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(54) **EMERGENCY STOP DEVICE, ELEVATOR, AND METHOD OF RESTORING EMERGENCY STOP DEVICE**

(57) An emergency stop apparatus includes a braking mechanism, a pull-up member, a driving mechanism, and an actuating mechanism. The pull-up member is connected to a brake element of the braking mechanism. The driving mechanism includes a connecting part connected to the pull-up member, and causes the braking mechanism to operate. The actuating mechanism is connected to the driving mechanism and actuates the driving mechanism. The connecting part allows only force to an upper side in an ascending-and-descending direction to be transmitted to the pull-up member.

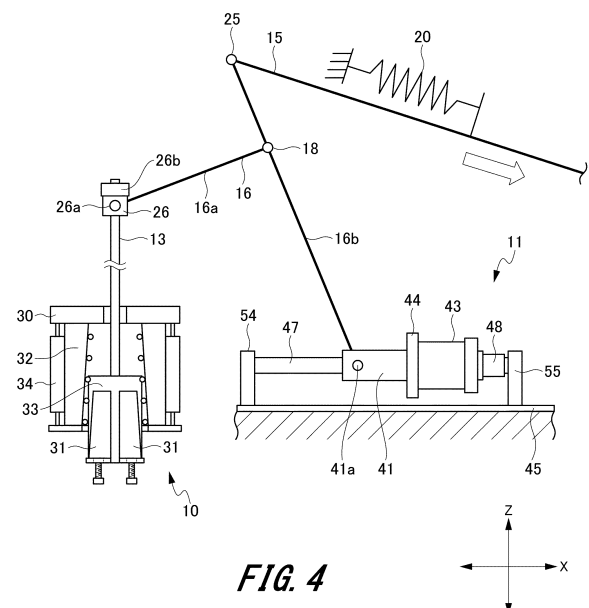


FIG. 4

Description

Technical Field

[0001] The present invention relates to an emergency stop apparatus which stops an elevator car in a case of emergency, an elevator provided with the emergency stop apparatus, and a returning method of an emergency stop apparatus.

Background Art

[0002] Typically, a rope elevator includes a main rope and a compensating rope which couple an elevator car and a counterweight, and a long object such as a governor rope used to detect a speed of the elevator car or the counterweight. Moreover, there is a regulation that the elevator needs to be provided with, as a safety apparatus, an emergency stop apparatus which automatically stops operation of the elevator car when a speed of the elevator car which ascends and descends along a guide rail exceeds a defined value.

[0003] In recent years, an emergency stop apparatus which electrically actuates a braking mechanism of the emergency stop apparatus, without using a governor, is proposed. For example, PTL 1 describes a technique as a conventional emergency stop apparatus of this type. PTL 1 describes an emergency stop apparatus including a normal stop apparatus provided with a braking mechanism, a driving mechanism, and an actuating mechanism. The driving mechanism includes a pull-up member, a link member, a drive shaft, and a drive spring. The drive spring is provided to the drive shaft, and biases the drive shaft in a direction in which the drive shaft pulls up a brake element. The actuating mechanism includes a connecting member, a movable iron core, an electromagnetic core, and a hold-return mechanism. The connecting member is connected to the other end portion of the link member. The movable iron core is fixed to the connecting member. The electromagnetic core attracts and separates the movable iron core thereto and therefrom. The hold-return mechanism moves the electromagnetic core in a direction to approach or separate from the movable iron core.

Citation List

Patent Literature

[0004] PTL 1: JP2020-83579A

Summary of Invention

Technical Problem

[0005] However, when return operation is performed using the technique described in PTL 1, a driving part provided to the actuating mechanism is caused to oper-

ate, so that the pull-up member is pushed down to resist biasing force of the driving spring, and sandwiching of the guide rail by the brake element of the braking mechanism is canceled. As a result, in the technique described in PTL 1, the driving part of the actuating mechanism requires not only the force to resist the biasing force of the driving spring, but also the force to cancel the sandwiching by the brake element, and the size of the driving part of the actuating mechanism is increased.

[0006] Moreover, in the technique described in PTL 1, during the return operation, in order to cancel the sandwiching by the brake element, it is necessary that while the driving part of the actuating mechanism is driven, the elevator car is caused to perform ascending operation at the same time. As described above, the technique described in PTL 1 also has a problem that control of various units during the return operation is complicated.

[0007] In view of the above problems, a present object is to provide an emergency stop apparatus, an elevator, and a returning method of an emergency stop apparatus, where a size of a driving part of an actuating mechanism can be reduced, and return operation can easily be performed.

Solution to Problem

[0008] In order to solve the above problem and to achieve the object, an emergency stop apparatus includes a braking mechanism, a pull-up member, a driving mechanism, and an actuating mechanism. The braking mechanism is provided to an ascending-and-descending body, includes a brake element configured to sandwich a guide rail where the ascending-and-descending body slides, and stops moving of the ascending-and-descending body. The pull-up member is connected to the brake element. The driving mechanism includes a connecting part connected to the pull-up member, and causes the braking mechanism to operate. The actuating mechanism is connected to the driving mechanism and actuates the driving mechanism. The connecting part allows only force to an upper side in an ascending-and-descending direction to be transmitted to the pull-up member.

[0009] Moreover, an elevator includes, in an elevator provided with an ascending-and-descending body which ascends and descends in a hoistway, a guide rail provided upright in the hoistway and which slidably supports the ascending-and-descending body, and an emergency stop apparatus which stops moving of the ascending-and-descending body based on a state of ascending-and-descending motion of the ascending-and-descending body. Furthermore, as the emergency stop apparatus, the above-described emergency stop apparatus is used.

[0010] Moreover, a returning method of an emergency stop apparatus includes, in a returning method of an emergency stop apparatus having the above-described configuration, the following steps (1) and (2).

- (1) Performing return operation of the actuating mechanism, and canceling load to the upper side in the ascending-and-descending direction applied from the driving mechanism to the brake element.
- (2) After completion of the return operation of the actuating mechanism, causing the ascending-and-descending body to perform ascending operation, and canceling sandwiching of the guide rail by the brake element.

Advantageous Effects of Invention

[0011] According to the emergency stop apparatus, the elevator, and the returning method of the emergency stop apparatus in the above-described configurations, the size of the driving part of the actuating mechanism can be reduced, and the return operation can easily be performed.

Brief Description of Drawings

[0012]

- [Fig. 1] Fig. 1 is a schematic configuration diagram illustrating an elevator according to an embodiment.
- [Fig. 2] Fig. 2 is a front view illustrating an emergency stop apparatus according to the embodiment.
- [Fig. 3] Fig. 3 illustrates a braking mechanism of the emergency stop apparatus according to the embodiment, where Fig. 3A is a front view and Fig. 3B is a sectional view.
- [Fig. 4] Fig. 4 is a front view illustrating an actuating mechanism of the emergency stop apparatus according to the embodiment.
- [Fig. 5] Fig. 5 is a front view illustrating an actuated state of the actuating mechanism of the emergency stop apparatus according to the embodiment.
- [Fig. 6] Fig. 6 is an explanatory diagram illustrating return operation of the emergency stop apparatus according to the embodiment.
- [Fig. 7] Fig. 7 is a flowchart illustrating the return operation of the emergency stop apparatus according to the embodiment.

Description of Embodiment

[0013] Hereinafter, an emergency stop apparatus, an elevator, and a returning method of an emergency stop apparatus according to an embodiment are described with reference to Figs. 1 to 7. Note that the same reference characters are given to components which are in common between the drawings.

1. Embodiment

1-1. Configuration Example of Elevator

[0014] First, a configuration of an elevator according

to the embodiment (hereinafter, be referred to as "this example") is described with reference to Fig. 1.

[0015] Fig. 1 is a schematic configuration diagram illustrating a configuration example of the elevator of this example.

[0016] As illustrated in Fig. 1, an elevator 1 of this embodiment performs ascending-and-descending operation in a hoistway 110 formed in a building structure. The elevator 1 is provided with an elevator car 120 which indicates one example of an ascending-and-descending body where a passenger or freight is placed, a main rope 130, and a counterweight 140 which indicates another example of the ascending-and-descending body.

[0017] Moreover, the elevator 1 is provided with a hoisting machine 100 and an emergency stop apparatus 5.

[0018] Moreover, the elevator 1 is provided with a controller 170 and a deflector sheave 150. Note that the hoistway 110 is formed in the building structure, and a machine room 160 is provided to a top portion of the hoistway 110.

[0019] The hoisting machine 100 and the deflector sheave 150 are disposed in the machine room 160. The main rope 130 is wound around a sheave of the hoisting machine 100 illustrated in the accompanying drawing. Moreover, the deflector sheave 150 where the main rope 130 is installed in a certain manner is provided near the hoisting machine 100.

[0020] The main rope 130 has one end connected to an upper portion of the elevator car 120, and has the other end connected to an upper portion of the counterweight 140. By the hoisting machine 100 being driven, the elevator car 120 and the counterweight 140 ascend or descend in the hoistway 110. Below, a direction in which the elevator car 120 and the counterweight 140 ascend and descend is referred to as an ascending-and-descending direction Z.

[0021] The elevator car 120 is slidably supported by two guide rails 201A and 201B with a guiding unit (not illustrated) interposed therebetween. Similarly, the counterweight 140 is slidably supported by a weight-side guide rail 201C with a guiding unit (not illustrated) interposed therebetween. The two guide rails 201A and 201B, and the weight-side guide rail 201C extend in the ascending-and-descending direction Z inside the hoistway 110.

