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(71) Applicant: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Tokyo 100-8310 (JP)

(72) Inventor: **KAJITA, Akinari**
c/o Inaryo Technica Co., Ltd.
Aichi 4928661 (JP)

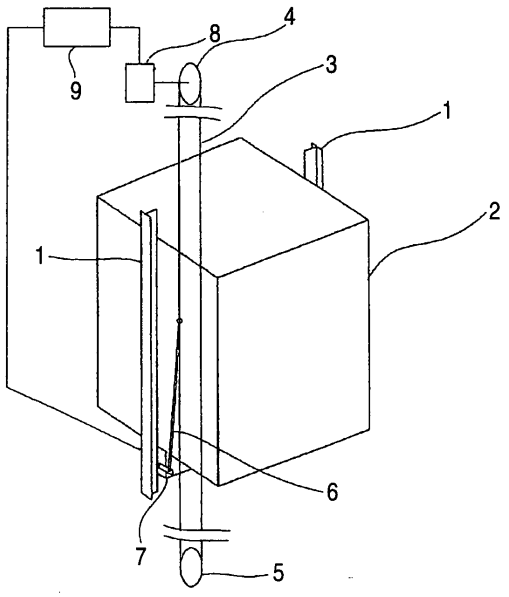
(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastrasse 4
81925 München (DE)

(54) EMERGENCY STOP DEVICE FOR ELEVATOR

(57) It is an object of the present invention to provide an emergency stop device of an elevator **characterized in that**: while the occurrence of malfunction is being prevented, a delay of the emergency stop action is reduced.

An emergency stop device of an elevator comprises: a cage; a guide rail; a governor; a governor rope; a connecting means, to one end of which the governor rope is connected; an emergency stop means operated according to a position of the other end of the connecting means, for obtaining a braking force to brake the cage when the emergency stop means comes into pressure contact with the guide rail; a malfunction prevention means for preventing malfunction when a predetermined pushing force is given to the action of the emergency stop means; and a malfunction prevention release means for releasing the predetermined pushing force given by the malfunction prevention means according to a cage speed when the cage speed exceeds a predetermined value.

FIG. 1



EP 1 806 310 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a safety device for stopping an elevator in case of an emergency.

BACKGROUND ART

[0002] In a conventional emergency stop device incorporated into an elevator, when a relatively upward force is given to a connecting means, to which one end of a governor rope of a governor is fixed, by a shake of a cage or by an inertial force generated at the time of start of the elevator and when an action of the elevator exceeds a predetermined value, the emergency stop device is operated.

[0003] In order to take countermeasures against the above problems, the official gazette of JP-A-5-319724 (Patent Document 1) discloses a technique of preventing malfunction of an emergency stop device for stopping an elevator. According to this prior art, concerning a lifting lever for lifting a braking piece upward when the lifting lever is rotated by a tensile force of a governor rope, an end portion of the lifting lever on the shaft side has a cam, and a curved surface seat coming into contact with the cam is provided and a coil spring for pushing the curved surface seat by a predetermined force is also provided. Due to the above structure, when a force not less than a predetermined force is given to the governor rope and an action of the governor rope exceeds a predetermined value, the braking piece can be moved upward.

[0004] Patent Document 1: JP-A-5-319724

DISCLOSURE OF THE INVENTION

PROBLEMS THAT THE INVENTION IS TO SOLVE

[0005] However, according to the technique described in Patent Document 1, a mechanism for preventing the occurrence of malfunction is composed so that it can give a pushing force to a lifting lever. Therefore, in order to move the braking piece upward by operating the lifting lever, it is necessary to give a force, the intensity of which is not less than a predetermined value. Further, in order to get over a cam shape, it is necessary for the lifting lever to be rotated by a predetermined rotation. Therefore, a delay of the emergency stop operation is caused.

[0006] The present invention has been accomplished to solve the above problems. It is an object of the present invention to provide an emergency stop device of an elevator characterized in that: while the occurrence of malfunction is being prevented, a delay of the emergency stop action is reduced.

MEANS FOR SOLVING THE PROBLEM

[0007] The present invention provides an emergency stop device of an elevator comprising: a cage; a guide rail; a governor; a governor rope; a connecting means, to one end of which the governor rope is connected; an emergency stop means operated according to a position of the other end of the connecting means, for obtaining a braking force for the cage coming into pressure contact with the guide rail; a malfunction prevention means for preventing malfunction when a predetermined pushing force is given to the action of the emergency stop means; and a malfunction prevention release means for releasing the predetermined pushing force given by the malfunction prevention means according to a cage speed when the cage speed exceeds a predetermined value.

