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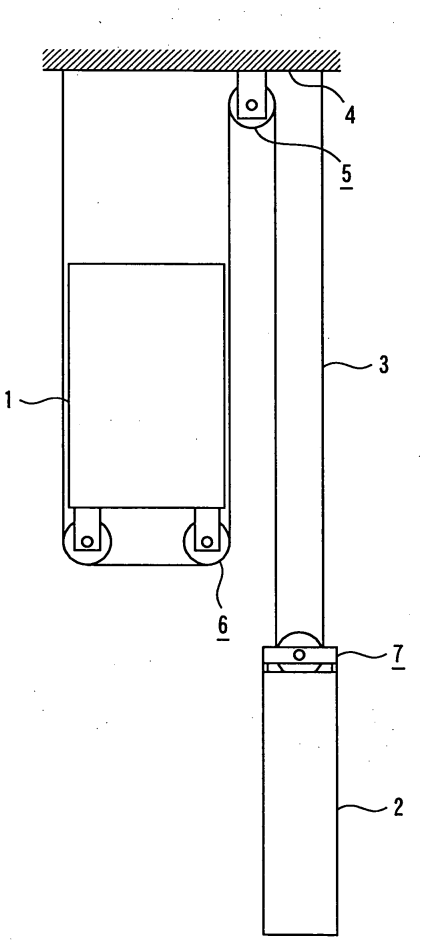
(54) ELEVATOR APPARATUS

(57) There is provided an elevator device in which a traction machine is separated into a drive device and a brake device or brake devices; and the separated drive device and brake device or brake devices are separately installed, thereby reducing installation space in a hoistway and facilitating maintenance work of the brake device. The traction machine is separated into the drive device and the brake device or brake devices, and the separated drive device is mounted to an upper return pulley 5 mounted to a top securing portion 4 of a hoistway, and the separated brake device is mounted to at least one of a car side suspension pulley 6 and a counter weight side suspension pulley 7, or the separated brake devices are mounted to both the car side suspension pulley 6 and the counterweight side suspension pulley 7.

FIG.1



EP 1 790 611 A1

Description

Technical Field

[0001] The present invention relates to an elevator device configured so that a traction machine is separated into a drive device and a brake device, and the separated drive device and brake device are separately installed in a hoistway.

Background Art

[0002] In conventional elevator devices, a traction machine includes a drive device and a brake device together, the drive device and the brake device are placed in parallel coaxially with the traction machine, and the brake device is placed outside the drive device (for example, see Patent Document 1).
In some elevator devices, a traction machine is placed in a lower portion of a hoistway (for example, see Patent Document 2).
Further, in some elevator devices, a traction machine is placed in a top portion of a hoistway (for example, see Patent Document 3).

[0003] Patent Document 1: International Publication WO01/042121
Patent Document 2: Japanese Patent Laid-Open No. 2000-289954
Patent Document 3: Japanese Patent No. 2593288

Disclosure of the Invention

Problems to be Solved by the Invention

[0004] In the traction machine of the conventional elevator, the drive device and the brake device are placed in parallel coaxially with the traction machine, and the brake device is placed outside the drive device, thereby increasing an axial length. Also, the traction machine is placed in the lower portion of the hoistway, which increases the amount of use of hoistway devices such as a return pulley or a rope to increase space on a plane of the hoistway and costs. Further, when the traction machine is placed in the top portion of the hoistway, maintenance work of the brake device needs to be performed by an operator riding on top of a car and is difficult, and a protection is needed of the operator from hitting his/her head on a ceiling of the hoistway resulting from an unexpected rise of the car.

[0005] The present invention is achieved to solve the above described problems, and has an object to provide an elevator device in which a traction machine is separated into a drive device and a brake device, and the separated drive device and brake device are separately installed, thereby reducing installation space in a hoistway and facilitating maintenance work of the brake device.

Means for Solving the Problems

[0006] The present invention provides an elevator device characterized in that a traction machine is separated into a drive device and a brake device, said separated drive device is mounted to an upper return pulley mounted to a top securing portion of a hoistway, and said separated brake device is mounted to at least one of a car side suspension pulley and a counterweight side suspension pulley.

[0007] Also, the present invention provides an elevator device characterized in that a traction machine is separated into a drive device and brake devices, said separated drive device is mounted to an upper return pulley mounted to a top securing portion of a hoistway, and said separated brake devices are mounted to both a car side suspension pulley and a counterweight side suspension pulley.

[0008] Moreover, the present invention provides an elevator device characterized in that the upper return pulley to which the drive device is mounted comprises: a rotor; a main shaft integrally provided in the center of the rotor; a base body to which the main shaft and the rotor are rotatably mounted; a sheave provided in an outer periphery of the rotor; a rotor provided in an inner side surface of the outer periphery of the rotor; and a stator that is placed on an outer periphery of the base body so as to face the rotor, and said main shaft, the sheave, the rotor, and the stator are placed axially substantially in line.

