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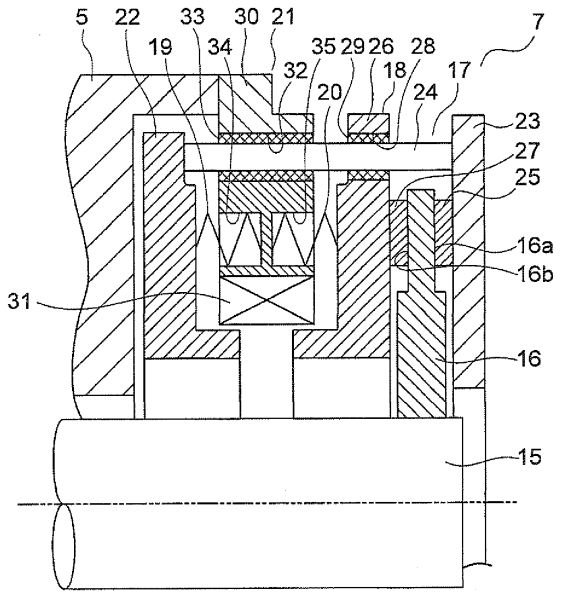
(54) BRAKE DEVICE FOR ELEVATOR HOIST

(57) A first displacing body includes: a first movable core; a driven body that is disposed so as to be separated from the first movable core; and a first lining that is disposed on a surface of the driven body near the first movable core. A rotating body is interposed between the first movable core and the first lining. A second displacing body includes: a second movable core that is disposed between the first movable core and the rotating body; and a second lining that is disposed on a surface of the second movable core near the rotating body. The first displacing body is forced by a first forcing body in a direction in which the first lining contacts the rotating body, and the second displacing body is forced by a second forcing body in a direction in which the second lining contacts the rotating body. A common electromagnet is disposed between the first and second movable cores. The electromagnet displaces the first and second movable cores in directions in which the first and second linings separate from the rotating body in opposition to the forces from the first and second forcing bodies.

FIG. 2



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Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator hoisting machine braking apparatus that is disposed on a hoisting machine that has a driving sheave around which is wound a rope or belt that suspends a car, and that brakes rotation of the driving sheave.

BACKGROUND ART

[0002] Conventionally, in order to apply a braking force to a rotor that is rotated together with a driving sheave, elevator hoisting machine electromagnetic brakes have been proposed in which two large and small annular armatures that are disposed coaxially to each other are made to perform braking operations on the rotor independently from each other. Each of the armatures is respectively pressed against the rotor by a force from a separate helical spring. Improvements in the operational reliability of the electromagnetic brake can thereby be achieved by enabling the braking forces from each of the armatures to be generated independently from each other (See Patent Literature 1).

CITATION LIST

PATENT LITERATURE

[0003]

[Patent Literature 1]
Japanese Patent Laid-Open No. 2000-211858 (Gazette)

SUMMARY OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0004] However, because the small armature has a smaller diameter than the large armature, sufficient braking force is less likely to be obtained if braking force is applied to the rotor from only the small armature. Strengthening the force from the helical spring that displaces the small armature in order to ensure the braking force from only the small armature is also conceivable, but problems arise such as the helical spring being enlarged, or impact noise increasing when the small armature contacts the rotor, etc.

[0005] The present invention aims to solve the above problems and an object of the present invention is to provide an elevator hoisting machine braking apparatus that can ensure braking operation reliability and that can also enable size reductions.

MEANS FOR SOLVING THE PROBLEM

[0006] In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator hoisting machine braking apparatus characterized in including: a rotating body that is rotated together with a rotating shaft; a first displacing body including: a first movable core; a driven body that is disposed so as to be separated from the first movable core; and a first lining that is disposed on a surface of the driven body near the first movable core, the rotating body being interposed between the first movable core and the first lining, and the first displacing body being displaceable in a direction in which the first lining contacts with and separates from the rotating body; a second displaying body including: a second movable core that is disposed between the first movable core and the rotating body; and a second lining that is disposed on a surface of the second movable core near the rotating body, the second displacing body being displaceable in a direction in which the second lining contacts with and separates from the rotating body; a first forcing body that forces the first displacing body in the direction in which the first lining contacts the rotating body; a second forcing body that forces the second displacing body in the direction in which the second lining contacts the rotating body; and a common electromagnet that is disposed between the first and second movable cores, and that displaces the first and second movable cores in the directions in which the first and second linings separate from the rotating body in opposition to the forces from the first and second forcing bodies.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Figure 1 is a block diagram that shows an elevator apparatus according to Embodiment 1 of the present invention;
Figure 2 is a longitudinal cross section that shows a braking apparatus from Figure 1;
Figure 3 is a front elevation that shows the braking apparatus from Figure 2;
Figure 4 is a longitudinal cross section that shows a state of the braking apparatus from Figure 1 when braking force on a driving sheave is released;
Figure 5 is a longitudinal cross section that shows an elevator hoisting machine braking apparatus according to Embodiment 2 of the present invention;
Figure 6 is a longitudinal cross section that shows an elevator hoisting machine braking apparatus according to Embodiment 3 of the present invention; and
Figure 7 is a longitudinal cross section that shows a state of the braking apparatus from Figure 6 when braking force on a rotating shaft is released.

DESCRIPTION OF EMBODIMENTS

[0008] Preferred embodiments of the present invention will now be explained with reference to the drawings.

Embodiment 1

[0009] Figure 1 is a block diagram that shows an elevator apparatus according to Embodiment 1 of the present invention. In the figure, a car 2 and a counterweight 3 are disposed so as to be able to be raised and lowered inside a hoistway 1. A hoisting machine 4 that generates a driving force that raises and lowers the car 2 and the counterweight 3 inside the hoistway 1 is disposed in a bottom portion (a pit portion) of the hoistway 1.

[0010] The hoisting machine 4 has: a hoisting machine main body 5 that includes a motor; a driving sheave 6 that is rotated by the hoisting machine main body 5; and a braking apparatus (an elevator hoisting machine braking apparatus) 7 that brakes the rotation of the driving sheave 6. The car 2 and the counterweight 3 are suspended inside the hoistway 1 by a plurality of suspending bodies 8 that are wound around the driving sheave 6. Ropes or belts, for example, are used as the suspending bodies 8.

[0011] A car return sheave 9, a counterweight return sheave 10, a first rope fastening apparatus 11, and a second rope fastening apparatus 12 are disposed in an upper portion inside the hoistway 1. A pair of car suspending sheaves 13 are disposed on a lower portion of the car 2. A counterweight suspending sheave 14 is disposed on an upper portion of the counterweight 3.