[0022] Moreover, the elevator car 120 is provided with the emergency stop apparatus 5 which causes emergency stop of ascending-and-descending motion of the elevator car 120. A detailed configuration of the emergency stop apparatus 5 will be described later.

[0023] Moreover, the controller 170 is installed in the machine room 160. The controller 170 is connected to the elevator car 120 through connection wiring (not illustrated). The controller 170 outputs a control signal to the elevator car 120. Furthermore, a state detection sensor (not illustrated) which is installed in the hoistway 110 and detects a state of the elevator car 120 is connected to the controller 170.

[0024] Information detected by the state detection sensor is, for example, location information of the elevator car 120 which ascends and descends in the hoistway 110, speed information of the elevator car 120, acceleration information of the elevator car 120, and the like. The location information of the elevator car 120 is, for example, abnormal closeness information which is detected when a space between two elevator cars 120 vertically adjacent to each other becomes narrower than a given space, in a multi-car elevator in which a plurality of elevator cars 120 ascend and descend in a single hoistway 110.

[0025] Moreover, the speed information of the elevator car 120 is, for example, abnormal descent speed information which is detected when a descent speed of the elevator car 120 reaches a given speed exceeding a rated speed. Furthermore, the acceleration information of the elevator car 120 is, for example, abnormal acceleration information which is detected when an acceleration of the elevator car 120 deviates from a pattern set in advance. The state detection sensor outputs the detected information to a control device.

[0026] The controller 170 determines whether the state of the elevator car 120 is normal or abnormal based on the information detected by the state detection sensor. Then, when the controller 170 determines that the state of the elevator car 120 is abnormal, the controller 170 outputs an operation command signal to the emergency stop apparatus 5. Therefore, the emergency stop apparatus 5 operates based on the operation command signal from the controller 170, and stops the elevator car 120.

[0027] Note that although this example describes the example in which the state detection sensor detects the location information, the speed information, and the acceleration information, the configuration is not limited to this example. For example, the location information, the speed information, and the acceleration information may respectively be detected by different sensors. Moreover, the controller 170 may select any of the location information, the speed information, and the acceleration information to acquire the information independently, or may acquire the information as a combination of some information.

[0028] Note that the controller 170 and the elevator car 120 are not limited to be connected to each other via a wire, but may be connected to each other such that a signal is wirelessly receivable and transmittable.

[0029] Below, the direction in which the elevator car 120 ascends and descends is assumed as the ascending-and-descending direction Z, and a direction orthogonal to the ascending-and-descending direction Z, and in which the elevator car 120 and the guide rail 201A are opposed to each other is assumed as a first direction X. Moreover, a direction orthogonal to the first direction X, and also orthogonal to the ascending-and-descending direction Z is assumed as a second direction Y.

1-2. Configuration of Emergency Stop Apparatus

[0030] Next, a detailed configuration of the emergency stop apparatus 5 is described with reference to Figs. 2 to 6.

[0031] Fig. 2 is a front view illustrating the emergency stop apparatus 5.

[0032] As illustrated in Fig. 2, the emergency stop apparatus 5 includes two braking mechanisms 10A and 10B, an actuating mechanism 11, a driving mechanism 12 which causes the braking mechanisms 10A and 10B to operate, a first pull-up member 13, and a second pull-up member 14. The actuating mechanism 11 is disposed at a crosshead 121 provided to an upper portion of the elevator car 120.

[Driving Mechanism]

[0033] The driving mechanism 12 includes a drive shaft 15, a first link member 16, a second link member 17, a first actuation shaft 18, a second actuation shaft 19, and a drive spring 20.

[0034] The first actuation shaft 18 and the second actuation shaft 19 are provided to the crosshead 121 installed at the upper portion of the elevator car 120. The first actuation shaft 18 is provided to one end portion of the crosshead 121 in the first direction X, and the second actuation shaft 19 is provided to the other end portion of the crosshead 121 in the first direction X. The first actuation shaft 18 rotatably supports the first link member 16, and the second actuation shaft 19 rotatably supports the second link member 17.

[0035] Each of the first link member 16 and the second link member 17 is formed in a substantially T-shape. The first link member 16 has an actuating piece 16a and a connecting piece 16b. The actuating piece 16a projects substantially perpendicularly from the connecting piece 16b. Moreover, the actuating piece 16a is connected to a portion of the connecting piece 16b on one end-portion side with respect to a middle portion in a longitudinal direction of the connecting piece 16b. Furthermore, the actuating piece 16a projects toward the guide rail 201A disposed on a negative side (left side in the drawing) of the elevator car 120 in the first direction X (hereinafter, in the drawings, the left side and the lower side of the XYZ-axis in the drawing sheets are referred to as the negative side, and the right side and the upper side of the XYZ-axis in the drawing sheets are referred to as a positive side). At an end portion of the actuating piece 16a on the opposite side from the connecting piece 16b, the first pull-up member 13 is connected with a connecting part 26 interposed therebetween. Note that a detailed configuration of the connecting part 26 will be described later.

[0036] The first link member 16 is rotatably supported by the first actuation shaft 18 at a location where the actuating piece 16a and the connecting piece 16b are connected together. The drive shaft 15 is connected to

the one end portion of the connecting piece 16b in the longitudinal direction with a coupling part 25 interposed therebetween. Moreover, a connecting member 41 of the actuating mechanism 11 (described later) is connected to an end portion of the connecting piece 16b on the opposite side from the end portion connected to the drive shaft 15 (that is, the other end portion in the longitudinal direction)(see Fig. 3).

[0037] The first link member 16 is disposed such that the one end portion of the connecting piece 16b in the longitudinal direction is directed to the upper side in the ascending-and-descending direction Z, and the other end portion of the connecting piece 16b in the longitudinal direction is directed to the lower side in the ascending-and-descending direction Z.

[0038] The second link member 17 has an actuating piece 17a and a connecting piece 17b. The actuating piece 17a projects substantially perpendicularly from the connecting piece 17b. Moreover, the actuating piece 17a is connected to a middle portion of the connecting piece 17b in a longitudinal direction. Furthermore, the actuating piece 17a projects toward the guide rail 201B disposed on the positive side of the elevator car 120 in the first direction X. The second pull-up member 14 is connected to an end portion of the actuating piece 17a with a connecting part 28 interposed therebetween, the end portion being on the opposite side from the connecting piece 17b.

[0039] The drive shaft 15 is connected to the other end portion of the connecting piece 17b in the longitudinal direction with a coupling part 27 interposed therebetween. Furthermore, the second link member 17 is rotatably supported by the second actuation shaft 19 at a location where the actuating piece 17a and the connecting piece 17b are connected together. The second link member 17 is disposed such that one end portion of the connecting piece 17b in the longitudinal direction is directed to the upper side in the ascending-and-descending direction Z, and the other end portion of the connecting piece 17b in the longitudinal direction is directed to the lower side in the ascending-and-descending direction Z.

[0040] One end portion of the drive shaft 15 in the first direction X is connected to the connecting piece 16b of the first link member 16, and the other end portion of the drive shaft 15 in the first direction X is connected to the connecting piece 17b of the second link member 17. Moreover, the drive spring 20 is provided to a middle portion of the drive shaft 15 in the axis direction.

[0041] The drive spring 20 includes a compression coil spring, for example. One end portion of the drive spring 20 is fixed to the crosshead 121 with a fixing part 21 interposed therebetween, and the other end portion of the drive spring 20 is fixed to the drive shaft 15 with a pressing member 22 interposed therebetween. The drive spring 20 biases the drive shaft 15 to the positive side in the first direction X with the pressing member 22 interposed therebetween.

[0042] When the actuating mechanism 11 is actuated, the drive shaft 15 is biased by the drive spring 20, and

moves to the positive side in the first direction X. Therefore, the first link member 16 turns centering on the first actuation shaft 18 such that the end portion of the actuating piece 16a to which the first pull-up member 13 is connected is directed upward in the ascending-and-descending direction Z. Moreover, the second link member 17 turns centering on the second actuation shaft 19 such that the end portion of the actuating piece 17a to which the second pull-up member 14 is connected is directed upward in the ascending-and-descending direction Z. As a result, the first pull-up member 13 and the second pull-up member 14 are pulled up to the upper side in the ascending-and-descending direction Z in an interlocking manner.

[0043] Moreover, the first braking mechanism 10A is connected to an end portion of the first pull-up member 13 on the opposite side from the end portion connected to the actuating piece 16a. The second braking mechanism 10B is connected to an end portion of the second pull-up member 14 on the opposite side from the end portion connected to the actuating piece 17a. The first pull-up member 13 pulls up a pair of brake elements 31 (described later with reference to Fig. 3) of the first braking mechanism 10A upward in the ascending-and-descending direction Z. Moreover, the second pull-up member 14 pulls up the pair of brake elements 31 (described later) of the second braking mechanism 10B upward in the ascending-and-descending direction Z.

[0044] The first braking mechanism 10A and the second braking mechanism 10B are disposed at a lower-end portion of the elevator car 120 in the ascending-and-descending direction Z. The first braking mechanism 10A is disposed to be opposed to the guide rail 201A at one end portion of the elevator car 120 in the first direction X. Moreover, the second braking mechanism 10B is disposed to be opposed to the guide rail 201B at the other end portion of the elevator car 120 in the first direction X.

[0045] Next, detailed configurations of the first braking mechanism 10A, the second braking mechanism 10B, and the connecting parts 26 and 28 are described with reference to Figs. 3A and 3B.

