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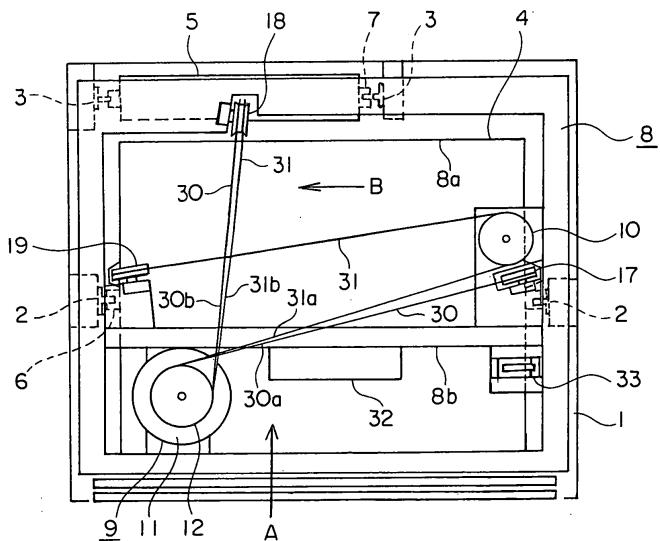
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(54) ELEVATOR APPARATUS

(57) According to the present invention, there is provided an elevator apparatus in which a car 4 and a counterweight 5 are suspended in a hoistway in a 1 : 1 roping system. A first main rope 30 is wrapped around a drive sheave 12 such that two lead-out portions 30a and 30b extending in different directions from the drive sheave 12 cross each other at a predetermined position so that a predetermined frictional force may be generated between the first main rope 30 and the drive sheave 12. In

order that the first main rope 30 may not undergo mutual contact at the position where it undergoes crossing, a driving machine 9 is installed so as to be inclined such that a rotation axis of the drive sheave 12 is at an acute angle with respect to a vertical line, and, there are provided a first deflector sheave 17 guiding the first main rope 30 from the driving machine 9 to the car 4 and a second deflector sheave 18 guiding the first main rope 30 from the driving machine 9 to the counterweight 5.

FIG. I



Description**TECHNICAL FIELD**

[0001] The present invention relates to an elevator apparatus of a type in which a hoisting machine is installed at a top of an interior of a hoistway.

BACKGROUND ART

[0002] There has been proposed in, for example, PCT Publication WO 02/16247, an elevator apparatus which adopts a 1:1 roping system and in which a hoisting machine is installed at a top of an interior of a hoistway such that a rotation axis of a drive sheave extends in a vertical direction thereof. The elevator apparatus thus constructed can achieve a reduction in number of components and simplification in its layout.

[0003] Generally speaking, however, in an elevator apparatus constructed as described above, an arc of contact of a main rope with respect to a drive sheave is small. Thus, in such an elevator apparatus, an expensive, special main rope made of a high friction material is adopted. Further, as a main rope engagement groove formed in order to enable the main rope to be wrapped around an outer peripheral surface of the drive sheave of a hoisting machine, an undercut groove of a special sectional configuration is adopted.

[0004] In an elevator realized through a combination of such a special rope and a main rope engagement groove of a special configuration, an increase in cost and a reduction in the service life of the main rope are involved.

[0005] Further, as stated above, in the elevator apparatus as proposed in PCT Publication WO 02/16247, the 1:1 roping system is adopted, and suspension portions are provided at tops of a car and a counterweight, respectively. That is, the respective top portions of the car and the counterweight are suspended by the main rope. Thus, it is necessary to ensure a vertical dimension corresponding to the suspension portions above the car and the counterweight.

DISCLOSURE OF THE INVENTION

[0006] The present invention has been made with a view toward solving the above problems in the prior art. It is an object of the present invention to provide an elevator apparatus which uses a general-purpose main rope to thereby achieve a reduction in cost, which allows a reduction in a vertical dimension of a hoistway, and which can elongate the service life of the main rope.

[0007] An elevator apparatus according to the present invention includes a driving machine arranged in an upper portion in a hoistway and having a drive sheave, a main rope wrapped around the drive sheave, and a car and a counterweight that are suspended in the hoistway by the main rope and raised and lowered by the driving

machine, and in the elevator apparatus : the car and the counterweight are suspended in the hoistway in a 1:1 roping system; a first main rope is wrapped around the drive sheave such that two lead-out portions extending in different directions from the drive sheave cross each other at a predetermined position so that a predetermined frictional force may be generated between the first main rope and the drive sheave; in order that the first main rope may not undergo mutual contact at the position where it undergoes crossing, the driving machine is installed so as to be inclined such that a rotation axis of the drive sheave is at an acute angle with respect to a vertical line; and in the upper portion in the hoistway, there are provided a first deflector sheave guiding the first main rope from the driving machine to the car and a second deflector sheave guiding the first main rope from the driving machine to the counterweight.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008]

