

Description

Technical Field

[0001] The present invention relates to a traction-type elevator apparatus having such a structure that a car and a counterweight are suspended in a hoistway by a main rope.

Background Art

[0002] For example, JP 7-10434 A discloses a conventional machine room less elevator apparatus having such a structure that a car and a counterweight are suspended in a hoistway by a 2:1 roping system. In such an elevator apparatus, it is necessary to provide the car and the counterweight with sash pulleys, resulting in a complicated construction and high cost. Further, due to the 2:1 roping system, the RPM of a drive sheave is high, which means there is a fear of an increase in the vibration and noise.

[0003] Further, JP 11-310372 A discloses a conventional machine room less elevator apparatus constructed such that a car and a counterweight are suspended in a hoistway by a 1:1 roping system by two lines of rope. As compared with adopting the 2 : 1 roping system, such an elevator apparatus allows a reduction of the RPM of the drive sheave by half. However, since the suspension load is doubled, it is necessary to increase the rigidity of the components, such as a driving machine, guide rails, and a support beam, so that there is a fear of an increase in cost and an increase in installation space.

[0004] Further, JP 11-310372 A also discloses an elevator apparatus using two driving machines. Since it requires two driving machines, an increase in cost and a complicated control operation are involved.

Disclosure of the Invention

[0005] The present invention has been made to solve the above-mentioned problems. It is an object of the present invention to provide an elevator apparatus which allows simplification in construction and helps to avoid an increase in the RPM of a drive sheave while restraining an increase in suspension load.

[0006] An elevator apparatus according to the present invention includes: a driving machine having a drive sheave; a car which has a first rope connecting portion provided on one side with respect to a width direction and a second rope connecting portion provided on the other side with respect to the width direction and which is caused to ascend and descend in a hoistway by the driving machine; a counterweight caused to ascend and descend in the hoistway by the driving machine; a first main rope which has a first end portion connected to the first rope connecting portion and a second end portion connected to the counterweight and which suspends the car and the counterweight in the hoistway; and a second

main rope which has a third end portion connected to the second rope connecting portion and a fourth end portion connected to the counterweight and which suspends the car and the counterweight in the hoistway, in which only the first main rope of the first and second main ropes is wrapped around the drive sheave, and in which, provided in the upper portion of the hoistway is a main rope return pulley around which only the second main rope of the first and second main ropes is wrapped.

[0007] Further, an elevator apparatus according to the present invention includes: driving machine having a drive sheave; a car and a counterweight that are caused to ascend and descend in a hoistway by the driving machine; and a main rope wrapped around the drive sheave and suspending the car and the counterweight in the hoistway, in which the car has a first rope connecting portion provided on one side thereof with respect to a width direction and a second rope connecting portion provided on the other side thereof with respect to the width direction, in which the main rope has a first end portion connected to the first rope connecting portion and a second end portion connected to the second rope connecting portion, in which, provided in the upper portion of the hoistway is a second end portion side return pulley around which the main rope is wrapped, in which the counterweight is provided with a rotatable counterweight sash pulley, and in which the main rope is wrapped successively, starting from the first end portion side, around the drive sheave, the counterweight sash pulley, and the second end portion side return pulley.

Brief Description of the Drawings

[0008]

Fig. 1 is a perspective view of a main portion of an elevator apparatus according to Embodiment 1 of the present invention;

Fig. 2 is a plan view of the elevator apparatus of Fig. 1;

Fig. 3 is a perspective view of a main portion of an elevator apparatus according to Embodiment 2 of the present invention;

Fig. 4 is a plan view of the elevator apparatus of Fig. 3;

Fig. 5 is a perspective view of a main portion of an elevator apparatus according to Embodiment 3 of the present invention;

Fig. 6 is a plan view of the elevator apparatus of Fig. 5;

Fig. 7 is a plan view of a main portion of an elevator apparatus according to Embodiment 4 of the present invention; and

Fig. 8 is a perspective view of a main portion of an elevator apparatus according to Embodiment 5 of the present invention.

Best Mode for carrying out the Invention

[0009] In the following, preferred embodiments of the present invention will be described with reference to the drawings.

Embodiment 1

[0010] Fig. 1 is a perspective view of a main portion of an elevator apparatus according to Embodiment 1 of the present invention, and Fig. 2 is a plan view of the elevator apparatus of Fig. 1.

[0011] In the drawings, installed in a hoistway 1 are a pair of car guide rails 2 (omitted in Fig. 1) and a pair of counterweight guide rails 3. A car 4 is guided by the car guide rails 2 as it ascends and descends in the hoistway 1. Further, the car 4 has a front surface 4a, a back surface 4b, a first side surface 4c, and a second side surface 4d. A car entrance 4e is provided in the front surface 4a.

[0012] A counterweight 5 is guided by the counterweight guide rails 3 as it ascends and descends in the hoistway 1. The counterweight 5 is arranged at the rear of the car 4 so that it faces the back surface 4b of the car 4 when it is positioned at the same height as the car 4. As seen in a plane of vertical projection (Fig. 2), a straight line connecting between the car guide rails 2 is parallel to a straight line connecting between counterweight guide rails 3.

[0013] A first rope connecting portion 6 is provided on one side (the first side surface 4c side) of the car 4 with respect to the width direction thereof. A second rope connecting portion 7 is provided on the other side (the second side surface 4d side) of the car 4 with respect to the width direction thereof. The first and second rope connecting portions 6, 7 are provided at the lower end portion of the car 4.

[0014] In the upper portion of the hoistway 1, there is installed a driving machine (hoisting machine) 8 for raising and lowering the car 4 and the counterweight 5. The driving machine 8 is supported by the upper portion of at least one of the guide rails 2, 3 or a support beam (not shown) fixed to the building side.

