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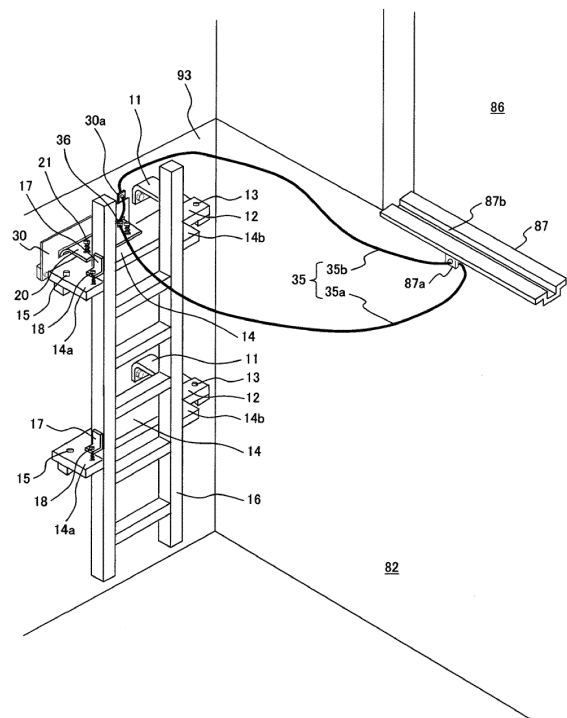
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(54) **ELEVATOR PIT LADDER DEVICE**

(57) The present invention provides a pit ladder device of an elevator which is provided in a pit of a hoistway of the elevator which is improved in installation performance. In order to realize the present invention, the pit ladder device of the elevator which is provided in the pit of the hoistway of the elevator, and is used by an operator to go up and down includes a bracket of which one end side is attached to a pit wall, a first arm member of which one end side is rotatably attached to the other end side of the bracket, a second arm member of which one end side is rotatably attached to the other end side of the first arm member, and a pit ladder which is attached to the second arm member.

**FIG. 1**



## Description

### Technical Field

**[0001]** The present invention relates to a pit ladder device which is installed in a pit of a hoistway of an elevator.

### Background Art

**[0002]** In a hoistway of an elevator, there is installed a space made by digging in the bottom of the lowest floor which is called a pit. In the pit, mechanisms necessary for the elevator such as a buffer and a limit switch are installed. When maintenance such as inspection and repair is performed, the elevator door in the elevator hall of the lowest floor is opened, an operator needs to go down into the pit of the lowest portion of the hoistway from an opened elevator doorway. In addition, after the work, the operator needs to go up to the elevator doorway from the pit of the lowest portion. Therefore, a pit ladder is provided in advance in the pit.

**[0003]** When the maintenance is performed, the operator draws the pit ladder stored in the inner side surface almost perpendicular to the front surface provided in the elevator doorway near up to an open aperture of the elevator door using a hook after opening the elevator door, and fixes the pit ladder to a landing sill. The pit ladder is drawn near to one end side of a bracket and attached. A hinge is provided on the other end side of the bracket. The hinge is attached to the elevator doorway side. The bracket rotates about the hinge, and the pit ladder moves up to the landing sill. Then, the operator goes down to the lowest portion using the drawn pit ladder, and does the maintenance work. After the maintenance work, the operator comes up to the elevator hall of the lowest floor using the pit ladder, and moves and fixes the pit ladder to a storage position by a hook. The storage position of the pit ladder is set at a position not interfering with the hoisting operation of the elevator car. Then, the operator closes the opened elevator door, and restarts the operation of the elevator. As such a related art, PTL 1 (JP 2007-62862 A) is disclosed.

### Citation List

#### Patent Literature

**[0004]** PTL 1: JP 2007-62862 A

### Summary of Invention

#### Technical Problem

**[0005]** In the configuration described in PTL 1, the bracket rotates about the attached hinge of the elevator doorway, so that the position of the pit ladder is defined by the length of the bracket. In the inner side surface almost perpendicular to the front surface where the ele-

vator doorway is provided, there is normally attached a rail which guides the hoisting of the car. Since the pit ladder needs not to interfere with the car, there is also a need not to interfere with the rail. Therefore, the length of the bracket depends on an installation position of the rail, that is, a depth dimension from the elevator doorway to the rail. Therefore, in the case of the hoistway in which the width dimension is large and the depth dimension from the elevator doorway is small, a sufficient length of the bracket is not secured in the configuration described in PTL 1. In a case where the bracket rotates to the elevator doorway, the pit ladder does not sufficiently reach the elevator doorway. Therefore, the maintenance work of the operator is hindered.

**[0006]** In addition, if there are irregularities in the lowest portion of the pit, the lower end of the pit ladder comes into contact with the irregularities when the pit ladder attached to the bracket is drawn up to the open aperture of the elevator door. The pit ladder is not easily drawn.

**[0007]** An object of the present invention is to solve the problem and to provide a pit ladder device of the elevator which is improved in installation performance.

**[0008]** In addition, another object of the present invention is to provide a pit ladder device of the elevator which easily pulls out the pit ladder.

#### Solution to Problem

**[0009]** A pit ladder device of an elevator which is provided in the pit of the hoistway of the elevator, and is used by an operator to go up and down, the pit ladder device of the elevator includes a bracket of which one end side is attached to a pit wall, a first arm member of which one end side is rotatably attached to the other end side of the bracket, a second arm member of which one end side is rotatably attached to the other end side of the first arm member, and a pit ladder which is attached to the second arm member.

**[0010]** In addition, according to the present invention, a biasing member is provided in the second arm member to bias the pit ladder upward.

#### Advantageous Effects of Invention

**[0011]** According to the present invention, it is possible to provide the pit ladder device of the elevator which is improved in installation performance.

**[0012]** In addition, according to the present invention, it is possible to provide the pit ladder device of the elevator which can easily pull out the pit ladder.

#### Brief Description of Drawings

##### [0013]

[FIG. 1] FIG. 1 is a perspective exterior view of a pit ladder device which is stored in a pit according to an embodiment of the present invention.

[FIG. 2] FIG. 2 is a side view of the pit ladder device which is stored in the pit according to the embodiment of the present invention.

[FIG. 3A] FIG. 3 is an enlarged view of Portion A of FIG. 2.

[FIG. 3B] FIG. 3 is an enlarged view of Portion A of FIG. 2.

[FIG. 4A] FIG. 4A is a diagram for describing an operation illustrating a state where the pit ladder device is stored.

[FIG. 4B] FIG. 4B is a diagram for describing an operation illustrating a state where the pit ladder device is pulled out.

[FIG. 4C] FIG. 4C is a diagram for describing an operation illustrating a state where the pit ladder device is engaged with a landing sill.

[FIG. 5] FIG. 5 is a perspective exterior view illustrating a state where the pit ladder device is engaged with the landing sill.

[FIG. 6] FIG. 6 is a front view illustrating a state where the pit ladder device is engaged with the landing sill.

[FIG. 7A] FIG. 7A is a diagram for describing an operation illustrating a process of engaging an engaging member and the landing sill.

[FIG. 7B] FIG. 7B is a diagram for describing an operation illustrating an engagement state between the engaging member and the landing sill.

[FIG. 8] FIG. 8 is a diagram schematically illustrating an elevator system which is provided in the pit ladder device of an elevator according to the embodiment of the present invention.

#### Description of Embodiment

**[0014]** Hereinbelow, embodiments of the present invention will be described on the basis of the accompanying drawings.

#### [First Embodiment]

**[0015]** FIG. 8 is a diagram schematically illustrating an elevator system which is provided in a pit ladder device of an elevator according to an embodiment of the present invention.

