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(54) **EMERGENCY BRAKE DEVICE OF ELEVATOR**

(57) An emergency brake device for an elevator has a braking member and braking/releasing means connected to the braking member. The braking member has an attachment member that is capable of rocking about a rotation shaft of a deflector sheave, and a brake shoe that is provided to the attachment member and brought into and out of contact with the deflector sheave side

outer peripheral surface of a drive sheave due to the rocking motion of the attachment member. Upon brake release, the braking/releasing means holds the brake shoe in a separated position separated from the drive sheave, and upon braking, the braking/releasing means causes the braking member to rock to thereby bring the brake shoe into abutment with the drive sheave.

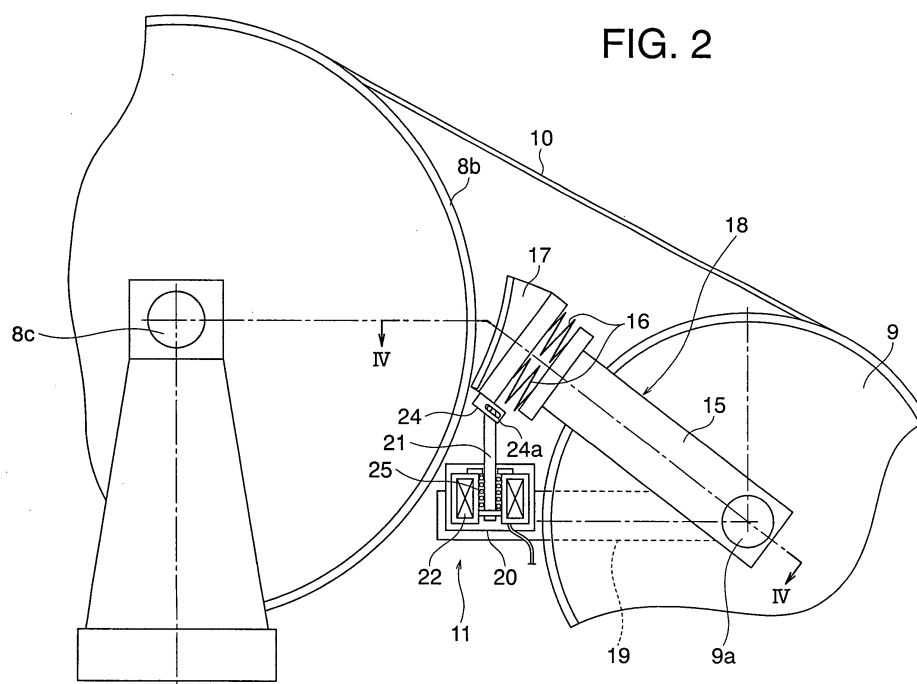


FIG. 2

Description

Technical Field

[0001] The present invention relates to an emergency brake device for an elevator which brakes rotation of a drive sheave to stop an upward travel of a car.

Background Art

[0002] In a conventional emergency brake device for an elevator disclosed in JP 5-193860 A, for example, a brake pulley located adjacent to an axial end portion of a drive sheave is rotated integrally with the drive sheave. The brake pulley is provided with a braking surface to be joined to the axial end portion of the drive sheave. Further, the brake pulley is pressed against the drive sheave by means of a brake spring.

[0003] When the ascent speed of a car exceeds a pre-set speed, a brake bolt engages with the brake pulley to stop the rotation of the brake pulley. When the brake pulley is stopped, braking is applied to the drive sheave due to the friction force between the drive sheave and the braking surface.

[0004] In the conventional emergency brake device described above, however, it takes time for the drive sheave to stop after the brake bolt is displaced in response to an emergency detection signal, resulting in a corresponding increase in the speed of the car.

Disclosure of the Invention

[0005] The present invention has been made with a view to solving the problems mentioned above, and therefore it is an object of the invention to provide an emergency brake device for an elevator which is capable of stopping the travel of a car more quickly.

