(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 717 184 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
02.11.2006 Bulletin 2006/44

(21) Application number: **04711442.6**

(22) Date of filing: **16.02.2004**

(51) Int Cl.:
B66B 7/02 *(2006.01)*

(86) International application number:
PCT/JP2004/001641

(87) International publication number:
WO 2005/077805 (25.08.2005 Gazette 2005/34)

(84) Designated Contracting States:
DE

(71) Applicant: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Tokyo 100-8310 (JP)

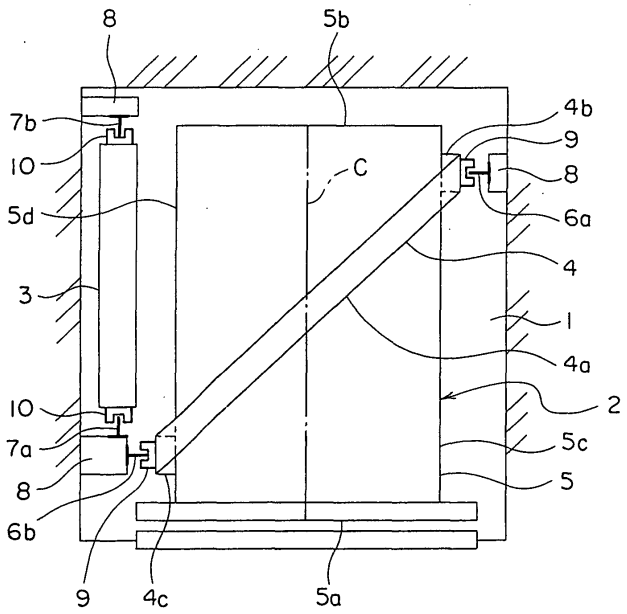
(72) Inventors:
- **KODERA, Hideaki,**
  C/o Mitsubishi Denki K.K.
  Tokyo 100-8310 (JP)
- **OKAMOTO, Kenichi,**
  C/o Mitsubishi Denki K.K.
  Tokyo 100-8310 (JP)
- **KIGAWA, Hiroshi,**
  C/o Mitsubishi Denki K.K.
  Tokyo 100-8310 (JP)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) ELEVATOR

(57) In an elevator apparatus, a car and a counterweight are raised and lowered inside a hoistway by a driving machine. A pair of car guide rails for guiding raising and lowering of the car are installed inside the hoistway. The car guide rails are disposed such that a straight line joining the car guide rails intersects a center line in a width direction of the car obliquely when viewed from above. The counterweight is disposed in a space behind a car guide rail positioned near a front end in a depth direction of the car.

FIG. 1



EP 1 717 184 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus in which a guide rail for guiding raising and lowering of a car is installed inside a hoistway.

BACKGROUND ART

[0002] In conventional elevator apparatuses such as that shown in Japanese Patent Laid-Open No. HEI 7-10434 (Gazette), for example, a pair of car guide rails are disposed in a vicinity of center in a depth direction of a car so as to be symmetrical relative to a center line in a width direction of the car. A counterweight is disposed behind one of the car guide rails in the depth direction of the car. For this reason, width dimensions of the counterweight are limited, and it is necessary to increase thickness dimensions of the counterweight, increasing horizontal dimensions of a hoistway.

DISCLOSURE OF THE INVENTION

[0003] The present invention aims to solve the above problems and an obj ect of the present invention is to provide an elevator apparatus enabling space saving in a hoistway.

