



(11)

EP 1 864 934 A1

(12)

EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(43) Date of publication:
12.12.2007 Bulletin 2007/50

(51) Int Cl.: **B66B 5/02** (2006.01) **B66B 3/00** (2006.01)

(21) Application number: **05727351.8**

(86) International application number:
PCT/JP2005/006289

(22) Date of filing: **31.03.2005**

(87) International publication number:
WO 2006/106574 (12.10.2006 Gazette 2006/41)

(84) Designated Contracting States:
DE ES FR NL PT

(71) Applicant: **mitsubishi denki kabushiki
kaisha**
Chiyoda-ku
Tokyo 100-8310 (JP)

(72) Inventors:
• **Okamoto, Kenichi**
c/o Mitsubishi Denki K. K.
Tokyo 1008310 (JP)

- **Matsuoka, Tatsuo**
c/o Mitsubishi Denki K. K.
Tokyo 1008310 (JP)

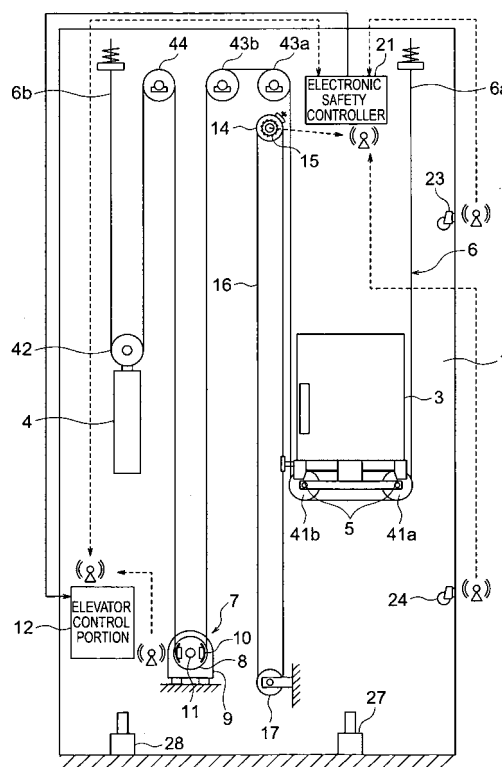
- Kondo, Takeharu
c/o Mitsubishi Denki K.K.
Tokyo 1008310 (JP)

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

(54) **ELEVATOR APPARATUS**

(57) In an elevator apparatus, sensors generate detection signals for detecting a state of an elevator. An electronic safety controller detects abnormality in the elevator based on the detection signals from the sensors, and outputs a command signal for shifting the elevator to a safe state. At least part of the detection signals and the command signal is transmitted through radio communication.

FIG. 1



Description

Technical Field

[0001] The present invention relates to an elevator apparatus which employs an electronic safety controller for detecting abnormality of an elevator based on a detection signal from a sensor.

Background Art

[0002] In conventional elevator safety systems, sensors or the like are connected to bus nodes provided to a hoistway, a machine room, and a car, allowing information from the sensors or the like to be sent through the bus nodes and a communication network bus to a safety controller (see, for example, Patent Document 1).

[0003] Patent Document 1: JP 2002-538061 A

Disclosure of the Invention

Problems to be solved by the Invention

[0004] In a conventional elevator apparatus constructed as described above, a large number of communication cables need to be wired within the hoistway, which makes it rather troublesome to install the elevator apparatus. Further, spaces need to be ensured within the hoistway for the wiring, which causes an increase in an area of the hoistway.

[0005] The present invention has been made to solve the problems as discussed above, and it is therefore an object of the invention to obtain an elevator apparatus capable of alleviating troubles during installation and reducing the spaces within the hoistway. Means for solving the Problems

[0006] An elevator apparatus according to the present invention includes: a sensor for generating detection signal for detecting a state of an elevator; and an electronic safety controller for detecting abnormality of the elevator based on the detection signal from the sensor and outputting a command signal for shifting the elevator to a safe state, and in the elevator apparatus, at least part of the detection signal and the command signal is transmitted through radio communication.

Brief Description of the Drawings

[0007]

[Fig. 1] A structural diagram of an elevator apparatus according to Embodiment 1 of the present invention.

[Fig. 2] A graph of patterns of overspeed set in speed governor and an ETS circuit portion of the electronic safety controller of Fig. 1.

[Fig. 3] A block diagram of a device configuration of a main part of the electronic safety controller of Fig. 1.

