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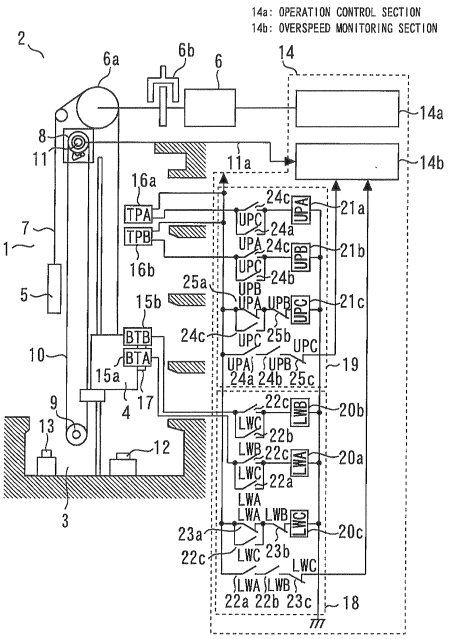
(54) TERMINATION FLOOR FORCED DECELERATION DEVICE FOR ELEVATOR

(57) There is provided a termination floor forced deceleration device of an elevator, in which the installation and adjustment can be simplified, and the time necessary for installation and adjustment can be shortened. For this purpose, in the termination floor forced deceleration device of an elevator, which has an overspeed monitoring section which outputs a braking instruction for decelerating a car in the case where the speed of the car lying at a position within a predetermined distance from the terminal of the shaft is not lower than a predetermined speed set in advance, an actuation plate provided on the car; two position detection sensors which are arranged side by side along the rising/lowering path of the car in the shaft and detect the actuation plate; and a consistency check circuit which reverses an output from itself, based on the outputs of both of the two position detection sensors, in the case where the outputs of the both are consistent with each other. Also, the overspeed monitoring section, based on the output from the consistency check circuit, recognizes whether or not the car lies at the position within the predetermined distance from the terminal of the shaft.

FIG. 1



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Description

Technical Field

[0001] The present invention relates to a termination floor forced deceleration device of an elevator.

Background Art

[0002] Generally, in an elevator, a buffer for preventing the collision of a car or a counterweight is provided in a pit in a bottom portion of a shaft. This buffer is required to have a stroke such that the car or the like is buffered sufficiently even when colliding with the buffer at full speed. This required stroke becomes longer with the increase in the rated speed of elevator. Therefore, there arises a need for increasing the depth of the pit in which the buffer is installed as the rated speed of elevator increases. However, if the rated speed is increased to some extent or more, the needed pit depth takes an unrealistic value. Accordingly, the pit depth has been decreased by making the stroke of the buffer shorter than the inherently required length, and there has often been provided a device (termination floor forced deceleration device) for decelerating the car or the like before colliding with the buffer.

[0003] Specifically, this termination floor forced deceleration device decelerates the car compulsorily when the car approaches the terminal of the shaft and the running speed of car reaches a speed at the overspeed detection level predetermined corresponding to the distance from the terminal. As the conventional termination floor forced deceleration device of elevator, there has been known a device in which a position detecting switch is provided in the car, and in the vicinities of the upper and lower terminals of the shaft, a cam engaging with the position detecting switch is provided (for example, refer to Patent Literature 1). In the conventional termination floor forced deceleration device described in Patent Literature 1, an operating point is provided on the cam, and the position detecting switch engaging with the cam is operated at this operating point, whereby it is detected that the car has reached the predetermined position from the shaft terminal. The car speed at this time is checked, and when that speed is at the overspeed detection level or higher, the car is decelerated compulsorily.

Citation List

Patent Literature

[0004] Patent Literature 1: Japanese Patent Laid-Open No. 10-324474

Summary of Invention

Technical Problem

[0005] In order to decelerate the car sufficiently at the shaft terminal, it is necessary that the car speed be checked at a farther position from the terminal as the rated speed of elevator increases. In the conventional termination floor forced deceleration device of elevator as described in Patent Literature 1, in order to detect the position of car, the operating point at which the position detecting switch is operated must be set by the cam.

[0006] Therefore, since the operating point for detecting the position of car is set at a position far from the terminal, the necessary overall length of cam is enlarged, and if the cam tilts even a little, the position of operating point is changed greatly. Therefore, the conventional termination floor forced deceleration device has a problem that the installation and adjustment of cam requires troublesome effort, and the time for installation and adjustment is lengthened.

Also, if the overall length of cam enlarges, there also arises a problem that the amount of material necessary for manufacturing the cam also increases, and the cost necessary for equipment increases.

[0007] The present invention has been made to solve the above problems, and accordingly an object thereof is to provide a termination floor forced deceleration device of an elevator, in which the installation and adjustment can be simplified, and the time necessary for installation and adjustment can be shortened.

Means for Solving the Problems

[0008] A termination floor forced deceleration device of an elevator according to the present invention, which has a car disposed elevatably in a shaft of the elevator, and an overspeed monitoring section which outputs a braking instruction for decelerating the car in the case where the speed of the car lying at a position within a predetermined distance from the terminal of the shaft is not lower than a predetermined speed set in advance, comprises: an actuation plate provided on the car; two position detection sensors which are arranged side by side along the rising/lowering path of the car in the shaft and detect the actuation plate; and a consistency check circuit which reverses an output from itself, based on the outputs of both of the two position detection sensors, in the case where the outputs of the both are consistent with each other, wherein the overspeed monitoring section, based on the output from the consistency check circuit, recognizes whether or not the car lies at the position within the predetermined distance from the terminal of the shaft.

Advantageous Effect of Invention

[0009] The termination floor forced deceleration device

of an elevator in accordance with the present invention achieves an effect that the installation and adjustment can be simplified, and the time necessary for installation and adjustment can be shortened.

Brief Description of the Drawings

[0010]

Figure 1 is a schematic general view for explaining the entire configuration of a termination floor forced deceleration device of an elevator relating to First Embodiment of the present invention.

Figure 2 is a time chart for explaining the operation states of consistency check circuits relating to First Embodiment of the present invention.

Figure 3 is a flowchart showing processing, at the time when the power source is turned on, in an operation control section relating to First Embodiment of the present invention.

Figure 4 is a time chart for explaining the operation states, at the time of sensor abnormality (ON failure), of the consistency check circuits relating to First Embodiment of the present invention.

Figure 5 is a time chart for explaining the operation states, at the time of sensor abnormality (ON failure), of the consistency check circuits relating to First Embodiment of the present invention.

Figure 6 is a time chart for explaining the operation states, at the time of sensor abnormality (OFF failure), of the consistency check circuits relating to First Embodiment of the present invention.

Figure 7 is a time chart for explaining the operation states, at the time of sensor abnormality (OFF failure), of the consistency check circuits relating to First Embodiment of the present invention.

Figure 8 is a schematic general view for explaining the entire configuration of a termination floor forced deceleration device of an elevator relating to Second Embodiment of the present invention.

Description of Embodiments

[0011] The present invention will now be described with reference to the accompanying drawings. In the drawings, the same signs are applied to the same or equivalent elements, and duplicated explanation thereof is simplified or omitted as appropriate.

First Embodiment

[0012] Figures 1 to 7 relate to a first embodiment of the present invention. Figure 1 is a schematic general view for explaining the entire configuration of a termination floor forced deceleration device of an elevator, Figure 2 is a time chart for explaining the operation states of consistency check circuits, Figure 3 is a flowchart showing processing in an operation control section at the time when the power source is turned on, Figures 4 and 5 are time charts for explaining the operation states of the consistency check circuits at the time of sensor abnormality (ON failure), and Figures 6 and 7 are time charts for explaining the operation states of the consistency check circuits at the time of sensor abnormality (OFF failure).

[0013] In Figure 1, reference sign 1 denotes a shaft of elevator. In the top portion of the shaft 1, a machine room 2 is provided. In the bottom portion of the shaft 1, a pit 3 that is dug down further from the floor surface of the bottom floor is formed. In the shaft 1, a car 4 that takes users and the like and goes up and down between a plurality of floors is disposed elevatably. Also, in the shaft 1, a counterweight 5 for making up for the load applied to the car 4 is also disposed elevatably.

[0014] In the machine room 2 in the top portion of the shaft 1, a traction machine 6 for driving the car 4 and the counterweight 5 is provided, and to the upper portion of the car 4, one end of a main rope 7 is connected. The main rope 7 extends upward vertically from the upper portion of the car 4 in the shaft 1, and the intermediate portion thereof is wound around a driving sheave 6a of the traction machine 6. The other end side of the main rope 7 extends downward vertically from the driving sheave 6a of the traction machine 6 into the shaft 1, and is connected to the upper portion of the counterweight 5. Thus, the car 4 and the counterweight 5 are hung in a well bucket form in the shaft 1 by the main rope 7.

[0015] In the machine room 2 in the top portion of the shaft 1, a governor 8 is installed. Also, in the pit 3 near the bottom portion of the shaft 1, a governor tension sheave 9 is provided rotatably. Between the governor 8 and the governor tension sheave 9, a governor rope 10 is wound in an endless form. The governor rope 10 is locked to the car 4 on one side thereof. When the car 4 goes up or down, the governor rope 10 goes around, and the sheave of the governor 8 rotates in the direction of rotation and at the rotating speed corresponding to the running speed of the car 4. The governor 8 is mounted with a speed detector 11 consisting of a rotary encoder or the like for detecting the rotating speed of the sheave of the governor 8. The rotating speed of the sheave of the governor 8 detected by the speed detector 11 is delivered as a speed detection signal 11a.

[0016] In the lowest end portion of the rising/lowering path of the car 4 in the bottom portion of the pit 3, a car buffer 12 for buffering the shock at the time of collision of the car 4 is provided. Also, in the lowest end portion of the rising/lowering path of the counterweight 5 in the bottom portion of the pit 3, a weight buffer 13 for buffering the shock at the time of collision of the counterweight 5 is provided.

[0017] The operation of equipment relating to the whole operation of elevator is controlled by various types of control units accommodated in a control panel 14. An operation control section 14a in the control panel 14 controls the operation of the elevator (the car 4) by controlling the operation of the traction machine 6 and a brake 6b.

Also, an overspeed monitoring section 14b in the control panel 14 monitors the speed of the car 4 based on the speed detection signal 11a delivered from the speed detector 11. When it is judged that the speed of the car 4 has become a predetermined overspeed detection speed or higher, the governor 8 is operated. When the governor 8 is operated, the governor rope 10 is grasped, and thereby an emergency brake, not shown, provided on the car 4 is operated to emergency stop the car 4.

[0018] At a predetermined position near the lower terminal in the shaft 1, a first lower position detection sensor (BTA) 15a and a second lower position detection sensor (BTB) 15b are provided to detect that the car 4 lies at a predetermined lower terminal position. These first lower position detection sensor (BTA) 15a and second lower position detection sensor (BTB) 15b are arranged side by side along the rising/lowering direction of the car 4 at a predetermined interval. In this configuration, the first lower position detection sensor (BTA) 15a is arranged so as to be positioned on the lower terminal side of the shaft 1 with respect to the second lower position detection sensor (BTB) 15b.

[0019] Also, at a predetermined position near the upper terminal in the shaft 1, a first upper position detection sensor (TPA) 16a and a second upper position detection sensor (TPB) 16b are provided to detect that the car 4 lies at a predetermined upper terminal position. These first upper position detection sensor (TPA) 16a and second upper position detection sensor (TPB) 16b are arranged side by side along the rising/lowering direction of the car 4 at a predetermined interval. In this configuration, the first upper position detection sensor (TPA) 16a is arranged so as to be positioned on the upper terminal side of the shaft 1 with respect to the second upper position detection sensor (TPB) 16b.

