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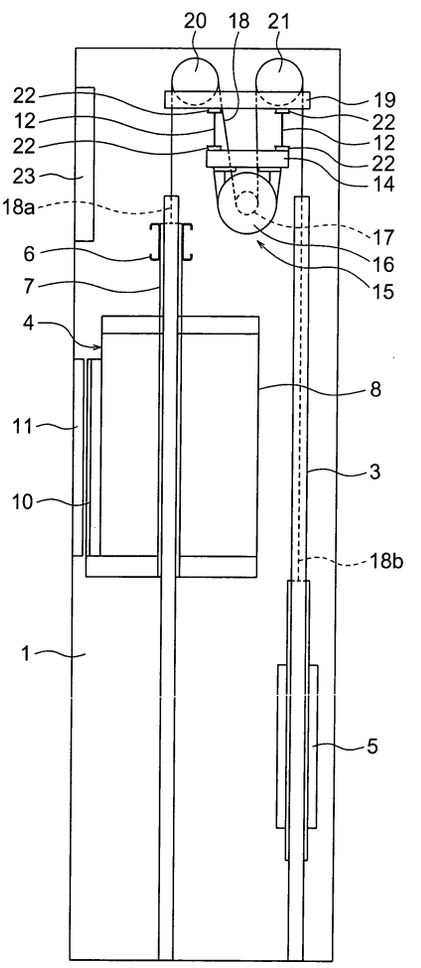
(54) ELEVATOR EQUIPMENT

(57) In an elevator apparatus, a car deflector sheave that guides main ropes from a driving sheave to a car, and a counterweight deflector sheave that guides the main ropes from the driving sheave to the counterweight are disposed in upper portions within a hoistway. The driving sheave, the car deflector sheave, and the counterweight deflector sheave are disposed such that their rotation axes extend in parallel with each other. A driving apparatus is disposed in a position which is located lower than the car deflector sheave and the counterweight deflector sheave and where the driving apparatus does not overlap with an upper beam in a vertical projection plane thereof.

FIG. 1



EP 1 568 644 A1

Description

Technical Field

[0001] The present invention relates to a machine room-less elevator apparatus in which a driving apparatus for causing a car and a counterweight to ascend and descend is disposed in an upper portion within a hoistway.

Background Art

[0002] With a conventional machine room-less elevator disclosed in JP 2002-80178 A, for example, a driving apparatus and a deflector sheave are disposed in an upper portion within a hoistway. A plurality of main ropes are wound around a driving sheave of the driving apparatus and the deflector sheave. In order to increase a traction force by increasing an angle at which the main ropes are wound around the driving sheave, the main ropes are wound around the driving sheave such that portions thereof extending to the car cross with portions thereof which extend to the deflector sheave. The driving apparatus is attached to a machine base such that a rotation axis of the driving sheave is inclined with respect to a rotation axis of the deflector sheave, so that the portions extending to the car and the portions extending to the deflector sheave do not interfere with each other.

[0003] Since the rotation axis of the driving sheave is thus inclined with respect to the rotation axis of the deflector sheave in the conventional elevator apparatus, it is necessary to attach the driving apparatus to the machine base at an incline. Thus, adjustment of the attachment angle takes time and trouble. Further, an angle at which the main ropes enter rope grooves of the driving sheave becomes large, and there is a fear that the lifetime of the main ropes will become short due to friction with the rope grooves.

[0004] Further, the driving apparatus is disposed in an uppermost portion within the hoistway, and therefore it is necessary to extend a space within the hoistway upward for cases where the driving apparatus is made larger, and the size of the hoistway becomes larger in the vertical direction.

Disclosure of the Invention

[0005] The present invention has been made in order to solve the problems described above. An object of the present invention is to obtain an elevator apparatus in which work for installing a driving apparatus and a deflector sheave is easy, in which wear of main ropes due to contact with rope grooves can be suppressed, and further, in which the size in a vertical direction of a hoistway can be made smaller.

[0006] To this end, according to one aspect of the present invention, there is provided an elevator apparatus comprising: a driving apparatus disposed in an upper portion within a hoistway, the driving apparatus having a motor portion and a driving sheave that is rotated by the motor portion; a main rope that is wound around the driving sheave, the main rope having a first end portion and a second end portion; a car that is suspended from the first end portion, the car having a car frame that includes an upper beam, and a cage that is supported by the car frame below the upper beam; and a counterweight that is suspended from the second end portion, wherein: a car def lector sheave that guides the main rope from the driving sheave to the car, and a counterweight deflector sheave that guides the main rope from the driving sheave to the counterweight are disposed in the upper portion within the hoistway; the driving sheave, the car deflector sheave, and the counterweight deflector sheave are disposed such that their rotation axes extend in parallel with each other; and the driving apparatus is disposed in a position which is located lower than the car deflector sheave and the counterweight deflector sheave and where the driving apparatus does not overlap with the upper beam in a vertical projection plane thereof.