[Fig. 4] An explanatory diagram of a method of exe-

cuting calculation processing by a microprocessor of Fig. 3.

[Fig. 5] A structural diagram schematically showing an elevator apparatus according to Embodiment 2 of the present invention.

Best Mode for carrying out the Invention

[0008] Preferred embodiments of the present invention will be hereinafter described with reference to the drawings.

Embodiment 1

[0009] Fig. 1 is a structural diagram of an elevator apparatus according to Embodiment 1 of the invention. In the drawing, a hoistway 1 includes a pair of car guide rails (not shown) and a pair of counterweight guide rail (not shown). A car 3 is raised and lowered in the hoistway 1 while being guided by the car guide rails. A counterweight 4 is raised and lowered in the hoistway 1 while being guided by the counterweight guide rail.

[0010] Provided in a lower part of the car 3 is a safety device 5 that engages with the car guide rails to stop the car 3 in case of an emergency. The safety device 5 has a pair of braking pieces that are moved by mechanical operation to be pushed against the car guide rails 2.

[0011] In the lower part of the hoistway 1, a driving apparatus (traction machine) 7 that raises and lowers the car 3 and the counterweight 4 via a main rope 6 is provided. The driving apparatus 7 has: a drive sheave 8; a motor portion 9 that rotates the drive sheave 8; a brake portion 10 that brakes the rotation of the drive sheave 8; and a motor encoder 11 that generates a detection signal according to the rotation of the drive sheave 8.

[0012] The brake portion 10 is, for example, an electromagnetic brake apparatus. In the electromagnetic brake apparatus, a spring force of a braking spring is used to push a brake shoe against a braking surface to brake the rotation of the drive sheave 8 and an electromagnetic magnet is excited to separate the brake shoe from the braking surface to cancel the braking.

[0013] An elevator control portion 12 is provided, for example, in a lower part of the hoistway 1. The elevator control portion 12 includes: an operation control portion that controls operation of the driving apparatus 7; and a safety circuit portion (relay circuit portion) that suddenly stops the car 3 when the elevator has abnormality. The operation control portion is input with a detection signal from the motor encoder 11. Based on the detection signal from the motor encoder 11, the operation control portion calculates the position and speed of the car 3 to control the driving apparatus 7.

[0014] When the relay circuit of the safety circuit portion is opened, an electric current to the motor portion of the driving apparatus 7 is blocked and an electric current to the electromagnetic magnet of the brake portion 10 is also blocked, whereby the drive sheave 8 is braked.

[0015] In the upper part of the hoistway 1, a speed governor (mechanical speed governor) 14 is provided. The speed governor 14 includes: a speed governor sheave, an overspeed detection switch, a rope catch, and a speed governor encoder 15 serving as a sensor. The speed governor sheave is wound at a speed governor rope 16. Both ends of the speed governor rope 16 are connected to an operational mechanism of the safety device 5. The lower end of the speed governor rope 16 is wound around a tightening pulley 17 provided in the lower part of the hoistway 1.

[0016] When the car 3 is raised or lowered, the speed governor rope 16 is moved in circulation and the speed governor sheave is rotated at a rotation speed corresponding to a traveling speed of the car 3. The speed governor 14 mechanically detects that the traveling speed of the car 3 reaches an overspeed. Set as overspeeds to be detected are a first overspeed (OS speed) that is higher than a rated speed and a second overspeed (Trip speed) that is higher than the first overspeed.

[0017] When the traveling speed of the car 3 reaches the first overspeed, the overspeed detection switch of the speed governor 14 is operated. When the overspeed detection switch is operated, the relay circuit of the safety circuit portion of the elevator control portion 12 is opened. When the traveling speed of the car 3 reaches the second overspeed, the rope catch of the speed governor 14 grips the speed governor rope 16 to stop the circulation of the speed governor rope 16. When the circulation of the speed governor rope 16 is stopped; the safety device 5 provides a braking operation.

[0018] The speed governor encoder 15 generates a detection signal according to the rotation of the speed governor sheave. The speed governor encoder 15 employs a dual sense type encoder that simultaneously outputs two types of detection signals, i.e., a first detection signal and a second detection signal.

[0019] The first detection signal and the second detection signal from the speed governor encoder 15 are input to an ETS circuit portion of an Emergency Terminal Slow-down apparatus (ETS apparatus) provided at an electronic safety controller 21. The ETS circuit portion detects, based on a detection signal from the speed governor encoder 15, abnormality of an elevator and outputs a command signal for shifting the elevator to a safe state. More specifically, the ETS circuit portion calculates, independently from the elevator control portion 12, a traveling speed and a position of the car 3 based on the signal from the speed governor encoder 15, and monitors whether the traveling speed of the car 3 in the vicinity of a terminal landing reaches an ETS monitoring overspeed.