[0015] The driving machine 8 has a driving machine main body 9 including a motor and a brake, and a drive sheave 10 rotated by the driving machine main body 9. As the driving machine 8, there is used a thin-type hoisting machine having an axial dimension smaller than an outer dimension thereof in a direction perpendicular to the axial direction. As the motor of the thin-type hoist, there is used, for example, a permanent magnet type motor (PM motor).

[0016] The driving machine 8 is arranged such that the rotation axis of the drive sheave 10 is parallel to the width direction of the car 4 and is horizontal. Further, the driving machine 8 is arranged such that, as seen in the plane of vertical projection, the driving machine main body 9 is situated on the car 4 side, and that the drive sheave 10 is situated on a hoistway wall 1a side.

[0017] In the upper portion of the hoistway 1, there are provided a rotatable, first deflection wheel 11, a rotatable, second main rope return pulley 12, and a rotatable, second deflection wheel 13. The first deflection wheel 11, the second main rope return pulley 12, and the second deflection wheel 13 are supported by the support beam. The first deflection wheel 11, the second main rope return pulley 12, and the second deflection wheel 13 are arranged such that their rotation axes are parallel to the rotation axis of the drive sheave 10.

[0018] As seen in the plane of vertical projection, the driving machine 8 and the first deflection wheel 11 are arranged between the first side surface 4c of the car 4 and the hoistway wall 1a opposed to the first side surface 4c. As seen in the plane of vertical projection, the second main rope return pulley 12 and the second deflection wheel 13 are arranged between the second side surface 4d of the car 4 and a hoistway wall 1b opposed to the second side surface 4d.

[0019] Further, as seen in the plane of vertical projection, the drive sheave 10 and the first deflection wheel 11, and the second main rope return pulley 12 and the second deflection wheel 13, are arranged substantially symmetrically with respect to the center line of the car 4 with respect to the width direction thereof.

[0020] A plurality of first main ropes (driving ropes) 14 are wrapped around the drive sheave 10 and the first deflection wheel 11. Each of the first main ropes 14 has a first end portion 14a connected to the first rope connecting portion 6 and a second end portion 14b connected to the counterweight 5. The second end portion 14b is connected to the upper portion of one end portion of the counterweight 5 with respect to the width direction thereof.

[0021] A plurality of second main ropes (ropes dedicated to suspension) are wrapped around the second main rope return pulley 12 and the second deflection wheel 13. Each of the second main ropes 15 has a third end portion 15a connected to the second rope connecting portion 7, and a fourth end portion 15b connected to the counterweight 5. The fourth end portion 15b is connected to the upper portion of the other end portion of the counterweight 5 with respect to the width direction thereof.

[0022] The car 4 and the counterweight 5 are suspended in the hoistway 1 by the 1:1 roping system by the first main ropes 14 and the second main ropes 15. The car 4 and the counterweight 5 are caused to ascend and descend in the hoistway 1 by the driving force of the driving machine 8 through the first main ropes 14.

[0023] In this elevator apparatus, there are used two lines of mutually independent main ropes, that is, the first and second main ropes 14, 15. The first and second main ropes 14, 15 are arranged without joining each other.

[0024] Of the first and second main ropes 14, 15, only the first main ropes 14 are wrapped around the drive sheave 10. Of the first and second main ropes 14, 15, only the second main ropes 15 are wrapped around the second main rope return pulley 12.

[0025] As the first and second main ropes 14, 15, there are used, for example, resin-coated ropes. In the outer periphery of the resin-coated ropes, there are provided outer layer covering members formed of a high-friction resin material. The outer layer covering members are constructed of a high-friction resin material having a coefficient of friction of 0.2 or more, for example, a polyurethane resin.

[0026] In this elevator apparatus having such a structure that the car 4 and the counterweight 5 are suspended by the 1:1 roping system, there is no need to mount sash pulleys on the car 4 and the counterweight 5, thus achieving simplification in construction. Further, the RPM of the drive sheave 10 can be reduced to 1/2 as compared with that in the case of the 2:1 roping system.

[0027] Further, the main ropes are divided into the first and second main ropes 14, 15, and only the first main ropes 14 are wrapped around the drive sheave 10, with only the second main ropes 15 being wrapped around the second main rope return pulley 12, whereby the suspension load is distributed, making it possible to keep the load applied to the driving machine 8, the main ropes 14, 15, the guide rails 2, 3, the support beam, etc. at a level equivalent to that in the case of the 2:1 roping system. As a result, it is possible to keep the rigidity of the apparatus at a low level, thereby restraining an increase in cost.

[0028] Further, there is provided only one driving machine 8, so that it is possible to avoid an increase in cost and installation space for the driving machine 8.

[0029] Thus, in the elevator apparatus of Embodiment 1, it is possible to simplify the construction and avoid an increase in the RPM of the drive sheave 10 while restraining an increase in suspension load.

[0030] Further, since the first and second rope connecting portions 6, 7 are arranged on either side of the car 4, it is possible to suspend the car 4 in a stable manner.

[0031] Further, by using resin-coated ropes as the first and second main ropes 14, 15, it is possible to improve the traction capacity, making it possible to run the car 4 in a stable manner solely with the traction force on the first main ropes 14 side. Further, since resin-coated ropes allow further enhancement in flexibility than simple steel ropes, it is possible to diminish the diameter of the drive sheave 10 and the diameter of the second main rope return pulley 12.

[0032] Furthermore, a thin-type hoisting machine is used as the driving machine 8, and the driving machine 8 is arranged between the first side surface 4c and the hoistway wall 1a as seen in the plane of vertical projection, so that it is possible to achieve a reduction in overhead dimension without increasing the planar dimension of the hoistway 1.