[0012] First end portions of the suspending bodies 8 are connected to the first rope fastening apparatus 11, and second end portions of the suspending bodies 8 are connected to the second rope fastening apparatus 12. The suspending bodies 8 are wound from the first rope fastening apparatus 11 sequentially around each of the car suspending sheaves 13, the car return sheave 9, the driving sheave 6, the counterweight return sheave 10, and the counterweight suspending sheave 14 to reach the second rope fastening apparatus 12. The car 2 and the counterweight 3 can be raised and lowered inside the hoistway 1 by rotation of the driving sheave 6.

[0013] Figure 2 is a longitudinal cross section that shows the braking apparatus 7 from Figure 1. Figure 3 is a front elevation that shows the braking apparatus 7 from Figure 2. In addition, Figure 4 is a longitudinal cross section that shows a state of the braking apparatus 7 from Figure 1 when braking force on the driving sheave 6 is released. Moreover, Figure 2 shows a state of the braking apparatus 7 when braking force on the driving sheave 6 is generated. In the figures, the braking apparatus 7 is supported by a casing of the hoisting machine main body 5. The braking apparatus 7 brakes the driving sheave 6 by applying the braking force to the rotating shaft 15 of the motor in the hoisting machine main body 5.

[0014] The braking apparatus 7 has: a brake disk (a rotating body) 16 that is rotated together with the rotating shaft 15; a first displacing body 17 and a second displacing body 18 that are each independently displaceable in directions of contact with and separation from the brake disk 16; a plurality of (in this example, four) first forcing springs (first forcing bodies) 19 that force the first displacing body 17 toward the brake disk 16; a plurality of (in this example, four) second forcing springs (second forcing bodies) 20 that force the second displacing body 18 toward the brake disk 16; and a common electromagnet 21 that is mounted to the hoisting machine main body 5, and that displaces each of the first and second displacing bodies 17 and 18 in opposition to the forces from the first and second forcing springs 19 and 20.

[0015] The brake disk 16 is a disk-shaped member that is disposed so as to be perpendicular to a shaft axis of the rotating shaft 15. The brake disk 16 is fixed to the rotating shaft 15. A first braking surface 16a and a second braking surface 16b that are mutually parallel are disposed on the brake disk 16. The first and second braking surfaces 16a and 16b are formed at positions that are on opposite sides of the brake disk 16 in a thickness direction of the brake disk 16. In this example, the first and second braking surfaces 16a and 16b are perpendicular to the shaft axis of the rotating shaft 15.

[0016] The first displacing body 17 has: a first movable core 22; an end plate (a driven body) 23 that is disposed so as to be separated from the first movable core 22; a plurality of (in this example, four) guiding pins (linking members) 24 that link the first movable core 22 and the end plate 23; and a first lining 25 that is disposed on a surface of the end plate 23 near the first movable core 22.

[0017] The first movable core 22 and the end plate 23 are disposed so as to be separated from each other in a direction that is parallel to the shaft axis of the rotating shaft 15. The first movable core 22 and the end plate 23 are annular members that are centered around the shaft axis of the rotating shaft 15.

[0018] Each of the guiding pins 24 is a rod-shaped member that is disposed so as to be parallel to the shaft axis of the rotating shaft 15 so as to avoid the brake disk 16. The respective guiding pins 24 are fixed between the first movable core 22 and the end plate 23. In addition, the respective guiding pins 24 are disposed at regular intervals in a circumferential direction of the first movable core 22 and the end plate 23.

[0019] The first displacing body 17 is supported by the electromagnet 21 with the respective guiding pins 24 passed through the electromagnet 21. The first displacing body 17 is disposed at a position at which the brake disk 16 is interposed between the first movable core 22 and the first lining 25.

[0020] The respective guiding pins 24 are slidable relative to the electromagnet 21. The first displacing body 17 is displaced in the direction that is parallel to the shaft axis of the rotating shaft 15 by the sliding of the respective guiding pins 24 relative to the electromagnet 21. The first lining 25 is placed in contact with and separated from the

first braking surface 16a of the brake disk 16 by the first displacing body 17 being displaced in the direction that is parallel to the shaft axis of the rotating shaft 15.

[0021] The second displacing body 18 has: a second movable core 26 that is disposed between the first movable core 22 and the brake disk 16; and a second lining 27 that is disposed on a surface of the second movable core 26 near the brake disk 16. The second displacing body 18 is displaceable relative to the first displacing body 17 along the guiding pins 24. Consequently, the second displacing body 18 is displaceable independently from the first displacing body 17 in the direction that is parallel to the shaft axis of the rotating shaft 15. The second lining 27 is placed in contact with and separated from the second braking surface 16b of the brake disk 16 by the second displacing body 18 being displaced in the direction that is parallel to the shaft axis of the rotating shaft 15.

[0022] The second movable core 26 is an annular member that is centered around the shaft axis of the rotating shaft 15. A plurality of penetrating apertures 28 are disposed on the second movable core 26 so as to be aligned with the positions of the respective guiding pins 24. Tubular bushes 29 through which the guiding pins 24 are slidably passed are fitted into the respective penetrating apertures 28. The second displacing body 18 is thereby made displaceable along the guiding pins 24.

[0023] The electromagnet 21 is disposed between the first movable core 22 and the second movable core 26. The electromagnet 21 is an annular body that is centered around the shaft axis of the rotating shaft 15. In addition, the electromagnet 21 has: a stator core 30 that is fixed to the hoisting machine main body 5; and a brake coil 31 that is disposed on the stator core 30.

[0024] A plurality of penetrating apertures 32 are disposed on the stator core 30 so as to be aligned with the positions of the respective guiding pins 24. Tubular bushes 33 through which the guiding pins 24 are slidably passed are fitted into the respective penetrating apertures 32. The first displacing body 17 is thereby made displaceable relative to the electromagnet 21 in the direction that is parallel to the shaft axis of the rotating shaft 15.

[0025] A plurality of first recess portions (first spring bearing portions) 34 are disposed on a surface of the stator core 30 near the first movable core 22. A plurality of second recess portions (second spring bearing portions) 35 are disposed on a surface of the stator core 30 near the second movable core 26. The first and second recess portions 34 and 35 are disposed at regular intervals in a circumferential direction of the electromagnet 21.

[0026] The first forcing springs 19 are respectively disposed in the first recess portions 34. The respective first forcing springs 19 are compressed between the electromagnet 21 and the first movable core 22. The first displacing body 17 is forced by the elastic forces of recovery of the respective first forcing springs 19 in a direction in which the first lining 25 contacts the first braking surface 16a.

