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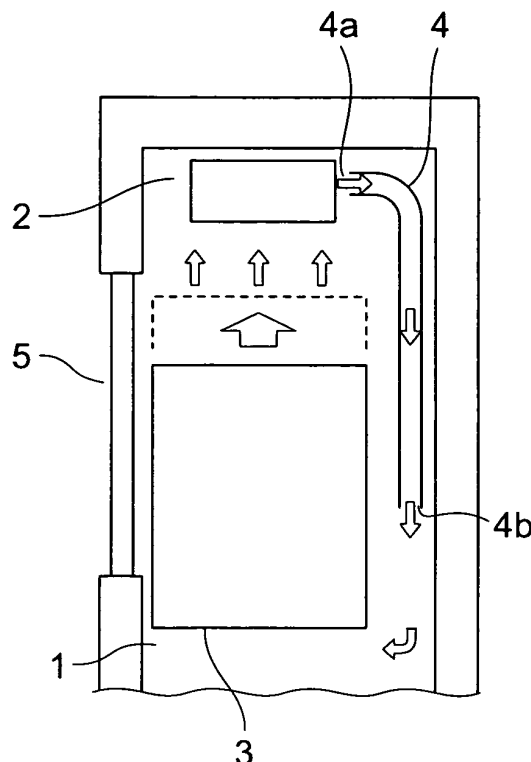
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(54) **ELEVATOR DEVICE**

(57) In an elevator apparatus, a driving machine is installed inside a hoistway. A car can be raised and lowered inside the hoistway by the driving machine. A ventilating duct is disposed inside the hoistway. The ventilating duct has: an upper portion air supply and exhaust

opening that is positioned higher than a landing entrance of an uppermost floor inside the hoistway; and a lower portion air supply and exhaust opening that is positioned lower than the upper portion air supply and exhaust opening inside the hoistway.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a machine-roomless elevator apparatus in which a driving machine is installed inside a hoistway.

BACKGROUND ART

[0002] In conventional machine-roomless elevator apparatuses, ventilation apparatuses are often generally unnecessary, but ventilation apparatuses are required if the temperature around a driving machine rises, etc. In answer to this, to allow for economy, etc., an elevator apparatus has been proposed in which the inside of a hoistway and the inside of a car are ventilated by a ventilation apparatus in the car while a car door is open when the car has stopped at an uppermost floor (see Patent Document 1, for example).

[0003] Patent Document 1: Japanese Patent Laid-Open No. 2001-72347

DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004] However, in conventional elevator apparatuses such as that described above, since ventilation of a top portion of the hoistway can only be performed when the car stops at the uppermost floor, there has been a risk that the temperature in the top portion of the hoistway will increase, making the service life of machinery that is installed in the top portion of the hoistway shorter. Furthermore, it is necessary for the car to be stopped at the uppermost floor for a long time with the door open in order for ventilation of the top portion of the hoistway to be performed satisfactorily, reducing availability of the elevator apparatus.

[0005] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator apparatus that enables temperature increases in a top portion of a hoistway to be suppressed efficiently.

MEANS FOR SOLVING THE PROBLEM

[0006] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator apparatus including: a driving machine that is installed inside a hoistway; a car that can be raised and lowered inside the hoistway by the driving machine; and a ventilating duct that has an upper portion air supply and exhaust opening that is positioned higher than a landing entrance of an uppermost floor inside the hoistway, and a lower portion air supply and exhaust opening that is positioned lower than the upper portion air supply and exhaust opening inside the hoistway.