ADVANTAGE OF THE INVENTION

[0008] The emergency stop device of an elevator comprises: a cage; a guide rail; a governor; a governor rope; a connecting means, to one end of which the governor rope is connected; an emergency stop means operated according to a position of the other end of the connecting means, for obtaining a braking force for the cage coming into pressure contact with the guide rail; a malfunction prevention means for preventing malfunction when a predetermined pushing force is given to the action of the emergency stop means; and a malfunction prevention release means for releasing the predetermined pushing force given by the malfunction prevention means according to a cage speed when the cage speed exceeds a predetermined value. Therefore, it is possible to improve a delay of the action of the emergency stop means caused by the pushing force given by the malfunction prevention means.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a view showing an emergency stop device of an elevator of Embodiment 1 of the present invention.

Fig. 2 is an arrangement view showing an emergency stop means 7 composing the emergency stop device of the elevator of Embodiment 1 of the present invention.

Fig. 3 is a sectional view taken on line B - B showing the emergency stop means 7 composing the emergency stop device of the elevator of Embodiment 1 of the present invention.

Fig. 4 is an operation view of a connecting lever 14, which composes the emergency stop device of the elevator of Embodiment 1 of the present invention, and a malfunction prevention means 19 and also Fig. 4 is a sectional view of an electromagnetic switch 10 in this case.

Fig. 5 is a view showing the emergency stop means 7 composing the emergency stop device of the elevator of Embodiment 1 of the present invention at

the time of operation of the emergency stop means 7. Fig. 6 is an operation view of a connecting lever 23, which composes an emergency stop device of an elevator of Embodiment 2 of the present invention, and a malfunction prevention means 19, and also Fig. 6 is a sectional view of an electromagnetic switch 24 in this case.

DESCRIPTION OF THE REFERENCE NUMERALS AND SIGNS

[0010] 1 Guide rail, 2 Cage, 3 Governor rope, 4 Governor, 5 Governor rope pulley, 6 Lifting rod, 7 Emergency stop means, 8 Switch, 9 Control means, 10 Electromagnetic switch, 11 Emergency stop lever, 12 Emergency stop means body, 13 Braking piece, 14 Connecting lever, 15 Guide, 16 Roller, 17 Spring, 18 Pin, 19 Malfunction prevention section, 20 Spring, 21 Electromagnetic switch body, 22 Electromagnet, 23 Connecting lever, 23a Hole, 24 Electromagnetic switch, 25 Stopper, 26 Movable piece, 26a Pin, 27 Electromagnetic switch body, 28 Stopper, 29 Indication pin

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] The best mode for carrying out the invention will be explained referring to Embodiments 1 and 2.

EMBODIMENT 1

[0012] Fig. 1 is a view showing a safety device of an elevator of Embodiment 1 of the present invention.
The cage 2 is elevated along the guide rails 1 in an elevating passage. The endless governor rope 3, which is arranged in parallel with the guide rails 1, is wound round the governor 4 and the governor rope pulley 5. The governor rope 3 is fixed to one end of the lifting rod 6 which is a connecting means. The other end of the lifting rod 6 is pivotally fixed to a component of the emergency stop means 7. The component will be described later.

[0013] On the other hand, the governor 4, the shape of which is formed into a disk-shape or a ball-shape, is a device for adjusting a rotation of a rotary body by changing a rotary speed into a centrifugal force so that the rotary speed can be maintained constant irrespective of a change in a load given to the rotary body. The governor 4 is rotated synchronously with an electric motor used for winding a cage. For example, when an overspeed of the cage reaches the first speed, which is a predetermined speed and lower than 1.3 times of the rated speed, an electric power source of the winding motor is turned off and an electromagnetic brake is operated at the same time. In the case where the overspeed of the cage is not reduced even when the electric power source of the winding motor is turned off and the electromagnetic brake is operated at the same time, and when the overspeed of the cage reaches the second speed which is 1.4 times lower than the rated speed, the governor 4 seizes the governor rope 3 and the lifting rod 6 is lifted upward, so that the emergency stop means 7 can be operated.

[0014] In the governor 4, the switch 8 is provided which is mechanically changed over by a centrifugal force generated by the pulley when the overspeed of the cage has reached the first speed. When the switch 8 is changed over, the control means 9, which is electrically connected to the switch 8, receives an OFF signal from the switch 8, so that the electromagnetic switch 10 can be operated. In this connection, concerning the switch 8, it is possible to use a mechanical overspeed switch, which is conventionally arranged, for turning off the electric power source of the winding electric motor when the speed has reached the first speed. The switch 8, the control means 9 and the electromagnetic switch 10 are respectively components provided for the malfunction prevention release means.