[0009] Also, the present invention provides an elevator device characterized in that the suspension pulley to which the brake device is mounted comprises: a rotor; a main shaft integrally provided in the center of the rotor; a base body to which the main shaft and the rotor are rotatably mounted; a sheave provided in an outer periphery of the rotor; a brake surface formed in an inner side surface of the outer periphery of the rotor; a brake placed on an outer periphery of the base body; and a brake piece that is placed outside the brake so as to face the brake surface of said rotor, and is pressed against the brake surface by energizing said brake, and said main shaft, the sheave, the brake surface, the brake, and the brake piece are placed axially substantially in line.

[0010] Also, the present invention provides an elevator device characterized in that the suspension pulley to which the brake device is mounted comprises: a main shaft; a sheave rotatably mounted to the main shaft; a brake placed to face, from outside, a main rope wound around the sheave; and a brake piece that is placed inside the brake, and pressed against the main rope by energizing said brake, and said main shaft, the sheave, the brake, and the brake piece are placed axially substantially in line.

[0011] Moreover, the present invention provides an elevator device characterized in that the suspension pulley to which the brake device is mounted comprises: a rotor; a main shaft integrally provided in the center of the rotor; a base body to which the rotor and the main shaft are

rotatably mounted; a sheave provided in an outer periphery of the rotor and around which a main rope is wound; a brake surface formed in an inner side surface of the outer periphery of the rotor; a first brake placed on an outer periphery of the base body; a first brake piece that is placed outside the first brake so as to face the brake surface of said rotor, and is pressed against the brake surface by energizing said first brake; a second brake placed on an inner side surface of an outermost portion provided outside the outer periphery of said base body; and a second brake piece that is placed to face, from outside, the main rope wound around said sheave inside the second brake, and pressed against the main rope by energizing said second brake, and said main shaft, the sheave, the brake surface, the first brake, the first brake piece, the second brake, and the second brake piece are placed axially substantially in line.

Advantages of the Invention

[0012] In the elevator device according to the present invention, the traction machine is separated into the drive device and the brake device, and the separated drive device and brake device are separately installed in the hoistway, thereby reducing the installation space in the hoistway. Also, the separated brake device is mounted to at least one or both of the car side suspension pulley and the counterweight side suspension pulley, thereby facilitating the maintenance work of the brake device.

Brief Description of the Drawings

[0013]

Figure 1 is a side view of a conceptual structure of the whole elevator device according to First Embodiment of the present invention;
Figure 2 is a sectional view of a structure of an upper return pulley to which a drive device is mounted of a traction machine of the elevator device according to First Embodiment of the present invention;
Figure 3 is a sectional view of a structure of a car side suspension pulley to which a first brake device is mounted of the traction machine of the elevator device according to First Embodiment of the present invention;
Figure 4 is a sectional view of a counterweight side suspension pulley to which a second brake device is mounted of the traction machine of the elevator device according to First Embodiment of the present invention;
Figure 5 is a side view of the counterweight side suspension pulley to which the second brake device in Figure 4 is mounted being mounted to a counterweight; and
Figure 6 is a sectional view of a car side suspension pulley to which a first brake device and a second brake device are mounted of a traction machine of an elevator device according to Second Embodiment of the present invention.

Description of Symbols

[0014]

1	car
2	counterweight
2a	counterweight frame
2b	column
3	main rope
4	top securing portion of the hoistway
5	upper return pulley to which a drive device
6	car side suspension pulley to which a brake device
7	counterweight side suspension pulley to which a brake device
9	rotor
10, 27	main shaft
11, 28	bearing
12	base body
13, 29	sheave
14	rotor
15	stator
16	encoder
17	mounting leaf spring
18	base portion
19	brake surface
20	first brake
21	first brake piece
25	second brake
26	second brake piece

Best Mode for Carrying out the Invention

[0015] In embodiments of the present invention, a 2:1 roping type elevator device will be described by way of example.

First Embodiment

[0016]

Figure 1 is a side view of a conceptual structure of the whole elevator device according to First Embodiment of the present invention;
Figure 2 is a sectional view of a structure of an upper return pulley to which a drive device is mounted of a traction machine of the elevator device according to First Embodiment of the present invention;
Figure 3 is a sectional view of a structure of a car side suspension pulley to which a first brake device is mounted of the traction machine of the elevator device according to First Embodiment of the present invention;
Figure 4 is a sectional view of a counterweight side suspension pulley to which a second brake device

is mounted of the traction machine of the elevator device according to First Embodiment of the present invention;

Figure 5 is a side view of the counterweight side suspension pulley to which the second brake device in Figure 4 is mounted being mounted to a counterweight.

