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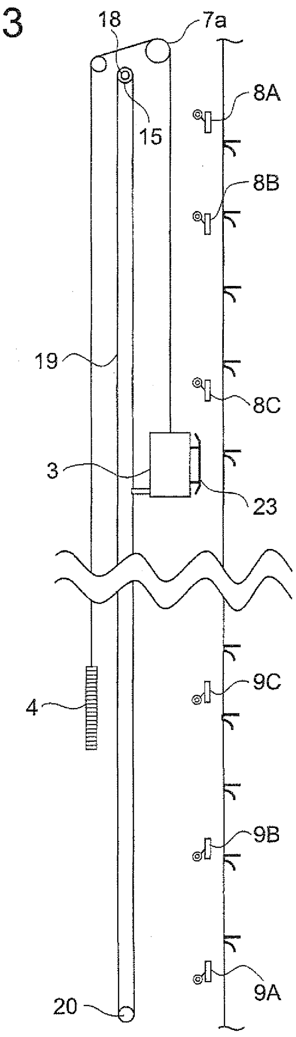
(54) **ELEVATOR DEVICE**

(57) In an elevator apparatus, a plurality of position sensors are provided vertically at intervals in a hoistway. An encoder generates a signal according to running of a car. A car position detecting device determines in which of a plurality of zones inside the hoistway, separated by the position sensors, a car is present, based on previously measured distances between the position sensors, a running distance of the car from a stop state, which is obtained based on the signal from the encoder, and a signal from the position sensors.

FIG. 3



EP 2 380 841 A1

Description

Technical Field

[0001] The present invention relates to an elevator apparatus including a car position detecting device for detecting a position of a car in a hoistway.

Background Art

[0002] In a conventional elevator apparatus, a car position is detected based on a signal from an encoder mounted to a hoisting-machine motor and a signal from a plate sensor mounted on top of a car so as to detect a plate provided in each floor (for example, see Patent Literature 1).

[0003] Patent Literature 1: JP 05-43159 A

Disclosure of the Invention

Problems to Be Solved by the Invention

[0004] With the conventional car position detecting method described above, it is necessary to provide a large number of plates in a hoistway. Thus, installation convenience is poor, and cost becomes high. Moreover, in an elevator apparatus using an electronic safety controller to perform safety monitoring, a device used for the electronic safety controller is often required to be provided independently of a device used for an operation control system for the car. In this case, the number of plates is doubled for the conventional car position detecting method, which further increases the cost.

[0005] The present invention has been made to solve the problems described above, and therefore has an object to provide an elevator apparatus capable of reducing cost of a device for detecting a car position and of saving labor in installation.

Means for Solving the Problems

[0006] An elevator apparatus according to the present invention includes: a car raised and lowered in a hoistway; an encoder for generating a signal according to running of he car; a plurality of position sensors provided vertically at intervals in the hoistway, each for detecting that the car reaches a position of each of the plurality of position sensors; and a car position detecting device for determining in which of a plurality of zones inside the hoistway the car is present, the zone being separated by the position sensors, based on previously measured distances between the position sensors, a running distance of the car from a stop state, the running distance being obtained based on a signal from the encoder, and a signal from the position sensors.

Brief Description of the Drawings

[0007]

FIG. 1 is a configuration diagram illustrating an elevator apparatus according to Embodiment 1 of the present invention.

FIG. 2 is a graph showing patterns of an overspeed level, which are set in a governor and an electronic overspeed detecting device illustrated in FIG. 1.

FIG. 3 is a configuration diagram illustrating a state in which a group of position sensors illustrated in FIG. 1 are arranged in a hoistway.

FIG. 4 is an explanatory diagram illustrating relations among a running direction and a running distance of a car illustrated in FIG. 3 from a stop state, states of the position sensors, and a car position.

Best Modes for Carrying Out the Invention

[0008] Hereinafter, preferred embodiments of the present invention are described referring to the drawings.

Embodiment I

[0009] FIG. 1 is a configuration diagram illustrating an elevator apparatus according to Embodiment 1 of the present invention. In the drawing, a pair of car guide rails 2 and a pair of counterweight guide rails (not shown) are provided in a hoistway 1. A car 3 is guided by the car guide rails 2 to be raised and lowered in the hoistway 1. A counterweight 4 is guided by the counterweight guide rails to be raised and lowered in the hoistway 1.

[0010] A safety gear 5 which is engaged with the car guide rails 2 to bring the car 3 to an emergency stop is mounted to a lower part of the car 3. The safety gear 5 includes a pair of braking pieces (wedge members) 6 which operate by a mechanical operation to be pressed against the car guide rails 2.

