(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 873 111 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 153(4) EPC

(43) Date of publication:
02.01.2008 Bulletin 2008/01

(21) Application number: **05734540.7**

(22) Date of filing: **20.04.2005**

(51) Int Cl.:
B66B 11/08 *(2006.01)* ***B66B 5/06*** *(2006.01)*
B66B 5/18 *(2006.01)*

(86) International application number:
PCT/JP2005/007537

(87) International publication number:
WO 2006/114872 (02.11.2006 Gazette 2006/44)

(84) Designated Contracting States:
DE

(71) Applicant: **MITSUBISHI ELECTRIC CORPORATION**
Chiyoda-ku
Tokyo 100-8310 (JP)

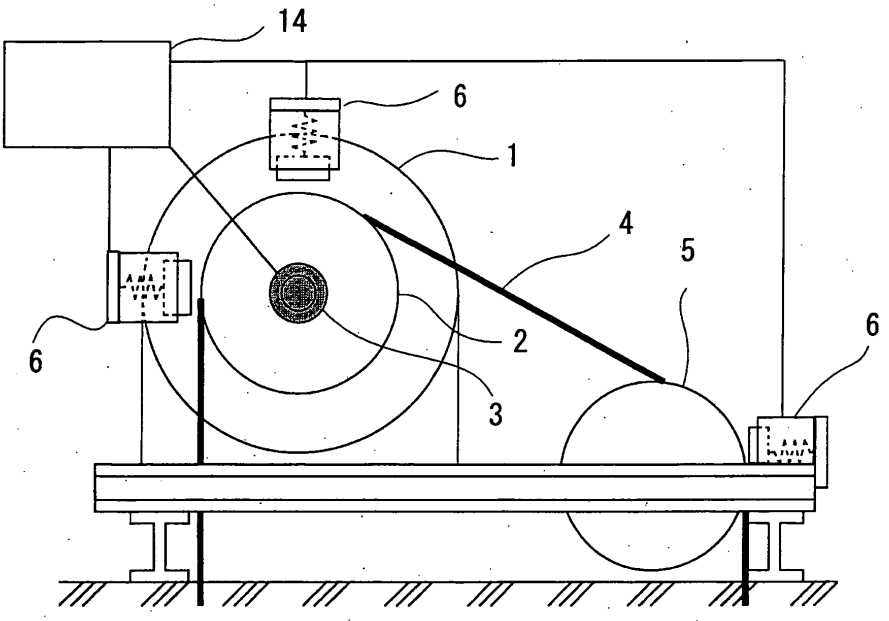
(72) Inventor: **MIYAMOTO, Kosei**
c/o Mitsubishi Denki K.K.
Tokyo 1008310 (JP)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) HOIST DEVICE FOR ELEVATOR

(57) An objective is to provide an elevator hoist apparatus that can resolve a problem in which acceleration for stopping a car increases when the braking characteristics of a brake decrease or malfunction occurs that the brake itself does not effectively drive, and can also prevent the increase of an installing space and the increase of the number of parts. The elevator hoist apparatus includes a hoist 1; a sheave 2 fixed to the output axis of the hoist 1; a speed detector 3 for detecting the output-axis rotation speed of the hoist 1; a rope-guard braking means 6 that functions as a rope guard of the sheave 2 or a deviation sheave 5 in the normal operation, and functions as a breaking means in an emergency; and a control means 14 for detecting abnormality, due to over speed, from the rotation speed detected by the speed detector 3, and for operating the rope-guard braking means 6.

FIG. 1



EP 1 873 111 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to elevator hoist apparatuses for moving a car up and down by driving a sheave around which a main rope engaged to the car is wound.

BACKGROUND ART

[0002] In a conventional elevator hoist apparatus, a sheave is mounted to which a main rope suspending the car of the elevator is engaged. Moreover, a brake is mounted not only for holding the car in the stopped state, but also for braking the car at an emergency stop; thereby, a rotator connected to the sheave is braked to which the main rope is engaged. In this brake for holding the car in the stopped state, braking force that can stop moving the car up and down is required in accordance with a live load having any margin in response to the riding capacity of the car. Furthermore, as the brake for braking the car at the emergency stop, the braking force is limited so that the up-and-down movement of the car is decelerated based on a deceleration speed that does not physically affect a passenger inside the car.