**[0016]** A pit 82 is provided in a lower portion of a hoistway 81 which is installed in a building. A machine room 83 is installed in an upper portion of the hoistway 81. A doorway 86 through which a passenger gets on and off a car 85 is formed in an elevator hall of each floor of a wall 84 where the hoistway 81 is formed. A protruding landing sill 87 in the hoistway is formed in a lower portion of the doorway 86. The landing sill 87 prevents a gap from being generated between the car 85 and the doorway 86, and is used to secure safety when the passenger gets on and off the car 65.

**[0017]** A winch 88 is installed in the machine room 83 and a rope 90 is suspended on a sheave 89 of the winch 88. The car 85 and a balance weight 91 are attached to

both ends of the rope 90. A control panel 92 controls the winch 88 to stop the car 85 on a predetermined floor.

**[0018]** In a pit wall 93 of the pit 82, a pit ladder device 10 according to this embodiment is provided. The pit ladder device 10 is stored in the inner side surface almost perpendicular to the front surface where the doorway 86 is installed. In addition, the pit ladder device 10 is located at a position not causing interference to the hoisting of the car 85 in the state of being stored in the wall 84. In addition, a safety switch 33 is provided to forcibly stop the hoisting of the car 85 when the pit ladder device 10 is used. The safety switch 33 is connected to the control panel 92 through a signal line 34, and controls the winch 88.

**[0019]** Next, the configuration of the pit ladder device of the elevator according to an embodiment of the present invention will be described. FIG. 1 is a perspective exterior view of the pit ladder device which is stored in the pit according to an embodiment of the present invention. FIG. 2 is a side view of the pit ladder device which is stored in the pit according to the embodiment of the present invention. FIGS. 3A and 3B are enlarged views of Portion A of FIG. 2.

**[0020]** In FIG. 1, in the pit wall 93 of the inner side surface almost perpendicular to the front surface where the doorway 86 is installed, end sides of two brackets 11 disposed vertically are fixed by bolts. One end side of a first arm member 12 is attached to the upper portion on the other end side of the bracket 11. The other end side of the bracket 11 extends toward the inside of the pit 82. The bracket 11 and the first arm member 12 are rotatably and axially supported by a rotation shaft 13. A second arm member 14 is attached to the upper portion on the other end side of the first arm member 12. The first arm member 12 and the second arm member 14 are rotatably and axially supported by a rotation shaft 15.

**[0021]** Two projections 14a and 14b are formed in the second arm member 14, and a pit ladder 16 is provided between the projections 14a and 14b. The projections 14a and 14b are formed to protrude from the pit wall 93 into the pit 82. In the pit ladder 16, L-shaped angles 17 are attached at four places up and down, and right and left.

**[0022]** The lower surfaces of the angles 17 protruding from the pit ladder 16 face the upper surfaces of the projections 14a and 14b. The angles 17 and the projections 14a and 14b (the second arm member 14) are connected by bolts 18. Compression springs 19 of a coil shape are provided as a biasing member between the angles 17 and the projections 14a and 14b (the second arm member 14) connected by the bolts 18. The compression springs 19 are disposed along the outer periphery of the bolt 18, and biased upward when viewed from the projections 14a and 14b (the second arm member 14). With the biasing force of the compression spring 19, the angles 17 move upward separated from the projections 14a and 14b (the second arm member 14), and the pit ladder 16 where the angles 17 are attached also moves upward.

Then, the lower end of the pit ladder 16 becomes floating from the lowest portion of the pit 82 (FIGS. 1 and 2).

**[0023]** In FIGS. 3A and 3B, an engaging member 20 is provided in the upper surface of the second arm member 14. The engaging member 20 is connected to the second arm member 14 by a bolt 21. A compression spring 22 of a coil shape is provided as a biasing member between the head of the bolt 21 and the upper surface of the engaging member 20. The compression spring 22 is disposed along the outer periphery of the bolt 21, and biased downward when viewed from the head side of the bolt 21. In other words, the engaging member 20 is pressed to the second arm member 14 by the biasing force of the compression spring 22.

**[0024]** A pit ladder fixing tool 30 is provided on the pit wall 93. The lower end of the pit ladder fixing tool 30 is attached to the pit wall 93 by a bolt 31, and the portion on the upper side from the attached portion is separated from the pit wall 93 to form a space. In addition, a long opening 32 is formed in the pit ladder fixing tool 30. The tip of the engaging member 20 is inserted to the opening 32. The tip of the engaging member 20 is bent downward, the tip of the engaging member 20 is hooked on the pit ladder fixing tool 30 in a state where the tip of the engaging member 20 is inserted to the opening 32, and the pit ladder 16 is fixed to the pit wall 93 (FIG. 3A).

**[0025]** In addition, the safety switch 33 is attached to the pit ladder fixing tool 30, and a switch 33a of the safety switch 33 is pushed downward in a state where the tip of the engaging member 20 is hooked on the pit ladder fixing tool 30. The information from the safety switch 33 is sent to the control panel 92 through the signal line 34 illustrated in FIG. 8, and the hoisting of the car 85 is allowed.

**[0026]** In a state where the tip of the engaging member 20 rides up on the lower end of the opening 32 against the biasing force of the compression spring 22 (FIG. 3B) and in a state where the tip of the engaging member 20 is separated from the opening 32, the switch 33a of the safety switch 33 is released and moves upward, and the information is sent to the control panel 92 through the signal line 34, so that the hoisting of the car 85 is forcibly stopped. In a state where the pit ladder device 10 is not completely stored (a state where the tip of the engaging member 20 and the opening 32 are engaged), the car 85 does not operate. Therefore, the collision between the car 85 and the pit ladder device 10, and the safety of an operator are secured.

**[0027]** As illustrated in FIG. 1, in the storage state of the pit ladder 16 (a state where the second arm member 14 and the pit ladder fixing tool 30 are engaged), the first arm member 12 is bent at about 90 degrees with respect to the bracket 11, and the second arm member 14 is bent at about 180 degrees with respect to the first arm member 12. In other words, the first arm member 12 and the second arm member 14 are overlapped and folded. Then, the tip of the engaging member 20 is hooked on the pit ladder fixing tool 30, and the storage state is held.

**[0028]** As illustrated in FIG. 1, a storage drawing rope 35 is provided between the pit ladder device 10 and the doorway 86. Both ends of the storage drawing rope are fixed to the upper surface of the engaging member 20 by a rope stopping tool 36. A storage drawing rope 35a extending from the rope stopping tool 36 is guided to a hole of a rope holding portion 87a which is provided on the lower side of the landing sill 87. A storage drawing rope 35b extending from the rope stopping tool 36 passes through a hole of a rope holding portion 30a which is provided on the upper portion of the pit ladder fixing tool 30, and is guided to the hole of the rope holding portion 87a which is provided on the lower side of the landing sill 87. Then, the storage drawing ropes 35a and 35b are connected.

**[0029]** Next, a method of pulling out the pit ladder device 10 will be described using FIGS. 4A, 4B, and 4C. FIG. 4A is a diagram for describing an operation illustrating a state where the pit ladder device is stored. FIG. 4B is a diagram for describing an operation illustrating a state where the pit ladder device is pulled out. FIG. 4C is a diagram for describing an operation illustrating a state where the pit ladder device is engaged with the landing sill.

**[0030]** First, an operator operates the control panel 92 (FIG. 8) to stop the car 85 on the upper side from the first floor. After the car 85 stops, the operator manually opens the elevator door from the elevator hall of the first floor using an unlocking key. The operator holds the storage drawing rope 35 which is hung on the lower side of the landing sill 87 by hand, pulls the storage drawing rope 35 to draw the pit ladder device 10 near to the landing sill 87. At this time, first, the operator grips the storage drawing rope 35a and pulls the storage drawing rope 35a toward the landing sill 87. Then, the rope stopping tool 36 is pulled, the tip of the engaging member 20 is lifted up against the biasing force of the compression spring 22 which biases the engaging member 20 downward, the engagement state with the pit ladder fixing tool 30 is released, and the tip of the engaging member 20 slips away from the opening 32 (FIG. 3B). The switch 33a of the safety switch 33 pressed by the engaging member 20 is released, the information is sent to the control panel 92 through the signal line 34 illustrated in FIG. 8, and the hoisting of the car 85 is not allowed. With this configuration, the car 85 does not operate during the pit ladder device 10 is used (that is, during a maintenance work of the operator), so that the safety of the operator can be secured.