According to another aspect of the present invention, there is provided an elevator apparatus including: a driving machine that is installed inside a hoistway; a car and a counterweight that can be raised and lowered inside the hoistway by the driving machine; and a partitioning plate that has an upper end portion that is positioned higher than a landing entrance of an uppermost floor inside the hoistway, and a lower end portion that is positioned lower than the upper end portion inside the hoistway, the partitioning plate being disposed between a hoisting zone of the car and a hoisting zone of the counterweight.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Figure 1 is a structural diagram that shows part of an elevator apparatus according to Embodiment 1 of the present invention;

Figure 2 is a structural diagram that shows a state as a car of the elevator apparatus in Figure 1 descends;

Figure 3 is a graph that shows relationships between distance from a hoistway ceiling in Figure 1 and temperature;

Figure 4 is a structural diagram that shows part of an elevator apparatus according to Embodiment 2 of the present invention;

Figure 5 is a structural diagram that shows part of an elevator apparatus according to Embodiment 3 of the present invention;

Figure 6 is a structural diagram that shows part of an elevator apparatus according to Embodiment 4 of the present invention; and

Figure 7 is a structural diagram that shows part of an elevator apparatus according to Embodiment 5 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0008] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0009] Figure 1 is a structural diagram that shows part of an elevator apparatus according to Embodiment 1 of the present invention. In the figure, a driving machine 2 is installed in an upper portion inside a hoistway 1 (a hoistway top portion). The driving machine 2 has: a drive sheave; a motor portion that rotates the drive sheave; and a brake portion that brakes rotation of the drive sheave. The driving machine 2 is disposed such that a rotating shaft of the drive sheave is vertical or approximately vertical. In addition, a thin hoisting machine that has a shorter axial dimension than a dimension that is perpendicular to an axial direction is used for the driving

machine 2. The driving machine 2 is supported by a supporting beam (not shown) that is fixed to the hoistway top portion.

[0010] A car 3 and a counterweight (not shown) are suspended inside the hoistway 1 by a main rope (not shown) that is wound around the drive sheave, and are raised and lowered inside the hoistway 1 by a driving force from the driving machine 2.

[0011] A ventilating duct 4 for ventilating the hoistway top portion is installed in an upper portion inside the hoistway 1. The ventilating duct 4 has: an upper portion air supply and exhaust opening 4a that is positioned higher than a landing entrance 5 of an uppermost floor inside the hoistway 1; and a lower portion air supply and exhaust opening 4b that is positioned lower than the upper portion air supply and exhaust opening 4a inside the hoistway 1.

[0012] The upper portion air supply and exhaust opening 4a is positioned in the hoistway top portion and faces a side surface of the driving machine 2. The lower portion air supply and exhaust opening 4b is positioned above a floor surface level of the uppermost floor inside the hoistway 1 and opens directly downward. Specifically, the ventilating duct 4 is bent approximately at a right angle in a vicinity of the upper portion air supply and exhaust opening 4a such that an end portion near the upper portion air supply and exhaust opening 4a of the ventilating duct 4 is horizontal and an end portion near the lower portion air supply and exhaust opening 4b is vertical. An upper end portion of the ventilating duct 4 is fixed to the supporting beam that supports the driving machine 2. Specifically, a driving machine mount portion to which the driving machine 2 is mounted and a duct mount portion to which the ventilating duct 4 is mounted are disposed on the supporting beam.

[0013] In an elevator apparatus of this kind, when the car 3 is raised inside the hoistway 1, air in an upper portion inside the hoistway 1 is pushed by the car 3 and flows down through the ventilating duct 4, as indicated by arrows in Figure 1. When the car 3 is lowered, on the other hand, warm air in the top portion of the hoistway is lowered with the car 3 and comparatively cold air is raised through the ventilating duct 4, as indicated by arrows in Figure 2. Temperature increases in the vicinity of the hoistway top portion are thereby suppressed efficiently, ensuring a temperature safety margin for machinery that is disposed in the hoistway top portion such as the driving machine 2, etc., enabling service life of the machinery to be extended.

[0014] Figure 3 is a graph that shows relationships between distance from a hoistway ceiling in Figure 1 and temperature, the broken line representing a case in which ventilation that uses the ventilating duct 4 is not performed and the solid line representing a case in which ventilation that uses the ventilating duct 4 is performed. If ventilation is not performed, the temperature in the top portion of the hoistway is highest at the ceiling portion and decreases rapidly in the vicinity of the landing entrance 5 of the uppermost floor, as indicated by the broken

line in Figure 3. In contrast, if ventilation is performed, the temperature in the top portion of the hoistway can be reduced, as indicated by the solid line in Figure 3. Furthermore, since ventilation between a landing and a vicinity of the landing entrance 5 is easily performed by opening and closing the door, temperature increases are only slight even if warm air from the top portion of the hoistway is conveyed there by the ventilating duct 4.