[0003] In the elevator hoist apparatus configured as described above, the opposite conditions of the braking ability for holding the car in the stopped state and the braking ability for emergently braking the car at the emergency stop are required to be satisfied. Therefore, because the control and maintenance of the braking torque are needed to be accurately performed, expense increases. Moreover, when, in addition to securing the desirable braking ability for holding, lightening of the car and miniaturizing of the hoist motor are accomplished, because its inertial load decreases, the deceleration speed of the car increases at the emergency stop. Therefore, a problem has occurred that the lightening and the miniaturizing of the hoist become difficult.

[0004] In order to take measures against such problem, a technology is disclosed in Japanese Laid-Open Patent Publication 294,385/2001 (Patent Document 1). According to this conventional technology, a hoist is provided for moving a car up and down by driving a sheave, which is engaged with a main rope for suspending the car, and a slow brake is also provided for decreasing the up-and-down speed of the car, by braking the rotation of a rotator connected to the sheave, based on deceleration that does not physically affect a passenger inside the car. Moreover, a holding brake that operates after the slow brake operates is provided for braking the rotator, and for holding the stopped car. Thereby, at an emergency stop, etc., first, the slow brake operates so as to decrease the speed of the car, and next, the holding brake operates so as to hold the car at the stopped position without sudden deceleration. Therefore, the slow-brake characteristics are independent from the condition of the holding torque; consequently, its designation can be simplified.

[0005] [Patent Document 1]
Japanese Laid-Open Patent Publication 294,385/2001

DISCLOSURE OF THE INVENTION

[Problems to be solved by the invention]

[0006] The conventional apparatus has a mechanism in which, if the car turns in an over-speed state, the brake provided in the driver operates so as to decelerate the speed of the car. The brake provided in the driver is also used at a time when the car is stopped in the normal operation. For example, due to unfavorable conditions being overlapped, when the braking characteristics of the brake decrease or malfunction occurs that the brake itself does not effectively drive, an emergency-stop device provided in the car or on the balance weight operates, and emergently stops the car; therefore, a problem occurs that the stopping acceleration inside the car increases.

[0007] By using the technology disclosed in Patent Document 1, the above problem can be resolved; however, because the sheave, the slow brake, and the holding brake are newly provided, a problem has occurred that a space for installing them and the number of parts increase.

[0008] An objective of the present invention, which is made to solve the above described problem, is to provide an elevator hoist apparatus that can resolve the problem in which the acceleration for stopping the car increases when the braking characteristics of the brake decrease or malfunction occurs that the brake itself does not effectively drive, and can also prevent the increase of the installing space and the increase of the number of parts.

[Means for solving the problem]

[0009] The present invention is characterized in that an elevator hoist apparatus includes a hoist; a sheave fixed to the output axis of the hoist; a speed detector for detecting the output-axis rotation speed of the hoist; a rope-guard braking means that functions as a rope guard of the sheave or a deviation sheave in the normal operation, and functions as a breaking means in an emergency; and a control means for detecting abnormality, due to over speed, from the rotation speed detected by the speed detector, and for operating the rope-guard braking means.

[Advantageous effect of the invention]

[0010] According to such elevator emergency stop device, the hoist; the sheave fixed to the output axis of the hoist; the speed detector for detecting the output-axis rotation speed of the hoist; the rope-guard braking means that functions as the rope guard of the sheave or the deviation sheave in the normal operation, and functions

as the breaking means in the emergency; and the control means for detecting abnormality, due to the over speed, from the rotation speed detected by the speed detector, and for operating the rope-guard braking means are provided; therefore, the problem can be resolved, in which the acceleration for stopping the car increases when the braking characteristics of the brake decrease or malfunction occurs that the brake itself does not effectively drive, and the increase of the installing space and the increase of the number of parts can also be prevented.

