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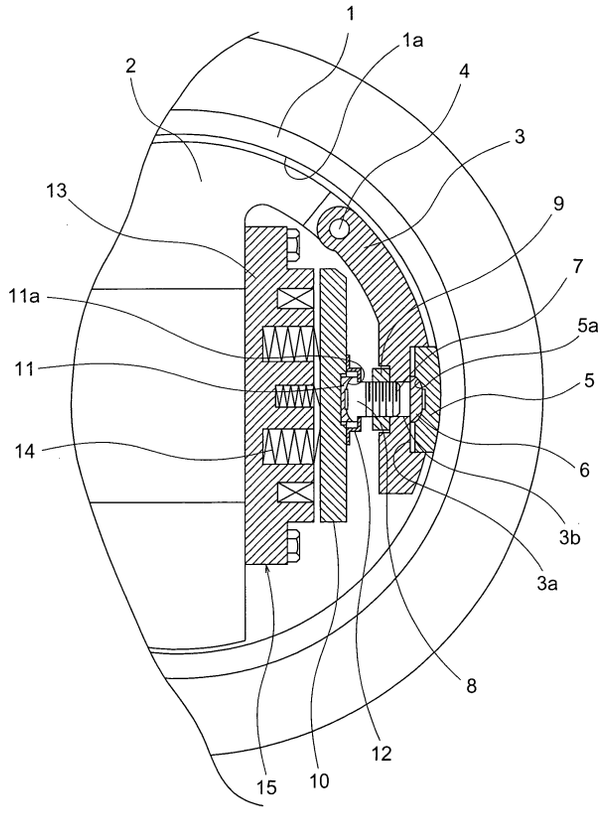
(54) BRAKE DEVICE OF ELEVATOR HOIST

(57) In an elevator hoisting machine braking apparatus, a first spherical seat is interposed between a brake arm and a braking segment. A second spherical seat is interposed between the brake arm and a pressing and attracting means. The first spherical seat is disposed relative to the second spherical seat in a direction that the pressing and attracting means presses the second spherical seat.

FIG. 1



EP 1 538 123 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator hoisting machine braking apparatus disposed on an elevator hoisting machine for braking rotation of a rotating portion.

BACKGROUND ART

[0002] In conventional elevator hoisting machine braking apparatuses, such as that disclosed in Japanese Patent Laid-Open No. 2000-289954 (Gazette), for example, a braking surface is disposed on an inner circumference of a cylindrical rotating portion. A pivotable brake arm is disposed inside the rotating portion. A braking segment separably placed in contact with the braking surface by pivoting of the brake arm is mounted to the brake arm. The brake arm is forced by a braking spring in such a direction that the braking segment contacts the braking surface.

[0003] An electromagnet is disposed inside the rotating portion. An armature attracted by the electromagnet is linked to the brake arm by means of a linking pin. When the electromagnet is not excited, the braking segment is pressed against the braking surface by the braking spring, braking rotation of the rotating portion by friction. By exciting the electromagnet, the armature can be attracted to the electromagnet, separating the braking segment from the braking surface counter to the braking spring, and releasing the brake.

[0004] However, in conventional braking apparatuses, it is necessary to adjust the mounted angle of the armature in order to attract the entire surface of the armature uniformly, requiring a great deal of adjustment time. Furthermore, since the braking spring is disposed at an opposite end of the brake arm from a pivot point and a bending moment acts on the brake arm due to pressure from the braking spring, it has been necessary to increase the strength of the brake arm.

DISCLOSURE OF THE INVENTION

[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 enabling a stable attracting operation to be achieved while reducing time spent on mounting and adjusting, and enabling strength of a brake arm to be reduced.

[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 including: a cylindrical rotating portion in which a braking surface is disposed on an inner circumference; a supporting portion fixed relative to a fixed portion of an elevator hoisting machine; a brake arm disposed inside the rotating portion and pivotably supported by the supporting portion; a braking segment mounted to the brake arm and separably placed in contact with the braking surface by pivoting of the brake arm; and a pressing and attracting means for braking rotation of the rotating portion by pressing the braking segment against the braking surface by means of the brake arm and for releasing braking of the rotating portion by attracting the brake arm such that the braking segment separates from the braking surface, wherein: a first spherical seat is interposed between the brake arm and the braking segment; a second spherical seat is interposed between the brake arm and the pressing and attracting means; and a central portion of the braking segment is pressed against the braking surface during braking by means of the first and second spherical seats.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

Figure 1 is a partially-sectioned front elevation showing an elevator hoisting machine braking apparatus according to Embodiment 1 of the present invention;

Figure 2 is a right side elevation showing a mounting construction of a braking segment in Figure 1;

Figure 3 is a cross section taken along line III - III in Figure 2;

Figure 4 is a partially-sectioned front elevation showing an elevator hoisting machine braking apparatus according to Embodiment 2 of the present invention; and

Figure 5 is a right side elevation showing a mounting construction of a braking segment in Figure 4.