[0033] Further, since the first and second rope connecting portions 6, 7 are provided below the upper end portion of the car 4, it is possible to secure the clearance between the rope connecting portions 6, 7 and the driving

machine 8 and the return pulley 12 that are situated above them, thereby making it possible to achieve a reduction in overhead dimension.

5 Embodiment 2

[0034] Next, Fig. 3 is a perspective view of a main portion of an elevator apparatus according to Embodiment 2 of the present invention, and Fig. 4 is a plan view of the elevator apparatus of Fig. 3.

[0035] In the drawings, the driving machine 8 is arranged in the lower portion of the hoistway 1 (in the vicinity of the bottom portion thereof). The driving machine 8 is arranged such that the rotation axis of the drive sheave 10 is parallel to the depth direction of the car 4 and is horizontal. Further, the driving machine 8 is arranged between the back surface 4b of the car 4 and a hoistway wall 1c opposed to the back surface 4b as seen in the plane of vertical projection. Furthermore, the driving machine 8 is arranged beside the car 5 as seen in the plane of vertical projection.

[0036] In the upper portion of the hoistway 1, there are arranged a pair of first main rope return pulleys 21 and a pair of second main rope return pulleys 22. In Fig. 3, only one of each pair of return pulleys 21, 22 is shown. The return pulleys 21, 22 are arranged such that their rotation axes are parallel to the width direction of the car 4 and are horizontal.

[0037] The return pulleys 21, 22 are arranged between the side surfaces 4c, 4d of the car 4 and the hoistway walls 1a, 1b as seen in the plane of vertical projection. Further, the return pulley 21 and the return pulley 22 are arranged substantially symmetrically with respect to the center line of the car 4 with respect to the width direction thereof.

[0038] Further, in the upper portion of the hoistway 1, there is arranged a counterweight side return pulley 23. The counterweight side return pulley 23 is arranged such that the rotation axis thereof is parallel to the depth direction of the car 4 and is horizontal. Further, the counterweight side return pulley 23 is arranged between the back surface 4c of the car 4 and the hoistway wall 1c as seen in the plane of vertical projection. Further, the counterweight side return pulley 23 is arranged between the drive sheave 10 and the counter weight 5 as seen in the plane of vertical projection.

[0039] The first main ropes 14 are successively wrapped, starting from the first end portion 14a side, around the first main rope return pulley 21, the drive sheave 10, and the counterweight side return pulley 23. The second main ropes 15 are wrapped around the second main rope return pulley 22.

[0040] The car 4 and the counterweight 5 are suspended by the 1:1 roping system in the hoistway 1 by the first main ropes 14 and the second main ropes 15. The car 4 and the counterweight 5 are caused to ascend and descend in the hoistway 1 through the first main ropes 14 by the driving force of the driving machine 8.

[0041] Of the first and second main ropes 14, 15, only the first main ropes 14 are wrapped around the drive sheave 10. Of the first and second main ropes 14, 15, only the second main ropes 15 are wrapped around the second main rope return pulley 22. Otherwise, this embodiment is of the same construction as Embodiment 1.

[0042] In this way, even in the case where the driving machine 8 is arranged in the lower portion of the hoistway 1, it is possible to achieve simplification in construction and avoid an increase in the RPM of the drive sheave 10 while restraining an increase in suspension load.

[0043] Further, since the driving machine 8 is arranged in the lower portion of the hoistway 1, it is possible to easily perform maintenance operation on the driving machine 8 from the pit (bottom portion) of the hoistway 1.

[0044] Further, since the return pulleys 21, 22, and 23 are arranged between the side surfaces 4c, 4d and the back surface 4b, and the hoistway walls 1a, 1b and 1c as seen in the plane of vertical projection, it is possible to achieve a reduction in overhead dimension without increasing the planar dimension of the hoistway 1.

Embodiment 3

[0045] Next, Fig. 5 is a perspective view of a main portion of an elevator apparatus according to Embodiment 3 of the present invention, and Fig. 6 is a plan view of the elevator apparatus of Fig. 5. In the drawings, the driving machine 8 is arranged between the first side surface 4c of the car 4 and the hoistway wall 1a as seen in the plane of vertical projection. Further, the driving machine 8 is arranged such that the rotation axis of the drive sheave 10 is parallel to the width direction of the car 4 and is horizontal.

[0046] The first and second rope connecting portions 6, 7 are arranged such that the straight line connecting them to each other passes the center of gravity of the car 4 or near the same as seen in the plane of vertical projection. That is, the first and second rope connecting portions 6, 7 are arranged symmetrically with respect to the center of gravity of the car 4 as seen in the plane of vertical projection.

[0047] Further, as seen in the plane of vertical projection, the straight line connecting the first and second rope connecting portions 6, 7 crosses the straight line connecting the car guide rails 2. That is, with respect to the depth direction of the car 4, the first rope connecting portion 6 is arranged at the rear of the car guide rails 2, and the second rope connecting portion 7 is arranged in front of the car guide rails 2.

[0048] Only one first main rope return pulley 21 is used. The distance between the second main rope return pulleys 22 and the width dimension of the counterweight 5 are larger than those in Embodiment 2. Otherwise, this embodiment is of the same construction as Embodiment 2.

[0049] In this way, even in the case where the driving machine 8 is arranged beside the car 4, it is possible to

achieve simplification in construction and avoid an increase in the RPM of the drive sheave 10 while restraining an increase in suspension load.

[0050] Further, by suspending the car 4 substantially at the position of its center of gravity, it is possible to cause the car 4 to ascend and descend in a stable manner.

