120 via the post connection section 215. The post connection section 215 is formed of a rectangular plate body elongated in the Y-axis direction and a side piece rising substantially perpendicularly from a long side of the plate body. The support posts 211a and 211d are integrally assembled using the post connection section 215.

[0030] A switch unit 240A is attached to the support post 211a. The switch unit 240A detects the position of the first movable unit 202A in the Z-axis direction. The switch unit 240B is attached to the support post 211d. The switch unit 240B detects the position of the second movable unit 202B in the Z-axis direction. Configurations of the switch units 240A and 240B will be described later with reference to Fig. 4.

[0031] The support post 211b is provided with a temporary fixing mechanism 270A. The support post 211e

is provided with a temporary fixing mechanism 270B. The temporary fixing mechanisms 270A and 270B respectively instruct sliding posts 221b and 221e to be described later at predetermined positions. Accordingly, the first movable unit 202A and the second movable unit 202B are held at the temporary fixing positions. The configurations of the temporary fixing mechanisms 270A and 270B will be described later with reference to Figs. 10 to 12.

[0032] The reinforcing sections 212 and 213 are formed in an elongated shape extending in the X-axis direction. The reinforcing section 212 is fixed to an intermediate portion of each of the support posts 211a, 211b, and 211c in the Z-axis direction. One end portion of the reinforcing section 212 in the X-axis direction is fixed to the support post 211a. The reinforcing section 213 is fixed to an intermediate portion of each of the support posts 211c, 211d, and 211f in the Z-axis direction. One end portion of the reinforcing section 213 in the X-axis direction is fixed to the support post 211c.

[0033] The reinforcing connection section 214 is formed in an elongated shape extending in the Y-axis direction. Both end portions of the reinforcing connection section 214 in the Y-axis direction are respectively connected to the other end portions of the reinforcing sections 212 and 213 in the X-axis direction.

(Movable Unit)

[0034] The first movable unit 202A is movably connected to the support posts 211a, 211b, and 211c of the support unit 201. As illustrated in Fig. 3, the first movable unit 202A includes sliding posts 221a, 221b, and 221c, a side rail section 222, and a back rail section 223.

[0035] The sliding posts 221a, 221b, and 221c are slidably connected to the insides of the support posts 211a, 211b, and 211c. As a result, the sliding posts 221a, 221b, 221c move in the Z-axis direction along support posts 211a, 211b, 211c.

[0036] In the reduced state of the handrail 200, the sliding posts 221a, 221b, and 221c are retracted into the support posts 211a, 211b, and 211c. Meanwhile, in the expanded state of the handrail 200, the sliding posts 221a, 221b, and 221c are extended out from the upper sections of the support posts 211a, 211b, and 211c.

[0037] The sliding posts 221a, 221b, and 221c are formed in a rectangular cylindrical shape smaller than the support post 211a. One of the four side surfaces of each of the sliding posts 221a, 221b, and 221c is opened, and the cross section thereof parallel to the horizontal plane is formed in a substantially C shape. Opening surfaces of the sliding posts 221a, 221b, and 221c face the right side in the Y-axis direction.

[0038] The side rail section 222 is fixed to the upper sections of the sliding posts 221a, 221b, and 221c. The side rail section 222 is formed in an elongated shape extending in the X-axis direction. The upper surface of the side rail section 222 is formed in a plane substantially

perpendicular to the Z-axis direction. The upper surface of the side rail section 222 is set at substantially the same height as the upper ends of the sliding posts 221a, 221b, and 221c. The side rail section 222 faces the reinforcing section 212 of the support unit 201 in the Z-axis direction.

[0039] The back rail section 223 is connected to a back end portion of the side rail section 222 in the X-axis direction. As a result, the back rail section 223 moves in the Z-axis direction together with the side rail section 222. The back rail section 223 is formed in an elongated shape extending in the Y-axis direction. The upper surface of the back rail section 223 is formed in a plane substantially perpendicular to the Z-axis direction. The upper surface of the back rail section 223 is set at substantially the same height as the upper surface of the side rail section 222.

[0040] The back rail section 223 faces the reinforcing connection section 214 of the support unit 201 in the Z-axis direction. The length of the back rail section 223 in the Y-axis direction is set to about 1/2 of the length of the reinforcing connection section 214 in the Y-axis direction. The back rail section 223 has a stopper piece 223a. In the reduced state of the handrail 200, the stopper piece 223a abuts on the upper surface of the reinforcing connection section 214. In the expanded state of the handrail 200, the side rail section 222 and the back rail section 223 are disposed at a predetermined height at which the worker can easily hold.

[0041] The second movable unit 202B is formed to be bilaterally symmetrical with the first movable unit 202A. That is, the second movable unit 202B includes sliding posts 221d, 221e, and 221f, a side rail section 224, and a back rail section 225. The second movable unit 202B is movably connected to the support posts 211d, 211e, and 211f of the support unit 201.

[0042] The sliding posts 221d, 221e, and 221f are slidably connected to the insides of the support posts 211d, 211e, and 211f. As a result, the sliding posts 221d, 221e, and 221f move in the Z-axis direction along the support posts 211d, 211e, and 211f. The opening surfaces of the sliding posts 221d, 221e, and 221f face the left side in the Y-axis direction.

[0043] In the reduced state of the handrail 200, the sliding posts 221d, 221e, and 221f are retracted into the support posts 211d, 211e, and 211f. Meanwhile, in the expanded state of the handrail 200, the sliding posts 221d, 221e, and 221f are extended out from the upper sections of the support posts 211d, 211e, and 211f.

[0044] The side rail section 224 faces the reinforcing section 213 of the support unit 201 in the Z-axis direction. The back rail section 225 moves in the Z-axis direction together with the side rail section 224. The back rail section 225 faces the reinforcing connection section 214 of the support unit 201 in the Z-axis direction. The length of the back rail section 225 in the Y-axis direction is set to about 1/2 of the length of the reinforcing connection section 214 in the Y-axis direction.

[0045] In the reduced state of the handrail 200, the stopper piece (not illustrated) of the back rail section 225

abuts on the upper surface of the reinforcing connection section 214. In the reduced state and the expanded state of the handrail 200, the back rail section 225 faces the back rail section 223. That is, the end surface on the left side in the Y-axis direction of the back rail section 225 faces the end surface on the right side in the Y-axis direction of the back rail section 223.

[0046] In the reduced state and the expanded state of the handrail 200, the side rail section 224 and the back rail section 225 are disposed at the same height as the side rail section 222 and the back rail section 223 of the first movable unit 202A.

[0047] As illustrated in Fig. 2, in the reduced state of the handrail 200, the upper ends of the sliding posts 221a to 221f in the first movable unit 202A and the second movable unit 202B are substantially at the same height as the upper ends of the support posts 211a to 211f in the support unit 201. In the reduced state of the handrail 200, the first movable unit 202A and the second movable unit 202B are fixed to the support unit 201 using a fixing mechanism 300 to be described later.

[0048] To switch the handrail 200 from the reduced state to the expanded state, the first movable unit 202A and the second movable unit 202B are moved in the Z-axis direction (upward), and the side rail sections 222 and 224 and the back rail sections 223 and 225 are disposed at a predetermined height. Next, the first movable unit 202A and the second movable unit 202B are fixed to the support unit 201 by using the fixing mechanism 300 to be described later. As a result, the handrail 200 is in the expanded state illustrated in Fig. 3.

(Switch Unit)

[0049] Next, configurations of the switch units 240A and 240B will be described with reference to Fig. 4.

[0050] Fig. 4 is a perspective view illustrating the switch unit 240B of the handrail 200.

[0051] The switch units 240A and 240B have the same configuration. Therefore, here, the configuration of the switch section according to the present invention will be described by taking the switch unit 240B as an example.

[0052] As illustrated in Fig. 4, the switch unit 240B includes a first switch 251 section and a second switch section 252. The first switch section 251 and the second switch section 252 are attached to a switch base 219 provided on the support post 211d. The first switch 251 section is disposed above the second switch section 252.

[0053] The first switch section 251 includes a normal switch 254 and a first actuator 255. The normal switch 254 and the first actuator 255 face each other in the X-axis direction. The side of the first actuator 255 opposite to the normal switch 254 faces the sliding post 221d. An actuator (not illustrated) of the switch unit 240A faces the sliding post 221a. The sliding posts 221a and 221d correspond to the sliding posts for switching according to the present invention.

[0054] The second switch section 252 includes a main-

tenance switch 256 and a second actuator 257. The maintenance switch 256 and the second actuator 257 face each other in the X-axis direction. The side of the second actuator 257 opposite to the maintenance switch 256 faces the sliding post 221d. The normal switch 254 and the maintenance switch 256 face each other in the Z-axis direction. The first actuators 255 and 257 face each other in the Z-axis direction.

[0055] The normal switch 254 and the maintenance switch 256 are fixed to the switch base 219. The normal switch 254 and the maintenance switch 256 are so-called momentary switches. The normal switch 254 and the maintenance switch 256 are turned off when buttons 254a and 256a are pressed, and are turned on when buttons 254a and 256a are not pressed.

[0056] The first actuator 255 is formed of a rectangular plate body elongated in the X-axis direction. An end surface 255a of the first actuator 255 on the side of the normal switch 254 faces the button 254a of the normal switch 254 in the X-axis direction. An inclined surface 255b facing downward is formed on the opposite side of the first actuator 255 from the normal switch 254. The inclined surface 255b faces the sliding post 221d via the opening surface of the support post 211d.

[0057] The switch base 219 supports the first actuator 255 so as to be movable in the X-axis direction. The first actuator 255 is movable to a first position at which the first actuator does not interfere with the sliding post 221d and a second position on the front side (sliding post 221d) in the X-axis direction with respect to the first position.

[0058] When the first actuator 255 is disposed at the first position, the end surface 255a of the first actuator 255 presses the button 254a of the normal switch 254. As a result, the normal switch 254 is turned off. Meanwhile, when the first actuator 255 is disposed at the second position, the end surface 255a of the first actuator 255 does not press the button 254a of the normal switch 254. As a result, the normal switch 254 is turned on.

[0059] The second actuator 257 is formed of a rectangular plate body elongated in the X-axis direction. The end surface 257a of the second actuator 257 on the maintenance switch 256 side faces the button 256a of the maintenance switch 256 in the X-axis direction. An inclined surface 257b facing upward is formed on the side of the second actuator 257 opposite to the maintenance switch 256. The inclined surface 257b faces the sliding post 221d via the opening surface of the support post 211d.

[0060] The switch base 219 supports the second actuator 257 so as to be movable in the X-axis direction. The second actuator 257 is movable to a first position at which the second actuator does not interfere with the sliding post 221d and a second position on the front side (sliding post 221d) in the X-axis direction with respect to the first position.

[0061] When the second actuator 257 is disposed at the first position, the end surface 257a of the second actuator 257 presses the button 256a of the maintenance

switch 256. As a result, the maintenance switch 256 is turned off. Meanwhile, when the second actuator 257 is disposed at the second position, the end surface 257a of the second actuator 257 does not press the button 256a of the maintenance switch 256. As a result, the maintenance switch 256 is turned on.

[0062] As illustrated in Fig. 4, the sliding post 221d has a notch 228. The notch 228 is provided on a side piece of the sliding post 221d exposed from the opening surface of the support post 211d. The notch is formed in a quadrangular shape larger than the side section where the inclined surface 255b of the first actuator 255 is formed.

[0063] In the reduced state of the handrail 200, the notch 228 faces the inclined surface 255b of the first actuator 255. As a result, the first actuator 255 does not interfere with the sliding post 221d and can be disposed at the second position. Meanwhile, when the notch 228 does not face the inclined surface 255b of the first actuator 255, the first actuator 255 interferes with the sliding post 221d. As a result, the first actuator 255 cannot be disposed at the second position.

(Switch Section in Reduced State of Handrail)

[0064] Next, the switch unit 240B in the reduced state of the handrail 200 will be described with reference to Fig. 5.

[0065] Fig. 5 is an explanatory view illustrating ON/OFF of the switch section in the reduced state of the handrail 200.

[0066] When the elevator 1 is normally operated, the handrail 200 is brought into the reduced state. As illustrated in Fig. 5, in the reduced state of the handrail 200, the handrail faces the notch 228 of the sliding post 221d. Therefore, the first actuator 255 of the first switch section 251 can be disposed at the second position. Meanwhile, since the second actuator 257 of the second switch section 252 interferes with the sliding post 221d, the second actuator cannot be disposed at the second position.

[0067] When the handrail 200 is brought into the reduced state, the first actuator 255 is disposed at the second position. Accordingly, the first actuator 255 does not press the button 254a of the normal switch 254. As a result, the normal switch 254 is turned on. Meanwhile, since the second actuator 257 cannot be disposed at the second position, the button 256a of the maintenance switch 256 is pressed. As a result, the maintenance switch 256 cannot be turned on. Therefore, the maintenance switch 256 is turned off.

(Switch Section During Expansion of Handrail)

[0068] Next, the switch unit 240B during expansion of the handrail 200 will be described with reference to Figs. 6A and 6B.

[0069] Figs. 6A and 6B are explanatory views illustrating ON/OFF of the switch unit 240B during the expansion of the handrail 200.

[0070] When the elevator 1 is maintained and inspected, the handrail 200 is shifted from the reduced state to the expanded state. In order to put the handrail 200 in the expanded state, the first movable unit 202A and the second movable unit 202B (see Fig. 2) are raised.

