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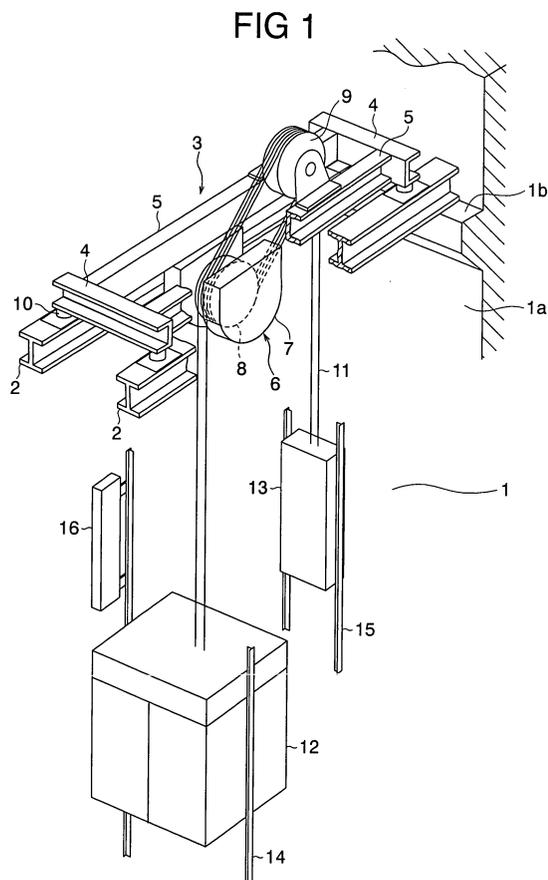
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(54) **ELEVATOR EQUIPMENT**

(57) In an elevator apparatus, a pair of supporting beams are secured at a distance from each other in an upper portion inside a hoistway. A machine base for supporting a driving machine and a deflection sheave is secured on the supporting beams. The driving machine is disposed on a lower portion of the machine base so as to be positioned between the supporting beams. A main rope is wound around a drive sheave and the deflection sheave by a double-wrap method.



Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus in which a driving machine for raising and lowering a car and a counterweight is disposed in an upper portion inside a hoistway.

BACKGROUND ART

[0002] In conventional elevator apparatuses such as that shown in Japanese Patent Laid-Open No. HEI 7-144857 (Gazette), for example, a driving machine is secured to a mounting beam secured to a top portion inside a hoistway. The mounting beam is secured to a wall portion or a ceiling portion of the hoistway. The driving machine has a drive sheave, and a car and a counterweight are suspended by a main rope wound around the drive sheave.

[0003] However, in conventional elevator apparatuses, since the driving machine is not disposed in a central portion inside the hoistway, the car cannot be suspended centrally by an upper portion thereof, and therefore a pair of car suspension sheaves are disposed on a lower portion of the car and the main rope is wound around these car suspension sheaves. For this reason, the arranged pathway of the main rope is long, and it is also necessary for a plurality of car suspension sheaves to be arranged so as to be diagonal relative to the car, etc., making the overall layout complicated.

DISCLOSURE OF THE INVENTION

[0004] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator apparatus enabling a car to be suspended centrally by an upper portion thereof, and also enabling a layout to be simplified.

[0005] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator apparatus including a hoistway; a driving machine having a rotatable drive sheave disposed in an upper portion inside the hoistway; a rotatable deflection sheave disposed in an upper portion inside the hoistway; a main rope wound around the drive sheave and the deflection sheave; and a car and a counterweight suspended inside the hoistway by the main rope and raised and lowered by a driving force from the driving machine, wherein a pair of supporting beams are secured at a distance from each other in an upper portion inside the hoistway; a machine base for supporting the driving machine and the deflection sheave is secured on the supporting beams; and the driving machine is disposed on a lower portion of the machine base so as to be positioned between the supporting beams.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

