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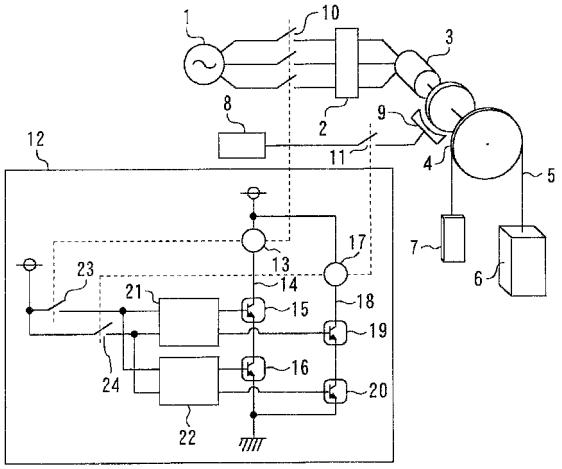
(54) SAFETY DEVICE FOR ELEVATOR

(57) There is provided a safety device for an elevator capable of reliably detecting a failure of each of two relay drivers provided corresponding to a relay for shutting off the power supply to a motor or a brake. For this purpose, the configuration is made such that cooperative operation is carried out so that one of the first and second arithmetic units issues a drive instruction, and also the other of the first and second arithmetic units issues a shut-off instruction; and the first and second arithmetic units make a failure diagnosis on the first and second drivers based on the output state of the diagnosing contact signal generated by the contact signal outputting unit during the cooperative operation.

FIG. 1



EP 2 492 231 A1

Description

Technical Field

[0001] The present invention relates to a safety device for an elevator.

Background Art

[0002] For the conventional safety device for an elevator, the configuration has been made such that an arithmetic unit controls the drive of a relay via a relay driver, and controls power supply to a motor or a brake. Unfortunately, on account of an abnormality of the arithmetic unit or a short-circuit failure of the driver, in an emergency, the power supply to the motor or the brake sometimes cannot be shut off.

[0003] To solve this problem, there has been proposed a technique in which two switches are connected in series with a brake coil, and when one of the switches fails, the electric current flowing in the brake coil is shut off by using the other of the switches (for example, refer to Patent Literature 1).

Citation List

Patent Literature

[0004] Patent Literature 1 : International Publication No: WO2008/152722

Summary of Invention

Technical Problem

[0005] Unfortunately, in the technique described in Patent Literature 1, a failure of the other of the switches cannot be detected. Therefore, there arises a problem that even if the two switches described in Patent Literature 1 are used as relay drivers, a failure of either one of the relay drivers cannot be detected.

[0006] The present invention has been made to solve the above-described problem, and accordingly an object thereof is to provide a safety device for an elevator capable of reliably detecting a failure of each of two relay drivers provided corresponding to a relay for shutting off the power supply to a motor or a brake.

Means for Solving the Problems

[0007] A safety device for an elevator of the present invention includes a relay having a function of shutting off the power supply to a motor or a brake for the elevator, a first driver connected in series with the relay, a second driver connected in series with the relay and the first driver, a first arithmetic unit which issues one of a drive instruction for applying a drive voltage to the relay and a shut-off instruction for shutting off the drive voltage to the first driver according to the situation, a second arithmetic unit which issues one of a drive instruction for applying the drive voltage and a shut-off instruction for shutting off the drive voltage to the second driver according to the situation and a contact signal outputting unit which generates a diagnosing contact signal according to the operation of the relay, wherein cooperative operation is carried out so that one of the first and second arithmetic units issues the drive instruction, and also the other of the first and second arithmetic units issues the shut-off instruction and the first and second arithmetic units make a failure diagnosis on the first and second drivers based on the output state of the diagnosing contact signal generated by the contact signal outputting unit during the cooperative operation.

Advantageous Effect of Invention

[0008] According to the present invention, a failure of each of two relay drivers provided corresponding to a relay for shutting off the power supply to a motor or a brake can be detected reliably.