**[0031]** If the storage drawing rope 35a is continuously pulled, the first arm member 12 rotates about the rotation shaft 13 in a counterclockwise direction when viewed from above, and the second arm member 14 rotates about the rotation shaft 15 in a clockwise direction when viewed from above (FIG. 4B). Further, if the storage drawing rope 35a is continuously pulled, the first arm member 12 and the second arm member 14 are aligned almost in a straight line, and the engaging member 20 is located

on the landing sill 87.

**[0032]** An engagement state between the engaging member 20 and the landing sill 87 will be described using FIGS. 5, 6, 7A, and 7B. FIG. 5 is a perspective exterior view illustrating a state where the pit ladder device is engaged with the landing sill. FIG. 6 is a front view illustrating a state where the pit ladder device is engaged with the landing sill. FIG. 7A is a diagram for describing an operation illustrating a process of engaging the engaging member and the landing sill. FIG. 7B is a diagram for describing an operation illustrating the engagement state between the engaging member and the landing sill.

**[0033]** When the engaging member 20 is located on the landing sill 87, the tip of the engaging member 20 and the landing sill 87 come into contact. Then, the tip of the engaging member 20 is lifted up against the biasing force of the compression spring 22, and rises up on the landing sill 87 (FIG. 7A). A groove 87b is formed in the landing sill 87, and the tip of the engaging member 20 rises up on the landing sill 87 falls and is fitted to the groove 87b (FIG. 7B). With this configuration, the movement of the pit ladder device 10 is fixed, and the operator can work with safety.

**[0034]** In addition, the lower end of the pit ladder 16 floats from the lowest portion of the pit 82 by the biasing force of the compression spring 19. Therefore, when the pit ladder device 10 is pulled out, the pit ladder device 10 can be easily pulled out even if there are irregularities in the lowest portion of the pit since the lower end of the pit ladder 16 does not come into contact with the irregularities.

**[0035]** As illustrated in FIG. 6, in a state where the tip of the engaging member 20 and the groove 87b are engaged, the operator uses the pit ladder 16 unstably if the lower end of the pit ladder 16 floats from the lowest portion of the pit 82. Therefore, in this embodiment, the lower end of the pit ladder 16 is configured to come into contact with the lowest portion of the pit 82 when the operator uses the pit ladder 16. If the operator puts his/her own foot on the pit ladder 16 and applies weight, the compression spring 19 contracts against the biasing force of the compression spring 19 by the weight of the operator, and the pit ladder 16 goes down. The lower end of the pit ladder 16 comes into contact with the lowest portion of the pit 82. With this configuration, the operator can go up and down the pit ladder 16 stably.

**[0036]** Next, the description will be given of an operation of storing the pit ladder device 10 after finishing the maintenance work. In the state of FIG. 5, the operator grips the storage drawing rope 35 standing on the landing sill 87 by hand, and pulls the storage drawing rope 35 to store the pit ladder device 10 into the pit ladder fixing tool 30. At this time, first, the operator grips the storage drawing rope 35b and pulls the storage drawing rope 35a toward the landing sill 87. Then, the rope stopping tool 36 is pulled, the tip of the engaging member 20 is lifted up against the biasing force of the compression spring 22 which biases the engaging member 20 downward, the

engagement state with the groove 87b of the landing sill 87 is released, and the tip of the engaging member 20 rises up on the landing sill 87 (FIG. 7A).

**[0037]** If the storage drawing rope 35b is continuously pulled, the first arm member 12 rotates about the rotation shaft 13 in a clockwise direction when viewed from above, and the second arm member 14 rotates about the rotation shaft 15 in a counterclockwise direction when viewed from above (FIG. 4B). Further, if the storage drawing rope 35a is continuously pulled, the first arm member 12 and the second arm member 14 are overlapped and folded, and the tip of the engaging member 20 and the pit ladder fixing tool 30 face.

**[0038]** Further, if the storage drawing rope 35b is pulled, the rope stopping tool 36 provided in the engaging member 20 is pulled, the tip of the engaging member 20 is lifted up against the biasing force of the compression spring 22 which biases the engaging member 20 downward, and inserted to the opening 32. The tip of the engaging member 20 and the pit ladder fixing tool 30 are engaged and fixed. Since the switch 33a of the safety switch 33 is pressed downward in a state where the tip of the engaging member 20 is hooked on the pit ladder fixing tool 30, the information from the safety switch 33 is sent to the control panel 92 through the signal line 34 illustrated in FIG. 8, and the hoisting of the car 85 is allowed.

**[0039]** As described above, according to this embodiment, the pit ladder device 10 which is provided in the inner side surface (the side surface when viewed from the doorway 86) of the pit almost perpendicular to the front surface where the doorway 86 is provided includes the first arm member 12 which is connected to the bracket 11, and the second arm member 14 which is connected to the first arm member 12 and includes the pit ladder 16. Since these components are rotatably provided, the first arm member 12 and the second arm member 14 can be overlapped and folded to be stored when the pit ladder device 10 is stored, and a depth dimension of the pit ladder device 10 can be reduced. In addition, since the first arm member 12 and the second arm member 14 can extend on almost the straight line when the pit ladder device 10 is pulled out, the pit ladder 16 can sufficiently move up to the doorway 86 even if in the pit 82, the side surface of the doorway 86 and the doorway 86 are separated. It is possible to provide the pit ladder device of the elevator which is improved in installation performance.

**[0040]** In addition, according to this embodiment, the compression spring 19 is provided in the second arm member 14 as a biasing member which biases the pit ladder 16 upward, so that the lower end of the pit ladder 16 floats from the lowest portion of the pit. Therefore, even if there are irregularities in the lowest portion of the pit when the pit ladder 16 is pulled out or stored, the lower end of the pit ladder 16 can easily move without coming into contact with the irregularities.

**[0041]** In addition, according to this embodiment, there

is provided the safety switch 33 which allows the hoisting of the car 85, and the engaging member 20 presses the safety switch 33 in a state where the pit ladder 16 is stored to allow the hoisting of the car 85. Therefore, in a state where the pit ladder device 10 is not completely stored (a state where the tip of the engaging member 20 and the opening 32 are engaged), the car 85 does not operate, so that the collision between the car 85 and the pit ladder device 10, and the safety of the operator can be secured.

**[0042]** Further, according to this embodiment, the storage drawing rope 35 passes through the rope holding portions 30a and 87a which are provided in the pit ladder fixing tool 30 and the landing sill 87 attached to the pit wall 93. Both ends of the storage drawing rope 35 are fixed by the rope stopping tool 36 provided in the engaging member 20. Therefore, it is possible to easily store and pull out the pit ladder device 10 by pulling the storage drawing rope 35 from the doorway 86.

**[0043]** Further, the present invention is not limited to the above embodiment, but various modifications may be contained. The above-described embodiment of the present invention has been described in detail in a clearly understandable way, and are not necessarily limited to those having all the described configurations.