Brief Description of the Drawings

[0007]

Fig. 1 is a side view that shows an elevator apparatus according to Embodiment 1 of the present invention;
Fig. 2 is a plan view that shows the elevator apparatus of Fig. 1;
Fig. 3 is a front view that shows a hoistway top portion of Fig. 1;
Fig. 4 is an explanatory diagram that shows an example of a relationship between a diameter of a driving sheave of Fig. 1 and diameters of a deflector sheave and a counterweight deflector sheave;
Fig. 6 is a side view that shows main portions of an elevator apparatus according to Embodiment 2 of the present invention; and
Fig. 7 is a side view that shows an elevator apparatus according to Embodiment 3 of the present invention.

Best Mode for carrying out the Invention

[0008] Preferred embodiments of the present invention are explained below while referring to the drawings.

Embodiment 1

[0009] Fig. 1 is a side view that shows an elevator apparatus (1:1 roping type machine room-less elevator) according to Embodiment 1 of the present invention, Fig. 2 is a plan view that shows the elevator apparatus of Fig. 1, and Fig. 3 is a front view that shows a top por-

tion of a hoistway of Fig. 1.

[0010] In the figures, a pair of car guide rails 2 and a pair of counterweight guide rails 3 are installed within a hoistway 1. A car 4 ascends and descends within the hoistway 1, guided by the car guide rails 2. The counterweight 5 ascends and descends within the hoistway 1, guided by the counterweight guide rails 3.

[0011] The car 4 has a car frame 7 that includes an upper beam 6, and a cage 8 that is supported by the car frame 7 below the upper beam 6. A plurality of guide shoes 9 that are engaged with the car guide rails 3 are mounted to the car frame 7. A car door apparatus 10 that opens and closes a car entrance (not shown) is provided in a front surface of the cage 8. A landing hall door apparatus 11 that opens and closes a landing hall entrance (not shown) is provided in a landing hall.

[0012] A pair of machine bases 12 that extend along a width direction of the hoistway 1 (a lateral direction in Fig. 2) are fixed to an upper portion within the hoistway 1. The machine bases 12 are fixed on structural beams 13 on the building side. A pair of driving apparatus support beams 14 are attached to lower portions of the machine bases 12.

[0013] A driving apparatus 15 for making the car 4 and the counterweight 5 ascend and descend is mounted to lower portions of the driving apparatus support beams 14. The driving apparatus 15 has a motor portion 16, and a driving sheave 17 that is rotated by the motor portion 16. Further, the driving apparatus 15 is disposed such that a rotation axis of the driving sheave 17 extends horizontally along the lateral direction of the hoistway 1.

[0014] A plurality of main ropes 18 are wound around the driving sheave 17. Each of the main ropes 18 has a first end portion 18a and a second end portion 18b. The car 4 is suspended from the first end portions 18a, through a car side rope fastener (not shown). The counterweight 4 is suspended from the second end portions 18b, through a counterweight side rope fastener (not shown).

[0015] A pair of deflector sheave support beams 19 are attached to upper portions of the machine bases 12. A car deflector sheave 20 that guides the main ropes 18 from the driving sheave 17 to the car 4, and a counterweight deflector sheave 21 that guides the main ropes 18 from the driving sheave 17 to the counterweight 5 are mounted to the deflector sheave support beams 19.

[0016] The main ropes 18 are wound around a lower side of the driving sheave 17, and upper sides of the car deflector sheave 20 and the counterweight 21.

[0017] The driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21 are disposed such that their rotation axes are mutually parallel and extend horizontally. The driving apparatus 15 is disposed in a position which is located lower than the car deflector sheave 20 and the counterweight deflector sheave 21 and where the driving apparatus 15 does not overlap with the upper beam 6 in a vertical projection plane thereof.

[0018] Further, the driving apparatus 15 is disposed in a position such where at least a portion of the driving apparatus 15 overlaps with the car 4 in the vertical projection plane thereof. In addition, the driving apparatus 15 is disposed in a position where a portion of the driving apparatus 15 partially overlaps with the car deflector sheave 20 and the counterweight deflector sheave 21 in the vertical projection plane thereof.

[0019] A plurality of vibration isolating members 22, such as a rubber vibration isolator that prevent vibrations of the driving apparatus 15, the car deflector sheave 20, and the counterweight deflector sheave 21 from being transmitted to a building, are disposed between the machine bases 12 and the driving apparatus support beams 14, and between the machine base 12 and the deflector sheave support beams 19.

[0020] A control panel 23 that controls the driving apparatus 15 and the like is fixed to a wall portion of the upper portion within the hoistway 1. The control panel 23 is disposed within a region in which the landing door apparatus 11 and the car door apparatus 10 are disposed, as seen in a vertical projection plane thereof.