Brief Description of the Drawings

[0009]

Figure 1 is a configuration view showing the whole of an elevator for which a safety device for an elevator in accordance with a first embodiment of the present invention is used.
Figure 2 is a diagram for explaining a failure diagnosis procedure at the time when the motor power source relay diagnosing contact of the safety device for an elevator in accordance with the first embodiment of the present invention is closed.
Figure 3 is a diagram for explaining a failure diagnosis procedure at the time when the motor power source relay diagnosing contact of the safety device for an elevator in accordance with the first embodiment of the present invention is open.

Description of Embodiment

[0010] An embodiment for carrying out the present invention will now be described with reference to the accompanying drawings. In the drawings, the same reference signs are applied to the same or equivalent parts, and the duplicated explanation thereof is simplified or omitted as appropriate.

First embodiment

[0011] Figure 1 is a configuration view showing the whole of an elevator for which a safety device for an elevator in accordance with a first embodiment of the present invention is used.
In Figure 1, reference sign 1 denotes a motor power

source, and 2 denotes a power converter. Reference sign 3 denotes a motor. This motor 3 has a function of rotating due to the power supplied from the motor power source 1 via the power converter 2. Reference sign 4 denotes a sheave. This sheave 4 has a function of rotating in response to the rotation of the motor 3.

[0012] Reference sign 5 denotes a main rope. This main rope 5 is wound around the sheave 4. Reference sign 6 denotes a car. This car 6 is connected to one end of the main rope 5. Reference sign 7 denotes a counterweight. This counterweight 7 is connected to the other end of the main rope 5. Reference sign 8 denotes a brake power source. Reference sign 9 denotes a brake. This brake 9 has a function of braking the rotation of the motor 3 when the power supplied from the brake power source 8 is shut off.

[0013] Reference sign 10 denotes a motor power source relay contact. This motor power source relay contact 10 consists of a normally open contact. The motor power source relay contact 10 is provided on a wiring between the motor power source 1 and the power converter 2. Reference sign 11 denotes a brake power source relay contact. This brake power source relay contact 11 consists of a normally open contact. The brake power source relay contact 11 is provided on a wiring between the brake power source 8 and the brake 9.

[0014] Reference sign 12 denotes an electronic safety device. This electronic safety device 12 has a function of controlling the closing and opening of the motor power source relay contact 10 and the brake power source relay contact 11. Also, the electronic safety device 12 has a function of detecting a state of emergency of the elevator.

[0015] In the elevator configured as described above, if a state of emergency occurs, the motor power source relay contact 10 and the brake power source relay contact 11 are opened by the control of the electronic safety device 12. By the opening of these relay contacts 10 and 11, the power supply to the motor 3 and the brake 9 is shut off. By the braking of the motor 3 that lost its driving force carried out by the brake 9, the car 6 is stopped in emergency. By this emergency stopping, the safety of users in the car 6 can be ensured.

[0016] Next, the internal configuration of the electronic safety device 12 is explained in more detail.

Reference sign 13 denotes a motor power source relay. This motor power source relay 13 is arranged on a motor power source relay wiring 14 provided between the power source and the ground. The motor power source relay 13 is used to control the closing and opening of the motor power source relay contact 10. That is, when a drive voltage is applied to the motor power source relay 13, the motor power source relay contact 10 is closed. On the other hand, when the drive voltage applied to the motor power source relay 13 is shut off, the motor power source relay contact 10 is opened.

[0017] Reference sign 15 denotes a first motor power source relay driver. This first motor power source relay driver 15 consists of a transistor. The first motor power source relay driver 15 is connected in series with the motor power source relay 13 on the motor power source relay wiring 14. Reference sign 16 denotes a second motor power source relay driver. This second motor power source relay driver 16 also consists of a transistor. The second motor power source relay driver 16 is connected in series with the motor power source relay 13 and the first motor power source relay driver 15 on the motor power source relay wiring 14. That is, the first and second motor power source relay drivers 15 and 16 are of a double-system configuration with respect to the motor power source relay 13.