BRIEF DESCRIPTION OF DRAWINGS

[0011]

Fig. 1 is a view illustrating an elevator hoist apparatus according to Embodiment 1 of the present invention;
Fig. 2 is a structural view illustrating a rope-guard braking means 6 according to Embodiment 1 of the present invention;
Fig. 3 is a cross-sectional view viewed from the side of Fig. 2; and
Fig. 4 is a structural view illustrating the rope-guard braking means 6 according to Embodiment 2 of the present invention.

EXPLANATION OF SYMBOLS

[0012]

1: Hoist
2: Sheave
3: Speed detector
4: Rope
5: Deviation sheave
6: Rope-guard breaking means
7: Housing
7a: Engaging portion
8: Rope guard
8a: Engaging portion
8b: Slide face
9: Spring
10: Spring
11: Actuator
12: Coil
13: Movable element
14: Control means

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] As the best mode for carrying out the present invention, Embodiments 1 and 2 are explained.

Embodiment 1.

[0014] Fig. 1 is a view illustrating an elevator hoist apparatus according to Embodiment 1 of the present invention. A sheave 2 is fixed to the leading axis of a hoist 1 on a table to which the hoist apparatus is mounted, and a speed detector 3 is coaxially fixed to the output axis of the hoist 1 in order to detect a rotation speed of the sheave 2 rotating due to driving of the hoist 1. Moreover, a rope 4 for moving a car up and down through the up-and-down path is applied to the sheave 2. Thus, the rope 4 is applied to a deviation sheave 5 rotatably fixed to the table to which the hoist apparatus is mounted, so that the rope 4 suspends the car from a predetermined position. Furthermore, although not illustrated here, a brake for braking the drive axis of the hoist 1 during the normal operation is installed inside the hoist.

[0015] Generally, in the elevator hoist apparatus, a rope guard is provided along the periphery of the sheave 2 and the deviation sheave 5 so that the rope 4 is not removed from the sheave 2 and the deviation sheave 5 during the operation. On the other hand, in the elevator hoist apparatus, from the viewpoint of safety, preparing for a case in which the brake provided inside the hoist 1 used during an operation loses its function to be originally effective, a spare brake other than that is needed to be arranged. Because the opposite conditions of the braking ability for holding the car during the stopped state and the braking ability for emergently braking the car at the emergency stop are required to be satisfied, in the embodiment disclosed in Japanese Laid-Open Patent Publication 294,385/2001, a sheave, a slow brake, and a holding brake are newly provided. However, a problem has occurred that a space for installing them and the number of parts increase.

[0016] Therefore, as in Fig. 1, a rope-guard braking means 6 is placed, instead of the rope guard, at the position that the rope guard is to be provided. Moreover, a control means 14 for controlling the operation of the rope-guard braking means 6 is electrically connected, and thus, the control means 14 is also electrically connected to the speed detector 3. A structure of the rope-guard braking means 6 is explained. Fig. 2 is a structural view illustrating the rope-guard braking means 6 according to Embodiment 1 of the present invention.

[0017] Due to the force of a spring 9 whose one end is fixed to a housing 7, and whose the other end is fixed to a rope guard 8 having a slide face facing the sheave 2 or the deviation sheave 5, by contacting the slide face of the rope guard 8 with that of the sheave 2 or the deviation sheave 5, braking force can be obtained. In order that the rope guard 8 only functions as a guard for the rope 4, by engaging an engaging portion 7a provided on the housing 7 and an engaging portion 8a of the rope guard 8, the slide face of the rope guard 8 and that of the sheave 2 or the deviation sheave 5 are configured not to contact to each other. Moreover, a spring 10, which is fixed between the housing 7 and the rope guard 8, is set for forcing in the direction to release the engagement between the engaging portion 7a provided on the housing 7 and the engaging portion 8a of the rope guard 8. Furthermore, an actuator 11, which is fixed to the housing 7, is set for moving in the direction to engage the engaging

portion 7a provided on the housing 7 and the engaging portion 8a of the rope guard 8, when it is determined to be abnormal.