[0020] The ETS circuit portion also converts the signal from the speed governor encoder 15 to a digital signal to perform a digital calculation processing and determine whether the traveling speed of the car 3 reaches an ETS monitoring overspeed. When the ETS circuit portion determines that the traveling speed of the car 3 has reached

the ETS monitoring overspeed, the relay circuit of safety circuit portion is opened.

[0021] The ETS circuit portion can also detect abnormality of the ETS circuit portion itself and abnormality of the speed governor encoder 15. When the ETS circuit portion detects abnormality of the ETS circuit portion itself or abnormality of the speed governor encoder 15, a nearest floor stop command signal is output from the ETS circuit unit to the operation control portion as a command signal for shifting the elevator to a safe state. Interactive communication is also possible between the ETS circuit portion and the operation control portion.

[0022] In predetermined positions in the hoistway 1, there are provided a first reference location sensor 23 and a second reference location sensor 24 for detecting that the car 3 is located at a reference position in the hoistway. Top and bottom terminal landing switches can be used for the reference location sensors 23 and 24. Detection signals from the reference location sensors 23 and 24 are input to the ETS circuit portion of the electronic safety controller 21. Based on the detection signals from the reference location sensors 23 and 24, the ETS circuit portion corrects information for the position of the car 3 calculated in the ETS circuit portion.

[0023] Between a bottom face of the hoistway 1 and lower faces of the car 3 and the counterweight 4, a car buffer 27 and a counterweight buffer 28 are provided. Here, the car buffer 27 and the counterweight buffer 28 are provided in the lower part in the hoistway 1. The car buffer 27 is provided just below the car 3 and reduces an impact caused when the car 3 collides with a bottom part of the hoistway 1. The counterweight buffer 28 is provided just below the counterweight 4 and reduces an impact caused when the counterweight 4 collides with a bottom part of the hoistway 1. These buffers 27 and 28 may be, for example, an oil-filled-type or spring-type buffer.

[0024] A pair of car suspending pulleys 41a and 41b are provided in a lower part of the car 3. A counterweight suspending pulley 42 is provided in an upper part of the counterweight 4. Car-side return pulleys 43a and 43b and a counterweight-side return pulley 44 are disposed in the upper part of the hoistway 1. The main rope 6 has a first end 6a and a second end 6b, which are connected to a top portion of the hoistway 1 via rope stop portions.

[0025] The main rope 6 is wound, sequentially from the first end 6a side, around the car suspending pulleys 41a and 41b, the car-side return pulleys 43a and 43b, the drive sheave 8, the counterweight-side return pulley 44, and the counterweight suspending pulley 42. That is, in this example, the car 3 and the counterweight 4 are suspended within the hoistway 1 according to a 2:1 roping method.

[0026] The motor encoder 11, the elevator control portion 12, the speed governor encoder 15, the electronic safety controller 21, and the reference location sensors 23 and 24 are each provided with a communication portion (an antenna portion) for transmitting a signal through radio communication (e.g., locale area wireless network

communication). Arrows of broken lines in Fig. 1 indicate radio communication.

[0027] More specifically, a detection signal of the motor encoder 11 is sent to the elevator control portion 12 through radio communication. Information transmission between the electronic safety controller 21 and the elevator control portion 12 is performed through radio communication. A nearest floor stop command issued from the electronic safety controller 21 to the elevator control portion 12 is transmitted through radio communication. However, an emergency stop command issued from the electronic safety controller 21 to the safety circuit portion of the elevator control portion 12 is transmitted through a communication cable (an arrow of a solid line in Fig. 1). Although not shown, an emergency stop command issued from the speed governor 14 to the safety circuit portion is also transmitted through a communication cable. A detection signal of the speed governor encoder 15 and detection signals from the reference location sensors 23 and 24 are sent to the electronic safety controller 21 through radio communication.

[0028] In this example, one signal is transmitted using a plurality of different carrier frequencies. In other words, the adoption of multiplex communication enhances reliability.

[0029] Furthermore, operation modes of the electronic safety controller 21 include a plurality of modes such as, for example, a normal operation mode, a maintenance operation mode, an emergency operation mode, and the like. Mode information in the electronic safety controller 21 is transmitted to the elevator control portion 12 through radio communication.