[0015] Here, since aperture area of the upper portion air supply and exhaust opening 4a of the ventilating duct 4 is sufficiently smaller than a vertical footprint area of the car 3, airflow velocity inside the ventilating duct 4 will be sufficiently faster than a traveling speed of the car 3 if flow channels of air that might flow outside the ventilating duct 4 due to ascent and descent of the car 3 are blocked as much as possible. If, for example, the vertical footprint area of the car 3 is ten times the aperture area of the upper portion air supply and exhaust opening 4a then, ignoring loss, the airflow velocity inside the ventilating duct 4 will be ten times the traveling speed of the car 3.

[0016] Thus, by increasing the airflow velocity inside the ventilating duct 4 and disposing the upper portion air supply and exhaust opening 4a so as to face machinery that is disposed in the hoistway top portion such as the driving machine 2, etc., a cooling airflow can be blown onto the machinery in the top portion of the hoistway as the car 3 descends, enabling the machinery to be cooled efficiently. Fans that are disposed on the machinery in the top portion of the hoistway can thereby be reduced in size or eliminated, enabling the machinery to be reduced in size.

Embodiment 2

[0017] Next, Figure 4 is a structural diagram that shows part of an elevator apparatus according to Embodiment 2 of the present invention. In the figure, a control apparatus 6 that controls a driving machine 2 is installed inside a hoistway 1. The control apparatus 6 is fixed to a hoistway wall so as to be approximately equal in height to an uppermost floor. A cooling fan 7 is disposed on the control apparatus 6.

[0018] A lower portion air supply and exhaust opening 4b is disposed so as to face an upper surface of the control apparatus 6. A plurality of electrical wires (not shown) that connect the control apparatus 6 and the driving machine 2 are inserted through and accommodated in a ventilating duct 4. In other words, the ventilating duct 4 also serves as a wiring duct. The rest of the configuration is similar to that of Embodiment 1.

[0019] In an elevator apparatus of this kind, because the control apparatus 6 is disposed so as to face the lower portion air supply and exhaust opening 4b, ventilation of the top portion of the hoistway can be performed through the ventilating duct 4 by driving the cooling fan 7 of the control apparatus 6 even when the car 3 has stopped or is being raised and lowered at lower floors,

etc., enabling temperature increases in the top portion of the hoistway to be suppressed efficiently.

Because the ventilating duct 4 also serves as a wiring duct, costs can be reduced and effective utilization of space can be achieved.

Embodiment 3

[0020] Next, Figure 5 is a structural diagram that shows part of an elevator apparatus according to Embodiment 3 of the present invention. In the figure, a driving machine 12 is installed in an upper portion inside a hoistway 11 (a hoistway top portion). The driving machine 12 has: a drive sheave; a motor portion that rotates the drive sheave; and a brake portion that brakes rotation of the drive sheave. The driving machine 12 is disposed such that a rotating shaft of the drive sheave is horizontal. In addition, the driving machine 12 is supported by a supporting beam (not shown) that is fixed to the hoistway top portion.

[0021] A deflection sheave 13 is disposed in a vicinity of the driving machine 12. A main rope 14 is wound around the drive sheave and the deflection sheave 13. A car 15 and a counterweight 16 are suspended inside the hoistway 11 by the main rope 14, and are raised and lowered inside the hoistway 11 by a driving force from the driving machine 12.

[0022] A control apparatus 17 that controls the driving machine 12 is installed in the hoistway top portion. The control apparatus 17 is fixed to a hoistway wall in the hoistway top portion. A flat partitioning plate 18 is installed between a hoisting zone of the car 15 and a hoisting zone of the counterweight 16 in an upper portion inside the hoistway 11. The partitioning plate 18 blocks circulation of air between those two zones. The partitioning plate 18 has: an upper endportion 18a that is positioned higher than a landing entrance 5 of an uppermost floor inside the hoistway 11; and a lower end portion 18b that is positioned lower than the upper end portion 18a of the partitioning plate 18 inside the hoistway 11.