[0046] Figs. 3A and 3B are views illustrating the braking mechanisms 10A and 10B, and the connecting part 26.

[0047] Since the first braking mechanism 10A and the second braking mechanism 10B have the same configurations, the first braking mechanism 10A is described here. The first braking mechanism 10A is simply referred to as a braking mechanism 10.

[0048] As illustrated in Fig. 3A, the connecting part 26 is formed in a cylindrical shape. The connecting part 26 has a cylinder hole into which an upper-end portion of the first pull-up member 13 in the ascending-and-descending direction Z is movably inserted in the ascending-and-descending direction Z. Moreover, a shaft portion 26a which rotatably supports the actuating piece 16a is formed in the connecting part 26. Note that the upper-end portion of the first pull-up member 13 is provided with

a stopper 26b. The stopper 26b is provided to a portion of the first pull-up member 13 on the upper-end portion side with respect to the connecting part 26 in the ascending-and-descending direction Z. By contacting the connecting part 26, the first pull-up member 13 is prevented from getting out of the connecting part 26.

[0049] Note that although this example describes the example in which the connecting part 26 is formed in a cylindrical shape, the configuration is not limited to this example. The connecting part 26 may have any type of shape other than the cylindrical shape, as long as the connecting part 26 has a hole into which the first pull-up member 13 is movably inserted.

[0050] When the first link member 16 turns and the connecting piece 16b turns upwardly in the ascending-and-descending direction Z, the connecting part 26 contacts the stopper 26b. Then, the connecting part 26 transmits the rotational torque of the first link member 16 to the first pull-up member 13 through the stopper 26b. Therefore, the first pull-up member 13 is pulled up upward in the ascending-and-descending direction Z together with the connecting part 26.

[0051] Moreover, when the first link member 16 turns and the connecting piece 16b turns downwardly in the ascending-and-descending direction Z, the connecting part 26 moves downward in the ascending-and-descending direction Z together with the connecting piece 16b. Note that a stopper is not provided to a portion of the first pull-up member 13 on the lower side with respect to the connecting part 26 in the ascending-and-descending. Therefore, a load when the connecting part 26 moves downward in the ascending-and-descending direction Z is not transmitted to the first pull-up member 13. That is, the connecting part 26 transmits, among driving force from the driving mechanism 12, only force to the upper side in the ascending-and-descending direction Z to the first pull-up member 13. As a result, only the connecting part 26 moves downward in the ascending-and-descending direction Z along the first pull-up member 13.

[0052] Note that since the connecting part 28 has a configuration similar to the configuration of the connecting part 26, description thereof is omitted.

[0053] As illustrated in Figs. 3A and 3B, the braking mechanism 10 includes a frame body 30, the pair of brake elements 31, a pair of guide members 32, a coupling member 33, and a biasing member 34. The pair of brake elements 31 are disposed to be opposed to each other while having the guide rail 201A therebetween. In a state before the emergency stop apparatus 5 is actuated, a given gap is formed between the guide rail 201A and each of the pair of brake elements 31.

[0054] One surface of the brake element 31, the one surface being opposed to the guide rail 201A, is formed to be in parallel to one surface of the guide rail 201A (that is, parallel to the ascending-and-descending direction Z). Moreover, the other surface of the brake element 31 on the opposite side from the one surface opposed to the guide rail 201A is inclined to be closer to the guide rail

201A from the lower side to the upper side in the ascending-and-descending direction Z. Therefore, the brake element 31 is formed in a wedge-like shape.

[0055] The pair of brake elements 31 are attached to a lower-end portion of the coupling member 33 in the ascending-and-descending direction Z through a support bolt 36. The support bolt 36 is inserted through a through-hole 33a provided to the lower-end portion of the coupling member 33. The pair of brake elements 31 are supported by the coupling member 33 through the support bolt 36 so as to be movable in a direction of approaching and separating from the guide rail 201A.

[0056] As illustrated in Fig. 3B, the first pull-up member 13 is connected to the coupling member 33. By the first pull-up member 13 being pulled up upward in the ascending-and-descending direction Z, the pair of brake elements 31 and the coupling member 33 move upward in the ascending-and-descending direction Z. Note that the pair of brake elements 31 are disposed to be movable with respect to the coupling member 33 in the ascending-and-descending direction Z by a length of the support bolt 36.

[0057] Moreover, the pair of brake elements 31 are movably supported by the pair of guide members 32. The pair of guide members 32 are fixed to the elevator car 120 (see Fig. 2) with the frame body 30 interposed therebetween. Moreover, the pair of guide members 32 are opposed to each other with a given gap therebetween while having the guide rail 201A and the pair of brake elements 31 therebetween.

[0058] A surface of the guide member 32, the surface being opposed to the brake element 31, is inclined to be closer to the guide rail 201A toward the upper side in the ascending-and-descending direction Z. Therefore, a gap between the one surfaces of the pair of guide members 32, the one surfaces being opposed to the corresponding brake elements 31, becomes narrower toward the upper side in the ascending-and-descending direction Z.

[0059] Moreover, on the other surface of the guide member 32 on the opposite side from the one surface opposed to the brake element 31, the biasing member 34 is disposed. For example, the biasing member 34 includes a plate spring whose cross-sectional shape taken along a horizontal direction orthogonal to the ascending-and-descending direction Z is a U-like shape. Both end portions of the biasing member 34 are opposed to each other with a given gap therebetween while having the guide rail 201A therebetween. On one surfaces of the biasing member 34 at the both end portions, the one surfaces being opposed to each other, the corresponding guide members 32 are fixed.

[0060] Note that the biasing member 34 is not limited to the U-like shaped plate spring, but a compression coil spring may be used to be interposed between the guide member 32 and a frame body (not illustrated).

[0061] When the pair of brake elements 31 move upward in the ascending-and-descending direction Z relatively to the guide members 32, the pair of brake elements

31 move in a direction to mutually approach the guide members 32 (that is, in a direction to approach the guide rail 201A). Moreover, when the pair of brake elements 31 move upward in the ascending-and-descending direction Z, the pair of brake elements 31 are pushed against the guide rail 201A by the biasing force of the biasing member 34 with the guide member 32 interposed therebetween. Therefore, ascending-and-descending motion of the elevator car 120 is braked.

[Actuating Mechanism]

[0062] Next, the actuating mechanism 11 is described with reference to Fig. 4.

[0063] Fig. 4 is a front view illustrating the actuating mechanism 11. Note that the Fig. 4 shows a waiting state of the actuating mechanism 11.

[0064] As illustrated in Figs. 3 and 4, the actuating mechanism 11 includes a connecting member 41, an electromagnetic core 43, a movable iron core 44, a base plate 45, a feed screw shaft 47, a feed nut 48, and a drive motor (not illustrated). The actuating mechanism 11 actuates the driving mechanism 12.

[0065] The base plate 45 is formed by a plate-like shaped member. The base plate 45 is fixed to the cross-head 121. A location where the base plate 45 is fixed is not limited to the crosshead 121, and is not particularly limited as long as the base plate 45 is fixed to the elevator car 120 which is the ascending-and-descending body. On an upper surface portion 45a of the base plate 45 on the upper side in the ascending-and-descending direction Z, a first shaft supporting part 54 and a second shaft supporting part 55 are fixed.

[0066] The first shaft supporting part 54 is disposed at one end portion of the base plate 45, and the second shaft supporting part 55 is disposed at the other end portion of the base plate 45. The first shaft supporting part 54 and the second shaft supporting part 55 are disposed to be opposed to each other. The first shaft supporting part 54 and the second shaft supporting part 55 rotatably support the feed screw shaft 47. The feed screw shaft 47 is disposed such that, between the first shaft supporting part 54 and the second shaft supporting part 55, an axis direction of the feed screw shaft 47 is in parallel to the first direction X. Moreover, one of the first shaft supporting part 54 and the second shaft supporting part 55 is provided with the drive motor (not illustrated). A rotation shaft of the drive motor is attached to the feed screw shaft 47 with a coupling interposed therebetween.

[0067] A trapezoidal thread is formed on an outer peripheral surface of the feed screw shaft 47, and the feed nut 48 is screwed onto the feed screw shaft 47. The electromagnetic core 43 is fixed to the feed nut 48.

[0068] The electromagnetic core 43 is provided with a coil. Power is supplied to the coil from a power supply (not illustrated), and when the coil is energized, the electromagnetic core 43 and the coil configure an electromagnet. An end portion of the electromagnetic core 43

on the opposite side from an end portion connected to the feed nut 48 is directed in the first direction X. The electromagnetic core 43 is opposed to the movable iron core 44 attached to the connecting member 41 (described later).

[0069] The controller 170 controls driving of the drive motor. When the drive motor rotates, the feed screw shaft rotates. By the feed screw shaft 47 rotating, rotational force of the feed screw shaft 47 is converted into force along the first direction X by the screw portion and the threaded hole. Then, the feed nut 48 moves in the first direction X. Moreover, the electromagnetic core 43 to which the feed nut 48 is fixed also moves in the first direction X.

[0070] When the drive motor rotates forward (forward rotation), the feed nut 48 moves to one end-portion side (that is, the first shaft supporting part 54 side) in the first direction X. Furthermore, when the drive motor rotates backward (backward rotation), the feed nut 48 moves to the other end-portion side (that is, the second shaft supporting part 55 side) in the first direction X. Here, the second shaft supporting part 55 is located at a waiting position of the feed nut 48 and the electromagnetic core 43. In the waiting state of the actuating mechanism 11, and when the actuating mechanism 11 returns to a returned state from the braking state, the electromagnetic core 43 contacts the second shaft supporting part 55 with the feed nut 48 interposed therebetween.

