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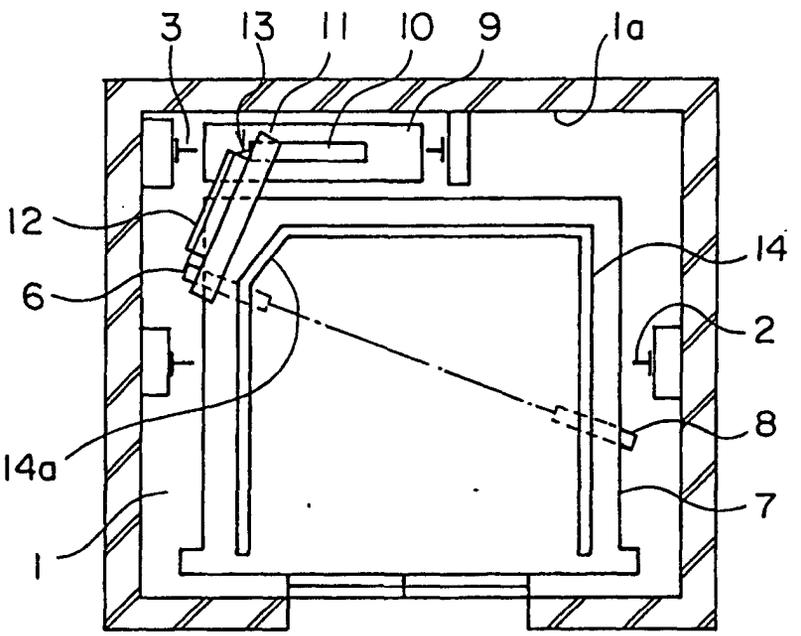
(54) ELEVATOR DEVICE

(57) In an elevator apparatus, a car is raised and lowered by a gear-less type driving machine in which a traction sheave is directly rotated by a motor. The driving machine is disposed at an upper portion in a hoistway. A portion of the driving machine is disposed inside an area on which the car is projected in its raising and lowering direction.

FIG. 4



EP 1 172 321 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus, a so called machine-room-less elevator apparatus that does not have a separate machine room at an upper portion of a hoistway.

BACKGROUND ART

[0002] Fig. 10 is a perspective view showing an essential portion of a conventional elevator apparatus such as disclosed in Japanese Patent No. 2593288, and Fig. 11 is a plan view showing the elevator apparatus in Fig. 10. In the figures, a pair of car guide rails 2 and a pair of counterweight guide rails 3 are installed in a hoistway 1. A driving machine 4 having a traction sheave 5 is disposed at an upper portion in the hoistway 1.

[0003] A middle portion of a main rope 6 is wound around the traction sheave 5. One end portion 6a of the main rope 6 is fixed to an upper end portion of the car guide rail 2, and the other end portion 6b of the main rope 6 is fixed to an upper end portion of the counterweight guide rails 3. A car 7 is suspended by the main rope 6 between the traction sheave 5 and one end portion 6a. A pair of car suspending sheaves 8 around which the main rope 6 is wound are provided at a lower end portion of the car 7.

[0004] A counterweight 9 is suspended by the main rope 6 between the traction sheave 5 and the other end portion 6b. A counterweight suspending sheave 10 around which the main rope 6 is wound is provided at an upper end portion of the counterweight 9.

[0005] In such a conventional elevator apparatus, as shown in Fig. 11, the driving machine 4 is disposed between an area on which the car 7 is vertically projected and a wall surface 1a of the hoistway 1, thereby omitting a machine room.

[0006] However, there is a necessity to secure the space at the side of the car 7 that matches the width of the driving machine 4 for disposing the driving machine 4, thereby increasing the planer size of the hoistway 1.

DISCLOSURE OF THE INVENTION

[0007] The present invention is made to solve the problem mentioned above, and an object of the present invention is to provide an elevator apparatus which can reduce the planer size of the hoistway.

[0008] To this end, according to one aspect of the present invention, there is provided an elevator apparatus comprising: a hoistway; a car and a counterweight alternately raised and lowered in the hoistway; a main rope suspending the car and the counterweight in the hoistway; and a gear-less type driving machine disposed at an upper portion in the hoistway and raising and lowering the car and the counterweight through the main rope, the driving machine having a motor and a traction sheave directly rotated by the motor, the main rope being wound around the traction sheave; wherein a portion of the driving machine is disposed inside an area on which the car is projected in its raising and lowering direction.

[0009] According to another aspect of the present invention, there is provided an elevator apparatus comprising: a hoistway; a car raised and lowered in the hoistway; a main rope suspending the car in the hoistway; a driving machine disposed at an upper portion in the hoistway and raising and lowering the car through the main rope, a portion of the driving machine being disposed inside an area on which the car is projected in its raising and lowering direction; a fixed handrail fixed on a top portion of the car; a movable handrail provided on the top portion of the car and being movable between an expanded position passing through a driving machine projecting area on which the driving machine is projected in the raising and lowering direction of the car and a storage position outside the driving machine projecting area; a handrail detecting switch for detecting the position of the movable handrail; and a controller for restraining the raising range of the car according to the information from the handrail detecting switch.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a perspective view showing an essential portion of an elevator apparatus according to a first embodiment of the present invention;
Fig. 2 is a plan view showing the elevator apparatus in Fig. 1;
Fig. 3 is a plan view showing an elevator apparatus according to a second embodiment of the present invention;
Fig. 4 is a plan view showing an elevator apparatus according to a third embodiment of the present invention;
Fig. 5 is a plan view showing an elevator apparatus according to a fourth embodiment of the present invention;
Fig. 6 is an explanatory view showing the relationship between the driving machine and the handrail in the elevator apparatus shown in Figs. 1 to 5;
Fig. 7 is a side view showing an essential portion of an elevator apparatus according to a fifth embodiment of the present invention;
Fig. 8 is a plan view showing an elevator apparatus according to a sixth embodiment of the present invention;
Fig. 9 is a side view showing an essential portion of the elevator apparatus in Fig. 8;
Fig. 10 is a perspective view showing an essential portion of a conventional elevator apparatus; and
Fig. 11 is a plan view showing the elevator appara-

tus in Fig. 10.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] Preferred embodiments of the present invention will be described below with reference to the accompanying drawings.