[0027] The second forcing springs 20 are respectively disposed in the second recess portions 35. The respective second forcing springs 20 are compressed between the electromagnet 21 and the second movable core 26. The second displacing body 18 is forced by the elastic forces of recovery of the respective second forcing springs 20 in a direction in which the second lining 27 contacts the second braking surface 16b.

[0028] When an electric current is passed to the brake coil 31, the electromagnet 21 generates an electromagnetic attractive force that attracts the respective first and second movable cores 22 and 26. The first and second movable cores 22 and 26 are thereby displaced toward the electromagnet 21 in opposition to the forces from the first and second forcing springs 19 and 20. The first lining 25 is separated from the first braking surface 16a by the first movable core 22 being displaced toward the electromagnet 21, and the second lining 27 is separated from the second braking surface 16b by the second movable core 26 being displaced toward the electromagnet 21.

[0029] In other words, when an electric current is passed to the brake coil 31, the electromagnet 21 displaces the first displacing body 17 in a direction in which the first lining 25 separates from the first braking surface 16a in opposition to the forces from the first forcing springs 19, and displaces the second displacing body 18 in a direction in which the second lining 27 separates from the second braking surface 16b in opposition to the forces from the second forcing springs 20.

[0030] Braking force is applied to the rotating shaft 15 by at least one of the first and second linings 25 and 27 contacting the brake disk 16. The braking force that is applied to the rotating shaft 15 is released by both of the first and second linings 25 and 27 separating from the brake disk 16.

[0031] Next, operation will be explained. When passage of an electric current to the brake coil 31 is stopped, the first lining 25 is pressed against the first braking surface 16a by the forces from the respective first forcing springs 19, and the second lining 27 is pressed against the second braking surface 16b by the forces from the respective second forcing springs 20. Braking force is thereby applied to the rotating shaft 15 and the brake disk 16.

[0032] When the electric current is passed to the brake coil 31, the electromagnet 21 generates an electromagnetic attractive force. The first movable core 22 is thereby displaced toward the electromagnet 21 in opposition to the forces from the respective first forcing springs 19, and the second movable core 26 is displaced toward the electromagnet 21 in opposition to the forces from the respective second forcing springs 20. The first lining 25 thereby separates from the first braking surface 16a, and the second lining 27 separates from the second braking surface 16b. When the first and second linings 25 and 27 separate from the first and second braking surfaces

16a and 16b, respectively, the braking force on the rotating shaft 15 and the brake disk 16 is released.

[0033] If, for example, a sliding failure of the guiding pins 24 through the bushes 33 occurs in a state in which the first lining 25 is separated from the first braking surface 16a, and displacement of the first displacing body 17 relative to the brake disk 16 becomes impossible, only the second lining 27 is pressed against the second braking surface 16b by the forces from the respective second forcing springs 20. A braking force is thereby applied to the rotating shaft 15 and the brake disk 16.

[0034] If, on the other hand, displacement of the second displacing body 18 relative to the brake disk 16 becomes impossible, only the first lining 25 is pressed against the first braking surface 16a by the forces from the respective first forcing springs 19. A braking force is thereby applied to the rotating shaft 15 and the brake disk 16.

[0035] In an elevator hoisting machine braking apparatus of this kind, because the brake disk 16 is interposed between the first movable core 22 and the first lining 25 of the first displacing body 17, and the second movable core 26 and the second lining 27 of the second displacing body 18 are disposed between the brake disk 16 and the first movable core 22, the first and second linings 25 and 27 can be pressed against the brake disk 16 from two sides in the thickness direction of the brake disk 16 by displacing the first and second displacing bodies 17 and 18 in opposite directions to each other. The respective positions at which the first and second linings 25 and 27 contact the brake disk 16 can thereby be set to positions at which the distances from the shaft axis of the rotating shaft 15 are equal to each other, Consequently, even if only one of the first and second linings 25 and 27 contacts the brake disk 16, a difference can be prevented from arising in the magnitude of the braking force that is applied to the rotating shaft 15 due to differences in the first and second linings 25 and 27, enabling braking operation reliability of the braking apparatus 7 to be ensured. Because distances between the respective positions of the first and second linings 25 and 27 and the shaft axis of the rotating shaft 15 can be made equal to each other, size reductions in the radial direction of the braking apparatus 7 can be achieved.

[0036] Moreover, in the above example, the first forcing springs 19 are disposed between the electromagnet 21 and the first movable core 22, but the first forcing springs 19 are not limited to this position. The first forcing springs 19 may also be disposed between the first movable core 22 and separate fixed members that are fixed to the hoisting machine main body 5, for example.

[0037] In the above example, the second forcing springs 20 are disposed between the electromagnet 21 and the second movable core 26, but the second forcing springs 20 are not limited to this position, either. The second forcing springs 20 may also be disposed between the second movable core 26 and separate fixed members that are fixed to the hoisting machine main body 5, for example.

[0038] In the above example, the second movable core 26 is guided along the guiding pins 24, but the second movable core 26 may also be guided along a separate rod-shaped member that is parallel to the guiding pins 24.

Embodiment 2

[0039] Figure 5 is a longitudinal cross section that shows an elevator hoisting machine braking apparatus according to Embodiment 2 of the present invention. Moreover, Figure 5 is a figure that shows a state of the braking apparatus when braking force on a driving sheave 6 is released. In the figure, a plurality of splines 41 that are parallel to a shaft axis of a rotating shaft 15 are disposed on an outer circumferential portion of the rotating shaft 15. The respective splines 41 are lined up in a circumferential direction of the rotating shaft 15.

[0040] Interfitting apertures 42 that are fitted over the respective spines 41 and through which the rotating shaft 15 is passed are disposed centrally on a brake disk 16. In other words, the brake disk 16 is fitted slidably over the respective splines 41. The brake disk 16 is thereby displaceable relative to the rotating shaft 15 in a direction that is parallel to the respective splines 41. The brake disk 16 is fixed relative to the rotating shaft 15 in a circumferential direction of the rotating shaft 15 by engagement with the respective splines 41. The rest of the configuration is similar to that of Embodiment 1.

[0041] Next, operation will be explained. When the respective displacements of the first and second displacing bodies 17 and 18 are performed smoothly, operation that is similar to that of Embodiment 1 is performed.

