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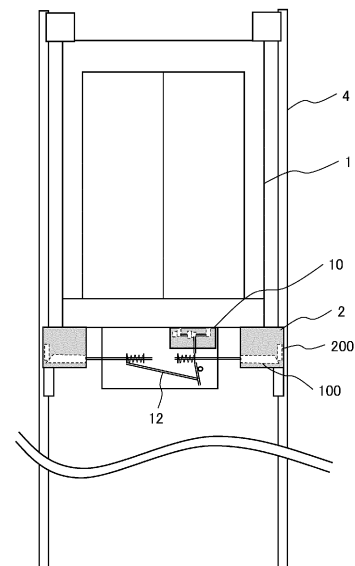
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(54) **ELEVATOR DEVICE**

(57) An elevator device including an electric emergency stop device having a high degree of freedom of placement and suitable for space saving is disclosed. The elevator device includes a car (1), an emergency stop device (2) provided in the car, and an electric actuator (10) provided in the car and configured to operate the emergency stop device. The electric actuator includes a movable member, an electromagnetic stone configured to attract the movable member in a standby state of the electric actuator, a rod connected to the movable member, and a braking element activation member (100) connected to an end portion of the rod. When excitation of the electromagnetic stone is stopped and the rod is driven, a braking element (200) of the emergency stop device is pushed up by the braking element activation member.

[FIG. 1]



EP 4 393 861 A1

Description

Technical Field

[0001] The present invention relates to an elevator device including an emergency stop device that is actuated electrically.

Background Art

[0002] An elevator device is provided with a governor and an emergency stop device in order to constantly monitor an elevating speed of a car and emergency-stop the car in a predetermined overspeed state. Generally, the car and the governor are coupled by a governor rope, and when an overspeed state is detected, the governor restricts the governor rope to operate the emergency stop device on a car side, thereby emergency-stopping the car.

[0003] In such an elevator device, the governor rope, which is a long object, is laid in a hoistway, and thus the space is hardly saved and the cost is hardly reduced. When the governor rope swings, a structure in the hoistway and the governor rope are likely to interfere with each other.

[0004] In response to this, an emergency stop device that does not use a governor rope is proposed.

[0005] As a related art relating to the emergency stop device that does not use a governor rope, a technique described in PTL 1 is known.

[0006] In the related art, a drive shaft that drives an emergency stop device and an actuating mechanism that actuates the drive shaft are provided on a car. The actuating mechanism includes a movable iron core mechanically connected to the drive shaft via a connection piece, and an electromagnetic stone that attracts the movable iron core. Although the drive shaft is biased by a drive spring, a movement of the drive shaft is restricted by the actuating mechanism because the electromagnetic stone is energized and the movable iron core is attracted during normal times.

[0007] In an emergency, the electromagnetic stone is demagnetized to release the restriction of the drive shaft, and the drive shaft is driven by a biasing force of the drive spring. Accordingly, a pull-up rod of the emergency stop device is pulled up, and thus the emergency stop device operates to emergency-stop the car.

[0008] When the emergency stop device is returned to a normal state, the electromagnetic stone is moved and brought close to the movable iron core moved in an emergency. When the electromagnetic stone abuts against the movable iron core, the electromagnetic stone is energized to attract the movable iron core to the electromagnetic stone. In a state in which the movable iron core is attracted to the electromagnetic stone, the electromagnetic stone is driven to return the movable iron core and the electromagnetic stone to a normal standby position. A moving mechanism of the electromagnetic stone in-

cludes a feed screw shaft to which the electromagnetic stone is screwed and a motor that rotates the feed screw shaft.

5 Citation List

Patent Literature

[0009] PTL 1: WO2020/110437

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Summary of Invention

Technical Problem

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[0010] In the related art, the actuating mechanism pulls up the pull-up rod of the emergency stop device, and thus the degree of freedom of placement of the actuating mechanism is limited, or a placement space of the actuating mechanism becomes large.

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[0011] In view of the above circumstances, the invention provides an elevator device including an electric emergency stop device which can improve the degree of freedom of placement and is suitable for space saving.

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Solution to Problem

[0012] In order to solve the above problems, an elevator device according to the invention includes: a car; an emergency stop device provided in the car; and an electric actuator provided in the car and configured to operate the emergency stop device. The electric actuator includes a movable member, an electromagnetic stone configured to attract the movable member in a standby state of the electric actuator, a rod connected to the movable member, and a braking element activation member connected to an end portion of the rod. When excitation of the electromagnetic stone is stopped and the rod is driven, a braking element of the emergency stop device is pushed up by the braking element activation member.