First Embodiment

[0012] Fig. 1 is a perspective view showing an essential portion of an elevator apparatus according to a first embodiment of the present invention, and Fig. 2 is a plan view showing the elevator apparatus in Fig. 1. In the figures, a pair of car guide rails 2 and a pair of counterweight guide rails 3 are installed in a hoistway 1.

[0013] A driving machine 13 having a motor 11 and a traction sheave 12 is disposed at an upper portion in the hoistway 1. The driving machine 13 is a gear-less type where the traction sheave 12 is directly rotated by the motor 11. The driving machine shown in, for example, Japanese Patent Application Laid-Open No. Hei 7-187187 may be used as this gear-less type of the driving machine 13.

[0014] A middle portion of a main rope 6 is wound around the traction sheave 12. One end portion 6a of the main rope 6 is fixed in relation to an upper end portion of the car guide rail 2, and the other end portion 6b of the main rope 6 is fixed in relation to an upper end portion of the counterweight guide rail 3. A car 7 is suspended by the main rope 6 between the traction sheave 12 and one end portion 6a. A pair of car suspending sheaves 8 around which the main rope 6 is wound is provided at a lower end portion of the car 7.

[0015] A counterweight 9 is suspended by the main rope 6 between the traction sheave 12 and the other end portion 6b. A counterweight suspending sheave 10 around which the main rope 6 is wound is provided at an upper end portion of the counterweight 9. A handrail 14 used during maintenance operations is provided on a top portion of the car 7.

[0016] Further, the driving machine 13 is supported by, for example, the guide rails 2 and 3 above the raising and lowering area of the car 7. Furthermore, a portion of the driving machine 13 is disposed inside the area on which the car 7 is projected in the raising and lowering direction.

[0017] In such an elevator apparatus, since the driving machine 13 is disposed above the raising and lowering area of the car 7 and the portion of the driving machine 13 is disposed inside the area on which the car 7 is projected in the raising and lowering direction, the distance between a wall surface 1a of the hoistway 1 and the car 7 can be decreased, thereby reducing the planer size of the hoistway 1. In other words, only a portion of the traction sheave 12 is required to be disposed between the wall surface 1a and the car 7, so the major portion of the driving machine 13 can overlap the top portion of the car 7 if the main rope 6 extending downwardly from the traction sheave 12 does not interfere with the car 7.

Second Embodiment

[0018] It should be noted that, while, in the first embodiment, the driving machine 13 is disposed to be inclined with respect to the wall surface 1a due to the restriction of the layout of the main rope 6, it is also possible, for example, as shown in Fig. 3 for the driving machine 13 to be disposed so that the rotation axis of the traction sheave 12 is perpendicular to the wall surface 1a by providing a deflection pulley 15 at the upper portion in the hoistway 1 and winding the main rope 6 around the deflection pulley 15, thereby further decreasing the distance between the wall surface 1a and the car 7 and further reducing the planer size of the hoistway 1.

Third Embodiment

[0019] Fig. 4 is a plan view showing an elevator apparatus according to a third embodiment of the present invention. In this embodiment, the counterweight 9 is disposed behind the car 7. The driving machine 13 is obliquely disposed above a corner portion of the car 7. Therefore, the distance between the wall surface 1a and the car 7 can be decreased. Also, a corner portion 14a of the handrail 14 is separated from the corner portion of the car 7, thereby preventing it from interfering with the driving machine 13.

Fourth Embodiment .

[0020] Fig. 5 is a plan view showing an elevator apparatus according to a fourth embodiment of the present invention. In this embodiment, a deflector sheave 17 is provided at the upper portion in the hoistway. The portion of the main rope 6 between the traction sheave 12 and the counterweight suspending sheave 10 is wound around the deflector sheave 17. Therefore, the driving machine 13 is disposed so that the rotation axis of the traction sheave 12 is parallel with the width direction of the car 7 (right and left direction in the figure).

[0021] Even when a car 7 has great depth and the counterweight suspending sheave 10 and the center of the car 7 are widely separated from each other, the portion of the driving machine 13 can be disposed above the car 7 by providing the deflector sheave 17. That is, it is possible to sufficiently respond to the change of the dimension between the car 7 and the counterweight 9, thereby improving the degree of freedom of the layout.

[0022] Fig. 6 is an explanatory view showing the relationship between the driving machine and the handrail in the elevator apparatus shown in Figs. 1 to 5. The handrail 14 is disposed more to the inside of the car 7 than the driving machine 13. Also, the handrail 14 is disposed so as not to interfere with the driving machine 13

even when the counterweight 9 collides against a buffer (not shown) disposed at the bottom portion of the hoistway 1 and the car jumps up to the position of the broken line in the figure. Accordingly, the height dimension H of the top clearance can be reduced.