[0071] The connecting member 41 is rotatably connected to the connecting piece 16b of the first link member 16 with a connection pin 41a interposed therebetween. Moreover, the movable iron core 44 is fixed to the connecting member 41. The movable iron core 44 is supported by the connecting member 42, and is opposed to the electromagnetic core 43 fixed to the feed nut 48. In the waiting state illustrated in Fig. 4, the movable iron core 44 is attracted to the electromagnetic core 43.

[0072] Moreover, the drive motor, the feed screw shaft 47, and the feed nut 48 are included in a moving mechanism which moves the electromagnetic core 43 in the direction to approach and separate from the movable iron core 44 (in this embodiment, in the first direction X).

[0073] Furthermore, the connecting member 41, the electromagnetic core 43, the movable iron core 44, the base plate 45, the drive motor, the feed screw shaft 47, and the feed nut 48 included in the actuating mechanism 11 described above are accommodated in a housing (not illustrated). In this manner, by the connecting member 41, the electromagnetic core 43 included in a holding part, the feed screw shaft 47 and the drive motor included in the moving mechanism being accommodated in a single housing, increase in size of the emergency stop apparatus 5 can be suppressed. Moreover, by the functions of the actuating mechanism 11 being aggregated into one location, maintenance operations become easier.

[0074] Furthermore, as described above, the drive spring 20 is disposed at the location different from the location of the actuating mechanism 11, and the drive

spring 20 and the actuating mechanism 11 are connected to each other with the first link member 16 which is a link mechanism interposed therebetween. Therefore, the size of the actuating mechanism 11 can be reduced.

2. Operation Example of Emergency Stop Apparatus

[0075] Next, an operation example of the emergency stop apparatus 5 having the above-described configuration is described.

[Waiting State]

[0076] First, the waiting state of the emergency stop apparatus 5 is described with reference to Fig. 4.

[0077] As illustrated in Fig. 4, in the waiting state of the emergency stop apparatus 5, the electromagnetic core 43 is disposed at the other-end portion side of the feed screw shaft 47 in the first direction X. Moreover, the coil of the electromagnetic core 43 is energized, and excitation is applied to the electromagnetic core 43. Therefore, the electromagnetic core 43 and the coil configure the electromagnet.

[0078] The movable iron core 44 is attracted to the electromagnetic core 43. Therefore, the one end portion of the connecting piece 16b of the first link member 16 is held to the positive side in the first direction X with the connecting member 41 where the movable iron core 44 is fixed interposed therebetween. As a result, the drive shaft 15 connected to the other end portion of the connecting piece 16b is biased to the negative side in the first direction X while resisting the biasing force of the drive spring 20.

[0079] At this time, the feed nut 48 is in contact with the second shaft supporting part 55. As described above, the second shaft supporting part 55 is located at the waiting position of the movable members. Therefore, the position where the feed nut 48 is in contact with the second shaft supporting part 55 is set as the waiting state of the emergency stop apparatus 5. Moreover, the gap between the brake element 31 of each of the braking mechanisms 10A and 10B coupled to the movable iron core 44, and the guide rail 201A or 201B is adjusted to be a desired gap.

[0080] Therefore, positioning of the electromagnetic core 43, the movable iron core 44, and the feed nut 48 which are the movable members can be performed easily. Moreover, by the feed nut 48 contacting the second shaft supporting part 55, moving of the movable members to the other-end portion side (that is, the positive side) in the first direction X can be regulated. Therefore, the gap between the brake element 31 and each of the guide rails 201A and 201B can be prevented from varying.

[0081] Moreover, since the position of the feed nut 48 can be regulated without using a switch which detects the position of the feed nut 48, the number of components of the emergency stop apparatus 5 can be reduced, and

operation to adjust a position of the switch is not required.

[0082] Note that although the example in which the position of the feed nut 48 is detected without providing the switch is described, a switch which detects the positions of the feed nut 48 and the electromagnetic core 43 may be provided.

[Operation to Braking State]

[0083] Next, operation from the waiting state to the braking state is described with reference to Fig. 5.

[0084] Fig. 5 is a front view illustrating the state where the actuating mechanism 11 is actuated.

[0085] During descending motion of the elevator car 120 (see Figs. 1 and 2), when the controller 170 determines that the descent speed of the elevator car 120 exceeds a given speed, the controller 170 outputs the operation command signal to the emergency stop apparatus 5. Therefore, energizing to the electromagnetic core 43 is interrupted. Note that the interruption of energizing to the electromagnetic core 43 is caused not only in the case of speeding of the elevator car 120, but also in a case of power outage of the elevator 1.

[0086] By the interruption of energizing to the electromagnetic core 43, magnetism of the electromagnetic core 43 is removed. Therefore, as illustrated in Fig. 5, the drive shaft 15 moves to the positive side in the first direction X by the biasing force of the drive spring 20, and the one end portion of the first link member 16 also moves to the positive side in the first direction X together with the drive shaft 15. As a result, the first link member 16 turns centering on the first actuation shaft 18, and the second link member 17 turns centering on the second actuation shaft 19. In this manner, the actuating mechanism 11 actuates the driving mechanism 12.

[0087] Moreover, as illustrated in Fig. 5, by the first link member 16 turning, the movable iron core 44 separates from the electromagnetic core 43. The connecting member 41 moves to the negative side in the first direction X accompanying with the turn of the first link member 16.

[0088] When the first link member 16 turns, and the actuating piece 16a moves to the upper side in the ascending-and-descending direction Z, the connecting part 26 moves upward in the ascending-and-descending direction Z together with the actuating piece 16a. Then, the connecting part 26 contacts the stopper 26b, and the stopper 26b is pushed upward in the ascending-and-descending direction Z by the connecting part 26. Therefore, the first pull-up member 13 is pulled up upward in the ascending-and-descending direction Z. Note that operation of the second link member 17, the second pull-up member 14, and the connecting part 28 is similar to the operation of the first link member 16, the first pull-up member 13, and the connecting part 26, and thus description thereof is omitted.

[0089] By the first pull-up member 13 and the second pull-up member 14 being pulled up upward in the ascending-and-descending direction Z, the first braking mech-

anism 10A connected to the first pull-up member 13, and the second braking mechanism 10B connected to the second pull-up member 14 (see Fig. 2) are actuated. As a result, the pair of brake elements 31 of the first braking mechanism 10A and the second braking mechanism 10B (see Fig. 3) move upward in the ascending-and-descending direction Z, and the pair of brake elements 31 of the second braking mechanism 10B coupled to the second pull-up member 14 sandwich the guide rails 201A and 201B, and thus ascending-and-descending motion of the elevator car 120 is mechanically stopped.

[0090] Moreover, by the movable iron core 44 separating from the electromagnetic core 43, the connecting member 41 can be moved without being affected by friction force and holding force of the feed screw shaft 47 and the feed nut 48 which are the moving mechanism.

[Return Operation]

[0091] Next, the return operation in which the emergency stop apparatus 5 returns from the braking state to the waiting state is described with reference to Figs. 6 and 7.

[0092] Fig. 6 is an explanatory diagram illustrating the return operation of the actuating mechanism 11 and the braking mechanism 10. Fig. 7 is a flowchart illustrating the return operation.

[0093] As illustrated in Fig. 7, in the waiting state, when power supply to the coil of the electromagnetic core 43 is interrupted or lost (Step S11), the actuating mechanism 11 is actuated as illustrated in Fig. 5.

[0094] Then, the controller 170 determines whether the elevator car 10 is stopped by the braking mechanisms 10A and 10B (Step S12). Here, in the processing at Step S12, the state of the emergency stop apparatus 5 may comprehensively be determined not only based on the determination of the stopped state of the elevator car 10, but also information including whether the actuating mechanism 11 is actuated.

[0095] In the processing at Step S12, if the controller 170 determines that the elevator car 10 is stopped (YES at Step S12), the controller 170 executes the return operation (a trigger which will be described later) of the actuating mechanism 11 (Step S13).

[0096] In the return operation at Step S13, first, the controller 170 controls the power supply and energizes the coil of the electromagnetic core 43. Therefore, the coil is energized, thus excitation being applied to the electromagnetic core 43. Next, the controller 170 drives the drive motor 46 by rotation, and causes the feed screw shaft 47 to rotate. By the feed screw shaft 47 rotating, the rotational force of the feed screw shaft 47 is converted into the force along the first direction X by the screw portion and the threaded hole of the feed screw shaft 47 and the feed nut 48. The feed nut 48 moves to the negative side in the first direction X. Then, the electromagnetic core 43 fixed to the feed nut 48 also moves in the direction to approach the movable iron core 44 (that is, to the neg-

ative side in the first direction X).

[0097] Next, when the electromagnetic core 43 contacts the movable iron core 44, the movable iron core 44 is attracted to the electromagnetic core 43. Then, the controller 170 drives the drive motor 46 by rotation, and causes the feed screw shaft 47 to rotate. Therefore, the feed nut 48 which is screwed onto the feed screw shaft 47 moves to the positive side in the first direction X. Thus, the electromagnetic core 43, and the movable iron core 44 and the connecting member 41 attracted to the electromagnetic core 43 move to the positive side in the first direction X.