[0017] In Figure 1, a 2:1 roping type elevator device is such that a car 1 of an elevator and a counterweight 2 are provided in a hoistway so as to be moved up and down by a main rope 3. An upper return pulley 5 to which a drive device of a traction machine is mounted is secured to a top securing portion 4 of the hoistway. A car side suspension pulley 6 to which a first brake device of the traction machine is mounted is provided below the car 1. A counterweight side suspension pulley 7 to which a second brake device of the traction machine is mounted is provided on top of the counterweight 2. The main rope 3 has one end secured to the top securing portion 4 of the hoistway and suspended downward, wound around the car side suspension pulley 6, then bent upward, wound around the upper return pulley 5 secured to the top securing portion 4 of the hoistway, then again bent downward and suspended, wound around the counterweight side suspension pulley 7, and then bent upward, and the other end secured to the top securing portion 4 of the hoistway.

In First Embodiment, the brake devices are mounted to the car side suspension pulley 6 and the counterweight side suspension pulley 7, and a brake device for normal stationary holding is mounted to, for example, the car side suspension pulley 6, and a separate emergency brake device, if necessary, is mounted to, for example, the counterweight side suspension pulley 7. When the emergency brake device is not necessary, the normal brake device may be mounted to either the car side suspension pulley 6 or the counterweight side suspension pulley 7.

[0018] Figure 2 is a sectional view of a structure of an upper return pulley to which a drive device is mounted of a traction machine of the elevator device. As shown in Figure 2, the upper return pulley 5 includes: a rotor 9; a main shaft 10 integrally provided in the center of the rotor 9; a base body 12 to which the rotor 9 and the main shaft 10 are rotatably mounted via a bearing 11; a sheave 13 provided in an outer side surface of an outer periphery of the rotor 9 and around which the main rope 3 is wound; a rotor 14 secured to an inner side surface of the outer periphery of the rotor 9; a stator 15 that is placed on an outer periphery of the base body 12, faces the rotor 14, and serves as a drive source; an encoder 16 mounted coaxially with the main shaft 10; a mounting leaf spring 17 that mounts the encoder 16 to the base body 12; and a base portion 18 for securing the whole upper return pulley 5 to the top securing portion 4 of the hoistway. The main shaft 10, the sheave 13, the rotor 14, and the stator 15 are placed axially substantially in line.

[0019] Figure 3 is a sectional view of a structure of a cage side suspension pulley to which a first brake device is mounted of the traction machine of the elevator device. As shown in Figure 3, the car side suspension pulley 6 includes: a rotor 9; a main shaft 10 integrally provided in the center of the rotor 9; a base body 12 to which the rotor 9 and the main shaft 10 are rotatably mounted via a bearing 11; a sheave 13 provided in an outer side surface of an outer periphery of the rotor 9 and around which the main rope 3 is wound; a brake surface 19 formed in an inner side surface of the outer periphery of the rotor 9; a first brake 20 placed on an outer periphery of the base body 12; a first brake piece 21 that is placed outside the first brake 20, faces the brake surface 19 of the rotor 9, and is pressed against the brake surface 19 by energizing the first brake 20 to exert braking effect; and a base portion 18 for securing the whole cage side suspension pulley 6 to a lower portion of the car 1. The main shaft 10, the sheave 13, the brake surface 19, the first brake 20, and the first brake piece 21 are placed axially substantially in line.

The first brake device may be mounted to the counterweight side suspension pulley 7 with a similar structure.

[0020] Figure 4 is a sectional view of a counterweight side suspension pulley to which a second brake device is mounted of the traction machine of the elevator device. Figure 5 is a side view of the counterweight side suspension pulley to which the second brake device in Figure 4 is mounted being mounted to a counterweight. As shown in Figures 4 and 5, the counterweight side suspension pulley 7 includes: a main shaft 27; a bearing 28 mounted to an outer periphery of the main shaft 27; a sheave 29 that has an inner side to which the bearing 28 is secured, is rotatably mounted to the main shaft 27, and has rope grooves in an outer peripheral surface around which the main rope 3 is wound; a second brake 25 secured between a pair of right and left counterweight frames 2a provided on top of the counterweight 2, and placed to face the rope grooves in the outer peripheral surface of the sheave 29; and a second brake piece 26 that is placed inside the second brake 25, faces the main rope 3 wound around the rope grooves of the sheave 29, and is pressed against the main rope 3 by energizing the second brake 25 to exert braking effect. When the second brake piece 26 is moved away from the main rope 3 by deenergizing the second brake 25, the sheave 29 becomes rotatable. The counterweight frames 2a are secured to columns 2b standing at opposite sides on the counterweight 2, and thus the whole counterweight side suspension pulley 7 is secured on top of the counterweight 2.