[0004] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator apparatus including: a driving machine having a drive sheave; a car and a counterweight raised and lowered inside a hoistway by the driving machine; a main rope wound around the drive sheave, the main rope suspending the car and the counterweight; and a pair of car guide rails installed inside the hoistway, the car guide rails guiding raising and lowering of the car, wherein the car guide rails are disposed such that a straight line joining the car guide rails intersects a center line in a width direction of the car obliquely when viewed from above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005]

Figure 1 is a plan showing part of an elevator apparatus according to Embodiment 1 of the present invention;

Figure 2 is a plan showing part of an elevator apparatus according to Embodiment 2 of the present invention;

Figure 3 is a plan showing part of an elevator apparatus according to Embodiment 3 of the present invention;

Figure 4 is a left side elevation of the elevator apparatus in Figure 3; and

Figure 5 is a plan showing part of an elevator apparatus according to Embodiment 4 of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0006] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0007] Figure 1 is a plan showing part of an elevator apparatus according to Embodiment 1 of the present invention. In the figure, a car 2 and a counterweight 3 are disposed inside a hoistway 1. The car 2 has: a car frame 4; and a cage 5 supported by the car frame 4.

[0008] The car frame 4 has: a lower frame (not shown) disposed on a lower portion of the cage 5; an upper beam 4a disposed horizontally above the cage 5; and first and second vertical stanchions 4b and 4c disposed vertically between the lower frame and the upper beam 4a.

[0009] The cage 5 has : a front surface portion 5a in which a car entrance is disposed; a back surface portion 5b opposite the front surface portion 5a; and a pair of first and second side surface portions 5c and 5d. The counterweight 3 is disposed beside the car 2 so as to face the second side surface portion 5d when positioned level with the car 2.

[0010] The first vertical stanchion 4b is disposed so as to face (or adjoin) the first side surface portion 5c behind a midpoint in a depth direction of the car 2. The second vertical stanchion 4c is disposed so as to face (or adjoin) the second side surface portion 5d in front of the midpoint in the depth direction of the car 2. In other words, the vertical stanchions 4b and 4c are disposed so as to be generally diagonal. Thus, the upper beam 4a, which is connected between the vertical stanchions 4b and 4c, is disposed so as to intersect a center line C in a width direction of the car 2 obliquely when viewed from above.

[0011] A driving machine (not shown) is disposed in an upper portion inside the hoistway 1. A plurality of main ropes (not shown) are wound around a drive sheave of the driving machine. The main ropes have: a car end portion connected to the upper beam 4a; and a counterweight end portion connected to an upper end portion of the counterweight 3. The car 2 and the counterweight 3 are suspended inside the hoistway 1 by the main ropes using a one-to-one (1:1) roping method, and raised and lowered by a driving force from the driving machine.

[0012] A pair of first and second car guide rails 6a and 6b for guiding raising and lowering of the car 2 and a pair of counterweight guide rails 7a and 7b for guiding raising and lowering of the counterweight 3 are installed inside the hoistway 1. The guide rails 6a, 6b, 7a, and 7b are fixed to hoistway walls by means of a plurality of brackets 8.

[0013] The car guide rails 6a and 6b are disposed such that a straight line joining the car guide rails 6a and 6b intersects a center line C in the width direction of the car 2 (or a car entrance center line) obliquely when viewed

from above. In other words, the car guide rails 6a and 6b are disposed inside the hoistway 1 so as to be generally diagonal. The first and second car guide rails 6a and 6b face the first and second vertical stanchions 4b and 4c, respectively.

[0014] In addition, the car guide rails 6a and 6b are installed so as to be oriented such that center lines of a horizontal cross section are parallel to the width direction of the car 2. Consequently, the center line of the horizontal cross section of the first car guide rail 6a and the center line of the horizontal cross section of the second car guide rail 6b are parallel to each other.

[0015] A plurality of car guide shoes 9 for engaging the car guide rails 6a and 6b are mounted to the car frame 4. A total of four car guide shoes 9 are disposed on upper and lower end portions of first and second sides of the car 2.

[0016] The counterweight guide rails 7a and 7b are disposed such that a straight line joining the counterweight guide rails 7a and 7b is parallel to the center line C in the width direction of the car 2 when viewed from above. The counterweight 3 is disposed in a space behind the second car guide rail 6b, which is positioned near a front end in a depth direction of the car 2.

[0017] A plurality of counterweight guide shoes 10 for engaging the counterweight guide rails 7a and 7b are mounted to the counterweight 3. A total of four counterweight guide shoes 10 are disposed on upper and lower end portions of the first and second end portions in a width direction of the counterweight 3. Sliding guide shoes or roller guide shoes, for example, can be used for the car guide shoes 9 and the counterweight guide shoes 10.