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Advantageous Effects of Invention

[0013] According to the invention, a space occupied by an actuating mechanism of an emergency stop device can be reduced and the degree of freedom of a placement position of the actuating mechanism can be improved.

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[0014] The problems, configurations, and effects other than those described above will become apparent in the following description of embodiments.

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Brief Description of Drawings

[0015]

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[FIG. 1] FIG. 1 is a schematic configuration diagram of an elevator device according to an embodiment. [FIG. 2] FIG. 2 is a front view showing a mechanism portion of an electric actuator in the embodiment.

[FIG. 3] FIG. 3 is a front view showing the mechanism portion of the electric actuator in the embodiment.

[FIG. 4] FIG. 4 is a side view showing the mechanism portion of the electric actuator in the embodiment.

[FIG. 5] FIG. 5 is a side view showing a mechanism portion of an electric actuator in a modification.

Description of Embodiments

[0016] Hereinafter, an elevator device according to an embodiment of the invention will be described with reference to the drawings. In the drawings, those having the same reference signs indicate the same components or components having similar functions.

[0017] FIG. 1 is a schematic configuration diagram of an elevator device according to an embodiment of the invention.

[0018] As shown in FIG. 1, the elevator device includes a car 1, an electric actuator 10, drive mechanisms (12, 100, etc.), and emergency stop devices 2.

[0019] The car 1 is suspended by a main rope (not shown) in a hoistway provided in a building, and is slidably engaged with a guide rail 4 via a guide device (not shown). When the main rope is frictionally driven by a drive device (hoist: not shown), the car 1 is moved up and down in the hoistway.

[0020] A speed detection device (not shown) is provided in the car 1, and constantly detects an elevating speed of the car 1 in the hoistway. Therefore, the speed detection device can detect that the elevating speed of the car 1 exceeds a predetermined overspeed.

[0021] In the present embodiment, the speed detection device includes an image sensor, and detects a speed of the car 1 based on image information on a surface state of the guide rail 4, which is acquired by the image sensor. For example, the speed detection device calculates a speed from a movement distance of image feature in a predetermined time.

[0022] The speed detection device may calculate a speed of the car based on an output signal of a rotary encoder that rotates as the car moves.

[0023] In the present embodiment, the electric actuator 10 is an electromagnetic actuator, and is disposed below the car 1. The drive mechanisms (12, 100, etc.) are also disposed below the car 1.

[0024] When the electric actuator 10 is actuated, a braking element 200 of the emergency stop device 2 is pushed up by a braking element activation member 100. That is, the braking element 200 is activated by the braking element activation member 100. Accordingly, the emergency stop device 2 operates.

[0025] The electric actuator 10 and the drive mechanisms (12, 100, etc.) will be described in detail later.

[0026] One emergency stop device 2 is disposed on each of the left and right sides of the car 1. The pair of braking elements 200 provided in each of the emergency stop devices 2 are movable between a braking position and a non-braking position, and clamp the guide rail 4 at

the braking position. When the emergency stop device 2 is moved up relative to the car 1 as the car 1 is moved down, a braking force is generated by a frictional force acting between the braking element 200 and the guide rail 4. Accordingly, the emergency stop device 2 is actuated when the car 1 falls into an overspeed state, and emergency-stops the car 1.

[0027] The elevator device in the present embodiment is provided with a so-called low-press governor system that does not use a governor rope. When an elevating speed of the car 1 exceeds a rated speed and reaches a first overspeed (for example, a speed that does not exceed 1.3 times the rated speed), a power supply of the drive device (hoist) and a power supply of a control device that controls the drive device are cut off. When a lowering speed of the car 1 reaches a second overspeed (for example, a speed that does not exceed 1.4 times the rated speed), the electric actuator 10 provided in the car 1 actuates the emergency stop device 2 to emergency-stop the car 1.

[0028] In the present embodiment, the low-press governor system includes the above-described speed detection device and a safety control device that determines an overspeed state of the car 1 based on an output signal of the speed detection device. The safety control device measures the speed of the car 1 based on the output signal of the speed detection device, and when it is determined that the measured speed reaches the first overspeed, the safety control device outputs a command signal for cutting off the power supply of the drive device (hoist) and the power supply of the control device that controls the drive device. When determining that the measured speed reaches the second overspeed, the safety control device outputs a command signal for actuating the electric actuator 10.