#### Reference Signs List

##### **[0044]**

|              |                        |
|--------------|------------------------|
| 10           | pit ladder device      |
| 11           | bracket                |
| 12           | first arm member       |
| 13           | rotation shaft         |
| 14           | second arm member      |
| 14a, 14b     | projection             |
| 15           | rotation shaft         |
| 16           | pit ladder             |
| 17           | angle                  |
| 18, 21, 31   | bolt                   |
| 19, 22       | compression spring     |
| 20           | engaging member        |
| 30           | pit ladder fixing tool |
| 30a, 87a     | rope holding portion   |
| 32           | opening                |
| 33           | safety switch          |
| 33a          | switch                 |
| 34           | signal line            |
| 35, 35a, 35b | storage drawing rope   |
| 36           | rope stopping tool     |
| 81           | hoistway               |
| 82           | pit                    |
| 83           | machine room           |
| 84           | wall                   |
| 85           | car                    |
| 86           | doorway                |
| 87           | landing sill           |
| 88           | winch                  |

|    |                |
|----|----------------|
| 89 | sheave         |
| 90 | rope           |
| 91 | balance weight |
| 92 | control panel  |
| 93 | pit wall       |

#### Claims

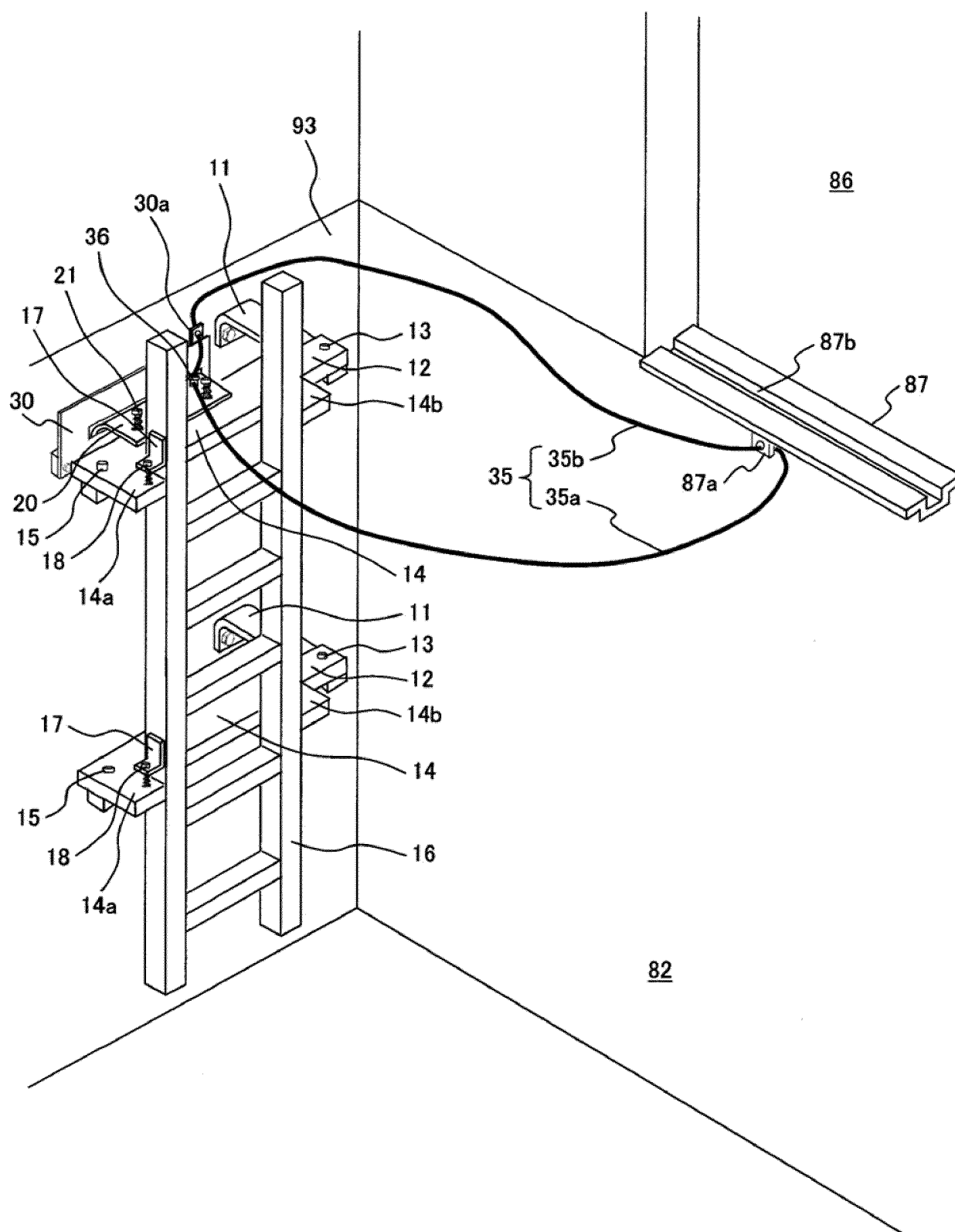
1. A pit ladder device of an elevator which is provided in an inner side surface of a pit almost perpendicular to a front surface of a doorway of the elevator, and is used by an operator to go up and down, the pit ladder device of the elevator comprising:
  - a bracket of which one end side is attached to a pit wall of the inner side surface of the pit;
  - a first arm member of which one end side is rotatably attached to the other end side of the bracket;
  - a second arm member of which one end side is rotatably attached to the other end side of the first arm member; and
  - a pit ladder which is attached to the second arm member.
2. The pit ladder device of the elevator according to claim 1, wherein a biasing member is provided in the second arm member to bias the pit ladder upward.
3. The pit ladder device of the elevator according to claim 2, wherein two projections are provided in the second arm member, the pit ladder is provided between the two projections, and the biasing member is provided in each of the two projections.
4. The pit ladder device of the elevator according to any one of claims 1 to 3, wherein a pit ladder fixing tool is provided on a wall in the pit, and wherein an engaging member to engage the pit ladder fixing tool is provided in the second arm member.
5. The pit ladder device of the elevator according to claim 4, wherein a safety switch is provided in the pit ladder fixing tool, the safety switch is pressed in a state where the pit ladder fixing tool and the engaging member are engaged.
6. The pit ladder device of the elevator according to claim 4, wherein a landing sill is provided to prevent a gap between a car and the doorway, a rope holding portion is provided in each of the landing sill and the pit ladder fixing tool, a storage drawing rope passes

through the rope holding portion, and both ends of the storage drawing rope are fixed by a rope stopping tool provided in the engaging member.

7. The pit ladder device of the elevator according to claim 6,  
wherein the engaging member is located in the landing sill in a state where the first arm member and the second arm member are aligned in almost a straight line, and a groove to engage the engaging member is provided in the landing sill. 5 10
8. A pit ladder device of an elevator which is provided in an inner side surface of a pit almost perpendicular to a front surface of a doorway of the elevator, and is used by an operator to go up and down, the pit ladder device of the elevator comprising: 15  
  
a bracket of which one end side is attached to a pit wall of the inner side surface of the pit; 20  
a first arm member of which one end side is rotatably attached to the other end side of the bracket;  
a second arm member of which one end side is rotatably attached to the other end side of the first arm member; 25  
a pit ladder which is attached to the second arm member;  
a pit ladder fixing tool which is attached to the pit wall; and 30  
an engaging member which is provided in the second arm member, and engages the pit ladder fixing tool,  
wherein, in a state where the second arm member and the pit ladder fixing tool are engaged, 35  
the first arm member is bent at about 90 degrees with respect to the bracket, and the second arm member is bent at about 180 degrees with respect to the other end of the first arm member. 40
9. The pit ladder device of the elevator according to claim 8,  
wherein an L-shaped angle is provided in the pit ladder, a lower surface of the angle and an upper surface of the second arm member face, a bolt is provided to connect the angle and the second arm member, and a biasing member is provided in an outer periphery of the bolt to bias a lower end of the pit ladder upward to make a lowest portion of the pit float. 45 50
10. The pit ladder device of the elevator according to claim 8 or 9,  
wherein a safety switch is provided in the pit ladder fixing tool, the safety switch sends, to a control panel of the elevator, a signal to allow a hoisting operation of a car in a state where the pit ladder fixing tool and the engaging member are engaged, and sends, to 55

the control panel of the elevator, a signal to forcibly stop the hoisting operation of the car in a state where an engagement with the pit ladder fixing tool and the engaging member is released.