[0006] To this end, according to one aspect of the present invention, there is provided an emergency brake device for an elevator which brakes rotation of a drive sheave, around which a main rope for suspending a car and a counterweight are wound, to stop upward travel of the car, comprising: a braking member having an attachment member and a brake shoe, the attachment member being capable of rocking motion about a rotation shaft of a deflector sheave around which the main rope is wound on a counterweight side with respect to the drive sheave, the brake shoe being provided to the attachment member and brought into and out of contact with a deflector sheave side outer peripheral surface of the drive sheave due to the rocking motion of the attachment member; and braking/releasing means connected to the braking member, for holding the brake shoe in a separated position separated from the drive sheave upon brake release and for causing the braking member to rock into abutment with the drive sheave upon braking.

Brief Description of the Drawings

[0007]

Fig. 1 is a schematic structural view showing an elevator apparatus according to an embodiment of the present invention;

Fig. 2 is a side view showing, partly in section, the construction of an emergency brake device of Fig. 1; Fig. 3 is a side view showing how braking is effected with the emergency brake device of Fig. 2;

Fig. 4 is a sectional view taken along the line IV-IV of Fig. 2; and

Fig. 5 is a sectional view taken along the line V-V of Fig. 3.

Best Mode for carrying out the Invention

[0008] Hereinbelow, a preferred embodiment of the present invention will be described with reference to the drawings.

[0009] Fig. 1 is a schematic structural view showing an elevator apparatus according to an embodiment of the present invention. In Fig. 1, a pair of car guide rails 2 and a pair of counterweight guide rails 3 are arranged in a hoistway 1. A car 4 is raised and lowered in the hoistway 1 while being guided by the car guide rails 2. A counterweight 5 is raised and lowered in the hoistway 1 while being guided by the counterweight guide rails 3.

[0010] A machine room 6 is provided at a top of the hoistway 1. A machine base 7 is arranged in the machine room 6. A drive device (hoisting machine) 8 and a deflector sheave 9 are supported to the machine base 7. The drive sheave 8 has a drive sheave main body 8a including a motor and a brake, and a drive sheave (traction sheave) 8b that is rotated by the motor of the drive device main body 8a.

[0011] A plurality of main ropes 10 (only one of which is shown in Fig. 1) are wound around the drive sheave 8b and the deflector sheave 9. Each main rope 10 has a first end portion 10a to which the car 4 is connected, and a second end portion 10b to which the counterweight 5 is connected. That is, in the hoistway 1, the car 4 and the counterweight 5 are suspended according to a 1:1 roping system and raised and lowered by the drive force of the drive device 8.

[0012] A rotation shaft 9a of the deflector sheave 9 is parallel and horizontal to a rotation shaft 8c of the drive sheave 8b. The rotation shafts 8c, 9a are stationary shafts, with the drive sheave 8b and the deflector sheave 9 being rotatable with respect to the drive shafts 8c, 9a, respectively. Further, the main rope 10 is wound around the deflector sheave 9 at a position on the counterweight 5 side with respect to the drive device 8. The deflector sheave 9 leads the main rope 10 from the drive sheave 8b to the deflector sheave 9.

[0013] Provided between the deflector sheave 9 and the drive sheave 8b is an emergency brake device 11 for

braking the rotation of the drive sheave 8b in an emergency situation to stop the car 4. The emergency stop device 11 is provided outside the drive sheave 8 separately from a brake arranged inside the drive device main body 8a. Further, the emergencybrake device 11 is electrically connected to a control device (control panel) 12 for controlling the drive device 8. A signal from a speed detector 13, which detects the speed of the car 4, is inputted to the control device 12.

[0014] When the ascent speed of the car 4 exceeds a preset speed, the emergency brake device 11 is actuated by the control device 12, whereby braking is applied to the rotation of the drive sheave 8b to thereby stop the car 4. It should be noted that when the descent speed of the car 4 exceeds a preset speed, a braking command signal is transmitted from the control device 2 to an emergency stop device (not shown) mounted in the car 4, thereby actuating the emergency stop device to stop the car 4.