[0021] With this type of elevator apparatus, the rotation axes of the driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21 are disposed extending parallel to each other, and therefore work for installing the driving apparatus 15, the car deflector sheave 20, and the counterweight deflector sheave 21 can be performed easily.

[0022] Further, the angle at which the main ropes 18 enter rope grooves of the driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21 can be made smaller. The lifetime of the main ropes 18 can thus be extended. That is, the rope grooves of the driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21 which correspond to the main ropes 18 can be disposed on one straight line, and the angle at which the ropes enter the rope grooves can be made substantially equal to 0°.

[0023] In addition, the driving apparatus 15 is disposed in a position which is located lower than the car deflector sheave 20 and the counterweight deflector sheave 21 and where the driving apparatus 15 does not overlap with the upper beam 6 in the vertical projection plane thereof. Accordingly, it is not necessary to extend a space within the hoistway 1 upward, even for cases where a large size driving apparatus 15 is used, provided that the driving apparatus does not interfere with the car frame 7 and the cage 8. The size in the vertical direction of the hoistway 1 can thus be made smaller. Further, the upper beam 6 does not contact the driving apparatus 15 even for cases where the car 4 ascends upward higher than an uppermost floor stopping position for some reason.

[0024] Still further, the driving apparatus 15 is disposed in a position at which a portion of the driving apparatus 15 overlaps with the car 4 in the vertical projec-

tion plane thereof, and therefore the cross sectional surface area of the hoistway 1 can be made smaller.

[0025] Further, the driving apparatus 15 is disposed in a position at which a portion of the driving apparatus 15 overlaps with the car deflector sheave 21 and the counterweight deflector sheave 21 in the vertical projection plane thereof. The cross sectional surface area of the hoistway 1 can therefore be made smaller.

[0026] In addition, the driving apparatus 15 is attached to the lower portions of the machine bases 12, and the car deflector sheave and the counterweight deflector sheave 21 are attached in the upper portions of the machine bases 12. The driving apparatus 15 can therefore be disposed in a position that is located lower than the car deflector sheave 20 and the counterweight deflector sheave 21 by using common machine bases 12.

[0027] Still further, the control panel 23 is disposed directly above the landing hall door apparatus 11 and the car door apparatus 10, and therefore the space within the hoistway 1 can be utilized effectively.

[0028] It should be noted that, although the machine bases 12 are supported by the structural beams 13 on the building side in the example described above, a structure may also be used in which the machine bases 12 are supported by, for example, at least either the car guide rails 2 or the counterweight guide rails 3. In this case, the load burden on the building can be reduced. Conversely, for cases where the machine bases 12 are supported by the structural beams 13, the load burden on the guide rails 2 and 3 is reduced, and the requisite strength of the guide rails 2 and 3 can be reduced.

[0029] Further, either a thin motor whose diameter dimension is larger than its axial dimension, or a large cylindrical motor whose axial dimension is larger than its radial dimension may be used for the motor portion 16 of the driving apparatus 15.

[0030] The diameter of the driving sheave 17 may be set to a value that differs from at least the diameter of the car deflector sheave 20 or the car deflector sheave 21. Adjustment of the winding angle of the main ropes 18 to the driver sheave 17 can thus be performed.

[0031] For example, Fig. 4 is an explanatory diagram that shows an example of a relationship between the diameter of the driving sheave 17 and the diameters of the car deflector sheave 20 and the counterweight deflector sheave 21 of Fig. 1. Fig. 5 is an explanatory diagram that shows another example. Adjustment of the angle at which the main ropes 18 are wound to the driving sheave 17 can thus be performed by changing the relationship between the diameter of the driving sheave 17 and the diameters of the car deflector sheave 20 and the counterweight deflector sheave 21.

[0032] Further, adjustment of the angle at which the main ropes 18 are wound to the driving sheave 17 can also be performed by changing the distances among the driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21.

[0033] In addition, the driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21 can be made smaller by setting a ratio D/d to a value equal to or less than 20, where D is the diameter of the driving sheave 17, the car deflector sheave 20, and the counterweight deflector sheave 21, and d is the diameter of the main ropes 18. Saving of space in the hoistway 1 can also be achieved.

[0034] Still further, in order to make the sheaves smaller as described above, resin-covered ropes in which an outer layer covering made from a high friction resin material is provided in an outer peripheral portion thereof may also be used as the main ropes.

Embodiment 2

[0035] Fig. 6 is a side view that shows main portions of an elevator apparatus according to Embodiment 2 of the present invention. In this example, the driving apparatus 15 is disposed so as to overlap with the counterweight 5 within a vertical projection plane thereof. A portion 18c of each main rope 18 which extends from the counterweight deflector sheave 21 to the counterweight 5 passes between the driving sheave 17 and the motor portion 16. Other structures are similar to those of Embodiment 1.