[0011] A driving device (hoisting machine) 7 for raising and lowering the car 3 and the counterweight 4 through an intermediation of suspension means (rope or belt) is provided in an upper part of the hoistway 1. The driving device 7 includes a driving sheave 7a, a motor portion (not shown) for rotating the driving sheave 7a, and a brake portion 7b for braking the rotation of the driving sheave 7a. A motor encoder 10 for generating a detection signal according to the rotation of the driving sheave 7a is provided to a rotary shaft of the driving device 7.

[0012] As the brake portion 7b, an electromagnetic brake device is used, for example. The electromagneticbrake device includes a brake drum coaxially connected to the driving sheave 7a, brake shoes brought into contact with and separated away from the brake drum, a brake spring for pressing the brake shoes against the brake drum to apply a braking force thereto, and an electromagnetic magnet for separating the brake shoes away from the brake drum against the brake spring to release the braking force.

[0013] Amain control section 11 is provided, for example, in a control board which is provided in a lower part of the hoistway 1. The main control section 11 includes an operation control section 12 for controlling an operation of the driving device 7 and a safety circuit section (relay circuit section) 13 for bringing the car 3 to a sudden stop when an abnormality is detected.

[0014] The detection signal from the motor encoder 10 is input to the operation control section 12. The operation control section 12 determines a position and a speed of the car 3 based on the detection signal from the motor encoder 10 and a detection signal from a plate sensor (not shown) to control the driving device 7. Moreover, the operation control section 12 includes a microcomputer. Functions of the operation control section 12 are realized by the microcomputer .

[0015] When a relay circuit of the safety circuit section 13 is brought into an open state, the motor portion of the driving device 7 is de-energized. At the same time, the electromagnetic magnet of the brake portion 7b is de-energized. As a result, the driving sheave 7a is braked.

[0016] In the vicinity of a top terminal landing in the hoistway 1, first to third upper position sensors (position detection switches) 8A to 8C are provided. In the vicinity of a bottom terminal landing in the hoistway 1, first to third lower position sensors (position detection switches) 9A to 9C are provided. The position sensors 8A to 8C and 9A to 9C are vertically provided at intervals in the hoistway 1.

[0017] In an upper part of the hoistway 1, a governor 14 is provided. The governor 14 includes a governor sheave 15, an overspeed detection switch 16, a rope catcher 17, and a governor encoder 18. A governor rope 19 is looped around the governor sheave 15. Both ends of the governor rope 19 are connected to an operating mechanism of the safety gear 5 . A lower end portion of the connected governor rope 19 is looped around a tension sheave 20 provided in a lower part of the hoistway 1.

[0018] When the car 3 is raised and lowered, the governor rope 19 is circulated to rotate the governor sheave 15 at a rotation speed according to a running speed of the car 3. The governor 14 mechanically detects that the running speed of the car 3 reaches an overspeed. As the overspeed to be detected, a first overspeed (OS speed) higher than a rated speed and a second overspeed (Trip speed) higher than the first overspeed are set.

[0019] When the running speed of the car 3 reaches the first overspeed, the overspeed detection switch 16 is operated. When the overspeed detection switch 16 is operated, the relay circuit of the safety circuit section 13 is brought into the open state. When the running speed of the car 3 reaches the second overspeed, the governor rope 19 is gripped by the rope catcher 17 to stop the circulation of the governor rope 19. When the circulation of the governor rope 19 is stopped, the safety gear 5 performs a braking operation.

[0020] The governor encoder 18 generates a detection signal according to the rotation of the governor sheave 15. As the governor encoder 18, a dual-sense type encoder for simultaneously outputting dual-system detection signals, specifically, the first detection signal and the second detection signal, is used.

[0021] The detection signals from the governor encoder 18, the upper position sensors 8A to 8C, and the lower position sensors 9A to 9C are input to an electronic safety controller 21. The electronic safety controller 21 includes an electronic overspeed detecting device (ETS device) 22 corresponding to a car position detecting device.

[0022] The electronic overspeed detecting device 22 determines the running speed and the position of the car 3 based on the input detection signals independently of the operation control section 12 so as to monitor whether the car speed reaches a predetermined overspeed level. The overspeed level is set as an overspeed monitoring pattern which changes according to the position of the car 3. Moreover, when it is determined that the running speed of the car 3 has reached the overspeed level, the electronic overspeed detecting device 22 bring the relay circuit of the safety circuit section 13 into the open state.