[0071] When the second movable unit 202B is raised, the sliding posts 221d to 221f move upward in the Z-axis direction along the support posts 211d to 211f. In this case, as illustrated in Fig. 6A, the lower end of the notch 288 in the sliding post 221d presses the inclined surface 255b of the first actuator 255. As a result, the first actuator 255 moves in a direction (toward the back side in the X-axis direction) approaching the normal switch 254.

[0072] When the sliding posts 221d to 221f further move upward in the Z-axis direction, as illustrated in Fig. 6B, the notch 288 of the sliding post 221d is located above the first actuator 255, and the distal end of the first actuator 255 on the inclined surface 255b side comes into contact with the side surface of the sliding post 221d. As a result, the first actuator 255 is disposed at the first position and presses the button 254a of the normal switch 254. As a result, the normal switch 254 is turned off.

[0073] As illustrated in Figs. 6A and 6B, while the sliding post 221d moves upward, the distal end of the second actuator 257 on the inclined surface 257b side is always in contact with the side surface of the sliding post 221d. As a result, the second actuator 257 does not move from the first position and maintains the state of pressing the button 256a of the maintenance switch 256. As a result, maintenance switch 256 does not change from OFF.

(Switch Section in Expanded State of Handrail)

[0074] Next, the switch unit 240B in the reduced state of the handrail 200 will be described with reference to Figs. 7A and 7B.

[0075] Figs. 7A and 7B are explanatory views illustrating ON/OFF of the switch unit 240B in the expanded state of the handrail 200.

[0076] When the handrail 200 is brought into the expanded state, as illustrated in Fig. 7A, the lower end of the sliding post 221d is positioned above the second actuator 257 of the second switch section 252. As a result, the second actuator 257 of the second switch section 252 does not interfere with the sliding post 221d and can be disposed at the second position. Meanwhile, the first actuator 255 of the first switch section 251 cannot be disposed at the second position because the first actuator interferes with the sliding post 221d.

[0077] When the handrail 200 is brought into the expanded state, the second actuator 257 is disposed at the second position as illustrated in Fig. 7B. As a result, the second actuator 257 does not press the button 256a of the maintenance switch 256. As a result, the maintenance switch 256 is turned on. Meanwhile, since the first actuator 255 cannot be disposed at the second position, the first actuator presses the button 254a of the normal switch 254. As a result, the normal switch 254 cannot be

turned on. Therefore, the normal switch 254 is turned off.

(Switch Section During Reduction of Handrail)

[0078] Next, the switch unit 240B during the reduction of the handrail 200 will be described with reference to Figs. 8A and 8B.

[0079] Figs. 8A and 8B are explanatory views illustrating ON/OFF of the switch unit 240B during contraction of the handrail 200.

[0080] When the elevator 1 is normally operated after the maintenance and inspection of the elevator 1, the handrail 200 is shifted from the expanded state to the reduced state. In order to put the handrail 200 in the reduced state, the first movable unit 202A and the second movable unit 202B (see Fig. 2) are lowered.

[0081] When the second movable unit 202B is lowered, the sliding posts 221d to 221f move downward in the Z-axis direction along the support posts 211d to 211f. In this case, as illustrated in Fig. 8A, the lower end of the sliding post 221d presses the inclined surface 257b of the second actuator 257. As a result, the second actuator 257 moves in a direction (toward the back side in the X-axis direction) approaching the maintenance switch 256.

[0082] When the sliding posts 221d to 221f further move downward in the Z-axis direction, as illustrated in Fig. 8B, the lower end of the sliding post 221d is positioned below the second actuator 257, and the distal end of the second actuator 257 on the inclined surface 257b side comes into contact with the side surface of the sliding post 221d. As a result, the second actuator 257 is disposed at the first position and presses the button 256a of the maintenance switch 256. As a result, the maintenance switch 256 is turned off.

[0083] As illustrated in Figs. 8A and 8B, while the sliding post 221d moves downward, the distal end of the first actuator 255 on the inclined surface 255b side is always in contact with the side surface of the sliding post 221d. As a result, the first actuator 255 does not move from the first position and maintains the state of pressing the button 254a of the normal switch 254. As a result, the normal switch 254 does not change from OFF.

(ON/OFF Pattern of Switch Unit and Operation Condition of Elevator)

[0084] Next, an ON/OFF pattern of the switch unit 240B and an operation condition of the elevator 1 will be described with reference to Fig. 9.

[0085] Fig. 9 is a table illustrating ON/OFF patterns of the switch unit 240B and operation conditions of the elevator 1.

[0086] As illustrated in Fig. 9, when the normal switch 254 is ON and the maintenance switch 256 is OFF, the handrail 200 is in a reduced state (see Fig. 5). Therefore, the control board 170 (see Fig. 1) enables normal operation of the elevator 1. Meanwhile, when the normal switch 254 is OFF and the maintenance switch 256 is

ON, the handrail 200 is in the expanded state (see Fig. 7B). Therefore, the control board 170 enables a maintenance operation of the elevator 1.

[0087] When the normal switch 254 and the maintenance switch 256 are ON, the control board 170 disables the operation of the elevator 1. As illustrated in Figs. 5 to 8, a situation in which the normal switch 254 and the maintenance switch 256 are turned on together cannot normally occur. Therefore, the control board 170 detects that an abnormality has occurred in the handrail 200 or the switch units 240A and 240B. Then, the control board 170 notifies that an abnormality has occurred. Examples of occurrence of abnormality include lighting of a lamp, output of a buzzer, and display by a video, an image, or the like.

[0088] When the normal switch 254 and the maintenance switch 256 are OFF, the control board 170 disables the operation of the elevator 1. As illustrated in Figs. 6B and 7A, during expansion or reduction of the handrail 200, the normal switch 254 and the maintenance switch 256 may be turned off together. The handrail 200 at this time is neither in the reduced state nor in the expanded state. Therefore, the control board 170 determines that the handrail 200 is expanding or reducing, and disables the operation of the elevator 1.

(Temporary Fixing Mechanism)

[0089] Next, configurations of the temporary fixing mechanisms 270A and 270B will be described with reference to Figs. 10 to 12.

[0090] Fig. 10 is an enlarged perspective view illustrating the temporary fixing mechanism 270B. Fig. 11 is an explanatory view illustrating the temporary fixing mechanism 270B in the reduced state of the handrail 200. Fig. 12 is an explanatory view illustrating a state in which the sliding post 221e is temporarily fixed by the temporary fixing mechanism 270B of the handrail 200.

[0091] The temporary fixing mechanisms 270A and 270B have the same configuration. Therefore, here, the configuration of the temporary fixing mechanism according to the present invention will be described by taking the temporary fixing mechanism 270B as an example.

[0092] As illustrated in Fig. 10, the temporary fixing mechanism 270B includes a stopper 281 and a shaft section 282 that rotatably supports the stopper 281. The stopper 281 includes a base section 285 and a hook section 286 continuous with the base section 285. The shaft section 282 is fixed to a hook base 220 provided on the support post 211e.

[0093] The base section 285 is formed of a substantially rectangular plate body. The hook section 286 protrudes from one long side of the base section 285. The hook section 286 is formed of a plate body having a substantially L-shaped planar shape. The hook section 286 faces the sliding post 221e via the opening surface of the support post 211e (see Fig. 11).

[0094] The shaft section 282 passes through the upper

side of the base section 285 above the hook section 286. The stopper 281 is stabilized in a posture in which two long sides of the base section 285 are substantially parallel to the Z-axis direction by its own weight. In the reduced state of the handrail 200, the hook section 286 abuts on the side surface of the sliding post 221e before the two long sides of the base section 285 become substantially parallel to the Z-axis direction. As a result, the stopper 281 is leaned against the side surface of the sliding post 221e in a posture in which the two long sides of the base section 285 are inclined with respect to the Z-axis direction.

[0095] As illustrated in Fig. 11, in the reduced state of the handrail 200, the hook section 286 of the stopper 281 abuts on the side surface of the sliding post 221e. When the second movable unit 202B is raised in a case where the handrail 200 is switched from the reduced state to the expanded state, the sliding post 221e moves upward in the Z-axis direction along the support post 211e while being in contact with the hook section 286.

[0096] As illustrated in Fig. 12, when the lower end of sliding post 221e moving upward in the Z-axis direction is located above the hook section 286, the hook section 286 rotates by its own weight to take a stable posture. Accordingly, the hook section 286 supports the lower end of the sliding post 221e. As a result, the second movable unit 202B is temporarily fixed.

[0097] To release the temporary fixing of the second movable unit 202B, the sliding post 221e is moved further upward than the temporarily fixed position. As a result, the hook section 286 and the sliding post 221e are disengaged. Next, the stopper 281 is rotated to separate the hook section 286 from the sliding post 221e. As a result, the temporary fixing of the second movable unit 202B is released.

[0098] When the temporary fixing of the second movable unit 202B is released, the stopper 281 may be rotated until the hook section 286 is positioned above the shaft section 282 to bring the base section 285 into contact with the side surface of the sliding post 221e. As a result, the stopper 281 cannot return to a stable posture due to its own weight, and the hand can be released from the stopper 281 when the sliding post 221e is moved downward. In addition, a protrusion section may be provided on the side surface of the sliding post 221e, and the sliding post 221e may be brought into contact with the base section 285 when moving downward. As a result, the stopper 281 rotates, and the state can be returned to the state (the state illustrated in Fig. 10) where the hook section 286 is in contact with the side surface of the sliding post 221e below the shaft section 282.

(Fixing Mechanism)

[0099] Next, a configuration of the fixing mechanism 300 will be described with reference to Fig. 13.

[0100] Fig. 13 is an enlarged perspective view illustrating the fixing mechanism 300.

[0101] One fixing mechanism 300 is provided for each pair of the support post and the sliding post. That is, the handrail 200 includes six fixing mechanisms 300. Here, the fixing mechanism 300 provided in a set of the support post 211d and the sliding post 221d will be described as an example.

[0102] As illustrated in Fig. 13, the fixing mechanism 300 includes a bolt 301, a welding nut 302 to which the bolt 301 is screwed, and a fitting section 303 to which a tip portion of the bolt 301 is fitted. The bolt 301 and the welding nut 302 are attached to the support post 211d. The fitting section 303 is attached to the sliding post 221d.

[0103] As illustrated in Fig. 13, the support post 211d includes a left plate 401 forming a left side surface in the Y-axis direction, a right plate 402 forming a right side surface in the Y-axis direction, and a front plate 403 forming a front side surface in the X-axis direction. The sliding post 221d includes a right plate 412 forming a right side surface in the Y-axis direction, a front plate 413 forming a front side surface in the X-axis direction, and a back plate 414 forming a back side surface in the X-axis direction.

[0104] The welding nut 302 is welded to the left plate 401 of the support post 211d. The bolt 301 is screwed into the welding nut 302 and passes through the left plate 401 of the support post 211d. A head section of the bolt 301 is disposed outside the support post 211d. The tip portion of the bolt 301 on the side opposite to the head section is disposed inside the support post 211d and faces the right plate 412 of the sliding post 221d.

[0105] The fitting section 303 is fixed to the right plate 412 of the sliding post 221d. The fitting section 303 is formed of a quadrangular plate body. One plane of the fitting section 303 abuts on the inner surface of the right plate 412. The fitting section 303 has a bolt fitting hole 303a (see Fig. 15) into which the tip portion of the bolt 301 is fitted. The diameter of the bolt fitting hole 303a is slightly larger than the diameter of the tip portion of the bolt 301.

(Fixing Work by Fixing Mechanism)

[0106] Next, the fixing work by the fixing mechanism 300 will be described with reference to Figs. 14 and 15.

[0107] Fig. 14A is a view illustrating a state in which the second movable unit 202B is fixed by the fixing mechanism 300 in the reduced state of the handrail 200. Fig. 14B is a view illustrating a state in which the fixing of the second movable unit 202B by the fixing mechanism 300 is released. Fig. 14C is a view illustrating a state in which the second movable unit 202B is fixed by the fixing mechanism 300 in the expanded state of the handrail 200. Fig. 15 is an enlarged perspective view illustrating the fixing mechanism 300 in the temporarily fixed state of the handrail 200.

[0108] First, the fixing of the second movable unit 202B in the reduced state of the handrail 200 will be described. As illustrated in Fig. 14A, in the reduced state of the hand-

rail 200, the tip portion of the bolt 301 in the fixing mechanism 300 is pressed against the right plate 412 of the sliding post 221d. As a result, the sliding post 221d (second movable unit 202B) is locked to move in the Z-axis direction. As a result, in the reduced state of the handrail 200, the sliding post 221d (second movable unit 202B) is fixed.

[0109] When the handrail 200 is shifted from the reduced state to the expanded state, as illustrated in Fig. 14B, the pressing of the fixing mechanism 300 against the sliding post 221d by the bolt 301 is loosened. Accordingly, the sliding post 221d (second movable unit 202B) can move in the Z-axis direction. Since the bolt 301 is screwed into the welding nut 302, the pressing can be loosened without being detached from the support post 211d. Then, the sliding post 221d (second movable unit 202B) is moved upward in the Z-axis direction.

[0110] When the handrail 200 is brought into the expanded state, the bolt fitting hole 303a of the fitting section 303 fixed to the sliding post 221d faces the tip portion of the bolt 301. Next, the tip portion of the bolt 301 is fitted into the bolt fitting hole 303a. As a result, the sliding post 221d (second movable unit 202B) is locked to move in the Z-axis direction. As a result, in the expanded state of the handrail 200, the sliding post 221d (second movable unit 202B) is fixed.