[0015] Fig. 2 is an arrangement view of the emergency stop means 7 composing the safety device of the elevator of Embodiment 1 of the present invention.
The other end portion of the lifting rod 6 is pivotally fixed to one end portion of the emergency stop lever 11 which is a component of the emergency stop device 7. The emergency stop lever 11 is pivotally fixed to the hole 12a with respect to the emergency stop means body 12 of the emergency stop means 7. The emergency stop lever 11 of the emergency stop means 7 is pivotally attached to one end of the braking piece 13 and also attached to one end of the connecting lever 14. In this connection, the emergency stop lever 11 is composed so that it can not be rotated counterclockwise from the present position by the stopper 28. Accordingly, the lifting rod 6 can not be moved downward from the present position.

[0016] Next, the braking piece 13 will be explained below. Fig. 3 is a sectional view taken on line B - B in Fig. 2 showing the emergency stop means 7 composing the safety device of the elevator of Embodiment 1 of the present invention.
When the lifting rod 6 is raised, two braking pieces 13 connected to the emergency stop lever 11 is moved upward. Then, both the braking pieces 13 are moved inward by the rollers 16 pivotally fixed to the guides 15 and slid with the guide rail 1, so that a braking force can be obtained. Each guide 15 is fixed to the emergency stop means body 12 through the spring 17. Therefore, by a force given to the guide 15 by the spring 17, an intensity of the braking force, which is generated by the sliding motion between the guide rail 1 and the braking piece 13, is determined.

[0017] In Fig. 2, the other end portion of the connecting lever 14 is connected to the malfunction prevention means 19 through the pin 18. In the malfunction prevention means 19, which is fixed to the cage 2, the spring 20 is arranged. By a force generated by this spring 20, the other end portion of the connecting lever 14 is pulled. Therefore, in order to operate the emergency stop means 7 by raising the lifting rod 6 when the governor 4 seizes the governor rope 3 in the prior art, it is necessary to

overcome the spring force generated by the spring 20. Accordingly, a delay is caused in the operation of emergency stop.

[0018] In Embodiment 1, the pin 18 composes a portion of the electromagnetic switch 10 which is the malfunction prevention release means. Therefore, when the electromagnetic switch 10 is operated and the pin 18 is reciprocated, the connecting lever 14 and the malfunction prevention means 19 can be connected to and released from each other. Accordingly, the malfunction release motion is not affected by the spring force generated by the spring provided in the malfunction prevention means 19 . Therefore, no delay is caused and the emergency stop operation can be quickly conducted. Detailed explanations will be made into this matter as follows.

Fig. 4 is an operation view of a connecting lever 14, which composes a safety device of the elevator of Embodiment 1 of the present invention, and a malfunction prevention means 18 and also Fig. 4 is a sectional view of an electromagnetic switch 10 in this case. Fig. 4 (a) is a view showing a normal state, Fig. 4 (b) is a view showing a state in which the governor 4 is operating at the first speed and Fig. 4 (c) is a view showing a state in which the governor 4 is operating at the second speed.

[0019] In Fig. 4 (a), the view on the lower side is an operation view of the connecting lever 14 and the malfunction prevention means 19, and the view on the upper side is a sectional view of the electromagnetic switch 10 at the time. The pin 18 is connected to the electromagnetic switch body 21 through the spring 20, and a force is always given to the pin 18 by the spring 20 so that the pin 18 can be pulled in the direction of the electromagnetic switch body 21. However, since an electric current always flows in the electromagnet 22 fixed to the electromagnetic switch body 21, the pin 18 is fixed while coming into contact with the electromagnet 22. Accordingly, since the pin 18 is located on the electromagnet 22 side in the usual case, the pin 18 is engaged in the holes provided in the connecting lever 14 and the malfunction prevention means 19.

[0020] In Fig. 4 (b), when the governor 4 reaches the first speed which is a predetermined speed, the switch 8 provided in the governor 4 is changed over, and the control means 9 electrically connected to the switch 8 receives an OFF signal from the switch 8. Therefore, the control means 9 shuts off an electric current of the electromagnet 22 in the electromagnetic switch 10 which is a component of the emergency stop device 7. Then, the pin 18 is moved upward by a tensile force of the spring 20. Accordingly, the connecting lever 14 and the malfunction prevention means 19 are disconnected from each other.