[0018] In Fig. 2, the actuator 11 adopts an electromagnet structure constituted by the housing 7 also having a stator portion, and by a coil 12 and a movable element 13; that is, the actuator 11 is configured so that, because a magnetic circuit is configured by the housing 7 and the movable element 13 due to the magnetic force generated by current flowing through the coil 12 during the current flowing through the coil 12, attraction force acts, on the movable element 13 fixed to the rope guard 8, in the direction of engaging the engaging portion 7a provided on the housing 7 and the engaging portion 8a of the rope guard 8. Because the control means 14 and the coil 12 are electrically connected to each other, the control means 14 becomes possible to control the coil 12.

[0019] Fig. 3 is a cross-sectional view viewed from the side of Fig. 2. The slide face of the rope guard 8 is formed so as to slide the sheave 2 and the rope 4 applied to the deviation sheave 5 along their surfaces.

[0020] An operation is explained.

When the control means 14 detects an over speed of the car due to the output value of the speed detector 3, coaxially fixed to the output axis of the hoist 1, for detecting the rotation speed of the leading axis, the control means 14 shuts down the current flowing across the coil 12 in the normal operation state. Thereby, the force acts in the direction to release the engagement between the engaging portion 7a provided on the housing 7 and the engaging portion 8a of the rope guard 8, and the engagement is removed.

Then, the rope guard 8 moves in the direction of the sheave 2 or the deviation sheave 5 by the force of the spring 9, and the slide faces slide against each other. The sheave 2 and the deviation sheave 5 can be braked by the slide.

[0021] Because a plurality of rope guards 8 is generally fixed to the sheave 2 and the deviation sheave 5, a plurality of rope-guard braking means 6 is also fixed. Therefore, without increasing the number of parts, the braking force needed per unit rope-guard braking means 6 can be decreased; consequently, the problem of the space increase can be resolved.

[0022] Moreover, by providing a plurality of rope-guard braking means 6, a function as an emergency brake is executed; therefore, a problem, in which the acceleration for stopping the car increases when the braking characteristics of the brake decrease or malfunction occurs that the brake itself does not effectively drive, can be resolved due to a function corresponding to the slow brake represented in Japanese Laid-Open Patent Publication 294,385/2001, by operating a part of the plurality of rope-guard braking means 6.

[0023] Therefore, according to Embodiment 1, the elevator hoist apparatus includes the hoist 1; the sheave 2 fixed to the output axis of the hoist 1; the speed detector 3 for detecting the output-axis rotation speed of the hoist 1; the rope-guard braking means 6 that functions as a rope guard of the sheave 2 or a deviation sheave 5 in the normal operation, and functions as a breaking means in an emergency; and the control means 14 for detecting abnormality, due to the over speed, from the rotation speed detected by the speed detector 3, and for operating the rope-guard braking means 6; therefore, a problem can be resolved, in which the acceleration for stopping the car increases when the braking characteristics of the brake decrease or malfunction occurs that the brake itself does not effectively drive, and the increase of the installing space and the increase of the number of parts can also be prevented.

[0024] Moreover, in this embodiment, although a case is explained in which the control means 14 operates normally, if electric power becomes impossible to be supplied to the control means 14 due to the blackout, etc., the control means 14 cannot be controlled; however, because the electric power is not supplied, current does not flow across the coil 12 as a component of the actuator 11 included in the rope-guard braking means 6 electrically connected to the control means 14, and consequently, the braking operation is performed against the movement of the car. Therefore, the elevator hoist apparatus according to this embodiment is also applicable to an abnormal state such as the blackout.

[0025] Here, in Embodiment 1, the actuator 11 of the rope-guard braking means 6 has been explained to be configured of the electromagnet composed of the coil 12, the stator, and the movable element 13; however, when significant force is needed for the maintenance, for example, by controlling the position of the movable element 13 using a motor and a reduction gear, the function can also be substituted. Needless to say, instead of the actuator including the electromagnet, an oil-pressure cylinder or an air-pressure cylinder may also substitute the function, and thus, due to the configuration using a pump, etc. utilizing an electric device such as a motor for supplying the air pressure and the oil pressure, when electric power is shut down, the cylinder does not function; therefore, the rope guard 8 may be configured to be slidable with respect to the sheave 2 and the deviation sheave 5.

Embodiment 2.