[0111] When the handrail 200 is brought into the expanded state, the sliding post 221d (second movable unit 202B) is supported and temporarily fixed by the stopper 281 of the temporary fixing mechanism 270B. The position of the sliding post 221d (second movable unit 202B) fully fixed by the fixing mechanism 300 in the expanded state in the Z-axis direction is set higher than the temporarily fixed position of the sliding post 221d (second movable unit 202B).

[0112] As illustrated in Fig. 15, in a state where the sliding post 221d (second movable unit 202B) is temporarily fixed, the bolt fitting hole 303a of the fitting section 303 is located below the tip portion of the bolt 301. Therefore, the sliding post 221d (second movable unit 202B) cannot be fully fixed by fixing mechanism 300 at the temporarily fixed position.

[0113] As illustrated in Fig. 15, in a state where the sliding post 221d (second movable unit 202B) is temporarily fixed, the lower end of the sliding post 221d is located below the second actuator 257 of the second switch section 252. As a result, the second actuator 257 interferes with the back plate 414 of the sliding post 221d, and thus cannot be disposed at the second position. As a result, the maintenance switch 256 cannot be turned on. Therefore, the maintenance operation of the elevator 1 cannot be performed in a state where the sliding post 221d (second movable unit 202B) is temporarily fixed.

[0114] As illustrated in Fig. 13, in a state where the sliding post 221d (second movable unit 202B) is fully fixed by the fixing mechanism 300, the lower end of the sliding post 221d is located above the second actuator 257 of the second switch section 252. As a result, the second

actuator 257 does not interfere with the back plate 414 of the sliding post 221d, and thus can be disposed at the second position. As a result, the maintenance switch 256 can be turned on. Therefore, when the sliding post 221d (second movable unit 202B) is fully fixed and the handrail 200 is in the expanded state, it is possible to perform maintenance operation of the elevator 1.

(Slide Guide Mechanism)

[0115] Next, the slide guide mechanisms 320 of the first movable unit 202A and the second movable unit 202B will be described with reference to Fig. 16.

[0116] Fig. 16 is an enlarged perspective view illustrating the slide guide mechanism 320 of the handrail 200.

[0117] One slide guide mechanism 320 is provided for each pair of the support post and the sliding post. That is, the handrail 200 includes six slide guide mechanisms 320. Here, the slide guide mechanism 320 provided in a set of the support post 211d and the sliding post 221d will be described as an example.

[0118] As illustrated in Fig. 16, the slide guide mechanism 320 includes a slit 331 provided in the support post 211d and an engagement pin 332 attached to the sliding post 221d. The slit 331 is formed in the right plate 402 of the support post 211d. The slit 331 extends in the Z-axis direction.

[0119] The engagement pin 332 is fixed to the right plate 412 of the sliding post 221d. The engagement pin 332 movably engages with the slit 331. The engagement pin 332 has a shaft section passing through the slit 331 of the support post 211d and a head section disposed outside the support post 211d. The head section of the engagement pin 332 is formed in a disk shape having a diameter longer than the length of the slit 331 in the width direction.

[0120] In the reduced state of the handrail 200, the engagement pin 332 engages with the lower end of the slit 331. As a result, in the reduced state of the handrail 200, the sliding post 221d is locked to move downward in the Z-axis direction. In the expanded state of the handrail 200, the engagement pin 332 engages with the upper end of the slit 331. As a result, in the expanded state of the handrail 200, the sliding post 221d is locked to move upward in the Z-axis direction.

[0121] By providing the slide guide mechanism 320 described above, rattling of the sliding posts 221a to 221f can be suppressed when the first movable unit 202A and the second movable unit 202B are moved in the Z-axis direction. As a result, the first movable unit 202A and the second movable unit 202B can smoothly move in the Z-axis direction.

[0122] In the present embodiment, the slit 331 is provided in the support post 211d, and the engagement pin 332 is attached to the sliding post 221d. However, the slide guide mechanism according to the present invention may have a configuration in which a slit is provided in a sliding post and an engagement pin is attached to a

support post.

[0123] As described above, the handrail 200 according to the present embodiment includes the plurality of support posts 211a to 211f, the plurality of sliding posts 221a to 221f, the side rail section 222 and the back rail section 223 (rail section), and the first switch section 251 and the second switch section 252. The plurality of support posts 211a to 211f is fixed to an upper section of the elevator car 120. The plurality of sliding posts 221a to 221f are slidably engaged with the plurality of support posts 211a to 211f, respectively, and can protrude upward from upper sections of the plurality of support posts 211a to 211f. The side rail section 222 and the back rail section 223 are fixed to the plurality of sliding posts 221a to 221f. The first switch section 251 and the second switch section 252 cannot be turned on by interfering with a sliding post 221d (sliding post for switching) which is one of the plurality of sliding posts 221a to 221f. In the expanded state in which the plurality of sliding posts 221a to 221f are extended out from the upper sections of the plurality of support posts 211a to 211f, the first switch section 251 interferes with the sliding post 221d which is one of the plurality of sliding posts 221a to 221f, and the second switch section 252 avoids interference with the sliding post 221d. Accordingly, the handrail 200 can be easily assembled in the expanded state. As a result, the assembly work of the handrail 200 can be easily performed at the upper section of the elevator car 120. Further, the expanded state of the handrail 200 can be easily detected.

[0124] In the reduced state in which the plurality of sliding posts 221a to 221f are retracted into the plurality of support posts 211a to 211f, the first switch section 251 is prevented from interfering with the sliding post 221d (sliding post for switch), and the second switch section 252 interferes with the sliding post 221d. As a result, the reduced state of the handrail 200 can be easily detected.

[0125] The first switch section 251 is disposed above the second switch section 252, and the sliding post 221d (sliding post for switching) has the notch 288 that avoids interference with the first switch section 251 in the reduced state. Accordingly, it is possible to easily realize a structure in which the sliding post 221d in the reduced state does not interfere with the first switch section 251.

[0126] The first switch section 251 includes the normal switch 254 and the first actuator 255 that moves in a direction orthogonal to the up-down direction and presses the normal switch 254. The first actuator 255 has the inclined surface 255b in contact with the sliding post 221d (sliding post for switching) rising from the reduced state. Thus, by raising the sliding post 221d, the first actuator 255 can be moved to a position not interfering with the sliding post 221d. The normal switch 254 can be pressed by raising the sliding post 221d.

[0127] In the expanded state, the lower end of the sliding post 221d (sliding post for switching) is located above the second switch section 252. As a result, it is possible to easily realize a structure in which the sliding post 221d

in the expanded state does not interfere with the second switch section 252.

[0128] The second switch section 252 includes the maintenance switch 256 and the second actuator 257 that moves in a direction orthogonal to the up-down direction and presses the maintenance switch 256. The second actuator 257 has the inclined surface 257b in contact with the lower end of the sliding post 221d (sliding post for switching) descending from the expanded state. As a result, by raising the sliding post 221d, the second actuator 257 can be moved to the position not interfering with the sliding post 221d. The maintenance switch 256 can be pressed by lowering the sliding post 221d.

[0129] In addition, the temporary fixing mechanism 270B that supports at least one (sliding post 221e) of the plurality of sliding posts 221a to 221f raised from the reduced state to the temporary fixing position is provided. The positions of the plurality of sliding posts 221a to 221f in the up-down direction in the expanded state are set higher than the positions of the plurality of sliding posts 221a to 221f in the up-down direction arranged at the temporary fixing positions. Accordingly, at the temporary fixing position, the second switch section 252 is not prevented from interfering with the sliding post 221d. As a result, when the plurality of sliding posts 221a to 221f are at the temporary fixing positions, the expanded state can be prevented from being detected. Therefore, it is possible to prevent the maintenance operation of the elevator 1 in a state where the plurality of sliding posts 221a to 221f is temporarily fixed.

[0130] The temporary fixing mechanism 270B includes the stopper 281 rotatably connected to at least one (support post 211e) of the plurality of support posts 211a to 211f. The stopper 281 supports the lower end of at least one (support post 211e) of the plurality of sliding posts. As a result, the plurality of sliding posts 221a to 221f can be temporarily fixed with a simple structure.

[0131] In addition, the stopper 281 is stable in a posture supporting at least one of the plurality of sliding posts 221a to 221f (support post 211e) by its own weight. As a result, the plurality of sliding posts 221a to 221f are raised and moved above the stopper 281, so that the stopper 281 can be easily brought into a posture of supporting the sliding post 221e. As a result, the plurality of sliding posts 221a to 221f can be temporarily fixed easily.

[0132] At least one of the plurality of support posts 211a to 211f has the slit 331 extending in the Z-axis direction (up-down direction). The sliding post engaged with at least one of the plurality of support posts 211a to 211f has an engagement pin 332 engaged with the slit 331. As a result, rattling of the sliding posts 221a to 221f can be suppressed. As a result, the sliding posts 221a to 221f can be smoothly moved in the Z-axis direction.

[0133] In addition, the elevator 1 according to the present embodiment includes the elevator car 120 that moves up and down in the hoist-way 110, the control board 170 (control section) that controls the raising and lowering operation of the elevator car 120, and the above-

described handrail 200 provided on the upper section of the elevator car 120. As a result, when the maintenance and inspection of the elevator 1 are performed, the assembly work of the handrail 200 can be easily performed at the upper section of the elevator car 120.

[0134] In the reduced state in which the plurality of sliding posts 221a to 221f are retracted into the plurality of support posts 211a to 211f, the first switch section 251 is prevented from interfering with the sliding post 221d (sliding post for switch), and the second switch section 252 interferes with the sliding post 221d. As a result, the reduced state of the handrail 200 can be easily detected.

[0135] The control board 170 (control section) permits the normal operation when the first switch section 251 is ON and the second switch section 252 is OFF. In addition, when the first switch section 251 is OFF and the second switch section 252 is ON, the maintenance operation, which is an operation for performing maintenance and inspection work, is permitted. As a result, when it is detected that the handrail 200 is in the reduced state, the normal operation of the elevator 1 can be performed. When it is detected that the handrail 200 is in the expanded state, the maintenance operation of the elevator 1 can be performed.

[0136] In addition, when the first switch section 251 and the second switch section 252 are ON, the control board 170 (control section) detects that an abnormality has occurred in the handrail 200. As a result, when an operation failure occurs in the first switch section 251 or the second switch section 252, the operation failure can be detected, and the operation of the elevator 1 can be stopped. As a result, the elevator 1 can be operated safely.

[0137] The present invention is not limited to the embodiments described above and illustrated in the drawings, and various modifications can be made without departing from the gist of the invention described in the claims.

[0138] In the above-described embodiment, the first movable unit 202A and the second movable unit 202B are provided. However, the handrail according to the present invention may have a configuration in which the first movable unit 202A and the second movable unit 202B are integrally joined. In the present embodiment, since the movable unit is divided into the first movable unit 202A and the second movable unit 202B, the worker can easily lift each of the movable units 202A and 202B alone when the handrail 200 is brought into the reduced state or the expanded state.

[0139] For example, it is assumed that the first movable unit 202A and the second movable unit 202B are integrally joined, and the length of the handrail 200 in the Y-axis direction is longer than the length in which both arms of the worker are expanded. In this case, the side rail section 222 (see Fig. 2) or the side rail section 224 is gripped and the entire movable unit is lifted. As a result, it is difficult to lift the entire movable unit in the Z-axis direction in a well-balanced manner. In addition, when

the first movable unit 202A and the second movable unit 202B are integrally joined, the weight may become equal to or more than the weight that can be lifted by one worker, and the workability of the assembly work is deteriorated.

[0140] In the embodiment described above, the first actuator 255 and the second actuator 257 are manually moved to the second position (the position at which the pushbutton switch is turned on). However, the switch section according to the present invention may include a biasing member that biases the actuators 255 and 257 toward the second position. In this case, when the handrail 200 is brought into the reduced state, the first actuator 255 is automatically disposed at the second position, and the normal switch 254 is turned on. When the handrail 200 is brought into the expanded state, the second actuator 257 is automatically disposed at the second position, and the maintenance switch 256 is turned on. As the biasing member that biases the actuators 255 and 257, for example, a tension coil spring can be adopted.

[0141] Further, in the above-described embodiment, the stopper 281 is stabilized in a posture supporting the sliding post 221e by its own weight. However, the temporary fixing mechanism according to the present invention may include a biasing member that biases the stopper 281 so as to be in a posture of supporting the sliding post 221e. As the biasing member that biases the stopper 281, for example, a torsion coil spring can be adopted.

[0142] In addition, in the above-described embodiment, the fixing mechanisms 300 are provided one by one in each pair of the support post and the sliding post. However, the number of fixing mechanisms according to the present invention can be appropriately set as long as the first movable unit 202A and the second movable unit 202B can be fixed in the reduced state and the expanded state of the handrail 200. The number of the temporary fixing mechanisms according to the present invention can also be set as appropriate.

[0143] In the above-described embodiment, one slide guide mechanism 320 is provided for each pair of the support post and the sliding post. However, at least one slide guide mechanism according to the present invention may be provided in each of the first movable unit 202A and the second movable unit 202B.

[0144] In the present specification, words such as "parallel" and "orthogonal" are used, but these do not strictly mean only "parallel" and "orthogonal", and may be in a state of "substantially parallel" or "substantially orthogonal" including "parallel" and "orthogonal" and in a range in which the function can be exhibited.