Fig. 1 is a plan view of a machine-room-less type elevator apparatus according to Embodiment 1 of the present invention.
 Fig. 2 is a front view showing a main portion of the elevator apparatus of Fig. 1.
 Fig. 3 is a detailed roping diagram, as seen from the direction of the arrow A of Fig. 1, showing how drive sheaves and a deflector sheave are arranged.
 Fig. 4 is a detailed roping diagram, as seen from the direction of the arrow B of Fig. 1, showing how a drive sheave and a deflector sheave are arranged.
 Fig. 5 is a plan view of a hoisting machine, illustrating the arc of contact of a drive sheave.
 Fig. 6 is a sectional view showing the configuration of main rope engagement grooves formed in the outer peripheral surface of a drive sheave.
 Fig. 7 is a plan view of a machine-room-less type elevator apparatus according to Embodiment 2 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION**45 Embodiment 1**

[0009] Fig. 1 is a plan view of a machine-room-less type elevator apparatus according to Embodiment 1 of the present invention, Fig. 2 is a front view showing a main portion of the elevator apparatus of Fig. 1, Fig. 3 is a detailed roping diagram, as seen from the direction of the arrow A of Fig. 1, showing how drive sheaves and a deflector sheave are arranged, Fig. 4 is a detailed roping diagram, as seen from the direction of the arrow B of Fig. 1, showing how a drive sheave and a deflector sheave are arranged, Fig. 5 is a plan view of a hoisting machine, illustrating the arc of contact of a drive sheave, and Fig. 6 is a sectional view showing the configuration

of main rope engagement grooves formed in the outer peripheral surface of a drive sheave. In Figs. 3 and 4, a second main rope 31 is omitted.

[0010] In the drawings, a pair of car guide rails 2 and a pair of counterweight guide rails 3 are provided inside a hoistway 1 so as to extend in the direction in which a car 4 ascends and descends. The car 4 ascends and descends inside the hoistway 1 while guided by the car guide rails 2. A counterweight 5 ascends and descends inside the hoistway 1 while guided by the counterweight guide rails 3.

[0011] At upper and lower ends of the side surface portions of the car 4, there are provided car guide shoes 6 adapted to be engaged with the car guide rails 2 and having a U-shaped sectional configuration. Further, at upper and lower ends of the side portions of the counterweight 5, there are provided a plurality of counterweight guide shoes 7 to be engaged with the counterweight guide rails 3.

[0012] At a top of the hoistway 1, a support stage 8 is mounted to upper end portions of the guide rails 2. The support stage 8 is composed of a main body portion 8a extending around an inner peripheral surface of the hoistway 1 and formed as a substantially rectangular frame, and a beam portion 8b extending across two opposing sides of the main body portion 8a.

[0013] A driving machine (hoisting machine) 9 and a return wheel 10 are provided on the support stage 8. The driving machine 9 has a motor 11 and a drive sheave 12 rotated by the motor 11. The driving machine 9 has a thin and flat external configuration whose axial length is smaller than the outer diameter thereof. As shown in Figs. 3 and 4, the driving machine 9 is arranged such that the axis of the drive sheave 12 extends substantially in the vertical direction and is inclined by 2.5 degrees with respect to the vertical line. Similarly, the return wheel 10 is arranged such that its axis extends in the vertical direction and is inclined by 2.5 degrees with respect to the vertical line. As shown in Fig. 1, the driving machine 9 is arranged above a corner portion of the car 4.

[0014] As first and second main ropes, general-purpose main ropes 30 and 31 for elevators are wrapped around the drive sheave 12 at an arc of contact of approximately 255 degrees. As shown in Fig. 5, the arc of contact refers to the angle of the portion where the main ropes 30 and 31 wrapped around the outer periphery of the drive sheave 12 are in contact with the drive sheave 12, and more specifically, the angle indicating the distance from the contact start point to the contact end point of the main ropes 30, 31 with respect to the drive sheave 12.

[0015] The car 4 is suspended at first ends of the main ropes 30, 31. The counterweight 5 is suspended at second ends of the main ropes 30, 31. That is, the car 4 and the counterweight 5 are suspended inside the hoistway 1 in the 1:1 roping system. As shown in Fig. 2, the first end of the main rope 30 is connected to a lower

beam end portion 4a (on the right-hand side in Fig. 2) of the car 4 by a suspension portion 20a composed of a rope shackle 13a and a buffer member 14a. The first end of the main rope 31 is connected to a lower beam end portion 4b (on the left-hand side in Fig. 2) of the car 4 by a suspension portion 20b composed of a rope shackle 13b and a buffer member 14b. The second ends of the main ropes 30 and 31 are connected to the top portion of the counterweight 5 by a rope shackle 15 and a buffer member 16.