BEST MODE FOR CARRYING OUT THE INVENTION

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

Embodiment 1

[0009] Figure 1 is a partially-sectioned front elevation showing an elevator hoisting machine braking apparatus according to Embodiment 1 of the present invention. In the figure, a cylindrical brake drum 1 constituting a rotating portion is rotated by a driving force from a motor of an elevator hoisting machine. The brake drum 1 is rotated together with a drive sheave (not shown) around which an elevator main rope is wound. A braking surface 1a is disposed on an inner circumference of the brake drum 1.

[0010] A frame 2 functioning as a supporting portion that is fixed relative to a fixed portion of the elevator hoisting machine is disposed inside the brake drum 1. An arc-shaped brake arm 3 is supported by the frame 2 so as to be pivotable around a pin 4. The brake arm 3

is disposed inside the brake drum 1 so as to face the braking surface 1a. The pin 4 is disposed on a base end portion of the brake arm 3.

[0011] A braking segment accommodating recess portion 3a is disposed on a surface of the brake arm 3 facing the braking surface 1a. A screw-threaded aperture 3b extending in a radial direction of the brake drum 1 and passing through the brake arm 3 is disposed in a bottom portion of the braking segment accommodating recess portion 3a.

[0012] A braking segment 5 is mounted in a vicinity of a tip portion of the brake arm 3. The braking segment 5 is disposed inside the braking segment accommodating recess portion 3a. The braking segment 5 is separably placed in contact with the braking surface 1a by pivoting of the brake arm 3. A first spherical seat 6 is interposed between the brake arm 3 and the braking segment 5. The first spherical seat 6 is disposed so as to be coaxial with the screw-threaded aperture 3b. A first spherical recess portion 5a coupling with the first spherical seat 6 is formed in a central portion of a surface of the braking segment 5 on an opposite side from a surface contacting the braking surface 1a.

[0013] A first end portion of a stroke adjusting screw 7 is screwed into the screw-threaded aperture 3b from an opposite side to the first spherical seat 6. A second spherical seat 8 is formed integrally on a second end portion of the stroke adjusting screw 7. A locknut 9 for fixing an amount of fastening of the stroke adjusting screw 7 inside the screw-threaded aperture 3b is screwed onto an intermediate portion of the stroke adjusting screw 7.

[0014] A disk-shaped armature 10 is linked to the second end portion of the stroke adjusting screw 7. A strike plate 11 is interposed between the armature 10 and the second spherical seat 8. A second spherical recess portion 11a coupling with the second spherical seat 8 is formed in the strike plate 11. A plurality of spherical-seat leaf springs 12 for pressing the second spherical seat 8 against the strike plate 11 are mounted to the armature 10.

[0015] An electromagnet 13 facing the armature 10 is secured to the frame 2. A plurality of braking springs 14 for braking rotation of the brake drum 1 by pressing the braking segment 5 against the braking surface 1a are disposed between the electromagnet 13 and the armature 10.

[0016] The braking segment 5 is pressed against the braking surface 1a by the braking springs 14 through the armature 10, the strike plate 11, the second spherical seat 8, the stroke adjusting screw 7, the brake arm 3, and the first spherical seat 6. By exciting the electromagnet 13, the armature 10 can be attracted by the electromagnet 13 so as to act against the braking springs 14, separating the braking segment 5 from the braking surface 1a.

[0017] The pressing and attracting means 15 in Embodiment 1 includes the armature 10, the electromagnet 13, and the braking springs 14. The first spherical seat 6 is disposed, relative to the second spherical seat 8, in a direction that the pressing and attracting means 15 presses the second spherical seat 8. In other words, the first and second spherical seats 6 and 8 are disposed in a straight line extending along a resultant force vector of the pressing forces from the braking springs 14.