[0029] As described above, when the pair of braking elements provided in the emergency stop device 2 are activated by the braking element activation member 100, the pair of braking elements clamp the guide rail 4.

[0030] FIG. 2 is a front view showing the electric actuator 10 and a mechanism portion of the drive mechanism in the present embodiment in the placement state shown in FIG. 1. In FIG. 2, the emergency stop device is in a non-braking state, and the electric actuator 10 is in a non-actuating state (standby state). That is, the elevator device is in a normal state.

[0031] When the elevator device is normally operated, the electric actuator 10 is in a standby state. In the standby state, a movable member 34 is attracted by the excited electromagnetic stone 35. Accordingly, a movement of a connection bracket 38 connecting the movable member 34 and a pressing member 15 (spring seat) is restricted against a biasing force of a drive spring 13 (compression spring). Note that at least a portion of the movable member 34 which is attracted to the electromagnetic stone 35 is made of a magnetic material.

[0032] A rod 21 penetrates the pressing member 15. The pressing member 15 is fixed to the rod 21. A fixing

member 14 is fixed to a structural member (not shown) of the car 1 located below the car, for example, a lower frame of the car. The rod 21 slidably penetrates the fixing member 14. The rod 21 is inserted through the drive spring 13. The drive spring 13 is located between the fixing member 14 and the pressing member 15. One end and the other end of the drive spring 13 abut against the fixing member 14 and the pressing member 15, respectively. In the standby state of the electric actuator 10, the drive spring 13 is pressed by the fixing member 14 and the pressing member 15. Therefore, the drive spring 13 is compressed and accumulates elastic energy. In other words, the drive spring 13 accumulates a biasing force.

[0033] The rod 21 is connected to each of the pair of left and right braking element activation members 100. The rods 21 can be operated in a manner of being interlocked with each other by a link mechanism including a link 12 and a link restraining pin 30.

[0034] In the present embodiment, the braking element activation member 100 has a tapered portion, and a tapered surface is in contact with a bottom portion of the braking element 200.

[0035] In the present embodiment, the braking element activation member 100 is made of a bar-shaped metal member. As the metal member, a bulk member, a bent plate-shaped member, or the like can be applied. Note that, as long as the member has sufficient strength to support and push up the braking element 200, the member is not limited to the bar-shaped metal member, and members of various shapes and materials can be applied.

[0036] FIG. 3 is a front view showing the electric actuator 10 and the mechanism portion of the drive mechanism in the present embodiment in the placement state shown in FIG. 1. In FIG. 3, the emergency stop device is in a braking state, and the electric actuator 10 is in an actuating state. That is, the elevator device is in a stopped state.

[0037] When the excitation of the electromagnetic stone 35 is stopped in response to a command from a safety control device (not shown), an attraction force acting on the movable member 34 disappears. Therefore, the biasing force of the drive spring 13 is released to drive the rod 21. At this time, a rod 21 that is not connected to the connection bracket 38 is also driven in a manner of being interlocked with the above driven rod 21 by the link mechanism. Accordingly, the braking element 200 is pushed up by the tapered surface of the braking element activation member 100.

[0038] In order to return the electric actuator 10 to the standby state, the electric actuator 10 is operated as described below.

[0039] The electric actuator 10 includes a feed screw 36 (for example, a trapezoidal screw) positioned on a planar portion of a substrate portion in order to drive the movable member 34. The feed screw 36 is rotatably supported by a first support member 41 and a second support member 42 which are fixed onto a planar surface of the

substrate portion. The electromagnetic stone 35 includes a nut portion, and the nut portion is screwed to the feed screw 36. The feed screw 36 is rotationally driven by a motor 37.

[0040] As the substrate portion, a plate-shaped member such as a metal plate may be used, or a planar portion of a steel constituting the lower frame of the car may be used.