[0036] Work for installing the driving apparatus 15 and the deflector sheaves 20 and 21 can also be made easier with this structure, and wear of the main ropes 18 due to contact with the rope grooves can be suppressed. Further, the size of the hoistway 1 in the vertical direction can be made smaller.

[0037] Furthermore, interference between the driving apparatus 15 and the upper beam 6 can be reliably prevented even if the depth dimension of the car 4 is small.

Embodiment 3

[0038] Fig. 7 is a side view that shows an elevator apparatus according to Embodiment 3 of the present invention. In this example, the driving apparatus 15 is attached to the upper portions of the machine bases 12 through the driving apparatus support beams 14. The deflector sheave support beams 19 are supported on the machine bases 12 through supports 24 above the driving apparatus 15. The car deflector sheave 20 and the counterweight deflector sheave 21 are therefore supported by the machine bases above the driving apparatus 11. Other structures are similar to those of Embodiment 1.

[0039] Work for attaching the driving apparatus 15 and the deflector sheaves 20 and 21 can also be made easier with this structure, and wear of the main ropes 18 due to contact with the rope grooves can be suppressed. Further, the size of the hoistway 1 in the vertical direction can be made smaller.

Claims

1. An elevator apparatus comprising:

   a driving apparatus disposed in an upper portion within a hoistway, the driving apparatus having a motor portion and a driving sheave that is rotated by the motor portion;
   a main rope that is wound around the driving sheave, the main rope having a first end portion and a second end portion;
   a car that is suspended from the first end portion, the car having a car frame that includes an upper beam, and a cage that is supported by the car frame below the upper beam; and
   a counterweight that is suspended from the second end portion, wherein:

      a car deflector sheave that guides the main rope from the driving sheave to the car, and a counterweight deflector sheave that guides the main rope from the driving sheave to the counterweight are disposed in the upper portion within the hoistway;
      the driving sheave, the car deflector sheave, and the counterweight deflector sheave are disposed such that their rotation axes extend in parallel with each other; and
      the driving apparatus is disposed in a position which is located lower than the car deflector sheave and the counterweight deflector sheave and where the driving apparatus does not overlap with the upper beam in a vertical projection plane thereof.

2. An elevator apparatus according to claim 1, wherein the driving apparatus is disposed in a position where at least a portion of the driving apparatus overlaps with the car in the vertical projection plane thereof.

3. An elevator apparatus according to claim 1, wherein the driving apparatus is disposed in a position where a portion of the driving apparatus partially overlaps with at least one of the car deflector sheave and the counterweight deflector sheave in the vertical projection plane thereof.

4. An elevator apparatus according to claim 1, wherein a diameter of the driving sheave differs from at least one of a diameter of the car deflector sheave and a diameter of the counterweight deflector sheave.

5. An elevator apparatus according to claim 1, wherein a machine base that supports the driving apparatus, the car deflector sheave, and the counterweight deflector sheave is fixed in the upper portion within the hoistway, the driving apparatus is attached to a lower portion of the machine base, and the car deflector sheave and the counterweight deflector sheave are attached to an upper portion of the machine base.

6. An elevator apparatus according to claim 1, wherein a machine base that supports the driving apparatus, the car deflector sheave, and the counterweight deflector sheave is fixed in the upper portion within the hoistway, the driving apparatus is attached to an upper portion of the machine base, and the car deflector sheave and the counterweight deflector sheave are supported above the driving apparatus by the machine base.

7. An elevator apparatus according to claim 1, wherein the main rope is a resin-covered rope in which an outer layer covering made from a high friction resin material is provided in an outer peripheral portion of the main rope.

8. An elevator apparatus according to claim 1, wherein diameters of the driving sheave, the car deflector sheave, and the counterweight deflector sheave are set to values equal to or less than 20 times a diameter of the main rope.

9. An elevator apparatus according to claim 1, wherein a control panel that controls the driving apparatus is fixed to a wall portion of the upper portion within the hoistway, and is disposed within a region in which a landing hall door apparatus and a car door apparatus are disposed, in a vertical projection plane thereof.