[0015] Fig. 2 is a side view showing, partly in section, the construction of the emergency brake device 11 of Fig. 1, Fig. 3 is a side view showing how braking is effected with the emergency brake device 11 of Fig. 2, Fig. 4 is a sectional view taken along the line IV-IV of Fig. 2, and Fig. 5 is a sectional view taken along the line V-V of Fig. 3.

[0016] Referring to the figures, an attachment member (attachment arm) 15 is attached to the rotation shaft 9a of the deflector sheave 9. The attachment member 15 is capable of rocking with respect to the rotation shaft 9a about the rotation shaft 9a. A brake shoe 17 is attached to the distal end portion of the attachment member 15 through a plurality of brake springs 16.

[0017] The brake shoe 17 is brought into and out of contact with the deflector sheave 9 side (counterweight 5 side) outer peripheral surface of the drive sheave 8b due to the rocking motion of the attachment member 15. That is, the brake shoe 17 is displaceable between a separated position (Fig. 2) where it is separated from the drive sheave 8b and a braking position (Fig. 3) where it is in abutment with the outer peripheral surface of the drive sheave 8b. Formed in the surface of the brake shoe 17 is a concave portion curved at the same curvature as the outer peripheral surface of the drive sheave 8b.

[0018] The attachment member 15, the brake springs 16, and the brake shoe 17 constitute a braking member 18.

[0019] A support member 19 is fixed to the rotation shaft 9a. The support member 19 is held in its horizontal position irrespective of the rotation of the deflector sheave 9 or the rocking motion of the braking member 18. Supported by the support member 18 is an electromagnetic actuator 20 serving as braking/releasing means.

[0020] The electromagnetic actuator 20 has a plunger 21 connected to the brake shoe 17 and a solenoid coil 22 for driving the plunger 21. When energized, the solenoid coil 22 serves to hold the brake shoe 17 in the sep-

arated position through the intermediation of the plunger 21.

[0021] Further, at the time of braking, the solenoid coil 22 is deenergized, whereby the braking member 18 falls due to its own weight so the brake shoe 17 is brought into abutment with the drive sheave 8b. The electromagnetic actuator 20 has a built-in auxiliary spring 25 urging the plunger 21 downward so that the plunger 21 is lowered with greater reliability at the time of braking.

[0022] An engaging member 24 is fixed to the brake shoe 17. The engaging member 24 is provided with an elongated hole 24a. The plunger 21 is provided with an engaging protrusion inserted in the elongated hole 24a. The plunger 21 is connected to the brake shoe 17 through the intermediation of the engaging member 24.

[0023] Respectively provided in the outer peripheral surface of the drive sheave 8b and the outer peripheral surface of the deflector sheave 9 are a plurality of rope grooves 8d, 9b (Figs. 4 and 5) into which the main ropes 10 are inserted.

[0024] Next, operation will be described. Normally, the solenoid coil 22 is energized so that the plunger 21 is pushed up by the electromagnetic force of the solenoid coil 22, whereby the brake shoe 17 is separated from the outer peripheral surface of the drive sheave 8b. Further, the travelling speed of the car 4 is detected by the speed detector 13 and constantly monitored by the control device 12.

[0025] When the ascent speed of the car 4 exceeds a rated speed and reaches a preset speed, the current to the solenoid coil 22 is shut off by the control device 12. When the solenoid coil 22 is deenergized, the braking member 18 is rocked due to its own weight and to the spring force of the auxiliary spring 25, thereby bringing the brake shoe 17 into abutment with the outer peripheral surface of the drive sheave 8b.