[0020] The car 4 is mounted with a shielding plate 17 facing to these position detection sensors. The configuration is made such that when the car 4 comes to the predetermined lower terminal position, the shielding plate 17 of the car 4 shields both of the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b. Also, the configuration is made such that when the car 4 comes to the predetermined upper terminal position, the shielding plate 17 of the car 4 shields both of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b.

[0021] These position detection sensors are of non-contact type. At the ordinary time, that is, at the time when the sensor part of the position detection sensor is not shielded by the shielding plate 17, the voltage (potential) is in a relatively high state. Also, the position detection sensor whose sensor part is shielded by the shielding plate 17 of the car 4 is in a state in which the voltage (potential) is relatively low. In the description below, in some cases, the state in which the voltage (potential) is relatively high is represented as a (signal) delivered state, and the state in which the voltage (potential) is relatively low is represented as a delivery shut-off state.

[0022] In the control panel 14, a lower position detection sensor consistency check circuit 18 and an upper position detection sensor consistency check circuit 19 are provided. The lower position detection sensor consistency check circuit 18 checks the coordination of the output results of the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b. The output from the lower position detection sensor consistency check circuit 18 is sent to the overspeed monitoring section 14b. Also, the upper position detection sensor consistency check circuit 19 checks the coordination of the output results of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b. The output from the upper position detection sensor consistency check circuit 19 is also sent to the overspeed monitoring section 14b.

[0023] The overspeed monitoring section 14b can recognize whether or not the car 4 lies on the lower terminal side of the predetermined lower terminal position or on the upper terminal side of the predetermined upper terminal position on the basis of the outputs of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19. If it is recognized that the car 4 lies on the terminal side of the respective terminal position, when the overspeed monitoring section 14b judges that the speed of the car 4 is a preset predetermined speed or higher on the basis of the speed detection signal 11a, the overspeed monitoring section 14b outputs a braking instruction to the operation control section 14a so that the car 4 is compulsorily stopped or decelerated. The operation control section 14a to which this braking instruction has been given controls the brake 6b to stop or decelerate the car 4.

[0024] At this time, the speed at which the car 4 is decelerated compulsorily when the car 4 lies on the lower terminal side of the lower terminal position and the speed at which the car 4 is decelerated compulsorily when the car 4 lies on the upper terminal side of the upper terminal position can be set at different and separate values.

[0025] The lower position detection sensor consistency check circuit 18 is configured by three safety relays of a first lower-side relay (LWA) 20a; a second lower-side relay (LWB) 20b; and a third lower-side relay (LWC) 20c, and a first lower-side normally opened contact 22a and a first lower-side normally closed contact 23a that are closed and opened in association with the operation of the first lower-side relay (LWA) 20a; a second lower-side normally opened contact 22b and a second lower-side normally closed contact 23b that are closed and opened in association with the operation of the second lower-side relay (LWB) 20b; and a third lower-side normally opened contact 22c and a third lower-side normally closed contact 23c that are closed and opened in association with the operation of the third lower-side relay (LWC) 20c.

[0026] The output side of the first lower position detec-

tion sensor (BTA) 15a is connected to the first lower-side relay (LWA) 20a. Between the first lower position detection sensor (BTA) 15a and the first lower-side relay (LWA) 20a, the third lower-side normally opened contact 22c is interposed in series. The second lower-side normally opened contact 22b is connected in parallel with the third lower-side normally opened contact 22c. Also, the output side of the second lower position detection sensor (BTB) 15b is connected to the second lower-side relay (LWB) 20b. Between the second lower position detection sensor (BTB) 15b and the second lower-side relay (LWB) 20b, the third lower-side normally opened contact 22c is interposed in series. The first lower-side normally opened contact 22a is connected in parallel with the third lower-side normally opened contact 22c.

[0027] To the third lower-side relay (LWC) 20c of the lower position detection sensor consistency check circuit 18, the output side of the first upper position detection sensor (TPA) 16a and the output side of the second upper position detection sensor (TPB) 16b are connected. Between the third lower-side relay (LWC) 20c and the first upper position detection sensor (TPA) 16a and between the third lower-side relay (LWC) 20c and the second upper position detection sensor (TPB) 16b, the first lower-side normally closed contact 23a and the second lower-side normally closed contact 23b are interposed in series. The third lower-side normally opened contact 22c is connected in parallel with the first lower-side normally closed contact 23a.

[0028] Also, on the output side of the first upper position detection sensor (TPA) 16a and the output side of the second upper position detection sensor (TPB) 16b, in the lower position detection sensor consistency check circuit 18, the first lower-side normally opened contact 22a, the second lower-side normally opened contact 22b, and the third lower-side normally closed contact 23c are connected in series, and also an output is delivered from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b.

[0029] The upper position detection sensor consistency check circuit 19 is configured by three safety relays of a first upper-side relay (UPA) 21a; a second upper-side relay (UPB) 21b; and a third upper-side relay (UPC) 21c, and a first upper-side normally opened contact 24a and a first upper-side normally closed contact 25a that are closed and opened in association with the operation of the first upper-side relay (UPA) 21a; a second upper-side normally opened contact 24b and a second upper-side normally closed contact 25b that are closed and opened in association with the operation of the second upper-side relay (UPB) 21b; and a third upper-side normally opened contact 24c and a third upper-side normally closed contact 25c that are closed and opened in association with the operation of the third upper-side relay (UPC) 21c.

[0030] The output side of the first upper position detection sensor (TPA) 16a is connected to the first upper-side relay (UPA) 21a. Between the first upper position detection sensor (TPA) 16a and the first upper-side relay (UPA) 21a, the third upper-side normally opened contact 24c is interposed in series. The second upper-side normally opened contact 24b is connected in parallel with the third upper-side normally opened contact 24c. Also, the output side of the second upper position detection sensor (TPB) 16b is connected to the second upper-side relay (UPB) 21b. Between the second upper position detection sensor (TPB) 16b and the second upper-side relay (UPB) 21b, the third upper-side normally opened contact 24c is interposed in series. The first upper-side normally opened contact 24a is connected in parallel with the third upper-side normally opened contact 24c.

[0031] Also, the output side of the first upper position detection sensor (TPA) 16a and the output side of the second upper position detection sensor (TPB) 16b are also connected to the third upper-side relay (UPC) 21c. Between the first upper position detection sensor (TPA) 16a and the third upper-side relay (UPC) 21c and between the second upper position detection sensor (TPB) 16b and the third upper-side relay (UPC) 21c, the first upper-side normally closed contact 25a and the second upper-side normally closed contact 25b are interposed in series. The third upper-side normally opened contact 24c is connected in parallel with the first upper-side normally closed contact 25a.

[0032] Further, on the output side of the first upper position detection sensor (TPA) 16a and the output side of the second upper position detection sensor (TPB) 16b, in the upper position detection sensor consistency check circuit 19, the first upper-side normally opened contact 24a, the second upper-side normally opened contact 24b, and the third upper-side normally closed contact 25c are connected in series, and also an output is delivered from the upper position detection sensor consistency check circuit 19 to the overspeed monitoring section 14b.

[0033] When the power source is turned on, the elevator equipped with the termination floor forced deceleration device configured as described above operates following the flow shown in Figure 7 explained later.

Figure 2 shows the operation states of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19 in the case where after the power source has been turned on in the state in which the car 4 lies on the bottom floor, the car 4 is first run to the top floor, next being run to the bottom floor, and thereafter is run again to the top floor.

[0034] First, when the car 4 lies on the bottom floor, the car 4 is located at a position lower than the predetermined lower terminal position. Therefore, all of the position detection sensors, that is, all of the first lower position detection sensor (BTA) 15a, the second lower position detection sensor (BTB) 15b, the first upper position detection sensor (TPA) 16a, and the second upper position detection sensor (TPB) 16b are not shielded by the shielding plate 17 of the car 4. Therefore, signals are

delivered from all of the position detection sensors.

[0035] In the lower position detection sensor consistency check circuit 18, in the initial state, the first lower-side relay (LWA) 20a and the second lower-side relay (LWB) 20b are in a released (not-energized) state. In this state, the first lower-side normally closed contact 23a and the second lower-side normally closed contact 23b between the first upper position detection sensor (TPA) 16a and the third lower-side relay (LWC) 20c and between the second upper position detection sensor (TPB) 16b and the third lower-side relay (LWC) 20c are closed, so that the third lower-side relay (LWC) 20c is in an energized state.

[0036] Also, in the upper position detection sensor consistency check circuit 19, in the initial state, the first upper-side relay (UPA) 21a and the second upper-side relay (UPB) 21b are in a released (not-energized) state. In this state, the first upper-side normally closed contact 25a and the second upper-side normally closed contact 25b between the first upper position detection sensor (TPA) 16a and the third upper-side relay (UPC) 21 c and between the second upper position detection sensor (TPB) 16b and the third upper-side relay (UPC) 21c are closed, so that the third upper-side relay (UPC) 21c is in an energized state.

[0037] In this state, the first lower-side normally opened contact 22a and the second lower-side normally opened contact 22b are opened, and the third lower-side normally closed contact 23c is also opened, so that the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off. Also, the first upper-side normally opened contact 24a and the second upper-side normally opened contact 24b are opened, and the third upper-side normally closed contact 25c is also opened, so that the output from the upper position detection sensor consistency check circuit 19 to the overspeed monitoring section 14b is also shut off. Therefore, since the state is such that no output is delivered from either of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19, in the overspeed monitoring section 14b, the detection of position of the car 4 is in an indefinite state.

[0038] When the car 4 goes up from the bottom floor in this state and approaches the predetermined lower terminal position, first, the shielding plate 17 of the car 4 shields the first lower position detection sensor (BTA) 15a, and the output from the first lower position detection sensor (BTA) 15a is shut off. Next, the shielding plate 17 shields the second lower position detection sensor (BTB) 15b, and both of the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b become in a state of being shielded by the shielding plate 17. In this state, the car 4 lies at the predetermined lower terminal position, and the outputs from both of the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b are shut off.

[0039] When the car 4 continues going up, first, the shielding plate 17 comes to not shield the first lower position detection sensor (BTA) 15a, and the output from the first lower position detection sensor (BTA) 15a is restarted. Since the third lower-side relay (LWC) 20c is energized, and the third lower-side normally opened contact 22c is closed, when the output from the first lower position detection sensor (BTA) 15a is restarted, the first lower-side relay (LWA) 20a is energized. When the first lower-side relay (LWA) 20a is energized, the first lower-side normally opened contact 22a in the lower position detection sensor consistency check circuit 18 is closed, and the first lower-side normally closed contact 23a therein is opened. Therefore, the first lower-side relay (LWA) 20a becomes in a self-held state.

[0040] Even if the first lower-side normally closed contact 23a is opened, since the third lower-side normally opened contact 22c is closed, the third lower-side relay (LWC) 20c is kept in an energized state. In this state, the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is still shut off. Therefore, in the overspeed monitoring section 14b, the detection of position of the car 4 is kept in an indefinite state.

