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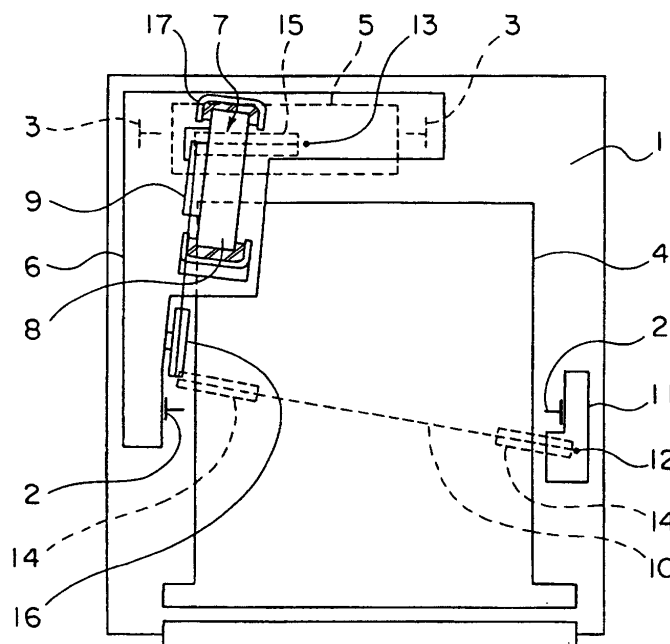
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(54) **ELEVATOR**

(57) Provided is an elevator apparatus including a deflector sheave that is arranged in an upper portion of the hoistway and guides a main rope from a driving sheave to a car suspension sheave. The driving machine is arranged so as to overlap a car in a vertical

plane of projection, and the deflector sheave is arranged such that the rotation shaft of the deflector sheave extends parallel to the rotation shaft of the driving sheave, with the deflector sheave being arranged in a plane perpendicularly crossing the rotation shaft of the driving sheave and including the driving sheave.

FIG. 2



Description

Technical Field

[0001] The present invention relates to an elevator apparatus in which a driving machine is arranged in an upper portion of the hoistway.

Background Art

[0002] JP 10-139321 A discloses a conventional example of a so-called machine-room-less type elevator apparatus in which no machine room is provided in an upper portion of the hoistway and in which a driving machine is provided in the upper portion of the hoistway. As compared with the case in which a machine room is separately provided in the upper portion of the hoistway, this type of elevator apparatus is advantageous in that the height of the building can be reduced. However, in this type of elevator apparatus, it is necessary to secure a space for arranging the driving machine in the upper portion of the hoistway. Thus, it is desired that the space inside the hoistway be utilized as efficiently as possible.

Disclosure of the Invention

[0003] The present invention has been made with a view toward solving the above problem in the prior art. It is an object of the present invention to provide an elevator apparatus which makes it possible to efficiently utilize the space inside the hoistway and to minimize the sectional area of the hoistway.

[0004] To this end, according to one aspect of the present invention, there is provided an elevator apparatus comprising: a hoistway; a car raised and lowered in the hoistway; a car suspension sheave provided at the car; a counterweight arranged behind the car and raised and lowered in the hoistway; a counterweight suspension sheave provided on the counterweight; a driving machine for raising and lowering the car and the counterweight, which has a driving machine main body arranged in an upper portion of the hoistway and a driving sheave rotated by the driving machine main body, the driving sheave having a rotation shaft arranged so as to extend horizontally; a main rope having a first end portion and a second end portion that are connected to the upper portion of the hoistway, the main rope being wrapped around the car suspension sheave, the driving sheave, and the counterweight suspension sheave to suspend the car and the counterweight in the hoistway; and at least one deflector sheave which is arranged in the upper portion of the hoistway and around which the main rope is wound, the deflector sheave guiding the main rope from the driving sheave to at least one of the car suspension sheave and the counterweight suspension sheave, wherein the driving machine is arranged so as to overlap the car in a vertical plane of projection, and wherein the deflector sheave is arranged such that

its rotation shaft extends parallel to the rotation shaft of the driving sheave, with the deflector sheave being arranged in a plane perpendicularly crossing the rotation shaft of the driving sheave and including the driving sheave.

Brief Description of the Drawings

[0005]

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

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

Fig. 3 is a front view of a driving machine of Fig. 1;

Fig. 4 is a plan view of the driving machine of Fig. 1;

Fig. 5 a perspective view of an elevator apparatus according to Embodiment Mode 2 of the present invention;

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

Fig. 7 is a perspective view of an elevator apparatus according to Embodiment Mode 3 of the present invention; and

Fig. 8 is a plan view of an elevator apparatus according to Embodiment Mode 4 of the present invention.