[0021] In Fig. 4 (c), when the governor 4 reaches the second speed, it seizes the governor rope 3, so that the lifting rod 6 can be raised upward. Then, the emergency stop lever 11, which is pivotally connected to the lifting rod 6, is rotated. According to the rotation of the emergency stop lever 11, the connection lever 14 is moved to the left. At this time, the connecting lever 14 and the malfunction prevention means 19 have already been disconnected from each other. The connecting lever 14, which has already been disconnected, is supported by the support pins 29, so that the connecting lever 14 can not be rotated but moved to the right and the left.

[0022] Fig. 5 is a view showing a state in which the emergency stop means 7 composing the emergency stop device of the elevator of Embodiment 1 of the present invention is operated.

Since the connecting lever 14 and the malfunction prevention means 19 are not connected to each other, when the lifting rod 6 is given a force upward, it is moved upward, so that the emergency stop lever 11 can be rotated and the braking piece 13 can be also moved upward. Therefore, the guide rail 1 and the braking piece 13 are slid on each other, and a braking force can be obtained. At this time, the emergency braking operation can be conducted. In this case, even when the lifting rod 6 is given an upward force, it is not affected by the pushing force of the malfunction prevention means 19. Therefore, the emergency stop operation can be conducted without causing any delay.

[0023] Accordingly, according to Embodiment 1, the emergency stop device of an elevator includes: a cage 2; a guide rail 1; a governor 4; a governor rope 3; a lifting rod 6, to one end of which the governor rope 3 is connected; an emergency stop means 7 operated according to a position of the other end of the lifting rod 6, for obtaining a braking force to brake the cage 2 by sliding on the guide rail 1; a malfunction prevention means 19 for giving a predetermined load so as to operate the emergency stop means 7; and an electromagnetic switch 10 for releasing the predetermined load given to the malfunction prevention means 19 when the control means 9 conducts controlling according to a signal inputted from the switch 8. Therefore, a delay of the emergency stop means 7 can be improved which is caused by a pushing force generated by the malfunction prevention means 19.

[0024] In Fig. 5, when a speed of the cage 2 is decreased by the emergency stop operation to a value lower than the second speed, the governor 4 releases a seizing motion of seizing the governor rope 3. Therefore, the emergency stop lever 11 is rotated counterclockwise by the lifting rod 6 and the braking piece 13 and stopped at the position shown in Fig. 2. Then, a center position of the hole provided in the connecting lever 14 connected to the emergency lever 11 coincides with a center position of the hole provided in the malfunction prevention means 19. When the speed of the cage 2 is further reduced to a value lower than the first speed, the switch 8 fixed to the governor 4 outputs an ON signal to the control means 9. Then, the control means 9 applies an electric current upon the electromagnetic switch 10. Therefore, the pin 18 is moved so that the connecting lever 14 and the malfunction prevention means 19 can be connected to each other. Accordingly, even after the emergency stop operation has been conducted, it is possible for the device to

be automatically returned to the usual operation state.

[0025] In this connection, concerning the lifting rod 6, as long as it is a means for connecting the governor rope 4 with the emergency stop lever 11, it is not necessarily a rod but it may be composed of a rope or others. Even the above structure is adopted, no problems are caused in the constitution of Embodiment 1.

In the constitution of the embodiment, when the speed reaches the first speed, the control means 9 electrically connected to the switch 8 receives an OFF signal from the switch 8, so that an electric current of the electromagnet 21 in the electromagnetic switch 10, which is a component of the emergency stop device 7, can be shut off. However, on the contrary, the following constitution may be adopted. When the speed reaches the first speed, the control means 9 electrically connected to the switch 8 receives an ON signal from the switch 8, so that an electric current of the electromagnet 22 in the electromagnetic switch 10, which is a component of the emergency stop device 7, can be applied. However, in this case, the following constitution is needed. In the constitution of the electromagnetic switch 12, the spring 20 must be composed so that it can generate a force in the direction in which the electromagnetic switch body 12 and the pin 18 are always contacted with each other. In the case where an electric current is made to flow in the electromagnet 22, in order to avoid a contact of the electromagnetic switch body 12 with the pin 18, for example, it is necessary to compose in such a manner that a position of the electromagnet 22 is located on the upper side of the pin 18.

Concerning the first and the second speed, the second speed must be higher than the first speed, and the first speed must be higher than the rated speed. However, the first speed is not necessarily 1.3 or 1.4 times higher than the rated speed as exemplarily shown here.

EMBODIMENT 2

[0026] Explanations will be made into Embodiment 2 in which the malfunction prevention release means is composed differently from that of Embodiment 1. Fig. 6 is an operation view of a connecting lever 23, which composes an emergency stop device of an elevator of Embodiment 2 of the present invention, and a malfunction prevention means 19 and also Fig. 6 is a sectional view of an electromagnetic switch 24 in this case. In this connection, portions not shown in the drawing are the same as those of Embodiment 1, and like reference characters are used to indicate like parts in Figs. 4 and 6.

