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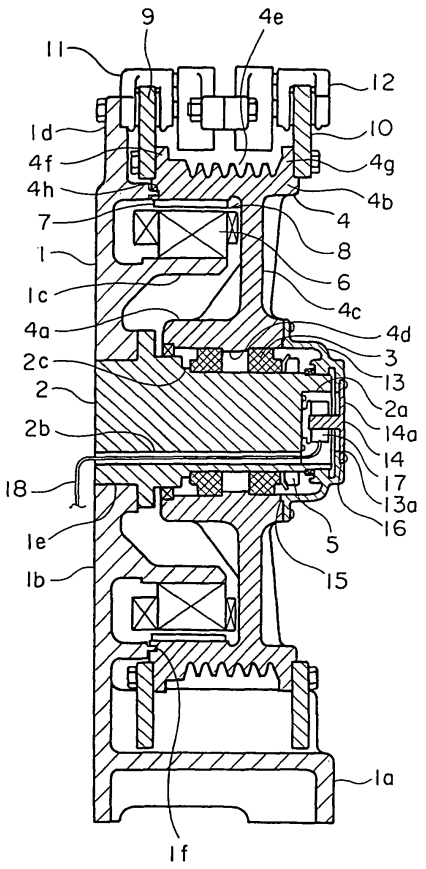
(54) **ELEVATOR HOIST**

(57) In an elevator apparatus, a cylindrical stator-mountingportion is provided to a housing. In the housing, a main shaft is provided so as to be located at the center of the stator mounting portion. A drive sheave is rotatable about the main shaft. A motor stator is mounted onto an outer peripheral portion of the stator mounting portion. A motor rotor is mounted to the drive sheave so that the motor rotor is opposed to the motor stator.

FIG. 1




EP 1 719 731 A1

## Description

Technical Field

**[0001]** The present invention relates to an elevator hoisting machine having a drive sheave around which a main rope is wound.

Background Art

**[0002]** In the conventional elevator hoisting machine disclosed in, for example, JP 2001-19322 A, the armature winding is fixed onto the outer peripheral portion of the stationary shaft fixed to the support frame. The drive sheave around which the main rope of the elevator is wound is rotatably supported by the stationary shaft and the bearing stand. A plurality of permanent magnets are fixed onto the inner peripheral surface of the drive sheave so as to be opposed to the armature winding. The drive sheave is rotated about the stationary shaft by the drive force of the motor including the armature winding and the permanent magnets.

**[0003]** Further, the brake disc that is rotated integrally with the drive sheave is fixed to one end portion of the drive sheave. The brake device main body is mounted on the bearing stand. The brake device main body pinches the brake disc to thereby brake the rotations of the brake disc and drive sheave.

**[0004]** Further, the drive sheave is provided with the detection shaft that is rotated integrally with the drive sheave. The detection shaft protrudes on the side of the bearing stand opposite from the drive sheave. An encoder for detecting the rotation of the detection shaft is mounted on the side of the bearing stand opposite from the drive sheave.

**[0005]** In the conventional elevator hoisting machine as described above, however, when a large motor output is required, it is necessary to enlarge the diameter or axial dimension of the stationary shaft in order to increase the number of armature windings, resulting in an increase in overall size.

**[0006]** Further, the encoder is arranged on the side of the bearing stand opposite from the drive sheave, so the encoder protrudes from an axial end portion of the entire hoisting machine, resulting in an increase in overall axial dimension. Further, there is a fear of the encoder being damaged by hitting other objects during transportation of the hoisting machine.

**[0007]** Further, in the case where an increased braking force is required due to an increase in motor output, the brake disc or the brake device main body must be enlarged in size, which also leads to an increase in the overall size of the hoisting machine.

Disclosure of the Invention

**[0008]** The present invention has been made to solve the above-mentioned problems, and therefore it is an object of the present invention to provide an elevator hoisting machine capable of achieving a reduction in its overall size.

**[0009]** To this end, according to one aspect of the present invention, there is provided an elevator hoisting machine comprising: a housing having a cylindrical stator mounting portion; a main shaft provided to the housing so that the main shaft is located at a center of the stator mounting portion; a cylindrical drive sheave rotatable about the main shaft; a motor stator mounted onto an outer peripheral portion of the stator mounting portion; and a motor rotor mounted to the drive sheave so that the motor rotor is opposed to the motor stator.

**[0010]** According to another aspect of the present invention, there is provided an elevator hoisting machine comprising: a housing; a main shaft fixed to the housing and having a recess provided at its one end portion; a cylindrical drive sheave rotatable about the main shaft; a motor portion for rotating the drive sheave; a detection shaft whose distal end portion is inserted into the recess and which is rotated integrally with the drive sheave; and a rotation detector disposed inside the recess, for detecting rotation of the detection shaft.