[0026] During ascent of the car 4, the brake shoe 17 is further displaced in the rotation direction of the drive sheave 8b after abutting with the outer peripheral surface of the drive sheave 8b, because the drive sheave 8b is rotating clockwise as seen in Figs. 2 and 3. That is, the braking member 18 functions like a wedge so as to be wedged between the rotation shaft 9a and the drive sheave 8b. At this time, the brake spring 16 is compressed between the attachment member 15 and the brake shoe 17.

[0027] The brake shoe 17 is displaced until equilibrium is reached between the spring force of the brake spring 16 and the friction braking force generated by the brake shoe 17. That is, as the brake spring 16 is compressed, a force for pressing the brake shoe 17 against the drive sheave 8b is generated, whereby a friction braking force is generated between the brake shoe 17 and the drive sheave 8b.

[0028] Accordingly, the ascending car 4 can be decelerated with a predetermined braking force to be brought to a stop more quickly, irrespective of the speed of the car 4.

[0029] Further, the attachment member 15 is capable of rocking about the rotation shaft 9a, thus allowing effective utilization of the space between the drive sheave 8b and the deflector sheave 9 in placing the emergency brake device 11. Furthermore, the casing of the deflector sheave 9 also serves as the casing of the emergency brake device 11 and thus it is unnecessary to provide a separate casing dedicated to the emergency brake device 11, thereby achieving a reduction in cost.

[0030] Further, the brake shoe 17 is held in the separated position by energizing the solenoid coil 22, and the brake shoe 17 is brought into abutment with the drive sheave 8b by deenergizing the solenoid coil 22, whereby the rocking motion of the braking member 18 can be effected immediately in response to a command from the control device 12.

[0031] Furthermore, upon deenergizing the solenoid coil 22, the braking member 18 rocks due to its own weight and the brake shoe 17 comes into abutment with the drive sheave 8b, thereby making it possible to bring the brake shoe 17 into abutment with the drive sheave 8b with greater reliability by means of a simple structure.

[0032] While in the above-described example the emergency brake device 11 is operated when the ascent speed of the car 4 reaches an abnormal speed, the emergency brake device 11 may also be operated when the car 4 is at rest at a landing floor during normal operation, thereby preventing the car 4 from ascending abnormally while passengers are getting into or out of the car 4.

[0033] Further, while in the above-described example the electromagnetic actuator 20 is exemplified as the braking/releasing means, the braking/releasing means is not limited to this. For example, an air actuator for holding the brake shoe in the separated position by means of air pressure or the like can also be employed.

arated position separated from the drive sheave upon brake release and for causing the braking member to rock into abutment with the drive sheave upon braking.

2. The emergency brake device for an elevator according to Claim 1, wherein the braking member further has a brake spring provided between the attachment member and the brake shoe.
3. The emergency brake device for an elevator according to Claim 1, wherein the braking/releasing means has a plunger connected to the braking member, and a solenoid coil that, when energized, causes the brake shoe to be held in the separated position through the plunger.
4. The emergency brake device for an elevator according to Claim 3, wherein deenergization of the solenoid coil causes the braking member to rock due to its own weight to bring the brake shoe into abutment with the drive sheave.

Claims

1. An emergency brake device for an elevator which brakes rotation of a drive sheave, around which a main rope for suspending a car and a counterweight are wound, to stop upward travel of the car, comprising:

a braking member having an attachment member and a brake shoe, the attachment member being capable of rocking motion about a rotation shaft of a deflector sheave around which the main rope is wound on a counterweight side with respect to the drive sheave, the brake shoe being provided to the attachment member and brought into and out of contact with a deflector sheave side outer peripheral surface of the drive sheave due to the rocking motion of the attachment member; and
braking/releasing means connected to the braking member, for holding the brake shoe in a sep-

