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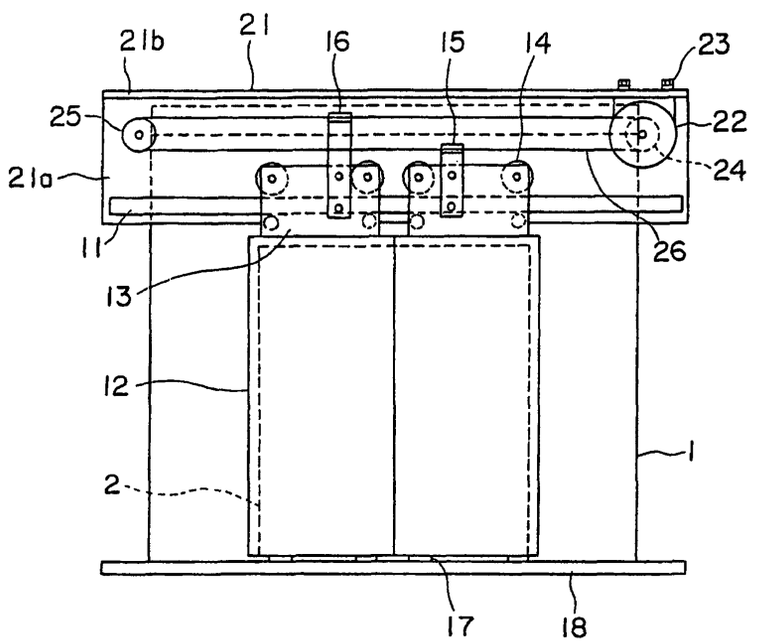
(54) ELEVATOR CAR DOOR DEVICE

(57) In a car door apparatus for an elevator, a door motor is directly coupled to a drive pulley and the whole door motor is disposed below an upper end portion of a door frame. Further, a permanent magnet type motor is used as the door motor. Furthermore, the door frame is provided with a horizontal portion, with the door motor suspended under the horizontal portion.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a car door apparatus for an elevator which is mounted on an elevator car for opening and closing a car entrance.

BACKGROUND ART

[0002] Fig. 6 is a front view showing a conventional elevator car disclosed, for example, in Japanese Patent Application Laid-Open No. Hei 2-81888 and Fig. 7 is a side view showing the car door apparatus in Fig. 6, a car body 1 being shown in cross-section. In the figures, a car entrance 2 is provided at the front face of the car body 1. A door frame 3 extending along the width direction of the car entrance 2 (the right and left direction in Fig. 6) is fixed to the car body 1 above the car entrance 2. A door motor 4 having a motor pulley 5 is mounted on the door frame 3.

[0003] A reduction pulley 6 having a larger diameter than the motor pulley 5 is provided at the door frame 3. A loop-like reduction belt 7 is wound between the motor pulley 5 and the reduction pulley 6. A drive pulley 8 having a smaller diameter than the reduction pulley 6, which is disposed coaxially with the reduction pulley 6 to be rotated integrally with the reduction pulley 6, is provided at the door frame 3. Further, a following pulley 9 is provided at the door frame 3. A loop-like belt 10 is wound between the drive pulley 8 and the following pulley 9.

[0004] A door rail 11 extending along the width direction of the car entrance 2 is attached to the door frame 3. Two car doors 12 are suspended from the door rail 11 through door hangers 13. Each door hanger 13 has two rollers 14 which are rotated along the door rail 11. The car doors 12 are connected to the belt 10 through the door hanger 13 and belt holders 15 and 16.

[0005] A plurality of door shoes 17 are attached to the lower end portion of each of the car doors 12. The door shoes 17 are inserted into a sill groove (not shown) of a sill 18 disposed at lower portion of the car entrance 2. Further, in Fig. 7, the car body 1 is provided with an upper panel 19 and a ceiling panel 20.

[0006] Next, the operation will be described. When the motor pulley 5 is rotated by the door motor 4, the rotation is transmitted to the reduction pulley 6 through the reduction belt 7 and the drive pulley 8 is rotated with the reduction pulley 6. When the drive pulley 8 is rotated, the belt 10 is circulated and the following pulley 9 is rotated.