Embodiment 4

[0051] Next, Fig. 7 is a plan view of a main portion of an elevator apparatus according to Embodiment 4 of the present invention. This embodiment differs from Embodiment 2 in the planar configuration of the car 4. Provided on the first and second side surfaces 4c, 4d of the car 4 are inclined surfaces 4f, 4g that are inclined so as to gradually diminish the width dimension as they extend rearwards in the depth direction of the car 4. Thus, the planar configuration of the car 4 exhibits a hexagonal configuration, with the rear corner portions thereof being beveled.

[0052] The first main rope return pulley 21 and the second main rope return pulley 22 are arranged such that their rotation axes are inclined with respect to the width direction of the car 4. That is, as seen in the plane of vertical projection, the rotation axes of the return pulleys 21, 22 are substantially perpendicular to the inclined surfaces 4f, 4g. And, the return pulleys 21, 22 are arranged between the inclined surfaces 4f, 4g and the hoistway walls 1a, 1b as seen in the plane of vertical projection. Otherwise, this embodiment is of the same construction as Embodiment 2.

[0053] Due to this construction, it is possible to diminish the admission angle of the main ropes 14, 15 with respect to the return pulleys 21, 22, making it possible to cause the car 4 and the counterweight 5 to ascend and descend smoothly and to increase the service life of the main ropes 14, 15. Further, both the return pulleys 21, 22 can be arranged right above the counterweight 5, making it possible to cause the counterweight 5 to ascend and descend smoothly. Further, it is also possible to achieve a reduction in overhead dimension.

Embodiment 5

[0054] Next, Fig. 8 is a perspective view of a main portion of an elevator apparatus according to Embodiment 5 of the present invention. In the drawing, a rotatable counterweight sash pulley 24 is provided on top of the counterweight 5. The car 4 and the counterweight 5 are suspended in the hoistway 1 by a plurality of main ropes 25. While in Embodiments 1 through 4 two lines of main ropes 14, 15 are used, in Embodiment 5, only one line of main ropes 25 is used. As the main ropes 25, it is possible to use resin-coated ropes.

[0055] In the upper portion of the hoistway 1, there are provided a first end portion side return pulley 26, a second end portion side return pulley 27, and a counterweight

side return pulley 28. The first and second end portion side return pulleys 26, 27 are arranged such that their rotation axes are parallel to the width direction of the car 4 and are horizontal. Further, the return pulleys 26, 27 are arranged between the side surfaces of the car 4 and hoistway walls as seen in the plane of vertical projection. Further, the first end portion side return pulley 26 and the second end portion side return pulley 27 are arranged substantially symmetrically with respect to the center line of the car 4 with respect to the width direction thereof as seen in the plane of vertical projection.

[0056] The counterweight side return pulley 28 is arranged such that the rotation axis thereof is parallel to the depth direction of the car 4 and is horizontal. Further, the return pulley 28 is arranged between the back surface of the car 4 and a hoistway wall as seen in the plane of vertical projection. Further, the return pulley 28 is arranged between the drive sheave 10 and the counterweight 5 as seen in the plane of vertical projection.

[0057] The main ropes 25 have first end portions 25a connected to the first rope connecting portion 6 (not shown in Fig. 8) and second end portions 25b connected to the second rope connecting portion 7. Further, the main ropes 25 are wrapped successively, starting from the first end portion 25a side, around the first end portion side return pulley 26, the drive sheave 10 (not shown in Fig. 8), the counterweight side return pulley 28, the counterweight sash pulley 24, and the second end portion side return pulley 27.

[0058] Embodiment 5 is substantially of the same construction as one obtained by modifying Embodiment 2 such that the second end portions 14b and the fourth end portions 15b are connected together and wrapped around the counterweight sash pulley 24. The car 4 and the counterweight 5 of Embodiment 5 are suspended in the hoistway 1 by the 1:1 roping system by the main ropes 25.

[0059] In this elevator apparatus also, it is possible to achieve simplification in construction and to avoid an increase in the RPM of the drive sheave 10 while restraining an increase in suspension load.

[0060] Further, due to the provision of the counterweight sash pulley 24, it is possible to automatically absorb the imbalance of the tension of the main ropes 25 on either side of the counterweight 5.

[0061] While in Embodiment 5 the counterweight sash pulley 24 is applied to the layout of Embodiment 2, it is also possible to apply the counterweight sash pulley to the layout of Embodiment 1, 3, or 4.

[0062] Further, while a thin-type hoisting machine is adopted in Embodiments 1 through 5 described above, the driving machine is not necessarily restricted to the thin-type hoist.

Claims

1. An elevator apparatus comprising:

a driving machine having a drive sheave;
a car which has a first rope connecting portion provided on one side with respect to a width direction and a second rope connecting portion provided on the other side with respect to the width direction and which is caused to ascend and descend in a hoistway by the driving machine;

a counterweight caused to ascend and descend in the hoistway by the driving machine;

a first main rope which has a first end portion connected to the first rope connecting portion and a second end portion connected to the counterweight and which suspends the car and the counterweight in the hoistway; and

a second main rope which has a third end portion connected to the second rope connecting portion and a fourth end portion connected to the counterweight and which suspends the car and the counterweight in the hoistway, wherein, of the first and second main ropes, only the first main rope is wrapped around the drive sheave, and

a second main rope return pulley is provided in the upper portion of the hoistway, around which only the second main rope of the first and second main ropes is wrapped.