Reference Signs List

[0145]

1 elevator
100 hoisting machine
110 hoist-way
120 elevator car

130 rope
140 counterweight
150 deflector wheel
160 machine room
170 control board
200 handrail
201 support unit
202A first movable unit
202B second movable unit
211a to 211f support post
219 switch base
220 hook base
221a to 221f sliding post
222, 224 side rail section
223, 225 back rail section
240A, 240B switch unit
251 first switch section
252 second switch section
254 normal switch
255 first actuator
255a end surface
255b inclined surface
256 maintenance switch
257 second actuator
257a end surface
257b inclined surface
270A, 270B temporary fixing mechanism
281 stopper
282 shaft section
285 base section
286 hook section
300 fixing mechanism
301 bolt
302 welding nut
303 fitting section
303a bolt fitting hole
320 slide guide mechanism
331 slit
332 engagement pin

Claims

1. A handrail comprising:

a plurality of support posts fixed to an upper section of an elevator car;
a plurality of sliding posts slidably engaged with each of the plurality of support posts and protruding further upward than upper sections of the plurality of support posts;
a rail section is fixed to the plurality of sliding posts; and
a first switch section and a second switch section interfering with a sliding post for switching which is one of the plurality of sliding posts so that it becomes impossible to turn the first switch section and the second switch section on,

- wherein in an expanded state in which the plurality of sliding posts are extended out from the upper sections of the plurality of support posts, the first switch section interferes with the sliding post for switching, and interference between the second switch section and the sliding post for switching is avoided.
2. The handrail according to claim 1, wherein in a reduced state in which the plurality of sliding posts are retracted into the plurality of support posts, interference between the first switch section and the sliding post for switching is avoided, and the second switch section interferes with the sliding post for switching.
 3. The handrail according to claim 2, wherein the first switch section is disposed above the second switch section, and the sliding post for switching has a notch that avoids interference with the first switch section in the reduced state.
 4. The handrail according to claim 3, wherein the first switch section includes a first switch and a first actuator configured to move in a direction orthogonal to an up-down direction and press the first switch, and the first actuator has an inclined surface in contact with the sliding post for switching rising from the reduced state.
 5. The handrail according to claim 3, wherein a lower end of the sliding post for switching is positioned above the second switch section in the expanded state.
 6. The handrail according to claim 5, wherein the second switch section includes a second switch and a second actuator configured to move in a direction orthogonal to an up-down direction and press the second switch, and the second actuator has an inclined surface in contact with a lower end of the sliding post for switching descending from the expanded state.
 7. The handrail according to claim 2, further comprising a temporary fixing mechanism configured to support at least one of the plurality of sliding posts raised from the reduced state to a temporary fixing position, wherein positions in the up-down direction of the plurality of sliding posts in the expanded state are set higher than positions in the up-down direction of the plurality of sliding posts arranged at the temporary fixing position.
 8. The handrail according to claim 7, wherein the temporary fixing mechanism includes a stopper rotatably connected to at least one of the plurality of support posts, and the stopper supports at least one lower end of the plurality of sliding posts.
 9. The handrail according to claim 8, wherein the stopper is stable in a posture supporting at least one of the plurality of sliding posts by its own weight.
 10. The handrail according to claim 1, wherein one of at least one of the plurality of support posts and a sliding post engaged with at least one of the plurality of support posts has a slit extending in an up-down direction, and the other of at least one of the plurality of support posts and the sliding post engaged with at least one of the plurality of support posts includes an engagement pin engaged with the slit.
 11. An elevator comprising:
 - an elevator car moving up and down in hoistway;
 - a control section configured to control a lifting/lowering operation of the elevator car; and
 - a handrail provided on an upper section of the elevator car, wherein the handrail includes
 - a plurality of support posts fixed to the upper section of the elevator car,
 - a plurality of sliding posts slidably engaged with each of the plurality of support posts and protruding further upward than upper sections of the plurality of support posts,
 - a rail section fixed to the plurality of sliding posts, and
 - a first switch section and a second switch section interfering with a sliding post for switching which is one of the plurality of sliding posts so that it becomes impossible to turn the first switch section and the second switch section on, and
 - in an expanded state in which the plurality of sliding posts are extended out from the upper sections of the plurality of support posts, the first switch section interferes with the sliding post for switching, and interference between the second switch section and the sliding post for switching is avoided.
 12. The elevator according to claim 11, wherein in a reduced state in which the plurality of sliding posts are retracted into the plurality of support posts, interference between the first switch section and the sliding post for switching is avoided, and the second switch section interferes with the sliding post for switching.
 13. The elevator according to claim 12, wherein the control section permits a normal operation when the first switch section is ON and the second switch section

is OFF, and permits a maintenance operation that is operation when maintenance and inspection work is performed in a case where the first switch section is OFF and the second switch section is ON.

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- 14.** The elevator according to claim 12, wherein the control section detects that an abnormality occurs in the handrail when the first switch section and the second switch section are ON.

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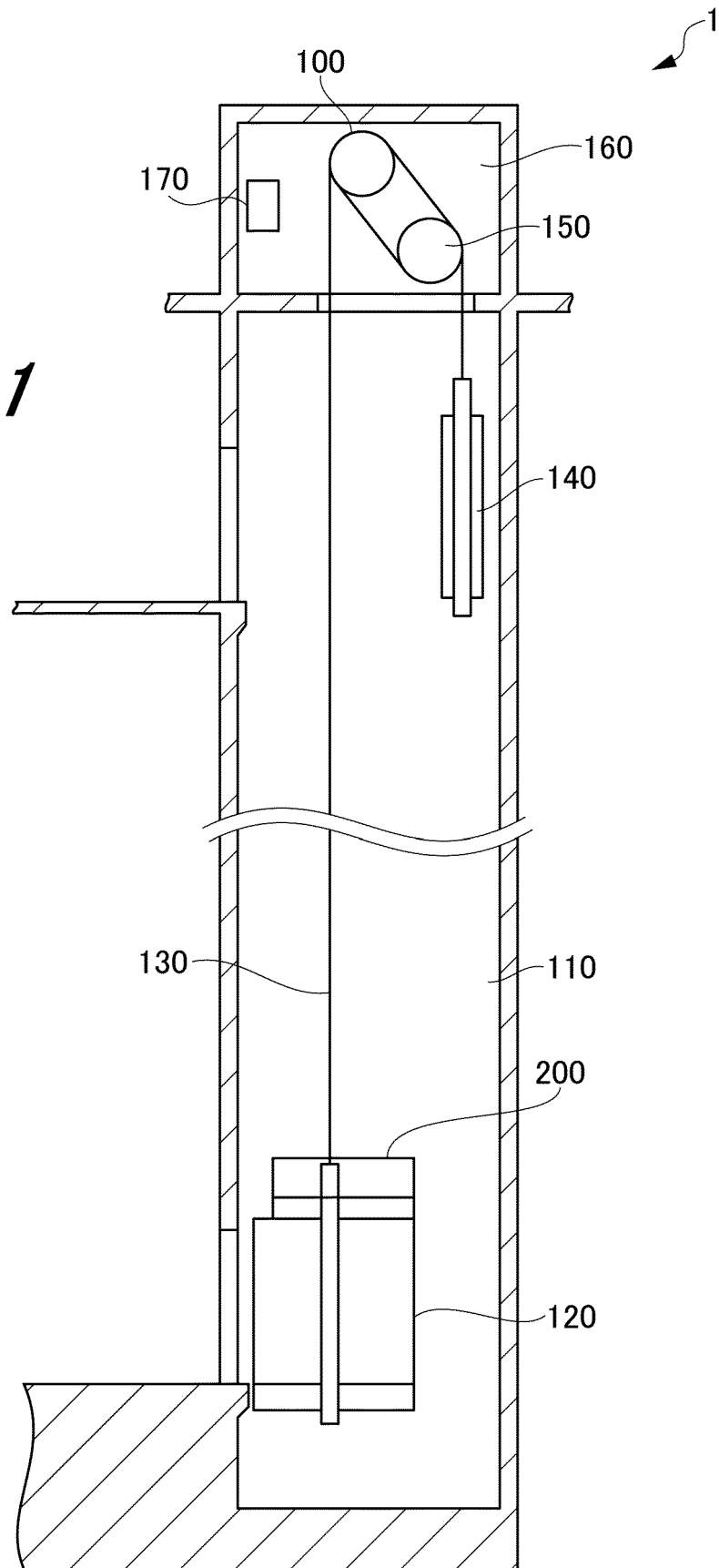
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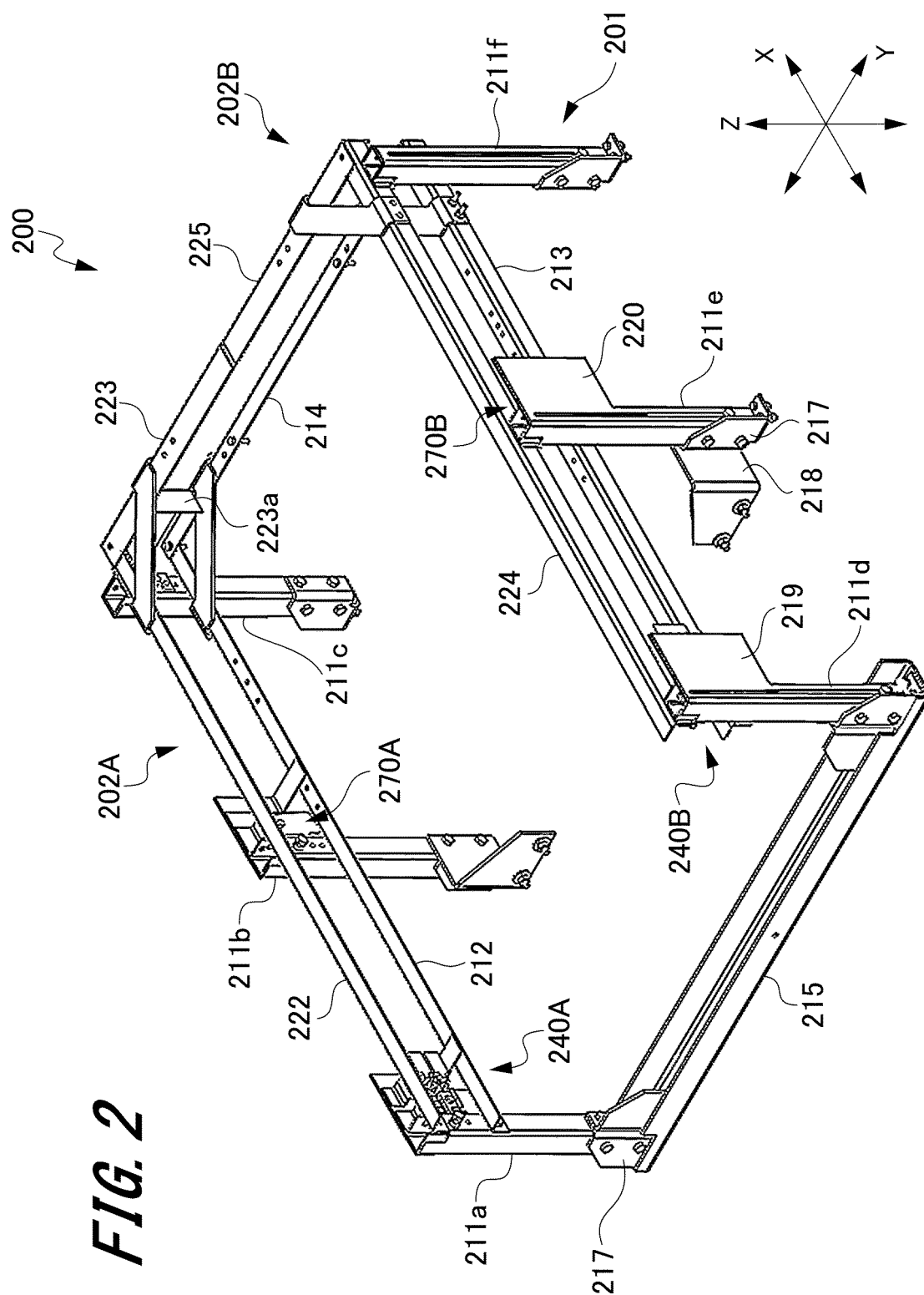
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FIG. 1