Best Mode for carrying out the Invention

[0006] Hereinafter, preferred embodiment modes of the present invention will be described with reference to the drawings.

Embodiment Mode 1

[0007] Fig. 1 is a perspective view of an elevator apparatus according to Embodiment Mode 1 of the present invention, and Fig. 2 is a plan view showing the elevator apparatus of Fig. 1.

[0008] In the drawings, installed in a hoistway 1 are a pair of car guide rails 2 and a pair of counterweight guide rails 3. A car 4 is guided by the car guide rails 2 to be raised and lowered in the hoistway 1. A counterweight 5 is arranged behind the car 4 and is guided by the counterweight guide rails 3 to be raised and lowered in the hoistway 1.

[0009] In a vertical plane of projection, a straight line connecting the centers of the pair of car guide rails 2 extends parallel to the frontage direction of the car 4 and passes the center of gravity of the car 4. Further, a straight line connecting the centers of the pair of counterweight guide rails 3 also extends parallel to the frontage direction of the car 4.

[0010] A machine base 6 is secured in position in the vicinity of the upper end of one of the car guide rails 2 and the upper ends of the pair of counterweight guide

rails 3. Mounted on the machine base 6 is a driving machine (hoist machine) 7 for raising and lowering the car 4 and the counterweight 5. The driving machine 7 has a driving machine main body 8 including a motor portion and a brake portion, and a driving sheave 9 rotated by the driving machine main body 8.

[0011] The driving machine 7 is arranged such that a rotation shaft of the driving sheave 9 extends horizontally. Further, the driving machine 7 is arranged so as to overlap, in a vertical plane of projection, a corner portion at the back of the car 4 and the counterweight 5. Further, the driving machine 7 consists of a thin hoist machine whose diameter is larger than the axial dimension thereof.

[0012] Further, the driving machine 7 is arranged such that the driving machine main body 8 is situated on the car 4 side and that the driving sheave 9 is substantially parallel and opposed to a hoistway wall opposed to a side surface of the car 4.

[0013] A plurality of main ropes 10 (only one of which is shown in the drawing) that suspend the car 4 and the counterweight 5 in the hoistway 1 are wrapped around the driving sheave 9. A rope support portion 11 is secured in position in the vicinity of the upper end of the other car guide rail 2. A first end 10a of each main rope 10 is connected to the rope support portion 11 through the intermediation of a car side rope stop 12. A second end 10b of each main rope 10 is connected to the machine base 6 through the intermediation of a counterweight side rope stop 13.

[0014] Under the car 4, there are provided a pair of suspension sheaves 14 around which the main ropes 10 are wrapped. On top of the counterweight 5, there is provided a counterweight suspension sheave 15 around which the main ropes 10 are wrapped.

[0015] Mounted to the machine base 6 is a rotatable deflector sheave 16 for guiding the main ropes 10 from the driving sheave 9 to the car suspension sheaves 14. The deflector sheave 16 is arranged such that its rotation shaft extends parallel to the rotation shaft of the driving sheave 9 and the deflection sheave 16 is arranged in a plane perpendicularly crossing the rotation shaft of the driving sheave 9 and including the driving sheave 9. That is, in a vertical plane of projection, the driving sheave 9 and the deflector sheave 16 are arranged in a straight line.

[0016] Extending from their first ends 10a, the main ropes 10 are wrapped around the car suspension sheaves 14, the deflector sheave 16, the driving sheave 9, and the counterweight suspension sheave 15 in the stated order to reach the second ends 10b. That is, the car 4 and the counterweight 5 are suspended in the 2:1 roping system.

[0017] The portions of the main ropes 10 extending from the counterweight suspension sheaves 14 to the car side rope stop 12 are arranged on the front side of the car guide rails 2. The portions of the main ropes 10 extending from the counterweight suspension sheaves

14 to the deflector sheave 16 are arranged on the rear side of the car guide rails 2. As a result, the car 4 is suspended at the position of its center of gravity.

[0018] Fig. 3 is a front view of the driving machine 7 of Fig. 1, and Fig. 4 is a plan view of the driving machine 7 of Fig. 1. In the drawings, a pair of brackets 17 opposed to each other are fixed to the machine base 6. The driving machine 7 is arranged between these brackets 17. A plurality of bottom vibration-isolating members 18 are provided between the bottom of the driving machine 7 and the machine base 6. Further, side vibration-isolating members 19 are provided between the driving machine 7 and the brackets 17. These vibration-isolating members 18 and 19 are formed of a resilient material such as rubber.