[0041] When the car 4 goes up further, the shielding plate 17 comes to not shield the second lower position detection sensor (BTB) 15b as well, and the output from the second lower position detection sensor (BTB) 15b is also restarted. Since the third lower-side relay (LWC) 20c is energized, and the third lower-side normally opened contact 22c is closed, when the output from the second lower position detection sensor (BTB) 15b is restarted, the second lower-side relay (LWB) 20b is energized. When the second lower-side relay (LWB) 20b is energized, the second lower-side normally opened contact 22b in the lower position detection sensor consistency check circuit 18 is closed, and the second lower-side normally closed contact 23b therein is opened. Therefore, the second lower-side relay (LWB) 20b also becomes in a self-held state.

[0042] When the second lower-side normally closed contact 23b is opened, the third lower-side relay (LWC) 20c is released. When the third lower-side relay (LWC) 20c is released, the third lower-side normally opened contact 22c in the lower position detection sensor consistency check circuit 18 is opened, and the third lower-side normally closed contact 23c therein is closed. Therefore, the first lower-side normally opened contact 22a and the second lower-side normally opened contact 22b are closed, and the third lower-side normally closed contact 23c is also closed, so that a state is established in which a signal is delivered from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b (the voltage is high).

[0043] Thus, when the car 4 goes up from the lower terminal position, a signal comes to be delivered from the lower position detection sensor consistency check circuit 18. Therefore, based on the signal delivered from

the lower position detection sensor consistency check circuit 18, the overspeed monitoring section 14b can recognize that the car 4 has gone up and separated from the lower terminal position. A state is established in which the output from the lower position detection sensor consistency check circuit 18 is present, and on the other hand, the output from the upper position detection sensor consistency check circuit 19 is absent. Based on this state of output, the overspeed monitoring section 14b recognizes that the car 4 lies at the upper terminal position.

[0044] When the car 4 continuing going up approaches the upper terminal position, the shielding plate 17 of the car 4 first shields the second upper position detection sensor (TPB) 16b, and next shields the first upper position detection sensor (TPA) 16a, so that a state is established in which both of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b are shielded by the shielding plate 17. In this state, the car 4 lies at the predetermined upper terminal position, and the outputs from both of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b are shut off. The output from the upper position detection sensor consistency check circuit 19 to the overspeed monitoring section 14b is still in a shut-off state.

[0045] When the car 4 further continues going up, first, the shielding plate 17 comes to not shield the second upper position detection sensor (TPB) 16b, and the output from the second upper position detection sensor (TPB) 16b is restarted. Since, in this state, the third upper-side relay (UPC) 21c is energized, and the third upper-side normally opened contact 24c is closed, when the output from the second upper position detection sensor (TPB) 16b is restarted, the second upper-side relay (UPB) 21b is energized. When the second upper-side relay (UPB) 21b is energized, the second upper-side normally opened contact 24b is closed, and the second upper-side relay (UPB) 21b is self-held. Also, the second upper-side normally closed contact 25b is opened, and the third upper-side relay (UPC) 21 c is released.

[0046] When the car 4 goes up further from this state, the shielding plate 17 comes to not shield the first upper position detection sensor (TPA) 16a as well, and the output from the first upper position detection sensor (TPA) 16a is restarted. Since the third upper-side relay (UPC) 21c has already been released, even if the output from the first upper position detection sensor (TPA) 16a is restarted, the first upper-side relay (UPA) 21a is not energized and is still released. Therefore, the output from the upper position detection sensor consistency check circuit 19 to the overspeed monitoring section 14b is still shut off.

[0047] When the car 4 goes up beyond the predetermined upper terminal position as described above and arrives at the top floor, at this time, the car 4 next begins going down toward the bottom floor. When the car 4 approaches the predetermined upper terminal position, first, the shielding plate 17 of the car 4 shields the first upper position detection sensor (TPA) 16a, and the output from the first upper position detection sensor (TPA) 16a is shut off. Then, the shielding plate 17 shields the second upper position detection sensor (TPB) 16b, and both of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b become in a state of being shielded by the shielding plate 17. In this state, the car 4 lies at the predetermined upper terminal position, and the outputs from both of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b are shut off.

[0048] As the output from the second upper position detection sensor (TPB) 16b has been shut off, the second upper-side relay (UPB) 21b is released. When the second upper-side relay (UPB) 21b is released, the second upper-side normally closed contact 25b is closed, so that the third upper-side relay (UPC) 21c is energized.

[0049] When the car 4 continues going down, first, the shielding plate 17 comes to not shield the first upper position detection sensor (TPA) 16a, and the output from the first upper position detection sensor (TPA) 16a is restarted. Since the third upper-side relay (UPC) 21c is energized, and the third upper-side normally opened contact 24c is closed, when the output from the first upper position detection sensor (TPA) 16a is restarted, the first upper-side relay (UPA) 21a is energized. When first upper-side relay (UPA) 21a is energized, the first upper-side normally opened contact 24a is closed, and the first upper-side normally closed contact 25a is opened. Therefore, the first upper-side relay (UPA) 21a becomes in a self-held state.

[0050] In this state, even if the first upper-side normally closed contact 25a is opened, since the third upper-side normally opened contact 24c is closed, the third upper-side relay (UPC) 21c is kept in an energized state. In this state, the output from the upper position detection sensor consistency check circuit 19 to the overspeed monitoring section 14b is still shut off. Therefore, in the overspeed monitoring section 14b, the state in which it is recognized that the car 4 lies at the upper terminal position is maintained.

[0051] When the car 4 goes down further, the shielding plate 17 comes to not shield the second upper position detection sensor (TPB) 16b as well, and the output from the second upper position detection sensor (TPB) 16b is also restarted. Since the third upper-side relay (UPC) 21c is energized, and the third upper-side normally opened contact 24c is closed, when the output from the second upper position detection sensor (TPB) 16b is restarted, the second upper-side relay (UPB) 21b is energized. When the second upper-side relay (UPB) 21b is energized, the second upper-side normally opened contact 24b is closed, and the second upper-side normally closed contact 25b is opened. Therefore, the second upper-side relay (UPB) 21b also becomes in a self-held state.

[0052] When the second upper-side normally closed

contact 25b is opened, the third upper-side relay (UPC) 21c is released. When the third upper-side relay (UPC) 21c is released, the third upper-side normally opened contact 24c is opened, and the third upper-side normally closed contact 25c is closed. Therefore, the first upper-side normally opened contact 24a and the second upper-side normally opened contact 24b are closed, and the third upper-side normally closed contact 25c is also closed, so that a state is established in which a signal is delivered from the upper position detection sensor consistency check circuit 19 to the overspeed monitoring section 14b.

[0053] When the car 4 goes down and separates from the upper terminal position, a signal comes to be delivered from the upper position detection sensor consistency check circuit 19. Therefore, based on the signal delivered from the upper position detection sensor consistency check circuit 19, the overspeed monitoring section 14b can recognize that the car 4 has gone down and separated from the upper terminal position. A state is established in which outputs are delivered from both of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19. Based on this state of output, the overspeed monitoring section 14b recognizes that the car 4 lies at an intermediate position between the upper and lower terminal positions.

[0054] When the car 4 having run from the bottom floor to the top floor once approaches the predetermined lower terminal position again, the shielding plate 17 of the car 4 first shields the second lower position detection sensor (BTB) 15b. Thereby, the output from the second lower position detection sensor (BTB) 15b is shut off, and the second lower-side relay (LWB) 20b having been energized is released. When the second lower-side relay (LWB) 20b is released, the second lower-side normally opened contact 22b is opened, so that the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off.

[0055] When the car 4 arrives at the predetermined lower terminal position, and the first lower position detection sensor (BTA) 15a as well is shielded by the shielding plate 17, the output from the first lower position detection sensor (BTA) 15a is also shut off. Thereby, the first lower-side relay (LWA) 20a having been energized is released. When the first lower-side relay (LWA) 20a is released, the first lower-side normally closed contact 23a is closed, so that the third lower-side relay (LWC) 20c is energized.

[0056] When the car 4 goes down further, and the second lower position detection sensor (BTB) 15b comes to be not shielded by the shielding plate 17, the output from the second lower position detection sensor (BTB) 15b is restarted, and the second lower-side relay (LWB) 20b is energized. When the second lower-side relay (LWB) 20b is energized, the second lower-side normally closed contact 23b is opened, so that the third lower-side relay (LWC) 20c is released.

[0057] When the car 4 continues going down, and the first lower position detection sensor (BTA) 15a comes to be not shielded by the shielding plate 17, the output from the first lower position detection sensor (BTA) 15a is restarted. However, since the third lower-side relay (LWC) 20c is not energized at this time point, the third lower-side normally opened contact 22c is opened. Therefore, even if the output from the first lower position detection sensor (BTA) 15a is restarted, the first lower-side relay (LWA) 20a is not energized. Therefore, the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is kept in a shut-off state.

[0058] After the car 4 has passed through the lower terminal position, and has arrived at the bottom floor as described above, when the car 4 begins going up again, first, the first lower position detection sensor (BTA) 15a is shielded by the shielding plate 17. Successively, the second lower position detection sensor (BTB) 15b is also shielded by the shielding plate 17, and the outputs from both of the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b are shut off, so that the third lower-side relay (LWC) 20c is energized.

[0059] When the car 4 goes up in the state in which the third lower-side relay (LWC) 20c is energized, the first lower position detection sensor (BTA) 15a comes to be not shielded by the shielding plate 17, and the output from the first lower position detection sensor (BTA) 15a is restarted. Thereby, the first lower-side relay (LWA) 20a is energized and self-held. Also, when the car 4 goes up further, the second lower position detection sensor (BTB) 15b also comes to be not shielded by the shielding plate 17, and the output from the second lower position detection sensor (BTB) 15b is restarted. Thereby, the second lower-side relay (LWB) 20b is also energized and self-held.

[0060] At the stage at which the second lower-side relay (LWB) 20b is energized, the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b, which output has been shut off, is restarted. Thus, during the time from when the car 4 passes through the predetermined lower terminal position and arrives at the bottom floor to when the car 4 goes up and passes again through upward beyond the lower terminal position, a signal is delivered from the upper position detection sensor consistency check circuit 19 only, and no signal is delivered from the lower position detection sensor consistency check circuit 18. Based on this state of output, the overspeed monitoring section 14b recognizes that the car 4 lies at the lower terminal position.

[0061] When the car 4 moves upward beyond the lower terminal position, the output from the lower position detection sensor consistency check circuit 18 is restarted, and a state is established in which outputs are delivered from both of the lower position detection sensor consist-

ency check circuit 18 and the upper position detection sensor consistency check circuit 19. Therefore, the overspeed monitoring section 14b recognizes that the car 4 lies at an intermediate position between the upper and lower terminal positions.

[0062] Thereafter, when the car 4 goes up and arrives at the upper terminal position, the output from the upper position detection sensor consistency check circuit 19 is shut off, and a state is established in which a signal is delivered from the lower position detection sensor consistency check circuit 18 only. Therefore, the overspeed monitoring section 14b recognizes that the car 4 lies at the upper terminal position. When the car 4 goes down and comes to a position lower than the upper terminal position, the output from the upper position detection sensor consistency check circuit 19 is restarted. Therefore, the overspeed monitoring section 14b recognizes that the car 4 lies at an intermediate position between the upper and lower terminal positions.

[0063] Thus, after the power source has been turned on, the car 4 is once operated from the bottom floor to the top floor, and by the shielding plate 17, the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b, and the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b are once shielded, whereby the operation states of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19 are reset. Based on the outputs of these consistency check circuits, the overspeed monitoring section 14b recognizes the position of the car 4.