[0026] Fig. 4 is a structural view illustrating the rope-guard braking means 6 according to Embodiment 2 of the present invention. Here, elements other than the elements specifically illustrated are the same as those in Embodiment 1, and the same symbols in Fig. 4 as those in Fig. 2 represent the same elements or the equivalent elements.

[0027] The difference from Embodiment 1 is explained. In Embodiment 1, a case has been explained in which the slide face, facing the sheave 2 or the deviation sheave 5, of the rope guard 8 included in the rope-guard braking means 6 is plane; however, in Embodiment 2, the slide face of the rope guard 8 is configured so as to

be along the slide-face shape of the sheave 2 or the deviation sheave 5.

[0028] Therefore, because the slide face of the rope guard 8 is configured so as to be along the slide face of the sheave 2 or the deviation sheave 5, the area of the actual slide face increases; however, in order that the rope 4 is configured not to be removed from the sheave 2 and the deviation sheave 5, because the slide face of the rope guard 8 cannot be narrowed, the force contacting the sheave 2 or the deviation sheave 5 is decreased, and consequently, the rope-guard braking means 6 can be further miniaturized.

[0029] Therefore, according to Embodiment 1, an effect similar to that in Embodiment 1 can be obtained. Moreover, because the slide face of the rope guard 8 is configured so as to be along the slide face of the sheave 2 or the deviation sheave 5, the force contacting the sheave 2 or the deviation sheave 5 can be decreased; therefore, the rope-guard braking means 6 can be further miniaturized.

INDUSTRIAL APPLICABILITY

[0030] The elevator hoist apparatus according to the present invention is suitable for operating elevators.

Claims

1. An elevator hoist apparatus **characterized in that** the apparatus comprises:

   a hoist;
   a sheave fixed to the output axis of the hoist;
   a speed detector for detecting the output-axis rotation speed of the hoist;
   a rope-guard braking means for functioning as a rope guard of the sheave or a deviation sheave in the normal operation, and for functioning as a breaking means in an emergency; and
   a control means for detecting abnormality, due to over speed, from the rotation speed detected by the speed detector, and for operating the rope-guard braking means.

2. An elevator hoist apparatus as recited in claim 1, wherein the face of the sliding portion of either the sheave or the deviation sheave of the rope-guard braking means is a circular arc shape to be along the peripheral shape of either the sheave or the deviation sheave.