[0018] Reference sign 17 denotes a brake power source relay. This brake power source relay 17 is arranged on a brake power source relay wiring 18 provided between the power source and the ground. The brake power source relay 17 is used to control the closing and opening of the brake power source relay contact 11. That is, when a drive voltage is applied to the brake power source relay 17, the brake power source relay contact 11 is closed. On the other hand, when the drive voltage applied to the brake power source relay 17 is shut off, the brake power source relay contact 11 is opened.

[0019] Reference sign 19 denotes a first brake power source relay driver. This first brake power source relay driver 19 consists of a transistor. The first brake power source relay driver 19 is connected in series with the brake power source relay 17 on the brake power source relay wiring 18. Reference sign 20 denotes a second brake power source relay driver. This second brake power source relay driver 20 also consists of a transistor. The second brake power source relay driver 20 is connected in series with the brake power source relay 17 and the first brake power source relay driver 19 on the brake power source relay wiring 18. That is, the first and second brake power source relay drivers 20 are of a double-system configuration with respect to the brake power source relay 17.

[0020] The control of the drivers 15, 16, 19 and 20 are also carried out by a double-system configuration using a first arithmetic unit 21 and a second arithmetic unit 2. Specifically, the first arithmetic unit 21 has a function of issuing a control instruction to the first motor power source relay driver 15 and the first brake power source relay driver 19 according to the situation. Also, the second arithmetic unit 22 has a function of issuing a control instruction to the second motor power source relay driver 16 and the second brake power source relay driver 20 according to the situation.

[0021] More specifically, the first arithmetic unit 21 has a function of issuing a drive instruction for applying a drive voltage to the motor power source relay 13 to the first motor power source relay driver 15. Also, the first arithmetic unit 21 has a function of issuing a shut-off instruction for shutting off the drive voltage applied to the motor power source relay 13 to the first motor power source relay driver 15. Further, the first arithmetic unit 21 has a function of issuing a drive instruction for applying

a drive voltage to the brake power source relay 17 to the first brake power source relay driver 19. In addition, the first arithmetic unit 21 has a function of issuing a shut-off instruction for shutting off the drive voltage applied to the brake power source relay 17 to the first brake power source relay driver 19.

[0022] On the other hand, the second arithmetic unit 22 has a function of issuing a drive instruction for applying a drive voltage to the motor power source relay 13 to the second motor power source relay driver 16. Also, the second arithmetic unit 22 has a function of issuing a shut-off instruction for shutting off the drive voltage applied to the motor power source relay 13 to the second motor power source relay driver 16. Further, the second arithmetic unit 22 has a function of issuing a drive instruction for applying a drive voltage to the brake power source relay 17 to the second brake power source relay driver 20. In addition, the second arithmetic unit 22 has a function of issuing a shut-off instruction for shutting off the drive voltage applied to the brake power source relay 17 to the second brake power source relay driver 16.

[0023] Reference sign 23 denotes a motor power source relay diagnosing contact. This motor power source relay diagnosing contact 23 consists of a normally open contact. The motor power source relay diagnosing contact 23 is arranged on a wiring between the power source and the first and second arithmetic units 21 and 22. The motor power source relay diagnosing contact 23 functions as a contact signal outputting unit that generates a normally open contact signal for diagnosis according to the operation of the motor power source relay 13.

[0024] Reference sign 24 denotes a brake power source relay diagnosing contact. This brake power source relay diagnosing contact 24 consists of a normally open contact. The brake power source relay diagnosing contact 24 is arranged on a wiring between the power source and the first and second arithmetic units 21 and 22. The brake power source relay diagnosing contact 24 functions as a contact signal outputting unit that generates a normally open contact signal for diagnosis according to the operation of the brake power source relay 17.

[0025] To the electronic safety device 12 configured as described above, various signals showing the operation state of elevator, such as the stopping state of the car 6, are inputted. The electronic safety device 12 is configured so that, when the car 6 stops during the ordinary operation of elevator, the first and second arithmetic units 21 and 22 perform cooperative operation to make a self-diagnosis on a failure of the relay drivers 15, 16, 19 and 20.