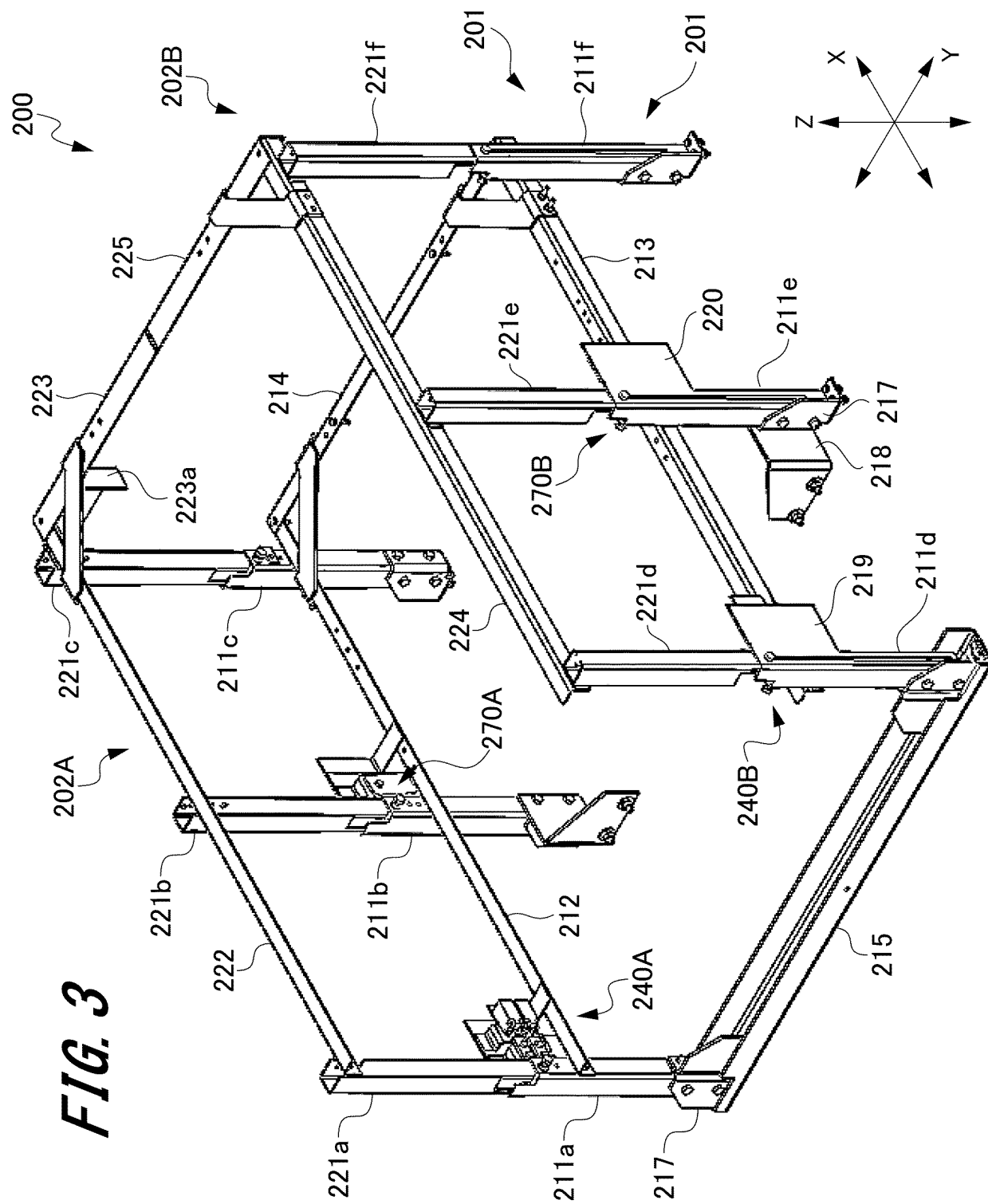
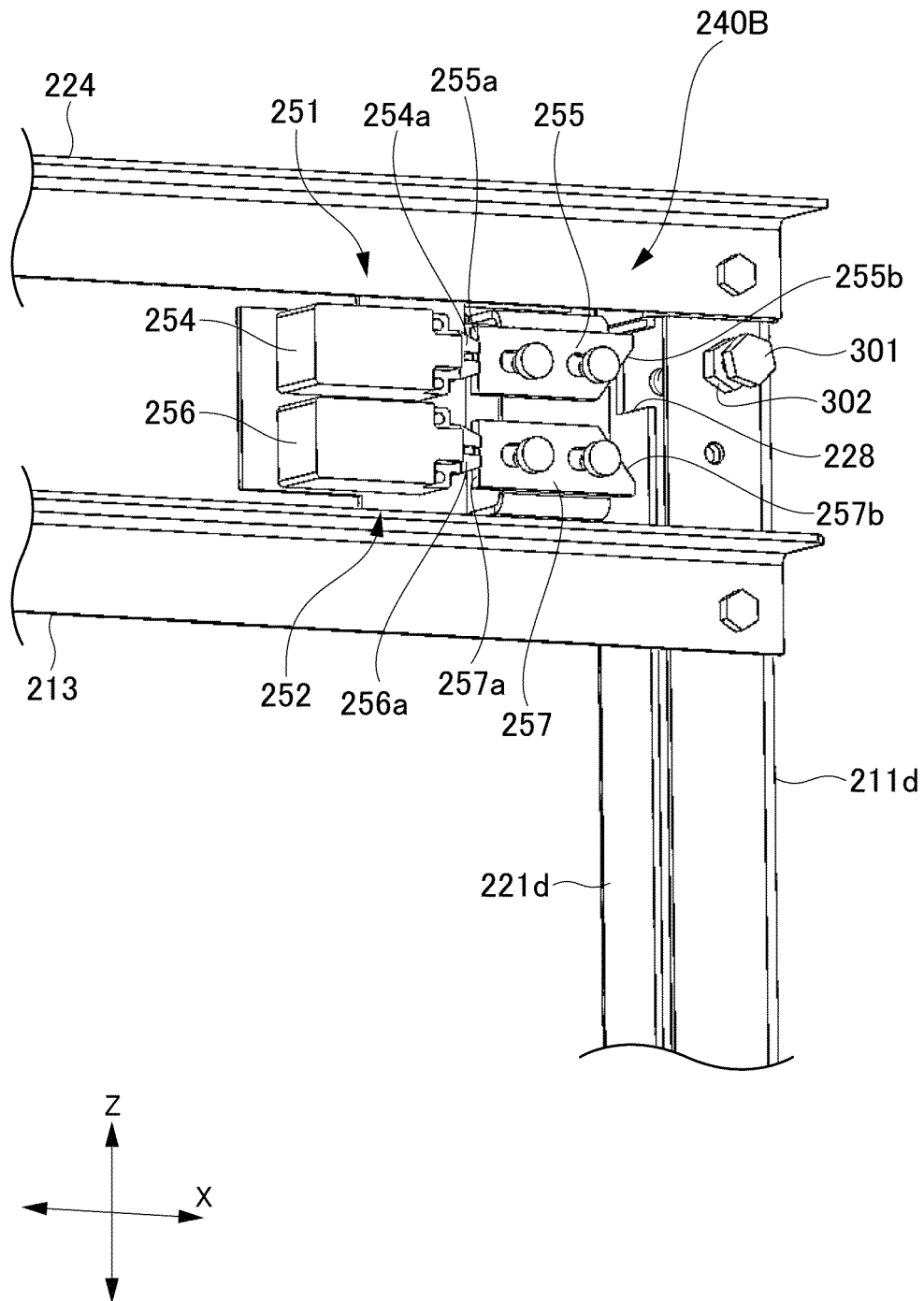