[0064] That is, in the case where an output is delivered from the lower position detection sensor consistency check circuit 18 only, and no output is delivered from the upper position detection sensor consistency check circuit 19, the overspeed monitoring section 14b recognizes that the car 4 lies at the upper terminal position. Also, inversely, in the case where an output is delivered from the upper position detection sensor consistency check circuit 19 only, and no output is delivered from the lower position detection sensor consistency check circuit 18, the overspeed monitoring section 14b recognizes that the car 4 lies at the lower terminal position. In the case where outputs are delivered from both of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19, the overspeed monitoring section 14b recognizes that the car 4 lies at an intermediate position.

[0065] Until the car 4 is operated once from the terminal floor to the opposite-side terminal floor after the power source has been turned on, and all of the position detection sensors are shielded by the shielding plate 17, it is not recognized that the car 4 lies at an intermediate position, but it is recognized that the car 4 lies at the terminal position. Therefore, until the car 4 reciprocates once between both of the terminal floors after the power source has been turned on, it is necessary for the operation control section 14a to set the highest speed of the car 4 at a speed corresponding to the buffer (hereinafter, referred to as a "buffer corresponding speed"), not at the rated speed.

[0066] Figure 3 is a flowchart showing the flow of processing in the operation control section 14a at the time when the power source of the operation control section is turned on.

When the power source is turned on, first, in Step S 1, the operation control section 14a checks whether or not the car call or the hall call has been registered. If the car call or the hall call has been registered, in Step S2, the highest speed is set at the buffer corresponding speed, and, in Step S3, the operation control section 14a runs the car 4 in response to the call having been registered.

[0067] If the car call or the hall call has not been registered in Step S1, or after the car 4 has been run in response to the call in Step S3, the process proceeds to Step S4. In Step S4, the operation control section 14a checks whether or not the car 4 stops at the bottom floor. If the car 4 stops at the bottom floor, the process proceeds to Step S5, where the operation control section 14a runs the car 4 to the top floor at the buffer corresponding speed. In the successive Step S6, the operation control section 14a checks whether or not the car call or the hall call has been registered.

[0068] If the car call or the hall call has not been registered in Step S6, in Step S7, the operation control section 14a runs the car 4 to the bottom floor at the buffer corresponding speed, and thereafter, in Step S8, the highest speed is set at the rated speed, and a series of processing is finished. On the other hand, if the car call or the hall call has been registered in Step S6, in Step S9, the operation control section 14a runs the car 4 in response to the call having been registered.

[0069] In the successive Step S10, the operation control section 14a checks whether or not the car 4 stops at the bottom floor. If the car 4 stops at the bottom floor, the process proceeds to Step S8, where the highest speed is set at the rated speed, and a series of processing is finished. On the other hand, if the car 4 does not stop at the bottom floor, the process returns to Step S6.

[0070] On the other hand, if the car 4 does not stop at the bottom floor in Step S4, the process proceeds to Step S11. In Step S 11, the operation control section 14a checks whether or not the car 4 stops at the top floor. If the car 4 does not stop at the top floor, in Step S12, the operation control section 14a checks whether or not the car 4 stops at an intermediate floor. If the car 4 stops at the top floor in Step S 11, or if the car 4 stops at an intermediate floor in Step S12, the process proceeds to Step S 13.

[0071] In Step S13, the operation control section 14a runs the car 4 to the bottom floor at the buffer corresponding speed. In the successive Step S14, the operation control section 14a checks whether or not the car call or the hall call has been registered. If the car call or the hall call has not been registered in Step S 14, in Step S 15,

the operation control section 14a runs the car 4 to the top floor at the buffer corresponding speed, and thereafter, in Step S8, the highest speed is set at the rated speed, and a series of processing is finished.

[0072] On the other hand, if the car call or the hall call has been registered in Step S14, in Step S 16, the operation control section 14a runs the car 4 in response to the call having been registered. In the successive Step S17, the operation control section 14a checks whether or not the car 4 stops at the top floor. If the car 4 stops at the top floor, the process proceeds to Step S8, where the highest speed is set at the rated speed, and a series of processing is finished. On the other hand, if the car 4 does not stop at the top floor, the process returns to Step S14.

[0073] As explained above, the termination floor forced deceleration device in accordance with this embodiment is configured so that the two position detection sensors are provided at each of the lower terminal and the upper terminal, and the outputs of these position detection sensors are delivered to the overspeed monitoring section 14b via the consistency check circuit, whereby it is recognized whether or not the car 4 lies at the predetermined terminal position. Figures 4 to 7 show the operations of the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19 in the case where an abnormality occurs in either one of the two position detection sensors provided on the same terminal side in the termination floor forced deceleration device configured as described above.

[0074] First, Figure 4 shows the case where an ON failure, that is, a failure such that a signal is delivered continuously at all times occurs in the first lower position detection sensor (BTA) 15a of the two lower position detection sensors. In this case, it is assumed that the failure occurs after the car 4 has been operated from the bottom floor to the top floor after the power source has been turned on. Therefore, the operation states of the consistency check circuits during the time until the car 4 is operated from the bottom floor to the top floor after the power source has been turned on, and thereafter the car 4 goes down from the top floor to a position just above the predetermined lower terminal position are the same as those shown in Figure 2, so that the explanation thereof is omitted.

[0075] When the car 4 approaches the predetermined lower terminal position, the shielding plate 17 of the car 4 first shields the second lower position detection sensor (BTB) 15b. Thereby, the output from the second lower position detection sensor (BTB) 15b is shut off, and the second lower-side relay (LWB) 20b having been energized is released. When the second lower-side relay (LWB) 20b is released, the second lower-side normally opened contact 22b is opened, so that the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off.

[0076] Next, the car 4 arrives at the predetermined lower terminal position, and the first lower position detection sensor (BTA) 15a is also shielded by the shielding plate 17. However, since the first lower position detection sensor (BTA) 15a ON-fails, the output from the first lower position detection sensor (BTA) 15a is continued without being shut off. Thereby, the first lower-side relay (LWA) 20a is kept in an energized state. Therefore, the first lower-side normally closed contact 23a is still open, and the third lower-side relay (LWC) 20c is not energized.

[0077] When the car 4 goes down further, and the second lower position detection sensor (BTB) 15b comes to be not shielded by the shielding plate 17, the output from the second lower position detection sensor (BTB) 15b is restarted. However, since the third lower-side relay (LWC) 20c is not energized, the third lower-side normally opened contact 22c is opened, and the second lower-side relay (LWB) 20b is not energized.

[0078] Thus, if the first lower position detection sensor (BTA) 15a ON-fails, when the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b are shielded by the shielding plate 17, the first lower-side relay (LWA) 20a is still in an energized state, and the second lower-side relay (LWB) 20b and the third lower-side relay (LWC) 20c become in a not-energized state. This situation is the same also when the car 4 goes up from the bottom floor and passes through the lower terminal position. Therefore, even when the car 4 goes up from the bottom floor and passes through the lower terminal position, no signal is delivered from the lower position detection sensor consistency check circuit 18.

[0079] That is, even if the first lower position detection sensor (BTA) 15a ON-fails, when the car 4 goes down to the predetermined lower terminal position, the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off. Therefore, the overspeed monitoring section 14b can recognize that the car 4 lies at the lower terminal position. However, even when the car 4 goes up from the bottom floor and passes through the lower terminal position, no signal is delivered from the lower position detection sensor consistency check circuit 18, so that the overspeed monitoring section 14b still recognizes that the car 4 lies at the lower terminal position.

[0080] This state means that the position of the car 4 is mistakenly recognized by the overspeed monitoring section 14b. However, this mistaken recognition is not on the danger side but on the safety side. That is, the state in which the highest speed of elevator is set at the buffer corresponding speed lower than the rated speed continues, so that the safety can be ensured.

[0081] Figure 5 shows the case where an ON failure occurs in the second lower position detection sensor (BTB) 15b of the two lower position detection sensors. In this case, as in the case shown in Figure 4, it is assumed that the failure occurs after the car 4 has been operated from the bottom floor to the top floor after the

power source has been turned on. Therefore, the operation states of the consistency check circuits during the time until the car 4 is operated from the bottom floor to the top floor after the power source has been turned on, and thereafter the car 4 goes down from the top floor to a position just above the predetermined lower terminal position are the same as those shown in Figure 2.

[0082] In this case, when the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b are shielded by the shielding plate 17, the second lower-side relay (LWB) 20b is still in an energized state, and the first lower-side relay (LWA) 20a and the third lower-side relay (LWC) 20c become in a not-energized state. Therefore, as in the above-described case where the first lower position detection sensor (BTA) 15a ON-fails, even when the car 4 goes up from the bottom floor and passes through the lower terminal position, no signal is delivered from the lower position detection sensor consistency check circuit 18.

[0083] That is, even if the second lower position detection sensor (BTB) 15b ON-fails, when the car 4 goes down to the predetermined lower terminal position, the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off. Therefore, the overspeed monitoring section 14b can recognize that the car 4 lies at the lower terminal position. Even when the car 4 goes up from the bottom floor and passes through the lower terminal position, no signal is delivered from the lower position detection sensor consistency check circuit 18, so that the overspeed monitoring section 14b still recognizes that the car 4 lies at the lower terminal position. Therefore, since the position of the car 4 is recognized on the safety side, as in the above-described case where the first lower position detection sensor (BTA) 15a ON-fails, it can be recognized, while the safety is ensured, that the car 4 has gone down to the predetermined lower terminal position.

[0084] Figure 6 shows the case where an OFF failure, that is, a failure such that no signal is delivered occurs in the first lower position detection sensor (BTA) 15a of the two lower position detection sensors. In this case, as in the above-described cases, it is assumed that the failure occurs after the car 4 has been operated from the bottom floor to the top floor after the power source has been turned on. Therefore, the operation states of the consistency check circuits during the time until the car 4 is operated from the bottom floor to the top floor after the power source has been turned on, and thereafter the car 4 goes down from the top floor to a position just above the predetermined lower terminal position are the same as those shown in Figure 2.

[0085] When the car 4 approaches the predetermined lower terminal position, the shielding plate 17 of the car 4 first shields the second lower position detection sensor (BTB) 15b. Thereby, the output from the second lower position detection sensor (BTB) 15b is shut off, and the second lower-side relay (LWB) 20b having been energized is released. When the second lower-side relay (LWB) 20b is released, the second lower-side normally opened contact 22b is opened, so that the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off.

[0086] Next, when the car 4 arrives at the predetermined lower terminal position, and the first lower position detection sensor (BTA) 15a is also shielded by the shielding plate 17, the output from the first lower position detection sensor (BTA) 15a is also shut off. Thereby, the first lower-side relay (LWA) 20a having been energized is released. When the first lower-side relay (LWA) 20a is released, the first lower-side normally closed contact 23a is closed, so that the third lower-side relay (LWC) 20c is energized.

[0087] Thereafter, when the car 4 goes down, the second lower position detection sensor (BTB) 15b and the first lower position detection sensor (BTA) 15a come to be not shielded by the shielding plate 17. At this time, the output from the second lower position detection sensor (BTB) 15b is restarted, but because the first lower position detection sensor (BTA) 15a has OFF-failed, the output from the first lower position detection sensor (BTA) 15a is not restarted thereafter.

[0088] Therefore, if the first lower position detection sensor (BTA) 15a OFF-fails, the first lower-side relay (LWA) 20a is not energized. Therefore, the first lower-side normally opened contact 22a is still opened, so that even when the car 4 goes up from the bottom floor and passes through the lower terminal position, no signal is delivered from the lower position detection sensor consistency check circuit 18.