[0042] If, for example, a sliding failure of the guiding pins 24 through the bushes 33 occurs in a state in which the first lining 25 is separated from the first braking surface 16a, and displacement of the first displacing body 17 relative to the brake disk 16 becomes impossible, the second displacing body 18 is displaced by the forces from the respective second forcing springs 20, and only the second lining 27 contacts the second braking surface 16b. The brake disk 16 is subsequently displaced along the splines 41 toward the first lining 25 while being pushed by the second displacing body 18 in a state of contact with the second lining 27. The first braking surface 16a is subsequently pressed against the first lining 25, and the second lining 27 is pressed against the second braking surface 16b, by the forces from the second forcing springs 20. In other words, the brake disk 16 is gripped between the first and second linings 25 and 27. A braking force is thereby applied to the rotating shaft 15 and the brake disk 16.

[0043] In an elevator hoisting machine braking apparatus of this kind, because splines 41 that are parallel to the shaft axis of the rotating shaft 15 are disposed on the rotating shaft 15, and the brake disk 16 is fitted slidably over the splines 41, rotation of the brake disk 16 relative to the rotating shaft 15 is prevented, and the brake disk

16 can also be made displaceable relative to the rotating shaft 15 in a direction that is parallel to the shaft axis of the rotating shaft 15. Thus, even if displacement of either one of the first and second displacing bodies 17 and 18 becomes impossible, the brake disk 16 can be displaced to a position of one of the displacing bodies by being pushed by the other displacing body. Consequently, the first and second linings 25 and 27 can be pressed against the first and second braking surfaces 16a and 16b, respectively, enabling decreases in the braking force that is applied to the rotating shaft 15 to be suppressed.

Embodiment 3

[0044] Figure 6 is a longitudinal cross section that shows an elevator hoisting machine braking apparatus according to Embodiment 3 of the present invention. Figure 7 is a longitudinal cross section that shows a state of the braking apparatus from Figure 6 when braking force on a rotating shaft 15 is released. In the figures, first and second brake disks 51 and 52 that have similar configurations to that of the brake disk 16 in Embodiment 2 are disposed between the first lining 25 and the second lining 27. The respective brake disks 51 and 52 are lined up in a direction that is parallel to the shaft axis of the rotating shaft 15. The respective brake disks 51 and 52 are displaceable independently from each other relative to the rotating shaft **15** in a direction that is parallel to respective splines 41.

[0045] A common bearing member 53 that bears the respective brake disks 51 and 52 that are displaced in directions that are parallel to the shaft axis of the rotating shaft 15 is disposed between the first brake disk 51 and the second brake disk 52. The first brake disk 51 is interposed between the first lining 25 and the bearing member 53, and the second brake disk 52 is interposed between the second lining 27 and the bearing member 53.

[0046] The bearing member 53 is fixed relative to the stator core 30. The bearing member 53 has: an intermediate plate 54 that is disposed so as to be perpendicular to a direction that is parallel to the shaft axis of the rotating shaft 15; an intermediate lining 55 that is disposed on a surface of the intermediate plate 54 near the first brake disk 51; and an intermediate lining 56 that is disposed on a surface of the intermediate plate 54 near the second brake disk 52.

[0047] The intermediate plate 54 is an annular plate that is centered around the shaft axis of the rotating shaft 15. The intermediate plate 54 is disposed so as to avoid the respective guiding pins 24.

[0048] The intermediate lining 55 faces the first lining 25 in the direction that is parallel to the shaft axis of the rotating shaft 15 so as to have the first brake disk 51 interposed. The second braking surface 16b of the first brake disk 51 is able to contact with and separate from the intermediate lining 55.

[0049] The intermediate lining 56 faces the second lining 27 in the direction that is parallel to the shaft axis of the rotating shaft 15 so as to have the second brake disk 52 interposed. The first braking surface 16a of the second brake disk 52 is able to contact with and separate from the intermediate lining 56. The rest of the configuration is similar to that of Embodiment 2.

[0050] Next, operation will be explained. When passage of an electric current to the brake coil 31 is stopped, the first lining 25 is pressed against the intermediate lining 55 through the first brake disk 51 by the forces from the respective first forcing springs 19, and the second lining 27 is pressed against the intermediate lining 56 through the second brake disk 52 by the forces from the respective second forcing springs 20. In other words, the first brake disk 51 is gripped between the first lining 25 and the intermediate lining 55, and the second brake disk 52 is gripped between the second lining 25 and the intermediate lining 56. Braking force is thereby applied to respective brake disks 51 and 52, and braking force is applied to the rotating shaft 15 and the brake disk 16.

[0051] When the electric current is passed to the brake coil 31, the first movable core 22 is displaced toward the electromagnet 21 in opposition to the forces from the respective first forcing springs 19, and the second movable core 26 is displaced toward the electromagnet 21 in opposition to the forces from the respective second forcing springs 20. The first lining 25 is thereby displaced in a direction of separation from the intermediate lining 55, and the second lining 27 is displaced in a direction of separation from the intermediate lining 56. The first brake disk 51 thereby separates from both the first lining 25 and the intermediate lining 55 while being slid along the splines 41, and the second brake disk 52 separates from both the second lining 27 and the intermediate lining 56 while being slid along the splines 41. The braking force on the respective brake disks 51 and 52 is thereby released.

[0052] If, for example, a sliding failure of the guiding pins 24 through the bushes 33 occurs in a state in which the first lining 25 is separated from the first brake disk 51, and displacement of the first displacing body 17 relative to the first brake disk 51 becomes impossible, only the second brake disk 52 is gripped between the second lining 27 and the intermediate lining 56. A braking force is thereby applied to the rotating shaft 15.

[0053] If displacement of the second displacing body 18 relative to the second brake disk 52 becomes impossible, only the first brake disk 51 is gripped between the first lining 25 and the intermediate lining 55. A braking force is thereby applied to the rotating shaft 15.

[0054] In an elevator hoisting machine braking apparatus of this kind, because the two brake disks 51 and 52 that are lined up in the direction that is parallel to the shaft axis of the rotating shaft 15 are disposed slidably on the rotating shaft 15, and the bearing member 53 is disposed between the respective brake disks 51 and 52, the number of braking surfaces that the linings are made to contact can be increased, enabling increases in the magnitude of the braking force on the rotating shaft 15.

Even if displacement of either one of the first and second displacing bodies 17 and 18 becomes impossible, the brake disks 51 and 52 can be gripped by either of the respective brake disks 51 and 52 being displaced while being pressed onto the other displacing body, and braking operation reliability of the braking apparatus 7 can also be ensured.

[0055] Moreover, in the above example, the bearing member 53 is fixed relative to the fixed core 30, but is not limited thereto, and the bearing member 53 may also be fixed relative to the hoisting machine main body 5, for example.