[0098] By the connecting member 41 moving to the positive side in the first direction X, the first link member 16 turns while resisting the biasing force of the drive spring 20. Then, when the feed nut 48 contacts the second shaft supporting part 55, moving of the feed nut 48 and the electromagnetic core 43 to the positive side in the first direction X is regulated. Therefore, positioning of the electromagnetic core 43, the movable iron core 44, and the feed nut 48 which are the movable members can be performed easily.

[0099] Moreover, by the first link member 16 turning, the connecting piece 16b turns downwardly in the ascending-and-descending direction Z, and the connecting part 26 moves downward in the ascending-and-descending direction Z together with the connecting piece 16b. As described above, only the force to the upper side in the ascending-and-descending direction Z is transmitted to the connecting part 26 and the first pull-up member 13. Therefore, only the connecting part 26 moves downward in the ascending-and-descending direction Z along the first pull-up member 13. Thus, the force of sandwiching the guide rail 201A by the brake elements 31 of the braking mechanism 10 does not act on the actuating mechanism 11 and the first link member 16. Therefore, the driving force of the drive motor (driving part) provided to the actuating mechanism 11 only requires the force to resist the biasing force of the drive spring 20 of the driving mechanism 12. The size of the drive motor (driving part) of the actuating mechanism 11 can be reduced.

[0100] Moreover, by the connecting part 26 moving downward in the ascending-and-descending direction Z, the biasing force to the upper side in the ascending-and-descending direction Z by the drive spring 20 with respect to the first pull-up member 13 and the coupling member 33 of the braking mechanism 10 is canceled. Therefore, the first pull-up member 13 and the coupling member 33 move downward in the ascending-and-descending direction Z by their own weight. Note that since the support bolt 36 attached to the brake element 31 is inserted into the through-hole 33a provided to the lower-end portion of the coupling member 33, the coupling member 33 can be prevented from falling off.

[0101] Moreover, since the load to the upper side in the ascending-and-descending direction Z with respect to the coupling member 33 is canceled, load to the upper side in the ascending-and-descending direction Z ap-

plied from the driving mechanism 12 to the brake elements 31 is also canceled. As a result, the force of sandwiching the guide rail 201A by the brake elements 31 is also weakened.

[0102] As illustrated in Fig. 6, when the return operation of the actuating mechanism 11 is completed, the controller 170 drives the hoisting machine 100, so that the elevator car 120 performs ascending (UP) operation (Step S14). Therefore, the frame body 30 of the braking mechanism 10 ascends together with the elevator car 120, and thus the brake elements 31 are lowered relatively. Thus, the sandwiching of the guide rail 201A by the brake elements 31 is canceled. By performing the above-described processing, the return operation of the emergency stop apparatus 5 is completed.

[0103] Note that, in the return operation of this example, the elevator car 120 is caused to perform the ascending operation after completion of the return operation of the actuating mechanism 11, and the operation of the elevator car 120 are carried out separately. Therefore, the return operation of the emergency stop apparatus 5 of the elevator 1 can be performed certainly, and the control of the return operation can be simplified.

[0104] Note that limitation to the embodiments described above and illustrated in the drawings is not intended, and various modifications are possible without departing from a scope of the invention described in the claims.

[0105] Although the embodiment describes the example in which the control of the actuating mechanism 11 and the control of the entire elevator 1 are executed by the controller 170, the configuration is not limited to this example. For example, the control of the actuating mechanism 11 and the control of the entire elevator 1 may be executed by controllers different from each other.

[0106] Moreover, although the example in which the drive motor 46, the feed screw shaft 47, and the feed nut 48 are used as the moving mechanism is described, the configuration is not limited to this example. As the moving mechanism which moves the electromagnetic core 43, various moving mechanisms such as a mechanism using a belt drive, a gear drive, a chain drive, or a linear-motion solenoid, may be applied.

[0107] Although the example in which the moving direction of the electromagnetic core of the actuating mechanism 11 is set to be substantially parallel to the first direction X is described, the configuration is not limited to this example. The moving direction of the electromagnetic core of the actuating mechanism 11 may be set to the ascending-and-descending direction Z or substantially parallel to the second direction Y, or may be a direction inclined with respect to the first direction X, the second direction Y, or the ascending-and-descending direction Z. Moreover, the first link member 16 and the second link member 17 may respectively be disposed on both end portions of the elevator car 120 in the second direction Y, and the drive shaft 15 may be disposed along

the second direction Y.

[0108] Moreover, the ascending-and-descending body is not limited to the elevator car 120, but the counterweight 140 may be applied. The emergency stop apparatus may be provided to the counterweight 140, and the ascending-and-descending motion of the counterweight 140 may be brought into emergency stop. In this case, the actuating mechanism, the driving mechanism, etc., included in the emergency stop apparatus are provided to the counterweight 140.

[0109] Moreover, although the embodiment describes the example in which the controller 170 which controls the entire elevator 1 is applied as the controller which controls the emergency stop apparatus, the configuration is not limited to this example. As the controller, various controllers such as a controller which is provided to the elevator car 120 and controls only the elevator car 120, and a controller which controls only the emergency stop apparatus may be applied.

[0110] Moreover, as the elevator, a multi-car elevator in which a plurality of elevator cars ascend and descend in a single hoistway may be applied.

[0111] Note that although the terms such as "parallel" and "orthogonal" are used herein, these terms do not only mean strict "parallel" and "orthogonal", but may include states of being "substantially parallel" and "substantially orthogonal" which include "parallel" and "orthogonal" and fall within a range where the functions can be demonstrated.

Reference Signs List

[0112]

- 1: elevator
- 5: emergency stop apparatus
- 10A, 10B: first braking mechanism
- 11, 11B: actuating mechanism
- 12: driving mechanism
- 13, 14: pull-up member
- 15: drive shaft
- 16: first link member
- 17: second link member
- 16a, 17b: actuating piece
- 16b, 17b: connecting piece
- 18: first actuation shaft
- 19: second actuation shaft
- 20: drive spring
- 26, 28: connecting part
- 26a: shaft portion
- 26b: stopper
- 41: connecting member
- 43: electromagnetic core
- 44: movable iron core
- 45: base plate
- 46: drive motor
- 46a: rotation shaft
- 47: feed screw shaft

48: feed nut
 54: first shaft supporting part
 55: second shaft supporting part
 100: hoisting machine
 110: hoistway
 120: elevator car (ascending-and-descending body)
 121: crosshead
 130: main rope
 140: counterweight (ascending-and-descending body)
 150: deflector sheave
 160: machine room
 170: controller
 201A, 201B: guide rail

Claims

1. An emergency stop apparatus, comprising:

a braking mechanism provided to an ascending-and-descending body, including a brake element configured to sandwich a guide rail where the ascending-and-descending body slides, and configured to stop moving of the ascending-and-descending body;
 a pull-up member connected to the brake element;
 a driving mechanism including a connecting part connected to the pull-up member, and configured to cause the braking mechanism to operate; and
 an actuating mechanism connected to the driving mechanism and configured to actuate the driving mechanism, wherein the connecting part allows only force to an upper side in an ascending-and-descending direction to be transmitted to the pull-up member.

2. The emergency stop apparatus according to Claim 1, wherein the braking mechanism includes a coupling member configured to support the brake element to be movable in a direction of sandwiching the guide rail, and the pull-up member is connected to the coupling member.

3. The emergency stop apparatus according to Claim 1, wherein the connecting part has a hole into which the pull-up member is inserted to be movable in the ascending-and-descending direction.

4. The emergency stop apparatus according to Claim 3, wherein a stopper configured to contact the connecting part is provided to a portion of the pull-up member on an upper side with respect to the connecting part in the ascending-and-descending direction.

5. The emergency stop apparatus according to Claim 4, wherein the driving mechanism includes:

a link member rotatably supported by an actuation shaft and connected to the connecting part, the actuation shaft being provided to the ascending-and-descending body; and
 a drive spring configured to bias an end portion of the link member to the upper side in the ascending-and-descending direction, the end portion being connected to the connecting part, and the connecting part includes a shaft portion configured to rotatably support an end portion to which the link member is connected.

6. The emergency stop apparatus according to Claim 5, wherein the actuating mechanism includes:

a connecting member connected to the link member;
 a movable iron core fixed to the connecting member;
 an electromagnetic core configured to separably attract the movable iron core; and
 a moving mechanism configured to support the electromagnetic core to be movable in a direction of approaching and separating from the movable iron core, and
 the moving mechanism includes a driving part configured to move the electromagnetic core.