[0089] That is, even if the first lower position detection sensor (BTA) 15a OFF-fails, when the car 4 goes down to the predetermined lower terminal position, the output from the lower position detection sensor consistency check circuit 18 to the overspeed monitoring section 14b is shut off. Therefore, the overspeed monitoring section 14b can recognize that the car 4 lies at the lower terminal position. Even when the car 4 goes up from the bottom floor and passes through the lower terminal position, no signal is delivered from the lower position detection sensor consistency check circuit 18, so that the overspeed monitoring section 14b still recognizes that the car 4 lies at the lower terminal position. Therefore, since the position of the car 4 is recognized on the safety side, as in the above-described case of ON failure, it can be recognized, while the safety is ensured, that the car 4 has gone down to the predetermined lower terminal position.

[0090] In the case where an OFF failure occurs in the second lower position detection sensor (BTB) 15b as shown in Figure 7, too, the same is true although the detailed explanation is omitted.

The above is an explanation of the case where either one of the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b fails. However, the same is true in the case where either

one of the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b fails.

[0091] In the termination floor forced deceleration device of elevator configured as described above, in the case where the car 4 lies at a position within a predetermined distance from the shaft terminal, that is, in the case where the car 4 lies on the lower terminal side of the lower terminal position or on the upper terminal side of the upper terminal position, when the speed of the car 4 is the preset predetermined speed or higher, the overspeed monitoring section 14b outputs a braking instruction for decelerating the car 4.

[0092] The two position detection sensors (the first lower position detection sensor (BTA) 15a and the second lower position detection sensor (BTB) 15b, or the first upper position detection sensor (TPA) 16a and the second upper position detection sensor (TPB) 16b) for detecting the shielding plate 17, which is an actuation plate provided on the car 4, are arranged side by side along the rising/lowering path of the car 4 in the shaft 1.

[0093] The device is provided with the consistency check circuit that reverses the output from itself based on the outputs of both of the two position detection sensors when the outputs of both of the two position detection sensors are consistent with each other, and based on the output from the consistency check circuit, the overspeed monitoring section 14b recognizes whether or not the car 4 lies at a position within the predetermined distance from the terminal of the shaft 1.

[0094] The state in which the outputs of both of the two position detection sensors are consistent with each other is a state in which, for example, as shown in Figure 2, if the output from one of the both is shut off, the output from the other is successively shut off, and if the output from one of the both is restarted, the output from the other is successively restarted. When the outputs from the both are consistent with each other as described above, the output from the consistency check circuit itself is reversed, that is, when a signal is delivered from the consistency check circuit, this output is shut off, and when the output from the consistency check circuit is shut off, the output is restarted.

[0095] Therefore, without using a cam, it can be detected that the car lies at the terminal position, so that the installation and adjustment can be simplified, and the time necessary for installation and adjustment can be shortened. Also, by using the two position detection sensors and the consistency check circuit, high reliability can be ensured without providing a failure detecting function on the position detection sensor itself. Further, since the cam is not used, the cost necessary for the manufacture and the like of equipment can be made low.

[0096] Further, the consistency check circuit delivers an output telling that the consistency check circuit has detected the actuation plate from at least one of both of the two position detection sensors, and when the outputs of both of the two position detection sensors are not consistent with each other, the output such that the overspeed monitoring section 14b recognizes that the car 4 lies at a position within the predetermined distance from the terminal of the shaft 1 is produced, that is, the output is shut off.

[0097] The state in which the outputs of both of the two position detection sensors are not consistent with each other (being inconsistent) is a state in which the output from one of the both is not shut off although the output from the other is shut off, for example, as shown in Figures 4 to 7, or a state in which inversely the output from one of the both is not restarted although the output from the other is restarted. In the case where such incoordination occurs, the output from the consistency check circuit is shut off, and the overspeed monitoring section 14b recognizes that the car 4 lies at the upper or lower terminal position.

[0098] Therefore, even if an abnormality occurs in one of the two position detection sensors, it can be recognized that the car has gone down to the terminal position while the safety is ensured by the judgment on the safety side.

Second Embodiment

[0099] Figure 8 relates to a second embodiment of the present invention, being a schematic general view for explaining the entire configuration of a termination floor forced deceleration device of an elevator.

[0100] In the first embodiment, in order to set the operation state of the position detection sensor consistency check circuit when the power source is turned on, it is necessary to operate the car once from the terminal floor to the opposite-side terminal floor and to shield all of the position detection sensors once by the shielding plate, as described above. This is the same when the power is restored after the power source has been shut off by power failure or the like. That is, if the power source is shut off by power failure or the like, the energization of all of the relays of the position detection sensor consistency check circuits is released. When the power is restored, the position of the car cannot be recognized normally unless the car is operated once from the terminal floor to the opposite-side terminal floor.

[0101] Accordingly, in the second embodiment explained below, a battery is provided to hold the operation states of relays in the position detection sensor consistency check circuits just before the power source is shut off when the power source is shut off by power failure or the like.

[0102] Specifically, as shown in Figure 8, a battery 26 is connected to the lower position detection sensor consistency check circuit 18 and the upper position detection sensor consistency check circuit 19. If the power source is shut off by power failure or the like, the power is supplied from this battery 26 to these position detection sensor consistency check circuits. By the power supplied from the battery 26, the operation (energization) of the

relays of the position detection sensor consistency check circuits is held.
Other configurations and operations are the same as those of the first embodiment, and the detailed explanation thereof is omitted.

[0103] In the termination floor forced deceleration device of elevator configured as described above, the same effect as that of the first embodiment can be achieved, and additionally, even if the power source is shut off by power failure or the like, the operation states of the relays in the position detection sensor consistency check circuits can be held. Also, the position of the car can be recognized normally without operating the car once from the terminal floor to the opposite-side terminal floor when the power is restored.

Industrial Applicability

[0104] The present invention can be utilized in the termination floor forced deceleration device of an elevator, which has an overspeed monitoring section that outputs a braking instruction for decelerating a car when the speed of the car lying at a position within a predetermined distance from the shaft terminal reaches a preset predetermined speed.

Description of Symbols

[0105]

1	shaft
2	machine room
3	pit
4	car
5	counterweight
6	traction machine
6a	driving sheave
6b	brake
7	main rope
8	governor
9	governor tension sheave
10	governor rope
11	speed detector
11a	speed detection signal
12	car buffer
13	weight buffer
14	control panel
14a	operation control section
14b	overspeed monitoring section
15a	first lower position detection sensor (BTA)
15b	second lower position detection sensor (BTB)
16a	first upper position detection sensor (TPA)
16b	second upper position detection sensor (TPB)
17	shielding plate
18	lower position detection sensor consistency check circuit
19	upper position detection sensor consistency check circuit
20a	first lower-side relay (LWA)
20b	second lower-side relay (LWB)
20c	third lower-side relay (LWC)
21 a	first upper-side relay (UPA)
21b	second upper-side relay (UPB)
21c	third upper-side relay (UPC)
22a	first lower-side normally opened contact
22b	second lower-side normally opened contact
22c	third lower-side normally opened contact
23a	first lower-side normally closed contact
23b	second lower-side normally closed contact
23c	third lower-side normally closed contact
24a	first upper-side normally opened contact
24b	second upper-side normally opened contact
24c	third upper-side normally opened contact
25a	first upper-side normally closed contact
25b	second upper-side normally closed contact
25c	third upper-side normally closed contact
26	battery

Claims

1. A termination floor forced deceleration device of an elevator, which has a car disposed elevatably in a shaft of the elevator, and an overspeed monitoring section which outputs a braking instruction for decelerating the car in the case where the speed of the car lying at a position within a predetermined distance from the terminal of the shaft is not lower than a predetermined speed set in advance, comprising:

an actuation plate provided on the car;
two position detection sensors which are arranged side by side along the rising/lowering path of the car in the shaft and detect the actuation plate; and
a consistency check circuit which reverses an output from itself, based on the outputs of both of the two position detection sensors, in the case where the outputs of the both are consistent with each other, wherein
the overspeed monitoring section, based on the output from the consistency check circuit, recognizes whether or not the car lies at the position within the predetermined distance from the terminal of the shaft.

2. The termination floor forced deceleration device of an elevator according to claim 1, wherein the consistency check circuit produces an output such that the overspeed monitoring section recognizes that the car lies at the position within the predetermined distance from the terminal of the shaft in the case where the output telling that the actuation plate has been detected is produced from at least one of the both and the outputs of the both are not consistent with each other.

3. The termination floor forced deceleration device of an elevator according to claim 1 or 2, wherein the consistency check circuit comprises a safety relay.

4. The termination floor forced deceleration device of an elevator according to any one of claims 1 to 3, wherein the consistency check circuit produces an output such that, in an initial state at the time when the power source of elevator is turned on, the overspeed monitoring section recognizes that the car lies at the position within the predetermined distance from the terminal of the shaft.

5. The termination floor forced deceleration device of an elevator according to claim 4, further comprising:

an operation control section which controls the operation of the car, wherein
the operation control section sets, when the power source of elevator is turned on, the highest speed of the car at a speed not higher than the predetermined speed.

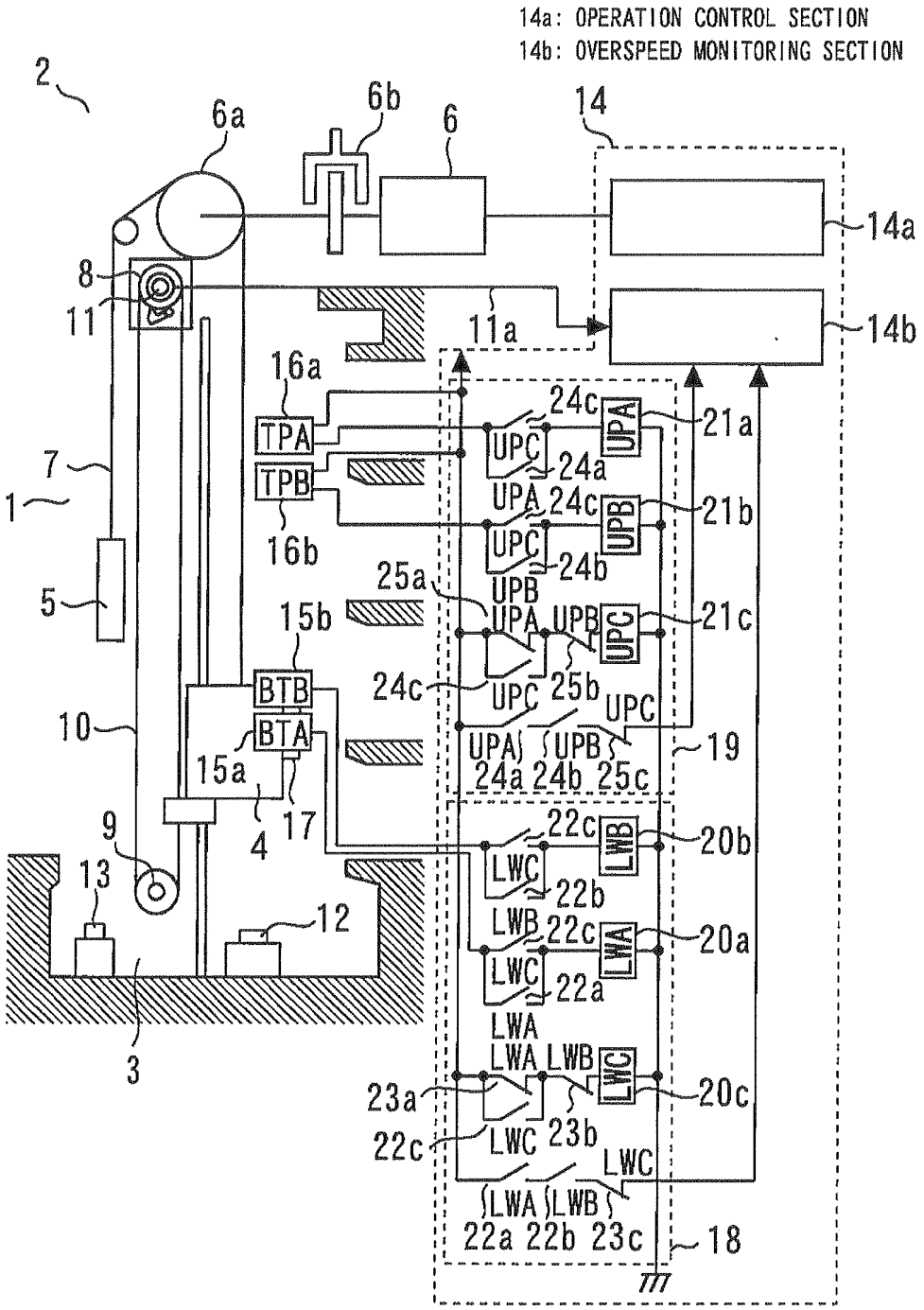
6. The termination floor forced deceleration device of an elevator according to claim 5, wherein the operation control section sets, after the car is reciprocatingly operated between the upper and lower terminal floors automatically after the power source of elevator has been turned on, the highest speed of the car at a rated speed.