**[0011]** According to a still further aspect of the present invention, there is provided an elevator hoisting machine comprising: a housing; a cylindrical drive sheave rotatable with respect to the housing; a motor portion for rotating the drive sheave; a first brake disc and a second brake disc that are provided to the drive sheave and rotate integrally with the drive sheave; a first brake device main body provided to the housing, for pinching the first brake disc to brake rotation of the drive sheave; and a second brake device main body provided to the first brake device main body, for pinching the second brake disc to brake rotation of the drive sheave.

Brief Description of the Drawings

**[0012]**

Fig. 1 is a sectional view of an elevator hoisting machine according to an embodiment of the present invention;

Fig. 2 is a front view showing the elevator hoisting machine shown in Fig. 1;

Fig. 3 is an enlarged main-portion sectional view of Fig. 1;

Fig. 4 is a sectional view showing another example of use of the elevator hoisting machine shown in Fig. 1;

Fig. 5 is a front view showing the elevator hoisting machine shown in Fig. 4; and

Fig. 6 is a schematic diagram showing an example of an elevator apparatus employing the elevator hoisting machine shown in Fig. 1.

Best Mode for carrying out the Invention

**[0013]** Hereinbelow, preferred embodiments of the present invention will be described with reference to the drawings.

Embodiment 1

**[0014]** Fig. 1 is a sectional view of an elevator hoisting machine according to an embodiment of the present invention, Fig. 2 is a front view showing the elevator hoisting machine shown in Fig. 1, and Fig. 3 is an enlarged main-portion sectional view of Fig. 1. Here, shown as an example is a thin hoisting machine whose overall axial dimension is smaller than its dimension in the direction perpendicular to the axial direction.

**[0015]** Referring to the drawings, a housing 1 made of metal has: a base portion 1a provided at a lower end portion of the housing 1; a stand portion 1b provided on top of the base portion 1a; a cylindrical stator mounting portion 1c protruding to one side from the stand portion 1b; and a brake mounting portion 1d provided to the outer periphery of the stand portion 1b. The stand portion 1b is provided with a shaft fitting hole 1e.

**[0016]** A main shaft (which in this example is a stationary shaft) 2 is fitted in the shaft fitting hole 1e and fixed in position. A recess 2a is provided in one end portion (distal end portion) of the main shaft 2. Further, the main shaft 2 is provided with a linear wiring hole 2b extending in parallel with the axial direction of the main shaft 2. One end portion of the wiring hole 2b is open to the recess 2a. Further, the other end portion of the wiring hole 2b is open to an end face at the other end portion (proximal end portion) of the main shaft 2.

**[0017]** A drive sheave 4 is supported on the main shaft 2 through the intermediation of a plurality of bearings 3. The drive sheave 4 is rotatable about the main shaft 2. Further, the drive sheave 4 has a cylindrical bearing fitting portion 4a, and a cylindrical outer cylinder portion 4b provided so as to be radially spaced apart from the bearing fitting portion 4a, and a connecting portion 4c connecting the bearing fitting portion 4a and the outer cylinder portion 4b to each other. The bearing fitting portion 4a, the outer cylinder portion 4b, and the connecting portion 4c are formed integrally with one another.

**[0018]** The bearings 3 are interposed between the outer peripheral surface of the main shaft 2 and the inner peripheral surface of the bearing fitting portion 4a. Positioning step portions 2c, 4d for positioning the bearing 3 with respect to the axial direction of the main shaft 2 are provided in the outer peripheral surface of the main shaft 2 and in the inner peripheral surface of the bearing fitting portion 4a, respectively.

**[0019]** A plurality of rope grooves 4e are formed in the outer peripheral surface of the outer cylinder portion 4b. A plurality of main ropes for suspending a car and a counterweight are inserted into the rope grooves 4e. That is, the main ropes are wound around the outer peripheral surface of the drive sheave 4.

**[0020]** A first disc fitting portion 4f is provided at one axial end portion of the outer cylinder portion 4b. A second disc fitting portion 4g is provided at the other axial end portion of the outer cylinder portion 4b. Further, an annular groove 4h is provided in an end face at the one axial end portion of the outer cylinder portion 4b. Further, the housing 1 is provided with a ring-like, annular protrusion 1f to be inserted into the annular groove 4h.

**[0021]** Fitted onto the main shaft 2 is a stopper 5 for preventing the bearings 3 from dislodging from the main shaft 2. A motor stator 6 including an armature winding and placed in a ring-like configuration is fitted and fixed onto the outer peripheral portion of the stator mounting portion 1c. A motor rotor 7 composed of a plurality of permanent magnets is fixed onto the inner peripheral surface of the outer cylinder portion 4b so as to be opposed to the motor stator 6. The drive sheave 4 is rotated by the drive force of a motor portion 8 composed of the motor stator 6 and the motor rotor 7.

**[0022]** A first brake disc 9 is mounted to the first disc fitting portion 4f. A second brake disc 10 opposed to the first brake disc 9 is mounted to the second disc fitting portion 4g. The materials and sizes of the first and second brake discs 9, 10 are identical to each other.