FIG. 1

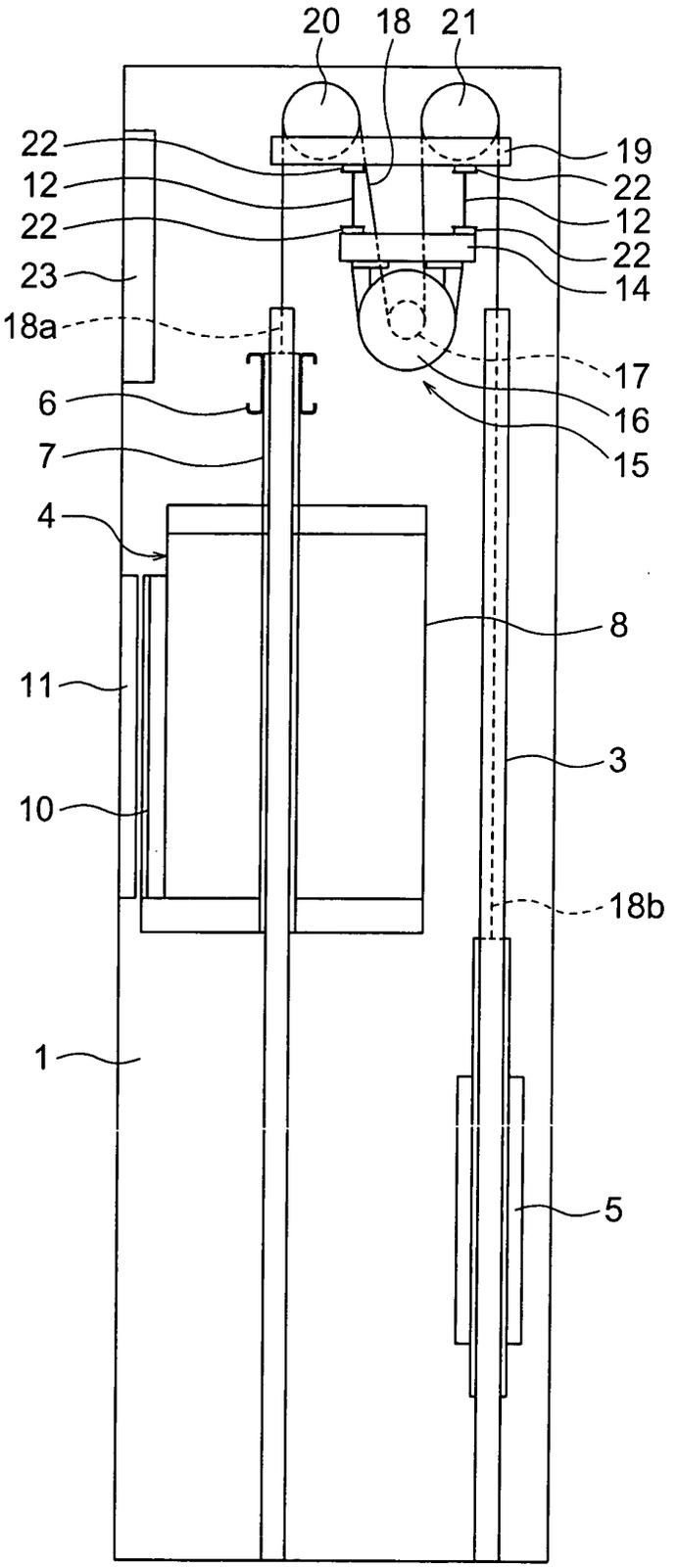


FIG. 2

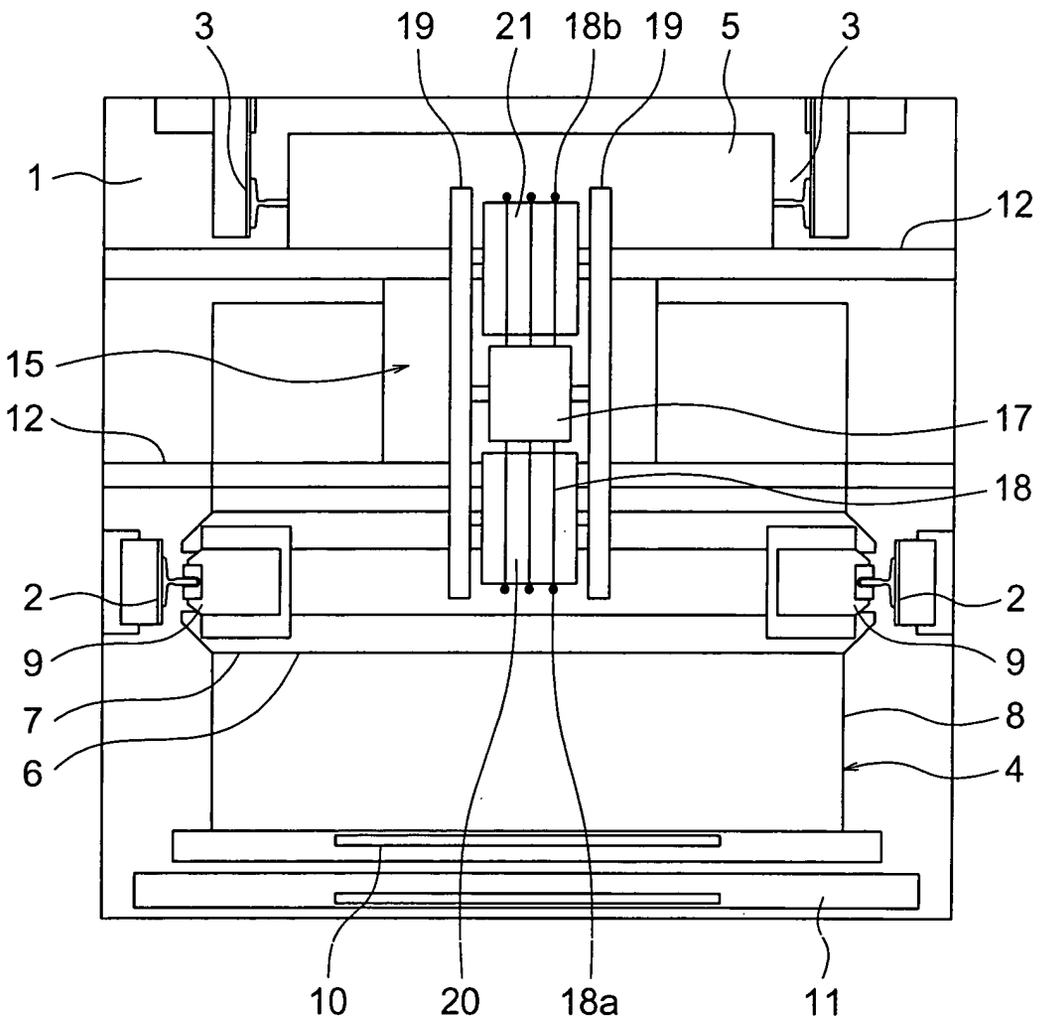


FIG. 3