Fifth Embodiment

[0023] It should be noted that, while, in the first to third embodiments, the handrail 14 is erected on the top portion of the car 7, it is also possible, for example, as shown in Fig. 7 for the handrail 14 to be foldable (or pivotable) so it can be folded down while not in use.

[0024] Further, although a ceiling light 16 is provided on the top portion of the car 7 as shown in Fig. 7, the height of the peripheral portion 7a of the car 7 may be lowered because the ceiling light 16 is not provided on the peripheral portion 7a. Therefore, the car 7 can be more surely prevented from interfering with the driving machine 13 by sufficiently securing the clearance between the peripheral portion 7a and the driving machine 13 when the car 7 jumps up.

Sixth Embodiment

[0025] Next, Fig. 8 is a plan view showing an elevator apparatus according to a sixth embodiment of the present invention, and Fig. 9 is a side view showing an essential portion of the elevator apparatus in Fig. 8. In the figures, a driving machine 21 for raising and lowering the car 7 is disposed at the upper portion of the hoistway 1. Further, at least one portion (greater portion in actual use) is disposed inside the area on which the car is projected in the raising and lowering direction.

[0026] A fixed handrail 22 is fixed to the top portion of the car 7. A movable handrail 23 which is capable of reciprocating in the right and left direction in Fig. 8 is connected to the fixed handrail 22. The movable handrail 23 is movable between an expanded position A passing through a driving machine projecting area on which the driving machine 21 is projected in the raising and lowering direction of the car 7 and a storage position B outside the driving machine projecting area. The fixed handrail 22 and the movable handrail 23 act as safety fences for maintenance operations.

[0027] A handrail detecting switch 24 for detecting the position of the movable handrail 23 is provided between the fixed handrail 22 and the movable handrail 23. The handrail detecting switch 24 is connected with a controller 25 for controlling the driving of the elevator apparatus. In Fig. 8, the controller 25 is shown as a block diagram. The controller 25 restricts the raising range of the car 7 according to the information from the handrail detecting switch 24.

[0028] A collision avoidance switch device 26 for stopping the raising of the car 7 by being contacted is provided at the lower portion of the driving machine 21. The collision avoidance switch device 26 has a plurality of attachment fittings 27, a contact body 28 supported by the attachment fittings 27 to be capable of moving up and down, a plurality of links 29 connecting the contact body 28 with the attachment fittings 27, and a contact detecting switch 30 being operated by the upward movement of the contact body 28.

[0029] In such an elevator apparatus, when the movable handrail 23 is received in the storage position B, the handrail detecting switch 24 is energized, and the car can be operated at a rated speed with fully automatic operation. Also, when the car 7 is stopped at the uppermost landing floor, the movable handrail 23 will not interfere with the driving machine 21.

[0030] Further, when an operator riding on the car 7 switches to manual operation and pulls the movable handrail 23 to the expanded position A, maintenance on the devices of the counterweight 9 or the like can be performed from the area surrounded by the movable handrail 23. Furthermore, the handrail detecting switch 24 is de-energized, the raising range of the car 7 is restricted, and the movable handrail 23 is more surely prevented from interfering with the driving machine 21.

[0031] Moreover, in the case where an operator performs a maintenance operation directly below the driving machine 21 while raising the car 7, if the contact body 28 is pushed up by contact with the operator, the contact detecting switch 30 is operated and the raising of the car 7 is stopped. Accordingly, safety can be further improved.

[0032] It should be noted that, while, in the sixth embodiment, the movable handrail 23 is slid in the right and left direction in Fig. 9, it is also possible, for example, for the movable handrail 23 to be pivoted about a connecting portion, as an axis, for connecting to the fixed handrail 22.

Claims

1. An elevator apparatus comprising:

a hoistway;
a car and a counterweight alternately raised and lowered in said hoistway;
a main rope suspending said car and said counterweight in said hoistway; and
a gear-less type driving machine disposed at an upper portion in said hoistway and raising and lowering said car and said counterweight through said main rope, said driving machine having a motor and a traction sheave directly rotated by said motor, said main rope being wound around said traction sheave;
wherein a portion of said driving machine is disposed inside an area on which said car is projected in its raising and lowering direction.

2. An elevator apparatus according to claim 1, wherein

the portion of said driving machine is disposed outside an area on which a handrail is projected in the raising and lowering direction of said car.

3. An elevator apparatus according to claim 1, wherein the height of said car at a portion which overlaps said driving machine when said car is projected in its raising and lowering direction, is lower than the height of the center portion of said car.

4. An elevator apparatus according to claim 1, further comprising a deflector sheave disposed at the upper portion in said hoistway, said main rope being wound around said deflector sheave at a portion between said traction sheave and said counterweight.

5. An elevator apparatus comprising:

a hoistway;
a car raised and lowered in said hoistway;
a main rope suspending said car in said hoistway;
a driving machine disposed at an upper portion in said hoistway and raising and lowering said car through said main rope, a portion of said driving machine being disposed inside an area on which said car is projected in its raising and lowering direction;
a fixed handrail fixed on a top portion of said car;
a movable handrail provided on the top portion of said car and being movable between an expanded position passing through a driving machine projecting area on which said driving machine is projected in the raising and lowering direction of said car and a storage position outside said driving machine projecting area;
a handrail detecting switch for detecting the position of said movable handrail; and
a controller for restraining the raising range of said car according to the information from said handrail detecting switch.

6. An elevator apparatus according to claim 5, wherein a collision avoidance switch device for stopping the raising of said car by being contacted is provided at a lower portion of said driving machine.