**[0023]** Further, the first and second brake discs 9, 10 are respectively fixed to the disc fitting portions 4f, 4g with a plurality of bolts, and are rotated integrally with the drive sheave 4. Accordingly, the first and second brake discs 9, 10 are detachably mountable to the drive sheave 4.

**[0024]** Mounted to the brake mounting portion 1d are a plurality of (in this example, three) first brake device main bodies 11 for braking the rotation of the drive sheave 4 by pinching the first brake disc 9. Each first brake device main body 11 is fixed to the brake mounting portion 1d with a plurality of bolts.

**[0025]** Mounted to each first brake device main body 11 is a second brake device main body 12 for braking the rotation of the drive sheave 4 by pinching the second brake disc 10. Each second brake device main body 12 is fixed to the first brake device main body 11 with a plurality of bolts. Accordingly, the second brake main body 12 is detachably attachable to the first brake device main body 11.

**[0026]** Further, the second brake device main body 12 is supported on the housing 1 through the first brake device main body 11.

**[0027]** Used as the brake device main bodies 11, 12 are electromagnetic brake devices adapted to generate a braking force by pressing a brake shoe against the brake discs 9, 10 by means of the spring force of a braking spring, and to release the braking force by separating the brake shoe from the brake discs 9, 10 by means of the attraction force of an electromagnet, respectively. Further, in this embodiment, the brake device main bodies 11, 12 have the same braking capacity.

**[0028]** Further, a brake device according to this em-

bodiment has the first and second brake discs 9, 10, and the first and second brake device main bodies 11, 12.

**[0029]** Mounted to one axial end portion of the bearing fitting portion 4a is a bearing cover 13 that covers the gap between the main shaft 2 and the bearing fitting portion 4a. The bearing cover 13 is provided with an opening 13a facing the recess 2a.

**[0030]** Mounted to the bearing cover 13 is a detection shaft 14 that is rotated integrally with the drive sheave 4. The distal end portion of the detection shaft 14 is inserted into the recess 2a. The detection shaft 14 is provided with a disc-shaped cover portion 14a that covers the opening 13a.

**[0031]** Positioning step portions 15, 16 are provided in the portion of the drive sheave 4 to which the bearing cover 13 is mounted and in the portion of the bearing cover 13 to which the detection shaft 14 is mounted, respectively. The step portions 15, 16 are formed through high-precision machining. Accordingly, the detection shaft 14 is positioned at the center of the drive sheave 4 with enhanced accuracy.

**[0032]** Arranged inside the recess 2a is an encoder 17 as a rotation detector that detects the rotation of the detection shaft 14. An electric wiring (cable) 18 is connected to the encoder 17. The electric wiring 18 is led out from the other end portion of the main shaft 2 through the wiring hole 2b.

**[0033]** In the elevator hoisting machine as described above, the stator 6 is mounted to the stator mounting portion 1c provided in the housing 1, so the diameter of the stator 6 becomes large. Therefore, the number of windings on the stator 6 can be increased to thereby achieve a reduction in the thickness of the stator 6, whereby the axial dimension of the hoisting machine as a whole can be reduced to achieve miniaturization.

**[0034]** Since the hoisting machine as a whole can be thus miniaturized, the hoisting machine can be disposed even in a narrow space, so the present invention can be effectively applied to an elevator with a small machine room space or to a machine room-less elevator in which the hoisting machine is disposed within the hoistway.

**[0035]** Further, the recess 2a is provided at one end portion of the main shaft 2, and the encoder 17 is arranged within the recess 2a, whereby it is possible to reduce the axial dimension of the hoisting machine as a whole to achieve miniaturization and it is also possible to prevent the encoder 17 from being damaged.

**[0036]** Further, the detection shaft 14 is provided with the cover portion 14a that covers the opening 13a of the bearing cover 13, so the recess 2a is hermetically sealed to achieve dust and drip proof construction for the encoder 17.

**[0037]** Furthermore, the step portions 15, 16 are provided, whereby it is possible to omit the adjustment of the mounting position of the encoder 17.

**[0038]** Further, since the electric wiring 18 from the encoder 17 is led out from the other end portion of the main shaft 2 through the wiring hole 2b provided in the main shaft 2, there is no need to fix the electric wiring 18 on the outer peripheral portion of the hoisting machine, thereby facilitating the installation of the hoisting machine.

**[0039]** Further, the first and second brake discs 9, 10 are mounted to the drive sheave 4, and the second brake device main body 12 for pinching the second brake disc 10 is mounted to the first brake device main body 11 for pinching the first brake disc 9. Accordingly, a large number of the brake device main bodies 11, 12 can be disposed within a narrow space, thereby making it possible to obtain a high braking force while achieving the miniaturization of the hoisting machine.