[0018] In an elevator apparatus of this kind, because the car guide rails 6a and 6b are disposed such that the straight line joining the car guide rails 6a and 6b intersects the center line C in the width direction of the car 2 obliquely when viewed from above, a wide space can be ensured behind the second car guide rail 6b. Consequently, width dimensions of the counterweight 3 can be increased and thickness dimensions reduced by disposing the counterweight 3 in the space behind the second car guide rail 6b. Thus, horizontal dimensions of the hoistway 1 can be reduced, enabling space saving.

Embodiment 2

[0019] Next, Figure 2 is a plan showing part of an elevator apparatus according to Embodiment 2 of the present invention. In the figure, a car 2 has: a car frame 11; and a cage 5. The car frame 11 has: a lower frame (not shown) disposed on a lower portion of the cage 5; a generally I-shaped upper frame 11a disposed horizontally above the cage 5; and four vertical stanchions (not shown) disposed vertically between the lower frame and the upper frame 11a. The upper frame 11a and the vertical stanchions are disposed so as to have bilateral symmetry relative to a center line C in a width direction of the car 2. The rest of the configuration is similar to that of Embodiment 1.

[0020] Thus, the car guide shoes 9 can also be mounted to the car frame 11 easily by using a bilaterally symmetrical car frame 11 having four vertical stanchions.

Embodiment 3

[0021] Next, Figure 3 is a plan showing part of an elevator apparatus according to Embodiment 3 of the present invention and Figure 4 is a left side elevation of the elevator apparatus in Figure 3. In the figures, a pair of first and second car suspension sheaves 12a and 12b are mounted to a lower portion of a car 2. A counterweight suspension sheave 13 is mounted to an upper portion of a counterweight 3.

[0022] A supporting platform 14 (omitted from Figure 3) is fixed to an upper portion of at least one guide rail 6a, 6b, 7a, and 7b. A driving machine 15 for raising and lowering the car 2 and the counterweight 3 is supported on the supporting platform 14. The driving machine 15 has : a driving machine main body 16 including a motor and a brake; and a drive sheave 17 rotated by the driving machine main body 16.

[0023] The driving machine 15 is a thin hoisting machine having an overall axial dimension that is less than an outside diameter dimension of the driving machine main body 16 or the drive sheave 17. In addition, the driving machine 15 is disposed such that a rotating shaft of the drive sheave 17 is horizontal. Furthermore, the driving machine 15 is disposed in an upper portion (top portion) inside a hoistway 1 so as to partially overlap with the car 2 and the counterweight 3 when viewed from above.

[0024] The car 2 and the counterweight 3 are suspended inside the hoistway 1 by a plurality of main ropes 18 (only one is shown in the figures) using a two-to-one (2:1) roping method. The main ropes 18 have a car end portion 18a and a counterweight end portion 18b. The car end portion 18a and the counterweight end portion 18b are connected to the supporting platform 14 by means of rope end connecting apparatuses 19a and 19b.

[0025] The main ropes 18 are wound from the car end portion 18a sequentially around the second suspension sheave 12b, the first car suspension sheave 12a, the drive sheave 17, and the counterweight suspension sheave 13.

[0026] A portion of the main ropes 18 passing under the car 2 is disposed so as to intersect a center line C in a width direction of the car 2 obliquely and so as to be spaced away from a straight line joining the car guide rails 6a and 6b when viewed from above. Here, the portion of the main ropes 18 passing under the car 2 is parallel to the straight line joining the car guide rails 6a and 6b when viewed from above.

[0027] Emergency stopping apparatuses (not shown) are disposed at least on portions of a lower portion of the car 2 facing the car guide rails 6a and 6b. The car sus-

pension sheaves 12a and 12b are disposed so as to be offset from the straight line joining the car guide rails 6a and 6b so as to avoid interference between the main ropes 18 and the emergency stopping apparatuses at the lower portion of the car 2.