[0041] In order to return the electric actuator 10 to the standby state, first, the motor 37 is driven to rotate the feed screw 36. The rotation of the motor 37 is converted into a linear movement of the electromagnetic stone 35 along an axial direction of the feed screw 36 by the rotating feed screw 36 and the nut portion of the electromagnetic stone 35. Accordingly, the electromagnetic stone 35 approaches the movable member 34 and comes into contact with the movable member 34. When contact between the electromagnetic stone 35 and the movable member 34 is detected according to a switch (not shown) or a load current of the motor 37, the electromagnetic stone 35 is excited and the motor 37 is stopped. The movable member 34 is attracted to the electromagnetic stone 35 under an action of the electromagnetic force. When the movable member 34 is attracted to the electromagnetic stone 35, the feed screw 36 is rotated in a reverse direction by reversing the rotation direction of the motor 37 while the excitation of the electromagnetic stone 35 is continued. Accordingly, the movable member 34 and the electromagnetic stone 35 are moved to a standby position.

[0042] FIG. 4 is a side view showing the mechanism portion of the electric actuator 10 in the present embodiment in the placement state shown in FIG. 1. That is, FIG. 4 is a view as seen from A viewpoint in FIG. 2.

[0043] As shown in FIG. 4, the rod 21 extends toward a portion directly below the pair of braking elements 200. Therefore, the braking element activation member 100 connected to an end portion of the rod 21 directly comes into contact with the braking element 200.

[0044] Note that the emergency stop device according to the present embodiment does not have a pull-up rod whose longitudinal direction extends in a height direction of the car, unlike an emergency stop device according to a known technique. The rest of the configuration is the same as that of the emergency stop device according to the known technique. For example, as shown in FIG. 4, the braking element 200 and an elastic body such as a plate spring for pressing the braking element 200 are stored in a housing 201 (or a frame body).

[0045] FIG. 5 is a side view similar to FIG. 4, which shows a mechanism portion of the electric actuator 10 in an elevator device according to a modification.

[0046] In the present modification, a lever 203 is connected to lower portions of the pair of braking elements 200. The lever 203 extends toward a direction perpendicular to a longitudinal direction of the rod 21 from a lateral side of the pair of braking elements 200, that is, lower portions of the braking elements 200. An end por-

tion of an extending portion, that is, a free end portion of the lever 203 comes into contact with the tapered surface of the braking element activation member 100.

[0047] In the present modification, the braking element 200 is pushed up by pushing up the lever 203 by the braking element activation member 100.

[0048] According to the above-described embodiment, the braking element 200 is pushed up by the braking element activation member 100, and therefore, a space occupied by the actuating mechanism (the electric actuator 10 and the drive mechanisms (12, 200, etc.)) of the emergency stop device can be reduced, and the degree of freedom of the placement position of the actuating mechanism is improved.

[0049] The invention is not limited to the above-described embodiments, and includes various modifications. For example, the embodiments described above have been described in detail to facilitate understanding of the invention, and the invention is not necessarily limited to those including all the configurations described above. A part of the configuration of the embodiment can be added to, deleted from, or replaced with another configuration.

[0050] For example, when the emergency stop device is placed above the car, the electric actuator may be provided on the car.

[0051] The elevator device may have a machine room or may be a so-called machine room-less elevator.

Reference Signs List

[0052]

1	car
2	emergency stop device
4	guide rail
10	electric actuator
12	link
13	drive spring
14	fixing member
15	pressing member
21	rod
30	link restraining pin
34	movable member
35	electromagnetic stone
36	feed screw
37	motor
38	connection bracket
41	support member
42	support member
100	braking element activation member
200	braking element
203	lever

Claims

1. An elevator device comprising:

a car;
an emergency stop device provided in the car;
and
an electric actuator provided in the car and configured to operate the emergency stop device, wherein
the electric actuator includes

a movable member,
an electromagnetic stone configured to attract the movable member in a standby state of the electric actuator,
a rod connected to the movable member, and
a braking element activation member connected to an end portion of the rod, and

when excitation of the electromagnetic stone is stopped and the rod is driven, a braking element of the emergency stop device is pushed up by the braking element activation member.

2. The elevator device according to claim 1, wherein

the braking element activation member has a tapered surface, and
the braking element is pushed up by the tapered surface.

3. The elevator device according to claim 2, wherein the tapered surface is in direct contact with a lower portion of the braking element.

4. The elevator device according to claim 2, wherein the tapered surface is connected to the braking element and is in contact with a lever extending to a lateral side of the braking element.