**[0040]** Here, Fig. 4 is a sectional view showing another example of use of the elevator hoisting machine shown in Fig. 1, and Fig. 5 is a front view showing the elevator hoisting machine shown in Fig. 4. In this example, the second brake disc 10 is removed from the drive sheave 4, and the second brake device main body 12 is removed from the first brake device main body 11. Further, the number of the first brake device main bodies 11 is reduced to two.

**[0041]** Since the second brake disc 10 and the second brake device main body 12 can be detached in this way, the numbers of brake discs and brake device main bodies can be changed according to the output of the motor portion 8, thereby enabling selection of an optimum braking force.

**[0042]** While in the above-described example the hoisting machine used is a thin type hoisting machine, the present invention is also applicable to a hoisting machine whose overall axial dimension is larger than its dimension in the direction perpendicular to the axial direction.

**[0043]** Further, while in the above-described example two brake discs are provided, more than three discs can also be provided while being spaced from each other in the axial direction of the drive sheave. When, for example, a third brake disc is provided to the drive sheave, a third brake device main body for pinching the third brake disc may be mounted to the second brake device main body.

**[0044]** Further, while in the above-described example the main shaft 2 is fixed to the housing 1, the drive sheave may be fixed to the main shaft, the main shaft being rotatably supported by the housing.

**[0045]** Here, Fig. 6 is a schematic diagram showing an example of an elevator apparatus employing the elevator hoisting machine shown in Fig. 1. Referring to the drawing, a machine room 22 is provided in an upper portion of a hoistway 21. A machine base 23 is disposed on the floor portion of the machine room 22. An elevator hoisting machine 24 and a deflector sheave 25 are mounted on the machine base 22. A control panel 26 for controlling the elevator hoisting machine 24 is disposed within the machine room 22.

**[0046]** A plurality of main ropes 27 (only one of which is shown in the drawing) are wound around the drive

sheave 4 of the elevator hoisting machine 24 and around the deflector sheave 25. A car 28 is connected to a first end portion of each main rope 27. A counterweight 29 is connected to a second end portion of each main rope 27. The car 28 and the counterweight 29 are suspended within the hoistway 21 by the main ropes 27 according to a 1:1 roping system. A car buffer 30 and a counterweight buffer (not shown) are disposed in a lower portion (bottom portion) of the hoistway 21.

**[0047]** While in Fig. 6 the elevator hoisting machine 24 is disposed within the machine room 22, the present invention is also applicable to a machine room-less elevator in which the elevator hoisting machine is arranged within the hoistway. In this case, the elevator hoisting machine can be disposed in an upper or lower portion of the hoistway.

**[0048]** Further, the elevator hoisting machine may be disposed such that the rotation shaft of the drive sheave becomes horizontal or such that it becomes vertical or substantially vertical.

## Claims

**1.** An elevator hoisting machine comprising:

a housing having a cylindrical stator mounting portion;
a main shaft provided to the housing so that the main shaft is located at a center of the stator mounting portion;
a cylindrical drive sheave rotatable about the main shaft;
a motor stator mounted onto an outer peripheral portion of the stator mounting portion; and
a motor rotor mounted to the drive sheave so that the motor rotor is opposed to the motor stator.

**2.** An elevator hoisting machine comprising:

a housing;
a main shaft fixed to the housing and having a recess provided at its one end portion;
a cylindrical drive sheave rotatable about the main shaft;
a motor portion for rotating the drive sheave;
a detection shaft whose distal end portion is inserted into the recess and which is rotated integrally with the drive sheave; and
a rotation detector disposed inside the recess, for detecting rotation of the detection shaft.

**3.** An elevator hoisting machine according to Claim 2, wherein:

the drive sheave is supported on the main shaft through a bearing; and a bearing cover for covering a gap between the main shaft and the drive sheave is attached to one axial end portion of the drive sheave, the detection shaft being attached to the bearing cover.

**4.** An elevator hoisting machine according to Claim 3, wherein:

the bearing cover is provided with an opening facing the recess 2a; and the detection shaft is provided with a cover portion that covers the opening.

**5.** An elevator hoisting machine according to Claim 2, wherein the rotation detector is connected with an electric wiring, the electric wiring being led out from the other end portion of the main shaft through a wiring hole provided in the main shaft.

**6.** An elevator hoisting machine comprising:

a housing;
a cylindrical drive sheave rotatable with respect to the housing;
a motor portion for rotating the drive sheave;
a first brake disc and a second brake disc that are provided to the drive sheave and rotate integrally with the drive sheave;
a first brake device main body provided to the housing, for pinching the first brake disc to brake rotation of the drive sheave; and
a second brake device main body provided to the first brake device main body, for pinching the second brake disc to brake rotation of the drive sheave.

**7.** An elevator hoisting machine according to Claim 6, wherein:

the second brake disc is detachably attachable to the drive sheave; and the second brake device main body is detachably attachable to the first brake device main body.