[0023] The upper end portion 18a is disposed between the driving machine 12 and the deflection sheave 13. The lower end portion 18b is positioned higher than a floor surface level of the uppermost floor. The partitioning plate 18 is fixed to at least one hoistway wall, or to the supporting beam, or to a combination thereof.

[0024] In an elevator apparatus of this kind, when the car 15 is raised inside the hoistway 11 and the counterweight 16 is lowered, an air current such as that indicated by arrows in Figure 5 arises inside the hoistway 11, warm air in the hoistway top portion flows down through a passage near the counterweight 16, and cool air below flows upward with the car 15. On the other hand, when the car 15 is lowered and the counterweight 16 is raised, warm air in the hoistway top portion flows downward with the car 15 and cool air below flows upward through the passage near the counterweight 16.

[0025] Temperature increases in the vicinity of the

hoistway top portion are thereby suppressed efficiently, ensuring a temperature safety margin for machinery that is disposed in the hoistway top portion such as the driving machine 2, etc., enabling service life of the machinery to be extended. The air current can also be regulated by the partitioning plate 18, enabling hoisting resistance of the car 15 to be reduced.

Embodiment 4

[0026] Next, Figure 6 is a structural diagram that shows part of an elevator apparatus according to Embodiment 4 of the present invention. In this example, a lower end portion 18b of a partitioning plate 18 is positioned lower than that of Embodiment 3. In other words, a vertical dimension of the partitioning plate 18 is longer than that of Embodiment 3. Specifically, the lower end portion 18b is positioned in a vicinity of a floor that is two floors lower than an uppermost floor. The rest of the configuration is similar to that of Embodiment 3.

[0027] In an elevator apparatus of this kind, a range over which air inside the hoistway 11 is agitated by raising and lowering the car 15 and the counterweight 16 is increased. Consequently, the temperature of the warm air flowing downward from the hoistway top portion is gradually reduced by a hoistway wall, which functions as a radiating surface 19. Temperature increases in the vicinity of the hoistway top portion are thereby suppressed more reliably.

Embodiment 5

[0028] Next, Figure 7 is a structural diagram that shows part of an elevator apparatus according to Embodiment 5 of the present invention. In the figure, a ventilating duct 4 similar to that of Embodiment 1 is installed in an upper portion inside a hoistway 1. A cooling fan 21 is disposed inside the ventilating duct 4. A temperature detector 22 for detecting hoistway top portion temperature is disposed on a ceiling portion of the hoistway 1. Detection signals from the temperature detector 22 are input into the control apparatus 17.

[0029] The control apparatus 17 detects the hoistway top portion temperature based on the signals from the temperature detector 22. If the hoistway top portion temperature reaches a preset temperature, the control apparatus 17 moves the car 15 to an upper floor to perform a ventilation operation by raising and lowering the car 15 and the counterweight 16. If the car 15 cannot be moved to an upper floor, or if the car 15 must be stopped, the control apparatus 17 drives the cooling fan 21 to ventilate the hoistway top portion forcibly. The rest of the configuration is similar to that of Embodiment 3.

[0030] In an elevator apparatus of this kind, temperature increases in a vicinity of the hoistway top portion can be suppressed efficiently while giving priority to service to passengers.

[0031] Moreover, in the above examples, the driving

machine 2 or 12 is disposed in the hoistway top portion, but a driving machine may also be disposed in another position inside the hoistway such as a hoistway floor portion, for example. In that case, the hoistway top portion is still ventilated and temperature increases in machinery that is disposed in the hoistway top portion can be suppressed.

The driving machine may also be a long, slender hoisting machine in which an axial dimension is longer than a dimension that is perpendicular to an axial direction, enabling similar effects to be achieved.

In addition, in the above examples, a single ventilating duct 4 was used, but a plurality of ventilating ducts may also be used.