[0030] Fig. 2 is a graph of overspeed patterns set in the speed governor 14 and the ETS circuit portion of the electronic safety controller 21 of Fig. 1. In the drawing, when the car 3 travels at a normal speed (rated speed) from a bottom terminal landing to a top terminal landing, the car 3 draws a normal speed pattern V0. A first overspeed pattern V1 and a second overspeed pattern V2 are set in the speed governor 14 by a mechanical position adjustment. An ETS monitoring overspeed pattern VE is set in the ETS circuit portion.

[0031] The ETS monitoring overspeed pattern VE is set to be higher than the normal speed pattern V0. The ETS monitoring overspeed pattern VE is also set to have equal intervals from the normal speed pattern V0 in the entire raising/lowering process. In other words, the ETS monitoring overspeed pattern VE changes according to a car position. More specifically, the ETS monitoring overspeed pattern VE is set to be held constant in the vicinity of an intermediate floor, and is set to continuously and smoothly decline in the vicinity of a terminal landing, as ends (upper end and lower end) of the hoistway 1 become closer. In this manner, the ETS circuit portion monitors the traveling speed of the car 3 not only in the vicinity of a terminal landing but also in the vicinity of an intermediate floor (a fixed speed traveling zone in the normal speed pattern V0). However, the ETS circuit por-

tion does not always have to monitor the traveling speed of the car 3 in the vicinity of the intermediate floor.

[0032] The first overspeed pattern V1 is set to be higher than the ETS monitoring overspeed pattern VE. The second overspeed pattern V2 is set to be further higher than the first overspeed pattern V1. The first overspeed pattern V1 and the second overspeed pattern V2 are fixed at all heights in the hoistway 1.

[0033] Fig. 3 is a block diagram of a device configuration of a main part of the electronic safety controller 21 of Fig. 1. The electronic safety controller 21 includes: a first microprocessor 31 that performs calculation processing for detecting abnormality of the elevator based on a first safety program; and a second microprocessor 32 that performs calculation processing for detecting abnormality of the elevator based on a second safety program.

[0034] The first safety program is a program that has the same content as that of the second safety program. The first microprocessor 31 and the second microprocessor 32 are capable of mutual communication via an interprocessor bus and a dual port RAM 33. The first microprocessor 31 and the second microprocessor 32 can also check the soundness of the first microprocessor 31 and the second microprocessor 32 themselves by mutually comparing the results of the calculation processing. In other words, the soundness of the first microprocessor 31 and the second microprocessor 32 is checked by causing the first microprocessor 31 and the second microprocessor 32 to perform identical processing, and communicating and comparing the processing results via the dual port RAM 33 or the like.

[0035] In addition to the abnormality of the microprocessors 31 and 32 themselves, the microprocessors 31 and 32 can also detect abnormality of the electronic-safety controller 21 by calculation processing.

[0036] Fig. 4 is an explanatory diagram of a method of performing calculation processing by the microprocessors 31 and 32 of Fig. 3. The microprocessors 31 and 32 repeatedly perform calculation processing with a predetermined computation cycle (e.g., 50 msec) based on a signal from a fixed-cycle timer and according to a program stored in a ROM. A program executed in one cycle includes a safety program for detecting abnormality of an elevator and a failure/abnormality check program for detecting the failure/abnormality of the electronic safety controller 21 itself and various sensors. The failure/abnormality check program can be set to be executed only when predetermined states are satisfied.

[0037] In the failure/abnormality check program, for example, detection of clock abnormality, detection of abnormality in a stack region of the RAM, detection of abnormality in a sequence of calculation processings, detection of abnormality in a relay contact, detection of abnormality in power supply voltage, and the like are carried out.

[0038] In the elevator apparatus, the electronic safety controller 21 can detect abnormality of the electronic

safety controller 21 itself and outputs a command signal for shifting the elevator to a safe state even when abnormality of the electronic safety controller 21 itself is detected. Thus, a relatively simple structure can be used to improve the reliability of a safety system while improving a speed to detect abnormality of an elevator and a speed of the processing for the abnormality.

[0039] The electronic safety controller 21 can also detect abnormality of various sensors and can output a command signal for shifting the elevator to a safe state even when abnormality of the sensor is detected. Thus, the safety system can have a further improved reliability.