[0007] Since the door hangers 13 are connected to the belt 10, the door hangers 13 and the car doors 12 are reciprocated along the door rail 11 by the circulation of the belt 10 to open or close the car entrance 2. The car doors 12 are suspended from the door rail 11 and the bottom portions of the car doors 12 are guided by the sill groove of the sill 18 during the opening and the closing of the car doors 12.

[0008] In the conventional car door apparatus for an elevator constructed as described above, the cylindrical door motor 4 is fixed to the upper portion of the door frame 3 and the car body 1 side end portion of the door motor 4 is disposed just above the car body 1. In other words, since the door motor 4 is disposed at a position higher than the ceiling panel 20, the height dimension of whole car is increased. Hence, there is the need to increase a height dimension of a hoistway.

[0009] Further, in the case where the position of the ceiling panel 20 needs to be raised, the position of the door motor 4 also need to be raised to prevent the door motor 4 from interfering with the ceiling panel 20 even if the height of the car entrance 2 is not changed. Accordingly, there is a need to increase the height dimension of parts of the car door apparatus such as the door frame 3 or the height dimension of the car doors 12, hence there is need to increase the number of kinds of parts.

DISCLOSURE OF THE INVENTION

[0010] The present invention is made to solve the problems mentioned above, and an object of the present invention is to provide a car door apparatus for an elevator which can have a reduced height dimension and in which prevent exerting an influence upon a height dimension of a car.

[0011] To this end, according to one aspect of the present invention, there is provided a car door apparatus for an elevator comprising: a door frame fixed to a car body above a car entrance and extending along a width direction of the car entrance; a door motor attached to the door frame so as to be located below an upper end portion of the door frame; a first rotating body directly driven by the door motor; a second rotating body provided at the door frame; a loop-like circulating body wound between the first and second rotating bodies to be circulated by the rotation of the first and second rotating bodies; a door rail attached to the door frame and extending along the width direction of the car entrance; and a car door moving along the door rail by the circulation of the circulating body to open and close the car entrance, said car door being suspended from the door rail and being connected to the circulating body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a front view showing an elevator car according to a first embodiment of the present invention;

Fig. 2 is a side view showing the car door apparatus in Fig. 1;

Fig. 3 is a schematic cross-sectional view of the door motor in Fig. 1;

Fig. 4 is a side view showing the car door apparatus in the case where the position of the ceiling panel in Fig. 2 is raised;

Fig . 5 is a side view showing a car door apparatus for an elevator according to a second embodiment of the present invention;

Fig. 6 is a front view showing an example of a conventional elevator car; and

Fig. 7 is a side view showing the car door apparatus in Fig. 6.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] Preferred embodiments of the present invention will be described below with reference to the accompanying drawings.

First Embodiment

[0014] Fig. 1 is a front view showing an elevator car according to a first embodiment of the present invention and Fig. 2 is a side view showing the car door apparatus in Fig. 1, the car body 1 being shown in cross section.

[0015] In the figures, a car entrance 2 is provided at the front face of the car body 1. A door frame 21 extending along the width direction of the car entrance 2 (the right and left direction in Fig. 1) is fixed to the car body 1 above the car entrance 2. The door frame 21 has an L-shaped cross section, and has a vertical portion 21a opposite a wall portion of the car body 1 located above the car entrance 2 and a horizontal portion 21b horizontally extending from the upper end portion of the vertical portion 21a to a landing side.

[0016] A door motor 22 is fixed to the bottom portion of the horizontal portion 21b through a plurality of bolts 23. A drive pulley 24 as a first rotating body which is directly driven by and connected to the door motor 22. A following pulley 25 as a second rotating body is provided at the door frame 21. A loop-like belt 26 as a circulating body is wound between the drive pulley 24 and the following pulley 25.