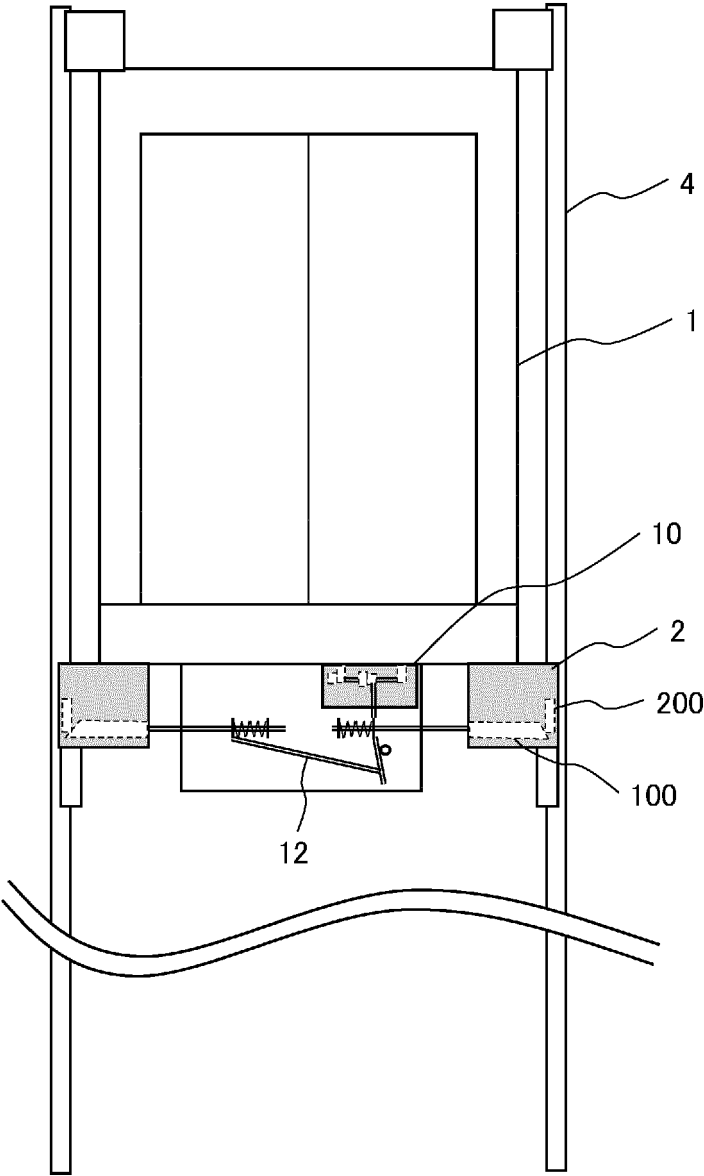
5. The elevator device according to claim 1, wherein the rod is driven by a spring force.

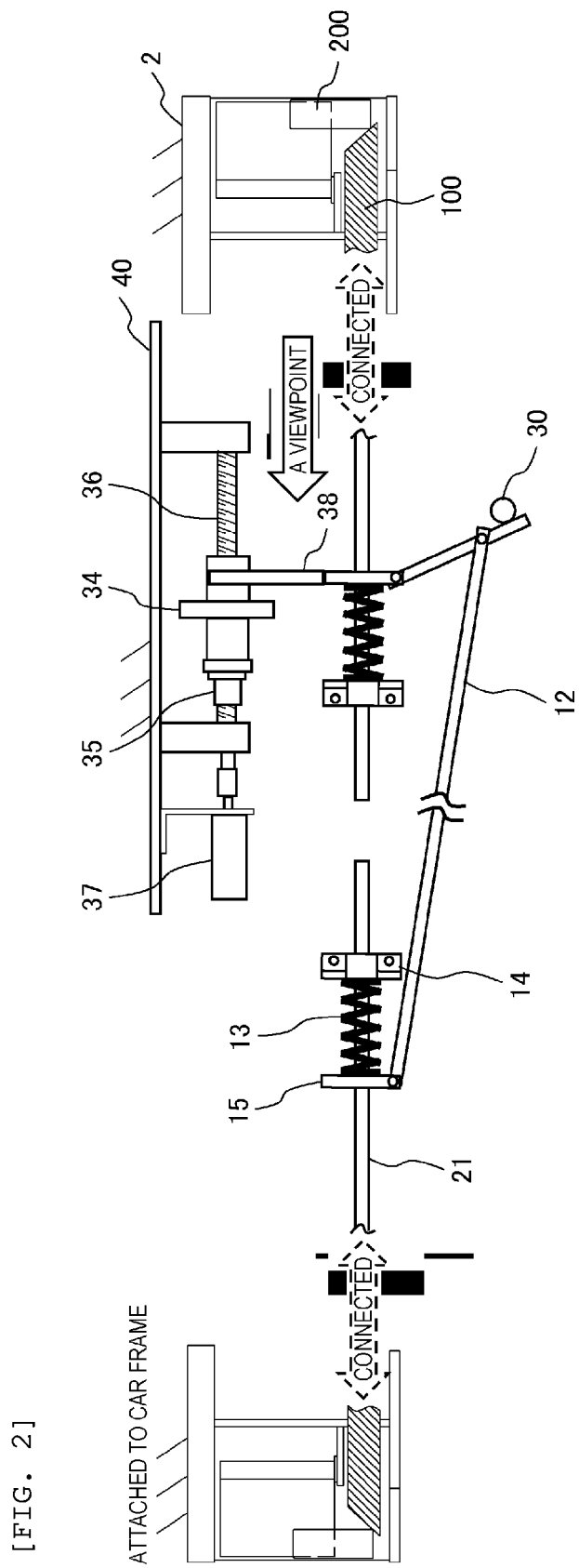
6. The elevator device according to claim 1, wherein the electric actuator includes