[0019] In the above-described layout of this machine-room-less elevator apparatus, it is possible to efficiently utilize the space inside the hoistway 1 and to minimize the sectional area of the hoistway 1. Further, since the driving machine 7 is arranged such that the driving machine main body 8 is situated on the car 4 side, maintenance operation on the motor portion and the brake portion contained in the driving machine main body 8 can be easily performed from the top of the car 4, and it is possible to sufficiently secure the requisite space for the maintenance operation.

[0020] Further, due to the provision of the bottom vibration-isolating members 18 between the bottom of the driving machine 7 and the machine base 6, it is possible to restrain transmission of the vertical vibration of the driving machine 7 to the car 4 and the building. Further, due to the provision of the side vibration-isolating members 19 between the driving machine 7 and the brackets 17, it is possible to restrain transmission of the horizontal vibration of the driving machine 7 to the car 4 and the building.

[0021] Furthermore, the mounting of the driving machine 7 and the deflector sheave 16 to the same machine base 6 leads to a simple structure and facilitates the installing operation.

Embodiment Mode 2

[0022] Next, Fig. 5 is a perspective view of an elevator apparatus according to Embodiment Mode 2 of the present invention, and Fig. 6 is a plan view of the elevator apparatus of Fig. 5. In the drawings, the driving machine 7 is arranged so as to overlap a side portion of the car 4 in a vertical plane of projection. Mounted to the machine base 6 is a rotatable deflector sheave 21 guiding the main ropes 10 from the driving sheave 9 to the counterweight suspension sheave 15.

[0023] The deflector sheave 21 is arranged such that its rotation shaft extends parallel to the rotation shaft of the driving sheave 9 and that the deflector sheave 21 is arranged in a plane perpendicularly crossing the rotation shaft of the driving sheave 9 and including the driving sheave 9. That is, in a vertical plane of projection,

the driving sheave 9 and the deflector sheave 21 are arranged in a straight line. otherwise, this embodiment mode is of the same construction as Embodiment Mode 1.

[0024] In the above-described layout of this machine-room-less elevator apparatus, it is possible to efficiently utilize the space inside the hoistway 1 and to minimize the sectional area of the hoistway 1. Further, by adjusting the position of the driving machine 7 according to the size of the car 4, it is possible to effect adjustment easily such that the main ropes 10 pass near the center of gravity of the car 4. As a result, it is possible to reduce the load burden on the car guide rails 2 and the car side rope stop 12 imposed due to the self weight of the car 4 and unbalance in the live load on the car 4.

Embodiment Mode 3

[0025] Next, Fig. 7 is a perspective view of an elevator apparatus according to Embodiment Mode 3 of the present invention. In the drawing, provided on top of the counterweight 5 are first and second counterweight suspension sheaves 22a and 22b around which the main ropes 10 are wrapped. Otherwise, this embodiment mode is of the same construction as Embodiment Mode 1.

[0026] By thus using two counterweight sheaves 22a and 22b, the main ropes 10, extending upwards from the counterweight sheaves 22a and 22b, can be arranged vertically, thereby raising and lowering the counterweight 5 in a stable manner.

Embodiment Mode 4

[0027] Next, Fig. 8 is a plan view of an elevator apparatus according to Embodiment Mode 4 of the present invention. In the drawing, a driving machine (hoist machine) 23 is mounted on the machine base 6. The driving machine 23 has a driving machine main body 24 including a motor portion and a brake portion, and a driving sheave 25 rotated by the driving machine main body 24. The driving machine 23 consists of a cylindrical hoist machine whose axial dimension is larger than the diameter thereof. Otherwise, this embodiment mode is of the same construction as Embodiment Mode 1.

[0028] Even in the case in which this driving machine 23 consisting of a cylindrical hoist machine is used, it is possible to efficiently utilize the space inside the hoistway 1 and to minimize the sectional area of the hoistway 1.

[0029] While in the above examples the machine base 6 is supported by the guide rails 2 and 3, the machine base may also be supported by a structure in the hoistway. In this case, it is possible to relieve the load applied to the guide rails and to simplify the structure of the guide rails.

[0030] Further, while in the above examples the deflector sheave is arranged between the driving sheave

and the car suspension sheave or the counterweight suspension sheave, it is also possible to arrange deflector sheaves respectively between the driving sheave and the car suspension sheave and between the driving sheave and the counterweight suspension sheave. That is, it is also possible to use a plurality of deflector sheaves.