[0026] Specifically, one of the first and second arithmetic units 21 and 22 issues a drive instruction to the corresponding driver. At the same time, the other of the first and second arithmetic units 21 and 22 issues a shut-off instruction to the corresponding driver. The first and second arithmetic units 21 and 22 are configured so as to monitor the output state of the diagnosing contact signal sent via the diagnosing contacts 23 and 24 and to make a diagnosis on a failure of the relay drivers 15, 16, 19 and 20.

[0027] Next, the method for failure diagnosis on the first and second motor power source relay drivers 15 and 16 and the first and second brake power source relay drivers 19 and 20 is explained specifically. The failure diagnosis on the first and second motor power source relay drivers 15 and 16 and the failure diagnosis on the first and second brake power source relay drivers 19 and 20 are carried out by the same method. Hereunder, the method for failure diagnosis on the first and second motor power source relay drivers 15 and 16 is explained with reference to Figures 2 and 3.

[0028] Figure 2 is a diagram for explaining a failure diagnosis procedure at the time when the motor power source relay diagnosing contact of the safety device for an elevator in accordance with the first embodiment of the present invention is closed. Figure 3 is a diagram for explaining a failure diagnosis procedure at the time when the motor power source relay diagnosing contact of the safety device for an elevator in accordance with the first embodiment of the present invention is open.

[0029] First, the case where the motor power source relay diagnosing contact 23 is closed is explained with reference to Figure 2. In Figure 2, reference sign 25 denotes a control instruction given to the first motor power source relay driver 15. Specifically, the first arithmetic unit 21 issues a Hi-level signal as a drive instruction to the control terminal of the first motor power source relay driver 15. On the other hand, the first arithmetic unit 21 issues a Low-level signal as a shut-off instruction to the control terminal of the first motor power source relay driver 15.

[0030] Reference sign 26 denotes a control instruction given to the second motor power source relay driver 16. Specifically, the second arithmetic unit 22 issues a Hi-level signal as a drive instruction to the control terminal of the second motor power source relay driver 16. On the other hand, the second arithmetic unit 22 issues a Low-level signal as a shut-off instruction to the control terminal of the second motor power source relay driver 16.

[0031] Reference sign 27 denotes a signal state of the motor power source relay diagnosing contact 23. Specifically, when the motor power source relay diagnosing contact 23 is closed, the Hi-level signal is inputted to the first and second arithmetic units 21 and 22. On the other hand, when the motor power source relay diagnosing contact 23 is open, the Low-level signal is inputted to the first and second arithmetic units 21 and 22.

[0032] In the initial state shown in Figure 2, both of the first and second arithmetic units 21 and 22 issue drive instructions as the control instructions 25 and 26. At this time, if both of the first and second motor power source relay drivers 15 and 16 are in an ON state, a drive voltage is applied to the motor power source relay 13. In this case, the signal state 27 of the motor power source relay diagnosing contact 23 is a closed state.

[0033] In this state, first, the first arithmetic unit 21 issues a shut-off instruction as the control instruction 25, and also the second arithmetic unit 22 keeps the issue of a drive instruction as the control instruction 26. At this time, after the first arithmetic unit 21 has issued the shut-off instruction, the signal state 27 of the motor power source relay diagnosing contact 23 becomes an open state before preset fixed time has elapsed. In this case, the first and second arithmetic units 21 and 22 determine that the first motor power source driver 15 has become in an OFF state in response to the shut-off instruction, and determine that a short-circuit abnormality has not occurred.

[0034] Subsequently, the first arithmetic unit 21 issues a drive instruction as the control instruction 25, and also the second arithmetic unit 22 issues a shut-off instruction as the control instruction 26. However, even if the preset fixed time has elapsed after the second arithmetic unit 22 issued the shut-off instruction, the signal state 27 of the motor power source relay diagnosing contact 23 is kept the open state. In this case, the first and second arithmetic units 21 and 22 determine that the second motor power source driver 16 does not respond to the shut-off instruction and keeps in the ON state, and determine that a short-circuit abnormality has occurred.