5 Figure 1 is a perspective showing an elevator apparatus according to Embodiment 1 of the present invention;
 Figure 2 is a plan showing the elevator apparatus in Figure 1;
 10 Figure 3 is a side elevation showing a state during maintenance work on an elevator apparatus similar to that in Figure 1; and
 Figure 4 is a perspective showing an elevator apparatus according to Embodiment 2 of the present invention.
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BEST MODE FOR CARRYING OUT THE INVENTION

[0007] Preferred embodiments of the present invention will now be explained with reference to the drawings.
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Embodiment 1

25 **[0008]** Figure 1 is a perspective showing an elevator apparatus according to Embodiment 1 of the present invention, and Figure 2 is a plan showing the elevator apparatus in Figure 1.

[0009] In the figure, a pair of supporting beams 2 extending horizontally in a depth direction of a hoistway 1 (left-to-right in Figure 2) are secured in an upper portion inside the hoistway 1 so as to be spaced parallel to each other. A plurality of beam bearing portions 1b for supporting first and second end portions of the supporting beams 2 are disposed on wall portions 1a of the hoistway 1. The beam bearing portions 1b project outward from the wall portions 1a, and the first and second end portions of the supporting beams 2 are secured to upper surfaces of the beam bearing portions 1b.
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[0010] A machine base 3 is secured on the supporting beams 2. The machine base 3 has: a pair of short frames 4 disposed at a distance from each other in a longitudinal direction of the supporting beams 2 so as to span the supporting beams 2; and a pair of long frames 5 secured between these short frames 4 so as to extend parallel to the supporting beams 2.
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[0011] A driving machine (a hoisting machine) 6 is supported by the machine base 3. The driving machine 6 has: a driving machine main body 7 including a motor and a brake portion; and a drive sheave 8 rotated by the driving machine main body 7. The driving machine 6 is disposed on a lower portion of the machine base 3 so as to be positioned between the supporting beams 2. Specifically, the driving machine main body 7 is secured to lower surfaces of the long frames 5. A lower extremity portion of the driving machine 6 is positioned lower than the supporting beams 2.
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[0012] A rotatable deflection sheave 9 is also support-
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ed by the machine base 3. The deflection sheave 9 is disposed on an upper side of the machine base 3 so as to be positioned diagonally above the drive sheave 8. A plurality of vibration isolating members 10 (rubber vibration isolators, for example) for reducing vibrations from the driving machine 6 from propagating to the supporting beams 2 are interposed between the supporting beams 2 and the machine base 3.

[0013] A plurality of main ropes 11 are wound around the drive sheave 8 and the deflection sheave 9 by a double-wrap method (a full-wrap method). A car 12 is suspended by first end portions of the main ropes 11. A counterweight 13 is suspended by second end portions of the main ropes 11. In other words, the car 12 and the counterweight 13 are suspended inside the hoistway 1 using a one-to-one (1:1) roping method.

[0014] A pair of car guide rails 14 for guiding raising and lowering of the car 12 and a pair of counterweight guide rails 15 for guiding raising and lowering of the counterweight 13 are installed inside the hoistway 1. A control board 16 for controlling activation of the driving machine 6 is mounted to one of the car guide rails 14.

[0015] A driving machine maintenance space and a control board maintenance space for performing maintenance work on the driving machine 6 and the control board 16 are secured in a vicinity of the driving machine 6 and the control board 16, respectively. The control board 16 is disposed such that the control board maintenance space is positioned in a position that is lower than the driving machine maintenance space.

[0016] Next, Figure 3 is a side elevation showing a state during maintenance work on an elevator apparatus similar to that in Figure 1. During maintenance work, maintenance personnel ride on top of the car 12 and perform maintenance work on the driving machine 6 from on top of the car 12. Maintenance work on the control board 16 is performed from on top of the car 12 by lowering the car 12 slightly from the position shown in Figure 3.