7. The termination floor forced deceleration device of an elevator according to any one of claims 1 to 6, further comprising:

a battery which supplies power to the consistency check circuit when the power source of elevator is shut off.

8. The termination floor forced deceleration device of an elevator according to any one of claims 1 to 7, wherein the outputs of the two position detection sensors are in a state in which the potential is relatively high when the actuation plate is not detected, and are in a state in which the potential is relatively low when the actuation plate is detected.

FIG. 1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14b: OVERSPEED MONITORING SECTION
2
6a
6b
6
14
14a
14b
8
11
11a
16a
TPA
TPB
16b
7
1
5
15b
BTB
BTA
15a
4
17
10
9
13
12
3
24c
UPC
24a
UPA
21a
21b
24b
25a
UPB
21c
25b
19
24a 24b 25c
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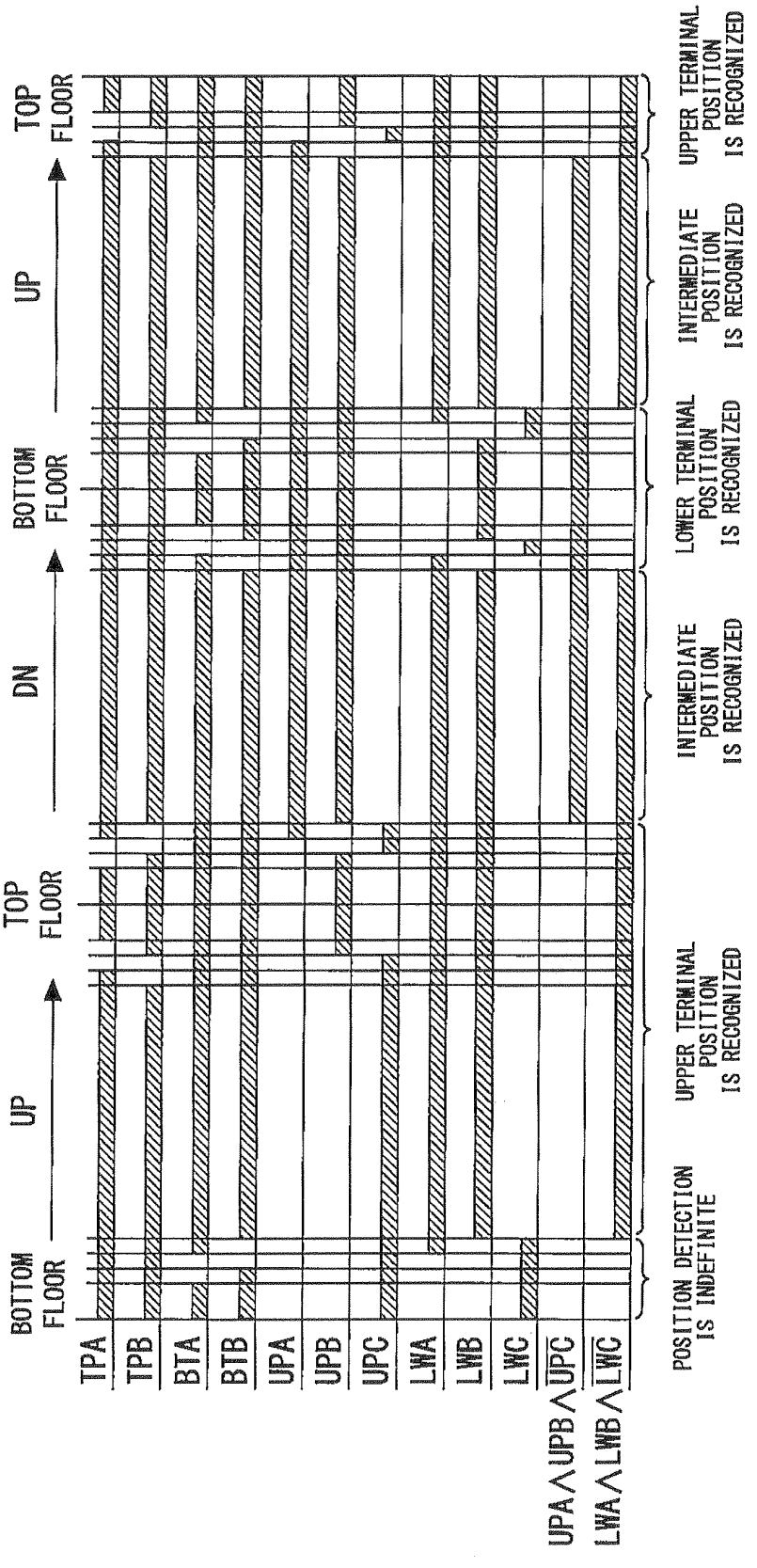
20c
23a
23b
22a 22b 23c
18

FIG. 2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UP
TOP FLOOR
DN
BOTTOM FLOOR
UP
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LWA
LWB
LWC
UPA∧UPB∧$\overline{UPC}$
LWA∧LWB∧$\overline{LWC}$
POSITION DETECTION IS INDEFINITE
UPPER TERMINAL POSITION IS RECOGNIZED
INTERMEDIATE POSITION IS RECOGNIZED
LOWER TERMINAL POSITION IS RECOGNIZED
INTERMEDIATE POSITION IS RECOGNIZED
UPPER TERMINAL POSITION IS RECOGNIZED

FIG. 3

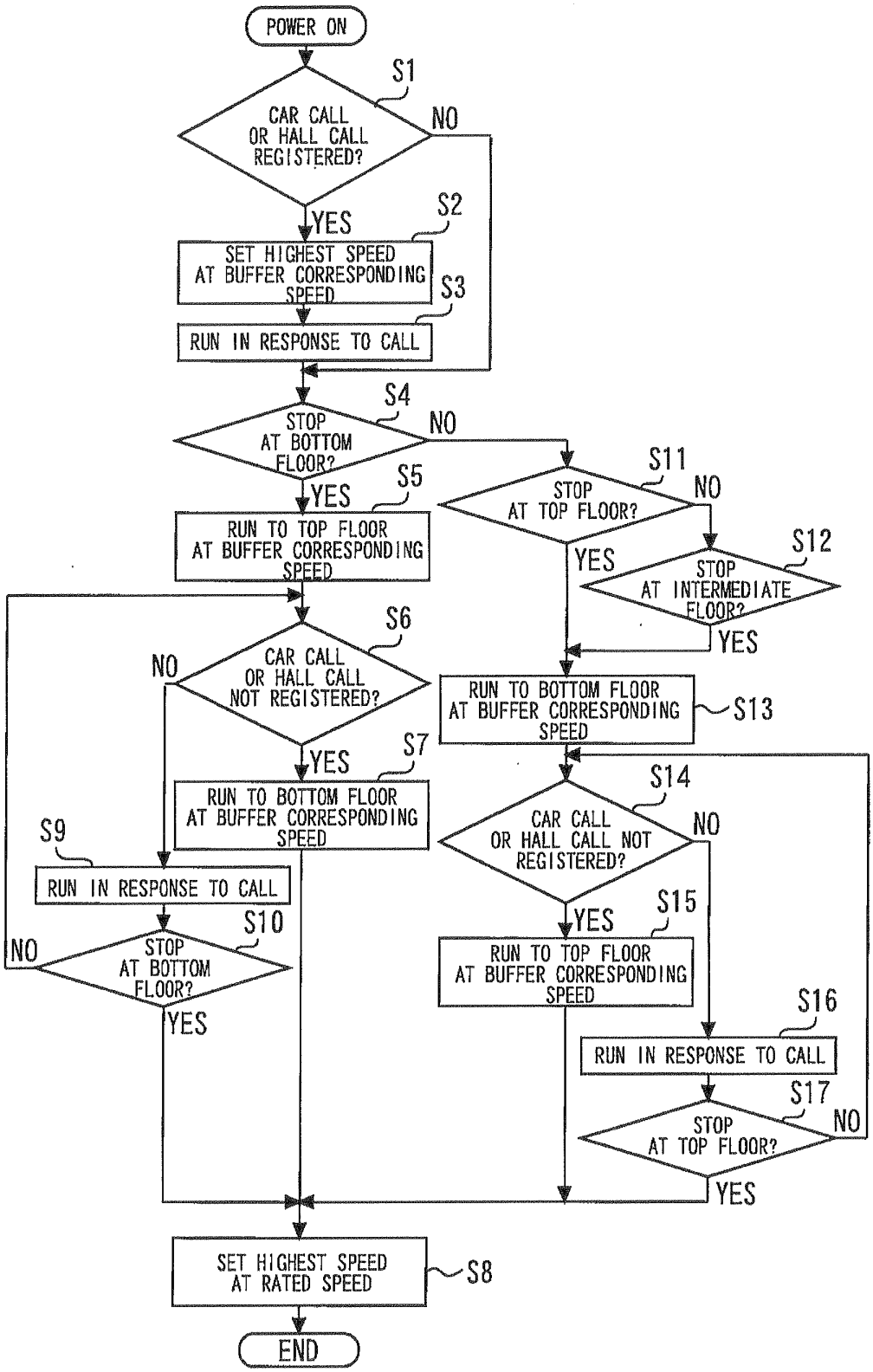
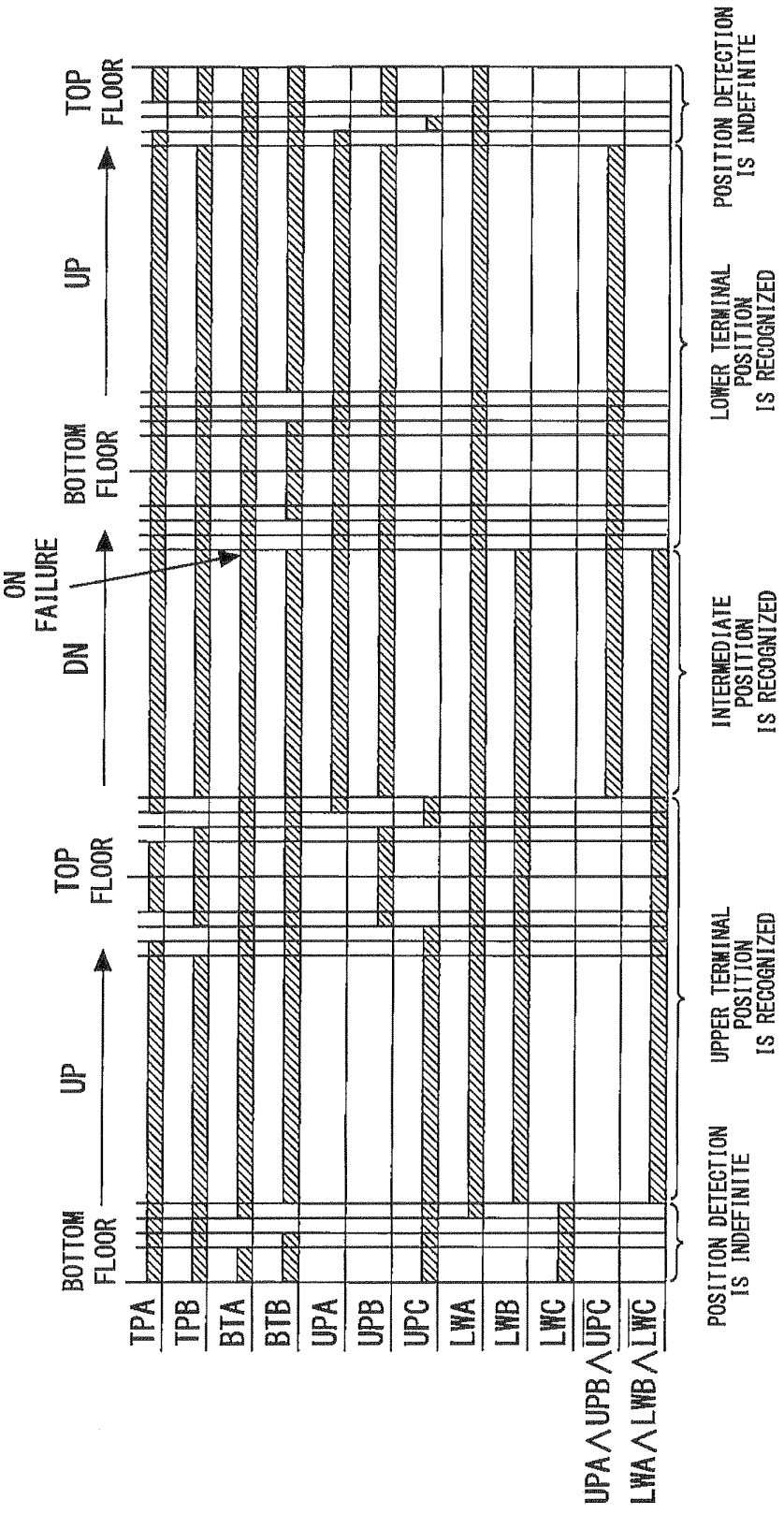