2. An elevator apparatus comprising:

a driving machine having a drive sheave;

a car and a counterweight that are caused to ascend and descend in a hoistway by the driving machine; and

a main rope wrapped around the drive sheave and suspending the car and the counterweight in the hoistway,

wherein the car has a first rope connecting portion provided on one side thereof with respect to a width direction and a second rope connecting portion provided on the other side thereof with respect to the width direction,

the main rope has a first end portion connected to the first rope connecting portion and a second end portion connected to the second rope connecting portion,

a second end portion side return pulley is provided in the upper portion of the hoistway, around which the main rope is wrapped,

the counterweight is provided with a rotatable counterweight sash pulley, and

the main rope is wrapped successively, starting from the first end portion side, around the drive sheave, the counterweight sash pulley, and the second end portion side return pulley.

3. An elevator apparatus according to Claim 1 or Claim 2, wherein the main ropes are resin-coated ropes

provided with outer layer covering members formed of a high friction resin material positioned in outer peripheral portions thereof.

4. An elevator apparatus according to Claim 1 or Claim 2, wherein the driving machine is a thin-type hoisting machine which has an axial dimension smaller than a dimension thereof in a direction perpendicular to the axial direction and which is arranged between the car and hoistway walls as seen in a plane of vertical projection. 5
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5. An elevator apparatus according to Claim 1 or Claim 2, wherein the driving machine is arranged in a lower portion of the hoistway. 15
6. An elevator apparatus according to Claim 1 or Claim 2, wherein the first and second rope connecting portions are provided below an upper end portion of the car. 20
7. An elevator apparatus according to Claim 1 or Claim 2, wherein the first and second rope connecting portions are arranged symmetrically with respect to the center of gravity of the car as seen in a plane of vertical projection. 25
8. An elevator apparatus according to Claim 1 or Claim 2, wherein provided on side surfaces of the car are inclined surfaces inclined such that the width dimension of the car 4 is gradually diminished rearwards in the depth direction thereof, and rotation axes of the return pulleys are substantially perpendicular to the inclined surfaces as seen in a plane of vertical projection. 30
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FIG. 1