[0016] As shown in Figs. 1 and 2, on the support stage 8, there are further provided a first direction changing deflector sheave 17, a second direction changing deflector sheave 18, and a third direction changing deflector sheave 19. The first direction changing deflector sheave 17 changes the direction of the first main rope 30 extending from the drive sheave 12 and guides it to the lower beam end portion 4a of the car 4. The third direction changing deflector sheave 19 changes the direction of the second main rope 31 extending from the drive sheave 12 and turned back by the return wheel 10 and guides it to the lower beam end portion 4b of the car 4. The second direction changing deflector sheave 18 changes the direction of the two main ropes 30 and 31 wrapped around the drive sheave 12 and then extending to the other side and guides them to the counterweight 5.

[0017] The second direction changing deflector sheave 18 is arranged so as not to involve mutual interference, at the position where the two main ropes 30 and 31 respectively extending from the drive sheave 12 to the first direction changing deflector wheel 17 and the return wheel 10 and the two main ropes 30 and 31 extending to the third direction changing deflector sheave 19 after being wrapped around the drive sheave 12 cross each other.

[0018] The first, second, and third direction changing deflector sheaves 17, 18, and 19 are arranged such that their respective rotation axes extend horizontally. The first and third direction changing deflector sheaves 17 and 19 are arranged so as to overlap the car 4 in a vertical plane of projection. The second direction changing deflector sheave 18 is arranged so as to overlap the counterweight 5 in a vertical plane of projection.

[0019] Further provided on the support stage 8 are elevator devices, such as a control panel 32 for controlling the elevator and a speed governor 33 for controlling the elevator speed. These elevator devices are arranged so as to be within the requisite vertical dimension D (Fig. 2) for the driving machine 9 and the first, second, and third direction changing deflector sheaves 17, 18, and 19.

[0020] Fig. 6 is a sectional view showing the configuration of main rope engagement grooves 12a for wrapping the first and second main ropes 30 and 31 around the drive sheave 12. As shown in Fig. 6, the two main rope engagement grooves 12a formed in the outer peripheral surface of the drive sheave 12 are grooves of a

U-shaped sectional configuration having a groove width approximate to the diameter of the main ropes 30 and 31, thus increasing the contact area between the main ropes 30, 31 and the drive sheave 12 to reduce the contact pressure.

[0021] In this way, in order to generate a predetermined frictional force between the drive sheave 12 and itself, the first main rope 30 is wrapped around the drive sheave 12 such that two lead-out portions 30a and 30b extending in different directions from the drive sheave 12 cross each other at a predetermined position. In order that the first main rope 30 may not undergo mutual contact at the position where it crosses, the driving machine 9 is installed such that the rotation axis of the drive sheave 12 is inclined with respect to the vertical line by an acute angle (2.5 degrees). In the upper portion in the hoistway 1, there are provided the first deflector sheave 17 guiding the first main rope 30 from the driving machine 9 to the car 4 and the second deflector sheave 18 guiding the first main rope 30 from the driving machine 9 to the counterweight 5.

[0022] Further, in order to generate a predetermined frictional force between the drive sheave 12 and itself, the second main rope 31 is wrapped around the drive sheave 12 such that two lead-out portions 31a and 31b extending in different directions from the drive sheave 12 cross each other at a predetermined position. In the upper portion in the hoistway 1, there are further provided the return wheel 10 turning back the second main rope 31 extending in a predetermined direction from the driving machine 9 and the third deflector sheave 19 guiding the second main rope 31 turned back by the return wheel 10 to the car 4, and the return wheel 10 is installed such that the rotation axis thereof is inclined with respect to the vertical line by an acute angle (2.5 degrees) in order that the portion of the second main rope 31 extending from the driving machine 9 toward the second deflector sheave 18 may not come into contact with the portion of the second main rope 31 extending from the return wheel 10 toward the third deflector sheave 19.

[0023] Due to this construction, the elevator apparatus of this embodiment can be constructed at low cost by using the general-purpose main ropes 30 and 31 and, further, can elongate the service life of the main ropes 30 and 31.

[0024] Further, since the driving machine 9 has a thin and flat external configuration whose axial length is smaller than the outer diameter thereof, it is possible to reduce the vertical dimension of the hoistway 1.

[0025] Further, the main rope engagement grooves 12 formed in the outer peripheral surface of the driving machine 9 and adapted to be engaged with the main ropes 30 and 31 have a U-shaped sectional configuration. Thus, it is possible to enlarge the contact area between the drive sheave 12 and the main ropes 30 and 31, making it possible to easily generate a predetermined frictional force.

[0026] Further, the car 4 is suspended with the main ropes 30 and 31 being connected to the lower portion of the car 4. That is, the car 4 is suspended with the main ropes 30 and 31 being connected to the lower beam end portions 4a and 4b, so that the length of the suspension portions 20a and 20b composed of the rope shackles 13a and 13b extending upwardly from the lower beam end portions 4a and 4b and the buffer members 14a and 14b is balanced by the vertical length of the car 4, whereby the vertical dimension of the entire car 4 can be made smaller than in the prior art, and, by extension, it is possible to reduce the vertical dimension of the hoistway 1.