[0018] Next, Figure 2 is a right side elevation showing a mounting construction of the braking segment 5 in Figure 1, and Figure 3 is a cross section taken along line III - III in Figure 2. In the figures, the braking segment 5 is mounted to the brake arm 3 by being pressed against the first spherical seat 6 by a pair of braking-segment leaf springs 16. The braking segment 5 is pressed toward a central direction of the first spherical seat 6 by the braking-segment leaf springs 16. The braking-segment leaf springs 16 are mounted to the brake arm 3 by the plurality of bolts 17.

[0019] Next, operation will be explained. When the electromagnet 13 is not excited, the braking segment 5 is pressed against the braking surface 1a by the spring forces from the braking springs 14, braking rotation of the brake drum 1 by friction. Here, a single central point of the braking segment 5 is pressed against the braking surface 1a.

[0020] When the electromagnet 13 is excited, the armature 10 is attracted toward the electromagnet 13 counter to the braking springs 14 and displaces, separating the braking segment 5 from the braking surface 1a. Thus, braking of the brake drum 1 is released, and the brake drum 1 is rotated together with the drive sheave by the driving force from the motor.

[0021] In addition, an operating stroke of the braking segment 5 is adjusted by loosening the locknut 9 and adjusting the amount of fastening of the stroke adjusting screw 7 inside the screw-threaded aperture 3b. More specifically, by tightening the stroke adjusting screw 7 to displace it toward the braking segment 5, a gap between the armature 10 and the electromagnet 13 during braking is increased, thereby also increasing the operating stroke of the braking segment 5. Conversely, by loosening the stroke adjusting screw 7 to displace it toward the electromagnet 13, the gap between the armature 10 and the electromagnet 13 during braking is reduced, thereby also reducing the operating stroke of the braking segment 5.

[0022] In a braking apparatus of this kind, because not only is a first spherical seat 6 disposed between the brake arm 3 and the braking segment 5 but a second spherical seat 8 is also disposed between the brake arm 3 and the armature 10, a stable attracting operation can be achieved without having to adjust the mounted angle of the armature 10, even when the precision of the attracting surface of the armature 10 relative to the brake arm 3 is low.

[0023] Because the first spherical seat 6 is disposed, relative to the second spherical seat 8, in a direction that the pressing and attracting means 15 presses the sec-

ond spherical seat 8, there is no bending moment acting on the brake arm 3, enabling the strength of the brake arm 3 to be reduced, thereby enabling the brake arm 3 to be made thinner.

[0024] In addition, because spherical-seat leaf springs 12 for pressing the second spherical seat 8 against the strike plate 11 are mounted to the armature 10, the second spherical seat 8 and the strike plate 11 do not separate from the armature 10 during the release operation, enabling the release operation to be stabilized. Furthermore, the brake arm 3 can be drawn closer during the release operation.

[0025] Furthermore, because the braking segment 5 is mounted to the brake arm 3 by being pressed against the first spherical seat 6 by braking-segment leaf springs 16, removal and replacement of the braking segment 5 can be performed easily, simply by removing the braking-segment leaf springs 16. Consequently,maintainabilitycan be improved even in a braking apparatus mounted in a limited space inside the brake drum 1.

[0026] Because the braking segment 5 is pressed toward a central direction of the first spherical seat 6 by the braking-segment leaf springs 16, the braking segment 5 is displaced and placed in contact with the braking surface 1a while constantly maintaining its attitude relative to the braking surface 1a. Consequently, the braking segment 5 can be stably pressed against the brake drum 1.

Embodiment 2

[0027] Next, Figure 4 is a partially-sectioned front elevation showing an elevator hoisting machine braking apparatus according to Embodiment 2 of the present invention, and Figure 5 is a right side elevation showing a mounting construction of a braking segment in Figure 4.

[0028] In the figures, a fixed rod 21 passing through a tip portion of a brake arm 3 being an end portion at an opposite end of a braking segment 5 from a pin 4 (a pivot point) is fixed to an armature 10. A spring bearing portion 21a is disposed on a tip portion of the fixed rod 21. A first backlash preventing spring (a coil spring) 22 for forcing the brake arm 3 toward the pressing and attracting means 15 is disposed between the spring bearing portion 21a and the tip portion of the brake arm 3.