**FIG. 1**



*FIG. 2*

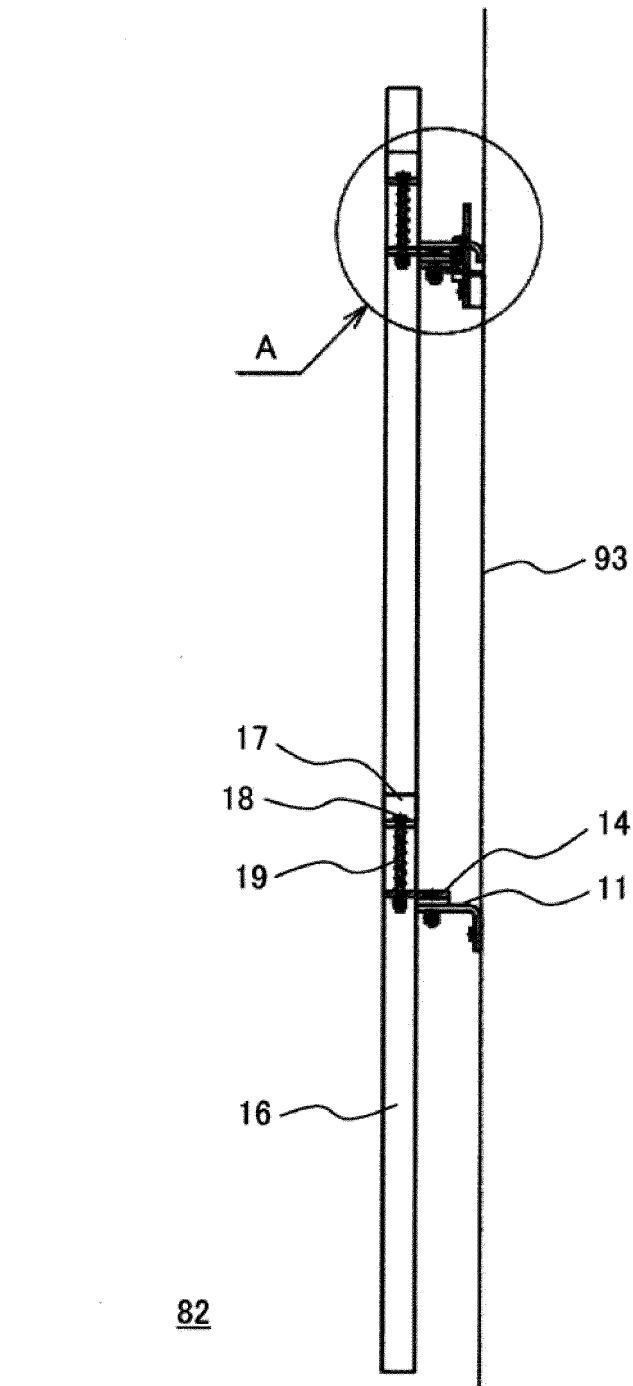


FIG. 3A

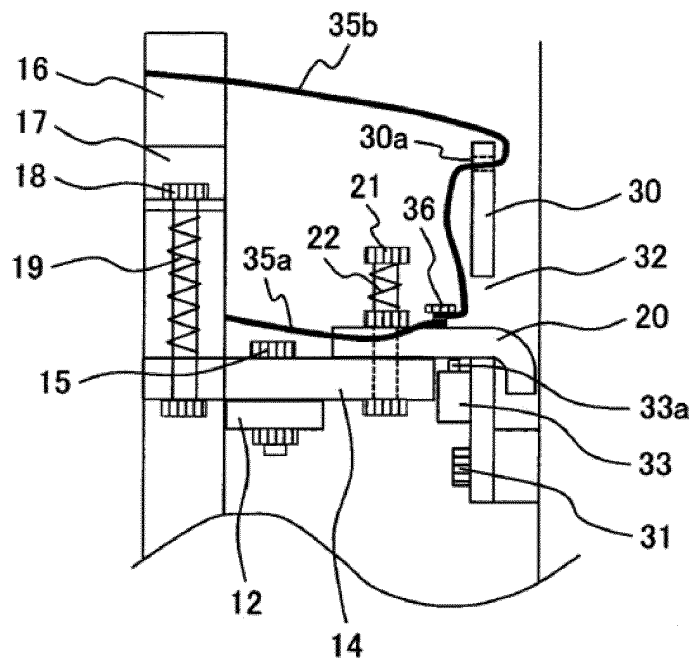


FIG. 3B

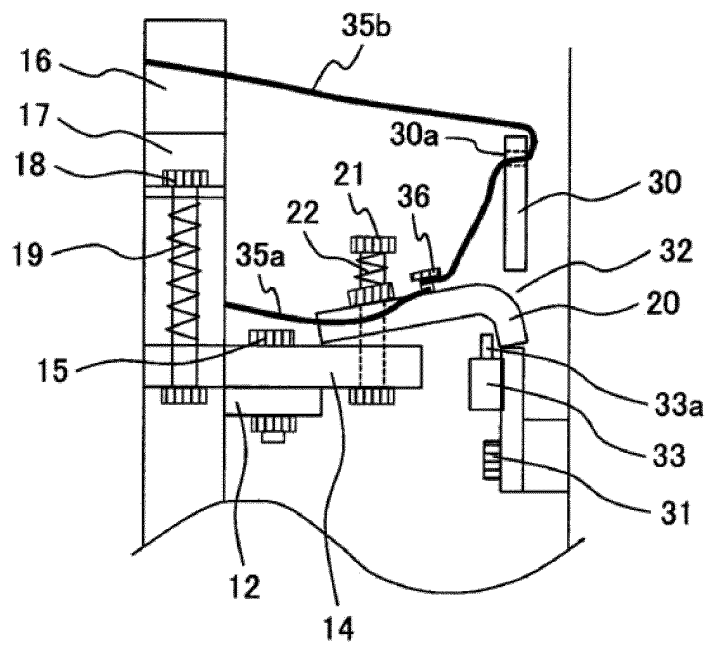