[0023] Moreover, the electronic overspeed detecting device 22 can detect an abnormality of the electronic overspeed detecting device 22 itself and an abnormality of the governor encoder 18. When the abnormality of the electronic overspeed detecting device 22 itself or the governor encoder 18 is detected, a nearest-floor stop command signal corresponding to a command signal for placing the elevator into a safe state is output from the electronic overspeed detecting device 22 to the operation control section 12.

[0024] The electronic overspeed detecting device 22 and the operation control section 12 are bidirectionally communicable with each other. Functions of the electronic overspeed detecting device 22 are realized by a microcomputer different from the microcomputer included in the operation control section 12.

[0025] On a bottom of the hoistway 1, a car buffer 27 and a counterweight buffer 28 are provided. As each of the buffers 27 and28, for example, an oil-filled or spring buffer is used.

[0026] FIG. 2 is a graph showing patterns of the overspeed level, which are respectively set in the governor 14 and the electronic overspeed detecting device 22 illustrated in FIG. 1. In the drawing, when the car 3 runs from the bottom terminal landing to the top terminal landing at a normal speed (rated speed), the speed pattern of the car 3 is a normal speed pattern V_0. A first overspeed pattern V_1 and a second overspeed pattern V_2 are set by mechanical positional adjustment in the governor 14. An ETS overspeed monitoring pattern V_E is set in the electronic overspeed detecting device 22.

[0027] The ETS overspeed monitoring pattern V_E is set higher than the normal speed pattern V_0. Moreover, the ETS overspeed monitoring pattern V_E is set so as to have an approximately equal difference from the normal speed pattern V_0 over an overall travel. Specifically, the

ETS overspeed monitoring pattern V_E changes according to the car position. More specifically, the ETS overspeed monitoring pattern V_E i s set so as to be constant in the vicinity of an intermediate pattern V_E is set so as to be constant in the vicinity of an intermediate floor(s) and to continuously and smoothly decline in the vicinity of the terminal landings as coming closer to the terminal (top or bottom) of the hoistway 1.

[0028] As described above, the electronic overspeed detecting device 22 monitors the running speed of the car 3 not only in the vicinity of the terminal landings but also in the vicinity of the intermediate floor (s) (in a constant-speed running zone of the normal speed pattern V_0). However, the running speed is not necessarily required to be monitored in the vicinity of the intermediate floor(s).

[0029] The first overspeed pattern V_1, is set higher than the ETS overspeed monitoring pattern V_E. The second overspeed pattern V_2 is set still higher than the first overspeed pattern V_1. The first overspeed pattern V_1 and the second overspeed pattern V_2 are constant at every height in the hoistway 1.

[0030] FIG. 3 is a configuration diagram illustrating a state in which a group of the position sensors illustrated in FIG. 1 are arranged in the hoistway 1. A distance L8AB between the first upper position sensor 8A and the second upper position sensor 8B is smaller than a distance L8BC between the second upper position sensor EB and the third upper position sensor 8C (L.8AB<L8BC). A distance L9AB between the first lower position sensor 9A and the second lower position sensor 9B is smaller than a distance L9BC between the second lower position sensor 9B and the third lower position sensor 9C (L9AB<L9BC) .

[0031] A cam 23 for operating the position sensors 8A to 8C and 9A to 9C is provided to the car 3. Each of the position sensors 8A to 8C and 9A to 9C is turned ON/OFF by the cam 23 for each passage of the car 3, and a signal thereof is transmitted to the electronic overspeed detecting device 22.

[0032] Next, a method of detecting the car position with the electronic overspeed detecting device 22 is described. The electronic overspeed detecting device 22 determines in which of five zones inside the hoistway the car 3 is present, the zones being separated by the position sensors 8A to 8C and 9A to 9C, based on states of the position sensors 8A to 8C and 9A to 9C of a discrete system, which are arranged in the hoistway 1 only in the vicinity of the terminal landings, and a running distance of the car 3 from a stop state. Moreover, the electronic overspeed detecting device 22 uses a pulse signal from the governor encoder 18 as continuous position information. Therefore, the car position in each of the zones can be determined based on the signal from the governor encoder 18.