[0029] A plurality of second backlash preventing springs 23 for forcing the brake arm 3 in such a direction as to be separated from the pressing and attracting means 15 are disposed between the brake arm 3 and the armature 10 in a vicinity of the pin 4 (closer to the pin 4 than the braking segment 5) . These backlash preventing springs 23 are disposed so as to be distributed uniformly in an axial direction of the pin 4 relative to an axial center of the pin 4, and are also disposed within a range of an axial length of the pin 4.

[0030] In a braking apparatus of this kind, because the brake arm 3 is forced toward the pressing and attracting means 15 by the first backlash preventing spring 22, even if there is a gap between the pin 4 and the brake arm 3 or between the pin 4 and the frame 2, due to manufacturing errors, etc., the pin 4 is always pressed in a constant direction. Consequently, backlash is prevented from arising in the operation of the brake arm 3, enabling the operation of the brake arm 3 to be stabilized.

[0031] Because the second spherical seat 8 and the strike plate 11 are also pressed against the armature 10 by the first backlash preventing spring 22, the spherical-seat leaf springs 12 shown in Embodiment 1 can be omitted.

[0032] In addition, because second backlash preventing springs 23 for forcing the brake arm 3 in such a direction as to be separated from the pressing and attracting means 15 are disposed between the brake arm 3 and the armature 10 in a vicinity of the pin 4, even if disturbances by twisting forces such as that represented by the arrow A in Figure 5 act on the brake arm 3, backlash is prevented from arising in the operation of the brake arm 3, enabling the operation of the brake arm 3 to be stabilized.

[0033] Moreover, in the above example, the first backlash preventing spring 22 is disposed between the armature 10 and the brake arm 3, but it may also be disposed between the electromagnet 13 and the brake arm 3.

[0034] In the above example, the second backlash preventing springs 23 are disposed between the armature 10 and the brake arm 3, but they may also be disposed between the electromagnet 13 and the brake arm 3.

[0035] In addition, in the above example, first and second backlash preventing springs 22 and 23 are provided, but the second backlash preventing springs 23 may also be omitted and only a first backlash preventing spring 22 provided.

[0036] Furthermore, the first backlash preventing spring 22 may also be omitted and only second backlash preventing springs 23 provided. In that case, it is necessary for the second spherical seat 8 to be pressed against the pressing and attracting means 15 by spherical-seat leaf springs 12, etc., such as those shown in Embodiment 1, for example.

[0037] Furthermore, only one braking apparatus is shown in Figure 1 and Figure 4, but two braking apparatuses may also be disposed inside the brake drum with bilateral symmetry. Three or more braking apparatuses can also be disposed inside the brake drum.

Claims

1. An elevator hoisting machine braking apparatus comprising:

   a cylindrical rotating portion in which a braking surface is disposed on an inner circumference;

a supporting portion fixed relative to a fixed portion of an elevator hoisting machine;
a brake arm disposed inside said rotating portion and pivotably supported by said supporting portion;
a braking segment mounted to said brake arm and separably placed in contact with said braking surface by pivoting of said brake arm; and
a pressing and attracting means for braking rotation of said rotating portion by pressing said braking segment against said braking surface by means of said brake arm and for releasing braking of said rotating portion by attracting said brake arm such that said braking segment separates from said braking surface,

wherein:

a first spherical seat is interposed between said brake arm and said braking segment;
a second spherical seat is interposed between said brake arm and said pressing and attracting means;

and

said first spherical seat is disposed relative to said second spherical seat in a direction that said pressing and attracting means presses said second spherical seat.

2. The elevator hoisting machine braking apparatus according to Claim 1, wherein:

said second spherical seat is pressed against said pressing and attracting means by a spherical-seat leaf spring.

3. The elevator hoisting machine braking apparatus according to Claim 1, wherein:

said braking segment is mounted to said brake arm by being pressed against said first spherical seat by a braking-segment leaf spring.

4. The elevator hoisting machine braking apparatus according to Claim 1, wherein:

a backlash preventing spring for forcing said brake arm toward said pressing and attracting means is disposed between said brake arm and said pressing and attracting means at an opposite end of said braking segment from a pivot point.

5. The elevator hoisting machine braking apparatus according to Claim 1, wherein:

said brake arm is supported on said supporting portion by means of a pin;
a plurality of backlash preventing springs for forcing said brake arm in such a direction as to be separated from said pressing and attracting means are disposed between said brake arm and said pressing and attracting means in a vicinity of said pin; and
said backlash preventing springs are disposed so as to be distributed uniformly in an axial direction of said pin relative to an axial center of said pin and also disposed within a range of an axial length of said pin.