[0017] In an elevator apparatus of this kind, that is, a machine-roomless elevator, because a pair of supporting beams 2 are secured to an upper portion inside the hoistway 1, and a machine base 3 for supporting a driving machine 6 and a deflection sheave 9 is secured to the supporting beams 2, and a driving machine 6 is disposed on a lower portion of the machine base 3 so as to be positioned between the supporting beams 2, the driving machine 6 can be disposed generally centrally in the hoistway 1 in a vertical plane of projection, enabling the car 12 to be suspended centrally by an upper portion thereof. Consequently, it is not necessary to dispose suspension sheaves on a lower portion of the car 12, enabling the arranged pathway of the main ropes 11 to be made shorter, and also enabling an overall layout to be simplified.

[0018] Because beam bearing portions 1b for supporting first and second end portions of the supporting beams 2 are disposed on the wall portions 1a of the hoist-

way 1, the supporting beams 2 can be supported more stably. Furthermore, the strength of the guide rails 14 and 15 can be reduced compared to when the supporting beams 2 are supported by the car guide rails 14 and the counterweight guide rails 15, and a degree of freedom in the layout of the supporting beams 2 and the guide rails 14 and 15 can be increased.

[0019] In addition, because the main ropes 11 are wound around the drive sheave 8 and the deflection sheave 9 by a double-wrap method, the total contact angle of the main ropes 11 on the drive sheave 8 can be made greater than or equal to 180 degrees, enabling sufficient traction capacity to be ensured.

[0020] Furthermore, because the driving machine 6 is disposed on a lower portion of the machine base 3, and a lower extremity portion of the driving machine 6 is positioned lower than the supporting beams 2, maintenance work on the driving machine 6 can be performed easily from on top of the car 12, as shown in Figure 3.

[0021] Because the deflection sheave 9 is disposed on an upper side of the machine base 3 so as to be positioned diagonally above the drive sheave 8, even if the drive sheave 8 and the deflection sheave 9 are disposed in close proximity, and the diameters thereof are large, as shown in Figure 3, the drive sheave 8 and the deflection sheave 9 can be disposed easily without interfering with each other, enabling the car 12 to be suspended centrally by an upper portion thereof.

[0022] In addition, if the control board 16 is disposed at the same height as the driving machine 6, both the control board maintenance space and the driving machine maintenance space must be secured at the same height, making disposal in a narrow hoistway 1 difficult, but because this control board 16 is disposed in a position that is lower than the driving machine 6 so that the control board maintenance space does not interfere with the driving machine maintenance space, the control board maintenance space and the driving machine maintenance space can be secured easily.

Embodiment 2

[0023] Next, Figure 4 is a perspective showing an elevator apparatus according to Embodiment 2 of the present invention. In the figure, a rotatable car suspension sheave 21 around which main ropes 11 are wound is disposed centrally on an upper portion of a car 12. A rotatable counterweight suspension sheave 22 around which the main ropes 11 are wound is disposed on an upper portion of a counterweight 13.

[0024] A rope connecting beam 23 extending parallel to supporting beams 2 is secured to an upper portion inside a hoistway 1. The rope connecting beam 23 may be secured to beam bearing portions 1b (see Figure 1) in a similar manner to the supporting beams 2, or may also be secured to the supporting beams 2. First end portions of the main ropes 11 are connected to the rope connecting beam 23 by means of car rope fasteners 24.

Second end portions of the main ropes 11 are connected to the rope connecting beam 23 by means of counterweight rope fasteners 25. Moreover, the rope connecting beam 23 may also be omitted, the first and second end portions of the main ropes 11 instead being connected to the supporting beams 2 or the machine base 3.

[0025] The main ropes 11 are wound in sequence from the first end portion, around the car suspension sheave 21, the drive sheave 8, the deflection sheave 9, the drive sheave 8, the deflection sheave 9, and the counterweight suspension sheave 22 to the second end portion. In other words, in Embodiment 2, the car 12 and the counterweight 13 are suspended inside the hoistway 1 using a two-to-one (2:1) roping method. The rest of the construction is similar to that of Embodiment 1.