FIG. 4A

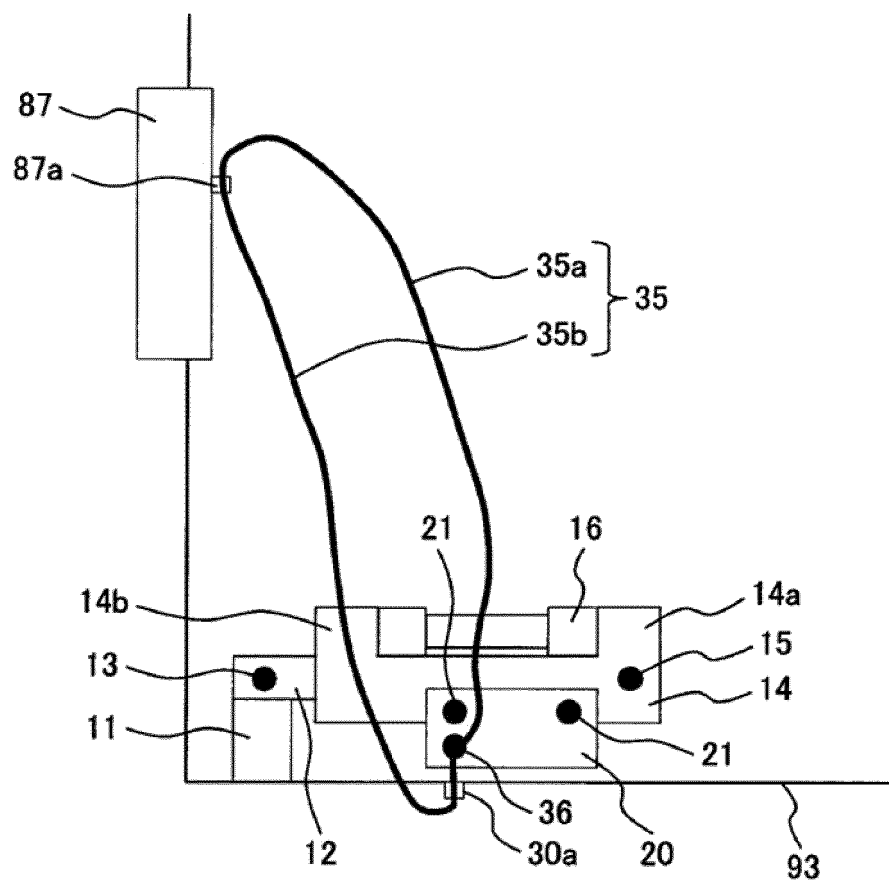


FIG. 4B

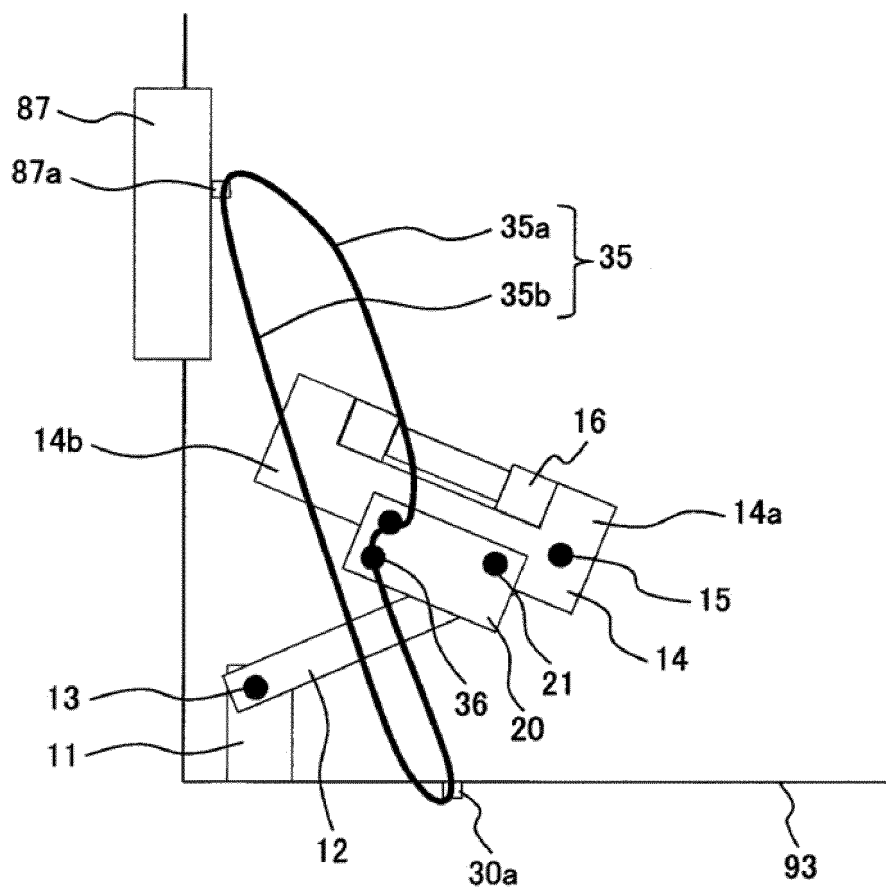
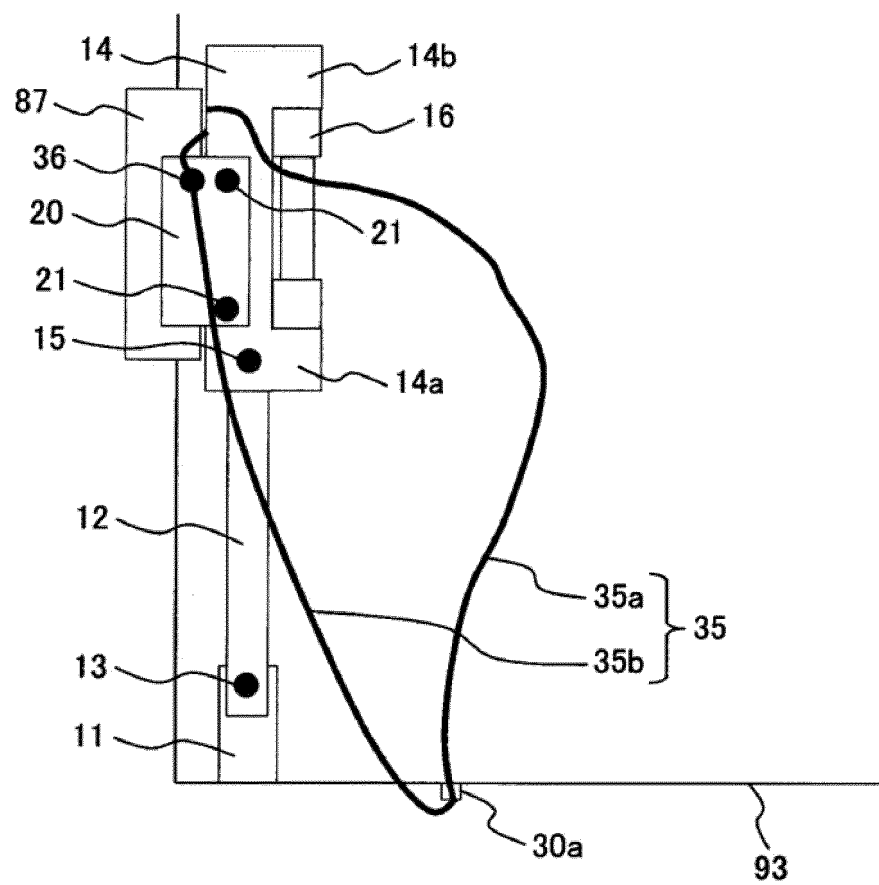