[0035] Next, the case where the motor power source relay diagnosing contact 23 is open is explained with reference to Figure 3. In the initial state shown in Figure 3, both of the first and second arithmetic units 21 and 22 issue shut-off instructions as the control instructions 25 and 26. At this time, if at least one of the first and second motor power source relay drivers 15 and 16 is in an OFF state, the drive voltage applied to the motor power source relay 13 is shut off. In this case, the signal state 27 of the motor power source relay diagnosing contact 23 is the open state.

[0036] In this state, first, the first arithmetic unit 21 keeps the issue of a shut-off instruction as the control instruction 25, and also the second arithmetic unit 22 issues a drive instruction as the control instruction 26. At this time, even if preset fixed time has elapsed after the second arithmetic unit 22 issued the drive instruction, the signal state 27 of the motor power source relay diagnosing contact 23 is kept the open state. In this case, the first and second arithmetic units 21 and 22 determine that the first motor power source driver 15 has become in the OFF state in response to the shut-off instruction, and determine that a short-circuit abnormality has not occurred.

[0037] Subsequently, the first arithmetic unit 21 issues a drive instruction as the control instruction 25, and also the second arithmetic unit 22 issues a shut-off instruction as the control instruction 26. However, after the first arithmetic unit 21 has issued the drive instruction, the signal state 27 of the motor power source relay diagnosing contact 23 becomes the open state within the preset fixed time. In this case, the first and second arithmetic units 21 and 22 determine that the second motor power source driver 16 does not respond to the shut-off instruction and keeps in the ON state, and determine that a short-circuit abnormality has occurred.

[0038] According to the first embodiment explained above, cooperative operation is carried out so that one of the first and second arithmetic units 21 and 22 issues the drive instruction, and also the other of the first and second arithmetic units 21 and 22 issues the shut-off instruction. The first and second arithmetic units 21 and 22 make a failure diagnosis on each of the drivers 15, etc. based on the signal state of the diagnosing contacts 23 and 24 during the cooperative operation.

[0039] Specifically, when the normally open contact signal has been inputted to the first and second arithmetic units 21 and 22, in the case where the input of the normally open contact signal continues even when the preset fixed time has elapsed after the cooperative operation was carried out, it is determined that the driver corresponding to the other of the first and second arithmetic units 21 and 22 is abnormal. Also, when the normally open contact signal has not been inputted, in the case where the normally open contact signal is inputted after the cooperative operation has been carried out and before the preset fixed time has elapsed, it is determined that the driver corresponding to one of the first and second arithmetic units 21 and 22 is abnormal.

[0040] Thereby, a failure of each of the relay drivers 15, etc. can be detected reliably. Therefore, even if the relay driver or the arithmetic unit of one-side system fails in emergency, the power supply to the motor 1 and the brake 9 can be shut off reliably.

[0041] Also, the first and second arithmetic units 21 and 22 make the failure diagnosis on each of the relay drivers 15, etc. when the car 6 stops. Therefore, the failure diagnosis on each of the relay drivers 15, etc. can be carried out without a hindrance to the operation of elevator.

Industrial Applicability

[0042] As described above, the safety device for an elevator in accordance with the present invention can be used for an elevator in which the power supply to a motor or a brake is shut off in emergency.

Description of symbols

[0043]

1 motor power source, 2 power converter, 3 motor, 4 sheave,
5 main rope, 6 car, 7 counterweight, 8 brake power source,
9 brake, 10 motor power source relay contact,
11 brake power source relay contact, 12 electronic safety device,
13 motor power source relay, 14 motor power source relay wiring,

15 first motor power source relay driver,
16 second motor power source relay driver,
17 brake power source relay, 18 brake power source relay wiring,
19 first brake power source relay driver,
20 second brake power source relay driver,
21 first arithmetic unit, 22 second arithmetic unit,
23 motor power source relay diagnosing contact,
24 brake power source relay diagnosing contact,
25 control instruction given to the first motor power source relay driver,
26 control instruction given to the second motor power source relay driver,
27 signal state of the motor power source relay diagnosing contact