[0040] Furthermore, the electronic safety controller 21 includes first microprocessor 31 and the second microprocessor 32. The first microprocessor 31 and the second microprocessor 32 can check the soundness of the first microprocessor 31 and the second microprocessor 32 themselves by mutually comparing results of calculation processing. Thus, the safety system can have a further improved reliability.

[0041] Still further, in this elevator apparatus, transmission of at least part of the detection signals from sensors for detecting a state of the elevator (the speed governor encoder 15 and the reference location sensors 23 and 24 in this case) and command signals from the electronic safety controller 21 for shifting the elevator to a safe state is performed through radio communication. Thus, there is no need to dispose a large number of communication cables within the hoistway 1 in a complicated manner, making it possible to alleviate troubles during installation and reduce spaces within the hoistway 1. Especially in the case of an electronic safety monitoring system, where many and various signals are transmitted and transmission paths are complicated, transmission of signals regarding the electronic safety controller 21 through radio communication is effective.

[0042] Further, in this elevator apparatus, detection signals from the motor encoder 11 and signals between the elevator control portion 12 and the electronic safety controller 21 are also transmitted through radio communication. Accordingly, it is possible to further alleviate the troubles during installation and further reduce the spaces within the hoistway 1.

[0043] In addition, the electronic safety controller 21 transmits a command signal for stopping the car 3 at a nearest floor through radio communication and transmits a command signal through cable communication to bring the car 3 to an emergency stop, thereby making it possible to ensure higher reliability.

[0044] Although the single elevator apparatus has been described in the foregoing example, signals from sensors of a plurality of elevator apparatuses located in the same building may be managed by a common electronic safety controller. Also in this case, the same effect as in the foregoing example can be achieved by transmitting detection signals and command signals through radio communication.

Although the speed governor encoder 15 and the refer-

ence location sensors 23 and 24 are mentioned as the sensors for sending detection signals to the electronic safety controller 21 in the foregoing example, the sensors should not be limited to the aforementioned ones. For instance, detection signals from various sensors such as a temperature sensor, a speed sensor, an acceleration sensor, a vibration sensor, and the like can be transmitted through radio communication.

Further, it is not necessary to transmit detection signals from all the sensors through radio communication. It is also appropriate to transmit detection signals from only selected sensors through radio communication.

Still further, it is not necessary either to transmit all the command signals from the electronic safety controller 21 through radio communication. On the contrary, it is also appropriate to transmit all the command signals including emergency stop commands through radio communication.

20 Embodiment 2

[0045] Next, Fig. 5 is a schematic diagram showing an elevator apparatus according to Embodiment 2 of the present invention. A first car 3a and a second car 3b are provided within the hoistway 1. The first car 3a and the second car 3b, which are arranged in a vertically aligned manner, are raised/lowered within the common hoistway 1 independently from each other. In other words, this elevator apparatus is a one-shaft multi-car type elevator. Accordingly, the first car 3a is raised/lowered by a first drive device (not shown), and the second car 3b is raised/lowered by a second drive device (not shown). A main rope and the like for suspending the first car 3a and the second car 3b are not illustrated.

[0046] The first car 3a and the second car 3b are each provided with a communication portion (an antenna portion) for transmitting signals (a request signal for a call registration, a confirmation signal for a call registration, and the like) to/from the elevator control portion 12 (Fig. 1) through radio communication. Other components are identical to those of Embodiment 1.

[0047] In the elevator apparatus constructed as described above, signals between the cars 3a and 3b and the elevator control portion 12 as well as signals regarding the electronic safety controller 21 (Fig. 1) are transmitted through radio communication. It is therefore possible to alleviate troubles during installation and reduce the spaces within the hoistway 1. That is, in a conventional one-shaft multi-car type elevator, two communication cables need to be connected to two cars respectively in such a manner as not to interfere with each other, which leads to a difficulty in layout and an increase in the spaces within a hoistway. However, according to Embodiment 2, it is possible to reduce the space of the hoistway 1.

[0048] Although Embodiment 2 deals with a one-shaft multi-car type elevator, the car 3 of the elevator apparatus according to Embodiment 1 of the present invention may

be provided with a communication portion so that signals are transmitted between the car 3 and the elevator control portion 12 through radio communication.

Although an emergency stop command from the electronic safety controller 21 is input to the safety circuit portion of the elevator control portion 12 in the foregoing example, a safety circuit portion for the electronic safety controller 21 may be provided separately from the safety circuit portion of the elevator control portion 12 so that an emergency stop command from the electronic safety controller 21 is input to the safety circuit portion for the electronic safety controller 21.