[0028] Moreover, a guide rail supporting platform 19 for supporting the guide rails 6a, 6b, 7a, and 7b is installed on a bottom portion of the hoistway 1. A car buffer (not shown) and a counterweight buffer 20 are fixed on top of the guide rail supporting platform 19. The rest of the configuration is similar to that of Embodiment 1.

[0029] Thus, the present invention can also be applied to an elevator apparatus using a two-to-one (2:1) roping method, enabling horizontal dimensions of the hoistway 1 to be reduced.

[0030] Because the portion of the main ropes 18 passing under the car 2 is disposed so as to be spaced away from the straight line joining the car guide rails 6a and 6b when viewed from above, interference between the main ropes 18 and the emergency stopping apparatuses at the lower portion of the car 2 can be avoided easily without having to dispose the main ropes 18 in a position that is lower than the emergency stopping apparatuses, preventing vertical dimensions of the car 2 from having to be increased. Consequently, a pit depth dimension of the hoistway 1 can be reduced, thereby also enabling space to be saved inside the hoistway.

[0031] Configuration of an emergency stopping frame, a suspension sheave frame, etc., positioned on a lower portion of the car 2 can also be simplified.

[0032] Moreover, the counterweight 3 may also be disposed in a space in front of the first car guide rails 6a, which is positioned toward near a rear end in a depth direction of the car 2.

Embodiment 4

[0033] Next, Figure 5 is a plan showing part of an elevator apparatus according to Embodiment 4 of the present invention. In this example, a counterweight 3 is disposed behind a car 2 so as to face a rear surface portion 5b when positioned level with the car 2. The car 2 is suspended at its center of gravity or a vicinity thereof. In other words, a portion of main ropes 18 passing under the car 2 is disposed so as to pass through the center of gravity of the car or a vicinity thereof when viewed from above. For this reason, the portion of the main ropes 18 passing under the car 2 intersects a center line C in a width direction of the car 2 obliquely when viewed from above.

[0034] Similarly, car guide rails 6a and 6b are also disposed such that a straight line joining the car guide rails 6a and 6b intersects the center line C in the width direction of the car 2 obliquely when viewed from above. In addition, the car guide rails 6a and 6b are disposed such that the straight line connecting the car guide rails 6a and 6b is spaced away from the portion of the main ropes 18 passing under the car 2 when viewed from above. Here, the portion of the main ropes 18 passing under the car 2 is parallel to the straight line joining the car guide rails 6a and 6b when viewed from above. The rest of the configuration is similar to that of Embodiment 2.

[0035] In an elevator apparatus of this kind, interference between the main ropes 18 and the emergency stopping apparatuses at the lower portion of the car 2 can be avoided easily, preventing vertical dimensions of the car 2 from having to be increased. Consequently, a pit depth dimension of the hoistway 1 can be reduced, thereby also enabling space to be saved inside the hoistway.

[0036] Configuration of an emergency stopping frame, a suspension sheave frame, etc., positioned on a lower portion of the car 2 can also be simplified.

[0037] Moreover, in the above examples, load on a driving machine is supported by guide rails, but the load may also be made to be supported by structural beams fixed to a top portion of a hoistway.

[0038] In the above examples, driving machines are disposed such that a rotating shaft of a drive sheave is horizontal, but the driving machines may also be disposed such that the rotating shaft of the drive sheave is vertical or generally vertical.

[0039] In addition, in the above examples, thin hoisting machines are shown as driving machines, but the driving machines may also be hoisting machines having an overall axial dimension that is greater than an outside diameter dimension of a driving machine main body or a drive sheave.

[0040] In the above examples, car guide shoes are mounted to a car frame, but the car guide shoes may also be supported from the car frame by means of supporting arms, or be mounted directly to external surfaces of a cage, etc.

[0041] In the above examples, center lines of horizontal cross sections of car guide rails 6a and 6b are made to be parallel to a width direction of a car 2, but car guide rails may also be disposed obliquely relative to the width direction of the car 2 such that center lines of horizontal cross sections of the car guide rails overlap lie on an identical straight line. In other words, the car guide rails may also be disposed diagonally and be disposed so as to face each other.