FIG. 4C



**FIG. 5**

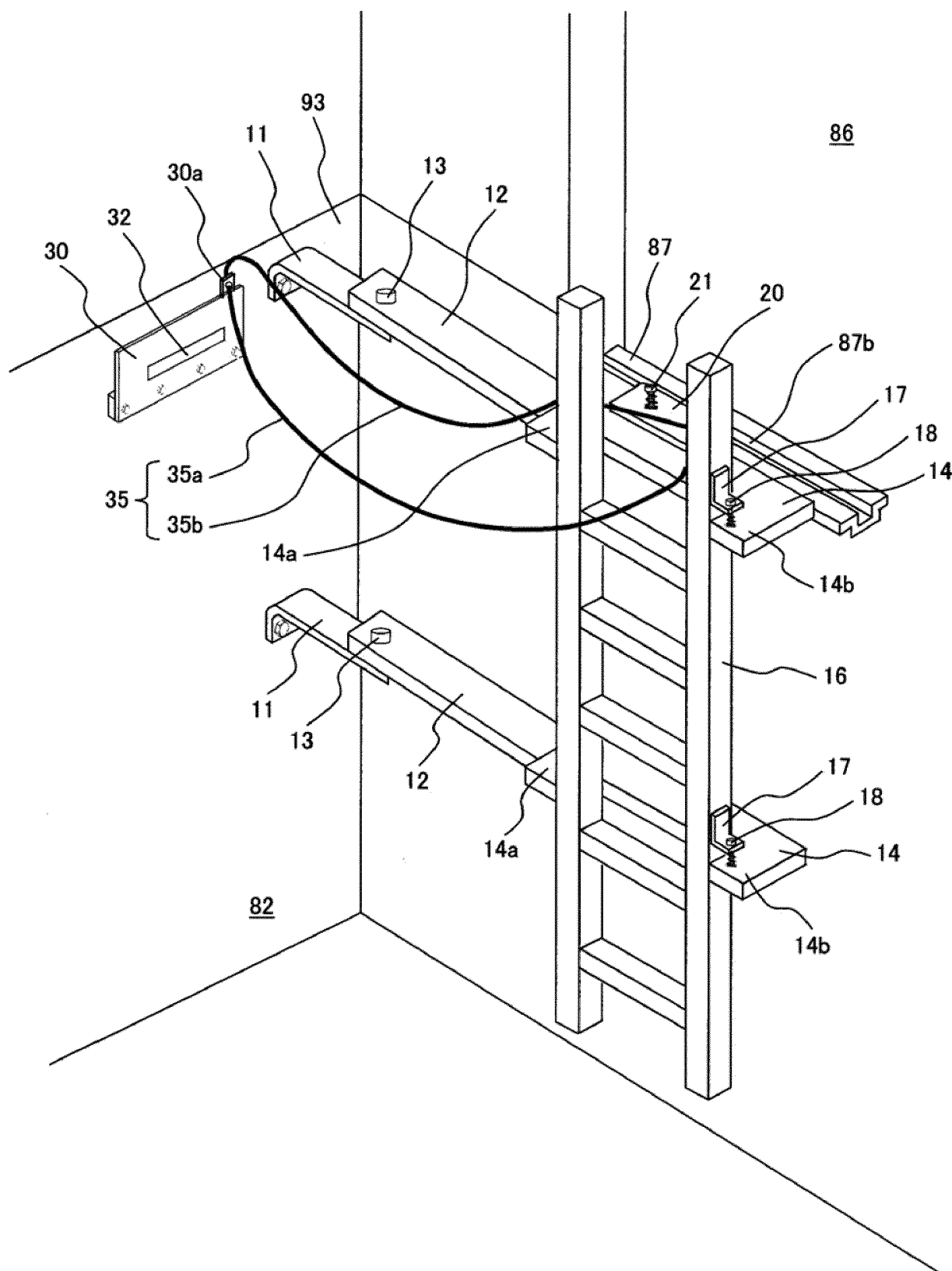
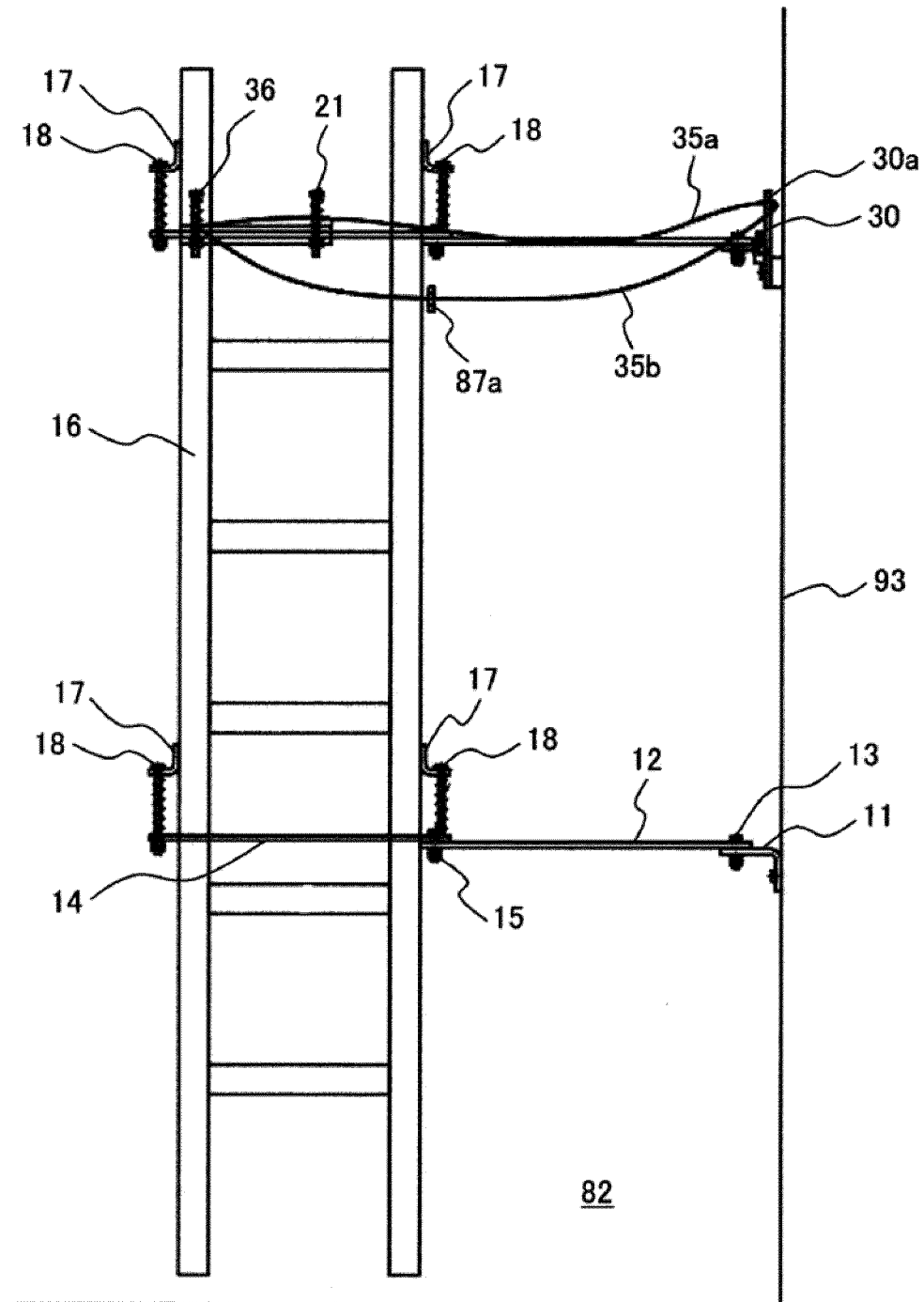
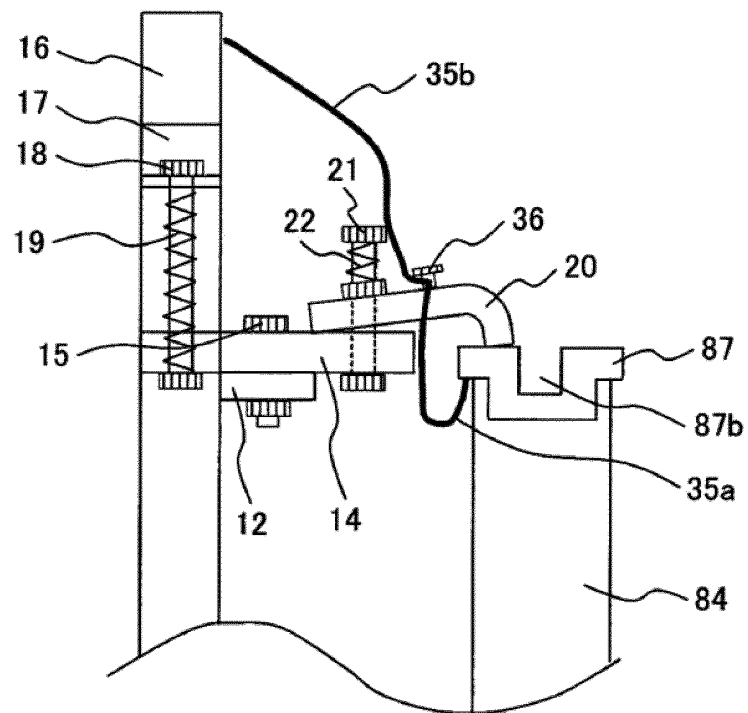