10 Claims

1. An elevator apparatus comprising:

a hoistway;
 a car raised and lowered in the hoistway;
 a car suspension sheave provided at the car;
 a counterweight arranged behind the car and raised and lowered in the hoistway;
 a counterweight suspension sheave provided on the counterweight;
 a driving machine for raising and lowering the car and the counterweight, which has a driving machine main body arranged in an upper portion of the hoistway and a driving sheave rotated by the driving machine main body, the driving sheave having a rotation shaft arranged so as to extend horizontally;
 a main rope having a first end portion and a second end portion that are connected to the upper portion of the hoistway, the main rope being wrapped around the car suspension sheave, the driving sheave, and the counterweight suspension sheave to suspend the car and the counterweight in the hoistway; and
 at least one deflector sheave which is arranged in the upper portion of the hoistway and around which the main rope is wound, the deflector sheave guiding the main rope from the driving sheave to at least one of the car suspension sheave and the counterweight suspension sheave,

wherein the driving machine is arranged so as to overlap the car in a vertical plane of projection, and wherein the deflector sheave is arranged such that its rotation shaft extends parallel to the rotation shaft of the driving sheave, with the deflector sheave being arranged in a plane perpendicularly crossing the rotation shaft of the driving sheave and including the driving sheave.

2. An elevator apparatus according to Claim 1, wherein the driving machine is arranged so as to overlap a corner portion at the back of the car and the counterweight in a vertical plane of projection, and wherein the deflector sheave guides the main rope from the driving sheave to the car suspension sheave.

3. An elevator apparatus according to Claim 1, wherein the driving machine is arranged so as to overlap a side portion of the car in a vertical plane of projection, and wherein the deflector sheave guides the main rope from the driving sheave to the counterweight suspension sheave. 5
4. An elevator apparatus according to Claim 1, wherein the driving machine and the deflector sheave are supported by a common machine base secured in position in the upper portion of the hoistway. 10