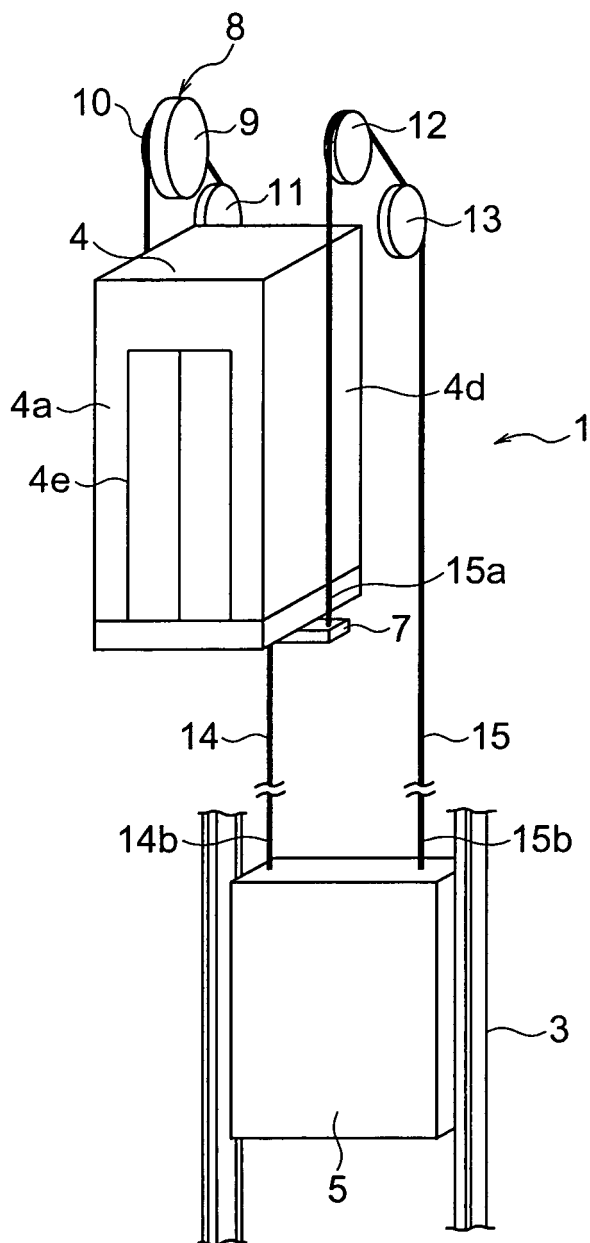


FIG. 2

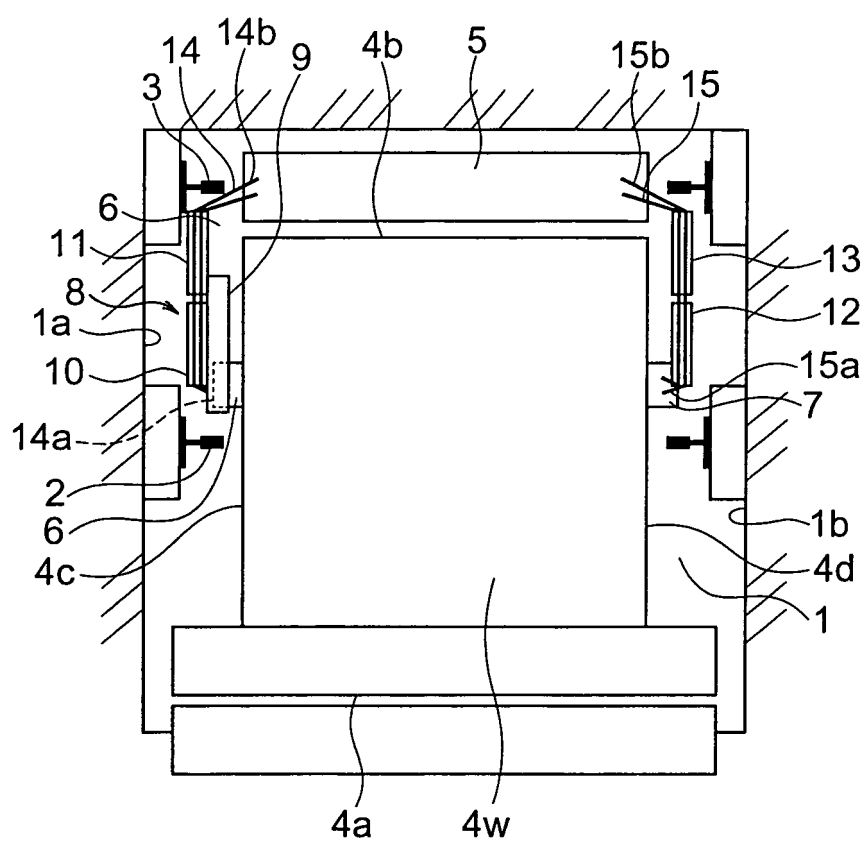


FIG. 3

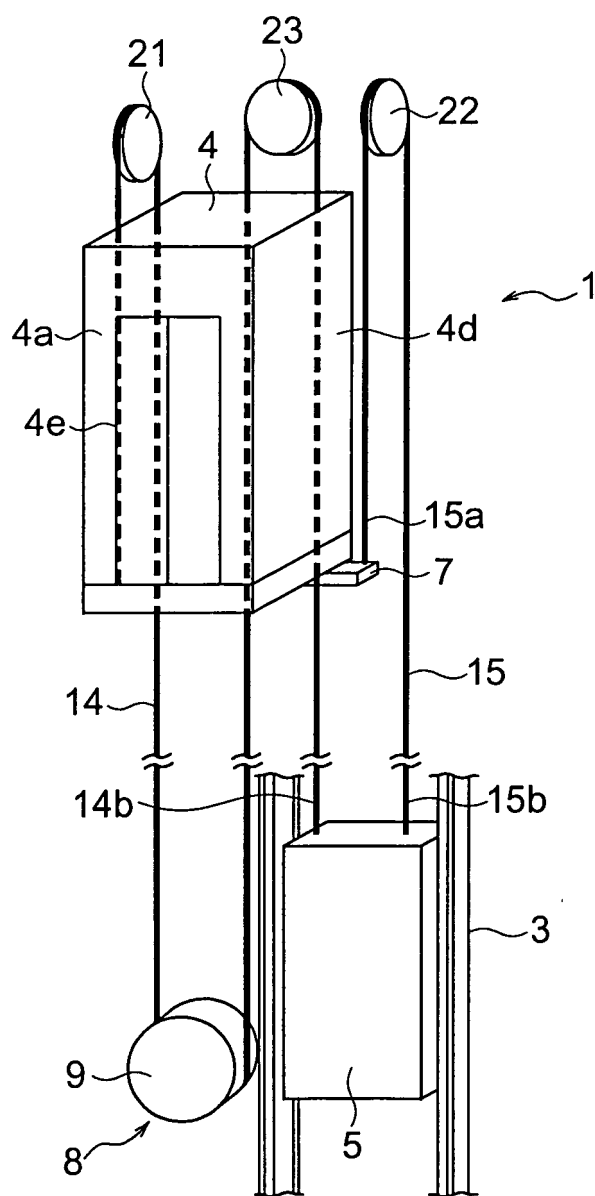


FIG. 4

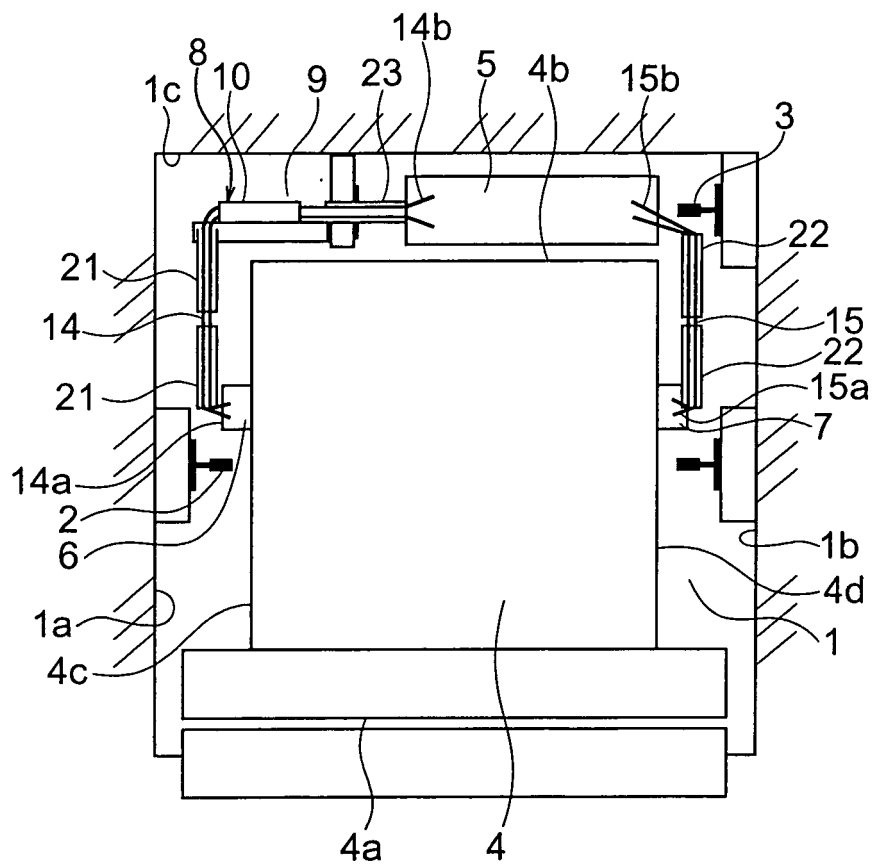


FIG. 5

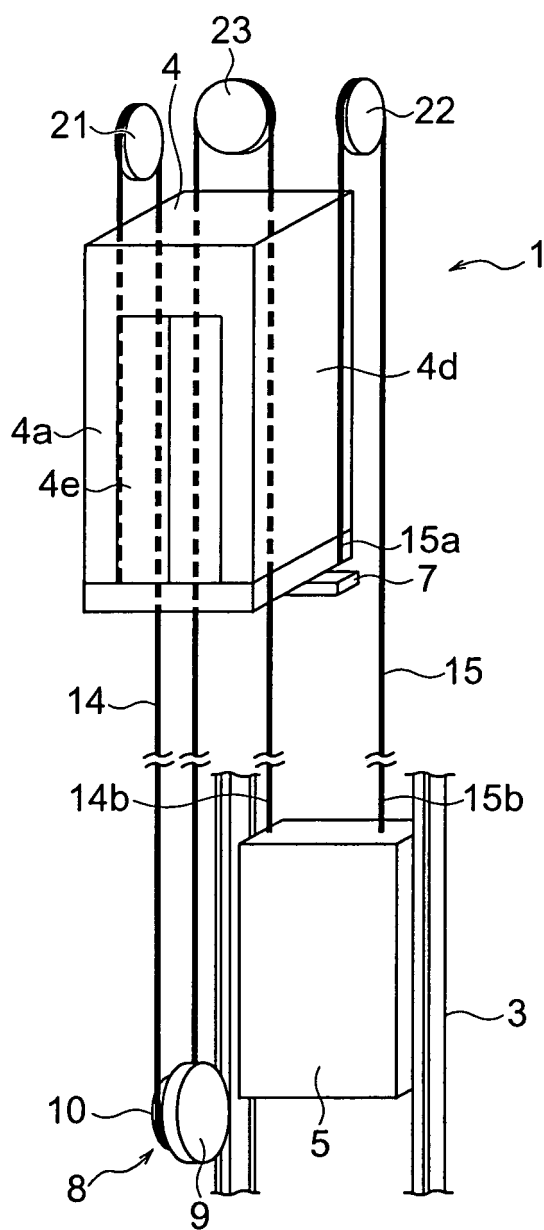


FIG. 6

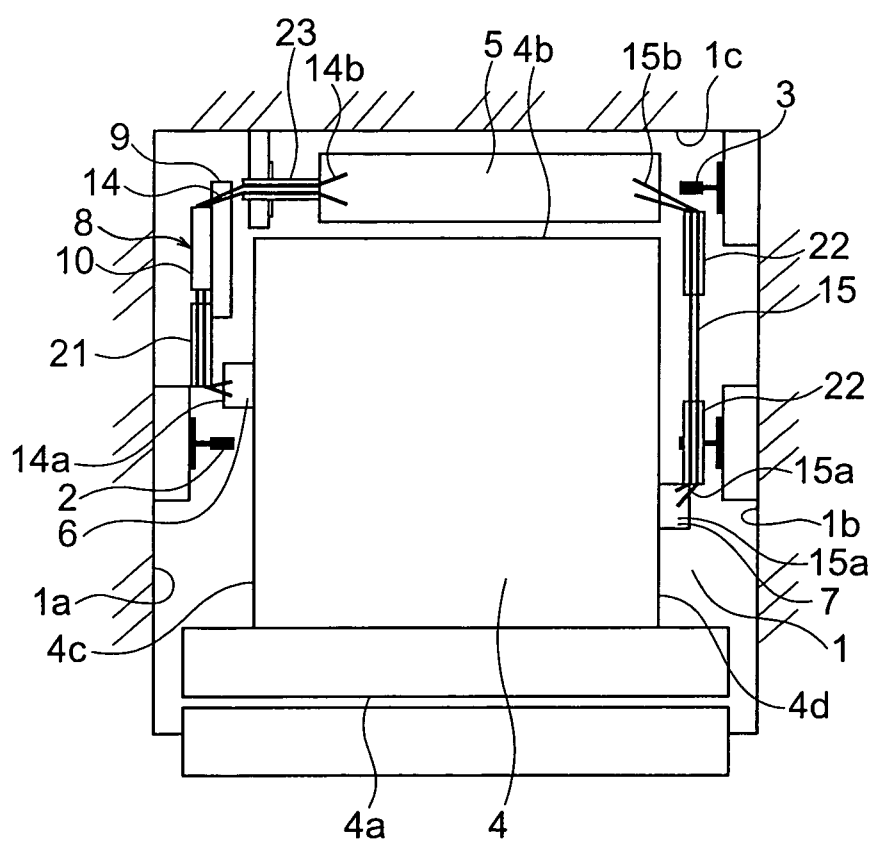


FIG. 7

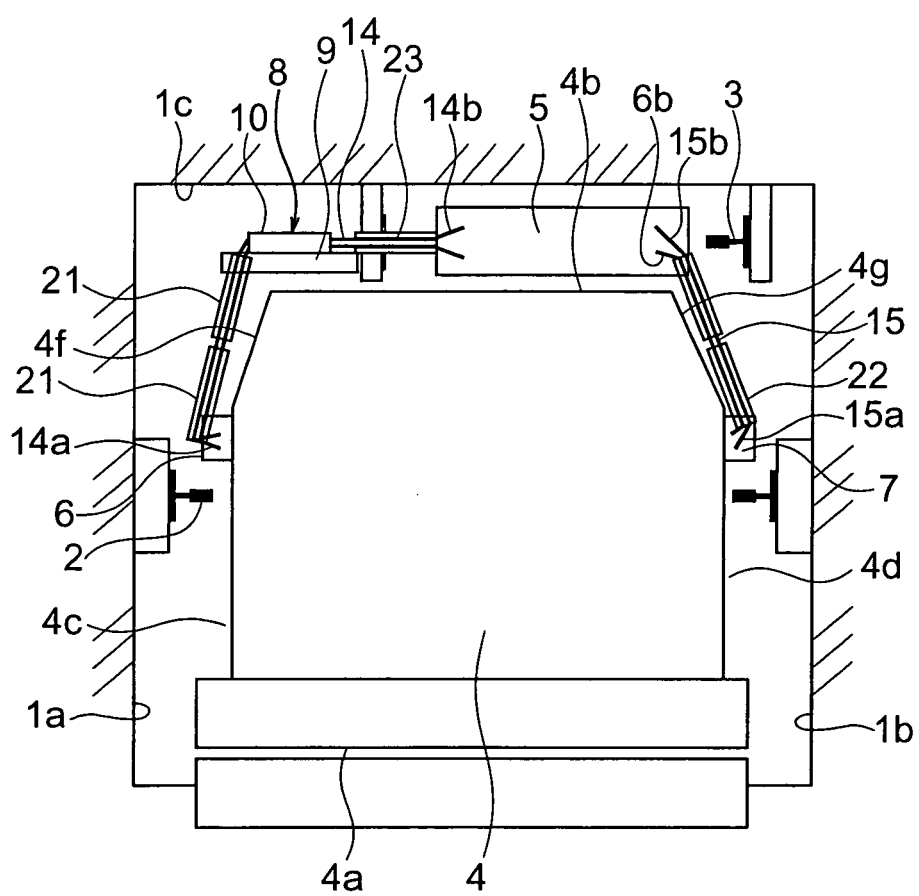
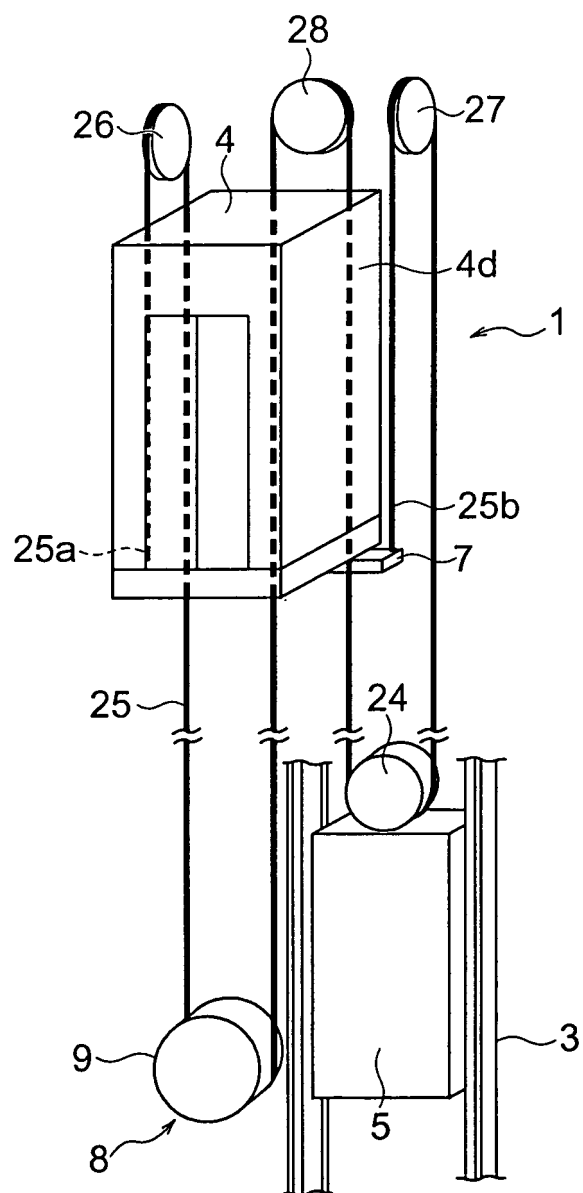


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/005289

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ B66B7/06		
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 B66B7/00-11/08		