FIG. 1

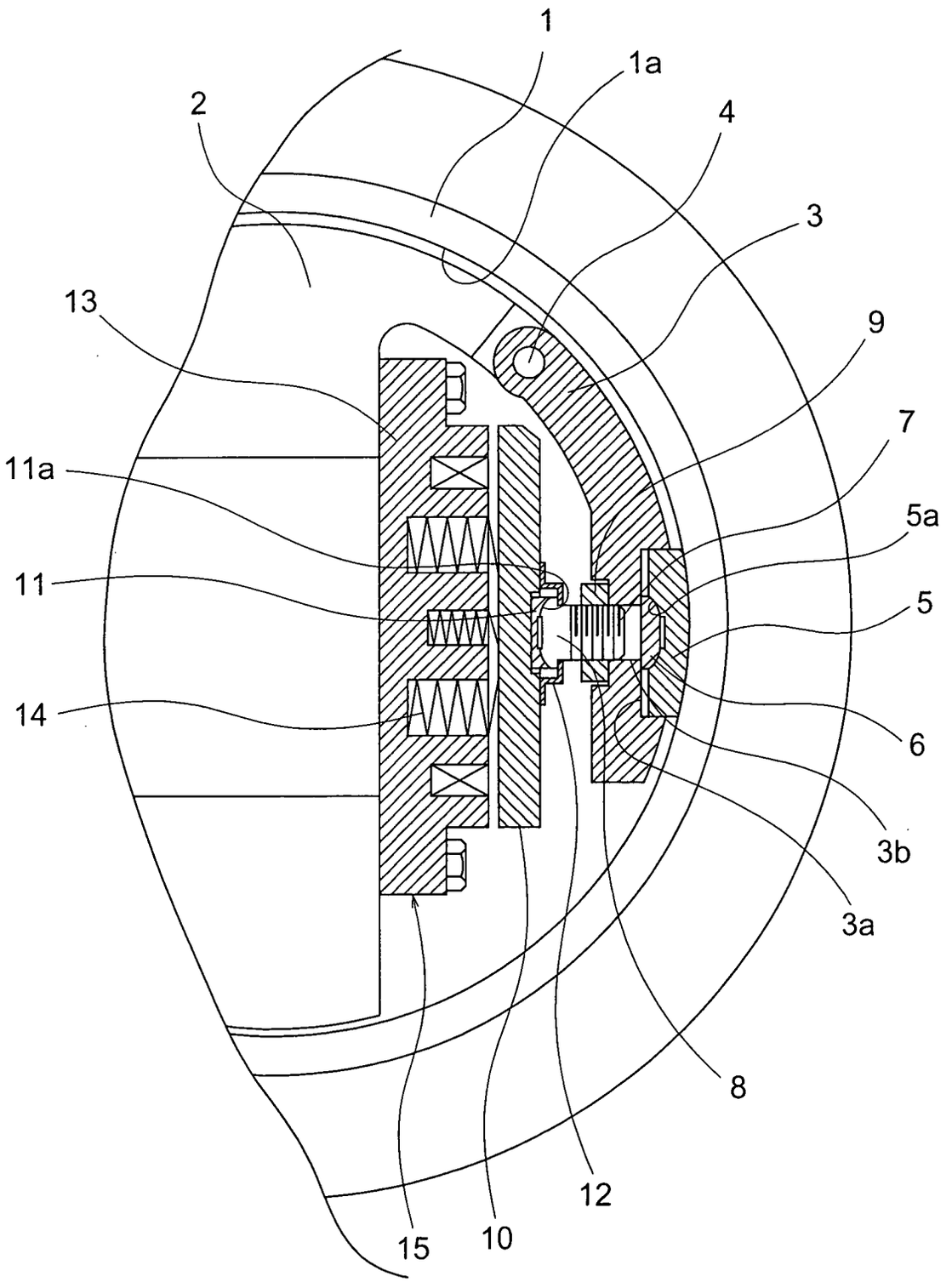


FIG. 2

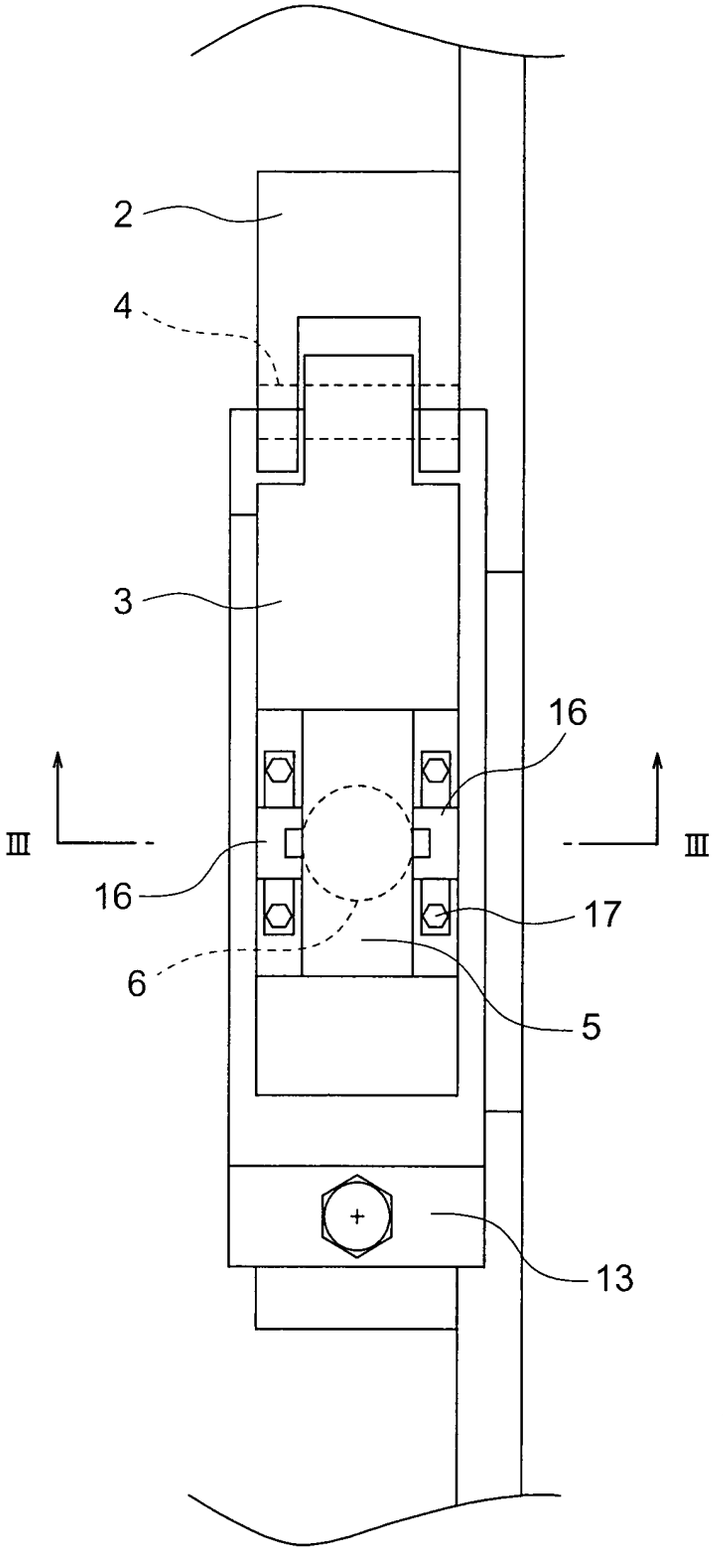


FIG. 3

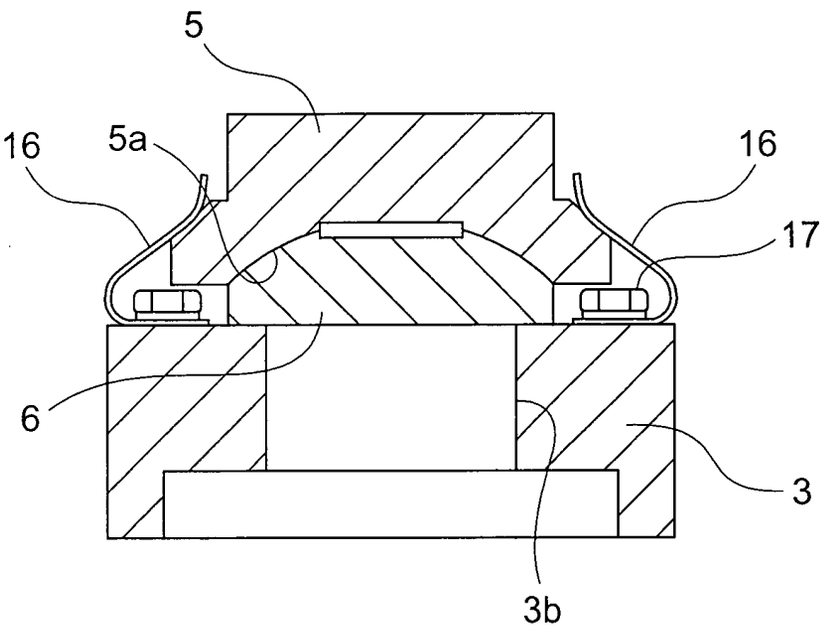


FIG. 4

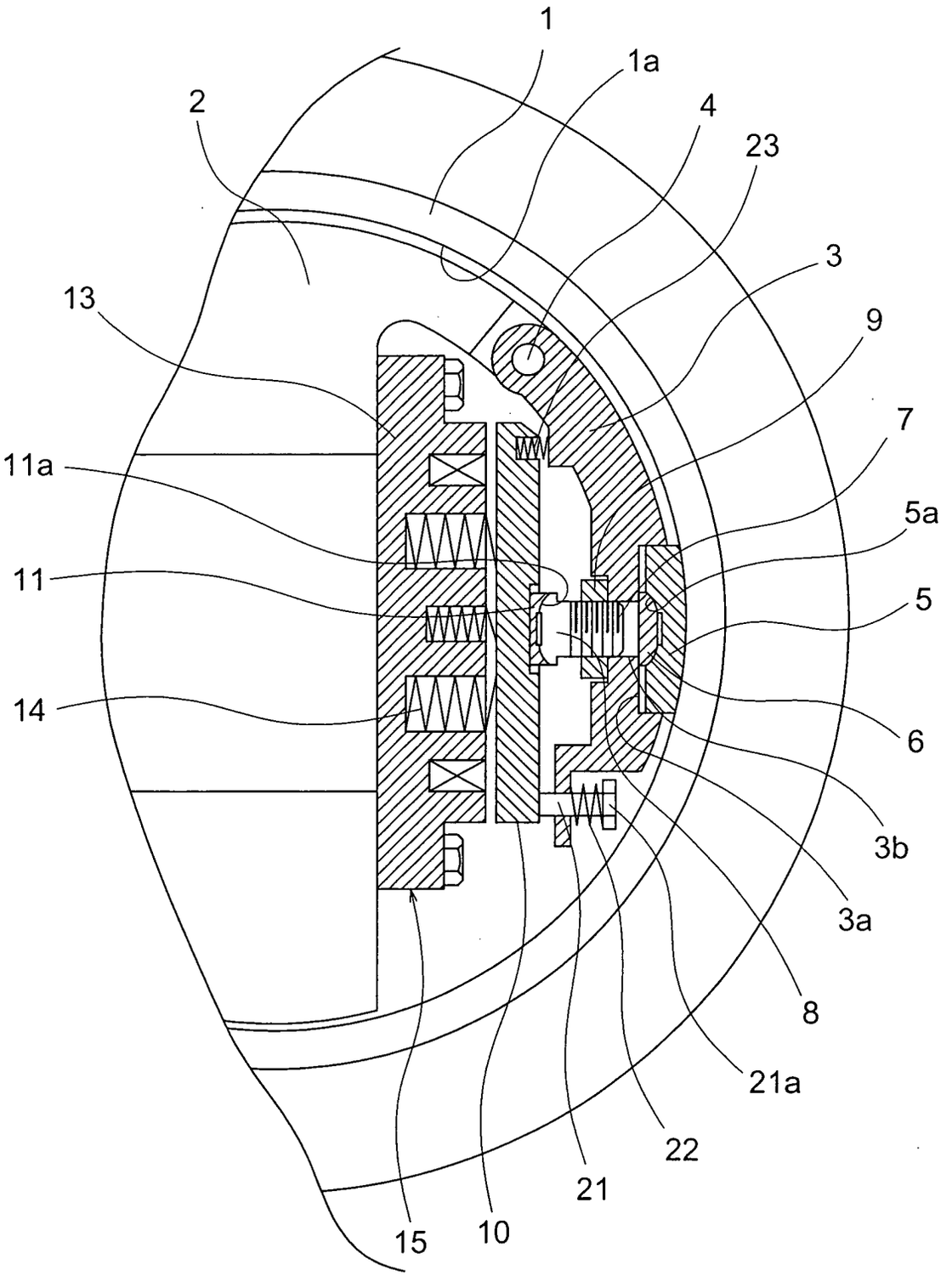
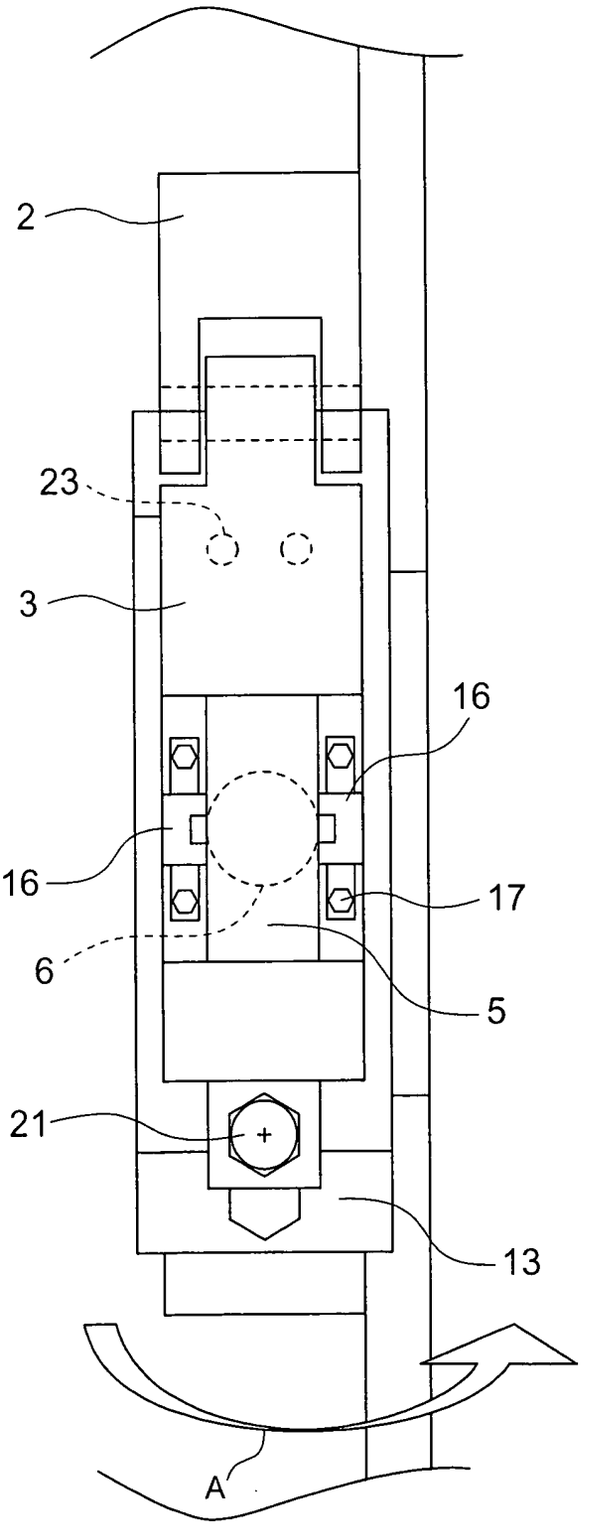


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/09356

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] B66B11/08, F16D49/00-71/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2002
Kokai Jitsuyo Shinan Koho	1971-2002	Toroku Jitsuyo Shinan Koho	1994-2002

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 2002-242961 A (Sanyo Kogyo Kabushiki Kaisha), 28 August, 2002 (28.08.02), (Family: none)	1-4 5
Y A	JP 2000-289954 A (Mitsubishi Electric Corp.), 17 October, 2000 (17.10.00), & EP 1043261 A2 & CN 1269323 A	1-4 5
Y A	JP 52-133473 A (Mitsubishi Electric Corp.), 08 November, 1977 (08.11.77), (Family: none)	1-4 5
Y A	JP 2002-106611 A (Sanyo Kogyo Kabushiki Kaisha), 10 April, 2002 (10.04.02), (Family: none)	4 5

[X] 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
03 June, 2003 (03.06.03)	17 June, 2003 (17.06.03)
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/JP02/09356

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E,A	JP 2003-21179 A (Mitsubishi Electric Corp.), 24 January, 2003 (24.01.03), (Family: none)	1-5

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