[0027] Further, the first, second, and third deflector sheaves 17, 18, and 19 are installed such that their respective rotation axes are horizontal and that they overlap the car 4 or the counterweight 5 in a vertical plane of projection, so that it is possible to reduce the cross-sectional area of the hoistway 1, thus realizing a small-space elevator apparatus.

[0028] Further, the driving machine 9, the speed governor 33, the return wheel 10, the first, second, and third deflector sheaves 17, 18, and 19, and the control panel 32 are mounted to the support stage 8 provided in the upper portion in the hoistway 1, and the driving machine 9, the speed governor 33, the return wheel 10, and the control panel 32 are installed within the range (indicated by symbol D) as defined by the vertical dimension of the first, second, and third deflector sheaves 17, 18, and 19 and between the rope groove 12a of the drive sheave 9 on the opposite side of the motor and the end surface of the drive sheave 12 on the opposite side of the motor. Thus, it is possible to achieve a reduction in the vertical dimension of the hoistway 1.

[0029] Further, the support stage 8 is supported at the upper ends of the guide rails 2. Thus, the support structure can be easily constructed, making it possible to realize an inexpensive elevator apparatus. Further, the support stage 8 is supported by the guide rails 2 through the intermediation of vibration-proof members 34. Thus, it is possible to prevent the vibration of the apparatuses, such as the driving machine 9, the speed governor 33, the return wheel 10, and the first, second, and third deflector sheaves 17, 18, and 19, generated during ascent and descent of the car 4, from being transmitted to the guide rails 2, thus achieving a reduction in vibration with a simple structure, whereby the elevator is made comfortable to ride in, and no increase in cost is involved.

[0030] In this way, in the elevator apparatus of this embodiment, the arc of contact of the main ropes 30 and 31 with respect to the drive sheave 12 is increased as compared with that in the prior art, and, further, the drive sheave 12 is provided with main rope engagement grooves with a U-shaped sectional configuration to thereby increase the contact area, whereby, in contrast to the prior art, there is no need to use an expensive, high-friction main rope or to provide a drive sheave with a main rope engagement groove of a special configuration into which such a high friction main rope is forced

to achieve an increase in traction, making it possible to ensure a predetermined traction with a general-purpose main rope and, further, to elongate the service life of the main ropes 30 and 31.

[0031] In this embodiment, two main ropes of the first and second main ropes 30 and 31 are used as the main ropes; this is mainly for the purpose of connecting the main ropes to the bottom portion of the car 4. That is, in this embodiment, a single main rope suffices if the suspension of the car is to be effected with the main rope connected to the top portion of the car 4, and either of the main ropes may be omitted.

[0032] Further, in this embodiment, the first and second main ropes 30 and 31 are wrapped around the drive sheave 12 at an arc of contact of approximately 255 degrees; this is due to the fact that the hoisting machine 9 is arranged at a position farthest apart from the deflector sheaves 17 through 19 in order to minimize the angular error with which the main ropes 30 and 31 paid out from the sheave grooves 12a are engaged with the grooves of the deflector sheaves 17 through 19.

[0033] Further, in this embodiment, the inclination angle of the driving machine 9 and the return wheel 10 with respect to the vertical line is 2.5 degrees; if the inclination angle is larger than this, it is highly possible that the main ropes 30 and 31 will be detached or that the corners of the sheave grooves 12a will come into contact with the main ropes when the main ropes 30 and 31 are attached with/detached from the sheave grooves 12a, resulting in the main ropes 30 and 31 and the rope grooves 12a being damaged.

[0034] While this embodiment employs general-purpose main ropes, it is also possible to adopt main ropes with high tension and small diameter. In the case in which such main ropes are used, it is possible, by adopting small diameter ropes, to reduce the diameter of the drive sheave 12 and that of the first, second, and third direction changing deflector sheaves 17, 18 and 19 (sheave-diameter/main-rope-diameter ≥ 40). For the same reason, it is also possible to achieve a reduction in the size of the driving machine 9.

[0035] Further, as stated above, in this embodiment, the driving machine 9 is arranged above a corner of the car 4, so that it is possible to ensure, between the driving machine 9 and the first, second, and third direction changing deflector sheaves 17, 18, and 19, a sufficient distance for twisting the main ropes 30 and 31, and, at the same time, it is possible to ensure a sufficient arc of contact with respect to the drive sheave 12.

Embodiment 2

[0036] Fig. 7 is a plan view of a machine-room-less type elevator apparatus according to Embodiment 2 of the present invention. In Embodiment 1, the counterweight 5 is arranged by the side of, that is, laterally to, the car 4 in the hoistway 1, whereas, in this embodiment, the counterweight 5 is by the side of the car 4 in the

hoistway 1, as shown in Fig. 7. Otherwise, this embodiment is of the same construction as Embodiment 1.