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 1996-2005 Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005		
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 Y	JP 11-310372 A (Toshiba Elevator and Building Systems Corp.), 09 November, 1999 (09.11.99), Par. Nos. [0071] to [0073]; Figs. 11 to 12 Par. Nos. [0079] to [0081]; Fig. 13 & EP 0953538 A2 & CN 1233583 A & US 6247557 B1	1, 3-4, 6-7 2, 8 5
Y A Y	JP 2000-63057 A (Meidensha Corp.), 29 February, 2000 (29.02.00), Par. Nos. [0018] to [0019]; Fig. 2 Par. Nos. [0022] to [0023]; Fig. 4 (Family: none)	1, 3-4, 6-7 2, 8 5
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 13 January, 2005 (13.01.05)		Date of mailing of the international search report 01 February, 2005 (01.02.05)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/005289

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 2002-179358 A (Fujitec Co., Ltd.), 26 June, 2002 (26.06.02), Abstract (Family: none)	1-2
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 187663/1982 (Laid-open No. 91267/1984) (Meidensha Corp.), 20 June, 1984 (20.06.84), Description; page 1, line 17 to page 2, line 5; Fig. 1 (Family: none)	1-2
A	JP 2000-247559 A (Hitachi, Ltd.), 12 September, 2000 (12.09.00), Abstract (Family: none)	1-2, 5
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