1. An elevator apparatus comprising:

a hoistway (1);
a car (7) and a counterweight (9) alternately raised and lowered in said hoistway (1);
a main rope (6) suspending said car (7) and said counterweight (9) in said hoistway (1); and
a gear-less type driving machine (13) disposed at an upper portion in said hoistway (1) and raising and lowering said car (7) and said counterweight (9) through said main rope (6), said driving machine (13) having a motor (11) and a traction sheave (12) directly rotated by said motor (11), said main rope (6) being wound around said traction sheave (12)

characterized in that

a portion of said driving machine (13) is disposed inside an area on which said car (7) is projected in its raising and lowering direction.

2. An elevator apparatus according to claim 1, wherein the portion of said driving machine (13) is disposed outside an area on which a handrail (14) is projected in the raising and lowering direction of said car (7).

3. An elevator apparatus according to claim 1 or 2, wherein the height of said car (7) at a portion which overlaps said driving machine (13) when said car (7) is projected in its raising and lowering direction, is lower than the height of the center portion of said car (7).

4. An elevator apparatus according to any one of claims 1 to 3, further comprising a deflector sheave (17) disposed at the upper portion in said hoistway (1), said main rope (6) being wound around said deflector sheave (17) at a portion between said traction sheave (12) and said counterweight (9).

5. An elevator apparatus comprising:

a hoistway (1);
a car (7) raised and lowered in said hoistway (1);
a main rope (6) suspending said car (7) in said hoistway (1); and
a driving machine (21) disposed at an upper portion in said hoistway (1) and raising and lowering said car (7) through said main rope (6), a portion of said driving machine (21) being disposed inside an area on which said car (7) is projected in its raising and lowering direction
a fixed handrail (22) fixed on a top portion of said car (7);
a movable handrail (23) provided on the top portion of said car (7) and being movable between an expanded position passing through a driving machine projecting area on which said driving machine (21) is projected in the raising and lowering direction of said car (7) and a storage position outside said driving machine projecting area;
a handrail detecting switch (24) for detecting the position of said movable handrail (23); and
a controller (25) for restricting the raising range of said car (7) according to the information from

said handrail detecting switch (24).

6. An elevator apparatus according to claim 5, wherein a collision avoidance switch device (26) for stopping the raising of said car (7) by being contacted is provided at a lower portion of said driving machine (21).