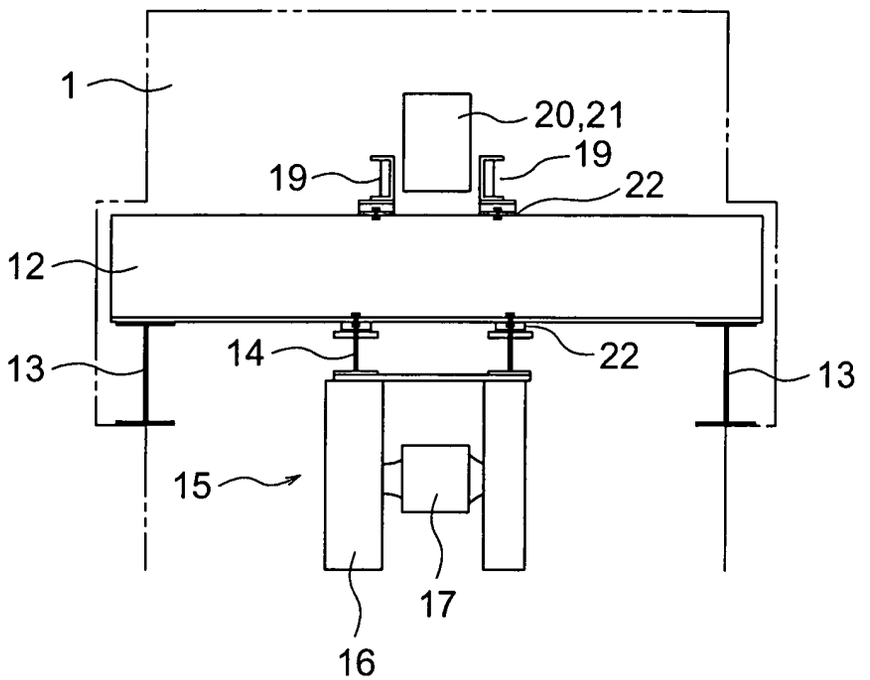


FIG. 4

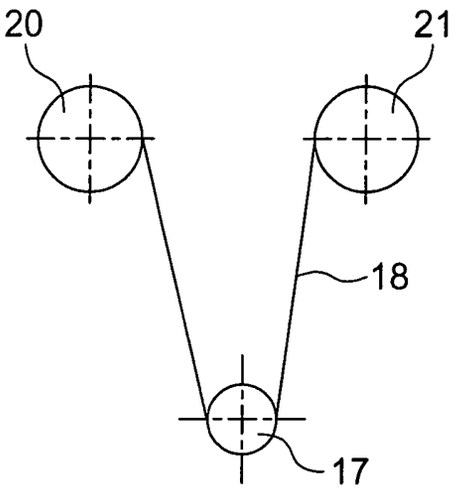


FIG. 5