Claims

1. An elevator apparatus comprising:

a driving machine having a drive sheave;
a car and a counterweight raised and lowered inside a hoistway by the driving machine;
a main rope wound around the drive sheave, the main rope suspending the car and the counterweight; and
a pair of car guide rails installed inside the hoistway, the car guide rails guiding raising and low-

ering of the car,

wherein the car guide rails are disposed such that a straight line joining the car guide rails intersects a center line in a width direction of the car obliquely when viewed from above.

2. The elevator apparatus according to Claim 1, wherein the counterweight is disposed in a space behind a car guide rail positioned near a front end in a depth direction of the car.

3. The elevator apparatus according to Claim 1, further comprising:

a plurality of car suspension sheaves disposed on a lower portion of the car, the main rope being wound around the car suspension sheaves,

wherein:

a portion of the main rope passing under the car intersects the center line in the width direction of the car obliquely when viewed from above; and
the car guide rails are disposed such that the straight line joining the car guide rails is spaced away from the portion of the main rope passing under the car when viewed from above.

4. The elevator apparatus according to Claim 1, wherein the portion of the main rope passing under the car is parallel to the straight line joining the car guide rails when viewed from above.

FIG. 1

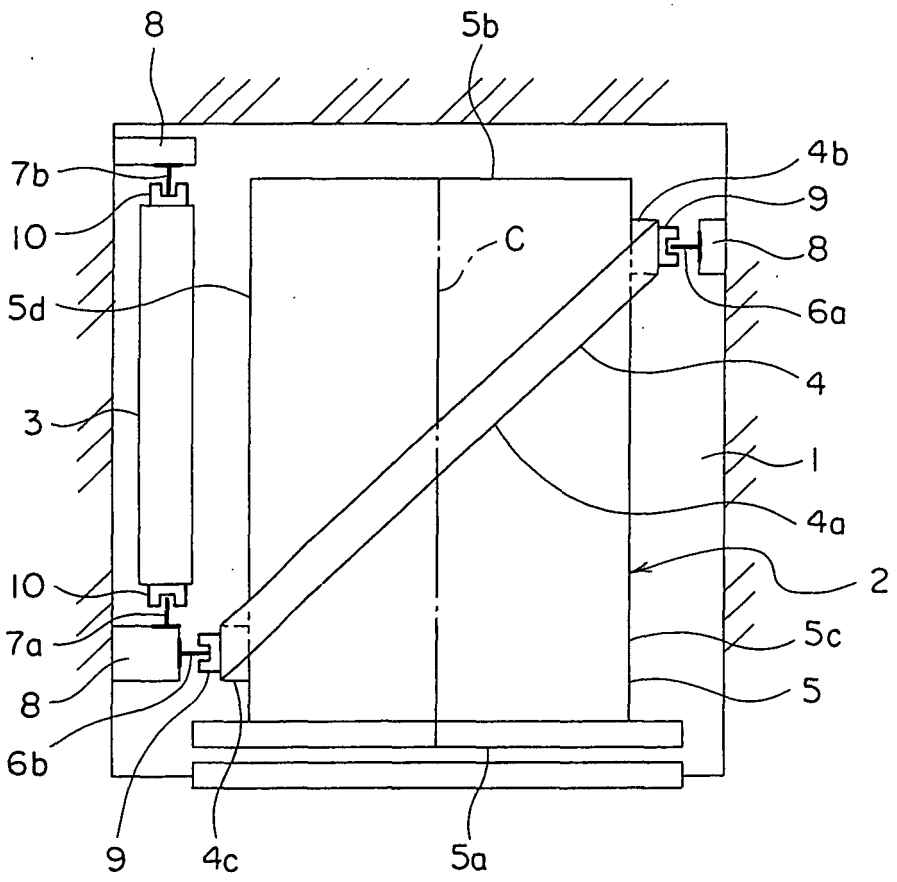


FIG. 2

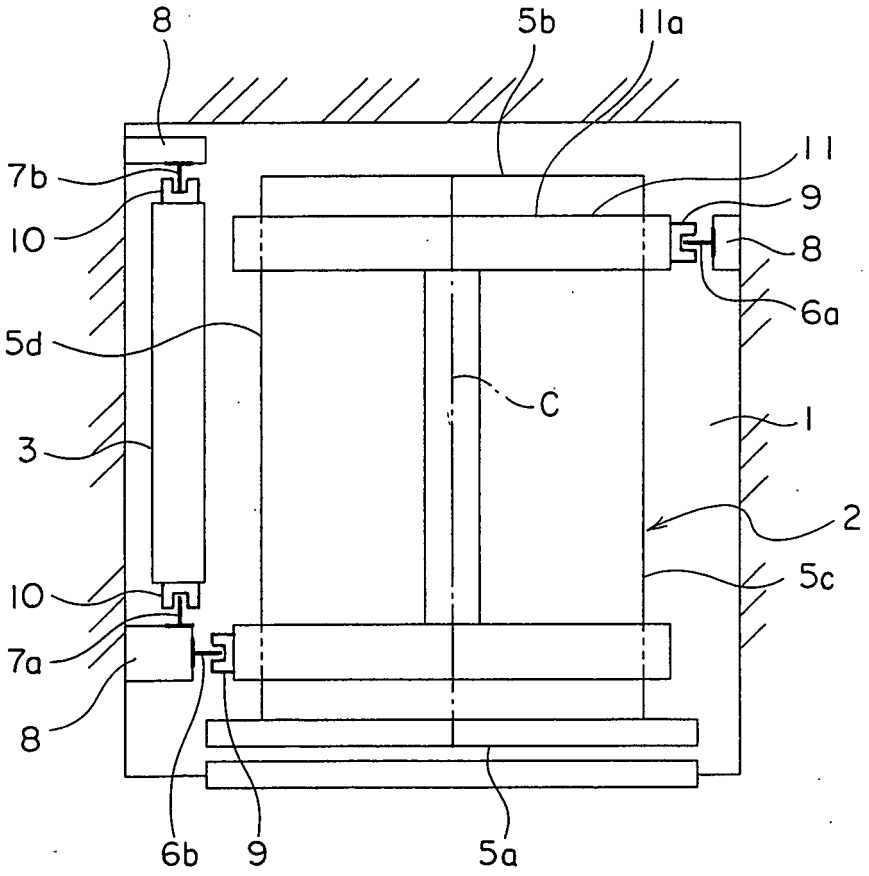


FIG. 3

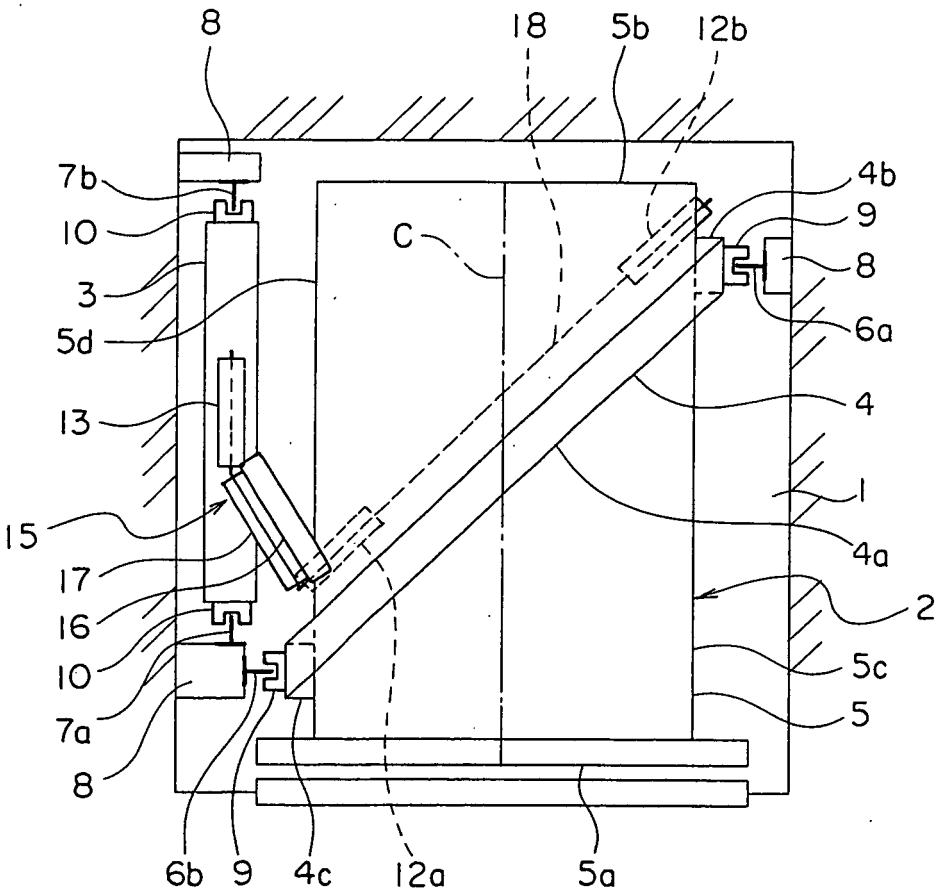

8
18
5b
12b
7b
10
3
5d
13
15
17
16
10
7a
8
6b
9
4c
12a
5a
C
4b
9
8
6a
4
1
4a
2
5c
5