[0026] In an elevator apparatus employing a 2:1 roping method of this kind, the driving machine 6 can also be disposed generally centrally in the hoistway 1 in a vertical plane of projection, enabling the car 12 to be suspended centrally by an upper portion thereof. Thus, the number of the car suspension sheaves 21 can be reduced, and the arranged pathway of the main ropes 11 can be made shorter, enabling an overall layout to be simplified.

[0027] Furthermore, reductions in the size of the driving machine 6 can be achieved compared to the 1:1 roping method.

[0028] Moreover, in the above examples, beam bearing portions 1b that project outward from wall portions 1a of a hoistway 1 are shown, but the beam bearing portions may also be recess portions. Furthermore, a construction may also be employed in which end portions of the supporting beams 2 are embedded in the wall portions 1a. In addition, it is also possible for the supporting beams 2 to be supported by one or more of the car guide rails or the counterweight guide rails.

[0029] In the above examples, a deflection sheave 9 is disposed diagonally above a drive sheave 8, but the deflection sheave may also be disposed diagonally below the drive sheave instead, enabling the total contact angle of the main ropes on the drive sheave to be further increased.

[0030] In addition, the drive sheave and the deflection sheave may also be disposed at the same height as each other provided that the drive sheave and the deflection sheave can be disposed without interfering with each other.

[0031] Furthermore, in the above examples, a driving machine 6 is disposed centrally in a hoistway 1, but a deflection sheave may also be disposed centrally in the hoistway 1, similarly enabling a car 12 to be suspended centrally by an upper portion thereof.

[0032] In the above examples, elevator apparatuses in which a counterweight 13 is disposed behind a car 12 are shown, but the present invention can also be applied to elevator apparatuses in which a counterweight 13 is disposed beside a car 12.

Claims

1. An elevator apparatus comprising:

a hoistway;
 a driving machine having a rotatable drive sheave disposed in an upper portion inside said hoistway;
 a rotatable deflection sheave disposed in an upper portion inside said hoistway;
 a main rope wound around said drive sheave and said deflection sheave; and
 a car and a counterweight suspended inside said hoistway by said main rope and raised and lowered by a driving force from said driving machine,

wherein a pair of supporting beams are secured at a distance from each other in an upper portion inside said hoistway,
 a machine base for supporting said driving machine and said deflection sheave is secured on said supporting beams, and
 said driving machine is disposed on a lower portion of said machine base so as to be positioned between said supporting beams.

2. The elevator apparatus according to Claim 1, wherein a plurality of beam bearing portions for supporting first and second end portions of said supporting beams are disposed on a wall portion of said hoistway.

3. The elevator apparatus according to Claim 1, wherein said main rope is wound around said drive sheave and said deflection sheave by a double-wrap method.

4. The elevator apparatus according to Claim 1, wherein a lower extremity portion of said driving machine is positioned lower than said supporting beams.

5. The elevator apparatus according to Claim 1, wherein said deflection sheave is disposed on an upper side of said machine base so as to be positioned diagonally above said drive sheave.

6. The elevator apparatus according to Claim 1, wherein:

a control board for controlling said driving machine is disposed inside said hoistway;
 a driving machine maintenance space and a control board maintenance space for performing maintenance work on said driving machine and said control board are secured in a vicinity of said driving machine and said control board; and

said control board is disposed such that said control board maintenance space is positioned in a position that is lower than said driving machine maintenance space.