[0017] A door rail 11 extending along the width direction of the car entrance 2 is attached to the door frame 21. Two car doors 12 are suspended from the door rail 11 through door hangers 13. Each door hanger 13 has two rollers 14 which are rotated along the door rail 11. The car doors 12 are connected to the belt 26 through the door hanger 13 and belt holders 15 and 16.

[0018] A plurality of door shoes 17 are attached to the lower end portion of each of the car doors 12. The door shoes 17 are inserted into a sill groove 18a of a sill 18 disposed at lower portion of the car entrance 2. Further, in Fig. 2, the car body 1 is provided with an upper panel 19 and a ceiling panel 20.

[0019] Fig. 3 is a schematic cross-sectional view of the door motor 22 in Fig. 1. A stator 33 having a plurality of coils 32 is fixed in a housing 31. Also, a rotor 35 is held in the housing 31 through a plurality of bearings 34. The rotor 35 has a drive shaft 36, and a plurality of permanent magnets 37 fixed to the drive shaft 36 so as to oppose the stator 33.

[0020] Further, as shown in Fig. 2, the whole of the door motor 22 is disposed so as to be located below the upper end portion of the door frame 21 and disposed in a region located at the car body 1 side with respect to a surface (the surface A in Fig. 2) defined by vertically extending upward a landing-side vertical end surface 18b of the car sill 18.

[0021] Next, the operation will be described. When the drive pulley 24 is directly rotated by the door motor 22, the belt 26 is circulated and the following pulley 25 is rotated. Since the belt 26 is connected to the door hangers 13, the door hangers 13 and the car doors 12 are reciprocated along the door rail 11 by the circulation of the belt 26 to open and close the car entrance 2. The car doors 12 are suspended from the door rail 11, the lower end portions of the car doors 12 are guided by the sill groove 18a during opening and closing of the car doors 12.

[0022] In such a car door apparatus, since the door motor 22 is directly coupled to the drive pulley 24 and the whole of the door motor 22 is disposed below the upper end portion of the door frame 21, the height dimension of the car door apparatus can be decreased and the influence exerted upon the height dimension of the whole car can be prevented. Accordingly, the height dimension of the whole car can be decreased, thereby decreasing the height dimension of the top portion of the hoistway.

[0023] Further, as shown, for example, in Fig. 4, even when the position of the ceiling panel 20 is raised, since the ceiling panel 20 does not interfere with the door motor 22, there is no need to increase the height dimensions of parts such as the door frame 21 and the height dimension of the car doors 12 if the height of the car entrance 2 is not changed, thereby achieving parts commonality between a plurality of types of elevators where ceiling heights are different from one another.

[0024] Furthermore, since the drive pulley 24 is directly driven by the door motor 22 without a reduction mechanism, noise of gears is not generated, and then the car doors 12 can be quietly opened and closed.

[0025] More, in the first embodiment, since the permanent magnet type motor in which the permanent magnets 37 are provided in the rotor 35 and the coils 32 are provided in the stator 33 is used as the door motor 22, the door motor 22 can be reduced in size and thickness while securing the torque required, thereby allowing the door motor 22 to be easily disposed within the range of the height of the door frame 21.

[0026] To be more specific, the diameter and the thickness of the door motor 22 can be reduced to be about 150mm and about 80mm, respectively. At such a size, the door motor 22 can be easily disposed in the region of the height of the door frame 21 and in the space of the car body 1 side with respect to the surface A without

upsizing of the door frame 21.

[0027] Moreover, in the first embodiment, since the door frame 21 is provided with the horizontal portion 21b and the door motor 22 is suspended under the horizontal portion 21b, the door motor 22 can be stably supported.

[0028] Still furthermore, since the door frame 21 and the door motor 22 are disposed in the car body 1 side with respect to the surface A defined by vertically extending upward the landing-side vertical end surface 18b of the car sill 18, the parts of the car door apparatus are surely prevented from interfering with the parts of the landing side.

Second Embodiment

[0029] Next, Fig. 5 is a side view showing a car door apparatus for an elevator according to a second embodiment of the present invention. In the figure, a vibration isolator 27 is interposed between the horizontal portion 21b of the door frame 21 and the door motor 22. The other constructions are the same as in the first embodiment.