FIG. 1

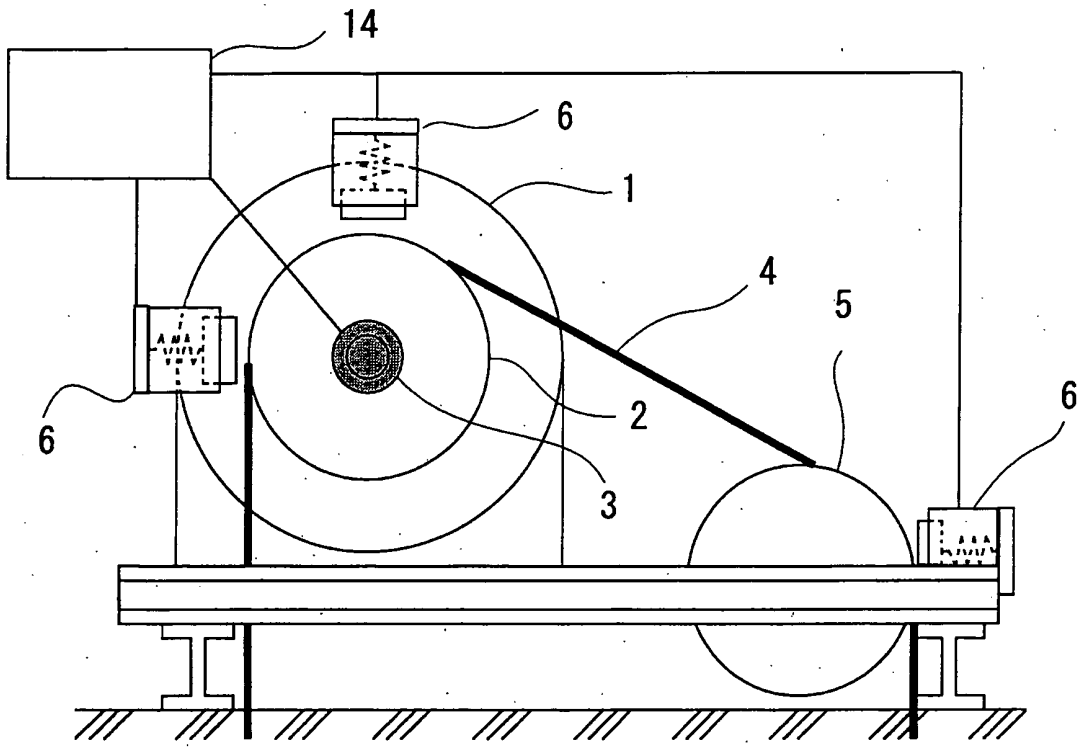


FIG. 2

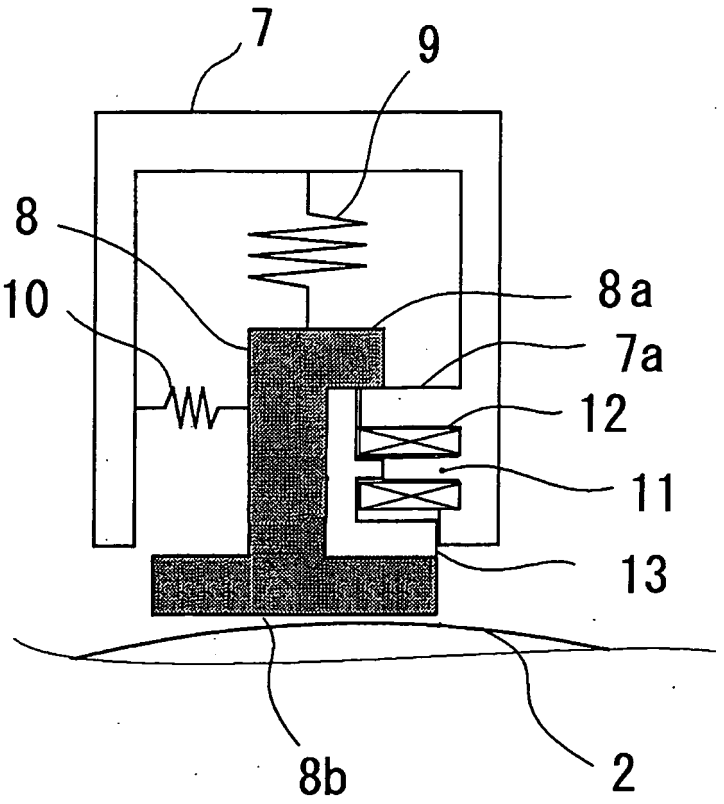


FIG. 3

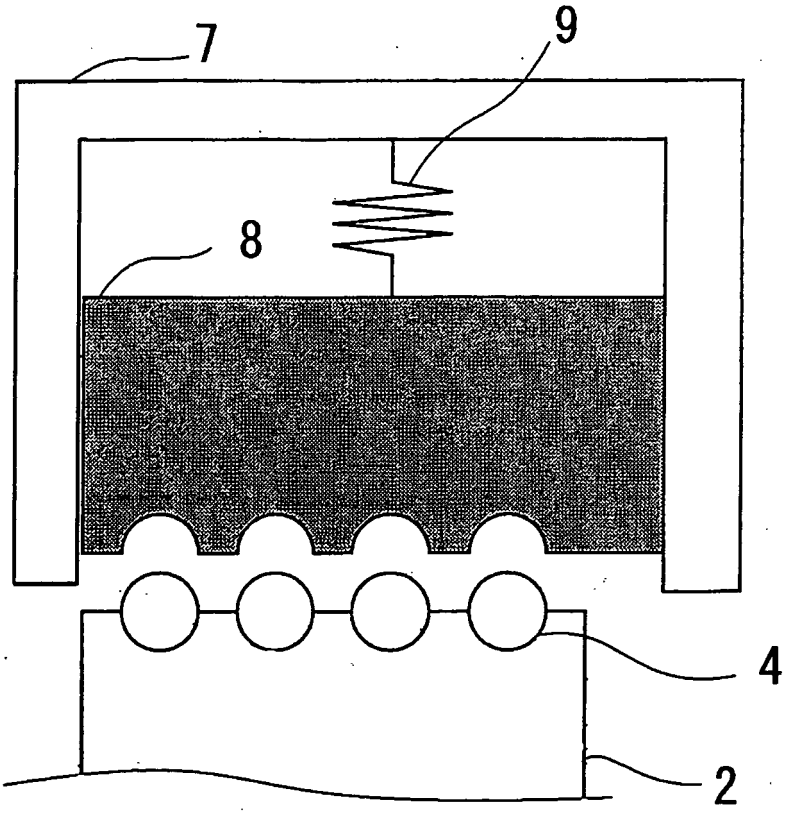
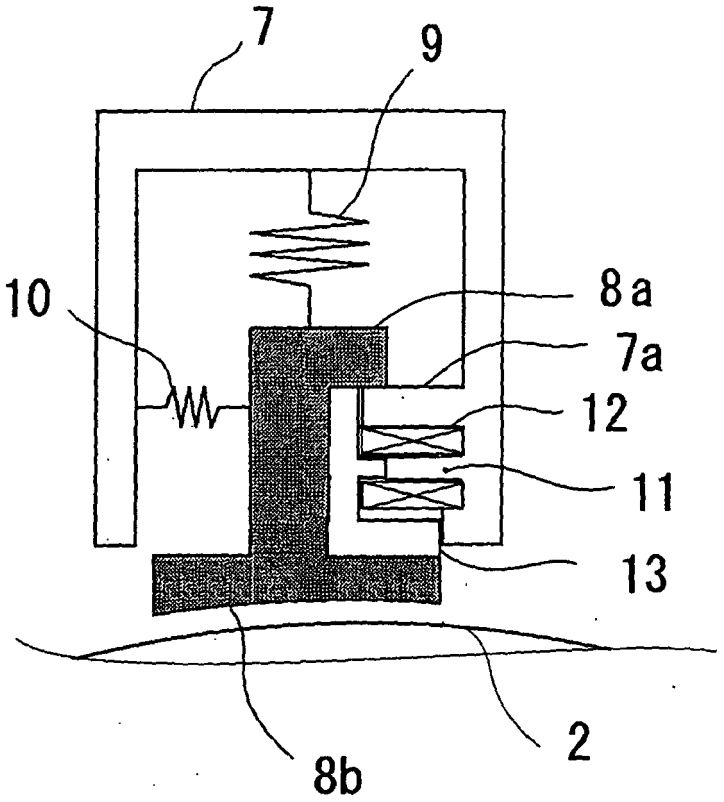


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/007537

A. CLASSIFICATION OF SUBJECT MATTER
B66B11/08(2006.01), ***B66B5/06***(2006.01), ***B66B5/18***(2006.01)

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)
B66B1/00(2006.01)-***B66B11/08***(2006.01)

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	1996-2006
Kokai Jitsuyo Shinan Koho	1971-2006	Toroku Jitsuyo Shinan Koho	1994-2006

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	JP 62-235181 A (Mitsubishi Electric Corp.), 15 October, 1987 (15.10.87), Page 2, upper right column, lines 3 to 15; Fig. 5 (Family: none)	1-2
Y	JP 6-199483 A (Mitsubishi Electric Corp.), 19 July, 1994 (19.07.94), Par. Nos. [0014] to [0022], [0026]; Figs. 1 to 2, 4, 6 to 7 (Family: none)	1-2
A	JP 2001-278572 A (Mitsubishi Electric Corp.), 10 October, 2001 (10.10.01), Abstract; Fig. 1 (Family: none)	1

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search 18 January, 2006 (18.01.06)	Date of mailing of the international search report 24 January, 2006 (24.01.06)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2005/007537

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 59-212371 A (Toshiba Corp.), 01 December, 1984 (01.12.84), Page 2, upper right column, line 2 to lower right column, line 9; Fig. 2 (Family: none)	2

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2001294385 A **[0004] [0005] [0015] [0022]**