In the above examples, a single upper portion air supply and exhaust opening 4a was disposed on a single ventilating duct 4, but a ventilating duct that has a plurality of upper portion air supply and exhaust openings may also be used. Similarly, a ventilating duct that has a plurality of lower portion air supply and exhaust openings may also be used.

If the upper portion air supply and exhaust opening of the ventilating duct is made to face the driving machine, extension of service life of a comparatively weak encoder (a rotation detector that generates signals that correspond to rotation of the motor portion) that is disposed on the driving machine can be achieved by making the upper portion air supply and exhaust opening face the encoder.

Claims

1. An elevator apparatus comprising:

a driving machine that is installed inside a hoistway;
a car that can be raised and lowered inside the hoistway by the driving machine; and
a ventilating duct that has an upper portion air supply and exhaust opening that is positioned higher than a landing entrance of an uppermost floor inside the hoistway, and a lower portion air supply and exhaust opening that is positioned lower than the upper portion air supply and exhaust opening inside the hoistway.

2. The elevator apparatus according to Claim 1, wherein the driving machine is disposed so as to face the upper portion air supply and exhaust opening in a hoistway top portion.

3. The elevator apparatus according to Claim 2, wherein the ventilating duct also serves as a wiring duct that accommodates wiring that is connected to the driving machine.

4. The elevator apparatus according to Claim 1, where-

in a cooling fan is disposed on the ventilating duct.

5. The elevator apparatus according to Claim 1, further comprising a control apparatus that has a cooling fan, that is installed inside the hoistway so as to face the lower portion air supply and exhaust opening and that controls the driving machine.

6. The elevator apparatus according to either of Claims 4 or 5, wherein the cooling fan is driven if a hoistway top portion temperature has reached a preset temperature.

7. An elevator apparatus comprising:

a driving machine that is installed inside a hoistway;
a car and a counterweight that can be raised and lowered inside the hoistway by the driving machine; and
a partitioning plate that has an upper end portion that is positioned higher than a landing entrance of an uppermost floor inside the hoistway, and a lower end portion that is positioned lower than the upper end portion inside the hoistway, the partitioning plate being disposed between a hoisting zone of the car and a hoisting zone of the counterweight.

8. The elevator apparatus according to either of Claims 1 or 7, further comprising a control apparatus that controls the driving machine, the control apparatus moving the car to an upper floor if a hoistway top portion temperature has reached a preset temperature to perform a ventilation operation by raising and lowering the car and the counterweight.