POWER ON
S1
CAR CALL OR HALL CALL REGISTERED?
NO
YES
S2
SET HIGHEST SPEED AT BUFFER CORRESPONDING SPEED
S3
RUN IN RESPONSE TO CALL
S4
STOP AT BOTTOM FLOOR?
NO
YES
S5
RUN TO TOP FLOOR AT BUFFER CORRESPONDING SPEED
S6
CAR CALL OR HALL CALL NOT REGISTERED?
NO
YES
S7
RUN TO BOTTOM FLOOR AT BUFFER CORRESPONDING SPEED
S9
RUN IN RESPONSE TO CALL
S10
STOP AT BOTTOM FLOOR?
NO
YES
S11
STOP AT TOP FLOOR?
NO
YES
S12
STOP AT INTERMEDIATE FLOOR?
YES
RUN TO BOTTOM FLOOR AT BUFFER CORRESPONDING SPEED
S13
S14
CAR CALL OR HALL CALL NOT REGISTERED?
NO
YES
S15
RUN TO TOP FLOOR AT BUFFER CORRESPONDING SPEED
S16
RUN IN RESPONSE TO CALL
S17
STOP AT TOP FLOOR?
NO
YES
SET HIGHEST SPEED AT RATED SPEED
S8
END

FIG. 4


BOTTOM FLOOR
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TOP FLOOR
DN
ON FAILURE
BOTTOM FLOOR
UP
TOP FLOOR
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BTA
BTB
UPA
UPB
UPC
LWA
LWB
LWC
UPA∧UPB∧UPC
LWA∧LWB∧LWC
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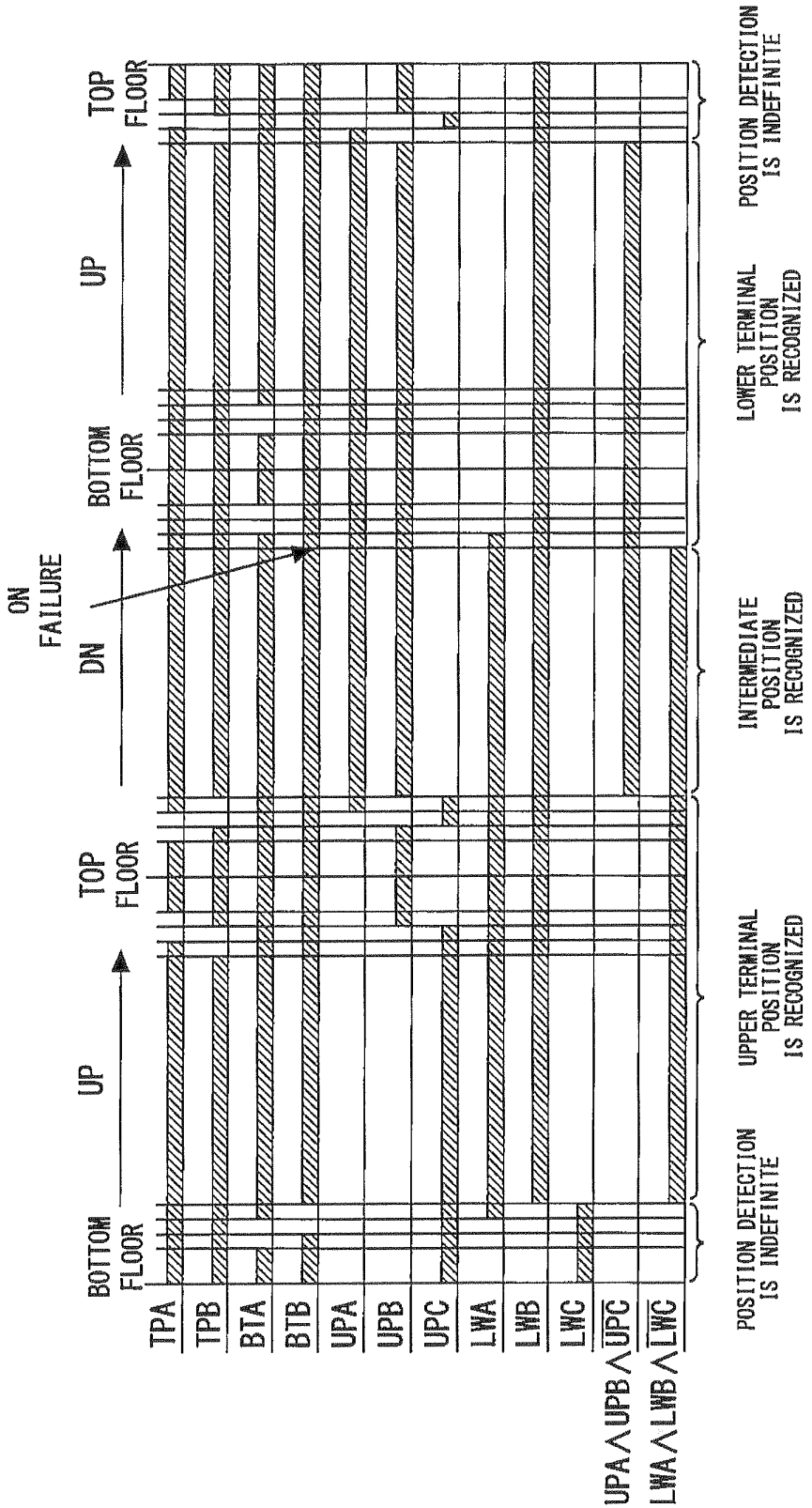
UPPER TERMINAL POSITION IS RECOGNIZED
INTERMEDIATE POSITION IS RECOGNIZED
LOWER TERMINAL POSITION IS RECOGNIZED
POSITION DETECTION IS INDEFINITE

FIG. 5


BOTTOM FLOOR
UP
TOP FLOOR
DN
ON FAILURE
BOTTOM FLOOR
UP
TOP FLOOR
TPA
TPB
BTA
BTB
UPA
UPB
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LWA
LWB
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UPA∧UPB∧UPC
LWA∧LWB∧LWC
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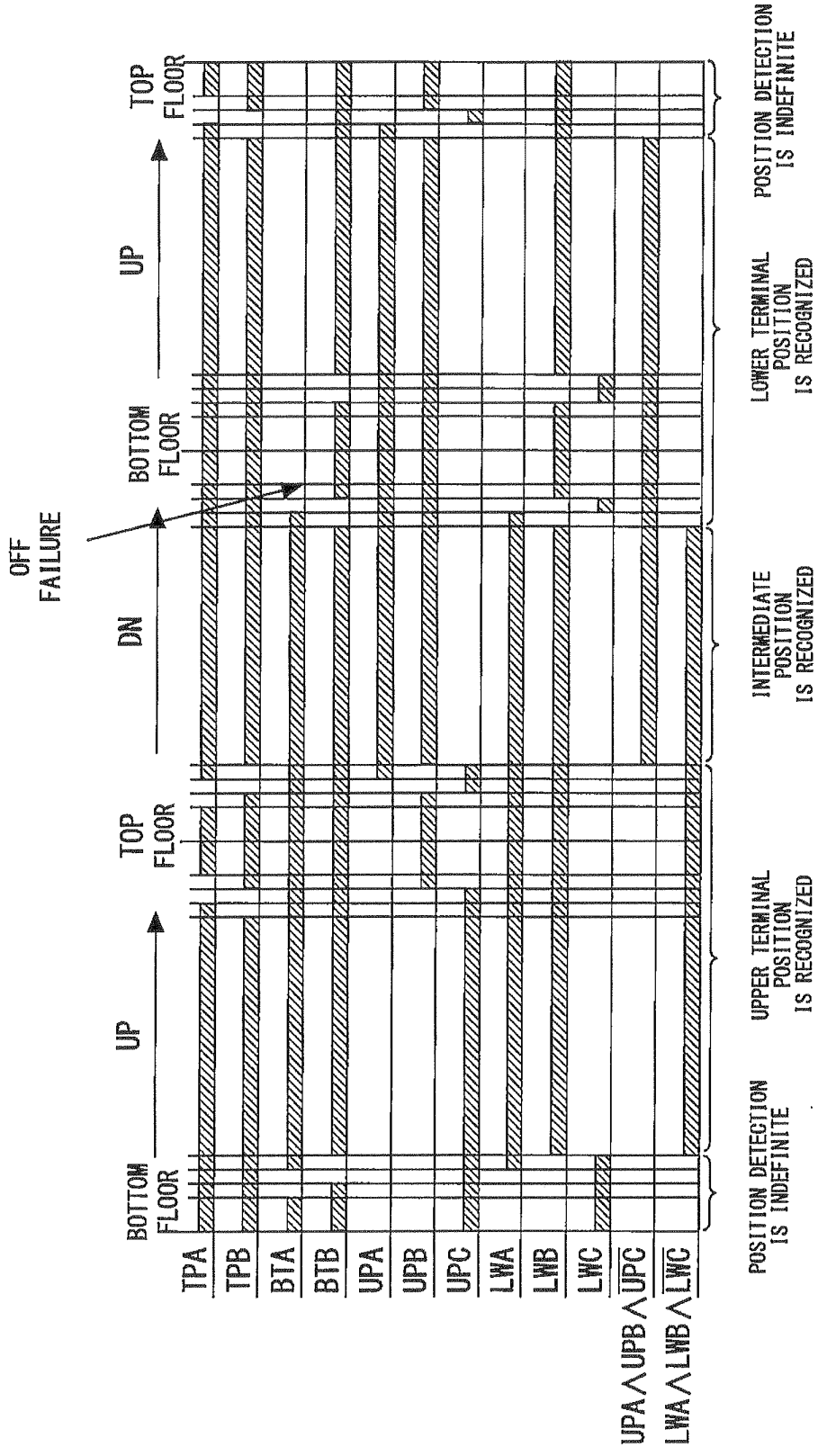
UPPER TERMINAL POSITION IS RECOGNIZED
INTERMEDIATE POSITION IS RECOGNIZED
LOWER TERMINAL POSITION IS RECOGNIZED
POSITION DETECTION IS INDEFINITE