Claims

1. An elevator apparatus, comprising:

a sensor for generating detection signal for detecting a state of an elevator; and
an electronic safety controller for detecting abnormality of the elevator based on the detection signal from the sensor and outputting a command signal for shifting the elevator to a safe state,

wherein, at least part of the detection signal and the command signal is transmitted through radio communication.

2. The elevator apparatus according to Claim 1, further comprising an elevator control portion for controlling operation of a car,

wherein, the sensor, the electronic safety controller, and the elevator control portion are provided respectively with communication portions for transmitting signals thereamong through radio communication.

3. The elevator apparatus according to Claim 1, wherein the electronic safety controller transmits a command signal for stopping the car at a nearest floor through radio communication and transmits a command signal for bringing the car to an emergency stop through cable communication.

4. The elevator apparatus according to Claim 1, wherein the electronic safety controller can detect abnormality in the electronic safety controller itself and outputs a command signal for shifting the elevator to a safe state also when detecting the abnormality in the electronic safety controller itself.

5. The elevator apparatus according to Claim 1, wherein the electronic safety controller can detect abnormality in the sensor and outputs a command signal for shifting the elevator to a safe state also when detecting abnormality in the sensor.

6. The elevator apparatus according to Claim 1, wherein:

the electronic safety controller includes a first microprocessor for performing a calculation processing for detecting abnormality in the elevator based on a first safety program, and a second microprocessor for performing a calculation processing for detecting abnormality in the elevator based on a second safety program; and the first microprocessor and the second microprocessor, which are capable of mutual communication via an interprocessor bus, and capable of checking soundness of the first microprocessor and the second microprocessor themselves by mutually comparing results of the calculation processing.

7. The elevator apparatus according to Claim 1, further comprising an elevator control portion for controlling operation of the car, wherein, the car and the elevator control portion also transmit signals to each other through radio communication.