[0033] As a preparation for the detection of the car position as described above, a learning operation of the car 3 is performed after the installation of the elevator apparatus. As the learning operation, the car 3 is reciprocated once at a low speed between the lowermost floor and the uppermost floor. In this learning operation, the electronic overspeed detecting device 22 sets an encoder count value in a state in which the car 3 is present at the lowermost floor to 0 and calculates a distance of each of the position sensors 8A to 8C and 9A to 9C from the lowermost floor based on the encoder count value using the signal generated when the car passes over the position of the corresponding one of the position sensors 8A to 8C and 9A to 9C as a trigger signal so as to store the calculated distance in a memory included therein. Then, the distances (intervals) L8AB, L8BC, L9AB, and L9BC are determined and stored in the memory.

[0034] As the trigger signal, the signal generated when the car passes over the position of each of the position sensors 8A to 8C and 9A to 9C as the car runs from an intermediate zone toward any one of the terminal landings. Therefore, for the upper position sensors 8A to 8C, the passage of the car 3 over a corresponding one of the upper position sensors while the car is ascending becomes effective. For the lower position sensors 9A to 9C, the passage of the car 3 over a corresponding one of the lower position sensors while the car is descending becomes effective.

[0035] When the car 3 starts running from a stop state, the electronic overspeed detecting device 22 detects the running direction of the car 3 based on the wave pulse from the governor encoder 18 and constantly computes the running distance based on the count value so as to determine in which of the zones inside the hoistway 1 the car 3 is present.

[0036] For example, if the trigger signal is input from the third upper position sensor 8C from the start of the upward movement of the car 3 until a travel distance becomes equal to L8AB, it is determined that the car 3 is present in the zone between the position sensors 8C and 9C just before the start of the movement and then enters the zone between the position sensors 8B and 8C.

[0037] Moreover, if the trigger signal is not input from the start of upward movement until the car 3 finishes running a distance equal to L8AB and the trigger signal is then input while the car 3 is running a distance equal to L8BC, it is determined that the car 3 moves from the zone between the position sensors 8C and 9C into the zone between the position sensors 8B and 8C.

[0038] If the trigger signal is not input even after the car runs a distance equal to L8BC, it can be determined that the current position of the car 3 is in the zone between the position sensors 8C and 9C.

[0039] FIG. 4 is an explanatory diagram illustrating the relations among the running direction and the running distance of the car 3 illustrated in FIG. 3 from the stop state, the states of the position sensors 8A to 8C and 9A to 9C, and the car position.

[0040] As described above, the electronic overspeed detecting device 22 determines in which of the zones inside the hoistway 1 the car 3 is present, based on the running direction and the running distance of the car 3 from the stop state, and the operation signal from any of the position sensors 8A to 8C and 9A to 9C of the discrete system, so as to set the overspeed level according to the zone in which the car is present. As a result, even when the car 3 runs at the overspeed due to runaway, the car 3 can be safe and quickly stopped.

[0041] Moreover, it is not necessary to provide a large number of plates for continuously detecting absolute positions of the car 3 in the hoistway 1 independently of plates for the operation control section 12. Therefore, the cost of the device for detecting the car position can be reduced, while labor in installation can be saved.

[0042] Further, a position detecting device for the operation control section 12 and the position detecting device for the electronic safety controller 21 can be both provided in the hoistway 1 at low cost to improve installation convenience. Thus, it is effective even in view of the independence of the electronic safety controller 21 from the operation control section 12.

Embodiment 2

[0043] Next, a car position detecting method for the elevator apparatus, according to Embodiment 2 of the present invention is described. The configuration of the elevator apparatus is the same as that of Embodiment 1.

[0044] The elevator apparatus for a long travel distance often repeats a reciprocating operation in an intermediate zone except for the terminal landings (reciprocating operation in the zone between the position sensors 8C and 9C). During the repeated reciprocating operation in the intermediate zone as described above, a cumulative error due to a shift of the governor rope 19 from the governor sheave 15 is generated. The encoder count value at the first passage over any one of the position sensors 8C and 9C after the reciprocating operation in the intermediate zone sometimes significantly deviates from the encoder counter value stored in the learning operation.

[0045] If it is determined that the significant deviation of the encoder count value as described above is due to an abnormality in detection of the car position and the operation of the elevator apparatus is interrupted, service for users is degraded.

[0046] On the other hand, in Embodiment 2, when the car 3 passes over any one of the position sensors 8C and 9C during a normal operation after the same learning operation as that of Embodiment 1 is performed, the encoder count value is forcibly replaced by an initial learning value. Specifically, when the car 3 is detected by any one of the position sensors 8C and 9C, the electronic overspeed detecting device 22 uses the car position information obtained from a corresponding one of the position sensors 8C and 9C in preference to the car position information obtained from the governor encoder 18.