[0056] In the above example, the bearing member 53 is fixed relative to the fixed core 30 or the hoisting machine main body 5 not only in the direction of rotation of the brake disks 51 and 52 but also in the direction that is parallel to the shaft axis of the rotating shaft 15, but the bearing member 53 may also be set so as to be fixed relative to the fixed core 30 or the hoisting machine main body 5 only in the direction of rotation of the brake disks 51 and 52. In other words, the bearing member 53 may also be displaceable relative to the rotating shaft 15 in the direction that is parallel to the shaft axis of the rotating shaft 15 provided that the bearing member 53 is fixed relative to the fixed core 30 or the hoisting machine main body 5 in the direction of rotation of the brake disks 51 and 52.

Claims

1. An elevator hoisting machine braking apparatus **characterized in** comprising:

a rotating body that is rotated together with a rotating shaft;
a first displacing body comprising:

a first movable core;
a driven body that is disposed so as to be separated from the first movable core; and
a first lining that is disposed on a surface of the driven body near the first movable core,

the rotating body being interposed between the first movable core and the first lining, and the first displacing body being displaceable in a direction in which the first lining contacts with and separates from the rotating body;

a second displacing body comprising:

a second movable core that is disposed between the first movable core and the rotating body; and
a second lining that is disposed on a surface of the second movable core near the rotating body,

the second displacing body being displaceable in a direction in which the second lining contacts with and separates from the rotating body;

a first forcing body that forces the first displacing body in the direction in which the first lining contacts the rotating body;
a second forcing body that forces the second displacing body in the direction in which the second lining contacts the rotating body; and
a common electromagnet that is disposed between the first and second movable cores, and that displaces the first and second movable cores in the directions in which the first and second linings separate from the rotating body in opposition to the forces from the first and second forcing bodies.

2. An elevator hoisting machine braking apparatus according to Claim 1, **characterized in that**:

the first and second displacing bodies are displaceable parallel to a shaft axis of the rotating shaft;
a spline that is parallel to the shaft axis of the rotating shaft is disposed on the rotating shaft; and
the rotating body is fitted slidably over the spline.

3. An elevator hoisting machine braking apparatus according to Claim 2, **characterized in that**:

two of the rotating bodies are disposed on the rotating shaft between the first and second linings so as to be lined up in the direction that is parallel to the shaft axis of the rotating shaft; and
a bearing member is disposed between the rotating bodies such that the rotating bodies separate from and contact with the bearing member.