The second brake device may be mounted to the cage side suspension pulley 6 with a similar structure.

Second Embodiment

[0021] Figure 6 is a sectional view of a cage side suspension pulley to which a first brake device and a second brake device are mounted of a traction machine of an

elevator device according to Second Embodiment of the present invention.

[0022] In Figure 6, a car side suspension pulley 6 in Second Embodiment includes: a rotor 9; a main shaft 10 integrally provided in the center of the rotor 9; a base body 12 to which the rotor 9 and the main shaft 10 are rotatably mounted via a bearing 11; a sheave 13 provided in an outer side surface of an outer periphery of the rotor 9 and around which the main rope 3 is wound; a brake surface 19 formed in an inner side surface of the outer periphery of the rotor 9; a first brake 20 placed on an outer periphery of the base body 12; a first brake piece 21 that is placed outside the first brake 20, faces the brake surface 19 of the rotor 9, and is pressed against the brake surface 19 by energizing the first brake 20 to exert braking effect; and a base portion 18 for securing the whole car side suspension pulley 6 to a lower portion of the car 1, as in First Embodiment in Figure 3. In addition to this configuration, a second brake device that brakes the main rope 3 from outside is further provided outside the sheave 13. Specifically, the second brake device includes: a second brake 25 placed on an inner side surface of an outermost portion provided outside the outer periphery of the base body 12; and a second brake piece 26 that is placed inside the second brake 25, faces the main rope 3 wound around the sheave 13, and is pressed against the main rope 3 by energizing the second brake 25 to exert braking effect. For example, the first brake 20 and the first brake piece 21 may be used for normal stationary holding of a car, and the second brake 25 and the second brake piece 26 may be used for emergency braking, or may be vice versa. The main shaft 10, the sheave 13, the brake surface 19, the first brake 20, the first brake piece 21, the second brake 25, and the second brake piece 26 are placed so that the centers of rotation thereof are axially substantially in line.

A first brake device and a second brake device may be mounted to a counterweight side suspension pulley 7 with a similar structure.

[0023] In an elevator device thus configured, the brake device for normal stationary holding and the brake device for emergency braking are placed in the same suspension pulley, thereby allowing simultaneous maintenance of both the braking devices and facilitating maintenance work.

Industrial Applicability

[0024] As described above, the elevator device according to the present invention is configured so that the traction machine is separated into the drive device and the brake device, and the separated drive device and brake device are separately installed in the hoistway, thereby reducing installation space in the hoistway and facilitating maintenance work of the brake device.

Claims

1. An elevator device **characterized in that** a traction machine is separated into a drive device and a brake device, said separated drive device is mounted to an upper return pulley mounted to a top securing portion of a hoistway, and said separated brake device is mounted to at least one of a car side suspension pulley and a counterweight side suspension pulley.

2. An elevator device **characterized in that** a traction machine is separated into a drive device and brake devices, said separated drive device is mounted to an upper return pulley mounted to a top securing portion of a hoistway, and said separated brake devices are mounted to both a car side suspension pulley and a counterweight side suspension pulley.

3. The elevator device according to claim 1 or 2, **characterized in that** the upper return pulley to which the drive device is mounted comprises: a rotor; a main shaft integrally provided in the center of the rotor; a base body to which the main shaft and the rotor are rotatably mounted; a sheave provided in an outer periphery of the rotor; a rotor provided in an inner side surface of the outer periphery of the rotor; and a stator that is placed on an outer periphery of the base body so as to face the rotor, and said main shaft, the sheave, the rotor, and the stator are placed axially substantially in line.

4. The elevator device according to claim 3, **characterized in that** the base body comprises a base portion for securing the whole upper return pulley to which the drive device is mounted to a top securing portion of the hoistway.

5. The elevator device according to claim 1 or 2, **characterized in that** the suspension pulley to which the brake device is mounted comprises: a rotor; a main shaft integrally provided in the center of the rotor; a base body to which the main shaft and the rotor are rotatably mounted; a sheave provided in an outer periphery of the rotor; a brake surface formed in an inner side surface of the outer periphery of the rotor; a brake placed on an outer periphery of the base body; and a brake piece that is placed outside the brake so as to face the brake surface of said rotor, and is pressed against the brake surface by energizing said brake, and said main shaft, the sheave, the brake surface, the brake, and the brake piece are placed axially substantially in line.

6. The elevator device according to claim 5, **characterized in that** the base body comprises a base portion for securing the whole suspension pulley to which the brake device is mounted to either a car or

a counterweight.

7. The elevator device according to claim 1 or 2, **characterized in that** the suspension pulley to which the brake device is mounted comprises: a main shaft; a sheave rotatably mounted to the main shaft; a brake placed to face, from outside, a main rope wound around the sheave; and a brake piece that is placed inside the brake, and pressed against the main rope by energizing said brake, and said main shaft, the sheave, the brake, and the brake piece are placed axially substantially in line.