7. An elevator provided with an ascending-and-descending body configured to ascend and descend in a hoistway, the elevator comprising:

a guide rail provided upright in the hoistway and configured to slidably support the ascending-and-descending body; and
 an emergency stop apparatus configured to stop moving of the ascending-and-descending body based on a state of ascending-and-descending motion of the ascending-and-descending body, wherein the emergency stop apparatus includes:

a braking mechanism provided to the ascending-and-descending body, including a brake element configured to sandwich the guide rail where the ascending-and-descending body slides, and configured to stop moving of the ascending-and-descending body;
 a pull-up member connected to the brake element;
 a driving mechanism including a connecting part connected to the pull-up member, and configured to cause the braking mechanism to operate; and

an actuating mechanism connected to the driving mechanism and configured to actuate the driving mechanism, and

the connecting part allows only force to an upper side in an ascending-and-descending direction to be transmitted to the pull-up member. 5

8. A returning method of an emergency stop apparatus, wherein the emergency stop apparatus includes: 10

a braking mechanism provided to an ascending-and-descending body, including a brake element configured to sandwich a guide rail where the ascending-and-descending body slides, and configured to stop moving of the ascending-and-descending body; 15

a pull-up member connected to the brake element;

a driving mechanism including a connecting part connected to the pull-up member, and configured to cause the braking mechanism to operate; and 20

an actuating mechanism connected to the driving mechanism and configured to actuate the driving mechanism, and 25

the connecting part allows only force to an upper side in an ascending-and-descending direction to be transmitted to the pull-up member, the method comprising the steps of: 30

performing return operation of the actuating mechanism, and canceling load to the upper side in the ascending-and-descending direction applied from the driving mechanism to the brake element; and 35

after completion of the return operation of the actuating mechanism, causing the ascending-and-descending body to perform ascending operation, and canceling sandwiching of the guide rail by the brake element. 40

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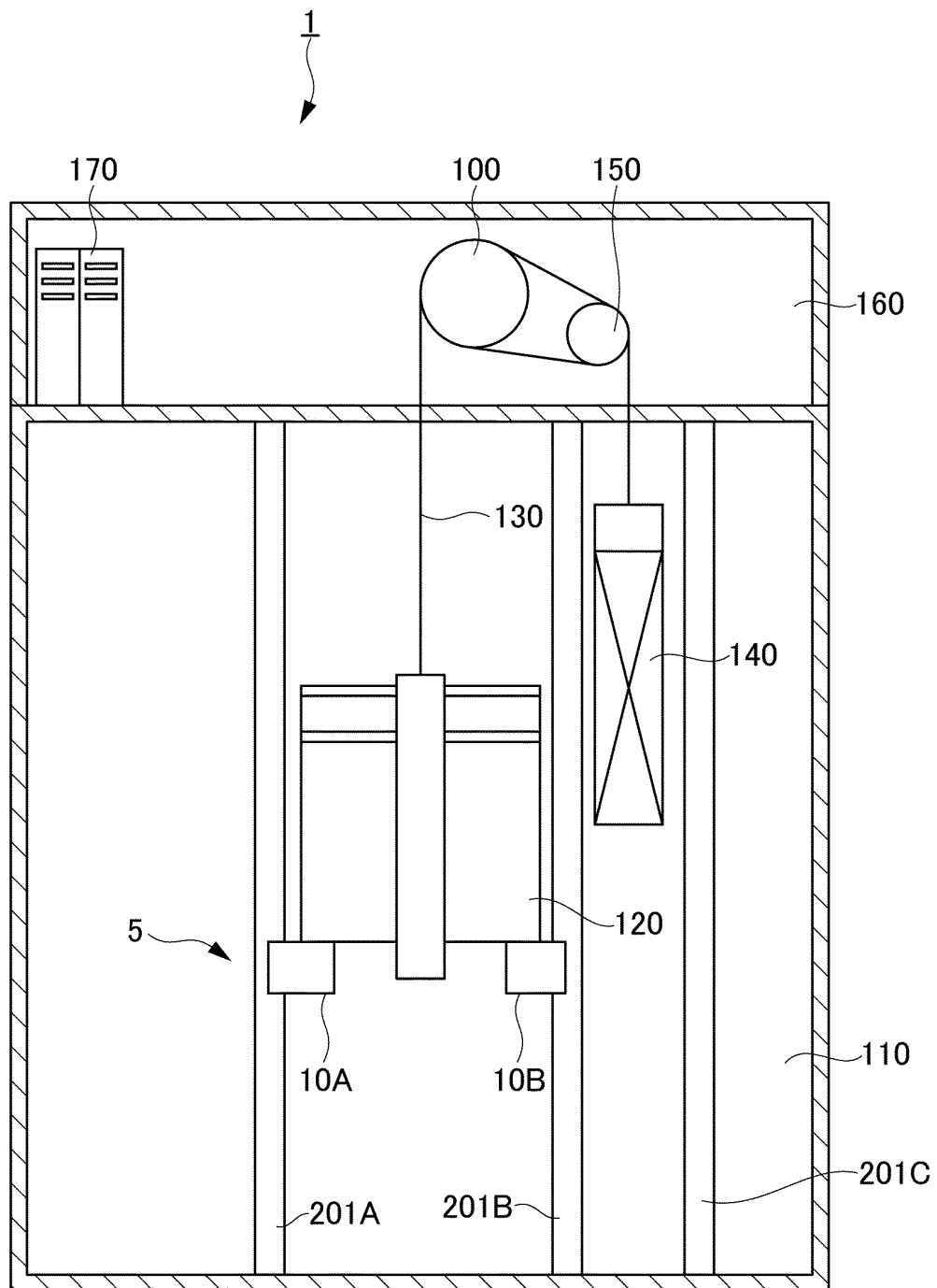
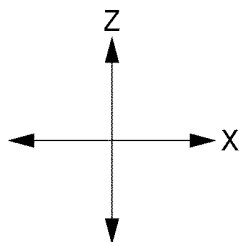