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FIG. 1

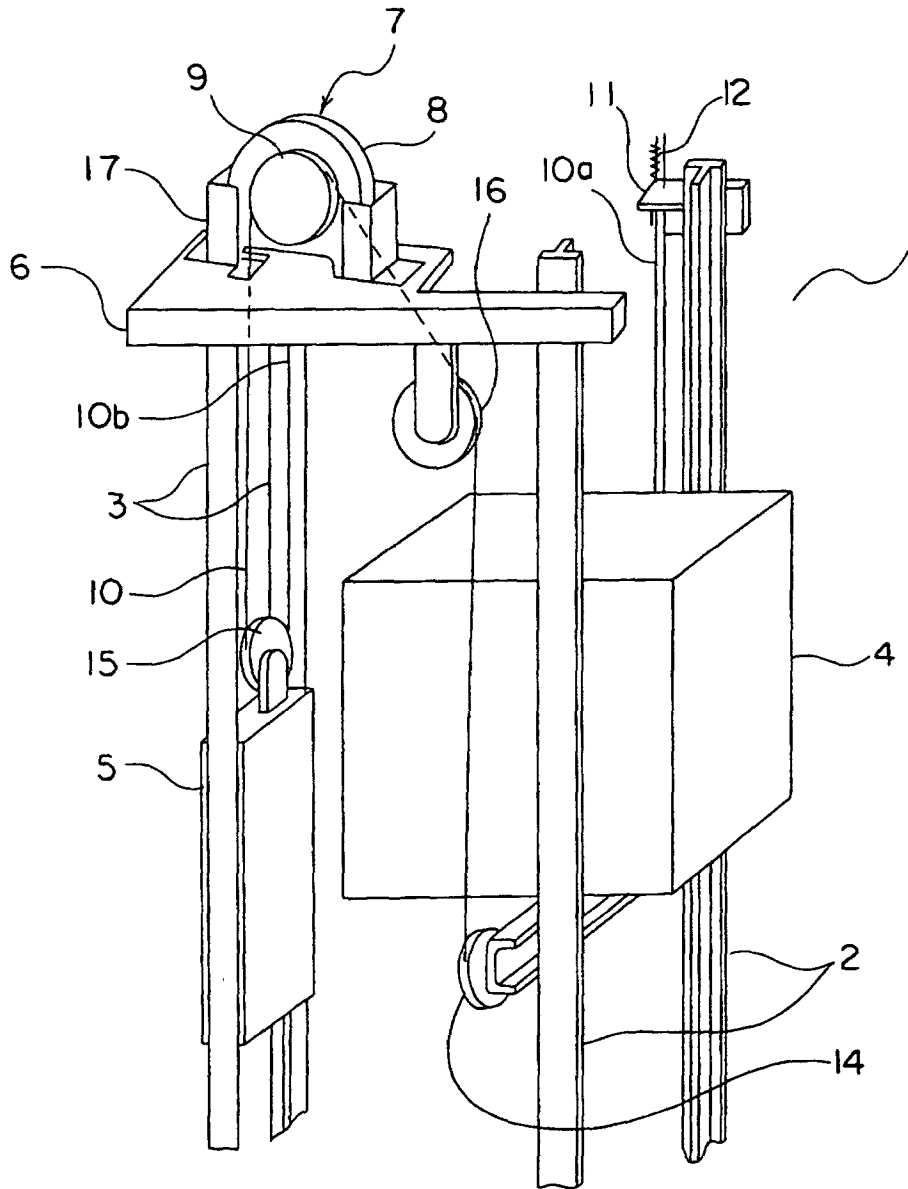


FIG. 2

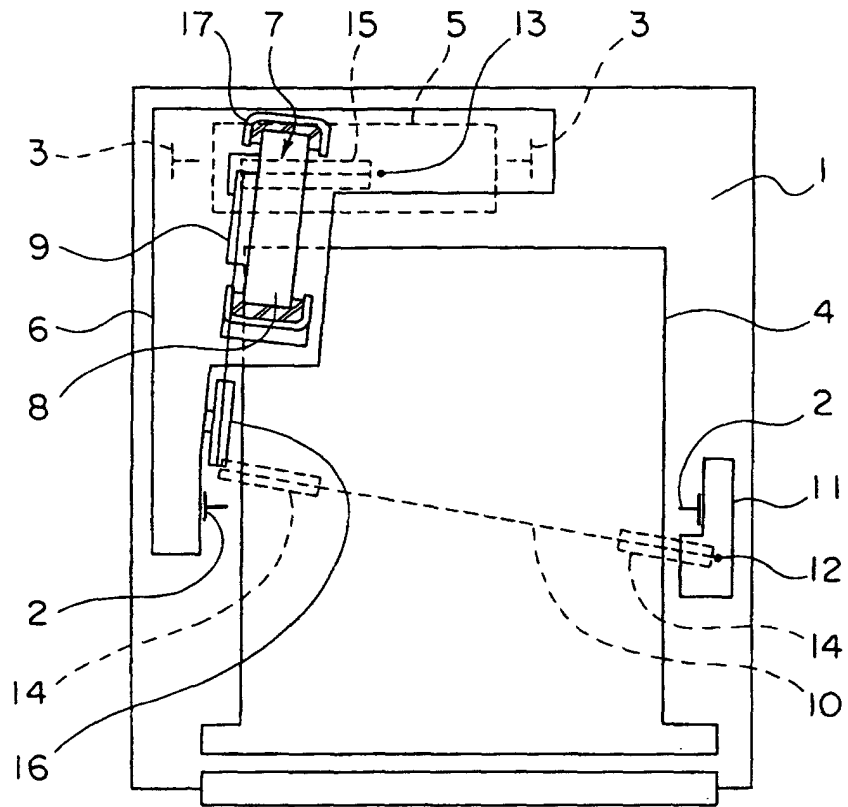