FIG. 4



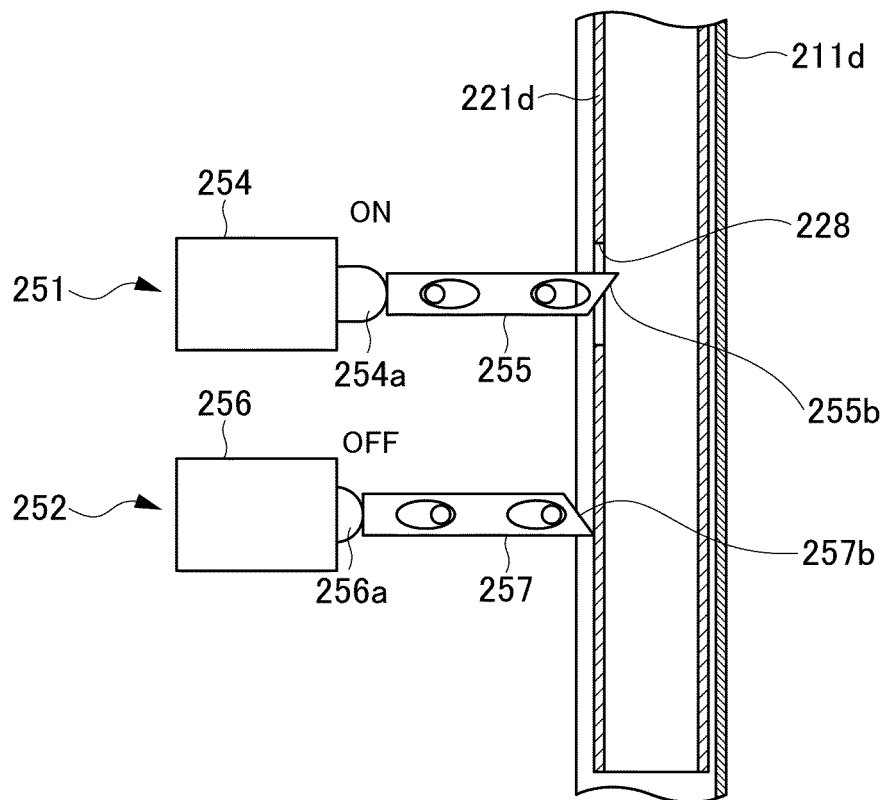


FIG. 5

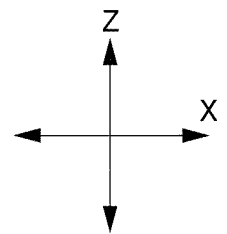


FIG. 6A

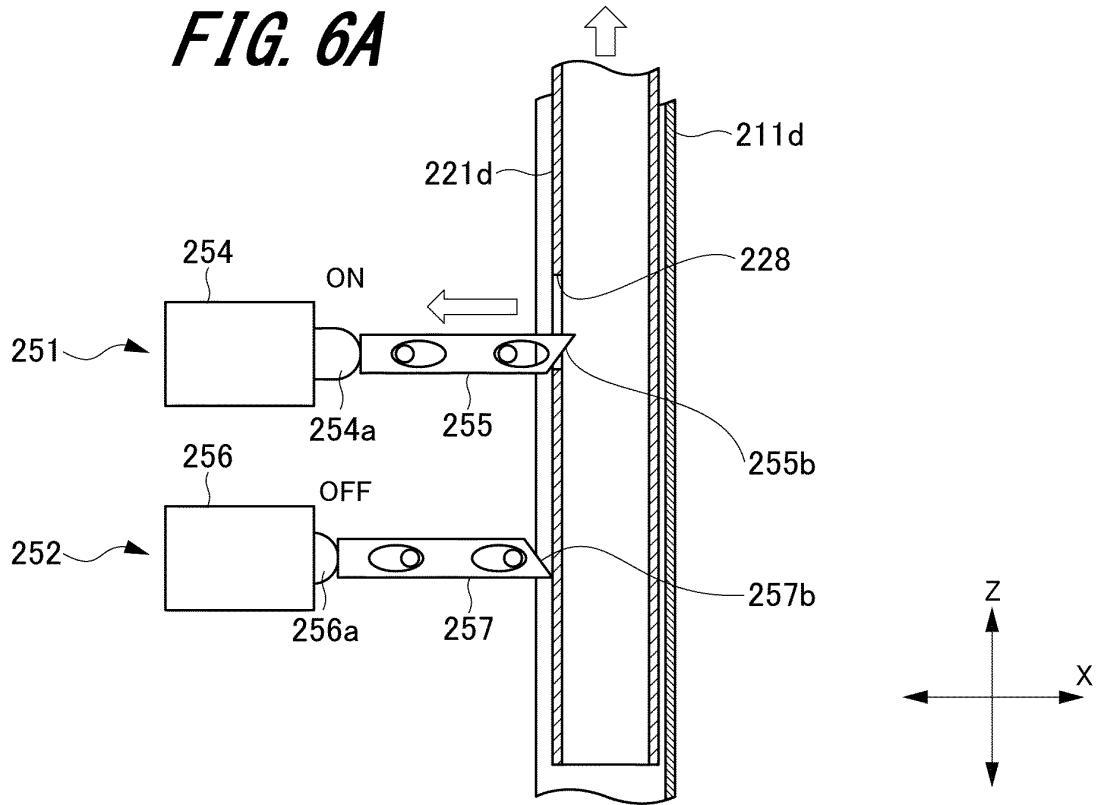


FIG. 6B

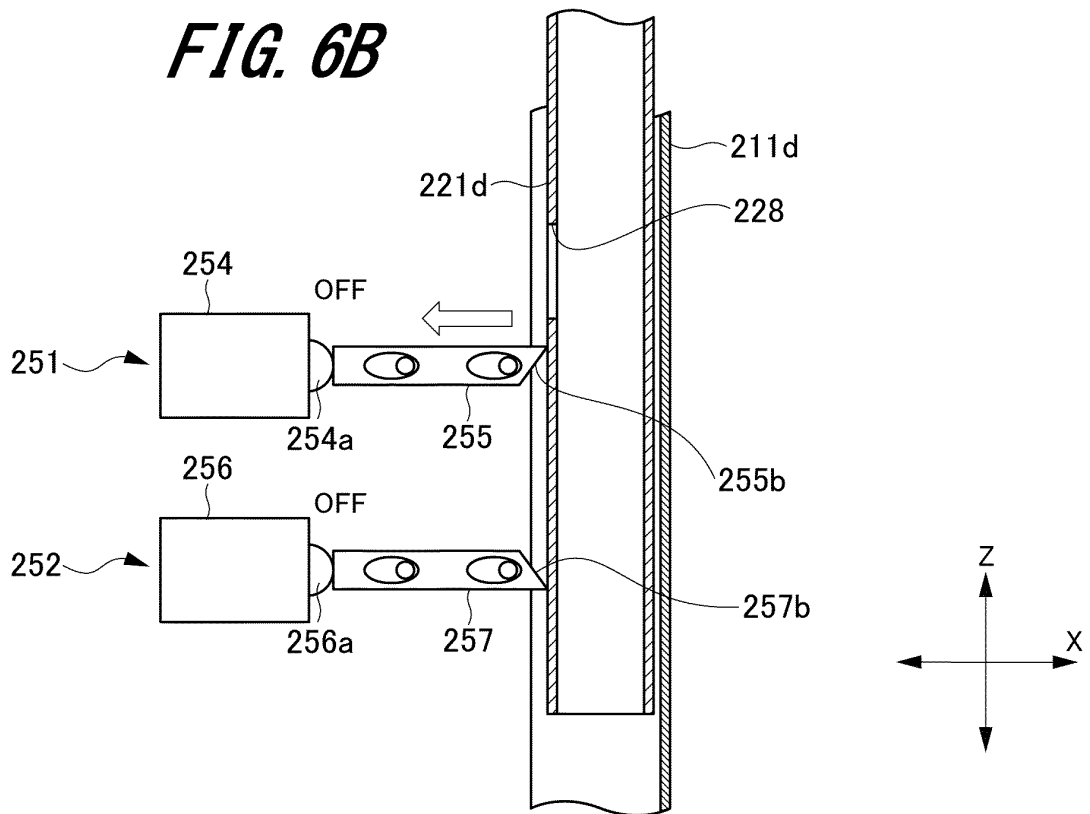


FIG. 7A

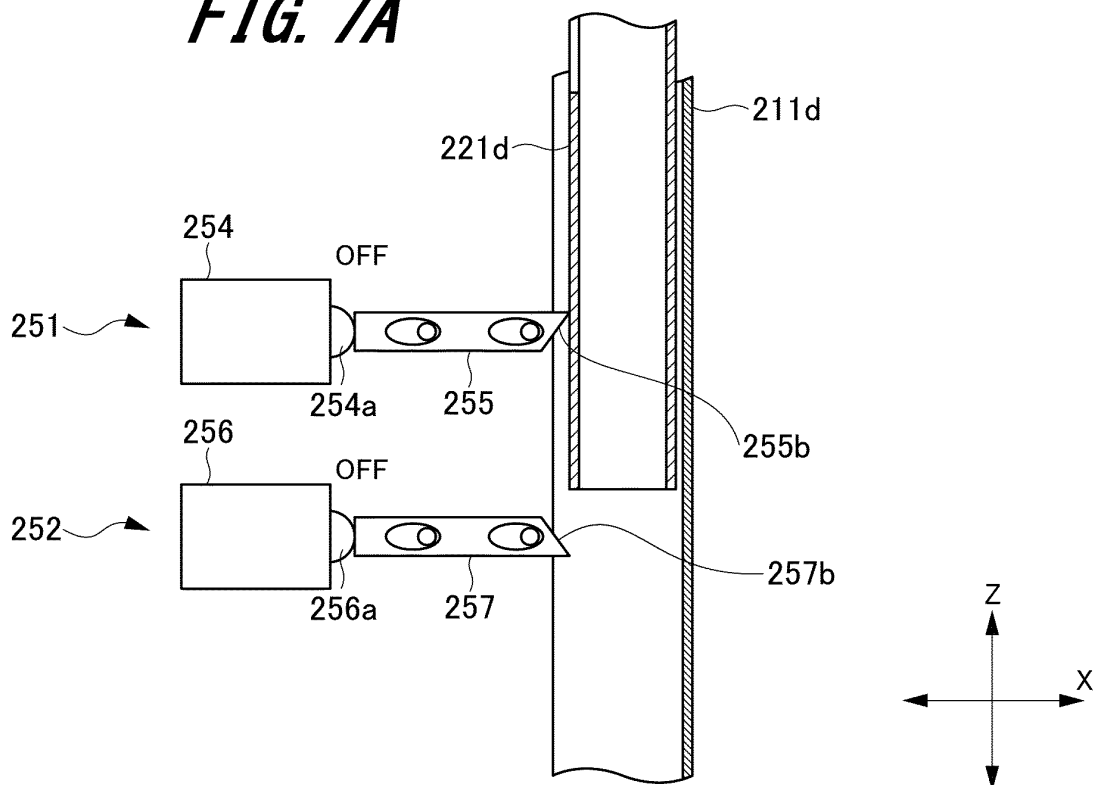


FIG. 7B

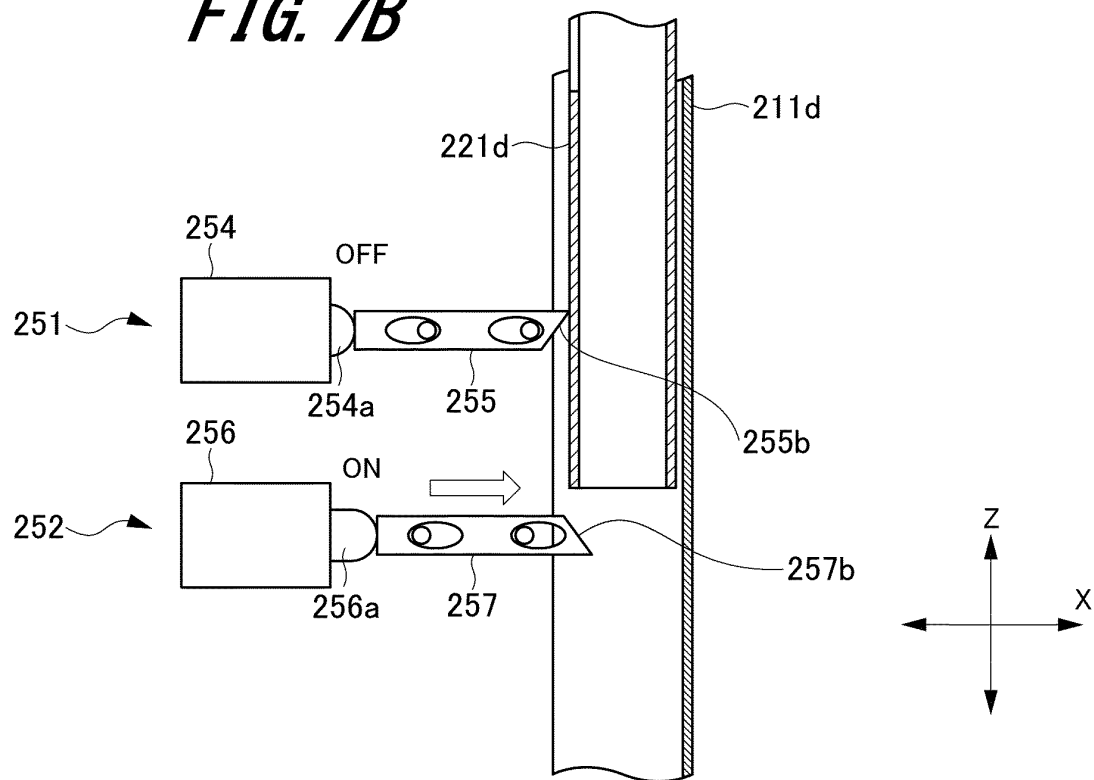


FIG. 8A

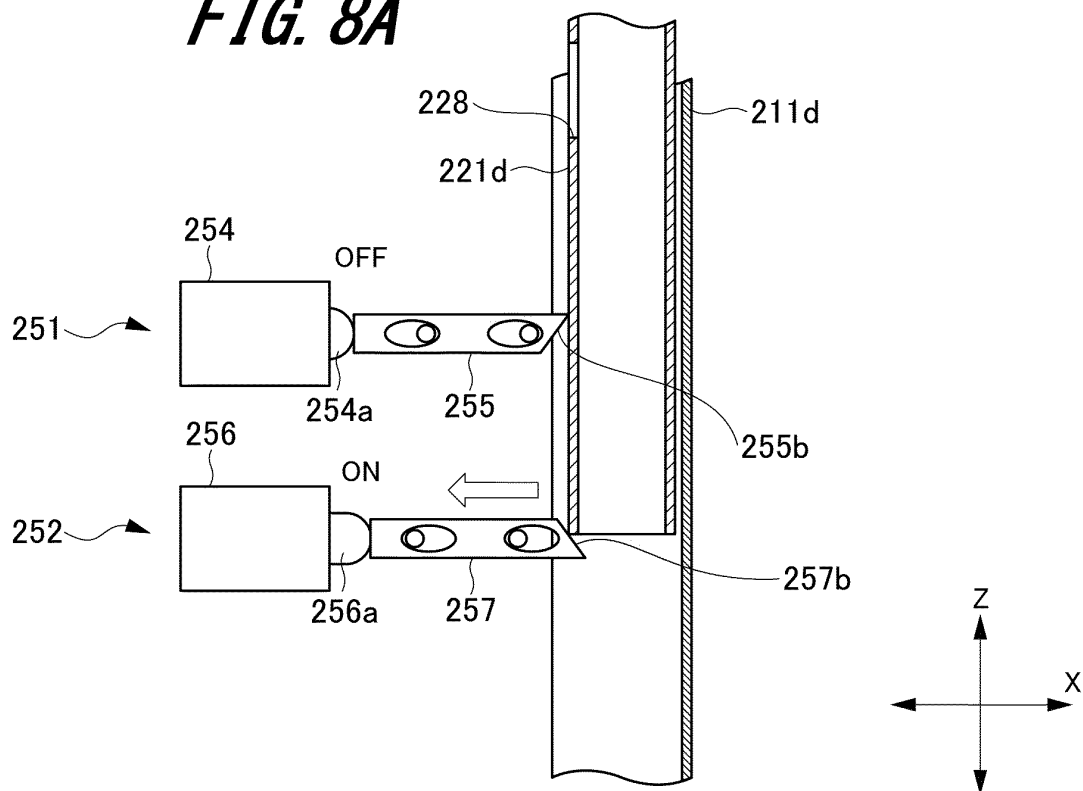