FIG. 6


BOTTOM FLOOR
UP
TOP FLOOR
DN
BOTTOM FLOOR
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TOP FLOOR
OFF FAILURE
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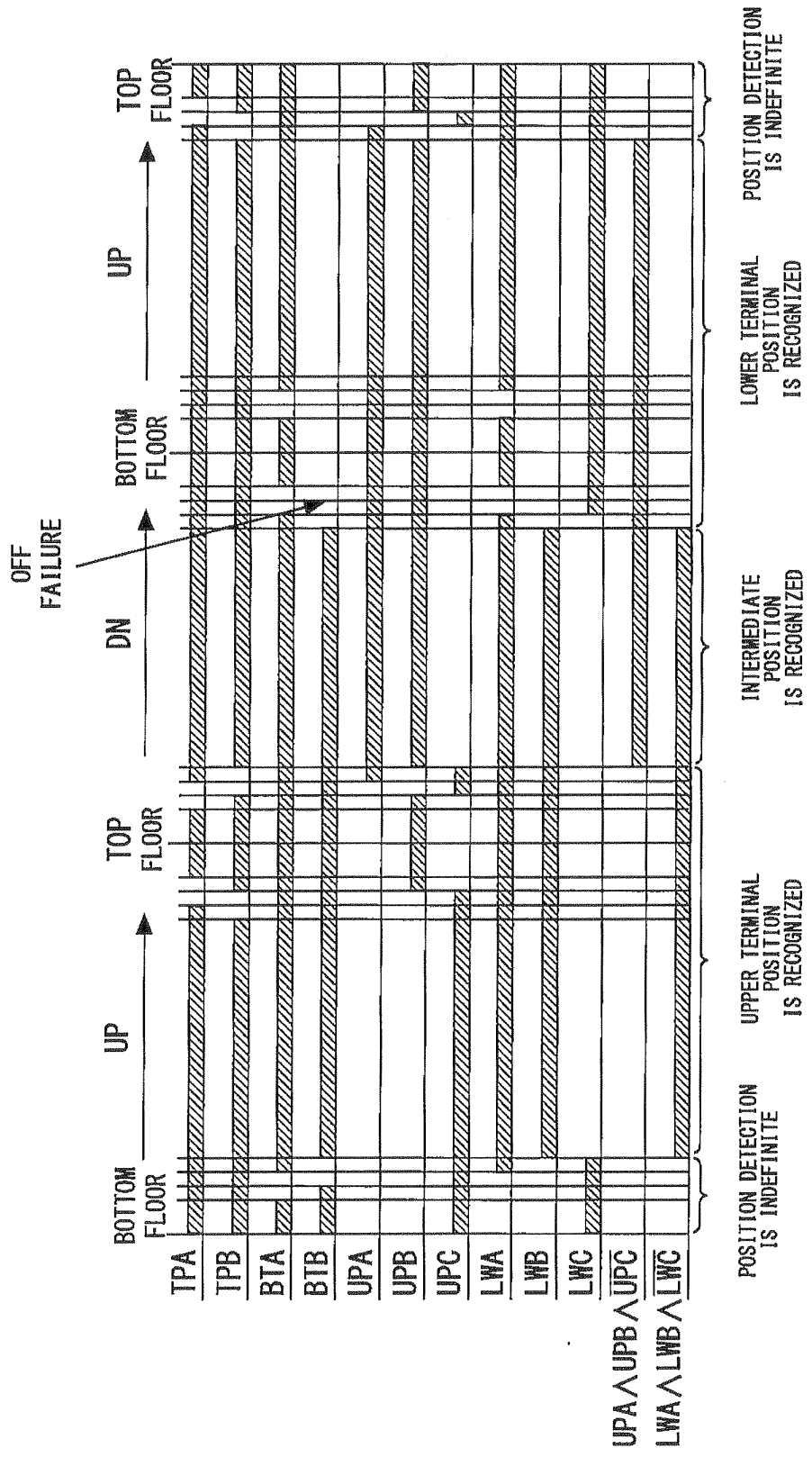
INTERMEDIATE POSITION IS RECOGNIZED
LOWER TERMINAL POSITION IS RECOGNIZED
POSITION DETECTION IS INDEFINITE

FIG. 7


BOTTOM FLOOR
UP
TOP FLOOR
DN
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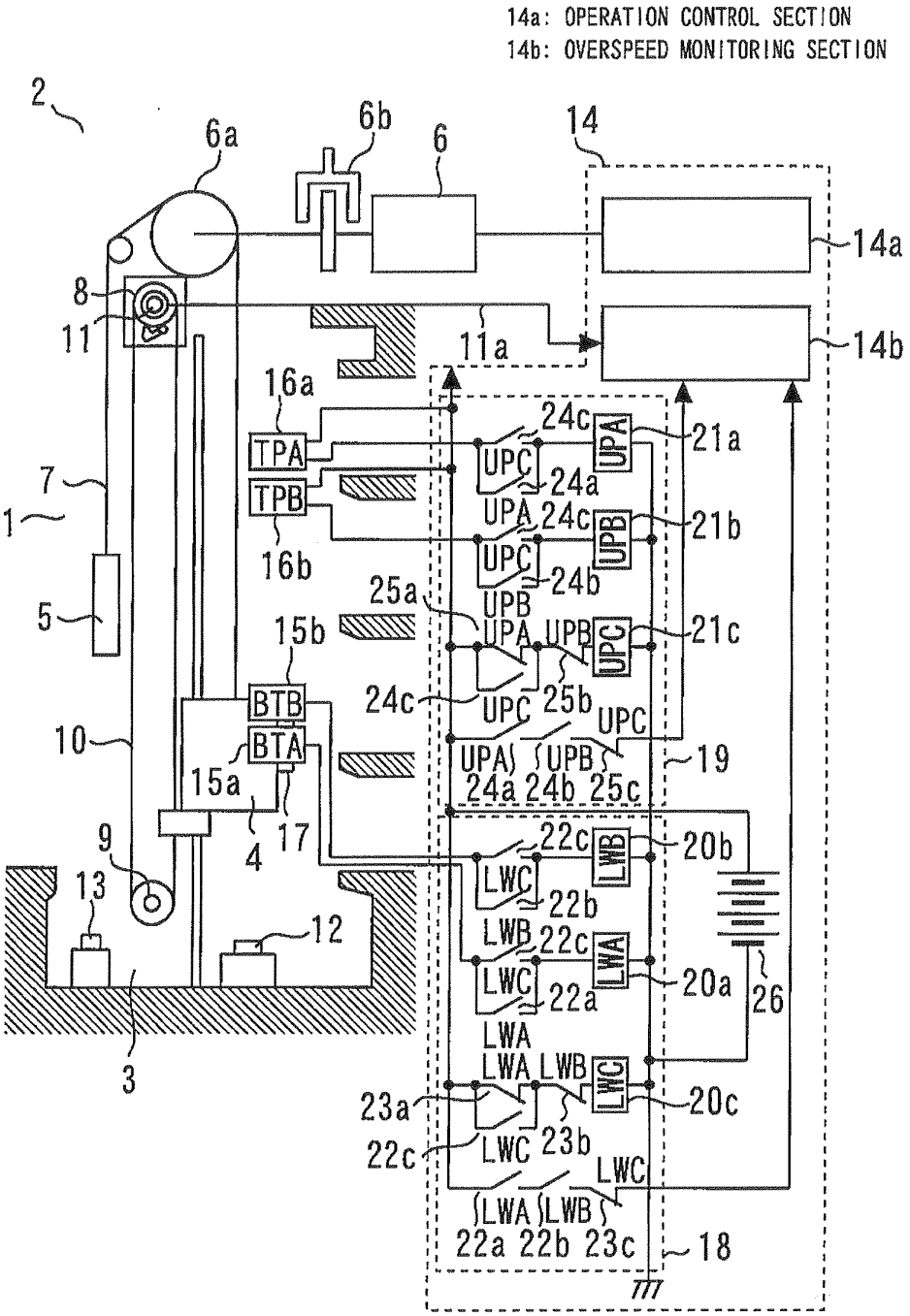
LOWER TERMINAL POSITION IS RECOGNIZED
POSITION DETECTION IS INDEFINITE

FIG. 8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14b: OVERSPEED MONITORING SECTION
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14b
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16a
TPA
TPB
16b
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BTB
BTA
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12
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25a
24c
UPC
24a
UPA
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21b
24b
UPB
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22c
LWB
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LWC
22b
LWA
22a
20a
26
23a
23b
20c
22a 22b 23c
18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/073527

A. CLASSIFICATION OF SUBJECT MATTER
B66B3/02(2006.01)i, *B66B5/06*(2006.01)i

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)
B66B3/02, B66B5/06

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	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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.
X Y A	JP 2003-95555 A (Toshiba Elevator and Building Systems Corp.), 03 April 2003 (03.04.2003), paragraphs [0010] to [0011], [0030] to [0031], [0060] (Family: none)	1,8 3,7 2,4-6
Y	JP 2009-126705 A (Mitsubishi Electric Corp.), 11 June 2009 (11.06.2009), paragraph [0025] (Family: none)	3
Y	JP 4-182287 A (Mitsubishi Electric Corp.), 29 June 1992 (29.06.1992), page 2, upper right column, line 18 to lower right column, line 10; fig. 1 (Family: none)	7

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

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Date of the actual completion of the international search	Date of mailing of the international search report
13 April, 2011 (13.04.11)	26 April, 2011 (26.04.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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Patent documents cited in the description

- JP 10324474 A **[0004]**