FIG. 3

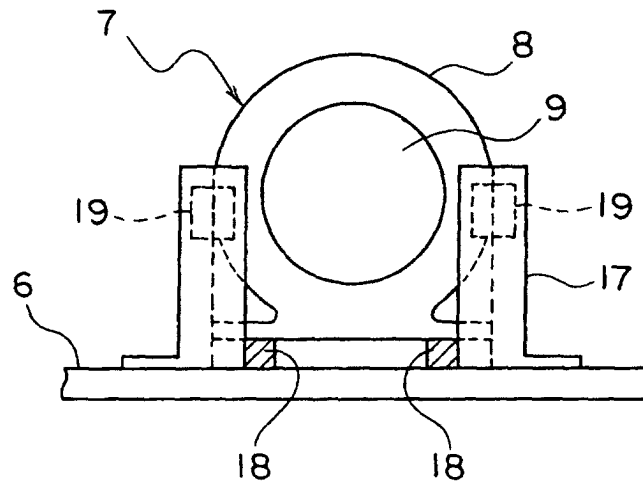


FIG. 4

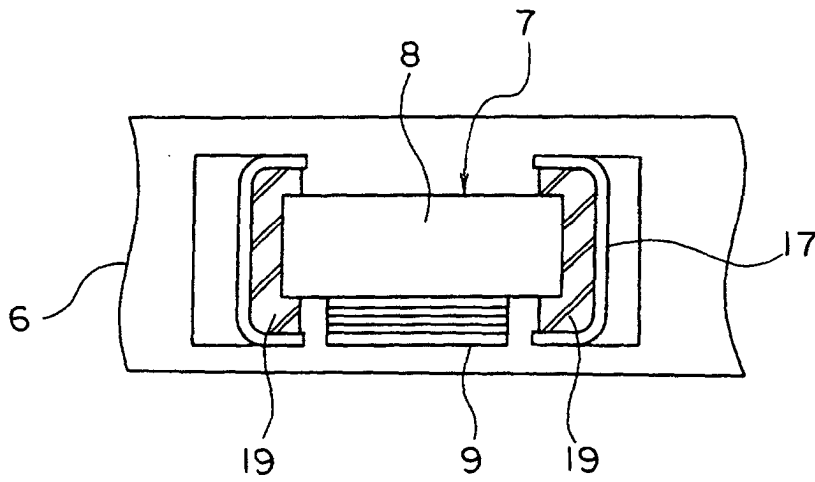


FIG. 5

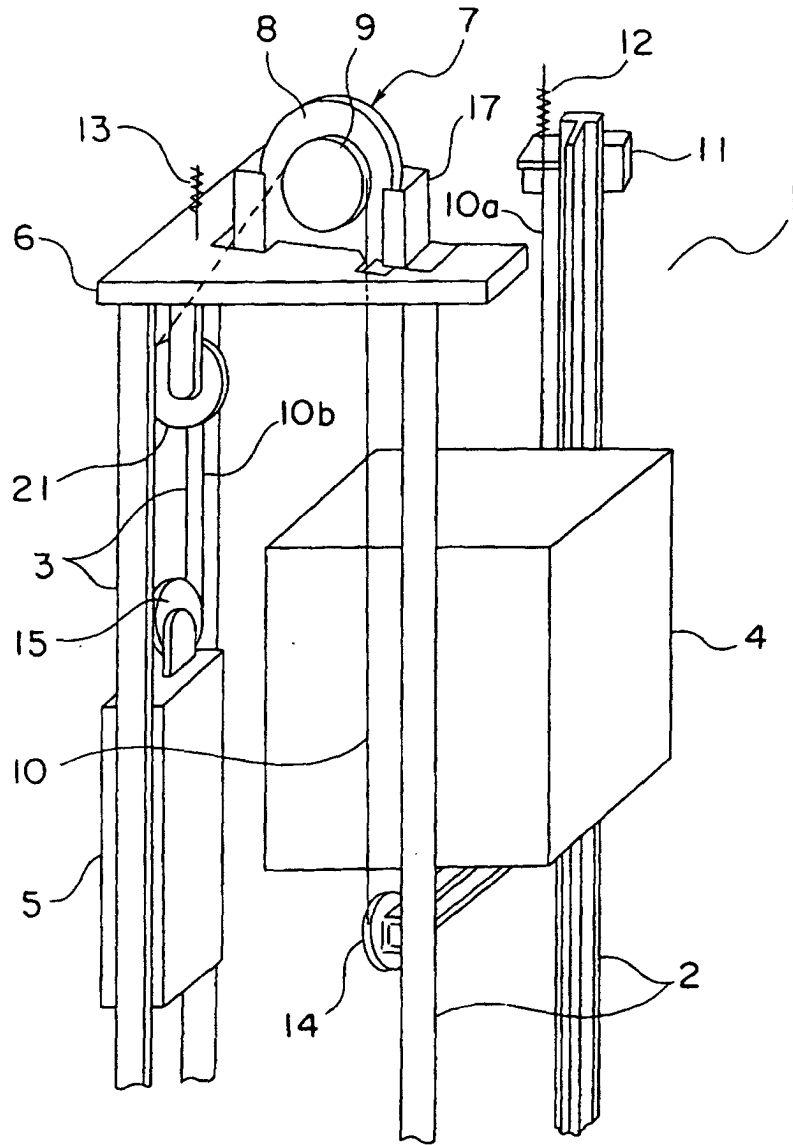