FIG. 8B

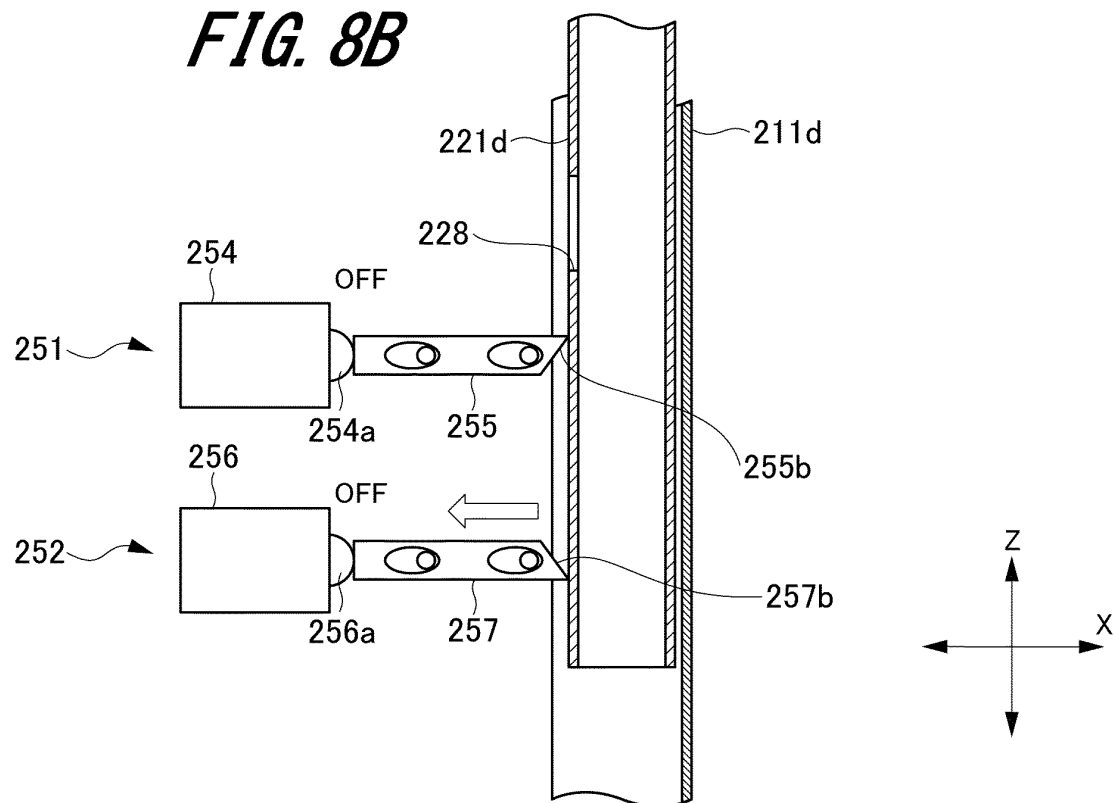
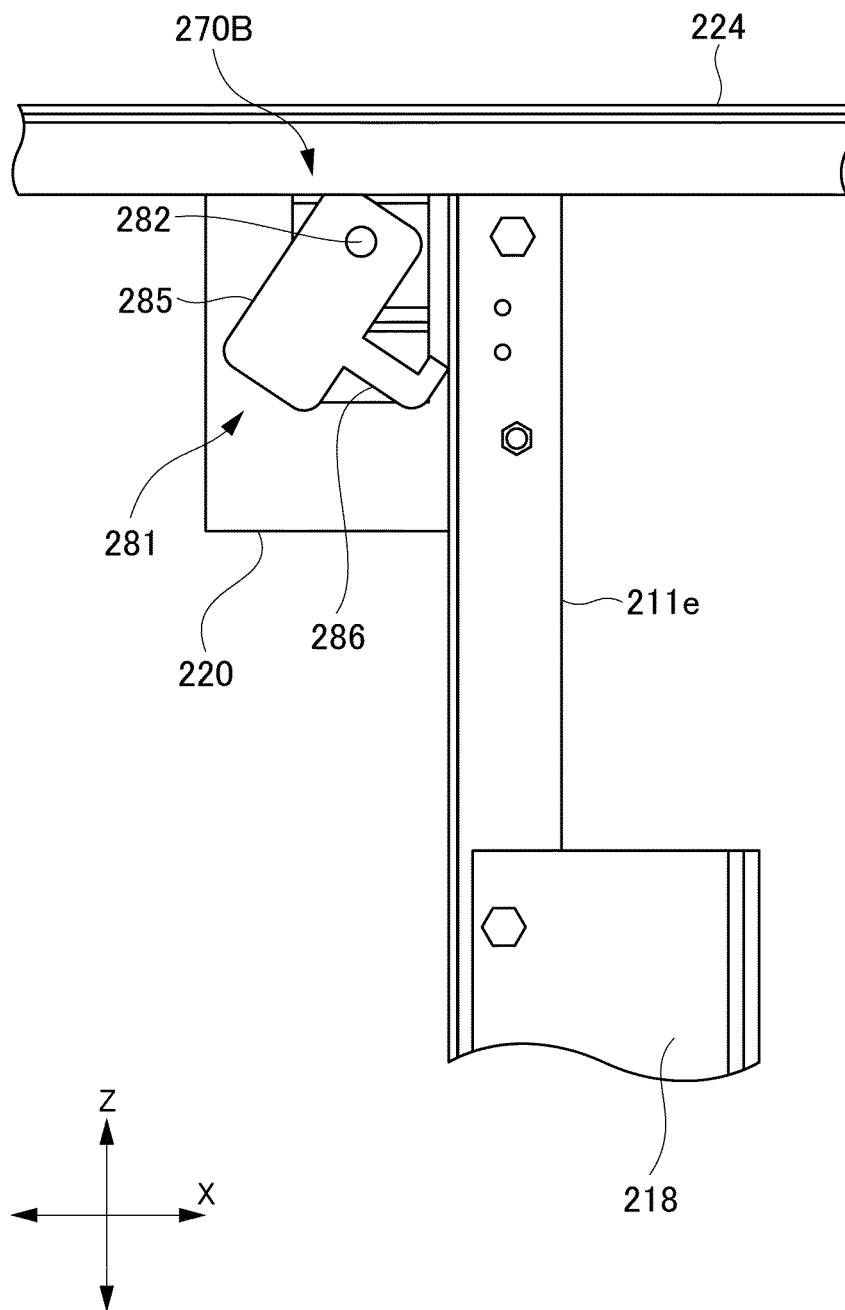
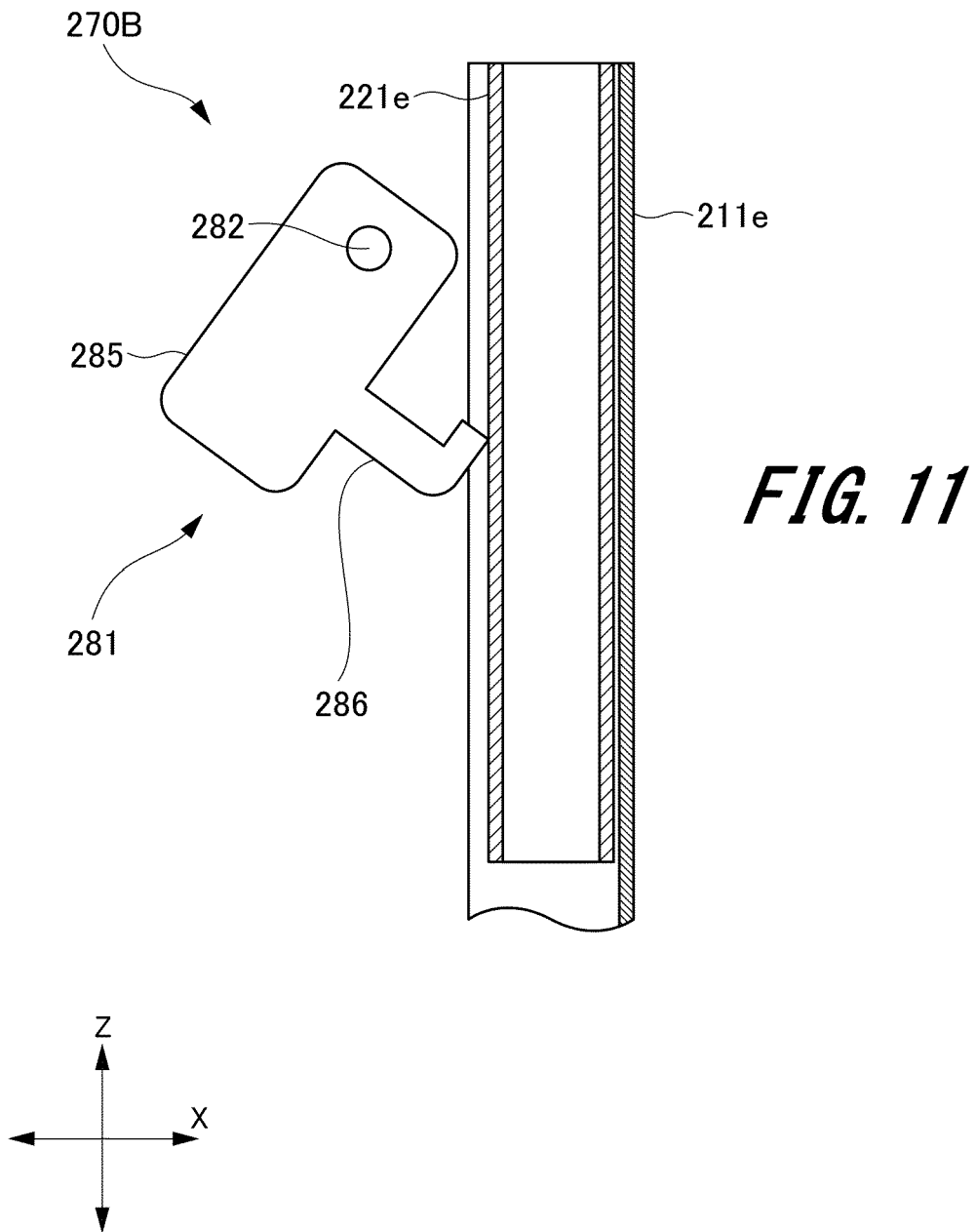


FIG. 9

No	NORMAL SWITCH	MAINTENANCE SWITCH	OPERATION OF ELEVATOR
1	ON	OFF	NORMAL OPERATION POSSIBLE
2	OFF	ON	MAINTENANCE OPERATION POSSIBLE
3	ON	ON	OPERATION IMPOSSIBLE AND DETECT ABNORMALITY
4	OFF	OFF	OPERATION IMPOSSIBLE