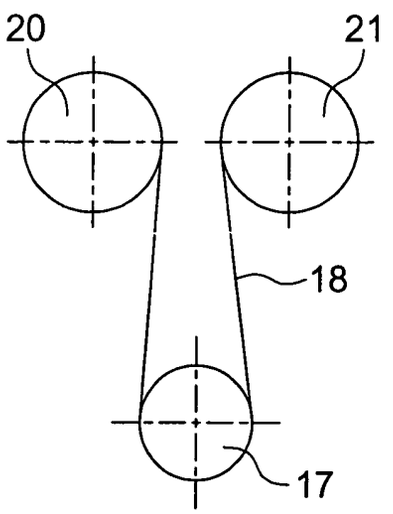


FIG. 6

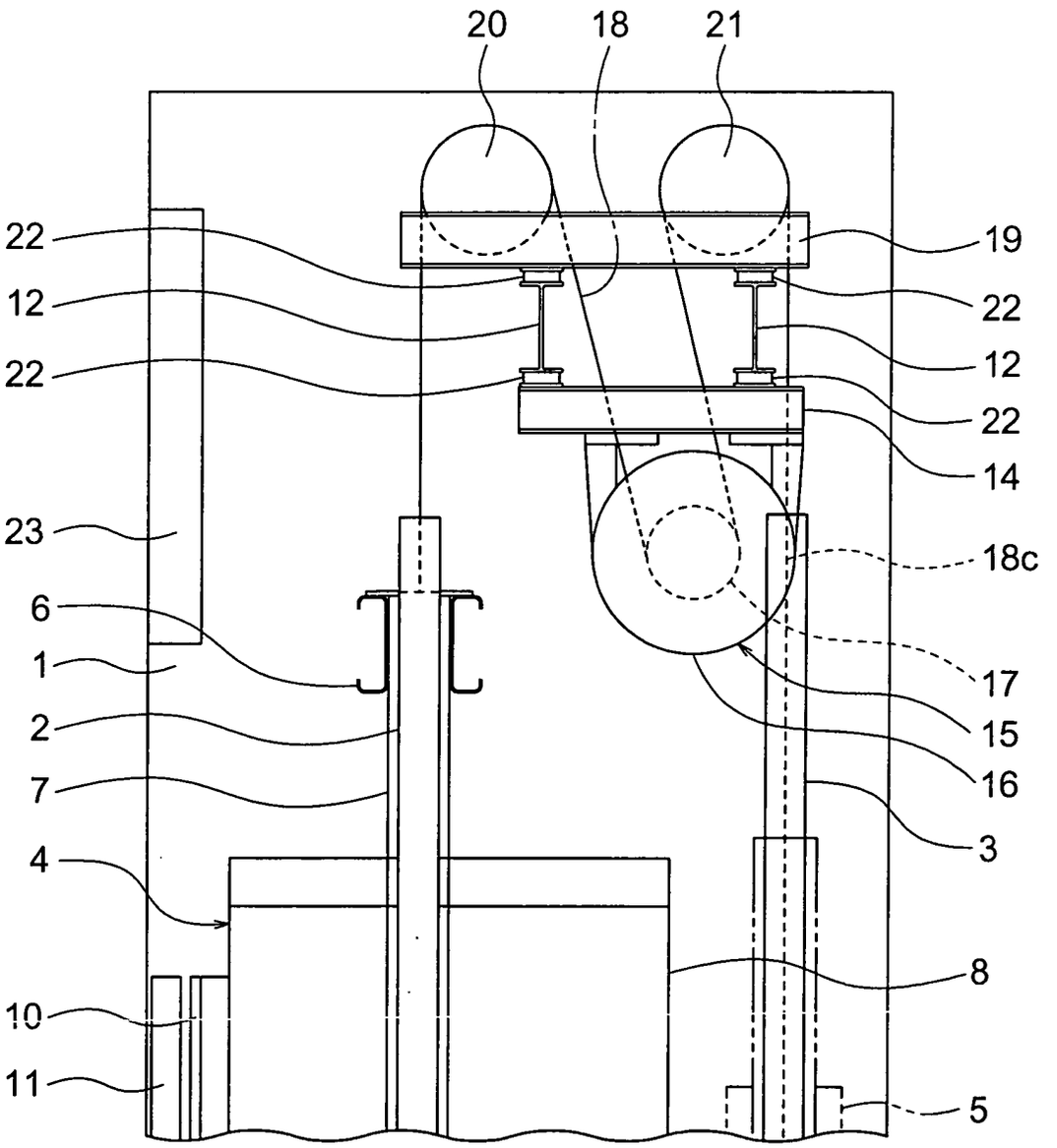
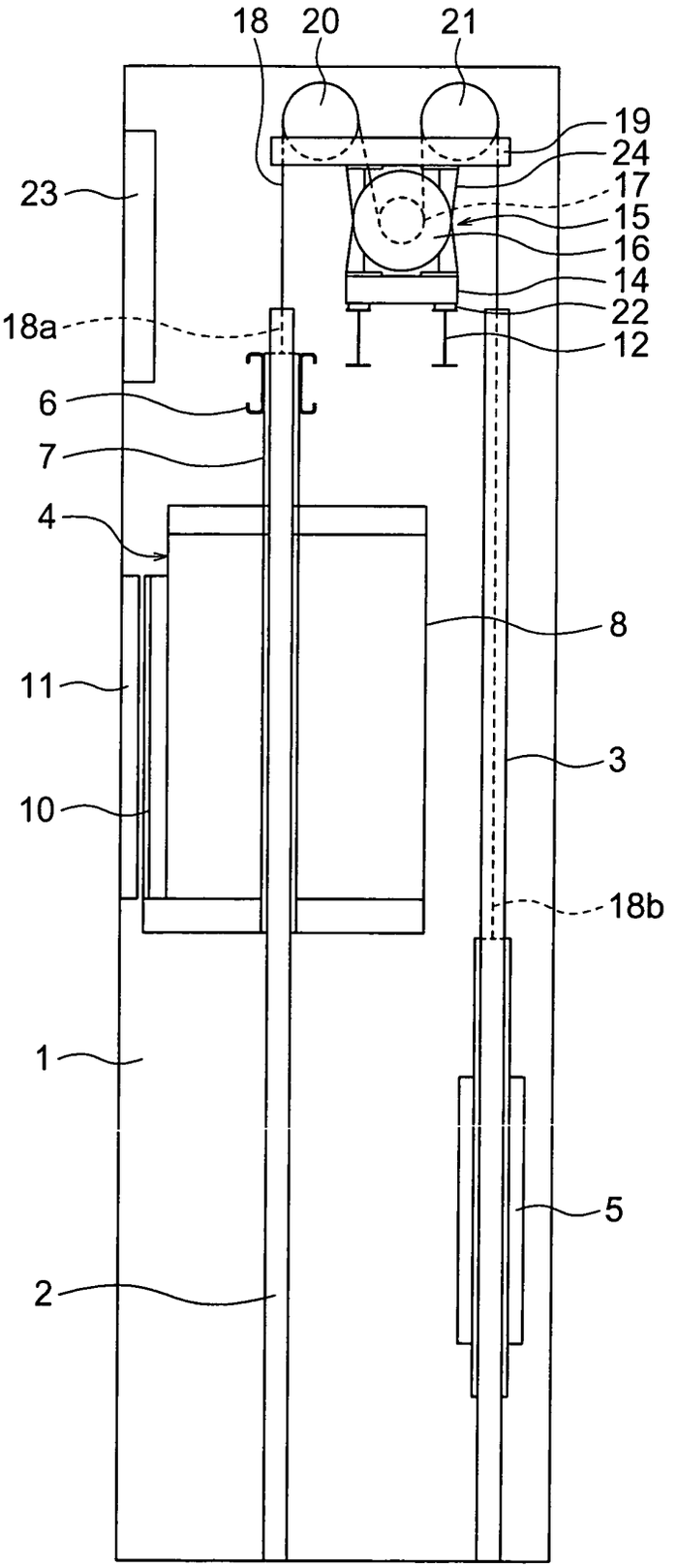