[0037] The present invention is also applicable to an elevator apparatus thus constructed; in this embodiment, the counterweight 5 is arranged on the opposite side of the first deflector sheave 17 and the return wheel 10 with respect to the car 4, so that it is possible for the arc of contact to be larger than that in the apparatus of Embodiment 1.

[0038] While in Embodiments 1 and 2 the driving machine 9 and the first, second, and third direction changing deflector sheaves 17, 18, and 19 are mounted at the upper end of the guide rails 2 by means of the support stage 8, it is also possible for the driving machine and the direction changing deflector sheaves to be directly supported by the ceiling of the hoistway 1 or the building. Alternatively, the support stage 8 may be directly supported by the ceiling of the hoistway 1 or the building.

INDUSTRIAL APPLICABILITY

[0039] The present invention is most suitable for an elevator to be installed in a small space. Further, it is most suitable for an elevator that is required to be inexpensive and easy to maintain.

Claims

1. An elevator apparatus comprising a driving machine arranged in an upper portion in a hoistway and having a drive sheave, a main rope wrapped around the drive sheave, and a car and a counterweight that are suspended in the hoistway by the main rope and raised and lowered by the driving machine,
wherein the car and the counterweight are suspended in the hoistway in a 1:1 roping system,
a first main rope is wrapped around the drive sheave such that two lead-out portions extending in different directions from the drive sheave cross each other at a predetermined position so that a predetermined frictional force may be generated between the first main rope and the drive sheave,
in order that the first main rope may not undergo mutual contact at the position where it undergoes crossing, the driving machine is installed so as to be inclined such that a rotation axis of the drive sheave is at an acute angle with respect to a vertical line, and
in the upper portion in the hoistway, there are provided a first deflector sheave guiding the first main rope from the driving machine to the car and a second deflector sheave guiding the first main rope from the driving machine to the counterweight.
2. An elevator apparatus according to Claim 1, further comprising a second main rope wrapped around the

drive sheave such that two lead-out portions extending in different directions from the drive sheave cross each other at a predetermined position so that a predetermined frictional force may be generated between the second main rope and the drive sheave,

in the upper portion in the hoistway, there are further provided a return wheel turning back the second main rope extending in a predetermined direction from the driving machine, and a third deflector sheave guiding the second main rope turned back by the return wheel to the car, and

the return wheel is installed so as to be inclined such that its rotation axis is at an acute angle with respect to the vertical line in order that a portion of the second main rope extending from the driving machine toward the second deflector sheave and a portion of the second main rope extending from the return wheel toward the third deflector sheave may not come into contact with each other.

3. An elevator apparatus according to Claim 2, wherein in the driving machine and the return wheel are installed so as to be inclined such that their respective rotation axes are at not more than 2.5 degrees with respect to the vertical line.

4. An elevator apparatus according to any one of Claims 1 to 3, wherein an arc of contact of the main rope with respect to the drive sheave ranges from 250 degrees to 280 degrees.

5. An elevator apparatus according to any one of Claims 1 to 4, wherein the driving machine has a thin and flat external configuration whose axial length is smaller than an outer diameter thereof.

6. An elevator apparatus according to any one of Claims 1 to 5, wherein a main rope engagement groove formed in an outer peripheral surface of the driving machine and adapted to be engaged with the main rope has a U-shaped sectional configuration.

7. An elevator apparatus according to any one of Claims 1 to 6, wherein the car is suspended with the main rope being connected to a lower portion of the car.

8. An elevator apparatus according to any one of Claims 2 to 7, wherein the first, second, and third deflector sheaves are installed such that their respective rotation axes are horizontal and that they each overlap the car or the counterweight in a vertical plane of projection.

9. An elevator apparatus according to any one of Claims 2 to 8, wherein the driving machine, a speed

5 governor, the return wheel, the first, second, and third deflector sheaves, and a control panel are mounted to a support stage provided in the upper portion in the hoistway, and the driving machine, the speed governor, the return wheel, and the control panel are installed within a range defined by the vertical dimension of the first, second, and third deflector sheaves and extending from a rope groove of the drive sheave on the opposite side of a motor to the end surface of the drive sheave on the opposite side of the motor.

10 15 10. An elevator apparatus according to Claim 9, wherein in the support stage is supported by a guide rail or the hoistway.

11 20 11. An elevator apparatus according to Claim 10, wherein the support stage is supported by the guide rail or a wall of the hoistway through the intermediation of a vibration-proof member.