FIG. 10





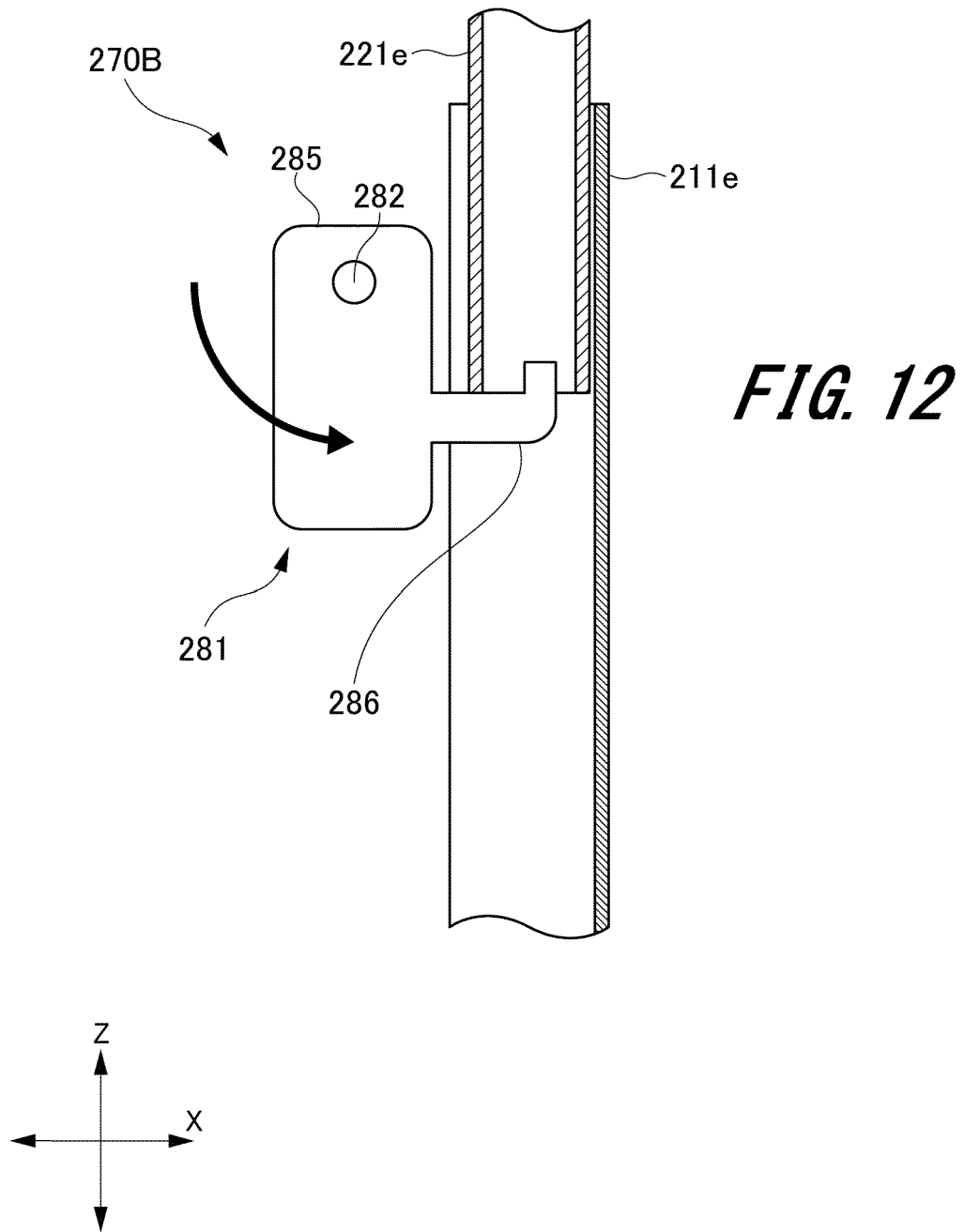


FIG. 13

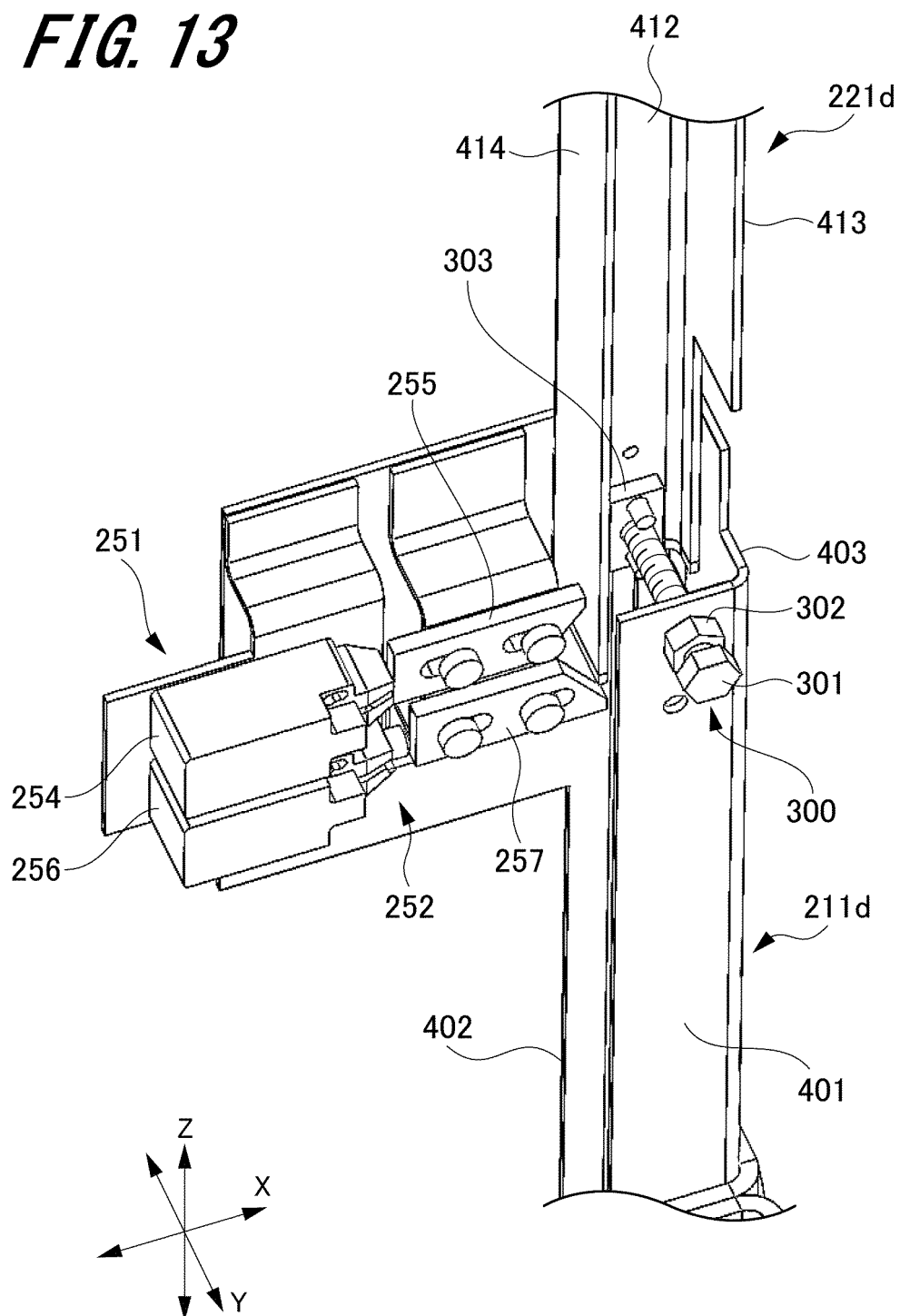


FIG. 14A

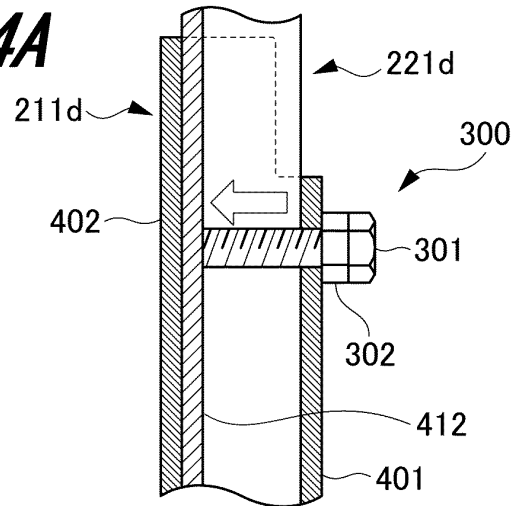


FIG. 14B

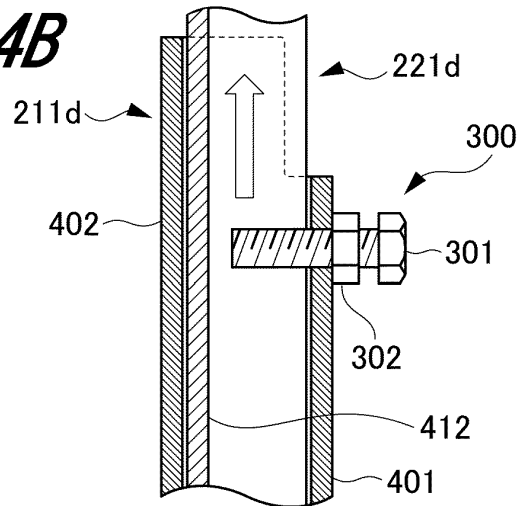
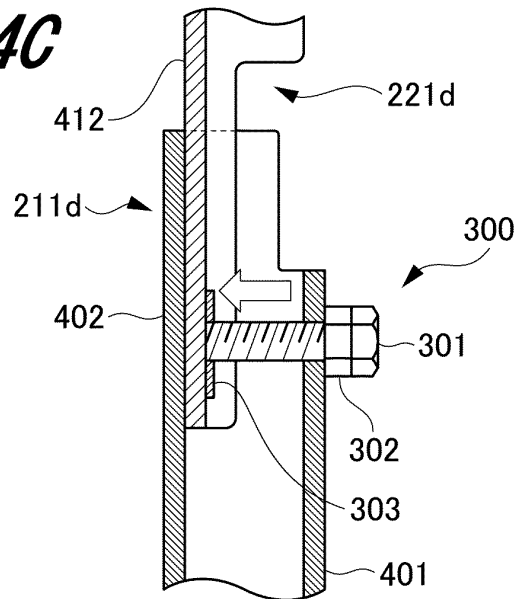


FIG. 14C



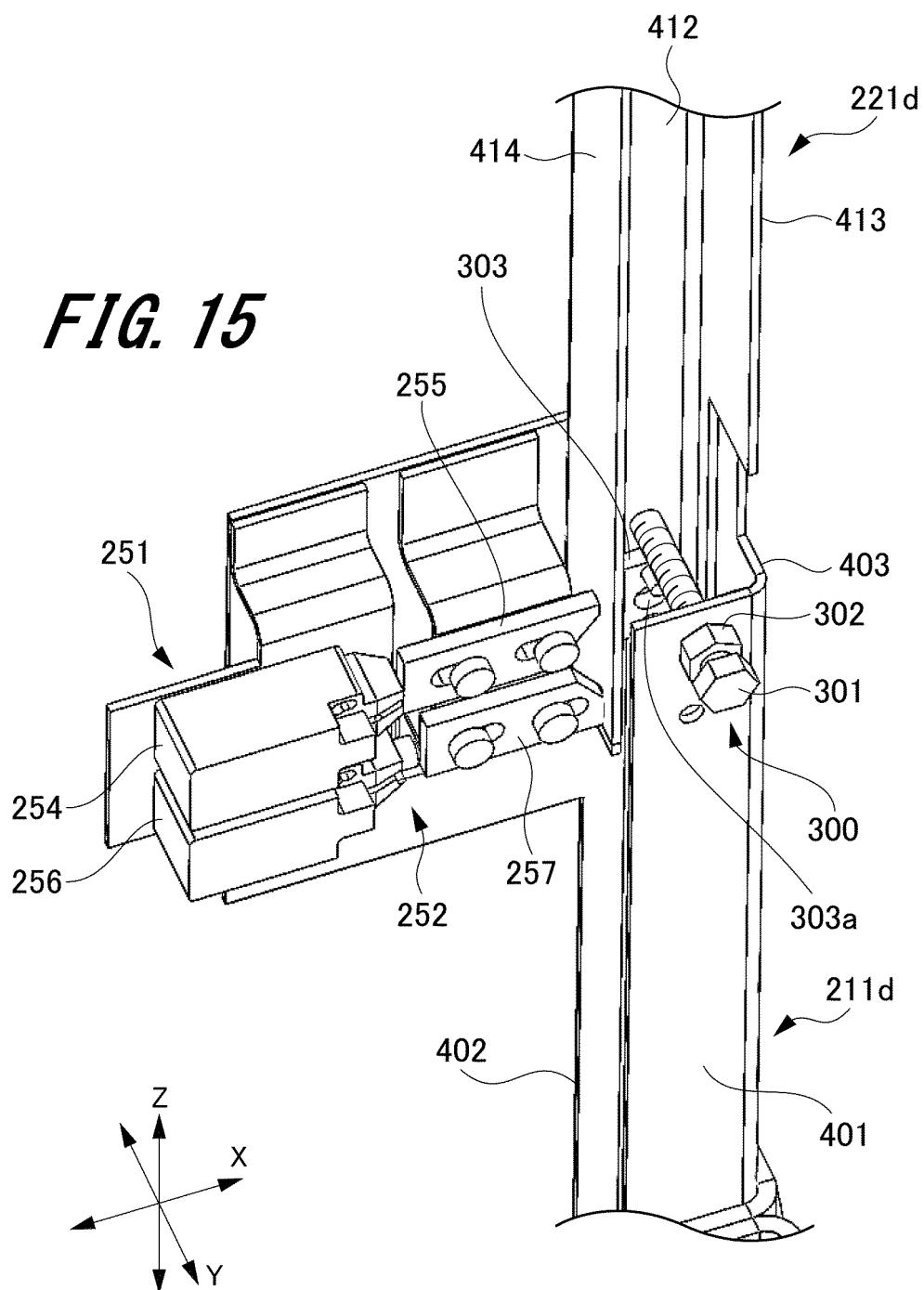
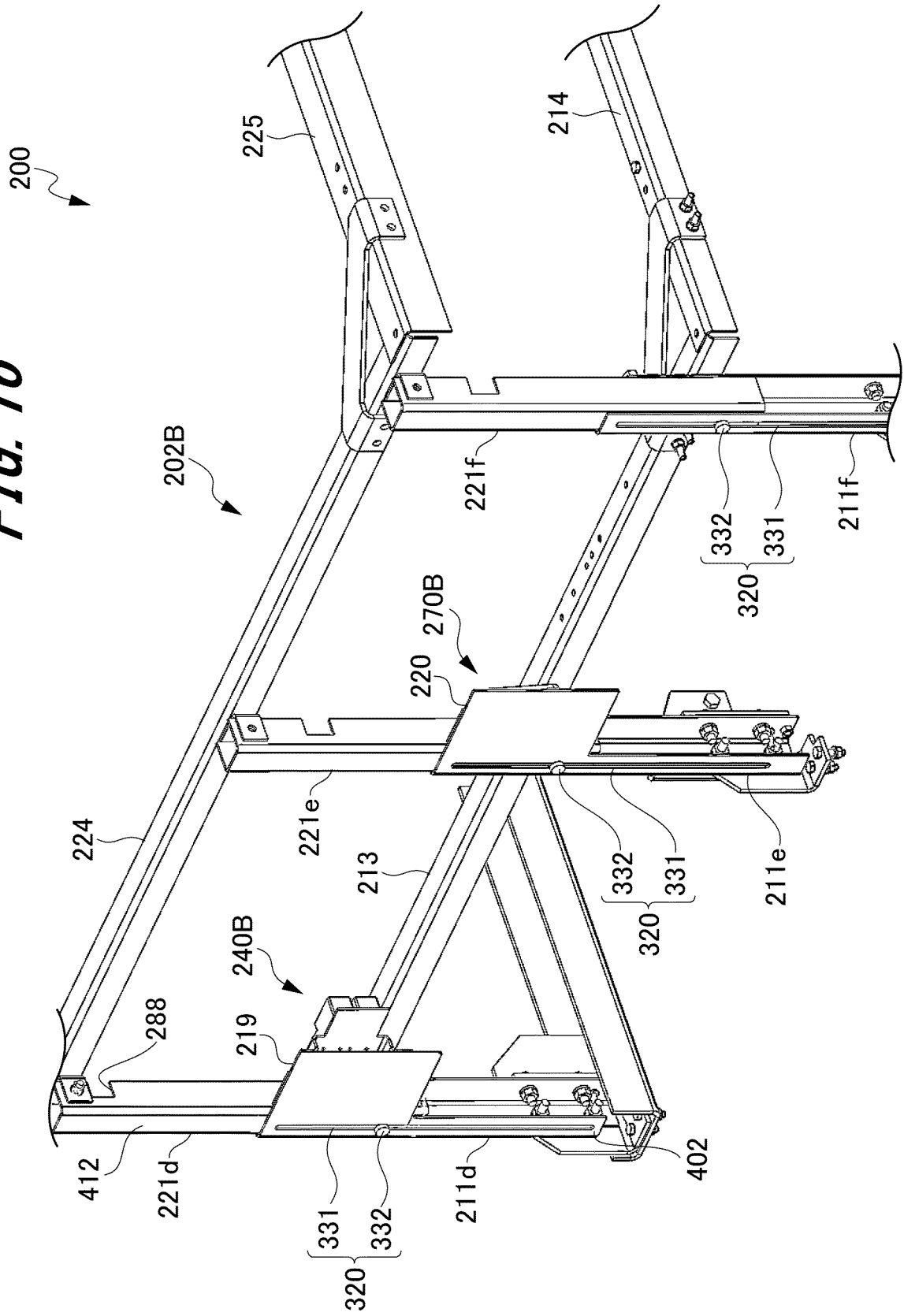


FIG. 16



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/021716

A. CLASSIFICATION OF SUBJECT MATTER

B66B 5/00(2006.01)i; B66B 11/02(2006.01)i

FI: B66B11/02 Q; B66B5/00 D

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)

B66B5/00; B66B11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996

Published unexamined utility model applications of Japan 1971-2021

Registered utility model specifications of Japan 1996-2021

Published registered utility model applications of Japan 1994-2021

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.
Y A	JP 2014-111486 A (MITSUBISHI ELECTRIC BUILDING TECHNO SERVICE CO LTD) 19 June 2014 (2014-06-19) paragraphs [0012]-[0040], fig. 1-4	1-2, 7, 10-14 3-6, 8-9
Y	JP 2009-542550 A (OTIS ELEVATOR COMPANY) 03 December 2009 (2009-12-03) paragraphs [0057]-[0065], fig. 8-11	1-2, 7, 10-14
Y	WO 2016/135922 A1 (MITSUBISHI ELECTRIC CORP) 01 September 2016 (2016-09-01) paragraphs [0011]-[0038], fig. 1-10	7
A	US 2018/0362298 A1 (INVENTIO AG) 20 December 2018 (2018-12-20)	1-14



Further documents are listed in the continuation of Box C.



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Date of the actual completion of the international search

16 August 2021 (16.08.2021)

Date of mailing of the international search report

24 August 2021 (24.08.2021)

Name and mailing address of the ISA/

Japan Patent Office
3-4-3, Kasumigaseki, Chiyoda-ku,
Tokyo 100-8915, Japan

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application no.
PCT/JP2021/021716

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
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JP 2009-542550 A	03 Dec. 2009	US 2010/0155184 A1	
		paragraphs [0089]-[0097], fig. 8-11	
		WO 2008/004022 A1	
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REFERENCES CITED IN THE DESCRIPTION

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- JP 2016147727 A [0004]