FIG. 1

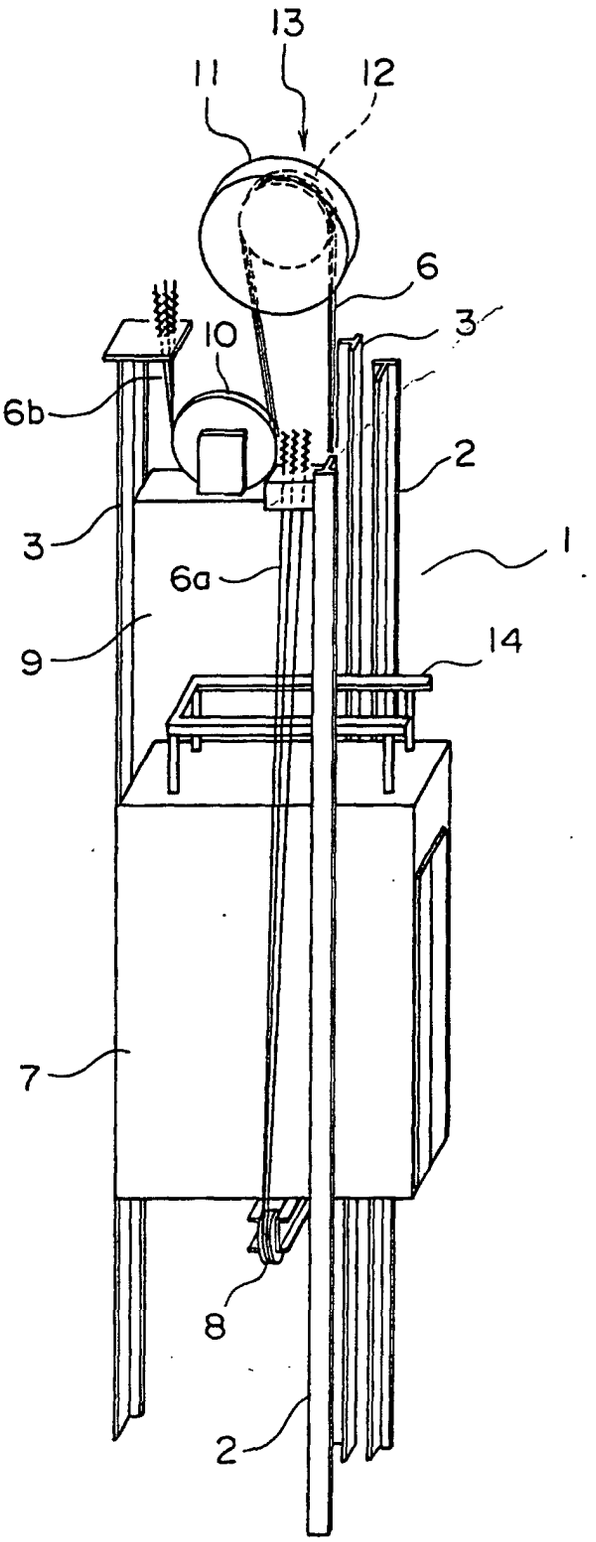


FIG. 2

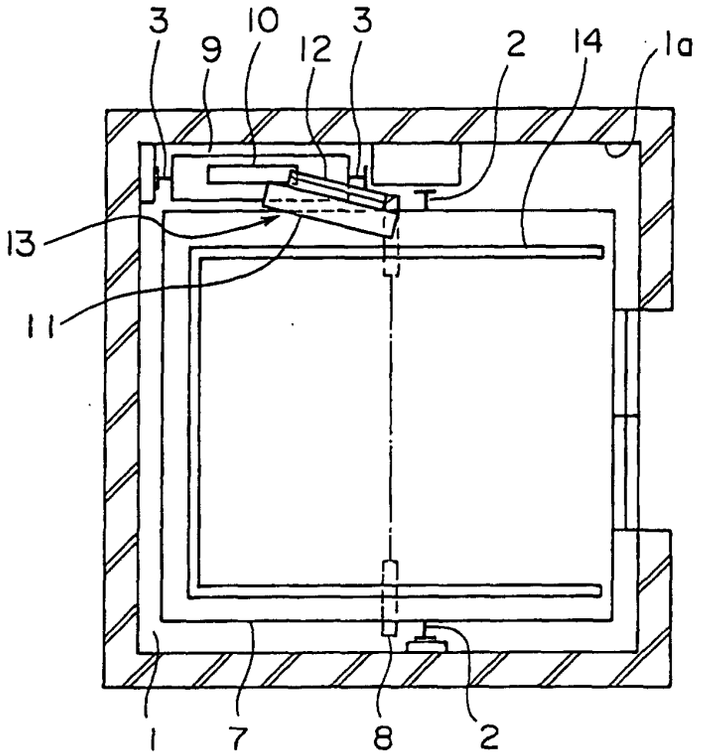


FIG. 3

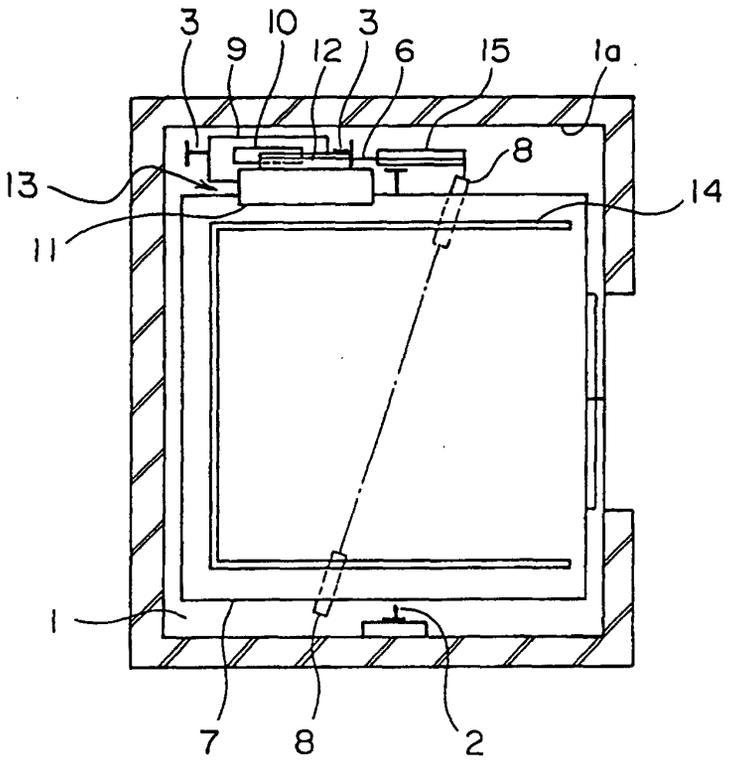


FIG. 4

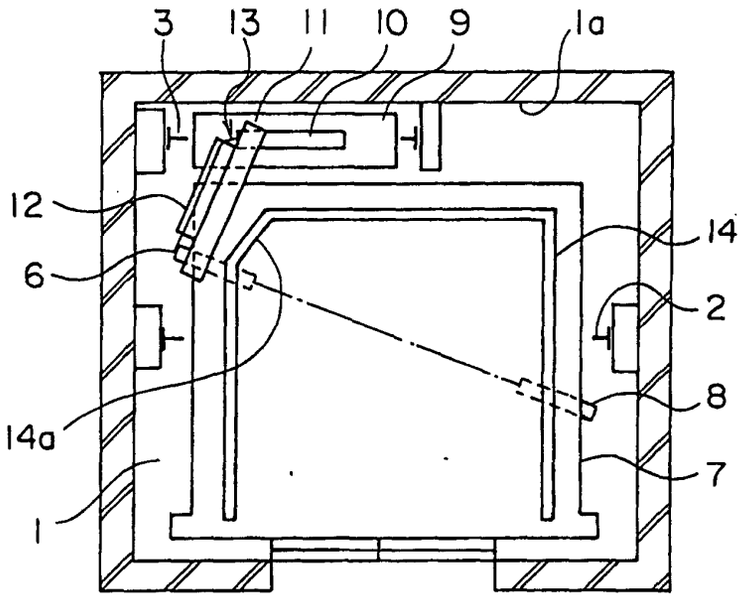


FIG. 6

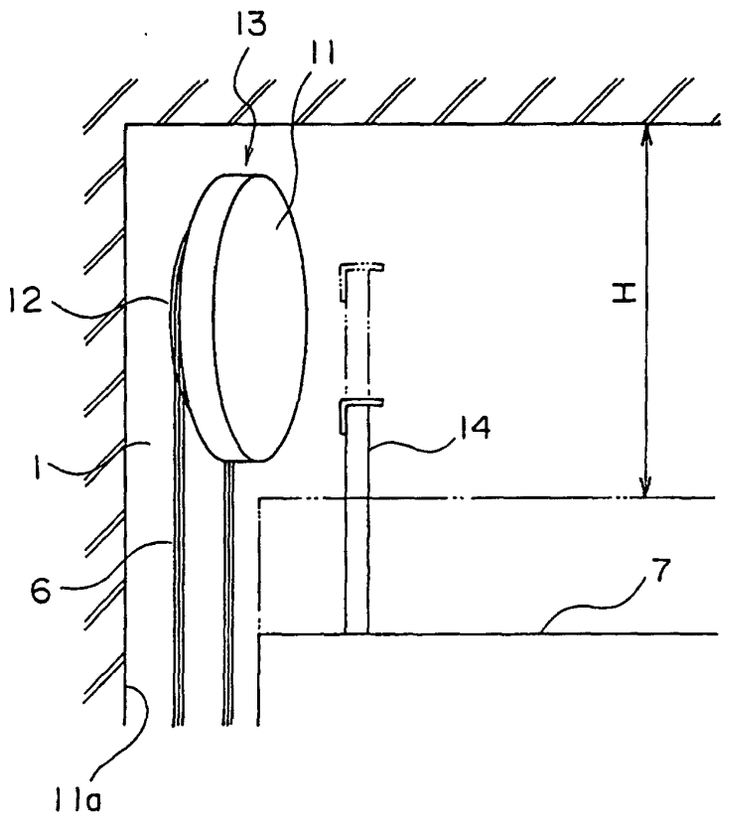


FIG. 5

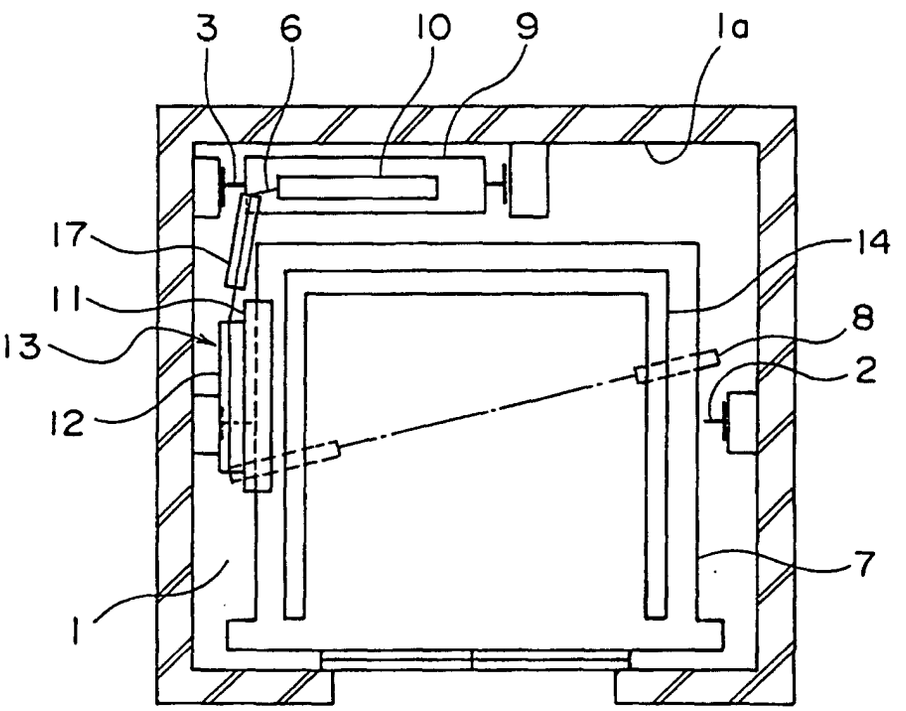


FIG. 7

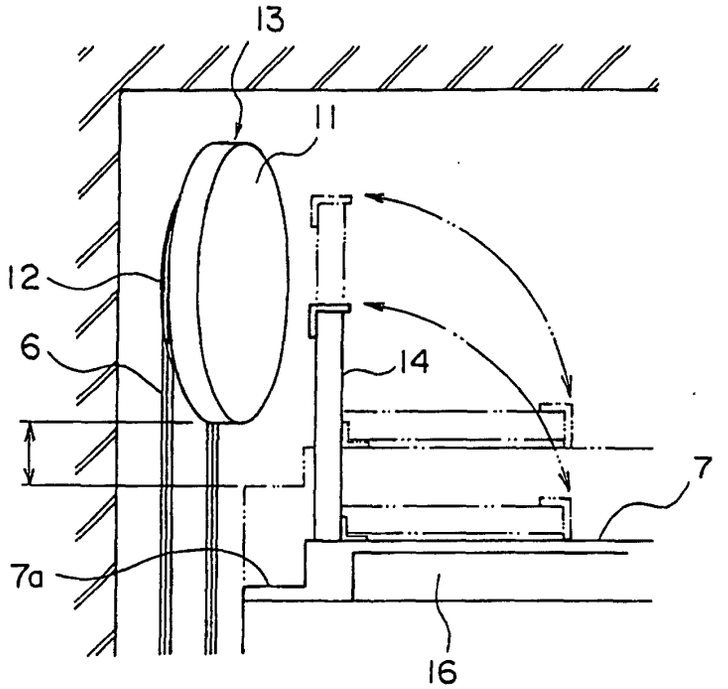


FIG. 8

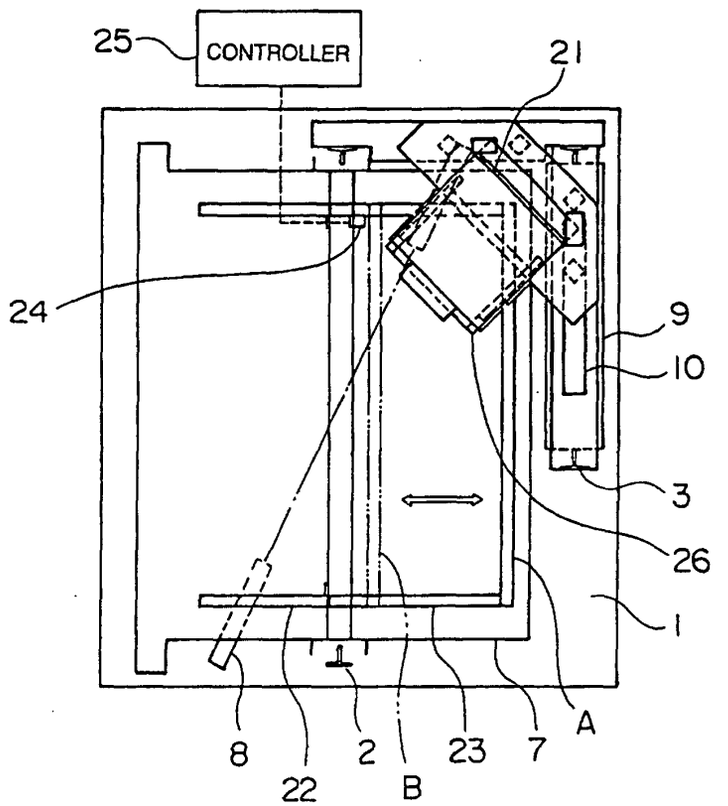


FIG. 9

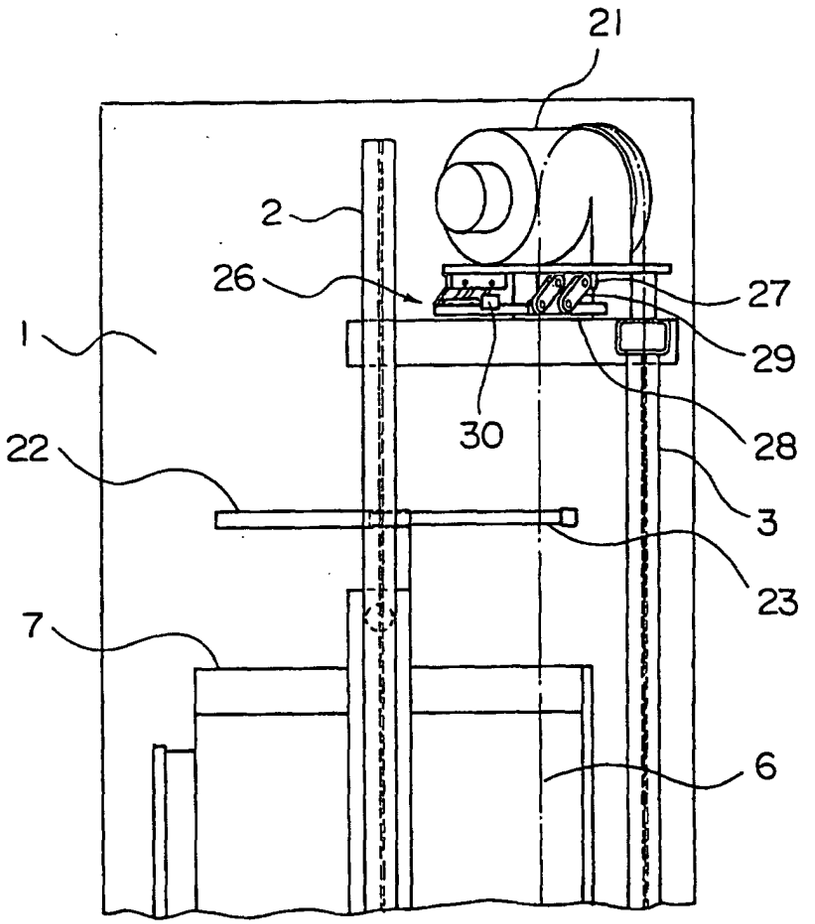


FIG. 10

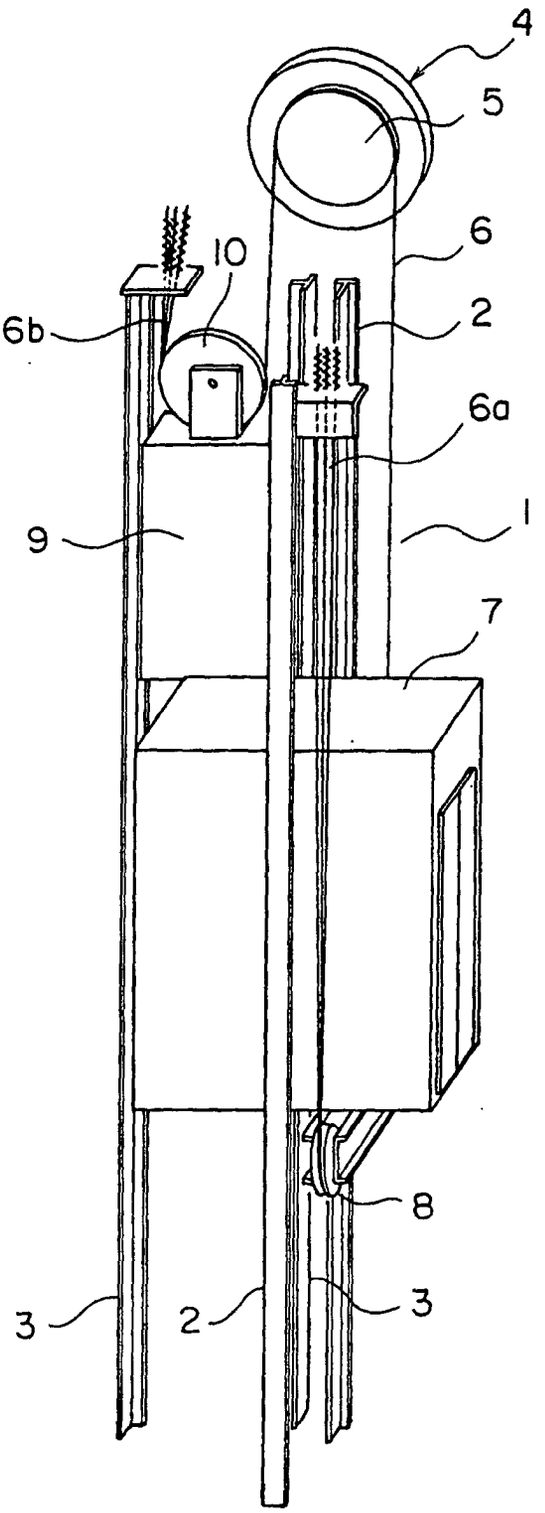