FIG. 1

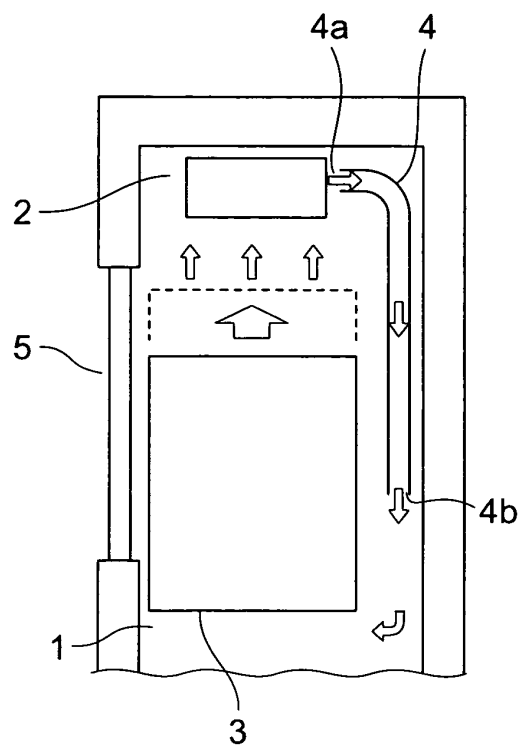


FIG. 2

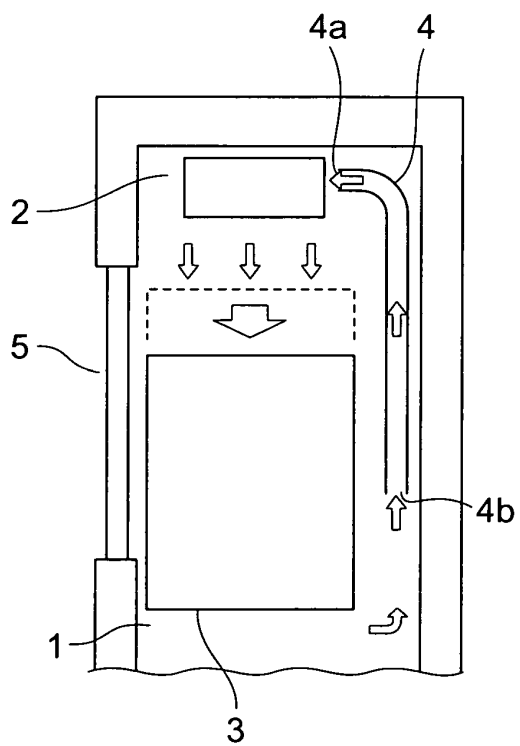


FIG. 3

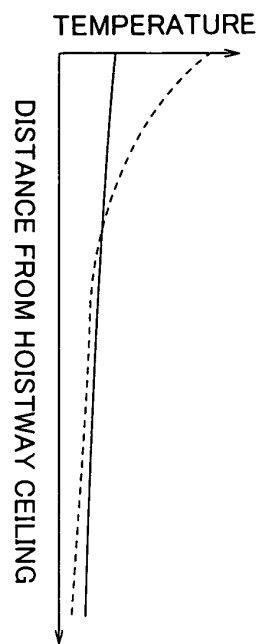


FIG. 4

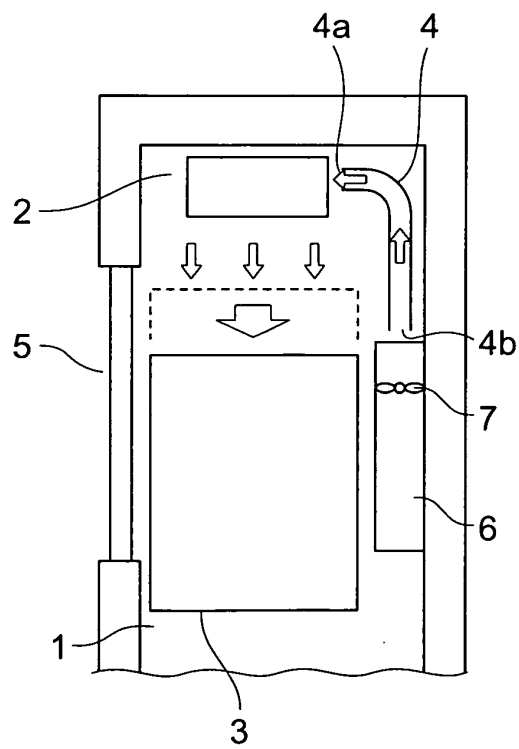


FIG. 5

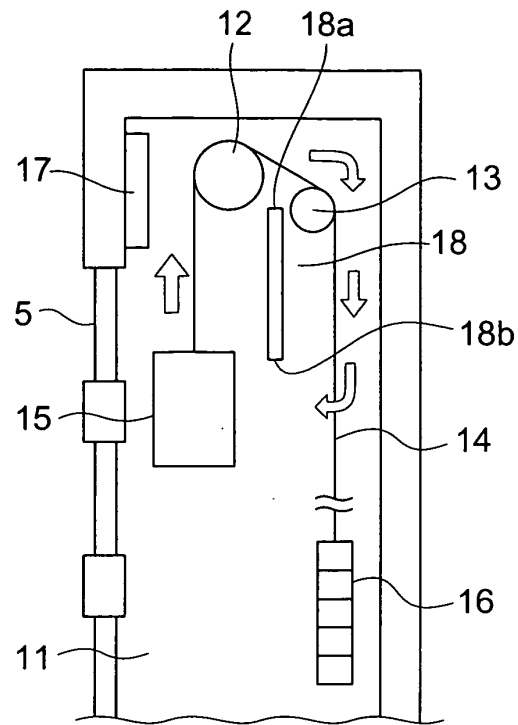


FIG. 6

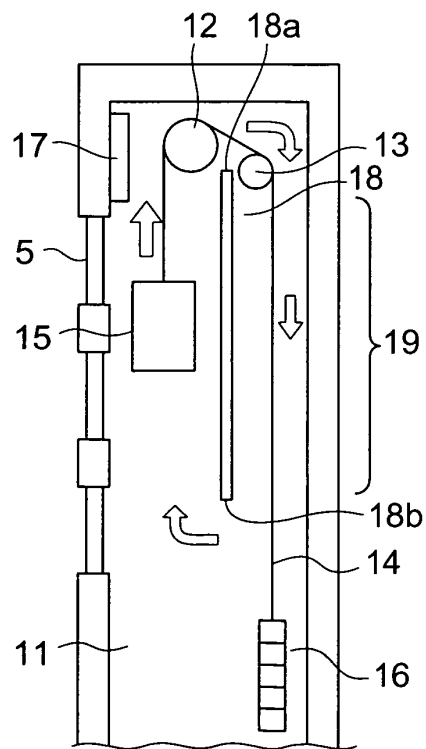
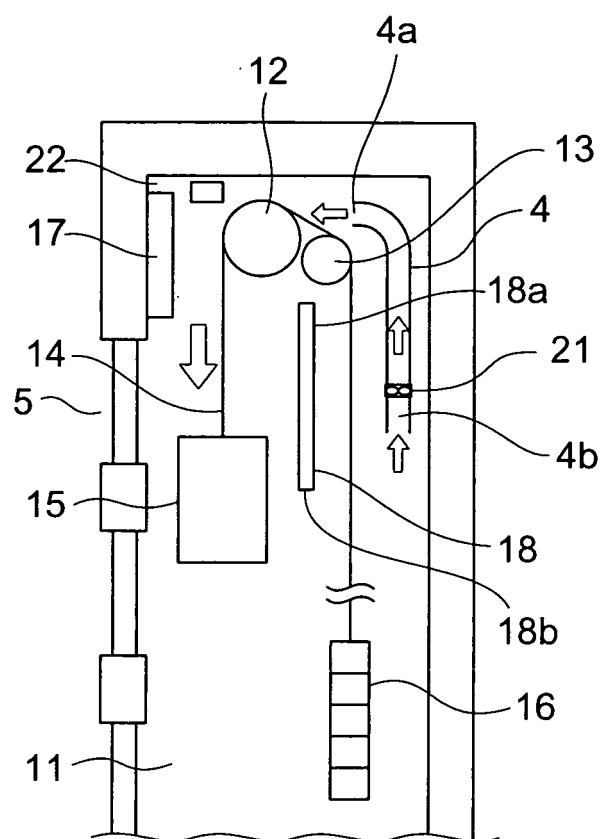


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/021442

A. CLASSIFICATION OF SUBJECT MATTER

B66B7/00(2006.01) i, B66B1/06(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)

B66B7/00, B66B1/06

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	1996-2006
Kokai Jitsuyo Shinan Koho	1971-2006	Toroku Jitsuyo Shinan Koho	1994-2006

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.
X Y A	JP 2001-072353 A (Mitsubishi Electric Corp.), 21 March, 2001 (21.03.01), Claims 1 to 3; Par. Nos. [0004], [0013], [0018] to [0019]; Figs. 1 to 3 (Family: none)	1-2, 7 4-6, 8 3
X Y	JP 48-009324 Y1 (Tokyo Shibaura Electric Co., Ltd.), 12 March, 1973 (12.03.73), Claim 1; Figs. 1 to 2 (Family: none)	1 4-6
Y	JP 06-227757 a (Kabushiki Kaisha Hitachi Building System Service), 16 August, 1994 (16.08.94), Par. Nos. [0013] to [0014] (Family: none)	8

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Date of the actual completion of the international search

21 August, 2006 (21.08.06)

Date of mailing of the international search report

29 August, 2006 (29.08.06)

Name and mailing address of the ISA/
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2001072347 A [0003]