FIG. 1

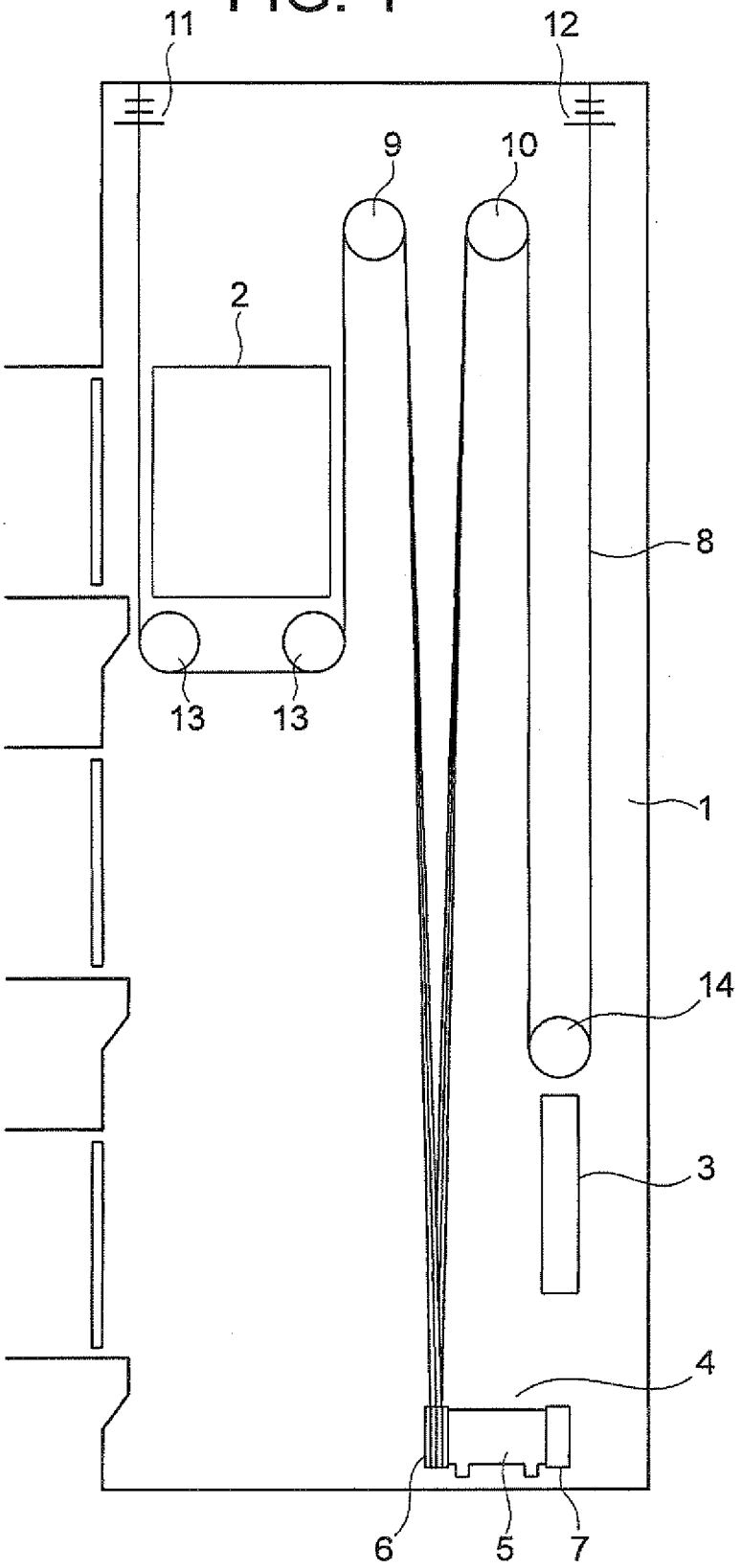

FIG. 2

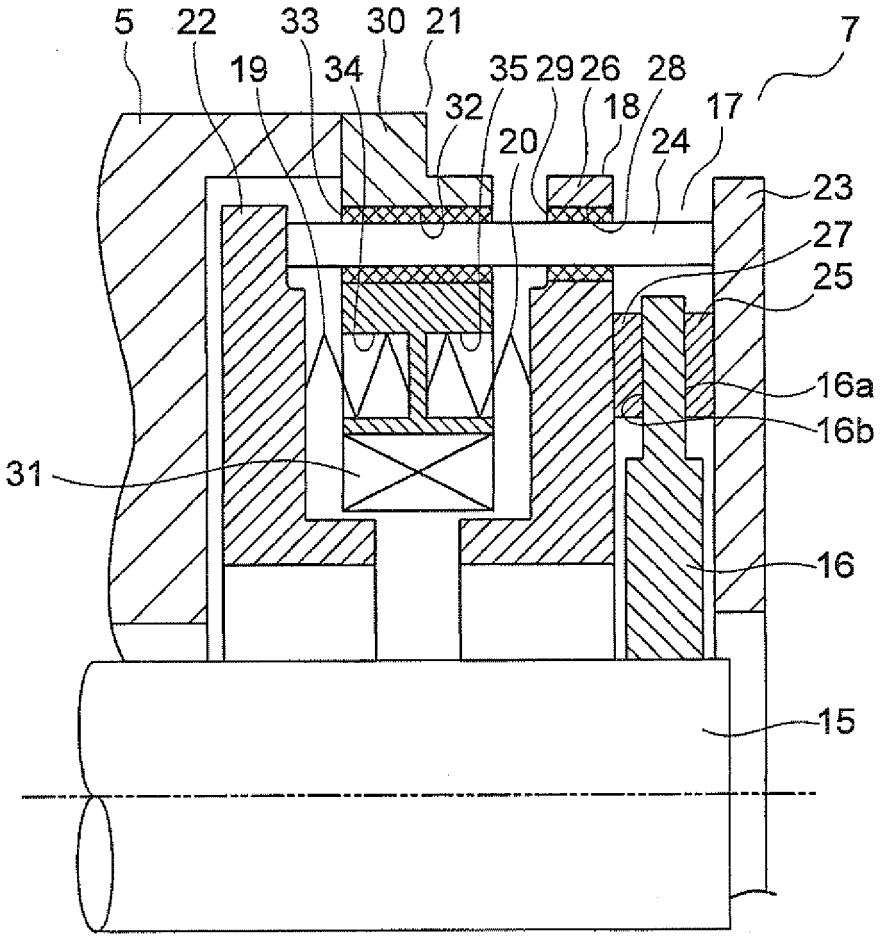
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FIG. 3