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FIG 1

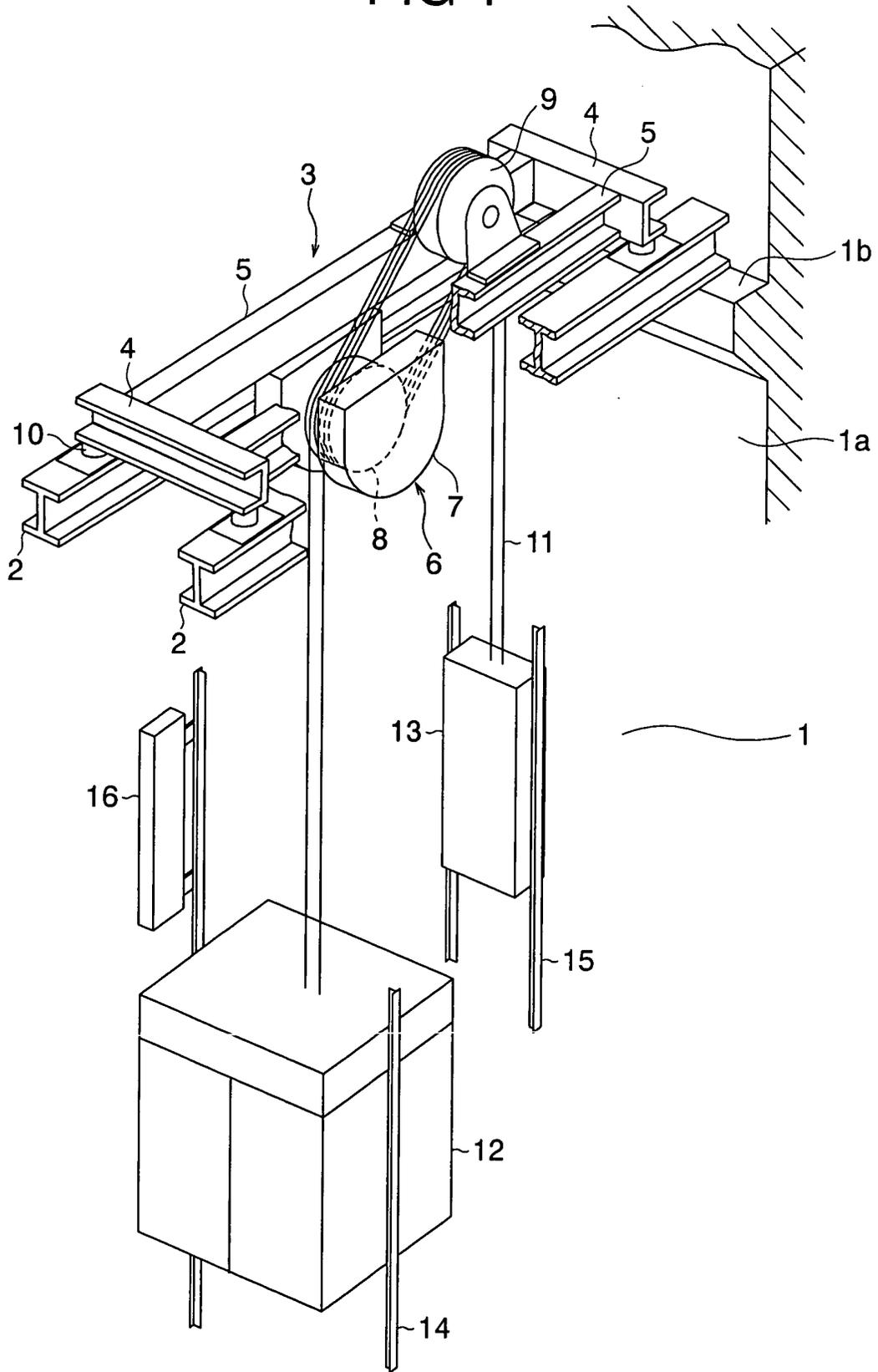