[0027] In Fig. 6 (a), one end of the emergency stop lever 11 is pivotally fixed to one end of the connecting lever 23. An L-shaped hole 23a is formed at the other end of the connecting lever 23 . This hole 23a is engaged with the rod-shaped stopper 25 fixed to the malfunction prevention section 19. The connecting lever 23 is engaged with the movable piece 26 to which two pins 26a are fixed. The movable piece 26 composes one component of the electromagnetic switch 24. The other components of the electromagnetic switch 24, which is a malfunction prevention release means, includes: an electromagnetic switch body 27; a spring 20 for generating a pushing force between the electromagnetic switch body 27 and the movable piece 26; and an electromagnet 22, which is fixed to the electromagnetic switch body 27, for generating an attraction force with the movable piece 26.

[0028] Since an electric current always flows in the electromagnet 22 fixed to the electromagnetic switch 24 at the usual time, the movable piece 26 is fixed, coming into contact with the electromagnet 22. Accordingly, at the usual time, the rod-shaped stopper 25, which is fixed to the malfunction prevention section 19, is located on the upper side of the L-shaped hole 23a. Therefore, the connecting lever 23 can not be moved to the right or the left by a force lower than the pushing force of the malfunction prevention section 19.

[0029] In Fig. 6 (b), when the governor 4 reaches the first speed which is a predetermined speed, the switch 8 provided in the governor 4 is changed over, and the control means 9 electrically connected to the switch 8 receives an OFF signal from the switch 8. Therefore, the control means 9 shuts off an electric current of the electromagnet 22 in the electromagnetic switch 24 which is a component of the emergency stop device 7. Then, the movable piece 26 is moved upward by a tensile force of the spring 20. Accordingly, the connecting lever 23 engaged with the movable piece 26 is also moved upward. Then, the stopper 25 is moved downward from the upper side of the L-shaped hole 23a of the connecting lever 23. Therefore, the connecting lever 23 can be moved to the right and the left without being affected by the pushing force of the malfunction prevention section 19.

[0030] In Fig. 6 (c), when the governor 4 reaches the second speed, it seizes the governor rope 3, so that the lifting rod 6 can be raised upward. Then, the emergency stop lever 11, which is pivotally connected to the lifting rod 6, is rotated. According to the rotation of the emergency stop lever 11, the connection lever 23 is moved to the left. At this time, the connecting lever 23 and the malfunction prevention means 19 have already been disconnected from each other by the shape of the hole 23a of the connecting lever 23. Therefore, the connecting lever 14 is not affected by the pushing force of the malfunction prevention means 19. Accordingly, the emergency stop motion can be conducted without causing any delay. Consequently, it is possible to provide the same effect as that of Embodiment 1.

INDUSTRIAL POSSIBILITY

[0031] The emergency stop device of an elevator of the present invention is suitably used for a safety device incorporated into an elevator.

Claims

1. An emergency stop device of an elevator comprising: a cage; a guide rail; a governor; a governor rope; a connecting means, to one end of which the governor rope is connected; an emergency stop means operated according to a position of an other end of the connecting means, for obtaining a braking force for the cage coming into pressure contact with the guide rail; a malfunction prevention means for preventing malfunction when a predetermined pushing force is given to an action of the emergency stop means; and a malfunction prevention release means for releasing the predetermined pushing force given by the malfunction prevention means according to a cage speed when the cage speed exceeds a predetermined value.

2. The emergency stop device of an elevator according to claim 1, wherein the malfunction prevention release means is provided in the governor, and includes: a switch for outputting a signal when the predetermined speed is detected; an electromagnetic switch for releasing the predetermined pushing force given by the malfunction prevention means; and a control means for controlling an electric current applied on the electromagnetic switch according to a signal from the switch.