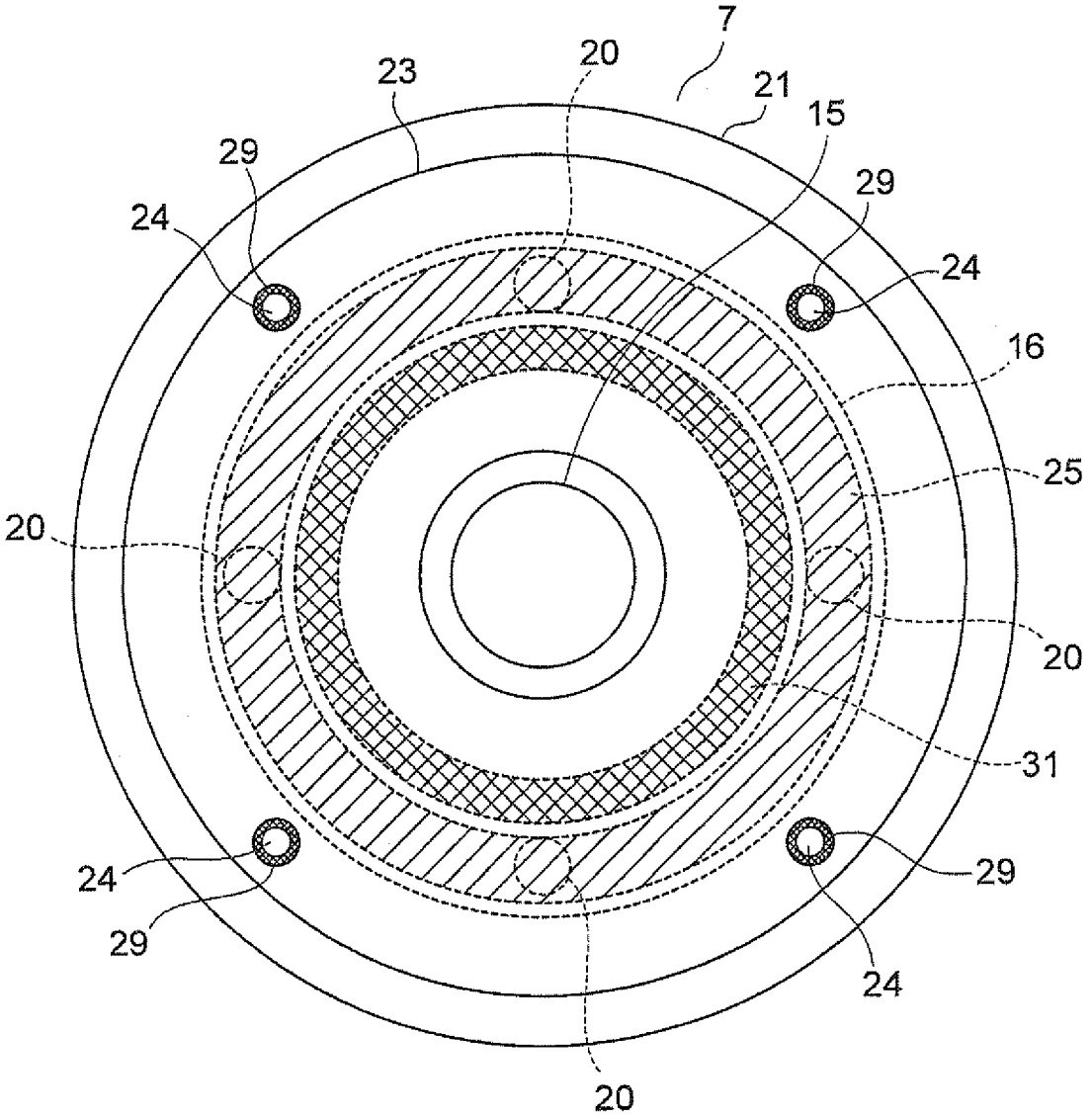

FIG. 4

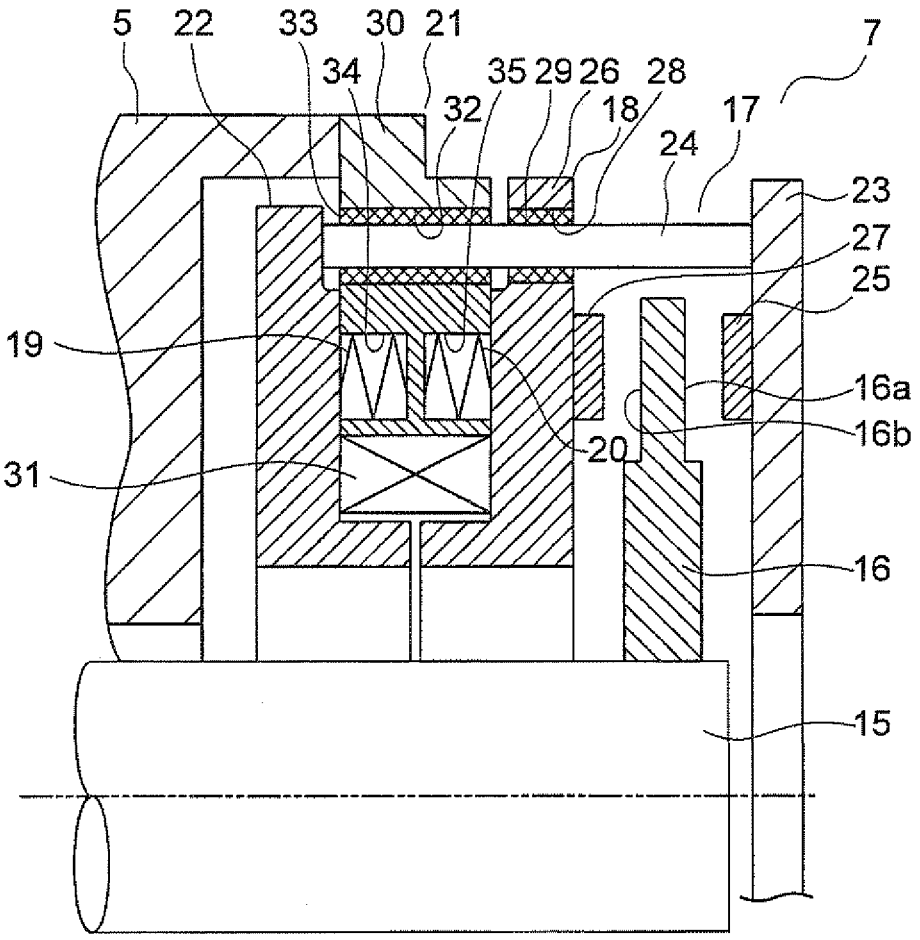
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FIG. 5

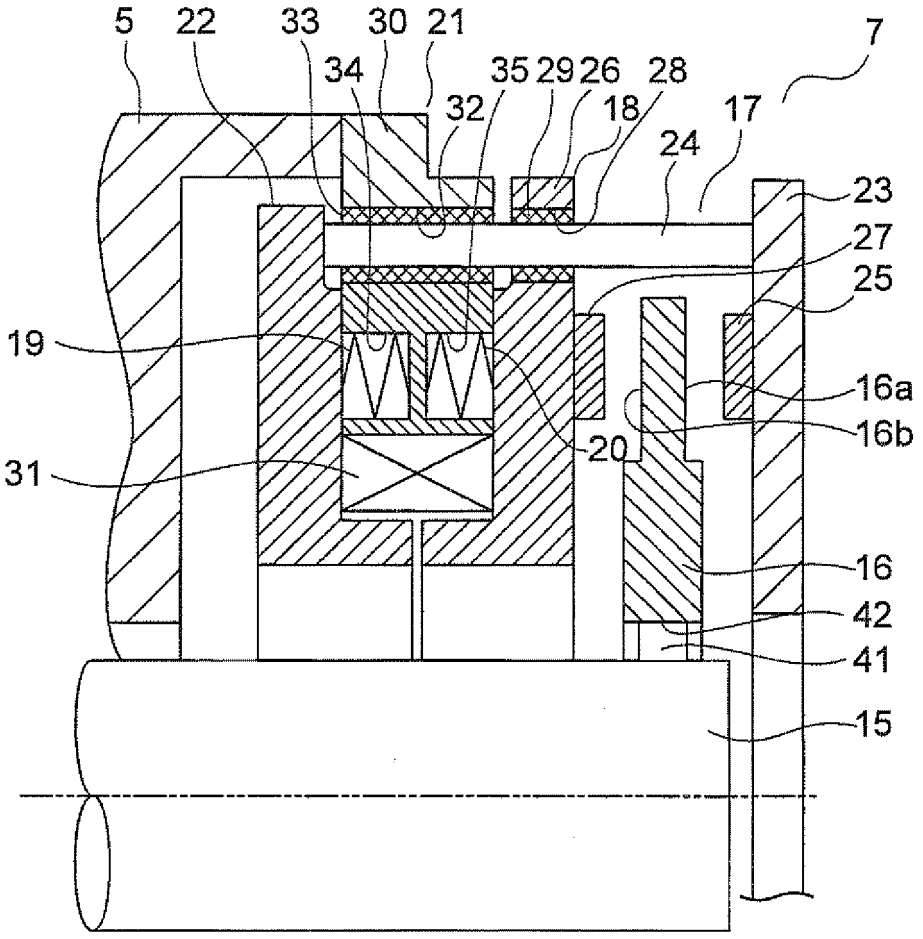
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FIG. 6