8. The elevator device according to claim 1 or 2, **characterized in that** the suspension pulley to which the brake device is mounted comprises: a rotor; a main shaft integrally provided in the center of the rotor; a base body to which the rotor and the main shaft are rotatably mounted; a sheave provided in an outer periphery of the rotor and around which a main rope is wound; a brake surface formed in an inner side surface of the outer periphery of the rotor; a first brake placed on an outer periphery of the base body; a first brake piece that is placed outside the first brake so as to face the brake surface of said rotor, and is pressed against the brake surface by energizing said first brake; a second brake placed on an inner side surface of an outermost portion provided outside the outer periphery of said base body; and a second brake piece that is placed to face, from outside, the main rope wound around said sheave inside the second brake, and pressed against the main rope by energizing said second brake, and said main shaft, the sheave, the brake surface, the first brake, the first brake piece, the second brake, and the second brake piece are placed axially substantially in line.

FIG.1

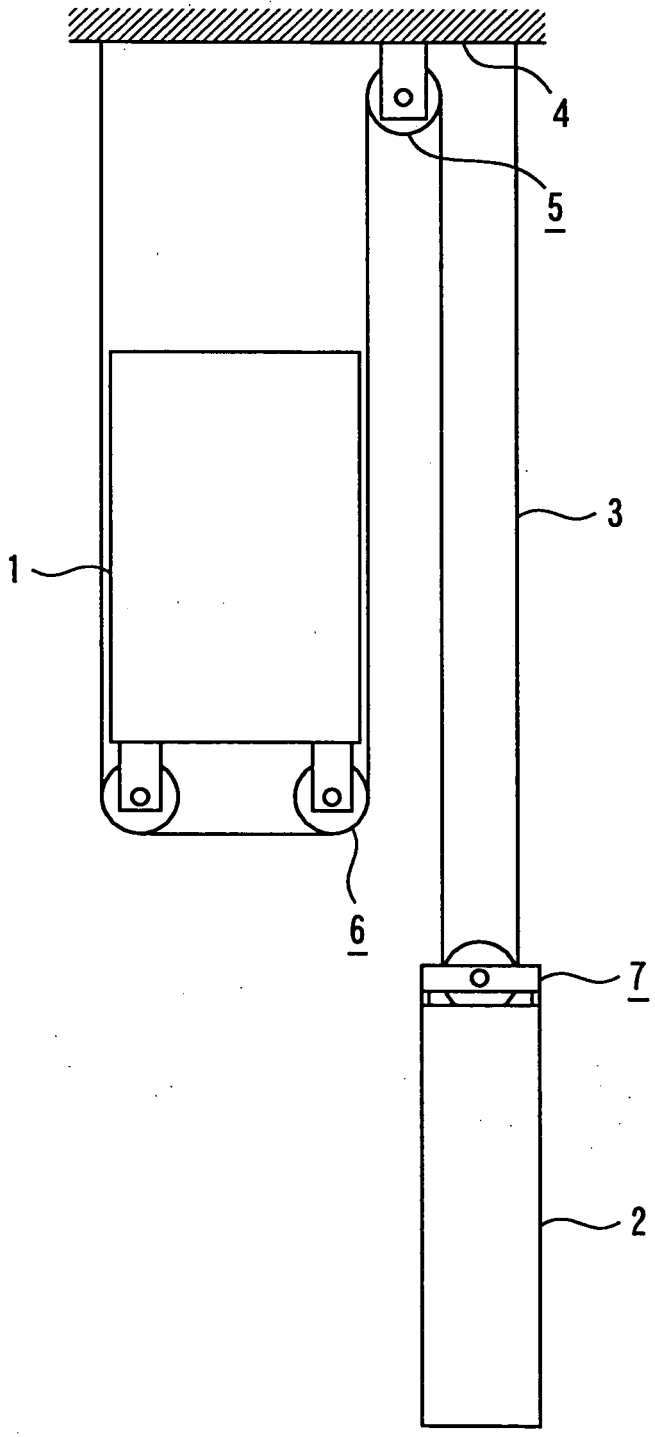


FIG.2

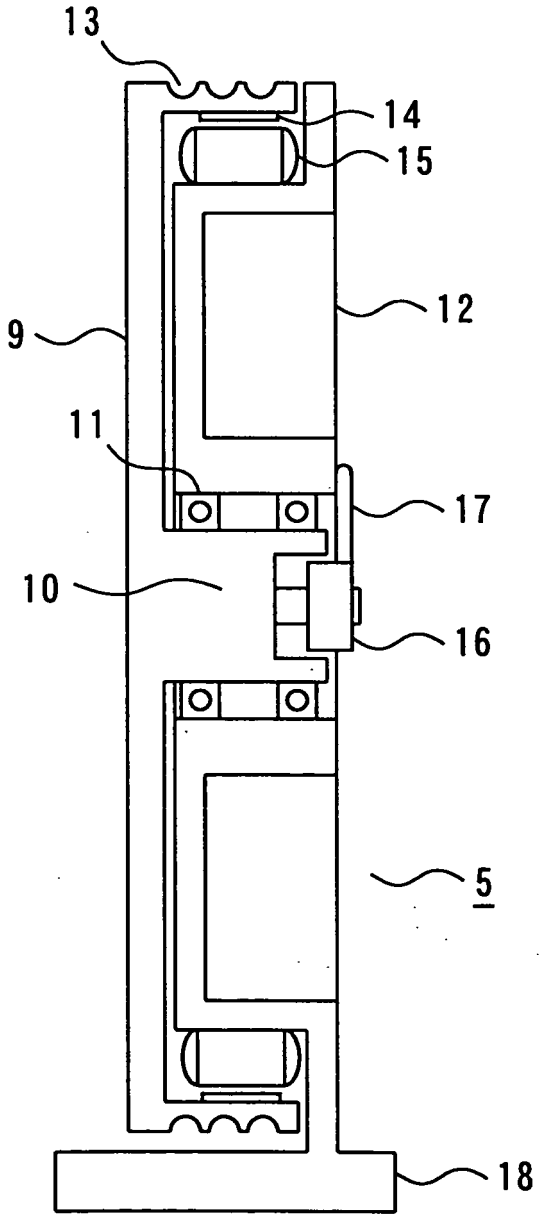


FIG.3

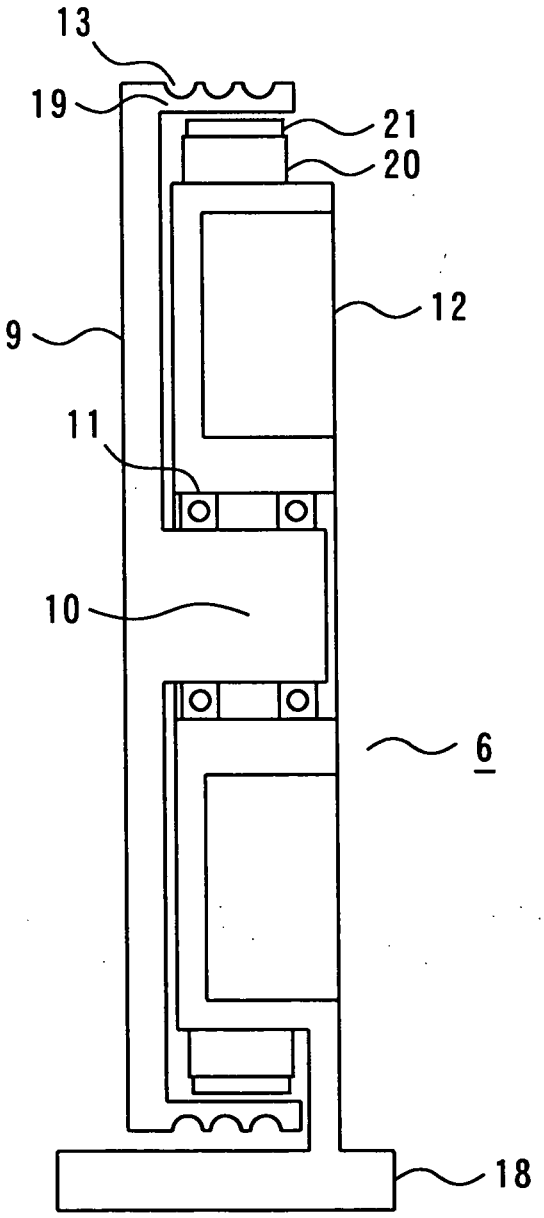


FIG.4

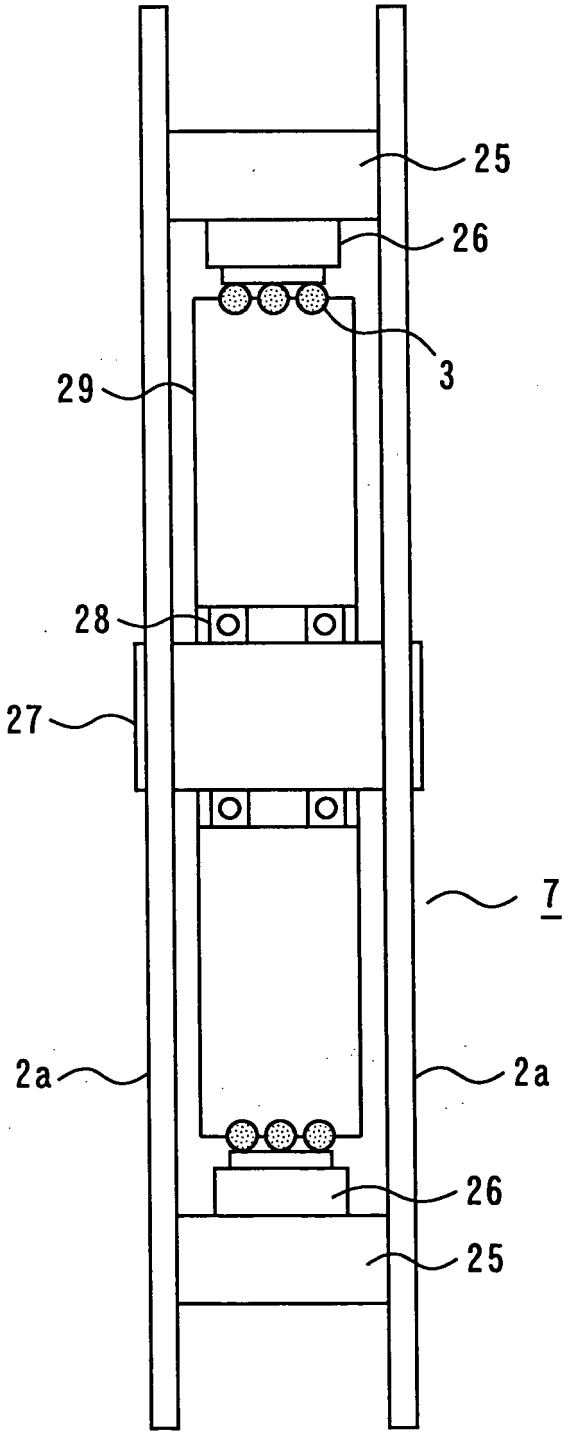


FIG.5

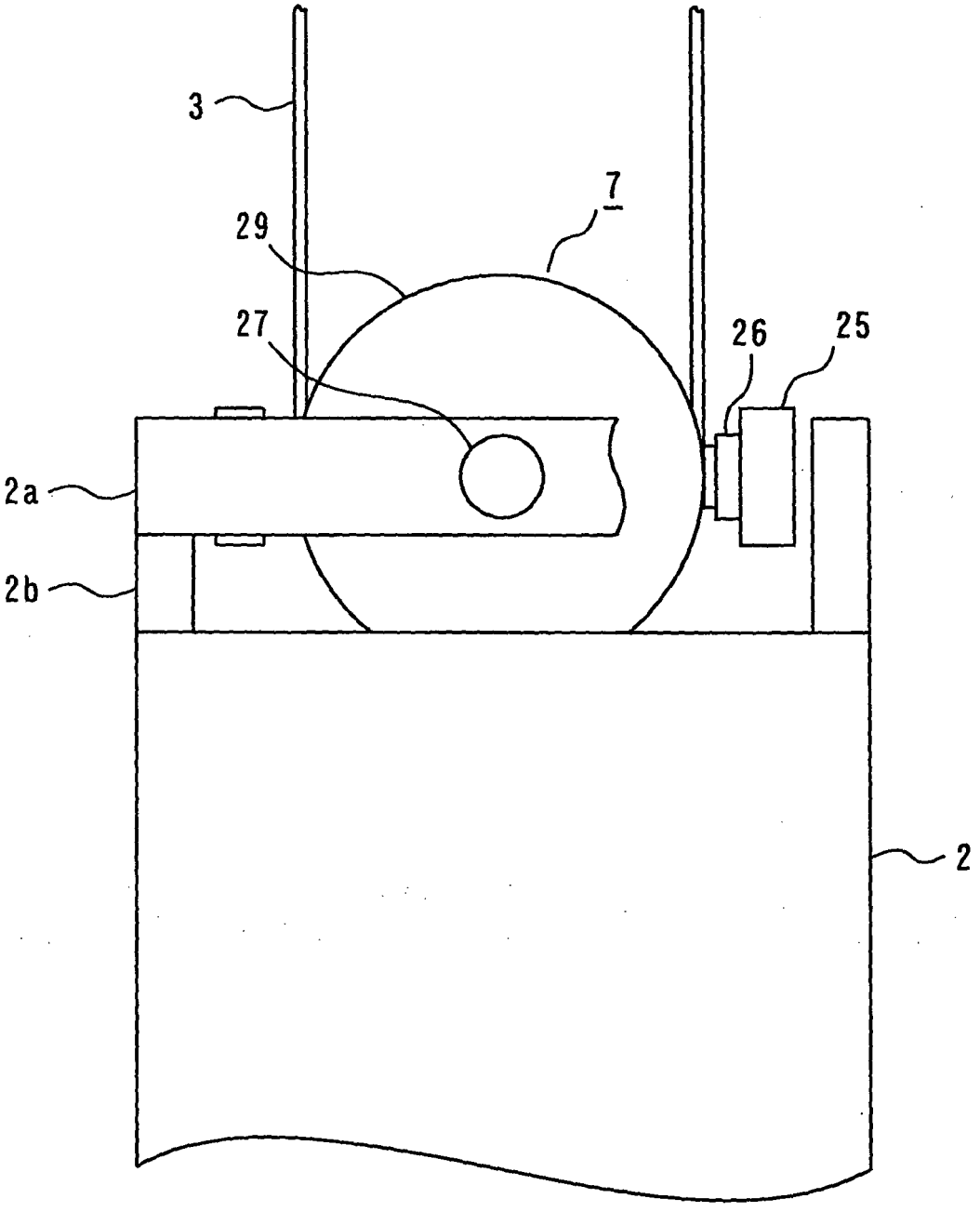
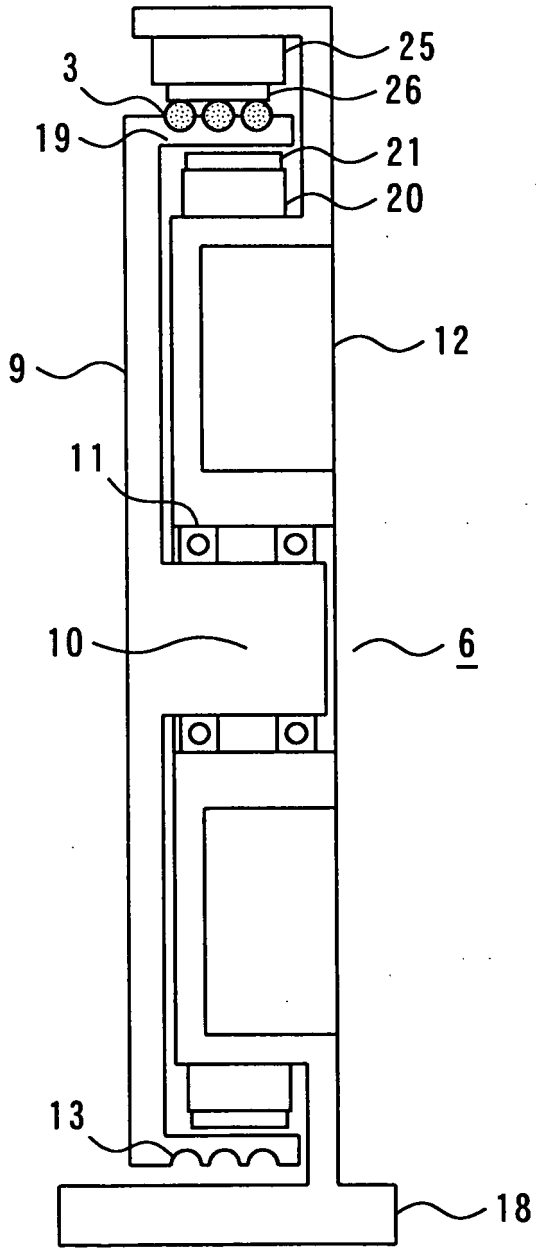


FIG.6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/013334

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B11/08