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FIG. I

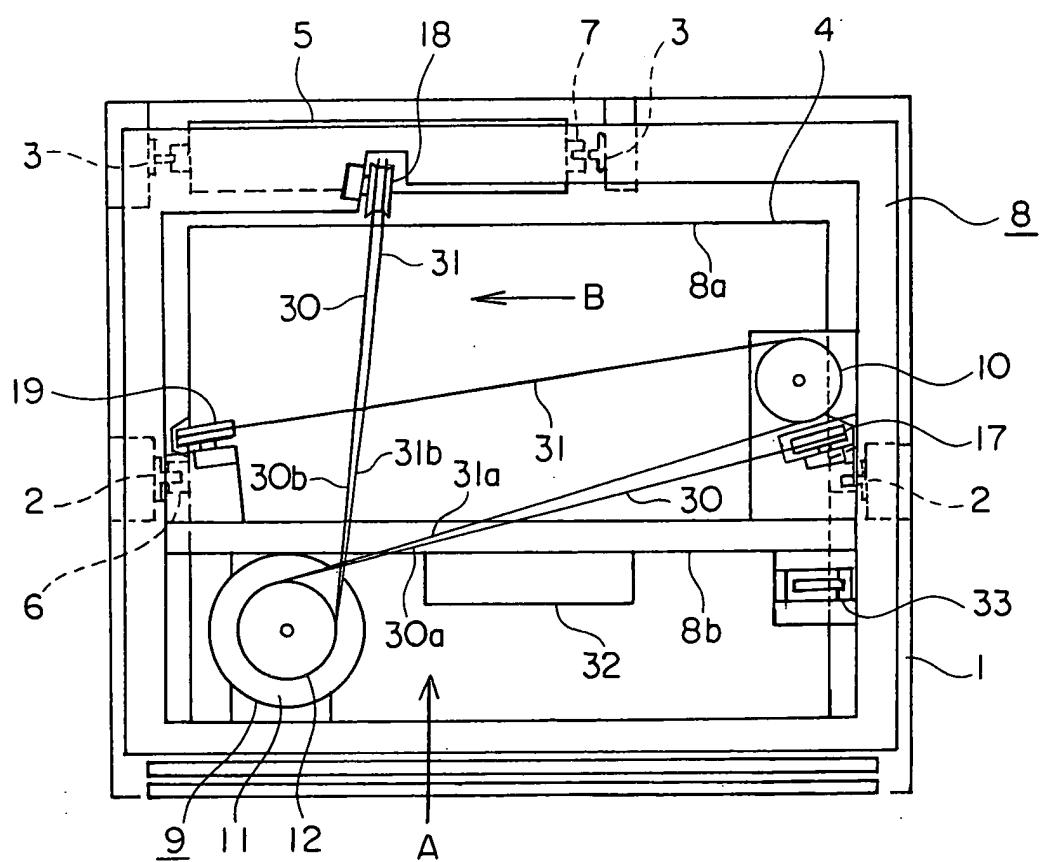


FIG. 2

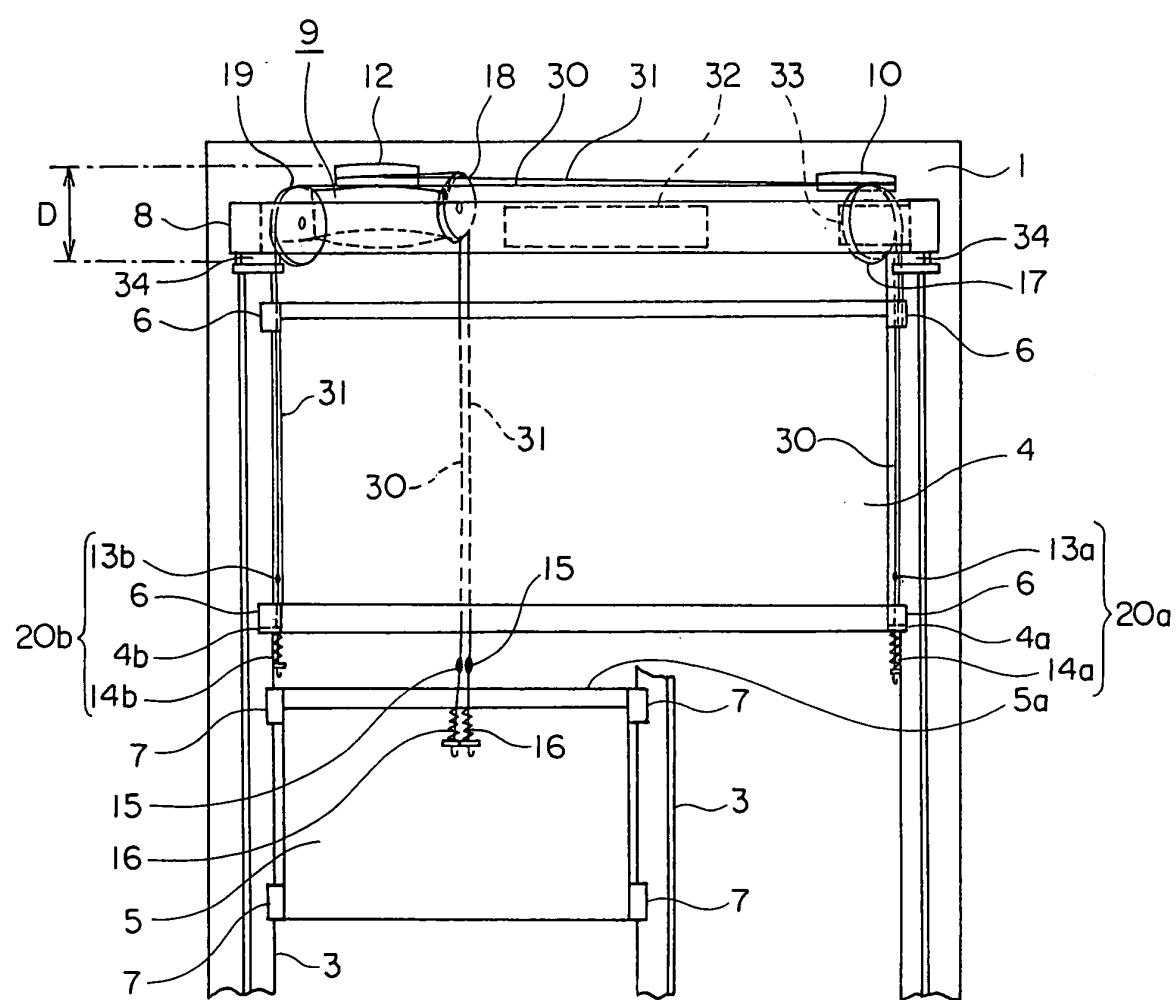


FIG. 3

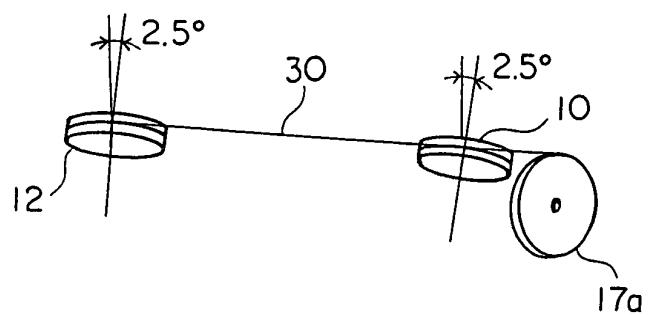


FIG. 4

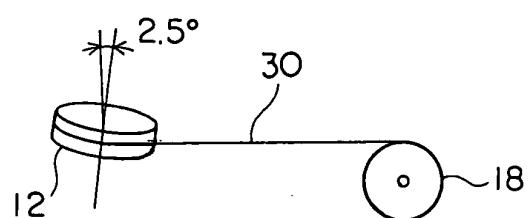


FIG. 5

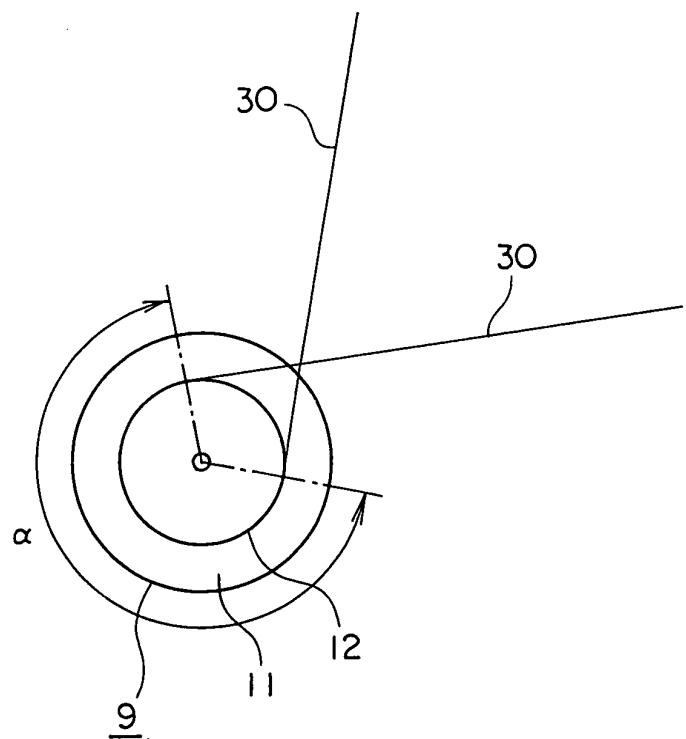


FIG. 6

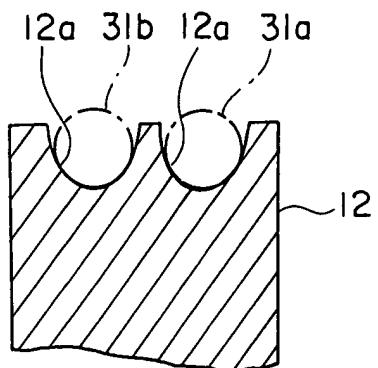
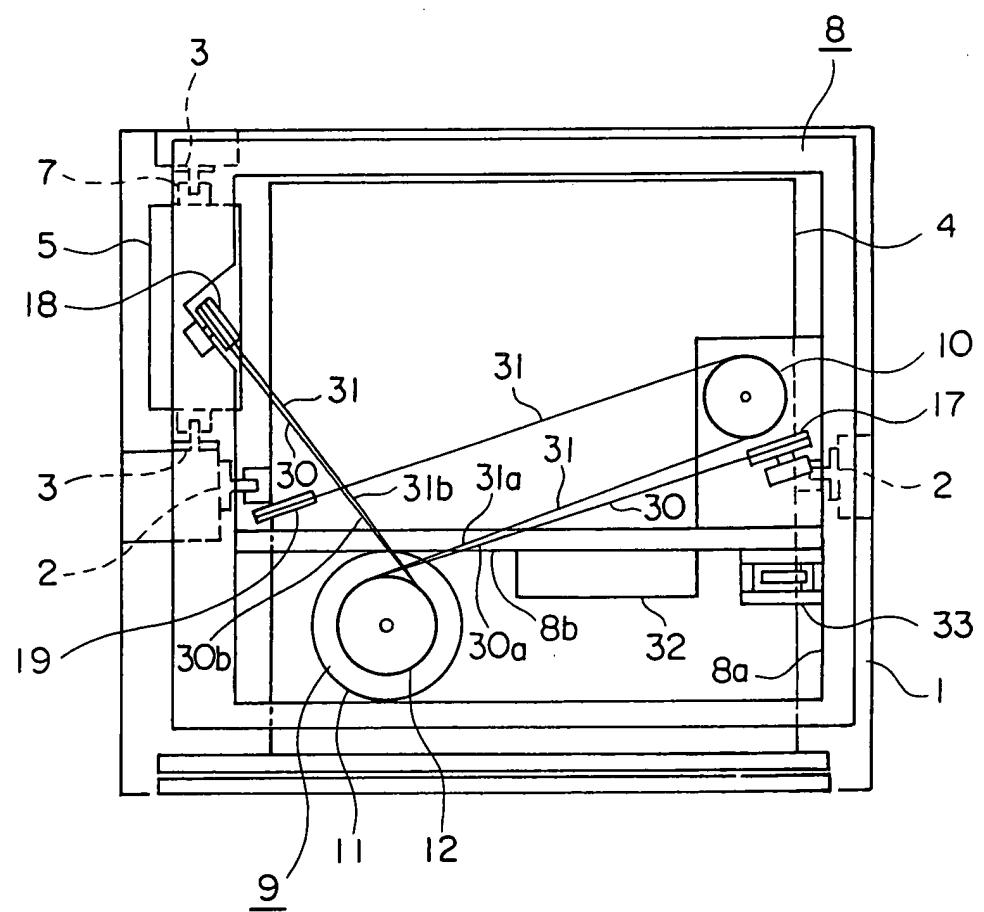


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/02928

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl⁷ B66B7/06, 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.Cl⁷ 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. |