FIG. 1

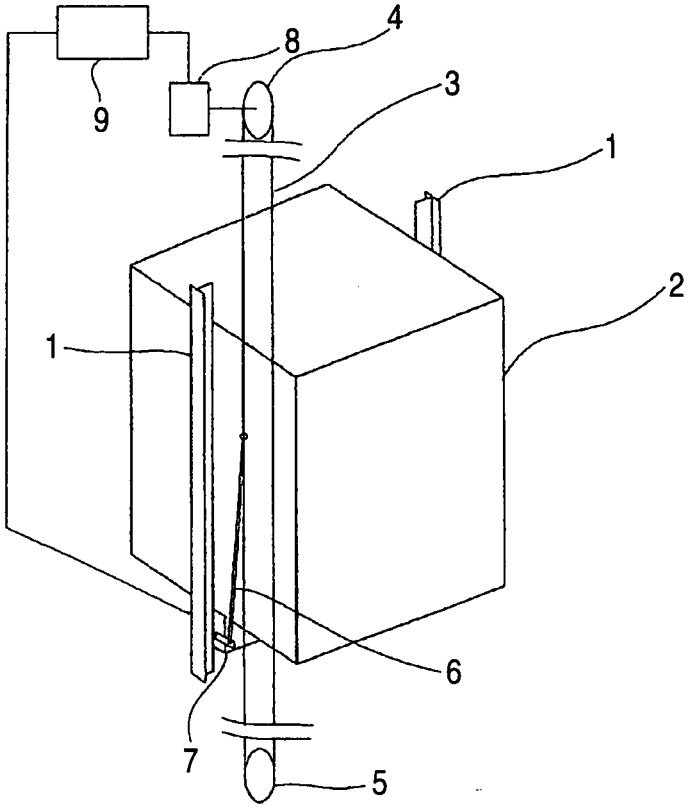


FIG. 2

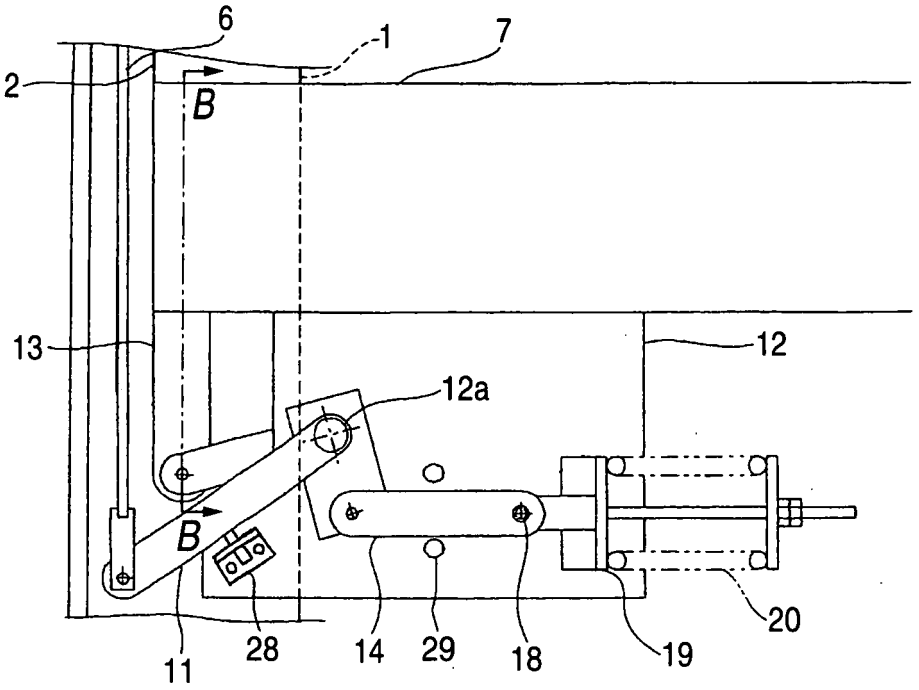


FIG. 3

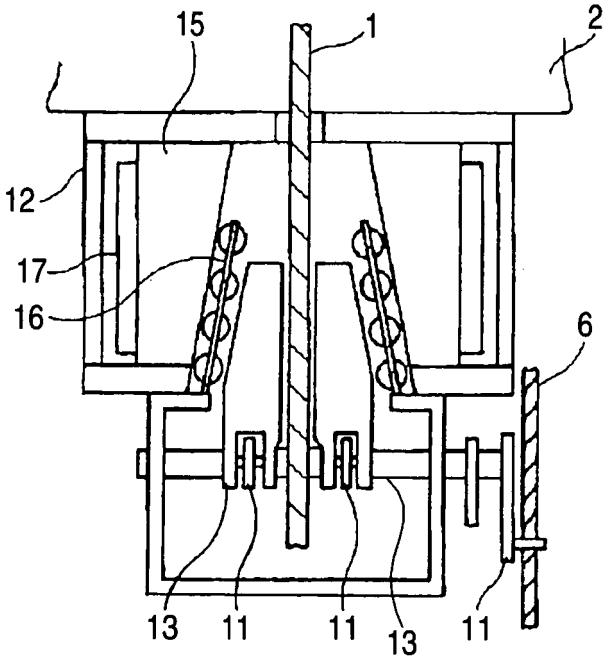


FIG. 4A

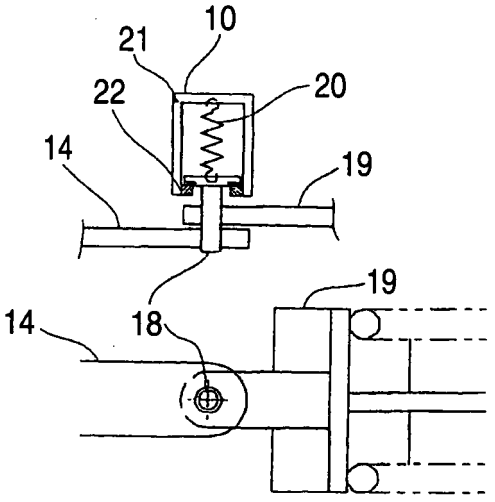


FIG. 4B

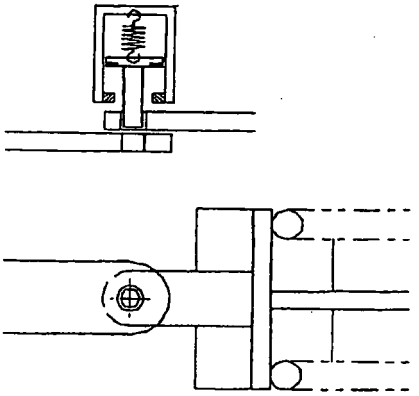


FIG. 4C

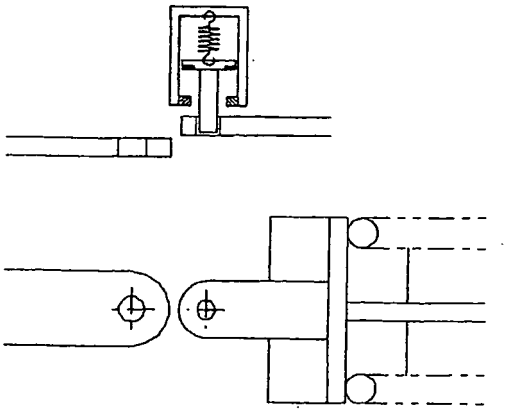


FIG. 5

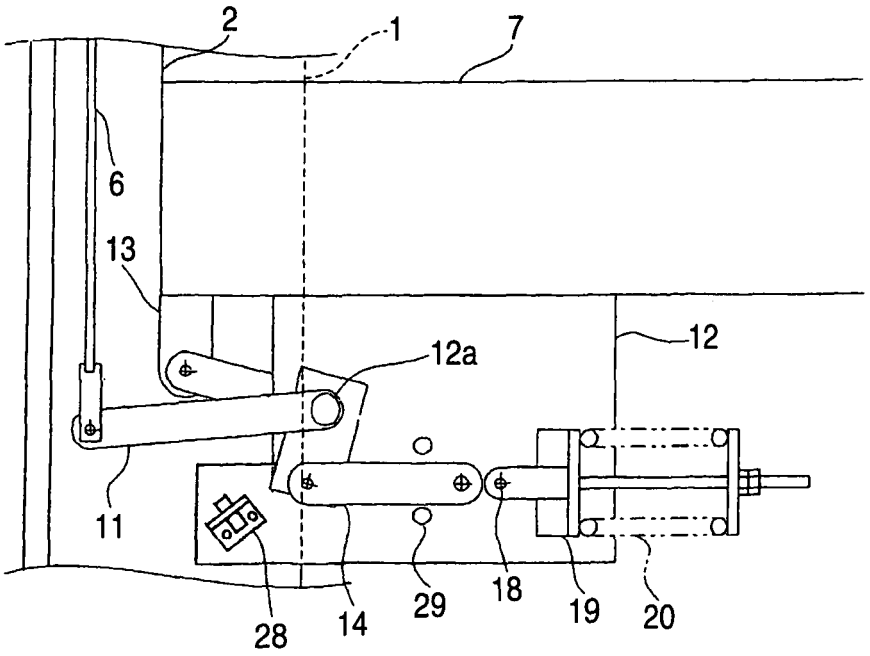


FIG. 6A

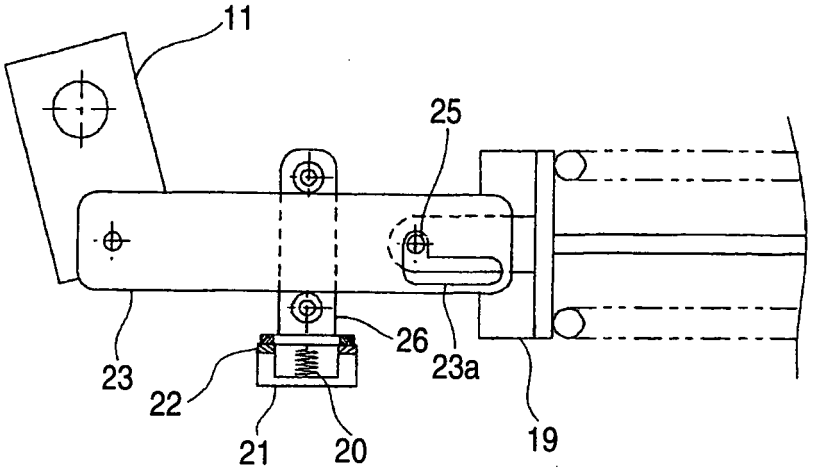


FIG. 6B

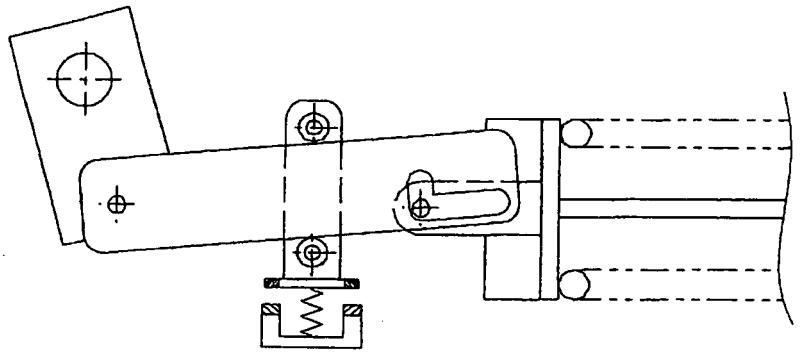
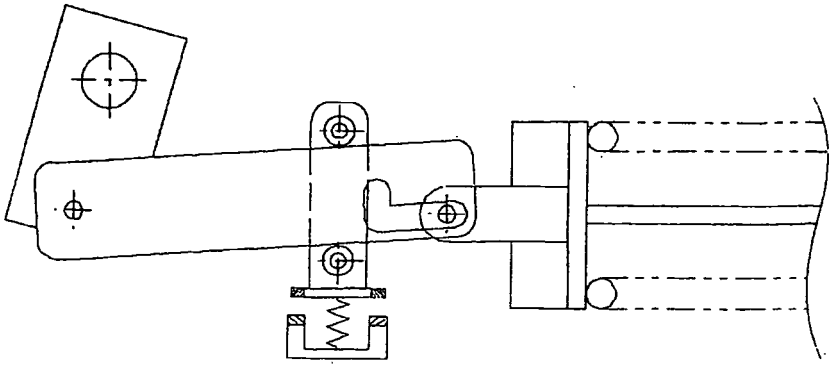


FIG. 6C



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/015895

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B5/18, B66B5/06

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-B66B5/28