FIG. 6

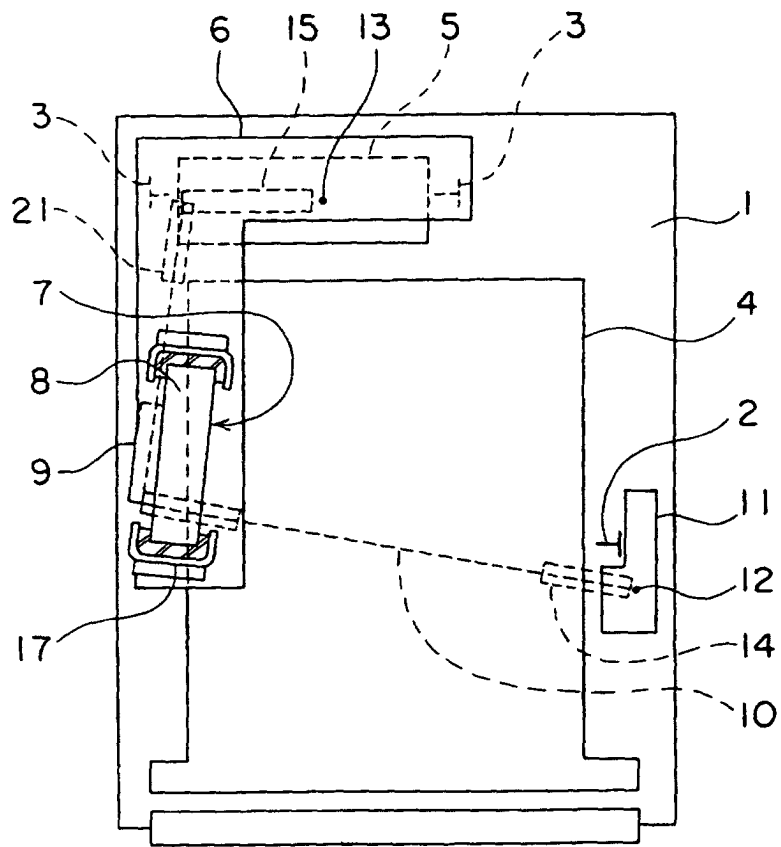


FIG. 7

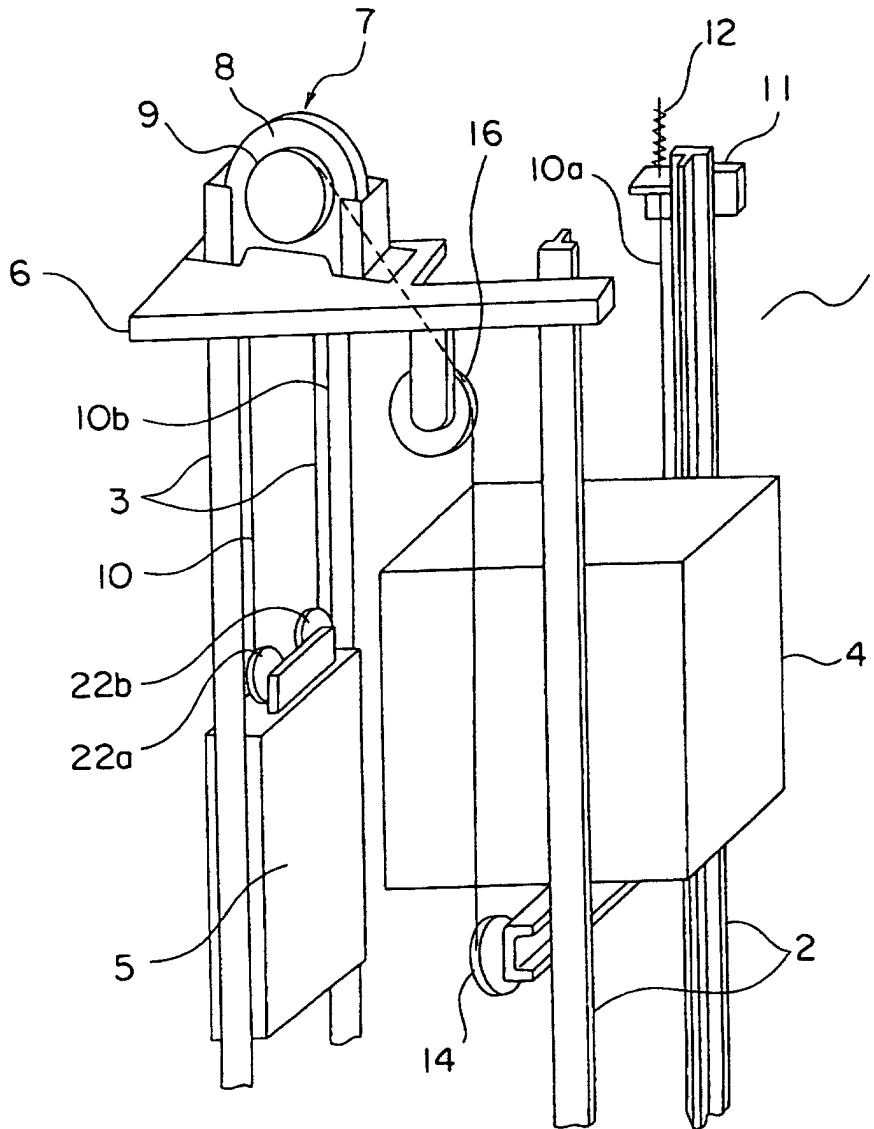
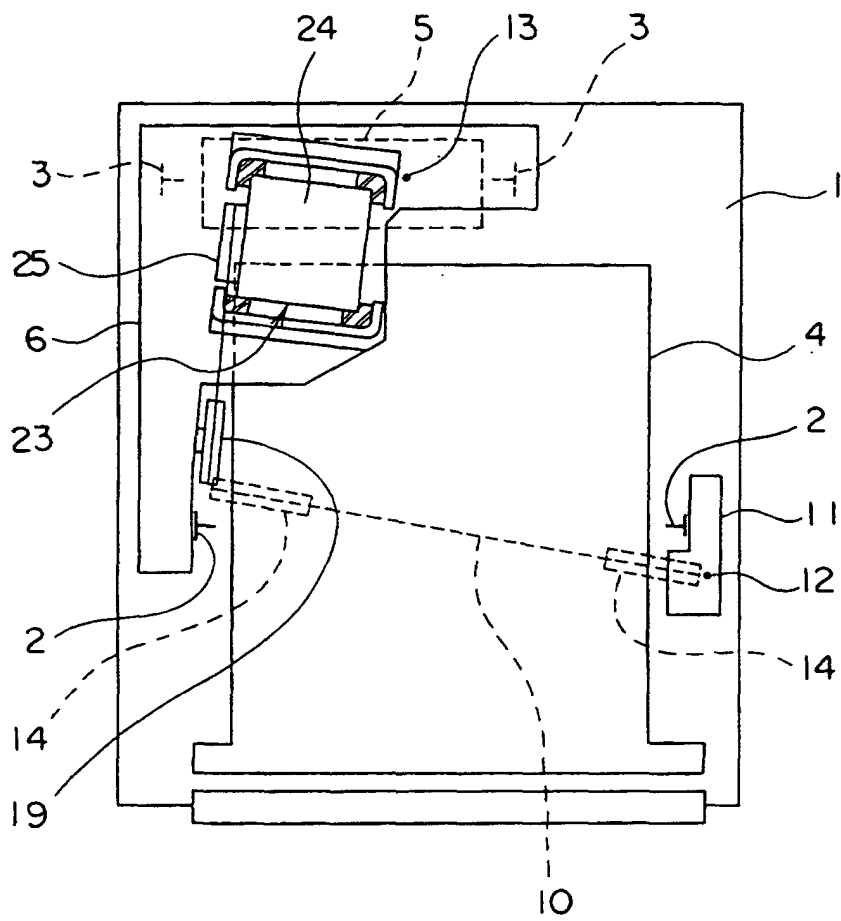