|-----------|---|-----------------------|
| X | JP 2001-48451 A (Mitsubishi Electric Corp.), 20 February, 2001 (20.02.01), Par. Nos. [0050] to [0054]; Figs. 9 to 11 | 1, 4-7 2-3, 8 |
| Y | Par. Nos. [0064] to [0066]; Figs. 18 to 19 & EP 1057771 A2 & CN 1276335 A | 9-11 |
| Y | WO 02/22486 A1 (Mitsubishi Electric Corp.), 21 March, 2002 (21.03.02), Description, page 3, line 2 to page 5, line 19; Figs. 1 to 3 & EP 1319627 A1 | 2-3, 8-11 |
| A | US 6006865 A (INVENTIO AG.), 28 December, 1999 (28.12.99), & CA 2220582 A & EP 0841283 A1 & JP 10-139321 A | 1-11 |

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 11 December, 2003 (11.12.03) | Date of mailing of the international search report 13 January, 2004 (13.01.04) |
| Name and mailing address of the ISA/ Japanese Patent Office | Authorized officer |
| Facsimile No. | Telephone No. |

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/02928

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|---|--|-----------------------|
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| A | US 5370205 A (KONE ELEVATOR GMBH.), 06 December, 1994 (06.12.94), & AU 4175793 A & FI 923113 A & CA 2099858 A & EP 0578237 A1 & BR 9302786 A & CN 1086788 A & JP 6-156952 A | 1-11 |

Form PCT/ISA/210 (continuation of second sheet) (July 1998)