FIG. 1



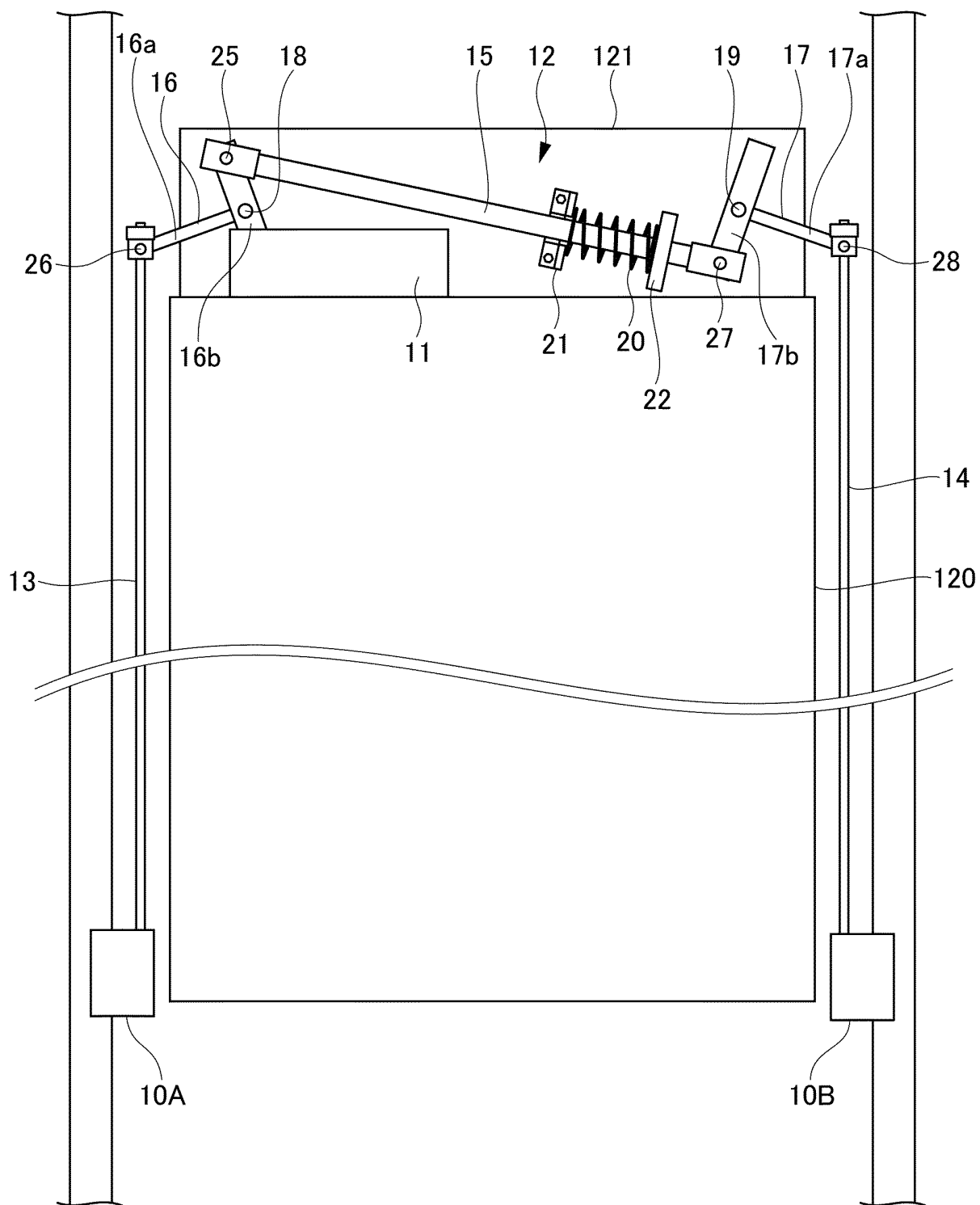


FIG. 2

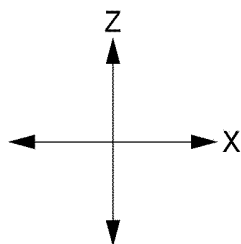


FIG. 3A

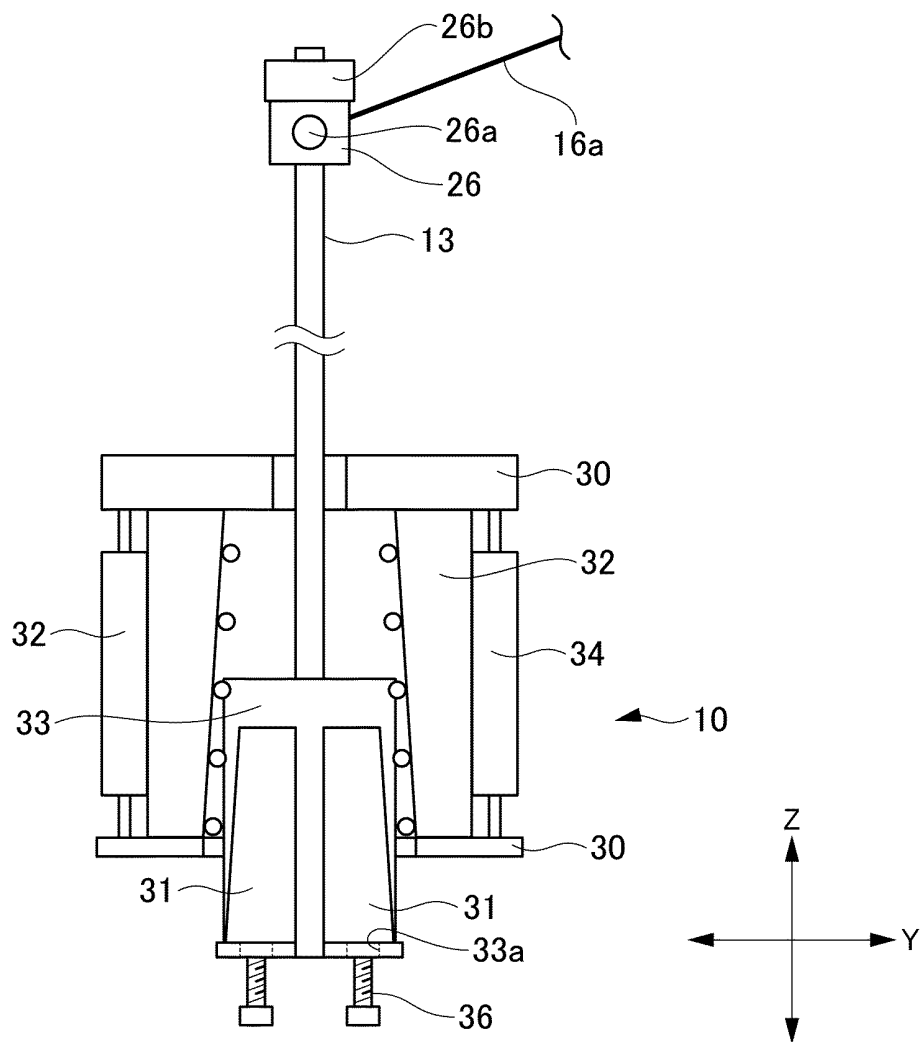
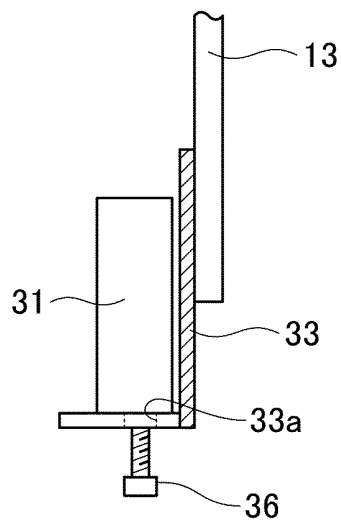
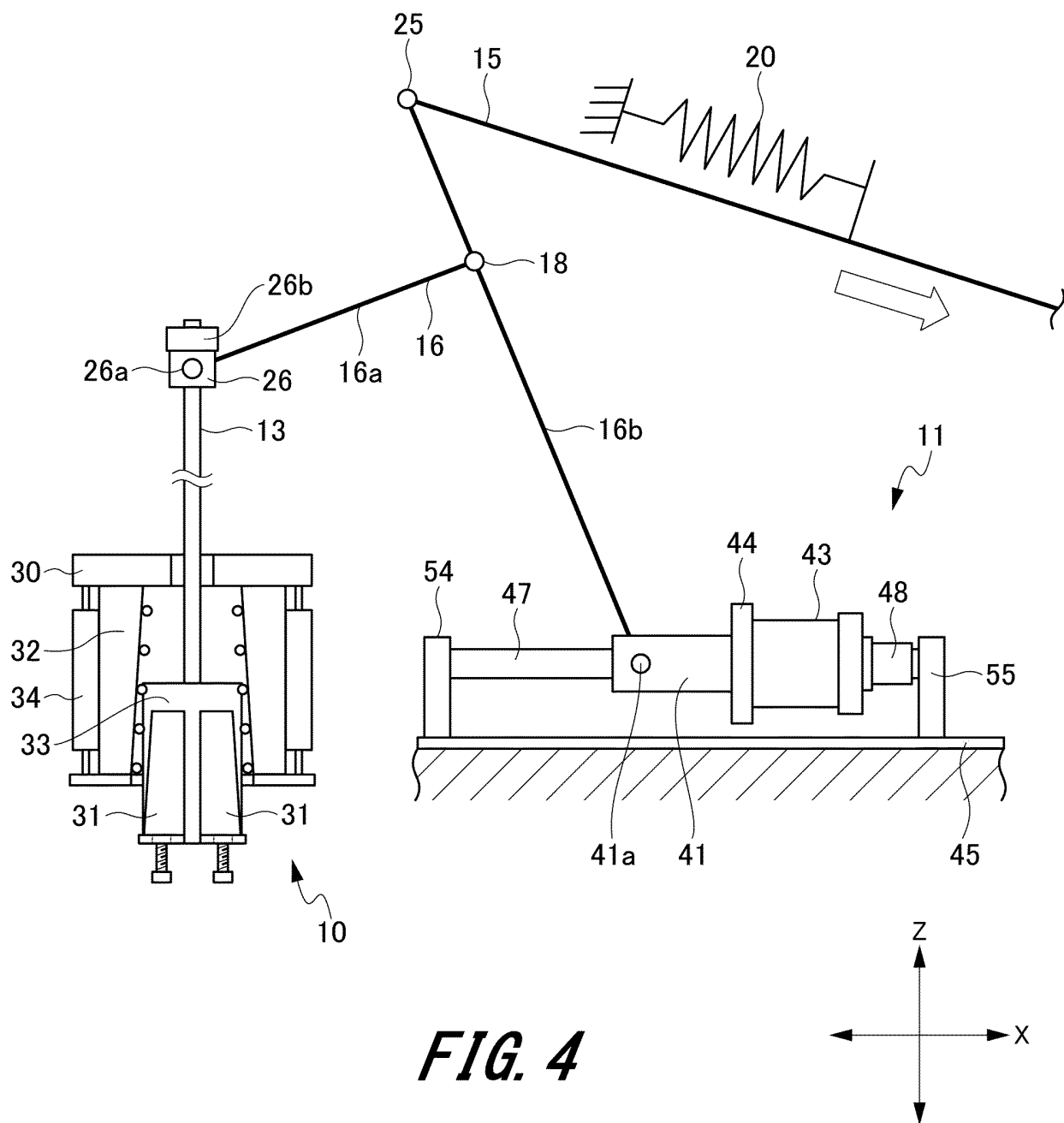
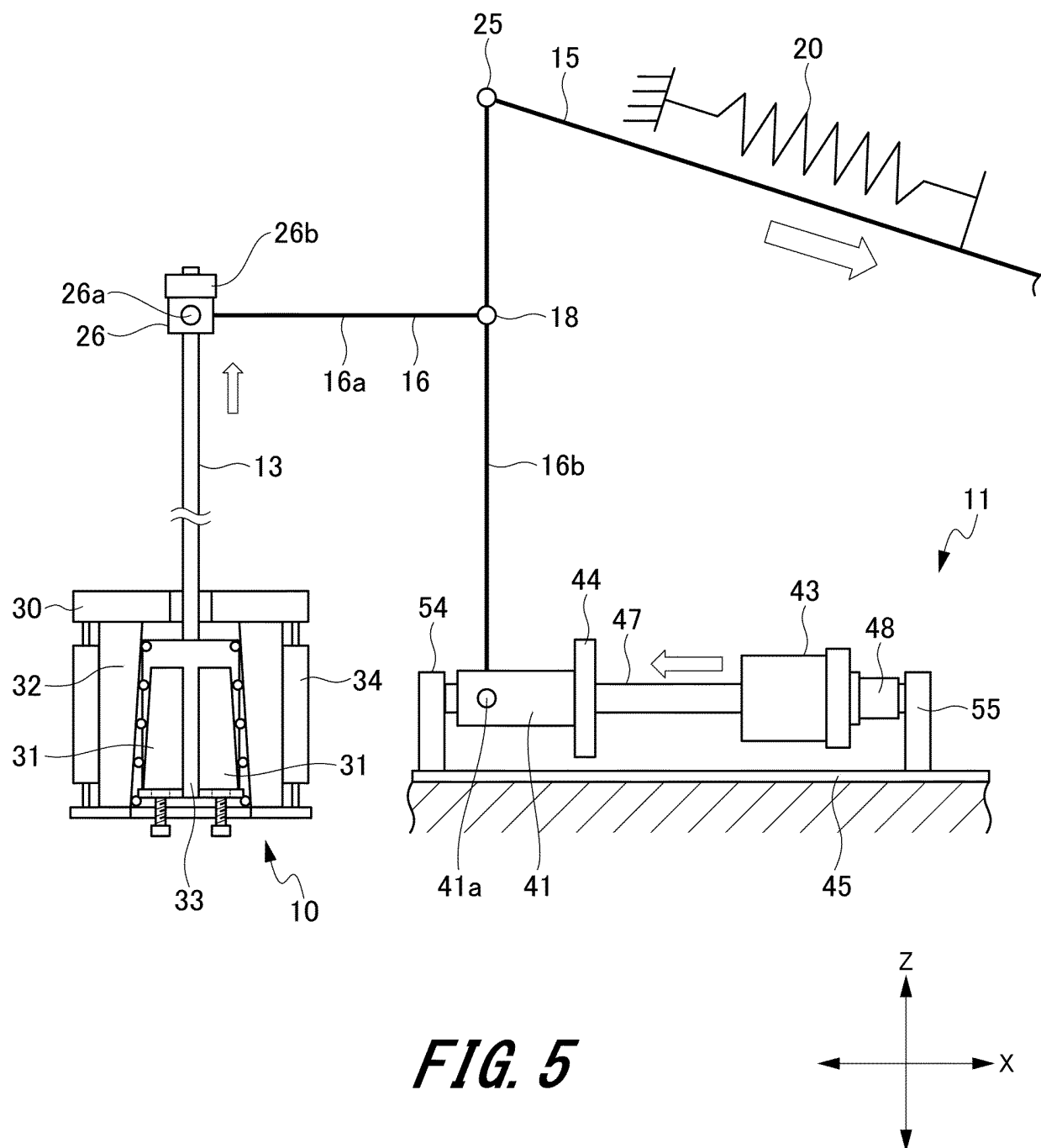