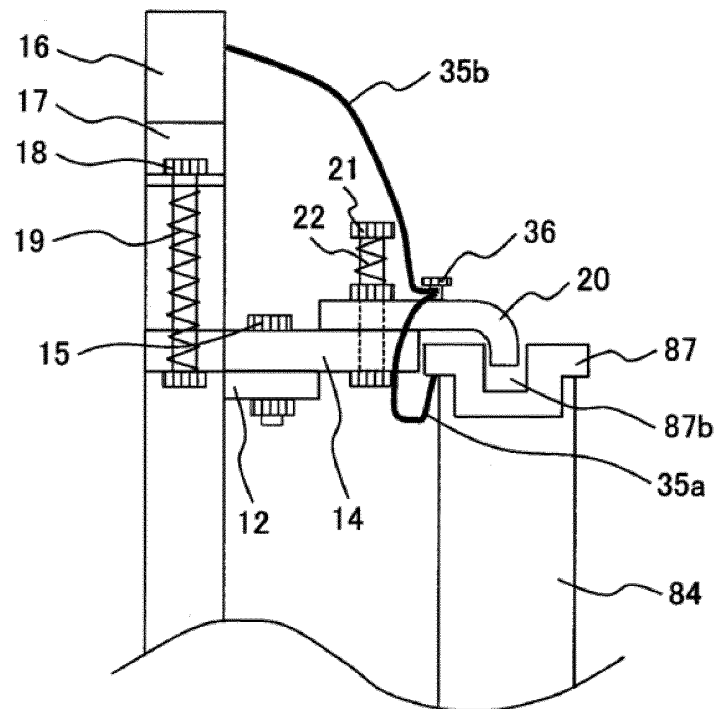
FIG. 6



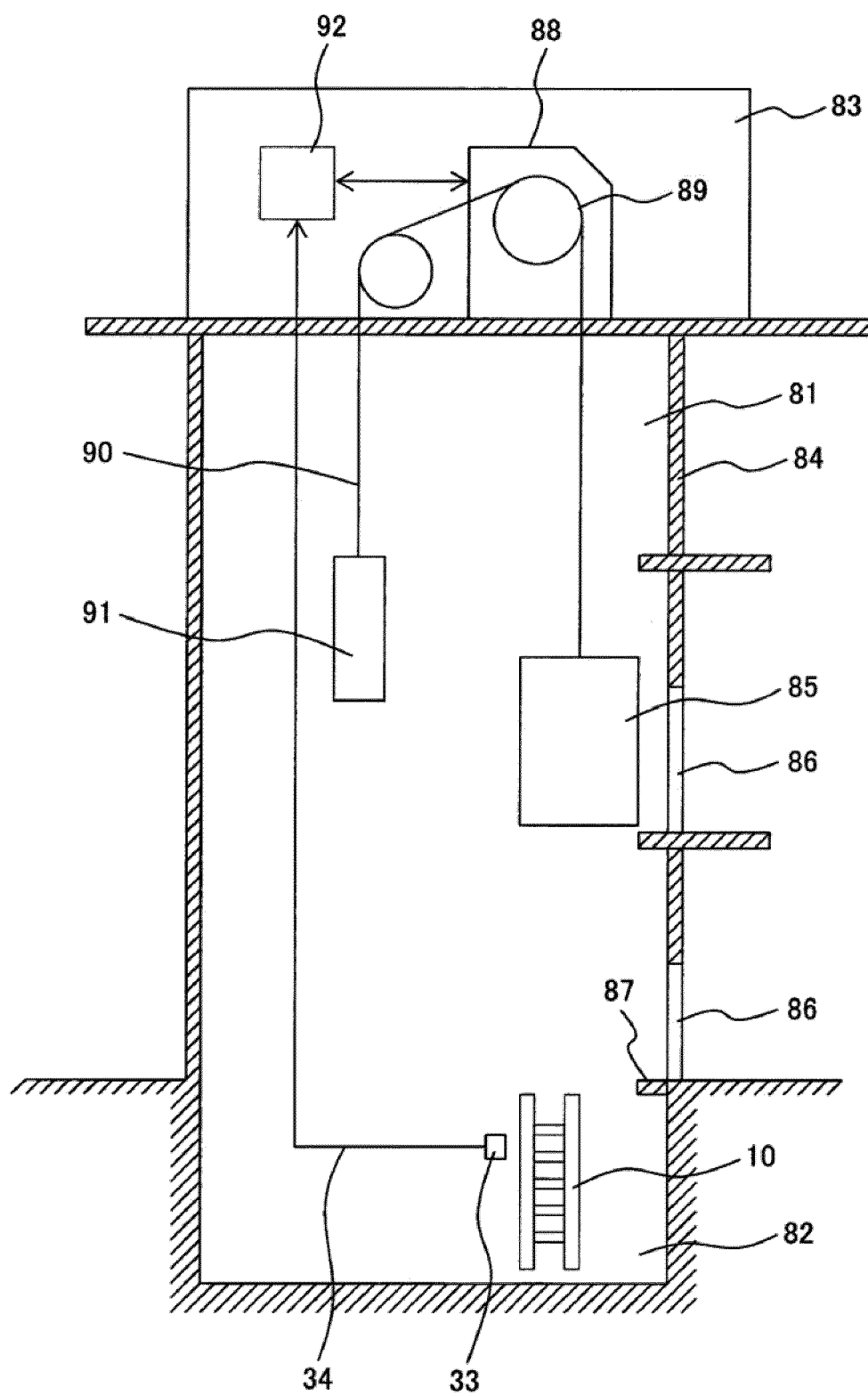
**FIG. 7A**



**FIG. 7B**



**FIG. 8**



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/021986

## A. CLASSIFICATION OF SUBJECT MATTER

B66B5/00(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)

B66B5/00-B66B5/28

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 1996-2017

Kokai Jitsuyo Shinan Koho 1971-2017 Toroku Jitsuyo Shinan Koho 1994-2017

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 2007-62862 A (Toshiba Elevator and Building Systems Corp.),<br>15 March 2007 (15.03.2007),<br>paragraphs [0033] to [0038]; fig. 6 to 8<br>(Family: none)   | 1-10                  |
| A         | JP 2016-108112 A (Toshiba Elevator and Building Systems Corp.),<br>20 June 2016 (20.06.2016),<br>paragraphs [0016] to [0029]; fig. 1 to 4<br>& CN 204588369 U | 1-10                  |
| A         | JP 2005-67883 A (Toshiba Elevator and Building Systems Corp.),<br>17 March 2005 (17.03.2005),<br>paragraphs [0038] to [0040]; fig. 1<br>(Family: none)        | 1-10                  |

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

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Date of the actual completion of the international search  
01 September 2017 (01.09.17)

Date of mailing of the international search report  
12 September 2017 (12.09.17)

Name and mailing address of the ISA/  
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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2017/021986

## 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 2009-249105 A (Mitsubishi Electric Building Techno-Service Co., Ltd.),<br>29 October 2009 (29.10.2009),<br>paragraphs [0012] to [0013]; fig. 3 to 5<br>(Family: none) | 1-10                  |
| A         | JP 2016-3104 A (Mitsubishi Electric Building Techno-Service Co., Ltd.),<br>12 January 2016 (12.01.2016),<br>paragraph [0024]; fig. 5<br>(Family: none)                   | 1-10                  |

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

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2007062862 A [0003] [0004]