FIG. 1

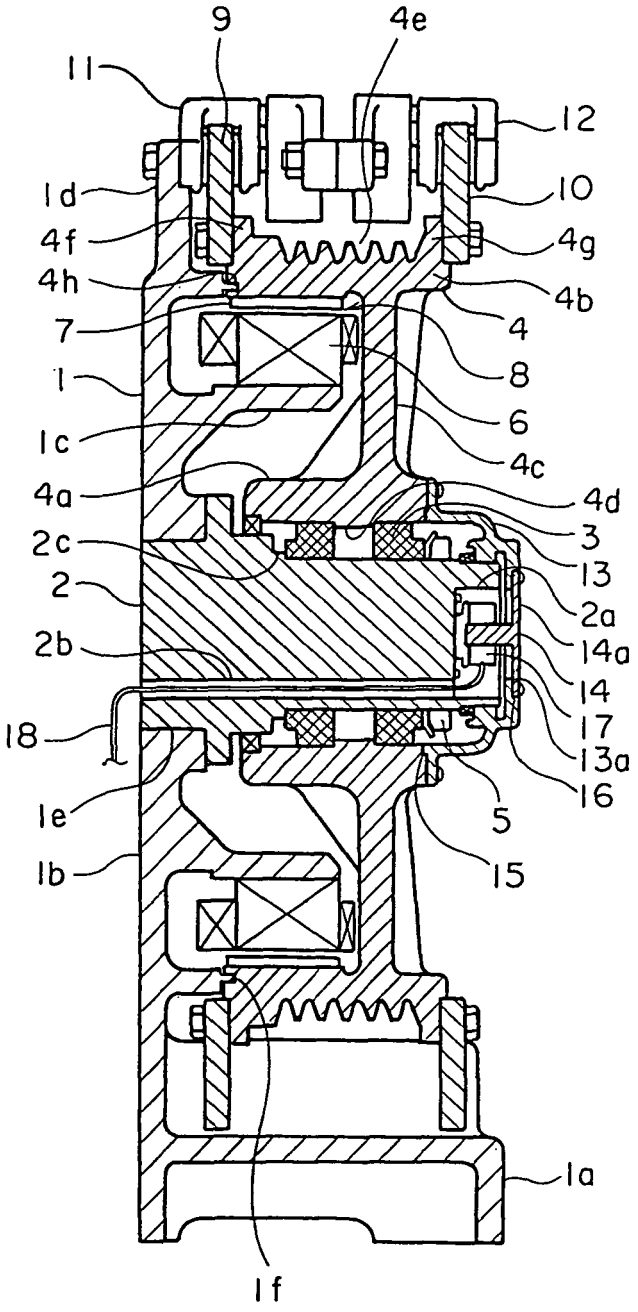

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FIG. 2

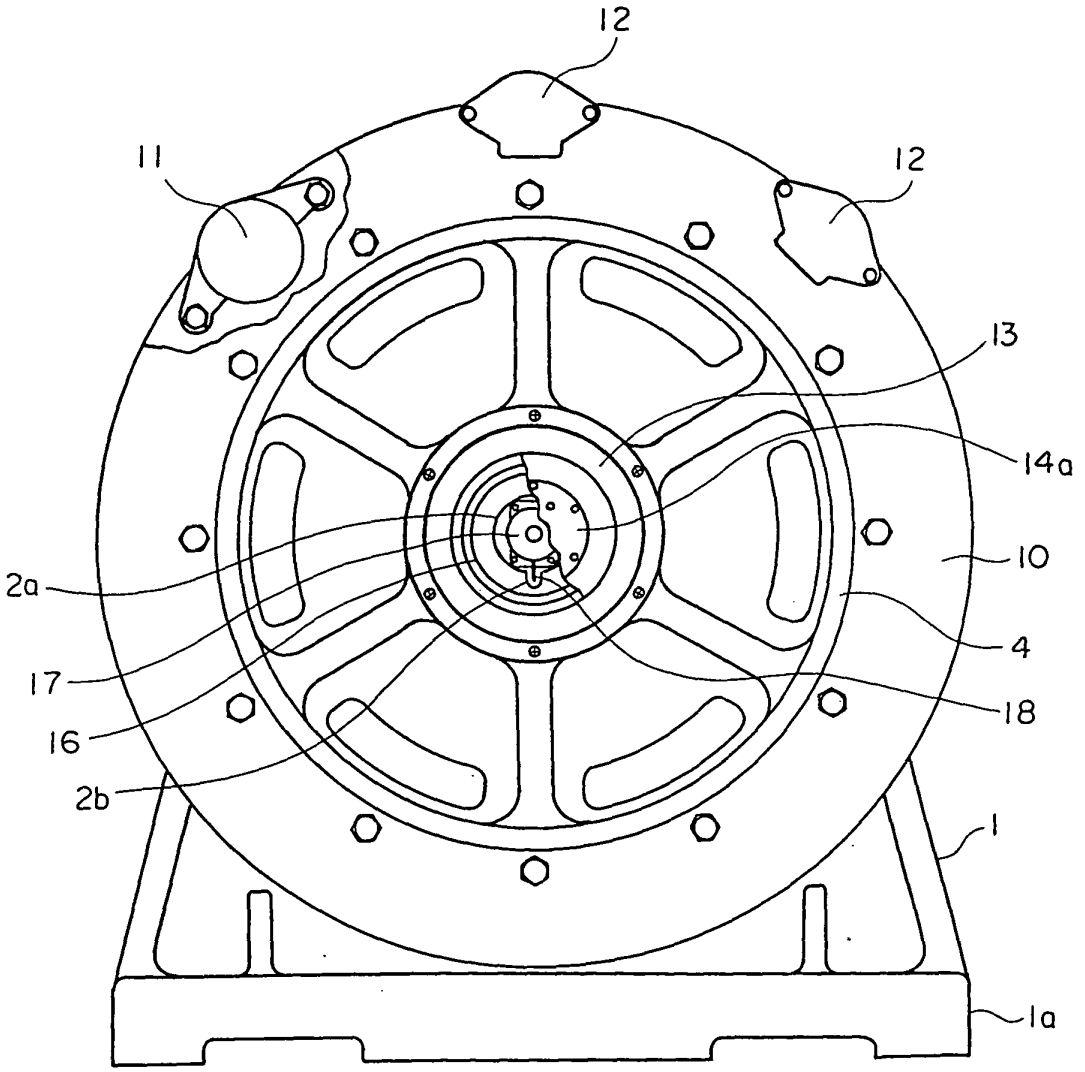