FIG 2

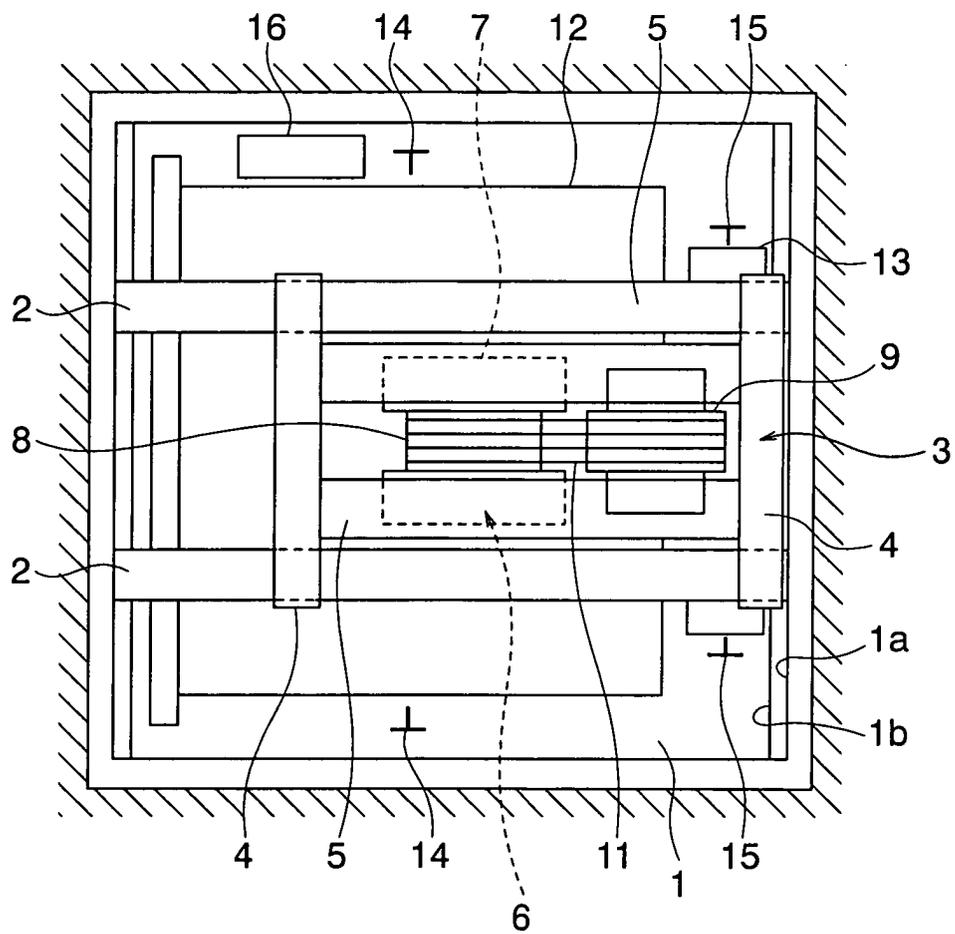


FIG 3