[0047] As a result, even if the cumulative error is generated as the result of the reciprocation of the car 3 in the intermediate zone during the normal operation, the cumulative error is cancelled when the car 3 passes over any one of the position sensors 8C and 8C for next time. As a result, service degradation due to erroneous detection of the abnormality can be prevented.

[0048] The deviation occurring in the terminal landing zones is negligibly small as compared with that generated due to the reciprocation in the intermediate zone because of a short distance, and therefore does not generally become a problem. However, for example, it is also conceivable that the large shift of the governor rope 19 from the governor sheave 15 is generated due to adhesion of oil to the governor sheave 15 or the governor rope 19, or a reduction in tension of the governor rope 19.

[0049] Therefore, in order to detect the above-mentioned abnormality, the distance from any one of the position sensors 8C and 9C to a corresponding one of the position sensors 8B and 9B, which is close thereto, is measured during the normal operation based on the signal from the governor encoder 18. Then, whether or not a difference between the measurement value and the previously stored value is within a tolerance is determined by the electronic overspeed detecting device 22. In this case, if the measured value is not within the tolerance, it is determined that the abnormality has occurred to perform processing of stopping the car 3 at the nearest floor or the like and interrupting the operation of the elevator apparatus.

[0050] According to the car position detecting method as described above, the service degradation due to the cumulative error can be prevented, and in addition, the abnormality in the detection of the car position can be detected. As a result, reliability can be improved.

Embodiment 3

[0051] Next, a car position detecting method for the elevator apparatus, according to Embodiment 3 of the present invention, is described. The configuration of the elevator apparatus is the same as that of Embodiment 1. The car position detecting method during the normal operation is the same as that of Embodiment 1 or 2.

[0052] In Embodiment 3, after recovery from a power failure, the operation control section 12 controls the car 3 to run, at a low speed, a distance equal to the distance L8AB between the first upper position sensor 8A and the second upper position sensor 8B or the distance L9AB between the first lower position sensor 9A and the second lower position sensor 9B. In this case, the electronic overspeed detecting device 22 detects input of the signal from any one of the positions 8A to 8C and 9A to 9C so as to determine in which of the zones the car 3 is present and sets the overspeed level according to the zone in which the car is present. Thereafter, the operation control section 12 increases the speed to move the car 3 to the nearest floor.

[0053] In the conventional elevator apparatuses, a control device cannot recognize a precise car position immediately after recovery from the power failure. Therefore, the car is often moved at the low speed to the nearest floor. Moreover, there is a method of storing a backup of car position data in a non-volatile memory or the like. However, if the car position shifts during the power failure, a deviation occurs between the backup of the car position data and an actual car position. As a result, the precise car position cannot be recognized.

[0054] On the other hand, in the elevator apparatus according to Embodiment 3, even for the first running immediately after the recovery from the power failure, the car is controlled to run a small distance at the low speed and is then immediately switched to run at a high speed so as to be able to arrive at the nearest floor. Specifically, as described in Embodiment 1, for example, when the car 3 is controlled to run upward a distance equal to L9AB, and in addition, the upper position sensors 8A and 8C do not operate, it is determined that the car 3 is present in the zone between the position sensors 8C and 9C or the zone between the position sensors 8B and 8C. When the upper position sensor 8B operates, it is determined that the car moves from the zone between the position sensors 8B and 8C into the zone between the position sensors 8A and 8B. When the upper position sensors 8A to 8C do not operate even after the car 3 is controlled to run upward the distance equal to L8AB and then an additional distance equal to L8BC, the presence of the car 3 in the zone between the position sensors 8C and 9C can be recognized.

[0055] Therefore, in a high-speed elevator for a long travel distance, and an observation elevator and a shuttle elevator which have a long distance between floors, running service time to the nearest floor after the recovery from the power failure can be reduced. As a result, a sense of insecurity and a stress of a passenger(s) can be decreased.

[0056] In the above-mentioned examples, the car position detecting device of the present invention is used for the electronic overspeed detecting device 22. However, the car position detecting device can be used for other safety devices and controllers. Moreover, the electronic overspeed detecting device 22 may monitor whether or not the car speed reaches the second overspeed. If the car speed has reached the second overspeed, a command signal for operating the safety gear 5 may be output.

Further, in the above-mentioned examples, the switches mechanically operated by the cam 23 are used as the position sensors. However, the position sensors are not limited thereto. For example, the position sensors may be, for example, proximity sensors and optical sensors or the like.

Further, in the above-mentioned examples, the three position sensors 8A to 8C are provided in the vicinity of the top terminal landing, whereas the three position sensors 9A to 9C are provided in the vicinity of the bottom terminal landing. However, the number of position sensors is not limited thereto.