FIG. 3

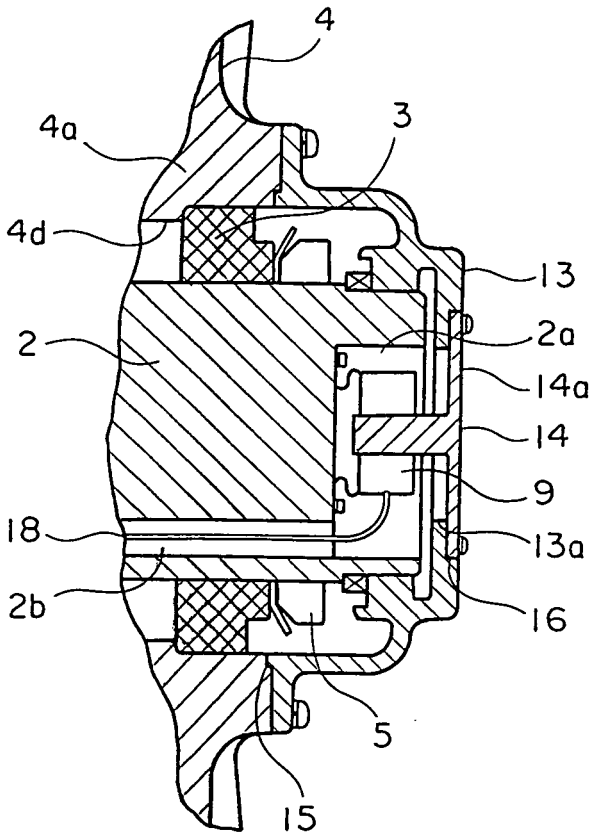

FIG. 4

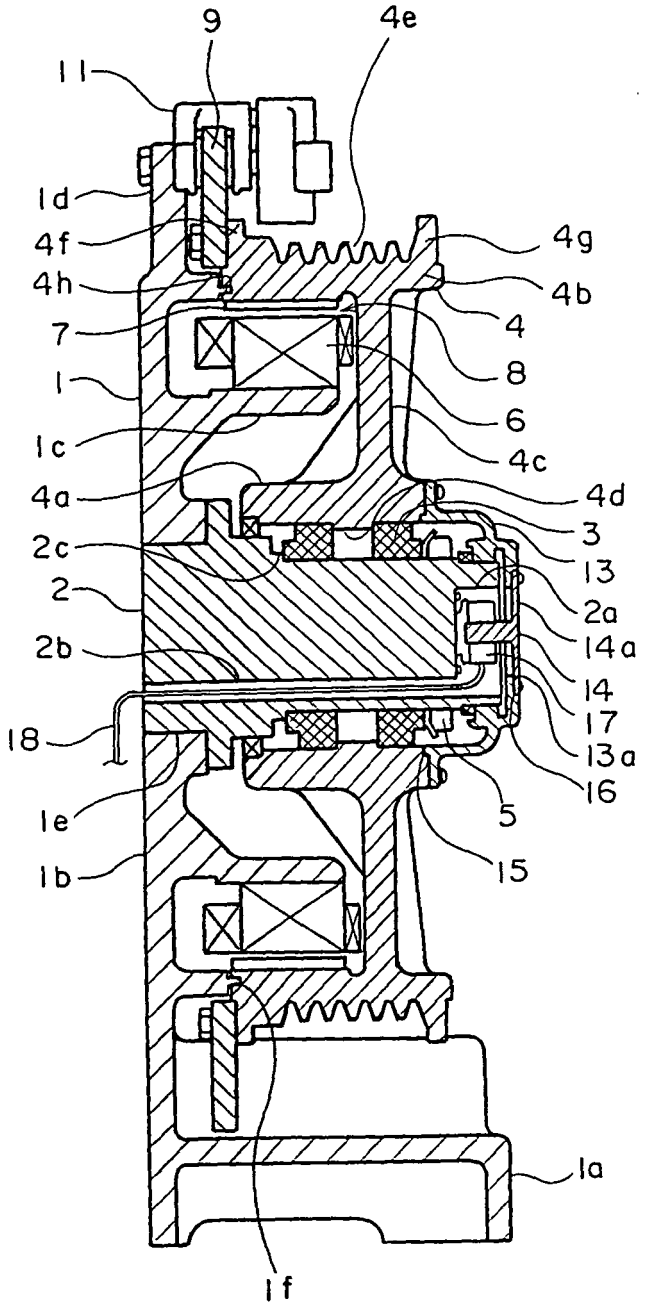
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FIG. 5