[0030] In such a car door apparatus, vibration of the door motor 22 can be prevented from being transmitted to the car body 1 and the car doors 12 through the door frame 21, so the car doors 12 can be stably opened and closed.

[0031] It should be noted that the number of the car door 12 and the open type (center open type, side open type or the like) are not limited to the first and second embodiments.

[0032] Further, while, in the first and second embodiments, the drive pulley 24 and the following pulley 25 are used as the first and second rotating bodies, it is also possible to use sprockets or the like. Also, while, in the first and second embodiments, the belt 26 is used as the circulating body, it is also possible to use a chain, a rope or the like.

Claims

1. A car door apparatus for an elevator comprising:

a door frame fixed to a car body above a car entrance and extending along a width direction of the car entrance;
a door motor attached to the door frame so as to be located below an upper end portion of the door frame;
a first rotating body directly driven by the door motor;
a second rotating body provided at the door frame;
a loop-like circulating body wound between the first and second rotating bodies to be circulated by the rotation of the first and second rotating bodies;
a door rail attached to the door frame and extending along the width direction of the car entrance; and
a car door moving along the door rail by the circulation of the circulating body to open and close the car entrance, said car door being suspended from the door rail and being connected to the circulating body.

2. The car door apparatus for the elevator according to claim 1, wherein the door motor is a permanent magnet type motor in which a permanent magnet is provided in a rotor and a coil is provided in a stator.

3. The car door apparatus for the elevator according to claim 1, wherein the door frame has a vertical portion opposing a wall portion of the car body located above the car entrance and a horizontal portion horizontally extending from the vertical portion to a landing side, the door motor being fixed to a bottom portion of the horizontal portion.

4. The car door apparatus for the elevator according to claim 1, wherein the door frame and the door motor are disposed at the car body side with respect to a surf ace defined by vertically extending upward a landing-side vertical end surface of a car sill which guides a lower end portion of the car door.

5. The car door apparatus for the elevator according to claim 1, wherein a vibration isolator is interposed between the door frame and the door motor.