a feed screw to be screwed with the electromagnetic stone, and
a motor configured to rotationally drive the feed screw.

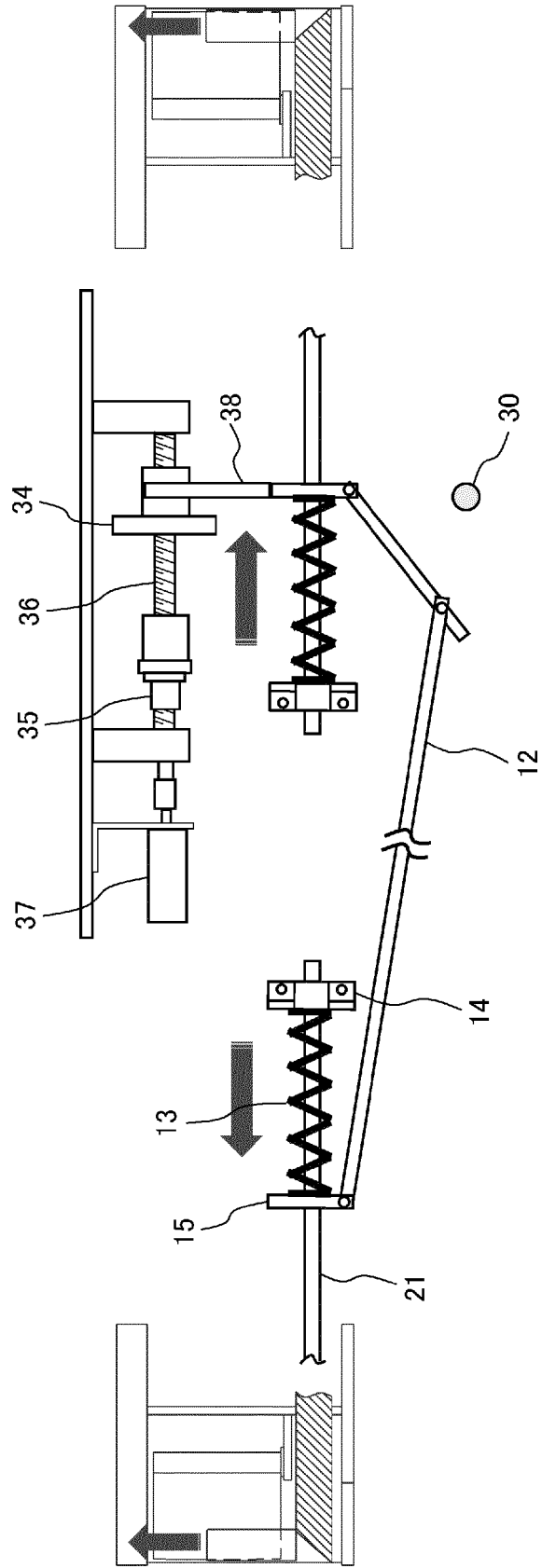
7. The elevator device according to claim 1, wherein the electric actuator is provided below the car.