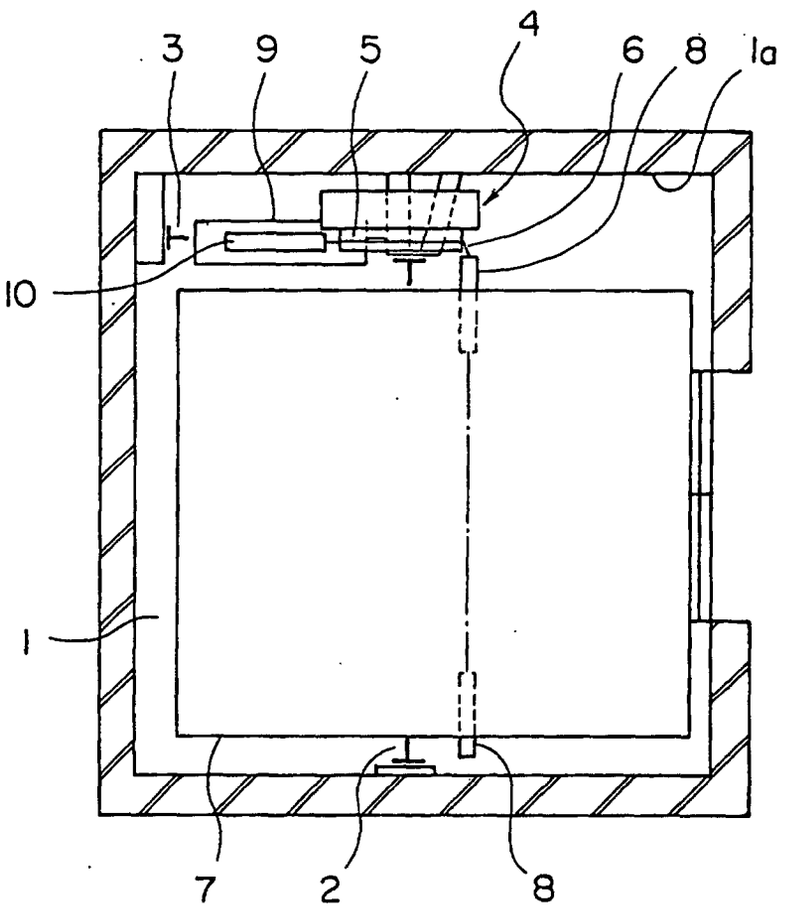


FIG. 11



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/01008

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 7/00

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] B66B 5/00-11/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2000
Kokai Jitsuyo Shinan Koho 1971-2001 Toroku Jitsuyo Shinan Koho 1994-2000

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 Y	JP, 11-157762, 1 (Toshiba Corporation), 15 June, 1999 915.05.99), & EP, 0905081, A2 & CN, 121948, A	1 5-6
X Y	EP, 0926093, A1 (Thyssen Aufzuge GMBH), 30 June, 1999 (30.06.99) & CN, 1218762, A & ES, 2136041, T & NO, 985529, A & PL, 329831, A	1-2 5-6
X Y	JP, 11-106159, A (Toshiba Corporation), 20 April, 19999 (20.04.99) & EP, 0905081, A2 & CN, 1212948, A	1,3 5-6
X Y	US, 6006865, A (Inventio AG), 28, December, 1999 (28.12.99), & EP, 0841283, A1 & JP, 10-139321, A	1,4 5-6
Y	JP, 6-49577, Y2 (Hitachi Building Systems Co., Ltd.), 14 December, 1994 (14.12.99) (Family: none)	5-6

☒ 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
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"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
23 May, 2000 (23.05.00)	06 June, 2000 (06.06.00)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/01008

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP, 48-3941, Y1 (Hitachi Ltd.), 31 January, 1973 (31.01.73) (Family: none)	6

Form PCT/ISA/210 (continuation of second sheet) (July 1992)