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] B66B7/00-B66B11/08

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	1996-2005
Kokai Jitsuyo Shinan Koho	1971-2005	Toroku Jitsuyo Shinan Koho	1994-2005

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.
A	JP 9-156855 A (Mitsubishi Electric Corp.), 17 June, 1997 (17.06.97), Pay attention to Par. Nos. [0042] to [0044]; Figs. 3, 7, 32 (Family: none)	1-8
A	JP 2001-39647 A (Toshiba Corp.), 13 February, 2001 (13.02.01), Pay attention to Claims; Figs. 1 to 5 (Family: none)	1-2
A	JP 7-10434 A (Kone OY), 13 January, 1995 (13.01.95), Pay attention to Par. No. [0022]; Fig. 6 & US 5429211 A & EP 0631967 A2	3-4

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

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Date of the actual completion of the international search	Date of mailing of the international search report
10 June, 2005 (10.06.05)	28 June, 2005 (28.06.05)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

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

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/013334

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 2-106590 A (Mitsubishi Electric Corp.), 18 April, 1990 (18.04.90), Pay attention to Claims; Fig. 1 (Family: none)	5-6,8
A	JP 2-310280 A (Mitsubishi Electric Corp.), 26 December, 1990 (26.12.90), Pay attention to Claims; page 4, upper right column, line 15 to lower left column, line 9; Figs. 5 to 7 (Family: none)	7-8

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 01042121 A **[0003]**
- JP 2000289954 A **[0003]**
- JP 2593288 B **[0003]**