Claims

1. A safety device for an elevator comprising:

a relay having a function of shutting off the power supply to a motor or a brake for the elevator;
a first driver connected in series with the relay;
a second driver connected in series with the relay and the first driver;
a first arithmetic unit which issues one of a drive instruction for applying a drive voltage to the relay and a shut-off instruction for shutting off the drive voltage to the first driver according to the situation;
a second arithmetic unit which issues one of a drive instruction for applying the drive voltage and a shut-off instruction for shutting off the drive voltage to the second driver according to the situation; and
a contact signal outputting unit which generates a diagnosing contact signal according to the operation of the relay, wherein
cooperative operation is carried out so that one of the first and second arithmetic units issues the drive instruction, and also the other of the first and second arithmetic units issues the shut-off instruction; and
the first and second arithmetic units make a failure diagnosis on the first and second drivers based on the output state of the diagnosing contact signal generated by the contact signal outputting unit during the cooperative operation.

2. The safety device for an elevator according to claim 1, wherein
the contact signal outputting unit generates a normally open contact signal as the diagnosing contact signal; and
when the normally open contact signal has been inputted to the first and second arithmetic units, in the case where the input of the normally open contact signal continues even when preset fixed time has elapsed after the cooperative operation was carried out, the first and second arithmetic units determine that the driver corresponding to the other of the first and second arithmetic units is abnormal.

3. The safety device for an elevator according to claim 2, wherein, when the normally open contact signal has not been inputted to the first and second arithmetic units, in the case where the normally open contact signal is inputted after the cooperative operation has been carried out and before the preset fixed time has elapsed, the first and second arithmetic units determine that the driver corresponding to the other of the first and second arithmetic units is abnormal.

4. The safety device for an elevator according to any one of claims 1 to 3, wherein, when a car of the elevator stops, the first and second arithmetic units carry out the cooperative operation to make a failure diagnosis on the first and second drivers.