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/12713

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B11/08

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)
Int.Cl[7] B66B7/00-B66B11/08

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	1996-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Toroku Jitsuyo Shinan Koho	1994-2003

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 11-310372 A (Toshiba Elevator and Building Systems Corp.), 09 November, 1999 (09.11.99), Fig. 7 & EP 0953538 A2 & CN 1233583 A & US 6247557 B1	1-9
A	JP 2000-351552 A (Hitachi, Ltd.), 19 December, 2000 (19.12.00), Fig. 1 (Family: none)	1-9
A	JP 2001-63935 A (Mitsubishi Electric Corp.), 13 March, 2001 (13.03.01), Figs. 1 to 2 & CN 1286209 A & EP 1081085 A2	1-9

☒ 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 29 August, 2003 (29.08.03)	Date of mailing of the international search report 16 September, 2003 (16.09.03)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/12713

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01/042121 A1 (Mitsubishi Electric Corp.), 14 June, 2001 (14.06.01), Figs. 8 to 10 (Family: none)	1-9
A	JP 2002-80178 A (Mitsubishi Electric Corp.), 19 March, 2002 (19.03.02), Figs. 1 to 3 & CN 1342595 A & US 2002/0040830 A1	1-9
A	WO 02/098782 A1 (Mitsubishi Electric Corp.), 12 December, 2002 (12.12.02), Figs. 1 to 2 (Family: none)	1-9
A	JP 2001-97649 A (Mitsubishi Electric Corp.), 10 April, 2001 (10.04.01), Figs. 1 to 3 (Family: none)	1-9
A	JP 2664619 B2 (KONE Elevator GmbH), 15 October, 1997 (15.10.97), Fig. 1 & AU 4175793 A & FI 923113 A & CA 2099858 A & EP 0578237 A1 & BR 9302786 A & CN 1086788 A & JP 6-156952 A & US 5370205 A	1-9

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