FIG. 1

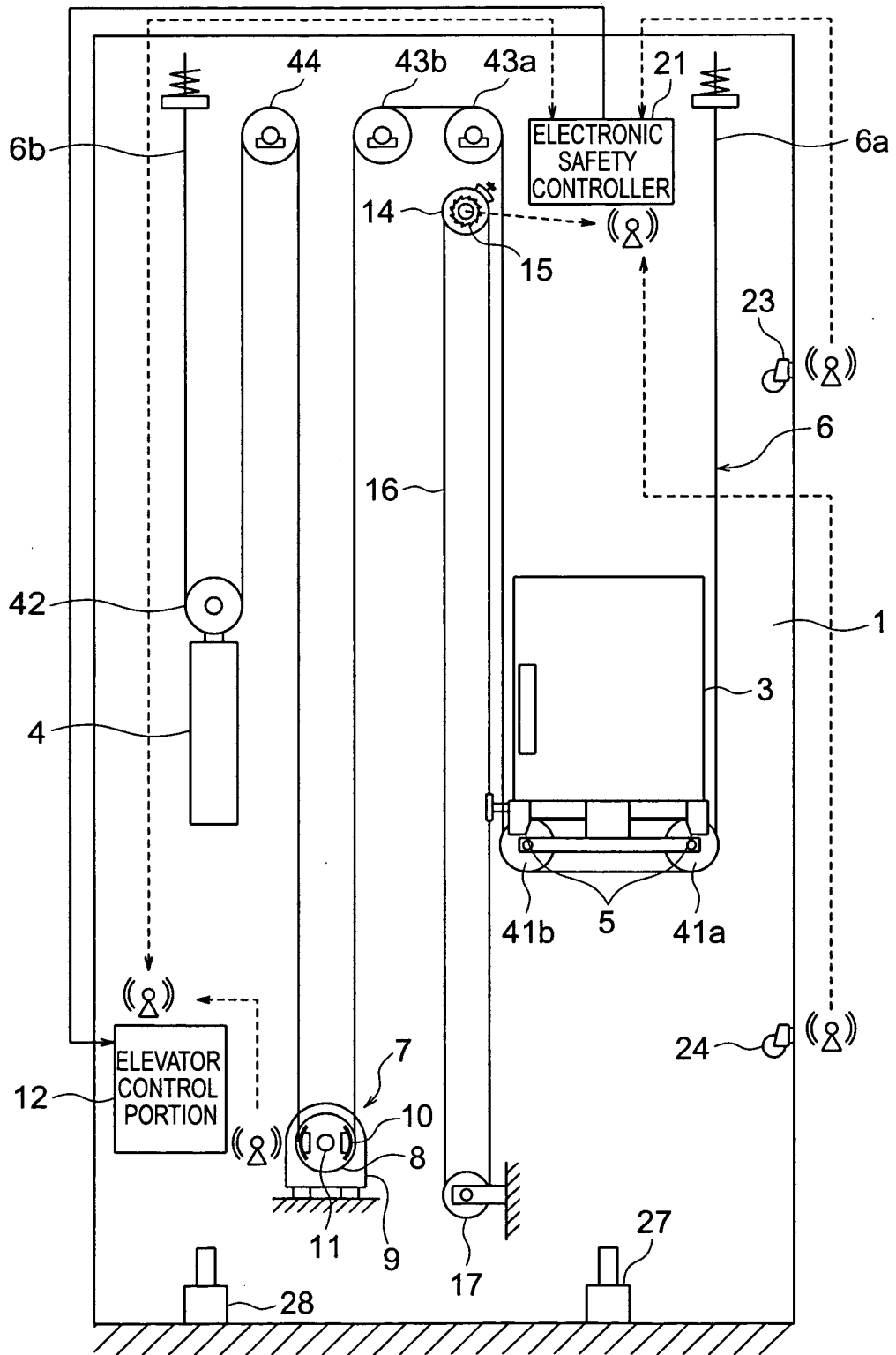


FIG. 2

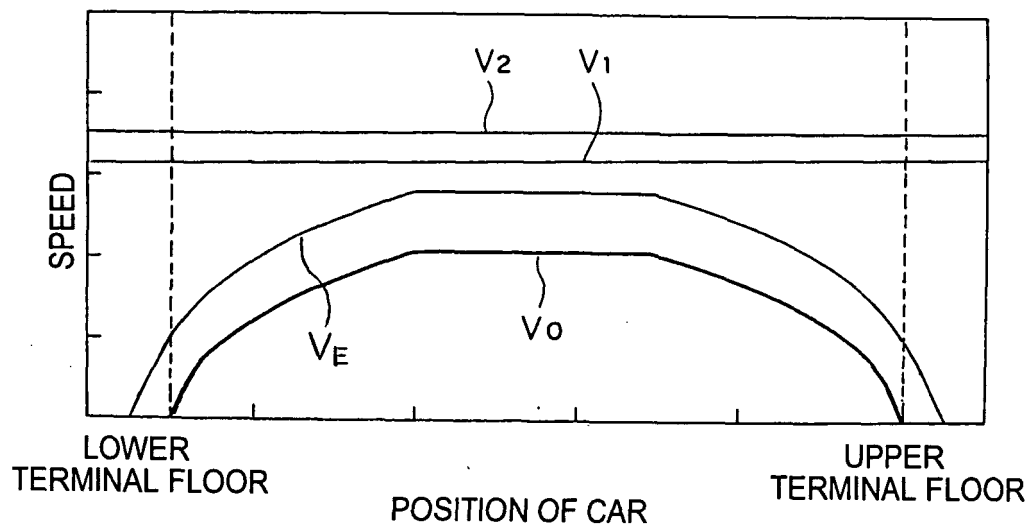


FIG. 3

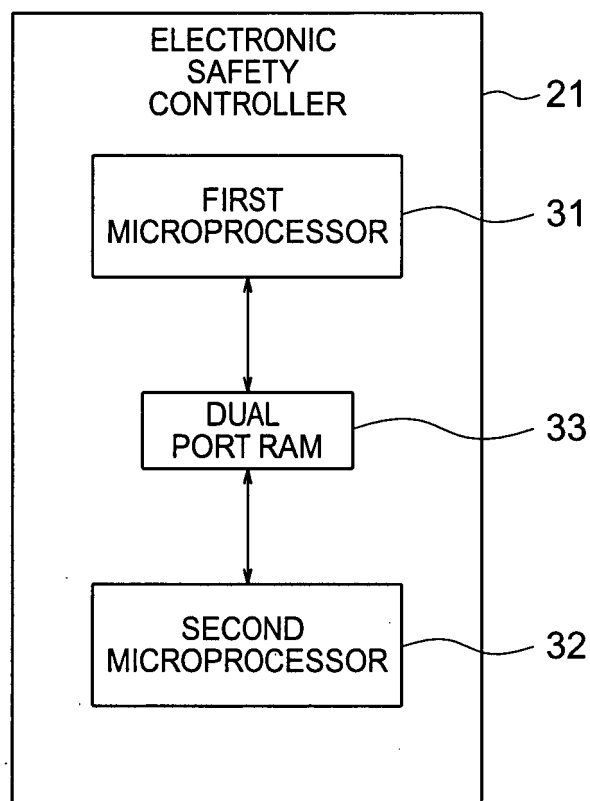


FIG. 4

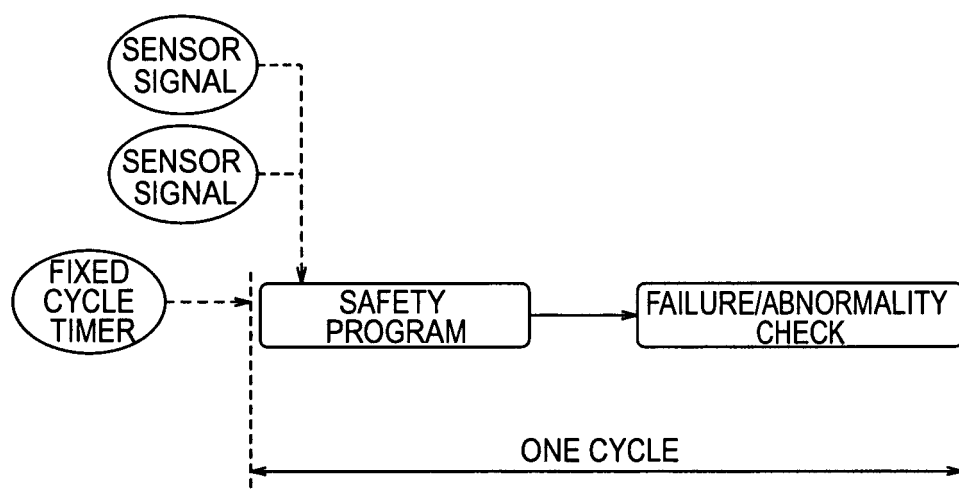
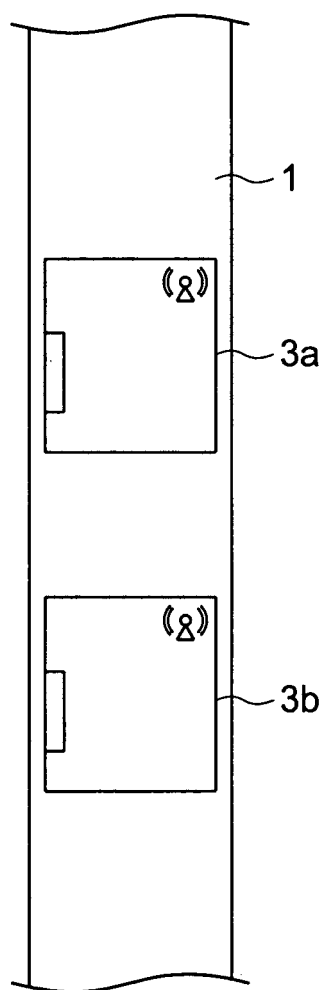


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/006289

A. CLASSIFICATION OF SUBJECT MATTER B66B5/02 (2006.01) , B66B3/00 (2006.01)		
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) B66B3/00 (2006.01) - B66B5/28 (2006.01)		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2005 Kokai Jitsuyo Shinan Koho 1971-2005 Toroku Jitsuyo Shinan Koho 1994-2005		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2002-538061 A (Otis Elevator Co.) , 12 November, 2002 (12.11.02) , Abstract; Par. No. [0033] ; Figs. 1, 3 & WO 00/51929 A1 & US 6173814 B1 & EP 1159218 A1 & BR 0008623 A & CN 1342129 A	1-7
Y	JP 2003-40543 A (Otis Elevator Co.) , 13 February, 2003 (13.02.03) , Par. Nos. [0009] to [0015] ; Figs. 1 to 3 & US 6467585 B1 & DE 10230380 A	1-7
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 26 December, 2005 (26.12.05)		Date of mailing of the international search report 10 January, 2006 (10.01.06)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2005/006289

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 1-60586 A (Mitsubishi Electric Corp.), 07 March, 1989 (07.03.89), Claims; page 4, lower right column, line 16 to lower left column, line 2 & US 4979593 A	3
Y	JP 6-227766 A (Hitachi, Ltd.), 16 August, 1994 (16.08.94), Abstract; Fig. 1 (Family: none)	7

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2002538061 A [0003]