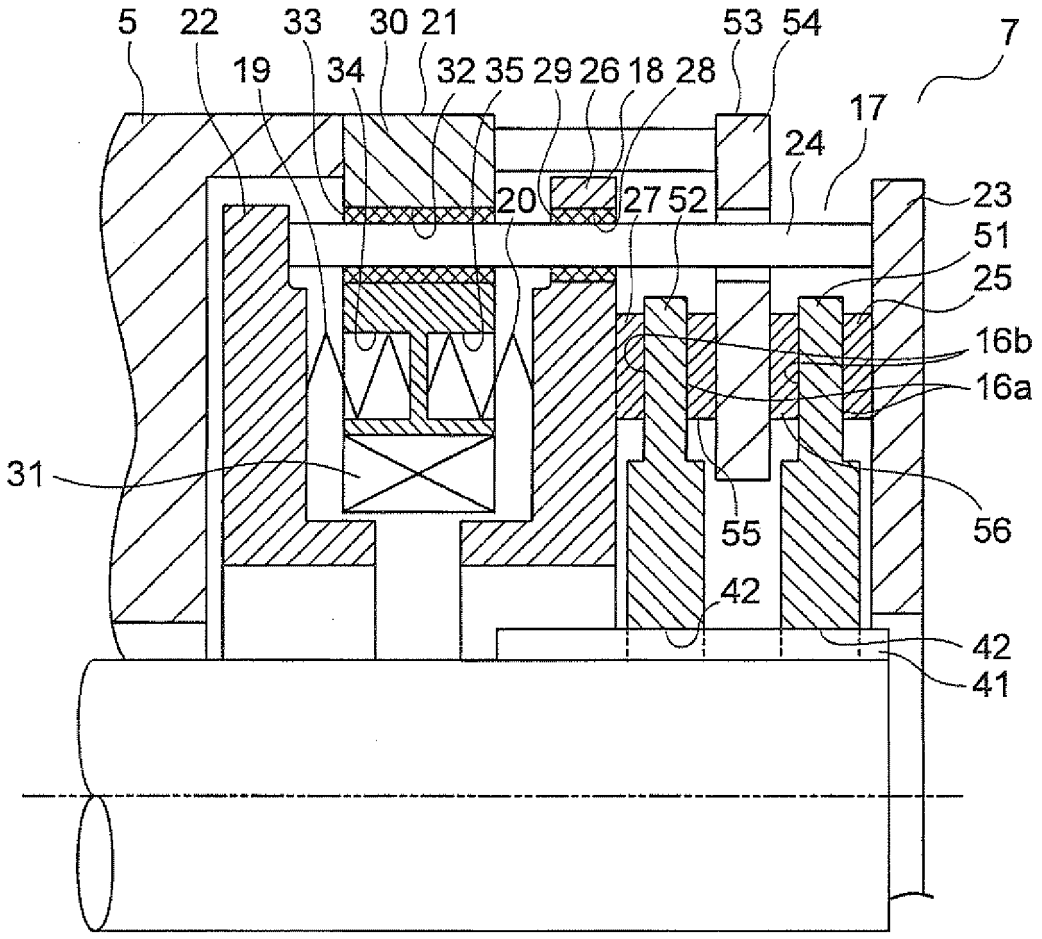
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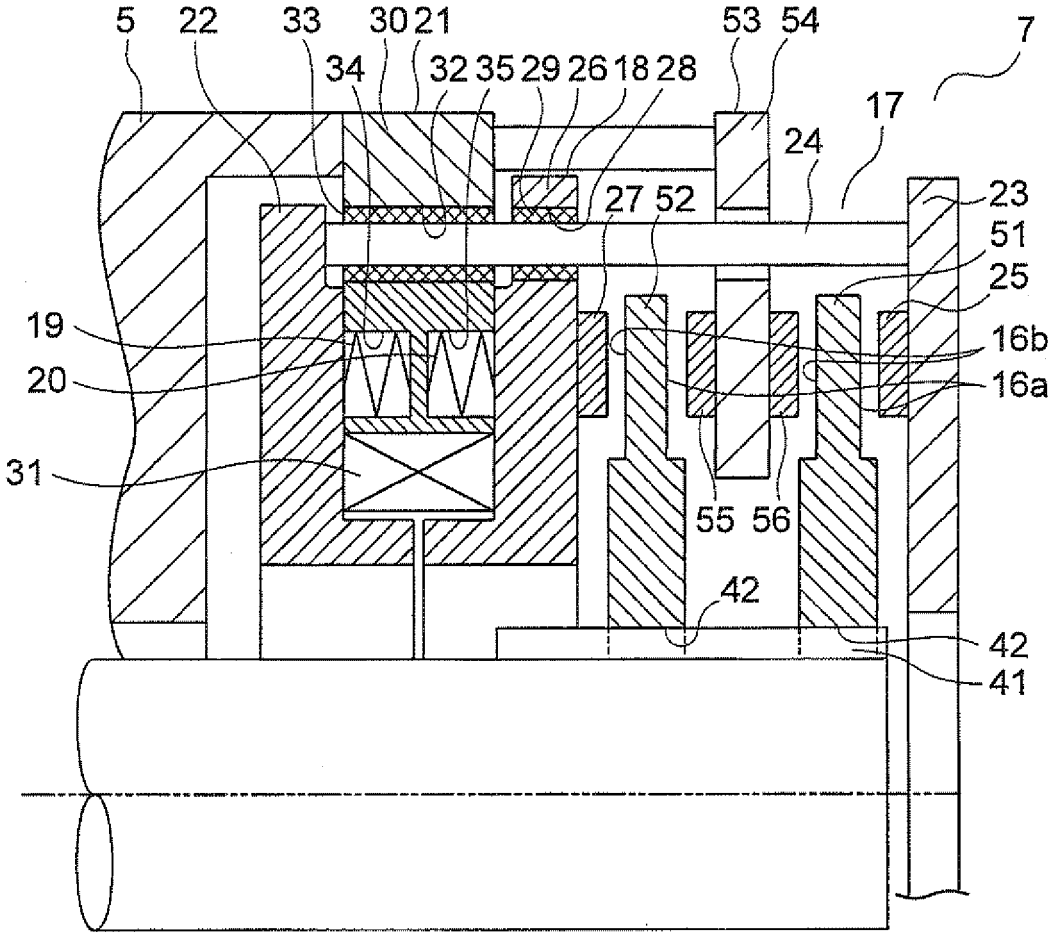
FIG. 7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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/060772

A. CLASSIFICATION OF SUBJECT MATTER
B66B11/08(2006.01)i

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)
B66B11/00-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 1996-2009
Kokai Jitsuyo Shinan Koho 1971-2009 Toroku Jitsuyo Shinan Koho 1994-2009

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 2000-110868 A (Mitsubishi Electric Corp.), 18 April 2000 (18.04.2000), paragraphs [0017] to [0035]; fig. 1 to 5 (Family: none)	1-3
A	JP 2003-246570 A (Mitsubishi Electric Corp.), 02 September 2003 (02.09.2003), paragraphs [0023] to [0050]; fig. 1 to 3 (Family: none)	1-3
A	JP 2009-73635 A (Meidensha Corp.), 09 April 2009 (09.04.2009), paragraphs [0014] to [0024]; fig. 1 to 2 (Family: none)	1-3

☒ 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
26 October, 2009 (26.10.09)	02 November, 2009 (02.11.09)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/060772

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2004/26750 A1 (Mitsubishi Electric Corp.), 01 April 2004 (01.04.2004), description, page 2, line 20 to page 8, line 10; fig. 1 to 3 & CN 1589233 A	1-3

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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