[FIG. 1]

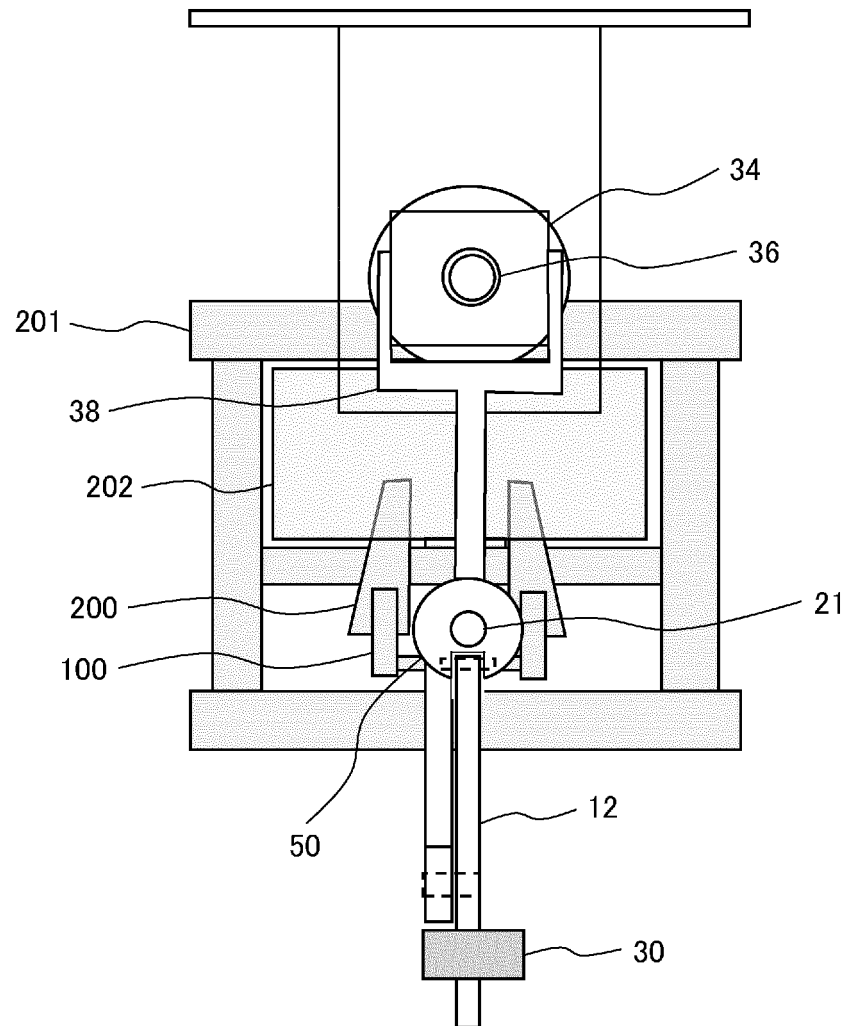




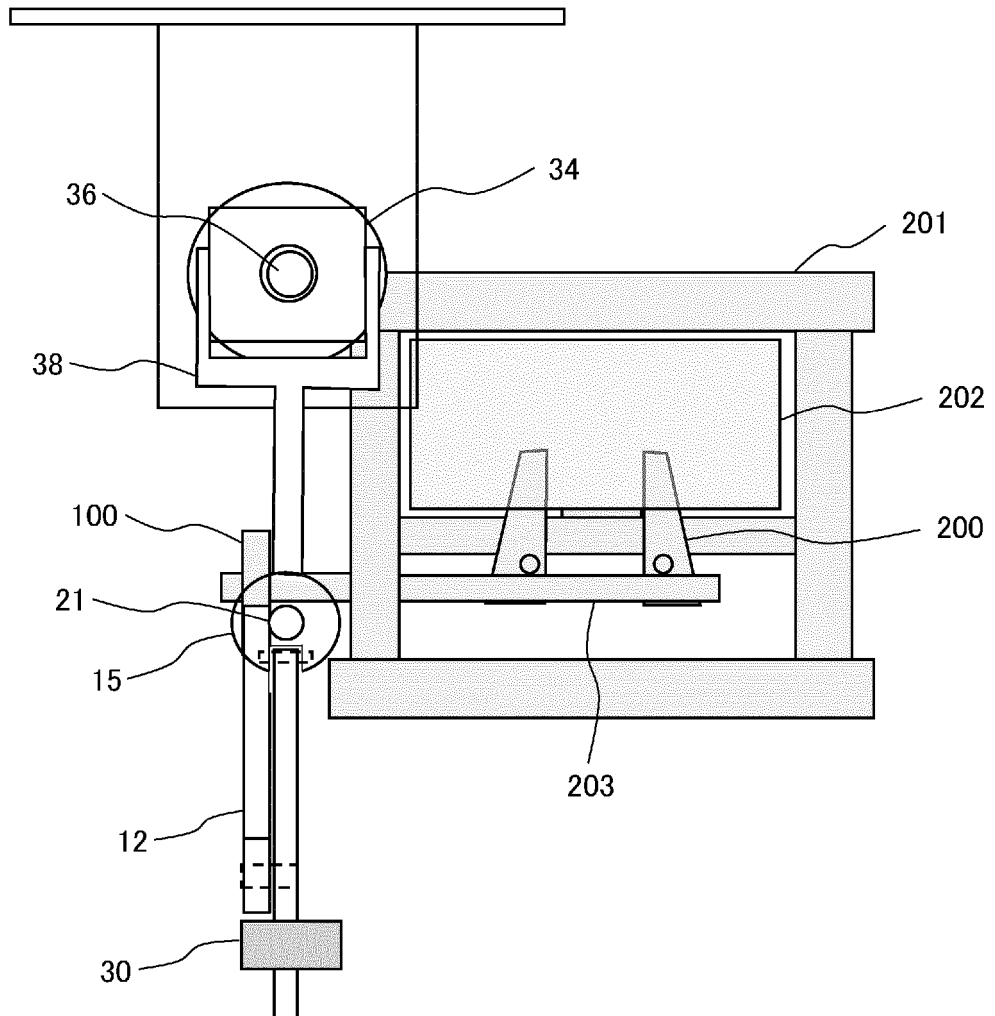
[FIG. 3]



[FIG. 4]



[FIG. 5]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/031300

A. CLASSIFICATION OF SUBJECT MATTER <i>B66B 5/06</i> (2006.01)i; <i>B66B 5/22</i> (2006.01)i FI: B66B5/06 Z; B66B5/22 Z 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) B66B5/06; B66B5/22 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Published examined utility model applications of Japan 1922-1996 Published unexamined utility model applications of Japan 1971-2021 Registered utility model specifications of Japan 1996-2021 Published registered utility model applications of Japan 1994-2021 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)															
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>WO 2020/110437 A1 (HITACHI, LIMITED) 04 June 2020 (2020-06-04) paragraphs [0027]-[0081], fig. 1-7</td> <td>1-7</td> </tr> <tr> <td>Y</td> <td>JP 2014-65589 A (TOSHIBA CORPORATION) 17 April 2014 (2014-04-17) paragraphs [0058]-[0060], fig. 9</td> <td>1-7</td> </tr> <tr> <td>Y</td> <td>WO 2005/115904 A1 (MITSUBISHI DENKI KABUSHIKI KAISHA) 08 December 2005 (2005-12-08) page 4, line 16 to page 6, line 9, fig. 2-7</td> <td>1, 5-7</td> </tr> <tr> <td>A</td> <td>US 2020/0207576 A1 (KONE CORPORATION) 02 July 2020 (2020-07-02) entire text, all drawings</td> <td>1-7</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	WO 2020/110437 A1 (HITACHI, LIMITED) 04 June 2020 (2020-06-04) paragraphs [0027]-[0081], fig. 1-7	1-7	Y	JP 2014-65589 A (TOSHIBA CORPORATION) 17 April 2014 (2014-04-17) paragraphs [0058]-[0060], fig. 9	1-7	Y	WO 2005/115904 A1 (MITSUBISHI DENKI KABUSHIKI KAISHA) 08 December 2005 (2005-12-08) page 4, line 16 to page 6, line 9, fig. 2-7	1, 5-7	A	US 2020/0207576 A1 (KONE CORPORATION) 02 July 2020 (2020-07-02) entire text, all drawings	1-7
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Date of the actual completion of the international search 27 October 2021	Date of mailing of the international search report 09 November 2021														
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No. PCT/JP2021/031300

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