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	1996-2005
Kokai Jitsuyo Shinan Koho	1971-2005	Toroku Jitsuyo Shinan Koho	1994-2005

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 5-319724 A (Mitsubishi Electric Corp.), 03 December, 1993 (03.12.93), Abstract; Figs. 1 to 4 (Family: none)	1-2
A	JP 2000-219450 A (Toshiba Corp.), 08 August, 2000 (08.08.00), Abstract; Figs. 1 to 2, 5 (Family: none)	1-2
A	JP 2002-68634 A (Hitachi, Ltd.), 08 March, 2002 (08.03.02), Abstract; Figs. 1 to 3 (Family: none)	1-2

☒ 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
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Date of the actual completion of the international search	Date of mailing of the international search report
27 June, 2005 (27.06.05)	09 August, 2005 (09.08.05)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/015895

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 54-31149 A (Hitachi, Ltd.), 07 March, 1979 (07.03.79), Claims; Figs. 1 to 4 (Family: none)	1-2
A	JP 2001-122549 A (Hitachi, Ltd.), 08 May, 2001 (08.05.01), Abstract; Fig. 1 (Family: none)	1-2
A	JP 2002-532366 A (Otis Elevator Co.), 02 October, 2002 (02.10.02), Abstract; Figs. 1 to 3, 10 & US 6161653 A & EP 1140687 A & WO 00/37348 A1 & CN 1331652 A	1-2

Form PCT/ISA/210 (continuation of second sheet) (January 2004)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 5319724 A **[0003] [0004]**