Further, the governor encoder 18 is used as an encoder in the above-mentioned examples. However, a hoisting-machine encoder or an encoder provided to the other sheaves may be used as long as the encoder generates the signal according to running of the car 3.

Claims

1. An elevator apparatus, comprising:

   a car raised and lowered in a hoistway;
   an encoder for generating a signal according to running of the car;
   a plurality of position sensors provided vertically at intervals in the hoistway, each for detecting that the car reaches a position of each of the plurality of position sensors; and
   a car position detecting device for determining in which of a plurality of zones inside the hoistway the car is present, the zone being separated by the position sensors, based on previously measured distances between the position sensors, a running distance of the car from a stop state, the running distance being determined based on a signal from the encoder, and a signal from the position sensors.

2. An elevator apparatus according to claim 1, wherein the car position detecting device is an electronic overspeed detecting device for monitoring whether a speed of the car reaches a predetermined overspeed level, and
   the overspeed level is set in the electronic overspeed detecting device as an overspeed monitoring pattern changing according to a position of the car.

3. An elevator apparatus according to claim 2, wherein the position sensors comprise a plurality of upper position sensors provided in the hoistway in the vicinity of a top terminal landing and a plurality of lower position sensors provided in the hoistway in the vicinity of a bottom terminal landing.

4. An elevator apparatus according to claim 1, wherein, when the car is detected by any one of the position sensors, the car position detecting device uses car position information obtained from the one of the position sensors in preference to car position information obtained from the encoder.

5. An elevator apparatus according to claim 4, wherein the car position detecting device measures a distance between any one of the position sensors to a corresponding one of the position sensors close thereto based on the signal from the encoder so as to determine whether a difference between a measurement value and the previously measured dis-

tance between the position sensors is within a tolerance.

6. An elevator apparatus according to claim 3, wherein the car position detecting device determines in which of the zones the car is present while the car is running at a low speed after recovery from a power failure and sets an overspeed level according to the zone in which the car is present.