FIG. 1

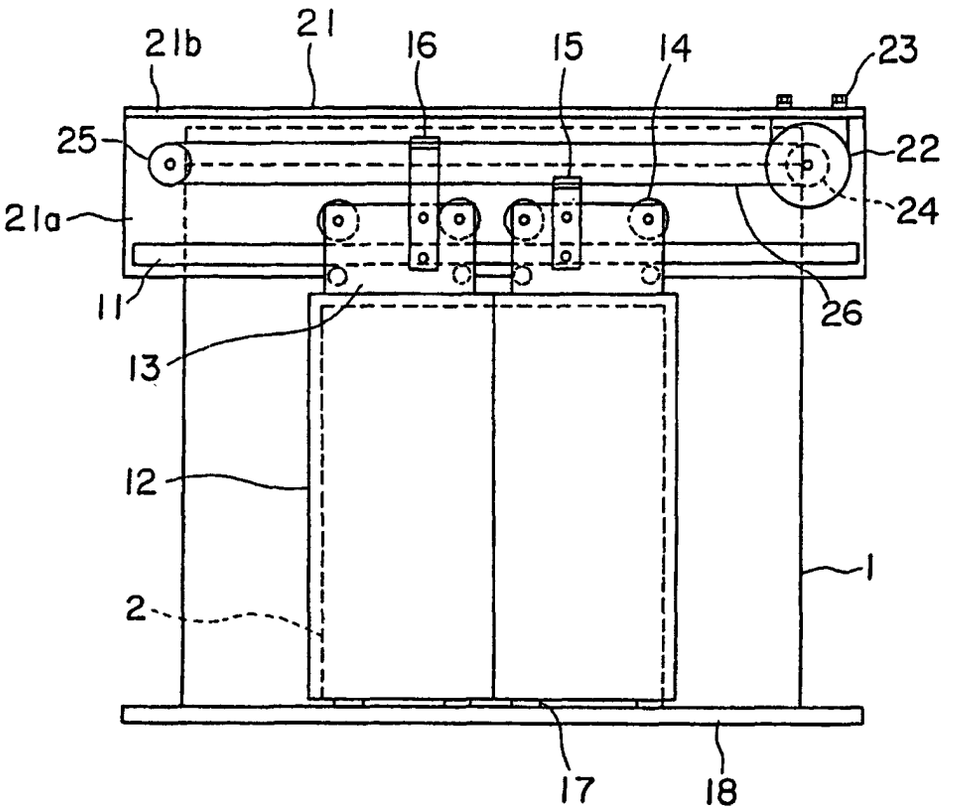


FIG. 2

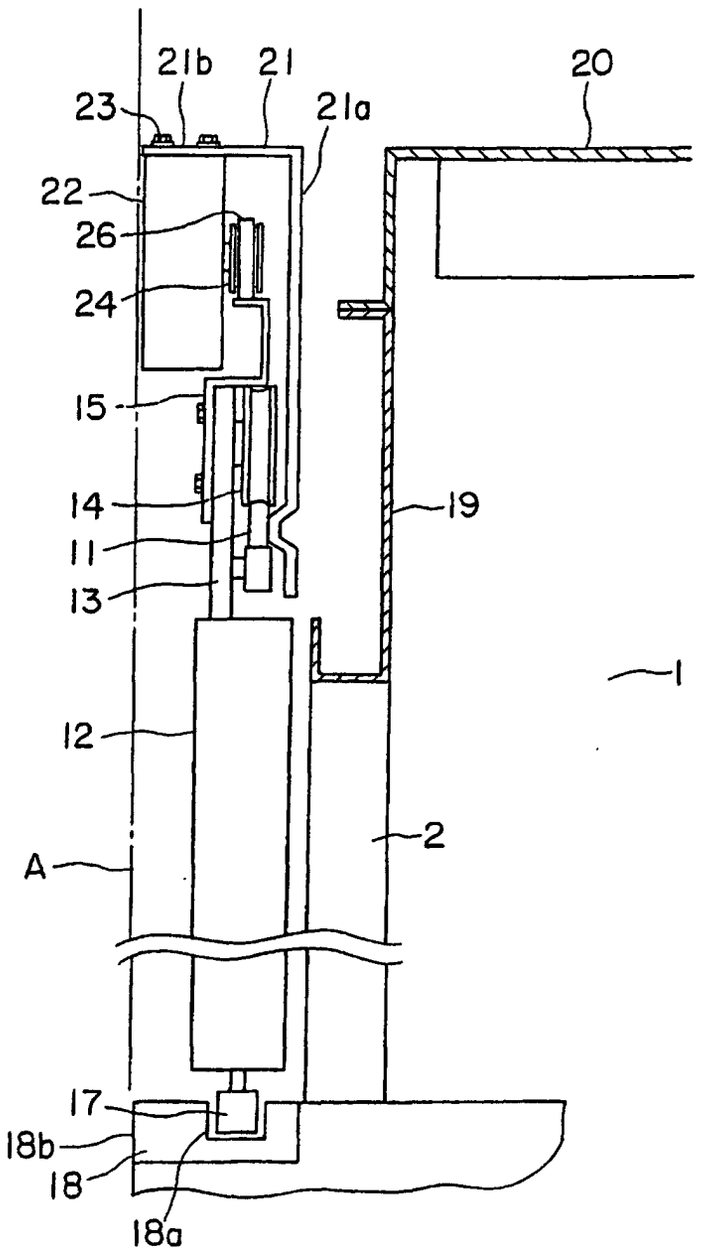


FIG. 3

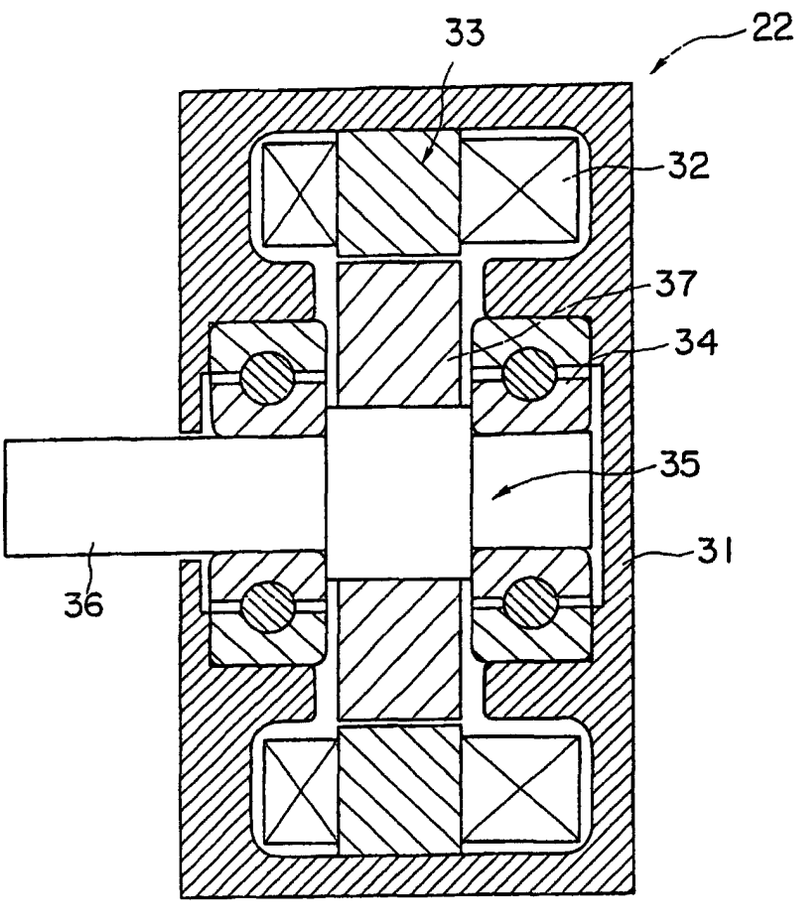


FIG. 4

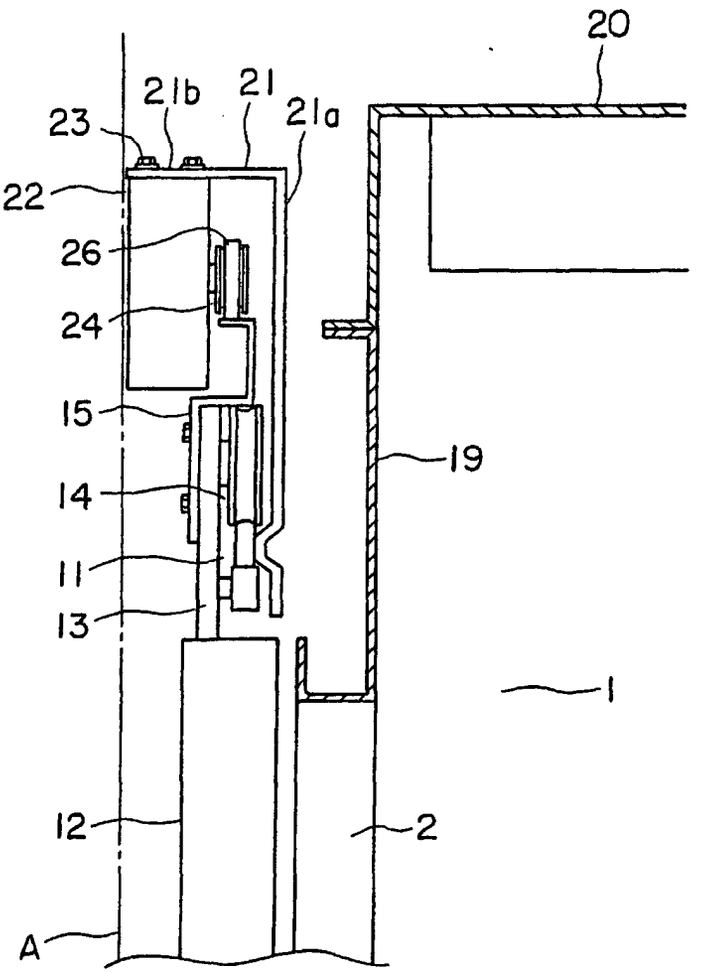


FIG. 5

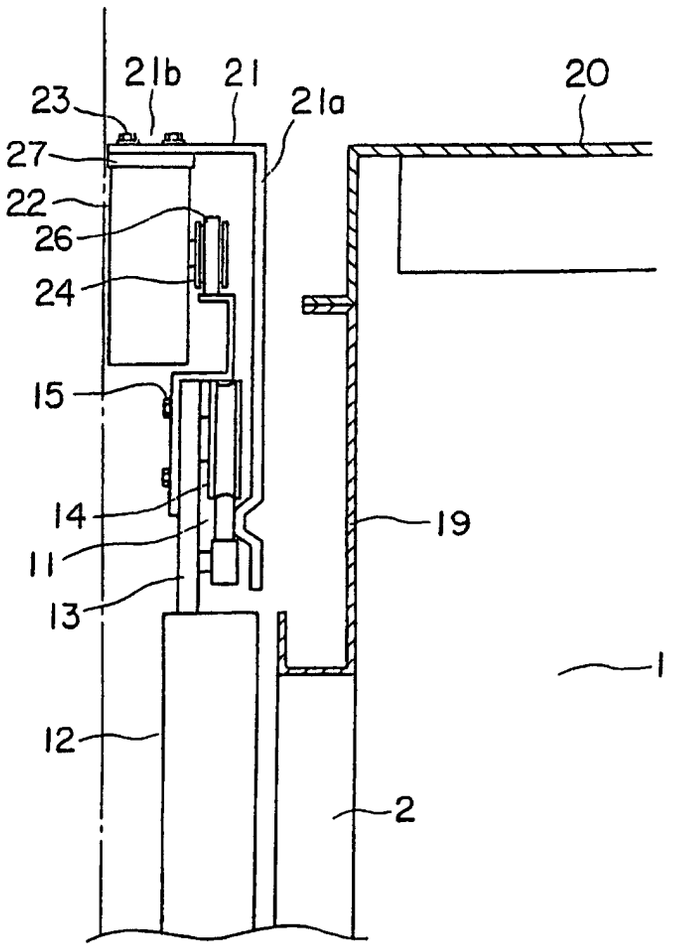


FIG. 6

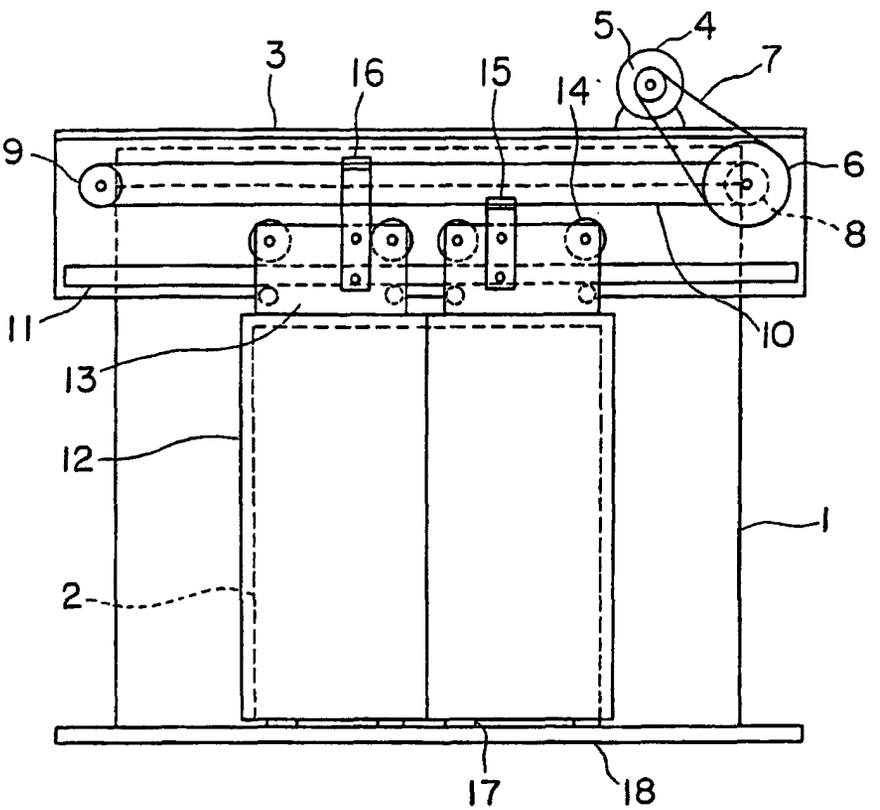
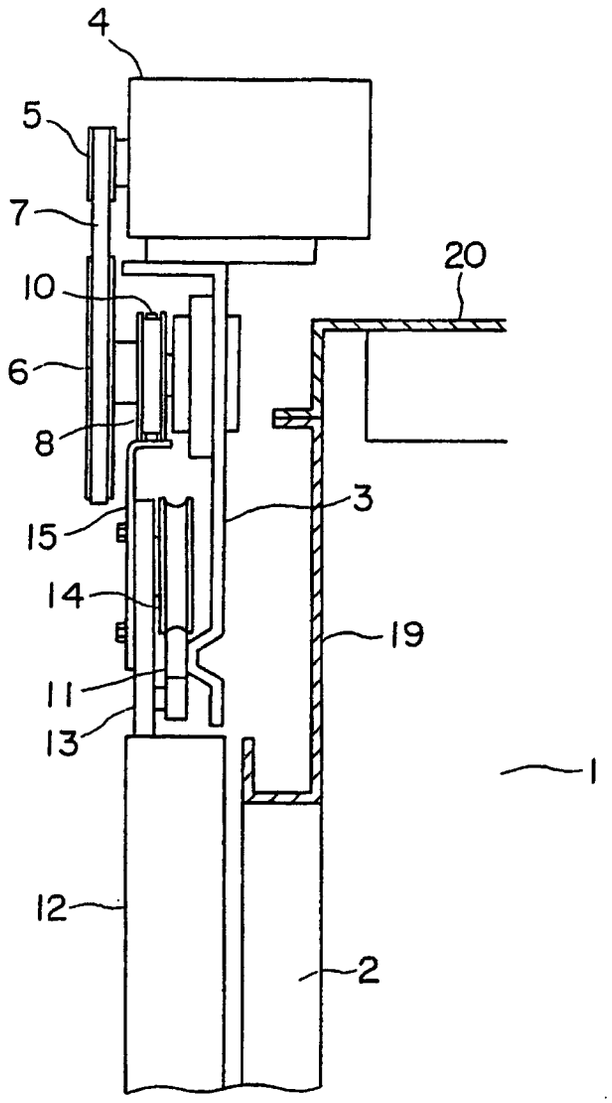


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/04780

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 13/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66B 13/00 - B66B 13/30

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 1996-2002
Kokai Jitsuyo Shinan Koho 1971-2002 Toroku Jitsuyo Shinan Koho 1994-2002

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.
EX	JP 2001-187681 A (Mitsubishi Electric Corporation), 10 July, 2001 (10.07.2001), (Family: none)	1-5
Y A	JP 11-292432 A (Otis Elevator Company), 26 October, 1999 (26.10.1999), (Family: none)	1-2 3-5
Y A	US 5701973 A (Otis Elevator Company), 30 December, 1997 (30.12.1997), (Family: none)	1-2 3-5
A	JP 3-264486 A (Mitsubishi Electric Corporation), 25 November, 1991 (25.11.1991), (Family: none)	1-5

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
19 February, 2002 (19.02.02)	05 March, 2002 (05.03.02)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
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