FIG. 1

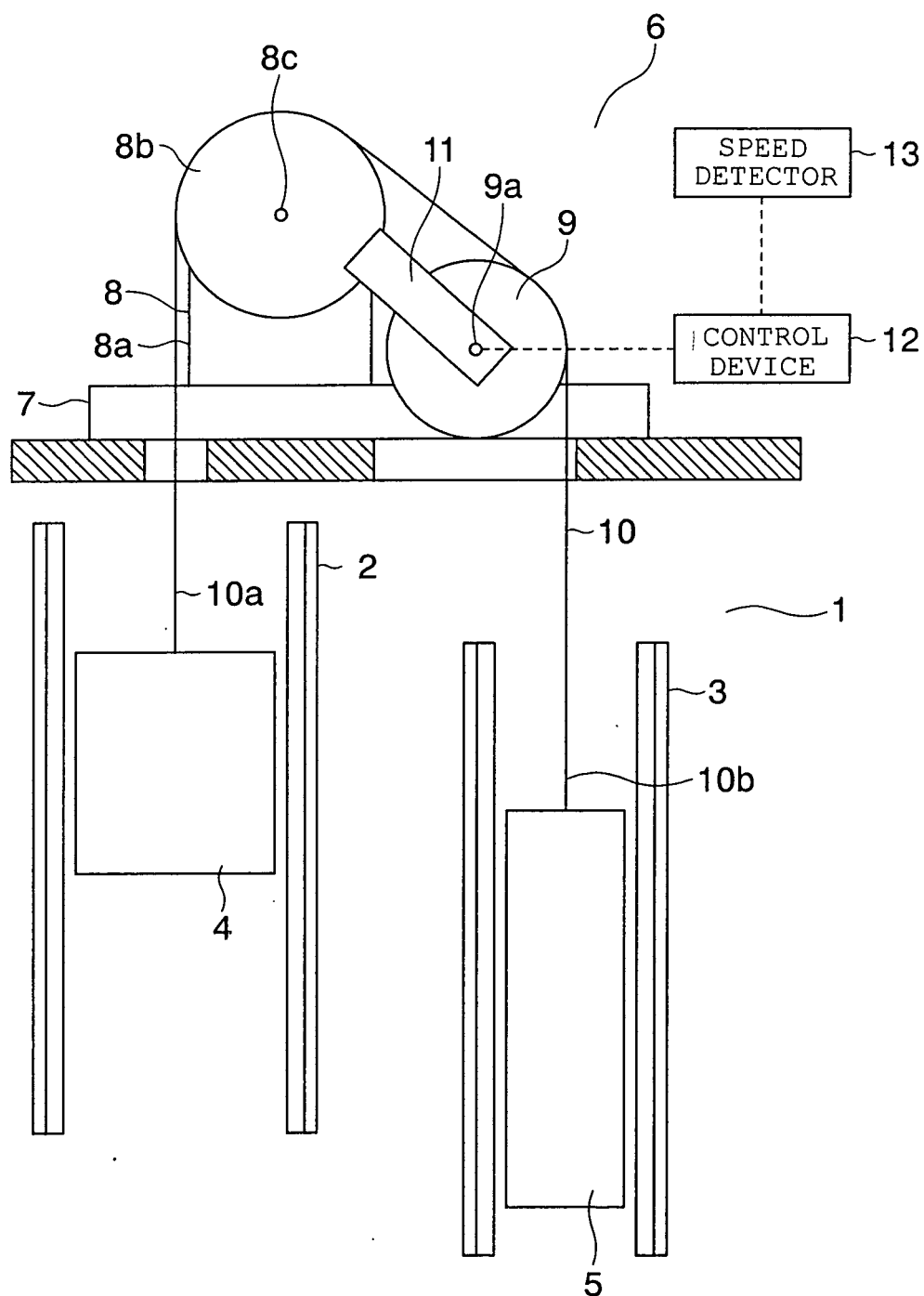


FIG. 2

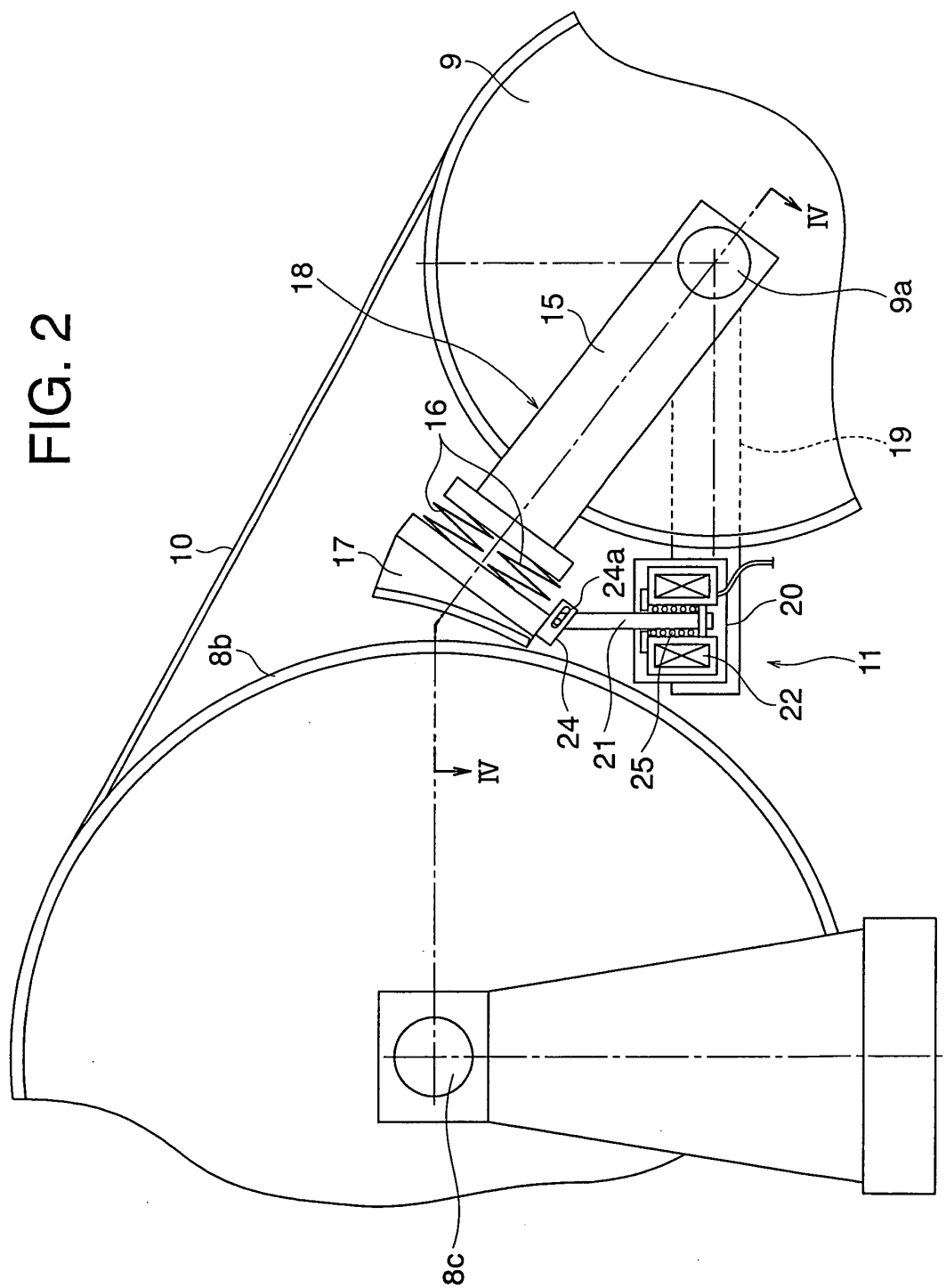


FIG. 3

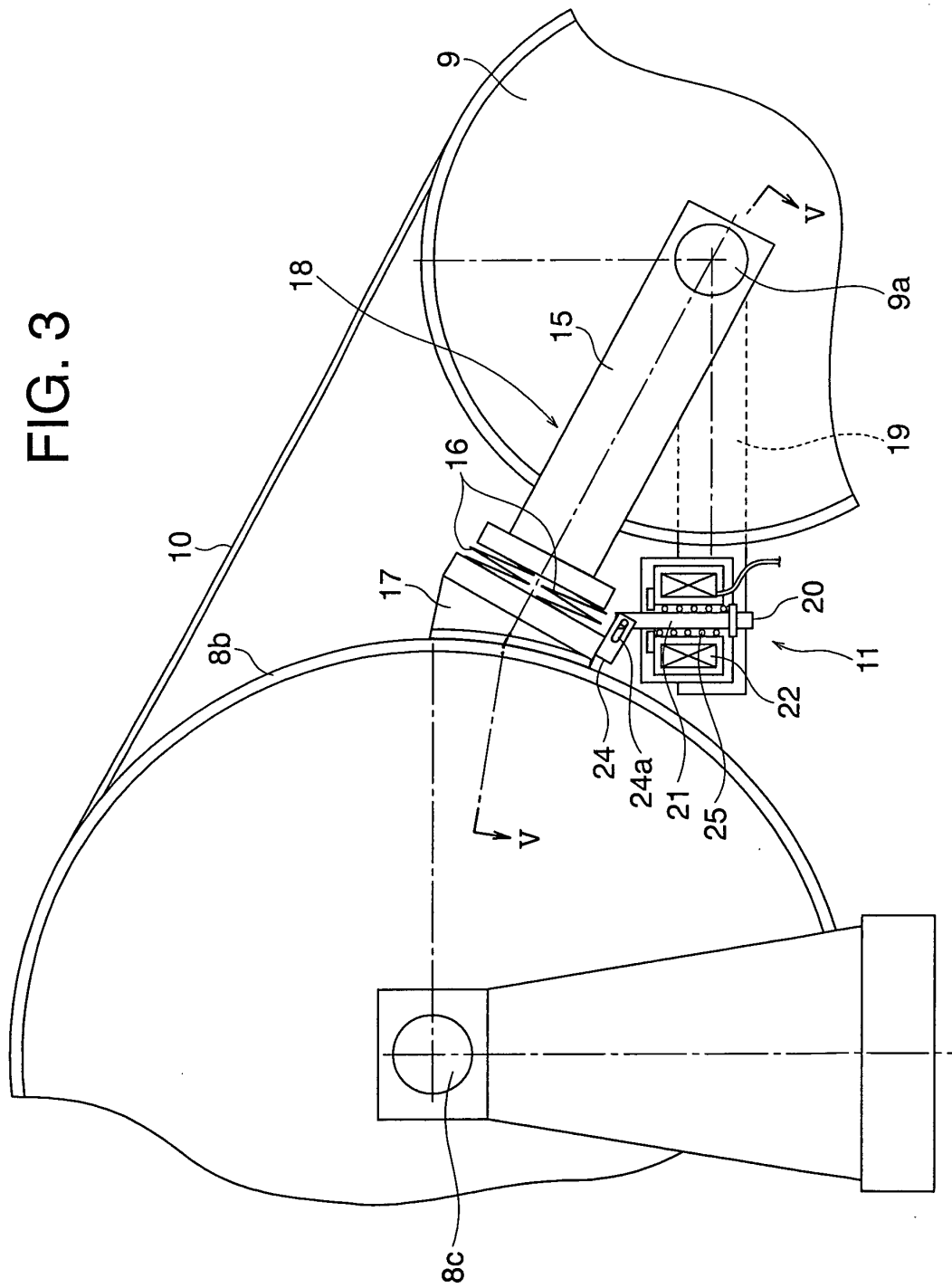


FIG. 4

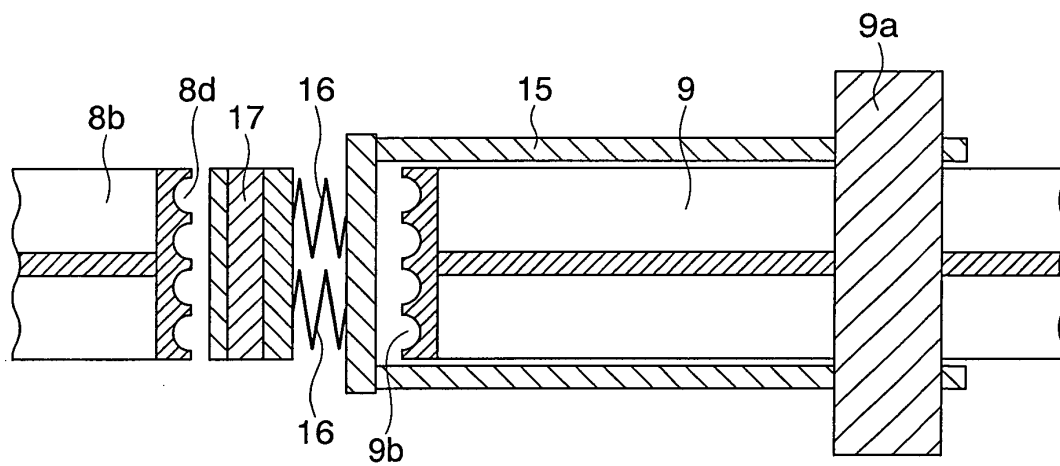
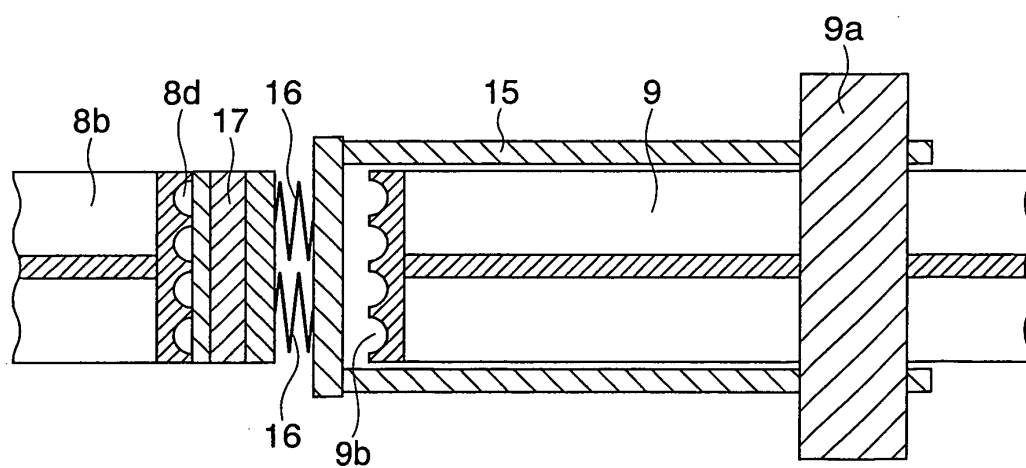


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/002056

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ B66B5/02		
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 B66B5/00-11/08, 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 1996-2004 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.
A	US 3795290 A (HITACHI, LTD.), 05 May, 1974 (05.05.74), & DE 2160935 A1 & GB 1336486 A & CA 946758 A & JP 49-48914 B1 & JP 50-22770 B1 & JP 51-13820 B1	1-4
A	WO 03/089354 A1 (Mitsubishi Electric Corp.), 30 October, 2003 (30.10.03), (Family: none)	1-4
A	WO 02/053485 A1 (Mitsubishi Electric Corp.), 11 July, 2002 (11.07.02), & EP 1352869 A1	1-4
☐ 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 16 November, 2004 (16.11.04)		Date of mailing of the international search report 07 December, 2004 (07.12.04)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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