FIG. 1

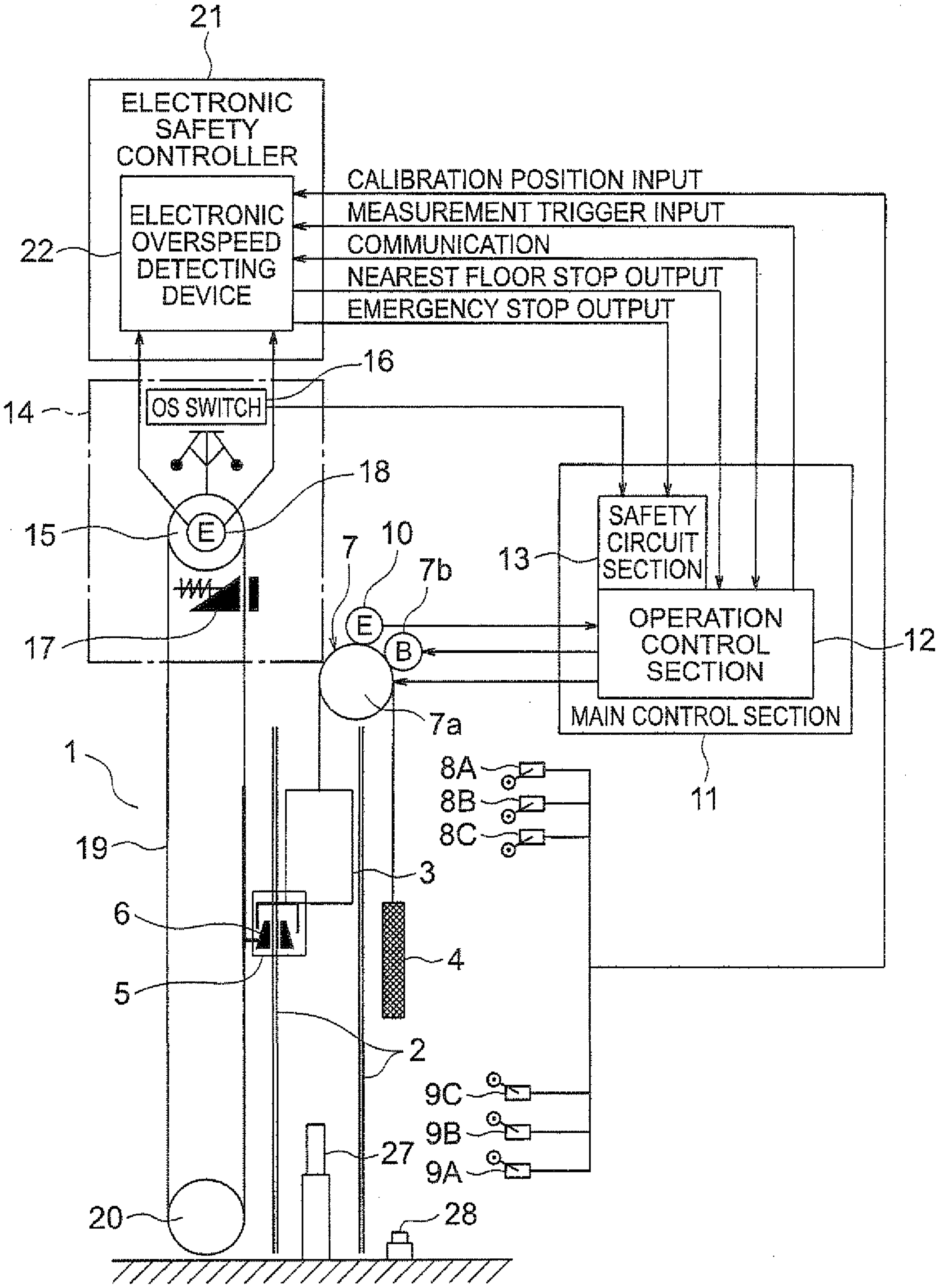
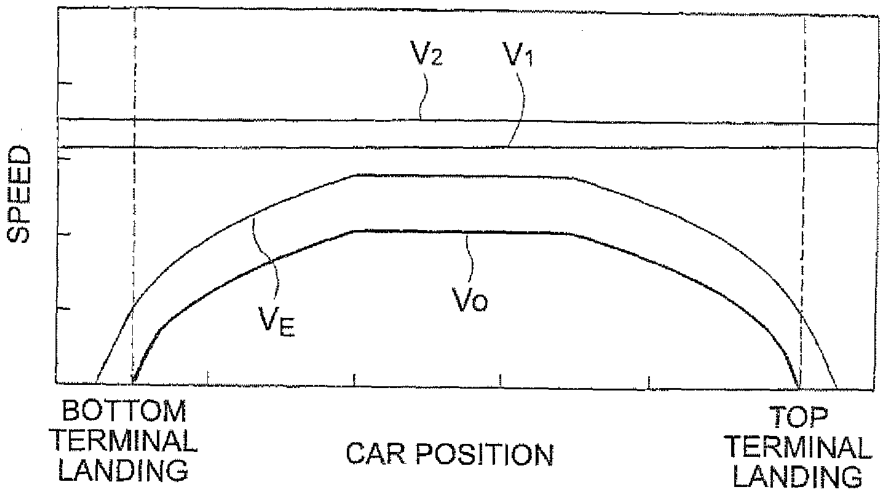

21
ELECTRONIC SAFETY CONTROLLER
ELECTRONIC OVERSPEED DETECTING DEVICE
22
CALIBRATION POSITION INPUT
MEASUREMENT TRIGGER INPUT
COMMUNICATION
NEAREST FLOOR STOP OUTPUT
EMERGENCY STOP OUTPUT
16
14
OS SWITCH
18
15
E
SAFETY CIRCUIT SECTION
13
10
7
7b
E
B
OPERATION CONTROL SECTION
12
17
7a
MAIN CONTROL SECTION
11
1
8A
8B
8C
19
3
6
4
5
2
9C
9B
9A
27
20
28