FIG. 4

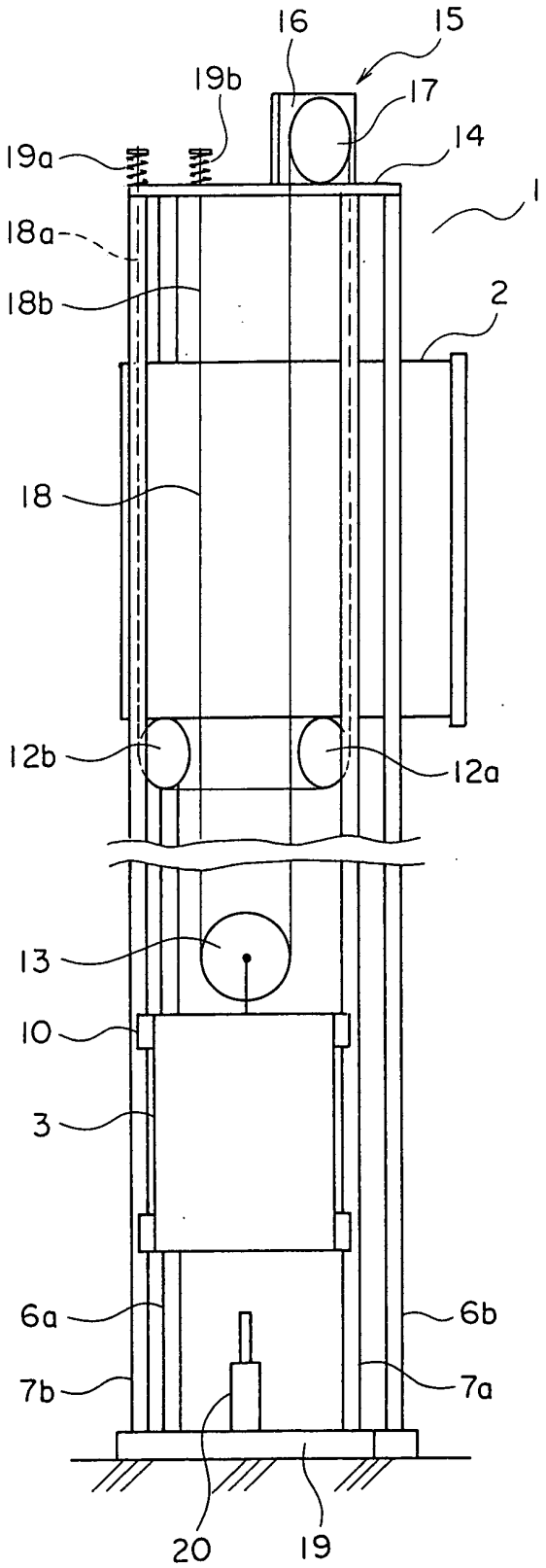
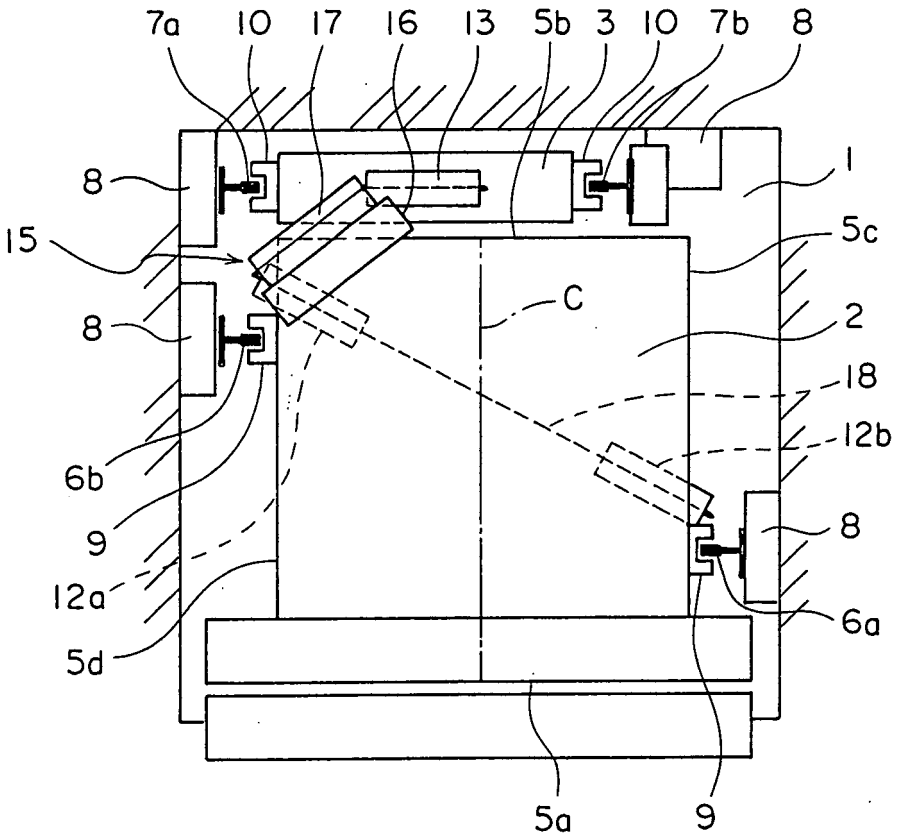


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/001641

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B7/02

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] B66B7/02

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 1996-2004
Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004

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 A	JP 2002-173279 A (Toshiba Corp.), 21 June, 2002 (21.06.02), Pay attention to Par. Nos. [0042] to [0044]; Figs. 6 to 7 (Family: none)	1-2 3
X	JP 56-49999 Y2 (Fuji Hensokuki Kabushiki Kaisha), 21 November, 1981 (21.11.81), Pay attention to page 1, column 2, line 8 to page 3, column 5, line 13; Figs. 1 to 11 & JP 52-12968 U	1

☒ 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	Date of mailing of the international search report
15 November, 2004 (15.11.04)	30 November, 2004 (30.11.04)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/001641

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 59-35823 B2 (Hitachi, Ltd.), 30 August, 1984 (30.08.84), Pay attention to page 1, column 2, line 30 to page 2, column 3, line 8; Figs. 1 to 2 & JP 56-75374 A	1,3
A	WO 03/020628 A1 (Mitsubishi Electric Corp.), 13 March, 2003 (13.03.03), Pay attention to page 5, line 24 to page 6, line 2; Fig. 7 & EP 1422183 A1	3-4

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 7010434 A **[0002]**