FIG. 1

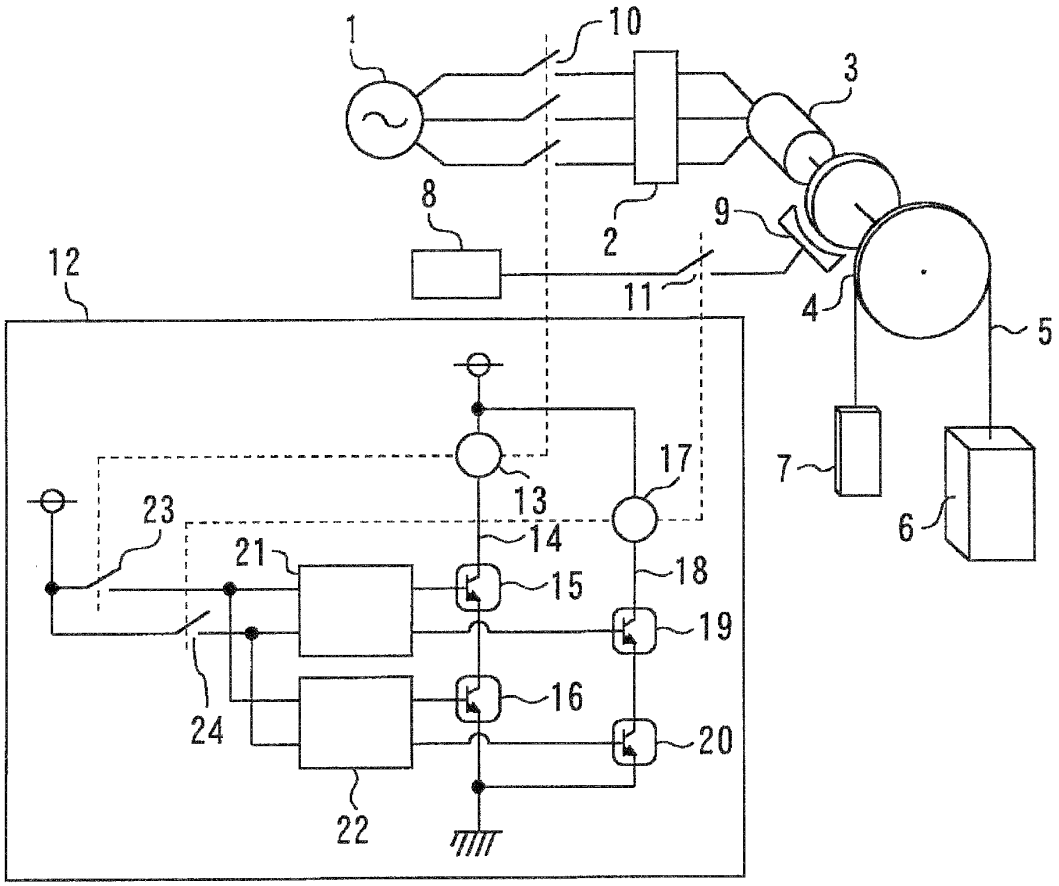


FIG. 2

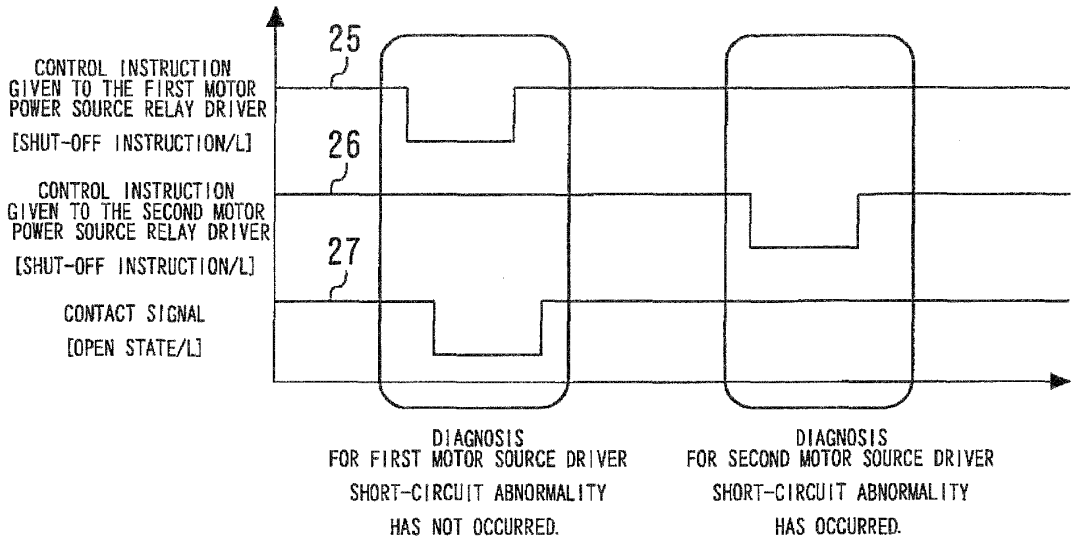
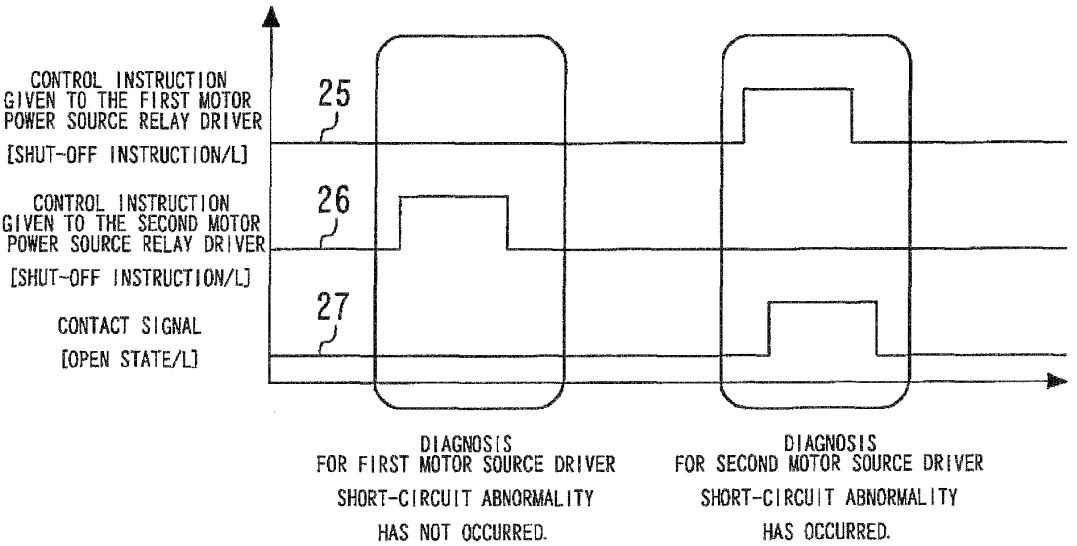