FIG. 2



V2
V1
SPEED
VE
VO
BOTTOM TERMINAL LANDING
CAR POSITION
TOP TERMINAL LANDING

FIG. 3

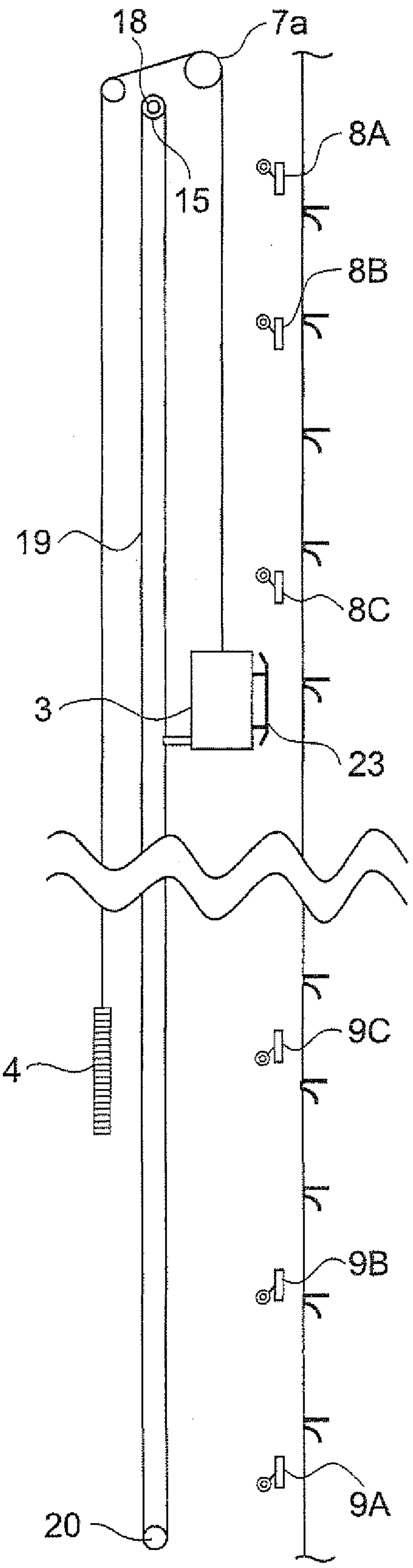


FIG. 4

RUNNING DIRECTION	RUNNING DISTANCE : X	STATES OF POSITION SENSORS						PREVIOUS CAR POSITION	CURRENT CAR POSITION
		8A	8B	8C	9A	9B	9C		
UPWARD	0<X≦L8AB	ON	–	–	–	–	–	BTWN 8A–8B	UPPERMOST FLOOR
		–	ON	–	–	–	–	BTWN 8B–8C	BTWN 8A–8B
		–	–	ON	–	–	–	BTWN 8C–9C	BTWN 8B–8C
		–	–	–	–	–	–	BTWN 8C–9C or BTWN 8B–8C	BTWN 8C–9C or BTWN 8B–8C
	L8AB<X≦L8BC	–	ON	–	–	–	–	BTWN 8B–8C	BTWN 8A–8B
		–	–	ON	–	–	–	BTWN 8C–9C	BTWN 8B–8C
		–	–	–	–	–	–	BTWN 8C–9C	BTWN 8C–9C
	L8BC<X	–	–	ON	–	–	–	BTWN 8C–9C	BTWN 8B–8C
		–	–	–	–	–	–	BTWN 8C–9C	BTWN 8C–9C
DOWNWARD	0<X≦L9AB	–	–	–	ON	–	–	BTWN 9A–9B	LOWERMOST FLOOR
		–	–	–	–	ON	–	BTWN 9B–9C	BTWN 9A–9B
		–	–	–	–	–	ON	BTWN 9C–8C	BTWN 9B–9C
		–	–	–	–	–	–	BTWN 9C–8C or BTWN 9B–9C	BTWN 9C–8C or BTWN 9B–9C
	L9AB<X≦L9BC	–	–	–	–	ON	–	BTWN 9B–9C	BTWN 9A–9B
		–	–	–	–	–	ON	BTWN 9C–8C	BTWN 9B–9C
		–	–	–	–	–	–	BTWN 9C–8C	BTWN 9C–8C
	L9BC<X	–	–	–	–	–	ON	BTWN 9C–8C	BTWN 9B–9C
		–	–	–	–	–	–	BTWN 9C–8C	BTWN 9C–8C

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/050823

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

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	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2008/068863 A1 (Mitsubishi Electric Corp.), 12 June 2008 (12.06.2008), entire text; all drawings & EP 2090541 A	1-6
A	JP 2003-95555 A (Toshiba Elevator and Building Systems Corp.), 03 April 2003 (03.04.2003), entire text; all drawings (Family: none)	1
A	WO 2006/103769 A1 (Mitsubishi Electric Corp.), 05 October 2006 (05.10.2006), entire text; all drawings & EP 1880967 A1 & CN 1950286 A	2

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 October, 2009 (09.10.09)	27 October, 2009 (27.10.09)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/050823

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	JP 9-263373 A (Mitsubishi Electric Corp.), 07 October 1997 (07.10.1997), entire text; all drawings (Family: none)	1,3
A	JP 4-75984 A (Mitsubishi Electric Corp.), 10 March 1992 (10.03.1992), entire text; all drawings (Family: none)	4-5
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REFERENCES CITED IN THE DESCRIPTION

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