FIG. 3B







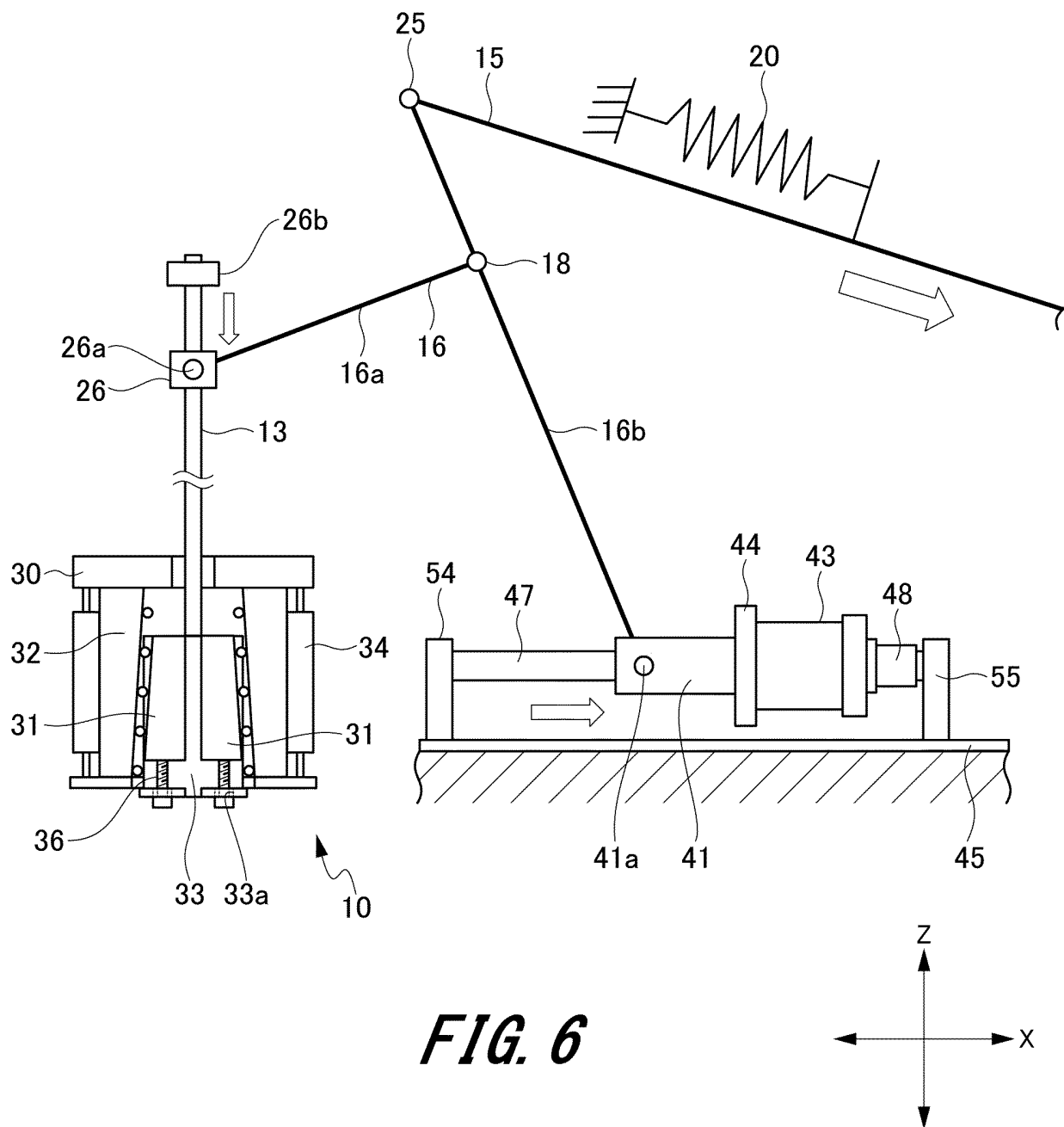
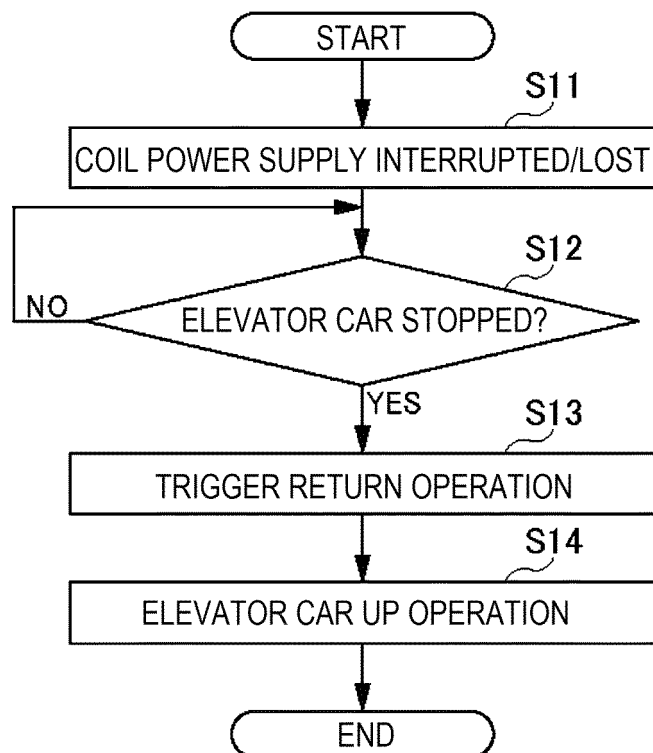


FIG. 6

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/018023

A. CLASSIFICATION OF SUBJECT MATTER B66B 5/22 (2006.01)i FI: 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) B66B5/22 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 1971-2022 Registered utility model specifications of Japan 1996-2022 Published registered utility model applications of Japan 1994-2022 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 2021/044662 A1 (HITACHI LTD) 11 March 2021 (2021-03-11) paragraphs [0013]-[0084], fig. 1-9</td> <td>1-7</td> </tr> <tr> <td>A</td> <td></td> <td>8</td> </tr> <tr> <td>Y</td> <td>CN 210884790 U (HANGZHOU XO-LIFT CO., LTD.) 30 June 2020 (2020-06-30) paragraphs [0010]-[0060], fig. 1-7</td> <td>1-7</td> </tr> <tr> <td>A</td> <td>Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 38852/1985 (Laid-open No. 157578/1986) (TOSHIBA KK) 30 September 1986 (1986-09-30), entire text, all drawings</td> <td>1-8</td> </tr> <tr> <td>A</td> <td>Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 13676/1971 (Laid-open No. 10269/1972) (HITACHI LTD) 06 October 1972 (1972-10-06), entire text, all drawings</td> <td>1-8</td> </tr> <tr> <td>A</td> <td>Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 047097/1974 (Laid-open No. 136161/1975) (TOKYO SHIBAURA ELECTRIC CO., LTD.) 10 November 1975 (1975-11-10), entire text, all drawings</td> <td>1-8</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	WO 2021/044662 A1 (HITACHI LTD) 11 March 2021 (2021-03-11) paragraphs [0013]-[0084], fig. 1-9	1-7	A		8	Y	CN 210884790 U (HANGZHOU XO-LIFT CO., LTD.) 30 June 2020 (2020-06-30) paragraphs [0010]-[0060], fig. 1-7	1-7	A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 38852/1985 (Laid-open No. 157578/1986) (TOSHIBA KK) 30 September 1986 (1986-09-30), entire text, all drawings	1-8	A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 13676/1971 (Laid-open No. 10269/1972) (HITACHI LTD) 06 October 1972 (1972-10-06), entire text, all drawings	1-8	A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 047097/1974 (Laid-open No. 136161/1975) (TOKYO SHIBAURA ELECTRIC CO., LTD.) 10 November 1975 (1975-11-10), entire text, all drawings	1-8
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/018023

5	Patent document cited in search report		Publication date (day/month/year)		Patent family member(s)	Publication date (day/month/year)
	WO	2021/044662	A1	11 March 2021	(Family: none)	
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