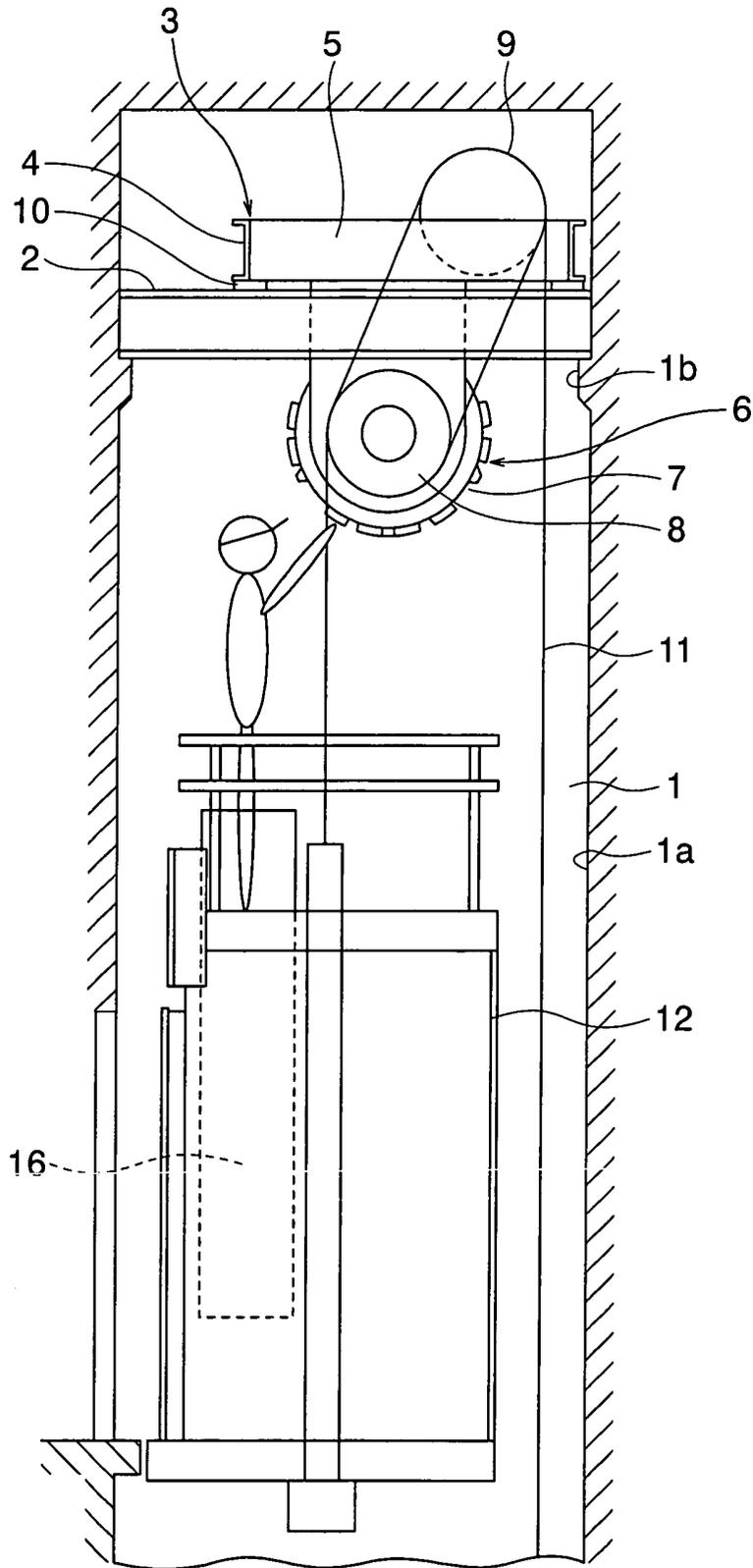
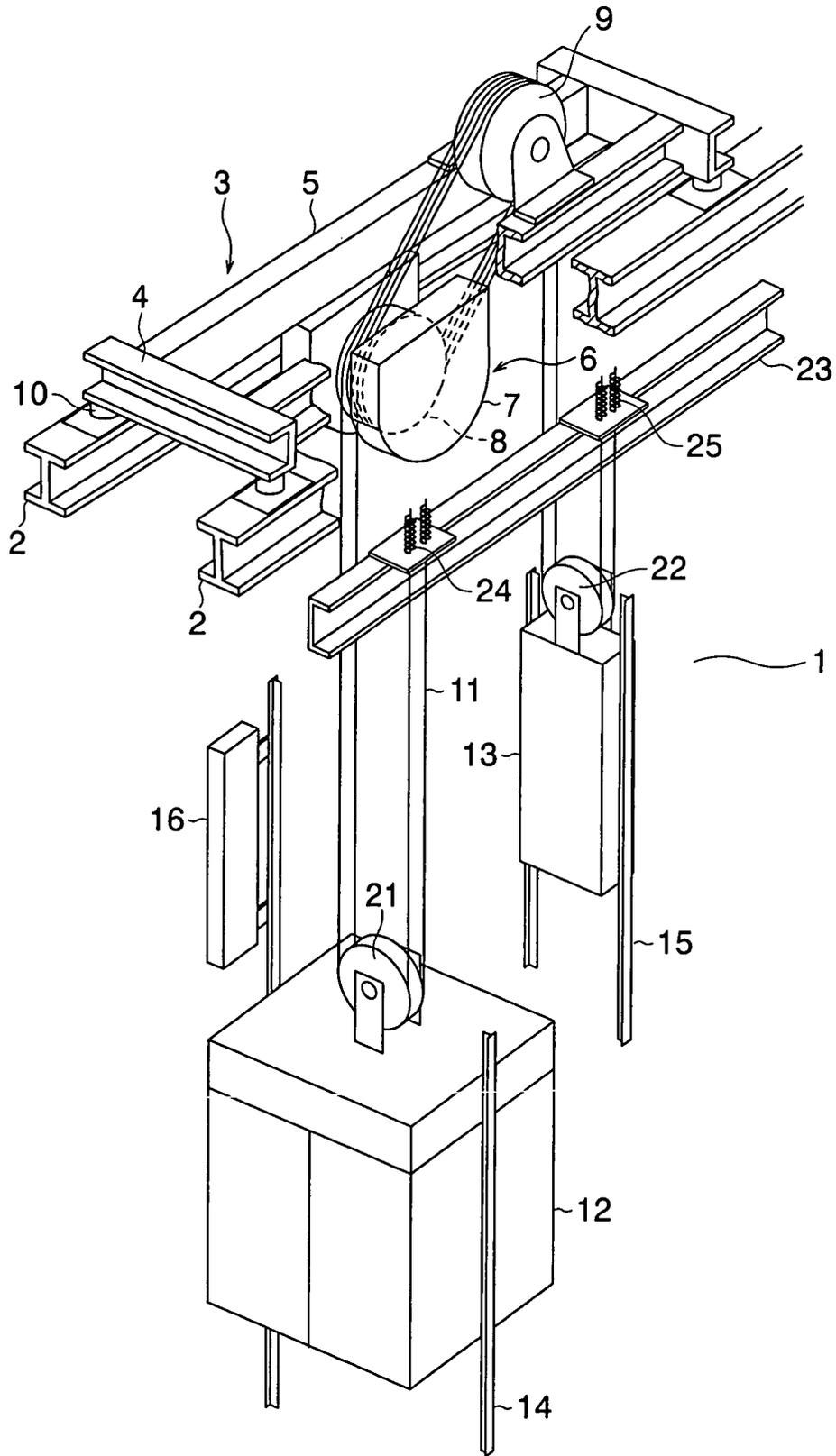