FIG. 8



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/04329

<p>A. CLASSIFICATION OF SUBJECT MATTER Int.Cl⁷ B66B7/00, 11/08</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>																			
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) Int.Cl⁷ B66B7/00-11/08</p> <p>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</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p>																			
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>JP 2001-80843 A (Mitsubishi Electric Corp.), 27 March, 201 (27.03.01), Par. Nos. [0046] to [0050]; Figs. 12 to 13 (Family: none)</td> <td>1-4</td> </tr> <tr> <td>A</td> <td>JP 10-139321 A (Inventio AG), 26 May, 1998 (26.05.98), Par. No. [0007]; Fig. 1 & CA 2220582 A & EP 0841283 A1 & US 6006865 A & EP 1118575 A2</td> <td>1-4</td> </tr> </tbody> </table> <p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.</p> <table border="1"> <tr> <td> <p>* 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 document 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</p> </td> <td> <p>"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</p> </td> </tr> </table> <table border="1"> <tr> <td>Date of the actual completion of the international search 28 January, 2003 (28.01.03)</td> <td>Date of mailing of the international search report 12 February, 2003 (12.02.03)</td> </tr> <tr> <td>Name and mailing address of the ISA/ Japanese Patent Office</td> <td>Authorized officer</td> </tr> <tr> <td>Facsimile No.</td> <td>Telephone No.</td> </tr> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	JP 2001-80843 A (Mitsubishi Electric Corp.), 27 March, 201 (27.03.01), Par. Nos. [0046] to [0050]; Figs. 12 to 13 (Family: none)	1-4	A	JP 10-139321 A (Inventio AG), 26 May, 1998 (26.05.98), Par. No. [0007]; Fig. 1 & CA 2220582 A & EP 0841283 A1 & US 6006865 A & EP 1118575 A2	1-4	<p>* 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 document 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</p>	<p>"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</p>	Date of the actual completion of the international search 28 January, 2003 (28.01.03)	Date of mailing of the international search report 12 February, 2003 (12.02.03)	Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer	Facsimile No.	Telephone No.
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