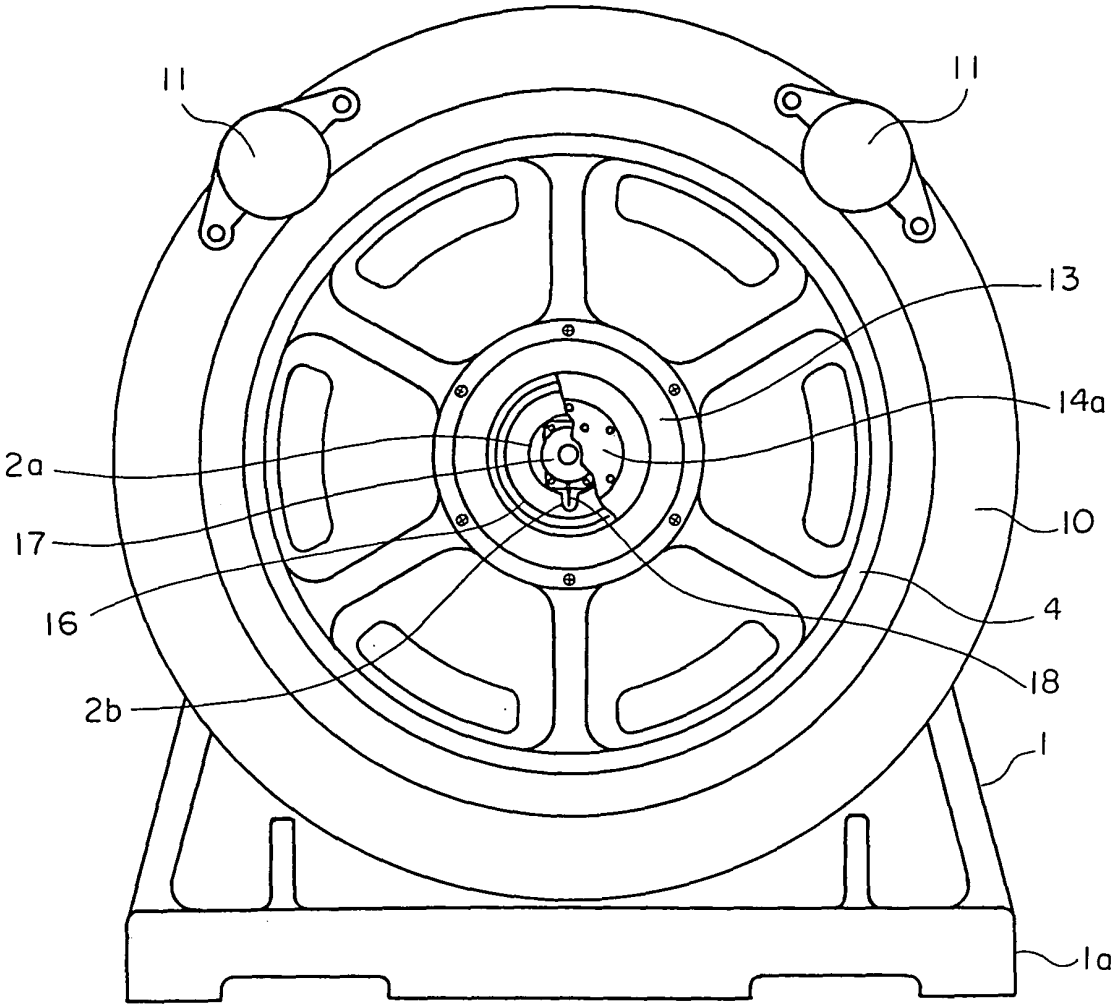
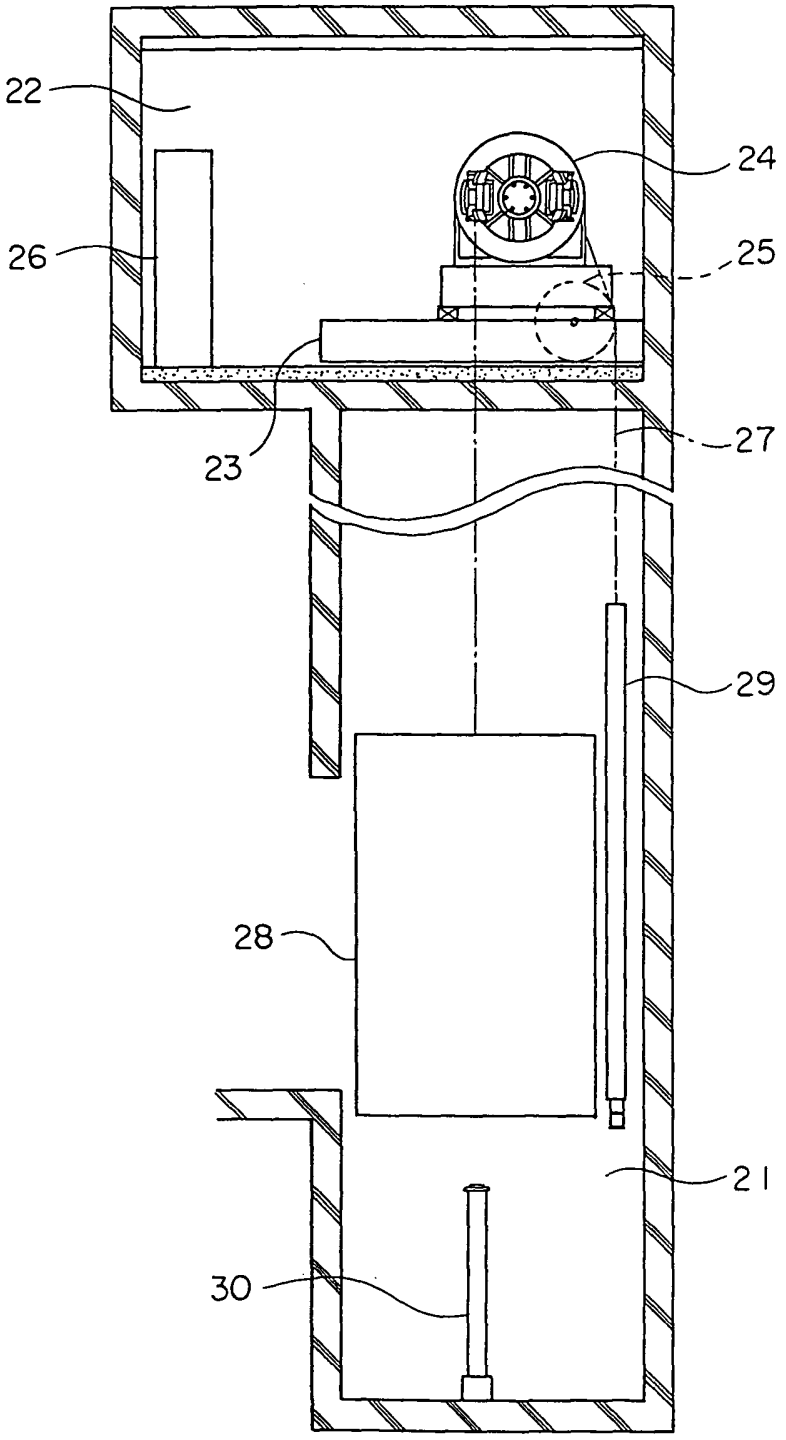


FIG. 6



**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2004/002172

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] B66B11/00-11/08, B66D5/00-5/34

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<br>Y | JP 2-62394 A (Mitsubishi Electric Corp.),<br>02 March, 1990 (02.03.90),<br>(Family: none) | 1<br>6-7 |
| X | JP 2000-86127 A (Hitachi, Ltd.),<br>28 March, 2000 (28.03.00),<br>(Family: none) | 2-5 |
| Y | JP 4-28695 A (Shikoku Kenki Kabushiki Kaisha),<br>31 January, 1992 (31.01.92),<br>Page 5, upper right column, line 11 to lower left column, line 20; Fig. 2.<br>(Family: none) | 6-7 |

☒ 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<br>14 May, 2004 (14.05.04) | Date of mailing of the international search report<br>01 June, 2004 (01.06.04) |
| Name and mailing address of the ISA/<br>Japanese Patent Office<br><br>Facsimile No. | Authorized officer<br><br>Telephone No. |

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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2004/002172

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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## REFERENCES CITED IN THE DESCRIPTION

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