FIG 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/11614

<p>A. CLASSIFICATION OF SUBJECT MATTER Int.Cl⁷ B66B11/04</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-B66B11/08</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>Y</td> <td>JP 2001-89051 A (Hitachi, Ltd.), 03 April, 2001 (03.04.01), (Family: none)</td> <td>1-6</td> </tr> <tr> <td>Y</td> <td>JP 2664619 B2 (KONE Elevator GmbH), 15 October, 1997 (15.10.97), & 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</td> <td>1-6</td> </tr> <tr> <td>Y</td> <td>JP 10-77171 A (Toshiba Corp.), 24 March, 1998 (24.03.98), (Family: none)</td> <td>3</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.</p> <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 "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> <table border="1"> <tr> <td>Date of the actual completion of the international search 31 July, 2003 (31.07.03)</td> <td>Date of mailing of the international search report 19 August, 2003 (19.08.03)</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.	Y	JP 2001-89051 A (Hitachi, Ltd.), 03 April, 2001 (03.04.01), (Family: none)	1-6	Y	JP 2664619 B2 (KONE Elevator GmbH), 15 October, 1997 (15.10.97), & 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	1-6	Y	JP 10-77171 A (Toshiba Corp.), 24 March, 1998 (24.03.98), (Family: none)	3	Date of the actual completion of the international search 31 July, 2003 (31.07.03)	Date of mailing of the international search report 19 August, 2003 (19.08.03)	Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer	Facsimile No.	Telephone No.
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP02/11614

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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