25
26
27
CONTROL INSTRUCTION GIVEN TO THE FIRST MOTOR POWER SOURCE RELAY DRIVER
[SHUT-OFF INSTRUCTION/L]
CONTROL INSTRUCTION GIVEN TO THE SECOND MOTOR POWER SOURCE RELAY DRIVER
[SHUT-OFF INSTRUCTION/L]
CONTACT SIGNAL
[OPEN STATE/L]
DIAGNOSIS FOR FIRST MOTOR SOURCE DRIVER SHORT-CIRCUIT ABNORMALITY HAS NOT OCCURRED.
DIAGNOSIS FOR SECOND MOTOR SOURCE DRIVER SHORT-CIRCUIT ABNORMALITY HAS OCCURRED.

FIG. 3


25
26
27
CONTROL INSTRUCTION GIVEN TO THE FIRST MOTOR POWER SOURCE RELAY DRIVER
[SHUT-OFF INSTRUCTION/L]
CONTROL INSTRUCTION GIVEN TO THE SECOND MOTOR POWER SOURCE RELAY DRIVER
[SHUT-OFF INSTRUCTION/L]
CONTACT SIGNAL
[OPEN STATE/L]
DIAGNOSIS FOR FIRST MOTOR SOURCE DRIVER SHORT-CIRCUIT ABNORMALITY HAS NOT OCCURRED.
DIAGNOSIS FOR SECOND MOTOR SOURCE DRIVER SHORT-CIRCUIT ABNORMALITY HAS OCCURRED.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/068056

A. CLASSIFICATION OF SUBJECT MATTER
B66B5/02(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)
B66B5/02

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 1996-2010
Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

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	WO 2004/076326 A1 (Mitsubishi Electric Corp.), 10 September 2004 (10.09.2004), description, page 9, lines 7 to 19; page 10, lines 11 to 20; fig. 1, 3 to 4 & EP 1621507 A1 & CN 1720189 A	1-4
Y	JP 2007-510608 A (Kone Corp.), 26 April 2007 (26.04.2007), paragraph [0015]; fig. 1 & US 2007/0272491 A1 & EP 1685056 A & WO 2005/047157 A2 & FI 20031647 D & CN 1871172 A	1-4
A	WO 2008/012896 A1 (Mitsubishi Electric Corp.), 31 January 2008 (31.01.2008), entire text; fig. 1 to 9 & EP 2048104 A1	1-4

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

* Special categories of cited documents:
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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
15 January, 2010 (15.01.10)	26 January, 2010 (26.01.10)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2009/068056

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2008/152722 A1 (Mitsubishi Electric Corp.), 18 December 2008 (18.12.2008), entire text; fig. 1 to 3 (Family: none)	1-4
A	JP 2009-23820 A (Toshiba Elevator and Building Systems Corp.), 05 February 2009 (05.02.2009), entire text; fig. 1 to 6 & CN 101353125 A	1-4

Form PCT/ISA/210 (continuation of second sheet) (April 2007)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2008152722 A **[0004]**